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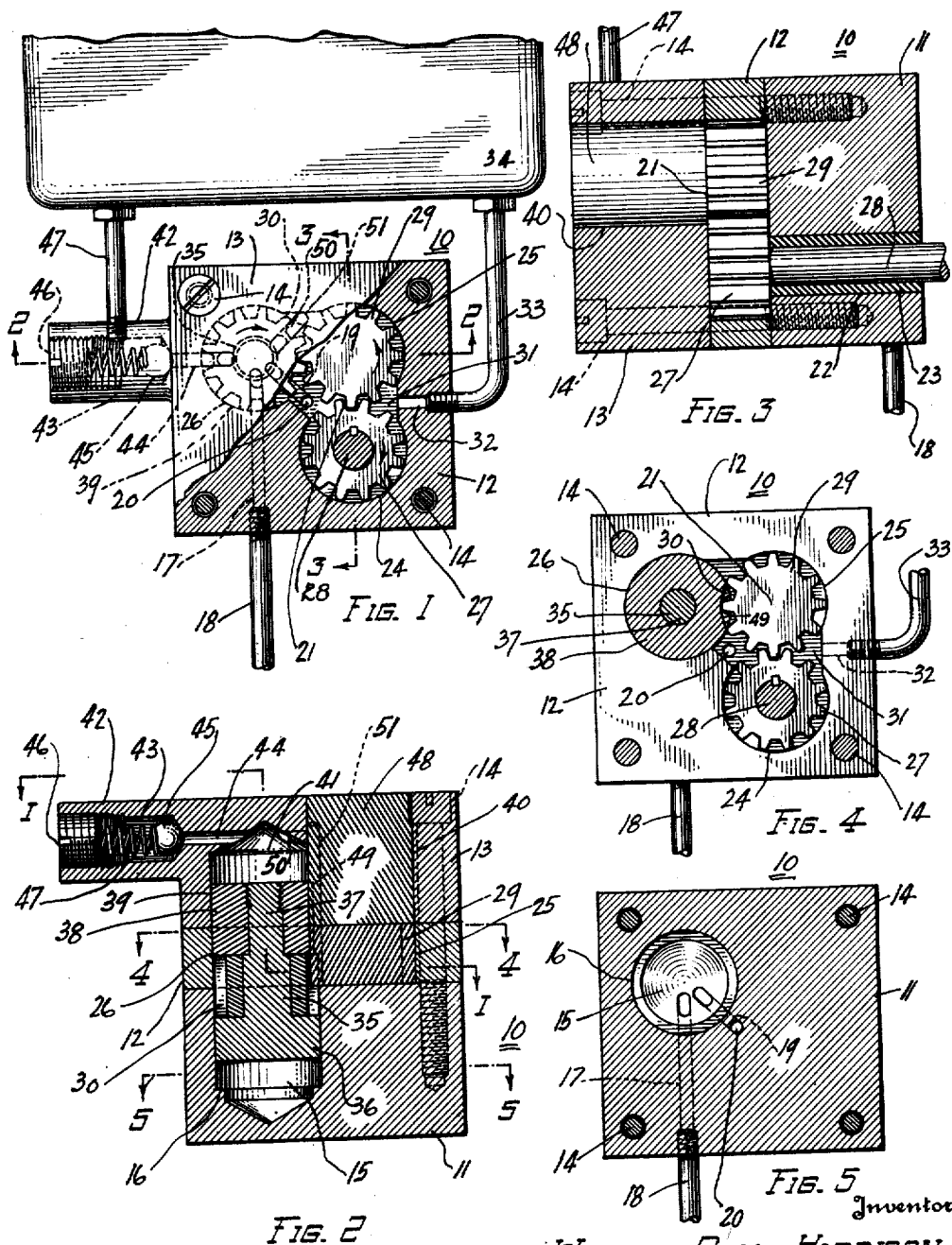
W. C. HARBISON

1,879,219

PUMP

Filed July 27, 1929

2 Sheets-Sheet 1



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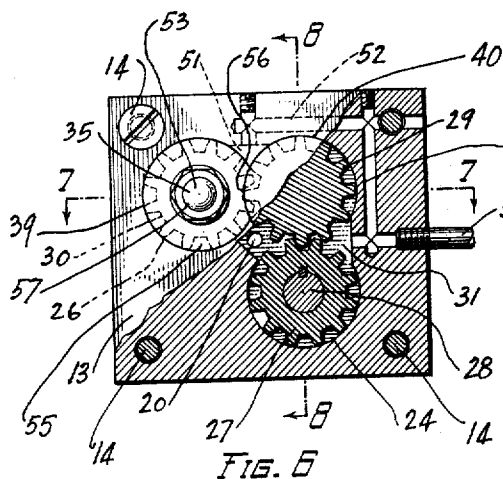
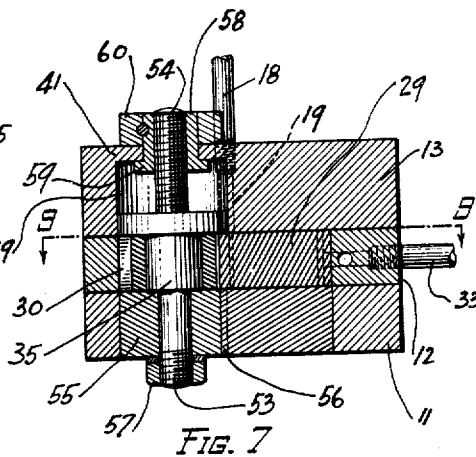
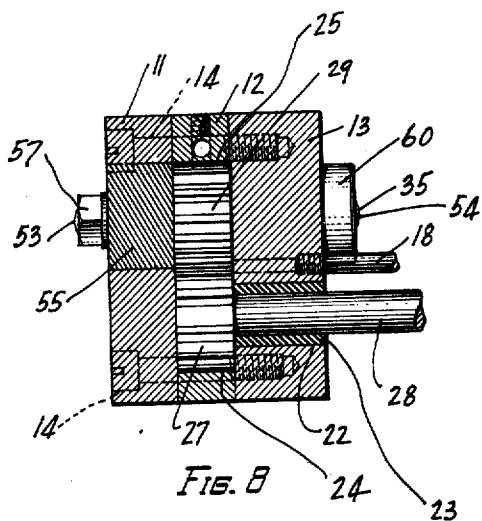
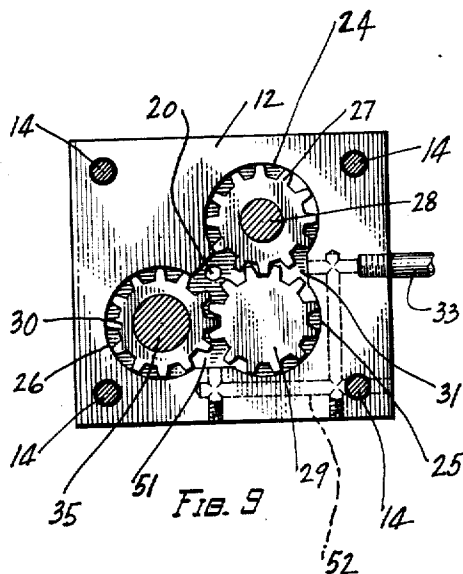
W. C. HARBISON

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Filed July 27, 1929

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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PUMP

Application filed July 27, 1929. Serial No. 381,501.

This invention relates to pumps, and more particularly to gear pumps.

An object of the invention is to provide a fluid pump in which the delivered output is controlled.

Another object of the invention is to provide a fluid pump in which the rate of flow of the delivered output may be selected within a predetermined range without alteration of the intake volume.

Still another object of the invention is to provide a pump in which the rate of flow of the delivered output is selective and which will maintain the selective output constant during any given range of operating speed, within limits.

Another object of the invention is to provide a pump in which a portion of the intake is by-passed to control the delivered output.

Other objects of the invention will appear from the following description, taken in connection with the drawings, which form a part of this specification, and in which:

Fig. 1 is a side elevation of a pump and a supply tank connected thereto, the pump being shown partly broken away and partly in section,

Fig. 2 is a sectional view substantially on lines 2—2, Fig. 1,

Fig. 3 is a sectional view substantially on lines 3—3, Fig. 1,

Fig. 4 is a sectional view substantially on lines 4—4, Fig. 2,

Fig. 5 is a sectional view substantially on lines 5—5, Fig. 2,

Fig. 6 is a modified form of the invention, illustrating a different means for adjusting the capacity of the pump,

Fig. 7 is a sectional view substantially on lines 7—7, Fig. 6,

Fig. 8 is a sectional view substantially on lines 8—8, Fig. 6, and

Fig. 9 is a sectional view substantially on lines 9—9, Fig. 7.

Referring to the drawings for more specific details of the invention, 10 represents, generally, the body of the pump. As shown, the body is built up with suitable plates 11, 12, and 13, super-imposed and secured together

by bolts 14, so that the joints between the plates are rendered air tight.

The plate 11 has positioned therein a chamber 15 provided with a shoulder 16, the object of which will hereinafter appear, and communicating with the chamber is a passage 17 leading to a pipe line 18, or a suitable spigot. The chamber 15 also has communicating therewith a passage 19 leading to the outlet port 20 of a pump mechanism 21 to be hereinafter described. A transverse bore 22 in which is positioned a bearing 23 is also provided in the plate 11.

The plate 12 is planed, or finished, to fit flush against the plate 11. The plate 12 has positioned therein three overlapping transverse bores 24, 25, and 26; one of which, the bore 26, registers with the chamber 15 and forms a continuation thereof; and another, the bore 24, is axially aligned with the bearing 23.

A gear 27 is positioned in the bore 24 and is suitably keyed to a driving shaft 28 positioned for rotation in the bearing 23. The bore 25 receives a gear 29 which meshes with the gear 27, and the bore 26 receives a gear 30 which meshes with the gear 29.

The intake chamber 31 of the pump has communicating therewith a passage 32 leading to a pipe line 33 connected to a source of supply, or, as shown, to a supply tank 34. The gears 27, 29, and 30 are of uniform thickness and of substantially the same thickness as the plate 12 so that there will be proper functional relationship between the gears and no perceptible leakage.

The gear 30 is axially bored to receive a piston 35 having an enlarged annular head 36 fitted for reciprocation in the chamber 15, and a reduced end portion 37 on which is threaded an annular member for retaining the gear 30 on the piston, and providing a head 38 corresponding substantially to the head 36, so that the piston, to all intents and purposes, is double headed. A longitudinally extending groove or cutaway portion 49 is provided in the side of the piston head 38 nearest the gear 29, which is adapted to register with the teeth on the gear 29 under certain conditions to be later described.

The plate 13 is planed to fit flush against the plate 12 and is provided with overlapping bores 39 and 40. The bore 39 registers with the bore 26 in the plate 12 and receives the annular member or head 38 which is fitted for reciprocation in the bore 39 to provide a compression chamber 41. A boss 42 is formed upon the plate 13 and this boss is bored to provide a chamber 43 communicating, as by a passage 44, with the chamber 41. A spring pressed ball valve 45 positioned in the chamber 43 is adapted to control the passage 44. As shown, a plug 46 is threaded in the chamber 43 to close the chamber and to provide means for regulating the tension of the spring for actuating the valve, and the chamber 43 is connected by a pipe line 47 to the supply tank 34.

A plug 48 has a press fit in the bore 40 above the gear 29 and is sufficiently close to the gear to prevent leakage. This plug is provided with a duct 51 which leads from the intake chamber 31 upwardly and communicates with a passage 50 formed in the boss 42 and which opens into the chamber 41.

The pump gears are rotated through rotation of the shaft 28 in the directions indicated by the arrows in Fig. 1. Fluid from the tank 34 will pass through the pipe line 33 to the passage 32 and to the intake chamber 31 and will be carried by the teeth of gears 27 and 29 around the adjacent wall of the chambers 24 and 25, each gear preferably carrying equal amounts in opposite directions. The fluid carried by gear 27 is conducted to the port 20 which leads to the chamber 15 so that one half of the maximum pump output is at all times in this manner conducted directly to the outlet 18.

The gear 29 carries its fluid to a space in the casing section 12 directly beneath the passage 51 in the plug 48 which communicates with the chamber 41 by means of the port 50. The driving shaft 28 may be driven from a moving part having a changeable speed, with the result that the speed of the gears will be varied. This variation of the gear speed will result in a variable pressure on the output side of the gears. When the pressure in the chamber 41 exceeds the tension of the spring 43 the valve 45 will be opened, allowing such fluid to by-pass to the tank 34 through the pipe 47. In this manner a constant maximum head pressure is maintained in the chamber 41 above the piston 45 carrying the gear 30, and such maximum head pressure can be varied by manipulation of the plug 46. When the pressure in the chamber 15 is greater than that of the set maximum head pressure, the piston will be moved upwardly carrying the gear 30 into substantially full meshed relation with the gear 29. When the pressure in the chamber 15 becomes less than the set maximum head pressure in the chamber 41, the piston and the

gear will be moved downwardly into relatively unmeshed relation with the gear 29. It will thus be seen that the gear 30 and its carrier are balanced hydraulically to control the delivered output.

When the teeth of the gears 29 and 30 are in full mesh, fluid is not permitted to pass to the port 20, but instead must pass upwardly through ports 51 and 50 to the chamber 41 decreasing the fluid supply moved to the chamber 15 from the gear 29 and thereby reducing the pressure until the pressures in the chambers are balanced. When the gear 30 is moved axially so that it meshes with only a portion of the gear 29, the grooved or cut-away portion 49 of the piston head 38 is brought into registering position with the upper portion of the gear 29 (Fig. 4), so that fluid can be carried by the teeth of the gear through the grooved portion to port 20 through which it is carried to the chamber 15, and therefore the fluid passing to the chamber 15 and the gear 27 is augmented by that flowing from the gear 29 thereby increasing the pressure on the lower face of the piston until the pressures in the chambers are again balanced.

It is well known that as the gear speed is increased, the fluid pressure and output will increase. However, with this device, the fluid output delivered through the pipe 18 will remain constant at a given setting of the plug 46 within any speed range, within certain limits. This result is permitted through the movable plunger and gear, and the by-pass arrangement leading back to the tank. It will also be seen that by changing the tension of the spring 43, the delivered pump output can be varied, because the head pressure or hydraulic balance will be varied, resulting in movement of the plunger and gear 30 which will allow more or less of the fluid from the gear 29 to pass to the port 20 or back to the tank through the chamber 41.

In Figures 6, 7, 8, and 9, I have shown a modified form of the invention, wherein the capacity of the pump is fixed or set by adjusting the piston 35 to retain the gear 30 in fixed relation to the gear 29. In this form, the return port 51 is connected by a passage 52 to the inlet 31, so that any quantity of liquid or fluid over and above the predetermined desired delivered output of the pump at a given speed may be returned to the inlet, or in other words, is by-passed from the return port to the inlet port.

As shown, in this modification, the piston 35 has oppositely extending shafts 53 and 54; one of which, the shaft 53, has positioned thereon a plug 55 provided with a cut-away portion 56 substantially the same as the cut-away portion in the piston head 38 in the preferred form. This plug is secured on the shaft 53 by a nut 57 threaded on the end of the shaft. The shaft 54 has threaded thereon

a sleeve 58 having a flange 59 to which is keyed a suitable nut 60 with a portion of the plate 13 interposed between the flange 59 and the nut 60, so that upon turning the nut 60, the plunger 35 may be reciprocated manually to vary the position of the gear 30 with respect to the gear 29 and to thereby change the maximum delivered output of the pump at any given speed, it being understood that variations in speed will vary this output in this modification.

Although the invention has been described in connection with certain specific embodiments, the principles involved are susceptible to numerous other applications, as will readily occur to persons skilled in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

Having thus described the various features of my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a variable output capacity pump, a casing having fixed intake and delivery orifices, a pair of impelling gears in the casing, said casing having a duct leading from one of the gear chambers to the outlet, means for connecting the other gear chamber with the outlet, and means for controlling the volume of fluid passing from the last mentioned gear chamber to the outlet.

2. A pump comprising a train of gears, means for driving the gears, automatic means operative in response to changes in the pressure of the fluid being pumped for moving one of the gears to vary the degree of engagement with another gear directly with the rate of rotation of the gears to maintain a constant output within a limited operating range of speed, and means for by-passing fluid in excess of said constant output.

3. A pump comprising a train of gears, a driving shaft connected to one of the gears, automatic pressure operated means for moving one of the gears to regulate the delivered output of the pump, and means for adjusting the pressure operated means including a by-pass.

4. A pump comprising a train of gears, a driving shaft connected to one of the gears, a movable carriage for one of the gears, differential pressure operated means controlling the movement of the carriage, and automatic means associated with said carriage for regulating the pressure means including a by-pass for returning fluid to the pump.

5. A fluid pump comprising a plurality of intermeshing gears, a reciprocable differential piston operated by the fluid pressure, one of said gears being secured to said piston and thereby being movable axially to increase the delivered output of the pump proportionate to the distance moved from alignment with the other gears.

6. A pump comprising a plurality of in-

termeshing gears, one of which is slidably movable to vary the delivered output of the pump proportionate to the movement of the gear, the output being increased as the gear is moved in a direction tending to disengage the gear and decreased when the gear is moved in the direction tending to align the gears.

7. In a variable output capacity pump, a casing, a pair of co-operating impelling gears in the casing, an inlet leading into the casing, an outlet leading from the casing, said casing having a duct leading from one of the impelling gear chambers to the outlet, and means comprising a movable flow controlling gear for connecting the other impelling gear chamber with the outlet.

8. In a gear pump, automatic hydraulic differential pressure operated means including an axially movable gear for maintaining a constant delivered output throughout a limited range of operating speeds, and adjustable means for determining the maximum output capacity of the pump including means for by-passing fluid in excess of said constant output.

9. In a pump, a casing having fixed intake and delivery orifices, impelling means in said casing, and automatic means including pumping elements movable with respect to each other and automatic means for moving the pumping elements in response to changes in pressure for maintaining a constant output through the delivery orifice throughout a range of variable impeller operating speeds and by-pass means for the fluid in excess of said constant output.

10. In a pump, a casing having fixed intake and delivery orifices, impelling means in said casing, and automatically operative means including an axially movable gear for maintaining a constant output through the delivery orifice throughout a portion of a variable impeller operating speed and means for by-passing fluid in excess of said constant output.

11. In a pump, a casing having fixed intake and delivery orifices, impelling means in said casing, and hydraulically controlled relatively movable pumping elements for maintaining a constant output through the delivery orifice throughout a portion of a variable impeller operating speed and by-pass means for the fluid impelled in excess of said constant output.

12. In a pump, a casing having fluid intake and delivery orifices, relatively movable impelling means in said casing, an automatically operable floating control member in the casing for controlling the position of the relatively movable impelling means for determining the delivered output, and adjustable fluid by-pass means for automatically regulating the normal position of said floating member.

13. In a pump, a casing having an intake and a delivery orifice, movable fluid impelling means in said casing for varying the capacity of the pump, and an automatically operative hydraulically balanced control member in the casing for moving the fluid impelling means for determining the delivered output and adjustable by-pass means for automatically regulating the normal position of said control member.

14. In a pump, a casing having fixed intake and delivery orifices, variable capacity pumping elements within the casing, an automatically operative hydraulically balanced flow controlling member for controlling the variable capacity pumping elements for controlling the volume of fluid flowing through the delivery orifice, and manually adjustable means including a by-pass for varying the balanced position of said flow control member.

15. In a fluid pump, a casing having inlet and outlet orifices and a chamber therein, a differential piston reciprocable in the chamber by the force of differential pressures thereon, and gearing in the casing for impelling fluid therethrough, one of said gears being movable by the piston to maintain a constant fluid output within a limited range of operating speed of said gearing and by-pass means for the fluid in excess of said constant output.

16. A pump comprising pumping elements adapted for movement with respect to each other to vary the pump output, a reciprocable member operated hydraulically to control the position of the pumping elements to maintain a constant delivered output within a limited variation in the rate of operation of the pump, and automatic means for controlling the movement of the reciprocable member including means for by-passing fluid in excess of said constant delivered output.

In testimony whereof I affix my signature.

WILLIAM CARL HARBISON.

CERTIFICATE OF CORRECTION.

Patent No. 1,879,219.

September 27, 1932.

WILLIAM CARL HARBISON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 114, claim 11, after "and" insert the words "automatically operative"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of March, A. D. 1933.

(Seal)

M. J. Moore.
Acting Commissioner of Patents.

13. In a pump, a casing having an intake and a delivery orifice, movable fluid impelling means in said casing for varying the capacity of the pump, and an automatically operative hydraulically balanced control member in the casing for moving the fluid impelling means for determining the delivered output and adjustable by-pass means for automatically regulating the normal position of said control member.

14. In a pump, a casing having fixed intake and delivery orifices, variable capacity pumping elements within the casing, an automatically operative hydraulically balanced flow controlling member for controlling the variable capacity pumping elements for controlling the volume of fluid flowing through the delivery orifice, and manually adjustable means including a by-pass for varying the balanced position of said flow control member.

15. In a fluid pump, a casing having inlet and outlet orifices and a chamber therein, a differential piston reciprocable in the chamber by the force of differential pressures thereon, and gearing in the casing for impelling fluid therethrough, one of said gears being movable by the piston to maintain a constant fluid output within a limited range of operating speed of said gearing and by-pass means for the fluid in excess of said constant output.

16. A pump comprising pumping elements adapted for movement with respect to each other to vary the pump output, a reciprocable member operated hydraulically to control the position of the pumping elements to maintain a constant delivered output within a limited variation in the rate of operation of the pump, and automatic means for controlling the movement of the reciprocable member including means for by-passing fluid in excess of said constant delivered output.

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