A. C. FERGUSON.

HYDRAULIC POWER APPARATUS.

APPLICATION FILED OCT. 28, 1908.

931,402.

Patented Aug. 17, 1909.

3 SHEETS—SHEET 1.

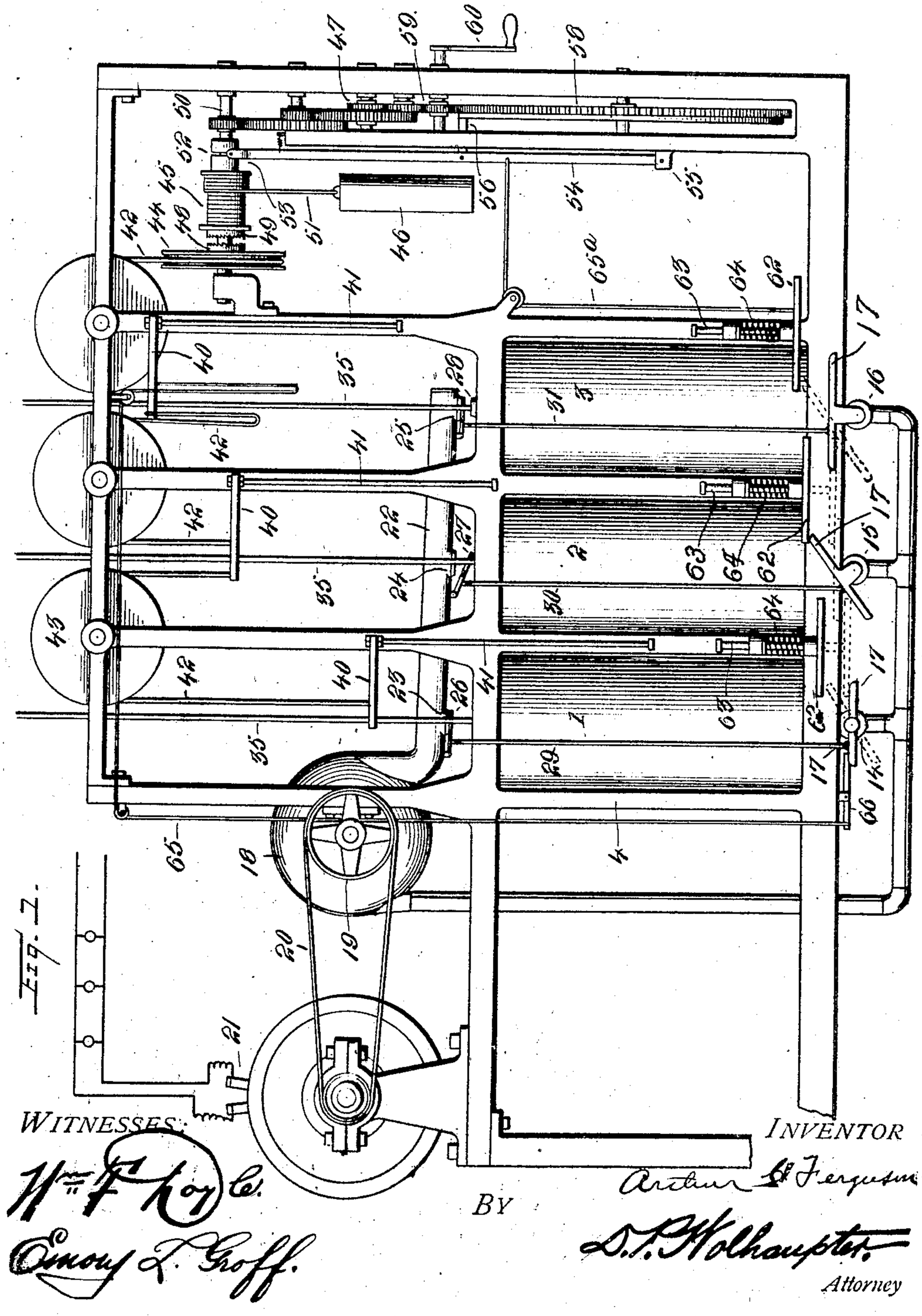

Fig. 1.

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3 SHEETS—SHEET 2.

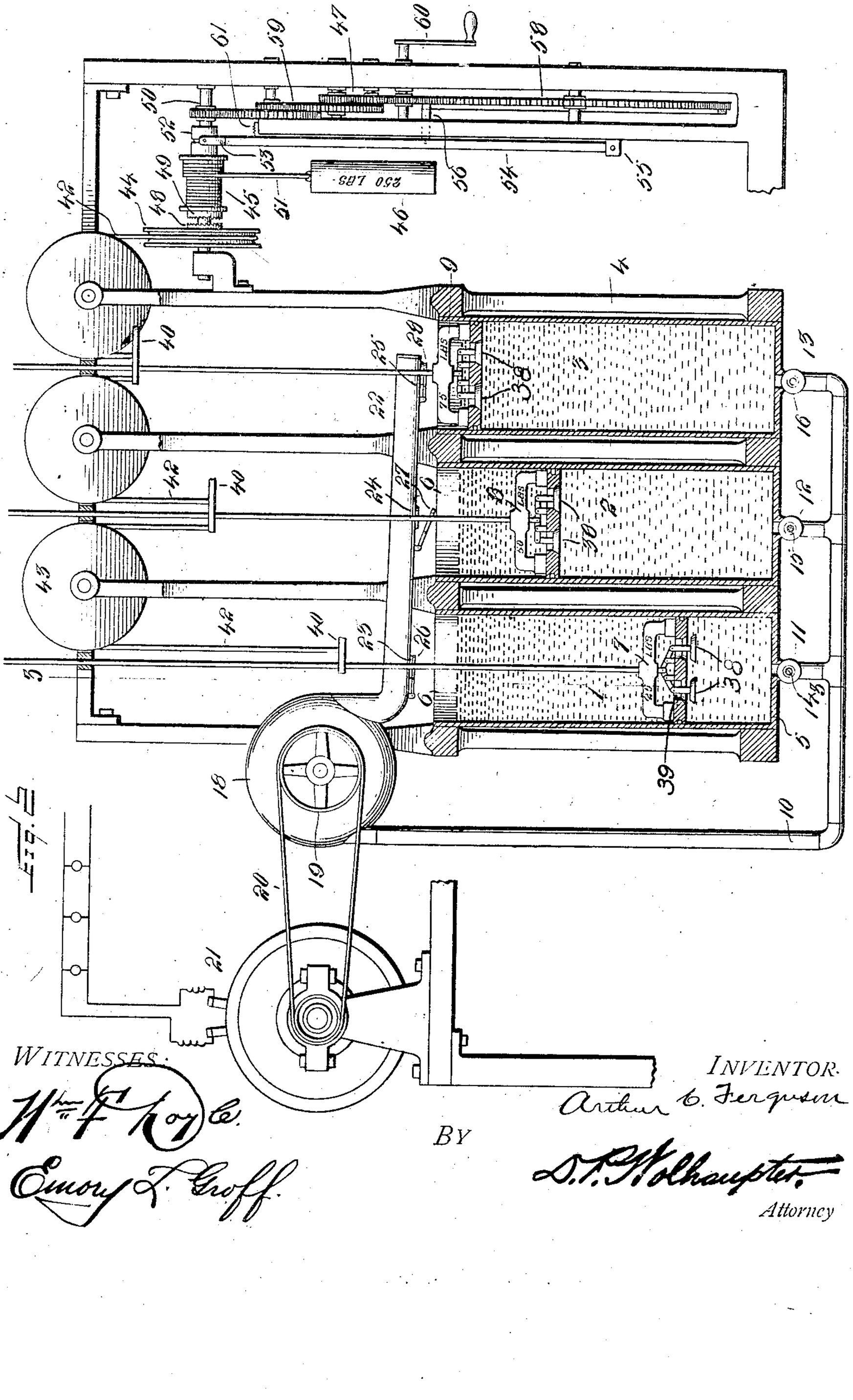

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 7.

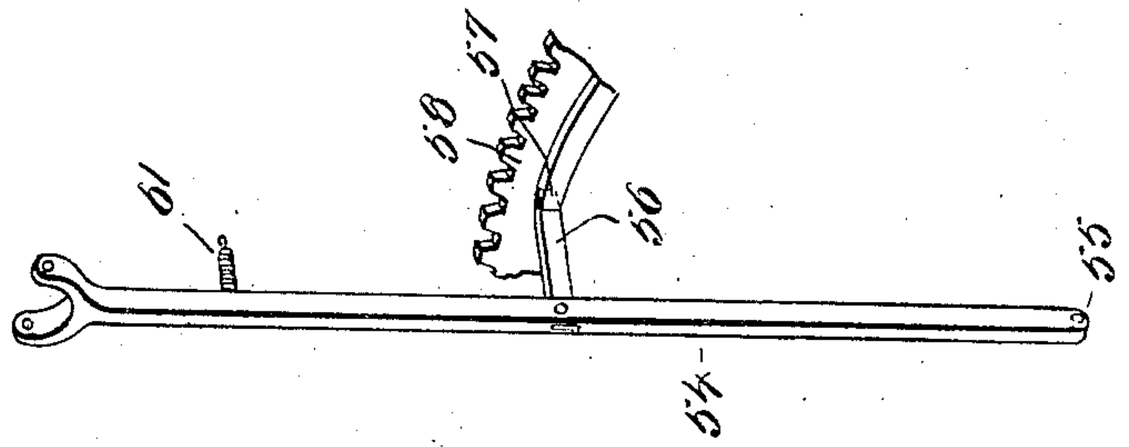


Fig. 5.

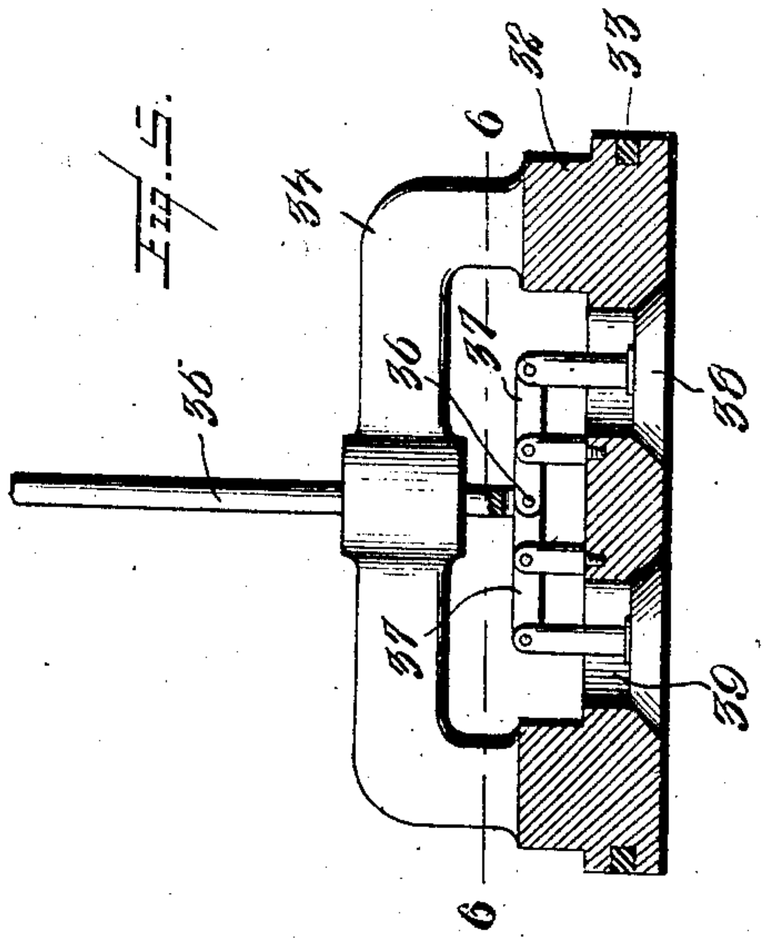
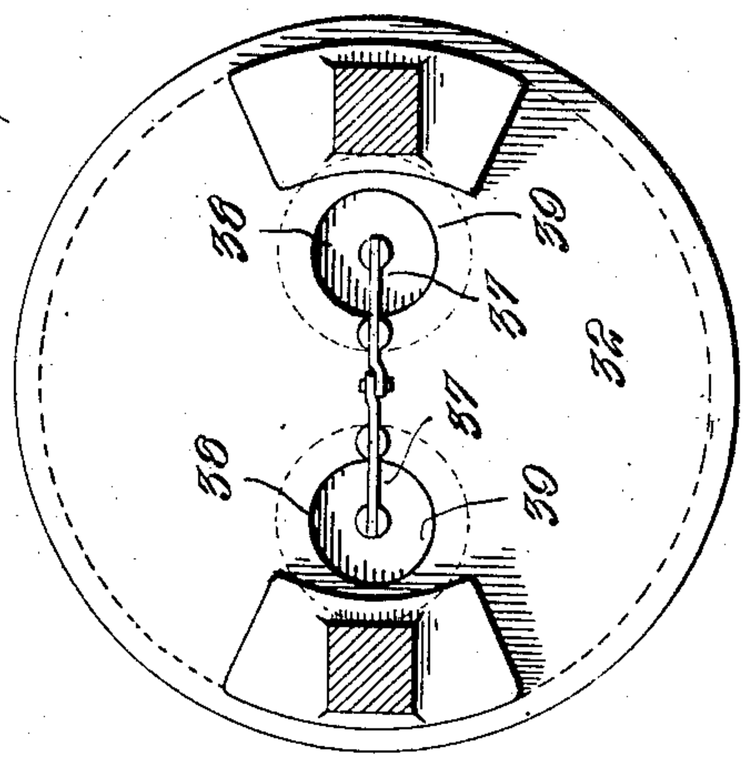


Fig. 6.



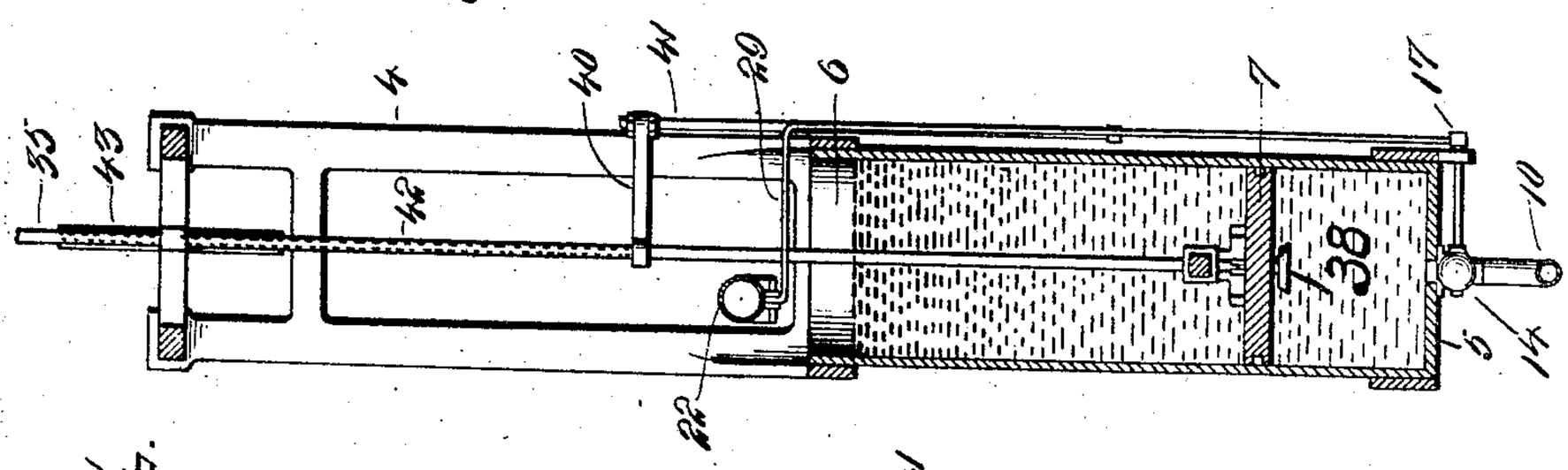


Fig. 4.

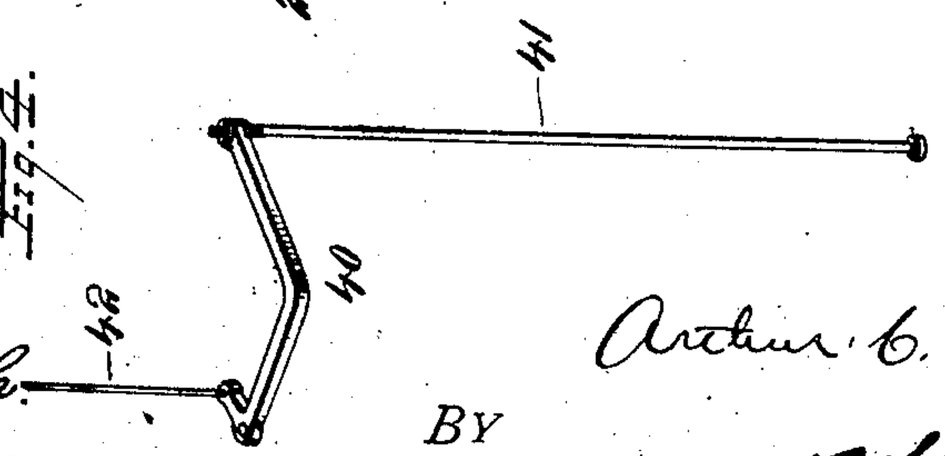


Fig. 3.

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UNITED STATES PATENT OFFICE.

ARTHUR C. FERGUSON, OF BROOKLYN, NEW YORK.

HYDRAULIC-POWER APPARATUS.

No. 931,402. Specification of Letters Patent. Patented Aug. 17, 1909.

Application filed October 28, 1908. Serial No. 459,917.

To all whom it may concern:

Be it known that I, ARTHUR C. FERGUSON, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Hydraulic-Power Apparatus, of which the following is a specification.

This invention relates to the subject of power apparatus of the hydraulic motor type, and has in view a continuously operating apparatus of this character comprising simple, practical, and reliable means for developing and maintaining power for any purpose at a minimum expense.

To this end the invention contemplates a continuously operating hydraulic power apparatus possessing special utility as a central source of power for electric lighting or other plants, but at the same time capable of general application for supplying power for any and all purposes.

The invention also has in view the provision of a power apparatus which is entirely automatic in its operation for considerable periods of time without requiring any special care or attention, and which is capable of utilizing the same pressure supply fluid over and over again, thus insuring the maintenance of the apparatus under the most economical conditions.

With these and many other objects in view, which will readily appear to those familiar with the art, the invention consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated, and claimed.

The essential features of the invention, involved in carrying out the objects above indicated, are necessarily susceptible to a wide range of structural modification without departing from the scope thereof, but a preferred and practical embodiment of the invention is shown in the drawings, in which:

Figure 1 is a side elevation of a power apparatus embodying the present invention. Fig. 2 is a longitudinal sectional elevation thereof. Fig. 3 is a vertical cross sectional view on the line 3—3 of Fig. 2. Fig. 4 is a detail in perspective of the operating connection with the piston rod of the individual actuating pistons. Fig. 5 is an enlarged detail sectional view of one of the weighted actuating pistons. Fig. 6 is a sectional view on the line 6—6 of Fig. 5. Fig. 7 is a detail in perspective showing the operative relation of the clutch lever to the stop wheel.

Like references designate corresponding parts in the several figures of the drawings.

In carrying out the invention, there are preferably employed a plurality of pressure chambers designated respectively by the reference numbers 1, 2, and 3, and while it will be understood that a single one, or any desired number, of these chambers may be utilized in carrying forward the invention, three of such chambers are shown in the drawings by way of illustrating the preferable construction and operation of the various instrumentalities constituting the invention.

Referring particularly to the embodiment of the invention as suggested in the drawings, it will be observed that the several pressure chambers 1, 2, and 3, are in the form of cylinders mounted in a suitable machine stand or frame 4, said cylinders having closed bottoms 5 and open at the top, as at 6. Each pressure chamber accommodates for a vertical reciprocating movement therein, an actuating element which may be properly termed a weighted actuating piston, the pistons for the several chambers being respectively designated by the reference numbers 7, 8, and 9, and providing means for forcing the pressure supply fluid out of the chambers and into a circulation pipe 10. This circulation pipe has separate chamber outlet connections 11, 12, and 13 respectively with the closed bottoms of the several pressure chambers, and said outlet connections are also respectively equipped with cut-off valves 14, 15, and 16, each of which has suitably fitted to the stem thereof a controlling trigger 17 in the form of a cross arm, and having the function hereinafter more particularly referred to. The said circulation pipe 10 has a connection with the inlet of a transmission unit 18 preferably in the form of a water-wheel motor, the drive shaft of which is equipped with a drive pulley 19 receiving a belt 20 to transmit the power to any desired machinery or apparatus to be driven, such for instance as an electrical generating plant 21, as suggested in the drawings. The outlet for said transmission unit is in communication with a fluid return pipe 22 arranged over the pressure chambers and provided with chamber supply ports 23, 24, and 25 lying respectively over the open upper ends

of the cylinders 1, 2, and 3, and covered and uncovered by the external hinged cut-off valves 26, 27 and 28 having controlling rod connections 29, 30, and 31, respectively with a movable part 17 of the cut-off valve equipment 14, 15, and 16 for the outlets of the several chambers, thus insuring synchronous action of the cut-off valves for the supply and outlet ports of each pressure chamber.

The weighted actuating pistons of the several chambers are of duplicate construction and differ only in the particular of the pistons being successively of greater weight. That is, the second piston 8 is twice the weight of the first piston 7, and the third piston 9 is three times the weight of the first piston 7, as for example, if the first piston 7 weighs 25 pounds, a working proportion that may be observed would be to have the piston 8 of the second chamber 50 pounds in weight, and the piston 9 75 pounds in weight, all for a purpose to be presently explained.

Each weighted actuating piston essentially consists of a piston disk 32 equipped with any approved piston packing 33, and suspended from a carrying yoke 34, in which is slidably mounted the lower end portion of a piston rod 35 which is pivotally connected, as at 36, to a pair of toggle levers 37 respectively connected with the stems of a pair of relief valves 38 arranged to cover and uncover venting ports 39 piercing the piston disk 32.

The piston rod 35 of each actuating piston has fitted thereto a connection bracket 40 affording a connecting means for the upper end of a presser rod 41, and one end of a connecting cable 42, which cable passes over a pulley or sheave 43, and the other end of which is connected with the bracket 40 of the piston rod of the next succeeding piston. This arrangement is preserved throughout the entire series except for the last piston 9, where the connecting cable 42 therefor is connected with a lifting pulley 44 forming a part of an auxiliary automatic actuating mechanism which includes in addition to the said pulley a winding drum 45, an auxiliary actuating weight 46, and rewinding mechanism 47. The pulley 44 and the drum 45 are equipped with complemental toothed clutch members 48 and 49 respectively, and are mounted on the same shaft 50, the pulley 44 being loose thereon, and the drum 45 having a feathered connection with the shaft, and having winding and unwinding thereon the weight cable 51 for the auxiliary actuating weight 46. The drum 45 is also provided with a grooved collar member 52 loosely engaged by the yoke 53 of a clutch lever 54 having a pivotal support 55 at its lower end and carrying at an intermediate point a stop member 56 adapted to engage a stop shoulder or equivalent element 57 on a toothed stop wheel 58 in gear with the train of gearing 59 which constitutes the rewinding mechanism, and one of the shafts of which gearing includes an operator's handle 60. A retracting spring 61 normally draws the clutch lever in a direction for disengaging the clutch 48—49 and moving the stop member 56 into operative relation to the stop wheels.

The presser rod element 41, associated with each piston, coöperates with one of the controlling triggers 17. Also, there is associated with the said triggers spring supported operating heads 62 arranged in a plane above and between the controlling elements 17, and whose stems 63 lie in the vertical plane of, and adapted to be engaged by, said rod elements 41, while the return springs 64 arranged on said stem 63 serve to return the head 62 to normal position when relieved from the pressure of the rods 41.

A starting connection 65 is run from the connection element 40, or other suitable movable part of the piston equipment for the last pressure chamber through a valve operating lever 66 supported in operative relation to the trigger 17 for the cut-off valve 14 of the first pressure chamber. Any equivalent connection or line of connection for the same purpose may obviously be employed without departing from the invention.

In the operation of the apparatus, it will be understood that with the supply and outlet valves 26 and 11 respectively for the first pressure chamber 1, open, the weighted actuating piston 7 is free, under its own weight, to descend and force the water or other fluid under pressure through the outlet connection 11 and the pipe 10 into the casing of the transmission unit or motor 18 with the result of driving such motor for power purposes, the fluid leaving the outlet of the unit 18 and returning to the pressure chamber 1 through the supply port 23. When the said actuating piston 7 completes its downward stroke, the presser rod 41 carried with such piston engages the stem of the first operating head 62 of the series with the result of depressing said head to the positions shown in dotted lines in Fig. 1. This movement of the said head 62 against the triggers 17 for the valves 14 and 15, causes a simultaneous closing of the valve 14 and an opening of the valve 15, but in this connection it will be observed that the valve 15 opens sufficiently in advance of the complete closing of the valve 14 so that the uniformity in the pressure of the fluid is maintained, and the flow of fluid under pressure from one chamber is started before such flow is cut off from the next preceding chamber.

With the closing of the cut-off valve 14 for the first chamber, the supply cut-off valve 26 is simultaneously closed through the rod connection 29, and at the same time the next succeeding rod connection opens the supply valve 27 for the chamber 2.

With the parts thus rearranged and the chamber 1 cut out of service, the actuating piston 8 commences to descend, and on account of its relative weight will lift the next preceding piston 7 through its idle up stroke. On this up stroke, the piston rod 35 of said piston 7 opens the relief valves 38 so as to uncover the venting port 39 and permit the free return of the piston to its starting point.

The same operation takes place between each pressure cylinder and its piston equipment and the next succeeding pressure chamber and its piston equipment, but in connection with the last pressure chamber of the series and its piston equipment, it will be noted that when the piston 9 of said last chamber reaches the limit of its downward stroke, the presser rod 41 for said piston has operated the last one of the heads 62 to close the valve 16 and also to draw upon a pull connection 65[a] between said last operating head 62 and the clutch lever 54, with the result of disengaging said lever from its stop (which also acts as a lock for the rewinding mechanism), and moving the winding drum 45 into clutched relation to the lifting pulley 44, thus bringing the auxiliary actuating weight 46 into service and thereby lifting the piston 9 through its up stroke. By the time the piston 9 reaches its upward limit of movement, a stop shoulder 57 will be brought into position permitting the lever 54 being drawn back by its spring with the result of throwing the clutch 48—49 out of engagement. After repeated operations of this character, limited only by the length of the weight cable 51, the latter may be rewound upon its drum through the rewinding mechanism. When the last piston 9 reaches the limit of its down stroke, the starting connection 65 will have opened the valve 14 and at the same time the valve 26 for the first pressure chamber, and the operation repeats itself.

I claim:

1. In an apparatus of the class described, a pressure chamber, a fluid circulation system including a transmission unit, a weighted actuating piston movable in the chamber, means, controlled by said piston, for cutting off the inlet and outlet of said chamber when the piston reaches the limit of its down stroke, and means for automatically lifting the piston.

2. In an apparatus of the class described, a pressure chamber, a fluid circulation system including a transmission unit, a weighted actuating piston, means, controlled by said piston for closing the inlet and outlet for said chamber on the down stroke of the piston, means for automatically lifting the piston, and means for automatically opening the inlet and outlet for said chamber when the piston has been lifted.

3. In an apparatus of the class described, a pressure chamber, a fluid circulation system including a transmission unit, a weighted actuating piston provided with venting ports and relief valves therefor, means for automatically controlling the fluid supply and outlet for the chamber, means for automatically lifting the piston, and means for automatically opening and closing said relief valves for the piston.

4. In an apparatus of the class described, a fluid pressure chamber, a fluid circulation system including a transmission unit, a weighted actuating piston movable in the chamber, means for automatically controlling the fluid supply and outlet for the chamber, and an auxiliary actuating mechanism operatively related to the piston for lifting the same and including a lifting element, a winding drum adapted to have a clutching engagement with said lifting element, a weight cable winding and unwinding on the drum and carrying a weight, and an automatic control and stop for said auxiliary actuating mechansim.

5. In an apparatus of the class described, a plurality of pressure chambers, a fluid circulation system including a transmission unit and having valved supply and outlet connections for all of said chambers, a weighted actuating piston for each chamber, the several pistons successively increasing in weight, means, controlled by each piston for automatically closing the supply and outlet valves for its chamber and simultaneously opening the corresponding valves for the next succeeding chamber in order of operation, and means for automatically lifting said pistons in order of operation.

6. In an apparatus of the class described, a plurality of pressure chambers, a fluid circulation system including a transmission unit and having valved supply and outlet connections for all of said chambers, a weighted actuating piston for each chamber, the several pistons successively increasing in weight, means, controlled by each piston, for closing the supply and outlet valves for its chamber, and for simultaneously opening the corresponding valves for the next chamber in order of operation, and connecting means between the several pistons whereby the piston in operation on its down stroke will automatically lift the next preceding lighter piston.

7. In an apparatus of the class described, a plurality of pressure chambers, a fluid circulation system including a transmission unit and having valved supply and outlet connections for all of said chambers, a weighted actuating piston for each chamber, the several pistons successively increasing in weight, means, controlled by each piston, for closing the supply and outlet valves for its chamber, and for simultaneously opening the corresponding valves for the next chamber in order of operation, and an auxiliary actuating

mechanism comprising means for mechanically lifting the last piston in the series.

8. In an apparatus of the class described, a plurality of pressure chambers, a fluid circulation system including a transmission unit and having valved supply and outlet connections for all of said chambers, a weighted actuating piston for each chamber, the several pistons successively increasing in weight, means, controlled by each piston, for closing the supply and outlet valves for its chamber, and for simultaneously opening the corresponding valves for the next chamber in order of operation, an auxiliary actuating mechanism comprising means for mechanically lifting the last piston in the series, and means controlled from the movement of said last piston in the series for automatically opening the supply and outlet valves for the first chamber in the series.

9. In an apparatus of the class described, a plurality of pressure chambers, a fluid circulation system including a transmission unit and having a valved supply and outlet connections for all of said chambers, weighted actuating pistons, means for automatically controlling in sequence the fluid supply and outlet for all of the chambers, and an auxiliary actuating mechanism comprising a lifting pulley having a lift connection with the last piston in the series, a winding drum having a clutch connection with said pulley, a weight cable winding and unwinding on said drum and carrying an auxiliary actuating weight, a clutch lever associated with said winding drum, a rewinding mechanism geared with the winding drum and including a stop member, a stop member coöperating with the clutch lever, and means for automatically throwing said lever in both directions.

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

ARTHUR C. FERGUSON.

Witnesses:
R. C. BRADDOCK,
EMORY L. GROFF.