No. 721,041. PATENTED FEB. 17, 1903.

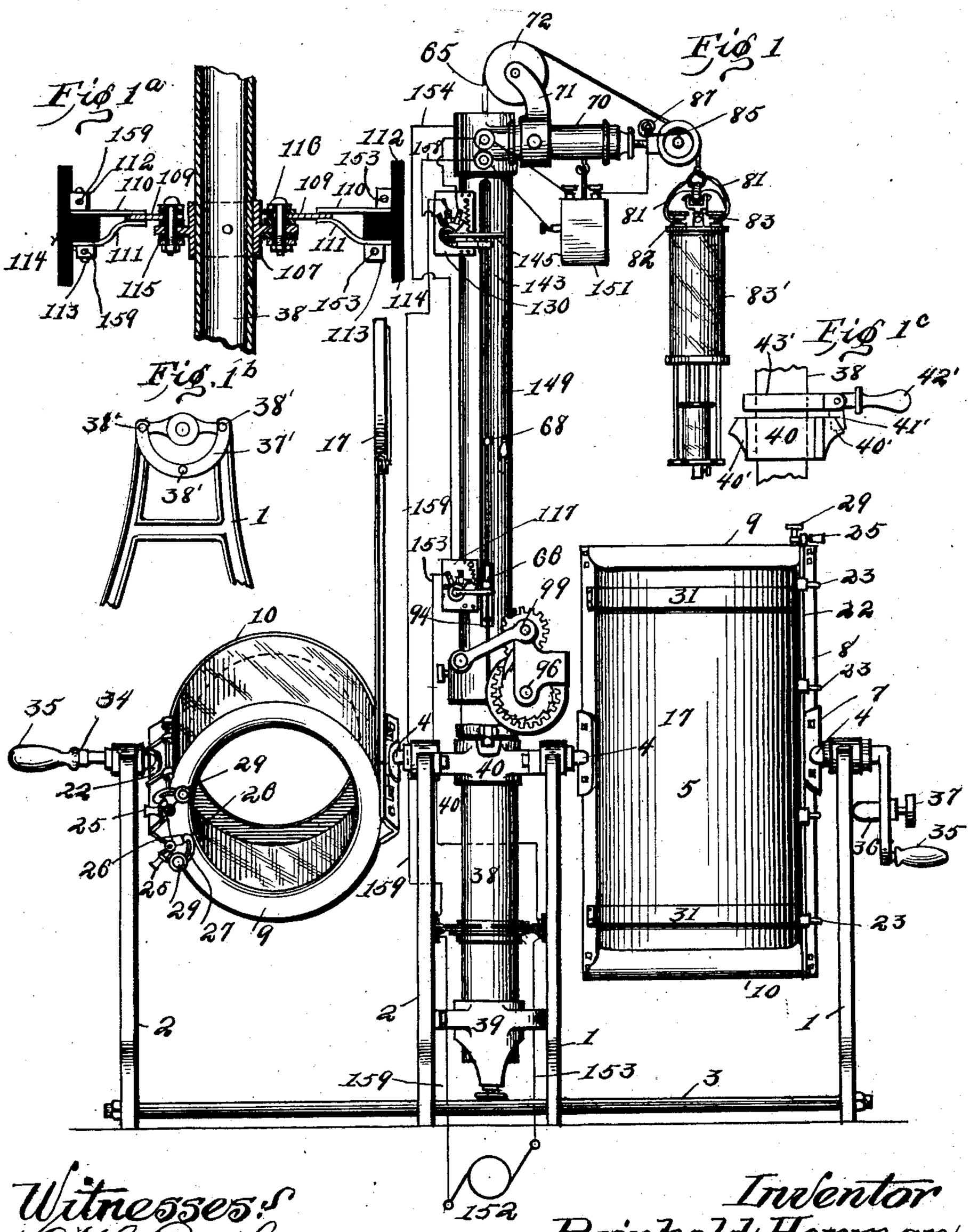
R. HERMAN.

PRINTING APPARATUS.

APPLICATION FILED NOV. 3, 1902.

NO MODEL. 5 SHEETS—SHEET 1.

Fig 1



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No. 721,041. PATENTED FEB. 17, 1903.

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APPLICATION FILED NOV. 3, 1902.

NO MODEL. 5 SHEETS—SHEET 2.

Fig. 2.

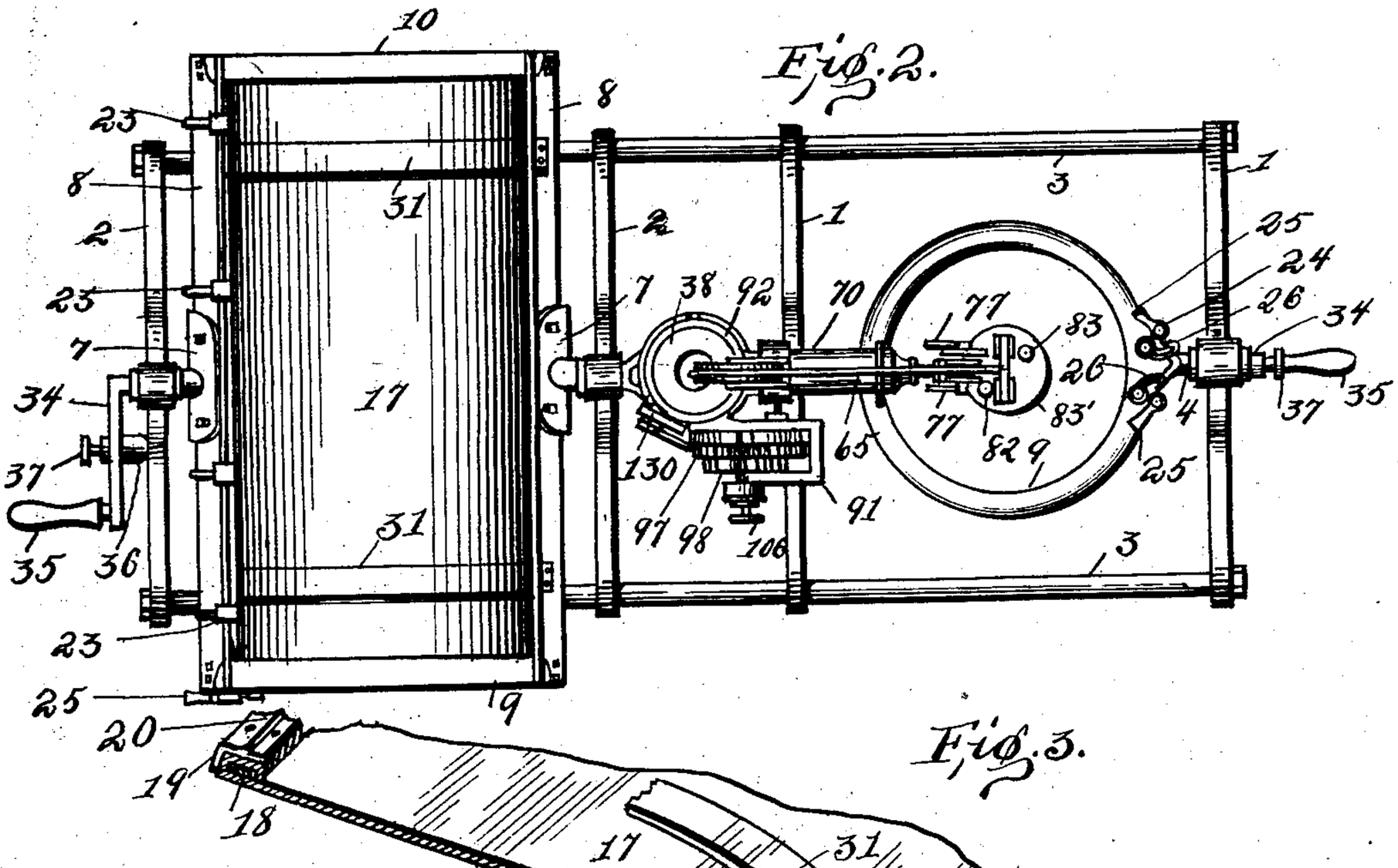

Fig. 3.

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NO MODEL. 5 SHEETS—SHEET 3.

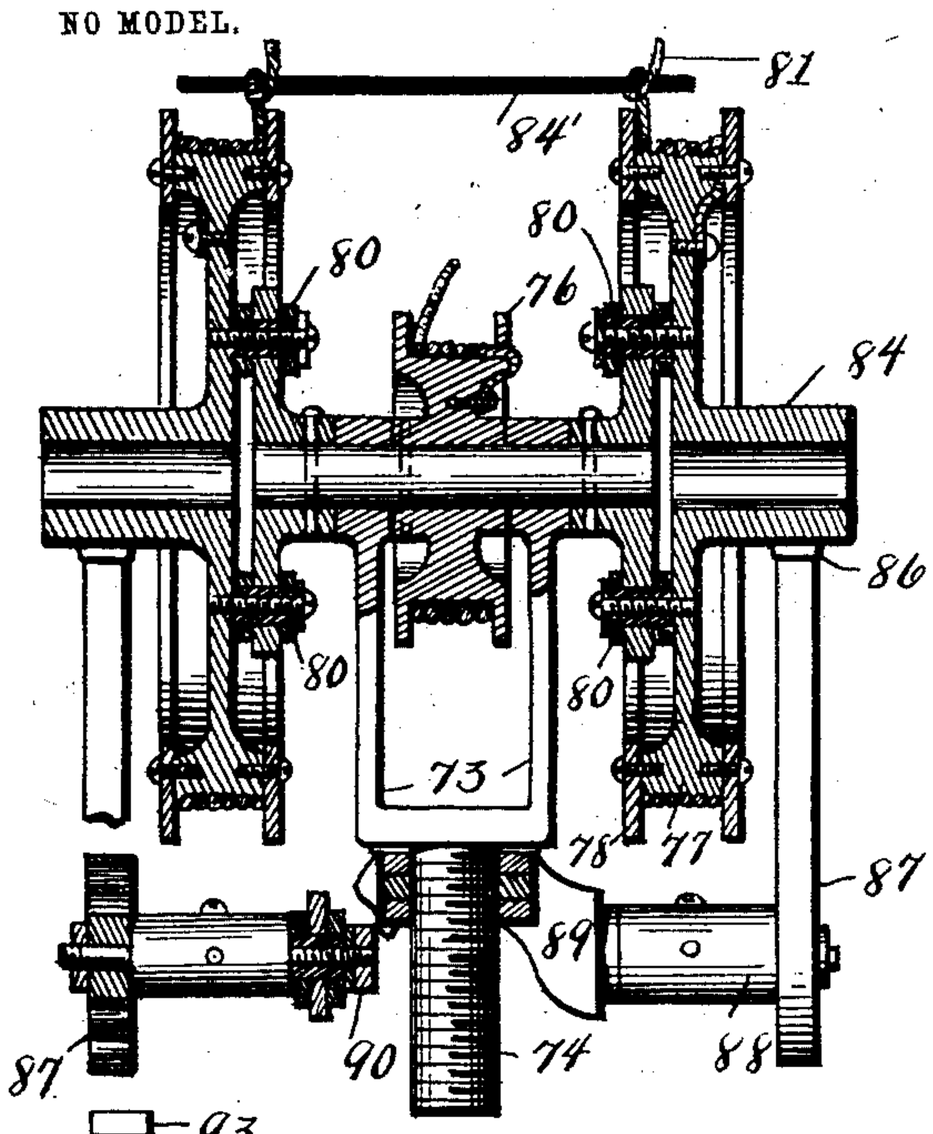

Fig 4.

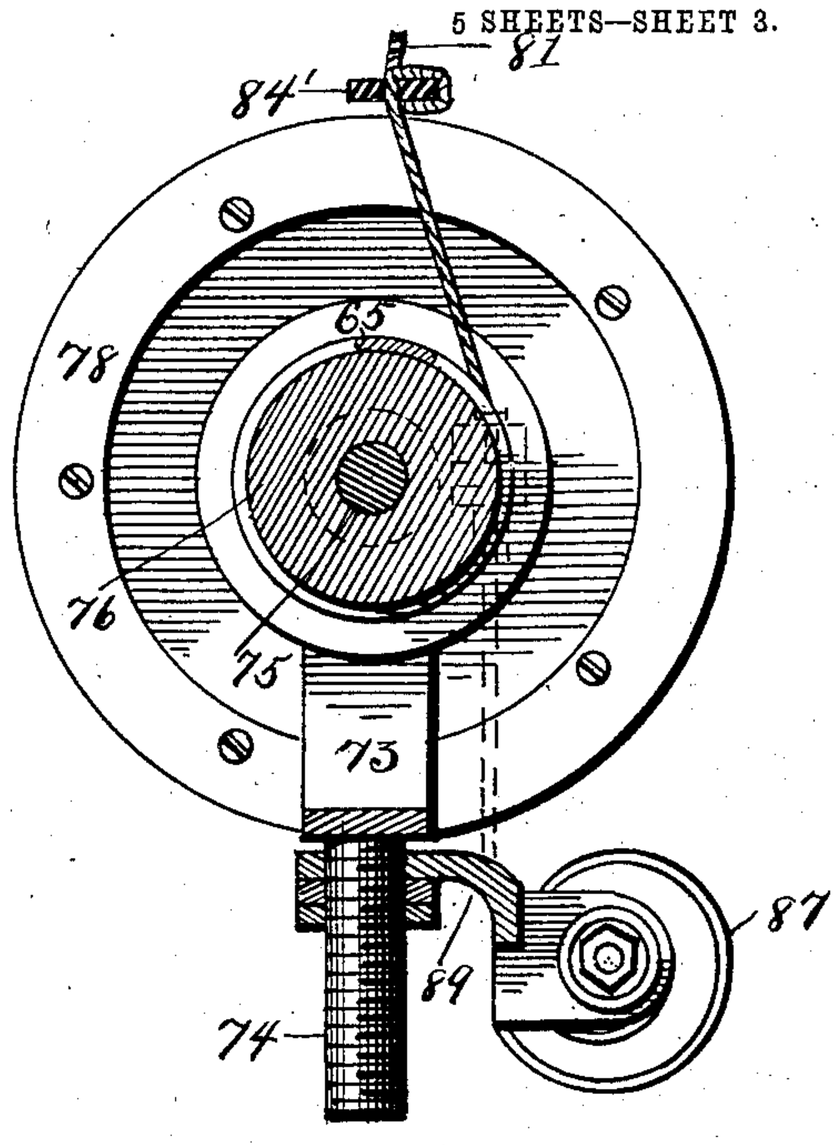

Fig 5.

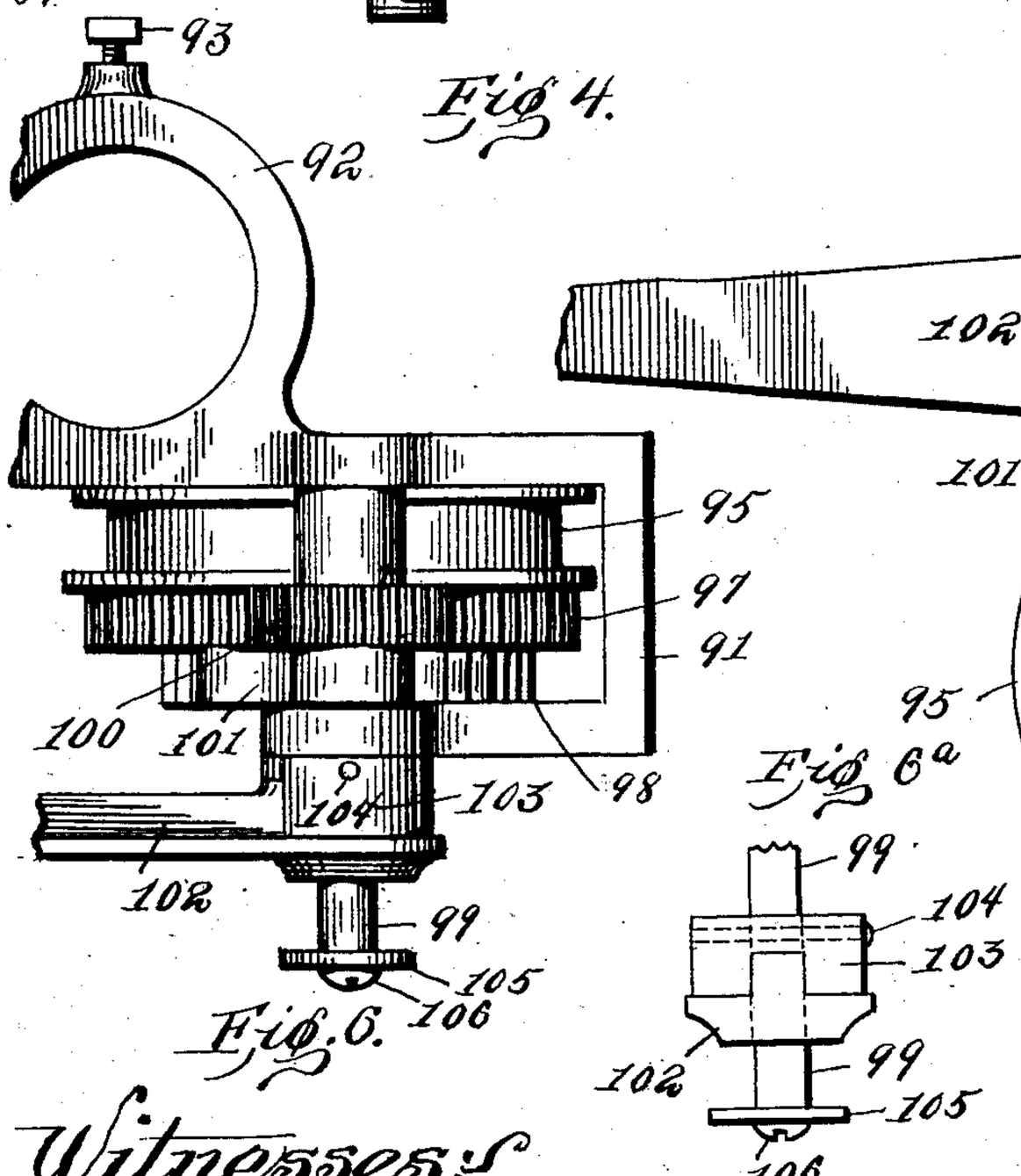

Fig. 6.

Fig 6a

Fig. 7.

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APPLICATION FILED NOV. 3, 1902.

NO MODEL. 5 SHEETS—SHEET 4.

Fig. 8.

Fig. 13.

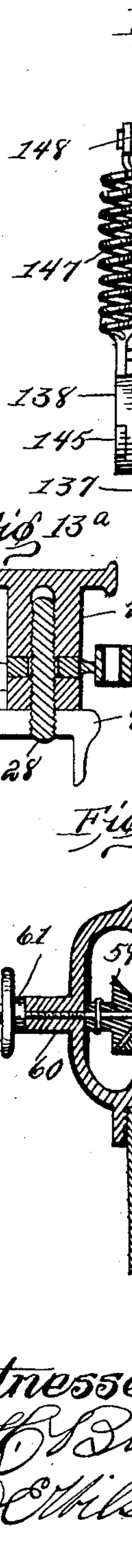

Fig. 13a.

Fig. 9.

Fig. 12.

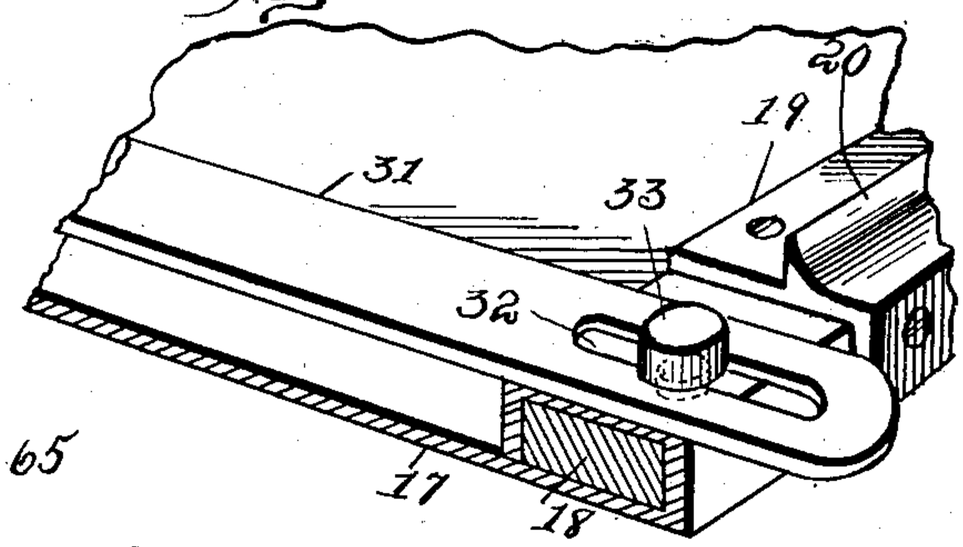

Fig. 11.

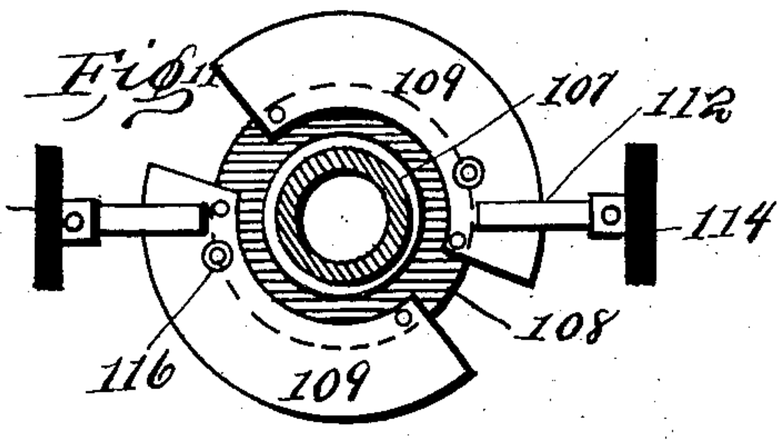

Fig. 10.

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APPLICATION FILED NOV. 3, 1902.

NO MODEL. 5 SHEETS—SHEET 5.

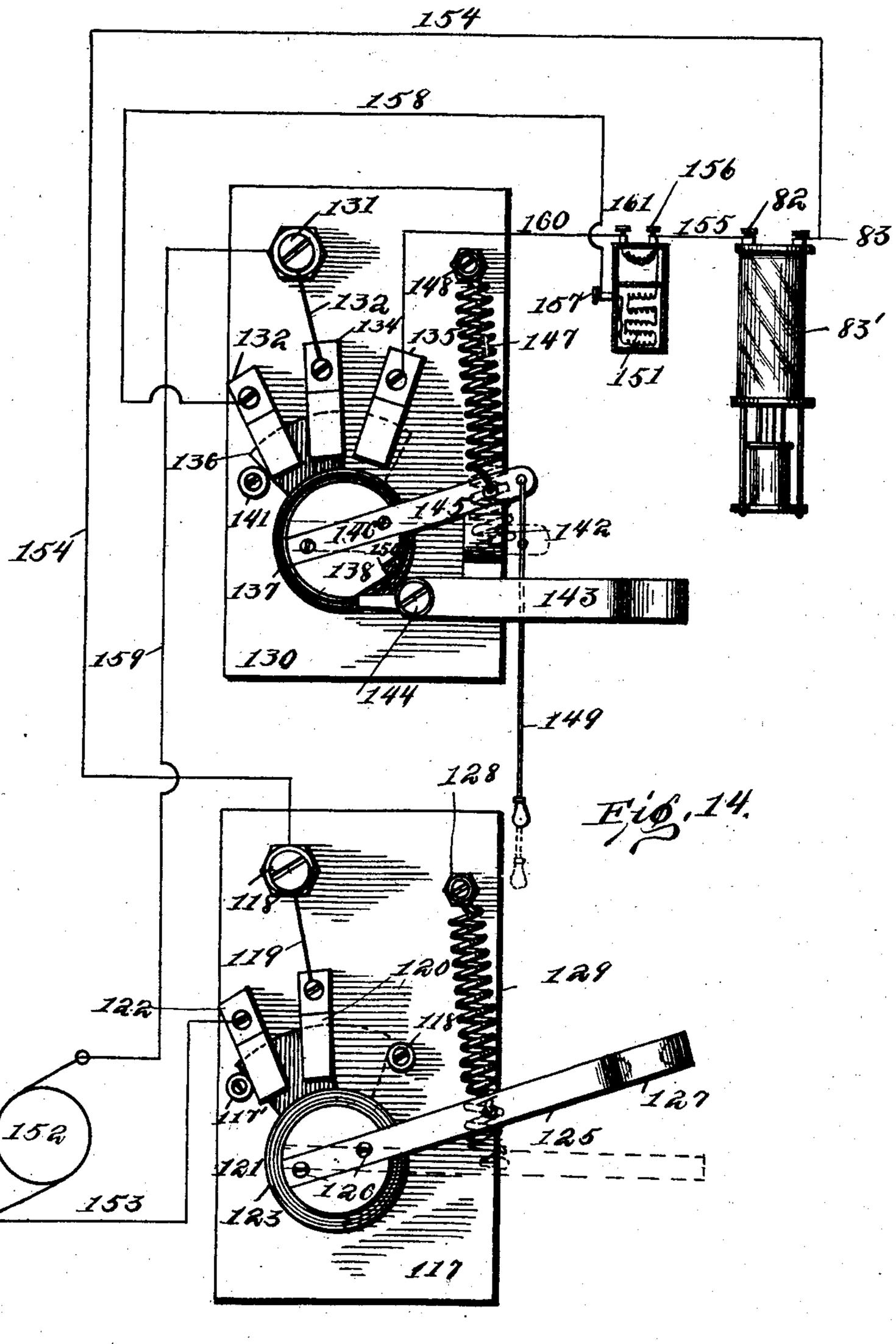

Fig. 14.

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UNITED STATES PATENT OFFICE.

REINHOLD HERMAN, OF CRAFTON, PENNSYLVANIA.

PRINTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 721,041, dated February 17, 1903.

Application filed November 3, 1902. Serial No. 129,817. (No model.)

To all whom it may concern:

Be it known that I, REINHOLD HERMAN, a citizen of the United States of America, residing at Crafton, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Printing Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in printing apparatus, and relates more particularly to devices employed for the reproduction of negatives by the aid of artificial light—such, for instance, as electric light.

The invention has for its object the construction of a machine or apparatus having two printing-cylinders, whereby as the lamp is being lowered in one cylinder to effect the printing operation the other cylinder may be loaded with negatives ready to receive the lamp, it being understood as being one of the objects of the invention that the same lamp is employed for both cylinders.

A further object of my invention is to provide means whereby the printing-cylinders may be turned on their trunnions in order that the negatives to be reproduced may be more easily, conveniently, and readily secured upon the cylinders and to provide improved means for securing said negatives in position on the cylinders.

A still further object of the invention is to provide automatic means for closing the circuit to the lamp, for maintaining a closed circuit during the descent of the lamp within the cylinder until the desired limit of its downward travel has been reached, and for then automatically changing the path of current from one of low resistance to one of high resistance, which is maintained during the ascent of the lamp until it has been elevated to the desired height, and then automatically cutting out the circuit after the lamp has come to rest in its elevated or normal position.

My invention, as heretofore stated, also contemplates improvements in the securing means for holding the negatives in position on the printing cylinder or cylinders, whereby after the negatives have been placed on the cylinder or cylinders in the desired position they may be secured without danger of accidental displacement.

My invention also contemplates many other improvements in the art of reproducing drawings, photographs, printed matter, &c., by the aid of artificial light, and these, together with the improvements enumerated, will be hereinafter more specifically described and then particularly pointed out in the appended claims, and in describing the invention in detail reference will be had to the accompanying drawings, forming a part of this application, and wherein like numerals of reference will be employed for indicating like parts throughout the different views, in which—

Figure 1 is a detail side elevation of my improved printing apparatus with one of the printing-cylinders in the upright position, ready to receive the lamp, and the other cylinder shown in perspective in a substantially horizontal position, ready to be loaded with the matter to be reproduced. Fig. 1[a] is a central vertical sectional view of a part of the central stand-pipe, showing the rotary circuit-controller in enlarged view. Fig. 1[b] is a detail side elevation of a portion of one of the supporting-standards, showing the segmental ways and conical recesses therein. Fig. 1[c] is a detail side elevation of a part of the stand-pipe, showing the means for rotating and locking the pipe in position. Fig. 2 is a detail top plan view showing one of the printing-cylinders in the upright or vertical position and the other in the horizontal position. Fig. 3 is a perspective view of a part of one of the printing-cylinders and a part of the securing-apron, the latter being shown closed on one side of the cylinder and open on the other, and also showing the means for clamping the apron in position. Fig. 4 is a central vertical sectional view of the bracket and pulleys from which the lamp and circuit-wires are suspended. Fig. 5 is a transverse vertical sectional view of the same. Fig. 6 is a top plan view, partly broken away, of the gear mechanism for returning the lamp to its elevated position. Fig. 6[a] is a detail top plan view of a part of the crank-shaft of the rewinding mechanism, showing the crank-clutch. Fig. 7 is a side elevation of the same. Fig. 8 is a central vertical sectional view of the central

stand-pipe and of the feed-controlling valve for the lamp. Fig. 9 is an enlarged central vertical sectional view of the adjusting mechanism for the controlling-valve. Fig. 10 is an enlarged central vertical sectional view of a part of the stand-pipe and the controlling-valve. Fig. 11 is a horizontal sectional view of the stand-pipe and controlling-valve cylinder, showing the rotary circuit-connector in top plan view. Fig. 12 is a detail perspective view of a part of the securing-apron and also of the spring releasing means therefor. Fig. 13 is a detached detail side elevation of the variable-resistance-changing switch. Fig. 13ª is a cross-sectional view of the lock for securing the apron-securing rods in the locked position. Fig. 14 is a diagrammatical view of the circuit, showing the two switches in plan view, the resistance-box in section, and the lamp in elevation.

In the art of reproducing drawings and the like by the aid of artificial light as heretofore practiced it has generally been the practice to provide a stationary vertical cylinder composed of transparent material, such as glass, on which the matter to be copied or reproduced is placed, and an arc-lamp is lowered into this cylinder, being controlled in its descent so as to travel gradually and allow the printing or reproducing operation to be performed. Since, as stated, these cylinders are maintained in the vertical position, it is a difficult matter to retain the drawing or other matter to be reproduced or copied in proper position on the cylinder while the fastening means therefor is being secured. In my invention, while I employ the transparent cylinder and the traveling lamp, I mount the cylinder in such a manner as to permit the rotating or revolving of the cylinder and the consequent bringing of the same to a substantially horizontal position, so that the matter to be reproduced or copied may be placed thereon and secured, after which the cylinder is returned to the upright position, ready to receive the lamp to perform the printing operation.

In my former application, filed October 1, 1901, Serial No. 77,192, I show a printing-cylinder mounted on trunnions, so as to be rotated or revolved, as above described; but in the former application I employ an automatic cut-out to cut out the circuit and extinguish the lamp upon the completion of the printing operation—that is, when it has reached the predetermined limit of its downward travel—while in the present application I do not extinguish the lamp upon the completion of the printing operation, or, in other words, do not cut out the circuit to extinguish the lamp when the printing operation is completed, but instead I maintain a closed circuit both during the descent and ascent of the lamp within the printing-cylinder and only cut out the lamp-circuit when the lamp is at its elevated or normal position.

I will now describe the mechanism in detail which I have shown herein and which constitutes a practical embodiment of my invention.

To put my invention into practice, I provide two pair of supporting standards or uprights 1 1 and 2 2, all connected rigidly together by tie bolts or rods 3. Each of these supporting standards or uprights is provided at its upper end with a suitable bearing, in which bearings are journaled the trunnions 4 of the respective cylinders. As each of the cylinders and also the securing means for retaining the matter to be reproduced or copied in position on the cylinders is identical, the same reference-numerals will be employed for like parts, aside from those just used, and the designating-numerals 5 and 6 for the respective cylinders. The two cylinders 5 and 6 have the trunnions 4 rigidly connected at their inner ends to angle-bar clamps 7, which are in turn rigidly fastened in any approved manner to angle-bar uprights 8 at opposite sides of the cylinder. These angle-bar uprights 8 are suitably connected at their upper and lower ends to supporting-rings 9 and 10, respectively, in which rings the ends of the transparent printing-cylinders are seated. In practice the transparent cylinders are made in two semicylindrical halves, which are securely joined together to form the cylinder by means as will be now described. To this end I employ a substantially T-shaped strip, the flanges 11 of which overlap on the inner face of the cylinder at the adjacent edges of the halves and the flange 12 of which is engaged by the adjacent edges of the said two halves of the cylinder. This flange 12 of the T-shaped binding-strip projects into a groove 14, provided therefor throughout the inner face of the two oppositely-disposed side strips 15, these strips on their outer faces being shaped so as to fit neatly in the angle-bars 8, the latter being fastened at suitable points throughout their length to the strips 15. The groove 14 in one of the strips 15 of each cylinder is made slightly larger in size than on the other strip 15 at the opposite side of each cylinder, so as to receive the apron of canvas or like durable material which binds the matter to be reproduced or copied upon the cylinder. I am thus enabled to employ a single piece of material to form the apron for both sides of the printing-cylinder, and to this end I take a piece of canvas or like durable material of suitable length and width as may be required, according to the length and diameter of the cylinder being employed, and place the center of the material within the groove 14 of one of the strips 15, where it is secured by the flange 12 of the T-shaped strip, which wedges the canvas or other material firmly in position, the T-shaped strips being held in position by bolts or screws 16 passing through the said T-shaped strips, through the strips 15,

and into the angle-bars 8. Thus two aprons 17 are provided for each cylinder, one for one side and the other for the opposite side of the cylinder, each apron being permanently fastened at one edge and detachably secured at its other edge. In order to secure the aprons in their binding position around the cylinder to hold the matter being reproduced or copied, or to loosen the aprons, so that the matter may be removed after the printing operation, I provide improved fastening means, which will now be described.

In Fig. 3 the manner of permanently securing the aprons at one edge, as above described, is fully shown, and in this view is also illustrated the manner in which the opposite edge of the aprons is fastened. This view shows one of the aprons bound upon the cylinder and the apron at the opposite side of the cylinder unfastened. Along the free edges of the aprons I place a strip of wood or thin metal 18 and wrap the edge of the apron around the same (see Fig. 3) and suitably fasten the apron to this strip. Then at intervals throughout the length of the apron I secure clamp-blocks 19, which may, if desired, be employed to form the means for securing the canvas wrapped around the strip 18. Each of these clamp-blocks carries a tooth or ridge 20 to be engaged by a series of pawls 21, carried on rods 22, journaled in the ends of angle-brackets 23, rigidly fastened to one of the bars 8 of each cylinder-frame. These rods 22 are adapted to be operated in the journals of the brackets 23, whereby all of the catches or pawls 21 of the one apron may be simultaneously engaged with and disengaged from the clamp-blocks 19 of the same apron, and to this end I rigidly secure to one end of the rods 22 a collar 24, carrying a handle 25. This collar also carries a segment 26, provided with a slot 27 to receive a threaded stud 28, carried by the ring 9, this stud projecting through the slot 27 of the segment and receiving a lock-nut 29, by means of which the rods 22 and their pawls are held in the locked position. As the lock-nut 29 is turned so as to tighten the same, the segment 26 will be firmly bound between said nut and the nut 30 on the stud 28 and the rod 22 held in the locked position, while when the nut 29 is loosened the rod 22 may be turned by the handle 25, the stud 28 riding in the slot 27 of the segment, the pawls 21 being disengaged from the clamp-blocks 19 by the turning of the rod. When the apron is unfastened, it is desirable that the same be held out of the way of the operator in removing the matter that has just been copied, and I therefore provide means for automatically elevating the apron and holding the same away from the cylinder, this means operating in such a manner as not to disturb the matter carried by the cylinder. This means also enables me to apply and secure the apron on the cylinder without danger of accidentally displacing the drawings or other matter out of the position in which they have been placed on the cylinder. As stated, the cylinder is placed in the horizontal position, both for placing the matter thereon and for removing the matter therefrom, as shown in the position of the left-hand cylinder in Figs. 1 and 2. In order, therefore, that the aprons may be suspended away from the cylinder, as shown for the one apron in Fig. 1, I attach to the inside bars 8 of each cylinder-frame the one end of spring strips or bars 31, one near each end of the apron, these strips or bars being provided near their other ends with slots 32 to receive the shank of headed studs or buttons 33, carried by the apron along its free edge, the buttons being carried by the strips 18. These strips or bars are preferably made of stiff spring-steel, and when the edge of the apron is unfastened the springs elevate the apron out of the way, as seen in Fig. 1, and hold the same suspended. As the springs are not rigidly fastened to the apron at the outer edge of the latter, (the shank of the button sliding in the slot,) it will be observed that the stretching qualities of the apron will not be impaired and that the same may be drawn down tightly upon the matter on the cylinder, firmly binding same in position. These springs also enable me to easily secure the matter on the cylinder without danger of accidentally displacing the same, as it will be observed that the flexible apron is held distended or stretched and may therefore be drawn down upon the cylinder, firmly binding the matter to be copied between the apron and the cylinder. The outside trunnion 4 of each cylinder may be provided with a crank 34, having a handle 35, and each crank carries an inwardly-extending boss 36, through which and through the crank extends a spring-pressed locking-pin 37, the inner end of which rides in segmental ways 37′, provided therefor on the outer face of the two outside standards 1 and 2. A plurality of conical recesses 38′ are made in the path of the ways 37′, into which the spring-pressed pins will engage and hold the cylinder in the position in which it has been placed. The recesses 38′ to receive the locking-pins 37 are made conical, whereby the pins may be forced out of seating engagement as the crank is operated without necessitating the withdrawal of the pins by hand.

In my present application I employ two cylinders, using the same lamp for both cylinders. To this end the cylinders are arranged side by side, and between the inside standard 1 and the inside standard 2 I place the rotatable stand-pipe which carries the lamp, the elevating mechanism therefor, and the switches controlling the circuit. The liquid or pneumatic cylinder for controlling the descent of the lamp is mounted within this stand-pipe, the pipe rotating in its support, whereby the lamp is swung around in position for either cylinder. The stand-pipe 38 is supported at its base in a stirrup 39, se-

curely fastened to the inside standards 1 and 2, which stirrup also acts as a spacer between the two standards, the stand-pipe also rotating in an upper collar 40, secured to the standards at their upper ends, and also acting as a spacer for the standards. The lower end of the stand-pipe 38 rests on the flange of a cap-nut 41, which closes the liquid or pneumatic cylinder 42 at its lower end, the flange of this nut being interiorly threaded to receive the exteriorly-threaded lower end of the cylinder 42. The cap-nut 41 is supported on an adjusting-screw 43, carried in the lower cross-strap of the stirrup. The brass cylinder in connection with its valves is the means employed for controlling and regulating the descent of the lamp, and, as will be evident, this may either be employed as a liquid or as a pneumatic cylinder. I prefer, however, to employ a liquid—such, for instance, as oil—as there is no waste and a smoother working is obtained. The cylinder 42 at its upper end is closed by a collar 44, threaded into the cylinder, and after this collar has been secured in position the cylinder is held against any vertical movement by means of set-screws 45, engaging through the stand-pipe 38 into the collar 44. A hollow plunger or piston rod 46 extends through the collar 44 and through a stuffing-box 47, carried by the collar, this plunger or piston rod carrying a plunger or piston 48 on its lower end, which is secured to the hollow plunger or piston rod by means of a collar 49, into which the rod is threaded. This plunger or piston is provided with ports 50, and during the ascent of the plunger or piston these ports are closed by a circular valve 51, which is mounted on the collar 49 and has vertical movement thereon between the head of the plunger or piston 48 and the flanged upper end 52 of the collar 49. The hollow plunger-rod 46 is provided at a point above the collar 49 with inlet-ports 53 and at its lower end has a valve-seat 54. The flow of the liquid into the ports 53 and down through the hollow plunger-rod below the plunger or piston 48 and the descent of the lamp thereby controlled is regulated by a valve 45, secured to the lower end of a valve rod or stem 56, extending through the hollow plunger-rod 46 and threaded at its upper end into a frame 57, secured to the upper end of the hollow plunger-rod 46, above the stuffing-box 47. As the rod 56 is elevated or lowered and the valve 55 thereby brought closer to or moved farther away from the valve-seat 54, thus decreasing or increasing the size of the opening at the outlet and regulating the ascent of the plunger or piston and the descent of the lamp, the valve and its stem or rod are operated to regulate the flow of the liquid by means of bevel-pinions 58 and 59, the former threaded on the rod or stem 56 within the frame 57 and the latter meshing with the pinion 58 and being firmly secured to a stem 60, journaled in a bushing 61, carried by the frame 57. The stem 60 carries a suitable operating-wheel 62. The bevel-pinion has bushings on its upper and lower faces, (see Fig. 9,) the lower bushing engaging the bottom of the frame and the upper bushing engaging the lower end of an interior extension 63, carried by the frame 57. This extension is interiorly threaded to receive the threaded upper end of the stem or rod 56. Thus as the pinion 59 is rotated by means of the hand-wheel 62 and connecting-stem 60 the pinion 58 is rotated and the stem 56 elevated or lowered, according to the direction in which the hand-wheel is turned, and the outlet-port at the bottom of the hollow plunger-rod is regulated. As the plunger or piston ascends the circular valve 51 is held to its seat by the pressure thereon, and as the plunger or piston descends the pressure of the liquid through ports 50 lifts this valve and permits the liquid to again flow into the cylinder 42 above the plunger or piston. At its upper end the frame 57 is provided with an eye 64, to which the plunger or piston cable 65 is attached, and at the side opposite to the bushing 61 the frame is provided with an extending lug 66, provided with an eye to receive a rod for connecting with the automatic cut-out or switch. The stand-pipe 38 is provided on opposite sides with slots 67 to receive the bushing 61 and the extension 66. These slots also receive the trip or lever 68, carried by the plunger or piston cable 65, for automatically changing the path of resistance of the circuit when the lamp has reached a predetermined point. This trip or lever is adjustably secured to the cable 65 by means of a set-screw 69. Secured to the upper end of the stand-pipe 42 is a mast-arm 70, which carries a bracket 71, in which is mounted a pulley or sheave 72, the grooved periphery of which is in line with the axis of the stand-pipe and which receives the piston or plunger cable 65. The mast-arm 70 has secured in the end thereof a fork 73, having a threaded stud or shank 74 for engagement in the union on the end of the mast-arm. This fork carries a shaft 75, and mounted rigidly on this shaft to revolve therewith is a sheave 76, to which the plunger or piston cable 65 is connected and upon which it is wound as the lamp descends. Mounted on the ends of the shaft 75 is a pair of pulleys or sheaves 77, which are insulated from the shaft 75, sheave 76, fork 73, and flanges 78, which are fastened to shaft 75 by dowel-pins 79 by insulation 80. The sheaves 77 are provided on their periphery with semicircular threads to conform to the size of conducting-cable 81, terminating at binding-posts 82 83 of the lamps 83′. The sheaves 77 have projecting hubs 84, which are engaged by brushes 85, carried in holders 86, fastened to springs 87, which are secured to insulated studs 88 and held by yoke 89, screwed onto stud 74 of fork 73. The studs 88 are insulated from yoke 89 by insulation 90. By the employment of the brushes for contact with the hubs 84 a constant contact is as-

sured at all times. The lamp is suspended from a cross-strip 84′ of insulation carried by the conducting-cables 81.

The mechanism for returning the lamp to the elevated or normal position comprises a yoke 91, which carries a collar 92, which embraces the stand-pipe 42 and is secured thereto by set-screw 93. The wire 94, (see Fig. 8,) which attaches to lug 66, winds over drum 95, mounted on a shaft 96, journaled in the yoke 91, this shaft also carrying gear 97 and ratchet-wheel 98. Also journaled in yoke 91 above shaft 96 is a shaft 99, which has a pinion 100 secured thereto and also carries pawl 101 for engagement with the ratchet 98. The shaft 99 is extended at one end beyond the yoke 91 (see Fig. 6) and carries a clutch-crank 102, loosely mounted for sliding movement thereon to be engaged with and disengaged from clutch member 103 of the shaft 99, this clutch member being fastened to the shaft by dowel-pin 104. To retain clutch-lever 102 on the shaft 99, the latter is provided at its outer end with a washer 105, secured by a screw 106 in the end of the shaft. This clutch-crank is employed instead of employing a lever or crank, so that when disengaged from the clutch member 103 the pinion 100, gear 97, and shafts 96 99 are free to turn without carrying the crank therewith, the latter hanging in a perpendicular position, and therefore not acting as counterweight to the lamp, as would be the case were the crank fixed rigidly on the shaft 99.

In order to obtain a flexible connection between the source of electrical supply and the stand-pipe 38, I employ a rotary circuit-connector. (See Figs. 1ª and 11.) This device comprises a collar 107, suitably attached by screws or other means to the stand-pipe 38 and provided with an annular flange 108, which carries insulated contact segments or plates 109, which engage contact-fingers 110 111. These contact-fingers are provided with binding-posts 112 113, secured to insulation-brackets 114, attached to the inside standards 1 and 2. The contact segments or plates 109 are insulated from the annular flange 108 by insulation 115 and secured by screws 116. The stand-pipe is locked after being turned so as to swing the lamp around into position for either cylinder, and to this end I provide the collar 40 with two notches 40′ on opposite sides of the collar to receive a lug 41′, carried by a handle 42′, pivoted to a ring 43′, secured to the stand-pipe directly above the collar 40. When the lever 42′ is raised so as to disengage lug 41′, the stand-pipe and lamp may be swung around by means of the handle and the lug 41′ engaged in the opposite notch 40′ to lock the stand-pipe in position.

The circuit is controlled to open and close the same by a switch carried by the stand-pipe, and the lamp-circuit is controlled to change the same from low to high resistance by a switch also carried by the stand-pipe, both of these switches being connected in series with the lamp, resistance, and each other.

In Fig. 14 I show a diagrammatical view of the switches connected up with the lamp, except that in this view the rotary circuit-connector is not shown, it being understood that in practice the rotary circuit-connector is interposed between the automatic main switch and the source of electrical energy, as shown in Fig. 1. The automatic main switch comprises a slate or other fireproof insulation 117, on which is fastened a binding-post 118, to which is attached a fuse 119, connecting with spring-clip 120, and forms a contact through sector-shaped knife 121 with spring-clip 122. The knife 121 is secured to insulation-disk 123, which disk is carried by brass trunnion 124. This brass trunnion 124 revolves in bushing (not shown) fastened to insulated base 117. On top of brass trunnion 124 is secured a lever 125 by screws 126. The end of this lever 126 is provided with a conical opening 127 to receive wire cable 94, Fig. 8. On insulated base 117 there is also secured a stud 128, to which there is fastened one end of a spring 129, the other end of which is secured to lever 125, this spring being adapted to automatically close the switch when the piston-rod travels upward and releases lever 125, due to extension 66 being moved out of engagement with lever 125. The base 117 carries stops 117′ 118′ for the segment-knife 121. The automatic variable-resistance-changing switch comprises an insulation-base 130, binding-post 131, fuse 132, spring-clips 133 134 135, sector-shaped knife 136, insulated disk 137, brass trunnion 138, brass bushing 139, secured to base 130, stops 141 and 142, trip-lever 143, secured to insulated base 130 by stud 144. Brass trunnion has secured thereto a lever 145 by screws 146. Spring 147 has one end attached to lever 145 and the other end to stud 148, which is secured to insulation-base 130. To lever 145 there is also attached a cord or chain 149 for the purpose of returning brass trunnion 138, so that notch 150 will engage with point of lever 143.

In order to describe the circuit, reference will be had to Fig. 14. The lamp is supposed to be at bottom of cylinder and showing the automatic variable-resistance-changing switch cut in series with high resistance 151, thereby forming a circuit from generator 152, wire 153 to spring-clip 122, across knife 121 to spring-clip 120, across fuse 119 to binding-post 118, over wire 154 to binding-post 82, across wire 155 to binding-post 156 of resistance, through high resistance 151 to binding-post 157, over wire 158 to spring-clip 132 of changing-switch, across knife 136 to spring-clip 134, across fuse 132 to binding-post 131, over wire 159 to generator 152, thereby maintaining a closed circuit. When the lamp is returned to its elevated or normal position, as shown in Fig. 1, the lug 66, (see Fig. 8,) depressing lever 125 of auto-

matic main switch, moves knife 121 out of engagement with clip 122, and thereby automatically opening the circuit when the lamp is returned to its elevated or normal position. In order to close the automatic main switch, the pawl 101 being disengaged from ratchet 98, the extension 66 is carried away from lever 125 of main switch, thereby allowing spring 118 to again force knife 121 in engagement with spring-clip 122, the variable-resistance-changing switch being manually returned by pulling on chain 149, so that trip-lever 143 is engaged with notch 150. When in this position, knife 136 has been removed from contact of spring-clip 132 and put in contact with spring-clip 135, thereby forming a circuit from clip 134 across knife 136 to spring-clip 135, over wire 160 to binding-post of low-resistance coil 161 to post 156, across wire 155 to binding-post 82 of lamp, through lamp to binding-post 83, over wire 154 to post 118 of main switch 117, over fuse 119 to clip 120, across knife 121, spring-clip 122, wire 153, through generator 152, over wire 159 to binding-post 131 of changing-switch, over fuse-wire 132 to beginning of circuit spring-clip 134.

It will be observed that I employ sheaves or pulleys 77 of a diameter considerably greater than the diameter of the sheave or pulley 76, which receives the cable attached to the lamp-controlling means. Attention is directed to the fact that by this construction a slow travel of the piston may be obtained in conjunction with a quick travel of the lamp, due to the small sheave 76 having a circumference considerably less than the circumference of the sheaves 77, carrying the lamp cords or wires. Consequently when the piston has traveled up (we will say for illustration) five inches the small sheave has taken up five inches of the piston-cable 65 in one revolution. Then necessarily if the sheaves 77, carrying the lamp-cable, have a circumference three times as great as the sheave 76 the sheaves 77 will have played out fifteen inches of the cable in one revolution. Of course the diameter of these sheaves may be decreased and increased in order to obtain the same travel with a shorter cylinder.

In connection with the rewinding means, as shown in Figs. 5, 6, and 6ª, I employ the clutch-crank, whereby it may be engaged with the clutch member for operating the drum to rewind the cord or cable and elevate the lamp, and after the lamp has been elevated the crank-clutch may be disengaged, whereby when the pawl 101 is disengaged from the ratchet 98 to permit the lamp to begin its descent into the printing-cylinder the crank will hang loosely on the shaft 99 and will not be carried around with the shaft as the latter revolves, thus offering no counterweight to the lamp during its descent into the cylinder and insuring a positive steady movement of the lamp.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A printing apparatus having duplex printing-cylinders, and a lamp common to said cylinders.

2. A printing apparatus having printing-frames, a lamp common to all of the frames, means whereby the printing process is automatically discontinued, and means for regulating said last-named means, substantially as described.

3. A printing apparatus having printing-frames, a lamp common to all of the frames, means to regulate the descent of the lamp, and means to automatically discontinue the printing process.

4. In a printing apparatus, the combination of a pair of rotatable printing-frames mounted to swing independently of each other on their supports, means for locking said frames at different angles, and a printing-lamp common to both of said frames, substantially as described.

5. In a printing apparatus, a pair of rotatably-mounted printing-frames movable on their support independently of each other, and a printing-lamp common to both of said frames, substantially as described.

6. In a printing apparatus, a pair of printing-frames rotatably mounted in a common support, and operative therein independently of each other, and a printing-lamp adapted to be lowered into the frames and common to both of said frames, substantially as described.

7. In a printing apparatus, the combination with a rotatably-mounted printing-cylinder, of a lamp adapted to be lowered into said cylinder, means for controlling the descent of the lamp into the cylinder, means for maintaining a closed circuit in the lamp during its descent and ascent within the cylinder, and means for opening the circuit of the lamp after the latter is returned to its elevated or normal position, substantially as described.

8. In a printing apparatus, the combination with a pair of printing-cylinders, of a lamp common to both of said cylinders and adapted to be lowered into the cylinders, means for controlling the descent of the lamp within the cylinders, means for maintaining a closed circuit within the lamp during its descent and ascent within the cylinders, and means for opening said circuit after the lamp has returned to its elevated or normal position, substantially as described.

9. In a printing apparatus, the combination with a pair of printing-cylinders rotatably mounted for independent movement, of a lamp common to both of said cylinders, means for controlling the descent of the lamp within the cylinders, means for maintaining a closed circuit in the lamp during its ascent and descent within the cylinders, and means for opening the said circuit when the lamp has returned to its elevated or normal position, substantially as described.

10. In a printing apparatus, the combination with a pair of transparent printing-cylinders, of a rotatable stand-pipe common to both of the cylinders, an arc-lamp carried by said stand-pipe and adapted for use in each of the cylinders, means within the stand-pipe for controlling the descent of the lamp within the cylinders, means for maintaining a closed circuit through the lamp during the descent and ascent of the lamp within the cylinders, and means for opening the circuit after the lamp has been returned to its elevated or normal position, substantially as described.

11. In a printing apparatus, the combination with a printing-cylinder and a printing-lamp, of means embodying spring-pressed aprons adapted to secure the matter to be reproduced or copied on the exterior of the cylinder, means for fastening said aprons to the cylinder, means for maintaining a closed circuit through the lamp during its descent and ascent in the cylinder, and means for opening said circuit after the lamp has been returned to its elevated or normal position, substantially as described.

12. In a printing apparatus for reproducing drawings and the like, the combination with a transparent printing-cylinder, a rotatable frame in which the printing-cylinder is secured, means for locking said frame at various angles, an electric lamp, electrical connections with said lamp, a resistance-changing switch for maintaining a closed circuit through the lamp during its ascent and descent within the cylinder, means for controlling the descent of the lamp within the cylinder, and means for opening the circuit of the lamp after it has been returned to its elevated or normal position, substantially as described.

13. In a printing apparatus, the combination of a portable frame, a rotatable frame pivotally mounted therein, a transparent cylinder carried by the rotatable frame, means for locking said frame and cylinder at various angles, an electric lamp, electrical connections to said lamp, a variable-resistance-changing switch in the lamp-circuit for maintaining a closed circuit in the lamp during its descent and ascent within the transparent cylinder, means for controlling the descent of the lamp, and a cut-out in the lamp-circuit for opening the circuit after the lamp has been returned to its elevated or normal position, substantially as described.

14. In a printing apparatus, a pair of separate supporting-frames connected together, printing-cylinders rotatably mounted in the supporting-frames, means for locking the printing-cylinders at various angles, a vertically-movable lamp common to both of said cylinders, and means for automatically lowering the said lamp into one or the other of said cylinders, substantially as described.

15. In a printing apparatus, a pair of supporting-frames, printing-cylinders rotatably mounted in said frames, means for locking the printing-cylinders at various angles, an electric lamp common to both of said cylinders and suitably connected to a source of electrical supply, means for automatically lowering the lamp into the printing-cylinders, a variable-resistance-changing switch in the electric connection, and an automatic cut-out for opening the circuit of the lamp when the latter has returned to its elevated or normal position, substantially as described.

16. In a printing apparatus, a pair of printing-frames, and a lamp common to both frames and movable in relation to the frames, in combination with an automatic switch to cut off the light to the lamp at a predetermined time, substantially as described.

17. In an apparatus for copying drawings or the like, the two cylindrical printing-frames, a suspended electric lamp common to both of said frames, and means for controlling its descent within either of the frames, an electric switch controlling the light-circuit, and means for automatically opening the switch when the lamp has been returned to its normal or elevated position.

18. In an apparatus for copying drawings and the like, a pair of cylindrical supports for the drawings, a suspended lamp common to both of the supports arranged to descend axially within the same, means for controlling the descent of the lamp, and an automatically-operated switch controlling the lamp-circuit, substantially as described.

19. In an apparatus for copying or reproducing drawings and the like, the combination of a pair of cylinders adapted to be rotated, means to support the subject-matter to be copied or reproduced upon the exterior of said cylinders, a lamp adapted to be lowered therein, means common to both cylinders for controlling the descent of the lamp within either of the cylinders, and means to automatically break the circuit for the purpose of extinguishing the light, substantially as described.

20. In an apparatus for reproducing drawings and the like, the combination of a pair of cylinders, means to support the subject-matter to be copied or reproduced upon the exterior of said cylinders, an arc-lamp common to both of said cylinders and adapted to be lowered into said cylinders, and means to automatically break the circuit for the purpose of extinguishing the light, substantially as described.

21. In a printing apparatus, the combination of a portable frame, a rotatable frame mounted therein, a transparent cylinder carried by the rotatable frame, an electric lamp, a stand-pipe supporting said lamp, electrical connections to said lamp, a liquid-cylinder arranged in the stand-pipe, a hollow piston-rod arranged in said liquid-cylinder having a port communicating with the chamber of the cylinder, a piston carried by said rod, and a

vertically-movable valve carried by the piston-rod, and an electric cut-out for the lamp-circuit, substantially as described.

22. In a printing apparatus, a pair of rotatable printing-cylinders, means for locking said cylinders at various angles, an electric lamp common to both of the cylinders, electrical connections with said lamp, means for operating said lamp to gradually feed the same into one or the other of the cylinders, and an automatic cut-out in the electric connections for extinguishing the lamp at a predetermined time, substantially as described.

23. In a printing apparatus, the combination of a pair of rotatable printing-cylinders, an electric lamp common to both cylinders, electric connections with said lamp, a liquid-cylinder, a hollow piston-rod operating in said cylinder, a piston carried by said rod, and means whereby the hollow piston-rod and piston are automatically raised by the counterbalance-weight of the lamp, substantially as described.

24. In a printing apparatus, the combination with a transparent cylinder, a lamp, and means for automatically lowering the lamp into the cylinder, of rings engaging the ends of said cylinder, brackets secured to the cylinder-frame, shafts journaled in said brackets, pawls mounted upon said shafts, binding-aprons secured at their one edge to said frame, clamp-blocks carried by the other edge of said aprons to be engaged with the pawls of the shafts, and locking means for holding the said pawls in engagement with the clamp-blocks, substantially as described.

25. In a printing apparatus, a pair of printing-cylinders, an electric lamp common to both of said cylinders, a rotatable stand-pipe supporting said lamp, means for rotating said stand-pipe to bring the lamp into position for one or the other of the cylinders, and means for locking the stand-pipe in position, substantially as described.

26. In a printing apparatus, a pair of printing-cylinders, rotatable frames in which said cylinders are mounted, supporting-frames in which the rotatable frames are mounted, a rotatable stand-pipe mounted between the two cylinders, a lamp carried by the pipe and common to both of the cylinders, means for locking the stand-pipe in the desired position, electrical connections with said lamp, and a liquid-cylinder within the said stand-pipe for controlling the descent of the lamp within either of the cylinders, substantially as described.

27. In a printing apparatus, a pair of printing-cylinders, a rotatable stand-pipe common to each cylinder, a lamp common to both of the cylinders, electrical connections with said lamp, a rotatable circuit-connector in the electrical connections, and means within the stand-pipe for controlling the descent of the lamp in either of the cylinders, substantially as described.

28. In a printing apparatus, the combination with a printing-cylinder, an electric lamp adapted to be lowered axially in said cylinder, an electric circuit to said lamp, and the means for controlling the descent of the lamp in the cylinder, of means for securing the matter to be reproduced upon the exterior of the printing-cylinder, said means comprising a binding-apron, spring-strips secured to said binding-apron for automatically removing the same from the cylinder when released, clamp-blocks carried by the binding-apron, a rotatable shaft, pawls carried by said shaft for engagement with the clamp-blocks to secure the apron in the fastened position, and locking means for said shafts, substantially as described.

29. In a printing apparatus, the combination with a printing-cylinder, an electric lamp adapted to be lowered in said cylinder, electric connections with said lamp, and means for controlling the descent of the lamp into the cylinder, of means for securing the matter to be reproduced upon the exterior of the cylinder, said means comprising a pair of binding-aprons, each adapted to inclose one-half of the printing-cylinder, means for securing the said binding-aprons in the closed or fastened position, and spring-strips attached to said aprons adapted to elevate or move the aprons away from the cylinders when unfastened, substantially as described.

30. In a printing apparatus, a rotatably-mounted printing-cylinder adapted to swing and be locked in the horizontal position, an electric lamp adapted to be lowered in said cylinder, electric connections with said lamp, means for controlling the descent of the lamp in the cylinder, and a pair of binding-aprons for securing the matter to be reproduced on the exterior of the cylinder, said binding-aprons being permanently fastened along one edge and detachably fastened along the other edge, and means attached to said binding-aprons for moving the same away from the printing-cylinder when unfastened, substantially as described.

31. In a printing apparatus, the combination with the printing-cylinder, of an electrical lamp adapted to be lowered axially into the cylinder, electric connections with said lamp, means for controlling the descent of the lamp within the cylinder, and rewinding means for returning said lamp to its elevated or normal position, said rewinding means including a drum, a shaft on which the drum is mounted, a clutch member carried by the shaft, and a clutch-crank adapted to be engaged with the clutch member to elevate the lamp, and to remain disengaged from the clutch member during the descent of the lamp.

32. In a printing apparatus, the combination with the printing-cylinder, of an electric lamp adapted to be lowered axially into the cylinder, electric connections with said lamp, and means for controlling the descent of the

lamp into the cylinder, said means including differential sheaves, as and for the purpose described.

33. In a printing apparatus, a printing-cylinder, an electric lamp, electric connections with the lamp, and means including differential pulleys for controlling the descent of the lamp into the cylinder, as and for the purpose described.

34. In a printing apparatus, a pair of printing-cylinders, a lamp common to both of the cylinders, electrical connection with said lamp, a circuit-connector in the electrical connections, and means for controlling the descent of the lamp in either of the cylinders, substantially as described.

35. In an apparatus for reproducing drawings and the like, the combination of a printing-cylinder, means to support the subject-matter to be copied or reproduced on the exterior of the cylinder, an arc-lamp adapted to be lowered within the cylinder, electrical connections with said lamp, means for maintaining a closed circuit within the lamp during its descent and ascent within the cylinder, and means for automatically opening said circuit after the lamp has returned to its elevated or normal position.

36. In an apparatus for reproducing drawings and the like, the combination with a printing-cylinder, of means for securing the matter to be reproduced upon the exterior of said cylinder, a lamp adapted to be lowered axially into the cylinder, electrical connections with said lamp, a rotary circuit-connector in said electrical connections, and means to automatically open the circuit at a predetermined time to extinguish the light, substantially as described.

37. In a printing apparatus, two frames connected together to form a common support, a printing-cylinder rotatably mounted in each of the frames and movable independently of each other, a rotatable stand-pipe, a lamp carried by said stand-pipe and common to both of the cylinders, electrical connections with the lamp, and means to automatically break the circuit to extinguish the light, substantially as described.

In testimony whereof I affix my signature in the presence of two witnesses.

REINHOLD HERMAN.

Witnesses:
JOHN GRAEBING, Jr.,
E. E. POTTER.