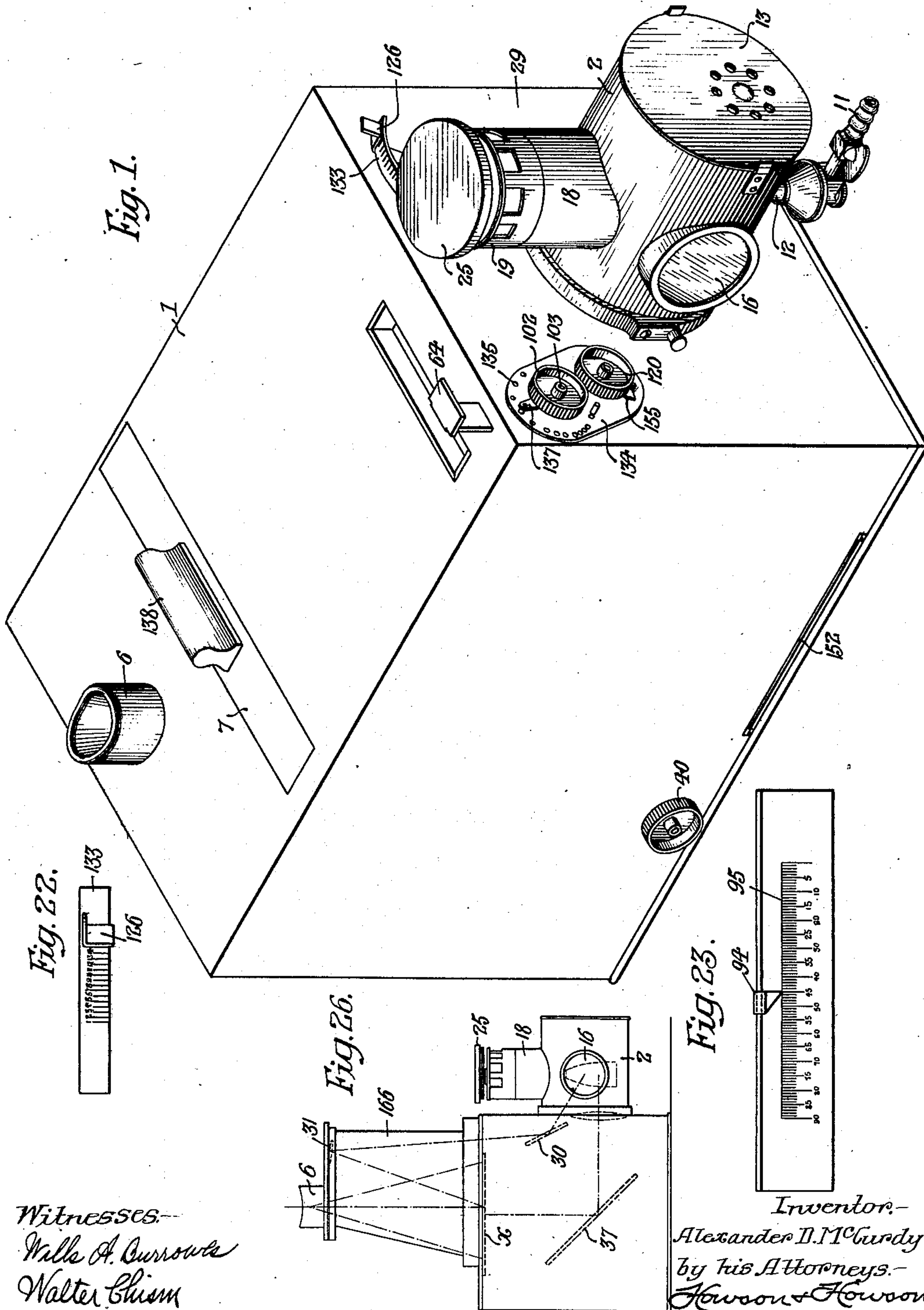


A. D. McCURDY.
 PHOTOGRAPHIC PRINTING APPARATUS.
 APPLICATION FILED DEC. 13, 1910.

994,475.

Patented June 6, 1911.

9 SHEETS—SHEET 1.



Witnesses:
 Wills A. Currowe
 Walter Chism

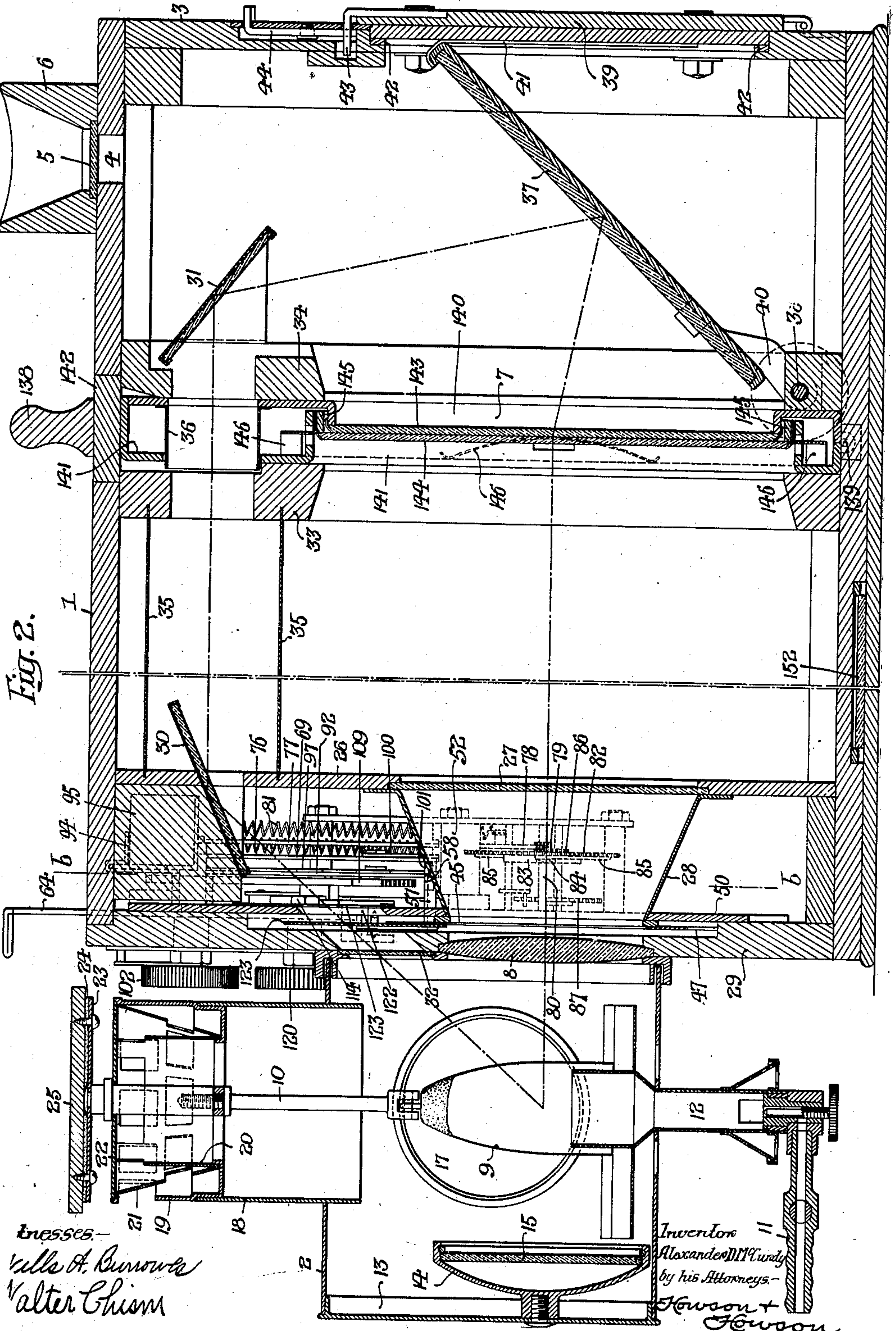
Inventor:
 Alexander D. McCurdy
 by his Attorneys:
 Howson & Howson

A. D. McCURDY.
 PHOTOGRAPHIC PRINTING APPARATUS.
 APPLICATION FILED DEC. 13, 1910.

994,475.

Patented June 6, 1911.

9 SHEETS—SHEET 2.



994,475.

A. D. McCURDY.
PHOTOGRAPHIC PRINTING APPARATUS.
APPLICATION FILED DEC. 13, 1910.

Patented June 6, 1911.

9 SHEETS—SHEET 3.

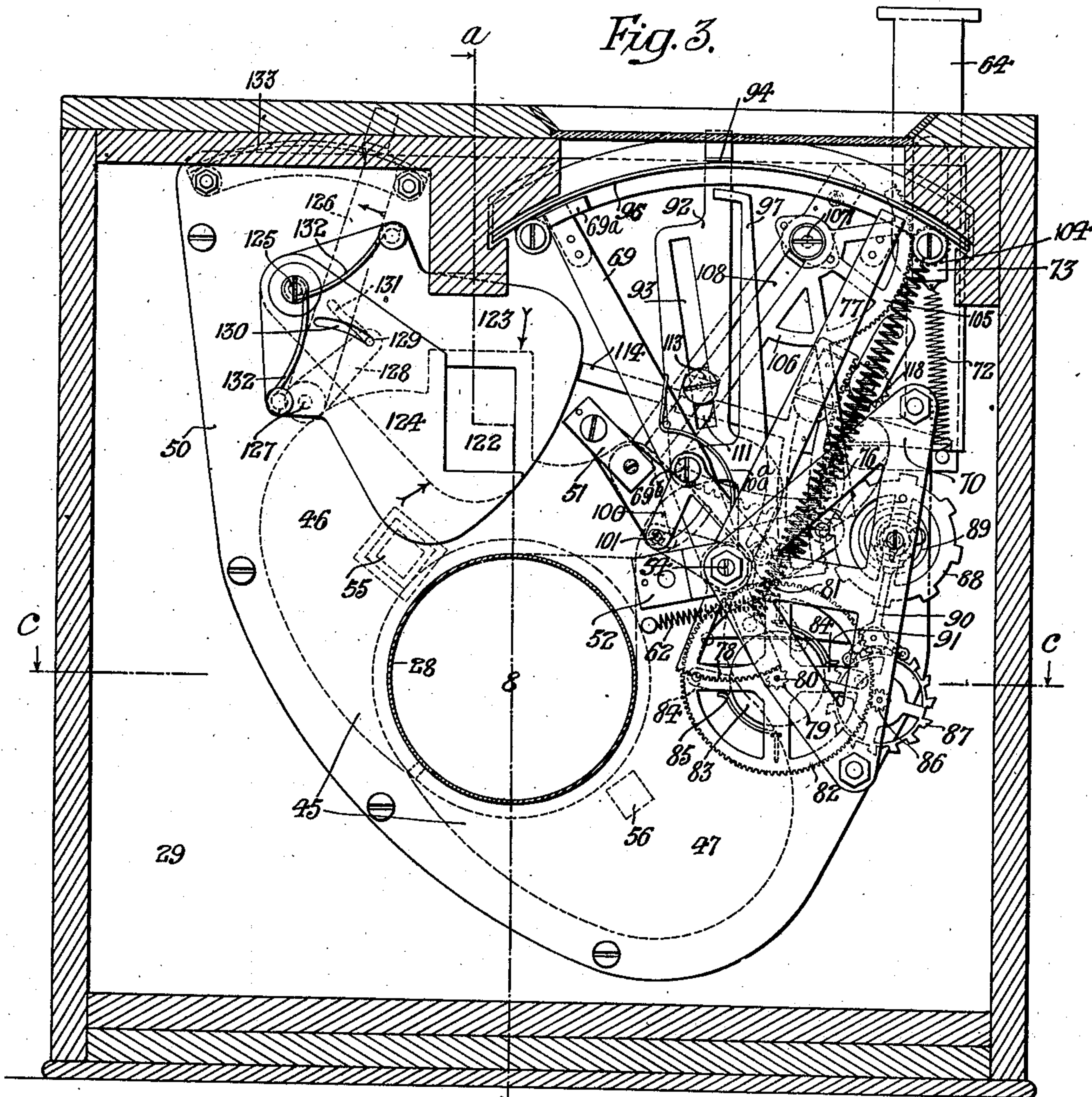
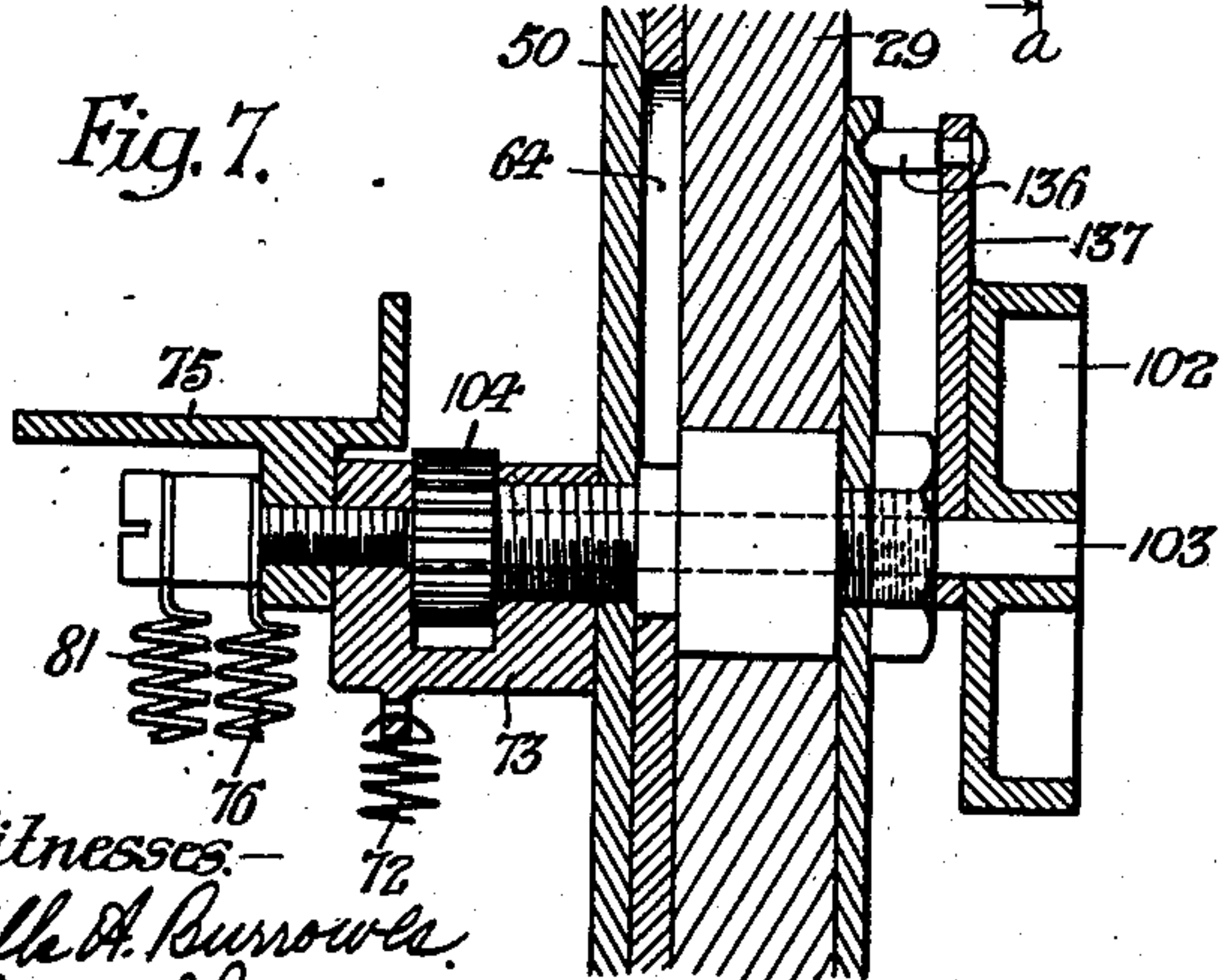
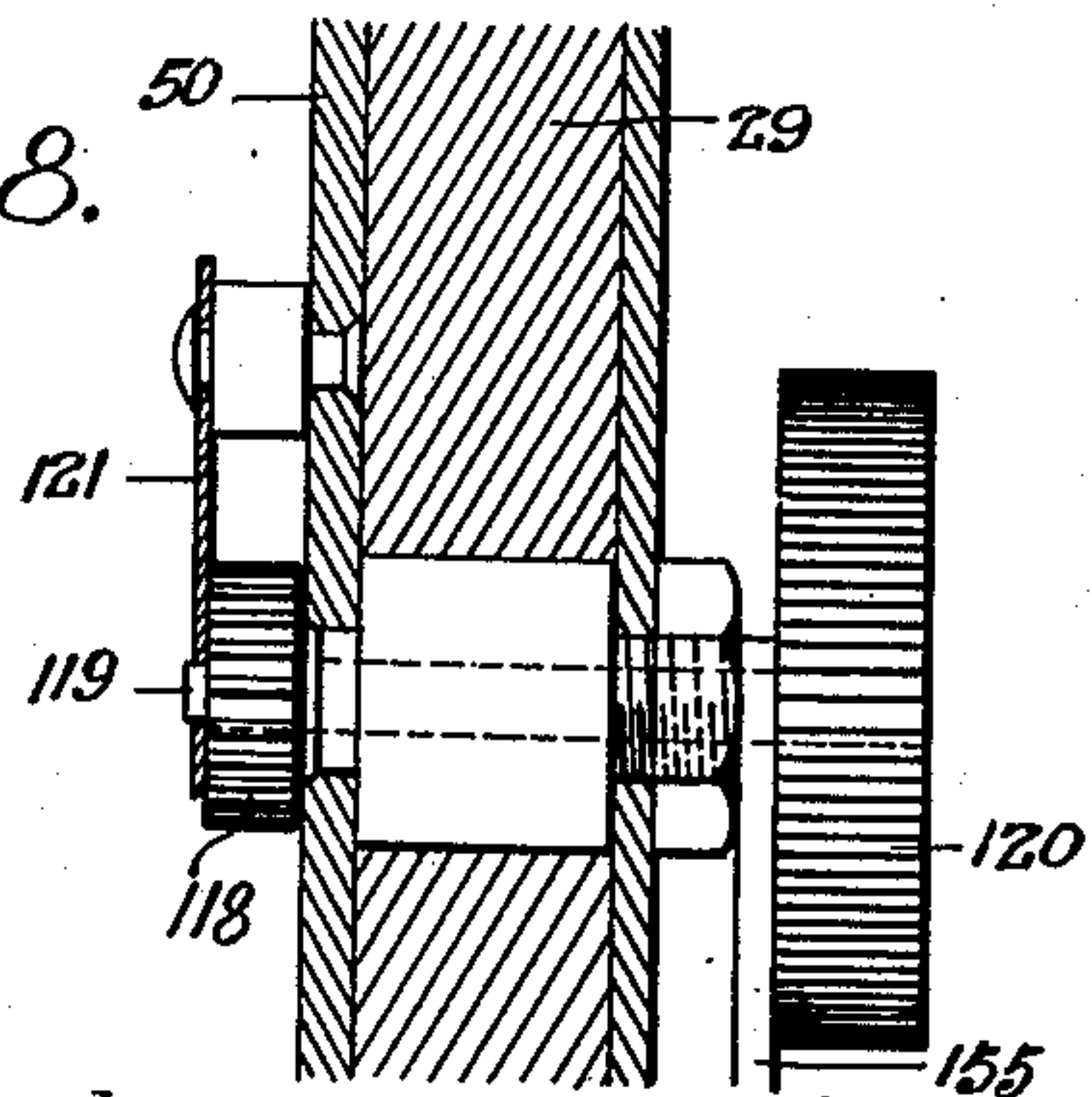


Fig. 7.



Witnesses—
Wm. H. Burrows.
Walter Chism

Fig. 8.



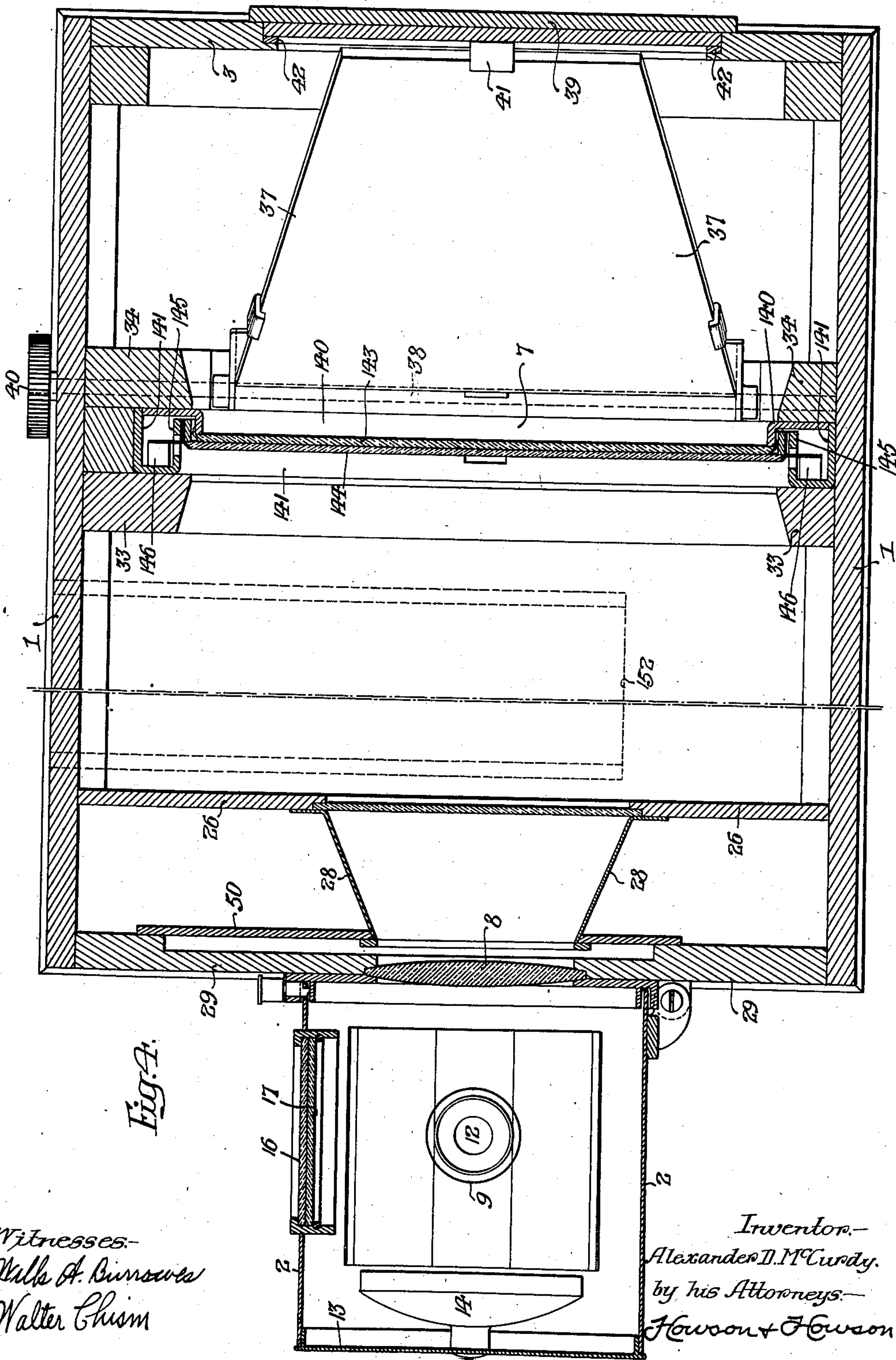
Inventor—Alexander D. McCurdy.
by his Attorneys—
Howson + Howson

A. D. McCURDY.
 PHOTOGRAPHIC PRINTING APPARATUS.
 APPLICATION FILED DEC. 13, 1910.

994,475.

Patented June 6, 1911.

9 SHEETS-SHEET 4.



Witnesses:
 Wm. A. Burrows
 Walter Chism

Inventor:-
 Alexander D. McCurdy.
 by his Attorneys:-
 Howson & Howson

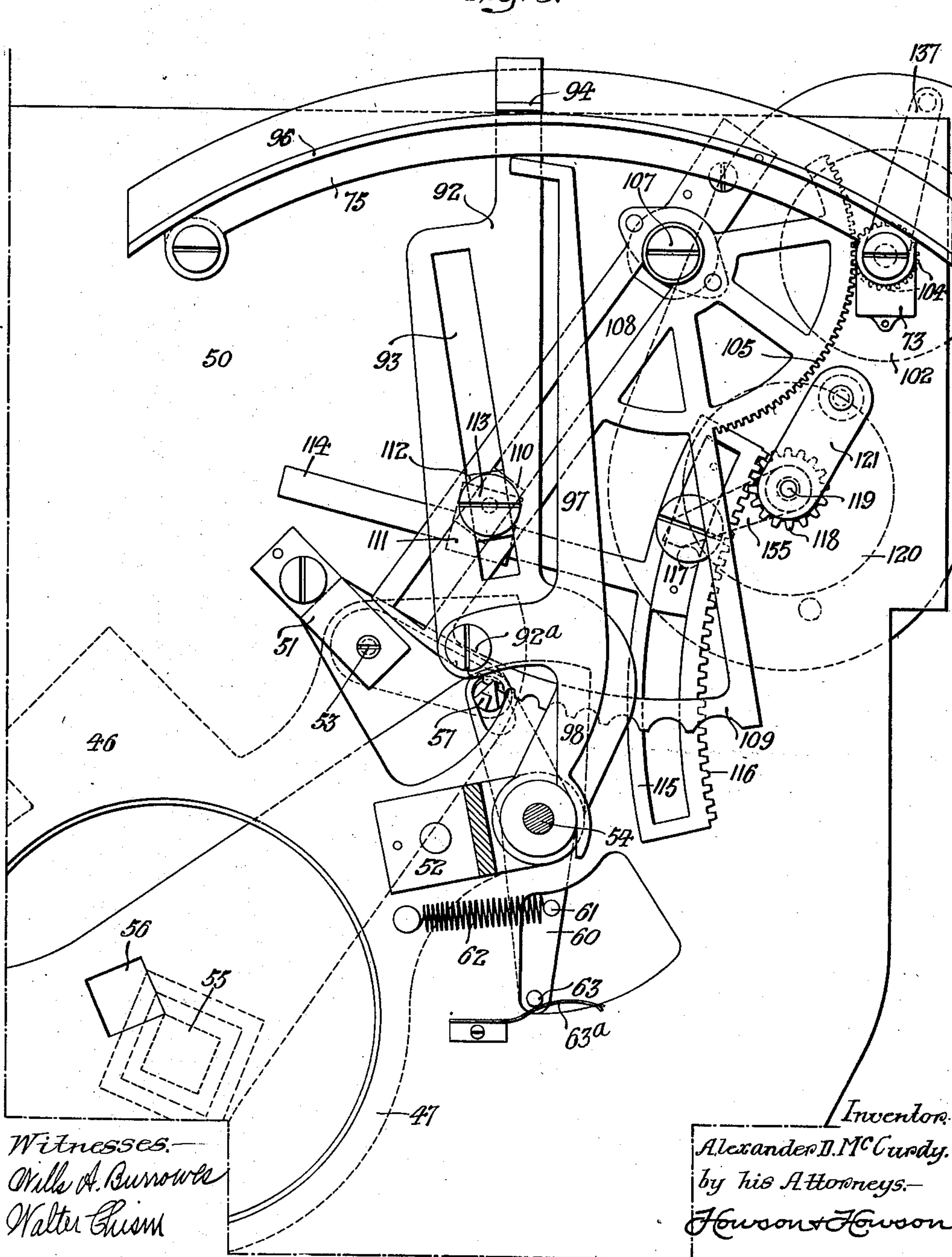
A. D. McCURDY.
 PHOTOGRAPHIC PRINTING APPARATUS.
 APPLICATION FILED DEC. 13, 1910.

994,475.

Patented June 6, 1911.

9 SHEETS—SHEET 5.

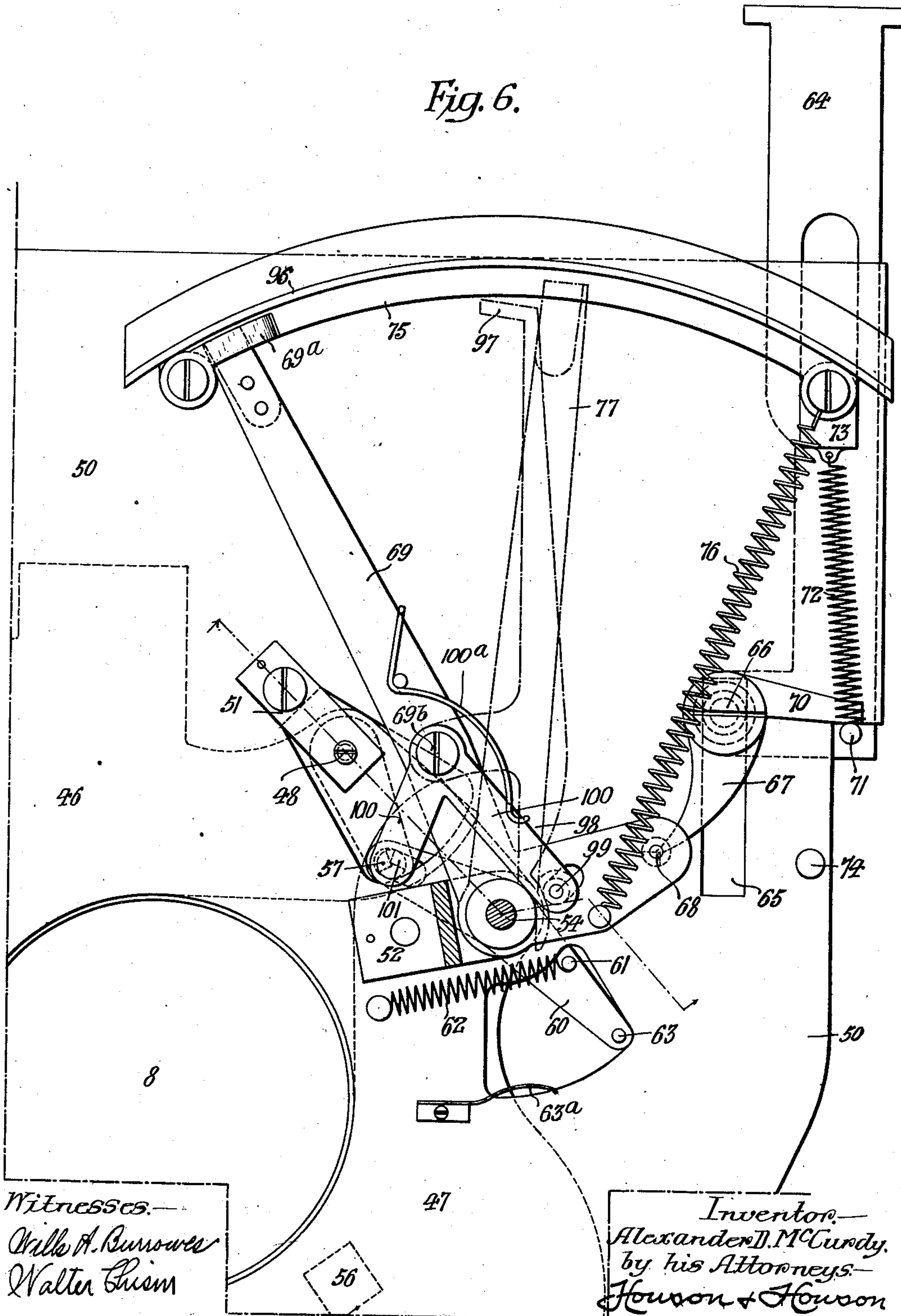
Fig. 5.



994,475.

9 SHEETS—SHEET 6.

Fig. 6.

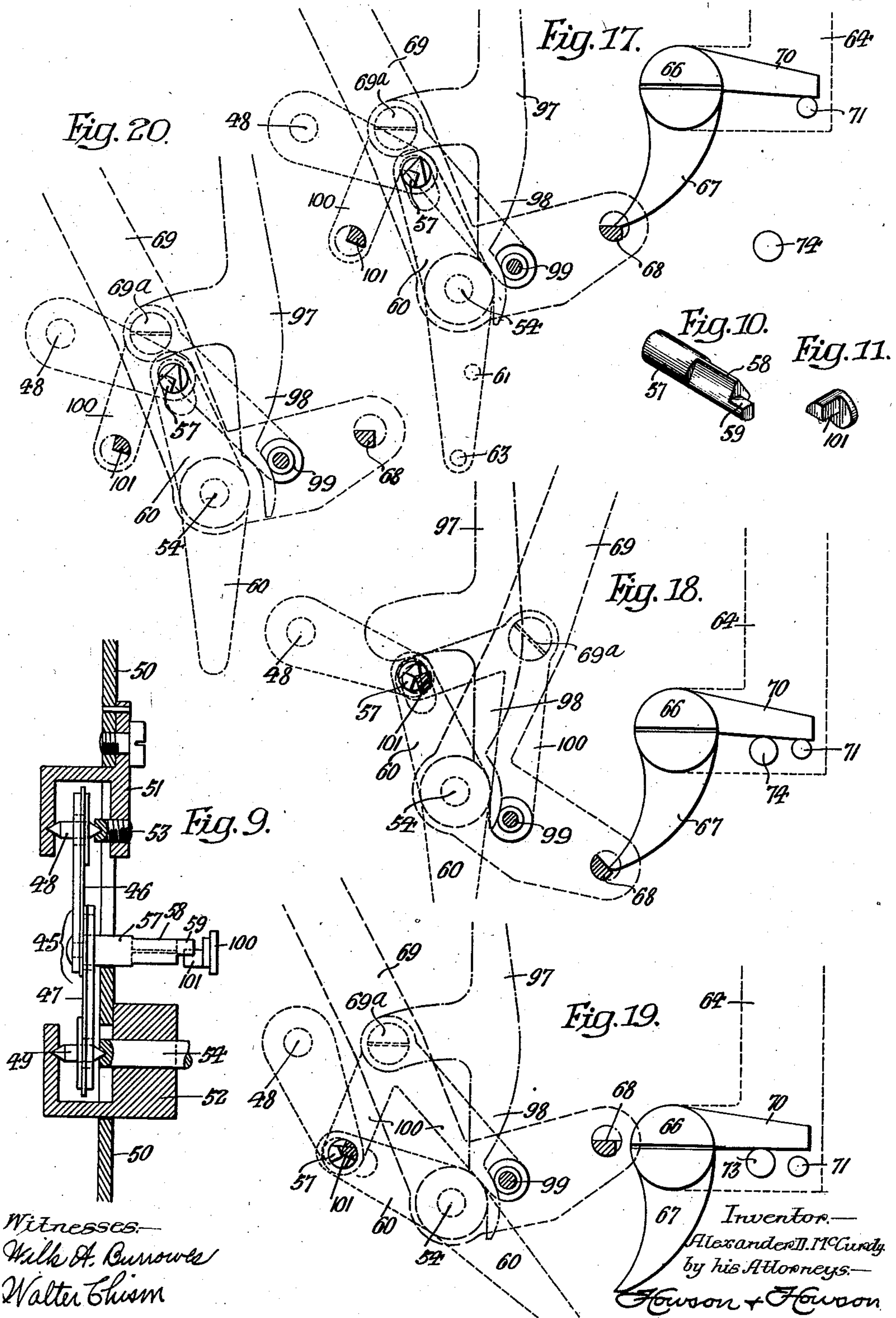


A. D. McCURDY.
 PHOTOGRAPHIC PRINTING APPARATUS.
 APPLICATION FILED DEC. 13, 1910.

994,475.

Patented June 6, 1911.

9 SHEETS—SHEET 7.



Witnesses—
 Walk H. Currower
 Walter Chism

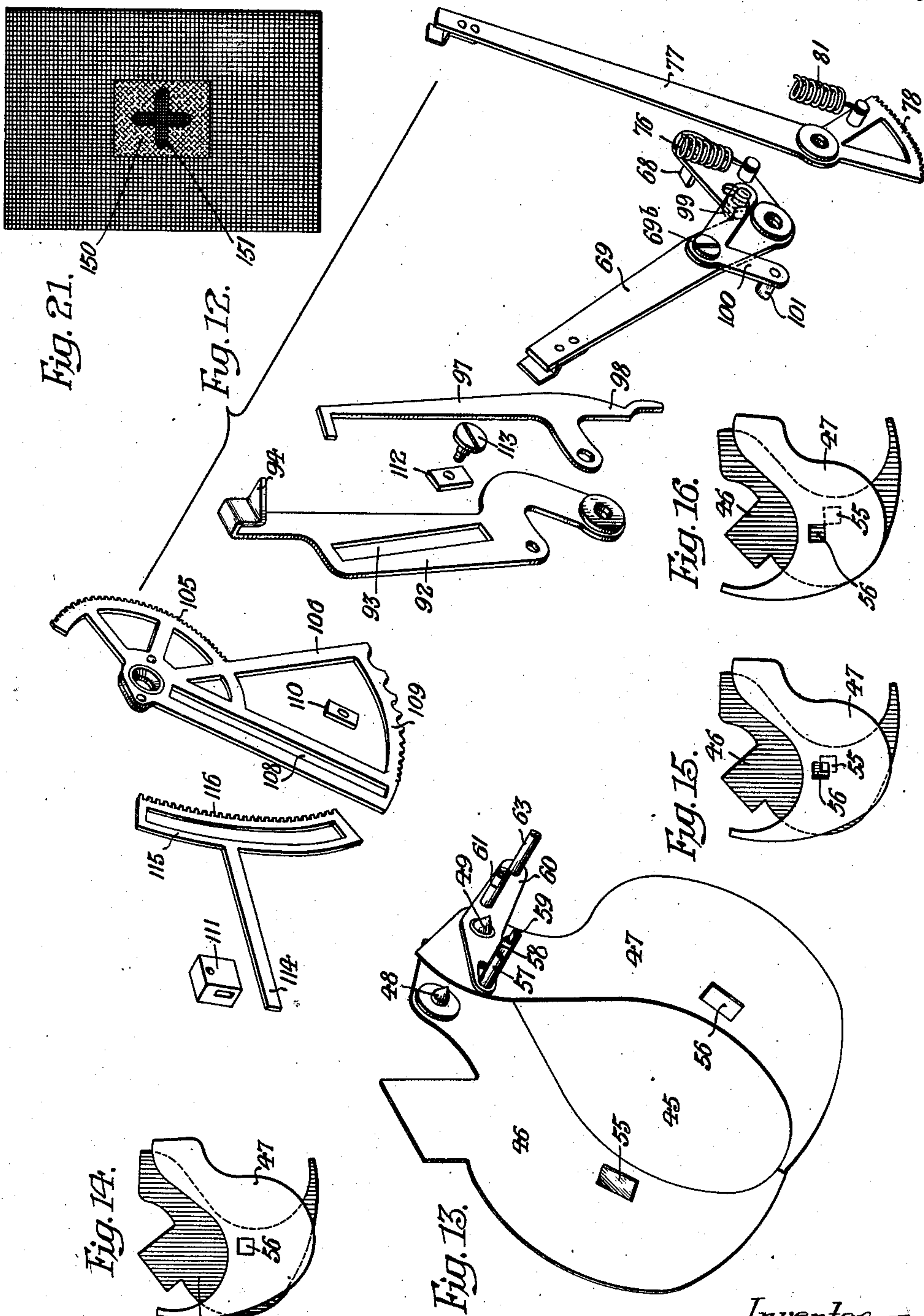
Inventor.—
 Alexander D. McCurdy
 by his Attorneys—
 Fowson & Fowson

A. D. McCURDY.
 PHOTOGRAPHIC PRINTING APPARATUS.
 APPLICATION FILED DEC. 13, 1910.

994,475.

Patented June 6, 1911.

9 SHEETS—SHEET 8.



Witnesses—
 Wills A. Burrows
 Walter Chism

Inventor—
 Alexander D. McCurdy.
 by his Attorneys—
 Howson + Howson

A. D. McCURDY.
 PHOTOGRAPHIC PRINTING APPARATUS.
 APPLICATION FILED DEC. 13, 1910.

994,475.

Patented June 6, 1911.

9 SHEETS—SHEET 9.

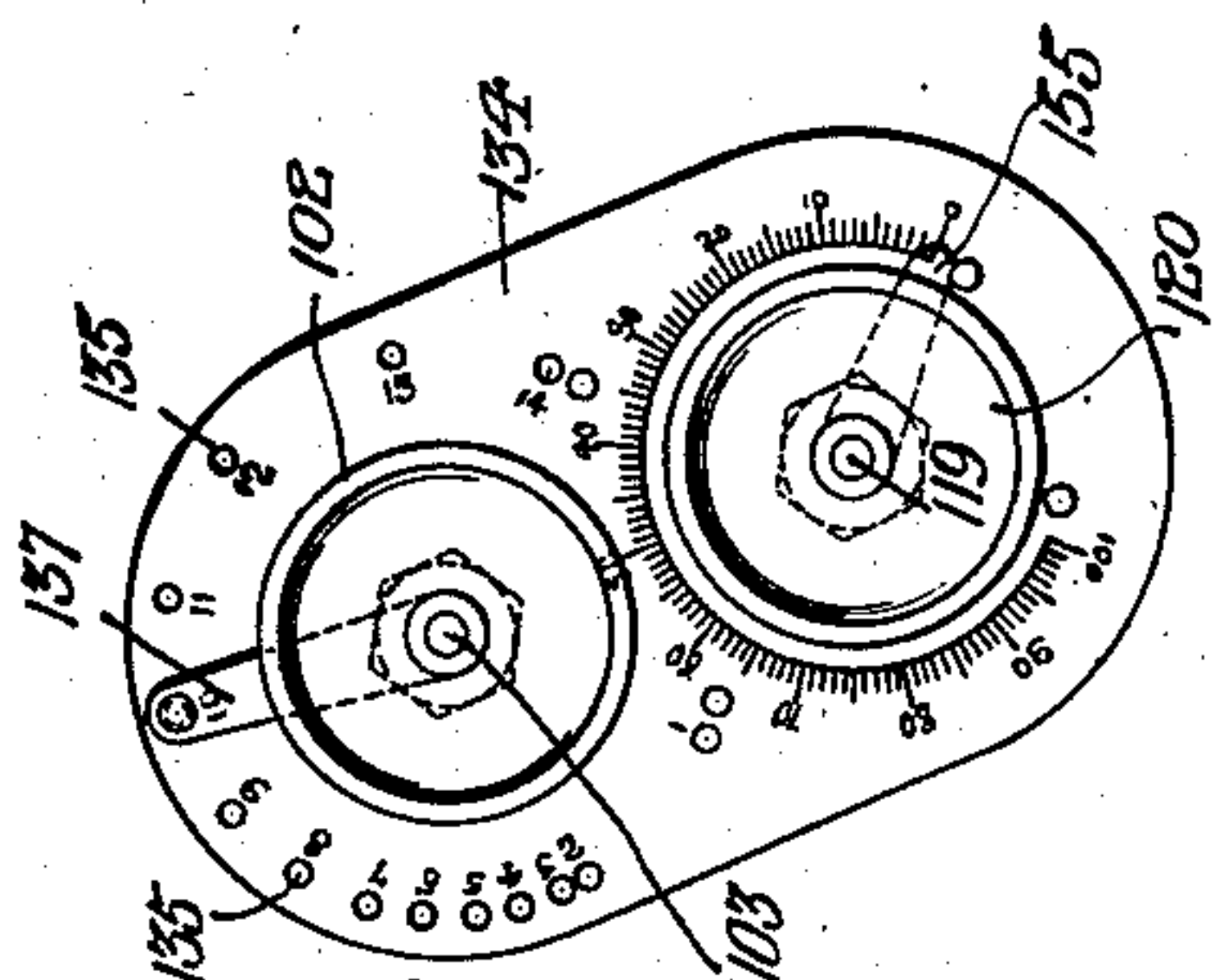


Fig. 23a.

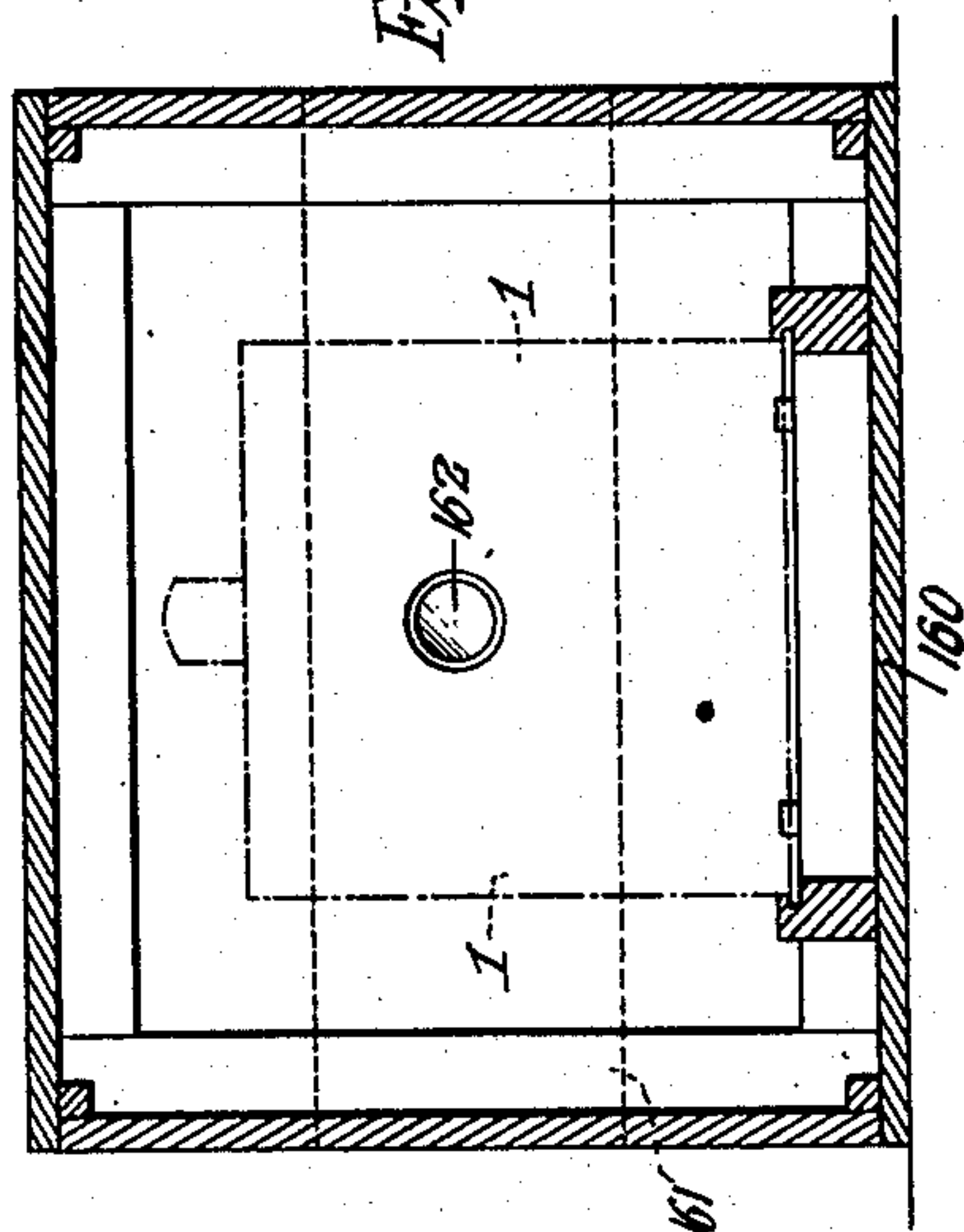


Fig. 25.

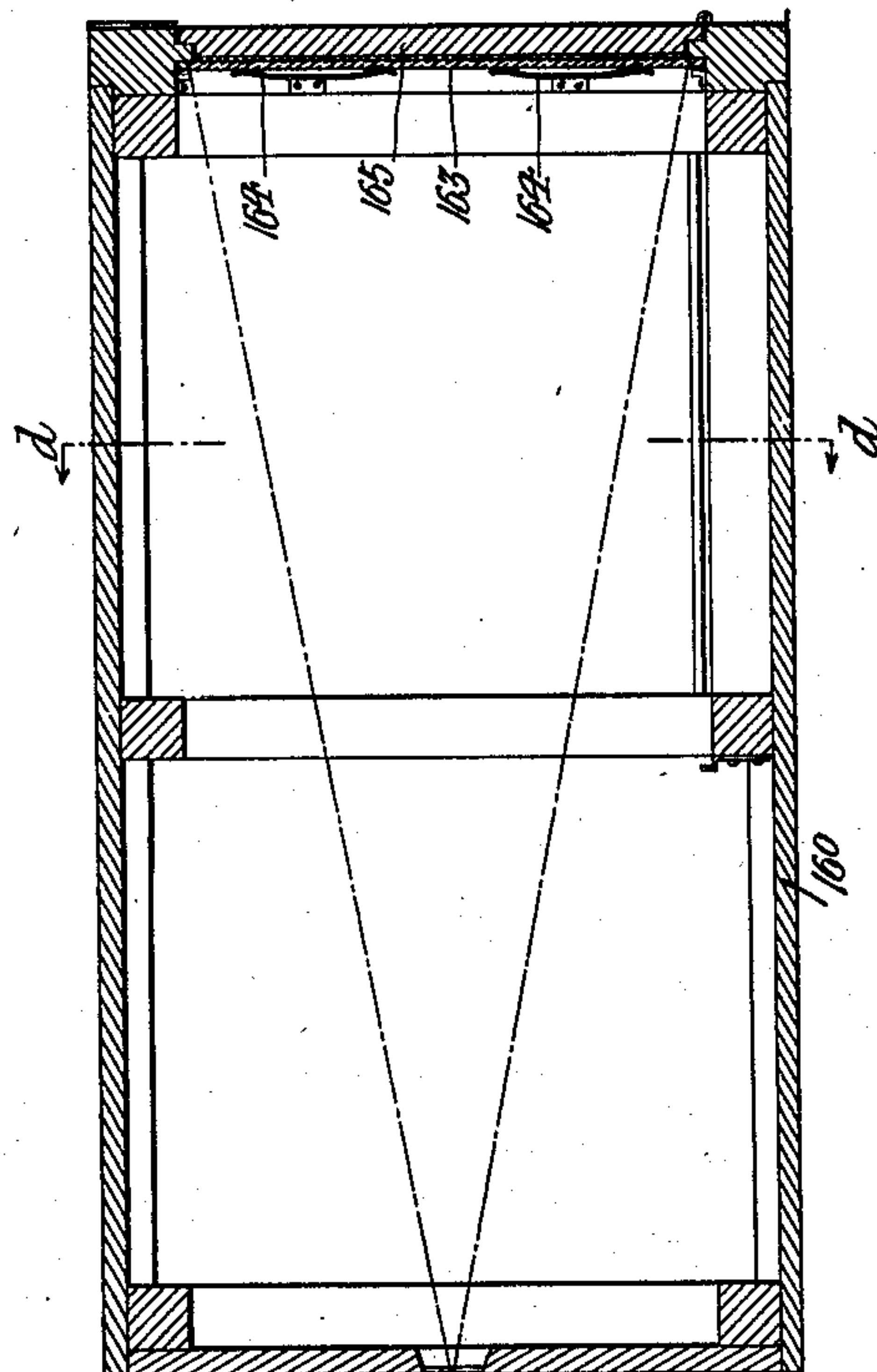
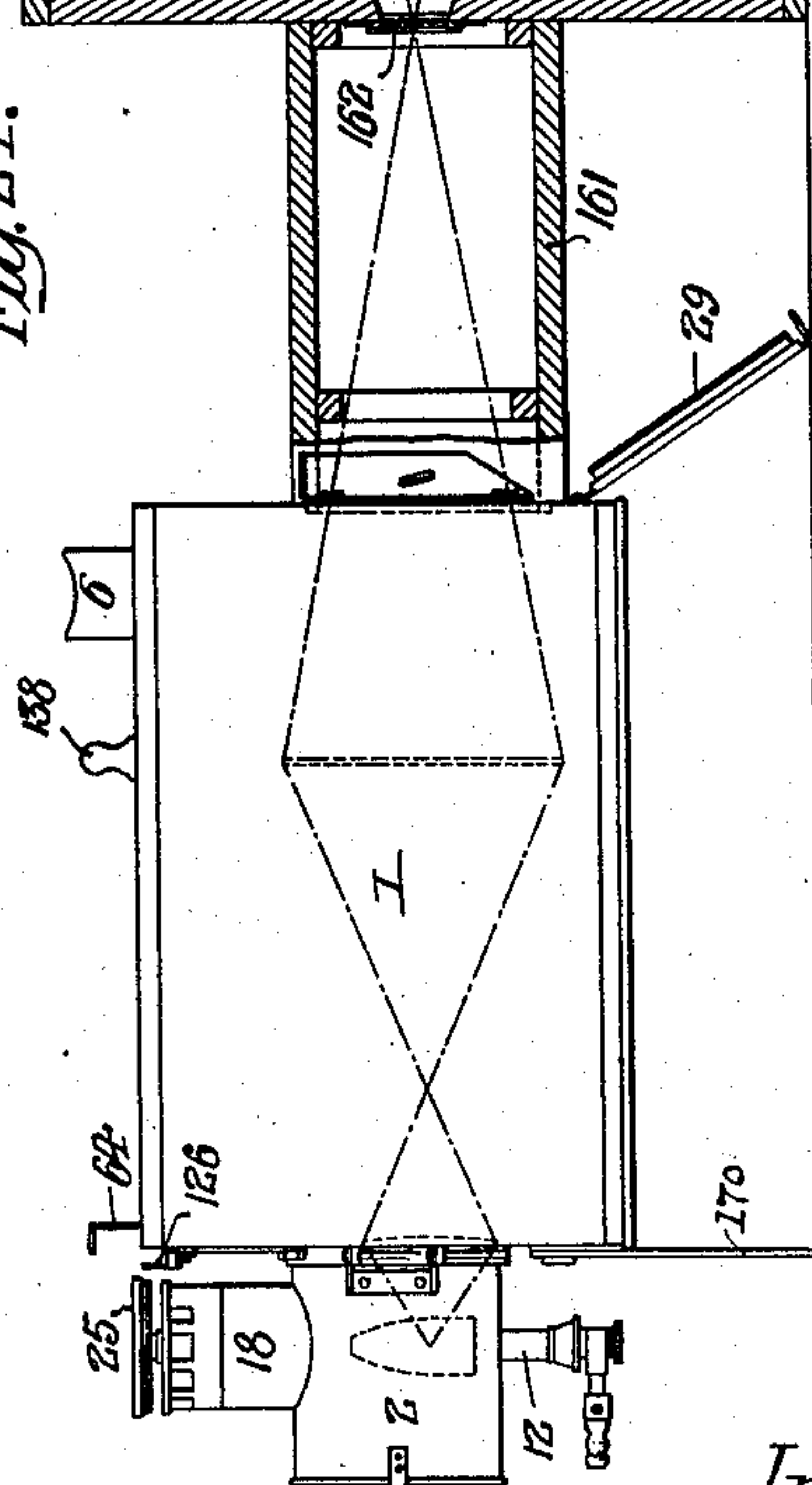


Fig. 24.



Witnesses—
 Wm. H. Burrows
 Walter Chism

Inventor—
 Alexander D. McCurdy.
 by his Attorneys—
 Howson & Howson

UNITED STATES PATENT OFFICE.

ALEXANDER D. McCURDY, OF PHILADELPHIA, PENNSYLVANIA.

PHOTOGRAPHIC-PRINTING APPARATUS.

994,475.

Specification of Letters Patent.

Patented June 6, 1911.

Application filed December 13, 1910. Serial No. 597,078.

To all whom it may concern:

Be it known that I, ALEXANDER D. McCURDY, a citizen of the United States, residing in Philadelphia, Pennsylvania, have
5 invented certain Improvements in Photographic-Printing Apparatus, of which the following is a specification.

One object of my invention is to provide
a machine for making positive prints from
10 photographic negatives, which may be quickly and conveniently adjusted to cause it to give what are practically perfectly uniform prints even though the paper used, the intensity of the source of illumination and
15 the negatives may vary widely as to their qualities.

Another object of the invention is to provide a photographic printing machine with means whereby the time of exposure may be
20 adjusted to the intensity of the light passing from a given source through a negative to a sensitized paper or other surface so as to produce prints of a predetermined density even though the negatives may vary widely
25 as to their density and the paper in use may likewise differ as to its sensitiveness.

I also desire to provide a photographic printing machine having the above characteristics with a simple and conveniently operated device whereby the intensity of the light admitted may be standardized before making the main adjustments, in order to compensate for variations in the luminous intensity of said source due to pressure, richness of gas, or variations in the quality of the incandescent mantle which may be used.

I also desire to provide a photographic printing machine which, after being adjusted to permit light from a source to pass
40 through a negative onto a sensitized surface, may be put in operation to cause said surface to be exposed for a predetermined time to the action of the light; the invention also contemplating novel devices for making the
45 various adjustments rendered necessary by variations in the light, in the density of the negatives, and in the character of the paper employed, which devices are relatively simple both as to their construction and mode of
50 operation.

A still further object of the invention is to provide a photographic printing machine whereby enlargements may be made from a given negative from a source of light and in
55 which the time of exposure to such light may be adjusted to meet the varying condi-

tions arising from the different grades of papers or other sensitized bodies which it is desired to print, from variations in the negative or in the light itself.

These objects and other advantageous ends I secure as hereinafter set forth, reference being had to the accompanying drawings, in which:—

Figure 1, is a perspective view of my
65 photographic printing machine; Fig. 2, is a vertical section of the machine shown in Fig. 1, on the line *a—*a**, Fig. 3; Fig. 3, is a transverse section of the machine on the line *b—*b**, Fig. 2; Fig. 4, is a horizontal section on the line *c—*c**, Fig. 3; Figs. 5 and 6
70 are enlarged front elevations illustrating the construction and operation of parts of the shutter actuating mechanism; Figs. 7, 8, and
75 9 are enlarged sectional views showing the detail construction and arrangement of certain parts of the shutter actuating means; Figs. 10 and 11 are two detached perspective views of two of the shutter controlling pins; Fig. 12, is a detached perspective view
80 further illustrating the construction of the shutter and its associated parts; Figs. 14, 15 and 16 are elevations illustrating different
85 positions of the shutter parts under operating conditions; Figs. 17, 18, 19 and 20 are diagrammatic views illustrating the different positions occupied by certain parts of the shutter actuating mechanism under op-
90 erating conditions; Fig. 21 is a front elevation of the test plate forming part of my invention; Figs. 22 and 23 are plans of two of the scales used in adjusting my machine and forming part thereof; Fig. 23^a is an ele-
95 vation of two of the adjusting wheels and their associated disks or scales. Fig. 24 is a side elevation, partly in longitudinal section, illustrating my invention used in connection with an enlarging camera; Fig. 25 is a ver-
100 tical section on the line *d—*d**, Fig. 24 showing the relative arrangement of the said camera and the printing machine when this latter is packed inside of the camera for purposes of transportation, and Fig. 26 is a
105 side elevation illustrating a modified form of my invention.

In the above drawings, 1 is a somewhat elongated box preferably of rectangular section, on one end of which is mounted a lamp
110 2 serving as the source of light for the machine, and which has its end 3 opposite the

lamp closed by a door 39 hinged adjacent to its lower edge to permit of its being opened for a purpose hereafter noted. At the top of the box is an observation opening 4 covered with a plate of glass 5 (which may under certain conditions be red or orange colored) and preferably having a projecting eye-piece 6. In the top of the box is an opening for the introduction of a slide or holder 7 designed to carry either a test plate or a negative with a sensitized paper or glass, etc., to be printed. Between the front end of the box and the lamp, suitably mounted in any desired manner, is a lens 8, and in the preferred form of my machine said lamp has as its source of light a mantle 9 supported from the top of the lamp structure by a rod 10, said mantle being supplied with gas through a pipe 11 and a burner 12. The rear end 13 of the lamp casing 2 is preferably made removable and carries a reflector 14 of metal or glass, although preferably this element consists of a highly polished body of aluminum. The reflector is preferably concave in form and its polished surface is protected from the tarnishing effect of the heat from the mantle by a glass cover 15. In one side of the lamp there is preferably an opening closed by plates 16 and 17 of orange and ruby glass or other bodies of material, incapable of transmitting actinic rays of light, so that with this construction the lamp may be used for ordinary photographic work.

The lamp casing is provided with a chimney 18 having at its upper portion a pair of concentric cylindrical deflectors 19 and 20, between which is placed an inverted conical deflector 21. The inner cylinder 20 as well as this deflector has openings for the escape of the heated products of combustion from the lamp, and there is a suitable cover 22 mounted on these parts;—the deflector 19 having a series of openings in its upper part immediately adjacent said cover, and the various parts with their openings being so arranged as to provide for the escape of gases from the lamp while effectually preventing any possible leakage of light.

In order to insure that the operator shall not be burned by accidental contact with the heated cover 22, I provide the rod 10 with an extension beyond said cover and fix to it a metallic plate 23 carrying a sheet of asbestos 24 and a plate or other cover 25 of wood or other suitable non-conductor of heat.

The interior of the box 1 may be considered as divided into three compartments, of which that adjacent the lens 8 contains the shutter operating and adjusting mechanism as well as an auxiliary shutter; this compartment being divided from the middle compartment by a vertical partition 26.

There is in this partition a circular opening, whose center is in the horizontal axis of the lens 8 and which is covered with a sheet 27 of clear glass. A frusto-conical tube 28 is mounted between the partition 26 and the end 29 of the box in such position that its axis is co-incident with the axis of the lens so that there is no danger of escape of light nor possibility of dirt or foreign bodies getting into the shutter. In the upper part of the first compartment is mounted a plane reflector or mirror 30 in such position that it extends through an opening in the partition 26 into the middle compartment of the box and is set at such an angle that rays of light emitted from the source 9, passing through an opening in the end 29 of the box, are reflected in substantially horizontal lines on to a second mirror 31, hereafter referred to and mounted in the third compartment of the box 1. The opening in the front end 29 of the box is covered or closed by a plate of clear glass as indicated at 32 to prevent entrance of products of combustion. The second and third compartments are divided from each other by a double partition whose two parts 33 and 34 are spaced apart by a distance equal to the thickness of the negative holder or printing frame 7, and there is in each of them a relatively large and usually rectangular opening practically the size of the negatives to be printed from and having its center in line with the optical center of the lens 8. A tube 35 extends between the partition 26 and the part 33 of the second partition, having its axis practically co-incident with a straight line joining the centers of the two mirrors 30 and 31; there being openings in the parts 33 and 34 of the double partition to permit of the unobstructed passage of the light between these two mirrors. There is also a tube 36 mounted in the negative holder or printing frame, which, when this latter is in its proper position, is in line with the two openings. In the third compartment is mounted a mirror 37 having a generally trapezoidal shape and hinged on a horizontally placed spindle 38 mounted in the lower portion of the partition 34 immediately below the large opening thereof. Under normal conditions this mirror lies at an angle of about 45° to the horizontal; its upper end resting against a door 39 in the back end 3 of the box 1. The spindle 38 extends through one side of the box and its end is provided with a knurled head or hand wheel 40 whereby the mirror may be moved when the enlarging attachment has been used, as hereafter noted. The door 39 is hinged at its lower edge to the end piece 3 of the box 1 and has fixed to its inner face a hook or catch 41 of sheet material designed to engage the upper edge of the mirror 37 so as to prevent this moving as long as the door is closed. Between the

door 39 and the countersunk portion of the end 3 in which it is mounted, I preferably place a gasket or washer 42 of some soft material such as felt in order to prevent possible leakage of light. In the upper part of the door is mounted an angular shaped piece 43 of sheet material whose free end extends into a recess in the end 3 of the box where it is engaged by a pivoted catch 44 in order to hold said door in its closed position.

As will be understood by those skilled in this art, it is necessary in making a photographic print from a given negative to take into consideration the density of said negative, the sensitiveness of said paper or other body which is to be printed, as well as the intensity of the light by which the printing is done, and it is obvious that if practically uniform results are to be secured regardless of these variable factors, means must be provided for varying the length of time during which the printing is continued. In other words, practically uniform prints can be obtained with papers of widely different sensitiveness, using negatives of different densities and with sources of light of various specific intensities, merely by increasing or decreasing the time of exposure of the paper and for the purpose of determining and adjusting this time of printing to suit the varying conditions above noted, I provide the particular mechanism shown in detail in Figs. 3 and 5 to 20 inclusive.

Immediately to the rear of the lens 8 and in front of the frusto-conical tube 28, I mount a two part shutter 45 whose construction is clearly shown in Fig. 13. Said shutter consists of two flat plates or leaves 46 and 47 so mounted as to overlap each other and supported by conical pivots 48 and 49 mounted in bearings preferably constructed as illustrated in Fig. 9. For the purpose of forming a supporting structure for the shutter and its associated parts I mount on the inside surface of the box end 29 a thin metal plate 50, having an opening into which fits the small end of the tubular structure 28 and which carries two small brackets or castings 51 and 52 for directly supporting the two shutter leaves. The first of these brackets has a short bearing screw 53 which engages the pivot spindle 48 of the shutter leaf 46, while the bracket 52 serves to support a somewhat larger screw 54 whose end engages and serves as one of the bearings for the conical pivot 49 of the shutter leaf 47. Both of the shutter leaves may be described as consisting of crescent shaped plates, each of whose supporting pivots is placed on an extension of one of the horns or ends thereof and it is noted that the shutter leaf 46 has an opening 55 adjacent the middle of its concave edge preferably of rectangular outline and covered by a plate of yellow glass. Likewise the shut-

ter leaf 47 has an opening 56 which, under certain conditions may be caused to overlap the opening 55 in the leaf 46 to a greater or less extent so as to permit of the passage of more or less light through the shutter. This leaf 46 has fixed to its extension a short post 57 extending at right angles to its general plane and formed adjacent its outer end to constitute an angular knife edge bearing 58; its extremity being cut away to form a flat bearing surface 59 for a purpose hereafter noted.

Fixed to the shutter leaf 47 is a projecting arm 60 having fixed to it a post 61 for the attachment of a spring 62 and also having a second post 63 for tripping a spring hereafter described; there being a braking spring 63^a mounted on the plate 50 for slowing down the movement of the shutter parts. The shutter leaf 47 is slotted for the passage of the post 57 and the slot is so placed that a force exerted laterally on said post will simultaneously swing both shutter leaves on their pivots so that their concave edges approach or recede from each other. The spring 62 acting through the post 61 and arm 60 normally holds the shutter leaves closed or tends to close them; it being understood that the shutter is in its closed position when said leaves overlap each other, while the opening 56 may or may not be in line with the glass covered opening 55.

For opening the shutter at will and thereafter closing it at the end of a predetermined time, I provide some form of time controlled mechanism which may be set by hand and at the same time caused to open the shutter; the time elapsing before the shutter is closed depending upon certain adjustments made in view of the differences in the negative, paper, and light employed. For this purpose I provide a longitudinally movable bar 64 projecting above the top surface of the box 1 at the end thereof adjacent the lamp 2 and extending within the compartment 1 parallel to one edge of the plate 50; the head of this bar being turned over to permit of its convenient manipulation. The said plate 50 is provided with a vertically extending slot 65 for the reception of a headed pin 66 carried by the lower end of the bar 64, which pin serves as a pivot for a pawl 67 operative on a post 68 projecting from one arm of the shutter opening lever 69. The pawl 67 has an arm 70, which, under certain conditions, strikes against or has its movement limited by a pin 71 fixed to the lower portion of the bar 64, and this same pin also serves as a point of attachment for one end of a spring 72 whose opposite end is connected to a bracket 73 or to any other convenient point of attachment. Said spring acts to oppose downward movement of the bar 64 and tends to return it to its upper position after it has been moved therefrom. Upon the plate 50 is

mounted a pin or post 74 in such position that when the bar 64 has been pushed downwardly to or adjacent its lower limit of movement, it will be engaged by the arm 70 of the pawl 67 and cause said pawl to be turned on its pivot pin 66 out of engagement with the pin 68.

The shutter closing lever 69 is preferably of the bell crank type as shown, and is pivoted or fulcrumed on the screw 54 hitherto referred to; the short arm of said lever carrying the pin 68, while its long arm is extended adjacent a segmental guide 75 rigidly fixed to the upper portion of the plate 50 as shown in Figs. 3, 5 and 6. The upper end of this long arm of the lever is forked or branched so as to extend on opposite sides of this guiding segment and is normally maintained at the end of the segment distant from that adjacent the bar 64 by means of a spring 76 having one end connected to the bracket 73 and the other to the short arm of said lever; there being a braking spring 69^a mounted on the guiding segment for slowing down the movement of the lever. Also mounted on the screw 54 is a timing lever 77 which, like the lever 69, is provided with a fork or branch at the end of its long arm whereby it is guided upon the segment 75. This lever has what is in effect a single short arm whose outer end is in the form of a toothed segment 78 curved concentrically with the pivot screw 54 and meshing with a pinion 79 (Fig. 3) carried on a spindle 80. This timing lever normally tends to move toward the end of the guide segment 75 distant from the bar 64, under the action of a spring 81 extending between its toothed arm and the bracket 73 heretofore referred to and is so mounted as to be engaged and turned on its pivot by the shutter opening lever 69 under certain conditions of operation.

The spindle 80 has loosely mounted on it a gear wheel 82 and has keyed to it a cylindrical drum 83 fixed to the pinion 79. The gear wheel carries a pair of dogs or pawls 84 so mounted as to act on the cylindrical surface of the drum 83 (which may be toothed if desired) so as to couple it with the pinion 79 to said gear wheel when said drum tends to turn in one direction, although said dogs are so placed that they do not operatively connect said drum and gear wheel when the drum turns in the opposite direction; there being springs 85 on the gear wheel pressing said dogs into engagement with the drum. Said gear wheel meshes with a pinion 86 fixed to an escapement wheel 87 and any suitable and desired form of escapement mechanism may be employed to regulate the operation of this escapement wheel and the mechanism connected thereto, under the action of the spring 81 transmitted through the toothed arm 78 of the

time lever 77, the pinion 79, drum 83, gear wheel 82, and pinion 86. In the present instance I have illustrated a balance wheel 88 having a hair spring 89 operative upon an escapement lever 90 whose two arms co-act with the teeth of the escapement wheel 87 in the well known manner. In order to prevent the possibility of the escapement lever stopping on what may be termed a dead center, I provide a spring 91 supported at one end on the plate 50 and normally extended into engagement with one arm of said escapement lever so as to hold it in one of its extreme positions. When, however, the device is put into operation, the post 63 which is carried by the arm 60 of the shutter leaf 47 raises said spring out of engagement with the escapement lever, thereby permitting the latter to operate in the well known manner. The pivot screw 54 in addition to supporting the levers hitherto referred to, also serves as a pivot or fulcrum for a lever 92 in which is formed an elongated radial slot 93 and which has its outer end turned over and pointed to form an indicator 94 designed to coöperate with a scale 95 on a suitably curved portion 96 of the segmental guide piece 75. This lever 92 has pivoted or fulcrumed to it by means of a screw 92^a, a trip lever 97 which has a long arm extending upwardly so as to be engaged under certain conditions by the time lever 77 as this latter moves under the action of its spring 81. The short arm 98 of the trip lever is extended in the general line of the long arm thereof so as to be capable of engagement with a pin 99, Figs. 6 and 12, carried by a bell crank lever 100 fulcrumed on the shutter closing lever 69 by a screw 19^a and normally held in a definite position by means of a spring 100^a carried by the shutter closing lever 69. The second arm of this bell crank lever carries a projecting pin or post 101 having a flattened surface, (Fig. 11) so placed as to coöperate with the flattened portion 59 of the post 57 which projects from the shutter leaf 46.

For manipulating the shutter leaves in order to determine the time of exposure to be given any particular negative, I provide a hand wheel 102 fixed to a spindle 103 extending into the interior of the box 1, and having a suitable portion whereby it is properly carried in a bearing formed in the end 29 of said box. Fixed to the spindle is a pinion 104 meshing with a toothed segment 105 preferably formed as part of a winking lever 106. This latter is pivoted or fulcrumed on a pin 107 mounted in the plate 50 and in addition to having an elongated radial slot 108, has a recessed edge portion 109 provided with a number of projections whose outer portions lie on a curve eccentric to the pivot 107; the bottoms of the recesses between said projections preferably all lying

on a circular curve concentric with said pivot. This winking lever is so mounted that its recessed edge coöperates with the knife edge portion 58 of the post 57 carried by the shutter leaf 46 so that as the lever 106 is turned on its pivot, the said post is alternately pushed away from the pivot 107 and then allowed to swing toward it; it being noted, however, that the amount of movement imparted to the post will vary from one end of the part 109 to the other. Since as heretofore described, the post 57 extends through the shutter leaf 47, this reciprocating movement of the said post causes both shutter leaves to be simultaneously swung in opposite directions and the parts are so arranged that when the smallest of the projections on the part 109 of the lever 106 engages the post, the two shutter leaves are moved apart a short distance so that the two openings 55 and 56 are caused to overlap at two of their adjacent corners for a relatively small amount, thus providing a small opening for the passage of light from the lamp 2 into the body of the box 1. As the post 57 is engaged by successively larger ones of the projections lying at greater distances from the pivot pin 107, the shutter leaves are moved apart or swung on their pivots away from each other through successively greater arcs; being allowed to return to their completely closed positions after each swing. Each time they move apart, successively greater areas of their openings 55 and 56 overlap so that increasing amounts of light are admitted to the middle compartment of the box 1, which light however, is non-actinic because of the colored glass covering the opening 55. The swing of the winking lever 106, in addition to causing alternate admission of light to and its cutting off from the middle compartment of the machine, is designed to assist in the adjustment of the indicator lever 92 and for this purpose I mount in the slot 108 a block 110 forming part of a cross head consisting of two blocks 111 and 112 besides the block 110 and having a screw 113 whereby said blocks are movably held together. The block 112 is slidable in the slot 93 of the indicator lever 92, while the block 111 has an opening for the reception of an arm 114 projecting from a curved slotted link 115 provided with teeth 116 on its inner or concave edge. In the slot of this link I mount a sliding block 117 which is rigidly fixed to the plate 50 so as to serve as a guide for the link and its arm.

Meshing with the teeth 116 of the link 115 is a pinion 118 carried on a spindle 119 (Figs. 5 and 8) mounted in suitable bearings in the end 29 of the machine adjacent the lamp. This spindle extends through said end and has fixed to its outer portion a hand wheel 120 whereby it, with the said

pinion, may be turned at will. For preventing undue ease of movement of this hand wheel and its attached parts, I provide a brake spring 121 mounted on the plate 50 in position to frictionally engage the outer face of the pinion 118.

The supporting plate 50 on the inner face of the end 29 of the machine has an opening 122 so placed as to permit light from the source 9 passing through the glass 32 to fall upon the mirror 30 and I provide an auxiliary shutter having two leaves 123 and 124 (Fig. 3) whereby this opening and hence the amount of light passing therethrough may be varied within certain predetermined limits. These two shutter leaves which are of thin metal and overlap each other, are pivotally mounted on a pin or screw 125 so as to be free to swing toward and from each other in parallel planes and have their adjacent edges notched or recessed. Each of these notches is in the form of a right angle triangle and they together form a rectangular opening whose area depends upon the relative position of the two shutter leaves; that is to say, when said leaves overlap to their maximum extent there is no opening whatsoever and as they swing apart, there is a rectangular aperture through them whose area increases as the leaves are further separated. For the purpose of operating the leaves of this auxiliary shutter, I provide a hand lever 126 mounted upon a spindle 127 projecting beyond the face of the end 29 of the machine, in which it is provided with a suitable bearing. Also fixed to this spindle is an arm 128 movable in a plane parallel with the plate 50 between this latter and the inside face of the end 29 of the machine. The arm 128 carries a pin 129 projecting through a slot in the plate 50 and operative in two cam slots 130 and 131 in the shutter leaves 124 and 123, so that as the lever 126 is moved with its pivot spindle 127, said shutter leaves are drawn together or separated as the case may be. Under normal conditions they tend to approach each other under the action of a spring 132 connecting them as shown.

Mounted on the outer face of the end 29 of the machine is a graduated scale 133 placed to coöperate with the upper end of the lever 126 and arbitrarily graduated to correspond with the graduation on a plate 134 through which both of the spindles 103 and 119 pass. As shown in Figs. 1 and 23, this plate is provided with a number of shallow recesses or holes 135 designed to receive a pin 136 (Fig. 7) carried by a spring arm 137 fixed to the spindle 103; the arrangement being such that when this pin is in such a position that it rests in one of the holes 135, the edge 58 of the post 57 rests upon the top or end of one of the projections on the edge 109 of the lever 106. The hand

lever 126 is now moved over the scale 133 to a similarly numbered graduation of the scale 133, thereby adjusting the shutter leaves 123 and 124 in a predetermined manner.

5 For supporting the negative and sensitized sheet or plate to be printed therefrom in the machine, I provide the negative holder or printing frame 7 which has a handle 138 whereby it may be manipulated. Said
10 holder preferably consists of two rectangular frames 140 and 141 of sheet metal of angular section, hinged together at 139 and having openings through them slightly
15 greater than the size of the paper and negatives to be used in the machine. The frame 141 has fastened to it a strip of wood or other suitable material 142 of such dimensions as to closely fit the opening in the top
20 of the box 1 through which the holder is inserted and the handle 138 is fixed to this strip. The frame 140 carries a plate or pane of ground glass 143 mounted over its opening and held in position by any suitable means such as the metallic clips shown.
25 Likewise the frame 141 has a plate or pane of clear glass 144 which, however, is so mounted as to permit of its relative movement toward and from the glass plate 143. For this purpose said plate 144 is provided
30 with a metallic supporting frame 145 connected by springs 146 to the frame 141 so that while being at all times pressed toward the frame 140, it is free to move parallel to itself away from the same sufficiently to permit
35 of the introduction of a celluloid or glass negative together with a sensitized glass or paper sheet to be printed. The springs 146 serve to press both the sensitized sheet and the negative closely together
40 as well as removably hold them in the position between the two glass plates 143 and 144 and to press the two frames 140 and 141 into close contact with the frames or parts 33 and 34 so as to
45 prevent leakage of light. As before indicated there is a tube 136 mounted in the printing frame which is preferably fixed to the part 140 thereof and designed to extend loosely through the frame 141 so as to have
50 its center line substantially coincident with the line joining the centers of the two mirrors 30 and 31.

For the preliminary adjustment of the machine I provide a test plate shown in Fig.
55 21 which consists of a rectangular piece of glass rendered opaque except for a small rectangular central portion 150. This is gray in color and has in its central portion a cross or other shaped figure 151, which
60 like the outer or main portion of the plate, is opaque. I preferably so construct the box 1 as to provide a cavity or container 152 for the reception of this test plate when it is not in use.

65 It is to be understood that before being

actually used the machine constructed according to my invention must be calibrated and its various parts are so proportioned as to properly perform their functions. Normally the shutter leaves 46 and 47 are held
70 in such position that they not only close the main opening through the lens 8 but also maintain the openings 55 and 56 out of line with each other.

In order to use the machine the lamp is
75 lighted and it then becomes necessary to ascertain the intensity of the light emitted which depends chiefly on the condition of the mantle, the temperature of the burner, and the composition and pressure of the gas
80 being used. For this purpose the negative holder 7 is removed from the machine and its frame 141 is turned on its hinge 139 to permit of the insertion of the test plate which is placed between the two clear glass
85 plates 143 and 144. Said holder 7 is then returned to the machine and the lever 126 for the auxiliary shutter leaves 123 and 124 is moved so as to completely close said shutter. It being assumed that the hand wheel
90 102 is in such position that the knife edge of the post or pin 57 is engaged by that end of the winking lever 109 having the largest projection, the turning of said hand wheel will, through the pinion 104 and toothed segment
95 105, turn this winking lever on its pivot or spindle, thereby causing the post 57 to be alternately moved away from said pivot and permitted to thereafter swing toward the same. With each movement of
100 the pin 57 away from the pivot 107 the shutter leaves 46 and 47 are turned on their supporting pivots 53 and 54 a sufficient distance to bring one corner of the rectangular opening 56 into register with one corner of
105 the rectangular glass covered opening 55 of the shutter leaf so that a maximum amount of light is permitted to pass from the source 9, through the lens 8 in such manner as to illuminate the front face of the test plate
110 to a predetermined extent. Thereafter the post 57, being allowed to swing back into one of the recesses in the edge of the lever 109, permits the shutter leaves to overlap sufficiently to completely cut off the passage
115 of light through the lens. As the hand wheel 102 is turned slightly farther, the shutter leaves are again swung apart, but since the outer peripheral portions between the various recesses in the edge of the lever
120 109 are at a decreasing distance from the pivot or spindle 107, said shutter leaves are swung apart through lesser arcs than those previously moved through so that slightly smaller areas of the two rectangular openings 55 and 56 are brought into line with
125 each other; thereby permitting a smaller quantity of the light than hitherto to pass through the lens 8 and illuminate the front face of the test plate. The winking lever
130

109 is thus kept moving until the operator making observations through the opening 4 is no longer able to distinguish the outline of the cross on the test plate as reflected in the mirror 37, from the surrounding translucent portion thereof when said cross is illuminated by the successive flashes of light; the winking action of the shutter leaves making it easier to judge when this condition obtains than if the leaves were opened gradually. The position of the index arm 137 is then noted and the lever 126 is moved from the position in which the auxiliary shutter leaves 123 and 124 are closed to a position indicated on the scale 133 the same as that given by the index arm 137, thus partially closing the opening formed by the two angular recesses in these auxiliary shutter leaves and consequently cutting down the quantity of light passing to the rear of the negative holder by way of the three mirrors. The negative holder 7 may now be removed and the test plate replaced by a photographic negative with a sheet of sensitized paper or other material; these two sheets being mounted between the glass plates 143 and 144 by placing them upon one of these latter after the frame holding the second plate has been turned sufficiently on the hinge 139 to open said holder. As is usual in photographic printing, the sensitized surface of the paper is placed in contact with that surface of the negative on or in which the picture is formed and the holder 7, after being closed, is then inserted in the machine in such position that the sensitized surface of the paper is presented to the front of the machine;—that is directed toward the lamp. The hand wheel 120 is now turned until the pointer 155 is brought opposite an arbitrarily placed mark or name on the plate 134 indicative of or depending upon the particular grade or sensitiveness of the paper used, and such turning, through the spindle 119, turns the pinion 118, which through the teeth 116 causes the link 115 to slide on the fixed block 117 into a definite position. Such movement causes the arm 114 attached to said link to sweep through an arc of greater or less extent, in which movement it necessarily carries with it the block 111. Since this movement of the block is necessarily toward or from the spindle 107 of the winking lever 109, the block 110 which slides in the slot 108 of said lever, does not in any way effect the adjustment of this latter, but the block 112, which is likewise attached to the block 111, causes a turning of the indicator lever 92 on its pivot, since its slot 93 is inclined to the line of movement of the three blocks 110, 111, and 112; it being obvious that in moving, the lever 92 necessarily carries with it the trip lever 97. Thereafter the operator, looking through the eye-piece

and opening 4 onto the mirror 37 and at the same time turning the hand wheel 102, moves the shutter leaves 46 and 47 to produce the winking action heretofore described, so that by means of the varying amounts of light transmitted through the negative and paper to be printed, he is enabled to distinguish more or less faintly an image of the negative in said mirror; it being noted that the presence of the sensitized paper does not interfere with this adjustment, as I have found that variations in the thickness of papers of the varieties ordinarily met with in practice, do not appreciably affect the adjustment either by reason of their partial opacity or because of differences in their thickness. The purpose of this winking or flashing operation is principally to avoid fatigue of the eyes of the operator in adjusting or balancing the illumination of the two faces of the negative to be printed from. As will be remembered, however, a certain amount of light is reflected from the mirrors 30, 31 and 37 to the back of the sensitized paper in the holder, depending upon the amount of opening of the auxiliary shutter leaves 123 and 124, so that as the two main shutter leaves 46 and 47 are "winked" between the extreme positions indicated in Figs. 14 to 16 inclusive, a point is finally reached at which the lighting effects through the openings 55 and 56 and from the mirror 37 are balanced and it is no longer possible to distinguish the details of the negative in said mirror. This second photometric adjustment by means of the hand wheel 102, swinging as it does the lever 109 on its pivot through the pinion 104 and toothed rack 105, slides the block 111 on the bar 114 without tending to move said bar, and likewise causes the block 112 to swing the lever 92 on its pivot 54. The machine is now adjusted for operation and the bar or plunger 64 is pressed downwardly to its full extent and is then released. From Figs. 6 and 17 it will be seen that the spring 72 is thus put under tension and the downward movement of the bar 64 is transmitted through the pawl 67 to the pin or post 68 on the short arm of the shutter opening lever 69. Said lever is therefore turned on its pivot 54 into the position shown in Fig. 18, until the downward movement of said bar has so far continued as to bring the arm 70 of the pawl 67 into engagement with the fixed pin or post 74, whereupon said pawl is so far turned on its supporting screw 66 as to disengage the post 68, thereby permitting the shutter opening lever to return to the extreme position shown in Fig. 6 under the action of its spring 76. This turning of the shutter opening lever 69 and its subsequent release just described first causes the bell crank lever 100 to be moved from the position shown in Fig. 17 to that illustrated

in Fig. 18, so that the post 101 carried thereby comes into engagement with the portion 59 of the post 57 for actuating the shutter leaves 46 and 47 and finally rests upon the flat face of this post as shown in Fig. 18. When, therefore, the lever 69 returns to its normal position under the action of its spring, the bell crank lever 100 is carried with it and its post 101, pushing upon the post 57, acts on the main shutter leaves 46 and 47 to move and hold these in their full open positions, as in Fig. 19, against the action of their closing spring. The shutter leaves are thus fully separated or opened and light from the mantle 9 passes through the lens 8, through the negative in the holder and acts upon the sensitized paper or other surface adjacent thereto to chemically change the same in the well known way. The time of this exposure to the light, which, in order to secure uniform results in the finished print, should depend upon the intensity of the light, the sensitiveness of the paper, and the density of the negative, has been provided for by the adjustments heretofore described and closure of the shutter at the proper time to effect the correct exposure is caused in the following manner.

In addition to the above action, the movement of the lever 69 from its normal position when the bar 64 is pushed downwardly, causes its upper end to engage the upper end of the timing lever 77 and turn it on its supporting spindle against the action of the spring 81 into the extreme right hand position shown in Fig. 3. Such turning of the lever 77, through its segmental rack 78, causes turning of the pinion 80 and with it of the drum 83 which, owing to the arrangement of the pawls or dogs 84, does not cause movement of the gear wheel 82. When, however, the shutter opening lever returns to its normal position (Fig. 3), the tendency of the lever 77 to follow it under the action of the spring 81, tends to cause the drum 83 to be turned in such direction that it is immediately gripped by the pawls or dogs 84, and it thereby becomes operatively coupled to the gear wheel 82. The said timing lever 77 is therefore permitted to move at a rate depending upon the escapement mechanism operative on said gear wheel and under the action of the spring 81 gradually moves toward the shutter opening lever which is in its normal position. It will be noted, however, that the indicator lever 92 with the trip lever 97, has been adjusted to some position intermediate the ends of the curved guide piece 75, and the parts are so arranged that the upper end of the timing lever, under the action of the escapement or governing mechanism, sooner or later comes into engagement with the upper end of said trip lever 97, which, as a result is turned on its pivot upon the indicator lever so as to move rel-

atively thereto. Such turning, however, causes its short arm 98 to engage the projection or pin 99 of the bell crank lever 100, which is thus turned on its pivot 100^a to such an extent as to move its pin or post 101 out of engagement with the shutter post 57, thereby permitting the shutter leaves to be drawn by their spring into their overlapping or closed positions. The light from the mantle 9 is thus cut off from the negative and the sensitized paper, after which the holder 7 may be removed and the paper taken out and developed in the well known manner. The various parts of the machine are now in position for another operation, it being only necessary that the hand wheel 102 be adjusted for variations in the density of the negative until the image of said negative as observed in the mirror 37, disappears, whereupon the bar 64 may be depressed to open the main shutter leaves and give the proper exposure for the particular negative in the machine.

As will be understood by those skilled in the art, it is only necessary to adjust the hand wheel 120 when the grade of sensitized paper is varied, and it is necessary to use the test plate in order to vary the opening in the auxiliary shutter leaves 123 and 124 only when it is suspected that some variation has occurred in the intensity of the light from the mantle 9.

If it be desired to use my invention for the purpose of making enlargements, it is adjusted in a manner the same as hitherto described for making a print of the same size as the negative. In this case, however, the negative alone is placed between the glass plates 143 and 144 of the holder 7 which is reversed in position to bring the ground glass plate in front and thereafter the catch 44 is operated to release the angular piece 44 of the rear door 39, which may then be dropped into the position shown in Fig. 24. The mirror 37 may now be let down until it rests on the bottom sill of the door opening; its movement being controlled by the head or hand wheel 40. Thereafter the enlarging camera 160 is placed in line with the rear or door opening of the machine, and for this purpose said camera is preferably provided at its forward end with a tubular extension 161 having some form of catch such as a bayonet joint, whereby it is connected to the rear end 3 of the box 1 so as to be axially in line with the lens 8. The printing machine has at its front end a sliding or folding supporting member 170 to assist in supporting it in the position shown.

The camera is provided with a lens 162 of the well known form and also has a suitable paper holding device, which in the present instance consists of a plate of glass 163 mounted on springs 164 in such position that the sensitized paper may be mounted between

it and the rear door 165 of the camera. Said door is hinged to swing outwardly and after the enlarging camera has been connected in line with the printing machine, as shown in Fig. 24, the paper on which the enlargement is to be printed may be introduced between the rear door 165 and the glass 163. Thereafter by pressing the bar 64, the main shutter leaves are opened and the sensitized sheet is exposed to the light for a predetermined time, as determined by the adjustments previously made and by the increased distance of said sensitized sheet from the light source.

It is of course obvious that instead of constructing the machine to expose the paper to be printed with the lens 8 full open for a variable period of time depending on the paper, light intensity, and density of the negative, I may so proportion the various parts that the main shutter leaves 46 and 47 will be operated to give variable apertures and all prints be made with the same time of exposure. The method of procedure above described is, however, decidedly to be preferred in view of the saving of time effected by it. It is further obvious that the form and arrangement of the various shutter controlling levers and other parts whereby the adjustments of my machine are made, may be widely varied without departing from my invention, which broadly contemplates the provision of a photographic printing machine with means whereby the time of exposure to a source of light of a sensitized surface to be printed may be varied to produce substantially uniform results in order to compensate for, and regardless of variations in, the intensity of the light, density of the negative, and the sensitiveness of the paper, the invention contemplating mechanism including a photometric balancing device for adjusting the mechanism to give the proper exposures necessary under the above noted variable conditions.

If it be desired to shorten the length of the machine it may be constructed as shown in Fig. 26 with a projection 166 extending upwardly from its top surface and carrying the eye-piece 6 as well as the mirror 31. With such a construction the mirror 30 is placed as shown and the negative with the sensitized paper is introduced in the position shown at X; the light from the lamp 2 being reflected onto it from the mirror 37. In any case, however, this modification in no way departs from my invention, but merely involves a re-arrangement of parts without affecting the principles or mechanism employed.

It will be noted that the end or the indicator lever 92 is visible from the outside of the casing through a suitable glass covered opening and is operative adjacent the scale 95 and inasmuch as the position of this indi-

cator on the scale is an indication of the adjustment of the tripping lever 97, it is obvious that by its use the machine may be adjusted to give a certain negative and paper a definite exposure without the necessity for using the photometric adjusting device.

It is to be noted that the gas connection to the lamp is preferably so made as to permit relative movement of the gas supply pipe 11 and the burner 12 without setting up strains or causing leakage of gas and for this purpose said pipe 11 is rigidly connected to the lower portion of the burner proper, though as shown in Fig. 2 it swivels therewith in the burner tube 12.

I claim:—

1. The combination in a photographic printing machine of means for supporting a sensitized body and a negative; with automatically acting means for exposing said sensitized body and negative to a source of light for a predetermined time; and a plurality of coacting independently adjustable devices for varying the time said body and negative are exposed to the light source.

2. The combination in a photographic printing machine of a source of light; means for supporting a negative and a sensitized body; a shutter between the source and said supporting means; mechanism for automatically closing the shutter after it has been open for a predetermined time; and a plurality of independent devices for adjusting said mechanism to vary the time the shutter remains open.

3. The combination in a photographic printing machine of a source of light; means for supporting a negative and a sensitized body to be printed in position to have one face of said body acted on by light from said source; mechanism for governing the time of exposure of the sensitized body to the light from the source; means for illuminating the second face of said sensitized body; and means for adjusting said mechanism to vary the time of exposure in accordance with the conditions revealed by such illumination.

4. The combination in a photographic printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a shutter for said light source; time controlled mechanism for causing closing of the shutter; means including an adjustable element for indicating variations in the sensitiveness of said sensitized body; and means operatively connected to said element for adjusting said mechanism to compensate for such variations.

5. The combination in a photographic printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a

shutter for said light source; time controlled mechanism for causing closing of the shutter; means including an adjustable element for indicating differences in the densities of
5 different negatives; and means for operatively connecting said element to said time controlled mechanism to permit of adjustment of the latter to compensate for such differences.

10 6. The combination in a photographic printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a shutter for said light source; time controlled
15 mechanism for causing closing of the shutter after it has been opened for a predetermined time; means for giving indication of variations in the intensity of the light; and means for adjusting said time controlled mechanism to compensate for such
20 variations.

7. The combination in a photographic printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a
25 shutter for said light source; time controlled mechanism for causing closing of the shutter after it has been open for a predetermined time; means for adjusting said mechanism to compensate for differences in the density
30 of the negative and other means for adjusting the mechanism to compensate for differences in the sensitiveness of the sensitized body.

8. The combination in a photographic
35 printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a shutter for said light source; time controlled mechanism for causing closing of the shutter
40 after it has been open for a predetermined time; means for adjusting said mechanism to compensate for variations in the density of different negatives; and photometric means including a winking device associated
45 with said adjusting means for giving visual indication when such adjustment has been perfected.

9. The combination in a photographic
50 printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a shutter for said light source; time controlled mechanism for causing closing of the shutter
55 after it has been open for a predetermined time; means for adjusting said mechanism to compensate for differences in the intensity of the light source; and photometric means including a winking device operatively associated with such adjusting means for giving
60 visual indication when said adjustment has been perfected.

10. The combination in a photographic printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a

shutter for said light source; time controlled mechanism for causing closing of the shutter after it has been open for a predetermined time; means for adjusting said mechanism to compensate for differences in density
7 the negatives employed; and photometric mechanism operatively associated with said means for indicating when said mechanism has been correctly adjusted.

11. The combination in a photographic
7 printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a shutter for said light source; time controlled
8 mechanism for causing closing of the shutter after it has been open for a predetermined time; means for adjusting said mechanism to compensate for differences in the intensity of the light source; and a photometric device
operatively associated with said mechanism
for indicating when such adjustment has
been correctly made.

12. The combination in a photographic printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a
shutter for said light source; time controlled mechanism for causing closing of the shutter; a device for delivering light through the
negative; and means for adjusting the
amount of light so delivered; the same being operatively connected to said time controlled mechanism.

13. The combination in a photographic printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a shutter for said light source; time controlled mechanism for causing closing of the shutter
after it has been open for a predetermined time; a device arranged to deliver light through the negative; means for illuminating the negative and sensitized body; means for adjusting the light delivering device to vary the quantity of light supplied; and means connecting the time controlled mechanism and said light delivering device for causing them to be simultaneously adjusted.

14. The combination in a photographic printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a shutter for said light source; time controlled mechanism for causing closing of the shutter
after it has been open for a predetermined time; means for illuminating the two faces of the negative; means for controlling said illumination; and means connected to said time controlled mechanism and to said illumination controlling means for simultaneously adjusting the latter and said time controlled mechanism.

15. The combination in a photographic printing machine of a casing; means for supporting a negative and a body of sensi-

5 sized material to be printed; a source of light; a shutter for said light source; means for opening the shutter at will, the same including a member operatively connected to the shutter; a movable bar having a catch detachably engaging said member; means for tripping said catch; and time controlled mechanism set in operation by said shutter opening means, for closing the shutter after
10 a predetermined interval.

15 16. The combination in a photographic printing machine of means for supporting a sensitized body and a negative; and automatically acting means for exposing said sensitized body and negative to a source of light for a predetermined time; the same including a shutter; means tending to move the shutter from an open to a closed position; means for temporarily holding the
20 shutter in an open position; the same including a lever; means for actuating the same; a second lever mounted on said first lever and operatively connected to the shutter; and escapement mechanism for actuating said
25 second lever to release said holding means.

30 17. The combination in a photographic printing machine of a casing; means for supporting therein a negative and a body of sensitized material to be printed; a shutter controlling the admission of light to the negative; means tending to close the shutter; holding means for preventing closing of the shutter; time controlled mechanism for governing the closing of the shutter; and means
35 for connecting the shutter and said time controlled mechanism; the same including a tripping member for causing releasing of the shutter holding means; and a member for actuating said tripping member after the
40 lapse of a predetermined time.

45 18. The combination in a photographic printing machine of a shutter; means tending to move the shutter from the open to the closed position; means for temporarily holding the shutter in its open position, the same including a pair of levers of which one is mounted upon the other; means for moving said latter lever at will; an adjustable tripping member for actuating said second
50 lever to release the shutter; and time controlled mechanism including a member capable of actuating the tripping member in any adjusted position.

55 19. The combination in a photographic printing machine of a shutter; means for supporting a negative and a body of sensitized material to be printed; means tending to move the shutter from an open to a closed position; means for holding the shutter in its open position; an adjustable tripping member for releasing said holding means; a photometric device for determining the adjustment of the tripping member, the same including an adjustable member operatively
60 connected to said tripping member; and

time controlled mechanism for actuating said tripping member in any adjusted position.

20. The combination in a photographic printing machine of a shutter; means for supporting a negative and a body of sensitized material to be printed; means tending to move the shutter from an open to a closed position; means for holding the shutter in its open position; an adjustable tripping member for releasing said holding means; 75 a photometric device having an element operative on said tripping member for adjusting the same, and including means for illuminating both faces of the negative; and time actuating means for causing operation 80 of the tripping member in any of its adjusted positions.

21. The combination in a photographic printing machine of a casing; means for supporting a negative and a body of sensitized material to be printed; a shutter; means tending to move the shutter from its open to its closed position; means for holding the shutter in its open position; time actuating mechanism including a tripping 85 member for releasing said holding means; means for adjusting the position of said tripping member to compensate for differences in the density of the negative; and means for giving visual indication when said adjusting means has been operated to the necessary extent. 95

22. The combination in a photographic printing machine of a casing; means for supporting the negative and a body of sensitized material to be printed; a shutter; means tending to move the shutter from its open to its closed position; means for holding the shutter in its open position; time actuated mechanism including a tripping 100 member for releasing said holding means; and two independent devices for adjusting the position of said tripping member in accordance with variations in the density of the negative and in the sensitiveness of the 110 material to be printed.

23. The combination in a photographic printing machine of a casing; means for supporting a negative and a sensitized body to be printed; a shutter; time actuated mechanism including an adjustable member for causing closing of said shutter; with a photometric device for indicating the density of the negative; and including a movable element operatively connected to said adjustable member. 120

24. The combination in a photographic printing machine of a casing; a device for supporting a negative and a sensitized body to be printed; a shutter having means normally tending to retain it in its closed position; means for holding the shutter in its open position; photometric means including a winking device for illuminating opposite faces of the negative; and time controlled 130

mechanism connected to said winking device so as to be adjustable therewith, for automatically releasing the shutter at the end of a predetermined time.

25. The combination in a photographic printing machine of a structure for supporting a negative and a sensitized body to be printed; a main shutter; a source of light placed to illuminate the face of the negative adjacent said shutter; an auxiliary shutter; means for transmitting light passing through said auxiliary shutter to the other face of the negative; and means for automatically closing the main shutter after it has been open for a predetermined time.

26. The combination in a photographic printing machine of a source of light; a structure for supporting a negative and a sensitized sheet to be printed; a main shutter between the light source and the negative for controlling the admission of light to one face of said negative; an auxiliary shutter; means for transmitting light passing through said auxiliary shutter to the other face of the negative; means for adjusting the aperture of the auxiliary shutter in accordance with variations in the intensity of the light source; and time controlled mechanism for automatically causing closing of the main shutter after it has been open for a predetermined time.

27. The combination in a photographic printing machine of a source of light; a structure for supporting a negative and a sensitized body to be printed; a main shutter controlling the admission of light to one face of the negative and including two leaves having openings capable of overlapping to a variable extent; means for transmitting light to the opposite face of the negative; and time controlled mechanism for causing closing of the main shutter after it has been open for a predetermined time; said mechanism including an adjustable element; and a device operative upon said element for oscillating the shutter leaves.

28. The combination in a photographic printing machine of a source of light; a structure for supporting a negative and a sensitized body to be printed; a main shutter controlling the admission of light to one face of the negative and including two leaves having openings capable of overlapping to a variable extent; means for transmitting light to the opposite face of the negative; an auxiliary shutter for controlling the amount of light so transmitted; and time controlled mechanism for causing closing of the main shutter after it has been open a predetermined time; said last means including an adjustable member controlling the operation thereof and a device for oscillating the leaves of the main shutter connected to actuate said adjustable member.

29. The combination in a photographic printing machine of a source of light; a structure for supporting a negative and a body of sensitized material to be printed; a main shutter between said negative and said source consisting of a plurality of leaves having openings capable of overlapping to a variable extent; a device for oscillating said shutter leaves to permit variable amounts of light to pass through said openings; means for illuminating the rear face of a negative in the supporting structure; means for holding the shutter leaves in their full open positions; with time controlled mechanism for releasing said holding device including a tripping member adjustable as to its position by and operatively connected with the shutter oscillating means.

30. The combination in a photographic printing machine of a casing having a printing frame and provided with an opening for observing one face of a negative in said frame; a source of light; a main shutter between said source and the printing frame; means for illuminating the rear face of the negative; means for opening the shutter at will; means tending to close the shutter; means for holding the shutter in its open position; time controlled mechanism for releasing said holding means, the same including an adjustable tripping member for governing the operation of said mechanism; a device for illuminating the front face of the negative with flashes of different amounts of light; and means for connecting said device with the tripping member of the time controlled mechanism.

31. The combination in a photographic printing machine of a casing; a source of light therefor; a printing frame in the casing; a main shutter interposed between the source of light and said printing frame and having members provided with openings capable of overlapping to a variable extent; reflecting means for transmitting light from said source to the rear of the printing frame; an auxiliary shutter interposed between the source and said reflecting means; means for adjusting said auxiliary shutter to compensate for variations in the intensity of the light source; time controlled mechanism for closing the main shutter after it has been opened for a predetermined time; and means for adjusting said time controlled mechanism including means for operating the shutter to cause a succession of variable flashes of light to pass therethrough to a negative in the printing frame.

32. The combination in a photographic printing machine of a casing having a printing frame; a source of light; a shutter interposed between the printing frame and said source; reflecting means for illuminating the rear face of a negative in the frame to a

predetermined extent; time controlled mechanism for closing the shutter after it has been open for a predetermined time; and means for adjusting the said mechanism including a device for alternately admitting and cutting off successively varying amounts of light to the negative in the frame.

33. The combination in a photographic printing machine of a casing having a printing frame; a source of light; a shutter interposed between the printing frame and said source; reflecting means for illuminating the rear face of a negative in the frame to a predetermined extent; time controlled mechanism for closing the shutter after it has been open for a predetermined time; a standardizing test plate formed to fit into the printing frame; and means for adjusting the said mechanism to vary the time the shutter remains open, the same including a device for alternately admitting and cutting off successively varying amounts of light to the negative or test plate in the frame.

34. The combination in a photographic printing machine of a casing having a printing frame; a source of light; a shutter interposed between the printing frame and said source; means for illuminating the rear face of a negative in the frame to a predetermined extent; time controlled mechanism for closing the shutter after it has been open for a predetermined time; a standardizing test plate formed to fit into the printing frame and having portions of varying transparency; and means for adjusting the said mechanism to vary the amounts of light delivered to the negative or test plate in the frame.

35. The combination in a photographic printing machine of a shutter and mechanism for actuating the same; said mechanism including a movable member for opening the shutter; time controlled shutter closing mechanism arranged to be set by said member; and a plurality of independent means for adjusting said time controlled mechanism to vary the time the shutter remains open.

36. The combination in a photographic printing machine of a shutter and mechanism for actuating the same; said mechanism including an escapement device; a member connected to simultaneously open the shutter and actuate said escapement device; means for holding said shutter in its open position; and mechanism adjustable at will to cause said escapement mechanism to release said shutter holding means at the end of a predetermined time.

37. The combination in a photographic printing machine of a shutter and mechanism for actuating the same, said mechanism including a member for opening the shutter; means for holding the shutter open; time controlled mechanism including a mov-

able member; a tripping member for releasing the shutter holding means, placed to be actuated by said movable member; with two independent devices for adjusting the position of said tripping member.

38. The combination in a photographic printing machine of a casing; means for supporting a negative and a body of sensitized material to be printed; a shutter; time controlling mechanism for actuating the shutter, including means for adjusting to compensate for variations in the density of the negative; with a lamp for said machine delivering two independent bodies of light into the casing and having an opening placed to deliver light outside of the casing, said opening being provided with a transparent cover incapable of permitting passage of actinic light.

39. The combination in a photographic printing machine of a structure for supporting a negative and a body of sensitized material to be printed; a source of light; a main shutter interposed between said supporting structure and said source; means for illuminating the rear face of a negative in the structure; an auxiliary shutter controlling the passage of light to the rear of the negative; and time controlling mechanism for closing said main shutter after it has been open for a predetermined period, the main shutter having a portion placed to cut off light from the path in which the auxiliary shutter is placed when said main shutter is in its open position.

40. The combination in a photographic printing machine of a shutter and time controlling operating mechanism for closing said shutter after it has been open a predetermined time; the same including an escapement device; and means controlled by the shutter for insuring starting of said escapement mechanism when said shutter is opened.

41. The combination in a photographic printing machine of a shutter and time controlling mechanism for causing closing of said shutter after it has been open for a predetermined time; said mechanism including an escapement device with a member controlled by the shutter and movable into and out of engagement with a portion of said escapement device for holding it in or releasing it from a self starting position.

42. The combination in a photographic printing machine of a shutter and time controlling mechanism for closing said shutter after it has been open for a predetermined time; said mechanism including a shutter opening device connected to wind the mechanism at the same time the shutter is opened.

43. The combination in a photographic printing machine of a structure for supporting a negative and a sensitized body to be printed; a source of light; a shutter for con-

trolling the passage of light to the negative in said structure; time controlling mechanism for automatically closing said shutter after it has been open for a predetermined time; a photometric device for adjusting said time controlling mechanism and operatively connected to the same to compensate for differences in the negatives and sensitized bodies used in the machine; and means
10 for giving indication of the adjustment of said time controlling mechanism independently of the photometric device.

44. The combination in a photographic printing machine of a casing; a source of
15 light; and a negative supporting structure consisting of two frames; a shutter for controlling the passage of light from said light source; a transparent plate in each frame of the negative supporting structure; one of
20 the plates being free to move relatively to its frame and means for yieldingly pressing said plates together.

45. The combination in a photographic printing machine of a casing including two
25 fixed frames spaced apart; a negative supporting structure designed to fit between said frames; a source of light; and a shutter for controlling the passage of light to the negative supporting structure from the
30 source; said structure consisting of two pivotally connected frames; a plate of transparent material mounted in each frame; with means for yieldingly pressing said plates together and at the same time forcing
35 said frames of the negative supporting structure into close engagement with the frames in the casing.

46. The combination in a photographic printing machine of a casing; means for
40 supporting a negative and a sensitized body to be printed; a source of light; a shutter controlling the passage of light from said source to said negative supporting structure; and time controlling mechanism for
45 closing the shutter after it has been open for a predetermined time, said mechanism including a photometric device for adjusting the time of its operation having a series of mirrors for transmitting light from the
50 source to the rear of the negative; and a tubular conduit for preventing escape of such light from a predetermined path.

47. The combination in a photographic printing machine of a casing; time controlling mechanism for closing said shutter
55 after a predetermined period; and means for adjusting the operation of said mechanism including a series of mirrors for illuminating the rear face of the negative; one
60 of said mirrors being adjustably mounted at the rear of the negative so as to be capable of movement to one side when the apparatus is used for enlarging.

48. The combination in a photographic
65 printing machine of a casing having a rear

door; means for supporting a negative and a body of sensitized material in said casing; a source of light; a shutter for controlling the passage of light to a negative; time controlling mechanism for closing said shutter
70 after a predetermined interval; and adjusting means for said mechanism; said means including a photometric device having a series of mirrors for illuminating the rear of the negative; one of said mirrors being held
75 in position by the rear door of the casing.

49. The combination in a photographic printing machine of a casing; means for supporting therein a negative and a sensitized body to be printed; a lamp mounted
80 on the casing; a shutter interposed between the lamp and the negative supporting structure; mechanism for actuating said shutter; means for adjusting said mechanism including a member extending adjacent the lamp;
85 and a heat insulating protective structure for that portion of the lamp adjacent said member.

50. The combination in a photographic printing machine of a casing; a source of
90 light; means for supporting a negative and a sensitized body to be printed; a shutter interposed between said means and the light source; mechanism for controlling the time of closing of said shutter; and photometric
95 means for adjusting said mechanism including a test plate; there being a cavity in the casing structure for the reception of said test plate when out of use.

51. The combination of a photographic
100 printing machine having means for supporting a negative; a source of light; and a shutter; with an enlarging camera formed to be connected to said printing machine and having means for supporting a body of sensitized material to be printed; said printing
105 machine fitting within said enlarging camera.

52. The combination in a photographic printing machine of means for supporting a
110 negative and a body of sensitized material to be printed; a source of light; a shutter controlling the passage of light from said source to the negative; time controlling mechanism for closing said shutter after it
115 has been opened for a predetermined period; and adjusting means operatively connected to said time controlling mechanism, said means including a plurality of co-acting levers mounted with their pivots in substantially
120 the same straight line.

53. The combination in a photographic printing machine of means for supporting
125 a negative and a body of sensitized material to be printed; a source of light; a shutter controlling the passage of light from said source to the negative; time controlling means for closing said shutter after it has been opened for a predetermined period;
130 and adjusting means operatively connected

to said time controlling mechanism, said means including a shutter opening lever, a timing lever, and an indicating lever mounted with their pivots in the same straight line and co-acting to determine the time of operation of the shutter.

54. The combination in a photographic printing machine of means for supporting a negative and a body of sensitized material to be printed; a source of light; a shutter controlling the passage of light from said source to the negative; time controlling means for closing said shutter after it has been opened for a predetermined period; and adjusting means operatively connected

to said time controlling mechanism, said means including a shutter opening lever, a timing lever and an indicating lever mounted with their pivots in the same straight line and co-acting to determine the time of operation of the shutter; said shutter including a pivotal support mounted in line with the pivots of said levers.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ALEXANDER D. McCURDY.

Witnesses:

WILLIAM E. BRADLEY,
WM. A. BARR.