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2,640,426

POWER UNIT OF THE PRESSURE FLUID TYPE

Filed April 16, 1951

2 Sheets-Sheet 1

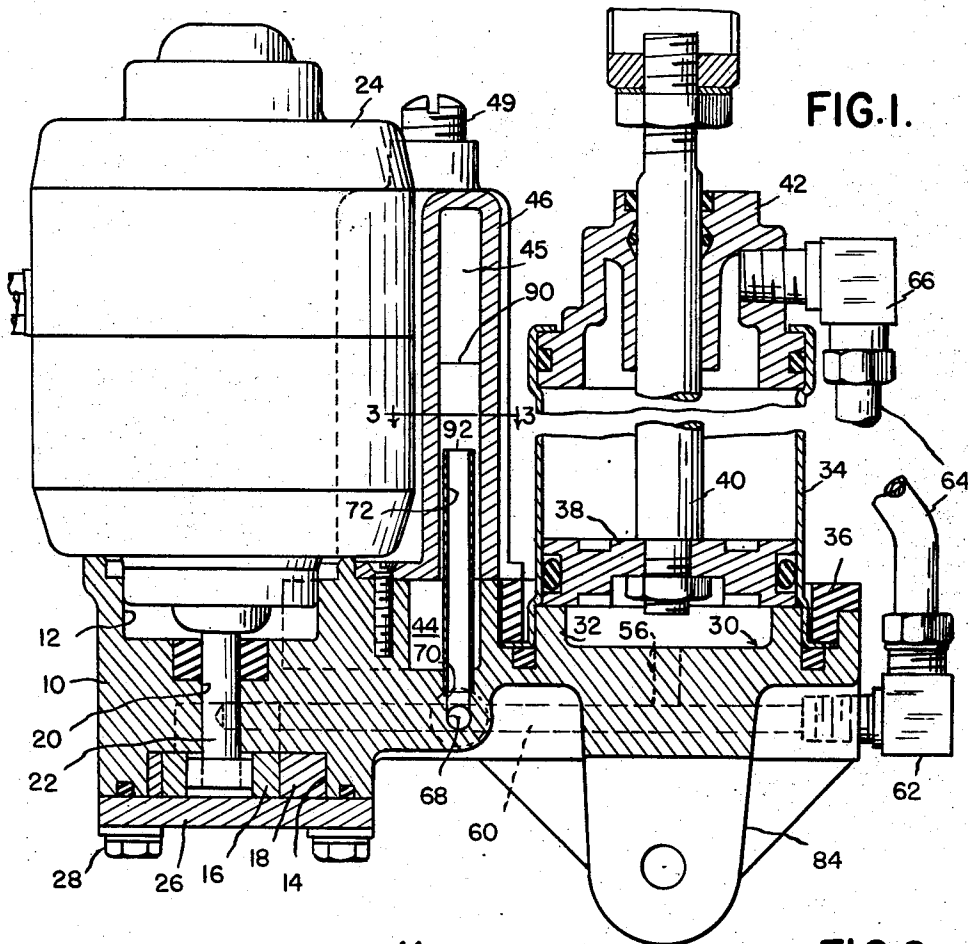


FIG. 1.

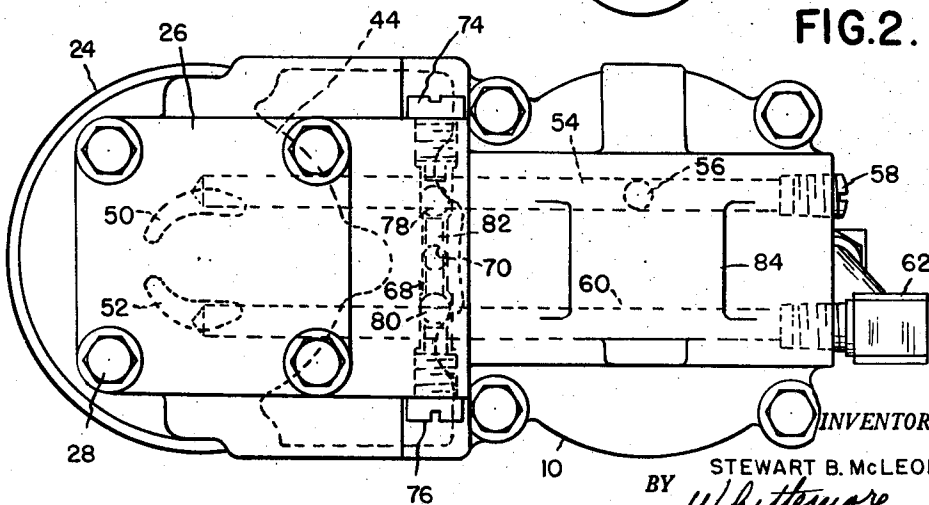


FIG. 2.

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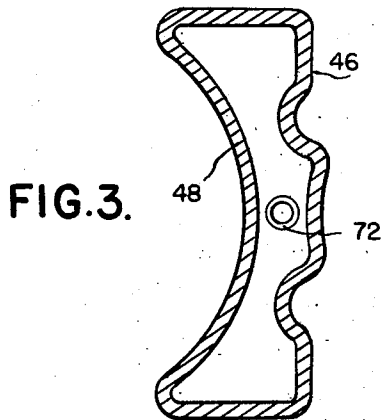
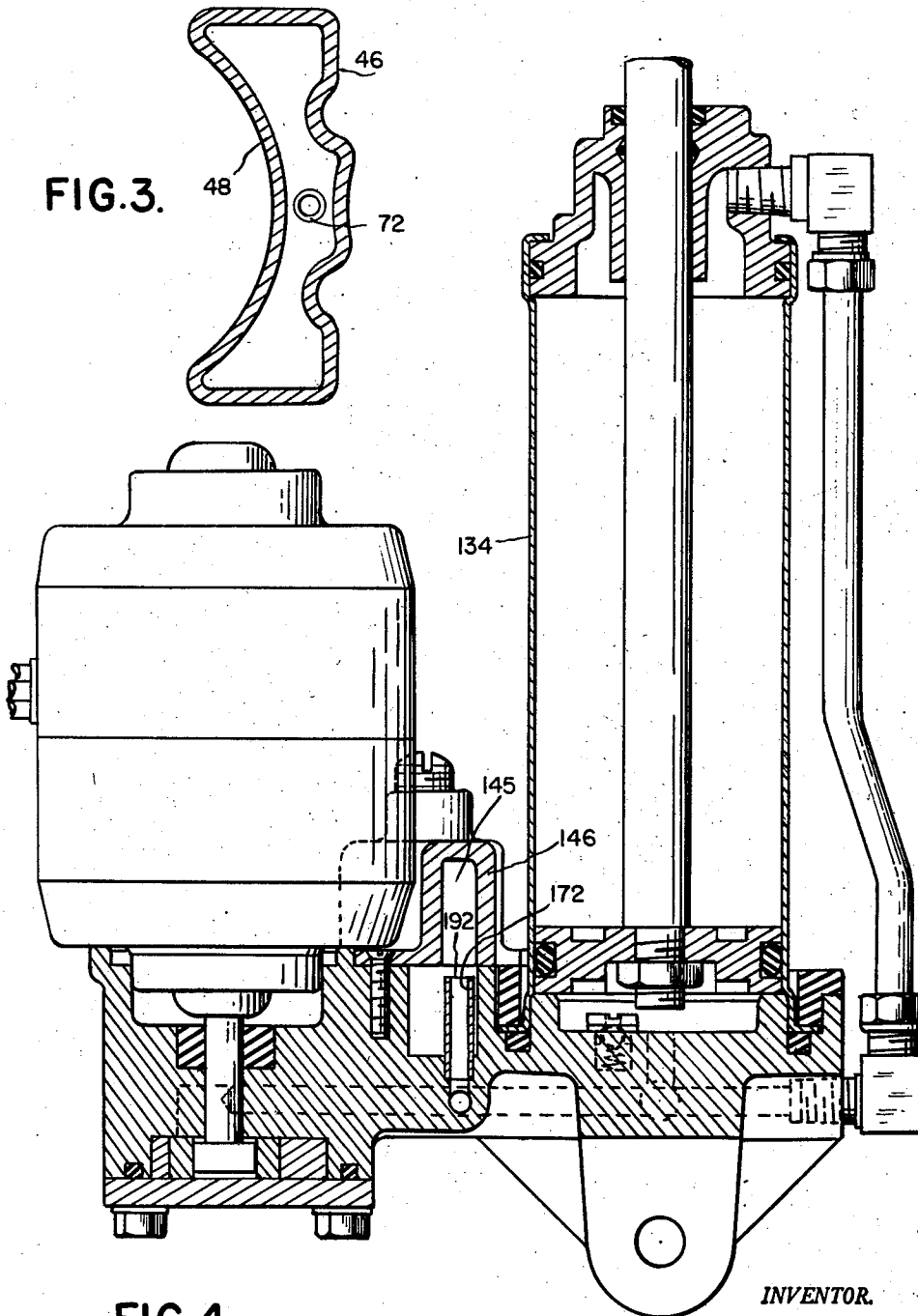


FIG. 4.

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POWER UNIT OF THE PRESSURE FLUID TYPE

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The present invention relates to a power unit and more particularly to a power unit comprising an electric motor, a pump, a reservoir, and a power cylinder, all connected to a supporting body to provide a self-contained compact source of hydraulic power. The power unit is capable of many applications but is particularly useful in conjunction with automotive vehicles. The electric motor may conveniently be operated off the electric system of the vehicle and the unit permits the development of hydraulic power for various purposes, such for example as raising and lowering windows and convertible tops, and causing longitudinal adjustment of the front seat of the vehicle.

It is an object of the present invention to provide a power unit of the character described capable of being used in a variety of positions, so that a single unit with or without minor changes in attachments, may be employed to perform any of the foregoing functions or other functions as desired.

More specifically, it is an object of the present invention to provide a power unit of the character described provided with a reservoir designed to receive a relief flow of hydraulic fluid upon operation of the unit in one direction and to restore such fluid to the power system upon operation of the unit in the other direction, in which the reservoir is so designed as to be operable for the purposes stated when the power unit is in any one of a variety of different positions.

More specifically, it is an object of the present invention to provide a body for supporting a motor, pump and power cylinder, said body having a reservoir cavity therein, a hollow or cup-like closure for the cavity designed to cooperate therewith to provide an enlarged reservoir, and conduit means in communication with the reservoir having a port located substantially midway between two opposite sides of the reservoir.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a longitudinal vertical section through the unit.

Figure 2 is a bottom plan view of the unit illustrated in Figure 1.

Figure 3 is a section on the line 3—3, Figure 1.

Figure 4 is a vertical section through a modified construction.

Referring now to Figures 1-3 the unit comprises a main supporting base or body 10 pref-

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erably in the form of a casting. While of irregular form the body 10 is generally an elongated flat body provided with certain recesses, seats and projections, as will presently be described.

Located at one side of the body 10 and adjacent one end thereof is a recessed motor seat 12. As the opposite side of the body 10 and adjacent the same end as the motor seat 12 is a cylindrical recess 14 adapted to receive rotary pump elements indicated generally at 16 and 18. The pump element 16 may be in the form of an externally toothed pinion and the pump element 18 may be in the form of an internal gear having one more tooth than the external pinion 16. The recess 14 and motor seat 12 are interconnected by a bore 20 to permit the attachment of the shaft 22 driven by motor 24, to the pinion 16 in driving relation thereto. A removable closure plate 26 is provided for the pump recess and is detachably secured thereto by suitable bolts 28.

At the same side of the body 10 as the motor seat 12 but at the opposite end thereof is a cylinder seat indicated generally at 30 and comprising an annular outwardly projecting wall 32. The cylinder seat 30 is adapted to constitute one end closure for a cylinder 34 which is supported on the wall 32 and retained in sealing relation thereon by a removable ring 36. Located within the cylinder 34 is a piston 38 to which is connected a piston rod 40 which extends through the opposite end wall 42 of the cylinder and is adapted to be connected to a part to be actuated by the unit.

The body 10 has a cavity 44 adapted to form a reservoir 45 when closed by a removable cup-like or hollow closure 46 which will presently be described in detail. The cavity 44 and the interior of the closure 46 together constitute the reservoir 45 for hydraulic fluid.

It will be appreciated that as the piston 38 moves longitudinally of the cylinder 34, a different amount of fluid is displaced from the cylinder than is introduced into the cylinder. In other words, as the piston 38 moves upwardly as seen in Figure 1, more fluid is required to be introduced below the piston 38 than is displaced from the upper end of the cylinder since the piston rod is located only in that portion of the cylinder above the piston.

The cavity 44 extends generally transversely of the body 10 intermediate the motor seat 12 and the cylinder seat 30, and is of a generally kidney shaped cross-section being relatively wider

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at its ends than intermediate the ends thereof, as well indicated in dotted lines in Figure 2. The closure 46 is downwardly open and of cup-shape so as to supplement the reservoir capacity as well illustrated in Figure 1. The closure 46, whose cross-section is best seen in Figure 3, is similar to that of the cavity 44, is however of less cross-sectional area than the cavity. The side of the closure 46 as indicated at 48, is concavely curved to conform to the outer cylindrical surface of the motor 24. Moreover, it will be observed that the elongated closure 46 is disposed intermediate the motor 24 and the cylinder 34 in a manner to conserve space. The closure 46 is provided with an opening in its top wall through which the reservoir may be filled and the opening is provided with a removable closure plug 49.

The body 10 is provided with arcuate ports 50 and 52 which communicate with the pump recess 14. The body is provided with a first passage 54 communicating with the port 50 and communicating also with a vertical passage 56 which opens into the bottom of the cylinder seat 30. The outer end of the passage 54 is sealed by a closure plug 58. The port 52 communicates with a passage 60 which extends longitudinally of the body 10 and is provided at its outer end with a fitting 62 to which is connected a metal pipe 64. The upper end of the pipe 64 carries a fitting 66 which communicates with the upper end closure 42 of cylinder 34. A transverse drilled passage 68 is provided which communicates with passages 54 and 60 and intermediate its ends the passage 68 communicates with a short vertically extending passage 70. Extending upwardly from the passage 70 and partly supported therein is a conduit 72 for a purpose which will presently appear. It may be mentioned at this time that the conduit 72 in general is responsible for the ability to use the power unit in a plurality of different positions.

The transverse passage 68 is closed at its outer ends by removable plugs 74 and 76 and is formed with an intermediate restricted portion providing valve seats with which ball valves 78 and 80 cooperate. Intermediate the ball valves 78 and 80 is a rigid elongated abutment element 82 which is of such length that only one of the ball valves 78 or 80 may be seated at one time.

The body 10 at the side thereof opposite to the motor and cylinder seats, and in alignment with the axis of the cylinder seat 30, is provided with a pair of mounting ears 84. It will be observed that the body 10 may thus be mounted for rocking movement during use about an axis which extends perpendicular to the axis of the piston rod 40.

The motor 24 is of the reversible type, and the pump composed of the pump elements 16 and 18 is reversible so that pump ports 50 and 52 may operate as inlet or discharge ports depending upon the direction of rotation of the motor. With the piston 38 in its lowermost position as illustrated in Figure 1, the motor may be rotated in a direction to discharge hydraulic fluid through the port 50 whence it will flow through the passage 54 to the vertical passage 56, and thence into the bottom of the cylinder 34, thus raising the piston. At this time, pressure in the passage 54 establishes pressure on the ball valve 78 and seats the valve on its seat, thus preventing flow of fluid from the passage 54 to the reservoir. Upward movement of the piston 38 forces hydraulic fluid out of the top of the cylinder through the conduit 64 and thence into the

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passage 60 in the body 10. Due to the fact that more fluid flows into the bottom of the cylinder 34 than is forced out of its upper end, the fluid returned to the passage 60 through the conduit 64 is insufficient to supply the needs of the pump. Since the ball valve 78 is at this time on its seat the ball valve 80 is forced off of its seat by the elongated rigid element 82 and fluid from the reservoir will therefore flow through conduit 72 into the transverse passage 68 and thence outwardly into the passage 60 whence it is returned to the inlet side of the pump.

With the piston moving downward in the cylinder, conditions are reversed and the pump port 52 becomes the outlet port. At this time fluid under pressure flows through the passage 60, through the fitting 62, conduit 64, fitting 66 and into the upper end of the cylinder 34. Pressure in the passage 60 retains the valve 80 on its valve seat and prevents flow of fluid from passage 60 into the reservoir 45. Under these operating conditions, downward movement of the piston displaces a greater quantity of fluid from the underside of the piston than is introduced into the upper side. Accordingly, more fluid is forced out of the passage 56 into the passage 54 than can be accommodated by the pump. However, at this time the ball valve 78 is retained off its seat due to pressure on ball valve 80 and the action of the rigid element 82. Thus the excess fluid forced into the passage 54 is at this time forced into the transverse passage 68, past the ball valve 78 and thence through the vertical passage 70 into the vertically extending conduit 72.

The operation of the unit as thus described does not require the presence of the vertically extending conduit 72. However, the conduit 72 is provided so that the unit may be operated in the position shown in Figure 1, or may be operated when inverted or on its side. The provision of the enlarged cup-like closure for the reservoir permits the reservoir to be filled to a level as indicated by the numeral 90, which as seen in Figure 1, is substantially above the port 92 constituted by the upper open end of the conduit 72. It will be recalled that the cross-sectional shape of the reservoir, and particularly the closure 46, is as indicated in Figure 3 so that a substantial volume of fluid is thus retained above the port 92, particularly when it is recalled that the end portions of the reservoir are substantially wider than the restricted central portion. Moreover, the cavity 44 in the body 10 is of greater cross-sectional area than the interior space within the closure 46. Therefore, if the unit is inverted the level of hydraulic fluid will shift toward and beyond the port 92 so that the conduit 72 will in such case extend down into the body of hydraulic fluid in the reservoir. The reservoir will normally be filled to an extent such that if the unit is turned on either side the level of hydraulic fluid will extend substantially above the position of the port 92 provided by the open end of the conduit 72. Thus, it will be apparent that the unit illustrated in Figure 1 may be operated in the position shown, in a position inverted with respect thereto, or in a position resulting from turning the unit 90 over in either direction about the longitudinal axis of the body 10. Moreover, the reservoir may be operated in such position that the motor 24 directly underlies the cylinder 34.

Referring now to Figure 4, there is illustrated a construction designed for use with a cylinder requiring a shorter stroke. Since the construction illustrated in Figure 4 is generally identical

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with that illustrated in Figure 1 only such features as involve differences will be described in detail. The cylinder 134 in Figure 4 is of substantially less stroke than the cylinder 34 in Figure 1, and accordingly a smaller volumetric capacity for the reservoir 145 is satisfactory. Therefore, the removable closure 146 may be of substantially less height than the closure 46 illustrated in Figure 1.

Also, the vertical conduit 172 may be correspondingly shorter than the conduit 72 illustrated in Figure 1. Accordingly, it is possible to provide identical castings or bodies 10 which are supplied with identical motors and pumps. In the event that a longer working stroke is required a longer cylinder is mounted on the cylinder seat and an enlarged reservoir forming closure 46 is provided. In the event that a shorter working stroke is satisfactory, a shorter cylinder 134 is substituted, and the shorter reservoir forming closure 146 is employed. The relatively long conduit 72 is of course employed with the enlarged closure 46, whereas the relatively short conduit 172 is employed with the relatively small closure 146. Conduits 72 and 172 are inserted in enlarged portions of the vertical bore 70 and may be readily exchanged.

Of course the exact valve arrangement may be modified or supplemented depending upon the use of the cylinder and whether the cylinder is to perform a locking function as well as a power moving function.

Accordingly, the present construction permits the most economical manufacture of power units, since the most expensive and critical parts thereof are standard for units intended for widely different purposes. Moreover, by providing the reservoir extension in the removable closure for the reservoir cavity in the body, and by providing a conduit connected to the hydraulic fluid system and having a port located generally centrally of the reservoir, the unit may be employed in a wide variety of different positions.

In connection with the location of the inlet ports 92 and 192, it will be observed that in either arrangement the port is located substantially midway between the top and bottom of the reservoir 45 when the reservoir is in the position illustrated. Moreover, it is located substantially midway between the ends of the reservoir which are adjacent the edges of the body 10. In more general terms, it may be said that the ports 92 and 192 are located substantially midway between at least two pairs of opposite reservoir defining walls.

The drawings and the foregoing specification constitute a description of the improved power unit in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. A power unit comprising a generally flat body having a pump recess at one side adjacent one end thereof, a motor seat at the other side of said body in alignment with said pump recess, a cylinder seat at the same side of said body as said motor seat, a reservoir cavity in said body open at the side thereof provided with said seats, said reservoir cavity extending generally transversely of said body intermediate said seats, a closure for said reservoir cavity cooperating therewith to form an enlarged reservoir, said closure being in the form of a cup having a cross-section similar to the cross-section of said cavity and extending

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outwardly of said body intermediate said seats, and passages including passages in said body connecting said pump recess, said reservoir cavity, and said cylinder seat.

2. A unit as defined in claim 1 comprising a conduit connecting said reservoir to said passages and opening into said reservoir substantially within the narrow central portion of said reservoir, and substantially midway between the bottom of said cavity and the top of said closure.

3. A power unit comprising a body having at one side thereof a pump recess, rotary pump mechanism in said pump recess, a motor seat at the opposite side of said body from said pump recess, a motor on said motor seat connected to said pump mechanism, a cylinder seat on said body at the same side as said motor seat, a cylinder having an inner end mounted on said cylinder seat, a reservoir within said body, a removable closure for said reservoir intermediate said motor and cylinder, said closure being hollow and forming an enlargement of said reservoir, a first flow passage in said body connecting said pump recess to the inner end of said cylinder, a second flow passage in said body and an external conduit connecting said pump recess to the outer end of said cylinder, relief and supply passages connecting said reservoir with both of said flow passages, valves controlling flow through said passages, said relief and supply passages comprising a common port located within said hollow closure.

4. A power unit comprising a body having at one side thereof a pump recess, rotary pump mechanism in said pump recess, a motor seat at the opposite side of said body from said pump recess, a motor on said motor seat connected to said pump mechanism, a cylinder seat on said body at the same side as said motor seat, a cylinder having an inner end mounted on said cylinder seat, a reservoir within said body, a removable closure for said reservoir intermediate said motor and cylinder, said closure being hollow and forming an enlargement of said reservoir, a first flow passage in said body connecting said pump recess to the inner end of said cylinder, a second flow passage in said body and an external conduit connecting said pump recess to the outer end of said cylinder, relief and supply passages connecting said reservoir with both of said flow passages, valves controlling flow through said passages, a conduit connected at one end to said relief and supply passages and open at its other end within said reservoir at a point located substantially midway between the bottom of said reservoir and the top of said closure.

5. A power unit comprising a body having at one side thereof a pump recess, rotary pump mechanism in said pump recess, a motor seat at the opposite side of said body from said pump recess, a motor on said motor seat connected to said pump mechanism, a cylinder seat on said body at the same side as said motor seat, a cylinder having an inner end mounted on said cylinder seat, a reservoir within said body, a removable closure for said reservoir intermediate said motor and cylinder, said closure being hollow and forming an enlargement of said reservoir, and extending outwardly of said body into the space between said motor and said cylinder, a first flow passage in said body connecting said pump recess to the inner end of said cylinder, a second flow passage in said body and an external conduit connecting said pump recess to the outer end of said cylinder, relief and supply passages connecting

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said reservoir with both of said flow passages, valves controlling flow through said passages, said relief and supply passages having a common port within said reservoir substantially midway between the bottom of said reservoir and the top of said closure.

6. Structure as defined in claim 5 in which one side of said closure is concavely curved to conform to one adjacent surface of said motor and cylinder.

7. Structure as defined in claim 5, said reservoir having enlarged endlobes and an intermediate narrow portion substantially on the center line of said motor and cylinder, a closure for said reservoir having an interior cavity of similar

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cross-section, and extending outward of said body alongside said motor.

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