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SELECTOR PUMP

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FIG.1.

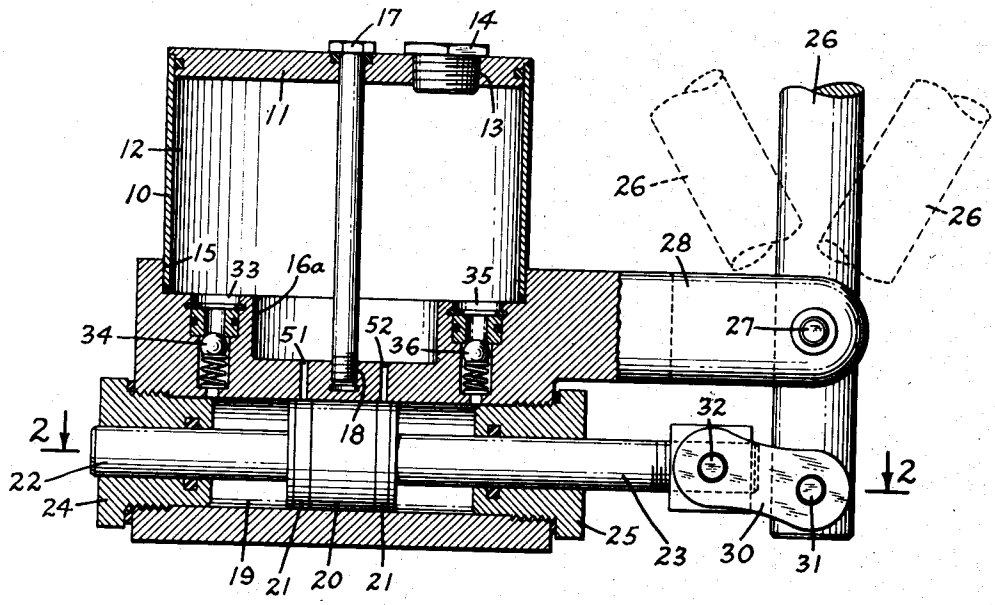
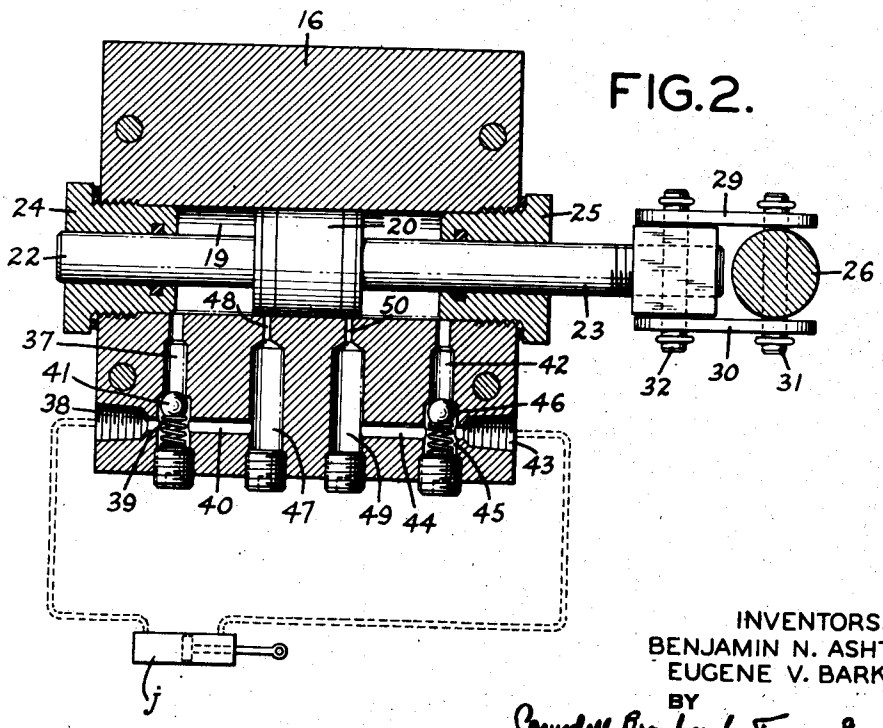


FIG.2.



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SELECTOR PUMP

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6 Claims. (Cl. 103—175)

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This invention relates to improvements in pumps for supplying liquid under pressure to the hydraulic systems used in aircraft, motor vehicles, lifting jacks and the like and it relates more particularly to a pump which can be actuated selectively to supply liquid under pressure to drive reversible motion jacks, motors and the like in either direction of operation.

The pumps heretofore used, either manually or motor driven, supply liquid under pressure only from one outlet port. In order to reverse the direction of movement of a hydraulic motor or the like, it has been necessary to provide a selector valve which changes the connections between the pump and the motor.

In aircraft and the like, the pressures used for actuating the various motors or jacks are very high, that is, on the order of 1,000 to 1,500 lbs. per square inch. For that reason, the selector valves used in the system must be manufactured within very close tolerances and are expensive. The cost of such combined pumps and selector valves has reduced their field of use and has prevented to a large degree the use of retractible landing gear and the like in inexpensive types of private or commercial planes.

The present invention overcomes the above-mentioned disadvantages of the prior pumps and selector valve elements by providing a pump that is capable of supplying liquid selectively to either of two outlet ports and returning liquid to a reservoir through either of two intake ports in response to movement of a pump piston through two different zones of movement. More particularly, a pump of the type embodying the present invention may include a cylinder in which is mounted a piston for reciprocation to withdraw liquid from a reservoir and discharge it through outlet ports at opposite ends of the cylinder. The pump is provided with separate inlets also at opposite ends of the cylinder to connect the pump with the reservoir and it also includes by-pass or return ports which are opened and closed by movement of the piston to return the liquid to the reservoir.

The intake and outlet ports are of a check valve controlled-type whereby liquid can flow through these ports only in one direction as is usual in pumps of the reciprocating piston type.

With the arrangement described generally above, if the piston is reciprocated only from about the middle of the cylinder toward one end, the liquid is drawn in through the intake port at that end and discharged through the outlet at the same end. Liquid is returned through the

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by-pass or return port to the reservoir from the outlet port at the other end of the cylinder.

When the piston is reciprocated between about the middle of the cylinder and the other end of the cylinder liquid is drawn into and discharged from that end of the cylinder while liquid is returned to the reservoir through the by-pass or return passage from the outlet at opposite end of the cylinder. In this way, by selectively reciprocating the piston, it is possible to cause liquid to flow under pressure in either direction through a hydraulic system thereby enabling selective movement of hydraulic jacks, rams, and other elements of hydraulic systems.

For a better understanding of the present invention, reference may be had to the accompanying drawing in which:

Fig. 1 is a view in vertical section taken through a typical pump embodying the present invention with part of the operating handle broken away; and

Fig. 2 is a view in section taken on line 2—2 of Fig. 1.

A typical pump embodying the invention which is actuated manually will be described hereinafter as illustrative of the invention. It will be understood, of course, that the pump could be actuated mechanically by means of cams, cranks, or the like, as the purpose demands. As best shown in Fig. 1, the pump may include as a part of its structure, a generally cylindrical casing 10 having a closure cap 11 of disc like form at its upper end to form a reservoir 12 to receive liquid. The cover plate 11 is provided with an opening 13 which may be closed by means of a suitable screw threaded plug 14.

The lower edge of the cylinder member 10 is seated in sealing relation in a circular recess 15 in the upper surface of a generally rectangular casing 16. The casing also has a circular recess 16a concentric with the recess 15 forming a sump in the bottom of the reservoir 12. The cover plate 11 is retained in contact with the edge of the cylindrical member 10 and the lower edge of the latter is retained in tight engagement with the bottom of the recess 15 by means of a screw 17 which is threaded into a socket 18 in the bottom of the recess 16a.

Directly below the reservoir 12 and extending through the casing 16 is a bore 19 forming the cylinder of pump. A piston 20, provided with suitable piston rings 21, is reciprocable lengthwise of the cylinder 19. The piston has oppositely extending guide rods 22 and 23 which extend axially of the bore and are slidably re-

ceived in the end closure plugs **24** and **25** which are screwed into the opposite ends of the bore or cylinder **19** in sealing relation thereto and to the rods **22** and **23**. The piston **20** is reciprocated lengthwise of the cylinder or bore **19** by means of a hand lever **26** which is supported for rocking movement on a pivot pin **27** mounted in a bifurcated extension **28** from the casing **16**. The lower end of the hand lever **26** is connected by means of the links **29** and **30** and the pins **31** and **32** to the outer end of the shaft **23**. Rocking of the handle, therefore, causes reciprocation of the piston **20** in the cylinder or bore **19**.

As shown in Fig. 1, the space in the cylinder to the left of the piston **20** is connected to the reservoir **12** by means of a passage **33** in which is mounted a ball-type check valve **34** permitting liquid to flow from the reservoir **12** into the cylinder or bore **19** but preventing flow through the passage **33** in the opposite direction.

The space to the right of the piston **20**, as viewed in Fig. 1 is also connected to the reservoir by means of a passage **35**, also containing a ball-type check valve **36**. While the check valves **34** and **36** are illustrated as ball-check valves, it will be understood that any other type of check valve may be used if desired.

Referring now to Fig. 2 of the drawing, the space in the cylinder **19** to the left of the piston **20** is connected to an outlet passage **37** which, in turn, communicates with an outlet port **38**. Mounted in a recess **39** at the junction of the passage **37** and a passage **40** communicating with the outlet port **38** is a ball check valve **41**. The ball check **41** permits flow of liquid from the cylinder **19** to the outlet port **38** and prevents reverse flow of the liquid.

The opposite end of the cylinder **19** also is connected with a passage **42**. An outlet port **43** is connected by means of a passage **44** and an interposed check valve chamber **45** to the passage **42**. A ball check valve **46** is mounted in the chamber **45** and allows the flow of liquid from the cylinder through the outlet or discharge port **43**.

The passage **40** is connected to a bore **47** which communicates with a smaller bore **48** opening into the cylinder **19** to the left of the center or middle of the cylinder.

The passage **44** also communicates with the bore **49** which is connected by a smaller passage **50** to the cylinder to the right of the center or mid-portion of the cylinder. The spacing between the passages **48** and **50** where they communicate to the cylinder **19** is, as shown in Fig. 2, less than the over-all length of the piston **20** so that the piston covers these ports when it is in about the middle of the cylinder.

The cylinder **19** is also connected to the sump **16a** by means of a pair of small passages **51** and **52**. These passages are spaced about the same distance apart as the passages **48** and **50** and are essentially in the same radial planes as these passages respectively. The passages **51** and **52** are disconnected from the cylinder **19** when the piston **20** is at about the middle of the cylinder **19**.

In operation, assuming that the reservoir **12** is filled or partially filled with liquid, and the portion of the cylinder to the left of the piston is full of liquid, movement of the operating handle **26** from its middle position toward the right will cause liquid to be forced out of the outlet port **38**. If the port **38** and the port **43** are connected to the opposite ends of a hydraulic jack *j*, as illustrated diagrammatically in Fig. 2, the liquid will cause the jack to be extended and the liquid to the right of the piston in the jack to be forced back into the outlet port **43**. As the piston **20** moves to the left it will uncover the passages **50** and **52** so that liquid being returned from the jack to the port **43** flows through the passage **44**, the bore **49**, the passage **50** into the cylinder **19** to the right of the piston and through the passage **52** into the reservoir **12**.

Return movement of the piston **20** to the right will draw liquid through the intake passage **33** from the reservoir **12** into the cylinder to the left of the piston and will continue to force liquid out of the cylinder **19** from the right-hand end through the passage **52** until the latter is closed by the piston. Liquid cannot flow out from the port **43** because the liquid is trapped in the jack *j* to the left of its piston. Therefore, oscillation of the operating handle **26** between its center position and its position to the right will cause liquid to be forced intermittently through the outlet passage **38** and allow liquid to return to the reservoir from the outlet port **43** as described above. If the operating handle is oscillated from its center position to the left, as viewed in Fig. 1, reverse flow of the liquid takes place. Liquid is drawn into the cylinder through the intake passage **35** and discharged through outlet port **43**. The liquid returned from the jack *j* enters the port **38** and flows through the passage **40**, the bore **47**, the passage **43**, the cylinder **19** and the passage **51** to the reservoir as the passages **48** and **51** are uncovered by movement of piston to the right and during a part of its return stroke to the mid-position. It will be understood that the spacing of the passages **48** and **50** and the passages **51** and **52** is such that only a very short movement of the piston from its center position is required to uncover one set of these ports. This prevents the piston from locking up in the cylinder **19**.

The pump, therefore, enables a hydraulic motor such as a jack or the like to be projected or retracted merely by operating the handle within a predetermined sector of its movement so that a separate manually operated selector valve is not required.

It will be understood that the size of the pump may be varied in accordance with the requirements, that the reservoir **12** may be separate from the remainder of the pump and connected thereto by suitable conduits, that the type of check valves used in the system may be varied, and that the piston may be operated by a motor or the like without departing from the invention. Therefore, the form of the invention described herein should be considered as illustrative and not as limiting the scope of the following claims.

We claim:

1. A selector pump comprising a pump cylinder, a piston in and reciprocable lengthwise of said cylinder, a reservoir for liquid adjacent to said cylinder, separate valve-controlled inlets at opposite ends of said cylinder connecting the latter to said reservoir, separate valve-controlled outlets at opposite ends of said cylinder, means for reciprocating said piston to draw liquid from said reservoir and discharge it through either of said outlets, separate, spaced apart return passages connecting each outlet to said cylinder on opposite sides of its center, said passages being covered by said piston when the latter is in the mid-portion of the cylinder, other spaced apart

return passages connecting said cylinder to said reservoir, the last-mentioned return passages being covered by said piston when the latter is in the mid-portion of said cylinder, the separate and other return passages on one side of the center of the cylinder being uncovered by said piston to return liquid from one of said outlets as liquid is discharged from the other outlet by said piston.

2. A selector pump comprising a pump cylinder, a piston in and reciprocable lengthwise of said cylinder, a reservoir for liquid adjacent to said cylinder, separate intake passages connecting said reservoir to opposite ends of said cylinder, check valves in said passages preventing flow of liquid from said pump to said reservoir, discharge passages connected to opposite ends of said cylinder, check valves in said discharge passages preventing flow of liquid through said passages toward said cylinder, and means connecting said discharge passages outwardly of the check valves therein with said cylinder and to said reservoir, said means being closed and opened by said piston to return liquid at one of said discharge passages to said reservoir as liquid is forced by said piston through the other discharge passage.

3. A selector pump comprising a pump cylinder, a piston in and reciprocable lengthwise of said cylinder, means to reciprocate said piston in said cylinder, a reservoir to receive liquid adjacent to said cylinder, a separate passage at each end of said cylinder communicating with said reservoir, a check valve in each passage permitting liquid to flow from said reservoir to said cylinder and preventing flow from said cylinder to said reservoir, a pair of return passages connecting the cylinder to said reservoir, said return passages being spaced apart lengthwise of said cylinder at about its mid-portion and both of said passages being covered by said piston when it is in the middle of the cylinder, said piston being movable in either direction to uncover one of said return passages when the piston is moved toward one end of the cylinder, a pair of discharge ports communicating with said cylinder at opposite ends thereof, check valves interposed between said discharge ports and said cylinder to prevent flow of liquid from said ports to said cylinder, and passages connecting each discharge

port to the cylinder at points substantially in the same radial planes as the return passages.

4. A selector pump comprising a pump cylinder, a piston reciprocable lengthwise of said cylinder, a reservoir for liquid adjacent to said cylinder, separate check-valve controlled inlets at opposite ends of said cylinder connecting the latter to said reservoir, separate check-valve controlled outlets at opposite ends of said cylinder, means to reciprocate said piston to withdraw liquid from said reservoir and discharge it through said outlets, a pair of return passages connecting said cylinder to said reservoir, said return passages communicating with said cylinder on opposite sides of its center and being spaced apart a distance less than the length of the piston and both being closed by the piston when the latter is about in the middle of the cylinder, each return passage being spaced from the nearest adjacent end of cylinder a distance less than the length of the piston, and another pair of passages connecting said outlets to said cylinder, the last-mentioned passages communicating with said cylinder at points lying in about the same radial planes as the return passages.

5. A selector pump comprising a cylinder, a piston reciprocable in said cylinder, a reservoir for liquid adjacent to said cylinder, means to reciprocate said piston in said cylinder, means at opposite ends of said cylinder to supply liquid to said cylinder from said reservoir and discharge it from said cylinder through separate outlets in response to reciprocation of said piston, and means including ports in the mid-portion of said cylinder covered and uncovered by said piston for returning liquid from one of said outlets to said reservoir as liquid is discharged from said cylinder through the other outlet.

6. The pump set forth in claim 5 in which the means to reciprocate said piston comprises a hand lever, said lever being movable selectively from a central position to reciprocate the piston only about one-half the length of the cylinder to discharge liquid selectively through either of said outlets.

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No references cited.