

April 29, 1947.

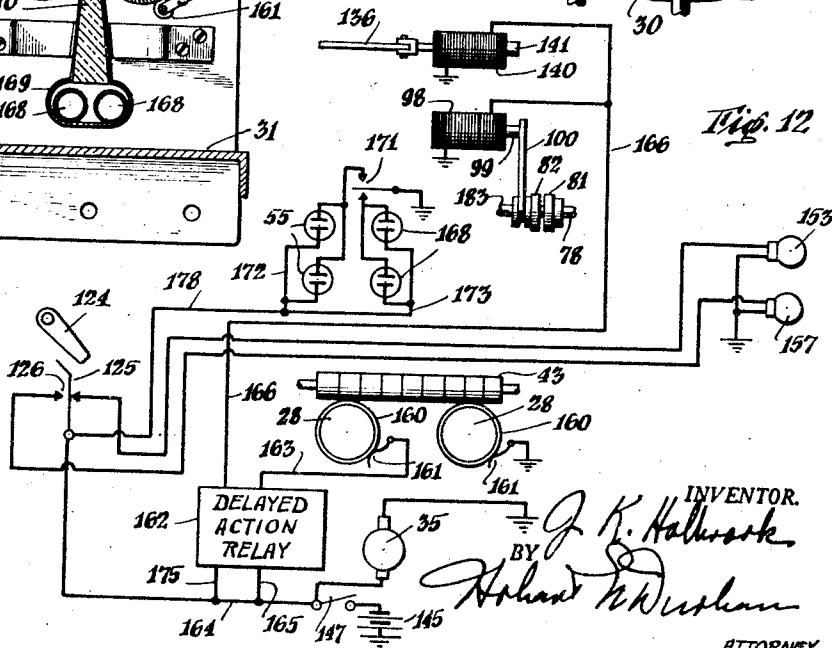
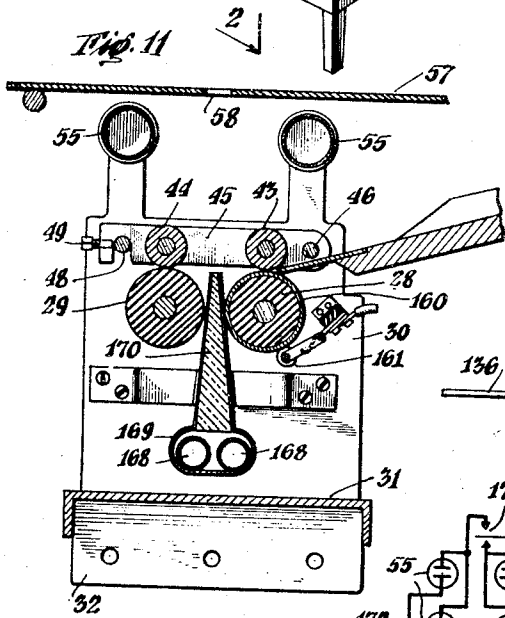
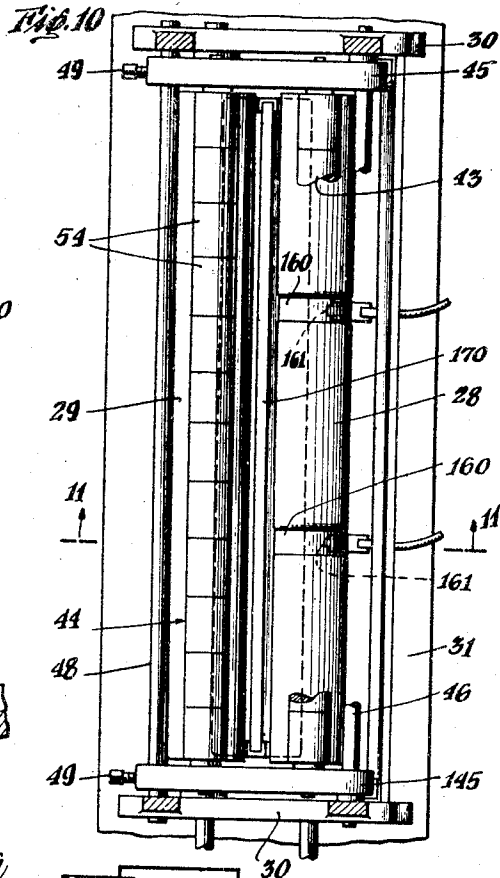
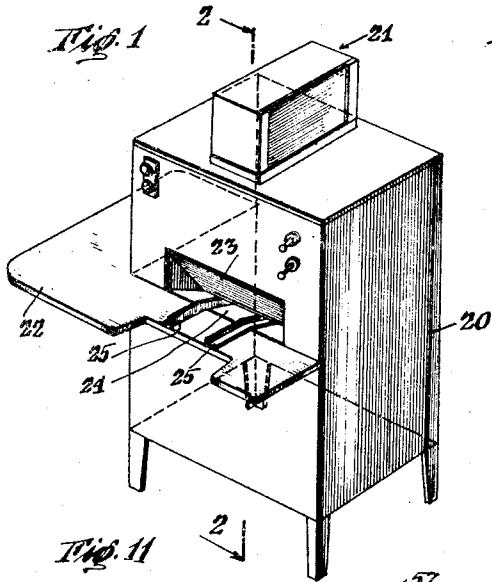
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2,419,836

DOCUMENT OPERATED SWITCH FOR PHOTOGRAPHIC COPYING CAMERAS

Filed April 13, 1944

5 Sheets-Sheet 1



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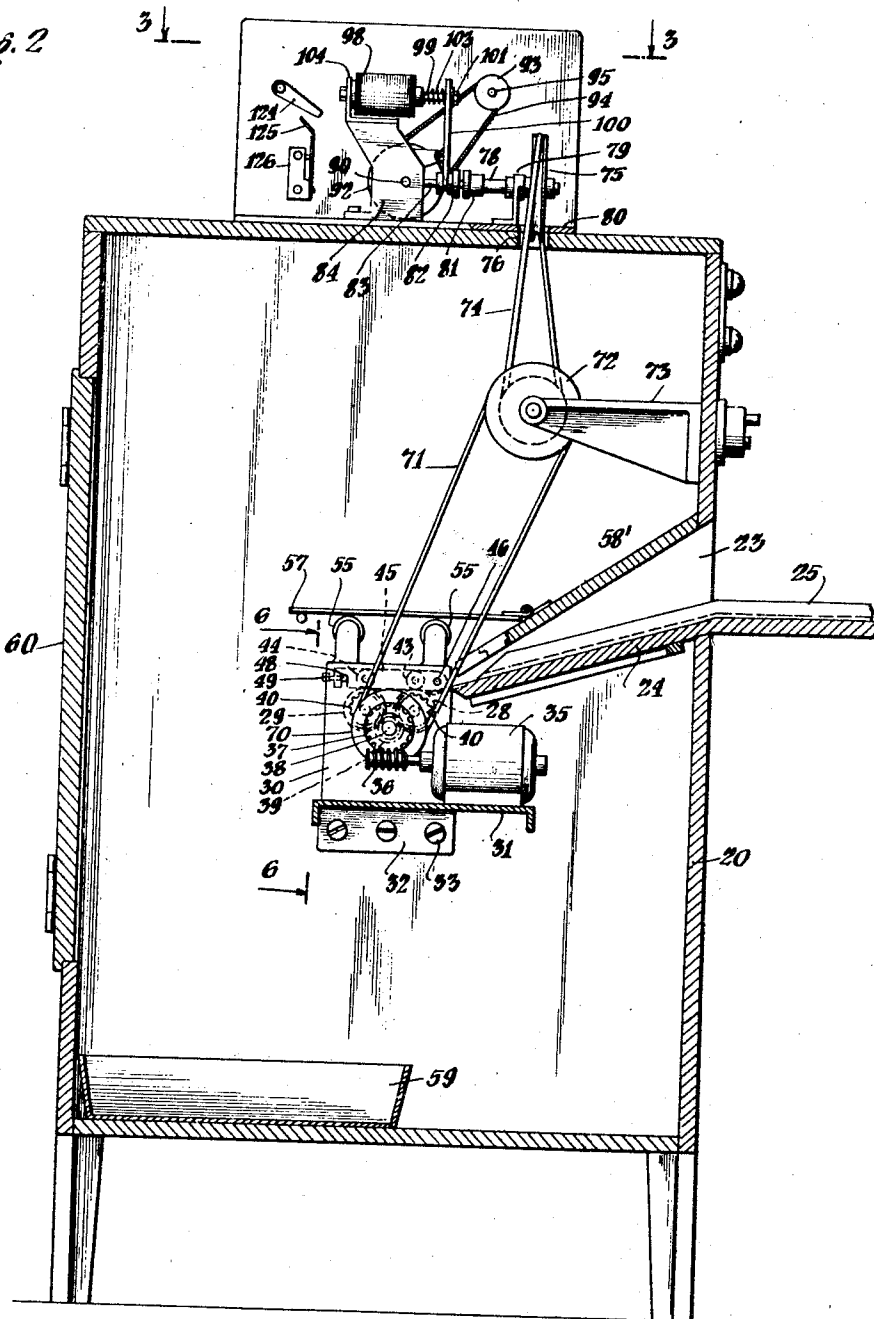
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DOCUMENT OPERATED SWITCH FOR PHOTOGRAPHIC COPYING CAMERAS

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Fig. 2



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Fig. 3

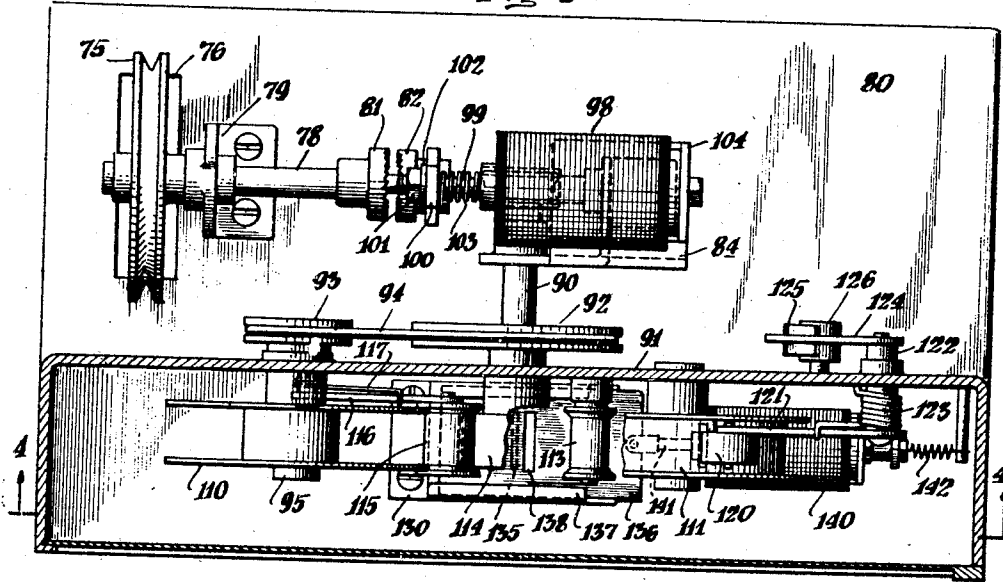
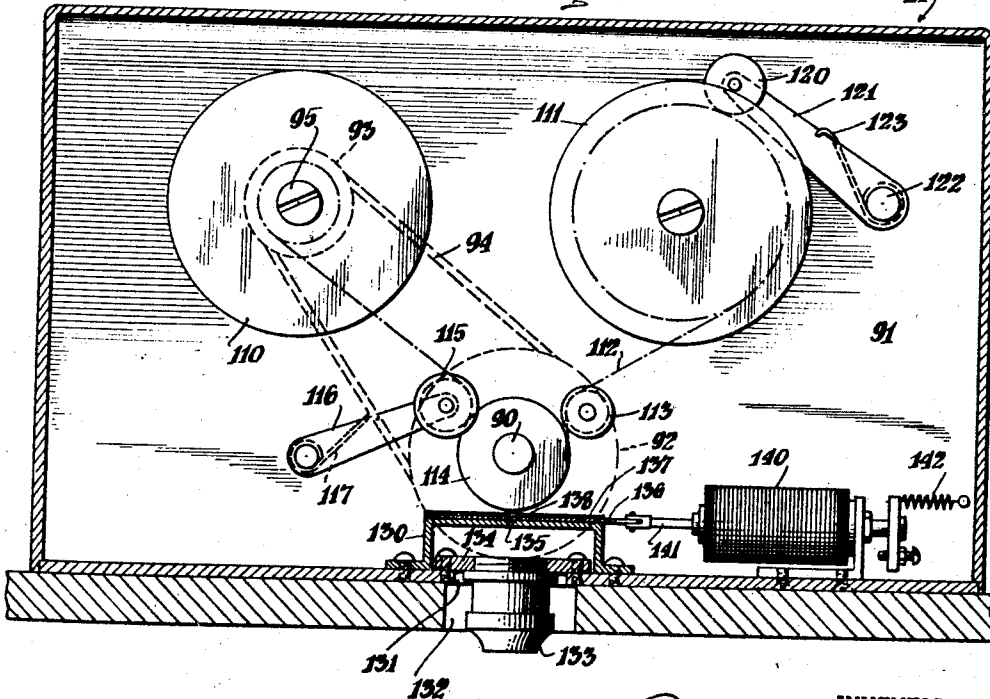


Fig. 4



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DOCUMENT OPERATED SWITCH FOR PHOTOGRAPHIC COPYING CAMERAS

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Fig. 5

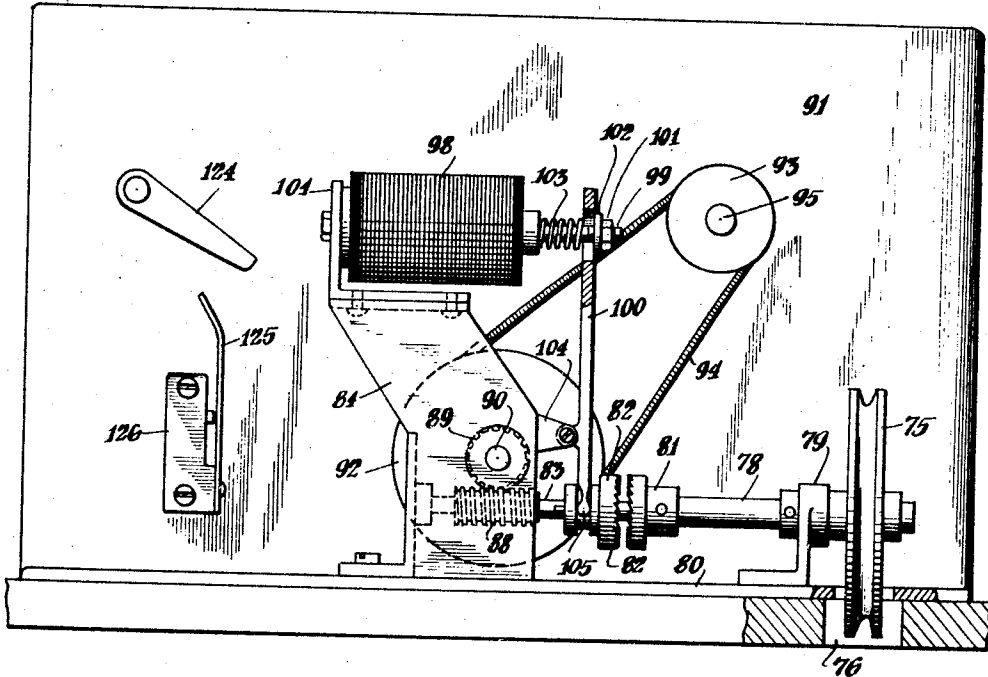
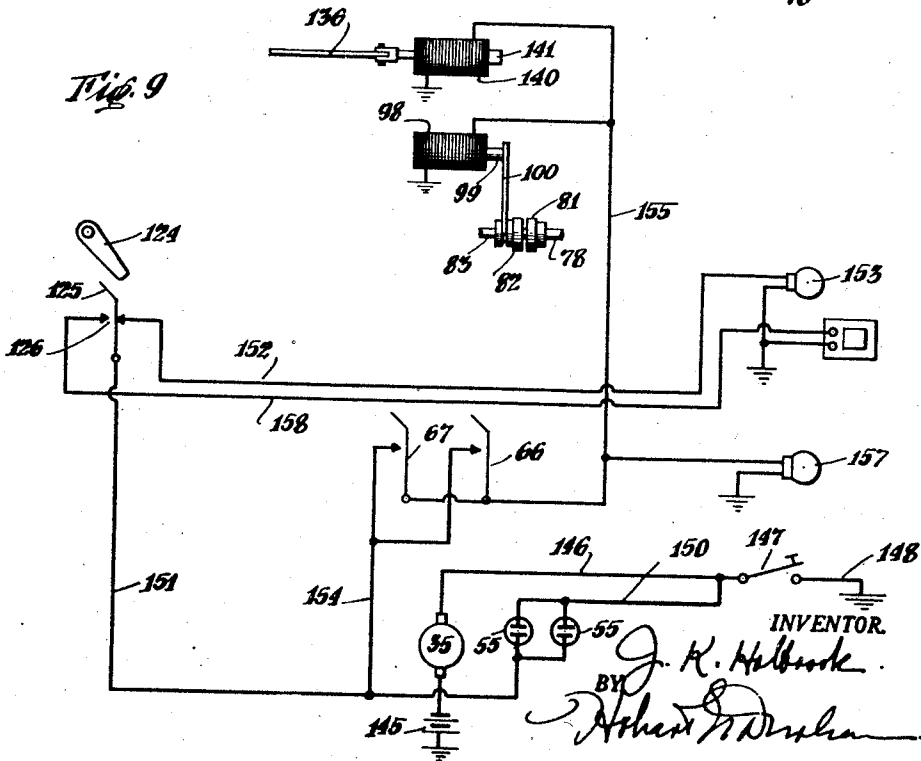


Fig. 9



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DOCUMENT OPERATED SWITCH FOR PHOTOGRAPHIC COPYING CAMERAS

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Fig. 6

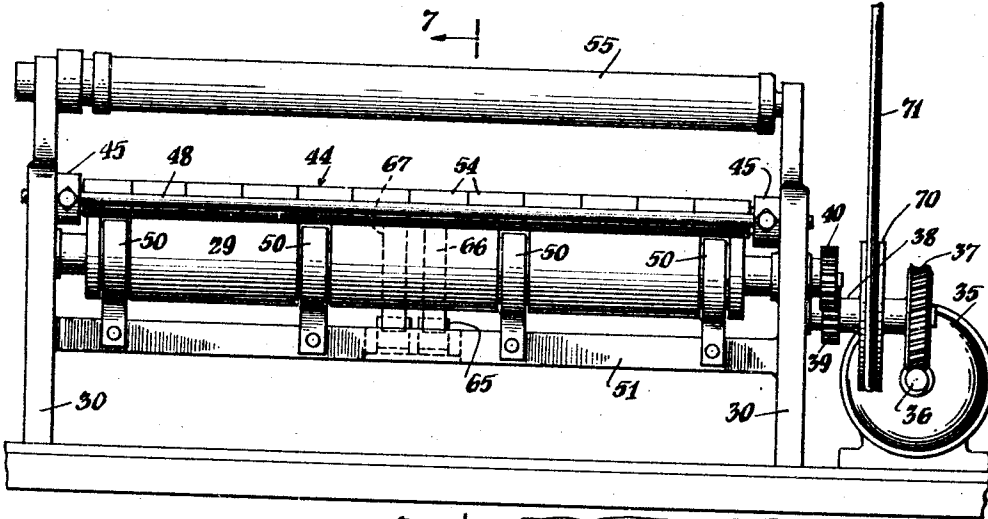


Fig. 7

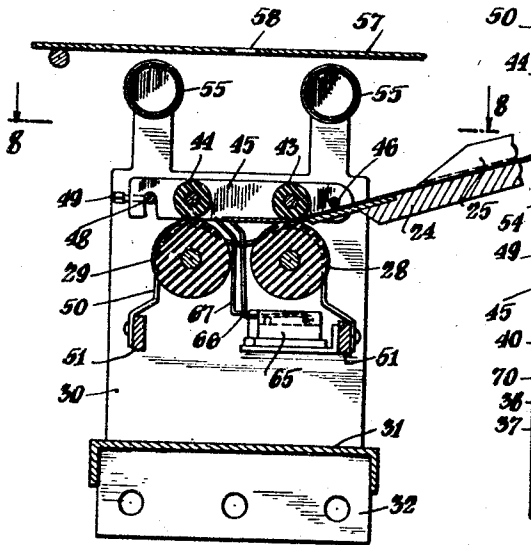
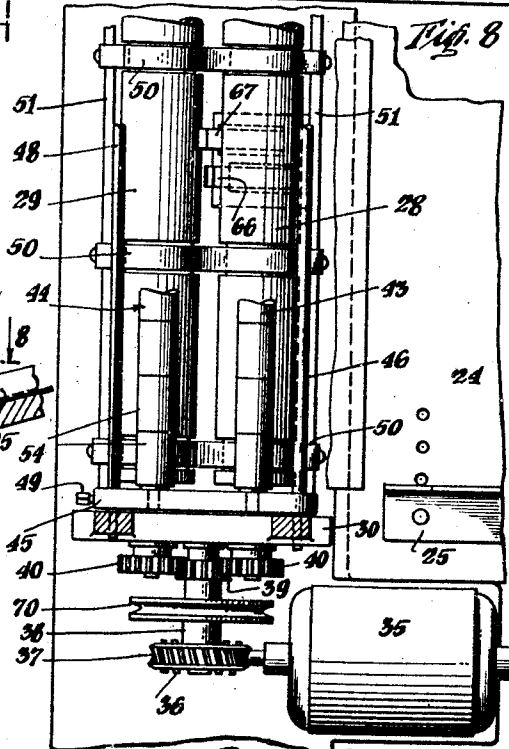


Fig. 8



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DOCUMENT OPERATED SWITCH FOR PHOTOGRAPHIC COPYING CAMERAS

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1 Claim. (Cl. 88—24)

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This invention relates to photographic copying apparatus and more particularly to the type of apparatus in which a strip of film is moved in one direction to photograph an object moving in an opposite direction, the velocities of the film and object being arranged proportionately to the conjugate focal distances so that a stationary image is projected on the film.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claim.

The invention consists in the novel parts, constructions, arrangements, combinations, and improvements herein shown and described.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

It is an object of the present invention to provide an improved copying apparatus particularly adaptable to the microphotographing, i. e., providing photographic copies on a reduced scale, of desired objects, such as business and other records of all types. A further object is the provision of such an improved apparatus of a continuous and automatic type in which a record to be photographed may be continuously moved through the photographic field of a camera having a strip of film which is continuously moved in an opposite direction the velocities of the film and object being arranged proportionately to the conjugate focal distances. The invention further provides improved and simplified apparatus for the photographing of both the front and reverse sides of such papers or records as it may be desired to record. Still another object is the provision of improved document feeding and lighting means for a copying apparatus, and also of improved control means for the automatic operation of the camera when a document is placed in the apparatus to be photographed.

Of the drawings:

Fig. 1 is a perspective view showing the front, side and top of a cabinet containing the photographic copying apparatus of the present invention;

Fig. 2 is a vertical sectional view taken along line 2—2 of Fig. 1 showing certain of the mechanism within the cabinet;

Fig. 3 is a horizontal cross sectional view taken

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along line 3—3 of Fig. 2 showing the camera and camera drive and clutch mechanism of the copying apparatus;

Fig. 4 is a vertical sectional view taken along line 4—4 of Fig. 3;

Fig. 5 is a side view of the camera drive and clutch mechanism shown in Fig. 3;

Fig. 6 is a side elevation of the document feeding and lighting means taken along line 6—6 of Fig. 2;

Fig. 7 is a vertical sectional view taken along line 7—7 of Fig. 6;

Fig. 8 is a plan view of the document feeding means taken along line 8—8 of Fig. 7;

Fig. 9 is a wiring diagram for the electrical control and drive mechanism of the apparatus shown in Figs. 1 to 8 inclusive;

Fig. 10 is a plan view of the document feeding means of a modified form of the photographic copying apparatus;

Fig. 11 is a vertical sectional view taken along line 11—11 of Fig. 10; and

Fig. 12 is a wiring diagram for the electrical control and drive mechanism of the modified construction shown in Figs. 10 and 11.

Referring now in detail to the illustrative embodiments of the present invention shown by way of example in the accompanying drawings, a cabinet 20 may be provided as a housing for the photographic copying apparatus, a smaller housing 21 being removably secured on the top of the cabinet as a cover for the camera. The cabinet 20 is provided with a shelf 22 extending across one side and the front of the cabinet as a convenient support for documents or other objects to be photographed. The front of the cabinet 20 is provided with an opening 23 through which such documents may be introduced by the operator on an inclined surface 24 having guide members 25 to correctly position the document.

As embodied, the document feeding means of the invention, as best shown in Figs. 2, 6, 7 and 8, may comprise a pair of feeding rollers 28 and 29 rotatably supported in a pair of end frames 30 which are supported on a transverse plate 31. The plate 31 supports the document feeding, driving and lighting means and, as shown, is removably secured to the ends of cabinet 20 by its end flanges 32 and screws 33 whereby the whole assembly may be conveniently removed from the cabinet.

The document feed is driven by means of electric motor 35 which has a worm gear 36 to drive a worm wheel 37 on shaft 38 which is journaled in one of the end frames 30. The shaft 38 car-

ries a gear 39 in mesh with a pair of gears 40 which are secured to respective shafts of rollers 28 and 29, whereby the rollers are driven by motor 35 for feeding the documents through the apparatus.

Idler rollers 43 and 44 are provided directly above the respective feeding rollers 28 and 29 and these rollers are rotatably mounted by their shafts in a pair of journal members 45. These journal members are positioned closely adjacent the side frames 30 and are pivotally positioned with respect thereto by means of a shaft 46 supported in the side frames and passing through the ends of members 45. The other ends of the journal members are supported by a rod 48 extending between side frames 30, and set screws 49 are provided for securing the members. With the construction shown it will be apparent that the idler rollers 43 and 44 may be conveniently swung back around the pivot of rod 48 in order to clear up a jam or stoppage in documents going through or to repair or adjust other parts of the mechanism.

A plurality of guide strips 50 are provided along the length of rollers 28 and 29 and are secured to supports 51 extending between side frames 30. The idler rollers 43 and 44, as may be seen in Fig. 8, are each formed of a plurality of roller sections 54 which are relatively loosely mounted on the respective roller shafts. The purpose of this construction is to provide a certain flexibility in the roller structure of the feed mechanism so that folded documents or documents having clips, seals, or other uneven objects may be accommodated between rollers 28, 29 and 43, 44 without jamming or straining the mechanism.

The space between the feed rollers 28 and 29 includes the photographic field of a camera positioned at the top of the cabinet, which will be hereinafter described, and preferably fluorescent lamps 55 are provided supported between end frames 30 for lighting the document to be photographed by the camera. As shown in Fig. 2, a light shield 57 is positioned above the lights 55, and has a central longitudinal aperture 58 through which photographing of objects is permitted. The light shield 57 is pivotally supported on the panel 58' comprising, with the surface 24, a chute into which objects are fed to be photographed and designed to prevent excessive light from entering the interior of the cabinet. Objects fed through the feeding rollers and photographed are dropped into a box 59 at the back of the cabinet, and may be removed through a door 60 provided in the back of the cabinet.

The drive and shutter mechanism of the camera of the present invention are controlled by the document to be photographed as it passes through the feeding means just described. As embodied, the controlling means may comprise a micro-switch 65 disposed centrally below roller 28 and supported by one of the supports 51. The switch 65 is provided with a pair of arms 66 and 67 extending upwardly between rollers 28 and 29 and having upper bent ends in a position to be contacted and slightly depressed by a document moving from roller 28 to roller 29 through the photographic field of the camera. The switch arm 67 is positioned slightly ahead of the arm 66 in the direction of travel of the document, and the arms are so positioned that the arm 66 will be contacted by a document substantially at the same time as the document enters the photographic field of the camera,

and the document will terminate contact with arm 67 a slight distance beyond the other side of the field. As hereinafter explained, the closing of switch 65 by means of either or both of arms 66 and 67 opens the camera shutter and drives the photographic film for photographing the document and the arrangement of the arms 66, 67 is preferably such that these operations are commenced just as the document enters the photographic field and are terminated somewhat after the document has left the photographic field, in order to provide a space between the images on the film.

The camera mechanism of the copying apparatus of the present invention is located on the top of the cabinet 20 and within the housing 21, and this mechanism is shown in detail in Figs. 2 to 5 inclusive of the drawings. The camera is driven from electric motor 35 by means of a pulley 70 on shaft 38 which is driven by the motor. A belt 71 drivingly connects pulley 70 and a double pulley 72 rotatably mounted on bracket 73 toward the top of the cabinet. Belt 74 extends between the other groove of pulley 72 to a third pulley 75, the belt extending through an aperture 76 provided in the top of the cabinet.

The camera drive includes a shaft 78 mounted in a journal 79 on a base plate 80 on the top of the cabinet 20, and pulley 75 is secured to shaft 78 for correlative rotation therewith. To the other end of shaft 78 is fixed the portion 81 of a toothed clutch, the other toothed portion 82 being splined to a shaft 83 which is journaled in an upstanding frame 84 on base plate 80. A worm gear 88 on shaft 83 is in mesh with worm wheel 89 on shaft 90, this shaft being journaled in frame 84 and in the side of camera casing 91. Shaft 90 drives a pulley 92 mounted thereon, and this in turn drives a pulley 93 by means of a spring belt 94. The pulley 93 is mounted on a shaft 95 journaled in the camera casing 91, and this shaft carries the film take up reel within the camera casing.

The toothed clutch for the drive of the camera is controlled by a solenoid 98 mounted on top of the frame 84. The shaft 99 of the solenoid armature is flexibly connected to a clutch arm 100 by means of nut 101 and a flexible washer 102, and the shaft 99 and arm 100 are normally outwardly urged from the solenoid by a coiled spring 103 between the arm 100 and the solenoid housing.

The arm 100 is pivotally mounted on a bracket 104 of frame 84 and terminates in yoke arms 105 positioned in a circumferential groove in the axially movable toothed member 82 of the clutch. It may be seen that the toothed members 81 and 82 comprising the clutch are normally out of engagement by reason of the action of spring 103 and there is no driving connection between shafts 78 and 83. When the solenoid 98 is energized arm 100 is moved against the compression of spring 103 to engage members 81 and 82 and drive the camera.

As shown in detail in Figs. 3 and 4, the camera comprises a film take up reel 110 mounted on shaft 95 and a supply reel 111 mounted within the camera casing 91. The strip of film, shown by dotted lines in Fig. 4 and denoted by the numeral 112, passes off of supply reel 111 around guide roller 113, thence around drum 114, around a second guide roller 115 and onto take up reel 110. Guide roller 113 is mounted for free rotation about a shaft secured in the camera casing 91, and guide roller 115 is mounted on an arm

116 which is pivotally mounted on a shaft also secured in the camera casing 91. The arm 116 is downwardly urged by a spring 117, providing a yielding means for maintaining tension in the film strip 112. The drum 114 is mounted on the end of shaft 90 extending into the camera housing 91 and is driven therewith.

A roller 120 is positioned to ride on the surface of the film strip wound on supply reel 111, and is mounted on arm 121 on shaft 122 journaled in the camera casing 91 and downwardly urged by means of spring 123. The shaft 122 extends through casing 91 and at its outer end carries a finger 124 to contact the arm 125 of a micro-switch 126. This assembly provides an indicator for the supply of film on reel 111, the roller 120 following the decreasing supply of film until a predetermined relatively small amount remains, at which point the finger 124 is so positioned to engage the micro-switch arm 125 and warn the operator of the condition.

A shutter mechanism is provided to control exposure of the film. As embodied this mechanism comprises a rectangular box 130 with an open side positioned against the camera base plate 80. The base plate 80 has an aperture 131 registering with an aperture 132 in the top of the cabinet 20, and the lens 133 is positioned in these apertures and threaded into a plate 134 secured to base plate 80.

The box 130 has a slit aperture 135 in its top, and a shutter member 136 is positioned in guide-ways 137 with a slit aperture 138 to be registered with aperture 135 when exposure of the film 112 is desired. The shutter member 136 is controlled by a solenoid 140, the armature 141 of which is normally urged by spring 142 away from box 130 so that apertures 135 and 138 are normally out of registration but are moved to registering position when the solenoid is energized.

The wiring diagram shown in Fig. 9 of the drawings will now be described and the operation of the photographic copying apparatus of the invention will therefrom appear. The power source is indicated diagrammatically as 145 connected with motor 35 through lead 146 through main switch 147, the circuit then being grounded at 148. The fluorescent lamps 55 are connected to the circuit through lead 150, so that when switch 147 is closed the motor is started to drive the document feeding means and the lights 55 are lighted. At the same time current is supplied through leads 151 and 152 through switch 126 to a light 153 on the front panel of the cabinet 20. The arm 124 is out of contact with switch arm 125 of switch 126 indicating a satisfactory amount of film on supply reel 111 and the light 153 may be green in color indicating the apparatus is in condition for operation.

A document to be photographed may then be fed through aperture 23 at the front of the cabinet and engaged between rollers 28 and 43 and fed forward thereby. When the document has reached the photographic field its forward edge depresses the first arm 66 of switch 65 closing a circuit through leads 154 and 155 to solenoid 98 to engage clutch members 81 and 82 and to solenoid 140 to move shutter 136 into film exposing position.

The film 112 is thus continuously fed off from reel 111 around drum 114 to be exposed, and onto reel 110, the direction of movement of the film being opposite to that of the document passing through the feeding means. The drive means for the film and document feeding means which have

been described are so constructed that the velocity of the film and document are proportional to the conjugate focal distances, so that a stationary image results on the film.

The document to be photographed, after passing beyond arm 66 of switch 65, will still hold arm 67 of the switch depressed, and the camera drive and shutter actuation will continue. After the trailing edge of the document has passed slightly beyond the photographic field, arm 67 will be disengaged and camera drive and shutter actuation will be discontinued until the next document is introduced.

When the supply of film on reel 111 has reached a predetermined relatively small supply, the finger 124 will engage switch arm 125 to close a circuit to a buzzer or other signal 157 through lead 158 and to cut off light 153. A second signal light 157', preferably red in color, indicates that an exposure is taking place and is energized with solenoid 140.

Figs. 10, 11 and 12 show a photographic copying apparatus modified in some particulars from the construction just described. As shown in Figs. 10 and 11 the document controlled switch at the feeding means may comprise a pair of rings 160 spaced apart along the length of the first feeding roller 28. The rings are of electrically conductive material such as copper and make electrical contact with the first idler roller 43 when no document is in the feeding means, roller 43 also being of electrical conductive material. Contact rollers 161 are positioned to roll against respective rings 160 and one of the rollers is grounded, while the other is connected through lead 163 to a delayed action relay 162. As shown in Fig. 12 the main switch 147 closes a circuit through motor 35, and through leads 164 and 165 to relay 162. The relay is also connected through lead 166 to the clutch solenoid 98 and the shutter solenoid 140.

In order to photograph easily and economically the backs and faces of documents such as checks or similar documents where the record of an endorsement, for instance, may be desired, fluorescent lights 168 may be positioned beneath and between the feed rollers 28 and 29 enclosed in a reflector 169. A tapered longitudinally extending light conducting member 170 made of "Lucite" (methyl methacrylate) or material of similar properties is positioned directly over lights 168 and extends upwardly between rollers 28 and 29 to a position just below the path of travel of documents through the feeding means. When the back and face of a document is to be photographed it is put through the feeding means in the usual way, front up and back down, but the upper lights 55 are extinguished and the lower lights 168 are lighted. The light is concentrated on the document as it passes through the photographic field by the Lucite member 170 and the back and face are photographed, but at the same time the light from the upper edge of member 170 is diffused so that there is no strong direct beam directed toward the lens of the camera.

As shown in Fig. 12, a two way switch 171 is provided between leads 172 and 173 leading to lights 55 and 168 respectively so that either set of lights may be selectively operated depending upon whether the front or the back and front of the document is being photographed. Leads 172 and 173 are connected to lead 164 and thus to the power source through main switch 147.

When a document entering the feeding means breaks contact of either of the rings 160 with the idler roller 43, the circuit to the solenoids 98 and 140 is closed through leads 164, 175 and the relay,

and the document is photographed in its passage through the feeding means. When the document has passed beyond the feed roller 28 the circuit will be re-established through the contact rollers 161 and idler roller 43 in readiness for the next document. However, the delayed action relay 162 is so set as to maintain the circuit to solenoids 98 and 140 until the trailing edge of the document has been fed slightly beyond the photographic field, so that the photographic copy may be complete and also a small space left between the image on the film and the next image.

Other portions of the mechanism shown in Figs. 10, 11 and 12 are identical with the apparatus already described and the balance of the mechanism and its operation is as has been described in connection with the other figures of the drawings. The plurality of spaced apart contacts 160 for the control of the camera are particularly useful where a document may be introduced into the feeding means at an angle or may be of irregular shape, as sensitivity is thus established at more than one point along the width of the feeding mechanism for starting and stopping the camera.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom within the scope of the accompanying claim without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:

In a control means for a photographic copying apparatus having shutter and film drive controlling solenoids and document feeding means the

combination of a driven roller having a pair of electricity conducting circumferential spaced apart rings contacting a second roller having a circumferential electric conducting surface between said rings, said rollers forming a part of said document feeding means, a delayed action relay, an electric power source, and electric circuit means interconnecting the power source, relay, rings, surface and solenoids so that the solenoids are energized upon breaking contact between either of said rings and said surface and energization of said solenoids is maintained for a predetermined time after contact of both rings with said surface is reestablished.

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