March 10, 1936. P. LANDROCK 2,033,290

PHOTOGRAPHIC COPYING MACHINE

Filed Dec. 21, 1932 6 Sheets-Sheet 1

Fig. 2

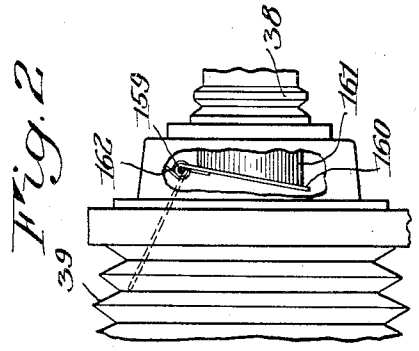
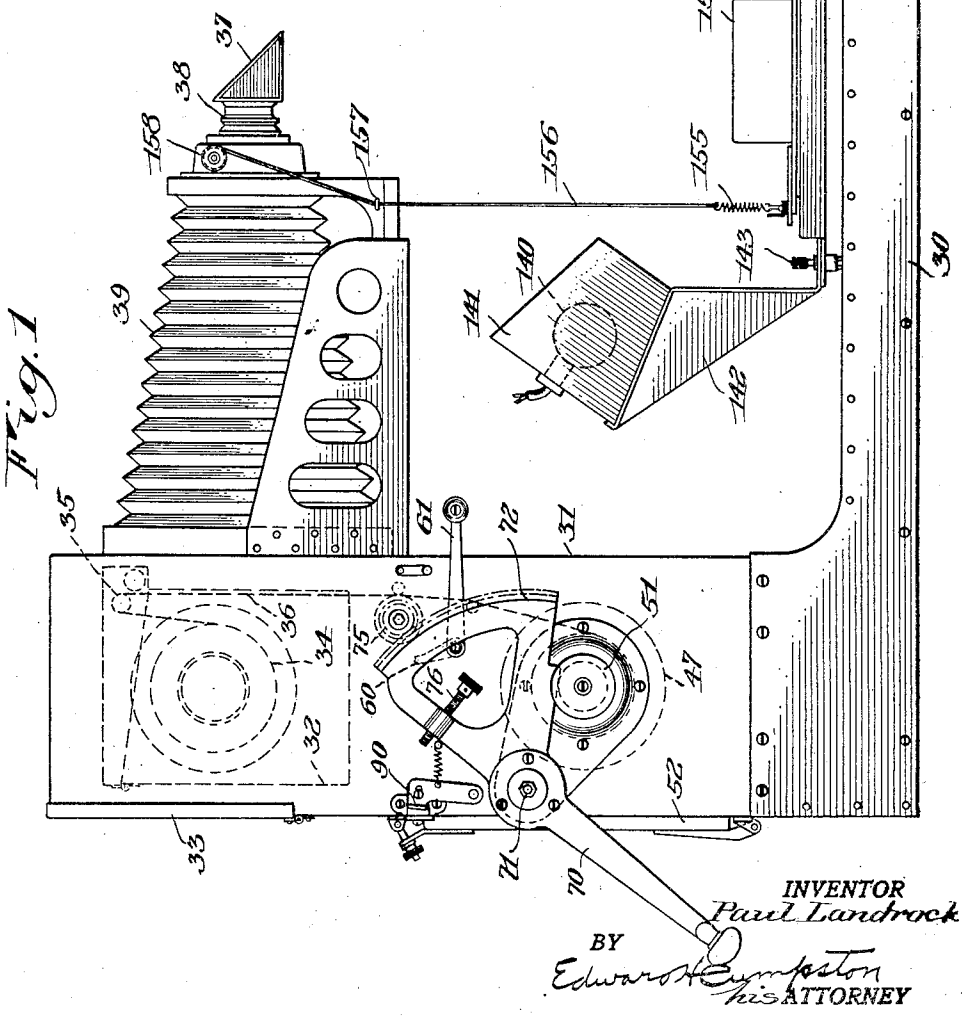


Fig. 1



INVENTOR
Paul Landrock

BY
Edward A. Cumpston
HIS ATTORNEY

March 10, 1936. P. LANDROCK 2,033,290

PHOTOGRAPHIC COPYING MACHINE

Filed Dec. 21, 1932 6 Sheets-Sheet 2

Fig. 3

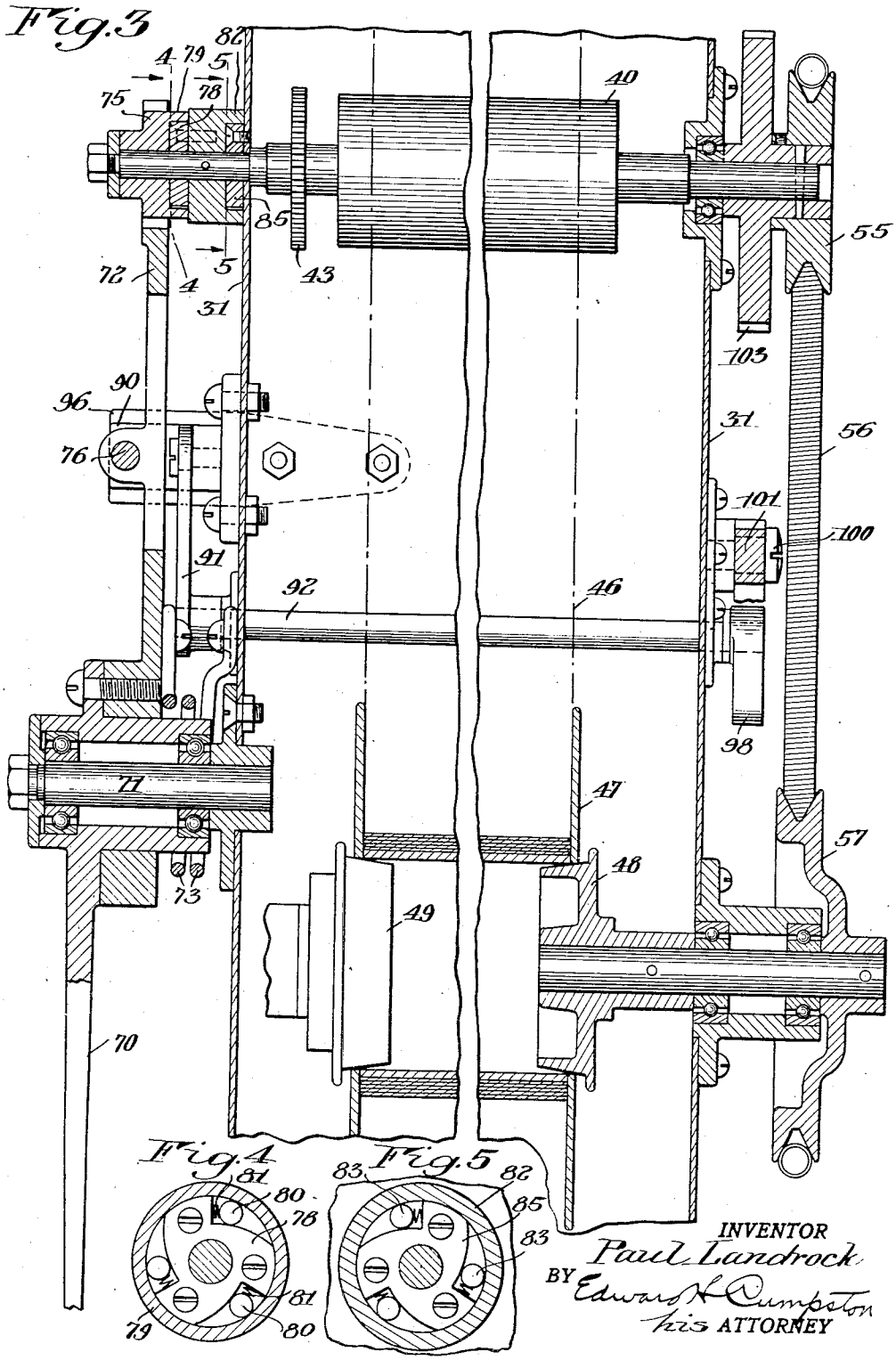


Fig. 4

Fig. 5

INVENTOR
Paul Landrock
BY Edward H. Dumpston
his ATTORNEY

March 10, 1936. P. LANDROCK 2,033,290

PHOTOGRAPHIC COPYING MACHINE

Filed Dec. 21, 1932 6 Sheets-Sheet 3

Fig. 6

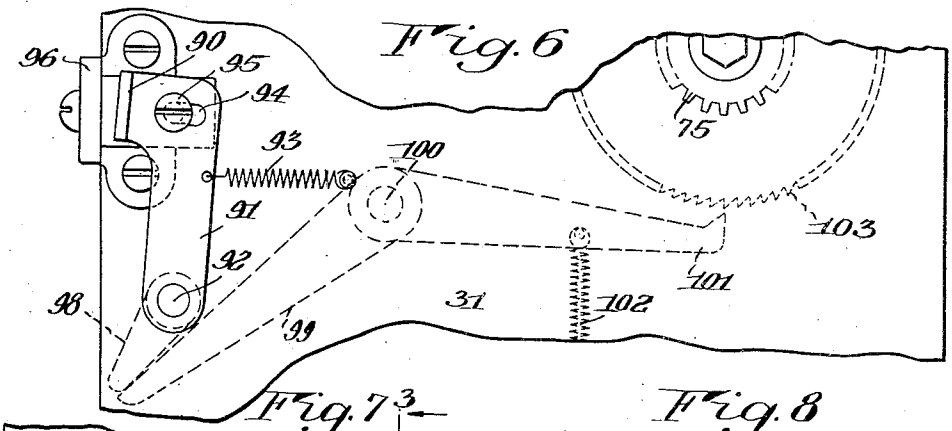


Fig. 7

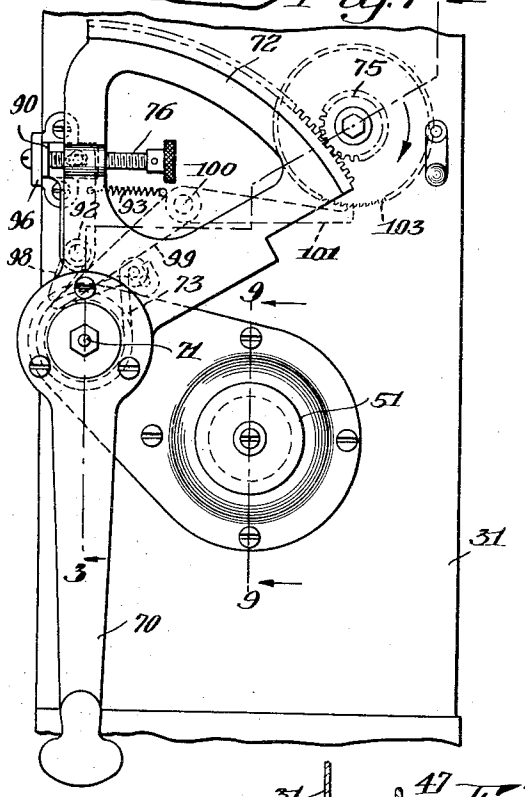


Fig. 8

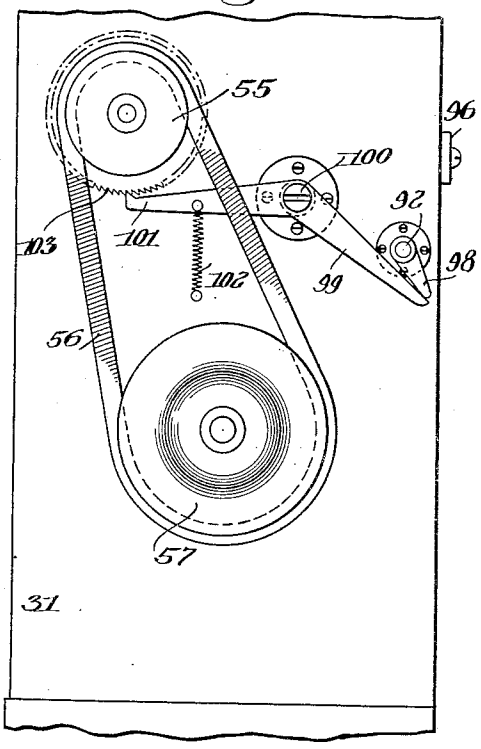
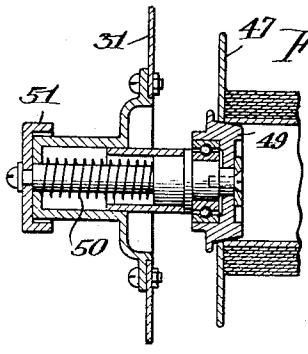


Fig. 9

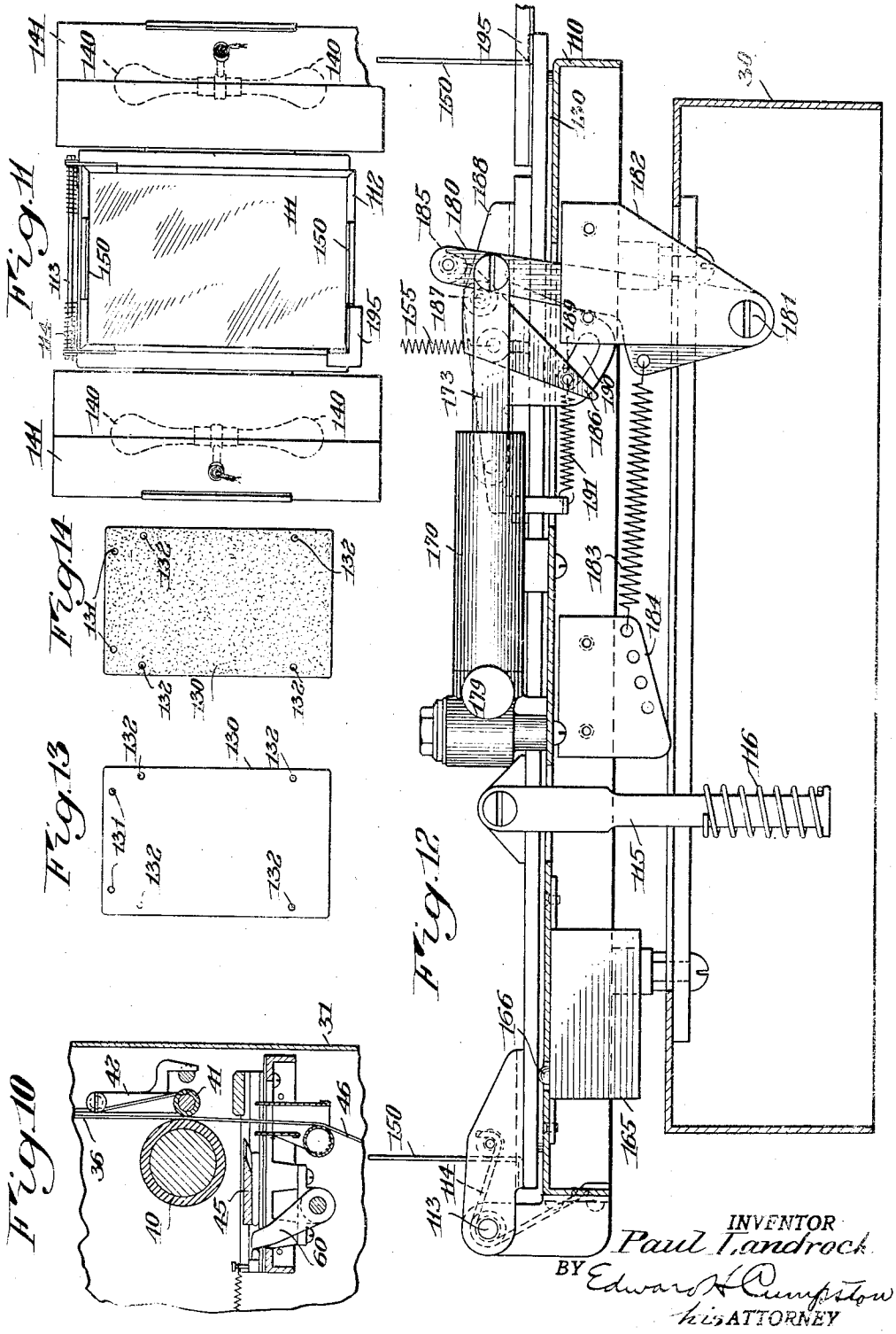


INVENTOR
Paul Landrock
BY Edward H. Rumpston
his ATTORNEY

March 10, 1936. P. LANDROCK 2,033,290

PHOTOGRAPHIC COPYING MACHINE

Filed Dec. 21, 1932 6 Sheets-Sheet 4



March 10, 1936. P. LANDROCK 2,033,290

PHOTOGRAPHIC COPYING MACHINE

Filed Dec. 21, 1932 6 Sheets-Sheet 5

Fig. 15

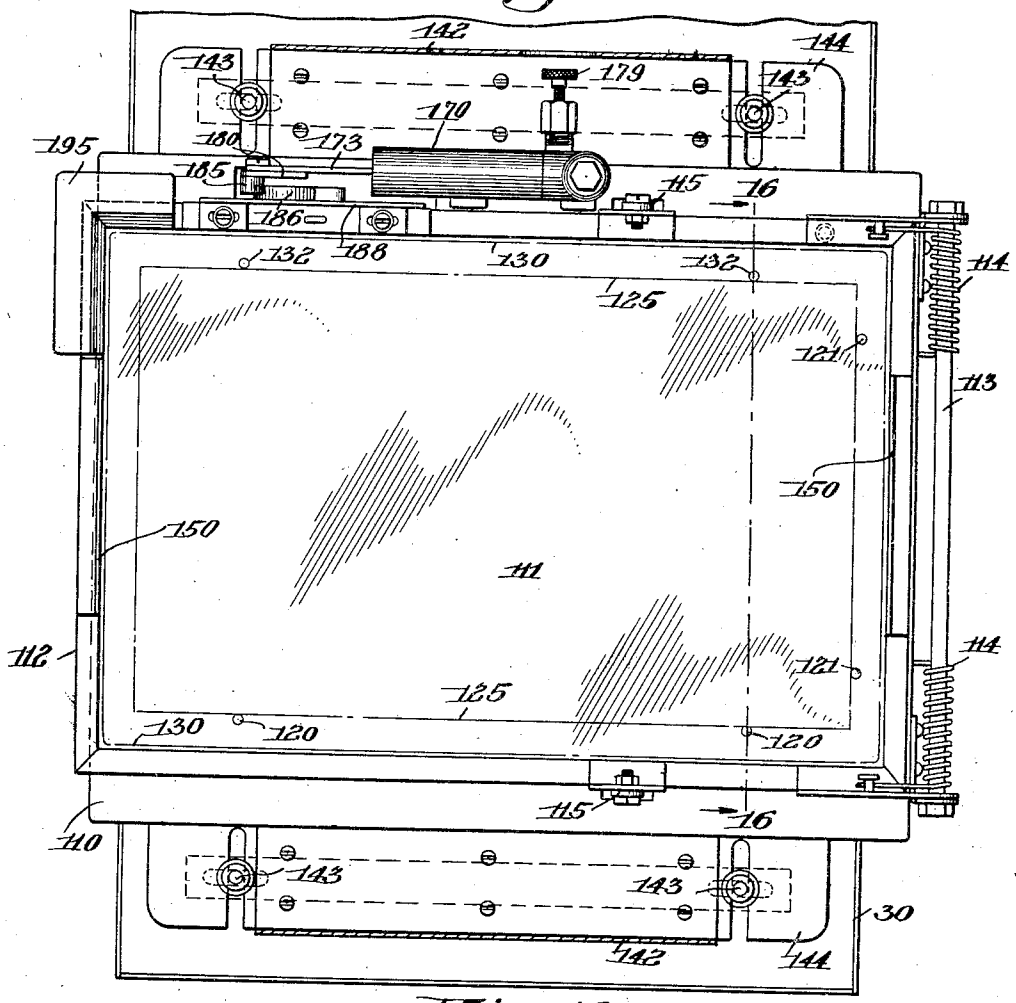


Fig. 16

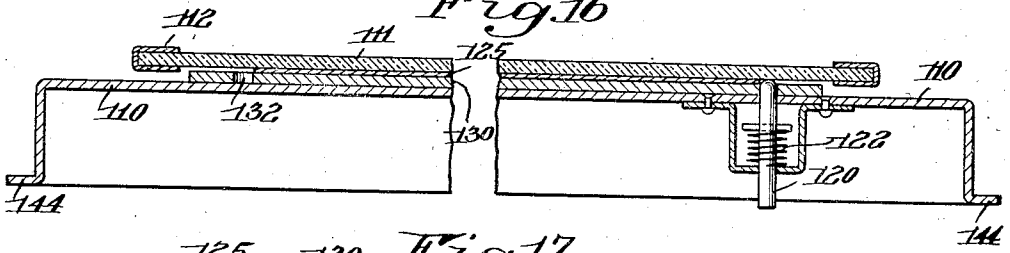
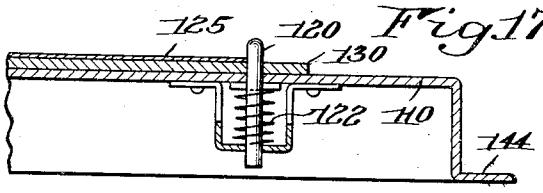


Fig. 17

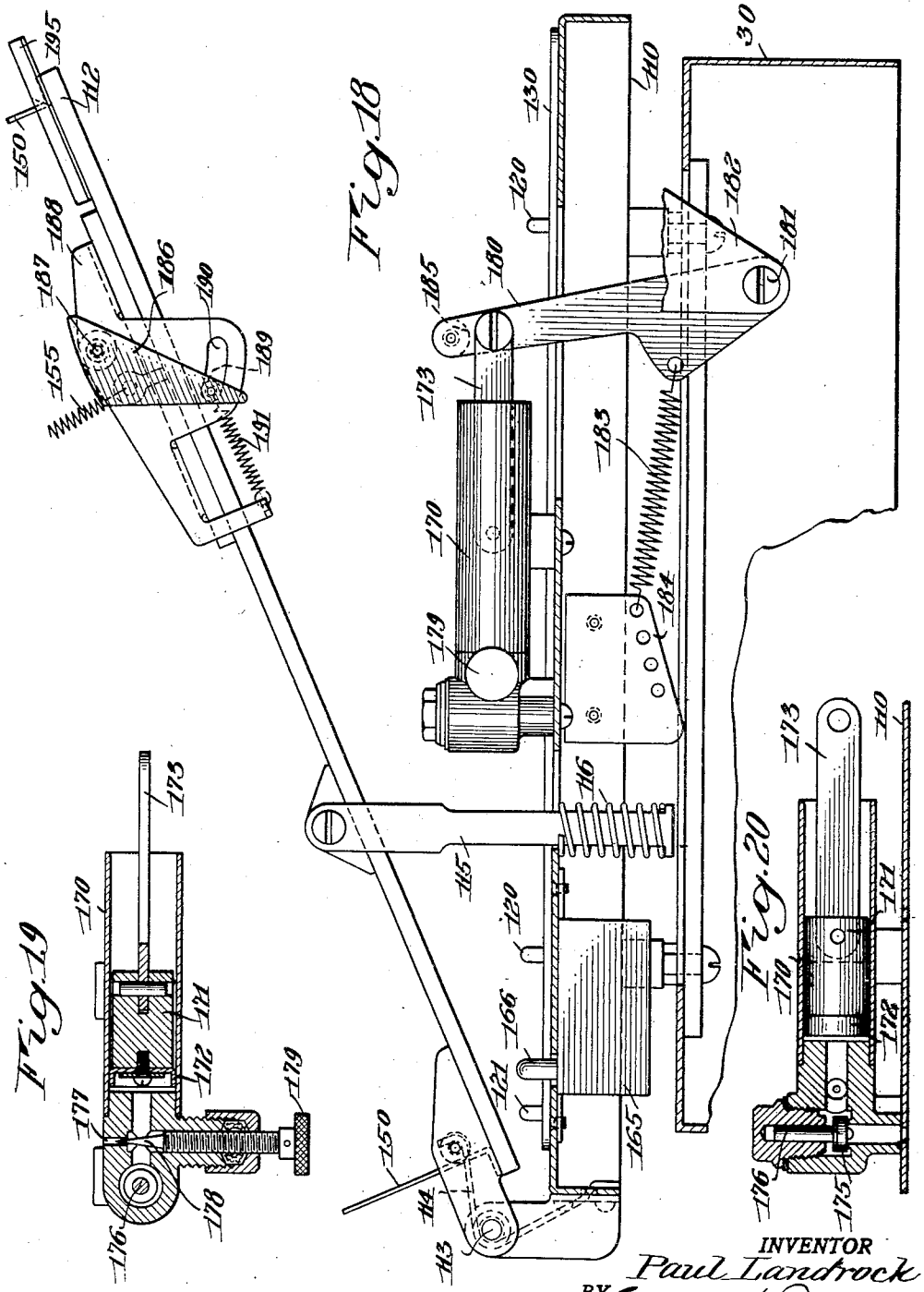


INVENTOR
Paul Landrock
BY Edward H Cumpston
his ATTORNEY

March 10, 1936. P. LANDROCK 2,033,290

PHOTOGRAPHIC COPYING MACHINE

Filed Dec. 21, 1932 6 Sheets-Sheet 6



INVENTOR
Paul Landrock
BY Edward H. Compton
his ATTORNEY

Patented Mar. 10, 1936 2,033,290

UNITED STATES PATENT OFFICE

2,033,290

PHOTOGRAPHIC COPYING MACHINE

Paul Landrock, Rochester, N. Y., assignor to Photostat Corporation, Providence, R. I., a corporation of Rhode Island

Application December 21, 1932, Serial No. 648,183

8 Claims. (Cl. 88—24)

This invention relates to a photographic copying machine.

An object of the invention is the provision of a simple and sturdy copying machine, of few parts, easy and comparatively inexpensive to construct, which is not liable to get out of order.

Another object is the provision of such a machine so designed and constructed that it may be operated satisfactorily and efficiently by a comparatively inexperienced operator.

Still another object is the provision of a simple and compact machine with relatively few moving parts, in which actuation of the machine may be manually initiated, but which has various functions performed automatically.

A further object is the provision of a photographic copying machine in which the performance of an act in connection with placing the copy to be photographed, such as the closing of the copy holder, for example, will automatically cause an exposure of the proper duration to be made.

A still further object is the provision of a photographic copying machine which, although simple and having but few parts, is substantially foolproof in operation.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a side elevation of a photographic copying machine constructed in accordance with a preferred embodiment of the invention;

Fig. 2 is a fragmentary view of a portion of the machine shown in Fig. 1, with parts broken away, to illustrate the shutter of the camera;

Fig. 3 is a vertical section through the lower part of the camera body taken substantially on the line 3—3 of Fig. 7;

Fig. 4 is a vertical section through a clutch, taken substantially on the line 4—4 of Fig. 3;

Fig. 5 is a similar section through another clutch, taken substantially on the line 5—5 of Fig. 3;

Fig. 6 is a view of part of the mechanism used to prevent overrunning of the feed rollers;

Fig. 7 is a side elevation of a part of the camera, illustrating certain of the mechanism shown in Fig. 1, with the parts in a different position;

Fig. 8 is a view of a fragment of the opposite side of the camera from that shown in Figs. 1 and 7;

Fig. 9 is a vertical section taken substantially on the line 9—9 of Fig. 7;

Fig. 10 is a vertical sectional view taken substantially centrally through a portion of the camera illustrating the sheet feeding and severing mechanism;

Fig. 11 is a general plan of the copy holder and the associated illuminating means;

Fig. 12 is a side elevation of the copy holder in its closed position, with parts in vertical section;

Fig. 13 is a view of a backing plate used in connection with the copy holder;

Fig. 14 is a view of the opposite side of the same backing plate;

Fig. 15 is a plan of the copy holder on a somewhat larger scale than Fig. 11, and with the illuminating means broken away;

Fig. 16 is a transverse section through the copy holder taken substantially on the line 16—16 of Fig. 15 illustrating the parts in their closed position;

Fig. 17 is a fragmentary view of certain of the parts shown at the right hand end of Fig. 16, as they appear when the copy holder is in its open position;

Fig. 18 is a side elevation somewhat similar to Fig. 12 but showing the copy holder in its open position;

Fig. 19 is a substantially horizontal section through the pneumatic cylinder for controlling the copy holder, and

Fig. 20 is a substantially vertical section through the same cylinder.

The same reference numerals throughout the several views indicate the same parts.

The machine illustrated in the accompanying drawings and described in detail in this specification as the preferred embodiment of the invention, is a machine particularly adapted for the rapid photographic copying of various documents and papers, at a predetermined constant size ratio (preferably one to one). It comprises, in general, a base 30 having near its left hand end an upwardly extending casing or chamber 31 constituting the camera body, in the upper part of which is placed a roll box 32 accessible through a door 33. The roll box may carry a roll 34 of sensitized photographic material such as paper, for example. The strip of sensitized material is gradually unwound from the roll 34, passed over a suitable guide roller 35, and led thence downwardly through the focal plane of the camera as indicated at 36.

Light entering the camera through the prism 37 and suitable lenses within the lens casing 38

passes through the bellows 39 and to the focal plane, where the light falls upon the sheet material at 36 and causes an exposure of this sheet material.

After each exposure, the exposed portion of the sheet material is moved out of the focal plane to bring a fresh unexposed portion of the sheet material into the focal plane ready for the next exposure. This feeding may be accomplished, for example, by means of a feed roller 40 (Figs. 1, 3, and 10) engaging one side of the sheet material, while another roller 41 mounted on swinging arms 42 presses the sheet material against the feed roller 40. The two rollers 40 and 41 are preferably connected to each other to rotate together, by means of a gear 43 on the shaft of the roller 40 meshing with another gear on the shaft of the roller 41.

Rotation of the rollers 40 and 41 feeds the sheet material downwardly past a severing knife 45 and into the lower part of the casing 31, where the sheet material is indicated at 46 and where it is preferably rewound on a suitable winding spool or reel 47 held, for example, on the tapered driven trunnion 48 and the supporting trunnion 49 (Figs. 3 and 9) which supporting trunnion is normally held in proper effective position by the spring 50 and may be withdrawn longitudinally against the action of the spring by pulling on the external knob 51, to release the trunnion from the spool and permit the spool to be withdrawn from the machine through a door 52.

The trunnion 48 may be driven in any suitable manner to produce the desired rotation of the spool 47 for rewinding purposes. For example, a pulley 55 may be mounted on the shaft of the feed roller 40 and connected by means of a coiled spring belt 56 to a pulley 57 on the shaft of the trunnion 48, so that rotation of the feed roller 40 causes rotation of the rewinding trunnion 48, but the coiled spring belt 56 may slip over the pulleys in known manner so that the sheet material is always kept reasonably tightly wound on the spool without being broken by too great a tension on it.

In many instances, the entire roll of sheet material from the roll 34 will be exposed and rewound on the spool 47 before the spool is removed from the machine to be developed and fixed. In other instances, however, it may be desired to develop part of a strip of sheet material without waiting for the entire strip to be exposed. This may be accomplished by cutting the strip at the proper point by means of the previously mentioned knife 45 (Fig. 10) which may be actuated by means of an arm 60 (Figs. 1 and 10) engaging the knife to reciprocate it, which arm is preferably directly connected to and operated by the external operating lever or arm 61 (Fig. 1).

The feed rollers 40 and 41 may be actuated in any suitable manner. It is an object of the present invention, however, to provide a machine which is substantially foolproof and which may be operated satisfactorily by a person having substantially no previous experience with machines of this kind. To this end, novel and improved mechanism of simplified construction is provided for operating the feed rolls.

Heretofore, it has been customary in machines of this same general character to operate the feed rolls by means of a crank which has usually had to be turned repeatedly through a number of revolutions in order to produce the proper amount of feeding for each exposure. This has required the operators to have some experience, at least to the extent of knowing how many revolutions should be imparted to the crank at each feeding operation, or else it has been necessary to provide a stop device for stopping the crank at the end of the proper number of revolutions, with the attendant necessity of instructing the operator in the function and use of such a stop device.

In the simplified and foolproof construction according to the present invention, however, a lever or arm is provided which, upon a single oscillation through materially less than one complete revolution, is effective to produce the desired amount of feeding of the sensitized sheet material. Thus, it is not necessary for an operator to be trained to turn a crank through a certain number of revolutions, to to understand the use of a stop device. All that it is necessary for him to do, when using the simplified machine of the present invention, is to grasp the feeding arm or lever and give it one pull as far as it will go, this being sufficient to produce the desired feeding.

The feeding lever is indicated at 70 in Figs. 1, 3, and 7, and is mounted for oscillation about an axis 71. A gear segment 72 is directly connected to the arm 70 to move therewith. This gear segment, as plainly shown in the drawings, extends through only a small part of a complete circle.

A spring 73 coiled around a hub on the arm 70 tends to hold this arm in its extreme clockwise position, in which an edge of the gear segment 72 abuts against a suitable stop on the side of the casing 31, such as the housing cooperating with the trunnion 49.

A pinion 75 mounted on the shaft of the feed roller 40 meshes with the gear teeth on the gear segment 72. The radius of the pinion is materially less than the radius of the gear segment, so that a single oscillation of the gear segment through a minor part of a single revolution will cause the necessary plurality of revolutions of the feed roller 40 to feed the sheet material through the required distance. The relative proportions of the radii of the pinion and of the gear segment may be varied as circumstances may require, but in practice it is found to be satisfactory to have the radius of the gear 72 approximately ten times the radius of the pinion 75.

To produce a feeding operation, the arm 70 is grasped when it is in its initial or normal position, illustrated in Fig. 1, in which it is held by the spring 73. The lower end of the arm 70 is then pulled rightwardly so as to rotate the gear segment in a counterclockwise direction, the pulling being continued to the extreme limit of the motion of the parts; that is, until an adjustable abutment screw 76 on the gear segment comes into contact with a suitable abutment on the casing. This single pull of the operating arm 70 produces a predetermined plurality of clockwise revolutions of the pinion 75 and of the feeding roller 40, thus feeding the sheet material accurately through exactly the predetermined amount necessary to remove the exposed portion of sheet material from the focal plane and to bring a fresh unexposed portion into the focal plane.

When the single pull on the operating member 70 has been completed, to the position shown in Fig. 7, the operator lets go of the arm 70 and the spring 73 causes it to move back from the position shown in Fig. 7 to its initial or normal position shown in Fig. 1. During this return movement of the parts, the pinion 75 has a corresponding return movement in a counterclockwise direc-

tion, but this does not affect the feed roller 40 because of the clutch arrangement now to be described with reference to Figs. 3, 4, and 5.

The pinion 75 is not directly connected to the shaft of the feed roller 40 but is free to rotate thereon. A clutch block 78 is fixed to the shaft between the pinion 75 and the wall of the casing 31. The pinion 75 is provided with an annular flange 79 cooperating with rollers or balls 80 pressed by springs 81 toward the small ends of tapered recesses in the block 78. These parts constitute a one-way clutch operating in a manner well understood in the art, whereby clockwise rotation of the pinion 75 and annular flange 79 is effective to cause corresponding clockwise rotation of the block 78 and the roller shaft on which it is mounted. Counterclockwise rotation of the pinion 75, however, causes no corresponding movement of the block 78 or the feed roller.

A similar one-way clutch, but effective in an opposite direction, is interposed between the block 78 and the casing 31 so as to prevent any possibility of accidental retrograde or counterclockwise rotation of the feed roller while the pinion 75 is moving in a counterclockwise direction. Thus, as shown in Figs. 3 and 5, the block 78 has an annular flange 82 cooperating with balls or rollers 83 similarly pressed by springs toward the small ends of tapered recesses which extend in an opposite direction from the recesses of the clutch shown in Fig. 4, these tapered recesses being formed in a block 85 fixed to the casing 31. These parts constitute a one-way clutch permitting the block 78 and the feed roller shaft to turn freely in a clockwise direction but preventing any retrograde or counterclockwise rotation.

By this arrangement, the movements of the feeding lever 70 are transferred to the feed roller 40 only when the lever is moved rightwardly or in a counterclockwise direction. When the lever 70 is released at the end of the stroke and is allowed to return to initial position under the influence of the spring 73, the pinion 75 rotates idly on the feed roller shaft and the feed roller is held against reverse rotation by means of the clutch illustrated in Fig. 5.

Because of the comparatively great step-up ratio of the gearing between the lever 70 and the feed roller 40, it is obvious that the feed roller will move much faster than the rate of angular movement of the lever 70. If an operator moves the lever 70 comparatively rapidly while making a feeding operation, the feed rollers 40 and 41 may attain a considerable velocity and the inertia of the parts might be so great that rotation of the rollers might continue to some extent even after the lever 70 had reached the limit of its movement. Such additional or excess rotation of the feeding rollers would be undesirable, not only from the standpoint of waste of sensitized material, but also because it would be more difficult to cut the separate exposures apart after a long roll of exposed sensitized material had been developed. Consequently, in furtherance of the object of making the machine simple and foolproof, the machine is preferably provided with stop mechanism which will prevent any such excess rotation or overthrow of the feed rollers, even if the feeding lever 70 is actuated rapidly or violently.

This is accomplished, in the present instance, by stop means actuated by the gear segment 72 when it reaches its predetermined limit of motion. The previously mentioned adjustable abutment screw 76 on the gear segment 72 is adapted, as previously stated, to cooperate with an abutment on the casing 31. The abutment, in the present instance, is in the form of an ear or lug 90 (Figs. 1, 3, 6, and 7) on a lever 91 fixed to the shaft 92 which is capable of slight oscillation and which extends through the casing 31 from one side to the other. A spring 93 normally pulls the lever 91 in a clockwise direction and holds it at the extreme rightward limit of its motion, where the left hand end of a slot 94 in the lever engages a stud 95 screwed through the slot and into the casing. The arm 91 can move counterclockwise or leftwardly against the influence of the spring 93 to a limited extent until the left hand edge of the arm comes into contact with a stop member 96 in the form of a lug or plate securely fastened to the casing 31.

As the gear segment 72 is swung leftwardly or in a counterclockwise direction by actuation of the lever 70, the adjustable abutment screw 76 comes into contact with the ear 90 on the lever 91 and thus moves the lever slightly leftwardly until it, in turn, comes into contact with the stop plate 96, when further motion of the parts is arrested. This determines the extreme limit of motion of the operating lever 70 and gear segment 72.

When the lever 91 is turned slightly as above described, a slight counterclockwise rotation of the shaft 92 is thereby produced, which moves an arm 98 (Figs. 3, 6, and 8) fixed to the opposite end of the shaft 92, which are 98 presses upon and moves an arm 99 of a two armed lever pivoted at 100 to the casing. The other arm 101 of this lever, normally pulled downwardly by a spring 102, has an end which, when it is elevated, constitutes a pawl engaging teeth 103 of a ratchet fixed to the shaft of the feed roller 40, thus stopping the rotation of the feed roller and preventing it from continuing to rotate by momentum after the feeding lever 70 has reached the limit of its motion.

Thus it is seen that the feeding lever 70, at the end of its stroke, operates stop mechanism for stopping the rotation of the feed rollers so that the sensitized sheet material is fed accurately through the same distance each time that the lever 70 is operated.

The feeding mechanism above described is not claimed per se in this application but forms the subject matter of a co-pending divisional application, Serial No. 707,001, filed Jan. 17, 1934.

Mounted near the right hand end of the base 30 of the machine is a copy holder for holding the articles to be photographed in proper position in the photographic field of the camera. This copy holder may comprise, for example, a base or body plate 110 suitably mounted on the base 30, and a holding member such as the transparent plate 111 (of glass or other suitable material) held in a frame 112 hinged to the body at 113. Springs 114 normally tend to throw the holding member 111, 112 upwardly to the open position shown in Fig. 18, but permit it to be forced downwardly when desired to the closed position shown in Fig. 12, in which the holding member will overlie the article to be photographed and hold it down flat in the photographic field of the camera. The copy holder is substantially centered under the prism 37, of course, so that light rays from objects held by the copy holder may pass upwardly to the prism, be bent by the prism through approximately a right angle, and enter the camera.

A stop member such as the link 115 (Fig. 18)

pivoted to the frame 112 and extending through a slot in the base member 110, is provided for limiting the upward movement of the frame under the influence of the spring 114. A coil spring 116 may surround the link 115 beneath the plate 110, as plainly shown in the drawings, to provide cushioning means for stopping the upward movement without jar or undue strain.

Suitable guide pins may be provided for accurately positioning the documents or other copy to be photographed, especially when it is intended to use the machine for photographing a series of documents of substantially the same size. Guide pins 120 may be provided along the right hand side of the copy holder, and other guide pins 121 along the back edge of the copy holder, as indicated particularly in Fig. 15, which pins may all be of the construction indicated in Figs. 16 and 17. As shown, each guide pin extends substantially vertically through a hole in the base plate 110 and is pressed upwardly by a spring 122 so that the pin normally projects a substantial distance above the plate 110 as shown in Fig. 17, but when the transparent plate 111 is brought down to its closed position it pushes down the guide pin against the influence of the springs 122, as plainly indicated in Fig. 16.

By the use of guide pins at one side and the back of the copy holder, the documents to be copied can thus be accurately positioned in predetermined relation to the photographic field of the camera, as by sliding a document rearwardly (when the frame 112 is open) with its right hand edge in contact with the side pins 120, until the rear edge comes into contact with the back pins 121. A document thus positioned is shown at 125 in Figs. 15, 16, and 17.

In many cases, when an exposure is made, the field of view of the camera takes in not only the actual document itself but a slight margin around the edge of the document. In other cases, even when the field of view of the camera is adjusted to take in only the document itself, it sometimes happens that one or several documents of the series being photographed may have frayed edges or otherwise be slightly smaller than the standard size, in which case the resulting photographic copy would show a slight margin in addition to the document itself.

In either case, it is usually desirable to have the background on which the document is laid of substantially the same color as the document itself, so that any margin which may appear around the document in the finished photographic copy will be of substantially the same color as the document and not of a conspicuous contrasting color. This result of a margin of the same color as the document can not be attained readily by coloring the copy holder base itself, because the documents to be photographed are frequently of materially different colors. For example, original documents to be photographed usually have writing or printing in black or dark colored letters on a white or light background, and in such cases it would be desirable to have the margin around the documents also of a white or light colored nature. In other cases, it may be desired with this copying machine to photograph photographic copies previously made of original documents. Such photographic copies, frequently called "negatives" in the photocopying art, usually have the colors of the original document reversed; that is, the writing or printing on the photographic copy will appear in white or light colored letters on a background which is black or dark colored. When photographing such articles, it is desirable to have the margin around the document of a black or dark colored nature.

In order to accommodate the copy holder to efficient and satisfactory copying of both classes of documents, the present invention provides a reversible backing plate of thin sheet material such as metal, indicated at 130 in Figs. 13 to 18 inclusive. One side of this plate is white or of a light color, as indicated in Fig. 13, while the opposite side is black or of a dark color, as indicated in Fig. 14. The plate has holes 131 near its rear edge to fit over the rear guide pins 121, and holes 132 at each of its opposite side edges, one pair of such holes 132 fitting over the side guide pins 120 when the plate has one side up, and the other pair of holes 132 fitting over the pins 120 when the plate is reversed with the other side up.

This plate, as will be plainly seen from Figs. 15 and 16, for example, is of greater length and breadth than the size of the document to be photographed, so that a margin is provided around all four sides of the document, which margin may be changed in color by turning the plate 130 over. Thus the apparatus is adapted for quick and easy copying of documents with either white backgrounds or black backgrounds. It will also be noted that the plate 130 has its edges just inside the frame 112 which holds the transparent plate 111, so that when the copy holder is closed the transparent plate rests upon the document on the backing plate 130 but the frame 112 does not contact or interfere with the plate 130 or with the base plate 110.

Illuminating means is provided for giving the proper illumination to articles held in the copy holder. Such illuminating means may comprise, for example, electric lamps 140 preferably arranged in the positions shown in Fig. 11 within a pair of lamp housings 141 mounted on brackets 142 (Fig. 1) secured as by means of thumb screws 143 to outwardly extending flanges 144 on the copy holder plate 110.

It is found that such illuminating means, arranged as shown in casings proportioned and placed substantially as shown in the drawings, give excellent illumination over most of the area of the copy holder, but that near the center of each end of the copy holder there is a small area having a less intensity of illumination than other parts of the copy holder. In order to remedy this, the present invention provides a pair of reflectors 150 in the form of upstanding members mounted on the front and back edges of the frame 112 to move bodily with the frame in its opening and closing movements. These reflectors 150 are found to be efficient and satisfactory if formed merely as thin upstanding plates having their inner surfaces painted or enameled white. It will be noted from Fig. 1 that these reflectors 150 do not extend the entire length of each end of the copy holder, but are materially narrower than the copy holder, being approximately the width of the dark spots for which further illumination is desired. It is found in actual practice that the use of such reflectors proportioned substantially as illustrated in the drawings, is satisfactory in giving proper illumination to the areas near each end of the copy holder which would otherwise be darker than the rest of the copy holder.

According to the present invention, the camera shutter and preferably also the illuminating

means are operated or controlled by the opening and closing movements of the copy holder. Thus efficient and rapid operation is secured, because as soon as the copy holder is closed, the lights go on and the shutter is opened to start an exposure, and as soon as the copy holder is opened, the shutter is closed to stop the exposure and the lights go off not only to save electricity but to call attention forcibly to the fact that the apparatus is ready for the removal of the photographed document and the insertion of the next document.

To accomplish these ends, a connection is provided between the camera shutter and the copy holder frame 112. This connection, in the present preferred embodiment, comprises the construction best shown in Fig. 1, in which a short coiled spring 155 has its lower end attached to the copy holder frame 112 and its upper end attached to a cord 156 extending upwardly through a guiding eyelet 157 and to a member 158 for controlling the shutter. The member 158 may be a wheel or pulley around which the cord 156 extends, which wheel or pulley may be mounted on the shaft 159 (Fig. 2) carrying a shutter flap 160 which, in its closed position, extends over the end of a tube 161 as shown in Fig. 2 so as to prevent passage of light into the camera. When the pulley 158 is rotated in a clockwise direction, the consequent turning of the shaft 159 moves the flap 160 to the open position illustrated in dotted lines in Fig. 2 so that light entering through the prism and lens system can pass the shutter. A spring 162 normally holds the shutter closed.

When the copy holder is open or in the position shown in Fig. 18, the cord 156 is slack and the shutter is closed. As the copy holder is closed, near the lower limit of its motion the cord 156 is tensioned and pulled downwardly, which turns the pulley 158 and opens the shutter, holding it open until the copy holder is again opened, at which time the shutter is closed.

The illuminating means, as above stated, are preferably also controlled from the copy holder. To this end there may be provided an electric switch of the plunger type indicated diagrammatically at 165 in Figs. 12 and 18, the switch being closed by depressing a plunger 166 and opened by releasing the plunger. The switch is mounted in such position that the plunger 166 will be depressed upon the closing of the copy holder frame 112, as shown in Fig. 12, and will be permitted to rise when the copy holder is opened, as in Fig. 18. The switch, of course, is connected to an electric circuit controlling the illuminating lamps 140. Thus, when the copy holder is closed, the switch is closed and the lamps are lit, and when the copy holder is opened the switch is opened and the lamps are extinguished. Preferably the switch 165 is the only switch effective to light the lights, so that it is not possible to light them except by closing the copy holder or otherwise depressing the plunger 166. Thus waste of current is eliminated and a careless operator can not leave the lights burning continuously even if he wishes to.

In furtherance of the object of making the copying machine extremely simple and foolproof, so that no experience is necessary to operate it, the present invention provides automatic timing mechanism for holding the copy holder closed during a predetermined amount of time necessary for making the proper exposure, and for then opening the copy holder. This timing mechanism may be of any suitable construction for accomplishing this purpose, but according to the present preferred embodiment it is made as indicated particularly in Figs. 12, 15, and 18 to 20 inclusive, to which reference will now be made.

Mounted near the left hand edge of the base plate 110 of the copy holder is a pneumatic cylinder 170 having within it a piston 171 provided with suitable packing 172 and connected to a connecting rod or link 173. When the piston is drawn forwardly (or to the right when viewed as in Figs. 19 and 20) air is readily admitted behind the piston through a check valve 175 mounted on a vertically movable stem 176. Then when the piston is moved rearwardly (or to the left when viewed as in Figs. 19 and 20) the air trapped behind the piston cannot escape through this check valve but can flow out only through a small discharge port 177 controlled by the needle valve 178 adjustable exteriorly by means of a knurled head 179. Suitable adjustment of the member 179 can be made to vary the rate of release of the entrapped air and thus to vary the length of time required for the piston to complete its rearward travel after a predetermined forward stroke.

The forward end of the connecting link 173 is pivoted to a lever 180 the lower end of which is pivotally mounted at 181 on a bracket 182 secured to a fixed part such as the plate 110. A spring 183 connected to the lever 180 and to any one of a series of holes in the plate 184, pulls rearwardly on the lever 180 and thus tends to move the piston rearwardly within the cylinder 170.

At its upper end, the lever 180 carries a roller 185 laterally offset from the lever and in the plane of a cam member 186 which is pivoted at 187 to a bracket 188 secured to the frame 112 of the movable part of the copy holder. A pin 189 on the cam 186 rides in an arcuate slot 190 of the bracket 188 to limit the extent of oscillation of the cam about its pivot 187, and a spring 191 tends to rotate the cam in a clockwise direction until the pin 191 comes into contact with the left hand end of the slot 190.

The cam and roller together constitute latching means for holding the copy holder closed. The pivoted cam 186 has a generally triangular shape with its upper edge somewhat curved, the preferred shape and proportions being best seen from the drawings. When the copy holder frame 112 is depressed to close the copy holder, the lower corner of the cam 186 comes down just behind (to the left when viewed as in Fig. 18) the roller 185, and the inclined forward edge of the cam causes the roller 185 to move forwardly, thus pulling the piston 171 forwardly and admitting air behind the piston. Then, just as the copy holder reaches its fully closed position, the roller 185 rides around the front corner of the cam 186 and begins to ride rearwardly on the top edge of the cam under the influence of the spring 183. The position of the parts at this moment is shown in Fig. 12. As soon as the roller has caught the upper edge of the cam in this manner, the roller holds the cam and consequently the frame 112 against upward movement under the influence of the spring 114, and thus the operator who depressed the copy holder frame can now let go of it.

The roller 185 now rides rearwardly along the upper surface of the cam 186 but this rearward movement is comparatively slow because of the dashpot action of the cylinder 170 and piston 171, the air escaping from behind the piston only at a relatively slow rate determined by the adjustment of the needle valve 178. Finally, the roller

185 passes beyond the upper rear corner of the cam, so that it no longer holds the cam downwardly and thus the spring 114 is permitted to raise the frame 112 and cam 186 upwardly to the open position shown in Fig. 18. During this upward movement, the cam oscillates in a counterclockwise direction about its pivot 187 against the tension of the spring 191, as the rear inclined edge of the cam rides along the roller 185 which is now substantially stationary, and after the cam has fully passed above the roller, the spring 191 snaps the cam back to its initial position shown in the drawings.

Thus, by means of this timing mechanism, the copy holder is maintained closed during a predetermined period of time which is capable of adjustment by means of the member 179. So long as the copy holder is closed the camera shutter is open and the lights are lit. At the end of the predetermined time, the copy holder is automatically opened without any attention on the part of the operator, and concomitantly with the opening the camera shutter is closed and the lights are extinguished. The photographed document can then be removed from the copy holder, the next document to be photographed can be placed therein, and, after pulling the lever 70 to feed the sheet material, the copy holder can be again closed to hold the document flat on the copy holder and to open the shutter and light the lights for the next exposure.

A hand piece 195 may be provided at the forward left hand corner of the frame 112 to be conveniently grasped by the operator for closing the copy holder.

A brief outline of the operation of the machine may be convenient at this point. With the copy holder in the open position shown in Fig. 18, the document to be copied is placed within the copy holder, preferably against the side guide pins 120 and the rear guide pins 121. If the document to be copied has a white or light colored background the backing plate 130 is used with its light side uppermost as in Fig. 13, whereas if the document to be copied has a dark or black background the plate 130 is turned over so that its dark side is uppermost as in Fig. 14.

The operator then grasps the hand piece 195 and depresses the copy holder frame 112 to the extreme downward limit of its motion. The roller 185 immediately snaps around the corner of and engages the top of the cam 186, which holds the copy holder in closed position so that the operator can immediately let go of it.

The last portion of the downward movement of the copy holder frame is effective to depress the switch plunger 166 to render the illuminating means effective, and to tension the cord 156 to open the camera shutter. Thus the actual exposure begins when the copy holder is closed, the transparent plate 111 meanwhile holding the document flat and accurately positioned in the photographic field of the camera.

No further attention to the exposure is necessary on the part of the operator. He does not have to time the exposure, as this is all done automatically by the timing mechanism, which may be adjusted at the factory making the machine, or by a factory representative installing the machine. No focusing of the camera is necessary, as the camera is preferably of the fixed focus type, always focused on the copy holder which is in fixed position relative to the camera. Hence an utterly inexperienced person, given only the simplest instructions, can operate the machine satisfactorily, because anyone without previous experience can at least learn quickly to place the documents in the open copy holder against the guide pins 120 and 121, and to close the copy holder.

At the end of the predetermined period of exposure, the roller 185 rides off of the top of the cam 186, releasing the cam so that the copy holder flies open under the influence of its spring 114. This opening of the copy holder at the same time closes the camera shutter and renders the illuminating means ineffective.

The operator then gives a single rightward pull to the feeding lever 70, which, through the gear segment 72, rotates the feed rollers 40 and 41 the necessary amount to feed the exposed part of the sensitized material out of the focal plane of the camera and to bring a fresh unexposed area of sensitized material into the focal plane. No matter how violently he may operate this feeding lever he does not produce excess feeding of the sheet material because at the end of the stroke of the feeding lever the stop pawl 101 comes into contact with the teeth of the ratchet 103 and stops further rotation of the feed rollers. Thus the operator need have no experience in feeding or winding sheet material in photographic apparatus, for it is necessary only for him to learn to give the feeding lever 70 a complete stroke in one direction to the limit of its motion, after each exposure. The spring 73 automatically returns the feeding lever to initial position ready for the next feeding operation.

While the copy holder is open, the operator also removes the photographed document and places the next document to be photographed in the copy holder. Then he once more closes the copy holder by pressing downwardly on the hand piece 195, and the next automatically timed exposure begins. The operation is thus repeated over and over again as often as may be necessary.

When the photographing of the several documents is completed, the strip of sensitized material can be cut by depressing the knife operating lever 61 if the entire roll of material 34 has not yet been consumed, and the spool 47 on which the exposed material is wound can be removed through the door 52 after releasing the spool by pulling outwardly on the trunnion knob 51. The sensitized material can then be developed and fixed in any desired manner. The advance end of the unexposed strip of material remaining in the camera after it has been cut by the severing knife, can then be pulled downwardly and connected to a fresh rewinding reel in known manner, thus making the machine ready for continued operation.

While one embodiment of the invention has been disclosed, it is to be understood that the inventive idea may be carried out in a number of ways. This application is therefore not to be limited to the precise details described, but is intended to cover all variations and modifications thereof falling within the spirit of the invention or the scope of the appended claims.

I claim:

1. A photographic copying machine comprising a camera, a copy holder for holding an article to be photographed by said camera, said copy holder including a member movable to an open position for inserting an article and to a closed position for holding an article, illuminating means adjacent one side of said member for illuminating an article held by said copy holder, and light re-

flecting means mounted on said movable member adjacent a different side thereof and movable bodily therewith.

2. A photographic copying machine comprising a camera, a copy holder for holding an article to be photographed by said camera, illuminating means for illuminating an article held by said copy holder, and an upstanding light reflecting flange mounted on said copy holder for reflecting light from said illuminating means.

3. A photographic copy holder comprising a bed, means movable with respect to said bed for overlying and holding an article placed on said bed, and two upstanding light reflecting members mounted on said movable means at opposite sides thereof and movable bodily therewith.

4. A photographic copy holder comprising a bed, a hinged member for overlying and holding an article placed on said bed, and a pair of upstanding light reflecting members mounted on and movable bodily with said hinged member.

5. A photographic copy holder comprising a base, a reversible backing plate supported on said base for underlying an article to be photographed, said reversible backing plate being of one color on one side for use with articles having a background of one color, and being of a different color on the opposite side for use with articles having a background of a different color, and cooperating interengaging parts for locating said backing plate with respect to said base.

6. A photographic copy holder comprising a base, a reversible backing plate supported from said base for underlying an article to be photographed, said reversible backing plate being substantially white on one side, for use with articles having a light background, and substantially black on the opposite side, for use with articles having a dark background, and cooperating interengaging parts for locating said backing plate with respect to said base.

7. A photographic copying machine comprising a substantially horizontal base, copyholding means mounted on said base near one end thereof, said means including a substantially horizontal flat surface for receiving a document to be copied and a movable transparent plate for overlying said document to hold it flat on said surface, a casing rising from said base near the opposite end thereof, said casing including means for holding sensitized material in a substantially vertical plane in position to be exposed, an extension projecting laterally from said casing toward a point over said copyholding means, light reflecting means mounted on said extension substantially over said copyholding means so that light rays may pass upwardly from said copyholding means to said reflecting means and be reflected thereby through said lateral extension to said sensitized material, shutter means in the path of travel of said light rays, and means connecting said shutter means to said transparent plate to operate said shutter means by movement of said transparent plate.

8. A photographic copying machine comprising a substantially horizontal base, copyholding means mounted on said base near one end thereof, said means including a substantially horizontal flat surface for receiving a document to be copied and a movable transparent plate for overlying said document to hold it flat on said surface, a casing rising from said base near the opposite end thereof, said casing including means for holding sensitized material in a substantially vertical plane in position to be exposed, an extension projecting laterally from said casing toward a point over said copyholding means, light reflecting means mounted on said extension substantially over said copyholding means so that light rays may pass upwardly from said copyholding means to said reflecting means and be reflected thereby through said lateral extension to said sensitized material, shutter means in the path of travel of said light rays, actinic illuminating means for throwing light upon said transparent plate and through said plate to a document held thereunder, and means operated by movement of said transparent plate for opening and closing said shutter means and lighting and extinguishing said illuminating means.

PAUL LANDROCK.