May 23, 1944. J. ZWICKY 2,349,784

RECIPROCATING PUMP

Filed July 17, 1942 2 Sheets-Sheet 1

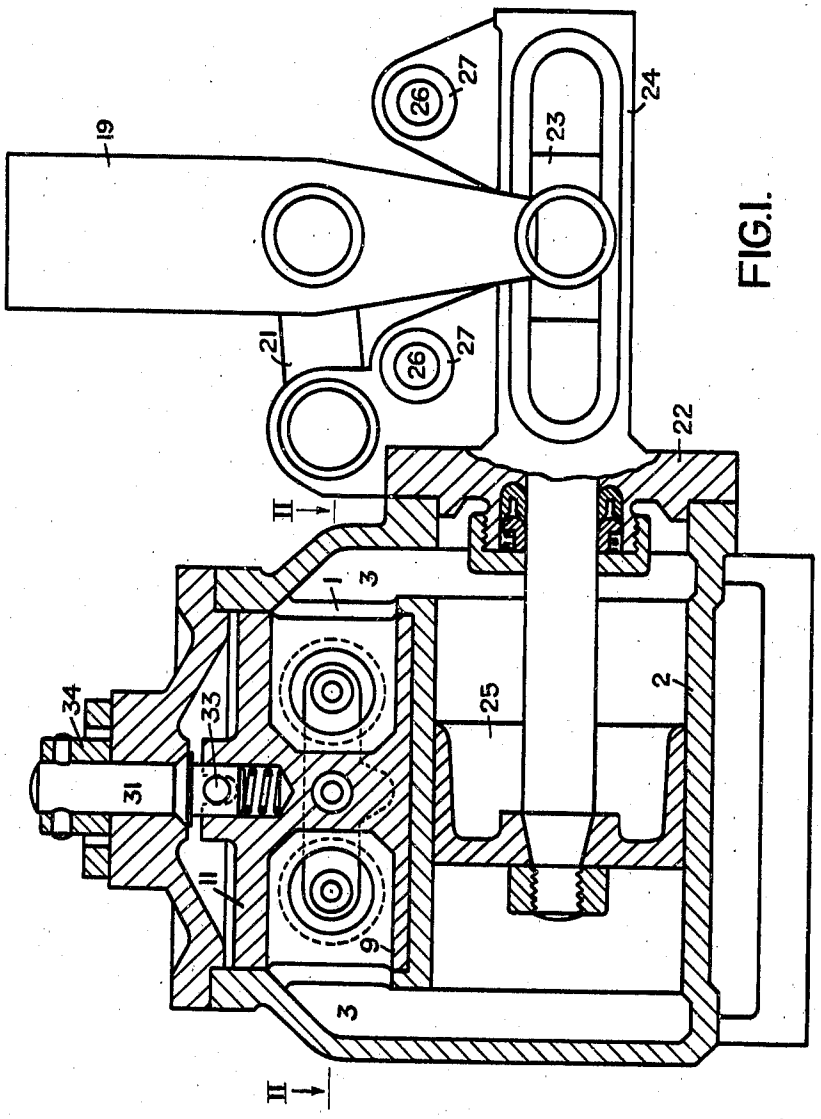

FIG.I.

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May 23, 1944. J. ZWICKY 2,349,784

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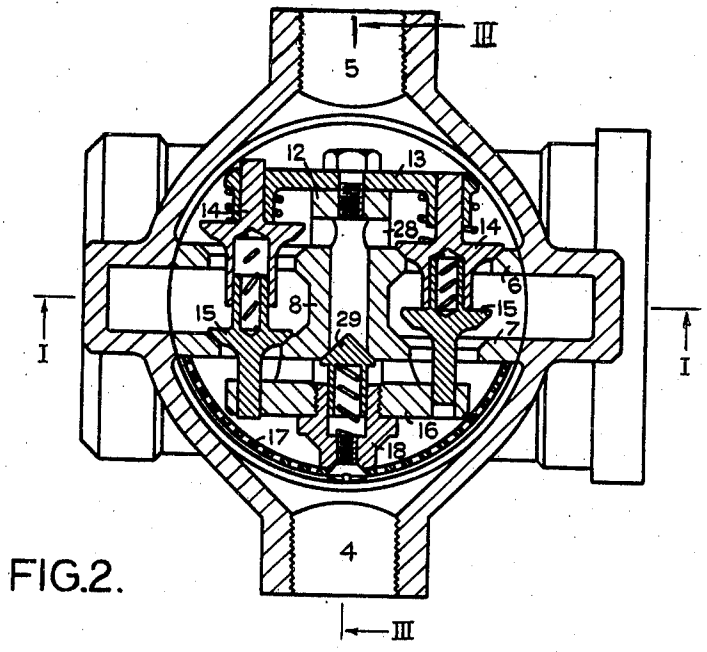

FIG.2.

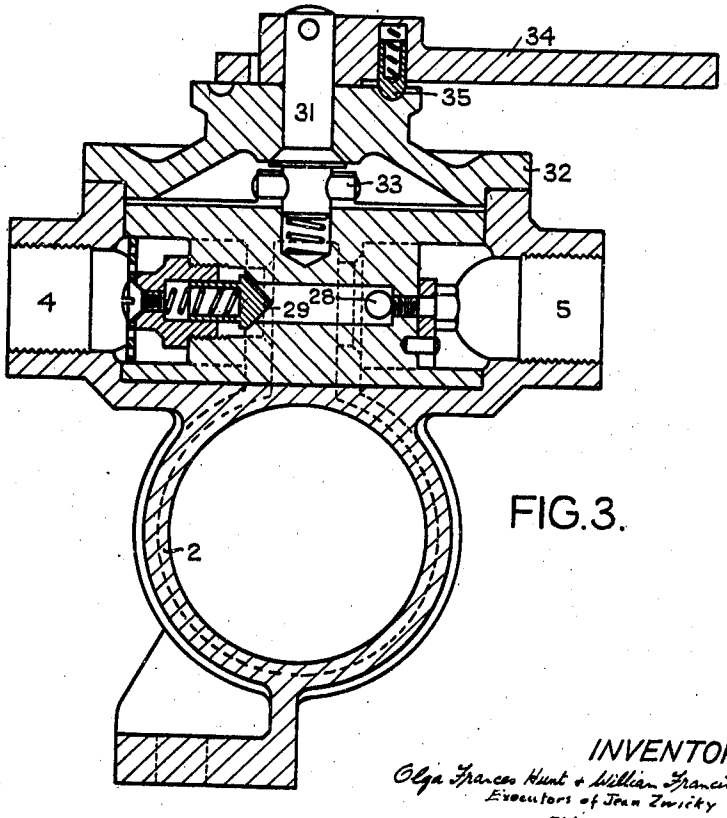

FIG.3.

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UNITED STATES PATENT OFFICE

2,349,784

RECIPROCATING PUMP

Jean Zwicky, deceased, late of Burnham, England, by William Francis Hunt and Olga Frances Hunt, executors, Slough, England

Application July 17, 1942, Serial No. 451,264
In Great Britain May 6, 1941

9 Claims. (Cl. 103—175)

In Patent No. 2,299,448 Jean Zwicky described a double acting reciprocating pump having all its valves mounted in one valve plate fitting a seating in the cylinder casting parallel with the cylinder axis. Besides other advantages this pump could be made reversible by providing for rotation of the valve plate through 180°.

A class of reciprocating pump known long before has inlet and outlet tappet valves located in parallel or X-shape seatings in the valve chest which separate the pump inlet connection from the outlet connection, while the space between the seatings communicates by channels in the cylinder casting with the ends of the cylinder and is transversely divided, the valve axes usually lying in a plane containing the cylinder axis.

According to the present invention pumps of this class are made reversible by mounting the valve seatings and valves so that they can rotate as a unit, the axis about which they turn being so located that rotation through 180° exchanges the positions of the inlet and outlet valves, with the result that the pump inlet becomes its delivery opening and its outlet the suction opening.

To this end the cylinder casting is so designed that the channels to the ends of the cylinder end in ports in a surface of revolution in the valve chest, while the pump inlet and outlet connections open upon the same surface and upon the same zone of it, the rotatable valve structure makes joint with the valve chest throughout the periphery of two co-axial surfaces of revolution on opposite sides of the zone in which the valve chest ports lie, and includes valve seatings which make joint with the ported surface of the valve chest on opposite sides of each port, the space between the seatings being transversely divided by a partition as hitherto. The surfaces of revolution may conveniently be cylindrical and may all be parts of the same cylinder.

The axis about which the valve structure rotates may be parallel with the cylinder axis, or at right angles to it though not intersecting it. In a preferred arrangement, however, the disposition of valve axes above described as usual is modified by setting the valve structure at right angles to the position so described, so that the valve seatings are in planes parallel to and on opposite sides of a plane containing the cylinder axis, and the valve axes are at right angles to the cylinder axis and do not intersect it. The valve structure is then made to rotate about an axis at right angles to the cylinder axis and intersecting it, with respect to which the valves are symmetrically disposed.

A pump of this construction is shown in the accompanying drawings, in which Figure 1 is an axial section through the pump, its actuating mechanism, however, being shown in elevation.

Figure 2 is a section on the line II—II of Fig. 1 omitting the actuating mechanism and

Figure 3 is a section on the line III—III of Fig. 2.

In this construction the valve chest 1 is an approximately cylindrical box with its axis at right angles to and intersecting the axis of the cylinder 2. Channels 3 from the cylinder ends open upon a cylindrical surface within this chamber at opposite ends of a diameter, while inlet and outlet connections 4, 5 are provided on the chamber at opposite ends of the diameter at right angles. The rotatable structure is a casting which comprises two parallel plates 6, 7 containing the valve seatings and a transverse partition 8 joining them and dividing in two the space between them, together with two discs 9, 11 fitting the valve chest 1, and making joint with it throughout their periphery. A boss 12 projecting from the outlet valve plate 6 towards the outlet 5 has attached to it a cross-bar 13 in the ends of which slide the stems of the outlet valve 14. These are in part hollow, and are prolonged beyond the valves to receive the stems of the inlet valves 15. The stems of the inlet valves are similarly prolonged to be guided by a cross-bar 16 forming part of the valve seating casting. All the valves are spring-pressed upon their seatings.

To turn the rotatable structure a stem 31 mounted in the cover plate 32 of the valve chest is engaged with the structure by a cross-pin 33, and outside the valve chest carries a handle 34; a spring-pressed plunger 36 in the handle, by engaging recesses in the cover plate, locates the structure in its operative positions.

If the pump needs to be combined with a filter the filter should turn with the valve structure so that the flow through the filter is not reversed by reversal of the pump. In the construction above described a strainer 17 of perforated metal and metal gauze bent to a cylindrical arc is secured to a boss 18 mounted in the cross-bar 16 and projecting on the inlet side, the radius of the strainer being a little less than that of the rotating structure.

The pump may be power-driven or hand-operated. In the latter case a handle 19 pivoted on a link 21 which in turn is pivoted on the end-plate 22 of the cylinder 2 is connected to a cross-head 23 sliding in a guide 24 integral with the end plate 22. To prevent damage to the piston

25 and cylinder 2 the rocking of the handle is limited by pins 26 set in its path in lugs upon the cross-head guide 24; the pins 26 are covered by rubber sleeves 27 and may be made spindle shaped to retain the sleeves in position.

A relief valve may be provided to short-circuit the pump if a predetermined pressure is exceeded. A convenient construction is to drill the partition 8 between the valve plates 6, 7 and make lateral openings beyond the valve plates to complete a connection 28 between outlet 5 and inlet 4 and to provide a spring-pressed valve 29 mounted within the boss 18 and seating on the end of the drilled channel to interrupt the connection.

What is claimed is:

1. In a reciprocating pump the combination of a cylinder casting comprising a cylinder and a substantially circular valve chest with channels leading from the respective ends of the cylinder to diametrally opposite ports in said valve chest and inlet and outlet connections also at diametrally opposite points of said valve chest and spaced from said channels, a valve structure rotatable within said valve chest through a half turn from one operative position to another to reverse the action of the pump and comprising parallel ported plates dividing said valve chest to separate said inlet and outlet connections and making joint with it in both operative positions on opposite sides of said channels, a partition dividing the space between said parallel plates and separating said channels, and spring-pressed valves controlling the ports in said plates.

2. In a reciprocating pump the combination of a cylinder casting comprising a cylinder and a valve chest, said valve chest having diametrally opposite ports upon a cylindrical surface and said casting including channels connecting said ports with the ends of the cylinder, a valve structure rotatable through a half turn from one operative position to another about the axis of said cylindrical surface including two ported valve seatings making joint with said valve chest in both operative positions on opposite sides of its ports and dividing the valve chest into three chambers, an inlet connection opening into one of said chambers, an outlet connection opening into another, and a transverse partition dividing into two the space between said valve seatings and so separating the ports in said valve chest, and spring-pressed valves controlling the ports in said valve seatings.

3. In a reciprocating pump the combination of a cylinder casting comprising a cylinder and a valve chest, said valve chest having diametrally opposite ports upon a cylindrical surface the axis of which intersects the cylinder axis at right angles and said casting including channels connecting said ports with the respective ends of the cylinder, a valve structure rotatable through a half turn from one operative position to another about the axis of said cylindrical surface and making joint with it in both operative positions along two cylindrical zones on opposite sides of said ports, inlet and outlet connections upon said valve chest opening into it between said zones, valve seatings integral with said valve structure parallel to each other and the axis of said cylindrical surface making joint with said surface on opposite sides of the ports in said valve chest, a transverse partition dividing the space between said seatings and separating said ports, and spring-pressed valves controlling ports through said seatings.

4. In a reciprocating pump the combination of a cylinder casting comprising a cylinder and a valve chest with channels connecting the ends of the cylinder to diametrally opposite ports in a surface of revolution in said valve chest, inlet and outlet connections upon said valve chest opening upon said surface and upon the same zone of it between said ports, a valve structure rotatable through a half turn from one operative position to another to reverse the action of the pump, said structure making joint with said valve chest throughout the periphery of two co-axial surfaces of revolution co-axial with the ported surface of the valve chest on opposite sides of the zone in which the valve chest ports lie, said valve structure also including valve seatings making joint with the ported surface of said valve chest in both operative positions on opposite sides of each port and a transverse partition dividing the space between said valve seatings and separating the ports of the valve chest, and spring-pressed valves controlling ports in said seatings.

5. In a reciprocating pump the combination of a cylinder casting comprising a cylinder and a valve chest with channels connecting the ends of the cylinder to diametrally opposite ports in a surface of revolution in said valve chest having its axis at right angles to and intersecting the axis of the pump cylinder, inlet and outlet connections upon said valve chest opening upon said surface and upon the same zone of it between said ports, a valve structure rotatable through a half turn from one operative position to another to reverse the action of the pump, said structure making joint with said valve chest throughout the periphery of two co-axial surfaces of revolution co-axial with the ported surface of the valve chest on opposite sides of the zone in which the valve chest ports lie, said valve structure also including valve seating making joint wtih the ported surface of said valve chest in both operative positions on opposite sides of each port and a transverse partition dividing the space between said valve seatings and separating the ports of the valve chest, and spring-pressed valves controlling ports in said seatings.

6. In a reciprocating pump the combination of a cylinder casting comprising a cylinder and a valve chest with channels connecting the ends of the cylinder to diametrally opposite ports in a cylindrical surface in said valve chest, inlet and outlet connections upon said valve chest opening upon said surface and upon the same zone of it between said ports, a valve structure rotatable through a half turn from one operative position to another to reverse the action of the pump, said structure making joint with said valve chest throughout the periphery of two zones of said ported surface of the valve chest on opposite sides of the zone in which the valve chest ports lie, said valve structure also including valve seatings making joint with the ported surface of said valve chest in both operative positions on opposite sides of each port and a transverse partition dividing the space between said valve seatings and separating the ports of the valve chest, and spring-pressed valves controlling ports in said seatings.

7. In a reciprocating pump the combination of a cylinder casting comprising a cylinder and a valve chest with channels connecting the ends of the cylinder to diametrally opposite ports in a cylindrical surface in said valve chest, inlet and outlet connections upon said valve chest opening

upon said surface and upon the same zone of it between said ports, a valve structure making joint with said valve chest throughout the periphery of two zones of said ported surface of the valve chest on opposite sides of the zone in which the valve chest ports lie, said valve structure also including valve seatings making joint with the ported surface of said valve chest on opposite sides of each port and a transverse partition dividing the space between said valve seatings and separating the ports of the said structure including said partition being tunnelled to provide a passage between said inlet and outlet connections, a spring-pressed valve in said tunnel normally closing it.

8. In a reciprocating pump the combination of a cylinder casting comprising a cylinder and a valve chest with channels connecting the ends of the cylinder to diametrally opposite ports in a cylindrical surface in said valve chest, inlet and outlet connections upon said valve chest opening upon said surface and upon the same zone of it between said ports, a valve structure rotatable through a half turn from one operative position to another to reverse the action of the pump, said structure making joint with said valve chest throughout the periphery of two zones of said ported surface of the valve chest on opposite sides of the zone in which the valve chest ports lie, said valve structure also including valve seatings making joint with the ported surface of said valve chest in both operative positions on opposite sides of each port and a transverse partition dividing the space between said valve seatings and separating the ports of the valve chest, spring-pressed valves controlling ports in said seatings and a part cylindrical straining member of less diameter than said ported cylindrical surface secured to and making joint with said valve structure and enclosing the valves in one of said seatings on the side from which they open.

9. In a reciprocating pump the combination of a cylinder casting comprising a cylinder and a substantially circular valve chest with channels from the respective ends of the cylinder opening into said valve chest on opposite sides of it and inlet and outlet connections also at opposite sides of said valve chest and between the channel openings, a valve structure rotatable by a half-turn within said valve chest from one operative position to another to reverse the action of the pump, said valve structure making joint with the valve chest throughout its periphery along two zones one on each side of said connections and channel openings and including valve seaings which in each operative position of said structure make joint with the valve chest from the one zone to the other along lines intermediate between the inlet and outlet connections and the channel openings, said valve structure dividing the valve chest into four compartments communicating respectively with the inlet connection the outlet connection and the one and the other end of the cylinder, and spring-pressed valves controlling ports in said seatings, two of them giving access to the compartment communicating with the outlet connection and two giving egress from the compartment communicating with the inlet connection.

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