R. HERMAN.

BLUE PRINTING APPARATUS.

APPLICATION FILED JAN. 18, 1909.

966,016.

Patented Aug. 2, 1910.

4 SHEETS—SHEET 1.

FIG. 1.

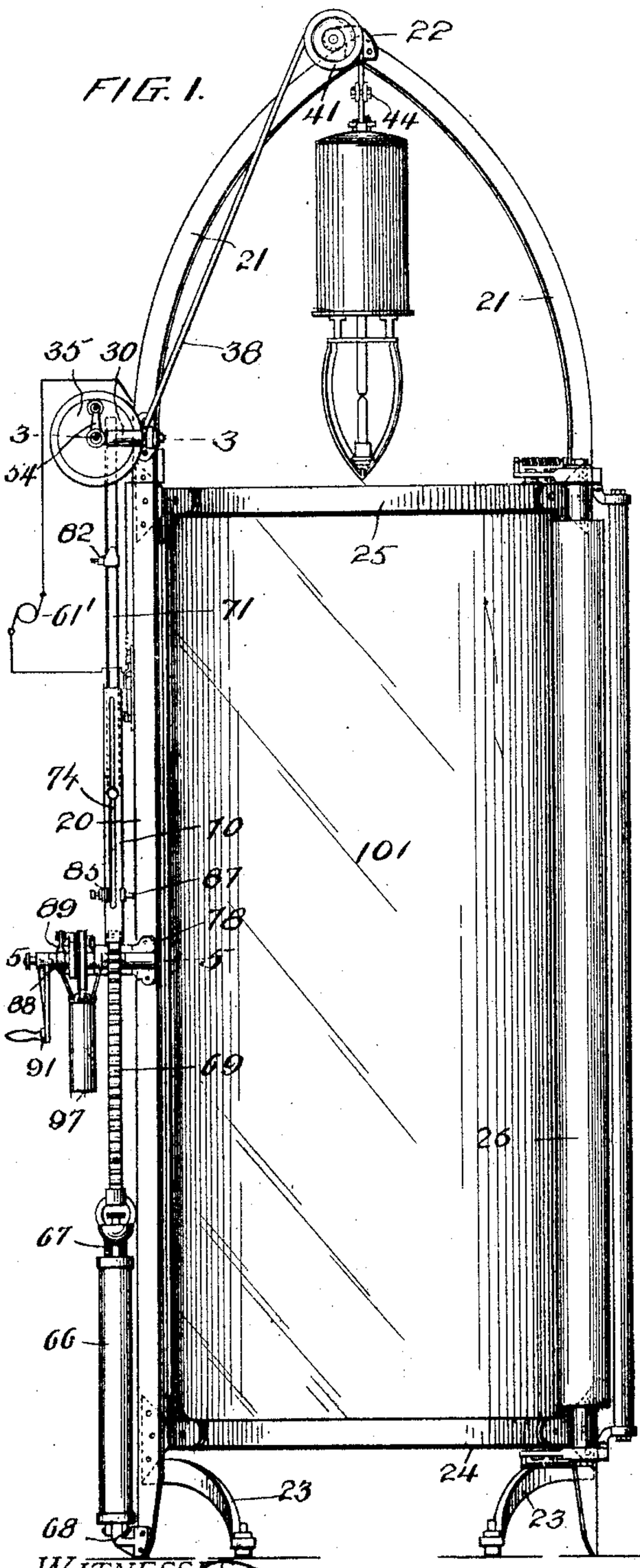
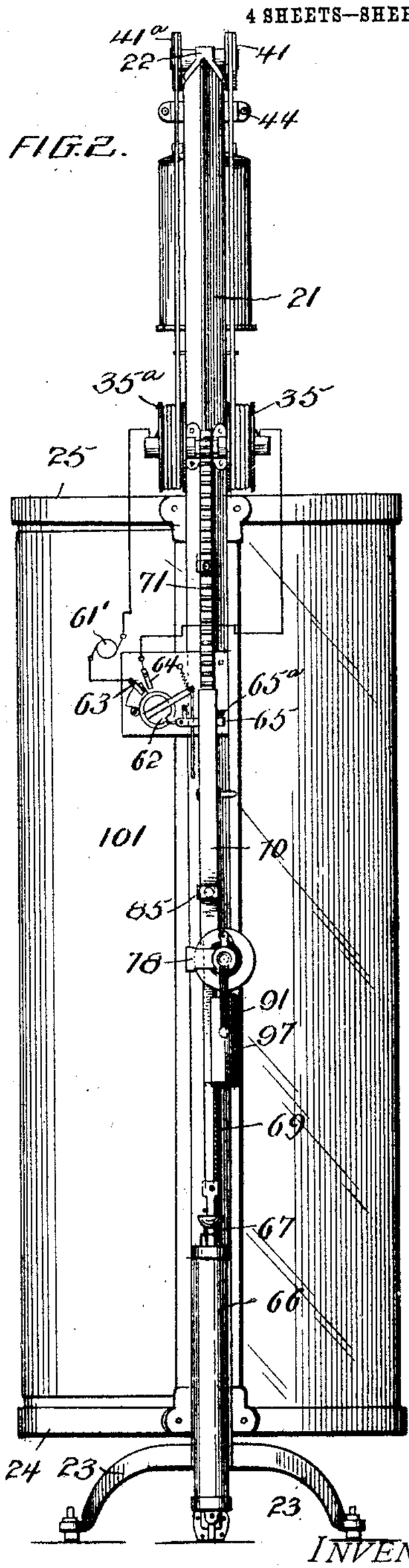


FIG. 2.



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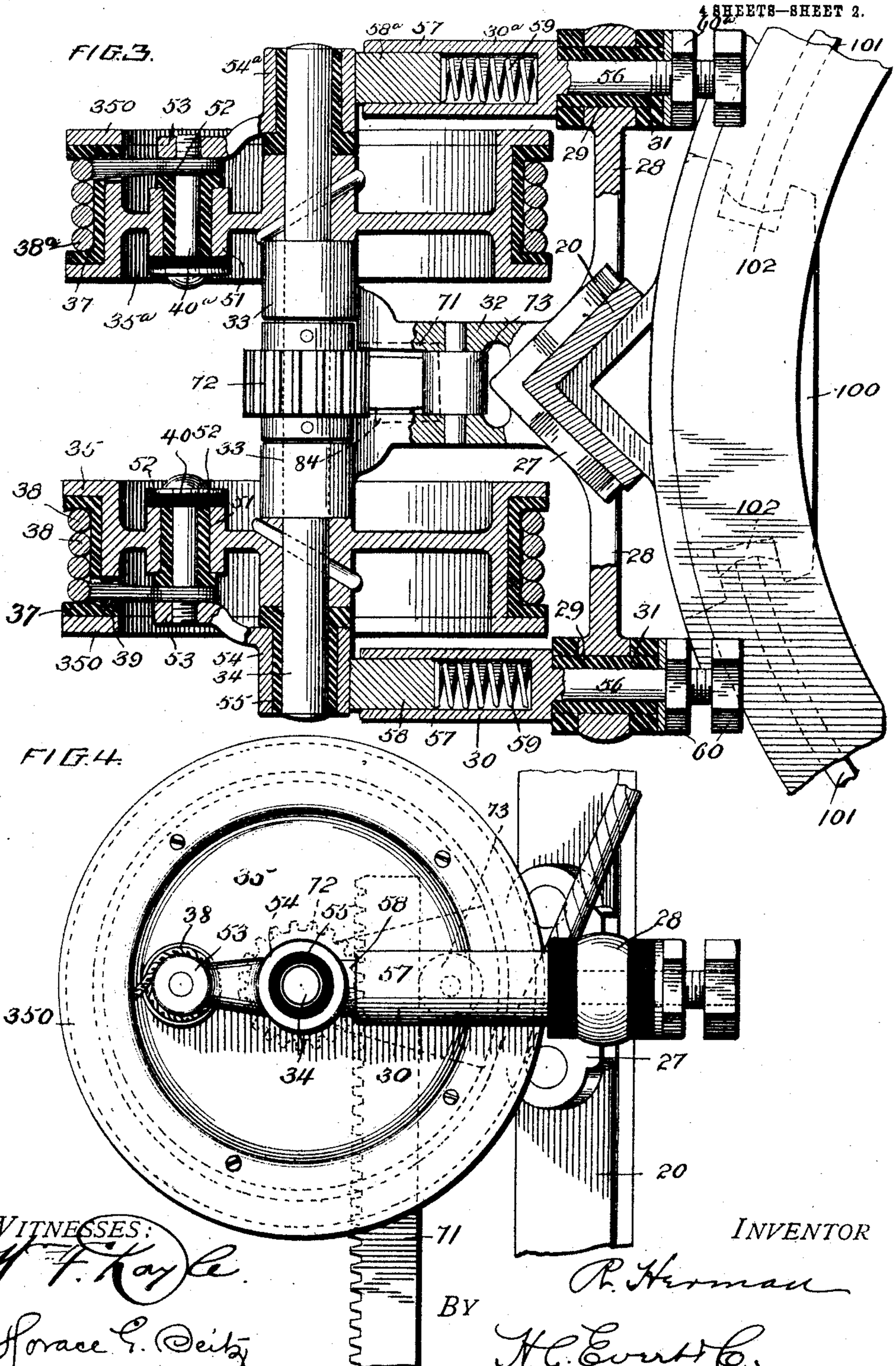
4 SHEETS—SHEET 2.

FIG. 3.



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4 SHEETS—SHEET 3.

FIG. 5.

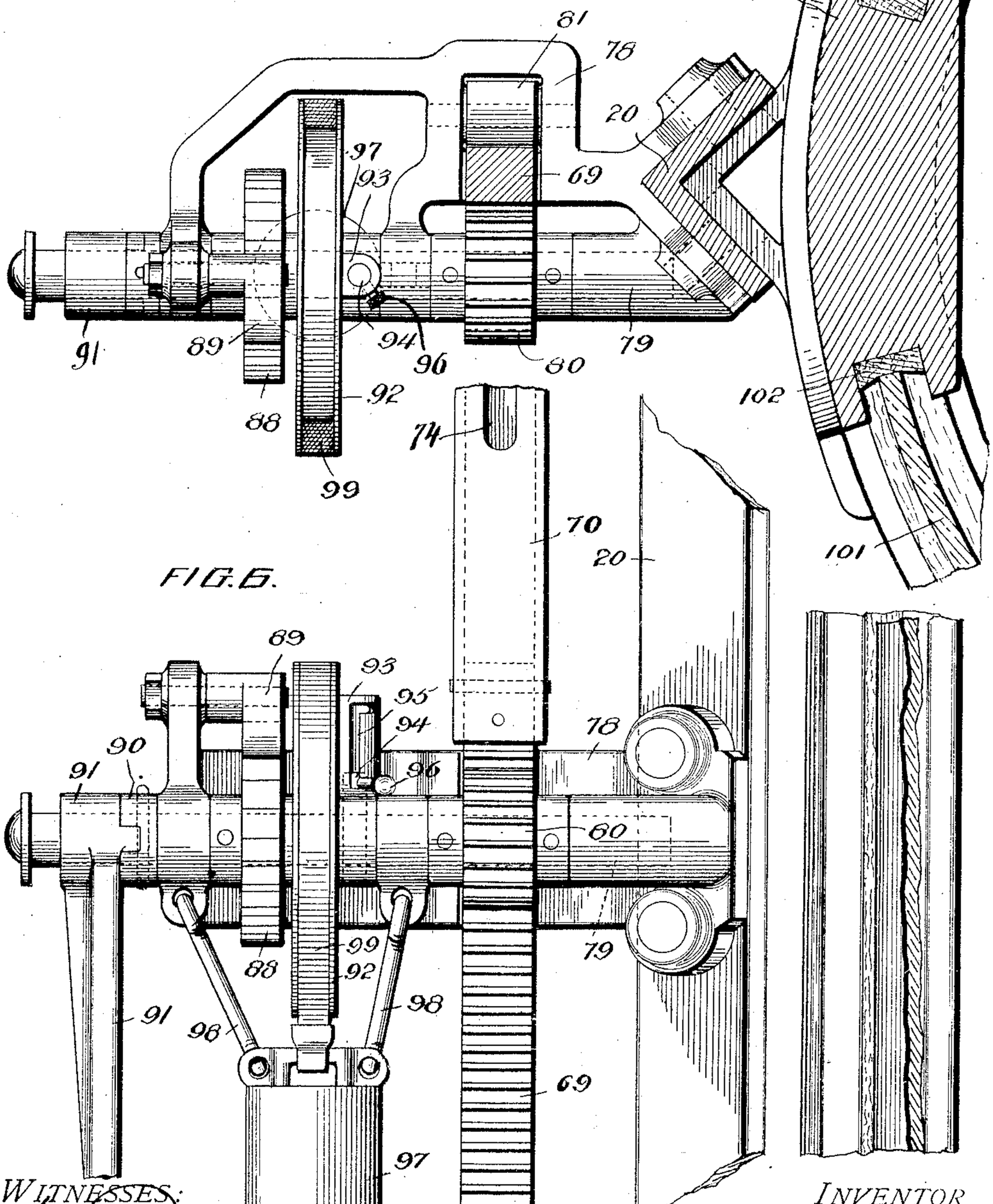

FIG. 6.

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4 SHEETS—SHEET 4.

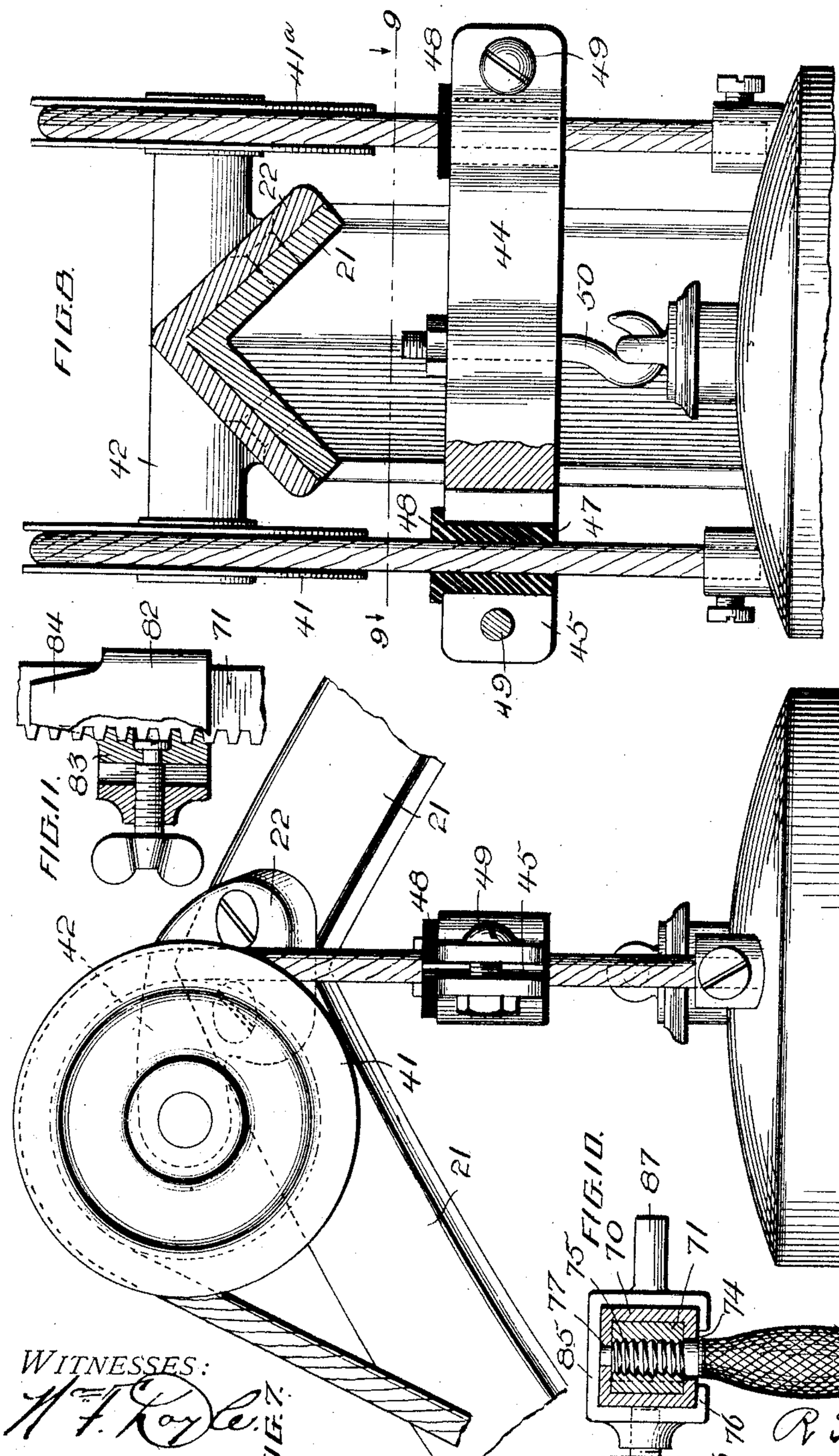

FIG. 8.

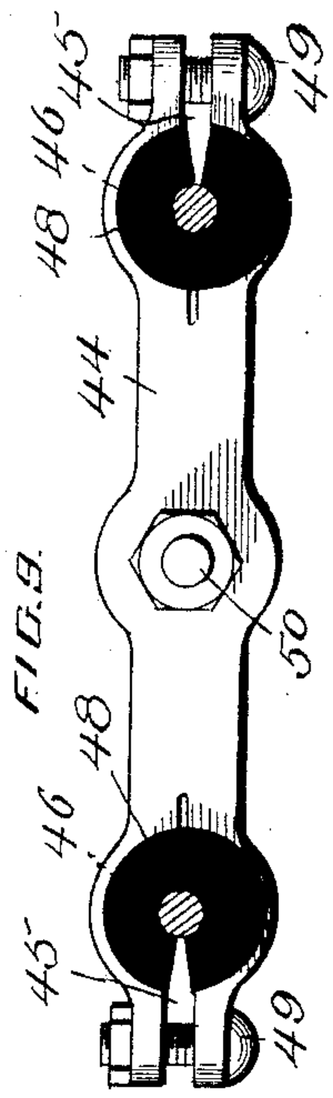

FIG. 9.

FIG. 11.

FIG. 10.

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BLUE-PRINTING APPARATUS.

966,016. Specification of Letters Patent. **Patented Aug. 2, 1910.**

Application filed January 18, 1909. Serial No. 472,844.

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 Blue-Printing Apparatus, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to blue printing apparatus, and has particular relation to the type preferably using an electric lamp as the source of light.

Heretofore, devices of this character have been employed of two general classes, viz:— (a) an apparatus in which the lamp is held stationary, the current thereto being controllable for the purpose of retaining the light in operation a predetermined period of time; and, (b) an apparatus in which the lamp is given a movement parallel with the plane of the print operated upon, the movement, in some cases, being of a predetermined length. In each of these cases, means have been employed for automatically cutting out the lamp at a predetermined time. While each of these classes of cases is substantially competent to perform the particular function desired of them, their use is limited solely to particular classes of work; for instance, in cases of the first class, the size of the print to be made is limited for the reason that the effective zone of light is limited unless the lamp itself be of a size sufficient to impart the light rays to all parts of the printing frame, in which case, an excessive amount of current is required when the print to be made is of a small size; where the lamp is movable, it is possible to give all parts of the printing frame the necessary light, but in such cases, the lamp not having provision for being held stationary at a predetermined point in the path of travel, and especially where the print is small and the drawing which is being printed is contained on a relatively heavy thickness of paper, the necessary time intervals required to give the maximum amount of light is not obtainable. In order, therefore, that all classes of work may be blue-printed with success, it has heretofore been essential that the establishment be provided with each class of machines, thereby making the cost of apparatus excessive, since certain classes of work could be made by either class of machines, but neither is capable of producing all classes of work.

The present invention aims to overcome these objections by providing an apparatus which will provide either a moving exposure or what may be termed a "time" exposure, viz., an exposure in which the source of light (the lamp) is held stationary.

The invention therefore has for its main object the provision of an apparatus in which the lamp may be given the movement across the face of the print, or be held stationary at any predetermined point, the electric circuit for the lamp being controllable with either form of operation.

Another object of the invention is to provide, in an apparatus of this character, a timing means for controlling the period of exposure in either form of operation of the apparatus.

A further object is to provide a timing means, operative by either the lamp or a weight, for controlling the exposure, said operating means being operative independently of each other.

A further object is to provide a timing means for controlling the period of exposure of the lamp regardless of whether the latter is operating to provide a movable exposure or a stationary exposure, said means forming the stop mechanism for the movement of the lamp when the latter is providing the moving exposure.

A further object is to provide an adjustable connection between the timing means and the lamp carrying support by which a positive movement will be given to the timing means by the movement of the lamp when the apparatus is being given one form of operation, and which connection is broken without affecting the operation of the timing means when the apparatus is used in the other form of operation, the timing means being in active operation during the period of exposure with either form of operation.

A further object of the invention is the provision of improved means for connecting the lamp cables in the electric circuit.

A further object is the provision of a novel supporting means for the lamp whereby the usual point of connection of the cable and lamp is freed from the strain of the lamp support.

A further object of the invention is to provide an apparatus of this character in which the lamp, its controlling mechanism, and the printing frame are directly carried by the supporting frame.

A further object of the invention is to provide in an apparatus of this character, a supporting frame positively held against movement relative to the printing frame, said supporting means carrying the lamp in a manner to normally fix the position of the lamp relative to predetermined portions of the printing frame, novel means being provided for preventing swinging movement of the lamp in a rotary direction to affect the position of the lamp relative to said predetermined portions.

A further object of the invention is the provision of an apparatus of this character which permits of a complete assemblage of parts in their proper relationship prior to being boxed for shipment, and which can therefore be shipped in a condition ready to be operated upon removing the crating and connecting up the circuit connections, the parts being so formed and positioned as to permit required preliminary adjustments, etc., which will remain unchanged in shipment except under handling such as would substantially destroy the apparatus.

Minor objects of the invention are to provide various mechanical improvements in the construction of the different parts of the apparatus and their manner of interconnection so as to produce an apparatus which is efficient, durable, of comparative low cost, and simple in operation.

To these and other ends, the nature of which will be understood as the invention is hereinafter disclosed, my invention consists in the improved construction and combination of parts hereinafter fully disclosed, illustrated in the accompanying drawings, and particularly pointed out in the appended claims.

In the accompanying drawings, in which similar reference characters indicate similar parts in each of the views,—Figure 1 is a front elevation of a blue printing apparatus constructed in accordance with my invention. Fig. 2 is a side elevation of the same. Fig. 3 is a horizontal sectional view taken on line 3—3 of Fig. 1, and showing the lamp cable supporting means and the circuit connections by means of which the current follows to the lamp. Fig. 4 is a front elevation of the structure shown in Fig. 3. Fig. 5 is a horizontal sectional view taken on line 5—5 of Fig. 1, and showing in plan view the mechanism for changing the operation from the moving lamp to the stationary lamp or vice versa. Fig. 6 is a front elevation of the construction shown in Fig. 5. Fig. 7 is a view in elevation of the upper portion of the lamp, the sheaves for the lamp cables, and the connector for the lamp and its cables. Fig. 8 is a view taken at right angles to Fig. 7, a portion of the connector being shown in section. Fig. 9 is a top plan view of the connector and showing the lamp cables in section, the section being taken on line 9—9 of Fig. 8. Fig. 10 is a horizontal sectional view through the upper rack and through the sleeve, and showing the sleeve and rack connecting member in operative position, said view also showing the finger carrier for cutting out the current to the lamp. Fig. 11 is a vertical sectional view showing the stop mechanism for limiting the downward movement of the lamp.

The complete apparatus in Figs. 1 and 2 consists of the print-carrying frame, including the apron, the supporting frame, the lamp, and the lamp controlling mechanism, said latter mechanism including the means for controlling the movement of the lamp and the means for controlling the period of exposure of the lamp. Of these particular constructions, the print-carrying frame and its apron is not specifically shown and described herein in detail, as the same forms the subject-matter of a separate application, and while the specific construction of the supporting frame is disclosed herein to some extent, this structure is not specifically claimed herein as it also forms the subject-matter of a separate application. Nor do I disclose or claim the specific structure of the piston-cylinder or of the switch mechanism, as the former is substantially disclosed in Letters-Patent granted to me December 13, 1904, No. 777,096, and the latter is of the type shown in Letters-Patent granted to me November 3, 1903, No. 743,160.

The main or supporting frame of my apparatus consists of two vertically-extending bars 20 located on diametrically-opposite sides of the printing frame, said bars having their upper ends curved inwardly, as at 21, to form a meeting point located in approximate alinement with the axis of the printing frame, being connected by a casting 22 which overlaps the meeting ends and is secured to both bars, as indicated in Fig. 7. The lower end of each of the bars 20 is provided with laterally-extending feet 23 to provide the equivalent of an expanded base to the bar. The bars may have any desired cross-sectional configuration, but I preferably make use of angle-iron for this purpose, as such form lends itself to the formation of an extremely durable and compact structure, as will be presently described. A preferred configuration of bar is shown in Figs. 3 and 5.

Adjacent the lower ends of the bars 20 I secure the lower ring 24 of the printing frame, said ring being secured to the bars in suitable manner. The upper ring of the printing frame is also secured to the bars 20, but for the purpose of permitting of a ready placing in position of the glass, said ring 25 is not secured in position until after the glass has been mounted, said ring being slid vertically on said bars to permit of the

insertion of the glass, the bars having their vertically - extending portions continued above the normal plane of the ring 25 to permit the latter to be raised during the insertion of the glass. The rings 24 and 25 are also preferably formed of angle-iron.

The printing frame, briefly stated, consists of the rings 24 and 25, the glass sections, and the spacing members 100 which form the closures between the vertically opposing edges of the semicylindrical halves or sections of the cylinder 101. The spacing members have their vertical edges recessed longitudinally of the members, the recesses being preferably of a width greater than the thickness of the glass, and which recesses receive suitable strips 102 of felt or its equivalent material for the purpose of cushioning the edges of the glass in the cylinder. The rings 24 and 25 are each provided on diametrically opposite sides with projecting portions adapted to fit the bars 20, as shown in Figs. 3 and 5, said portions being preferably arranged to aline with the spacing members 100, thereby placing the blind portions in the cylinder, formed by the spacing members, in alinement with the bars 20 and enabling the lamp to be accurately positioned to provide movements thereof in which the zone of the obstructed light rays, due to the presence of the frame of the lamp, will be positively fixed, the blind portions of the light rays and the similar portions of the cylinder thereby being in accurate alinement as hereinafter disclosed.

26 designates the apron, the structure of which and its operating mechanism is not specifically set forth herein, as heretofore set forth.

In order that the controlling mechanisms for the lamp may be more readily understood, I will first describe the manner in which the lamp is supported from the frame and in which it is connected in the electric circuit.

Referring first to Figs. 3 and 4, 27 designates a bracket secured to one of the bars 20, said bracket having wings 28 extending on opposite sides of the bar 20, each of said wings having an opening 29 to receive a brush holder, an insulating collar 31 being interposed between the holder and the bearing. The central portion of said bracket is extended outwardly, as at 32, the extension being in two spaced parts substantially duplicated and terminating in bearings 33 spaced apart a greater distance than the two parts of the extension, said bearings 33 being adapted to support a shaft 34 extending therethrough. Mounted on the shaft 34, on the outer sides of the bearings 33, are two sheaves 35, 35[a], said sheaves being secured to and deriving movement from said shaft in any preferred manner.

The sheaves 35 and 35[a], with their co-operating parts, are substantial duplicates in construction, and I will therefore describe, in detail, the structure in connection with the sheave 35. The sheave 35 has its periphery formed with an annular depression in which is secured an insulating bushing 37 also formed with an annular depressed portion to receive the strands of an insulated lamp cable 38 having one end passed through a radial opening 39 formed in the bushing 37 and the rim of the sheave, (the opening in the latter being insulated) and suitably secured in position on a screw 40. To enable the bushing 37 to be placed in position the sheave 35 is formed with a detachable side face 350, held in position by suitable screws, as shown in Fig. 4. The opposite end of the cable 38 is carried over a sheave 41 (Figs. 7 and 8) carried by a bracket 42 formed on the casting 22, and secured to the proper binding screw of the lamp. To prevent liability of grounding the electric circuit on the frame through the sheave 41, said sheave is provided with an annular insulating bushing within which the cable is located.

For the purpose of preventing liability of the cables being withdrawn from their connection with the lamp, I provide a supporting device which is best illustrated in Figs. 7, 8 and 9. This device comprises a bar 44 having its ends split or bifurcated, as at 45, each end being provided intermediate the ends of the bifurcations with an enlarged opening 46 to receive an insulated bushing 47, which also is split longitudinally on one of its sides and provided with a head 48 which normally rests on the upper face of the bar 44. A bolt 49 extending transversely of the bar 44 adjacent each of its ends, serves as a clamping member to provide pressure on the split insulating bushing 47. A suitable hook 50 has its shank extending vertically through the bar 44 at its center, said hook being adapted to be removably engaged with an eye formed at the upper end of the lamp.

The supporting of the lamp by means of the bar 44 is obtained by permitting the bifurcated ends of the bar to be opened by the release of the bolts 49 and the insertion of the insulating bushings 47 into the openings 46, the bushings being passed over the cables. The hook is then inserted in its eye and the cables connected to their binding posts on the lamp. The bar is then moved along the cables until properly positioned thereon to take all strain off of the end of the cables, after which the bolts 49 are tightened, placing the grip of the bushings 47 on the cables a distance extending the entire length of the bushings. By this construction, not only is the weight of the lamp removed from the point of connection of the cables and lamp, but in addition, the bar

and insulating bushings form positioning members for the cables which prevent the latter from being swung out of the sheaves 41, and prevent a rotatory swinging of the lamp during its downward movement. This latter is of especial advantage for the reason that in an apparatus of this type, there are necessarily what may be termed "blind" portions to which the light rays cannot pass, owing to the presence of the frame of the lamp obstructing the rays of the arc. By retaining the lamp against a swinging movement in a rotary direction, these "blind" portions are positively fixed. In view of the fact that these "blind" portions are alined with the vertical bars 20, the particular arrangement of the upper ends of these bars and the mounting of the shaft 41, provides, with the steadying-effect of the three-point connection of the cables and lamp, a positive retaining-means for holding the lamp-frame alined with such "blind" portions, and thereby permitting all the remaining portions of the printing frame to be used for printing purposes without liability of obstructing the light rays at any point.

From the above description of parts, it will be understood that the cables from which the lamp is supported are wound around the sheaves 35 and 35ª and have their sheave ends secured to a screw carried by the sheaves, and that a rotative movement of the shaft 34 will wind or unwind the cables from the sheaves 35 and 35ª according to the direction in which the shaft is being rotated.

The circuit connections by means of which the current is supplied to the lamp through the cables 38, are as follows: The sheave 35 is provided in its web with a bearing 51, and within said bearing is located an insulating collar 52, through which the screw 40, heretofore referred to, is passed, the outer end of said screw being adapted to receive a threaded-extension 53 formed on a rotary circuit connector or collector ring 54 mounted on a collar 55 formed of insulation and located on the shaft 34. For the purpose of insulating the extension 53 from the sheaves 35, the insulating collar 52 projects beyond the face of the bearing 51; the end of the cable is located between said projecting portion of the collar and the extension 53, being clamped in position by the action of the screw 40 in placing the connector 54 in proper position. The brush-holder 30, which provides the connections between the binding posts for the wires from the line to the connector 54, comprises a shank 56 located within the collar 31 and having a projecting portion 57 which is recessed longitudinally to receive a brush 58, of suitable type, and an actuating spring 59 which serves to retain the brush in contact with the face of the connector 54. The free end of the shank 56 is provided with screw threads to receive two nuts 60 which serve to clamp the wires for the circuit connections, a brass washer being interposed between the inner nut and the insulation. It will be understood that as the shaft 34 is rotated, as hereinafter described, the connector 54 moves therewith, and, through the brush and brush holder with its binding post, forms a part of the circuit connections for supplying the lamp with current.

For the purpose of clearly distinguishing the parts carried by or coöperating with the sheave 35ª, from the similar parts in connection with sheave 35, the parts are designated as follows: the lamp cable 38ª; sheave, 41ª; binding post or screw, 40ª; rotary circuit connector, 54ª; brush-holder, 30ª; brush 58ª, and nuts 60ª.

The circuit, which is best illustrated in Figs. 1 and 2, includes the following: 61′ is a diagrammatic representation of the source of electrical supply and 62, an automatic switch having switch contact clips 63 and 64. As shown in Fig. 2, the circuit passes from source 61′ to the switch contact clip 63, through the sector of the switch, to the switch contact clip 64, and thence to the brush holder 30 and brush 58. From the brush 58 it passes to the rotary circuit connector 54 and binding post or screw 40, from which it passes to the insulated cable 38 carried by the sheave 35, through said cable (the latter passing over sheave 41) to the lamp. The return circuit passes from the lamp to the cable 38ª (the latter passing over sheave 41ª), through said cable, over sheave 35ª, to the binding post or screw 40ª, carried by the circuit connector 54ª, through said connector to brush 58ª, and brush-holder 30ª to the source of supply 61′. It will now be understood that when the switch 62 is set to complete the circuit, a complete circuit will be formed through the lamp which circuit will be continued regardless of the movements of the cables and their sheaves, and will continue until the switch has been operated to break the circuit.

As heretofore stated, the automatic switch structure is not herein shown and described in detail, it being preferred to use the structure disclosed in Patent No. 743,160, above referred to. It will therefore be sufficient herein, to state that the switch is in the form of a member having a partial pivotal movement which will bring an extension or sector thereof into or out of engagement with both contact plates of the circuit connection, said member being under spring tension and having a notch within which is received a pawl carried by a tripping lever, having a limited pivotal movement, said lever, when tripped, releasing the pawl and permitting the spring to rotate the member

and break the circuit. For the purpose of clearness, I have designated the tripping lever as 65, the stop for limiting the movement of the lever being designated as 65[a].

As heretofore pointed out, the apparatus is intended to provide for either of two forms of lamp exposure, viz: by a movement of the lamp within the printing frame or by retaining the lamp at a stationary position within the frame. These operations are controlled by certain operating elements which, in one operation, are in conjunction, and in the other operation are separated. For the purpose of explaining these operations, I will first describe the construction of parts and their operation when used in conjunction to permit movement of the lamp to carry it through the printing frame for the purpose of making the print.

66 designates a cylinder having a piston 67, said cylinder having its lower end pivoted to a bracket 68 located adjacent the bottom of the bar 20, this form of mounting providing for an accurate alining of the connections presently described, during the operation of the device. The particular construction of cylinder and piston is not herein described, the structure thereof, as heretofore pointed out, being of suitable character, such for instance as shown in the Patent # 777,096 above set forth. It may be noted that the structure is arranged to permit of a controllable passage of fluid through by-passes formed in the piston, in order to control the rapidity of movement of the piston in either direction, the piston being adjustable to control the passage of fluid.

Fixedly connected to the end of the piston is a rack-bar 69 which extends vertically a suitable distance, and at its upper end is connected to a sleeve 70, which, in turn, is adapted to receive the lower end of a rack-bar 71. The rack-bar 71 is adapted to engage with a pinion 72 mounted on the shaft 34 between the bearings 32, said rack-bar being held in engagement with said pinion by means of a roller 73, as best shown in Fig. 3. The rack-bar 71 is of a size in cross section to loosely fit the sleeve 70, said sleeve having one of its faces provided with a longitudinally-extending slot 74. Adjacent the lower end of the rack-bar 71, the same is provided with a screw-threaded opening 75, which is adapted to receive a screw-threaded stud 76 having a handle projecting through the slot 74 of the sleeve, said stud having its inner end reduced and free from screw-threads. The sleeve 70 is provided approximately central of its length with an opening 77 positioned and of a size to receive the reduced end of the stud 76 when the stud and opening are in alinement, the engagement being obtained by the rotary movement of the stud.

78 designates a bracket secured to the bar 20, and having a configuration such as indicated in Fig. 5, said bracket having suitable bearings to receive a shaft 79 on which is mounted a pinion 80 fast on the shaft and adapted to engage the rack-bar 69 which passes vertically through an opening in the bracket 78. To retain the rack-bar 69 against lateral movement and in contact with the pinion 80, I provide a roller 81, which rides against the rear face of said rack-bar. While the shaft 79 carries other parts which will be presently described, movements of the pinion in the operation now to be described do not materially affect the parts carried by said shaft, the parts being so arranged that in this operation, the pinion acts mainly as a guide for retaining the rack-bar in alinement with the remaining parts forming the connection between the cylinder and the lamp-supporting sheaves.

With the parts connected in the manner thus described, a release of the lamp from its position-retaining means, places the weight of the lamp on the cables and causes them to rotate the sheaves 35 and 35[a] which in turn communicate motion to the shaft 34 and pinion 72. The movement of pinion 72 causes an upward movement of the rack-bar 71, and by reason of the connection of said rack-bar with the sleeve 70 through the stud 76 engaging the opening 77, causes the sleeve to move as an integral part of the rack-bar 71, said sleeve in turn drawing on the rack-bar 69 and, through the connection of the latter with the piston, placing the movement of the lamp under the control of the controlling structure provided by the cylinder and piston, the rapidity of movement of the lamp being controlled entirely by the greater or less quantity of fluid permitted to pass through the by-passes of the piston.

The cutting out of the current from the lamp by the operating of the automatic switch to break the circuit is provided by this movement of the connections. For this purpose, I place on the sleeve 70 a collar 85 having a set-screw 86 by means of which the collar may be clamped to the sleeve at any desired point intermediate the ends of the latter, the collar being best shown in plan view in Fig. 10 of the drawings. Said collar is also provided with a finger 87 which has a path of movement adapted to cross that of the tripping-lever 65 of the automatic switch. The movement of the switch to complete the circuit, places the tripping-lever 65 in its proper position; hence, the movement of the sleeve 70 heretofore indicated will carry the finger 87 into contact with the lever 65 and operate the latter to release the switch and break the circuit, the movement of the lever 65

being pivotal until contact is made between the lever and its stop 65ª, at which time the lever does not pass out of the path of travel of finger 87, but remains therein to provide a positive stop against further movement of the finger, and, through the connections heretofore noted, to the sheaves 35 and 35ª and the lamp. Hence, the movement of the lamp will be stopped immediately after the circuit is broken, the finger 87 and the tripping lever 65 being the particular parts which control this result, and thereby providing coöperating elements common to produce both results. It will therefore be understood that a single adjustment of the finger 87 will control the length of movement of the lamp through the printing frame, the lowermost position which the lamp can assume during its movement, and the length of exposure of the lamp.

The mechanism for returning the lamp to its normal position is best shown in Figs. 5 and 6 and consists mainly of a ratchet wheel 88 pinned to the shaft 79, a pawl 89 carried by a projection formed on the bracket 78 and adapted to coöperate with said ratchet-wheel, a coupling member 90 pinned to said shaft 79, and an operating handle 91 having a face complemental to the coupling-member, said handle being mounted to move longitudinally of the shaft 79 to permit engagement and disengagement of the coupling-faces of the handle 91 and coupling member 90.

When the lamp has reached the lowermost position permitted by the finger 87, an engagement of the handle 91 with the coupling-member 90 and a rotation of the handle 91 to impart a movement to the pinion 80 in the opposite direction will cause the pinion 72 to be rotated in a manner to wind the cables on the sheaves 35 and 35ª, thereby withdrawing the lamp from the printing frame. During this operation, it is preferred that the controlling mechanism formed by the cylinder and piston be adjusted to permit of a relatively rapid movement of the parts.

It is preferred that the sheaves 35 and 35ª be of such size relative to the pinion 72 as will provide a differentiating-movement between the rack-bar 71 and the lamp in such a manner that the lamp will travel a relative number of times the distance of travel of the rack 71 during the same period, the parts being so proportioned that, for instance, a movement of the rack-bar 71 in Fig. 1 a distance approximately that of the length of said rack will cause the lamp to travel the entire length of the printing frame.

To permit the lamp to be used as a stationary exposure-element, means must be provided for retaining the lamp in the desired position, and the construction for producing this result will now be explained.

Adjustably mounted on the rack-bar 71 is a sleeve 82, shown in detail in Fig. 11, said sleeve having a set screw and a follower 83, the latter having a toothed face adapted to engage the toothed face of rack-bar 71, said sleeve being provided with a vertically-extending projection 84.

When it is desired to use the apparatus with the lamp held stationary within the printing frame, the sleeve 82 is placed at its proper position on the rack-bar 71 and the stud 76 unscrewed until its reduced end is disengaged from the opening 77, thereby breaking the connection between the sleeve 70 and rack-bar 71, leaving the rack-bar free to move vertically until the engagement of the projection 84 with the bracket 27 is had. During this movement, the handle of the stud enables the operator to control the movement of the lamp to prevent accident.

The disconnection of the sleeve 70 and rack bar 71, however, eliminates the power for moving said sleeve and its circuit breaking finger. To provide this movement of the sleeve 70 I mount on the shaft 79, a sheave 92 having a laterally-projecting radially extending portion 93 provided with a longitudinal opening within which is located a bolt 94 mounted to move longitudinally of said opening, said portion 93 having a slot 95, the ends of which are enlarged laterally, said slot forming a passage-way for a handle 96 carried by the bolt, the enlarged ends of the slot permitting said handle to be locked at either end of the slot 95. The shaft 79 is provided with a suitable diametrically extending opening (shown in dotted lines in Fig. 6) for the passage of the bolt thereinto.

97 designates a weight, approximately equal to that of the lamp, and which is normally supported by means of hooks 98 secured to suitable ears formed on the bracket 78. The weight 97 is connected to the sheave 92 by means of a flexible-connection 99, preferably in the form of a metallic band, as shown in Fig. 5, the cross-sectional configuration of the latter tending to prevent swinging of the weight when the weight is released from its supporting hooks.

When the lamp has been positioned within the printing frame as heretofore described, and the circuit breaking finger properly positioned on the sleeve 70, the bolt 94 is passed into the opening in the shaft 79, thereby locking the sheave 92 to the shaft. Upon disengagement of the hooks 98 from the weight, the latter exerts its power through the connection 99 to the sheave 92 and the shaft 79, imparting a rotary movement to said shaft. This movement in turn causes the pinion 80 to move the rack-bar 69 with

the sleeve 70. The rapidity of movement of the weight is controlled by the controlling mechanism formed by the cylinder and piston as in the case where the weight of the lamp forms the power. This movement of the rack-bar 69 and sleeve 70 moves the finger 87 into engagement with the tripping-lever 65, and actuates the circuit-breaker or automatic switch.

When the connections heretofore described are engaged to provide the operative connection between the sheaves 35 and 35[a] and the rack-bar 69, the lamp is supported in its uppermost position by the pawl and ratchet carried by shaft 79. When the movement of the lamp is to be had, the lever 65 is moved to close the switch 62, the handle 96 disengaged, and the pawl raised, leaving the connections free to move downwardly. When the winding movement takes place, the pawl is placed in engagement with its ratchet so as to retain the lamp in its raised position. When the lamp is in its stationary position within the printing frame, the movement of the sleeve 70 is permitted by the disengagement of said pawl from its ratchet; to permit the lamp to be raised to its uppermost position, however, the rack-bar 71 may be lowered (by means of the handle on stud 76,) until said stud alines with the opening in sleeve 70, whereupon engagement is completed and the winding takes place in the usual manner.

When the weight is being used as the motor, the flexible connection is re-wound by the handle 91, the same movements of the remaining parts in operative relation with the shaft 79 having their usual movements.

It is to be noted that when the apparatus is being used to provide a moving exposure, the sleeve 82 is placed in position adjacent the lower end of rack-bar 71, to enable the latter to have free movement.

From the above it will be seen that whether the lamp or the weight provides the actuating means, the breaking of the circuit is performed by the same member through the same controlling means, the only difference in operation being the provision of an auxiliary actuating device and the disconnection of the lamp from the moving elements without affecting the circuit-connections. The changes required to modify the operations from one class to the other are comparatively slight, consisting simply in adjusting the sleeve 82 on rack-bar 71, disengaging the rack-bar 71 and sleeve 70 by means of the stud 76, positioning the lamp by the free movement of rack bar 71, engaging the sheave 92 with the shaft 79, and releasing the hooks 98. With these changes, the entire method of printing is changed, permitting of an increased length of exposure beyond what could be provided by the moving lamp, without requiring any change whatever in the circuit-breaking mechanism. And it will be obvious, that a reversal of these operations will return the lamp to a position where its operation will be limited to that of a moving lamp.

The specific construction of the mechanism for including the lamp cables within the lamp circuit is not claimed herein, as the same forms the subject-matter of a divisional application hereof, filed July 27, 1909, Serial No. 509,874.

The various operations are believed to have been indicated with sufficient clearness.

As will be seen, the entire apparatus is supported solely by the frame formed of the bars 20, said bars, being rigidly connected at their top, forming supports which need not be adjusted relatively to any portions of the remaining structures after the latter have been secured thereon. Hence, it will be readily understood that the apparatus may be assembled and tested before leaving the manufactory, and boxed and placed in condition for shipment in its exact operative positions, the lamp being connected up and boxed or braced so as to prevent swinging movement during shipping, however, remaining within the crate or box used for the entire apparatus. When the apparatus is delivered to the consignee, it will be necessary only for him to remove the box or crating, and apply the circuit connections to the automatic switch, to place the apparatus in condition for operation. In other words, the apparatus is one which is wholly self-contained.

The advantages of the present invention are many, and include the following in addition to those heretofore pointed out: The ability to provide for either a moving or a stationary exposure without substitution of parts and by a simple manipulation of portions of the operating mechanism; the use of exposure timing means common to either form of operating, and at the same time using the tripping element for the circuit breaker as a movement-limiting member for the lamp; the provision of an auxiliary power device or motor for operating the timing mechanism, connectible with the operating elements without affecting the position or connections of any of the elements controlling the timing structure; the provision of a compact, durable and efficiently-operating supporting structure for the lamp-cables, said structure being positively movable and at the same time insulated against all liability of leakage of current; the provision of circuit connections to the lamp-cables and to form the automatic switch which insures a continuous passage of the current; the use of the lamp-cables for the passage of the current as well as a support for the lamp; the prevention of a rotary swinging of the lamp to eliminate liability

of affecting the print; and the accurate alining of the blind portions of the lamp and printing frame.

Having thus described my invention and pointing out one mode for carrying the same into effect, but without indicating all of the forms which might be used for the purpose, and reserving all my rights to such changes and modifications therein as may be desired or necessary so far as they may fall within the spirit and scope of my invention, what I claim as new is:—

1. In a blue-printing apparatus, a printing frame, means for providing a moving or a stationary print exposure to said frame, and means for controlling the time-length of exposure.

2. In a blue-printing apparatus, a printing frame, a source of light, and means for providing a controllable moving or a stationary print-exposure to said frame during a predetermined period.

3. In a blue-printing apparatus, a printing frame, a source of light, and means for providing a controlled moving or a stationary print-exposure to the frame, said means including a timing mechanism for controlling the length of the exposure.

4. In a blue-printing apparatus, a printing frame, a source of light, and means for providing a controlled moving or a stationary print-exposure to the frame, said means including a timing mechanism for controlling the length of the exposure, said timing mechanism controlling the rate of movement during the moving print-exposure.

5. In a blue-printing apparatus, a printing frame, a lamp, means for controlling the time-length of the emission of light rays from said lamp, and means for providing a controlled movement or a stationary position to the lamp relative to said frame during the period of light-ray emission.

6. In a blue-printing apparatus, a printing frame, a lamp, means for controlling the time-length of the emission of light rays from said lamp, and means for providing a controlled movement or a stationary position to the lamp relative to said frame during the period of light-ray emission, said time-length controlling means regulating the rate of movement of the lamp during its controlled movement.

7. In a blue-printing apparatus, a printing frame, a lamp, means for controlling the time-length of the emission of light rays from said lamp, and means for providing a controlled movement or a stationary position to the lamp relative to said frame during the period of light-ray emission, said time-length controlling means and said lamp movement-imparting means having a common motive power.

8. In a blue-printing apparatus, a printing frame, a lamp, means for controlling the time-length of the emission of light rays from said lamp, and means for providing a controlled movement or a stationary position to the lamp relative to said frame during the period of light-ray emission, said time-length controlling means and said lamp movement-imparting means having a common motive power, independent motive power being provided for the time-length controlling means when the lamp is in stationary position during the light-ray emission.

9. In a blue-printing apparatus, a printing frame, an electric lamp, a lamp-circuit, an automatic switch in said circuit, means for controllably moving said lamp relative to the printing frame, and controllable means for breaking the circuit at a predetermined period, said latter means being adjustably connected to and operating with the lamp-movement controlling means, said switch and the circuit-breaking means coöperating to limit the movement of the lamp when the circuit has been broken.

10. In a blue-printing apparatus, a printing frame, an electric lamp, means for controlling the circuit of said lamp to provide periods of light-exposure of the lamp, and means connected to said circuit controlling means for controlling movements of the lamp relative to the printing frame, said latter means being disengageable from the circuit-controlling means to permit independent movement of the lamp.

11. In a blue-printing apparatus, a printing frame, an electric lamp, means for controlling the circuit of said lamp to provide periods of light-exposure of the lamp, means connected to said circuit controlling means for controlling movements of the lamp relative to the printing frame, said latter means being disengageable from the circuit-controlling means to permit independent movement of the lamp, and a stop for controlling the length of independent movement of the lamp.

12. In a blue-printing apparatus, a printing frame, an electric lamp, means for controlling the circuit of said lamp to provide periods of light-exposures of the lamp, means connected to said circuit controlling means for controlling movements of the lamp relative to the printing frame, said latter means being disengageable from the circuit-controlling means to permit independent movement of the lamp, and a stop for controlling the length of independent movement of the lamp, said stop being adjustably carried by the disengageable means.

13. In a blue-printing apparatus, a printing frame, an electric lamp, means for controlling the circuit of said lamp to provide periods of light-exposure of the lamp, and means connected to said circuit controlling means for controlling movements of the

lamp relative to the printing frame, said latter means being disengageable from the circuit-controlling means to permit independent movement of the lamp without affecting movements of the circuit-controlling means.

14. In a blue-printing apparatus, a printing frame, an electric lamp, means for controlling the circuit of said lamp to provide periods of light-exposure of the lamp, and means connected to said circuit controlling means for controlling movements of the lamp relative to the printing frame, said latter means being disengageable from the circuit-controlling means to permit independent movement of the lamp, said circuit-controlling means being operative irrespective of the engagement or disengagement of the disengageable means.

15. In a blue-printing apparatus, a printing-frame, an electric lamp movable relative to said printing frame, means for controlling the circuit of said lamp to provide periods of light-exposure of the lamp, said means being operable by movements of the lamp, and means independent of the lamp for imparting controlling movements to the circuit-controlling means when the lamp is held in stationary position.

16. In a blue-printing apparatus, a printing-frame, an electric lamp movable relative to said printing frame, means for controlling the circuit of said lamp to provide periods of light-exposure of the lamp of predetermined length, said means being operable by movements of the lamp, and means independent of the lamp for imparting controlling movements to the circuit-controlling means when the lamp is held in stationary position.

17. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism, and connections between the cable support and said timing mechanism to control the movement of the lamp relative to said frame, said connections being disengageable to permit independent movements of the lamp.

18. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism, and connections between the cable support and said timing mechanism to control the movement of the lamp relative to said frame, said connections being disengageable to permit independent movements of the lamp without affecting the movements of the timing mechanism.

19. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism, connections between the cable support and said timing mechanism to control the movement of the lamp relative to said frame, said connections being disengageable to permit independent movements of the lamp, and auxiliary means for operating the timing mechanism, said auxiliary means being operative when said connections are inoperative to control timed movements of the lamp.

20. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism including a sleeve, and a connection between said sleeve and said cable support, whereby movement of the lamp in one direction will operate the timing mechanism, said connection being disengageable to permit independent movement of the lamp in the same direction.

21. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism including a sleeve, and a connection between said sleeve and said cable support, whereby movement of the lamp in one direction will operate the timing mechanism, said connection being disengageable from said sleeve to permit independent movement of the lamp in the same direction.

22. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism including a sleeve, a connection between said sleeve and said cable support, whereby movement of the lamp in one direction will operate the timing mechanism, said connection being disengageable from said sleeve to permit independent movement of the lamp in the same direction, and means carried by the connection to limit the length of free movement of the lamp.

23. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism including a sleeve, a connection between said sleeve and said cable support, whereby movement of the lamp in one direction will operate the timing mechanism, said connection being disengageable from said sleeve to permit independent movement of the lamp in the same direction, and adjustable means carried by the connection for controlling the length of free movement of the lamp.

24. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism including a sleeve, a connection between said sleeve and said cable support, whereby movement of the lamp in one direction will operate the timing mechanism, said connection being disengageable from said sleeve to permit independent movement of the lamp in the same direction, and an adjustable stop carried by the connection for controlling the length of free movement of the lamp.

25. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism including a sleeve, a connection between said sleeve and said cable support, whereby movement

of the lamp in one direction will operate the timing mechanism, said connection being disengageable from said sleeve to permit independent movement of the lamp in the same direction, and an adjustable stop carried by the connection for controlling the length of free movement of the lamp, said stop being positionable to render it inoperative when said connection is in engaged position.

26. In a blue-printing apparatus, a printing frame, an electric lamp, a rotary cable support for said lamp, said support carrying circuit connections to provide a continuous operative current path between the cables and the lamp circuit, an automatic switch within the lamp circuit, a timing mechanism for controlling the movements of said switch to break the circuit, and a connection between said support and said mechanism to provide movements of the latter during movements of the support, said connection being disengageable from the timing mechanism.

27. In a blue-printing apparatus, a printing frame, an electric lamp, a rotary cable support for said lamp, said support carrying circuit connections to provide a continuous operative current path between the cables and the lamp circuit, an automatic switch within the lamp circuit, a timing mechanism for controlling the movements of said switch to break the circuit, and a connection between said support and said mechanism to provide movements of the latter during movements of the support, said connection being disengageable from the timing mechanism without affecting the lamp circuit or the circuit-breaking movements of the timing mechanism.

28. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism, a connection between said support and the timing mechanism to control the movements and light-exposure of the lamp, said connections being disengageable to permit free movements of the lamp, and independent mechanism coöperating with the timing mechanism for operating the latter upon disengagement of said connections.

29. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism including a rack-bar and sleeve, a connection between said sleeve and the cable support, whereby movements of the support will be controlled by said timing mechanism, said connections being disengageable, and independent means coöperating with said rack-bar for imparting movements to the timing mechanism independent of movements of the support.

30. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism including a rack-bar and sleeve, a connection between said sleeve and the cable support, whereby movements of the support will be controlled by said timing mechanism, said connections being disengageable, and independent means coöperating with said rack-bar for imparting movements to the timing mechanism independent of movements of the support, said independent means including a normally-inactive motor.

31. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism including a rack-bar and sleeve, a connection between said sleeve and the cable support, whereby movements of the support will be controlled by said timing mechanism, said connections being disengageable, and independent means coöperating with said rack-bar for imparting movements to the timing mechanism independent of movements of the support, said independent means including a normally-inactive weight.

32. In a blue-printing apparatus, a printing frame having predetermined "blind" portions, a support for said frame, an electric lamp suspended from said support and operable within said frame, said lamp being normally suspended to provide an alinement of the "blind" light-zone of the lamp and the "blind" portions of the frame, means for providing such lamp-suspension, and means carried by the lamp-suspending means for preventing a rotary swinging movement of the lamp to disturb said alinement.

33. In a blue-printing apparatus, a printing frame having predetermined "blind" portions, a support for said frame, an electric lamp suspended from said support and operable within said frame, said lamp being normally suspended to provide an alinement of the "blind" light-zone of the lamp and the "blind" portions of the frame, means for providing such lamp-suspension, and means carried by the lamp-suspending means for preventing a rotary swinging movement of the lamp to disturb said alinement, said means including a member engaging the supporting cables of the lamp and the lamp.

34. In a blue-printing apparatus, a printing frame having predetermined "blind" portions, a support for said frame, an electric lamp suspended from said support and operable within said frame, said lamp being normally suspended to provide an alinement of the "blind" portions of the frame, means for preventing a rotary swinging movement of the lamp to disturb said alinement, said means including a member engaging in the supporting cables of the lamp and the lamp, and comprising a bar having clamping ends, and cable-receiving split bushings mounted within said ends, said bushings being

clamped to the cables by the clamping of the ends of the bar.

35. In a blue-printing apparatus, a lamp, a printing frame, mechanism for providing controlled movements and print-exposure of the lamp, and a supporting frame, said latter frame forming the sole support for each of said remaining elements.

36. In a blue-printing apparatus, a lamp, a printing frame, mechanism for providing controlled movements and print-exposure of the lamp, and a supporting frame, the remaining elements being positioned on said supporting frame.

37. In a blue-printing apparatus, a lamp, a printing frame, mechanism for providing controlled movements and print-exposure of the lamp, and a supporting frame, said latter frame forming the sole support for each of said remaining elements, said remaining elements being positioned on said supporting frame and connected therewith in a manner to permit movements of the supporting frame without affecting the position of the remaining elements relatively thereto.

38. In a blue-printing apparatus, a printing frame, an electric lamp, a cable support for said lamp, a timing mechanism, and connections between the cable support and said timing mechanism to control the movement of the lamp relative to said frame, said connections being disengageable, means being provided to adjustably limit the length of such independent movements.

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

REINHOLD HERMAN.

Witnesses:
CARL R. HERMAN,
ERNEST PAYNE.