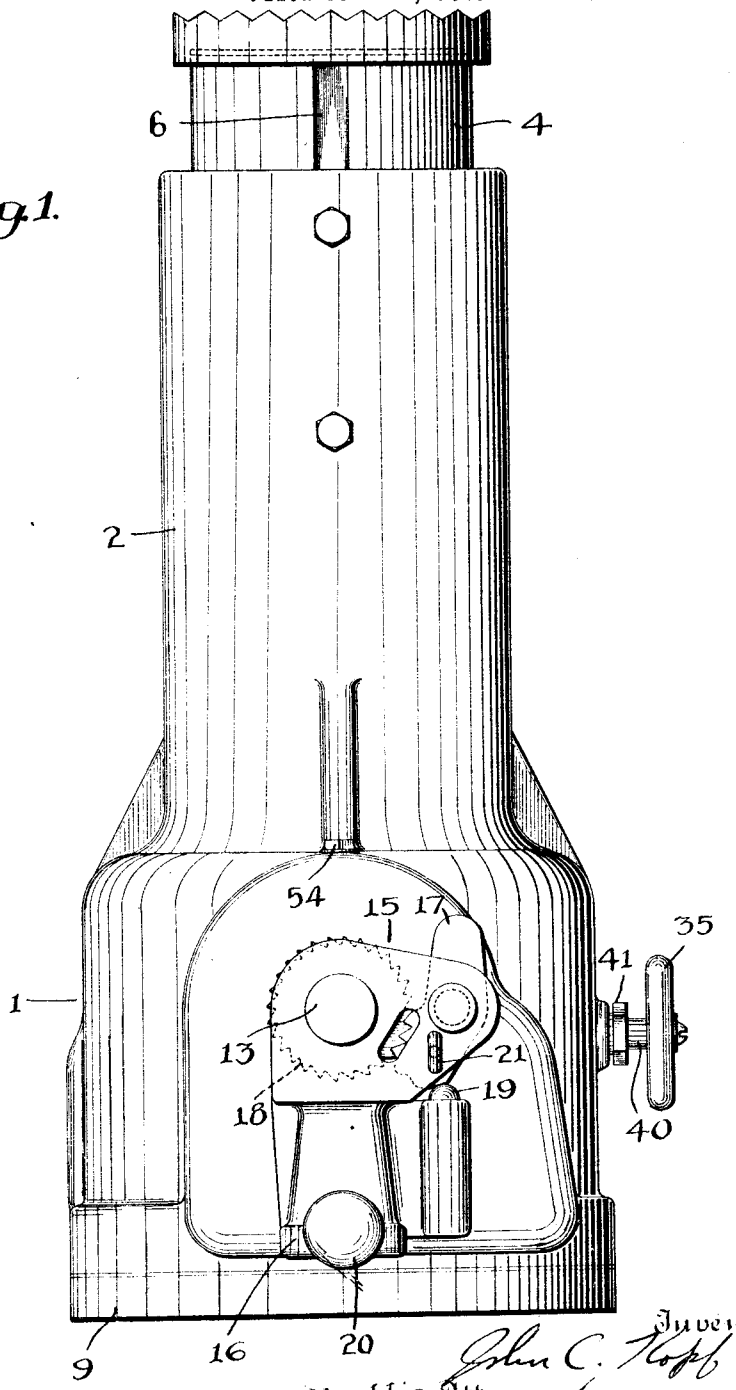
July 14, 1925. 1,545,963

J. C. KOPF

SELF LOWERING JACK

Filed Oct. 26, 1920 5 Sheets-Sheet 1

Fig. 1.



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SELF LOWERING JACK

Filed Oct. 26, 1920 5 Sheets-Sheet 2

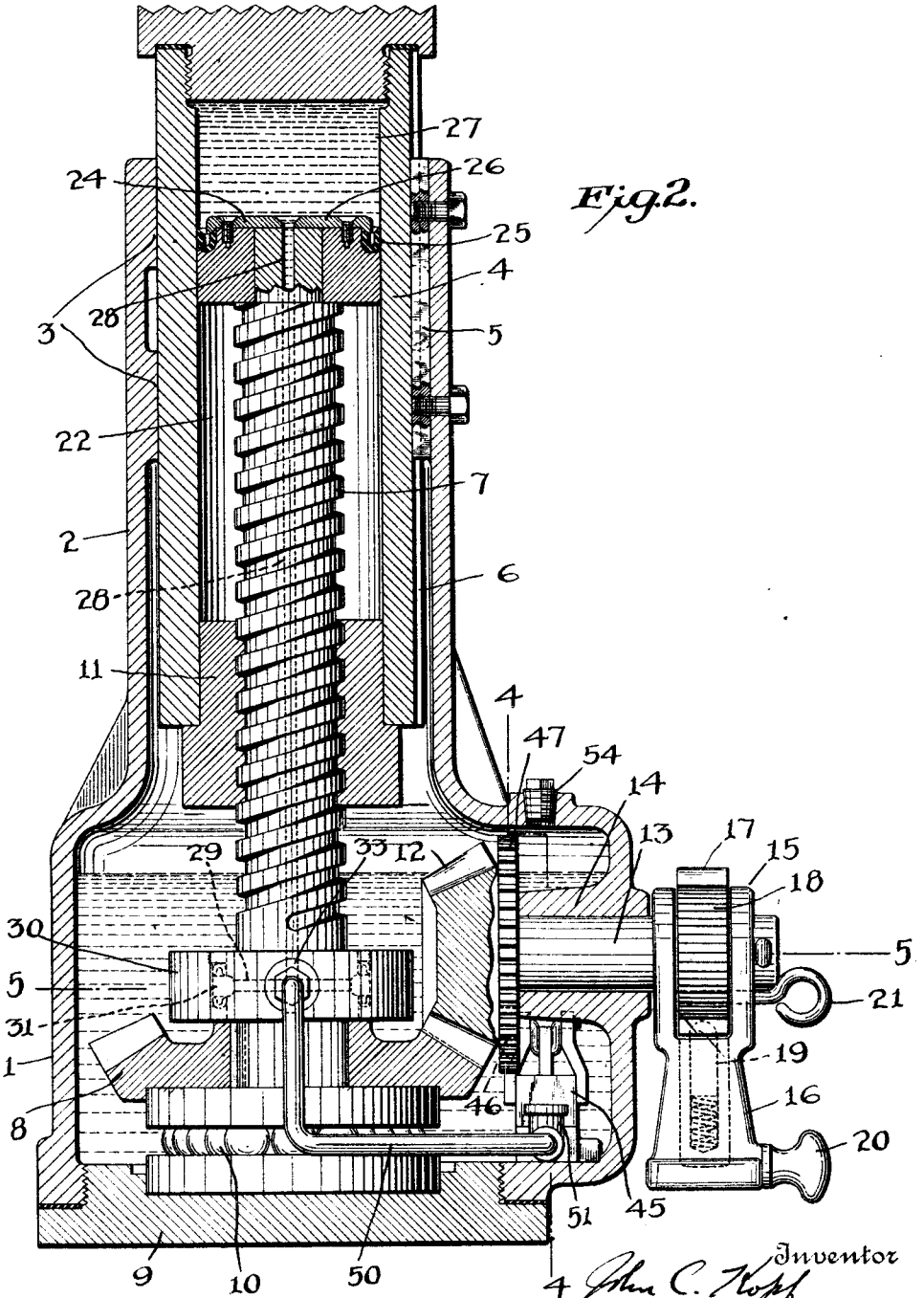


Fig.2.

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SELF LOWERING JACK

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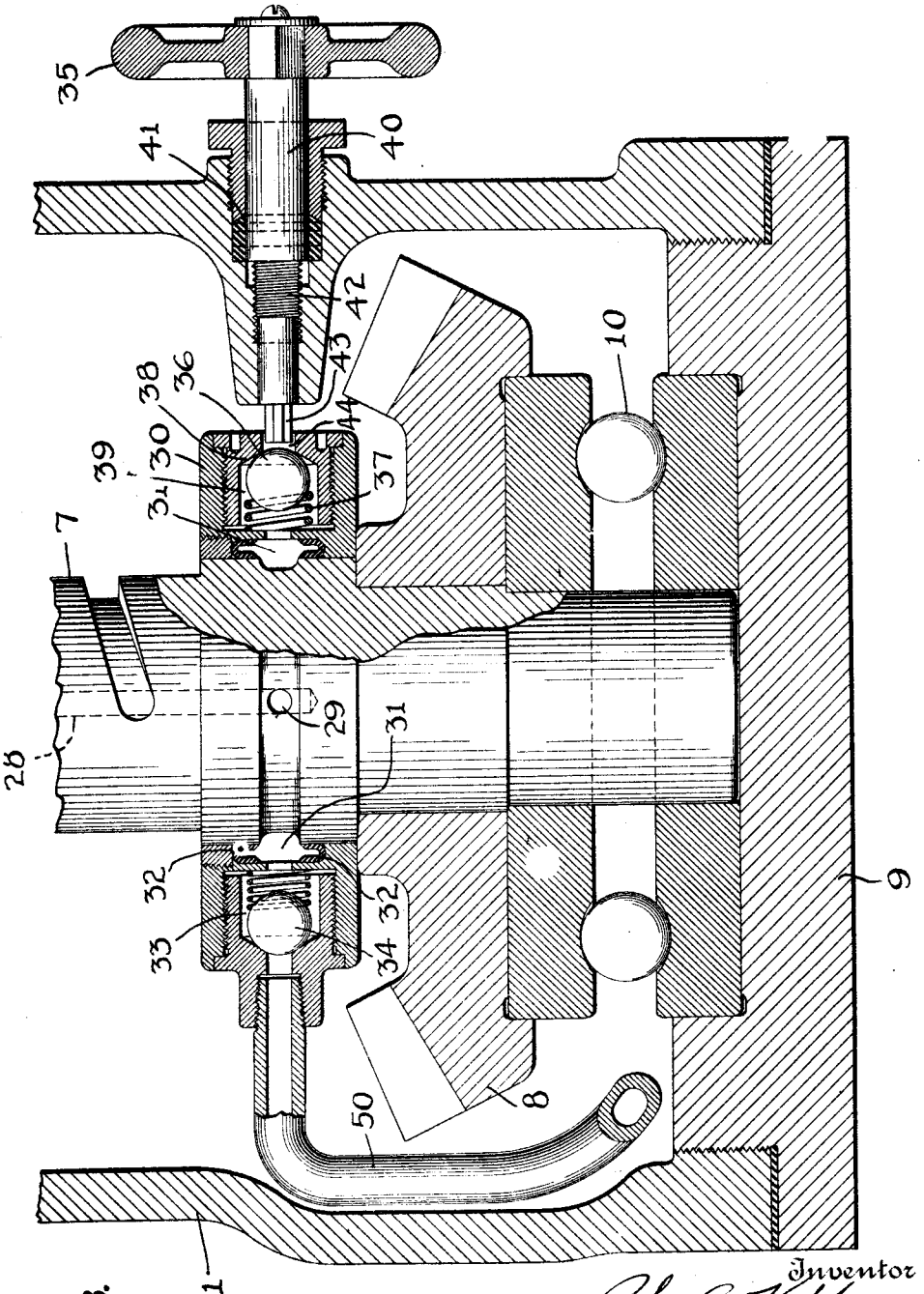


Fig.3.

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SELF LOWERING JACK

Filed Oct. 26, 1920 5 Sheets-Sheet 4

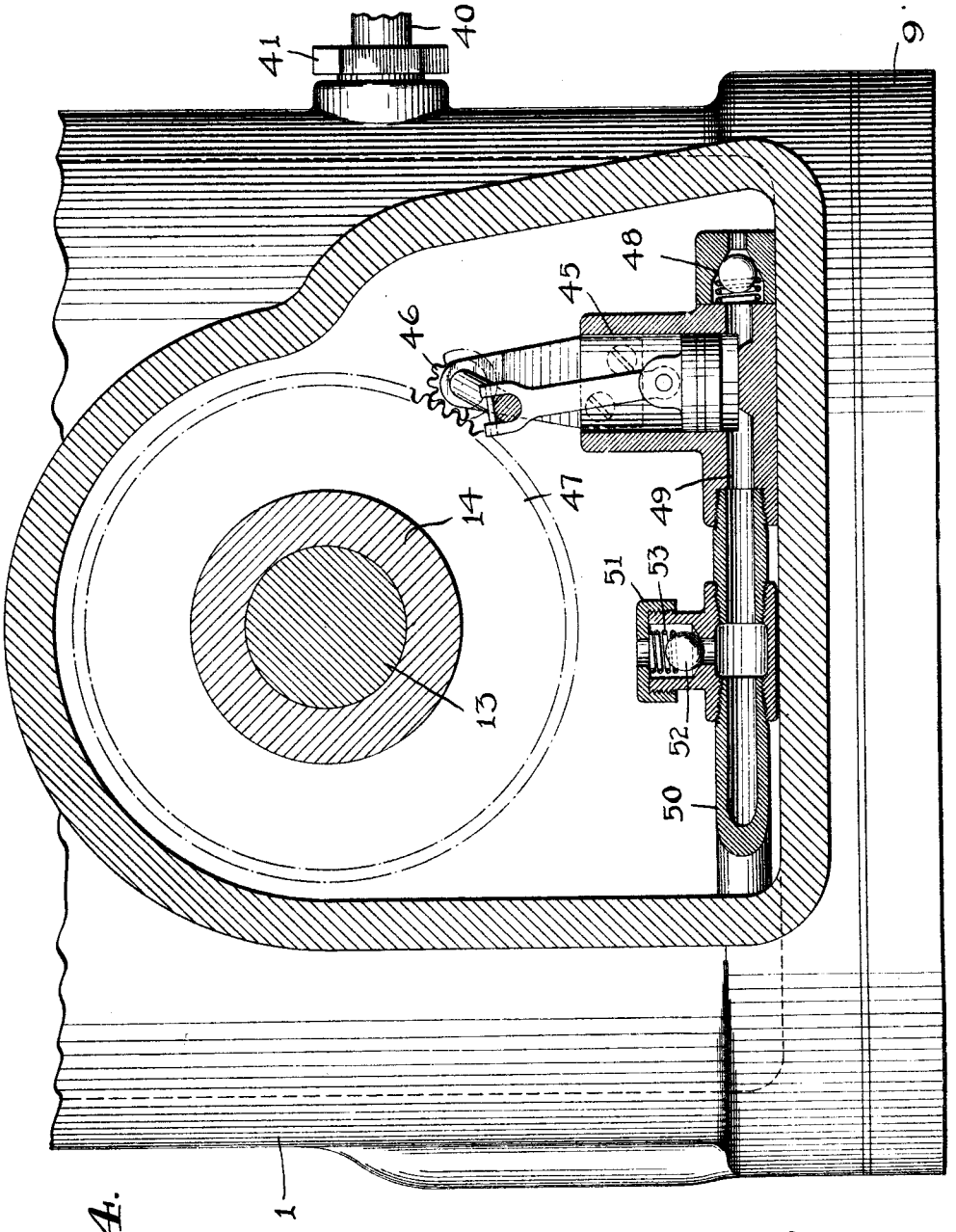


Fig. 4.

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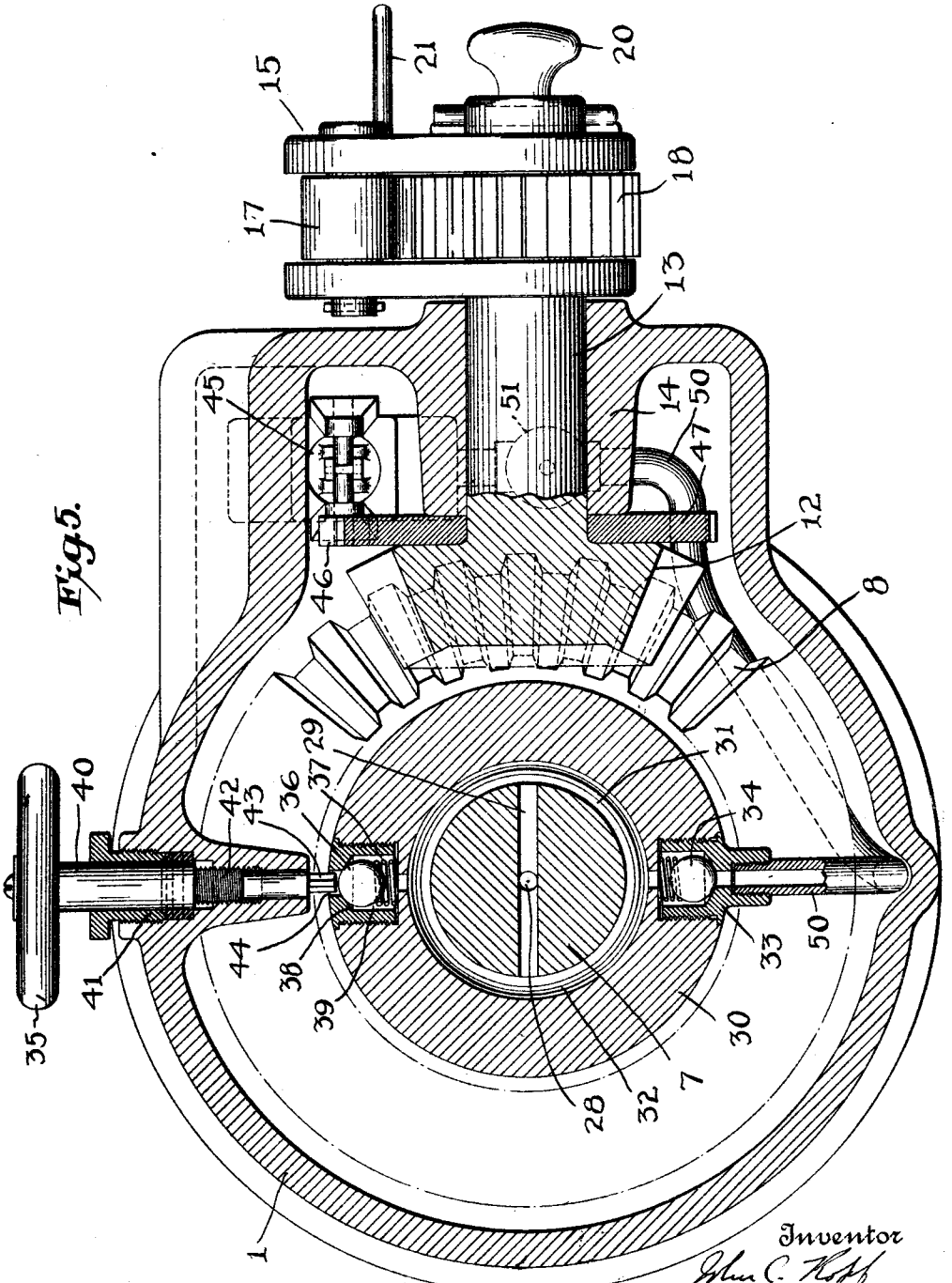
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Filed Oct. 26, 1920 5 Sheets-Sheet 5

Fig. 5.



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Patented July 14, 1925. 1,545,963

UNITED STATES PATENT OFFICE.

JOHN C. KOPF, OF BELLEVUE BOROUGH, PENNSYLVANIA, ASSIGNOR TO THE DUFF MANUFACTURING COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

SELF-LOWERING JACK.

Application filed October 26, 1920. Serial No. 419,634.

To all whom it may concern:

Be it known that I, JOHN C. KOPF, a citizen of the United States, and a resident of the borough of Bellevue, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Self-Lowering Jack, of which the following is a specification.

My object is to provide a self-lowering jack suitable for high lift and heavy duty, which shall be safe, efficient in lifting, easily and certainly controlled for lowering, not subject to failure in operation or to deterioration through lack of attention, and susceptible of very simple and economical construction. In accordance with the invention the vertically movable load member of the jack, with the load, is lifted by mechanical means comprising a steep-pitch screw adapted to run down under the load, and held or chocked indefinitely at any height and lowered by fluid means. Other features of the invention will become apparent from the description of the present preferred embodiment shown in the accompanying drawings, wherein:

Fig. 1 is an elevation of the jack with its load member slightly raised;

Fig. 2 is a central vertical section looking at right angles to Fig. 1, with some of the parts cut by the plane of the section and other parts in front of the plane in elevation;

Fig. 3 is a central vertical section, on a larger scale, of the lower part of the jack, looking at right angles to Fig. 2;

Fig. 4 is a vertical section, on the scale of Fig. 3, taken on the line 4—4 of Fig. 2; and

Fig. 5 is a horizontal section on an intermediate scale, taken on the line 5—5 of Fig. 2.

The jack illustrated in these views comprises a closed base 1 having an upstanding hollow standard 2 with a bearing 3 in its top, and a vertically movable cylindrical load member or ram 4 slidably guided in the bearing. A key 5 in the bearing cooperating with a vertical groove 6 in the ram keeps the latter from turning.

A vertical screw 7 having a bevel gear 8 upon its lower portion is rotatably supported on the removable bottom plate 9 of the base, by means of a ball thrust bearing 10, and passes upward through a nut 11, or female nut part, formed on or secured in the lower end of the load member 4. The threads of the screw parts are of steep-pitch, that is to say, beyond the angle of repose, so that they will permit the load member to descend under the action of the load, the nut in this instance rotating the screw, and the remainder of the operating mechanism being such as to permit this action.

Operating means for the screw may comprise the bevel gear 8 and a bevel pinion 12 on a horizontal operating or lifting shaft 13 passing through a bearing 14 in the wall of the base, on the outer end of which shaft is a pivoted pawl rocker 15, having the usual socket 16 for the reception of a lever handle. A pawl 17 pivoted on the rocker engages a customary ratchet wheel 18 fixed on the shaft, the pawl being pressed by a spring plunger 19, which will also hold the pawl out of action for lowering.

A handle knob 20 on the pawl rocker enables the rocker to be used as a crank for quickly raising the jack up to the load, or for running it down unloaded when the weight of the ram itself is insufficient. For the latter purpose means are provided for locking the pawl to the rocker so that it will not ride idly over the sloping sides of the teeth, which may be accomplished in a simple manner by providing registering holes in the pawl and rocker, and a pin 21, which can be inserted through them or removed.

The load member is here constructed so that its hollow interior 22 forms a fluid-pressure-tight cylinder or working chamber, in which is a stationary piston 24 on the upper end of the screw, said piston having a tight sliding fit with the smooth wall of the cylinder by virtue of a cup packing 25, secured by a plate 26, and adapted to hold against pressure in the pressure chamber 27 of the cylinder, which extends and contracts as the ram rises and descends.

In the case of an overhead pressure chamber such as illustrated, oil is supplied thereto from the general reservoir in the base, through a longitudinal duct 28 in the screw, this duct opening into the pressure chamber through the upper end, and having one or more lateral openings 29 in the lower part of the screw, above the gear 8. A sta-

tionary header collar 30 encircles this portion of the rotary screw, containing an annular chamber 31 communicating with the openings 29, and made tight by upper and lower reversed cup packings 32. At one side the header has an inlet connection 33 containing an outwardly closing ball check valve 34; and at another point is a valved escape, controlled by a handle 35 outside the jack. Preferably, the retarding or escape valve 36 is likewise a ball closing outwardly under the pressure of the fluid and a spring 37 against a seat 38, said seat being in an enlarged portion 39 of the escape passage. The handle is a wheel on the outer end of a stem 40 passing through a stuffing-box 41 in the wall of the base and having a screw-threaded portion 42 engaging internal threads in the wall, the inner end 43 of the stem being adapted to project within the escape opening 44 in the valve seat, to contact with and unseat the ball. When the stem is out of contact with the valve, the escape is entirely closed, and by virtue of this and the sealing provisions, the liquid is absolutely confined in the pressure chamber so that the load cannot sink. By advancing the screw control stem the escape valve is unseated, and according to the extent of opening thus created the load will descend at any speed desired, and uniformly since the retarding means does not pick up momentum. At any point the lowering can be stopped without jar by causing or permitting the escape valve to close, the screw control having sufficient time element to avoid abrupt closing.

The load-sustaining chamber 27, including the supply passage from the check-valve onward, is always full of oil; and when the load member and load are lifted by means of the screw, partial vacuum might be relied upon to draw liquid from the base into the enlarging chamber to cause the liquid to follow the load. In order to obviate resistance, however, it is advantageous to provide positive means for delivering the liquid simultaneously with the lifting of the load. For this purpose a supply pump 45 has been represented in the base, driven by crank connection with a small spur pinion 46 from a gear 47 on the shaft 13 behind the bevel pinion 12. As this pump acts against trifling pressure it is substantially without wear and can be of simple and inexpensive character. The check valve inlet 48 of the pump is arranged to take in oil from the lowest part of the general reservoir, and its outlet 49 is connected by a pipe 50 with the inlet connection 33 of the header. The capacity of the pump should be greater than that of the chamber 27, and an automatic relief 51 containing a valve 52 opening outwardly against a spring 53 discharges the excess, the said spring being adjusted to a pressure such that it insures an ample supply from the pump to the chamber, without substantial pressure on the liquid during the lifting strokes. The relief outlet is between the pump and the check valve 34, and can be extended so as to serve for lubrication of bearings and mechanism. The pump can be connected so as to be driven in the lowering operation as well as when lifting, since during lowering the oil which it pumps is merely discharged through the relief passage.

The header collar 30 is held against rotary or vertical displacement by its connection with the pipe 50, and also by the end of the stem 40, or special means may be provided for the purpose.

The operation of the illustrated embodiment will be briefly described. After the load member has been run up to the load, the lever handle is inserted and the shaft 13 ratcheted in the usual way, so as to lift the load through the gears and quick-pitch screw. At each stroke liquid is introduced correspondingly into the fluid-tight cylinder chamber in sustaining relation to the load member, and is trapped by the check valve and the seal or packings. At any point, therefore, the load is absolutely held by the liquid, to which the pressure of the load is applied. Controlled lowering and stopping is effected by the screw stem 40, causing variable opening and closing of the escape valve 36 connected with the pressure chamber. By fully opening the valve the confined fluid is released for the purpose of lowering or depressing the load member in the absence of a load.

Since the load is sustained at all times by the liquid, there is no possibility of falling as the result of lifting the load above the liquid. If oil is not kept replenished at the plug 54 or other filling opening, the load member will merely oscillate up and down in place, under attempted lifting strokes, when the limit of the liquid has been reached, or if there is no liquid present.

The invention thus combines compulsory screw action on the load member of a jack, for lifting, with hydraulic or fluid-pressure action in connection with the same member for holding and lowering. Inasmuch as there are a variety of ways in which a sealing and closed working chamber, with control means for opening and closing a passage for the confined fluid, can be arranged, directly or indirectly in sustaining relation to the load member, I do not necessarily limit myself to the form of construction illustrated. The jack is efficient and always operative in lifting, and affords sure holding and lowering with a heavy liquid, such as a liquid suitable for lubrication of the jack mechanism, in contradistinction to ordinary hydraulic lifting jacks which re-

quire a thin liquid, such as alcohol, which creates difficulty in producing and holding the pressure and causes packings to dry and become useless.

What I claim as new is:

1. In a jack, the combination of a base, a load member, an interposed lifting screw of run-down pitch, and a hydraulic device capable of holding the load member and load indefinitely at any height to which they may be lifted by the screw, and a valve for said hydraulic device to permit lowering and effect stopping of the load.

2. In a jack, the combination of a base, a load member, interposed mechanical lifting means adapted to run down under the load, a fluid device capable of holding the load member and load indefinitely at any height to which they may be lifted by the lifting mechanism, and valve means cooperating with said fluid device to permit, retard and stop the descent of the load.

3. In a jack, the combination of a base, a load member, interposed mechanical lifting means adapted to run down under the load, and a valved fluid device by which the load will be held indefinitely and by which it may be safely lowered at will.

4. A self-lowering jack, having a base and a load member, in combination with interposed mechanical lifting means adapted to run down under the load, and means comprising a sealing piston and working chamber device confining a body of fluid and so related as to hold the load member with its load at any height to which it may be lifted by said lifting mechanism, together with a valve means for converting the indefinitely supported loaded load member into a slowly descending member and for stopping it at will.

5. In a jack, a base, a load member, and interposed steep-pitch screw lifting mechanism, in combination with means comprising a device confining a body of fluid for holding the loaded load member at any height, and valve means operated by one handle to release the confined fluid and to bring about lowering and stopping of the load at will.

6. A jack having a base, a load member, and interposed lifting mechanism adapted to run down under the load, the base containing a basin for oil for lubricating its mechanism, in combination with a hydraulic device in relation to derive liquid from said basin of lubricating oil and therewith to hold the load at any height to which it may be lifted by the lifting mechanism, and means for controlling said hydraulic device for lowering and stopping of the load.

7. In a jack, a base, a load member, and interposed lifting mechanism, in combination with a device comprising a sealing piston and working chamber in holding relation between the base and the load member, and pumping means operated with the lifting of the load for positively supplying fluid to said working chamber.

8. In a jack, a base, a load member, and interposed lifting mechanism, in combination with a hydraulic device comprising a sealing piston and working chamber in holding relation between the base and the load member, and pumping means operated with the lifting of the load for positively supplying liquid to the working chamber and tending to supply the same at an excessive rate.

9. A jack comprising a base, a load member, a steep-pitch screw interposed between the base and the load member, and lever-operated mechanism for actuating said screw to lift the load member with its load, in combination with hydraulic means upon which the load member and load are dependent for support at any position to which they may be lifted by the screw, and means for controlling the hydraulic means.

10. A self-lowering jack, having in combination with its base and a load member, screw lifting mechanism adapted to run down under the load, means for confining a body of liquid by which the load member and load are held, means for positively supplying liquid to the body simultaneously with the lifting of the load by the screw means, said supply means being of excess capacity, an automatic relief for the excess, and means for effecting lowering and stopping of the load by opening and closing an escape from the confined body of liquid.

11. A self-lowering jack, having a base and a load member, and a sealing piston and working chamber between the base and load member, said chamber having an inlet passage, with a check-valve closing against outflow from the chamber, steep-pitch-screw mechanism for lifting the load member and load and adapted to run down under the load except as the same is held by the liquid, and a pump operated with the lifting of the load and having its outlet connected with the inlet of the chamber.

12. A self-lowering jack, having a base and a load member, a sealing piston and working chamber between the base and load member, said chamber having an inlet passage, with a check-valve closing against outflow from the chamber, steep-pitch-screw mechanism for lifting the load member and load and adapted to run down under the load except as the same is held by the liquid, a shaft geared to the screw means, and a pump in the base operated from said shaft and connected with the inlet of the liquid chamber.

13. In a self-lowering jack, the combination of closed base and load members, steep-pitch-screw mechanism for lifting the load member and load comprising a male screw

part in one of the members and a female screw part in the other, and means for rotating one of said parts, a hydraulic cylinder in the jack member containing the nut, and a sealing piston on the end of the screw, whereby the load is held, means for supplying liquid to said cylinder as the load is lifted, together with a check valve to prevent its return, and means for opening and closing an outlet from the cylinder to effect lowering and stopping of the load.

14. A self-lowering jack, having a closed base and a load member slidable therein, said load member containing a cylinder and a steep-pitch nut, a steep-pitch screw rotatably supported on the base and extending upward through said nut within the cylinder, a sealing piston on the upper end of the screw, mechanism for rotating the screw to lift the load, means of supply for the cylinder including a duct passing upward through the screw, means preventing return of the liquid, and means for opening and closing an outlet from the cylinder to effect lowering and stopping of the load.

15. In a self-lowering jack, the combination of closed base and load members, steep-pitch-screw mechanism for lifting the load member and load comprising a male screw part in one of the members and a female screw part in the other, and means for rotating one of said parts, a hydraulic cylinder in the jack member containing the nut, and a sealing piston on the end of the screw, whereby the load is held, means for supplying liquid to said cylinder as the load is lifted including a duct passing upward in the screw part supported by the base, said duct having a lateral opening at the base, an encircling header forming a tight rotary joint with said part, a pump connected with the header, means to prevent return of the liquid, and means for effecting escape of the liquid for lowering.

16. In a self-lowering jack, base and load members containing steep-pitch screw and nut elements for lifting and fluid-pressure-tight cylinder and piston elements for holding, the rotary screw element containing a longitudinal duct communicating with the holding cylinder, an escape connected with said duct, and means for opening and closing said escape.

17. In a self-lowering jack, the combination with a base and a load member, of a lifting mechanism constructed to run down under the load, a hydraulic device comprising a body of fluid, means for causing the fluid to accumulate under the load member as the latter ascends and to co-act directly with the load member to sustain the latter indefinitely at any position thereof, and means operatable at will to enable the accumulated fluid to retard the load when descending.

18. In a self-lowering jack, the combination with a base member and a load member, of mechanical means for lifting the load member and the load, said load member capable of running down under the load, a piston connected to one of the aforesaid members, a chamber which is connected to the other member and in which the piston is contained, a body of liquid, means to cause the liquid to flow into said chamber, said piston having sealing means to co-operate with the liquid to sustain the load indefinitely, and means operatable to control the outlet of liquid from said chamber for permitting a retarded descent of the load member with its load.

19. In a self-lowering jack, the combination with a base and a load member, of mechanical means for lifting the load member and the load, hydraulic means affording a body of liquid, and means to enable said liquid to chock the load member indefinitely in any position to which it may be raised.

20. A self-lowering jack, having a closed base and a load member slidable therein, said load member containing a cylinder and a steep-pitch nut, a steep-pitch screw rotatably supported on the base and extending upward through said nut within the cylinder, a piston on the upper end of the screw, mechanism for rotating the screw to lift the load, means for positively supplying liquid to the cylinder so as to cause the liquid to follow the load as the latter is lifted by the screw, means to prevent return of the liquid so that it holds the load at any height, and sealing means on the piston to enable the liquid to sustain the load indefinitely.

21. A self-lowering jack comprising a base, a load member and a lever-operated mechanism for lifting the load member and the load, in combination with hydraulic means for indefinitely sustaining the load, whereby the load will be lifted by the lever operated mechanism and sustained by the hydraulic means: said lever mechanism and said hydraulic means being so associated that, upon failure of the hydraulic means to follow the lifting, the load member and its load will move idly up and down with the strokes of the lever.

22. A self-lowering jack comprising a base, a load member, mechanical means for lifting the load member and load, said load member capable of running down under the load, and hydraulic means capable of sustaining the raised load member and load indefinitely, and comprising means tending to cause the liquid to follow the load member at an excessive rate.

23. A self-lowering jack comprising a base, a load member, lifting mechanism mounted in said base and connected to said load member to raise the same, said base com-

prising a basin containing an oil bath in which said lifting mechanism works, said load member and lifting mechanism capable of running down under the load, hydraulic means for chocking the load and sustaining the same indefinitely at different elevations, said hydraulic means comprising means for causing lubricating oil to flow up from said basin to chock the load member, and means under control of the operator for permitting and regulating the return flow of the liquid to said basin, thereby causing a slow descent of the load member with its load.

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