

Oct. 20, 1942.

J. ZWICKY

2,299,448

PUMP AND FILTER THEREFOR

Filed Jan. 23, 1941

10 Sheets-Sheet 1

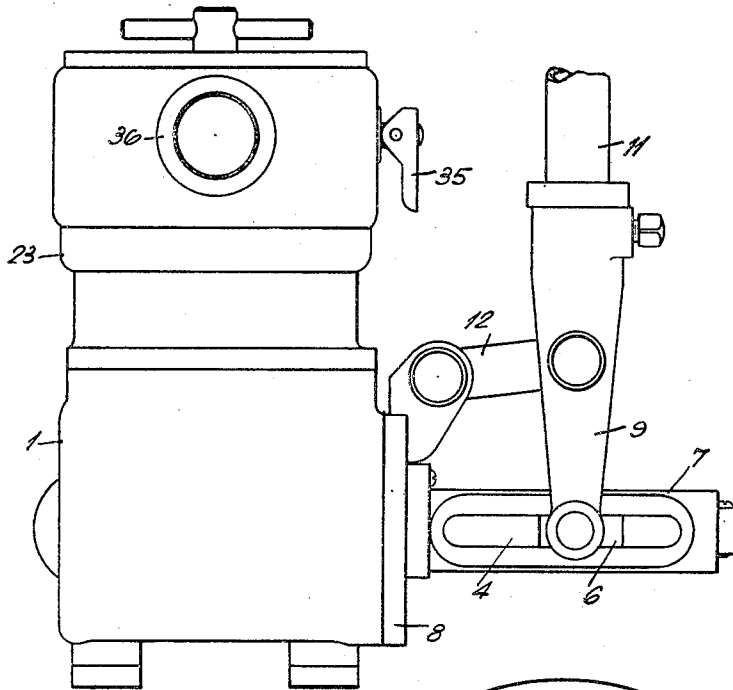


FIG. 1.

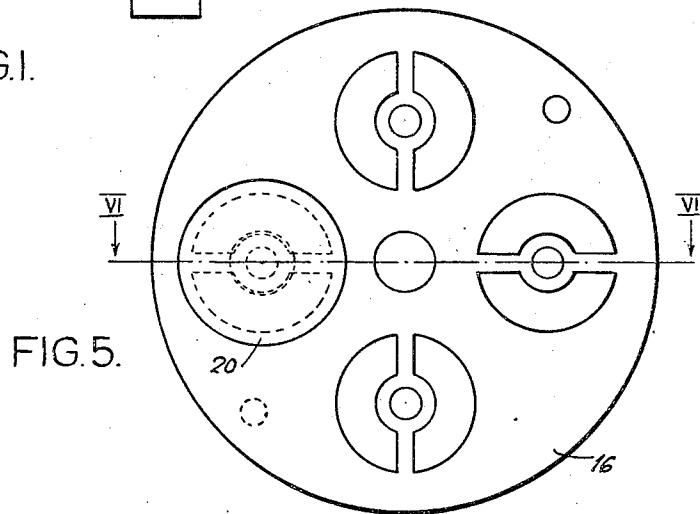


FIG. 5.

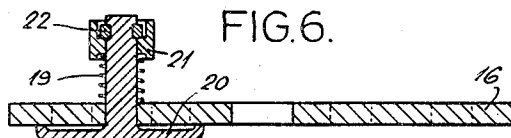


FIG. 6.

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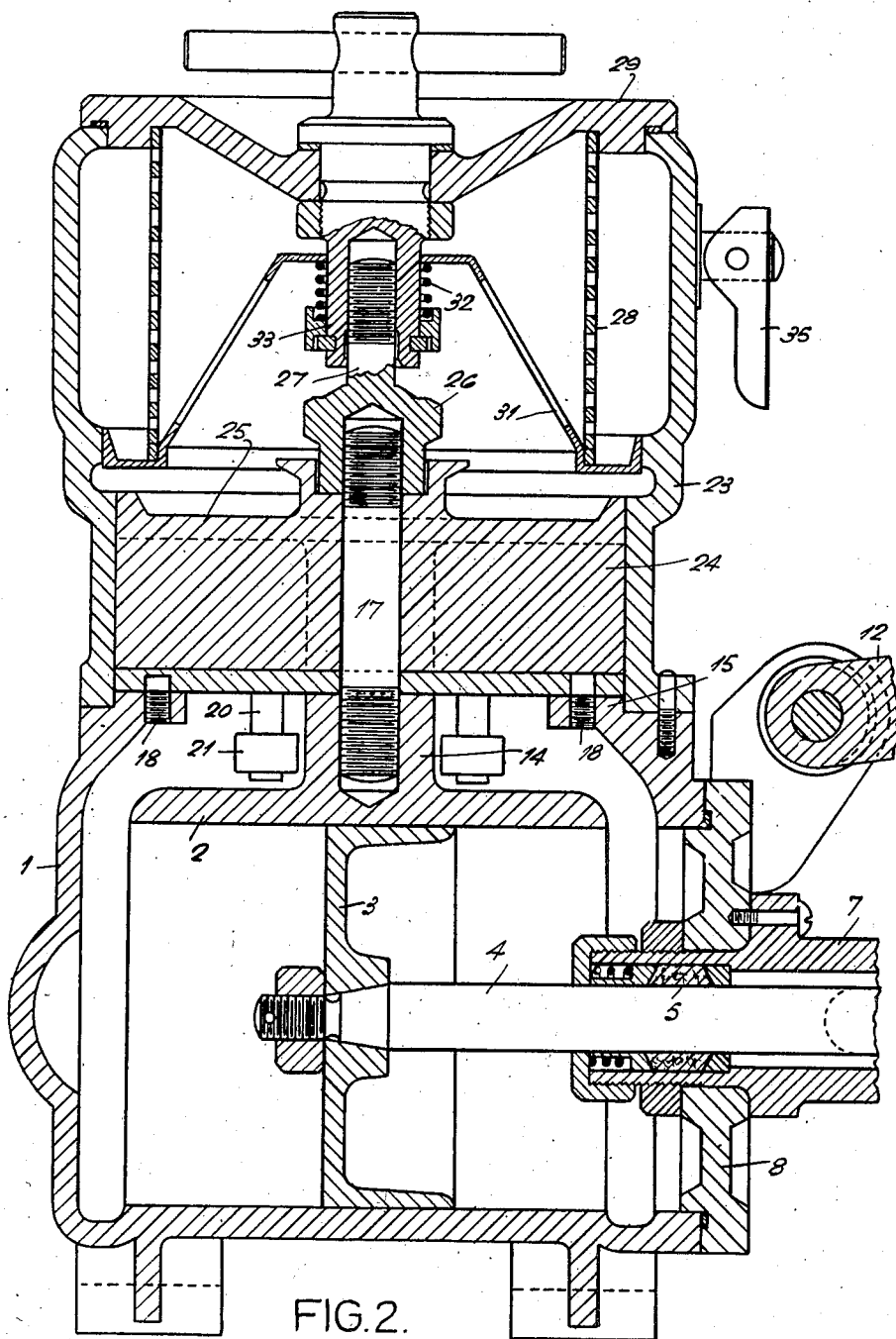
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10 Sheets-Sheet 2



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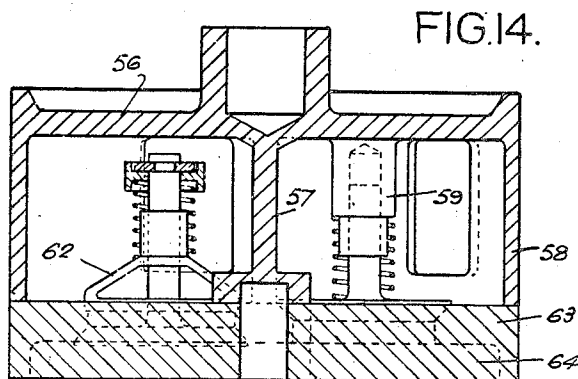
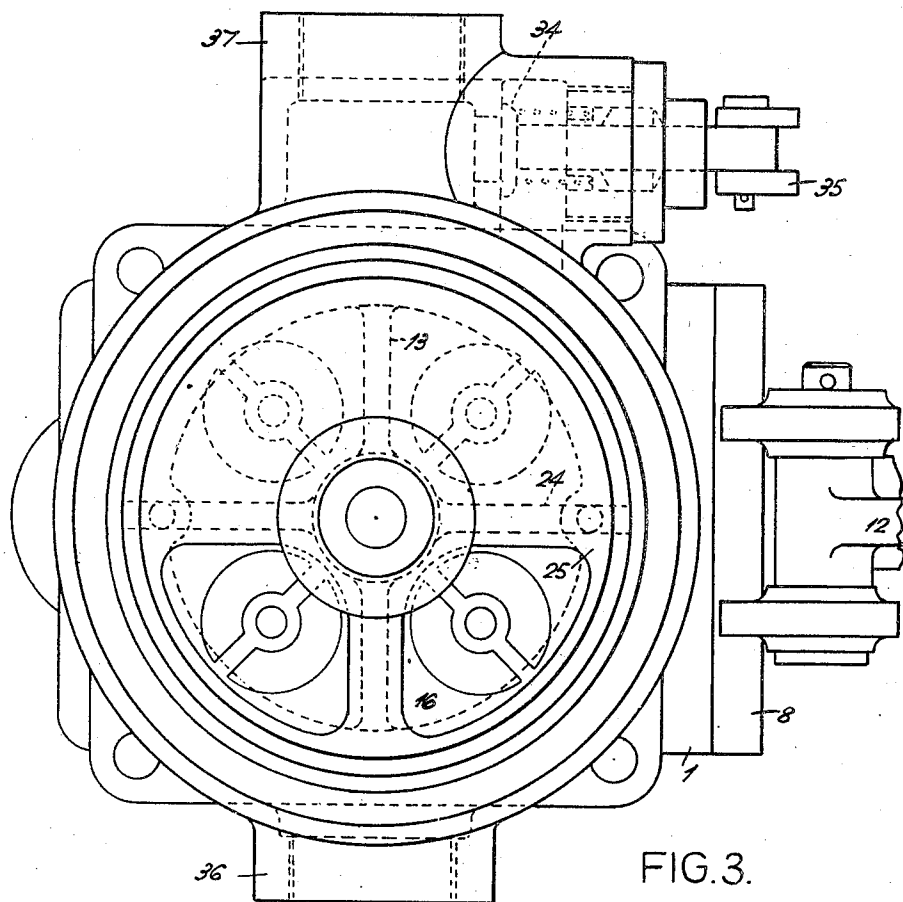
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10 Sheets-Sheet 3



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10 Sheets-Sheet 4

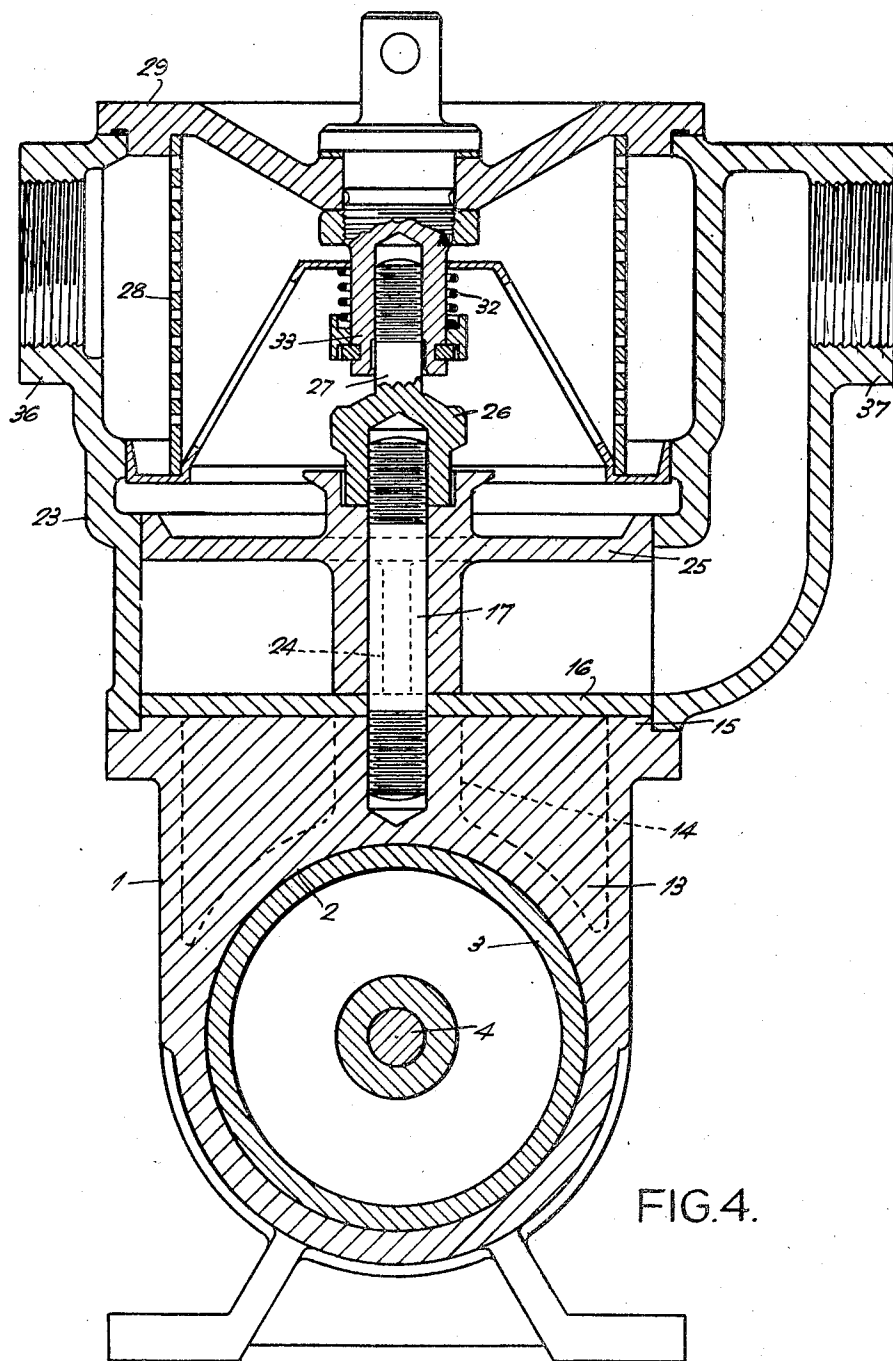


FIG. 4.

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10 Sheets-Sheet 5

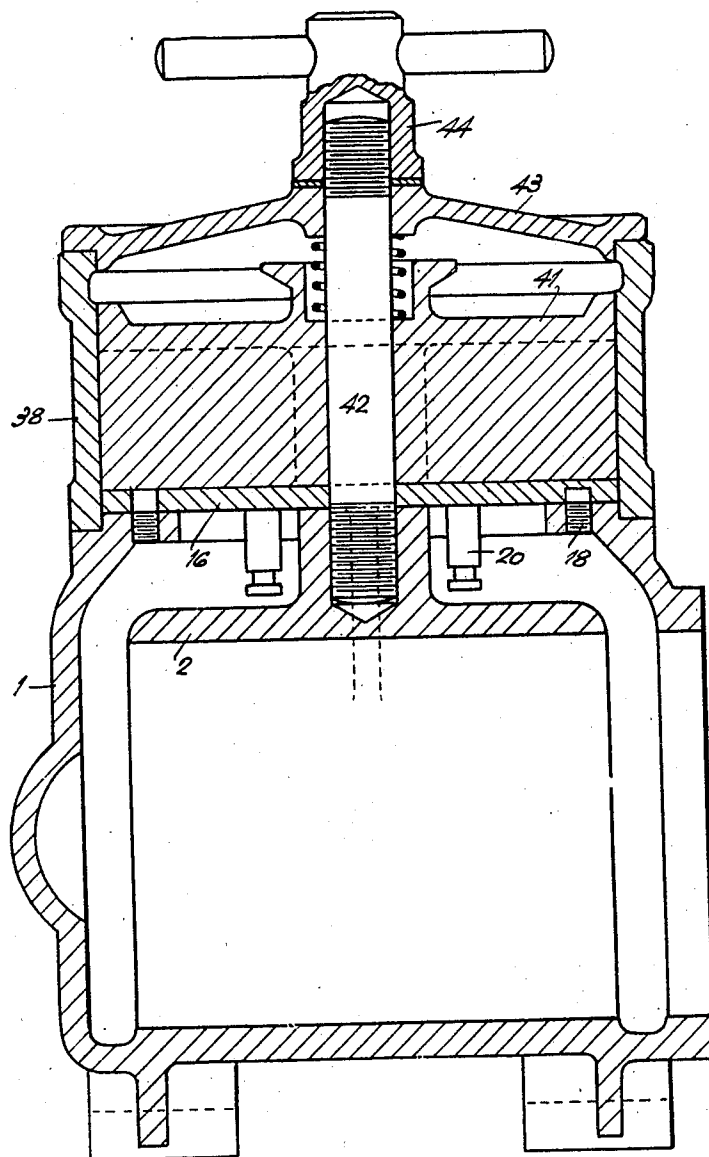


FIG. 7.

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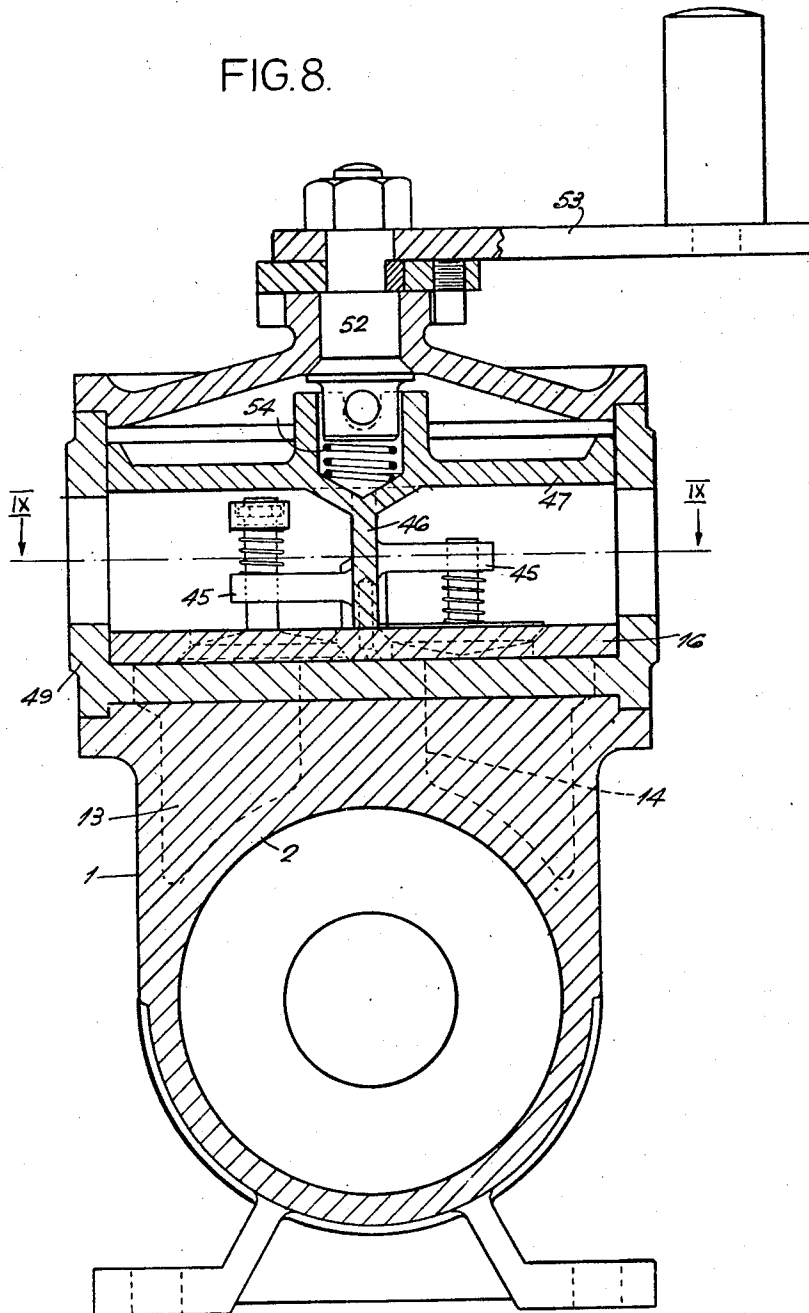
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FIG. 8.



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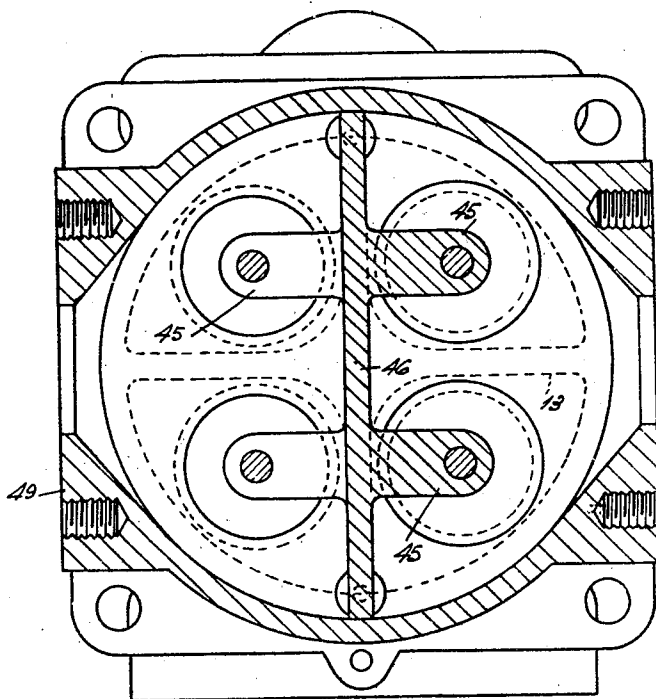


FIG. 9.

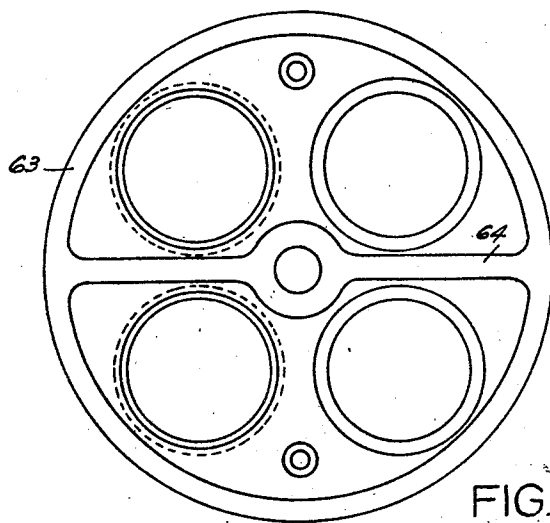


FIG. 13.

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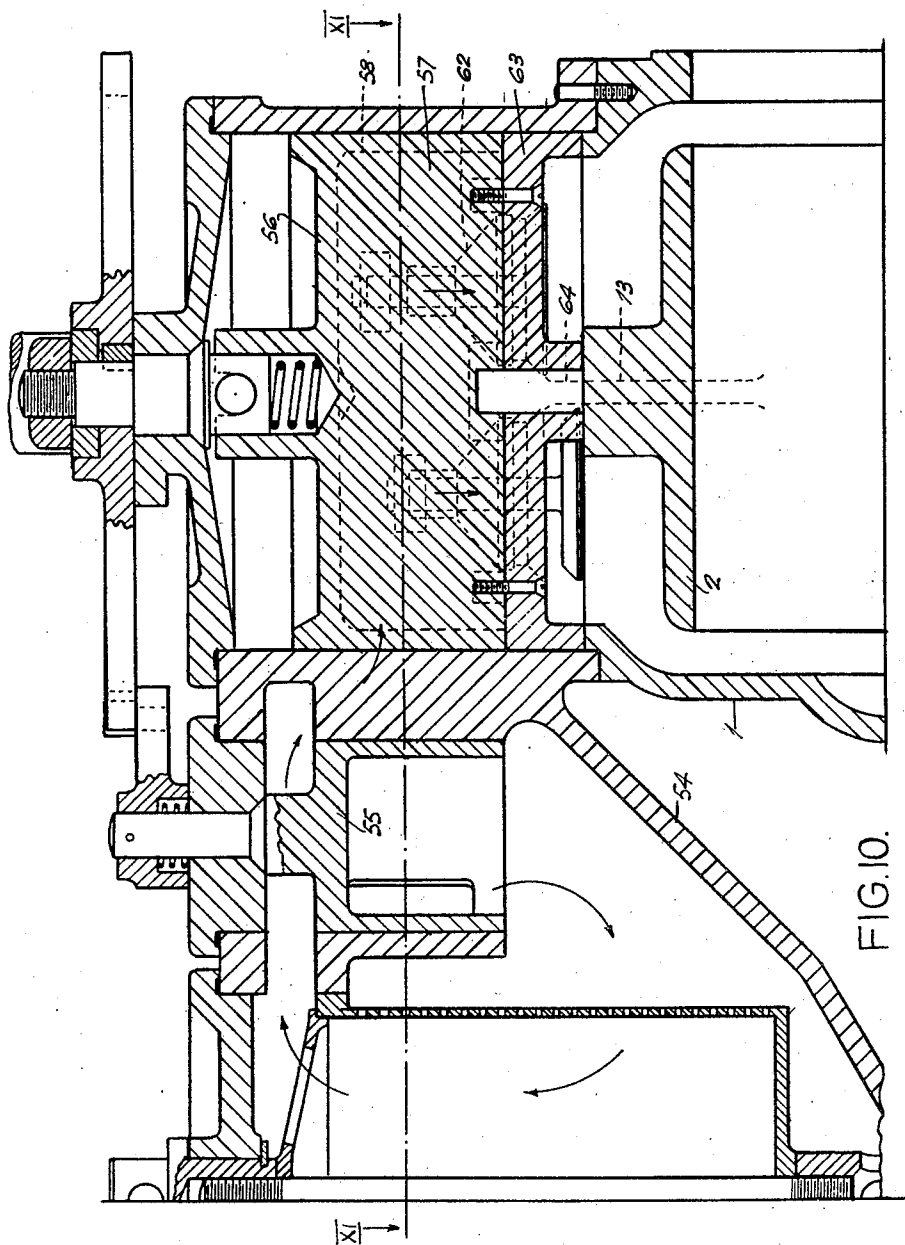
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2,299,448

PUMP AND FILTER THEREFOR

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10 Sheets-Sheet 8



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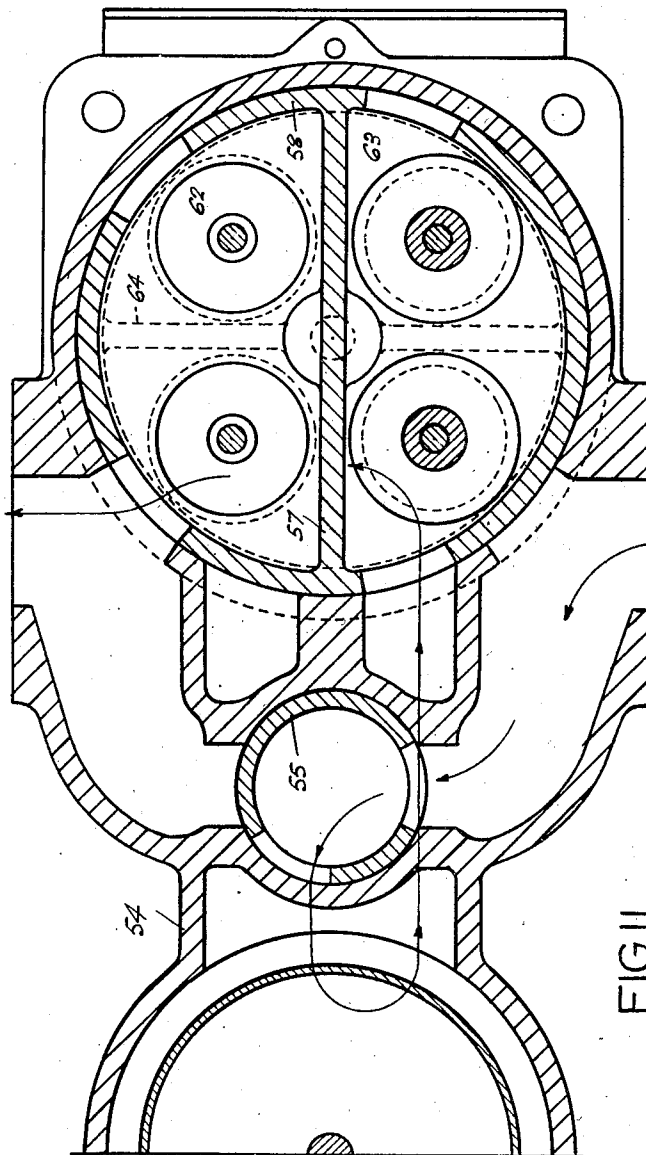


FIG. II.

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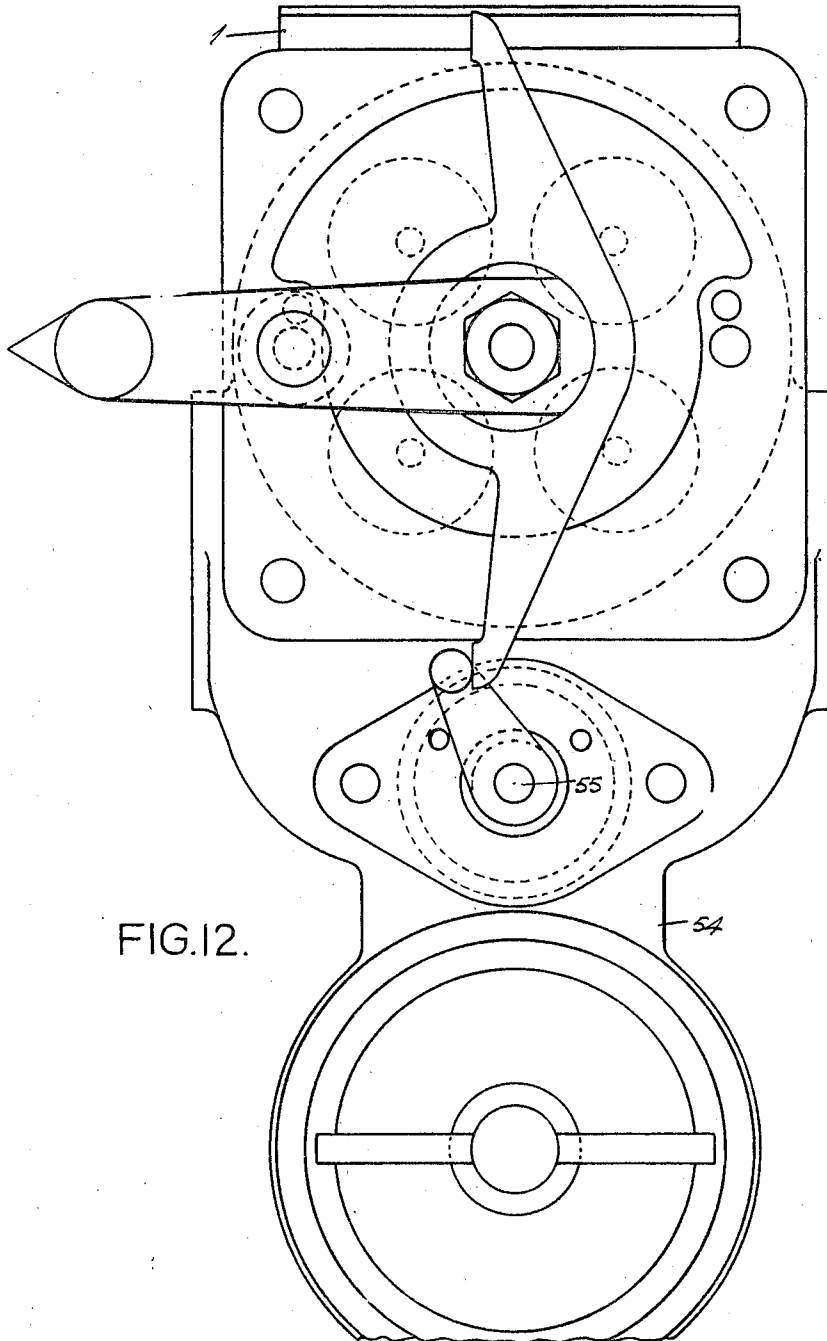
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10 Sheets-Sheet 10



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UNITED STATES PATENT OFFICE

2,299,448

PUMP AND FILTER THEREFOR

Jean Zwicky, Burnham, England

Application January 23, 1941, Serial No. 375,655
In Great Britain January 16, 1940

5 Claims. (Cl. 103—175)

This invention relates to an improved construction of double-acting reciprocating pump which is simple and cheap to manufacture and lends itself to ready combination with a filter where required.

The cylinder casting is characterised by a flat preferably circular seating formed on one side of it, that is to say in a plane parallel with the cylinder axis, passages in the casting connecting this seating with the ends of the cylinder being separated from each other by a partition at right angles to the cylinder axis lying diametrically across the seating. Upon this seating fits a flat valve plate in which are four openings controlled by valves, two opening outward from the valve plate and the other two inward.

The valve chest of the pump, of which the transversely divided space within the seating may be considered to be the lower part, is completed by a valve box which may be integral with a filter casing where the pump is to be combined with a filter. This valve box makes joint with the seating and is divided lengthwise of the cylinder, its partition making joint with the valve plate. The valve box, and the valve box and filter casing, either of which may be used to complete the pump, have each an inlet and outlet for the attachment of piping. In the case of a combined valve box and filter casing there is also a connection between the valve box part and the filter part which is separated from the inlet of the filter part by the straining member of the filter, and from the outlet of the valve box by the partition and a wall integral with it closing in the half of the valve box into which the connection opens.

The pump so constructed may be reversed, so that its inlet becomes its outlet, and vice versa, by turning the valve plate and valves through 180°. For some purposes it is convenient to be able thus to reverse the pump without detaching the pipe connections, and this may be done by making the valve plate with its valve and the partition of the valve box rotatable from outside the pump. The flow should not be reversed through the filter, so where a reversible pump is combined with a filter a reversing valve is provided in the connections between valve box and filter casing, and is interconnected with the means for turning the valve plate and partition, so that the reversing valve is moved from one position to the other at the end of each half turn of the valve plate.

Several constructions of pump embodying the

invention are illustrated in the accompanying drawings.

Figure 1 is an elevation of a hand-operated pump combined with a filter,

Figure 2 is an axial section of it,

Figure 3 a plan of it with the straining member removed,

Figure 4 a median section at right angles to the axis of the pump,

Figure 5 a plan and Figure 6 a sectional elevation of the valve plate with one valve in position, the section being taken on the line VI—VI of Figure 5,

Figure 7 is an axial section of the same pump as constructed for use without a filter,

Figure 8 is a section transverse to the axis of the pump cylinder of a reversible pump, that is to say one in which the direction of flow can be reversed without taking the pump to pieces,

Figure 9 is a sectional plan of this reversible pump on the line IX—IX of Figure 8,

Figure 10 is an axial section, omitting part of the pump cylinder, of a reversible pump combined with a filter,

Figure 11 is a sectional plan of this pump and filter on the line XI—XI of Figure 10,

Figure 12 is a plan of this pump and filter,

Figure 13 is a plan, looking from below, of the valve plate used in this reversible pump and filter, and

Figure 14 is a section, on a plane at right angles to the pump cylinder axis, of the valve plate, valves and rotatable valve box of the pump.

In all the drawings 1 denotes the pump cylinder casting, 2 being the pump cylinder proper in which is a piston 3 with a piston rod 4 passing through a gland 5 kept tight by a spring. The pump may be designed for operation by power or by hand; Figure 1 shows a hand-operated pump, the piston rod 4 ending in a cross-head 6 sliding in a guide 7 attached to the end plate 8 of the cylinder; to the cross-head there is pivoted a fork 9 socketed to receive an operating handle 11, the fork rocking on a link 12 pivoted on a lug on the end plate 8.

Outside the cylinder 2 the cylinder casting 1 is divided by a transverse partition 13, appearing in dotted lines in Figure 3, the middle of this partition being enlarged to form the boss 14. This part of the casting forms the lower portion of the valve chest, the upper portion of which is hereinafter designated the valve box. This lower portion of the valve chest ends at the top in a circular seating 15 for the valve plate 16.

As appears more clearly from Figures 5 and 6 this valve plate 16 is a flat circular plate having four circular openings in it. A central perforation in it receives a stud 17 set in the boss 14, and the plate is further located by dowels 18 set in lugs in the seating 15 which enter blind or open holes in the valve plate. Of the four valves 20 two are on the under side of the plate and open downward, serving as suction or inlet valves; the other two are above the plate and open upward as outlet or delivery valves; there must be one valve of each kind on each side of the partition 13, and this is taken care of by dowels 18 or other locating means. All the valves may be identical in structure; one of them is shown completely in Figures 5 and 6; they are omitted in Figure 3, and shown for simplicity without their springs in Figure 2. Each valve is a simple disc—preferably with a narrow up-standing rim on the side next the valve plate to make a good joint—integral with a central stem having a neck formed near its end. A spring 19 surrounds the valve stem and is compressed between the valve plate 16 and a recessed collar 21 retained upon the stem by a horse-shoe retainer 22 engaging in the neck of the stem and held in position by its location within the deeper recess of the collar.

The valve chest is completed by a separate valve box casting which in the construction shown in Figures 1 to 4 is integral with a filter casing. This combined valve box and filter casing 23 is fastened by set screws upon the cylinder casting 1. The valve box is circular in section and is divided diametrically by a partition 24 and closed at the top on one side of that partition. The partition and closure may be integral with the valve box, but for convenience of machining and assembly are made as a separate member comprising a disc 25 fitting the valve box, having two quadrantal openings in it as appears from Figure 3, and having the partition 24 depending from it. This member is held upon the stud 17, which passes through a boss formed by the central enlargement of the partition 24, by a nut 26, made integral with a stud 27 the purpose of which will presently appear.

The upper part of the casting 23 is also circular in section save for its inlet 36 and outlet 37 and forms the casing of a filter of any convenient form. The filter shown, which is known in principle, has for its strainer member wire gauze stretched upon a perforated metal cylinder 28 held between the cap 29 and a spider 31. The latter is pressed against the end of the straining member by a spring 32 surrounding a nut 33 which is mounted in the cap 29 and fits the stud 17.

A relief valve 34 upon the outlet 37 can open under excess pressure, or can be opened to drain the piping beyond the filter by means of the lever 35.

The path of the liquid is from inlet 36 to the space within the filter casing surrounding the straining member 28, through the straining member, through the quadrantal openings in the member 25 on the suction side of the partition 24, through one or other suction valve, the pump cylinder, and one or other delivery valve to the other side of the partition 24 of the valve box and so to the outlet 37.

Where a filter is not required or is already separately installed, the same pump may be equipped with the valve box 38 shown in Figure 7 in place of the valve box and filter casing 23.

The valve disc 16 remains the same. The valve box 38 corresponds with the lower part of the combined valve box and filter casing 23, with the addition of an inlet and outlet. No openings are needed in the top of the valve box, and the member 41 differs in this respect, but not otherwise from the member 25. The stud 42 is lengthened as compared with the stud 17 to pass through the cap 43 and receive the nut 44.

The pump shown in Figure 7 may easily be reversed, so that the inlet becomes the outlet and vice versa, by turning the valve plate 16 through 180°, provided the dowels or other locating means are made to permit assembly in this position; but the pump would need to be taken to pieces to make the change. The pump shown in Figures 8 and 9 is reversible by the mere turning of a handle. The principal change necessary to make this possible is the arrangement of all the valve stems on the outer side of the valve plate 16. To this end the valve stems are mounted in lugs 45 upon the partition 46 of the member 47 which otherwise corresponds with the members 25 and 41. Incidentally this arrangement has the advantage of leaving the valve openings in the valve plate 16 wholly unencumbered; an advantage that could alternatively be secured by mounting the outlet valves in sockets in the cylinder 2 and the inlet valves in sockets in the member 47, as hereinafter explained with reference to Figure 10. The cap 48 is now secured upon the valve box 49 by set screws and carries at its middle a rotatable stem 52 to the outer end of which is attached the handle 54. A pin and slot connection permits the member 47 to move axially relatively to the stem 52, but not to turn relatively to it. A spring 54 beneath the stem 52 ensures a sufficient joint between the member 47 and the valve plate 16.

The pump is reversed simply by turning the handle 53 through 180°, the handle always pointing towards the outlet of the pump.

This scheme of reversal is adequate for a hand-operated pump, since the user will naturally stop pumping while he effects the reversal; but with a power operated pump reversal might be effected while the pump was working, in which case an open inlet valve might strike the partition 13 of the cylinder casting, or the prolongation of it shown in Figure 8 as forming part of the valve box 49. For a power operated pump, therefore, the scheme of Figures 10 to 14 is preferable, where a part of the partition 13 equal in depth to the inlet valve opening is made integral with the valve plate 16 and turns with it.

Figures 10 to 14 illustrate a reversible pump combined with a filter. It is naturally not desirable to reverse the flow through the filter. The combined valve box and filter casing 54 is therefore now made to accommodate between the valve box and the filter a reversing valve 55. The member 56 carrying the partition 57 of the valve box is formed with a ported skirt 58 to prevent direct connection being established between inlet and outlet in the course of reversal. The outlet valves are mounted, as above suggested, in sockets 59 in the member 56, leaving their ports in the valve plate 63 wholly free. All the ports are made without the central boss and cross-bar which appear in Figure 5, the inlet valves being carried in coned spiders 62 which fit into the inlet ports. The valve plate 63 is also formed with a short skirt and with a diametral partition 64 which in each of the working positions of the valve plate forms a continuation of the partition 13 of the

cylinder casting 2. This partition 64 is of sufficient depth, as appears from Figure 10, to permit the full opening of the inlet valves without their projecting beyond it.

What I claim is:

1. A double-acting reciprocating pump comprising a cylinder casting having therein a cylinder, a circular seating in a plane parallel to the cylinder axis, passages connecting said seating with the ends of the cylinder and a transverse partition separating said passages, in combination with a valve plate fitting upon said seating and having four ports through it, two on each side of said transverse partition, a valve box casing making joint with said cylinder casting and having an inlet and outlet, a diametral partition fitting rotatably within said valve box casting separating said inlet and outlet and making joint with said valve plate, two ports of the valve plate being on one side of said diametral partition and two on the other, spring-controlled inlet and outlet valves governing the ports in said valve plate and means for rotating said diametral partition and valve plate from outside the pump.

2. A double-acting reciprocating pump comprising a cylinder casting having therein a cylinder, a circular seating in a plane parallel to the cylinder axis, passages connecting said seating with the ends of the cylinder and a transverse partition separating said passages, in combination with a valve plate fitting upon said seating and having a transverse rib beneath it making joint with the partition of the cylinder casting and two ports through it on each side of said rib, a valve box casing making joint with said cylinder casting and having an inlet and outlet, a diametral partition fitting rotatably within said valve box casing and separating said inlet and outlet and making joint with said valve plate, two ports of the valve plate being on one side of said diametral partition and two on the other, spring controlled inlet and outlet valves governing the ports in said valve plate, and means for rotating said diametral partition and valve plate from outside the pump.

3. A double-acting reciprocating pump comprising a cylinder casting having therein a cylinder, a circular seating in a plane parallel to the cylinder axis, passages connecting said seating with the ends of the cylinder and a transverse partition separating said passages, in combination with a valve plate fitting upon said seating and having four ports through it, two on each side of said transverse partition, a valve box and filter casing making joint with said cylinder casting and having an inlet in the filter part of the casing and an outlet in the valve box part and a

passage connecting the two parts, a diametral partition in the valve box part of the casing separating the outlet from the connecting passage and making joint with said valve plate, two ports of the valve plate being on one side of said diametral partition and two on the other, a straining member in the filter part separating the connecting passage from the inlet, and spring controlled inlet and outlet ports governing the ports in said valve plate.

4. A double-acting reciprocating pump comprising a cylinder casting having therein a cylinder, a circular seating in a plane parallel to the cylinder axis, passages connecting said seating with the ends of the cylinder and a transverse partition separating said passages, in combination with a valve plate fitting upon said seating and having four ports through it, two on each side of said transverse partition, a valve box and filter casing making joint with said cylinder casting and having two pipe connections, a rotatable valve box in the valve box part of the casing with a diametral partition making joint with said valve plate, two ports of the valve plate being on one side of said diametral partition and two on the other, a straining member in the filter part of the casing, a reversing valve for connecting each of said pipe connections in turn to the filter part on the one side of the straining member and the other of said pipe connections to the rotatable valve box, spring controlled inlet and outlet valves governing ports in said valve plate, means for rotating said rotatable valve box and valve plate from outside the pump through 180° and for shifting said reversing valve at the end of each half-turn movement.

5. A double-acting reciprocating pump comprising a cylinder casting having therein a cylinder, a seating in a plane parallel to the cylinder axis, passages connecting said seating with the ends of the cylinder and a transverse partition separating said passages, in combination with a valve plate fitting upon said seating and having four ports through it evenly spaced about the middle of the seating, two on each side of the said transverse partition, a valve box making joint with said cylinder casting and having inlet and outlet connections and a partition running lengthwise of the cylinder separating said inlet and outlet pipe connections and making joint with said valve plate, two ports of the valve plate being on one side of said lengthwise partition and two on the other, and spring-controlled inlet and outlet valves governing the ports in said valve plate.

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