May 24, 1938. J. R. HEIDLOFF 2,118,604

FLUID PRESSURE PRODUCING DEVICE

Filed Feb. 20, 1936

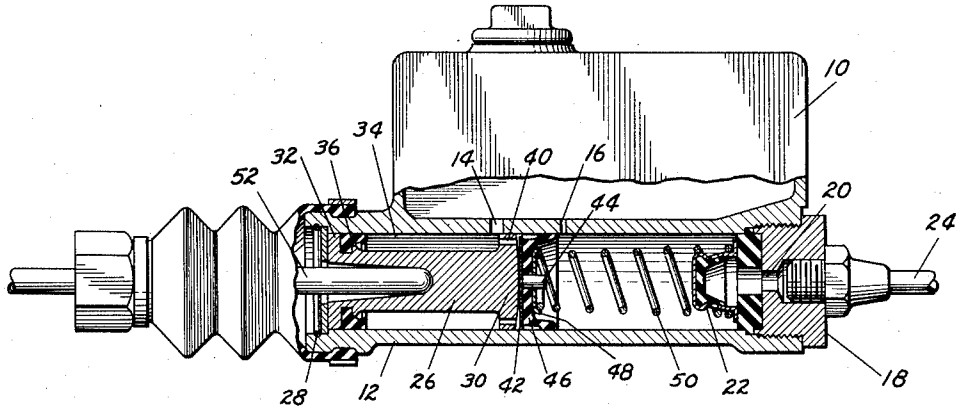


Fig. 1.

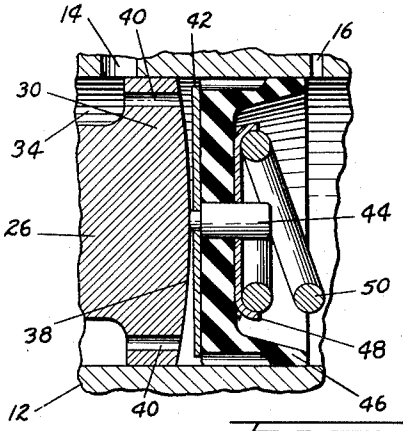


Fig. 2.

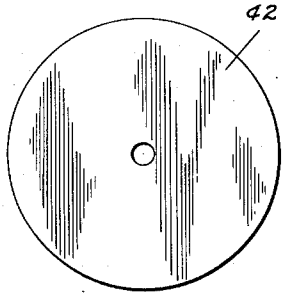


Fig. 3.

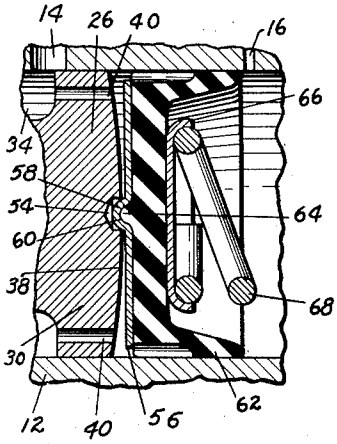


Fig. 4.

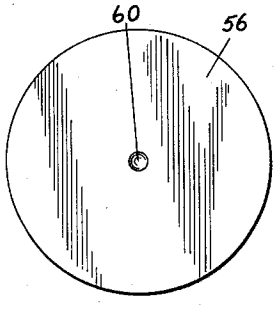


Fig. 5.

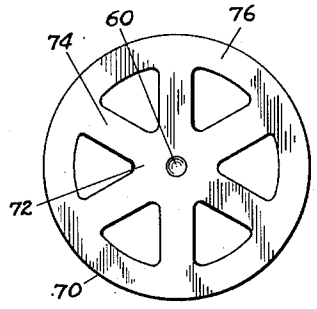


Fig. 6.

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Patented May 24, 1938 2,118,604

UNITED STATES PATENT OFFICE

2,118,604

FLUID PRESSURE PRODUCING DEVICE

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Application February 20, 1936, Serial No. 64,855

7 Claims. (Cl. 60—54.6)

This invention relates to fluid pressure systems, and more particularly to fluid pressure producing devices for such systems.

In the production of fluid pressure producing devices including a cylinder and a piston reciprocable therein, the piston is generally provided with a plurality of spaced ports for by-passing fluid on the return stroke of the piston from the chamber back of the piston to that portion of the cylinder forward of the piston. The ports are generally controlled by a collapsible leak-proof cup seated on the head of the piston. The cup is universally molded from flexible material, such as rubber, and is repeatedly subjected to high fluid pressures introduced in the cylinder by movements of the piston on its compression stroke. The high pressures deform the cup and compress the material from which the cup is made into the ports, resulting in injury to the cup and destroying the efficiency of the apparatus.

In many fluid pressure producing devices of the type hereinabove described the cylinder is provided with a port commonly known as a compensating port. This port is slightly in advance of a collapsible leak-proof cup seated on the head of the piston when the piston is in retracted position. Because of the high pressures imposed on the cup during the compression stroke of the piston, the wall of the cup is forced into the port. This results, after repeated operations, in cutting a groove in the cup and destroying its efficiency. It is the aim of the present invention to overcome these objections.

An object of the invention is to prolong the life of a packing member.

Another object of the invention is to provide a shield for a packing member.

Another object of the invention is to provide a piston having a plurality of ports in its head controlled by a flexible cup, with a flexible shield arranged between the piston and the cup to avoid injury to the cup.

A further object of the invention is to provide a cylinder having a port, a piston reciprocable in the cylinder having a plurality of ports in its head controlled by a collapsible leak-proof cup, and a flexible shield for protecting the cup against injury.

Other objects of the invention will appear from the following description taken in connection with the drawing which forms a part of this specification, and in which,—

Fig. 1 is a vertical sectional view of a fluid pressure producing device embodying the invention;

Fig. 2 is an enlarged fragmentary view in section illustrating a portion of the cylinder, the head of the piston, and the mechanism for controlling the ports in the head of the piston;

Fig. 3 is a plan view of the flexible disk;

Fig. 4 is an enlarged fragmentary view in section illustrating a modified form of the invention;

Fig. 5 is a plan view of the flexible disk employed with the modification of the invention; and

Fig. 6 is a plan view of another modified form of the flexible disk.

Referring to the drawing for more specific details of the invention, 10 represents a fluid reservoir of conventional type. A cylinder 12 at the base of the reservoir has spaced ports 14 and 16 providing communications between the cylinder and the reservoir, and a removable head 18 having a concentric opening constituting a discharge port 20 for the cylinder preferably controlled by a two-way valve 22. The discharge port may be connected by a fluid pressure delivery pipe or conduit 24 to fluid pressure actuated motors for actuating the friction elements of brakes, or other fluid pressure actuated mechanism.

A piston 26, reciprocable in the cylinder, may be retained against displacement as shown at 28. This piston has a head 30, a skirt 32, and a section reduced in diameter to provide in conjunction with the wall of the cylinder an annular chamber 34. A leak-proof washer 36 on the skirt of the piston provides against seepage of fluid from the chamber. The head of the piston is convex as shown at 38 and is provided with a plurality of spaced ports 40 arranged in a circle, the center of which is in the axis of the piston. The ports 40 provide communications between the annular chamber 34 and that portion of the cylinder 12 forward of the head of the piston.

A flexible disk 42 is seated on the head of the piston. This disk is preferably stamped from relatively thin sheet metal stock having such characteristics that it may be easily flexed to conform to the profile of the head of the piston without developing fatigue, crystalization, or otherwise injuriously affecting the disk. The diameter of this disk is slightly less than the diameter of the piston head, yet sufficient for the disk to completely cover the spaced ports 40 when it is flexed to conform to the head of the piston.

A pin 44 is mounted concentrically on the disk 42, and a collapsible leak-proof cup 46 seated on the disk has a concentric opening receiving the pin and a marginal flange or lip engaging the

wall of the cylinder. The cup centers the disk in the cylinder so as to eliminate the possibility of the perimeter of the disk scoring, chafing or otherwise injuring the wall of the cylinder. The cup is also free to rotate relative to the disk and with the disk so that injury to the cup due to its movement over the port 16 while under pressure is reduced to a minimum. A spring seat 48 positioned on the cup has a concentric opening receiving the pin so as to center the seat in the cup, and a spring 50 interposed between the seat 48 and the two-way valve 24 retains the assembly of the disk and cup on the piston head and the valve 22 on its seat. This spring also serves to return the piston to its retracted position. A thrust pin 52, seated in a recess in the back of the piston and suitably connected to any desirable type of actuator, may be employed for moving the piston on its compression stroke.

A modification of the invention is illustrated in Figs. 4 and 5. In this modification the head of a piston corresponding to the piston 26 has a concentric recess 54. A flexible disk 56, having the same characteristics as the disk 42, is concentrically swedged to provide a protrusion 58 on its back and a recess 60 on its face. The protrusion 58 is received by the recess 54 in the head of the piston so as to center the disk 56, and this protrusion provides a trunnion on which the disk may be freely rotated. A collapsible leak-proof cup 62, similar to the cup 46, is seated on the disk 56. This cup has a concentric projection 64 fitted in the recess 60 so as to center the cup on the disk and to provide for relative rotation between the cup and the disk, and a spring seat 66 in the cup receives one end of a spring 68 corresponding to the spring 50.

Another modification of the disk is illustrated in Fig. 6. In this modification a disk 70, of the same general characteristics as the disks 42 and 56, is cut away to provide a hub 72, preferably corresponding to the central portion of the disk 56, and a plurality of spokes 74 supporting a rim 76, the rim being of sufficient width to completely cover the ports 40 in the head of the piston when the disk is flexed to conform to the profile of the head of the piston. The advantage of this particular type of disk over those hereinabove described is the increased flexibility of the disk due to its skeleton-like characteristics. However, it has its disadvantage in that relative rotation between the disk and the leak-proof cup seated thereon is practically impossible due to the tendency of the disk to become embedded in the back of the cup after the cup has been repeatedly subjected to high fluid pressures. Hence, when this type of disk is employed, the disk and the cup rotate together.

In operation, upon advancing the piston 26, pressure is created in the cylinder 12 forward of the piston. This pressure is received on the cup 48 supported on the disk 42, resulting in flexing the disk 42 to conform to the convex head of the piston and effectively closing the ports 40. Further movement of the piston displaces the fluid from the cylinder 12 past the two-way valve 22, and through the fluid pressure delivery pipe or conduit 24 to the fluid pressure actuated mechanism.

Upon release of the applied force, the piston 26 is returned to its retracted position under the influence of the spring 50. As the piston returns to its retracted position a partial vacuum is created in the cylinder forward of the piston and pressure on the cup 48 and the disk 42 is released, resulting in the disk assuming its static condition and thereby uncovering the ports 40 so that fluid may be drawn from the reservoir 10 through the port 14, the annular chamber 34 and the ports 40 in the head of the piston, past the leak-proof cup 46 into that portion of the cylinder 12 forward of the piston to completely fill the cylinder for subsequent operation.

Because of the provision for relative rotation between the cup and the head of the piston, wear on the cup incidental to its movement over the port 16 may be more evenly distributed, and hence the life of the cup may be prolonged. Rotation of the cup relative to the piston may be caused by the action of the spring 50, by the flow of fluid around the periphery of the cup, or by variations in the cylinder wall.

Although this invention has been described in connection with certain specific embodiments, the principles involved are susceptible of numerous other applications that 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 the invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a fluid pressure producing device, a cylinder, a piston reciprocable in the cylinder having a port therethrough, a flexible disk on the piston rotatable relative thereto, said disk having a portion normally spaced from said port, but flexing under pressure created in the cylinder to contact said port, and a flexible cup centered on the disk, said cup controlling fluid flow through said port.

2. In a fluid pressure producing device, a cylinder, a piston reciprocable in the cylinder having spaced ports therethrough, a flexible disk on the piston rotatable relative to the piston, and a flexible cup on the disk rotatable relative to the disk, said cup controlling fluid flow through said ports.

3. In a fluid pressure producing device, a cylinder, a piston reciprocable in the cylinder having spaced ports therethrough, a flexible disk on the piston rotatable relative thereto, a flexible cup on the disk, said disk having portions normally spaced from said ports but flexing under pressure created in the cylinder to contact said ports, and means for centering the cup on the disk and permitting rotation of the cup relative to the piston.

4. In a fluid pressure producing device, a cylinder, a piston reciprocable therein having a convex head provided with a plurality of spaced ports therethrough, a flexible disk on the head overlying the ports and rotatable relative to the piston, a flexible cup seated on the disk, and means for centering the cup on the disk and permitting rotation of the cup relative to the disk.

5. In a fluid pressure producing device, a cylinder, a piston reciprocable therein having a convex head provided with spaced apertures therethrough and a concentric recess, a flexible disk on the head having a part received by the recess for centering and supporting the disk for rotation, a flexible cup on the disk, and means for centering and supporting the cup for rotation.

6. In a fluid pressure producing device, a cylinder, a piston reciprocable therein having a convex head provided with spaced apertures therethrough and a concentric recess, a flexible disk on the head of the piston having a concentric deformed portion cooperating with the recess

for centering the disk and supporting the disk for rotation, and a flexible cup seated on the disk having a concentric projection on its back cooperating with the deformed portion of the disk for centering the cup and for supporting the cup for rotation.

7. In a fluid pressure producing device, a cylinder, a piston reciprocable therein having a convex head provided with spaced apertures therethrough and a concentric recess, a flexible disk on the head of the piston having an embossed center and portions cut away to enhance the flexibility of the disk, the embossed center cooperating with the recess for centering and supporting the disk for rotation, and a flexible cup seated on the disk having a concentric projection on its back received by the embossed center of the disk.

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