R. J. GIBBON.

HYDRAULIC PRESS.

APPLICATION FILED JAN. 10, 1907.

919,568.

Patented Apr. 27, 1909.

8 SHEETS—SHEET 1.

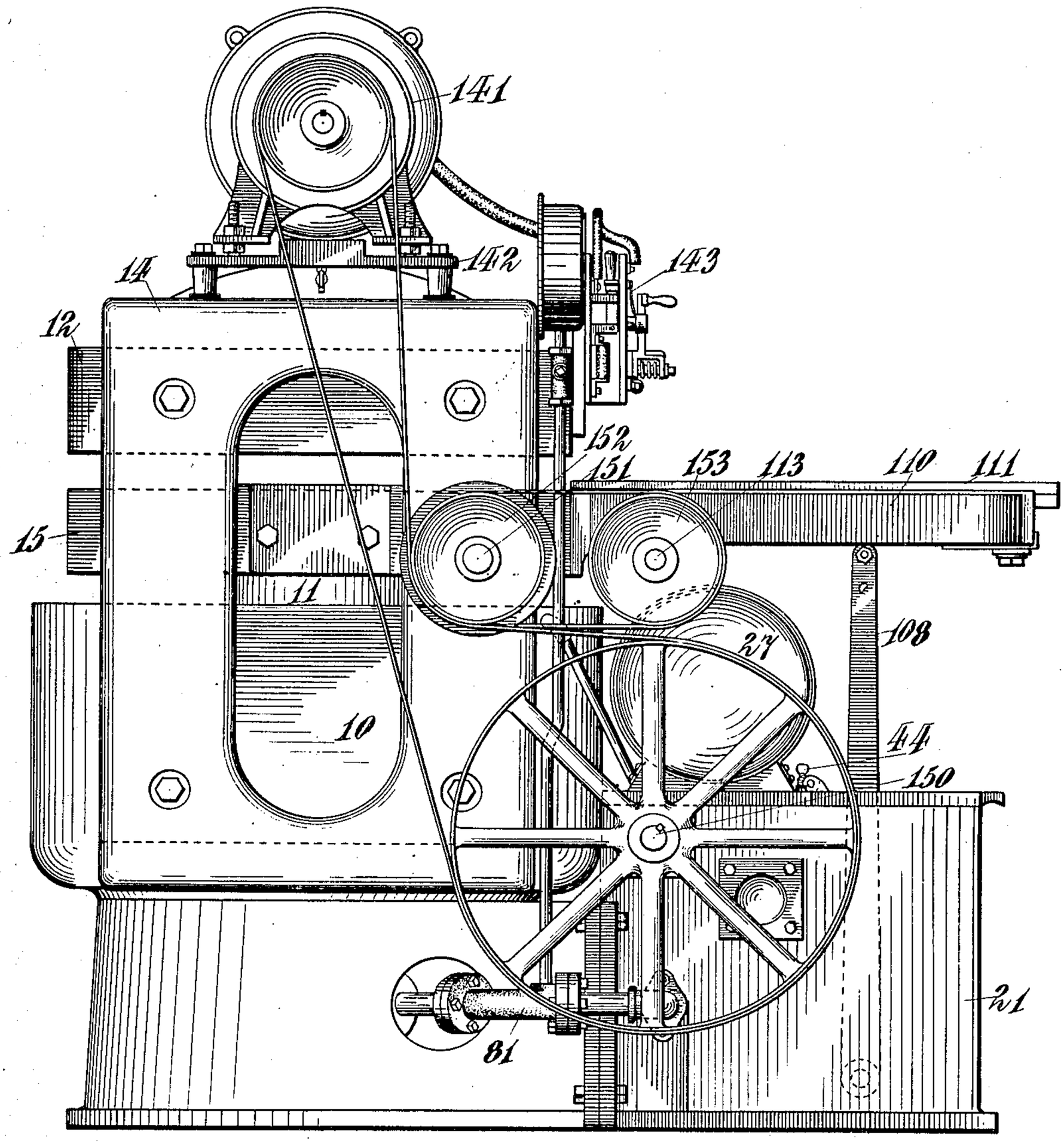

Fig. 1.

Witnesses:
W. H. Cotton
S. O. Henning

Inventor:
Robert J. Gibbon.
By Reading Hiden & Green
Atty's.

R. J. GIBBON.

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8 SHEETS—SHEET 2.

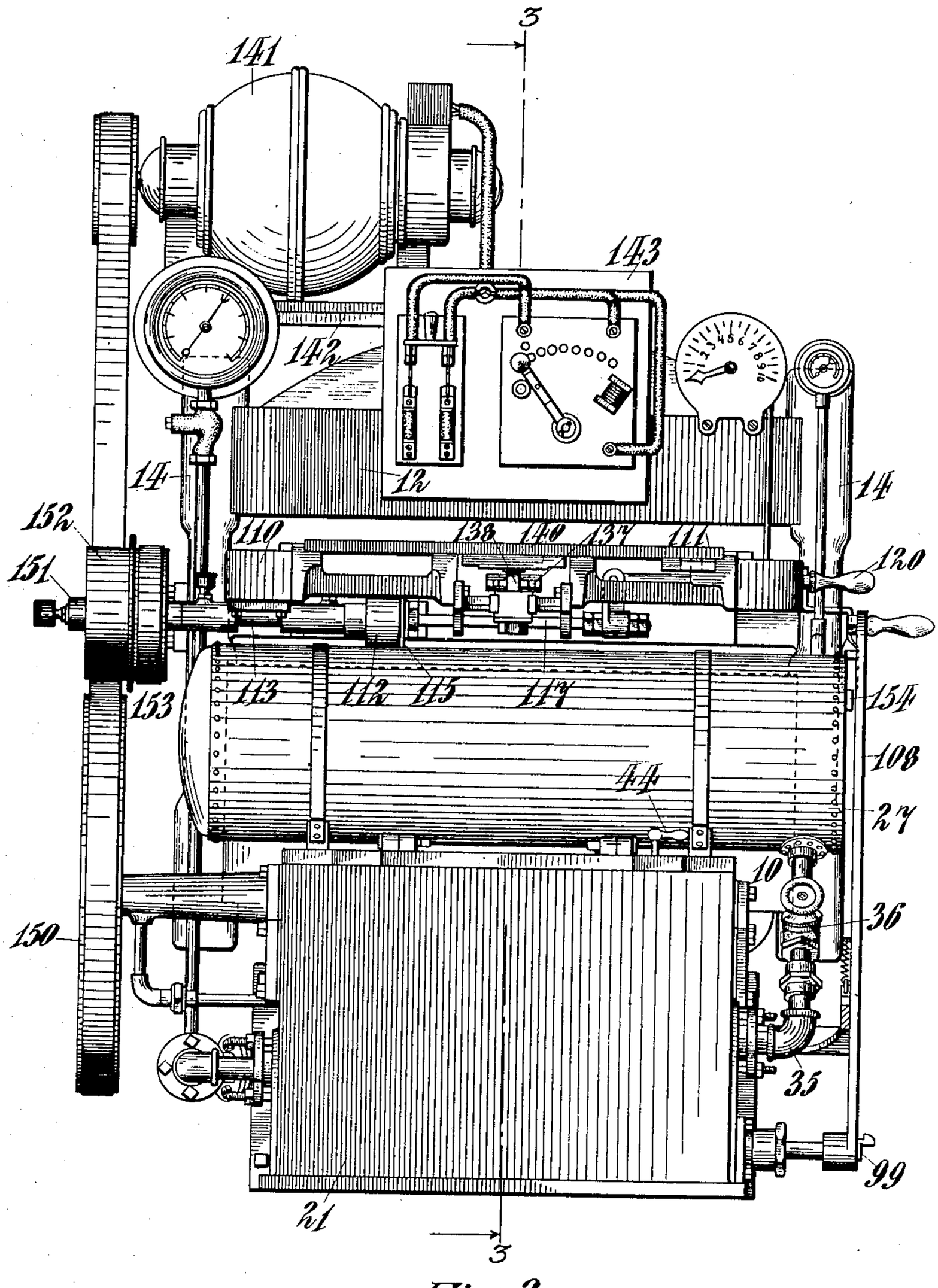

Fig. 2.

Witnesses:
H. H. Cotton
B. O. Henning

Inventor:
Robert J. Gibbon.
By Redding Liddle & Greeley
Attys

R. J. GIBBON.

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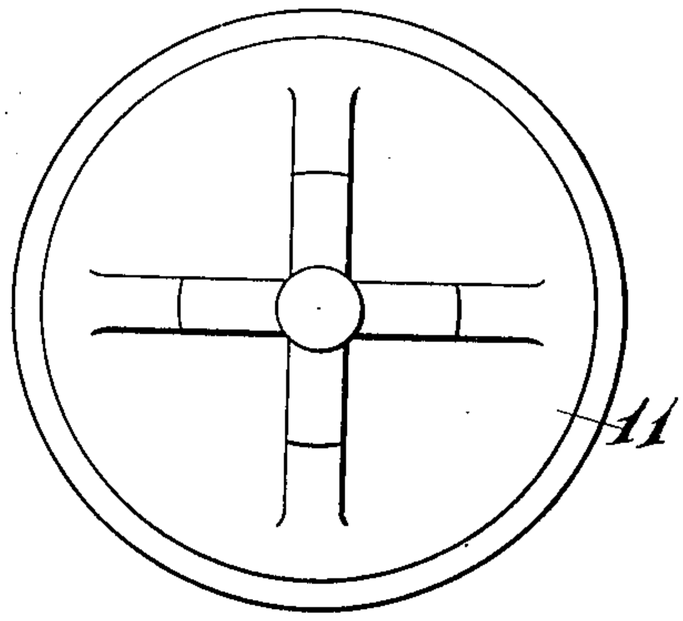

Fig. 12.

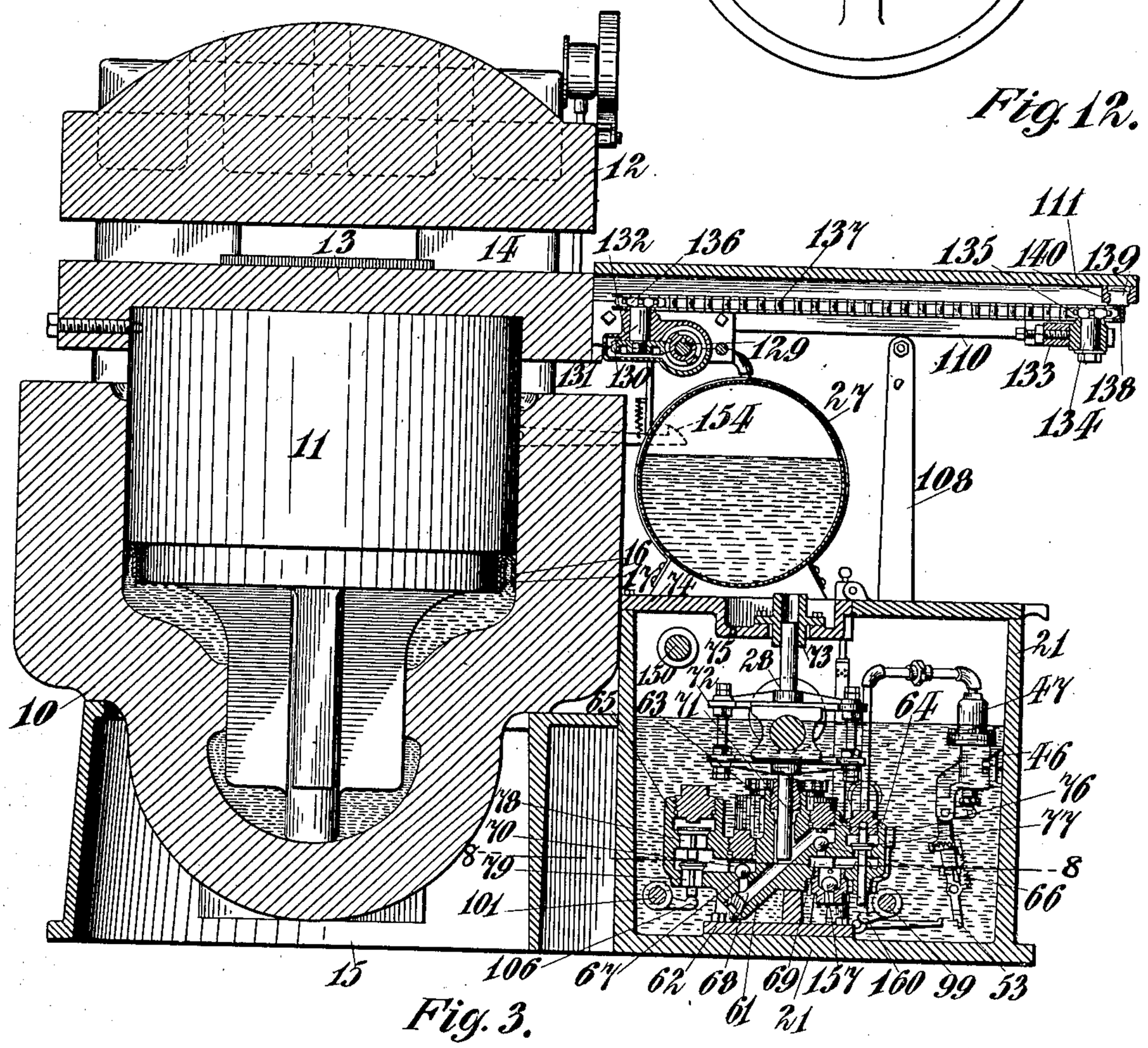

Fig. 3.

Witnesses:
W. H. Cottom
B. O. Henning

Inventor:
Robert J. Gibbon.
By Redding & Ridout & Greeley
Attys.

R. J. GIBBON.

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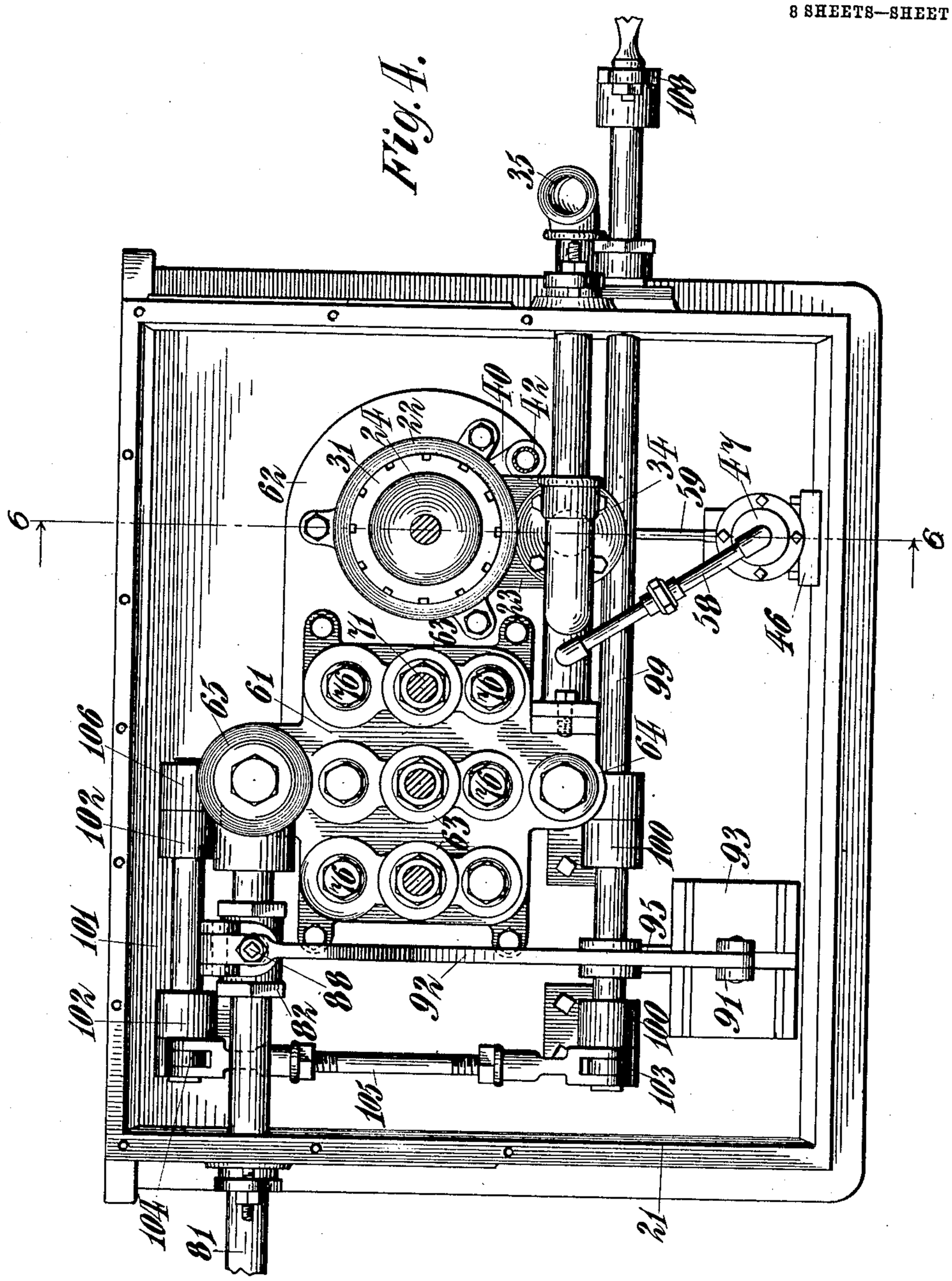
8 SHEETS—SHEET 4.

Fig. 4.



Witnesses:
W. H. Cotton
O. O. Hemming

Inventor:
Robert J. Gibbon.
By Redding, Siade & Roche
Attys.

R. J. GIBBON.

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8 SHEETS—SHEET 5.

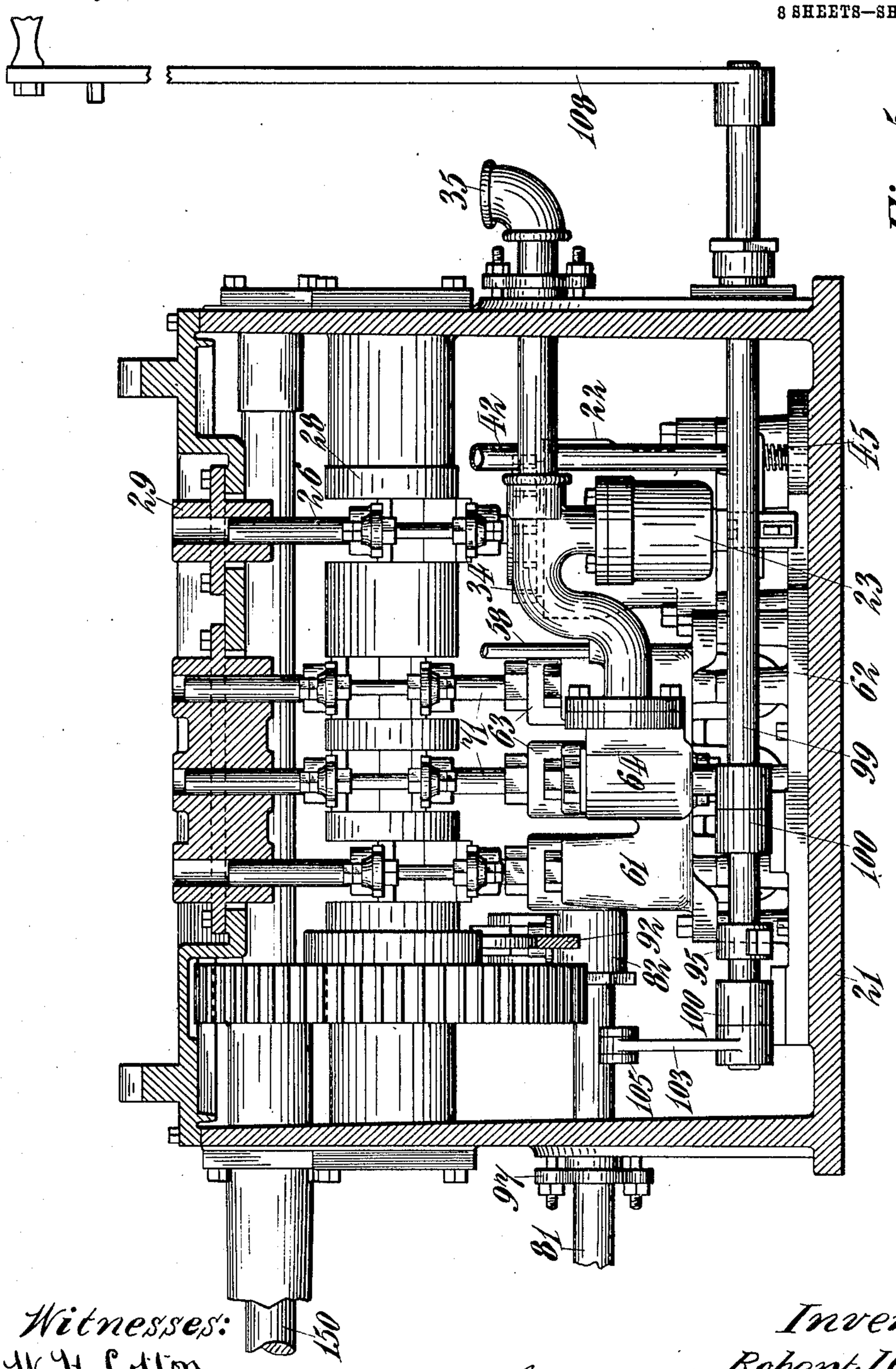

Fig. 5.

Witnesses:
W. H. Colton
B. O. Henning

Inventor:
Robert J. Gibbon.
By Redding, Liddell & Greeley
Attys.

R. J. GIBBON.

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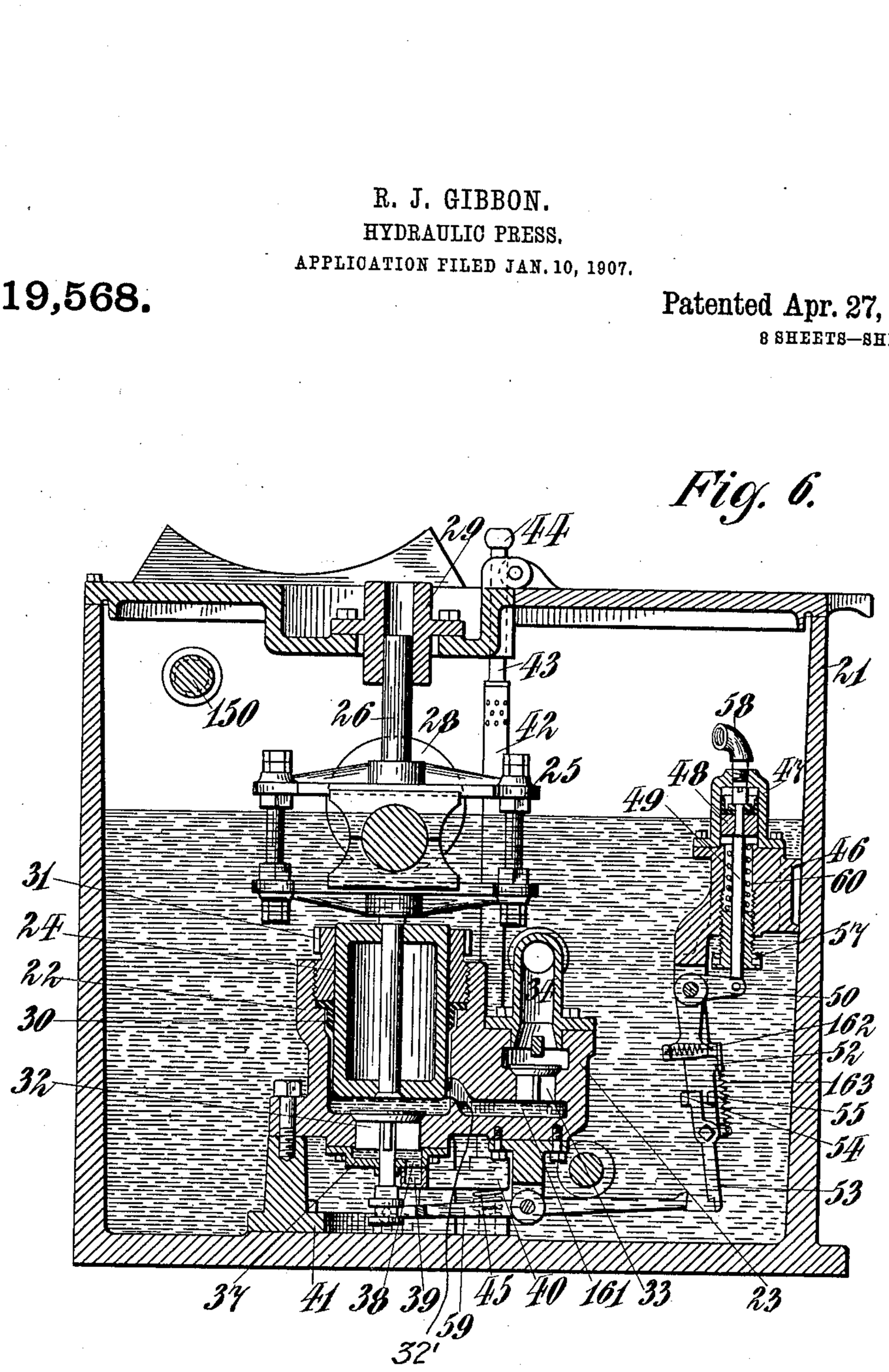
8 SHEETS—SHEET 6.

Fig. 6.



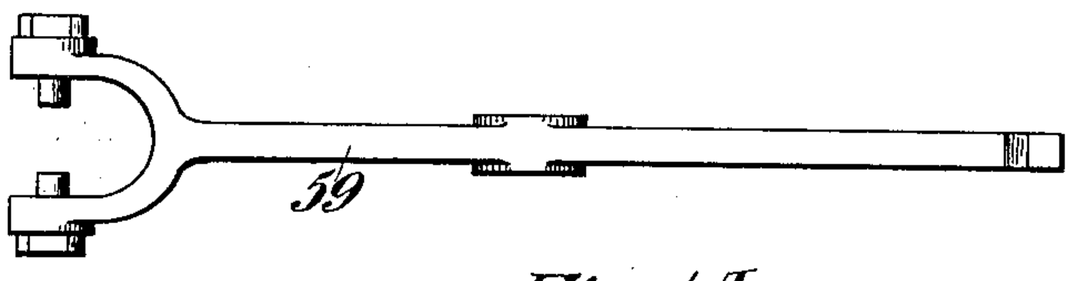


Fig. 14.

Witnesses:
W. H. Cotton.
B. O. Henning

Inventor:
Robert J. Gibbon.
By Redding, Lidde & Greeley
Attys.

R. J. GIBBON.

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8 SHEETS—SHEET 7.

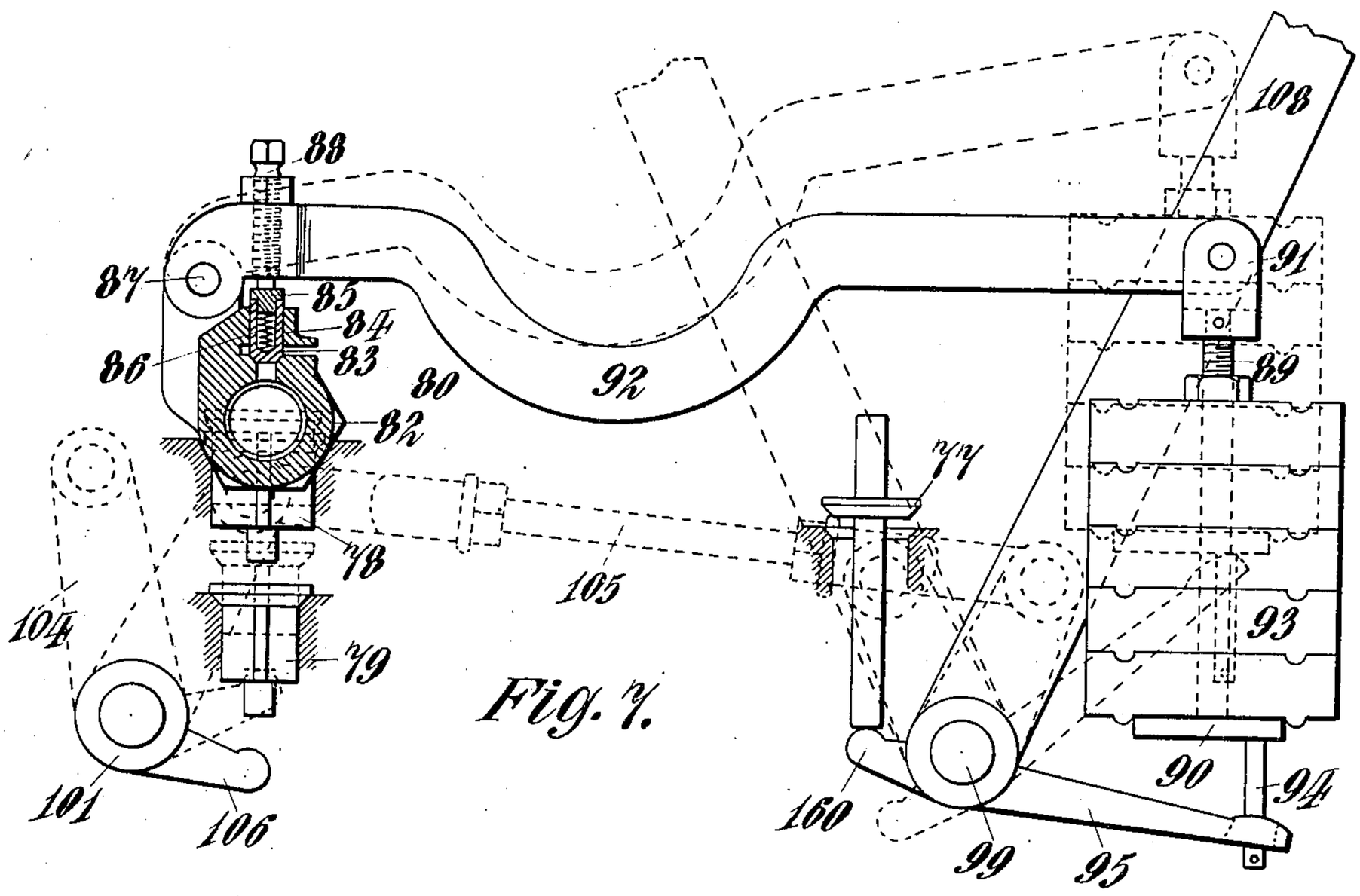

Fig. 7.

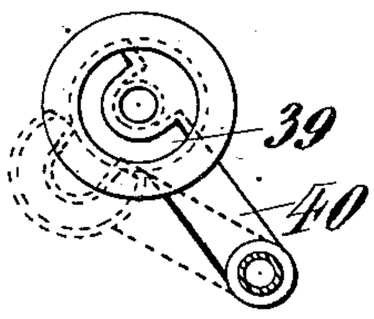

Fig. 13.

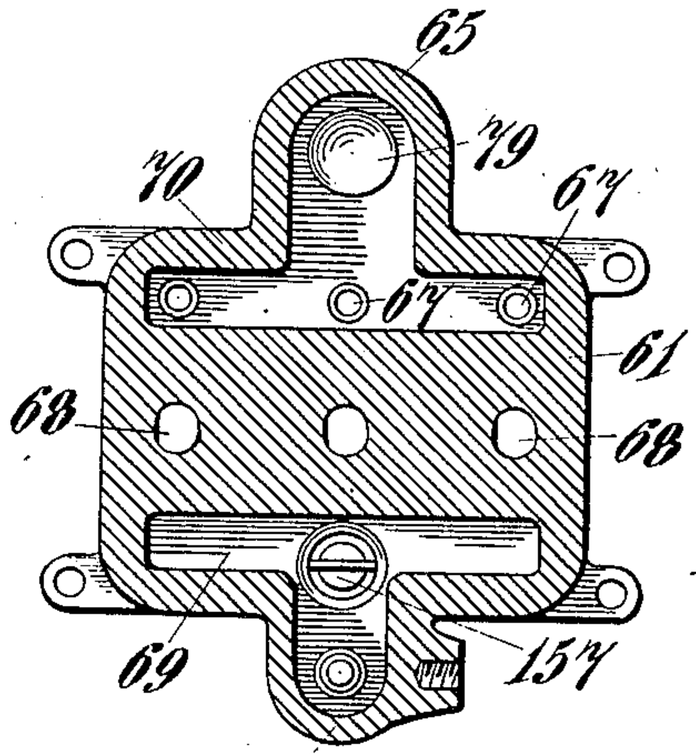

Fig. 8.

64

Witnesses:
W. H. Cotton
[illegible]

Inventor:
Robert J. Gibbon.
By Redding Siddall & Gregory
Attys.

R. J. GIBBON.

HYDRAULIC PRESS.

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919,568.

Patented Apr. 27, 1909.

8 SHEETS—SHEET 8.

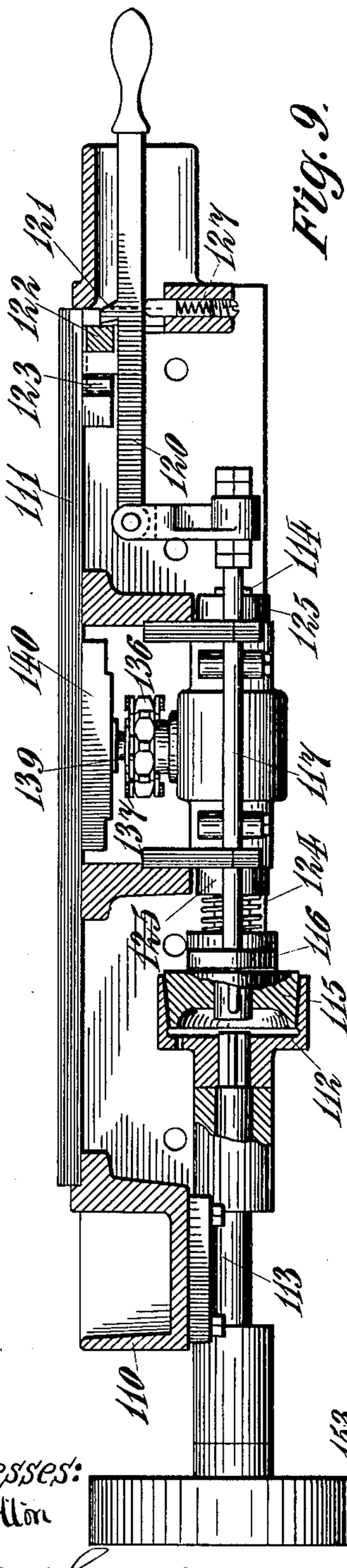

Fig. 9.

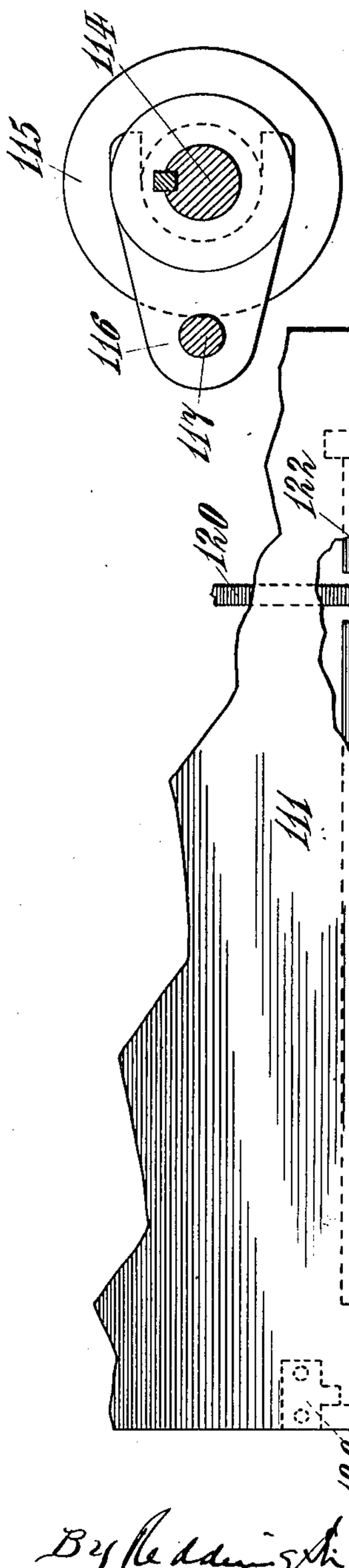

Fig. 11.

Fig. 10.

Witnesses:
W. H. Collon
B O Henning

Inventor:
Robert J. Gibbon.
By Redding Ridout & Gocey
Attys.

UNITED STATES PATENT OFFICE.

ROBERT J. GIBBON, OF CHICAGO, ILLINOIS, ASSIGNOR TO F. WESEL MANUFACTURING COMPANY, OF BROOKLYN, NEW YORK, A CORPORATION OF NEW YORK.

HYDRAULIC PRESS.

No. 919,568. Specification of Letters Patent. Patented April 27, 1909.

Application filed January 10, 1907. Serial No. 351,604.

To all whom it may concern:

Be it known that I, ROBERT J. GIBBON, a citizen of the United States, and a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Hydraulic Presses, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

The invention relates particularly to molding presses such as are employed in the manufacture of electrotype plates, and, while the general object of the invention is to provide a hydraulic molding press suitable for use in electrotype plants, the several features of the invention will find application both alone and in combination in hydraulic presses of various kinds.

Hydraulic presses, particularly where excessive pressures are to be developed, are generally characterized by extreme slowness of operation. The movement of the ram, for instance, which is necessary to bring the work against the abutment, is, as a rule, very slow. In the present case one of the objects has been toward rapidity of operation. To this end, means are provided to cause the ram to move rapidly, in the first instance, in connection with other means for developing the higher pressures after the ram has moved sufficiently for the compression to take place. Moreover, the improvements embody particular relations between the different parts of the mechanism of a hydraulic press, whereby the operation is to a large extent automatic, thus making it move rapidly as well as rendering the manipulation of the press particularly easy and convenient for workmen. In addition to these features of the invention, improved means have been provided for storing energy, of raising the potential of the stored energy, and of transmitting such energy to the parts which are to be operated thereby. Furthermore the invention comprises improved means for releasing or relieving the pressure in the working cylinder after the desired compression has been effected.

The invention also includes a conveying mechanism for delivering the work into the press and returning it from the press, which mechanism is largely automatic and yet under the manual control of the operator.

The invention will be more fully described in connection with the accompanying drawings in which the several features thereof have been embodied in a hydraulic molding press suitable to be used in an electrotype plant.

In such embodiment, Figure 1 is a view in side elevation of the complete machine, Fig. 2 is a view in front elevation. Fig. 3 is a view in vertical section taken on a plane indicated by the line 3—3 of Fig. 2. Fig. 4 is a plan view, on a slightly larger scale, of the pumping mechanism contained within the tank. Fig. 5 is a view in vertical section through the tank, on the same scale as Fig. 4, showing the pumping mechanism in front elevation. Fig. 6 is a view in vertical section through the tank, on the same scale, the plane of the section being indicated by the line 6—6 in Fig. 4. Fig. 7 is a sectional view of the safety valve, upon a still larger scale, with some of the adjacent parts indicated for the purpose of more clearly illustrating the relation of these parts to each other and to the operating lever. Fig. 8 is a detail sectional view of the pump, the plane of the section being indicated by the line 8—8 in Fig. 3. Fig. 9 is a view, partly in elevation and partly in section, showing the front of the work-plate together with its lateral support and the mechanism for moving the work-plate. Fig. 10 is a detail plan view, partly broken away, of the work-plate and its support. Fig. 11 is a detail view of a portion of the mechanism for moving the work table. Fig. 12 is a plan view of the ram as seen from below. Fig. 13 is a detail view of the lower portion of air attachment for the reservoir pump, and, Fig. 14 is a plan view of a lever controlling the intake valve of the reservoir pump.

In order that the relation of the several parts may be the more readily understood as the description proceeds, a brief outline of the general operation of the press will be given at the outset. Assuming that the work is in position above the ram, the operating lever of the press is moved to establish communication between a reservoir, in which pressure is stored, and the working cylinder in which the ram moves. The energy stored in the reservoir is preferably in the form of liquid under air compression, and as soon as the operating lever has been thus moved, this liquid flows rapidly into the cylinder

and raises the ram until the work upon the ram is brought into contact with the abutment plate. In the conduit, through which the liquid flows from the reservoir to the cylinder, is the high pressure pump, or simply "the pump" as it will be referred to hereinafter. The plunger of this pump, is arranged to run continuously, but the liquid is permitted to flow through the pump from the reservoir to the cylinder without being acted upon by the pump, until the ram has been raised to such a position that the pressures in the conduit on both sides of the pump are equal or balance each other. The pump is provided with suitable gravity or other check valves, which, at this stage, drop into operative position and enable the pump to act upon the liquid in the conduit in such a way as to force the liquid into the cylinder, thus developing the required pressure. When the work of compression has been effected, the operating lever is moved to its other extreme position to release or relieve the pressure in the cylinder and to cut off communication between the cylinder and the reservoir. The latter is filled by an auxiliary pump in connection with which automatic means are provided for controlling the intensity of pressure within the reservoir.

Referring particularly to Figs. 1 and 3, the cylinder 10 with its ram 11 is suitably supported upon a base 15. The upper platen or abutment plate 12 is connected to the cylinder by means of appropriate tension frames 14, and the ram may carry as usual the lower platen 13. The ram, as will be understood, is designed to reciprocate in the cylinder and is provided with the usual hydraulic packing ring 16 which is retained in position by a band 17.

The pump, which in the present case happens to have three cylinders, is indicated in the drawings by the reference character 61 (Figs. 3, 4 and 5). This pump is located within a tank 21 upon the top of which is the pressure reservoir 27. The reservoir is connected with the cylinder by a conduit which includes the pipe 35 (Figs. 2 and 5), the trap fitting 34, the valve chamber 64 of the triple pump, the canal 68 and valve chamber 65 of the triple pump (Figs. 2 and 3), and the delivery pipe 81 (Fig. 1). The several cylinders of the triple pump are indicated by the reference character 63 and their plungers by the reference character 71. Each of these plungers is connected by a cross head movement to a crank shaft 28 and is provided with a rod which works in a member 73 bolted to the lid 74 of the tank or pump box, in order to guide the several plungers. Preferably the member 73 is secured in a cupped recess of the lid which construction, besides adding to the stability of said member, serves to catch any leakage of oil that may pass through the guide which is returned to the box through the perforations 75.

Within the valve chamber 64 (Fig. 3) a reservoir check valve 77 is provided to control the discharge of liquid from the reservoir, and on the other side of the pump a cylinder check valve 78 is provided to control the return of the liquid from the cylinder after the compression has been effected. Both of these valves, as will be explained hereinafter, are under the control of the operating lever 108. Each of the cylinders of the pump, which is suitably mounted upon a sub-base 62 bolted to the bottom of the tank, is provided with an intake check valve 66 and a discharge check valve 67 which are arranged so as not to interfere with the free flow of liquid from the reservoir through the pump and into the cylinder. These valves are preferably ball valves which will seat themselves by gravity when conditions permit, being limited in their movements by plugs 76 disposed vertically over the same in the main body of the pump.

Besides the reservoir check yalve 77 and the cylinder check valve 78, the triple pump is provided with an eduction valve 79, located preferably directly underneath the cylinder check valve 78 and so related to that check valve that when the former is raised to its fullest extent to open the eduction port it will also raise the cylinder check valve thus opening the port controlled by that valve. Finally the triple pump is provided with an intake or circulator valve 157 whereby liquid may be introduced into said pump directly from the tank 21.

Fig. 3 represents the normal condition of the parts before the ram is driven up. In this condition, the eduction valve 79 is slightly raised to open the eduction port and the reservoir check valve 77 is seated so as to cut off communication between the reservoir and the pump. It will thus be seen that at this stage the three plungers of the pump operate to circulate the liquid through the pump simply, the liquid entering in by the valve 157 to the ports 69 of each cylinder and being discharged through the ports 70 and finally returning to the tank through the eduction port controlled by the valve 79. The energy consumed in pumping the liquid through this by-pass is extremely small and therefore negligible.

Assuming now that the work is in position between the ram and the abutment and that the parts are otherwise in the positions represented in Fig. 3, the operator pulls the handle 108 toward him. This handle is secured upon a shaft 99 journaled in bearings 100 bolted to the sub-base 62. Behind the pump is another shaft 101 journaled in bearings 102 bolted to the sub-base 62, which shaft is parallel to the shaft 99 and is operatively connected therewith through a link

105 which joins levers 103 and 104 upon each of these shafts respectively. The shaft 99 (Fig. 3) has an arm 160 which is adapted to engage the reservoir check valve 77 and the lever 101 has a similar arm 106 which is adapted to engage the eduction valve 79. When the operator pulls the lever 108 forward, the arm 160 will operate to lift the reservoir check valve 77 and the arm 106 will be depressed thereby permitting the eduction valve 79 to seat itself. Thus, with the lever 108 in this extreme position and the valves thus disposed, liquid will flow from the reservoir through the pump past the cylinder check valve 78 through the pipe 81 and into the cylinder 10 to raise the ram 11. When the pressure in the cylinder and the pressure in the reservoir balance, the check valves 66 and 67 will drop and the pump is thus automatically thrown into effective operation. It should be particularly noted that during the operation of the pump at this stage, the liquid flows into it without suction for, the reservoir check valve 77 being open, the pressure in the reservoir will force the liquid into the pump during what would otherwise be the suction strokes of the several pistons, thus giving precisive action to the valves and excluding all possible cause for the induction of air.

When the compression has been effected, as may be indicated by a suitable pressure gage, the lever 108 is pushed to its extreme backward position where it is caught and held by a spring detent 154 pivoted to the side of the cylinder. In this position of the lever 108, the reservoir check valve 77 drops upon its seat and the eduction valve 79 has been raised to its fullest extent in which case, as was heretofore explained, the cylinder check valve is also raised to permit the release of pressure in the cylinder, the liquid in the cylinder flowing back through the pipe 81 and the eduction port into the tank and permitting the ram to return to its first position. When the ram has returned to its first position, the latch 154 releases the operating lever 108 which settles back by gravity into its intermediate position, illustrated in Fig. 3. This permits the eduction valve 79 to settle sufficiently to allow the cylinder check valve 78 to drop upon its seat again thus stopping the further flow of liquid from the cylinder.

In addition to relieving the pressure in the cylinder through the cylinder check valve 78 in the manner thus described, this pressure also finds relief through a safety valve which is disposed in the pipe 81 and serves the double function of releasing the pressure in the cylinder after the compression and of providing against excessively high pressure during the compression. This valve may consist of the following parts: A body 82 (Fig. 7) having threaded engagement with the discharge conduit 81 is provided with a seat for the valve 83 guided by a perforated lug 84. The valve is provided with a head 85, having a teat extending into same and between the teat and the valve lies a compression spring 86. A lever 92 is pivoted to the body by a pivot pin 87 and is provided with an adjusting screw 88 which lies directly over the valve. A weight hanger consisting of a threaded bar 89 having a base 90 and a link connection 91 is pivoted on the end of the lever 92 remote from the body 82 of the valve. This weight hanger is adapted to carry a plurality of weights 93 slotted so that they may be slid into position, a nut serving to hold the weights to the base. Extending below the base of the weight hanger is a pin 94 which passes through a perforation in an arm 95 which is keyed to the operating shaft 99 and is adapted to receive an oscillatory movement.

When the operating lever 108 has been moved to its extreme rearward position to release the pressure in the cylinder, as has been described above, the arm 95, as indicated in the dotted lines of Fig. 7, raises the lever 92, thus removing the high tension tending to hold the safety valve upon its seat. In this way the safety valve serves as a relief for the pressure in the cylinder after the compression has taken place, thus assisting the cylinder check valve 78 and easing the lifting of the valves 78 and 79 just previous to the lowering of the ram. It should be noted however, that the spring 86 within the valve plug 83 is of sufficient strength to retain the valve upon its seat after the ram has reached it lowest position, thus overbalancing the pressure due to the head of liquid in the press cylinder and thus preventing the liquid in the press cylinder from flowing out. It is obvious that if the liquid flowed out of the cylinder, air would be admitted past the packing of the ram resulting in the spasmodic and slow action of the ram.

The pressure in the reservoir 27 is established by means of an auxiliary pump which is also located in the receptacle or tank 21. This pump (Fig. 6) has a cylinder 22, a valve chamber 23 extending laterally therefrom, a plunger 24 connected by a cross head movement to a crank shaft 28, a rod 26 attached to the cross head 25 and a guide 29 bolted to the lid of the receptacle. A packing ring 30 and a gland 31 may be provided, as usual, to prevent leakage. This pump has a relatively large induction which is controlled by a valve 32, to permit the easy access thereto of the comparatively heavy liquid which is preferably employed in the operation of the apparatus. The pump discharges through a port 161, the trap fitting 34 and pipe 35 into the reservoir 27, a check valve 33 being provided between the trap fitting 34 and port 161. It will thus be seen

that this pump discharges through a portion of the conduit through which liquid flows from the reservoir to the cylinder during the upward movement of the ram. A gate valve 36 is preferably interposed in the piping 35 as a convenient means of preventing leakage from the reservoir when the press is not in use. In connection with this pump, automatic means are provided to control the intensity of pressure in the reservoir whereby a constant pressure may always be maintained therein. A convenient device for this purpose is comprised in the following mechanism: A piston 48 contained within a suitable cylinder casting 47 is suitably mounted upon a base 46 bolted to the forward wall of the receptacle 21. A spring 60 mounted within the base 46 causes the piston to react against the reservoir pressure within the cylinder 47 which communicates with the reservoir through a pipe 58 which connects the same with the trap fitting 34, and an adjusting nut 57 may be provided to regulate the tension of the spring. The piston has a rod 49 which is connected to a bell crank lever 50 pivoted on an extension 51 from the base 46 to which extension is also pivoted a swinging arm 52 carrying a pivoted member 53 on the lower end thereof. Fulcrumed directly below the discharge valve chamber 23 is a lever 59 one end of which is operatively connected with the induction valve 32 of the reservoir pump while the other end is adapted to be engaged by the pivoted member 53 upon the swinging arm 52. It will be obvious that as liquid under pressure is delivered to the cylinder 47 through the pipe 58, the piston and its rod will be depressed thereby moving the bell crank lever 50. This lever is connected to the arm 52 by a spring 162 whereby as the piston moves downwardly, the arm will be swung forward toward the pump until the member 53 is in contact with the lever 59. The member 53 is limited in its movements by two lugs 54 and 55 on the arm 52 and is normally held against the lug 54 by a spring 163. When, in the forward movement of the arm 52, the member 53 reaches the lever 59, it is yieldingly held against said lever through the spring 162 and upon the next induction stroke of the pump it engages said lever thereby holding up the induction valve 32 and thus interrupting the action of the pump. As soon as the pressure drops, as will be obvious, the piston 48 will rise and the arm 52 will be drawn back, the member 53 swinging slightly as the arm 52 commences its backward movement and permitting the arm 52 to be disengaged from the lever 59 without resistance.

It may often happen that it will be desirable to fill the reservoir with a given head of liquid and to raise the potential of the liquid by pumping air into the reservoir. For this purpose means are provided to adapt the reservoir pump to supply air to the reservoir as well as oil. These means may comprise a cap or valve seat 37 having a semicircular port 38 (Fig. 13) which registers with a similar port 39 in an arm 40 pivotally connected to the pump sub-base 41; from the arm 40 a pipe 42 perforated at its top, rises vertically and to which is attached a stem 43 and handle 44 through which the arm 40 may be oscillated so as to draw the two semicircular ports into register. While the ports thus register, the induction of oil will be prevented and air will be drawn into the pump through the perforations in the pipe 42 which of course should be above the oil level. A spring 45 is provided so as to hold the arm 40 tightly against the valve seat 38.

It will be clear from Fig. 6 that the piston of the pump which works vertically has a clearance with the bottom of the pump chamber or cylinder head in which the valve 32 is located, and when the pump is used as an air compressor, as just explained, it is desirable to avoid the effect of this clearance space in some way so that the action of the pump may be the more effective. Under conditions of operation, the space between the cylinder head and the bottom of the plunger when the latter is at its lowest point as in Fig. 6, is at all times filled with liquid, and as this space represents the clearance referred to, it will be clear that the liquid in this space will have the desired effect. Moreover, a dam 32′ will retain liquid in the space 161 so that this space leading from the discharge port of the pump will always be filled with liquid. Thus, when the pump is used for air, the presence of liquid in the clearance space of the pump and in the space 161 (between the discharge port of the pump and the check valve 33), will make the pump much more effective in operation than if air were allowed to fill these spaces.

In Figs. 1, 2, 3, 9 and 10 is shown a lateral support or shelf 110 extending from and bolted to the lower platen 14. This support carries the work-plate 111 suitably guided and in such a position that it may slide from the shelf 110 to a position between the upper and lower platens. This plate is moved horizontally from its position upon the lateral shelf to its position between the platens by means of mechanism which is set in operation by a hand controlled lever 120 or some other equivalent means and which is automatically stopped in both of its resting positions by automatic means. This mechanism and automatic means will now be described.

Referring particularly to Figs. 3 and 9, it will be seen that a shaft 113 journaled in suitable bearings upon the shelf 110 is provided with a friction clutch, one member 112 of which is rigidly keyed thereto and rotates therewith. The other member 115 of

the clutch is slidably secured upon a shaft 114 journaled in bearings 118 upon the shelf 110 and arranged axially with respect to the shaft 113. The clutch member 115, which is thus movable longitudinally upon the shaft 114 and rotates therewith, is engaged by a forked member 116 upon a slide rod 117 to which the handle or trigger 120 is pivoted, a spring 124 being provided which constantly urges the two clutch members into engagement. The shaft 114 is provided with end thrust collars 125 and is also provided with a worm 129 (Fig. 3) rigidly keyed thereto. This worm operates a worm gear 130 (Fig. 3) upon a vertical shaft 131 having a bearing 132, a worm gear casing being preferably employed and which may be filled with oil for lubricating purposes. Upon the end of the shelf remote from the worm gearing is provided an adjustable bearing 133 which carries a vertical shaft 134 to which a sprocket 135 is secured, which sprocket is in line with a sprocket 136 on the shaft 131. Around these sprockets runs an endless chain 137 which is provided with a special link 138 containing a pivot pin adapted to rotate in a block 139 slidably connected to the work-plate in a guide 140. It will thus be seen that when the two clutch members 114 and 115 are in engagement, the sprocket chain will travel around its sprockets and reciprocate table 111. The clutch members are normally withheld from engagement, however, against the action of the spring 124, by means of a cam 122 which coöperates with a projection 121 upon the handle or trigger 120. This cam (Fig. 10) preferably consists of a long strip slidable in the lateral support 110 and provided at each end with a projection adapted to be engaged, when the table is near either of its limiting positions, by a lug 123 rigidly secured to the underside of the table. A portion of the strip 122 is cut away to form what may be referred to as a cam surface and the operation of this part of the mechanism is as follows: When the table is resting in either of its positions, the projection 121 rests at one side or the other of the cut in the slide 122. After the handle or trigger 120 has been depressed, the spring 124 will draw in the slide rod 117 thus throwing in the clutch and drawing the projection 121 underneath the cam or slide 122. As soon however, as the table has reached the limit of its movement, the projection 123 thereon will move the slide so that the projection 121 will register with the cut in the slide. At this point, the trigger 120 together with the projection 121 will be forced upwardly by a spring 127 underlying the trigger 120 so that the projection 121, riding as it does upon the cam surface of the strip 122, will, as the latter continues to move, be drawn out of the cut therein. This, as will be obvious, will serve to draw back the sliding rod 117 until the clutch members have been disengaged and the movement of the table checked. It will be clear, moreover, that the table will be automatically checked by means of this mechanism as it moves into the machine between the platens and also as it moves back again upon its lateral support.

In Figs. 1 and 2 a motor 141 is conventionally illustrated and is shown to be adjustably connected to a sub-base 142 bolted rigidly to the upper platen and left tension frame. There is also similarly shown a starting box 143 together with the motor connections. The motor is belted to a shaft 150 journaled in bearings upon the receptacle or tank 21. An idle shaft 151 which has secured thereto a double pulley 152 which is driven from the motor belt and from which a belt extends to the pulley 153 upon the shaft 113. It will be seen therefore, that the pump is constantly in action and that the shaft which furnishes power to the work-plate intermittently is rotated continuously.

No claim is made herein to the work table just described, the same having been made the subject of a separate application which was filed May 8, 1907 and is Serial No. 372,585.

In the drawings several gages are shown for indicating the pressures and the like, and it will be understood that their employment and manner of attachment may be such as convenience or particular conditions dictate.

It will be understood that the tank 21, when the machine is in use, will be supplied with a suitable liquid. For a pump designed to be used in the manufacture of electrotype plates, it seems preferable to employ a comparatively heavy oil for this purpose, but the character of the liquid, as will be obvious, is immaterial to the present invention. It is also immaterial to the present invention that the improvements be embodied in the same form in connection with which they have been illustrated and described herein, and it is equally immaterial to the invention that a press containing the improvements be applied or adapted to a particular use.

I claim as my invention:—

1. In a hydraulic press, the combination of a pressure reservoir, a pump to establish the pressure in the reservoir, a tank to hold liquid for the pump, a tube with perforations at one end supported so that its other end can be operatively connected with the inlet of the pump whereby air may be supplied to the inlet instead of liquid, and means for adjusting the position of the tube.

2. In a hydraulic press, the combination of a pressure reservoir, means manually adapted for pumping air or liquid into the

reservoir whereby the reservoir may be supplied with a given head of liquid under a given air pressure, and automatic means for controlling the first named means to regulate the intensity of the pressure.

3. In a hydraulic press, the combination of a pressure reservoir, means manually adapted for pumping air or liquid into the reservoir whereby the reservoir may be supplied with a given head of liquid under a given air pressure, and means for controlling the first named means to maintain a constant pressure in the reservoir.

4. In a hydraulic press, the combination with the cylinder, and the ram, of a reservoir, a pump to establish the pressure in the reservoir, an attachment for the inlet of the pump manually adaptable to supply either liquid or air thereto, a conduit connecting the reservoir with the cylinder, and automatic means for interrupting the operation of the pump.

5. In a hydraulic press, the combination of a pressure reservoir, a tank, a pump to establish pressure therein having its induction near the bottom of the tank, and automatic means including an arm adapted for yielding engagement and frictionless disengagement to retain the pump induction open at the maximum reservoir pressure.

6. In a hydraulic press, the combination of a pressure reservoir, a pump to establish the pressure in the same, an intake valve for the pump, a lever connected thereto, a spring actuated piston subject to the pressure in the reservoir, and an arm adapted to be moved yieldingly into engagement with said lever and having a pivoted member through which the engagement is effected and by means of which member the release of said arm from the lever can take place without resistance.

7. In a hydraulic press, the combination of a pressure reservoir, a pump to fill the same, an intake valve for the pump, a lever connected thereto, a cylinder communicating with the reservoir, a piston in the cylinder provided with a spring to cause the piston to re-act against the reservoir pressure, a bell crank lever one arm of which is operatively connected with the piston, a swinging arm, a member pivoted upon the end of the arm, and a loose connection between said arm and bell crank lever, for the purpose set forth.

8. In a hydraulic press, the combination with the cylinder, ram and pump, of a pressure reservoir, means to maintain a substantially constant pressure in the reservoir, a conduit leading from the reservoir through the pump into the cylinder, and means to throw the pump into effective operation automatically when the pressure on both sides of the pump are in equilibrium.

9. In a hydraulic press, the combination with a cylinder, ram and pump, of a pressure reservoir, means to maintain a substantially constant pressure in the reservoir, a conduit leading from the reservoir through the pump into the cylinder, means to drive the pump continuously, and means to throw the pump into effective operation automatically when the pressures on both sides of the pump are in equilibrium.

10. In a hydraulic press, the combination with a cylinder, ram and pump, of a pressure reservoir, means to maintain a substantially constant pressure in the reservoir, a conduit leading from the reservoir through the pump into the cylinder, and an intake gravity valve and a discharge gravity valve for the pump adapted to permit a flow through the pump from the reservoir until the pressure in the cylinder and reservoir balance and then to drop and throw the pump into effective operation automatically.

11. In a hydraulic press, the combination with the cylinder, ram reservoir and pump, the latter permitting liquid to flow freely therethrough from the reservoir to the cylinder, of a conduit leading from the reservoir through the pump into the cylinder, and a reservoir check valve and cylinder check valve in said conduit.

12. In a hydraulic press, the combination with the cylinder, ram reservoir and pump, the latter permitting liquid to flow freely therethrough from the reservoir to the cylinder, of a conduit leading from the reservoir through the pump into the cylinder, a reservoir check valve and an eduction valve in said conduit, and means to close one of the valves and open the other simultaneously.

13. In a hydraulic press, the combination with a cylinder, ram reservoir and pump, the latter permitting liquid to flow freely therethrough from the reservoir to the cylinder, of a conduit leading from the reservoir through the pump into the cylinder, a reservoir check valve, cylinder check valve and an eduction valve in said conduit, an operating lever, and connections from the operating lever to each of said valves whereby when said lever is in its intermediate position the eduction valve is open and the reservoir check valve is closed and when said lever is in one extreme position the reservoir check valve is open and the eduction valve is closed, while when said lever is in the other extreme position, the reservoir check valve is closed and the eduction and cylinder check valves are both open.

14. In a hydraulic press, the combination with the pump, cylinder and a conduit connecting the pump and cylinder, of an eduction valve, a cylinder check valve and a safety valve all in said conduit, and means to operate said valves simultaneously to relieve the pressure in the cylinder.

15. The combination with the cylinder and a conduit communicating therewith, of a safety valve in said conduit, means to hold the valve upon its seat under relatively low tension, means to hold the valve upon its seat under relatively high tension, and means to release the high tension valve holding means.

16. In a hydraulic press, the combination with the cylinder and a conduit communicating therewith, of a safety valve in said conduit, a relatively weak spring to hold the valve in position, a weighted lever also to hold the valve in position, and means to lift the weighted lever from the valve.

17. In a hydraulic press, the combination with a cylinder, ram and pump, of a pressure reservoir, a tank, a conduit leading from the pressure reservoir through the pump into the cylinder, means to fill the reservoir from the tank and means to discharge from the cylinder into the tank.

18. In a hydraulic press, the combination with the cylinder, ram and pump, of a pressure reservoir, a tank, a conduit leading from the tank to and through the reservoir to and through the pump and into the cylinder, and means to discharge from the cylinder into the tank.

19. In a hydraulic press, the combination with the cylinder, ram and pump, of a pressure reservoir, a tank, a conduit leading from the tank to and through the reservoir to and through the pump and into the cylinder, means to discharge from the cylinder into the tank, a reservoir check valve between the reservoir and pump, a cylinder check valve between the cylinder and pump, and an eduction valve.

20. In a hydraulic press, the combination with the cylinder, ram and pump, of a tank, a pressure reservoir adapted to receive liquid from the tank and to discharge into the pump, an eduction valve for the cylinder, and an intake valve for the pump to admit liquid from the tank to the pump directly.

21. In a hydraulic press, the combination of a reservoir, a pump means to supply fluid from the reservoir to the pump, a check valve in said means closing toward the pump, a discharge conduit from the pump, a tank, an eduction valve leading from the discharge conduit into the tank, and an intake valve for the pump whereby it may receive liquid directly from the tank.

This specification signed and witnessed this 15th day of December, 1906.

ROBERT J. GIBBON.

Signed in the presence of—

B. O. HENNING,

E. H. ERICK.