J. W. NELSON.

HYDRAULIC PRESSURE GENERATING AND APPLYING DEVICE.

APPLICATION FILED FEB. 14, 1908.

939,535. Patented Nov. 9, 1909.

4 SHEETS—SHEET 1.

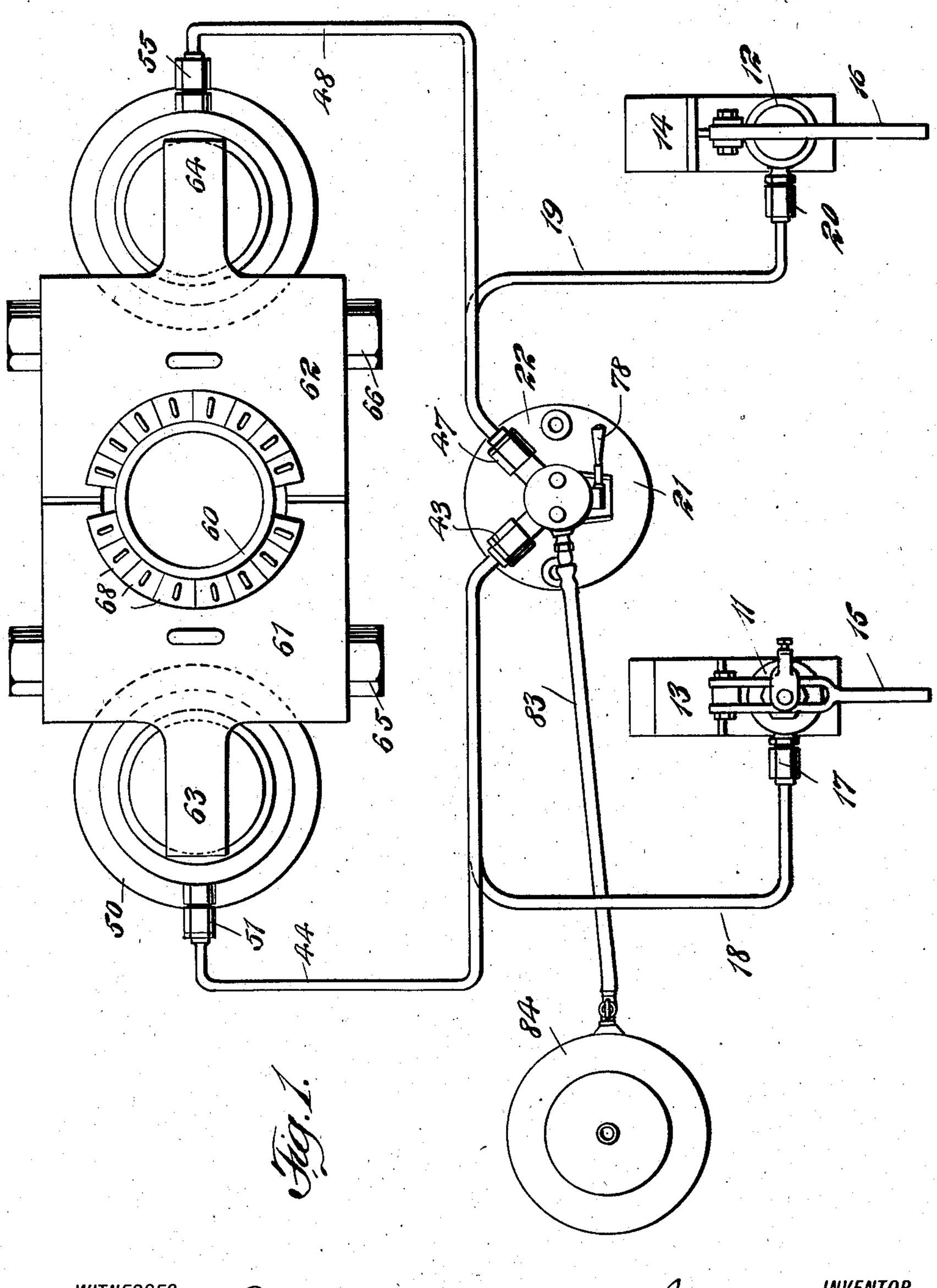


Fig. 1.

WITNESSES:
Julius H. Schultz.
R. F. Bonnell

INVENTOR
James W. Nelson
BY
Fred H. Bowersock
ATTORNEY

J. W. NELSON.

HYDRAULIC PRESSURE GENERATING AND APPLYING DEVICE.

APPLICATION FILED FEB. 14, 1908.

939,535. Patented Nov. 9, 1909.

4 SHEETS—SHEET 2.

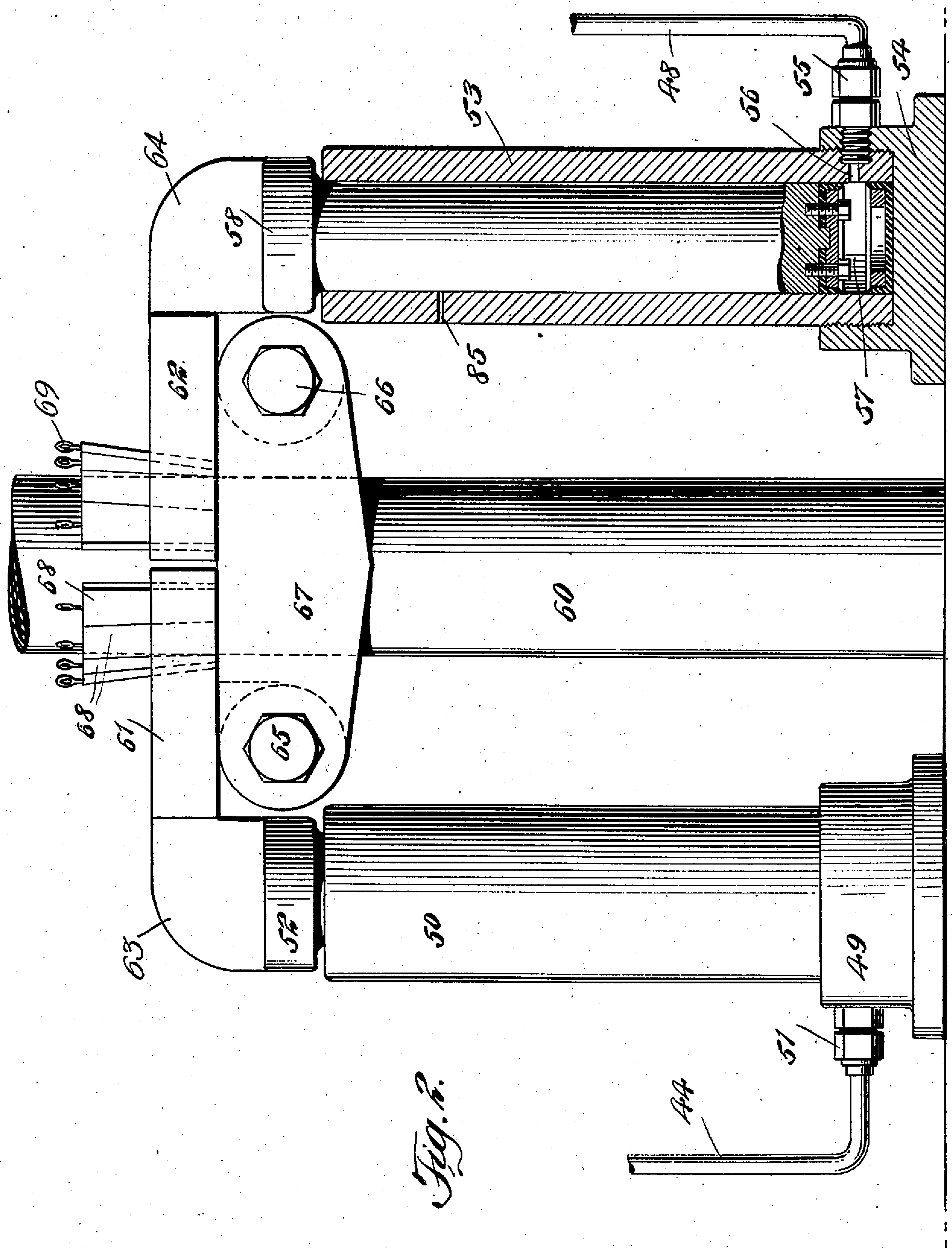


Fig. 2.

WITNESSES:

INVENTOR
James W. Nelson

BY

ATTORNEY

J. W. NELSON.

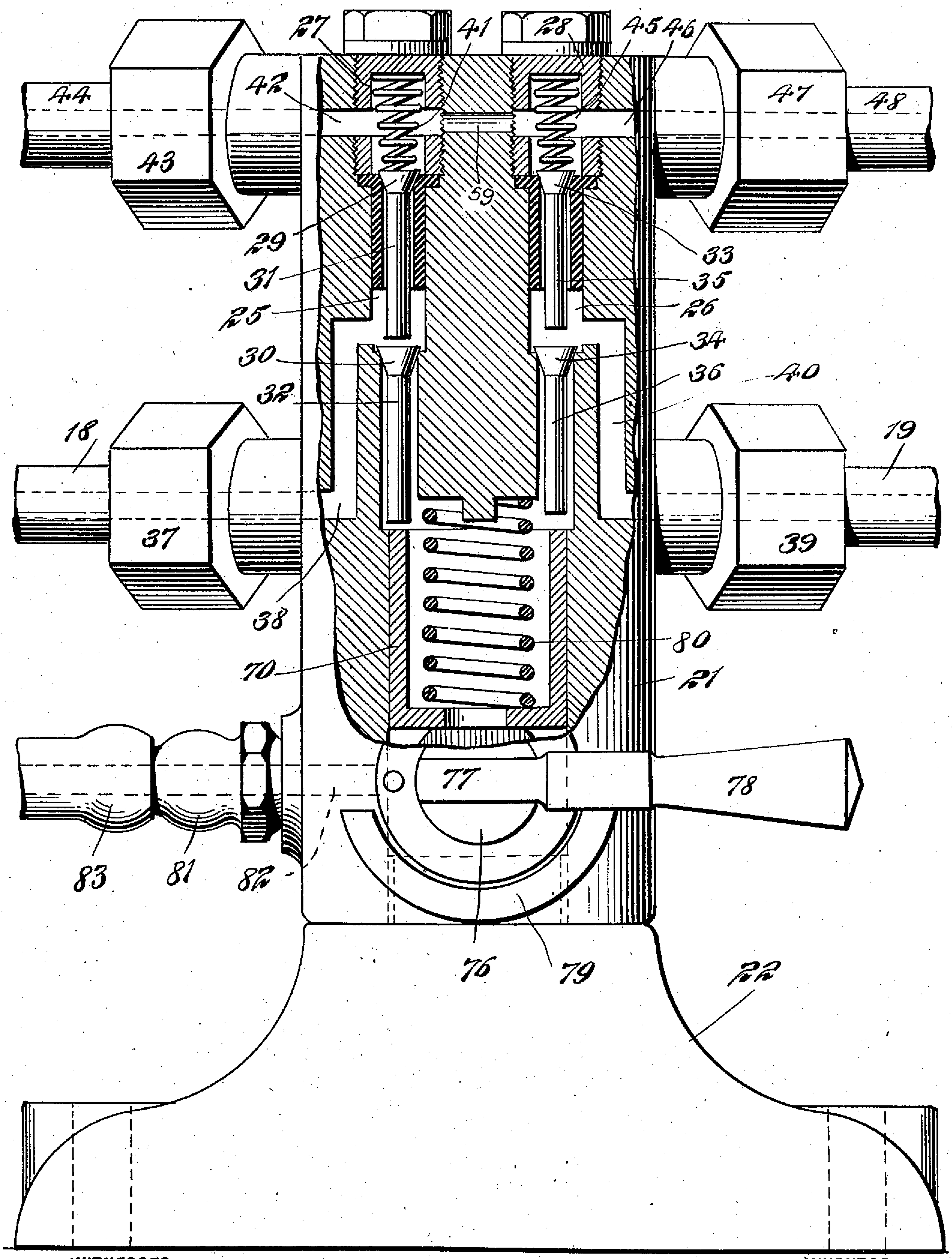
HYDRAULIC PRESSURE GENERATING AND APPLYING DEVICE.

APPLICATION FILED FEB. 14, 1908.

939,535.

Patented Nov. 9, 1909.

4 SHEETS—SHEET 3.



WITNESSES:

Fig. 3.

INVENTOR

James W. Nelson

BY

ATTORNEY

J. W. NELSON.

HYDRAULIC PRESSURE GENERATING AND APPLYING DEVICE.

APPLICATION FILED FEB. 14, 1908.

939,535. Patented Nov. 9, 1909.

4 SHEETS—SHEET 4.

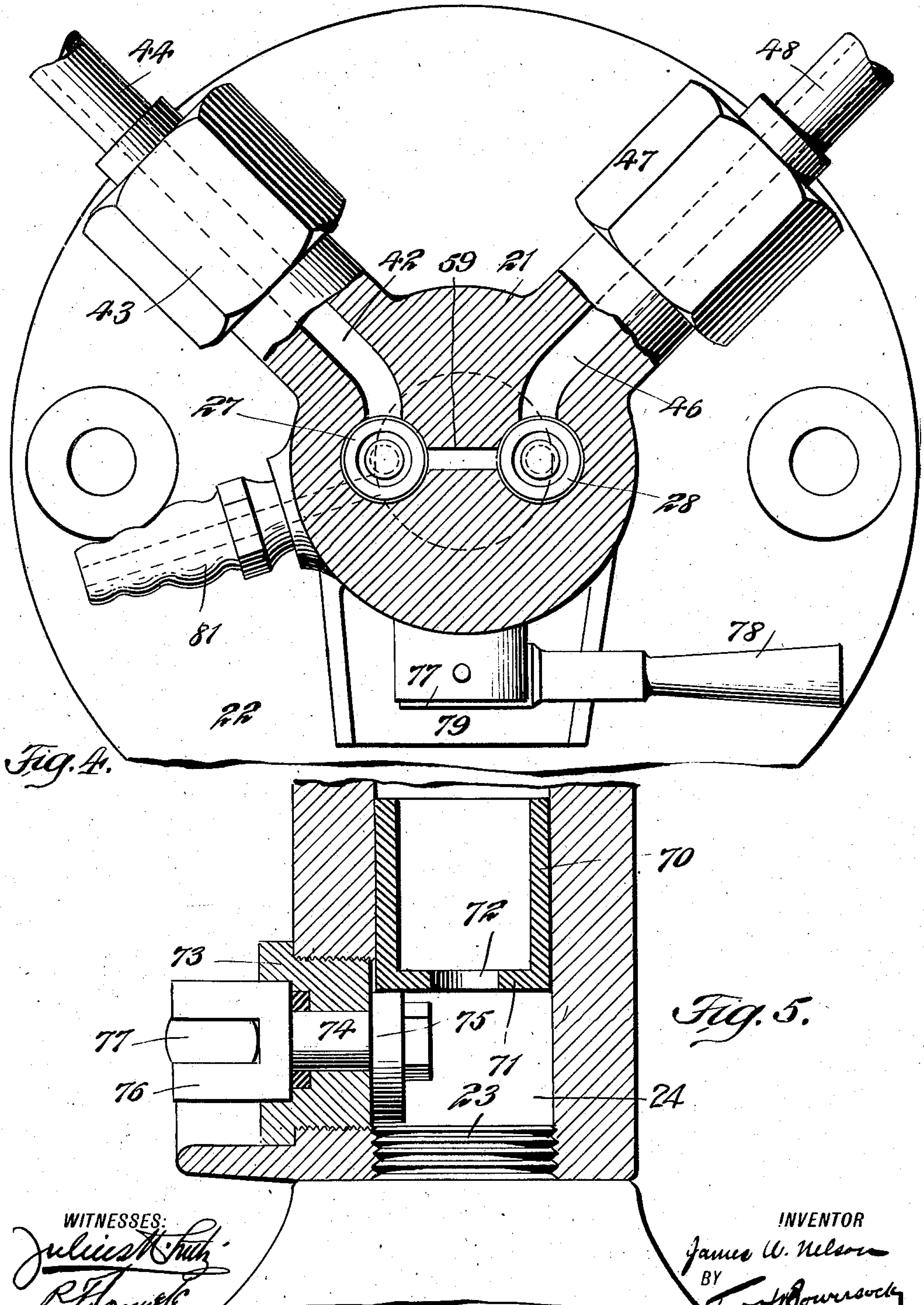


Fig. 4.

Fig. 5.

WITNESSES:
Julius M. Smith
R. F. Homick

INVENTOR
James W. Nelson
BY
Fred H. Bowersock
ATTORNEY

UNITED STATES PATENT OFFICE.

JAMES W. NELSON, OF NEW YORK, N. Y.

HYDRAULIC-PRESSURE GENERATING AND APPLYING DEVICE.

939,535. Specification of Letters Patent. Patented Nov. 9, 1909.

Application filed February 14, 1908. Serial No. 415,868.

To all whom it may concern:

Be it known that I, JAMES W. NELSON, a citizen of the United States, and a resident of the city of New York, borough of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Hydraulic-Pressure Generating and Applying Devices, of which the following is a specification.

This invention relates to apparatus for generating and applying hydraulic pressure, with particular reference to devices of this character comprising a plurality of pressure generating means, of preferably different capacities, means separate from the generating means for applying the pressure, and means intermediate said generating and applying means for the control of the application, extent and relief of the generated pressures.

The present invention more particularly contemplates a powerful multiple-pump hydraulic jack, for the purpose of removing the pipe from abandoned oil wells. As is well known, this pipe is driven into the ground in sections and has been known to approximate a mile in length. For obvious reasons, the pipe-sections must be heavy, and when friction is considered the difficulties attendant upon the operation of the starting and withdrawal of the pipe will be appreciated. Naturally, the greatest power is required to start the pipe, which has been more or less firmly "set" in the well. Once started, the required lifting pressure may be, of course, gradually diminished as each section of pipe is brought above the level of the ground, detached and removed.

For the purpose above briefly explained, it has been the practice to employ two ordinary hydraulic jacks, located upon opposite sides of the pipe to be withdrawn and acting against opposite ends of a suitable cross-brace which is provided with what is known as the pipe-grip. Even where these jacks are of nominally equal power, however, being independently operated by different workmen, difficulty is experienced in insuring the application of equal lifting powers on both sides of the pipe. The general object of this invention is the provision of two rams, located and operated in the manner above described, which receive liquid under pressure from either one or two pumps, in the latter case said pumps being of preferably different capacities, a separate member being provided intermediate said pumps and said rams, said member being provided with means for, first, combining and equalizing the pressures generated by a plurality of pumps and distributing the same equally between both rams; second, for rendering all but one of said pumps effectively inoperative, in order that a maximum of power may be generated through the employment of one pump only, under the well known principles of hydrostatics; third, to render all pumps effectively inoperative, irrespective of a continuance of the pumping operations, whereby the application of increased pressure may be temporarily suspended without relieving the pressure which has been already generated and which is being applied; and, fourth, to simultaneously relieve the pressures in both ram-chambers underneath the rams, and thereby permit of the lowering of these devices for the purposes of removal or for readjustment to grip the pipe at a lower point or position.

While I have above briefly outlined a specific and undoubtedly valuable application of my invention, it must not be understood that I desire to limit myself in its application to apparatus for withdrawing oil-well pipe from the ground. It will be apparent that my invention is equally applicable to apparatus designed for many other purposes.

The more important features of the present invention may be said to reside in controlling means, suitably and conveniently located, in an apparatus of this character which comprises a plurality of either independent or connected pressure generating means, and a plurality of independently movable devices for applying the generated pressures at selective points.

My invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a diagrammatic view of a complete apparatus embodying my invention; Fig. 2 is a partly sectional side elevation of the pressure applying devices, showing the means for gripping the pipe when the device is employed for the specific purpose hereinbefore referred to; Fig. 3 is a partly sectional side elevation of the intermediately-located pressure controlling member; Fig. 4 is a partly sectioned top plan view of Fig. 3, and Fig. 5 is a transverse section through the lower part of Fig. 3.

Referring now to the drawings in detail,

numerals 11 and 12 refer to separate and independent hydraulic pumps, mounted upon suitable supporting base plates 13 and 14, respectively, and operated in the usual manner by pump levers 15 and 16. For the purposes of this description, it may be assumed that each of these pumps is of the simple-piston type. I prefer, however, for reasons which I shall hereinafter explain, that these pumps be of different capacities, the diameter of the piston in one being two or more times the diameter of the piston in the other.

From the pump chamber within the pump 11, an open duct leads to the coupling or connection 17, by means of which the preferably flexible pipe or tube 18 is secured to the pump block and is open to the pump chamber. In a similar manner, a pipe 19 leads through the coupling or connection 20 and a similar duct to the pump chamber underneath the piston in the pump 12.

The pressure controlling means, to which I have hereinbefore referred, preferably comprises a cylindrically shaped body 21 mounted upon a heavy supporting base or standard 22 which insures the retaining of this device in a vertical position. The cylinder 21 is first provided with a central bore, the lower end of which is closed and sealed by means of the screw-plug 23 to form the interior chamber 24. This chamber 24 extends upwardly approximately half the length of the cylinder. From the upper end of this cylinder, bores 25 and 26 are provided, extending from the upper end of the cylinder to the chamber 24. The top of these bores 25 and 26 are closed and sealed by means of the screw-plugs 27 and 28, respectively. Near the upper end of the bore 25 is provided a seat for the valve 29, below which another seat is provided for the valve 30. The valve 29 is provided with stem 31 which extends downwardly under normal conditions nearly but not quite to the valve 30. The valve 30 is similarly provided with a stem 32 which projects downwardly into the upper portion of the chamber 24. Correspondingly, the bore 26 is, near its upper end, provided with a seat for the valve 33, and below the valve 33 with a seat for the valve 34, the former having a stem 35 which projects downwardly under normal conditions nearly but not quite to the valve 34—the normal distance between the end of the stem 35 and the valve 34, in the bore 26, is slightly greater than the distance between the end of the stem 31 and the valve 30, in the bore 25, for reasons which I will hereinafter explain. The valve 34 is provided with a stem 36, which extends downwardly into the top portion of the chamber 24.

The end of the pipe 18 is secured to the cylinder 21 by means of the coupling or connection 37 and is open to a duct 38 in said cylinder 21 which leads to the bore 25 between the valves 29 and 30. Similarly, the end of the pipe 19 is secured to said cylinder by means of a coupling or connection 39 and is open to the duct 40 which leads to the bore 26 between the valves 33 and 34.

The plug 27 sealing the upper end of the bore 25 provides what may be termed a valve chamber 41 at the upper end of the bore 25, from which leads the lateral duct 42 open through the coupling or connection 43 to the similarly flexible pipe or conduit 44. At the upper end of the bore 26, a similar chamber 45 is provided from which leads the lateral duct 46 to the coupling or connection 47, by means of which the pipe 48 is secured to said cylinder 21 and open to the top of the valve bore 26.

The pipe 44 is secured to the base 49 of the ram-cylinder 50 by means of the coupling or connection 51, through which and a suitable duct said pipe is open to the pressure chamber in said ram-cylinder underneath the ram 52. This construction and arrangement is better shown in connection with the ram cylinder 53, to the base 54 of which the pipe 48 is secured through the coupling or connection 55. This pipe is open through the duct 56 in the ram-cylinder to the pressure chamber 57 underneath the ram 58. These rams and their operating parts are identical in all respects, the pressure areas of each being equal whereby the upward force exerted against each ram is the same for each of these lifting members. The chambers 41 and 45 in the cylinder 21 being connected by means of the duct 59, it will be apparent that whether pressure is directed through either one of the bores 25 or 26 alone or through both of said bores, the pressures in the chambers 41 and 46 are invariably equal and, therefore, identical pressures are transmitted to each of the ram chambers. The pressure areas in these chambers being the same, the lifting forces of the two rams will at all times be equal irrespective of the source or sources of pressure.

In the specific application of my invention herein shown and described, I mount upon the heads of the rams 52 and 58 a device for gripping and, upon the application of pressure, raising a section of vertical pipe, such as I have designated by the numeral 60 in Fig. 2. This device comprises a pair of heavy plates 61 and 62, adjoining end-edges of which are semi-circularly recessed for the reception of the pipe 60. These plates are provided with projecting arms 63 and 64, respectively, extending over and resting upon the heads of the rams 52 and 58. These plates are furthermore provided with depending lugs, arranged in oppositely located pairs, to which are secured by means of the bolts 65 and 66, heavy supporting

cross braces, of which one, 67, is shown in Fig. 2, the other being its opposite counterpart. In this manner an exceedingly strong and rigid supporting frame is provided, yet one which is to a slight extent expansible for the purpose of providing for ready and easy gripping and release of the pipe, as hereinafter explained.

The substantially circular apertures formed by the semi-circular recesses in the adjoining end-edges of the plates 61 and 62, is of somewhat greater diameter than the diameter of the pipe to be raised. The ram members being located and adjusted in proper position over the protruding end of the pipe (and it may be stated that if the end of the pipe does not protrude from the ground, it may be rendered accessible by suitable excavation), with said pipe-end projecting through the circular aperture provided by the recesses in the plates 61 and 62. In the annular space between the pipe and the edges of said aperture, I place a plurality of wedges 68 68, the outer faces of which may be smooth, but the inner faces of which are serrated, with teeth upwardly directed, whereby the same will bite into the pipe as the wedges are gripped or clamped thereagainst through upward movement of the plates 61 and 62 against the resistance of the pipe. I prefer to provide rings 69 69 secured to or within the upper ends of the wedge-blocks 68, so that a rope or chain may be passed through said rings and suitably secured to prevent one or more of said wedge-blocks, upon being released or dislodged, from falling out and possibly dropping down the well.

Snugly fitting and slidable within the bore 24 in the cylinder 21, is the cylindrical push-tube 70, the upper end of which is in coöperative positional relation to the lower ends of the stems 32 and 36 of the valves 30 and 34, respectively. This push-tube 70 is preferably provided with a lower inturned flange 71, leaving an aperture 72 for the flow of liquid in an upward direction through the bore 24. A lateral bore is provided through the side wall of cylinder 21 to the bore 24, which lateral bore is interiorly screw-threaded for the reception of the sealing screw-plug 73. This plug 73 provides bearings for the short shaft 74, at the inner end of which, in the bore 24, is provided a cam 75 in coöperative positional relation to the bottom of the push-tube 70 which normally rests thereupon and in its normal position is not in contact with the valve stems 32 and 36, and, therefore, non-interferent with the usual automatic functions of said valves.

The outer end of the shaft 74 is provided with a head 76, within which is mounted the bearing portion 77 of a lever 78 by means of which the shaft 74 may be rotated and the cam 75 operated to raise the push tube 70. I prefer to provide, on the exterior of the cylinder 21, a curved plate 79 which normally checks the lever 78 against accidental movement, rendering it necessary to turn the lever 78 in its bearings in the head 76 until it clears the end of said plate 79, whereupon it may be rotated to operate the cam 75 in the manner described.

The inturned flange 71 of the push tube 70 is provided to secure a bearing for the spring 80 in compression between said flange and the upper end of the bore 24. This spring 80 operates to return the push tube 70 to its normal and lowermost position when the latter is relieved of action of the cam.

Communicating with the bore 24 and leading to and through the nipple 81, is the lateral duct 82. The nipple 81 is designed to receive and secure the end of a rubber or other flexible hose or tube 83 leading from a tank 84 or other suitable container for the liquid employed.

It will now be apparent that with the various parts of the device located and adjusted as shown and hereinbefore described, and it being necessary or desirable, as heretofore explained, to generate the maximum degree of pressure for the purpose of first starting upward movement of the pipe, the smaller pump alone should be operated. Assuming, for the purposes of this description, that the pump 12 is the smaller pump and, therefore, the pump first to be employed, the other, for the time being, remaining idle, upon the upstroke of the piston within said pump, a partial vacuum will be created within the pump chamber. The inequality of pressure thus created, the excess of pressure being upon the underside of the valve 34 in the bore 26 and this being the only valve in the passage from the tank 84, or other source of supply, to said pump chamber, will result in the unseating of this valve 34, and the flow of liquid from the tank 84 to said pump chamber. Upon the downstroke of the piston in the pump 12, the excess of pressure will be above the valve 34, which, with the assistance of the force of gravity, will seat said valve, and direct the flow of the liquid upward through the upper portions of the bore 26, unseating the valve 33, and into the chamber 45. From this chamber the flow, and therefore the pressure, is distributed, a part thereof being transmitted through the duct 46 and the pipe 48 to the ram chamber 57 below the ram 58, and an equal part thereof being transmitted through the duct 58 to the chamber 27, and thence through the duct 42 and the pipe 44 to the pressure chamber below the ram 52.

The equal pressures exerted upon the rams 52 and 58 will start them upon their upward movement, the first effect of which will be

the gripping of the pipe 60, in the manner explained, and in due time the starting of the pipe. When the rams have been raised to the highest point practicable, considering the lengths of the ram-cylinders, the workman stationed at the location of the valve-controlling device 21—which should be located so that this workman can at all times note the progress and effect of the work—will turn the lever 78 through an arc sufficient to raise the push tube 70, through the cam 75, through a distance sufficient to cause the upper end of said push tube to impinge against the stem 32 of the valve 30, and the latter to similarly impinge against the stem 31 of the valve 29, positively raising both of these valves from their seats and providing an open passage from both ram chambers to the source of liquid supply. Of course, this operation will similarly unseat the valves 33 and 34, although not simultaneously with the valves 29 and 30, respectively, for reasons which I shall hereinafter explain. With this open passage or passages provided from the ram chambers to the source of supply, the weight of the rams, augmented by the weight of the pipe gripping device, will effect the automatic release of the latter from the pipe, in view of the downwardly tapering sides of the wedge-blocks 68 68, and the lowering of rams and therewith gripping device, forcing the liquid in the ram chambers back into the tank 84. The plates 61 and 62, with the now-released wedge-blocks, 68, will slip downwardly over the pipe until the rams have again reached their lowermost position, whereupon the operator will return the lever 78 to its normal position, thus relieving the push-tube 70 of the action of the cam 75, and through action of the spring 80 returning said push-tube to normally lowermost position and restoring the automatic functions of all of the valves. As the pumping operation is again started—or, if not theretofore terminated, is continued—the wedge-blocks 68 having dropped into place, as the rams 52 and 58 start upon their upward movement, the pipe 60 is again firmly gripped by the supporting and lifting device and is raised through the next succeeding step of its withdrawal from the earth.

As hereinbefore stated, and as is obvious, the greatest power is required to start the pipe. As this pipe is raised and the end of each section brought above the pipe-gripping device, it is detached and thrown to one side. The pipe being thus materially decreased in weight as operations continue, and the friction of the earth against the side thereof is reduced, less power is required to lift the same and, therefore, a larger pump, or additional pumps, may be employed to force a greater volume of liquid into the ram chambers and, therefore, augment the speed at a sacrifice of power under the laws of hydrostatics.

Heretofore, great inconvenience has been experienced through efforts to bring into commission, at this stage of the operations, a larger or an additional pump, but it will be apparent that through the employment of my invention it is only necessary for the workman who has been operating the smaller and more powerful pump 12, to step to the larger pump 11, the operation of which will immediately, and without readjustment of any part or parts of the apparatus, force a larger volume of liquid to the ram chambers.

It will be noted that there are no parts of the device to change or readjust. As the piston in the larger pump 11 is raised, the partial vacuum in the pump chamber will result in the unseating of the valve 30, and a flow of liquid from the source of supply to said pump chamber. In a manner precisely similar to that already explained in connection with operations of the pump 12, downstroke of the piston in the pump 11 will seat the valve 30, force the liquid into the chamber 41 and thence under equal pressures and greater volume to the ram chambers.

It is needless to say, of course, that both pumps may be simultaneously operated, nor is it necessary to terminate the pumping operations when the rams have been raised to their highest points in order to lower the latter for the next succeeding operation. The rams are preferably limited in their upward movement at a proper point through the provision of ducts in the ram-cylinders, the duct 85 being shown in the ram-cylinder 53 (see Fig. 2) and the ram-cylinder 50 being provided with a similar and correspondingly located duct. It will be apparent that when the rams have been raised so that the bottom thereof have cleared these ducts, the pressures will be relieved therethrough and further upward movement of the rams prevented.

Should the pumping operations continue, as suggested, and the location or arrangement of the parts of my apparatus be such that the operator at the pump cannot well be signaled, the operator at the controlling device may turn the lever 78 through an arc sufficient to raise the push-tube 70, through the cam 75, to a point where the valves 30 and 34 are unseated without, however, interfering in any way with automatic actions of the valves 29 and 33. Under these conditions, operation of either or both of the pumps is ineffective, open passages having been provided from both pumps to the source of supply and the liquid under the pumping operations will merely flow idly back and forth to and from said source of supply. The pumping operations may again

be rendered effective through returning the lever 78 to its normal position, or, irrespective of the continuance of the pumping operations, said lever 78 turned through its complete arc to unseat all the valves and lower the rams in the manner suggested.

It will be apparent that in order to relieve the pressure in the ram chambers to lower the rams, one of the valves 29 and 33 must be unseated against the full extent of the generated pressure in the ram chamber. Obviously, the unseating of a valve against such pressure is no easy matter, and the simultaneous unseating of two valves would require double the power required to unseat one thereof. The moment one valve is even to the very slightest extent pushed off its seat, however, the pressure becomes equal on both sides thereof, and it may be further forced off its seat with comparative ease. This is the reason why I have made the valve stems 31 and 32 of slightly greater length than the valve stems 35 and 36. It will be noted that upward movement of the push-tube 70 will first operate through the stem 32 to unseat the valve 30; next, the valve 34, through its stem 36, will be unseated; next, the valve 30 will impinge against the stem 31 and unseat the valve 29; and, last, the valve 34 will impinge against the stem 35 and unseat the valve 33. It will be seen that the valve 29 is unseated prior to the valve 33, when the lever 78 is turned for the purpose of relieving the pressure in the ram chamber. Therefore, but one final pressure valve is unseated against the full force of the liquid in the ram chamber.

It will of course be apparent that I may substitute for either or both of the single-piston type of pumps hereinbefore referred to, one or more double or multiple piston pumps. Furthermore, I may, if convenient and desirable, couple these pumps to any suitable sort of power instead of relying upon manual operation thereof.

Among the many decided advantages claimed for apparatus embodying the present invention are, first, the comparative lightness and easy portability of the entire outfit. This is undoubtedly an important feature, as these oil wells are often in practically inaccessible localities, and if self-contained jacks were employed, weighing seven or eight hundred pounds each, the transportation of these jacks to the well is not an easy matter. The heaviest part of the apparatus herein shown and described is the pipe-grip, and each cylinder alone is only of about half the weight of a self-contained jack.

The second of the advantages to which I have referred, is that of ease of repair. The valves are all located in an individual member, are seated downwardly, and can be rendered accessible through the removal of a single bonnet without in any way disturbing the pumps, the cylinders, the pipes or conduits, or the connections.

Third among the advantages referred to, is the increased speed available through the employment of the apparatus herein shown and described. Pumps with pistons of varying areas being employed, the proper pump is always in position for instant service. All that is necessary, when it is desired to increase power at a sacrifice of speed, or increase speed at a sacrifice of power, is for the operator to change from the lever of one pump to the lever of another.

Fourth among the advantages referred to, is that of the saving of labor. When a pair of jacks is employed, the constant attendance of two operators is required, whereas in this device one operator alone will suffice for the pumping operation.

Many modifications of minor details of my improved hydraulic pressure generating and applying apparatus will doubtless readily suggest themselves to those skilled in the art to which it appertains, and I therefore do not desire to limit my invention to the specific construction, and location and arrangement of parts, herein shown and described.

I claim as new and desire to secure by Letters Patent:

1. In combination, a plurality of separate and independently operating mechanisms for generating hydraulic pressure, a plurality of separate devices for conjointly applying the generated pressures, and means for equalizing the applied pressures and for rendering effectively inoperative one or all of said generating mechanisms.

2. In combination, a plurality of separate and independently operating mechanisms for generating hydraulic pressures, a plurality of devices for conjointly applying the generated pressures, and means for equalizing the applied pressures and for rendering effectively inoperative one or more of said generating mechanisms and for simultaneously relieving the applied pressures.

3. In combination, a plurality of independently operating pumps, a plurality of devices conjoining to apply the generated pressures, and means common to all of said elements for equalizing, controlling and finally simultaneously relieving the applied pressures.

4. In combination, a plurality of pumps, a plurality of devices separate therefrom conjoining to apply the generated pressures, and a flexible conduit from each of said pumps and to each of said applying devices, said conduits uniting in a member which is provided with means for controlling the flow through said conduits.

5. In combination, a plurality of pumps, a plurality of devices separate therefrom for

applying the generated pressures, means for effecting the conjoint action of said applying devices, and a flexible conduit from each of said pumps, and to each of said applying devices, said conduits uniting in a member which is provided with means for rendering effective operations of one only of said pumps and for equalizing the applied pressures.

6. In combination, a plurality of pumps, a plurality of devices separate therefrom for applying the generated pressures, means for effecting the conjoint action of said applying devices, and a flexible conduit from each of said pumps and to each of said applying devices, said conduits uniting in a member which is provided with means for rendering effective operations of one only of said pumps and for equalizing and finally relieving the pressures in said applying devices.

7. In combination, a plurality of pumps, a plurality of devices separate therefrom conjointing to apply the generated pressures, a flexible conduit from each of said pumps and to each of said applying devices, said conduits uniting in a member which is provided with means for rendering effective operations of one only of said pumps or all thereof.

8. In combination, a plurality of pumps, a plurality of devices separate therefrom conjointing to apply the generated pressures, a flexible conduit from each of said pumps and to each of said applying devices, said conduits uniting in a member which is provided with means for rendering effective operations of one only of said pumps or all thereof, and with means for equalizing the pressures in said applying devices.

JAMES W. NELSON.

Witnesses:
A. E. FARLEY,
JAS. MOORE.