No. 863,781. PATENTED AUG. 20, 1907.

J. G. CALLAN.

GEAR PUMP.

APPLICATION FILED JAN. 19, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

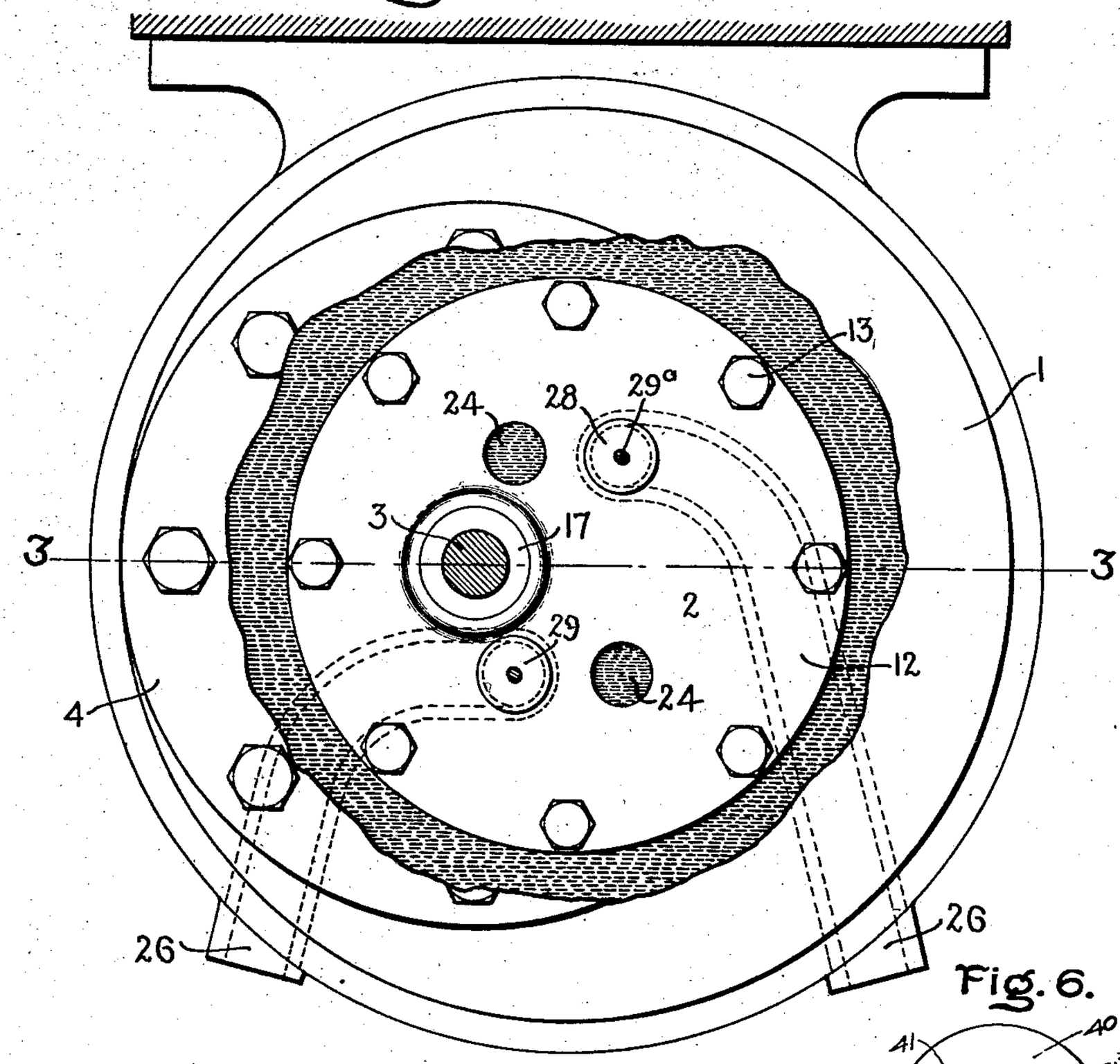


Fig. 6.

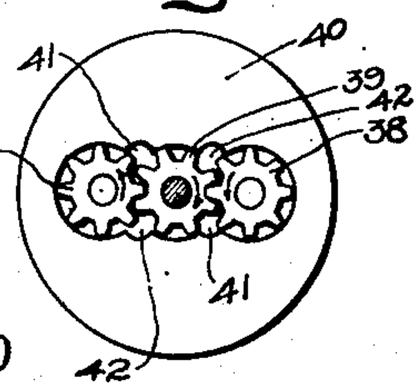
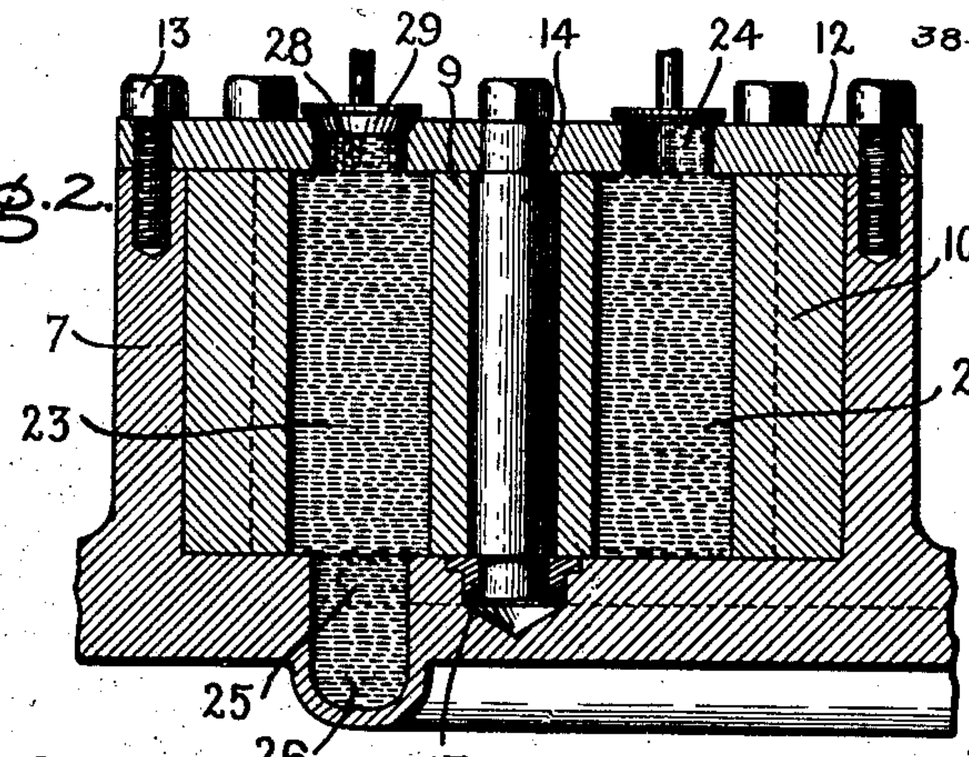


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

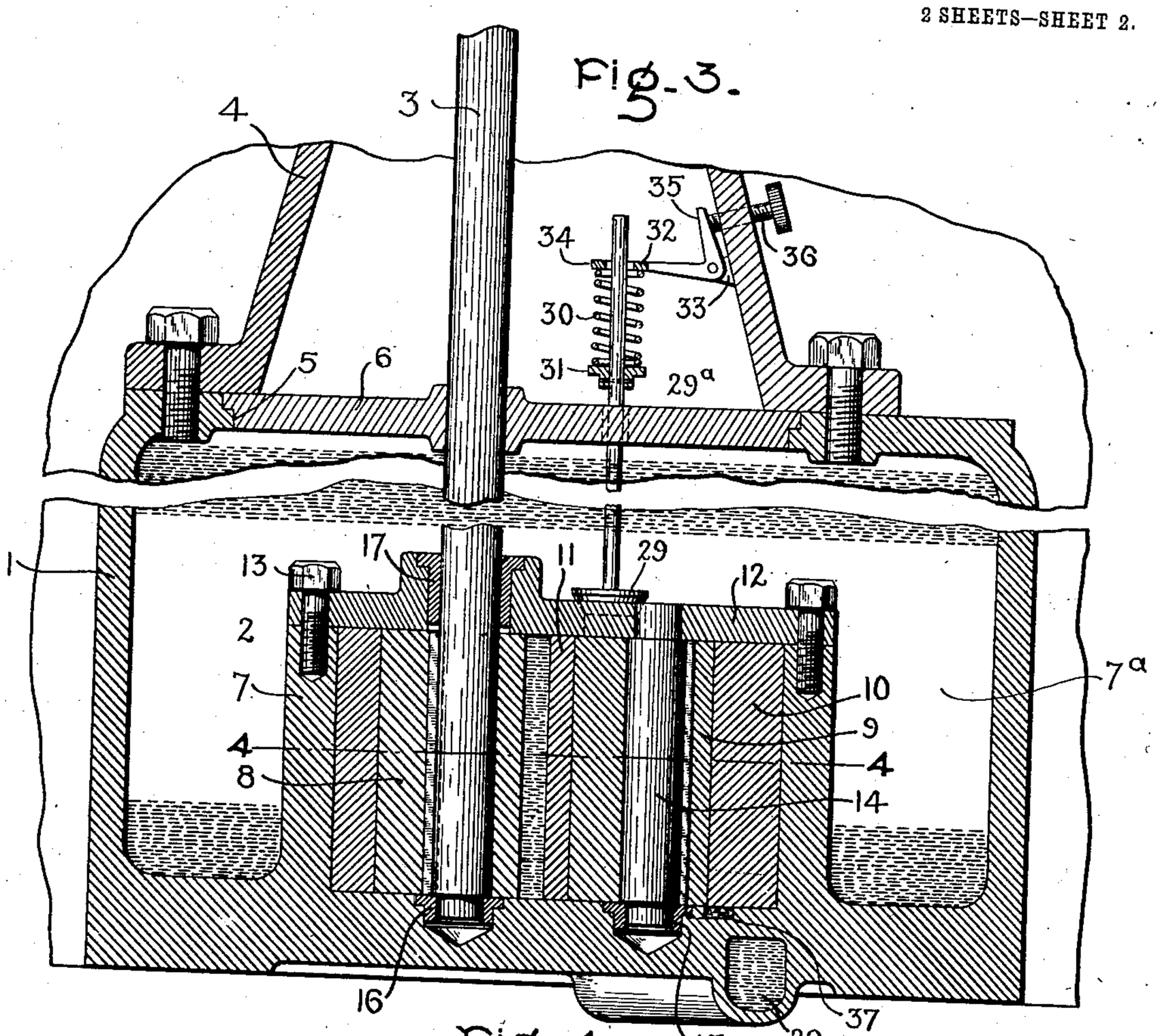

Fig. 4.

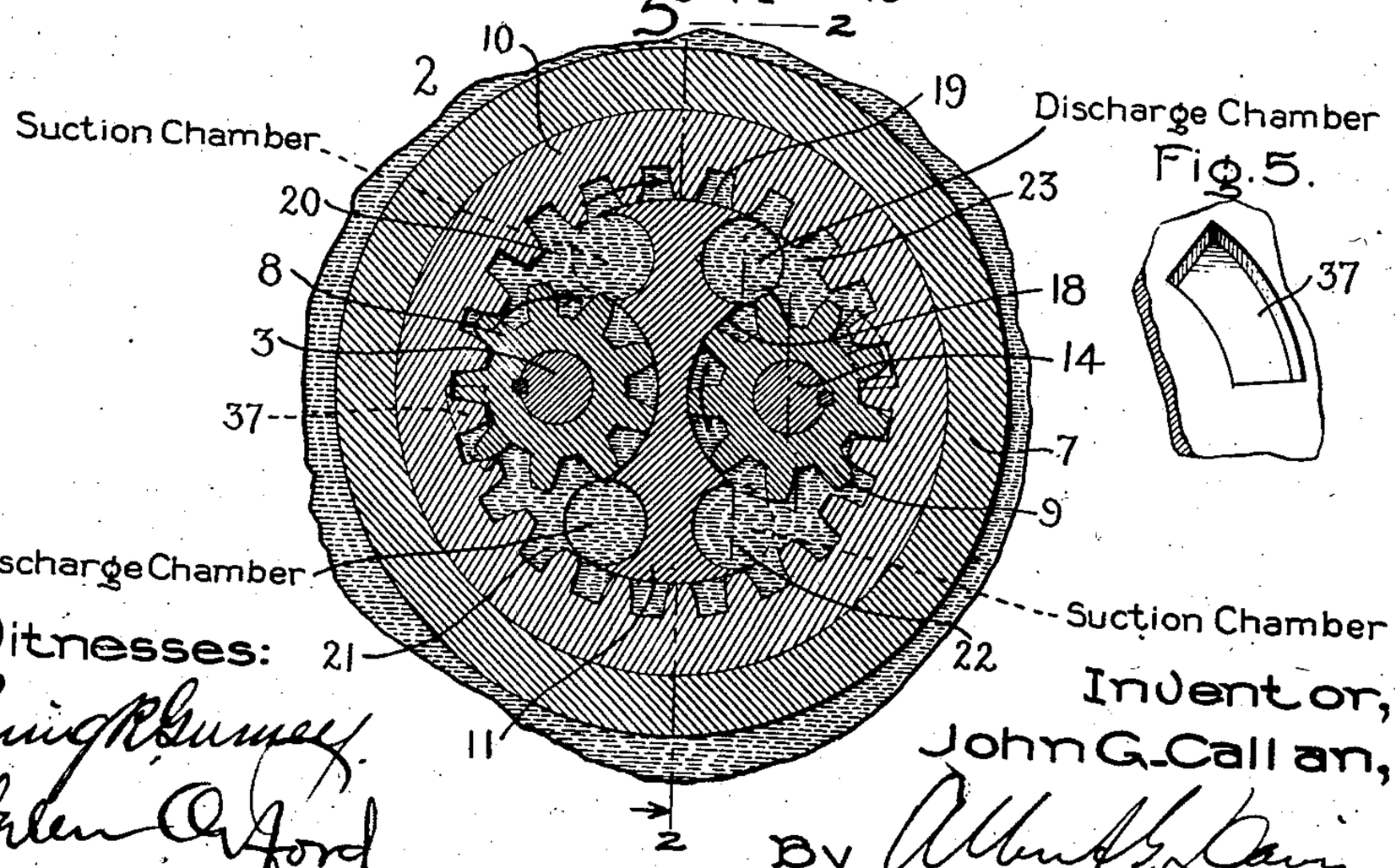

Fig. 5.

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UNITED STATES PATENT OFFICE.

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GEAR-PUMP.

No. 863,781. Specification of Letters Patent. Patented Aug. 20, 1907.

Application filed January 19, 1905. Serial No. 241,789.

To all whom it may concern:

Be it known that I, JOHN G. CALLAN, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Gear-Pumps, of which the following is a specification.

My invention relates to rotary pumps of the gear type, and it relates more particularly to a duplex gear pump, that is to say, a pump provided with two independent discharge chambers, one for each pumping element or gear, as distinguished from those pumps which have only a single discharge chamber common to both pumping elements. The advantage that the former type has over the latter resides in the fact that a single pump structure may be used to supply separate hydraulic distribution systems at the same or different pressures, and in equal or different quantities, according to the demands of service.

The object of the invention is to provide a pump of the character specified which shall be of simple and improved construction and shall operate with a high degree of efficiency.

For an understanding of the invention attention is directed to the following description which sets forth with particularity the construction and mode of operation, and the scope of the invention will be more fully defined in the claims appended hereto.

In the accompanying drawings, which illustrate one embodiment of the invention, Figure 1 is a plan view of the pump structure with a portion broken away to show the pump proper within the liquid-containing casing or reservoir; Fig. 2 is a vertical section of the pump taken on line 2 2, Fig. 4; Fig. 3 is a central vertical section of the pump structure taken on line 3 3, Fig. 1; Fig. 4 is a transverse section of the pump proper line 4 4, Fig. 3; Fig. 5 is a view of a detail of construction; and Fig. 6 is a view of a modified form of pump.

Referring to the drawings, the pump structure comprises a liquid-containing casing or reservoir 1, a pump 2, a driving shaft 3 therefor, and a pedestal 4 superposed on and bolted to the casing, and which is intended to form at its upper end (not shown) a bearing for the driving shaft and a support for the gearing or equivalent means for driving the shaft. The casing 1 serves as a reservoir for the liquid from which the pump draws its supply, and it may be of any capacity and shape desired. Preferably it is a casting which is closed at every point except the top which is provided with an opening 5, Fig. 3, of sufficient size to permit the parts of the pump to be assembled in or removed from the casing. The opening is closed by a removable cover plate 6 whose overhanging edge rests on a shoulder formed at the edge of the opening, Fig. 3, and the bolting of the pedestal in place secures the cover plate. The opening may be located at any other point but the location shown obviates the need of a packed or liquid tight joint.

Arranged within the casing, preferably centrally and on the base thereof, is a cylinder 7 which contains the working parts of the pump. The cylinder may be separate from the casing and suitably secured thereto, or, as shown, it may be cast integral with the base in the form of a flange having a cylindrical interior surface. This surface is carefully finished to form a bearing. The casing is preferably of larger diameter than the cylinder so that a space 7^a, Fig. 3, is provided that serves as a settling well for grit and sediment.

The pump 2 comprises two similar spur gears 8 and 9, an internal gear 10 with which the two gears mesh, and a filler piece or partition 11 which lies within the internal gear and between the gears 8 and 9. These parts are all contained in the pump body or cylinder 7 and the latter is closed by a cover plate 12 which at its edge makes a tight fit with the upper end of the cylinder to which it is bolted by the bolts 13. The gear 8 is keyed to the driving shaft 3 and constitutes one of the pumping elements, and the gear 9 is keyed to a shaft 14, journaled at one end in the cover and at the other in a step bearing or bushed depression 15 in the base of the casing, and constitutes the other pumping element. The shaft 3 is also mounted in a step bearing or bushed depression 16 and it extends through a bushed opening 17 in the pump cover plate 12, Fig. 3. The internal gear snugly fits in the cylinder 7 and rotates freely therein, one of its functions being to transmit motion from one pumping element to the other, or from the driven gear 8 to the driving gear 9.

The partition or filler piece 11 divides the space interior of the internal gear into two symmetrical gear compartments, and each gear 8 or 9 divides its respective compartment into two chambers, one a suction and the other a discharge chamber. The filler piece is held stationary between the spur gears by reason of the latter rotating in contact with concaved surfaces or grooves 18 on opposite sides of the filler piece at the center thereof, Fig. 4. These surfaces are each concaved in an arc having a curvature corresponding to that of the addendum circle of the spur gears. The chord of the arc subtends a certain number of the teeth and the interdental spaces of the subtended teeth form with the concaved or cylindrical surfaces the effective pumping buckets or pockets. The ends 19 of the filler piece are convexed on a circle corresponding to the addendum circle of the teeth of the internal gear and each forms a good working contact with the ends of the teeth, so as to prevent leakage of liquid pocketed between the

interdental spaces and the ends of the filler piece. The number of teeth or interdental spaces of the internal gear which are embraced between the edges of each end of the filler piece is the same as between the edges of each concaved surface 18, Fig. 4, although the numbers may be different if desired, without affecting the principle of operation.

The gear 8 is rotated in the direction indicated by the arrow applied thereto, Fig. 4, or clockwise. This drives the internal gear in the same direction and the latter gear in turn rotates the other spur gear 9 in a clockwise direction, as indicated by the arrow shown on the same. With the gears rotating in the manner indicated, the pockets or buckets of the spur gear 8 receive liquid from the chamber 20 and deliver it to the chamber 21. The pockets of the spur gear 9 receive liquid from the chamber 22 and deliver it to the chamber 23, while the pockets of the internal gear at the ends of the filler piece or partition receive liquid from the chambers 20 and 22 and deliver it to the chambers 23 and 21 respectively. The chambers 20 and 22 are, therefore, suction chambers and the chambers 21 and 23 are discharge chambers. The suction chambers are each provided with an inlet or suction port 24 in the cover plate of the pump, Figs. 1 and 2, which communicate with the liquid-containing reservoir. The discharge chambers deliver through ports 25 in the base of the casing 1, Fig. 2, which communicate with conduits 26 cored in the base, Figs. 1 and 2, that may connect with separate distribution systems, or a single system, as desired. From the foregoing it will be noted that the operating parts are contained in a single pump body or cylinder, and the filler piece divides the cylinder into two compartments, with a pumping element or gear in each. Both elements draw their supply from a common source, viz., the reservoir in which they are contained. It is also to be noted that while the internal gear transmits motion from the driving spur gear 8 to the driven spur gear 9, it itself contributes in delivering liquid.

The speed of the two pumping elements and their capacity are equal, and they may deliver liquid at the same pressure or at different pressures according to the demands of the distribution systems. It may be desirable to vary the quantity of liquid delivered by the pumping elements. As the capacities of the elements are substantially constant for a given speed a portion of the effective delivery of each element may be by-passed in any proportion desired. For this purpose a by-pass is provided between each discharge chamber and the reservoir, so that the liquid delivered by the elements may be proportioned between the distribution systems and the reservoir. These by-passes each comprise a port 28 in the cover plate of the pump, which communicates with the reservoir and one discharge chamber, and an outwardly opening valve 29 for closing the ports. These valves may be set to open at any desired pressure of liquid in the distribution systems. It is preferable to control the operation of these valves from a point exterior to the pump structure. To accomplish this each valve is provided with a stem 29^a which extends freely through the cover plate, and carries a helical spring 30 which rests upon an abutment 31 on the stem, Fig. 1. At the upper end of the spring an adjustable abutment 32 is provided, the position of which determines the tension on the spring. This abutment preferably takes the form of a bell-crank lever which is fulcrumed on a lug 33 formed on the interior surface of the pedestal 4. The inner end of the lower arm of the bell-crank lever is provided with an eye 34 which receives the valve stem and it engages with the upper end of the valve stem spring. The other arm 35 of the lever engages with a set screw 36, the knurled head of which is located exterior to the pedestal and the end of the screw impinges upon the lever. Thus, by adjusting the set screw, the lever or abutment varies the tension of the spring. To facilitate this operation a suitable pointer and scale may be employed in connection with the set screw, as is obvious.

In order to prevent destruction to the teeth of the gears, by the wedging or compression of liquid between the meshing teeth of the spur and internal gears, passages 37 are formed at the top or bottom of the gears at a point where the teeth mesh. These passages are shown, Figs. 3, 4 and 5, as arc-shaped depressions or recesses, and they permit the liquid that is entrapped between the meshing teeth to by-pass back to the discharge chambers.

In cases where the working pressure of the two distribution systems is different, it is preferable to utilize the driving spur gear 8 as the heavy duty pumping element, since this gear is rotated by the driving shaft and, therefore, the power is more direct.

I find a pump of the construction described useful in forced feed lubricating systems for high speed machinery, such, for instance, as the bearings of steam turbines, and as the distribution or feed systems are independent the likelihood of failure of lubrication is reduced to a minimum. Obviously the pump is not limited to this particular use.

According to the modified construction of pump, Fig. 6, the gears or pumping elements 38 are driven by a spur gear 39 which meshes with both. The spur gear, like the filler piece in the pump previously described, divides the cylinder or drum 40 into two compartments, and like the internal gear, it contributes to deliver fluid. It delivers fluid from the suction chamber 41 of one compartment to the discharge chamber 42 of the other compartment.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by equivalent means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a rotary pump, the combination of a pump body, imperforate means dividing the same into two compartments, and a rotary pumping element in each compartment.

2. In a rotary pump, the combination of a cylinder, two spur gears therein, and a partition between the gears which is provided with curved surfaces that coöperate respectively with the teeth of each gear to form delivery pockets.

3. In a rotary pump, the combination of a cylinder, separate pumping elements therein, means surrounding said elements for transmitting motion from one element to the other, and separate discharge chambers for the elements.

4. In a rotary pump, the combination of a cylinder, separate pumping elements therein, means within the cylinder which transmits motion from one element to the other, and an imperforate partition between the elements which divides the cylinder into separate compartments.

5. In a rotary pump, the combination of a cylinder, an internal gear therein, spur gears meshing therewith, and means which divides the space within the internal gear into separate discharge and suction chambers for each spur gear.

6. In a rotary pump, the combination of a cylinder, separate pumping elements therein, separate suction and discharge chambers for the elements, and means surrounding said elements by which one element drives the other which also operates to discharge liquid.

7. In a rotary pump, the combination of a cylinder, a cylindrical internal gear fitted in the cylinder, a spur gear which drives the internal gear, a second spur gear which is driven by the internal gear, a filler piece within the internal gear which divides the interior of the latter into separate suction and discharge chambers, and surfaces on the said piece which coöperate with the teeth of the gears to form discharge pockets.

8. In a rotary pump, the combination of a cylinder, two spur gears therein, a filler piece between the gears which divides the cylinder space into separate discharge and suction chambers for the gears, and an internal gear within the cylinder which transmits motion from one gear to the other and coöperates with the filler piece for discharging liquid from the suction chamber of one spur gear to the discharge chamber of the other.

9. In a structure of the character described, the combination of a casing or reservoir, a cylinder located therein, pumping elements in the cylinder, free supply connections between the cylinder and reservoir, and separate discharge conduits which deliver liquid from the cylinder to points exterior to the casing.

10. In a structure of the character described, the combination of a casing or reservoir, a cylinder cast integral with the base thereof, separate pumping elements in the cylinder supply connections between the reservoir and the elements, and independent discharge conduits for said elements.

11. In a structure of the character described, the combination of a liquid-containing casing or reservoir, a pump chamber, separate pumping elements in the chamber, and a by-pass between the discharge side of one element and the reservoir.

12. In a structure of the character described, the combination of a casing or reservoir having an internal cylinder cast integral therewith, a cover plate for the cylinder, independent pump elements in the cylinder, ports in the cover plate through which liquid flows from the casing to the pumping elements, independent discharge conduits, and controlled by-passes between the pumping elements and the reservoir.

13. In a structure of the character described, the combination of a casing or reservoir, a cylinder therein, a pumping element in the cylinder, a by-pass between the discharge side and the suction side of the element, and means controllable from without the casing for regulating the by-pass.

14. In a structure of the character described, the combination of a casing or reservoir, a pump therein, a by-pass for the pump also within the casing, an automatic valve for the by-pass, a stem therefor which extends through the wall of the casing, and means exterior to the casing which engages the stem for regulating said valve.

15. In a structure of the character described, the combination of a casing or reservoir, a pump located therein, a by-pass for the pump, a valve for the by-pass, a rotary driving shaft for the pump, a pedestal on the casing for the shaft, a stem on the valve which extends through the casing into the pedestal, a spring on the stem, an adjustable abutment for the spring, and means exterior to the pedestal for adjusting the abutment to vary the tension of the spring.

16. In a rotary pump, the combination of two rotary pumping elements, a casing or inclosure for the same, an imperforate partition between the elements, means for admitting fluid to the elements, and means for conveying fluid from them.

17. A pump comprising a structure having two concentric chambered portions of which one forms a reservoir, rotary pumping elements in the other chambered portion, means for rotating the elements, and independent permanently open ports between said chambered portions through which fluid from the reservoir is drawn by the elements and means for discharging fluid from the pumping chamber.

18. A pump comprising a structure having a chambered portion which forms a reservoir for the liquid to be pumped, independent rotary pumping elements mounted in said structure and arranged below the level of the liquid in the reservoir, free ports communicating with the reservoir through which liquid is drawn by the elements, and independent relief valves between the discharge side of the element and reservoir.

In witness whereof, I have hereunto set my hand this sixteenth day of January, 1905.

JOHN G. CALLAN.

Witnesses:

JOHN A. MCMANUS, Jr.,

DUGALD MCK. MCKILLOP.