E. A. GATHMANN.

HYDRAULIC JACK.

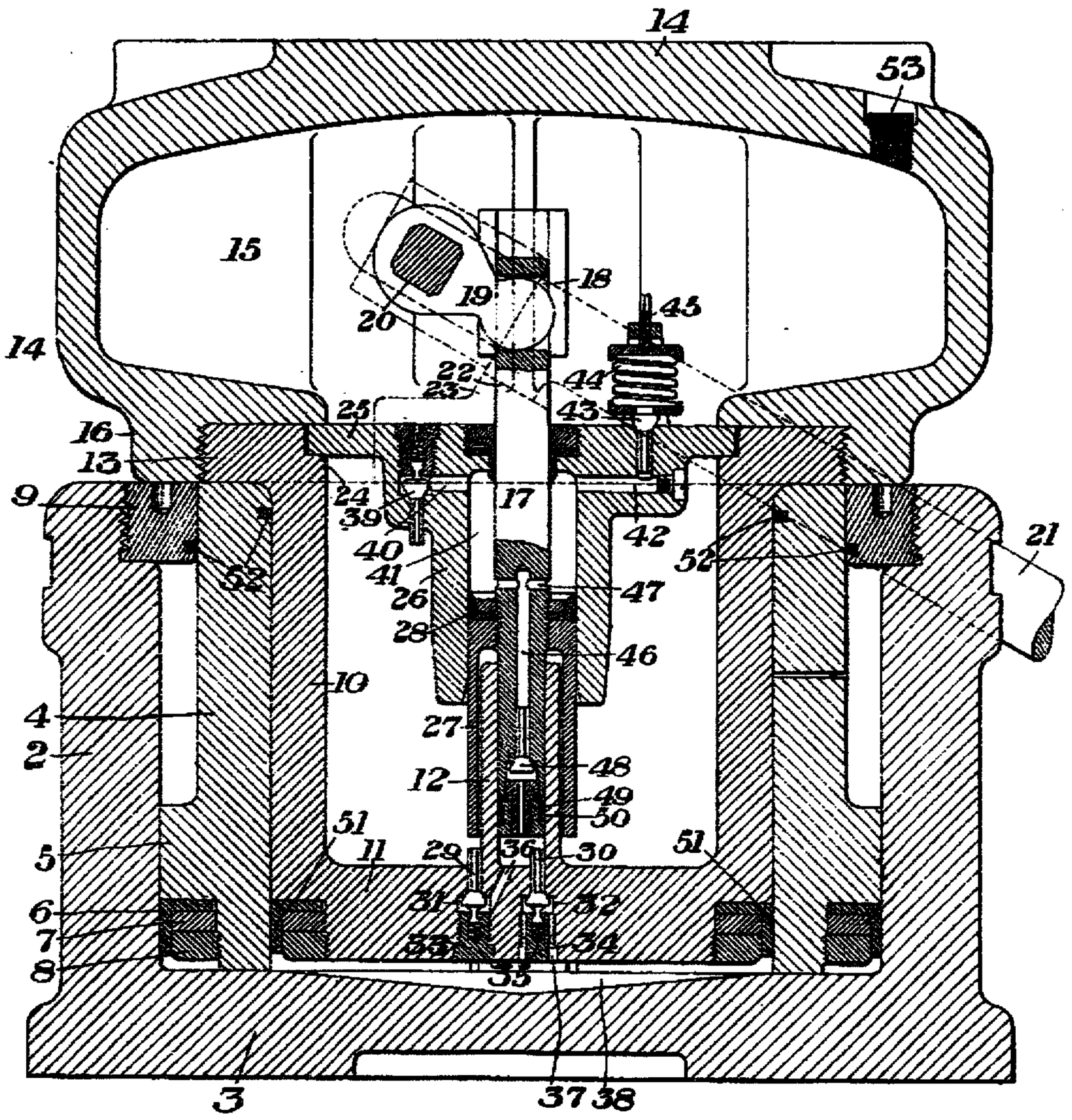
APPLICATION FILED MAR. 15, 1909.

947,613.

Patented Jan. 25, 1910.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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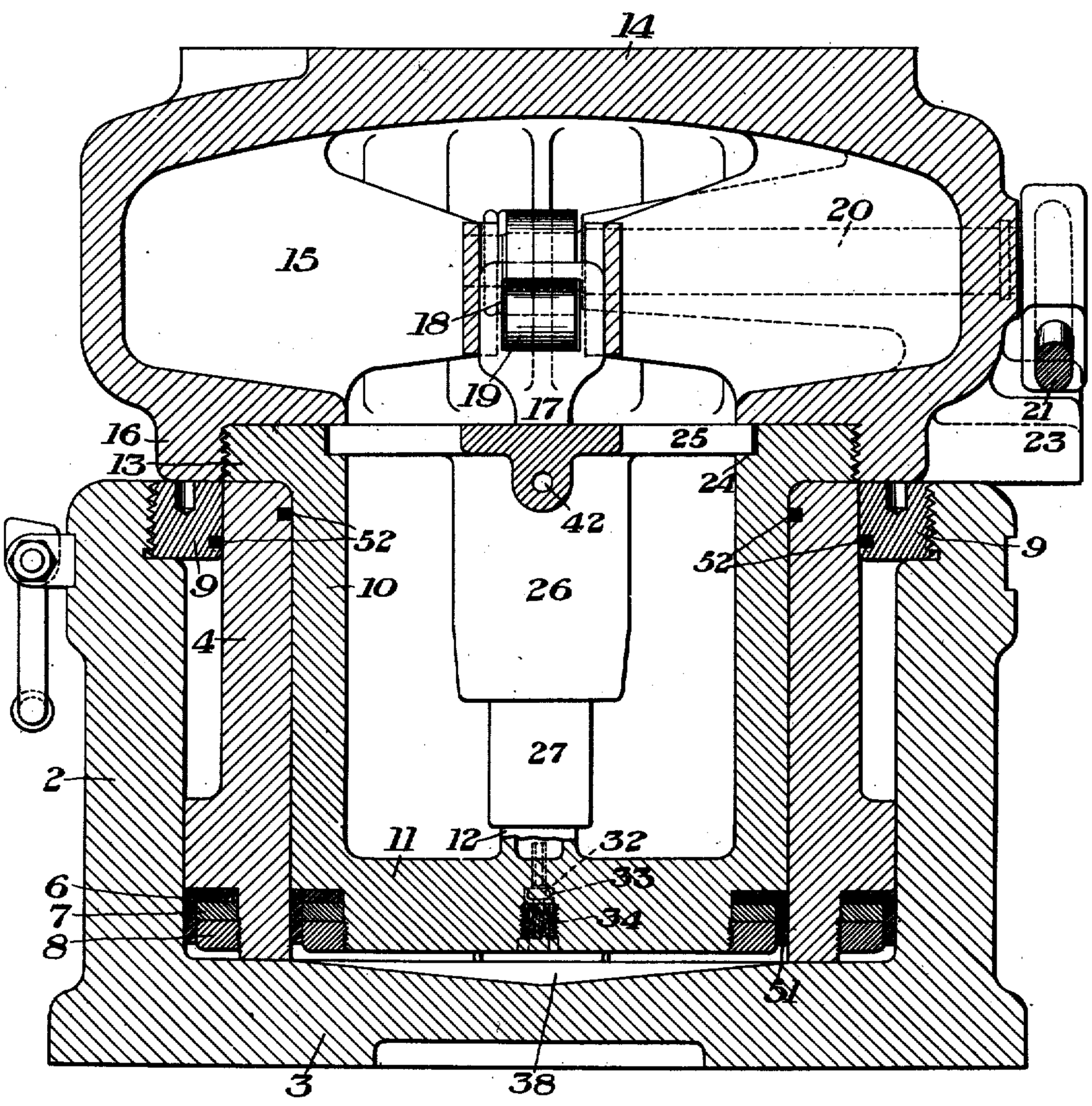
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

EMIL A. GATHMANN, OF BETHLEHEM, PENNSYLVANIA, ASSIGNOR TO BETHLEHEM STEEL COMPANY, OF BETHLEHEM, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

HYDRAULIC JACK.

947,613. Specification of Letters Patent. Patented Jan. 25, 1910.

Application filed March 15, 1909. Serial No. 483,402.

To all whom it may concern:

Be it known that I, EMIL A. GATHMANN, of Bethlehem, Northampton county, Pennsylvania, have invented a new and useful Improvement in Hydraulic Jacks, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figures 1 and 2 are central vertical sections of one form of jack embodying my invention, the two sections being taken in planes at right angles to each other.

My invention relates to the class of hydraulic jacks, particularly portable jacks, and is designed to provide pump mechanism of a novel and efficient character for effecting the operation of the jack.

A further object of my invention is to provide pump mechanism of this character by which the speed of the ram of the jack may be automatically reduced in proportion to the load being lifted. This enables a light load to be lifted rapidly and the speed to be reduced in proportion as the load is increased. It further enables the ram of the jack to be run out rapidly to the load.

The power of a hydraulic jack being inversely proportional to the speed of its ram travel, a small unit lift is necessary when the load is heavy, and my invention provides a pump which is so arranged that the volume of the liquid forced under the ram is automatically increased under a light load, but is reduced with a heavy load to meet the varying conditions of usage.

The nature of my invention will be best understood by reference to the accompanying drawings, in which I have shown the preferred embodiment thereof, it being premised, however, that various changes can be made in the details of construction and arrangement of the parts and that the pump mechanism there shown can be applied to other forms of jacks, without departing from the spirit and scope of my invention, as defined in the appended claims.

In these drawings, the numeral 2 represents a hollow jack cylinder having an integral closed bottom or base 3, the cylinder and base being preferably made in one integral piece from forged steel, although it may be constructed in any suitable manner.

4 designates an outer ram having a lower portion 5 of larger diameter and provided with a cup-packing 6, secured in a circumferential recess thereof by washer 7 and nut 8. The upper reduced diameter portion of this ram moves through a stop collar 9, which is screwed or otherwise secured within the upper end of the cylinder 2 and which projects inwardly to act as a stop against the lower or larger diameter portion 5 of the outer ram.

10 designates the inner hollow ram or piston, having an integral bottom 11, carrying a central upwardly projecting pump cylinder 12. This pump cylinder may be formed integrally with the base 11, as shown. The upper end of the ram piston 10 is provided with a flange 13, extending over the upper end of the outer ram 4, and having screwed or otherwise secured thereto the enlarged hollow ram head 14. This head has an inclosed cavity or chamber 15, which, together with the interior of the ram piston 10, is in operation filled with a suitable liquid, such as oil or alcohol or a mixture of alcohol and water. When the rams are in the lowered position shown in the drawings, the flange 16 of the ram head rests upon the stop ring 9, and the flange 13 of the ram piston 10 rests upon the upper end of the outer ram 4.

The jack as thus far described is substantially similar to one of the forms shown in my Patent No. 941,870, dated November 20, 1909.

17 designates a pump rod having a horizontally extending eye 18, at its upper end portion, which is engaged by a rocker arm 19, projecting from a rocker shaft 20. This rocker shaft 20 is provided with suitable bearings in the ram head, and has its external portion provided with the usual operating handle 21, which has, in the form shown, a stop portion 22, which coacts with a stationary stop 23, on the outside of the head to limit the downward movement of the handle.

Supported on a shoulder 24 at the upper inner portion of the ram piston 10, is a head or spider 25, which carries a cylinder 26, which depends into the hollow ram piston and has its vertical axis concentric with the axis of the pump rod 17, and of the cylinder 12. Secured to the piston rod 17, within the cylinder 26, is a combined piston and valve sleeve 27, whose upper piston end, working within the cylinder 26, has a cup-packing 28, and whose lower portion loosely

fits over and surrounds the lower pump cylinder 12.

29 designates a release valve for the purpose hereinafter described. 30 is a discharge valve for the pump cylinder 12, these valves seating upwardly in the respective chambers 31 and 32, which are bored or otherwise formed in the bottom of the hollow ram, piston, their lower ends being closed by the screw plugs 33 and 34.

35 designates springs which normally hold the valves upwardly against their seats.

The stem of the valve 29 extends upwardly into the chamber in the piston ram to a point directly below the lower end of the sleeve 27, and the stem of the valve 30 projects upwardly into the chamber of the pump cylinder 12. The valve chamber 31 has a port or passage 36, which leads into the chamber of the cylinder 12, and the plug 34 of the valve 30 is formed with grooves or channels 37, which lead downwardly into the space 38 between the hollow ram piston and the base of the cylinder.

The inlet valve for the upper pump chamber is shown at 39, this valve controlling a port 40, which leads from the interior of the hollow ram into the pump chamber 41, of the upper cylinder 26. This upper pump chamber 41 is also provided with an escape port or passage 42, leading into the chamber of the hollow head and normally closed by a spring-seated valve 43. The spring 44 which seats this valve is provided with a suitable tension-adjusting device 45, whereby the valve may be set to open at any desired pressure.

The pump rod 17 is provided with a vertical port or passage 46, which communicates at its upper end with the pump chamber 41, by means of one or more branch ports or passages 47, and which, at its lower end, opens into the lower pump chamber through a check valve 48. This check valve seats upwardly in the pump rod, a screw plug 49, being inserted in the lower end of the pump rod below said valve, the plug also securing the packing 50.

51 designates a packing for the inner ram piston, and 52 designates packing or cleaning rings which are interposed one between the stop ring 9 and the outer ram, and the other between the upper portions of the two rams, for the purpose of preventing dirt or foreign matter from entering.

53 designates a filling plug in the ram head.

The operation is as follows: The hollow head, the hollow ram piston and the pump chambers are, as before described, filled with a suitable liquid. Upon the downstroke of the pump rod, the valve 39 is unseated, and liquid flows into the upper pump chamber. At the same time, the liquid in the lower chamber is forced past the discharge valve 32 and into the lifting chamber. On the upstroke of the pump rod, the valve 39 is closed, and the liquid in the upper chamber, above the piston 28, is forced into the port 47 and passage 46 and past the valve 48 into the lower pump chamber. To lower the jack, the sleeve 27 is engaged with the upwardly projecting stem of the valve 29 to hold said valve open. The load on the jack will then force the liquid in the lifting chamber past the valve 32 (which will also be held open by the engagement with its stem of the lower end of the pump rod), and thence outwardly from the lower pump chamber by the port or passage 36 and past the valve 29 into the lower portion of the reservoir. It will be seen, therefore, that the pump is a double-acting one, liquid being forced underneath the rams by the pump on both strokes. The inner rams are raised simultaneously in direct proportion to the relative displacement of the pump chamber and the rams. During this lifting and for about one-quarter the lifting movement of the inner ram, I obtain a lifting capacity equal to the combined area of the lower end of the two rams, since the upper end of the outer ram bears against the flange at the upper end of the inner ram of the piston. After the outer ram is stopped by the stop ring 9, the inner ram piston continues upwardly for the rest of its stroke.

It will be noted that the upper piston chamber 41 has a much larger volume than the lower pump chamber. In practice, I prefer to make the upper chamber of about five times the volume of the lower chamber. So long as the load to be lifted does not exceed the pressure at which the valve 43 is set to open, it will be seen that this larger volume of the chamber 41 provides for a comparatively rapid lifting of the ram, so that a light load can be lifted rapidly or the ram run rapidly out to the load. When, however, the load on the jack increases beyond the point at which the valve 43 is set to open, said valve will open and a large part of the liquid in the pump chamber 41 instead of passing downwardly to the space below the ram in the manner described, will pass out into the hollow head through the port 42, and the valve 43, the proportionate volume of liquid so escaping depending upon the load. This is an important feature of my invention. In all other differential speed hydraulic jacks with which I am familiar, an adjustment of valves must be made by the operator when a change in the speed of the ram run-out is desired. By my invention, this change of speed is automatically effected and is regulated proportionally to the load being lifted by means of the spring-controlled valve 43, which acts in the nature of a safety valve opening at a predetermined pressure per square inch. To

lower the ram, the operating lever is reversed, enabling the lower end of the sleeve 27 to be brought into contact with the upwardly projecting stem of the valve 29, and the lower end of the pump rod to be brought into contact with the upwardly projecting stem of the valve 30. This unseats these valves and allows the liquid to flow back into the reservoir of the ram.

While I have shown my invention as applied to duplex jacks of the type shown and described, it will be obvious that it may be applied to single jacks. It will also be obvious that many changes may be made in the details of construction and arrangement of the parts, without departing from my invention.

I claim:

1. In a hydraulic jack, a cylinder, a hollow ram piston seated therein, a double-acting lever-actuated pump within the ram piston and arranged to force liquid underneath the ram piston on both strokes, and means for automatically regulating the amount of liquid so forced according to the load being lifted; substantially as described.

2. In a hydraulic jack, a hollow ram piston, having a hollow head attached to its upper portion, a pump cylinder within the lower part of the ram piston, a larger pump cylinder supported by the ram piston, a pump rod working in said cylinders, valve-controlled means for admitting liquid to both cylinders, ports which connect both cylinders with the space below the ram piston, and valves controlling said ports said pump cylinders, pump rod and valves being arranged to force liquid underneath the ram piston during both strokes of the pump rod, substantially as described.

3. A hydraulic jack having a cylinder, a hollow ram piston coöperating therewith, a hollow ram head secured to said piston, upper and lower pump chambers carried by the piston, said chambers being of different capacities, valve and port means whereby liquid is forced from one of said chambers underneath the ram during both strokes of the pump, the larger cylinder and the larger chamber having an escape opening, and an adjustable valve controlling said opening, substantially as described.

4. In a hydraulic jack, the combination with a ram piston, of a double-acting lever-actuated pump located within the ram piston and arranged to force liquid below the said piston on both strokes of the lever, and means for permitting the free escape of a portion of the liquid proportionally to the load from one of the pump chambers on one stroke of the pump, substantially as described.

5. A hydraulic jack, comprising a cylinder, a ram piston arranged to work in said cylinder, and having a hollow head, upper and lower pump cylinder chambers, the lower chamber being within and a part of the ram piston, and the upper one being supported within the ram piston, and a pump rod having pistons of different areas working in said cylinders, the larger cylinder having an escape opening, and an adjustable valve controlling the said opening, substantially as described.

6. In a hydraulic jack, a hollow ram piston having upper and lower pump cylinders of different capacities, a pump rod working in said cylinders, valve-controlled means for admitting liquid to said cylinders, ports connecting both cylinders with the space below the ram piston, and valves controlling said ports, the cylinder of larger capacity having an escape opening and an adjustable spring-controlled valve controlling the said opening, substantially as described.

7. In a hydraulic jack, a hollow ram piston and a hollow head secured thereto, a lower pump cylinder carried by the ram piston, an upper pump cylinder of larger capacity within the upper portion of the piston, a pump rod having pistons of unequal areas working in said cylinders, valve and port means whereby liquid is forced underneath the ram on both strokes of the pump, and means for automatically regulating the amount of liquid so forced during one stroke of the ram, substantially as described.

8. In a hydraulic jack, a hollow ram piston and a hollow head carried thereby, an upper pump cylinder carried by the piston and having a valved inlet passage communicating with the interior of the piston and an escape passage communicating with the interior of the hollow head, a spring-seated valve controlling the escape passage, a lower pump cylinder also carried by the piston, a pump rod working in said cylinders, and ports connecting both cylinders with a lifting chamber below the ram, substantially as described.

9. In a hydraulic jack, a hollow ram piston, a hollow head carried thereby, upper and lower pump cylinders within the ram piston and having different capacities, a pump rod having differential piston areas working in the respective cylinders, a valved port in the pump rod connecting the pump chambers of the two cylinders, said upper cylinder having an inlet port, and there being a valved outlet port connecting the lower piston chamber with a lifting chamber below the ram, the upper piston chamber having an escape opening, and an adjustable automatically opening valve controlling said opening, said pump rod and cylinders being arranged to force liquid into said lifting chamber on both strokes of the rod; substantially as described.

10. In a hydraulic jack, a cylinder, inner and outer rams coacting with said cylinder, a

double-acting pump located within the inner ram and arranged to force liquid below both rams on both strokes, and a spring-actuated valve for automatically regulating the volume of liquid forced under the ram during one stroke of the piston according to the load on the ram, substantially as described.

11. A hydraulic jack, comprising a cylinder, a hollow ram piston seated within the cylinder and having a hollow head, said piston and head forming a reservoir for the actuating fluid, a lower pump cylinder within the lower portion of the ram piston an upper and larger pump cylinder detachably supported within the ram piston, a pump rod having piston portions of different areas working in the respective cylinders, said upper cylinder having a valved inlet port, and the pump rod having a valved port connecting the two cylinders, and means for actuating the pump rod, said cylinders and rod being arranged to force liquid into actuating contact with the ram piston on both strokes of the rod; substantially as described.

12. A hydraulic jack, comprising a cylinder, a hollow ram piston seated within the cylinder and having a hollow head, said piston and head forming a reservoir for the actuating fluid, a lower pump cylinder within the lower portion of the ram piston, an upper and larger pump cylinder detachably supported within the ram piston, a pump rod having piston portions of different areas working in the respective cylinders, said upper cylinder having a valved inlet port, and the pump rod having a valved port connecting the two cylinders, and means for actuating the pump rod, said cylinders and rod being arranged to force liquid into actuating contact with the ram piston on both strokes of the rod, together with means for permitting the escape of a portion of the liquid from the upper cylinder under predetermined conditions; substantially as described.

In testimony whereof, I have hereunto set my hand.

EMIL A. GATHMANN.

Witnesses:

EDW. J. CLORNEY,

G. E. SELLERS.