

Sept. 22, 1953

E. GOLDBERG

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 1

FIG. 1.

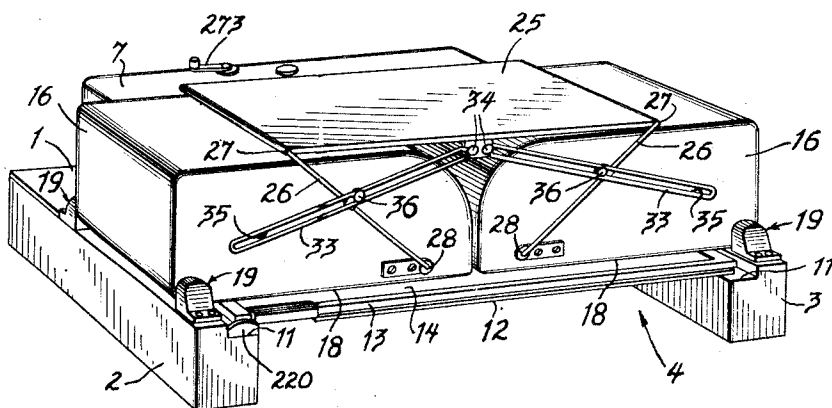
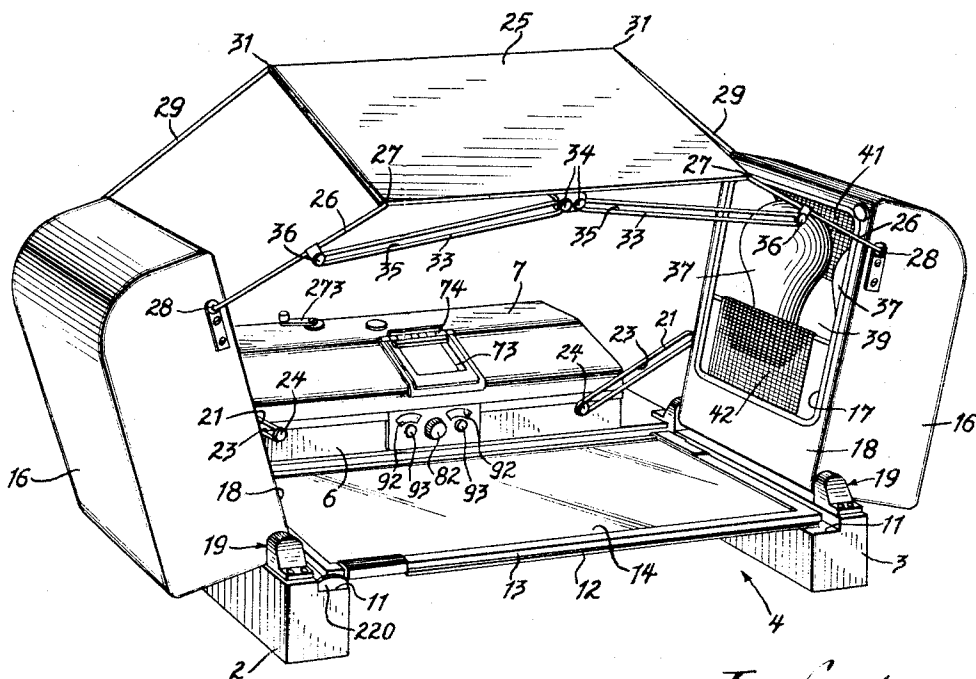


FIG. 2.



Inventor:
Emanuel Goldberg
By Robert F. Muehl, Atty.

Filed June 1, 1950

PHOTOGRAPHIC COPYING APPARATUS

14 Sheets-Sheet 2

Inventor:
By Emanuel Goldberg
John E. Mickle, Atty.

Sept. 22, 1953

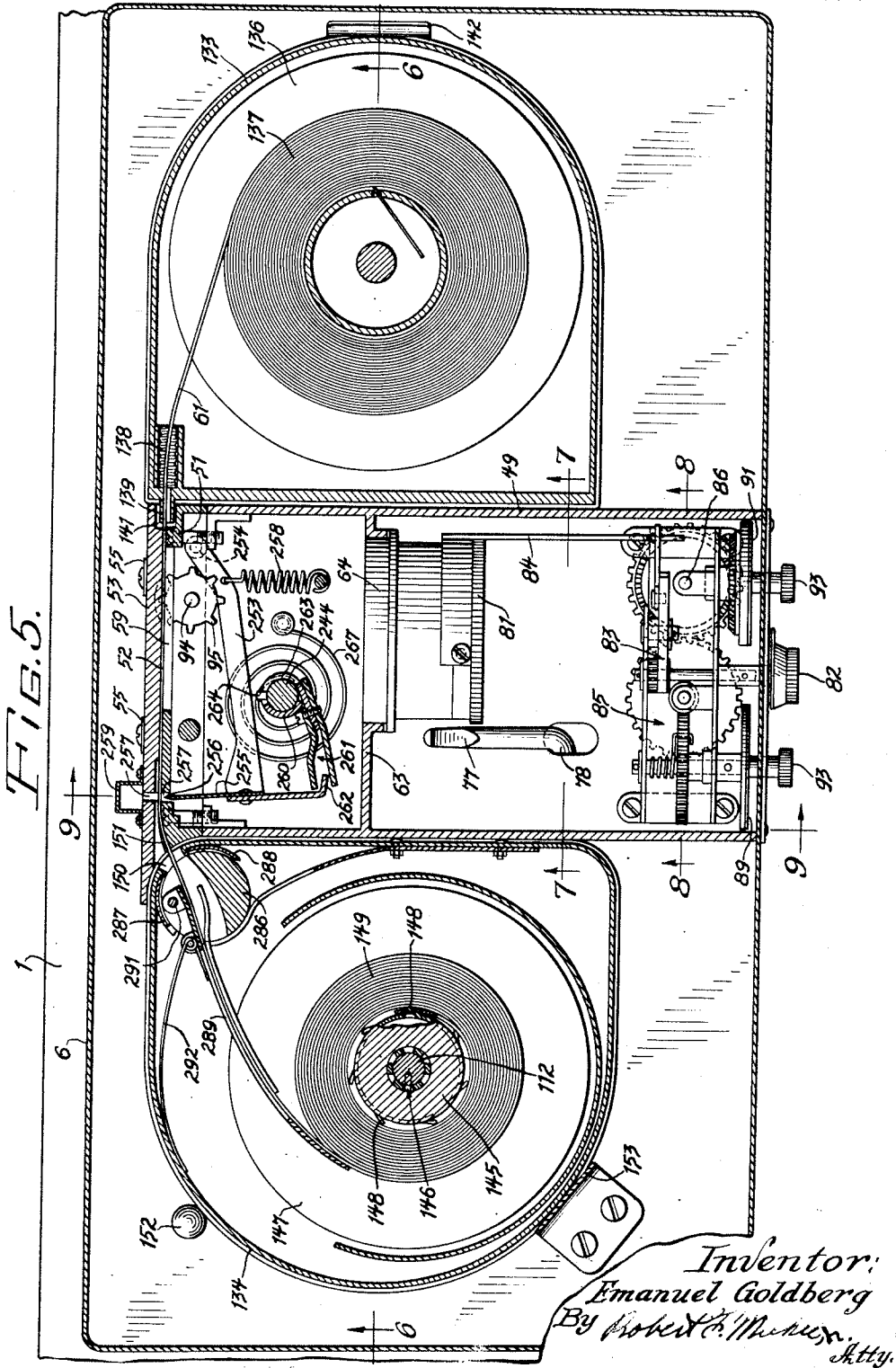
E. GOLDBERG

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 3



Sept. 22, 1953

E. GOLDBERG

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 4

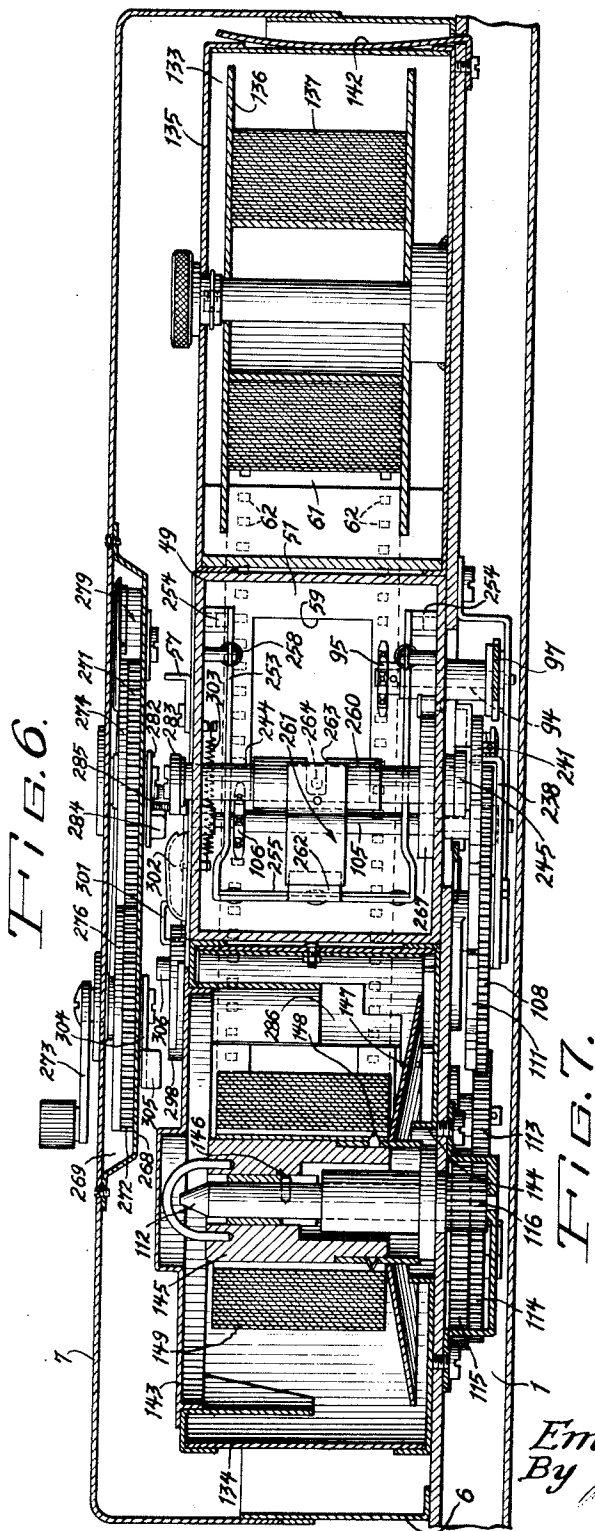
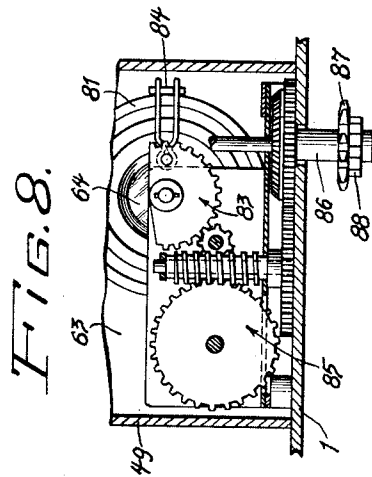
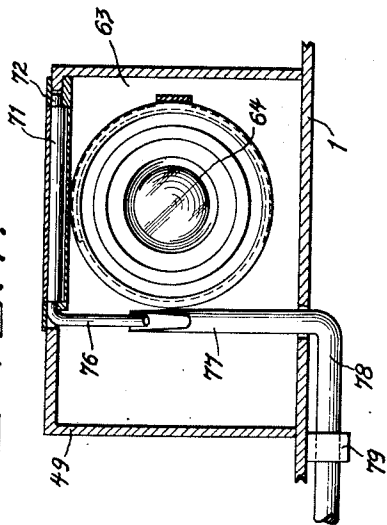


FIG. 7.



Inventor:
Emanuel Goldberg
By *Robert C. [Signature]* Atty.

Sept. 22, 1953

E. GOLDBERG

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 5

FIG. 9.

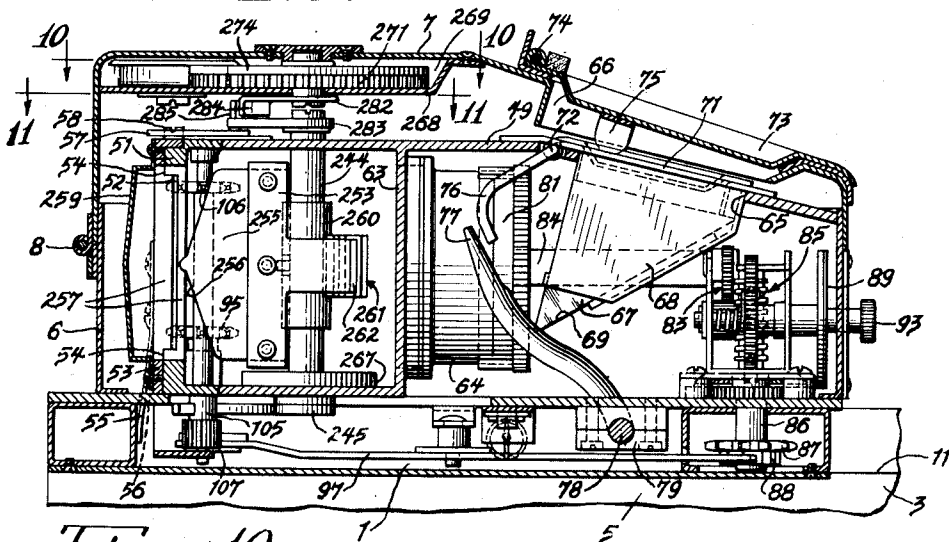


FIG. 10.

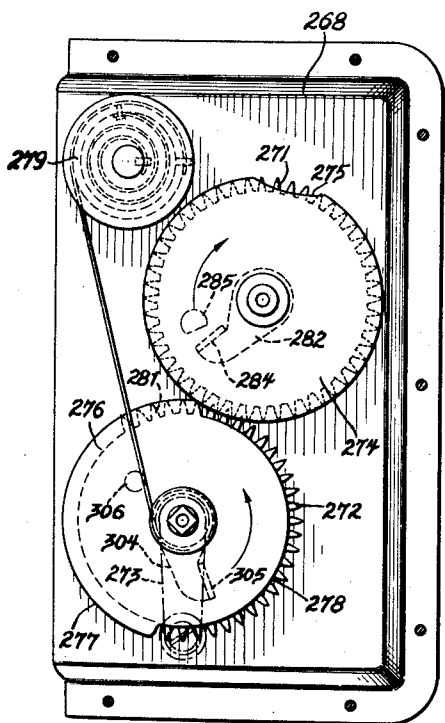
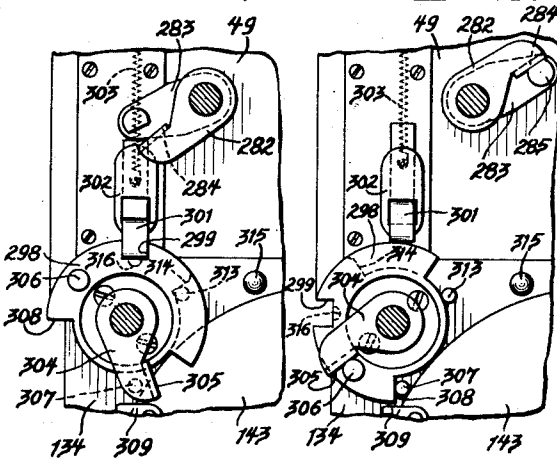


FIG. 11. FIG. 12.



Inventor:
Emanuel Goldberg
By Robert C. Mink, Jr. Atty.

Sept. 22, 1953

E. GOLDBERG

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 6

FIG. 13.

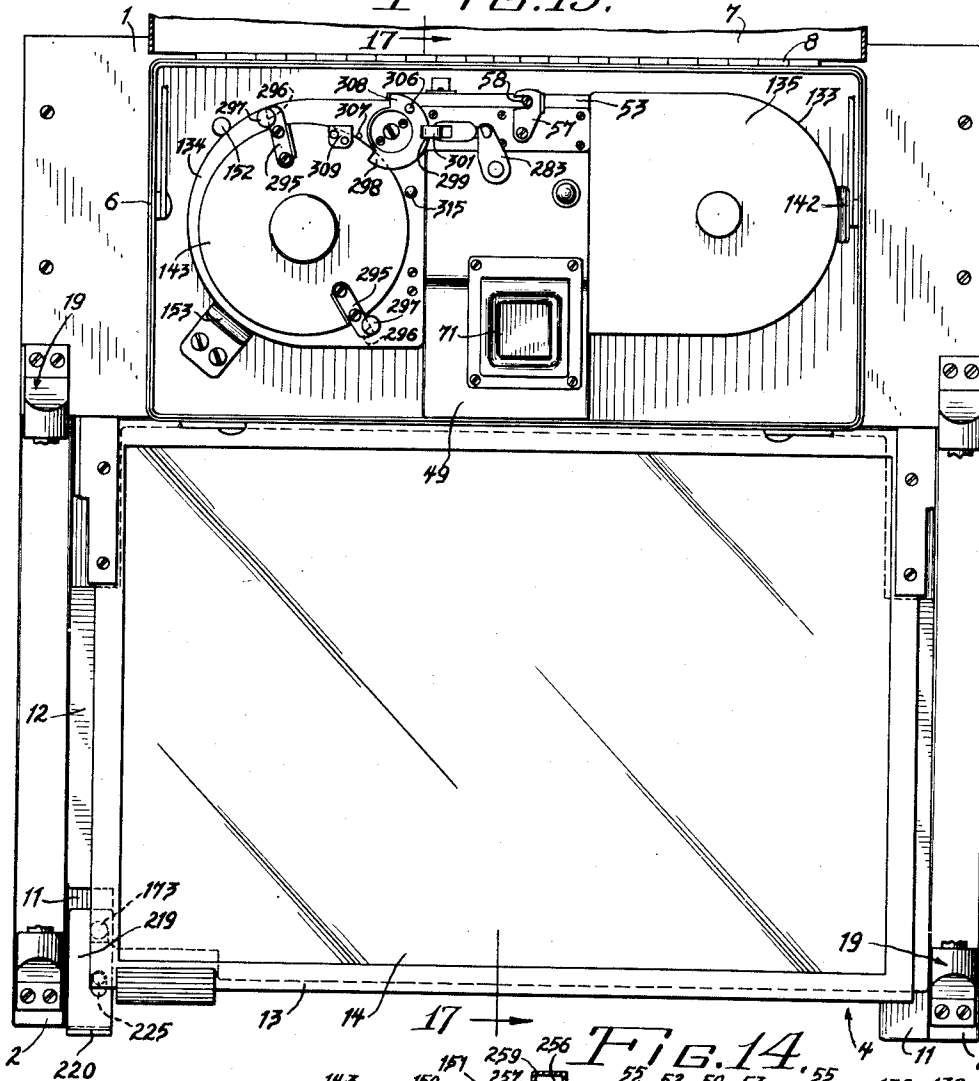


FIG. 14.

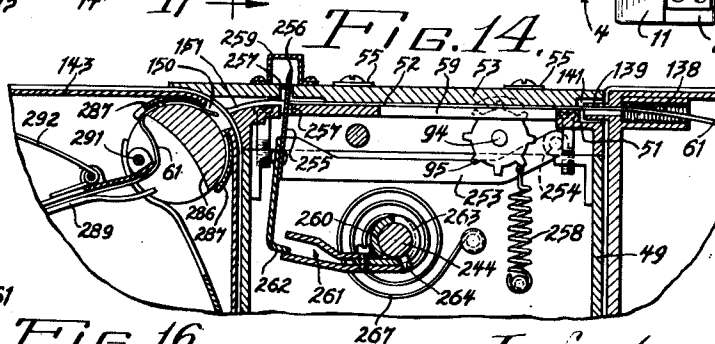


FIG. 15.

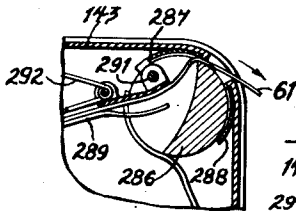
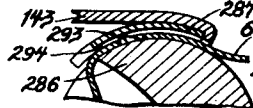


FIG. 16.



Inventor:
Emanuel Goldberg
By Robert C. Minter, Atty.

Sept. 22, 1953

E. GOLDBERG

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 7

FIG. 17.

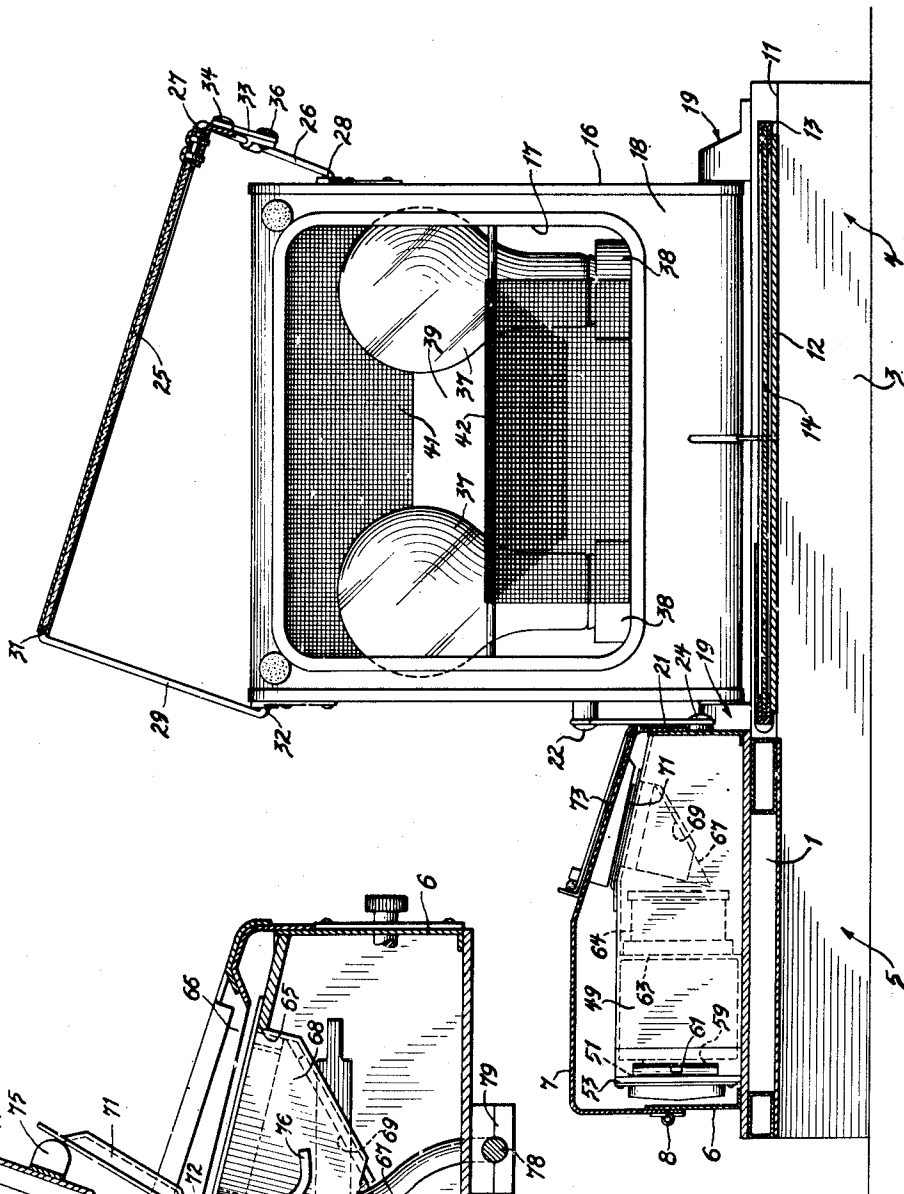
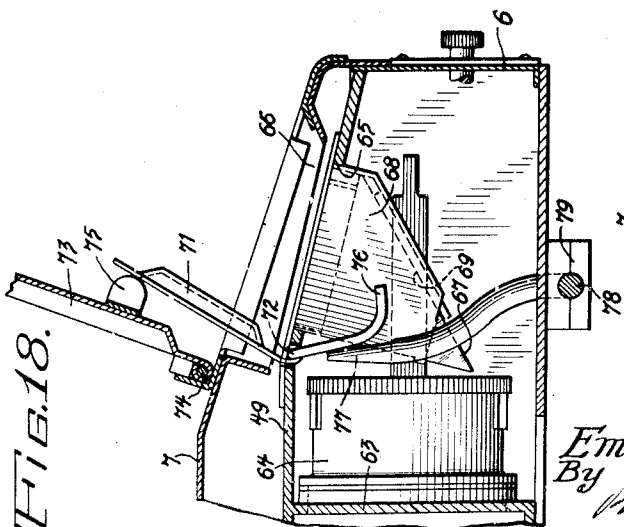


FIG. 18.



Inventor:
Emanuel Goldberg.
By *Walter K. Minter, Jr.* Atty.

Sept. 22, 1953

E. GOLDBERG

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 8

FIG. 19.

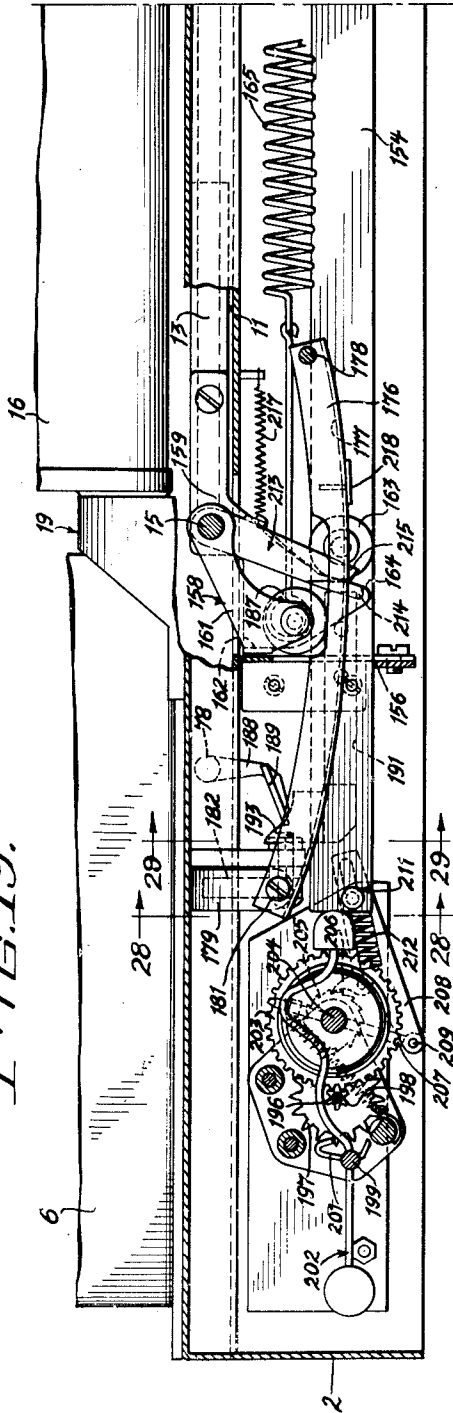
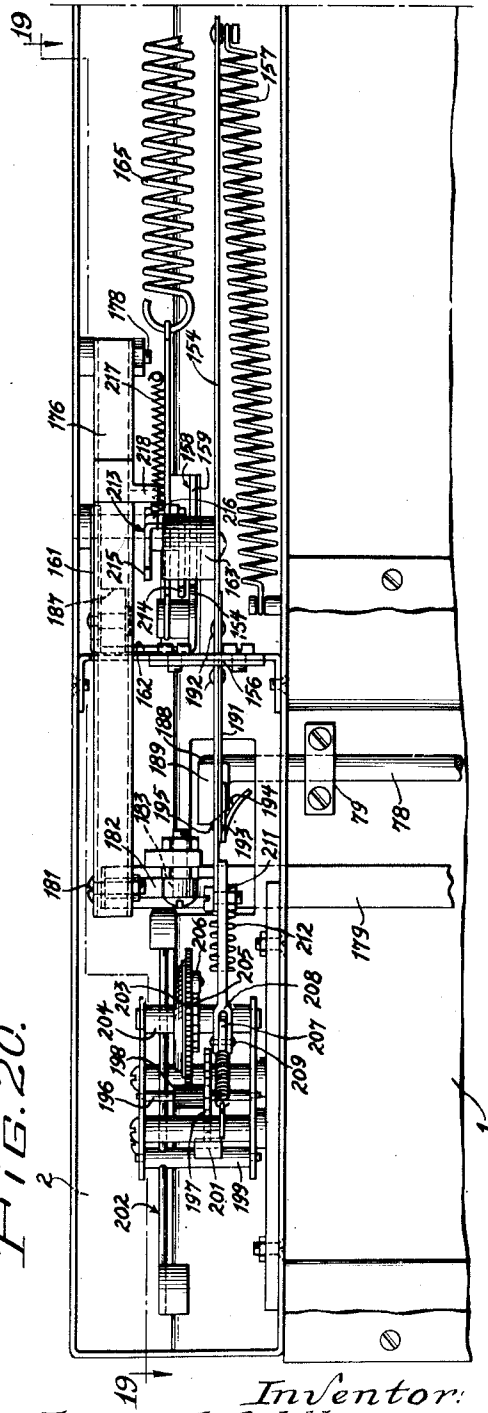


FIG. 20.



Inventor:
Emanuel Goldberg
By *Robert A. Hirsch, Jr.* Atty.

Sept. 22, 1953

E. GOLDBERG

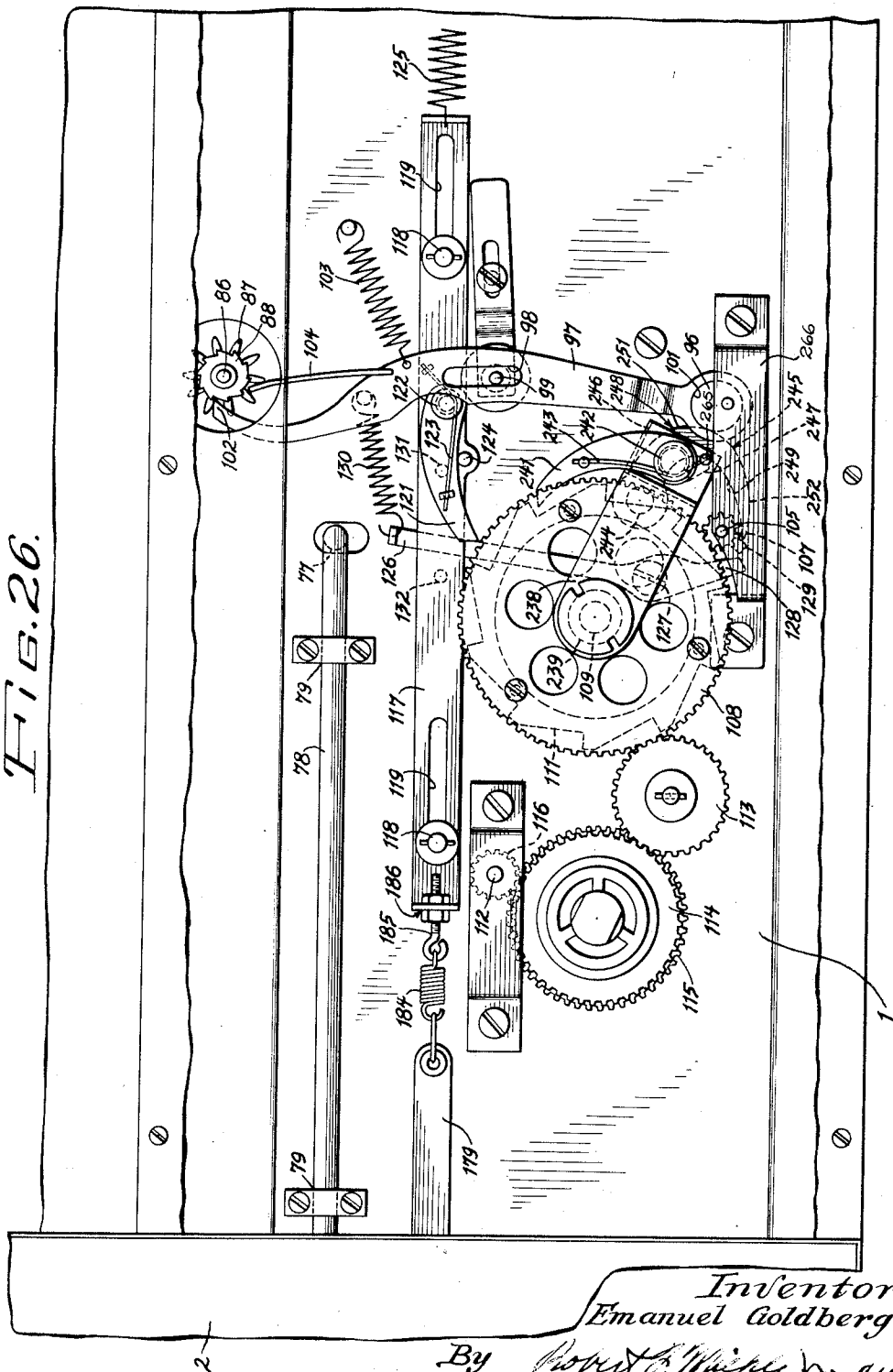
2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 10

FIG. 26.



Inventor:
Emanuel Goldberg

By Robert C. Winkler, Jr. Atty.

Sept. 22, 1953

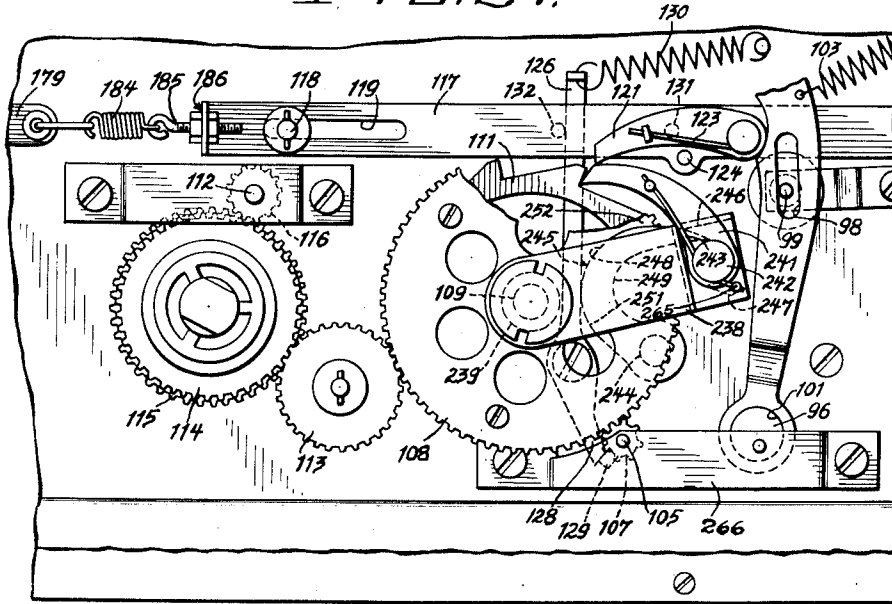
E. GOLDBERG

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 11

FIG. 27.

FI G. 28.

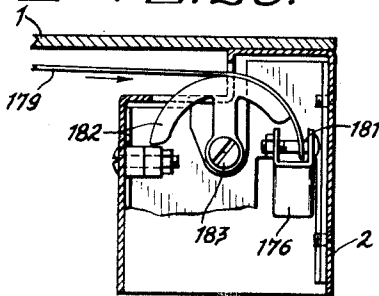


FIG. 29.

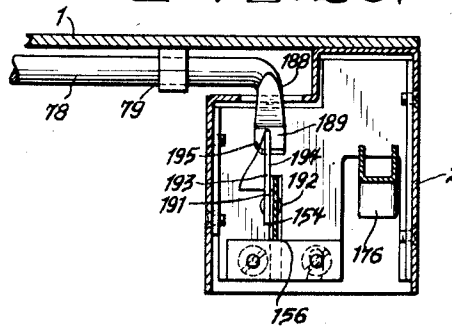


Fig. 30.

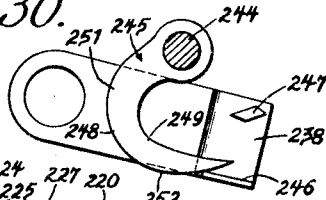
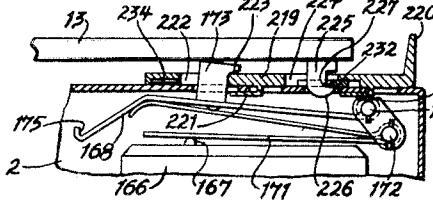


FIG. 31.



252
221
169
Inventor:
Emanuel Goldberg
By David B. Mink, Jr. Atty.

Sept. 22, 1953

E. GOLDBERG

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 12

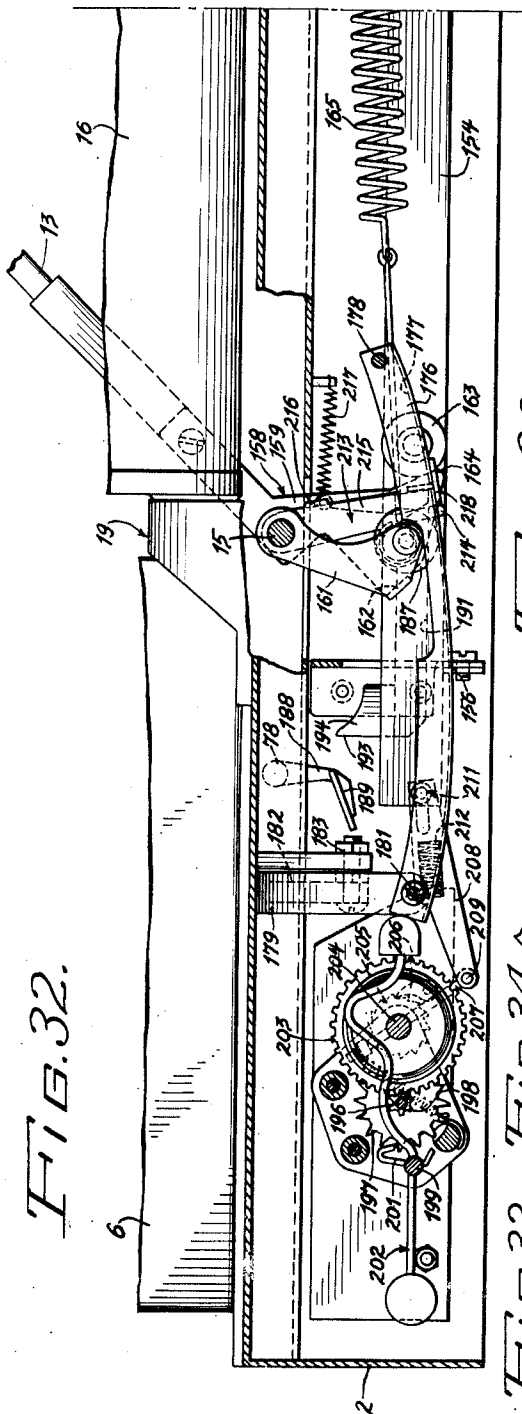


FIG. 32.

FIG. 36.

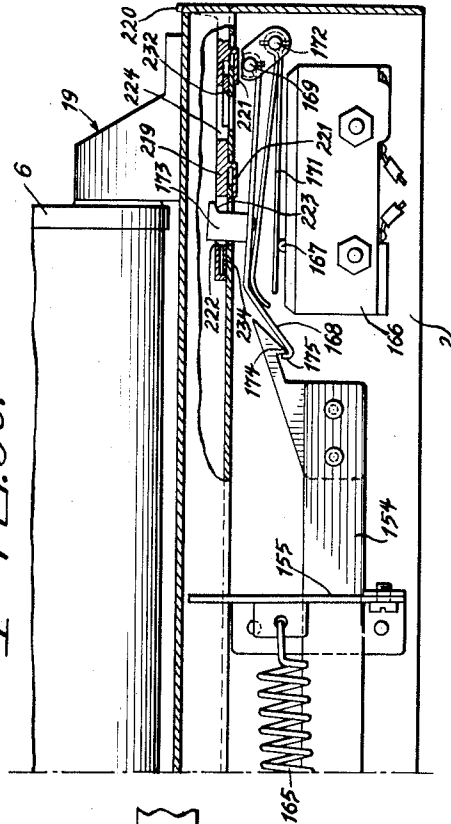
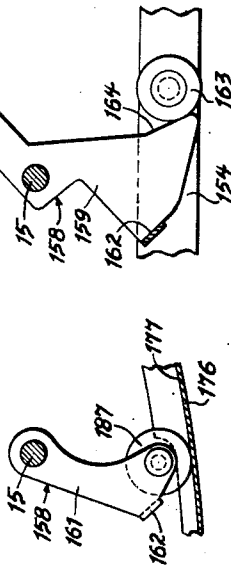


FIG. 33

FIG. 34



Sept. 22, 1953

E. GOLDBERG

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 13

FIG. 37.

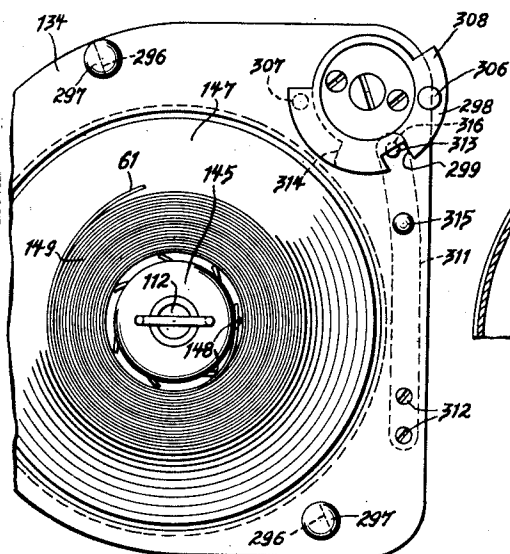


FIG. 38.

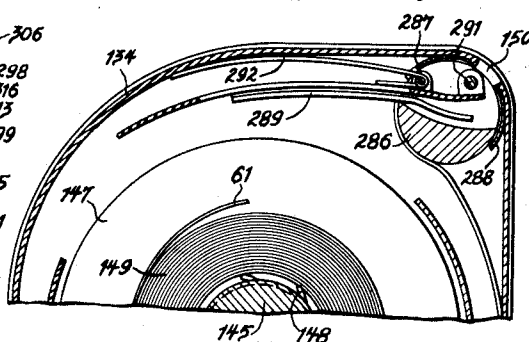
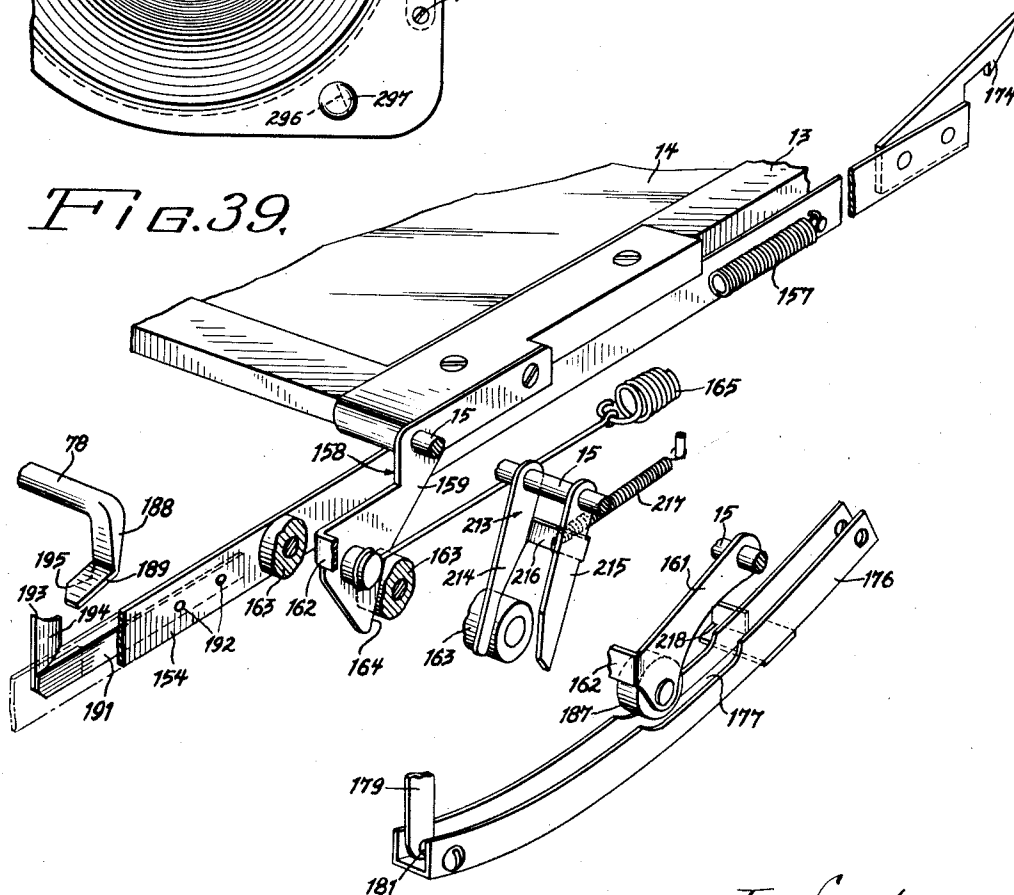


FIG. 39.



Inventor:
Emanuel Goldberg
By Robert F. Mickle, Jr. Atty.

Sept. 22, 1953

E. GOLDBERG

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Filed June 1, 1950

14 Sheets-Sheet 14

FIG. 40.

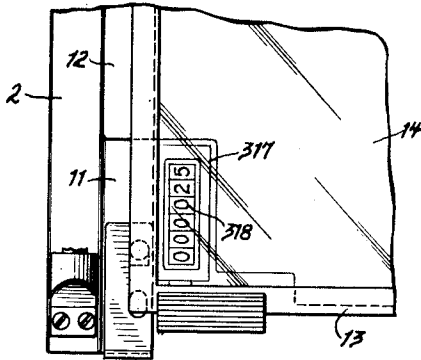


FIG. 43.

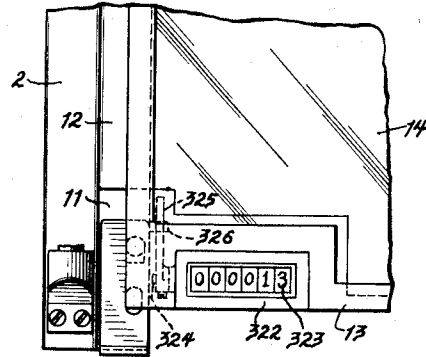


FIG. 41.

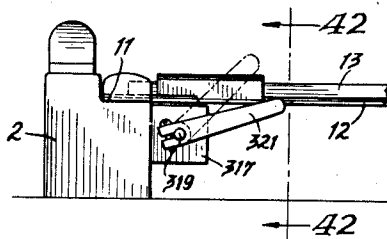


FIG. 44.

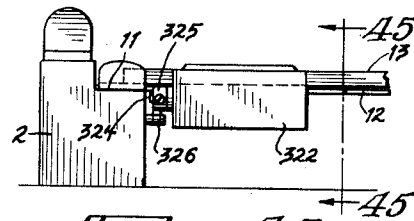


FIG. 42.

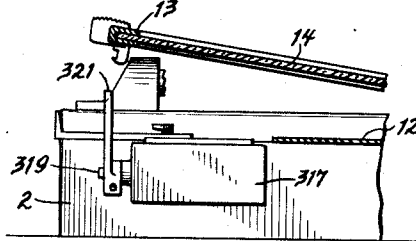


FIG. 45.

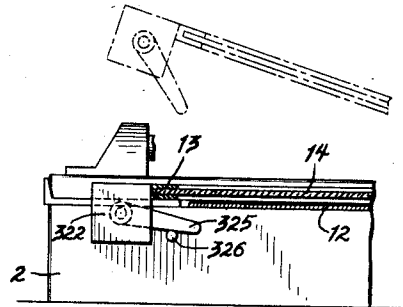
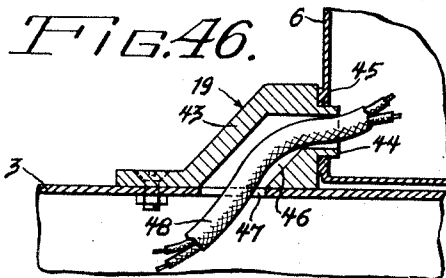


FIG. 46.



Inventor:
Emanuel Goldberg
By Robert C. Miehle, Atty.

UNITED STATES PATENT OFFICE

2,652,744

PHOTOGRAPHIC COPYING APPARATUS

Emanuel Goldberg, Tel Aviv, Israel, assignor to
Bell & Howell Company, a corporation of Illinois

Application June 1, 1950, Serial No. 165,422

14 Claims. (Cl. 88—24)

1

My invention relates to photographic copying apparatus which is particularly adapted for producing microfilm records of documents, books or other articles although not limited to this use alone.

Objects of the invention reside in the provision of a novel, efficient and conveniently operated photographic copying apparatus, which is of compact arrangement, which embodies foldably related parts permitting the apparatus to be reduced to a compact size for convenient portability, which provides for the automatic accurate relative positioning of the foldably related parts when they are in extended functioning position, which provides for the convenient photographing of single sheets, books or other articles, which accommodates relatively large books or other articles, which has the mechanism thereof of desirably arranged particularly for the photographing of books, which, being of the folded light path type, provides for the double reflection of the image bearing light so that the image photographed on the film is properly handed, which provides for the image bearing light path being disposed at a desirably small angle of incidence to a reflector of the optical system, which provides for the placing of the reflector relative to the camera lens so that the optical quality of the reflector is of secondary importance, which provides for equalizing the illumination of the article being photographed, which, embodying a transparent platen, provides for the prevention of undesirable reflection therefrom, which embodies mechanism whereby the several functions entering into the photographing operation, such as advancing the film, turning the illumination on and off, and operation of the exposure shutter, are automatically effected in proper sequence, and the photographing operation is under the control of a single manually actuated control member so that the operator merely actuates the control member to effect each photographing operation, which embodying a platen which is manually movable to facilitate the positioning of documents or other articles for the photographing thereof and the removal of the same, utilizes the platen to control the photographing operation, which, embodying the manually operated platen, utilizes movement thereof, preferably in the direction away from its sheet engaging position, to advance the film and/or cock the exposure shutter, and final movement of the platen into its sheet engaging position to effect actuation of the exposure shutter, which embodies means whereby movement of the platen

2

plate to the extent necessary to fully advance the film and/or to cock the exposure shutter is indicated to the operator so that assurance is provided that each article is photographed, which, after the film has been advanced for the exposure of a frame thereof, prevents further inadvertent advance of the film until an exposure of this frame has been made, which is provided with an exposure counter for automatically recording the number of photographing operations performed, which counter is operated directly by the movable platen plate, which counter is arranged so that its indications are photographed simultaneously with the articles and is preferably mounted on the movable platen plate, which, embodying a camera having a light tight take up magazine removably mounted thereon and provided with a film entry passage and a light valve for closing the film passage to exclude light and for opening the same for the passage of the film, provides for preventing the magazine being mounted in the camera when the film passage is closed, which provides for the light valve drawing a projecting film end into the magazine when the light valve is closed, which provides for the light valve controlling a film guide in the taken up magazine, which guide is normally urged toward the hub of a driven removable spool in the magazine to guide a film end to the hub to be gripped thereby, to position the guide away from the spool and a film roll thereon for the removal of the spool and the film roll from the magazine, which provides for conveniently cutting off at will the exposed portion of a film in the camera from the unexposed portion of the film and removing the exposed film portion in the light tight take up magazine for development, so that it is unnecessary to wait until the film is fully exposed or waste the unexposed portion of the film in order to remove and develop an immediately wanted exposed portion of the film, which provides for the operation of the film cutting device of the camera and the valve of the take up magazine in timed relation from a common actuating member for facilitating the cutting off and removal of an exposed film portion, and which provides for the desirable mounting of the actuating member or handle of the film cutter and magazine valve operating mechanism on the access cover of the camera casing and a disengageable connecting means between the handle and the film cutter and magazine valve to permit opening of the camera casing cover.

The invention will be more readily understood

by reference to the accompanying drawing forming a part hereof and in which—

Figure 1 is a perspective view of a photographic copying apparatus embodying my invention and showing it in folded compact condition;

Figures 2 and 3 are respectively rearwardly and forwardly directed perspective views of the apparatus showing it in expanded or functioning condition;

Figure 4 is a partial perspective view of the apparatus taken similarly to Figure 2 and showing the apparatus as used for copying pages of a book;

Figure 5 is a horizontal sectional view of the photographic camera of the apparatus;

Figure 6 is a partial sectional view taken substantially on the line 6—6 of Figure 5;

Figure 7 is a partial sectional view taken substantially on the line 7—7 of Figure 5;

Figure 8 is a partial sectional view taken substantially on the line 8—8 of Figure 5;

Figure 9 is a partial sectional view taken substantially on the line 9—9 of Figure 5;

Figure 10 is a partial interior view taken substantially on the line 10—10 of Figure 9;

Figures 11 and 12 are partial sectional views taken substantially on the line 11—11 of Figure 9;

Figure 13 is a top plan view of the apparatus with parts omitted and with the access cover of the camera in open position and partially broken away;

Figure 14 is a partial horizontal sectional view, similar to Figure 5, of a portion of the camera;

Figure 15 is a partial sectional view taken similarly to Figure 14 and showing parts in different positions from those in which they are shown in Figure 14;

Figure 16 is an enlarged partial horizontal sectional view of certain of the parts shown in Figures 14 and 15 and showing further details thereof;

Figure 17 is a sectional view taken substantially on the line 17—17 of Figure 13;

Figure 18 is an enlarged partial sectional view taken similarly to Figure 17 and showing further details and parts in different positions than those in which they are shown in Figure 17;

Figure 19 is a partial sectional view taken substantially on the line 19—19 of Figure 20 with the related bottom cover of the casing removed;

Figure 20 is a partial bottom plan view of the same portion of the apparatus as is shown in Figure 19 and with the corresponding bottom cover of the casing removed;

Figure 21 is a partial sectional view and is a continuation of Figure 19;

Figure 22 is a partial bottom plan view and is a continuation of Figure 20;

Figure 23 is a partial view taken substantially on the line 23—23 of Figure 21;

Figure 24 is a partial section taken substantially on the line 24—24 of Figure 21;

Figure 25 is a partial section taken substantially on the line 25—25 of Figure 21;

Figure 26 is a partial bottom plan view with the corresponding bottom cover of the casing broken away;

Figure 27 is a view similar to Figure 26 with parts broken away and showing parts in different positions from those in which they are shown in Figure 26;

Figure 28 is a partial sectional view taken substantially on the line 28—28 of Figure 19;

Figure 29 is a partial sectional view taken substantially on the line 29—29 of Figure 19;

Figure 30 is a view of certain parts shown in Figures 26 and 27 and showing them in top plan;

Figure 31 is a partial sectional view taken similarly to Figure 21 and showing parts in different positions than those in which they are shown in Figure 21;

Figure 32 is a partial sectional view taken similarly to Figure 19 and showing parts in positions different from those in which they are shown in Figure 19;

Figures 33, 34 and 35 are detail sectional views of different portions of the mechanism shown in Figure 32;

Figure 36 is a partial sectional view taken similarly to Figure 21 and showing parts in positions different from those in which they are shown in Figure 21;

Figure 37 is a partial top plan view of the film take up magazine of the camera with the cover of the magazine removed;

Figure 38 is a partial horizontal sectional view of the film take up magazine of the camera;

Figure 39 is an exploded and condensed perspective view of a portion of the mechanism;

Figures 40, 41 and 42 illustrate a modification of the exposure counter mechanism of the apparatus and respectively are a partial top plan view, a partial view in front elevation, and a partial sectional view taken substantially on the line 42—42 of Figure 41;

Figures 43, 44 and 45 illustrate another modification of the exposure counter mechanism of the apparatus and respectively are a partial top plan view, a partial view in front elevation, and a partial sectional view taken substantially on the line 45—45 of Figure 44; and

Figure 46 is an axial sectional view of one of the lamp house pivots of the apparatus.

Referring to the drawing, the base of the apparatus comprises a casing of flat character enclosing the major portion of the mechanism, and the casing is of horizontal U shape of which the transverse portion 1 is disposed rearwardly and of which the legs 2 and 3 extend forwardly from the transverse portion and form an opening 4 therebetween. See Figures 1 to 4 inclusive, 13 and 17. The transverse portion 1 is of lesser height than the legs 2 and 3 and is disposed at the upper portions of the legs and is elevated from the bottom of the base at least to the plane of the photographing position of a sheet article, as hereinafter described, so as to provide an opening 5 thereunder, which forms a rearward horizontal continuation of the corresponding portion of the opening 4 as best shown in Figure 17. An elongated camera casing is mounted on the top of the transverse base portion and extends therealong, and comprises a lower portion 6 fixed on the transverse base portion and an upper access cover 7 which is hinged, as designed at 8, to the lower portion at the rear of the camera casing to provide access thereto, the covering being secured in closed position by releasable latches 9 at the ends of the camera casing of which one is shown in Figure 3.

The inside longitudinal portions of the tops of the base legs 2 and 3 are downwardly offset a short distance to provide ledges 11, and an easel 12 is engaged downwardly on these ledges and extends across the opening 4 to provide a horizontal support downwardly on which documents or other sheet material are placed for the photographing thereof, see Figures 1, 2 and 17, the

easel establishing the photographing position of a sheet article supported on the easel in a plane spaced upwardly from the bottom of the base and above a space clear of the base and being detachably secured on the ledges in a suitable manner so that it may be removed for a purpose hereinafter appearing. A platen, comprising a marginal metal frame 13 and a transparent member 14 mounted in the frame, is arranged above the easel and is pivoted on a horizontal axis at the rear thereof immediately forward of the transverse base portion 1 by means of oppositely projecting aligned pivot studs 15 fixed with the frame 13 and respectively projecting into the base legs 2 and 3 and pivotally mounted thereon, one of these studs being shown in Figures 19, 32 and 39. As so pivotally mounted, the platen 13-14 is mounted for pivotal movement, on a rearwardly disposed horizontal axis transverse to the base legs, from a lower horizontal position overlying the easel 12, see Figures 1, 13 and 17, for holding a document or sheet flat on the easel for the photographing thereof through the transparent platen member 14, to an upper inclined position, see Figure 32, in which documents or sheets may be conveniently placed on and removed from the easel.

Two lamp housings 16 of generally rectangular shape, see Figures 1 to 4 inclusive and 17, have light openings 17 through oppositely related long sides 18 thereof and are respectively pivoted on and above the base legs 2 and 3, by means of bearings generally designated at 19, on parallel horizontally spaced axes extending forwardly and rearwardly and longitudinally of the base legs and transversely of the pivotal axis of the platen and adjacently spaced above respective of the tops of the base legs and disposed at ends of the lamp housings adjacent the oppositely related sides 18 thereof, so that the lamp housings may be positioned in either folded aligned horizontal positions extending toward each other and closely overlying the base and platen in compact relation therewith, as shown in Figure 1, or in upwardly extending functioning positions, as shown in Figures 2, 3, 4 and 17, in which the light openings 17 face toward each other and across the platen and easel.

Two restraining arms 21 are pivotally mounted, as designated at 22 in Figure 3, respectively on the rear walls of the lamp housings on axes spaced longitudinally of the lamp housing from the pivotal axes thereof, and these arms are provided with longitudinal slots 23 which are slidably and pivotally engaged respectively on transversely spaced studs 24, see Figures 2 and 4, mounted on the front of the fixed camera casing portion 6, so that these arms limit outward movement of the lamp housings and thus establish the upwardly extending functioning positions of the lamp housings, as shown in Figures 2, 3 and 4, and permit the lamp housings to be positioned in their folded horizontal positions, as shown in Figure 1, in which the arms are disposed within the vertical and transverse limits of the lamp housings.

A rectangular downwardly directed reflector 25 is arranged above the platen 13 and 14, and is carried with the lamp housings 16 by a suitable folding structure for movement with and with respect to said lamp housings so that when the lamp housings 16 are in their folded horizontal positions, as shown in Figure 1, the reflector is parallel to the base and closely overlies the lamp housings, and when the lamp housings are in their upwardly extending functioning positions, 75

as shown in Figures 2, 3, 4 and 17, the reflector is positioned in its functioning position upwardly spaced from the platen 13-14 and the lamp housings and is inclined in a vertical plane traversing the sides of the photographing position adjoining the sides thereof at which the lamp housings are disposed and upwardly and rearwardly at a small angle to a horizontal plane for reflecting an image of an article below the platen, such as a document on the easel 12, downwardly and rearwardly of the platen and easel for the photographing of the article as hereinafter described, the aforesaid folding structure comprising as follows:

Two arms 26 have ends thereof pivotally mounted on the reflector 25 at the front thereof, as designated at 27, respectively on parallel rearwardly and forwardly extending axes spaced along the reflector and preferably as shown at the front corners thereof, see Figures 1 and 2, and have their other ends pivotally mounted respectively on the front walls of the lamp housings, as designated at 28, on forwardly and rearwardly extending axes radially spaced longitudinally of the lamp housings from the pivotal axes thereof, the pivotal mountings 28 providing a small amount of universal pivotal movement of these arms to accommodate for the tilting of the reflector as hereinafter described.

Two arms 29 have ends thereof pivotally mounted on the reflector at the rear thereof, as designated at 31, respectively on parallel rearwardly and forwardly extending axes spaced along the reflector and preferably as shown at the rear corners thereof, see Figure 3, and have their other ends pivotally mounted respectively on the rear walls of the lamp housings, as designated at 32, on forwardly and rearwardly extending axes radially spaced longitudinally of the lamp housings from the pivotal axes thereof, the pivotal mountings 32 providing a small amount of universal pivotal movement of these arms to accommodate for the tilting of the reflector as hereinafter described.

The arms 26 and 29, pivotally connected to the reflector 25 and the lamp housings 16 as above described, support the reflector in its functioning position upwardly spaced from the platen 13-14 and the lamp housings 16 and inclined upwardly and rearwardly when the lamp housings are in their upwardly extending functioning positions, as shown in Figures 2, 3, 4 and 17, and the arms 26 are shorter than the arms 29 and the spacing of the axes of the pivotal mountings 28 of the arms 26 radially from the pivotal axes of the lamp housings is less than the spacing of the axes of the pivotal mountings 32 of the arms 29 radially of the pivotal axes of the lamp housings, so that when the lamp housings are in their folded positions, as shown in Figure 1, the arms 26 and 29 position the reflector in parallelism with the base and in closely overlying relation with the lamp housings, so that the apparatus is quite compact when the lamp housings and reflector are in their folded positions for convenient portability of the apparatus.

Two restraining arms 33 are pivotally mounted on the reflector 25 at the front thereof and intermediate the pivotal mountings 27 of the arms 26, as designated at 34 in Figures 1, 2 and 3, and the arms 33 are provided with longitudinal slots 35 which are slidably and pivotally engaged on respective of studs 36 respectively secured on the intermediate portions of the arms 26, so that the arms 33 limit pivotal movement of the

arms 26 upwardly with respect to the reflector when the lamp housings and reflector are in their extended functioning positions to fix the reflector against transverse shifting and rocking movement and to resist downward pressure on the reflector, see Figures 2 and 3, and permit the lamp housings and reflector to be positioned in their folded positions, as shown in Figure 1, in which the arms 33 are disposed within the vertical and transverse limits of the lamp housings.

Two incandescent electric lamps 37 are arranged within each lamp housing 16 and are arranged in rearwardly and forwardly spaced relation opposite the light opening 17 thereof, the lamps being mounted in usual sockets 38. See Figure 17. The lower portions 39 of the interior of each lamp housing is white to increase the light directed upon an article below the platen 13—14, and the upper portion 41 of the interior of each lamp housing is black in order to avoid spots on a film being exposed due to specular reflection from this portion of the lamp housing in the transparent member 14 of the platen. A light reducing screen 42, such as a wire screen, is placed across the lower portion of the light opening 17 of each lamp housing in front of the lamps to reduce excessive illumination on the parts of the easel adjacent the lamps. The lamp housings, when in functioning positions, are inclined outwardly, as shown, at such an angle that the virtual image of the lamps which is formed by reflection in the transparent member 14 of the platen, is not reimaged on the film by the camera lens hereinafter referred to.

Referring to Figure 46, one bearing 19 of each of the lamp housings comprises a bearing member 43 secured downwardly on the top wall of the corresponding base leg 2 or 3 and having a horizontally projecting stud bearing portion 44 about which a bored bearing member 45 in a wall of the lamp housing is engaged for pivotal movement. The bearing member 43 is provided with an angled bore 46 therethrough which extends through the bearing portion 44 and thus communicates with the interior of the lamp housing and which communicates with the interior of the corresponding base leg through an aperture 47 in the top wall of the base leg. An electric cable 48 extends from the interior of the base leg, through the aperture 47 and bore 46 and into the lamp housing for energizing the lamps within the lamp housing, so that the cable is concealed.

A camera is arranged closely adjacent the rear side of and directed toward the aforesaid photographing position and has its optical axis substantially parallel to and adjacent the plane of the photographing position, and includes a forwardly and rearwardly extending hollow camera body 49 which is arranged within the camera casing 16—17 intermediately thereof and is secured on the transverse base portion 1. See Figures 5, 6 and 9. The rear wall 51 of the camera body is spaced forwardly of the rear wall of the camera casing, see Figures 5 and 9, and is provided with a vertically disposed horizontally extending film guide extending transversely of the apparatus and comprising a rearwardly facing guide channel 52 in the rear face of this wall and a pressure plate 53 engaged in the guide channel and provided with longitudinally extending shoulders 54 at the sides thereof, which cooperate with the shoulders formed by the guide channel to light seal the sides of

the film guide. Leaf springs 55 are secured on the rear face of the pressure plate 53 at spaced points along the same and extend downwardly therefrom through apertures 56 through the top wall of the transverse base portion 1 to yieldably hold the lower portion of the pressure plate forwardly in engagement with the guide channel, and a latch arm 57, see Figures 9 and 13, pivoted on the top wall of the camera body and an upwardly projecting pin 58 on the top of the pressure plate, with which this latch is releasably engageable, cooperate with the springs 55 to hold the pressure plate forwardly for guiding a film in the guide. Release of the latch arm 57 from the pin permits the pressure plate to tilt rearwardly for insertion and removal of a film in the guide, and when so released the pressure plate may be easily removed or installed by withdrawal of the springs 55 from the apertures 56 or insertion of the same therein.

The rear wall 51 of the camera body is provided with an exposure aperture 59 through which a film 61 in the guide is exposed, see Figure 6, the film for which the camera is adapted being standard 35 mm. motion picture film provided with spaced feed perforations 62 along each edge thereof.

The camera body 49 is provided with an interior transverse partition 63 disposed intermediate the ends thereof, see Figures 5 and 9, and a camera lens 64 is mounted in an opening through this partition and is disposed on a rearwardly and forwardly extending horizontal axis centered with the exposure aperture 59 for photographically exposing film at the aperture. The forward portion of the top wall of the camera body forwardly of the lens 64 is provided with a light opening 65, see Figures 9 and 18, and the corresponding portion of the camera casing cover 7 is provided with a light opening 66, so that light may enter the camera body forwardly of the lens in a downward and rear direction. A right angle optical prism 67 is mounted, by means of a bracket 68 secured on the top wall of the camera body, within the camera body and forwardly of the camera lens in such position that its hypotenuse face 69 which acts as a reflecting surface, is internally directed rearwardly and upwardly for reflecting an image of an article below the platen 13—14 from the reflector 25, which is directed toward the camera, horizontally rearward through the camera lens for the photographing of the article on the film at the exposure aperture 59.

The reflector 25 is disposed approximately midway of the optical distance between the easel 12 or the position of the articles being photographed and the camera lens 64 so that the reflector is far enough from the camera lens that its optical quality is of secondary importance, and the angle of incidence of the light path with respect to this reflector is small, preferably not greater than approximately 25°, so that the separation of the two images formed by separate reflections at the front and rear surfaces of this reflector, in case it is a rear surface reflector, is minimized. Where two reflectors are used in the optical system, as shown, the image photographed on the film is properly handed.

A shutter 71 is pivotally mounted on a rearwardly disposed axis, as designated at 72, on the top wall of the camera body 49 for movement from a lower position closing the light opening 65 of the camera body, as shown in Figures 9 and 17, to an upper position opening the light opening

66 as shown in Figure 18, and a shutter 73 is pivotally mounted on a rearwardly disposed axis, as designated at 74, on the camera casing cover 7 for movement from a lower position closing the light opening 66 of the cover 7, as shown in Figures 9 and 17, to an upper position opening the light opening 66 as shown in Figure 18. The shutters are yieldably urged by gravity into their closed positions, and the shutter 73 is provided with downwardly projecting lugs 75 upwardly against which the shutter 71 engages to open and close the shutter 73 simultaneously with opening and closing of the shutter 71, these shutters forming the exposure shutter of the camera and the shutter 73 serving to light seal the camera casing 6-7 when photographs are not being made as a precaution though the film in the camera is protected from being light struck, as hereinafter described, even though the casing cover 7 is opened. The shutter 71 is provided with a downwardly projecting arm 76 by means of which the shutters 71 and 73 may be actuated, see Figures 7 and 18, and an upwardly projecting arm 77, fixed on a transversely extending horizontal shaft 78 within the transverse base portion 1 and pivotally mounted on bearings 79, forwardly engages the arm 76 for opening and closing the shutters 71 and 73 with opposite pivotal movement of the shaft.

The camera lens 64 is provided with a usual adjustable diaphragm including an angularly movable adjusting ring 81, see Figures 5 and 8, and the ring is adjustable by means of a rotatable knob 82 on the front of the lower camera casing portion 6 and connected with the adjusting ring by a suitable mechanism, generally designated at 83, and including a forwardly extending arm 84 fixed on the adjusting ring.

An exposure counter of suitable construction, generally designated at 85 in Figures 5, 8 and 9, is driven from a vertical rotatably mounted shaft 86 which projects downwardly into the transverse base portion 1 and terminates therein with a toothed detent wheel 87 and a ratchet wheel 88 both of which are fixed on the shaft. The counter is inclusive of forwardly facing numbered indicating dials 89 and 91 which are visible through openings 92 in the front wall of the lower camera casing portion 6, see Figures 2 and 4, and setting knobs 93 on the exterior of this front wall.

A vertical shaft 94, see Figures 5, 6 and 9, is rotatably mounted on the camera body 49 a short distance forwardly of the rear wall 51 thereof, and a sprocket 95 is fixed on the upper end of this shaft for rotation therewith. The teeth of the sprocket project into the film guide 52-53 and are engaged with the lower series of longitudinally spaced perforations 62 of the film 61, so that as the film is fed, the sprocket and its shaft are rotated. An eccentric 96 is fixed on the lower end of the shaft 94 within the transverse base portion 1 for rotation with the shaft. A horizontal forwardly and rearwardly extending arm 97, see Figure 26, within the transverse body portion 1, is provided with a longitudinally extending slot 98 at the intermediate portion thereof which is loosely engaged for sliding and pivotal movement on a vertical pin 99 carried on the transverse body portion.

The forward end of the arm 97 is bored, as designated at 101, and is rotatably engaged on the eccentric 96, and the other end of the arm is in the form of a ratchet pawl 102 which is engageable with the ratchet wheel 88 of the counter shaft 86 for rotating the same with longitu-

dinal reciprocation of the arm 97 which is effected by rotation of the film engaged sprocket 95, shaft 94 and eccentric 96 as the film 61 is fed in the guide, a spring 103, connected with the arm 97, serving to yieldably urge the pawl 102 into engagement with the ratchet wheel 88.

Thus, the counter is actuated by the feeding of the film in the guide to indicate the number of exposures made. In order to prevent the pawl from causing retrograde movement of the counter drive shaft 86 during return movement of the pawl, the arm 97 is provided with a branch arm 104 which, as the arm 97 reciprocates, successively engages and disengages from between the teeth of the detent wheel 87 to prevent the pawl from causing retrograde movement of the shaft as the pawl slides over a tooth of the ratchet wheel.

A vertical shaft 105, see Figures 5, 6 and 9, is rotatably mounted in the camera body 49 a short distance forwardly of the rear wall 51 thereof and transversely spaced from the shaft 94, and a sprocket 106 is fixed on the upper end of this shaft for rotation therewith. The teeth of this sprocket project into the film guide 52-53 and are engaged with the upper series of longitudinally spaced perforations 62 of the film 61, so that as this sprocket and its shaft are rotated the film is fed in the guide.

The lower end of the shaft 105 projects into the transverse base portion 1 and has a gear pinion 107 fixed thereon for rotation therewith. See Figures 6 and 26. A large gear 108, within the transverse base portion 1, is rotatably mounted on a vertical axis, as designated at 109, and meshes with the gear pinion 107 for rotating the same and the sprocket 106 to feed the film, and a ratchet wheel 111 is secured on the gear 108 for rotation therewith. The gear 108 is also connected with a vertical rotatable film take up spool drive shaft 112 by a train of gears within the transverse base portion 1 and comprising a rotatable gear 113 meshing with the gear 108 and with a rotatable gear 114, a rotatable gear 115 disposed coaxial with the gear 114 and having a usual friction slip driving connections therewith and a rotatable gear 116 fixed on the lower end of the shaft 112 for rotation therewith and meshing with the gear 115.

A shift bar 117 within the transverse base portion 1, see Figures 26 and 27, extends transversely and is mounted for longitudinal reciprocating movement by means comprising transversely spaced bearing studs 118 slidably engaged in respective of longitudinally spaced longitudinal slots 119 through the shift bar. A pawl 121 is pivotally mounted on the shift bar 117, as designated at 122, and is yieldably urged toward the ratchet wheel 111 by a spring 123, this movement of the pawl being limited by a pin 124 on the shift bar. A spring 125 yieldably actuates the shift bar to the right in Figures 26 and 27 and normally maintains it in its right position, and movement of the shift bar to the left effects engagement of the pawl 121 with a tooth of the ratchet wheel 111 and angular movement of the ratchet wheel and gear 108 counterclockwise and consequent rotation of the sprocket 106 and feed of the film 61 in the film guide 52-53 to bring another frame of the film into registry with the exposure aperture, and rotation of the film take up drive shaft 112 to take up the fed film as hereinafter described. When the power actuating the shift bar 117 to the left is discontinued, the spring 125 returns the shift bar to its right

position preparatory to another film feeding operation.

A stop arm 126, within the transverse base portion 1, is intermediately pivotally mounted, as designated at 127, and one end 128 thereof is in the form of a stop which is movable with pivotal movement of the stop arm into and out of the path of a radial stop pin 129 fixed on the feed sprocket shaft 105 for rotation therewith. A spring 130 is connected to the stop arm 126 and yieldably urges and normally maintains the stop arm in a position, see Figure 26, in which the end 128 is out of the path of the pin 129. A pin 131 fixed on the shift bar 117 engages the stop arm 126 as the shift bar reaches its left position and actuates the arm against the spring 130 to place the stop end 128 in the path of the stop pin 129 to accurately stop rotation of the film feed sprocket 106 and consequent feeding of the film. The film feed stopping position of the stop arm 126 is shown in Figure 27, but in this figure the stop arm is so positioned by means other than the pin 131 as hereinafter described. A second pin 132, fixed on the shift bar 117 and spaced to the left of the pin 131, engages the arm 126 with final movement of the shift bar to the right to move the arm end 128 out of the path of the stop pin 129 to assure release of the stop pin.

Referring to Figures 5, 6 and 13, lighttight film supply and film take up magazines 133 and 134 are removably mounted in the camera casing 6—7 respectively on opposite sides of the camera body 49. The film supply magazine 133 is provided with a removable top cover 135 for access thereto and contains a usual film spool 136 removably and rotatably mounted therein and carrying a roll 137 of the film 61. The supply magazine is provided with a light sealed film exit passage 138 for the film, see Figure 5, and is provided with a projecting portion 139 continuing the exit passage and engaging into an enlargement 141 of the corresponding end of the film guide 52—53 to provide a light seal between the film guide and supply magazine, the supply magazine being held in the camera casing and against the camera body 49 by an upwardly projecting spring clip 142 fixed with the lower camera casing portion 6.

The film take up magazine 134 is provided with a removable top cover 143 for access thereto, see particularly Figure 6, and is provided with an inwardly flanged central opening 144 through the bottom wall thereof and upwardly through which the take up spool drive shaft 112 projects when the take up magazine is mounted in the camera casing 6—7. The take up magazine contains a removable film spool comprising a bored hub 145, the bore of which is removably engageable on the shaft 112 in angularly fixed relation therewith as is usual and as generally designated at 146, and a flange 147 at the lower end of the hub and slanted downwardly and outwardly to form a light trap with the inwardly flanged opening 144. The spool hub 145 is provided, upwardly adjacent the flange 147, with a series of film perforation engaging teeth 148, spaced about the same and inclined in the direction in which the take up spool is driven, for engagement with the lower series of perforations 62 of the film 61 for taking up the film in the form of a roll 149 on the take up spool hub 145 as the take up spool is rotated.

The take up magazine is provided with a film entry passage 150 in the region of the corresponding end of the film guide 52—53, see particularly Figure 5, and this end of the film guide is curved, as designated at 151, to guide the film into the

entry passage, the arrangement being such that the film is sealed against light in its passage from the film guide into the take up magazine. The take up magazine is held in the camera casing and against the camera body 49 by an upwardly projecting stud 152 and an upwardly projecting spring clip 153 both fixed with the lower camera casing portion 6. As the film is fed in the film guide by the rotation of the feed sprocket 106 it is drawn from the film roll 137 on the supply spool 136 and is wound on the film roll 149 on the take up spool 145—146 which is driven with the feed sprocket as above described.

A forwardly and rearwardly extending shift bar 154, within the base leg 2, is mounted for longitudinal sliding movement in spaced bearings 155 and 156 carried by the base leg. See Figures 19, 20, 21, 22 and 39. A spring 157 is connected with this shift bar and serves to yieldably actuate it rearwardly. A platen arm 158 is secured with the platen 13—14 for pivotal movement therewith at the side thereof corresponding with the base leg 2 and projects thereinto. This arm comprises, see particularly Figure 39, axially spaced arm portions 159 and 161 through apertures of which the platen pivot stud 15, associated with the base leg 2, extends and a transverse portion 162 connecting the outer ends of the arm portions to fix them together. A roller 163 is mounted on the shift bar 154 and projects laterally therefrom, and the arm portion 159 is provided with a cam portion 164 which is forwardly engageable against the roller 163 to actuate the shift bar 154 against the influence of spring 157 forwardly or to the right as the platen is removed from its lower horizontal position, as shown in Figures 19, 34 and 39, to its upper inclined position as shown in Figure 32, a spring 165 being connected with the arm portion 159 for counterbalancing the platen.

An electric switch 166 of the micro-switch type, see Figures 21, 22 and 36, is mounted forwardly within the base leg 2, and is of the normally open type and has its operating plunger 167 extending and yieldably urged upwardly to normally maintain the switch open, downward depression of the switch plunger closing the switch. A forwardly and rearwardly extending arm 168 is disposed within the base leg 2 above the switch 166, and its forward end is pivoted, as designated at 169, on a horizontal axis for vertical movement of the arm. A forwardly and rearwardly extending spring 171, of hair pin shape, is disposed between the arm 168 and the switch plunger 167, and is pivoted at its closed forward end, as designated at 172 on a horizontal axis for vertical movement of the spring. The legs of the spring 171 respectively engage the switch plunger 167 and the arm 168, and reacting on the switch plunger, the spring 171 yieldably urges the arm upwardly and normally maintains it in such position as shown in Figure 36, the spring, not shown, of the switch plunger 167 being of sufficient strength to normally maintain the switch plunger in its upper or open position. A plunger 173 secured on the arm 168 and extending upwardly through an opening in the top wall of the base leg 2, is downwardly engaged by the frame 13 of the platen 13—14 with final downward movement of the platen into its lower horizontal position, see Figure 21, and is thereby moved downwardly to move the arm 168 downwardly and compress the spring 171 sufficiently to overcome the resistance of the spring, not shown, of the switch plunger 167 to thereby move the switch

plunger downwardly into its switch closed position.

The switch 166 is connected in series with the lamps 37 through the cables 48 to energize the lamps when the switch is closed and to deenergize the lamps when the switch is open, so that when the platen 13—14 is in its lower horizontal position overlying an article for photographing the same, the lamps are energized to illuminate the article.

A rearwardly and downwardly directed cam detent 174 is secured on the forward end of the shift bar 154, and the forward end of the arm 168 is provided with a forwardly and upwardly directed detent 175. As above described, upward movement of the platen 13—14 from its lower horizontal position actuates the shift bar 154 forwardly against the spring 157, and with final upward movement of the platen and consequent final forward movement of the shift bar the cam detent 174 cams the arm 168 downwardly against the spring 171 and passes the detent 175 whereupon the spring 171 causes the detent 175 to engage the detent 174, see Figure 36, and latch or cock the shift bar in its forward position and permit downward movement of the platen independently of rearward movement of the shift bar.

As the arm 168 is cammed downwardly by the cam detent 174, the switch 166 is momentarily closed by compression of the spring 171 and depression of the switch plunger 167 with consequent momentary energization of the lamps 37 to provide a signal to the operator that the platen has been raised high enough for the proper functioning of the mechanism.

Assuming the shift bar 154 to have been latched or cocked in its forward position, final movement of the platen 13—14 into its lower horizontal position depresses the plunger 167 and arm 168 and disengages the detent 175 on the detent 174, whereupon the shift bar is moved rearwardly by its spring 157.

An arm 176 of channel cross section extends longitudinally within the base leg 2 and has its channel 177 facing upwardly. See Figures 19, 20, 28 and 39. This arm extends past the pivotal axis of the platen 13—14, and its forward end is pivoted on the base leg 2, as designated at 178, for vertical movement of the arm. A flexible metal tape 179 has one end thereof pivotally secured, as designated at 181, on the rear end of the arm 176, and extending upwardly from the arm, the tape is trained over a guide segment within and pivotally mounted on the base leg 2 on a horizontal forwardly and rearwardly extending axis, as designated at 183, and the tape then extends from the segment horizontally and transversely within the transverse base portion 1 and has its other end connected with one end of a relatively stiff tension spring 184, stronger than the actuating spring 125 of the shift bar 117, and the other end of the spring 184 is connected with a screw 185 which is adjustably secured with the shift bar 117 as designated at 185, the spring 184 compensating for differences in movement between the tape 179 and the shift bar 117 and the adjustment of the screw 185 relative to this shift bar providing for adjustment between the tape and this shift bar.

The arm 176 being so connected to the shift bar 117, the spring 125, which actuates this shift bar to the right as shown in Figure 26, actuates this arm upwardly and normally maintains it in its upper position as shown in Figures 19 and 20. The arm portion 161 of the platen arm 158 has

a roller 187 mounted on its outer end above the arm 176, see Figures 19, 33 and 39, and when the platen 13—14 is moved upwardly from its lower horizontal position, the roller 187 moves forwardly and downwardly and engages in the channel 177, see Figures 32 and 33, and thus actuates the arm 176 downwardly and through the tape 179 and its connections with this arm and the shift bar 117, actuates this shift bar against the spring 125 and to the left in Figure 26. As a result the film feed pawl 121 engages a tooth of the ratchet wheel 111 and advances the film in the guide 52—53 to bring another frame of the film into registry with the exposure aperture of the camera as hereinbefore described. As the platen is moved downwardly from its upper position, the roller 187 moves rearwardly and upwardly and permits the spring 125 to actuate the shift bar 117 to the right in Figure 26 during which movement the pawl 121 ratchets over a tooth of the ratchet wheel 111 preparatory to another film feeding movement.

The end of the shutter actuating shaft 78 within the base leg 2, see Figures 19, 20, 32 and 39, is provided with a downwardly projecting arm 188 which terminates in a cam 189 which, when the shaft 78 is in its shutter closed position, is directed forwardly and downwardly as shown. A resilient metal arm 191 extends longitudinally of the shift bar 154 and has its forward end secured on this shift bar as designated at 192, and a shutter actuating cam 193 is secured on the rearward end of the arm 191 for movement with this shift bar and, extending transversely from this arm, is normally positioned by the resiliency of the arm 191 in alinement with the cam 189, the resiliency of this arm permitting the cam 193 to be laterally displaced from the cam 189 so as to pass thereby.

When the shift bar 154 is disposed in its forward position, as shown in Figure 32, the cam 193 is spaced forwardly of the cam 189 in alinement therewith, and when this shaft bar is moved rearwardly by its spring 157, the cam 193 engages the cam 189 and actuates it and the shutter actuating shaft 78 to open the camera shutter, above described, and sliding along the cam 189 maintains the shutter open for an interval of the rearward movement of this shift bar, after which the active portion of the cam 193 passes rearwardly of the cam 189 with further rearward movement of this shift bar to its rear position, see Figures 19, 20 and 39, and releases the cam 189 and thus effects closing of the camera shutter. When the shift bar 154 is moved forwardly from its rear position, a side cam face 194 of the cam 193 engages an opposing side cam face 195 of the cam 189 and the cam 193 is displaced laterally of the cam 189, the resilient arm 191 flexing for this purpose, and the cam 193 passes the cam 189, and when the cam 193 passes forwardly beyond the cam 189, the resilient arm 191 restores the cam 193 into alinement with the cam 189 preparatory to again opening the camera shutter with rearward movement of the shift bar 154.

A timing mechanism of usual construction is mounted within the rear end portion of the base leg 2, see Figures 19, 20 and 32, and comprises a rotatable escapement wheel shaft 196, an escapement wheel 197 and a gear pinion 198 both of which are fixed on this shaft, an oscillatory shaft 199, a pallet 201 cooperating with the escapement wheel and a pendulum 202 both of which are fixed on the shaft 199, a relatively large gear 203 rotatably mounted on an oscil-

latory shaft 204 and meshing with the pinion 198, a ratchet wheel 205 fixed on the shaft 204, a pawl 206 pivotally mounted on the gear 203 and yieldably urged into engagement with the ratchet wheel 205, a radial arm 207 fixed on the shaft 204, a link 208 pivotally connected with the arm, as designated at 209, and pivotally and longitudinally slidably connected with the rear end of the shift bar 154 by a lost motion connection, generally designated at 211, and a cushioning device, generally designated at 212, which serves to cushion the impact of the shift bar 154 on the link 208 as the shift bar moves rearwardly and takes up the lost motion of the connection 211.

Forward movement of the shift bar 154 from its rear position takes up the lost motion of the connection 211 and then actuates the shaft 204 in the direction which causes the ratchet wheel 205 to ratchet past the pawl 206 to set the timer. When the shift bar 154 moves rearwardly from its forward position under the influence of its spring 157 the lost motion of the connection 211 is first taken up, which permits quick acceleration of the shift bar, and then the shift bar actuates the link 208 through the cushioning device 212 and consequently actuates the ratchet wheel 205 in the direction to drive the pawl 206 and gear 203, so that the velocity of the shift bar farther in the rearward direction is controlled by the timer, and it is during the interval in which the velocity of the shift bar is controlled by the timer that the camera shutter is opened and closed, so that the exposure interval of the shutter is controlled by the timer.

Assuming that the mechanism is in the condition thereof after a photographing cycle has been completed, an exposed portion of the film is at the exposure aperture 59 of the camera, the camera shutter 51—53 is closed, the illumination control switch 166 is open and the illuminating lamps thus deenergized, the film shift bar 117 is in its spring urged position at the right in Figure 26, the main shift bar 154 is in its spring urged rear position, the camera shutter cams 189 and 193 are in uncocked relation, the timer is in unset condition, and the platen 13—14 is in a lower position. See Figures 9, 19, 20, 21, 22, 26 and 39.

Upward movement of the platen 13—14, which conveniently permits a previously photographed article to be removed from its photographing position and another article to be placed in photographing position, causes the main shift bar 154 to be moved forwardly and the film feed shift bar 117 to be moved to the left in Figure 26, and as a result of these movements of the shift bars, the film is advanced, the exposure counter is actuated to indicate the instant advance of the film, the camera shutter cams 189 and 193 are placed in shutter cocked relation, the timer is set, and final movement of the main shift bar engages the detents 174 and 175 to releasably retain the main shift bar in its forward cocked position and permit downward movement of the platen independently of rearward movement of the main shift bar. See Figures 32 and 36. As hereinbefore described, the engagement of the detents 174 and 175 causes momentary closure of the illumination control switch 166 and consequent momentary energization of the lamps 37 to provide a signal to the operator that the platen has been raised high enough for the proper functioning of the apparatus.

As the platen is moved downwardly, it permits the film feed shift bar 117 to return to the right

under the influence of its spring 125 as shown in Figure 26, and final movement of the platen into its lower horizontal position depresses the plunger 173 and the arm 168 and consequently disengages the detents 174 and 175 and closes the illumination control switch 166 to illuminate the lamps 37, and the main shift bar 154, being thus released, is actuated rearwardly by its spring 157. During this movement of the main shift bar, the shutter cams 189 and 193 open and close the shutter under the control of the timer to expose the film at the camera aperture, the operator holding the platen in its lower horizontal position to maintain energization of the lamps 37 during the exposure interval. This completes the photographing cycle, and a succeeding cycle is effected by again raising and lowering the platen. Thus, the photographing operation is conveniently effected by a single manually controlled member and, as shown is effected by merely raising and lowering the platen under the control of the operator.

A stop arm 213, within the base leg 2, is pivotally mounted on the corresponding platen pivot stud 15 and comprises axially spaced arm portions 214 and 215 and an intermediate connecting portion 216. See Figures 19, 20, 32, 35 and 39. The arm 213 projects downwardly from the pivot stud 15, and a spring 217 urges this arm forwardly. A V-shaped stop 218 is fixed on the arm 176 and has its throat directed upwardly and rearwardly, and the arm portion 215 is urged forwardly against the stop by the spring 217, so that when the arm 176 is moved upwardly from a lower position, the stop engages upwardly against the lower end of the arm portion 215 and prevents movement of the arm 176 to its upper position as shown in Figures 32 and 35.

This prevention of movement of the arm 176 to its upper position limits reciprocation of this arm, the film feed shift bar 117 and the film feed pawl 121 as effected by oscillation of the platen 13—14 as hereinbefore described, so that the feed pawl cannot engage in back of the tooth of the ratchet wheel 111 succeeding the tooth which the feed pawl last engaged and thus, feeding of the film by oscillation of the platen is prevented.

The arm portion 214 of the arm 213 lies rearwardly and in the path of the roller 163 of the main shift bar 154, and when this shift bar is in its forward position, the arm portion 214 is spaced from the roller 163, so that the arm portion 215, under the influence of the spring 217, can be upwardly engaged by the stop 218. However, when the main shift bar moves rearwardly from its forward position, the roller 163 engages the arm portion 214 and moves the arm portion 215 out of engagement with the stop 218 to permit the arm 176 to move to its upper position and consequently permit feeding of the film by oscillation of the platen.

Assuming that the mechanism is in the condition thereof after a photographing cycle has been completed as shown in Figures 19, 20, 21, 22 and 39, the main shift bar 154 is in its rear position and the roller 163 is holding the arm 213 rearwardly with the arm portion 215 out of engagement with the stop 218, so that the arm 176 is in its upper position and the film feed pawl 121, see Figure 26, is in position to engage a tooth of the ratchet wheel 111 and advance the film with downward movement of the arm 176, and upward movement of the platen causes downward movement of the arm 176 to feed the film. During this downward movement of this arm, the arm

17

portion 215 moves into its forward position to be upwardly engaged by the stop 218 by reason of the forward movement of the main shift bar 154, which is effected by upward movement of the platen.

Final upward movement of the platen causes the detents 174 and 175 to be engaged and the main shift bar 154 is thus retained in its forward position, and unless the platen is moved to its lower horizontal position and the main shift bar thus released to move rearwardly, feeding of the film by oscillation of the platen is prevented. However, when the main shift bar is released to move rearwardly, by downward movement of the platen into its lower horizontal position, the roller 163 of this shift bar engages the arm portion 214 and moves the arm portion 215 out of engaging relation with the stop 218 to permit feeding of the film with the next upward movement of the platen. Thus, improper feeding of the film is prevented.

A latching member 219, provided with a forwardly disposed upwardly projecting manipulating portion 220, is mounted for forward and rearward movement, as generally designated at 221, on the upper surface of the front end portion of the ledge 11 of the base leg 2. See Figures 13, 21, 23, 31 and 36. This latching member underlies the platen frame 13 when the platen is in its lower horizontal position, and is provided with an aperture 222 upwardly through which the plunger 173 of the arm 168 projects. The upper end of this plunger is provided with a forward projection providing a downwardly directed shoulder 223 underneath which the latching member 219 engages when the latching member is in its rear latching position to latch the plunger in its upper position, see Figure 31, and when the latching member is in its forward non-latching position, see Figures 21 and 36, the latching member is disengaged from underneath the shoulder 223 so that the plunger may be depressed. When the plunger 173 is thus latched in its upper position downward movement of the platen cannot effect disengagement of the detents 174 and 175 so that exposure of the film is prevented, it being also observed that closing of the illumination control switch is also prevented.

The latching member 219 is provided with another and forwardly and rearwardly elongated aperture 224, and a downwardly projecting stud 225 on the platen frame 13 engages in this aperture when the platen is in its lower horizontal position and is provided with a convex lower cam end 226 and with a forwardly directed groove immediately above the cam end and providing an upwardly directed shoulder 227. A latching arm 228 is pivotally mounted, as designated at 229 in Figure 23, in a cavity 231 in the lower face of the latching member 219, and is provided with a latching portion 232 which is movable forwardly and rearwardly with pivotal movement of the latching arm. The latching arm is yieldably urged by a spring 233 to urge and normally maintain the latching portion into its rear or latching position, see Figures 23 and 31, in which the latching portion extends across the forward portion of the aperture 224.

When the latching member 219 is in its forward non-latching position in which the plunger 173 is free of the latching member to be depressed by the platen, the stud 225 enters the latching member aperture 224 without engagement with the latching portion 232 of the latching arm 228, see Figure 21, so that the platen is free to be

18

moved into and out of its lower horizontal position for normal operation of the mechanism to effect sequential photographing cycles.

However, when the latching member 219 is in its rear locking position, with the plunger 173 latched in its upper position, the latching portion 232 of the latching arm 228 is disposed across the path of the stud 225, and as the platen is moved approximately into its lower horizontal position, the lower cam end 226 of the stud 225 cams the latching portion 232 forwardly after which the spring 233 moves the latching portion 232 rearwardly and engages it over the shoulder 227 of the stud 225 to latch the platen approximately in its lower horizontal position without necessitating wasting an exposure of the film in case the mechanism is cocked by engagement of the detents 174 and 175. A bow spring 234 of flat material is confined in a cavity 235 in the lower surface of the latching member 219 and frictionally engages downwardly on the upper surface of the ledge 11 of the base leg 2 to maintain the latching member in either its rear or forward position as positioned by the operator.

Recalling that the base legs 2 and 3 are spaced and provide the opening 4 therebetween, that the easel 12 is removable, and that the bottom of the transverse base portion 1 is disposed above the bottoms of the base legs to provide the opening 5 under the transverse base portion and continuing the opening 4, pages of a book 236, see Figure 4, may be photographed by removing the easel and placing the book in open condition in the opening 4 and resting it on a surface 237, such as a table top, on which the apparatus rests, and the opening 5 in cooperation with the opening 4 provides for similarly photographing portions of objects of greater extent than can be accommodated in the opening 4 in that the opening 5 can accommodate a portion of an article extending horizontally from the photographing position, it being observed that articles other than books can also be photographed with the easel removed.

An arm 238 within the transverse base portion 1, see Figures 6, 26, 27 and 30, is mounted for pivotal movement, as designated at 233, in coaxial relation with the gear 108 and ratchet wheel 111, and a second film feed pawl 241 is pivotally mounted, as designated at 242, on the outer end of the arm 238 and is yieldably urged by a spring 243 into engagement with this ratchet wheel for feeding the film 61 in the camera with oscillation of the arm 238, it being recalled that the film feed sprocket 106 is driven by the gear 108. A vertical rotatable shaft 244 extends through the camera body 49 in the region of the rear end thereof, and a crescent shaped cam 245, within the transverse base portion 1, is fixed on this shaft for pivotal movement therewith. The arm 238 is provided with two angularly spaced lateral projections 246 and 247, see particularly Figure 30, between which the cam 245 engages for oscillating the arm 238 to effect film feed and return movement of the arm and pawl 241 with oscillation of the shaft 244 and cam 245, the external surface 248 of the cam engaging the projection 246 to effect film feeding movement of the arm and pawl with pivotal movement of the shaft 244 and cam 245 from their position as shown in Figure 26 to their position as shown in Figures 27 and 30, and the internal cam surface 249 of the cam 245 engaging the projection 247 to effect return movement of the arm and pawl with pivotal movement of the shaft 244 and cam

245 from their position as shown in Figures 27 and 30 to their position as shown in Figure 26. A degree of lost motion is provided between the cam 245 and the projections 246 and 247 and the external cam surface 248 comprises a lift portion 251 which serves to actuate the arm 238 and pawl 241 to feed the film, and a dwell portion 252 which permits further pivotal movement of the shaft 244 and cam 245 in the film feeding direction after the film has been advanced a predetermined amount by the lift portion 251.

As the arm 238 and pawl 241 approach the end of their film feeding movement, the lift portion 251 of the external cam surface 248 of the cam 245 engages the stop arm 126, see Figure 27, and actuates it to place the end 128 in the path of the stop pin 129 to accurately stop rotation of the film feed sprocket 106 and consequent feeding of the film, the stop arm, as so actuated, engaging and actuating the pin 132 of the shift bar 117 a short distance against the influence of the shift bar spring 125, so that actuation of the stop arm to position the end 128 out of the path of the stop pin 129 is assured as the cam 245 is returned to the position shown in Figure 26.

An arm 253, see Figures 5, 6, 9 and 14, extends transversely within the rear portion of the camera body 49 and is pivotally mounted, as designated at 254, on the upper and lower walls of the camera body on a vertical axis disposed in the region of the film entry or film supply magazine adjacent end of the film guide 52-53, the arm being of U shape to straddle the exposure aperture 59. A vertical cutting blade 255, provided with a rearwardly directed V-shaped cutting edge 256, is secured on the free end of the arm 253 adjacent the film exit or film take up magazine adjacent end of the film guide 52-53. The rear wall 51 of the camera body and the pressure plate 53 are provided with registering vertical slots 257 therethrough between the exposure aperture 59 and the film exit end of the film guide and through which the cutting blade may be moved rearwardly by rearward movement of the arm 253 to cut the film 61 in the guide in two at the slots 257 as shown in Figure 14. A spring 258 is connected with the arm 253 to actuate the same and the cutter blade 255 forwardly and normally maintain them in a position in which the cutter blade is disposed forwardly of the film 61 in the film guide as shown in Figures 5 and 9. An enclosure 259 is secured on the rear face of the pressure plate 53 and light seals the slot 257 of the pressure plate and permits the cutting blades 255 to project thereinto when the cutting blade is moved rearwardly.

A sleeve 260 is pivotally mounted on the shaft 244, and a bifurcated arm, generally designated at 261, is fixed on this sleeve and embraces a projection 262 on the free end of the arm 253 so that the arm 253 and the sleeve 260 are connected to oscillate together through the arm 261 and the projection 262. The sleeve 260 is provided with an angular slot 263, and a radial pin 264 is fixed on the shaft 244 and is slidably engaged in the slot 263 to provide a lost motion connection between the shaft 244 and the sleeve 260 and consequently between this shaft and the cutter blade carrying arm 253.

Movement of the arm 238, which carries the feed pawl 241, in the pawl return direction, clockwise in Figure 26 and opposite the film feed direction thereof, is limited by a pin 265 on the arm 238 and engaging a bracket 266 mounted on the transverse base portion 1, and movement of the shaft 244 in the corresponding direction, clock-

wise in Figure 26 and counterclockwise in Figure 5, is limited by the engagement of this pin and bracket and by the internal cam surface 249 of the cam 245 engaging the projecting portion 247 of the arm 238. A torsion spring 267 within the camera body 49, see Figures 5 and 9, is connected with the shaft 244 and yieldably urges the same counterclockwise in Figure 5 and normally maintains it in its normal position as shown in Figures 5 and 26 and the arm 238 in its normal position as shown in Figure 26 in cooperation with the limiting means just described.

In the normal position of the shaft 244, as shown in Figure 5, the pin 264 is disposed in the region of the counterclockwise end of the slot 263. Rotation of the shaft 244, clockwise in Figure 5, from its normal position first causes the cam 245 to move from the position shown in Figure 26 to the position shown in Figure 27 and thereby actuate the arm 238 and the film feed pawl 241 to feed the film. Engagement of the dwell portion 252 of the cam 245 with the projection 246 terminates the feeding of the film, and further rotation of the shaft 244 clockwise in Figure 5 causes the pin 264 to engage the clockwise end of the slot 263 and actuate the arm 253 and cutter blade 255 rearwardly to cut the film 61 as shown in Figure 14. Return of the shaft 244 from the position shown in Figure 14 to the normal position shown in Figure 5, by counterclockwise rotation thereof in these figures, causes forward withdrawal of the cutting blade 255 from the film plane in the film guide and return movement of the arm 238 and feed pawl 241.

A closure member 268 is secured to the camera casing cover 7, see Figures 6, 9 and 10, and is arranged below the rear intermediate portion of the top thereof in adjacent spaced parallel relation therewith, and forms a closure 269 therewith, and overlies the camera body when the casing cover is closed. A gear 271 is rotatably mounted within the enclosure 269 and is disposed to aline with the shaft 244 when the cover 7 is closed. A gear segment 272 is also rotatably mounted within the closure 269 in parallel meshing relation with the gear 271, and is disposed to overlie the region of the film entry passage 149 of the film take up magazine 134 for a purpose hereinafter appearing. A hand crank 273, see Figures 1, 3 and 10, above the top of the camera casing cover 7, is fixed for rotation with the segment gear 272 for conveniently manually rotating the same from the exterior of the camera casing. A circular disk 274, within the closure 269, is secured on the gear 271 in concentric relation therewith and is provided with a peripheral concave lock portion 275. A circular disk 276, within the closure 269, is secured on the gear segment 272 in concentric relation therewith and is provided with a peripheral convex segment lock portion 277 of relatively large radius arranged in diametrically opposite relation with the teeth of the gear segment and an inactive peripheral portion 278 of relatively small radius arranged in coincident relation with the teeth of the gear segment. A torsional spring device 279, within the closure 269, is connected with the segment gear 272 to yieldably urge the gear segment clockwise in Figure 10 and maintain it in its normal position in which an end of the lock portion 277 engages the disk 274 and thus prevents further clockwise movement of the gear segment, the gear segment meshing with the gear 271 in the normal position of the gear segment.

21

The gear segment 272 being in mesh with the gear 271 in the normal position of the gear segment, rotation of the gear segment by the hand crank 273, counterclockwise in Figure 10, causes clockwise rotation of the gear 271 until the convex lock portion 277 engages the concave lock portion 275 and locks the gear 271 against rotation. Simultaneously with locking of the gear 271, the gear segment disengages from the gear 271 and counterclockwise rotation of the segment continues with the gear 271 locked against rotation, counterclockwise rotation of the gear segment being limited by an end portion 281 of the gear segment overlapping the lock portion 277 and engaging the gear 271 while the lock portions 275 and 277 are engaged. As the segment gear is returned to its normal position, as by the spring device 279, the converse of the above occurs, and the gears 271 and 272 return to their normal positions as shown in Figure 10.

A crank 282, immediately below the closure member 268, is fixed for rotation with the gear 271 and is carried therewith, see Figures 9, 10, 11 and 12, and a crank 283, immediately above the camera body 49, is fixed on the upper end of the shaft 244 for rotation therewith and underlies the crank 282 when the camera casing cover 7 is closed. The crank 282 is provided with a downward projection 284, and the crank 283 is provided with an upward projection 285 which is angularly engageable with the projection 284 when the camera casing cover 7 is closed to provide a driving connection between the gear 271 and the shaft 244, which is disengageable to permit opening and closing of the camera casing cover.

When the gear 271 and the shaft 244 are in their normal positions above described, the projections 284 and 285 are positioned as shown in Figures 10 and 11, and when the gear segment 272 is rotated, counterclockwise in Figure 10, by means of the hand crank 273, from its normal position and drives the gear 272 clockwise in Figure 10, the shaft 244, through the cranks 282 and 283 and their engaged projections, is rotated correspondingly or clockwise in Figure 5 and the film 61 is thereby advanced in the guide 52—53 and thereafter cut at the slots 257 as hereinbefore described. The advancing and cutting of the film takes place before the lock portions 275 and 277 engage and lock the gear 271 against rotation, and locking of the gear 271 locks the shaft 244 against return to its normal position, with the cranks 282 and 283 and their projections in the positions thereof shown in Figure 12, until return rotation of the gear segment 272 disengages the lock portions 275 and 277, whereupon the gear 271, the gear segment 272 and the shaft 244 return to their normal positions.

The cutting of the film as above described is for the purpose of removing an exposed portion of the film from the camera for the development thereof and of leaving the unexposed portion of the film in the camera for the subsequent exposure thereof. As shown, the film is advanced one exposure frame with each reciprocation of the feed pawl 121 which is actuated by the platen 13—14 as an incident of the photographing operation, or with each reciprocation of the feed pawl 241 which is actuated by the shaft 244 as an incident of the cutting operation, and the film cutting station, established by the cutting blade 255 is spaced from the exposure frame 59, in the direction of advance of the film, a distance of approximately one-half of the length of an ex-

22

posure frame. Consequently, it is necessary, in order to cut off an exposed frame of the film instantly at the exposure aperture, that the film be advanced two frames in order that this exposure frame be advanced beyond the cutting station. This may be accomplished by actuating the platen 13—14 to advance the film one frame and then actuating the hand crank 273 to first advance the film another frame and then to cut the film at the frame succeeding the exposed frame, or by actuating the hand crank 273 from its normal position to the point where the film is advanced one frame, as may be sensed or observed from the exposure counter 85, and returning the hand crank to its normal position and again actuating it from its normal position to first advance the film a second frame and then cut the film at the frame succeeding the exposed frame.

A vertically disposed segmental light valve 286, see Figures 5, 6, 14, 15, 16 and 38, is mounted for pivotal movement within the film take up magazine 134 immediately inward of the entry passage 150, and is pivotally movable to open and close the entry passage, concave shields 287 and 288, arranged within the take up magazine on opposite sides of the entry passage in concentric relation with the light valve, cooperating with the light valve for excluding light from the take up magazine.

When the light valve 286 is in its normal open position, as shown in Figure 5, the film 61 may enter the take up magazine for taking up the film on the roll 149 on the take up spool 145—147, and a film guide 289, within the take up magazine and through which the film passes from the entry passage 150, has one end thereof pivotally mounted, as designated at 291, on the light valve in parallelism with the pivotal axis of the light valve, and extends inwardly of the take up magazine. A spring 292 yieldably urges the other end of the guide 289 toward the hub 145 of the take up spool, and when there is no film on this hub, this guide serves to guide the end of a film to the hub so that a tooth 148 of the hub automatically engages a perforation 62 of the film end for the taking up of the film on the take up spool in the form of the roll 149 after which the guide bears against this roll and maintains it in compact condition.

The light valve 286 is provided with two vertically spaced teeth 293, see Figure 16, adjacent the closing edge of the light valve, which, when the light valve is moved from open to closed position engage perforations 62 of the film 61 and move the film a small extent into the take up magazine, as shown in Figures 14 and 16, the shields 287 and 288 being provided with angular channels 294 for accommodation of the teeth 293.

Accordingly, when the film is cut for the removal of an exposed portion of the film, as hereinbefore described, and the light valve is moved to closed position to light seal the take up magazine entry passage 150, the film end projecting from the magazine, which does not bear any photographic record by reason of the cutting of the film having taken place at the middle of the frame of the film succeeding the photographically exposed portion thereof, is moved inwardly of the magazine to assure that the photographically exposed portion of the film is light sealed within the take up magazine for the removal of this magazine with the exposed film therein for developing the film. Figure 15 shows the light valve partially closed and Figures 14 and 16 show

the light valve fully closed. Opening of the light valve again projects the outer end of the film from the entry passage 156, and the film in the take up magazine may be removed in the "dark room" by opening the light valve and pulling the film out of the entry passage by grasping the projecting end of the film, which is convenient for removing short pieces of film, rather than removing the cover 143 of the take up magazine.

The light valve 286 also is movable to an extreme open position, shown in Figure 38, in which the light valve engages the film guide 289 and positions it adjacent the side wall of the take up magazine against the influence of the spring 292, so that this film guide does not interfere with removal of the take up spool 145—147 from the take up magazine or its insertion therein, it being observed that inasmuch as the take up spool is removed in the "dark room," the opening of the light valve is of no consequence. The take up magazine cover 143 is detachably secured on the take up magazine, see Figures 13 and 37, by two substantially diametrically opposite radial arms 295 secured on the cover and engageable and disengageable in lateral grooves 296 of upwardly projecting studs 297 on the take up magazine with opposite angular movements of the cover with respect to the take up magazine, clockwise movement of the cover in Figure 13 serving to disengage the arms from the grooves.

A control segment 298, on the take up magazine immediately above the top thereof, is secured with the light valve 286 for pivotal movement therewith. See Figures 6, 11, 12, 13 and 37. When the light valve is in its normal open position, as shown in Figure 5, the control segment is in the position thereof shown in Figure 11 in which an intermediate peripheral notch 299 on the segment faces radially toward the camera body 49. A latch 301 is mounted, as generally designated at 302, on top of the rear portion of the camera body for movement transversely of the camera body into and out of engagement with the notch 299, the latch locking the light valve in its normal open position when the latch is engaged in the notch. A spring 303 yieldably urges the latch out of engagement with the notch 299, but the crank 283 when it is in its normal position under the influence of its more powerful spring 267 engages the latch in opposition to the spring 303 maintains the latch in position for engagement with the notch 299. Thus, the take up magazine cannot be seated in the camera casing, unless the light valve 286 is in open position, so that the opening of the light valve when the take up magazine is seated in the camera casing is assured for the feeding of the film into the magazine.

A crank 304, immediately below the closure member 268, see Figures 6, 11 and 12, is fixed for rotation with the gear segment 272 and is provided with a downward projection 305, and the control segment 298 is provided with an upward projection 306 which is angularly engageable with the projection 305 when the camera casing cover 7 is closed to provide a driving connection between the gear segment and the control segment 298, which is disengageable to permit opening and closing of the camera casing cover.

When the gear segment 272 and control segment 298 are in their normal positions, above described, the projections 305 and 306 are positioned, as shown in Figures 10 and 11, in angularly spaced relation of considerable extent, and when the gear segment 272 is rotated counter-

clockwise in Figure 10, by means of the hand crank 273, from its normal position and drives the gear 272 clockwise in Figure 10, the shaft 244 is actuated to advance the film 61 and cut it before the lock portions 275 and 277 engage and lock the gear 271 against rotation and permit further counterclockwise rotation of the gear segment 272 as hereinbefore described.

When the lock portions 275 and 277 are in locking relation, the crank 283 of the shaft 244 is maintained out of its normal position as shown in Figure 12, and this crank, consequently being out of engagement with the latch 301, permits the spring 303 to withdraw the latch out of engagement with the control segment notch 299, so that the control segment 298 and light valve 286 are free to be actuated. Further movement of the segment gear 272, counterclockwise in Figure 10, after the lock portions 275 and 277 are in locking relation, causes the projection 305 of the crank 304 to engage the projection 306 of the control segment 298 and thereby actuate the light valve 286 to closed position, see Figures 12 and 14, preparatory to removing the take up magazine with the light valve closed to light seal the exposed film in the magazine.

Return of the segment gear 272 and hand crank 273 to their normal positions, into which they are urged by the spring device 279, causes the gear 271 and the cranks 282 and 304 to return to their normal positions as shown in Figures 10 and 11, and permits the crank 283 of the shaft 244 to return under the influence of the spring 277, into engagement with the latch 301 and urge it into position for locking engagement with the segment notch 299. Upon return of the segment gear 272 and hand crank to their normal positions, the camera casing cover 7 may be opened and the take up magazine removed for the development of the exposed film therein and reinstallation in the camera casing preparatory to receiving additional exposed film.

A stop pin 307 on the top wall of the take up magazine 134, see Figures 12 and 13, is engageable with an end 308 of the control segment 298 to limit movement of the light valve 286 in its closing direction and thus establish the closed position of the light valve as shown in Figures 14 and 16; and in the light valve closed position of the control segment, the segment end 308 engages a lug 309 on the take up magazine cover 143 to prevent angular movement of the cover, clockwise in Figures 12 and 13, to disengage the cover arms 295 from the stud grooves and thus prevent removal of the cover while the light valve is closed, this tending to prevent accidental opening of the take up magazine before it and the exposed film therein reaches the "dark room."

A spring arm 311, within the take up magazine 134, see Figure 37, has one end thereof secured, as designated at 312, upwardly against the top wall of the take up magazine, and a stop pin 313, see Figures 11, 12 and 37, is secured on the free end of this arm and projects upwardly through the top wall of the magazine, and is normally engageable by an angularly facing shoulder 314 on the control segment 298 to limit movement of the light valve 286 in its opening direction and thus establish the normal open position of the light valve as shown in Figures 5 and 11. A push plunger 315 is secured on the spring arm 311 and projecting upwardly through the top wall of the take up magazine, may be manually depressed to depress the stop pin 313 out of the path of the shoulder 314 to permit the light valve to be moved further in its opening direction to the

extreme open position thereof in which the light valve is positioned, as shown in Figure 38 and thus position the film guide 289 so as not to interfere with removal of the take up spool 145—147 from the take up magazine or its insertion thereinto. The control segment 298 is provided with a notch 316 into which the stop pin 313 engages when the light valve is in its said extreme open position, see Figure 37, for retaining the light valve in this position, depression of the plunger 315 releasing this stop pin from this notch.

Figures 40, 41 and 42 and Figures 43, 44 and 45 show modifications which may be substituted for the exposure counter 85 and the mechanism for actuating the same as above described.

Referring to Figures 40, 41 and 42, an exposure counter 317 of usual construction is mounted on the forward portion of the inside wall of the base leg 2 below the lower horizontal position of the platen 13—14, and has its indications 318 facing upwardly and disposed below the transparent platen member 14 and approximately in the plane of the surfaces of objects being photographed, so that the counter indications are desirably photographed on the film 61 simultaneously with the objects being photographed. The counter is provided with a usual oscillable actuating shaft 319 yieldably urged in one direction, and an arm 321 is secured on this shaft and is engaged by the platen frame 13, so that it and the countershaft 319 are oscillated to actuate the counter as the platen is moved toward and away from its lower horizontal position.

Referring to Figures 43, 44 and 45, an exposure counter 322 of usual construction is mounted on the outer portion of the platen frame 13 adjacent the base leg 2 and has its indications 323 facing upwardly and disposed approximately in the plane of the surfaces of objects being photographed when the platen 13—14 is in its lower horizontal position, so that the counter indications are desirably photographed on the film 61 simultaneously with the objects being photographed. The counter is provided with a usual oscillable actuating shaft 324 yieldably urged in one direction, and an arm 325 is secured on this shaft and engages a pin 326 on the base leg 2, so that it and the countershaft 324 are oscillated to actuate the counter as the platen is moved toward and away from its lower horizontal position.

Certain of the structure described and illustrated herein forms the subject matter of my pending application for U. S. Letters Patent, Serial No. 233,912, filed June 19, 1951, for Improvement in Photographic Copying Apparatus, which is a division hereof.

While I have thus described my invention, I do not wish to be limited to the precise details described, as changes may be readily made without departing from the spirit of my invention, but having thus described my invention, I claim as new and desire to secure by Letters Patent the following:

1. In a photographic copying apparatus, the combination of means establishing the photographing position of an article, two illuminating lamp containing housings mounted respectively at opposite sides of said photographing position for pivotal movement from positions extending upwardly from said photographing position respectively on opposite sides thereof to aligned positions closely overlying said photographing position, said housings being provided with light openings directed across an article in said photographing position when said housings are in their upwardly extending positions, and a re-

flector for reflecting an image of an article at said photographing position for the photographing thereof and mounted for movement with respect to said housing from a position spaced above said housings when they are in said first mentioned positions thereof and facewise above said photographing position and inclined to the plane thereof in a vertical plane traversing the other sides of said photographing position to a position closely overlying said lamp housings when they are in their second mentioned positions.

2. In a photographic copying apparatus, the combination of a base, means on said base establishing the photographing position of an article, two illuminating lamp containing housings mounted on said base for pivotal movement on substantially parallel axes respectively on opposite sides of said photographing position from positions extending upwardly from said photographing position respectively on opposite sides thereof to aligned positions closely overlying said photographing position, said housings being provided with light openings directed across an article in said photographing position when said housings are in their upwardly extending positions, a reflector for reflecting an image of an article at said photographing position for the photographing thereof, and mounting means carrying said reflector on said lamp housings for movement therewith and with respect thereto from a position spaced above said housings when they are in said first mentioned positions thereof and facewise above said photographing position and inclined to the plane thereof in a vertical plane traversing the other sides of said photographing position to a position closely overlying said lamp housings when they are in their second mentioned positions.

3. In a photographic copying apparatus, the combination of a base, means on said base establishing the photographing position of an article, two illuminating lamp containing housings mounted on said base for pivotal movement on substantially parallel axes respectively on opposite sides of said photographing position from positions extending upwardly from said position respectively on opposite sides thereof to positions closely overlying said position, said housings being provided with light openings directed across an article in said photographing position when said housings are in their upwardly extending positions, a reflector for reflecting an image of the positioned article for the photographing thereof, and mounting means carrying said reflector on said lamp housings for movement therewith from a position spaced facewise above the positioned article and inclined to the plane thereof in a vertical plane traversing the other sides of said photographing position when said lamp housings are in their first mentioned positions to a position closely overlying said lamp housings when they are in their second mentioned positions, said mounting means comprising two pairs of arms the arms of each pair of which are pivotally connected with said reflector at points spaced transversely of said lamp housing axes and are respectively pivotally connected with said lamp housings in spaced relation with their pivotal connections with said reflector and in spaced relation with said lamp housing axes and said pairs of arms being spaced longitudinally of said lamp housing axes and the spacing between the pivotal connections of one of said pairs of arms with said reflector and

lamp housings and the spacing of the pivotal connections of this pair of arms from said lamp housing axes being greater than those of the other pair of said arms.

4. In a photographic copying apparatus, the combination of claim 3 and further comprising stop means limiting outward movement of said housings in their first mentioned positions, and said mounting means further comprising stop means for limiting upward pivotal movement of said arms relative to said reflector and lamp housings when said reflector and housings are in their first mentioned positions.

5. In a photographic copying apparatus, the combination of a base, means on said base establishing the photographing position of an article and comprising a transparent platen pivotally mounted at one side thereof for movement upwardly from a lower horizontal position, a camera on said base and arranged closely adjacent said side of said platen, two illuminating lamp containing housings mounted on said base at opposite sides of said platen adjoining said first mentioned side thereof for pivotal movement from positions extending upwardly from said photographing position respectively on said opposite sides of said platen to aligned positions closely overlying said platen when it is in its said lower horizontal position, said housings being provided with light openings directed across an article in said photographing position when said housings are in their upwardly extending positions, and means for reflecting an image of an article in said photographing position to said camera comprising a reflector mounted for movement with respect to said base and housings from a position spaced above said housings when they are in said first mentioned positions thereof and facewise above said photographing position and inclined to the plane thereof in a vertical plane traversing the pivoted side of said platen and directed toward said camera to a position closely overlying said lamp housing when they are in their second mentioned positions.

6. In a photographic copying apparatus, the combination of a base, means on said base establishing the photographing position of an article and comprising a transparent platen pivotally mounted at one side thereof for movement upwardly from a lower horizontal position, a camera on said base and arranged closely adjacent said side of and directed toward said platen and having its optical axis substantially parallel and adjacent to the plane of an article in said photographing position, two illuminating lamp containing lamp housings mounted on said base for pivotal movement on substantially parallel axes respectively at opposite sides of said platen adjoining said first mentioned side thereof from positions extending upwardly from said photographing position respectively on said opposite sides of said platen to aligned positions closely overlying said platen when it is in its said lower horizontal position, said housings being provided with light openings directed across an article in said photographing position when said housings are in their upwardly extending positions, a reflector, mounting means carrying said reflector on said lamp housings for movement therewith and with respect thereto from a position spaced above said housings when they are in said first mentioned positions thereof and facewise above said photographing position and inclined to the plane thereof in a vertical plane traversing the pivoted side of said platen at an

angle not exceeding approximately 25° and directed toward said camera to a position closely overlying said lamp housings when they are in their second mentioned positions, and a second reflector on said base and inclined across said camera axis for reflecting an image of the positioned article from said first mentioned reflector to said camera when said first mentioned reflector is in its first mentioned position.

7. In a photographic copying apparatus, the combination of a base of horizontal U shape, means establishing the photographing position of an article in a horizontal plane at the opening between the legs of said base, two illuminating lamp containing housings carried respectively on said legs and extending upwardly from said opening respectively on opposite sides thereof and provided with light openings directed across an article in said photographing position, a camera mounted on the transverse portion of said base and arranged closely adjacent and directed toward said position and having its optical axis substantially parallel and adjacent to the plane of an article in said position, and means for reflecting an image of the positioned article to said camera and comprising a reflector spaced facewise above the positioned article and inclined to the plane thereof and directed toward said camera and a second reflector between said camera and first mentioned reflector and inclined across said camera axis.

8. In a photographic copying apparatus, the combination of a base of horizontal U shape, means establishing the photographing position of an article in a horizontal plane at the opening between the legs of said base and comprising a transparent platen extending across between the legs of said base and pivotally mounted on said base on a horizontal axis adjacent and substantially parallel to the transverse portion of said base for movement upward from and downward into position overlying an article in said photographing position, a camera mounted on said transverse base portion and provided with an exposure shutter, means for feeding a film in said camera step by step, and mechanism within one of said base legs and on said transverse base portion for actuating said feeding means to feed the film one step and to open and close said shutter with each movement of said platen out of and into said position thereof and comprising a stud fixed on said platen and forming a part of the pivotal mounting thereof and extending within said base leg.

9. In a photographic copying apparatus, the combination of a base of horizontal U shape, means establishing the photographing position of an article in a horizontal plane at the opening between the legs of said base and comprising a transparent platen extending across between the legs of said base and pivotally mounted on said base on a horizontal axis adjacent and substantially parallel to the transverse portion of said base for movement upward from and downwardly into position overlying an article in said photographing position, lamp containing housings extending respectively upward from said base legs and provided with light openings directed across an article at said photographing position, a camera mounted on said transverse base portion and provided with an exposure shutter, means for feeding a film in said camera step by step, mechanism within one of said base legs and on said transverse base portion for actuating said feeding means to feed the film one step and to

open and close said shutter with each movement of said platen out of and into said position thereof and comprising a stud fixed on said platen and forming a part of the pivotal mounting thereof and extending within said base leg, and a lamp switch controlling the lamps in said housings and under the control of said platen to be opened and closed with said pivotal movement thereof.

10. In a photographic copying apparatus, the combination of means establishing the photographing position of an article comprising a platen mounted for movement out of and into position overlying an article at said photographing position, a camera provided with an exposure shutter, means for feeding a film in said camera step by step, means under the control of said platen for actuating said feeding means to feed the film one step with each movement of said platen out of and into said position thereof, a reciprocable actuating member yieldably urged to one end of its movement, a one way connection between said platen and actuating member for moving said actuating member to the other end of its movement with movement of said platen out of said position thereof, releasable latch means for automatically latching said actuating member at said other end of its movement, means for opening and closing said shutter in sequence with said feeding of the film and with movement of said actuating member toward said first mentioned end of its movement, and means for releasing said latch means with final movement of said platen into said position thereof.

11. In a photographic copying apparatus, the combination of claim 10 and further comprising means for rendering said step by step feeding means inoperative after each film feeding actuation thereof, and means for rendering said last mentioned means inoperative and operative with movement of said actuating member respectively toward and away from said first mentioned end of its movement.

12. In a photographic copying apparatus, the combination of claim 10 and further comprising said latch means comprising a latch member yieldably urged into latching position and actuated out of latching position as an incident of latching said latch means and actuated out of latching position to release said latch means with final movement of said platen into said position thereof, and an illuminating lamp switch under the control of said latch member to be opened and closed with movement of said latch member respectively into and out of latching position.

13. In a photographic copying apparatus, the combination of means establishing the photographing position of an article comprising a platen mounted for pivotal movement out of and into a position overlying an article at said photographing position, a camera provided with an exposure shutter, means for feeding a film

in said camera step by step, means under the control of said platen for actuating said feeding means to feed the film one step with each movement of said platen out of and into said position thereof, a reciprocable actuating member yieldably urged to one end of its movement, a one way connection between said platen and actuating member for moving said actuating member to the other end of its movement with movement of said platen out of said position thereof, releasable latch means for automatically latching said actuating member at said other end of its movement, means for opening said shutter during a predetermined movement of said actuating member toward said first mentioned end of its movement and closing the same in sequence with said feeding of the film, a timing device for controlling the velocity of said actuating member during said predetermined movement thereof, and means for releasing said latch means with final movement of said platen into said position thereof.

14. In a photographic copying apparatus, the combination of claim 13 and further comprising said latch means comprising a latch member yieldably urged into latching position and actuated out of latching position as an incident of latching said latch means and actuated out of latching position to release said latch means with final movement of said platen into said position thereof, an illuminating lamp switch under the control of said latch member to be opened and closed with movement of said latch member respectively into and out of latching position, means for rendering said step by step feeding means inoperative after each film feeding actuation thereof, and means for rendering said last mentioned means inoperative and operative with movement of said actuating member respectively toward and away from said first mentioned end of its movement.

EMANUEL GOLDBERG.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,808,118	Peterson	June 2, 1931
1,940,187	Salchow	Dec. 19, 1933
1,985,072	Bauersfeld	Dec. 18, 1934
1,993,178	Mitchell	Mar. 5, 1935
2,095,849	Wittel	Oct. 12, 1937
2,134,704	Cornell	Nov. 1, 1938
2,184,698	Heybourne	Dec. 26, 1939
2,234,717	Altman	Mar. 11, 1941
2,248,627	Holbrook	July 8, 1941
2,369,247	Pratt	Feb. 13, 1945
2,433,133	Lindsey	Dec. 23, 1947
2,492,005	Pratt	Dec. 20, 1949

FOREIGN PATENTS

Number	Country	Date
909,415	France	Dec. 20, 1945