Aug. 24, 1943. A. J. KIZAUR 2,327,603

RADIOGRAPHIC APPARATUS

Filed June 22, 1942 5 Sheets-Sheet 1

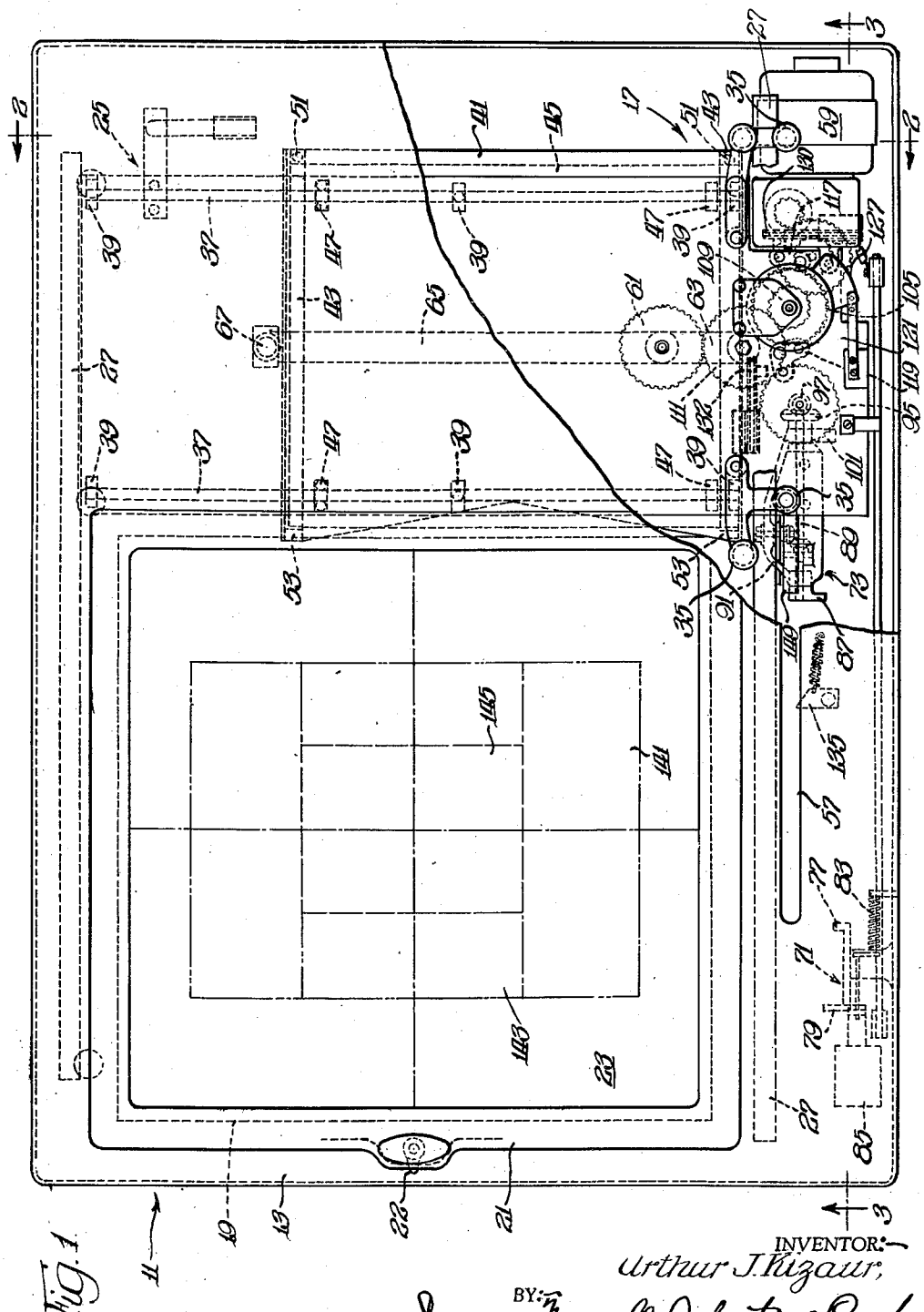


Fig. 1

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Filed June 22, 1942 5 Sheets-Sheet 2

Fig. 2.

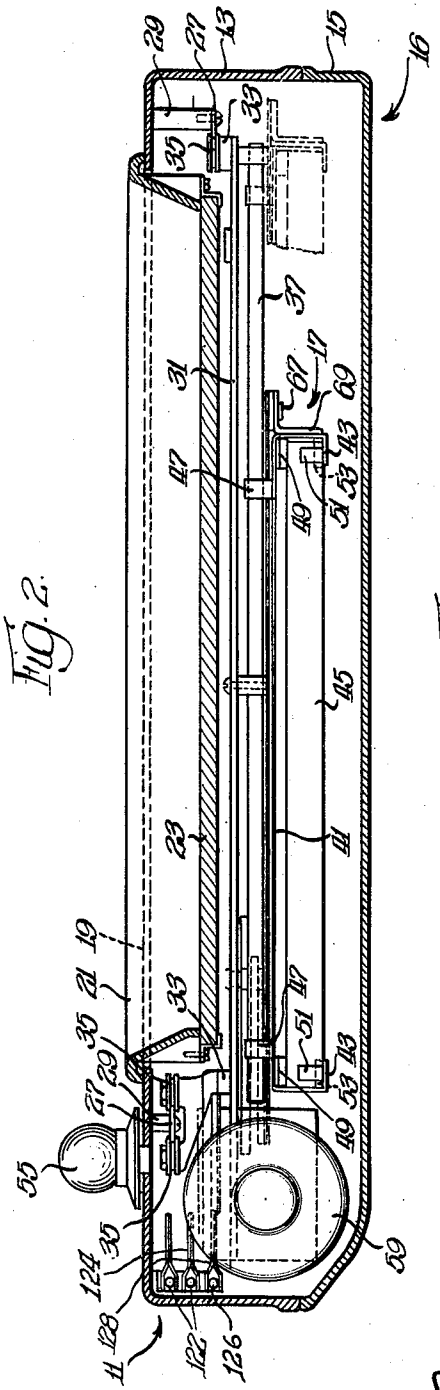
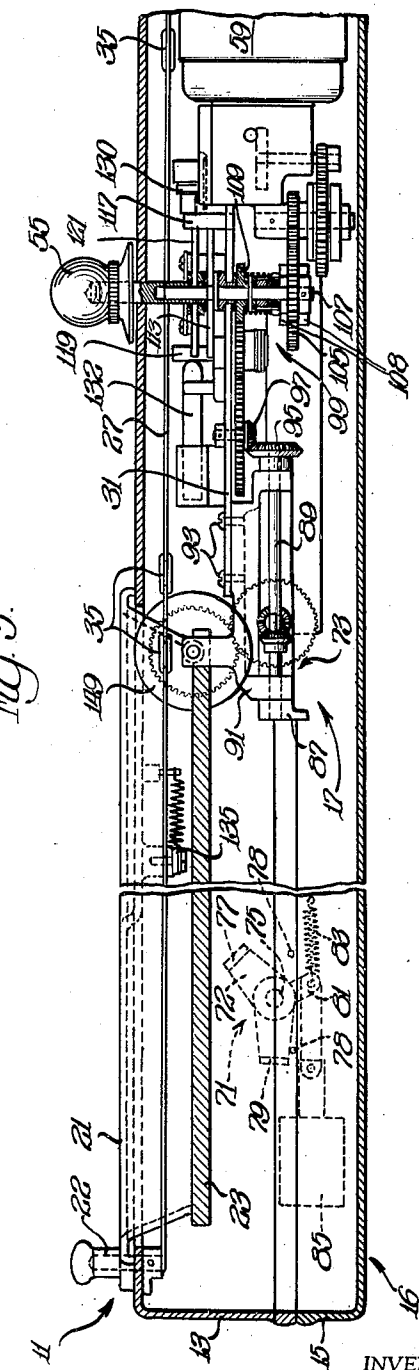


Fig. 3.



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Filed June 22, 1942 5 Sheets-Sheet 3

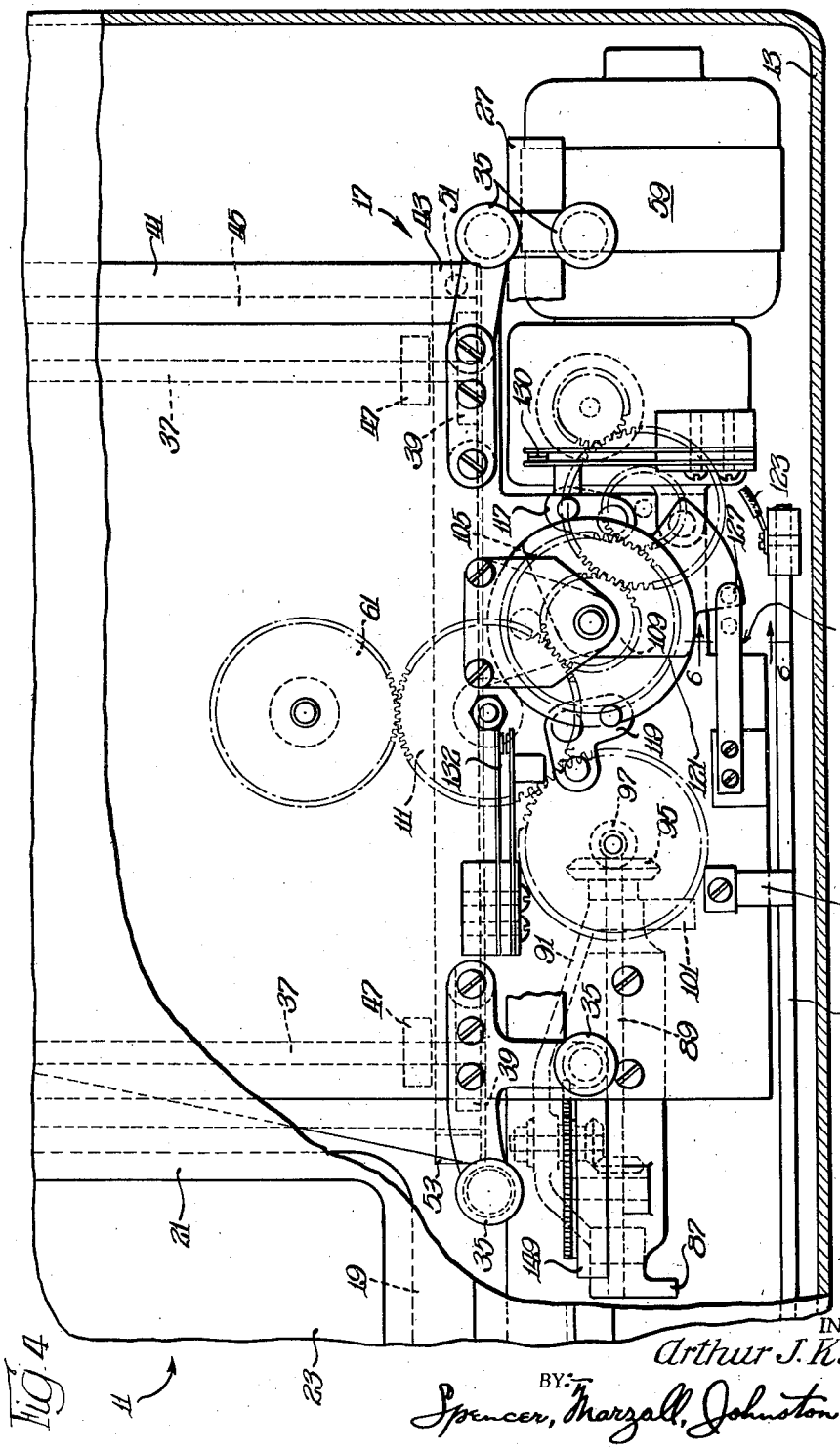


Fig. 4

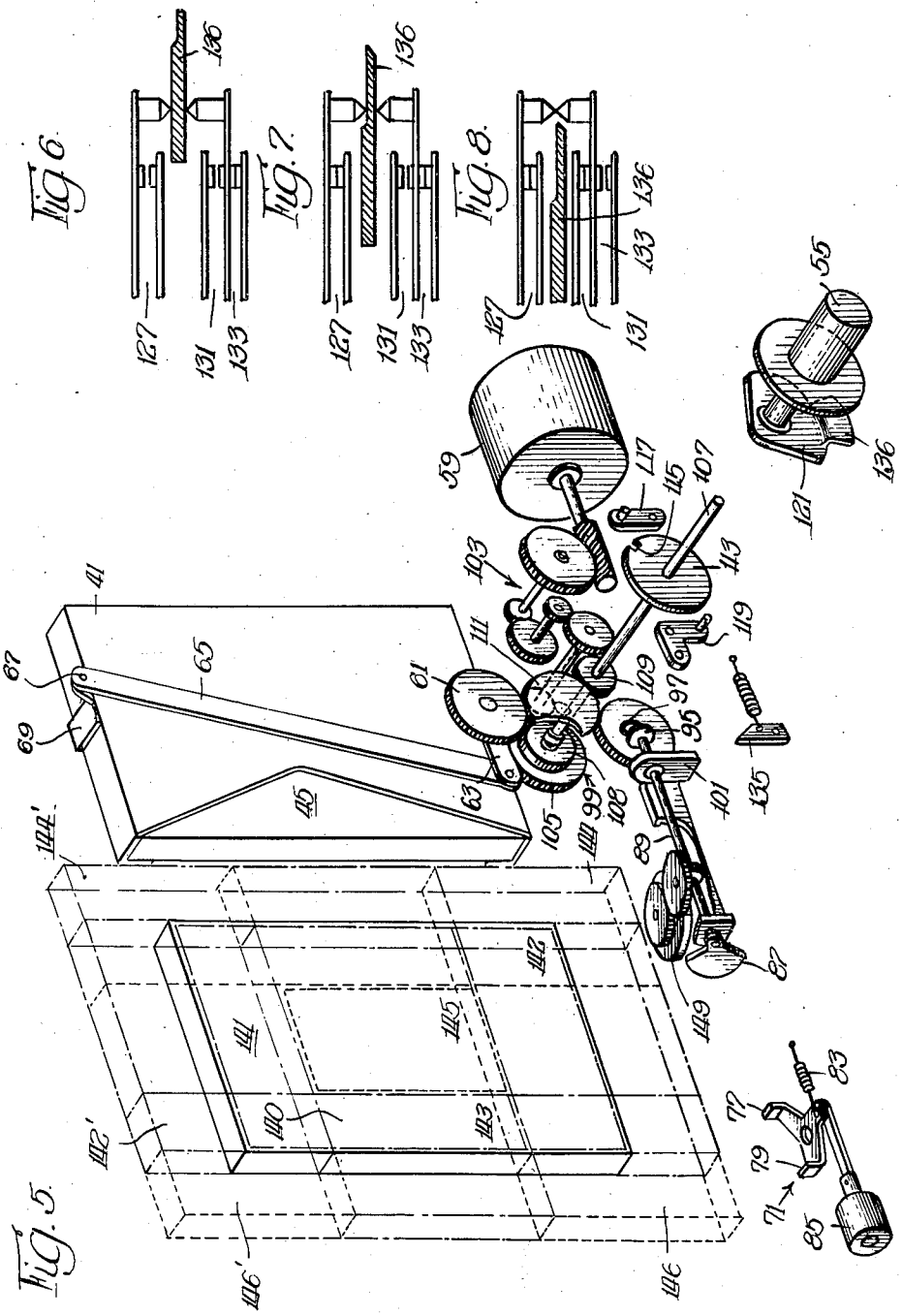
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RADIOGRAPHIC APPARATUS

Filed June 22, 1942 5 Sheets-Sheet 4



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RADIOGRAPHIC APPARATUS

Filed June 22, 1942 5 Sheets-Sheet 5

Fig. 9.

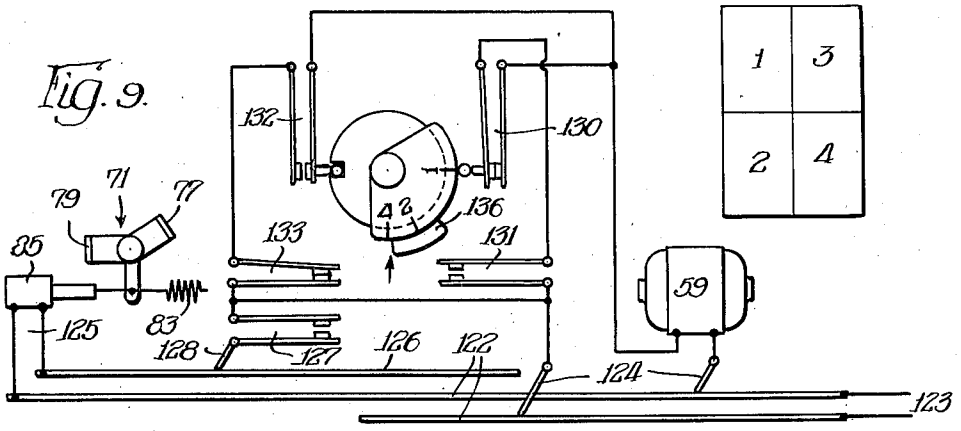


Fig. 10.

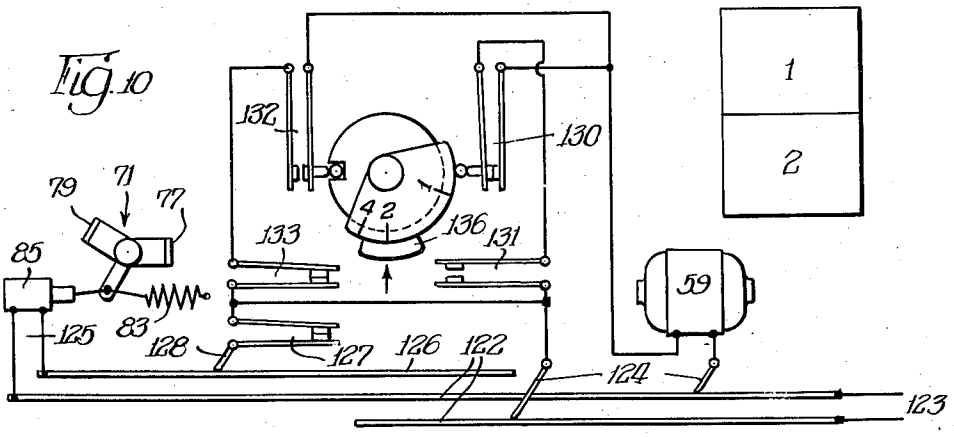
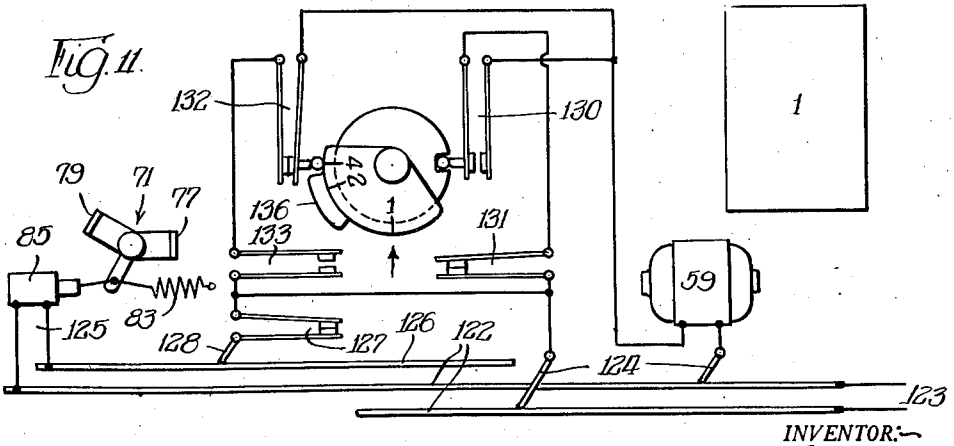


Fig. 11.



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Patented Aug. 24, 1943 2,327,603

UNITED STATES PATENT OFFICE

2,327,603

RADIOGRAPHIC APPARATUS

Arthur J. Kizaur, Cicero, Ill., assignor to General Electric X-Ray Corporation, Chicago, Ill., a corporation of New York

Application June 22, 1942, Serial No. 447,957

12 Claims. (Cl. 250—66)

The present invention relates in general to plate changers and has more particular reference to plate supporting and shifting mechanism for use in radiography, that is to say, the making of X-ray pictures on sheets or plates sensitive to X-rays.

An important object of the invention is to provide neat and compact apparatus for supporting sensitive material in position for exposure to X-rays for the making of X-ray photographs, and for shifting the supported material successively to a number of predetermined exposure positions; a further object being to provide plate shifting apparatus which will accomplish the shifting operation rapidly and substantially without vibration or jar; a still further object being to provide apparatus of the character mentioned which is of simple construction and light in weight whereby the same may be readily supported, as over a diagnostic table, and easily manipulated and shifted thereby facilitating the positioning of the apparatus in the making of X-ray photographs.

Another important object is to provide apparatus for progressively shifting a plate of sensitive photographic material successively to a number of predetermined relatively displaced exposure positions comprising a plate shifting cycle.

Another important object is to provide mechanism selectively adjustable for shifting a plate in accordance with a desired one of a number of different plate shifting cycles; a further object being to provide an apparatus which may be adjusted to present a plate in fixed position for exposure or to present the plate successively for exposure in two exposure positions, or to present the plate successively in a plurality of relatively shifted exposure positions.

Another important object is to provide mechanism operable to present a plate successively in a plurality of exposure positions whereby to enable several adjacent plate portions to be successively exposed in order to produce several related pictures upon adjacent portions of the same plate.

Another important object is to provide apparatus for successively projecting a plate carrier from retracted position into position for exposure, the apparatus being self-adjusting to successively present different portions of a plate in the holder in position to be exposed whereby several portions of the supported plate may be successively exposed as the plate holder is successively projected from retracted position.

Another important object resides in utilizing the reciprocating movement of the holder for the purpose of actuating tripping devices adapted progressively to condition the device to present the plate successively for exposure in relatively shifted or offset positions.

Another important object is to provide a simplified control for plate shifting mechanism whereby the same may be readily conditioned for the presentation of a plate in any desired one of a number of different plate changing cycles; a further object being to utilize progressively shiftable stop means for determining the position at which the plate is presented by the projecting movement of a plate carrier.

Another important object is to provide for displacing a plate carrier in a direction normal to the direction of plate projecting movement of the carrier; a further object being to utilize selectively operable stops for determining the projecting movement of the carrier in combination with means determining carrier displacement in a normal direction.

Another important object is to utilize means for projecting a plate carrier simultaneously in a plurality of directions in combination with selectively operable means for limiting the movement in each direction whereby to selectively determine the projected position of the plate; a further object being to progressively actuate the limiting means in order to alter the projected position of the plate carrier; a still further object being to actuate the stops selectively whereby the plate carrier may successively be presented in a plurality of positions forming a plate shifting cycle; a still further object being to provide a master control whereby the limiting stops may be conditioned to control the mechanism for operation in accordance with any one of a number of plate changing cycles.

Another important object is to provide a plate carrier reciprocable in a predetermined path between retracted and projected position, in combination with motor driven means and selectively conditionable stops for determining the projecting movement of the plate carrier and for displacing the plate selectively within predetermined limits in a direction normal to or outwardly of the direction of reciprocable movement of the carrier.

The foregoing and numerous other important objects, advantages and inherent functions of the invention will become apparent as the same is more fully understood from the following description, which, taken in connection with the

accompanying drawings, discloses a preferred embodiment of the invention.

Referring to the drawings:

Figure 1 is a face view of plate changing apparatus embodying the present invention;

Figures 2 and 3, respectively, are sectional views taken substantially along the lines 2—2 and 3—3 in Figure 1;

Figure 4 is an enlarged view of a portion of the apparatus shown in Figure 1;

Figure 5 is a perspective view of parts, including selectively operable control means for controlling operation of the apparatus;

Figures 6, 7 and 8 are sectional views taken along the line 6—6 in Figure 4 showing control switches forming a part of the control means in position for accomplishing four, two and single position operating cycles; and

Figures 9, 10 and 11 are diagrammatic views showing the control means positioned for accomplishing, respectively, four-position, two-position and single position operating cycles.

To illustrate the invention, I have shown on the drawings plate shifting mechanism 11 particularly adapted for presenting a sheet or plate of sensitive material in position for exposure to X-rays for the purpose of making X-ray photographs.

It is frequently desirable, in making X-ray photographs for diagnostic purposes, to make exposures by successively placing plates in the same position with respect to the patient and exposing the plates to X-rays emanating from a source of X-rays. In order to accomplish the foregoing purpose, it is highly desirable to provide means for quickly presenting sensitive material successively in accurately aligned position for exposure, and particularly when dealing with a restless patient is speed and accuracy desirable. It will be appreciated, also, that the plate shifting operation desirably should be accomplished substantially without jar to eliminate the possibility of misaligning the sensitive material. Since X-ray photographs are frequently required of injured persons, frequently not in any condition to cooperate in the picture making, it is desirable to provide lightweight apparatus adapted for convenient mounting, as on or over a diagnostic table, and it is also desirable to provide apparatus in form capable of easy adjustment to the patient.

The apparatus of the present invention embodies a frame and mechanism of lightweight construction adapted for easy application to a patient and containing mechanism for serially positioning light sensitive material in the same relative position with respect to the patient whereby to facilitate the making of a series of X-ray pictures by successively exposing the material to the action of X-rays emanating from a source of X-rays.

The plate shifting mechanism or serialographic apparatus 11, as shown in the drawings, comprises a frame preferably formed as a pair of cooperating shell-like housings 13 and 15 suitably secured together to provide a relatively flat box-like enclosure or housing 16 for plate shifting mechanism 17. The casing portion 13 comprises the front of the device and is formed on one side with a window opening 19 in which is mounted a removable frame 21 secured in place as by means of the latch 22 on one side and suitable hinges or other fastening means at the other. This frame carries a fluorescent screen 23 comprising a panel of material adapted to become luminescent when exposed to X-rays in proportion to the intensity of the rays impinging thereon. The device is adapted to be positioned upon the patient with the casing member 15 against the object to be photographed, the device being positioned with the panel 23 opposite the portions to be photographed. The X-ray source is then positioned at a suitable distance on the side of the object being photographed remote from the plate changing device 11 so that rays from the source may pass through the object and then impinge upon the screen 23. If desired, the screen may be etched with centering lines to enable the device 11 to be accurately positioned with respect to the object by means of a preliminary X-ray examination and the shadow thereby cast upon the screen 23.

The plate shifting apparatus 17 comprises carriage means 25 supported in the housing 16 for movement longitudinally thereof upon guide rails 27 preferably mounted on the housing portion 13 along the upper and lower edges thereof. The rails 27 preferably comprise metal strips fastened as by screws on pedestals 29 formed on the frame 13. The carriage means 25 comprises a plate 31 secured at its opposite edges on mounting straps 33 which carry grooved roller wheels 35 adapted to engage the edges of the strips forming the rails 27 whereby the plate 31 may be moved in the housing 16 from a retracted position on one side of the window opening 19 to projected position within said opening, the carriage means 25 being shown in retracted position in Figure 1 of the drawings.

The plate 31 carries a pair of parallel spaced-apart rods 37 secured in suitable mountings 39 on the plate 31 at the opposite ends of the rods and intermediate said ends, the rods extending in a direction normal to the direction of longitudinal plate projecting movement of the carriage means on the rails 27. A plate holder 41 preferably comprising a sheet metal frame having upper and lower flanged edges 43 for slidably receiving the upper and lower edges of a plate container or cassette 45 is carried on the rods 37 for sliding movement therealong, the plate holder 41 being fitted with slide brackets 47 to permit such movement.

The cassette 45 is a light tight container of suitable construction in which sensitive material may be mounted, and the cassette may be positioned in the holder 41 when the carriage means 25 is in the retracted position illustrated in Figure 1 by opening the screen carrying frame 21 and passing the cassette through the opening 19 and thence inserting it edgewise into the carrier 25, the upper and lower flanges of which are fitted with spring means 49 for yieldingly securing the cassette in place in the holder, stop pins 51 for limiting the insertion of the cassette, and latch lugs 53 which, in combination with the springs 49, serve to retain the cassette in mounted position.

It should be understood that X-rays from the source may be confined to impinge upon a restricted area within the confines of the window 19, thereby defining an exposure position, by adjusting the position of the source and by adjusting suitable diaphragm means associated with the source.

The carrier 25, together with the mechanism thereon, may be manually shifted from retracted position into position for exposure opposite the window 19, and means are provided for serially or successively altering the position at which the plate is presented opposite the opening 19 in

order thus to enable adjacent portions of the material in the cassette to be presented in position for exposure by successively presenting the plate carrier in various relatively shifted positions within the exposure area represented by the opening 19.

To this end, the carriage means 25 is fitted with a handle 55 which projects outwardly of the casing member 13 through a slot 57 in the housing, so that, by manipulating the handle 55, the carriage means 25 may be reciprocated in the housing 15 between retracted and projected positions. In order to shift the sensitive material on the carriage means and thus allow it to be presented at various elevations in the opening 19, I provide, suitably mounted on the carriage means 25, an electric motor 59 which is supported on the plate 31 by means of a suitable bracket in position below the carrier 25. This motor, through a train of gears and a selectively operable clutch, drives a gear 61 which is journaled on the plate 31. The gear 61 has an arm 63 secured thereon and extending radially therefrom. The end of the arm 63 is pivotally connected to one end of a connecting rod 65, the other end of which is pivotally connected as at 67 to a bracket 69 on the plate holder 41 so that by turning the gear 61 through one-half revolution from the position shown in Figure 1 the plate holder may be projected upwardly through a distance equal to twice the length of the arm 63. The arm 63, it will be noted, is approximately equal in length to one-quarter of the effective length of the sensitive material in the cassette so that the total displacement of the material between the lower and upper limits of movement of the holder 41 is one-half the effective length of the sensitive material between its upper and lower edges. By selectively controlling the clutch connection between the motor 59 and the gear 61 I may position either the upper half or the lower half of the sensitive material in the cassette at a definite elevation in the carriage, and, of course, I may similarly locate any intermediate portion of the sensitive material at said definite elevation. In the present embodiment of my invention the apparatus is arranged to position the upper half of the light sensitive material at an elevation midway between the upper and lower edges of the opening 19 when the holder 41 is in the position shown in Figure 1, and to position the lower half of the sensitive material in the same position midway between the upper and lower edges of the opening 19 when the holder 41 is at the upper limit of movement on the carriage means 25.

By moving the carriage means into position opposite the opening 19, I may make a picture on the upper half of the light sensitive material when the holder 41 is at the elevation shown in Figure 1 and then merely by elevating the holder 41 I may immediately make a second picture on the lower half of the sensitive material. This may be accomplished, of course, by suitably shielding the lower and upper portions of the light sensitive material when making these successive exposures. Likewise, by utilizing selective stops for limiting the movement of the carriage means 25 in a longitudinal direction I may successively expose each quarter section of the sensitive material by successively positioning each quarter section in the same exposure position.

The entire area of the light sensitive material may, of course, be exposed, if desired, whenever the holder 41 is projected into position in the opening 19. Consequently, the illustrated apparatus may be used either to expose the entire area of material or to position the upper and lower halves of the sensitive plate successively or to successively expose the quarter sections of the plate.

In order to cause the holder 41 to be automatically shifted as a result of successive reciprocations of the carriage means 25 between projected and retracted position whereby to present the several portions of the plate in position to be exposed, I provide selectively operable stop means 71 in the frame 11 in position to selectively engage cooperating stop means 73 supported on the carriage means 25, the stop means 73 being supported in position to engage the stop means 71 during the projecting movement of the carriage means 25 and thereby stop the carriage means and the plate holder 41 when the plate has reached a desired position within the opening 19. The stop means 71 comprises an element 72 pivoted as at 75 and having a pair of arms formed with upstanding lugs 77 and 79. The element 72 is provided with an arm 81 whereby it may be turned on its pivot 75, the arm 81 being normally urged as by means of a spring 83 into position presenting the lug 79 in place for cooperative engagement with stop means 73. The arm 81 is also connected with a solenoid 85 which when energized serves to turn the element 72 against the influence of the spring 83 to present the lug 77 in position to cooperate with the stop means 73. Suitable pins 78 or equivalent stop means may be provided to limit the turning movement of the element 72 in either direction under the influence of the spring 83 and solenoid 85.

The stop means 73 comprises a turnable detent 87 comprising a plate in the form of a quadrant secured on a shaft 89 which is journaled for rotation in bracket means 91 fastened as by screws 93 to the plate 31 forming the carriage means. The shaft 89 carries a bevel gear 95 which drivingly engages a cooperating pinion 97, which in turn has geared connection with the motor 59 through selectively operable mechanism 99 which is under the control of the knob 55. By manipulating the knob 55 the control mechanism 99 may be conditioned to turn the detent 87 so that as the carriage means is successively projected the detent 87 may selectively engage the stop lug 79 or may pass said stop means. It will be noted that the lug 79 projects above the top of the lug 77. The configuration of the detent 87 is such that it may not at any time engage the lug 77 but it cooperates selectively only with the lug 79. The frame 91 includes a projection 101 which depends in position to engage the lug 77 when the same is presented in operating position. When the lug 79 is in operating position and the detent 87 is in position to pass said lug 79 the projection 101 will engage the lug 79. It will be seen from the foregoing that the carriage means may be stopped at the position defined by the engagement of the detent 87 with the lug 79, or it may be stopped in either of the positions determined by the engagement of the projection 101 with either of the lugs 77 and 79. The co-operating stop means 71 and 73 thus provide for the stoppage of the carriage means and the holder 41 in three adjacent relatively shifted positions within the opening 19, and the parts are arranged so that the holder 41 may be stopped in a medial position within the opening 19 and in offset positions on opposite sides of the medial position and

displaced from said medial position a distance equal to one-half the effective width of the light-sensitive plate which the holder is adapted to mount.

It will be apparent that by correlating the operation of the co-operating stop means 71 and 73 with the means determining the position of the holder 41 on the rails 37, the carrier may be successively presented in the opening 19 in position with the several sections of a sensitive plate therein presented successively in a predetermined exposure position. To this end, the selectively operable means 99 comprises a train of gears connecting the motor 59 with a gear element 105 mounted for free turning movement on a shaft 107 between spring pressed clutch members 108 keyed on the shaft on opposite sides of the gear element 105, whereby the shaft 107 may be driven through friction clutch means comprising the element 105 and the clutch members 108.

The shaft 107 carries a pinion 109 which, through an idler gear 111, drives the carrier elevating gear 61 and the selector cam driving gears 95 and 97. The shaft 107 also carries a selectively operable circular stop plate 113 having an edge notch 115 adapted to receive one or other of a plurality of locking detents for holding the shaft against rotation in predetermined angular positions. In the illustrated embodiment, there are two detents 117 and 119 disposed on diametrically opposite sides of the axis of the shaft to lock it against turning in two positions relatively displaced by 180°. The detents are spring urged to press upon the periphery of the plate and are thus adapted to fall into the notch 115 when in registration therewith. When locked by the detent 119, the shaft 107 is in position such that the holder 41 is either at its maximum or at its minimum elevation on the carriage means 25, and when the shaft is locked by the detent 117, the holder is in position midway between the upper and lower limits of its vertical movement.

The handle 55 is mounted for limited turning movement on the carriage, being conveniently journaled on the projecting end of the shaft 107 which, of course, is free to turn with respect to the handle. The handle, however, as shown in Figures 6, 7 and 8, may be turned to and secured in any selected one of three positions, representing the three operating cycles which the device shown is adapted to perform, namely, the four, the two, and the single position cycles, respectively, illustrated in Figures 6, 7 and 8. Fastened to the handle is a detent control cam 121, and when the handle 55 is positioned to condition the apparatus for the performance of the two and four position cycles of operation, the cam 121 blocks the detent 117 from entering the slot 115, while leaving the detent 119 free to latch in the notch 115 each time the shaft 107 turns through 180°. When the handle is set to condition the apparatus for single position operation, the cam 121 blocks the detent 119 and leaves the detent 117 free to operate.

The motor 59 and the solenoid 85 are controlled through an electrical circuit system energized from a suitable electrical power source 123 including switches which, in turn, are controlled by the handle 55 and the detents 117 and 119. Power from the source 123 is delivered to a pair of bus bars 122 mounted on insulated supports in the casing 13 adjacent the edge of the carriage means 25, which carries wiping contacts 124 in position to engage the bars 122, whereby to energize the electrical system on the movable carriage. Another bar 126 and wiping contact 128 connects the electrical system on the carriage with the stationary solenoid on the frame 13. The control system comprises a solenoid control circuit 125 comprising a normally open switch 127 in series with the solenoid between the power source. The switch 127 is closed to energize the solenoid and draw the stop 77 into active position whenever the handle 55 is in position to condition the apparatus for either the one or the two position operation, the switch being open to allow the stop 79 to be active during four position operation.

The motor is controlled by a circuit comprising four normally open switches 130, 131, 132 and 133 arranged in series connected pairs, the switch pair 130 and 131 being connected in parallel relationship with the pair 132 and 133 so that both pairs are in series with the motor and the power source. The motor therefore may operate only if both switches of a pair are closed. The switches 130 and 132, respectively, are under the control of the detents 117 and 119, being open only when the corresponding detent is in the notch 115 and closed whenever the detent is out of the notch, whether riding on the edge of the disk or held out by the cam 121.

The switches 131 and 133 are normally open but are closed by operation of cam means 136 on the handle 55, the switch 131 being closed only when the handle is set for one position operation of the apparatus and open otherwise, while the switch 133 is closed for two and four position operation and open for single position operation. The switch 127 is also controlled by the cam means 136 so as to be open for the four position cycle and closed for the one and two position cycles.

The switches may be mounted on the frame of the carriage 25 in driving relation with the detents 117 and 119 and with the cams 121 and 136, the switches 127, 131 and 133 being preferably arranged as a stack 138 in position to cooperate with the cam means 136.

Operation

When the control handle 55 is set for one position operation, as shown in Figure 8, the carriage 25 being in retracted position shown in Figure 1, the switch 131 will be in closed position, the switch 133 being open so long as the handle 55 remains in the setting for one position operation. The switch 130, however, will be closed if the detent 117 is not in latched position in the notch 115. As the handle is turned to the setting shown in Figure 8, the cam 121 will raise the detent 119 from the disc 113 to render the detent 119 inactive so long as the handle remains in such setting. Should the detent 119 be latched in the notch when the handle is set for one position operation, it will be released from the notch by the cam; and if the detent 117 is supported on the edge of the disc 113 when the handle is turned to its setting, the motor will be energized through the closed switches 130 and 131 until it shall have turned the shaft 107 into position permitting the detent 117 to latch in the notch 115, whereupon the switch 130 will open, the motor 59 will stop, and the shaft 107 will be latched in position with the plate carrier in the intermediate position shown in Figure 5. The handle 55, in the control position shown in Figure 8, also causes closure of switch 127 so that the solenoid is energized to present the stop

member 77 in operative position to engage the stop lug 101 on the carriage frame 25, whereby to limit longitudinal movement of the frame to a position in which the plate holder is centered in the window 19. Consequently, by merely pushing upon the handle to move the carriage 25 into the window 19, the sensitive material in the holder 41 may be accurately placed in the mid exposure position shown at 141 in Figure 5. After exposure of the material in such mid position, the carriage may be retracted by pushing on the handle 55, an unexposed plate may be mounted in the holder and the carriage again advanced by pushing on the handle 55 to place the unexposed plate in the same mid exposure position 141. The apparatus thus may be operated without change of adjustment to present plates for exposure in the mid position where the plates or any portion thereof may be exposed.

If it be desired to expose the upper and lower halves of a plate successively, or to expose successively the quarter sections of the plate, the handle 55 may be set in the position shown, respectively, in Figures 6 and 7 in which the switch 133 is closed, the switch 131 being open so long as the handle 55 remains in the settings for two or four position operation. The switch 132, however, will be closed whenever the detent 119 is not in latched position in the notch 115. As the handle is turned to the setting shown in Figures 6 or 7, the cam 121 will raise the detent 117 from the disk 113 to render the detent 117 inactive so long as the handle remains in such settings. Should the detent 117 be latched in the notch 115 when the handle is shifted to either the two or four position settings, the detent 117 will be released from the notch by the cam 121; and if the detent 119 is supported on the edge of the disk 113 when the handle is turned to either setting, the motor will be energized through the closed switches 132 and 133 until it shall have turned the shaft 107 into position permitting the detent 119 to latch in the notch 115, whereupon the switch 132 will open, the motor 59 will stop, and the shaft 107 will be latched in position with the plate carrier either at the uppermost or lowermost limit of its vertical movement on the carriage 25.

When the handle is in the two position setting shown in Figure 7, the solenoid switch 127 will be closed to energize the solenoid and thus present the stop member 77 in operative position to engage the stop lug 101 on the carriage frame 25 and thus limit the longitudinal movement of the frame to a position in which the plate holder is centered in the window 19, as is the case when the apparatus is set for one position operation. Consequently, by merely pushing upon the handle to move the carriage 25 into the window space 19, the sensitive material in the holder 41 may be accurately centered in the window. Since the detent 119, however, is latched in the notch 115, the holder will be either at the upper or lower limit of its vertical travel on the carriage and consequently the plate will be presented in either the lower or upper medial position shown at 142 and 142' in Figure 5, and it will be seen that the lower half of the plate in the upper position 142' occupies the same medial exposure position 143 occupied by the upper half of the plate in the lower position 142. After exposure of one-half of the plate in the said medial exposure position 143, the carriage 25 may be moved to the retracted position shown in Figure 1 by pushing on the handle 55 and immediately returned to projected position determined by the stops 77 and 101. During the retraction and projection, and preferably during the retracting movement, the detent 119 is engaged by a tripping finger 135 and released from the notch 115. The tripping finger 135 may comprise a spring actuated lug pivoted on the housing in position to engage the detent 119 during the longitudinal movement of the carriage 25 on the tracks 27, and as shown, it is arranged to release the detent 119 as the carriage is retracted from projected position in the window 19, the trip finger depressing against the influence of its spring to permit the detent 119 to ride freely over the finger during projecting movement of the carriage 25 toward the window.

By releasing the detent 119 during retractive carriage movement, the shaft 107 will be released and the switch 132 will be closed to energize the motor, which will turn the shaft through one revolution before the detent 119 may relatch in the notch 115, the detent 117 being held inactive by the cam 121. One revolution of the shaft 107 turns the gear 61 through 180° of rotation, thus moving the plate holder from the down position 142 to the up position 142', or vice versa, so that when the holder again reaches the projected position determined by the stops 77 and 101, the unexposed half will be in the medial exposure position 143 previously occupied by the other half of the plate during exposure thereof. The unexposed half may then be exposed and the plate removed from the holder for development by retracting the carriage and removing the plate in its cassette from the holder 41. The apparatus thus may be operated without change of adjustment to present the upper and lower portions of the plates successively in the medial exposure position 143.

When the handle 55 is in the four position setting shown in Figure 6, the apparatus is set to successively position the quarter sections of a plate in an exposure station disposed at the center of the window 19. In such four position setting, the solenoid switch 127 is released by the handle 55 and assumes open position so that the solenoid 85 is de-energized and the stop member 79 is brought into active position by the spring 83, the stop 77 being moved out of active position. As is the case when set for two position operation, the apparatus, when set for four position operation, functions to present the holder 41 in the opening 19 in either fully raised or fully lowered position when the carriage 25 is projected by pushing on the handle. The segmental stop 87 has such geared connection with the shaft 107 that it will turn through one complete rotation while the shaft 107 turns four times and the gear 61 turns twice. The segmental stop 87 is adapted to engage the stop 79 during two successive carriage projections and then to ride over the stop 79 during two successive carriage projections.

Initial projection of the carriage 25, when the apparatus is set for four position operation, will be stopped in a position determined by the engagement of the members 79 and 87. If the holder be in lowered position on the carriage during the initial projection thereof, the plate will be presented in the window in offset position shown at 144 in Figure 5, with its upper left-hand quarter of the plate in exposure position 145 at the center of the window 19. After exposure of such centered plate quadrant, the carriage may be retracted and immediately re-projected

to present the plate in shifted position for a second exposure. During retraction, the release finger 135 will disengage the detent 119 and cause the motor to turn the shaft 107 through one complete turn, thus moving the holder 41 to raised position, and turning the segmental stop through 90° of rotation.

The second projection of the carriage will be stopped by the engagement of the members 79 and 87 in offset position with the plate in position shown at 144' in Figure 5, the lower left hand quarter of the plate being in the centered exposure position 145. After exposure of such centered plate quadrant, the carriage may again be retracted and immediately re-projected to present the plate in shifted position for a third exposure. During retraction, the release finger 135 will disengage the detent 119 and cause the motor to turn the shaft 107 through one complete turn, thus moving the holder 41 to lowered position and turning the segmental stop through 90° of rotation.

The third projection of the carriage will be stopped by the engagement of the members 79 and 101, since the segmental stop member has been turned to an inactive position and over-rides the stop member 79. The plate will thus be presented in the window 19 in the offset position shown at 146 in Figure 5, with the upper right-hand quarter of the plate in the centered exposure position 145. After exposure of such centered plate quadrant, the carriage may again be retracted and immediately re-projected to present the plate in shifted position for a fourth exposure. During retraction, the release finger 135 disengages the detent 119 and causes the motor to turn the shaft 107 through one complete turn, thus moving the holder 41 to raised position and turning the segmental stop through 90° of rotation.

The fourth projection of the carriage will thus be stopped by the engagement of the members 79 and 101, the segmental stop being inactive and over-riding the stop 79 so that the plate will be presented in the offset position shown at 146' in Figure 5, with its lower right-hand quarter in the centered exposure position 145. After exposure of such centered plate quadrant, the carriage may be retracted to complete the operating cycle, the release finger 135, during final retraction, again tripping the detent 119 to allow the motor to lower the holder and to advance the segmental stop 87 through 90° of rotation into active position for engagement with the stop 79. At the conclusion of the four position operating cycle, the exposed plate, in its cassette, may be removed from the holder 41 and replaced with an unexposed plate, the apparatus being ready to repeat its operating cycle.

As a refinement, the shaft 89 which carries the segmental stop may be geared to an index wheel 149, having its rim projecting through a slot in the housing and marked at 90° intervals with the numerals 1, 2, 3 and 4 to indicate the progressive condition of the apparatus in the performance of its four position cycle of operation. This index wheel also functions to indicate progress during two position operation and shows fixed positions for one position operation. By noting the wheel and always starting the four position cycle with the index wheel at the initial index position, the condition of the apparatus will be known at all times, and the exposure sequence will be identical in each exposed plate. Likewise, by starting the two cycle operation always with the index wheel showing either the first or third index position, the operating sequence will be known at all times and identical exposure sequence will be had in all exposed plates.

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the form herein disclosed being a preferred embodiment for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

1. Plate positioning mechanism comprising frame means forming a work station, plate carriage means movable to and retractable from the work station to provide a working cycle, said frame means and carriage means comprising relatively movable structures, and cooperating stop mechanism on the carriage means and on said frame means, said stop mechanism being selectively operable to halt movement of the carriage means in any one of several relatively shifted positions at the work station to present a plate on said carriage means in a desired position at said station, said stop mechanism comprising an adjustably shiftable stop on one of said relatively movable structures, said shiftable stop being positionable selectively to engage a cooperating stop on the other structure when the carriage reaches a position in its path determined by said shiftable stop and to by-pass said cooperating stop to allow the carriage means to be stopped in a different position.

2. Plate positioning mechanism comprising frame means forming a work station, plate carriage means movable to and retractable from the work station to provide a working cycle, said frame means and carriage means comprising relatively movable structures, and cooperating stop mechanism on the carriage means and on said frame means, said stop mechanism being selectively operable to halt movement of the carriage means in any one of several relatively shifted positions at the work station to present a plate on said carriage means in a desired position at said station, said stop mechanism comprising a stop member and an adjustably shiftable stop on one of said relatively movable structures, said shiftable stop being positionable selectively to engage a cooperating stop on the other structure when the carriage reaches a position in its path determined by said shiftable stop and to by-pass said cooperating stop to allow the carriage means to be stopped in a different position by the engagement of said stop member with the cooperating stop.

3. Plate positioning mechanism comprising frame means forming a work station, plate carriage means movable to and retractable from the work station to provide a working cycle, said frame means and carriage means comprising relatively movable structures, cooperating stop mechanism on the carriage means and on said frame means, said stop mechanism being selectively operatable to halt movement of the carriage means in any one of several relatively shifted positions at the work station to present a plate on said carriage means in a desired position at said station, said stop mechanism comprising an adjustably shiftable stop on one of said rela-

tively movable structures, said shiftable stop being positionable selectively to engage a cooperating stop on the other structure when the carriage reaches a position in its path determined by said shiftable stop and to by-pass said cooperating stop to allow the carriage means to be stopped in a different position, and means operable when the carriage passes a predetermined position in its working cycle to move said shiftable stop and thus automatically determine the stopping position of the carriage means for successive cycles.

4. Plate positioning mechanism comprising frame means forming a work station, plate carriage means movable to and retractable from the work station to provide a working cycle, said frame means and carriage means comprising relatively movable structures, cooperating stop mechanism on the carriage means and on said frame means, said stop mechanism being selectively operable to halt movement of the carriage means in any one of several relatively shifted positions at the work station to present a plate on said carriage means in a desired position at said station, and progressively operable means to adjust the selectively operable stop mechanism during successive working cycles of the carriage means.

5. Plate positioning mechanism comprising frame means forming a work station, plate carriage means movable to and retractable from the work station to provide a working cycle, said frame means and carriage means comprising relatively movable structures, cooperating stop mechanism on the carriage means and on said frame means, said stop mechanism being selectively operable to halt movement of the carriage means in any one of several relatively shifted positions at the work station to present a plate on said carriage means in a desired position at said station, a carrier for supporting the plate on said carriage means, said carrier being movable on the carriage means in a direction transverse with respect to the movement of the carriage means toward and from said station, and means to support the carrier and plate in any selected one of a plurality of transversely shifted positions on the carriage means.

6. Plate positioning mechanism comprising frame means forming a work station, plate carriage means movable to and retractable from the work station to provide a working cycle, said frame means and carriage means comprising relatively movable structures, cooperating stop mechanism on the carriage means and on said frame means, said stop mechanism being selectively operable to halt movement of the carriage means in any one of several relatively shifted positions at the work station to present a plate on said carriage means in a desired position at said station, progressively operable means to adjust the selectively operable stop mechanism during successive working cycles of the carriage means, a carrier for supporting the plate on said carriage means, said carrier being movable on the carriage means in a direction transverse with respect to the movement of the carriage means toward and from said station, actuating means to so move the carrier progressively from one transversely shifted position to another, and means selectively conditionable to cause the actuating means to operate and to remain inoperative during successive working cycles of the carriage means.

7. Plate positioning mechanism comprising frame means forming a work station, carriage means movable to and retractable from the work station in a working cycle, a carrier for supporting the plate on said carriage means, said carrier being movable on the carriage means in a direction transverse with respect to the movement of the carriage means toward and from said station, actuating means to so move the carrier progressively from one transversely shifted position to another, and means selectively conditionable to cause the actuating means to operate and to remain inoperative during successive working cycles of the carriage means.

8. Plate positioning mechanism comprising frame means forming a work station, plate carriage means movable to and retractable from the work station to provide a working cycle, said frame means and carriage means comprising relatively movable structures, cooperating stop mechanism on the carriage means and on said frame means, said stop mechanism being selectively operable to halt movement of the carriage means in any one of several relatively shifted positions at the work station to present a plate on said carriage means in a desired position at said station, a carrier for supporting the plate on said carriage means, said carrier being movable on the carriage means in a direction transverse with respect to the movement of the carriage means toward and from said station, an electric motor on said carriage means, means for drivingly connecting the motor with said carrier, comprising latch means normally operable to latch the carrier against movement and releasable to allow the carrier to be moved by said motor, and latch control means selectively conditionable to cause relatching of the carrier after the same has been shifted a predetermined distance on the carrier means.

9. Plate conditioning mechanism comprising frame means forming a work station, plate carriage means movable to and retractable from the work station to provide a working cycle, said frame means and carriage means comprising relatively movable structures, cooperating stop mechanism on the carriage means and on said frame means, said stop mechanism being selectively operable to halt movement of the carriage means in any one of several relatively shifted positions at the work station to present a plate on said carriage means in a desired position at said station, a carrier for supporting the plate on said carriage means, said carrier being movable on the carriage means in a direction transverse with respect to the movement of the carriage means toward and from said station, an electric motor on said carriage means, means for drivingly connecting the motor with said carrier, comprising latch means normally operable to latch the carrier against movement and releasable to allow the carrier to be moved by said motor, and latch control means selectively conditionable to cause relatching of the carrier after the same has been shifted a predetermined distance on the carrier means, said latch means comprising a plurality of latch portions operable to latch the carrier in any one of a plurality of relatively shifted positions and said latch control means comprising manually operable cam means conditionable selectively to disable certain of said latch portions while permitting others to function.

10. Plate positioning mechanism comprising frame means forming a work station, plate carriage means movable to and retractable from the work station to provide a working cycle, said

frame means and carriage means comprising relatively movable structures, cooperating stop mechanism on the carriage means and on said frame means, said stop mechanism being selectively operable to halt movement of the carriage means in any one of several relatively shifted positions at the work station to present a plate on said carriage means in a desired position at said station, a carrier for supporting the plate on said carriage means, said carrier being movable on the carriage means in a direction transverse with respect to the movement of the carriage means toward and from said station, an electric motor on said carriage means, means for drivingly connecting the motor with said carrier, comprising a slip clutch having a driven side connected to the carrier and a driving side connected to said motor, latch means normally operable to latch the carrier against movement and releasable to allow the carrier to be moved by said motor, latch control means selectively conditionable to cause relatching of the carrier after the same has been shifted a predetermined distance on the carrier means, and switch means for energizing the motor upon release of said latch means and for disabling the motor upon relatchment thereof.

11. Plate positioning mechanism comprising frame means forming a work station, plate carriage means movable to and retractable from the work station to provide a working cycle, said frame means and carriage means comprising relatively movable structures, cooperating stop mechanism on the carriage means and on said frame means, said stop mechanism being selectively operable to halt movement of the carriage means in any one of several relatively shifted positions at the work station to present a plate on said carriage means in a desired position at said station, a carrier for supporting the plate on said carriage means, said carrier being movable on the carriage means in a direction transverse with respect to the movement of the carriage means toward and from said station, an electric motor on said carriage means, means for drivingly connecting the motor with said carrier, comprising a slip clutch having a driven side connected to the carrier and a driving side connected to said motor, latch means normally operable to latch the carrier against movement and releasable to allow the carrier to be moved by said motor, latch control means selectively conditionable to cause relatching of the carrier after the same has been shifted a predetermined distance on the carrier means, and switch means for energizing the motor upon release of said latch means and to disable the motor upon relatchment thereof, said latch means comprising a plurality of latch portions operable to latch the carrier in any one of a plurality of relatively shifted positions and said latch control means comprising manually operable cam means conditionable selectively for disabling certain of said latch portions while permitting others to function.

12. Plate positioning mechanism comprising frame means forming a work station, plate carriage means movable to and retractable from the work station to provide a working cycle, said frame means and carriage means comprising relatively movable structures, cooperating stop mechanism on the carriage means and on said frame means, said stop mechanism being selectively operable to halt movement of the carriage means in any one of several relatively shifted positions at the work station to present a plate on said carriage means in a desired position at said station, a carrier for supporting the plate on said carriage means, said carrier being movable on the carriage means in a direction transverse with respect to the movement of the carriage means toward and from said station, an electric motor on said carriage means, means for drivingly connecting the motor with said carrier, comprising a slip clutch having a driven side connected to the carrier and a driving side connected to said motor, latch means normally operable to latch the carrier against movement and releasable to allow the carrier to be moved by said motor, latch control means selectively conditionable to cause relatching of the carrier after the same has been shifted a predetermined distance on the carrier means, switch means for energizing the motor upon release of said latch means and for disabling the motor upon relatchment thereof, said latch means comprising a plurality of latch portions operable to latch the carrier in any one of a plurality of relatively shifted positions and said latch control means comprising manually operable cam means conditionable selectively to disable certain of said latch portions while permitting others to function by the engagement of said stop member with the cooperating stop, means to drive said shiftable stop from said motor through said clutch under the control of said latch means, said cooperating stop being adjustably movable, switch means controlled by said manually operable means for controlling the movement of said cooperating stop, and switch means controlled by said manually operable means for controlling the operation of said motor.

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