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MASTER CYLINDER FOR HYDRAULIC BRAKES
AND OTHER HYDRAULIC INSTALLATIONS
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Fig. 1

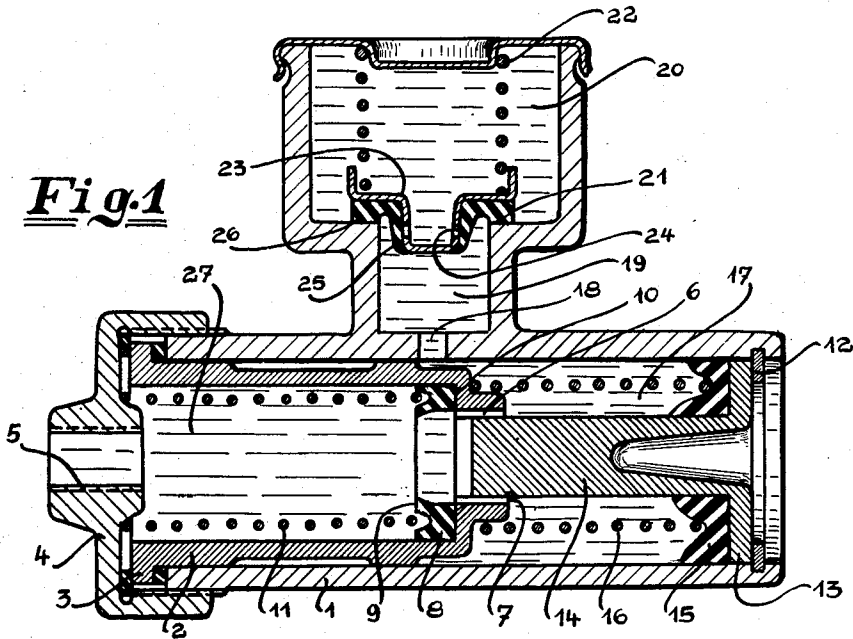


Fig. 2

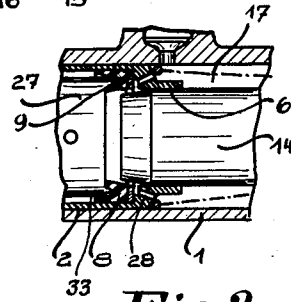
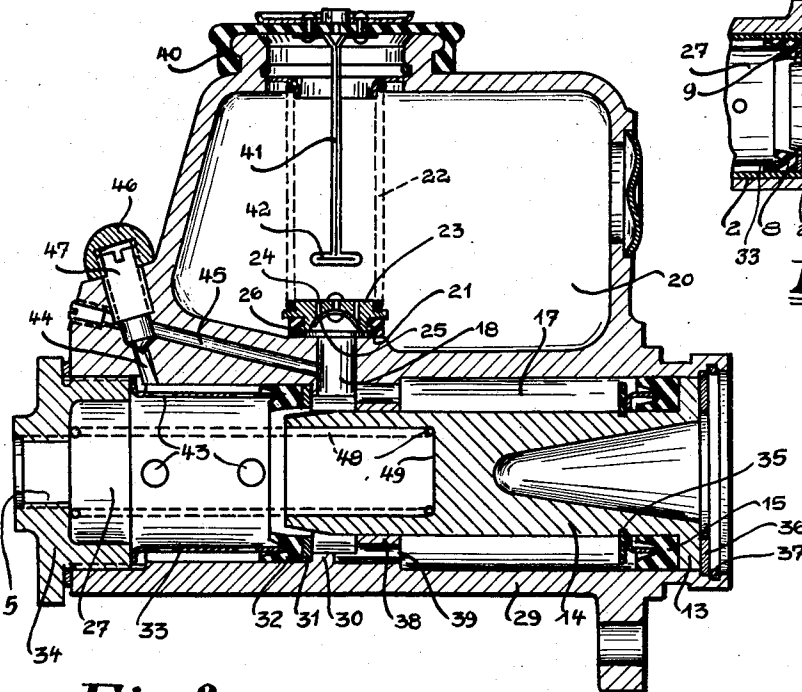


Fig. 3



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MASTER CYLINDER FOR HYDRAULIC
BRAKES AND OTHER HYDRAULIC
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2 Claims. (Cl. 60—54.6)

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This invention has reference to hydraulically actuated installations such as hydraulic brake systems of motor road vehicles, of the type wherein the operation of the installation is initiated by the depression or displacement of a pedal or equivalent hand or foot-operated member. The invention is more particularly concerned with pressurizing cylinders for embodiment in installations of the above type.

The principal object of the present invention is to ensure that the system is always completely filled with the liquid whereby the forces are transmitted from the hand or foot-operated member to the mechanism that is to be actuated so as to eliminate idle movements and loss of power.

Another object of the invention is to establish a degree of positive pressure in the pressurizing cylinder when the installation is at rest.

A further object of the invention is to compensate automatically for any inadvertent loss of force-transmitting liquid from the installation.

A still further object of the invention is to obviate the provision of small diameter holes or passages through which the liquid must flow when the appliance is actuated and which are liable to become choked or obstructed.

An additional object is to enable the pressure of the force-transmitting liquid to be increased rapidly during the initial stages of each actuation of the installation.

In accordance with the said invention, a pressurizing cylinder for embodiment in an installation of the type referred to is formed internally thereof with a high pressure zone and a low pressure zone which are in communication with one another when the installation is at rest, a spring loaded piston, comprising a low pressure portion and a smaller diameter high pressure portion, being displaceable axially within the cylinder, a partition, having an aperture therein, being disposed transversely of the cylinder intermediate the said zones and the high pressure portion of the piston being arranged to enter the said aperture and cut off communication between the cylinder zones during the initial stages of the working stroke of the piston.

Preferably the low pressure zone of the cylinder is connected constantly to a liquid storage tank through a conduit, the flow of liquid along

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the said conduit being controlled by a spring-loaded double acting valve, and an internal sealing ring, having a flexible lip around its internal periphery, is provided on the high pressure zone so that, in the initial stages of its working stroke, the high pressure piston portion enters the said internal sealing ring and makes a close sliding fit within the lip to cut off communication between the two cylinder zones.

In order that the invention may be more readily understood and carried into practice, reference will now be made to the accompanying drawing, wherein:

Figure 1 is a sectional elevation of one construction of pressurizing cylinder.

Figure 2 is a section showing part of a modified or alternative construction, and

Figure 3 is a sectional elevation of still another modified or alternative construction.

The cylinder shown in Figure 1, comprises an open-ended cylindrical body or casing 1 and a cup-like sleeve or liner 2 which fits within one end of the said body comprising the piston receiving section. The outer end of the sleeve is formed with a flange 3 around its external periphery; the said flange seats, in a liquid tight manner, upon the corresponding open body end and the sleeve is clamped in position, again in a liquid-tight manner, by a cap 4 which is screwed on to the outside of the body 1. The cap is formed with a central tapped outlet 5 which provides means for connection of a pressure pipe line to the cylinder.

At its end located innermost of the cylinder, the sleeve 2 is formed with a central bored hub or partition 6 along the length of the inner periphery of which a system of grooves 7 is formed. A resilient annular sealing ring 8 is seated upon the base of the sleeve 2 by a coil spring 11 which is compressed between the annular sealing ring and the cap 4. The inner periphery of the annular sealing ring 8 is provided with a lip 9 which is of a smaller diameter than the bore of the hub 6.

The other open end of the body 1 comprising the piston holding section is closed by a reciprocable piston comprising a low pressure portion 13 which is a sliding fit within the said body, and a high pressure and smaller diameter, cylindrical portion 14. An annular locking ring 12 is se-

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cured within this body end and the lower pressure piston 13 is urged into contact with the said ring by a coil spring 16 which is compressed between the inner end of the liner 2 and a deformable liquid-sealing washer 15 located around the high pressure piston 14 and seating on the inner face of the low pressure piston. The high pressure piston is of such a length that its forward end extends into and fits within the bore of the hub 6 when the lower pressure piston is spring retained upon the locking ring 12; under such conditions communication is established between the low pressure zone 17 and the high pressure zone 27 of the cylinder, through the grooves 7.

A storage tank 20, for oil or other force transmitting liquid, is provided on the exterior of the cylinder body 1; a sump 19 is interposed between the tank and the body 1 and the interior of this sump is in free and constant communication with the interior of the low pressure zone 17 through a port 18; communication between the sump and the interior of the tank is controlled by a two-way valve 21 which is so loaded by a coiled compression spring 22 that, normally, it is resiliently seated on the bottom of the said tank.

The said two-way valve 21 comprises an annular washer 26 which is composed of flexible material and is formed around its inner edge with a collar 25 arranged to depend into the sump 19. The surface of the washer remote from the bottom of the tank is lined by a dished plate 23, the dished portion of which depends into and is closely embraced by, the collar 25, and is formed with a system of ports 24 in its wall. As and when the level of the liquid contents of the sump falls, the sump is adapted to be replenished automatically by the flow of liquid from the tank through the ports 24. Consequently, both the high and low pressure zones 27 and 17 of the cylinder, and the sump 19 are constantly and completely filled with liquid.

However, as the piston unit 13, 14 is displaced through its working stroke axially of the cylinder against the action of spring 16 (for example by an endwise thrust imparted to a rod projecting through the locking ring 12 into engagement with the said unit), upon depression of a brake pedal or other actuating member or mechanism (not shown in the drawings), the pressure of the liquid in the cylinder and sump is increased, thereby compressing the collar 25 around the dished portion of the plate 23 and effectively closing the ports 24 acting thus as a check valve; this increase of pressure is effected both in the low pressure and high pressure zones 27 and 17 of the cylinder, since these two zones are in communication through the grooves 7.

As the piston unit displacement continues, the leading end of the high pressure portion 14 passes out of the hub 6 and enters the flexible annular sealing ring 8 and then enters and makes a close fit within the annular lip 9 so that, thereafter, there is no communication between the high and low pressure zones 27 and 17. Continued displacement of the piston unit causes the piston portion 14 to project further and further into the high pressure zone so that the pressure in this zone rises rapidly and the force resulting from this increase is transmitted through any pipe line connected to the cap 4 for actuating a vehicle brake system (not shown) or any other hydraulically operable appliance to which the said pipe line is coupled.

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On the other hand, as the pressure, resulting from the piston displacement, in the low-pressure zone 17 reaches a critical value which is sufficient to overcome the action of the valve spring 22 in the storage tank 20, the two-way valve 21 is raised from its seating to establish communication with the interior of the said tank and the interior of the low pressure zone.

Upon removal of the endwise thrust on the piston unit, the unit is automatically driven through its idle return stroke by the spring 16 and immediately the pressure in the low pressure zone falls below the said critical value, the two-way valve is closed by its spring 22; should closure of the valve 21 take place before the high pressure piston-portion is withdrawn from the flexible lip 9, liquid will flow from the tank, through the ports 24, into the sump 19 and low-pressure zone 17. As the piston unit approaches the end of its idle return stroke, the high pressure portion 14 is withdrawn from the lip 9 and communication is re-established between the cylinder zones 27 and 17. Since, during the whole of the return stroke of the piston unit, liquid at considerable pressure is flowing from the pressure pipe line to the high pressure zone 27 and since, after re-establishment of communication between the two zones 27 and 17, the pressure in both zones and in the sump 19 is equalized, any excess liquid that has been drawn from the storage tank into the sump is returned automatically to the said tank at the completion of the idle stroke by the re-opening of the valve 21 against the action of its loading spring 22. However, the valve 21 is again closed by the said spring as the pressure reaches the above-mentioned critical value and, consequently, the pressure in the sump and the cylinder remains at a small positive pressure, determined by the strength of the spring 22. Thus air cannot infiltrate into the sump, cylinder or pressure pipe line, and any loss of liquid from the pressure system is automatically compensated. Also, owing to the fact that an initial positively pressure exists in the high pressure zone from the commencement of the working stroke of the piston unit, the area of the piston portion 14 may be kept small and still enable a rapid pressure increase in the high pressure zone 27 to be created when communication between the zones 27 and 17 has been cut off.

If desired a spring-loaded two-way valve may be fitted in the cylinder end of the pressure pipe line to ensure that, at all times, the liquid remaining in the said line, is also at a positive pressure.

In the alternative construction of pressurizing cylinder shown in Figure 2, communication between the zones 27 and 17 is established through inclined ducts 28 formed in the inner end of the cup-like liner 2, instead of through the hub grooves 7, and the leading end of the piston portion 14 is a close fit within the hub so that the said ducts are closed shortly after the commencement of the working stroke of the piston unit. Also instead of seating the resilient and lipped washer 8 against the said liner end by means of a spring, a perforated spacing sleeve 33, extending between the said collar and the cap 4, is used for this purpose.

The alternative construction of pressurizing cylinder shown in Figure 3, again comprises an open-ended body 29, but instead of providing this body with a cup-like liner 2 as in the construction shown in Figures 1 and 2, the said body

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is formed with an internal shoulder 30 which locates a seating ring 31 for a flexible and internally lipped collar 32. The collar is retained upon its seating by a spacing sleeve 33 which is clamped down by a closure cap 34 screwed into the appropriate body end and formed with the tapped pipe receiving aperture 5.

A seating ring 36 for the piston unit 13, 14 is retained within the other open end of the cylinder body 29, by a spring locking ring 37 and the sealing washer 15 is held upon the inner face of the low-pressure piston portion 13 by another spring ring 35 which engages a groove formed around the root of the high pressure piston portion 14.

The leading end of the piston portion 14 makes a close sliding fit within a central aperture in a partition 38 extending transversely of the cylinder body and, around the said aperture, the partition is formed with a series of ports 39 whereby communication is established between the high and low pressure zones 27 and 17 when the piston is withdrawn from the lip of the collar 32. The piston is loaded by a coil spring 48 which is compressed between the cap 34 and the floor of a well 49 formed in the said leading end of the piston unit.

To ensure that the high pressure zone 27 may be filled with liquid when the storage tank 20 is initially charged with liquid, the spacing sleeve 33 is formed with a system of ports 43 and the body 29 is formed with ducts 44 and 45 which extend between the cylinder zone containing the said sleeve and the sump 18. The ducts are controlled by a normally closed conical valve 47 which, after removal of a protecting cap 46, is adapted to be rotated to establish communication through the ducts between the cylinder and sump and, after the high pressure zone is filled with liquid, to be reclosed; the cap 46 is then replaced in position to prevent inadvertent opening of the said valve 47.

The filling orifice of the storage tank is closed by a removable cap 40 having a dip-stick 41 depending from its underside so that ready means is provided to ascertain the amount of liquid in the tank. A deflector plate 42 is formed or provided on the free end of the dip-stick to break up any stream of liquid injected into the tank during the displacement of the piston unit through its working stroke.

We claim:

1. A master cylinder unit comprising an open-ended casing having a cylindrical bore there-through, an annular sleeve lining a portion of the interior wall of said casing and having a centrally bored hub integral therewith, said hub dividing said casing into a low pressure chamber and a high pressure chamber, said high pressure chamber being formed by said annular sleeve, an annular sealing ring positioned in said sleeve extending radially inwardly from the interior surface thereof and having an aperture coinciding with the bore of said hub, spring means positioned in said high pressure chamber for urging said ring against said hub, said hub being a piston guide means and having longitudinal passageways along the internal periphery thereof between said two chambers, a dual piston positioned in said low pressure chamber and having one end smaller in cross sectional area than its other end, said smaller end being slidably positioned in said bore of said hub, whereby said hub acts as a guide means for said piston, a reservoir exterior to said casing, a passageway connecting said reservoir and said low pressure chamber,

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check valve means associated with said reservoir for preventing fluid from moving from said low pressure chamber into said reservoir until a predetermined pressure in said low pressure chamber is exceeded, whereby said smaller cross sectional area end of said piston forms a fluid tight seal with said annular ring when said piston is moved toward said high pressure chamber.

2. A master cylinder unit comprising an open-ended casing having a cylindrical bore there-through and inlet and discharge openings at the respective ends thereof, an annular sleeve lining the portion of the interior wall of said casing adjacent said discharge opening, a flange around the external periphery of said sleeve adjacent said discharge opening, an apertured cap on said casing at said discharge opening and adjacent said flange, said cap having means for connecting a pressure pipe to said casing at said cap aperture, a hub integral with and forming a base of said annular sleeve at the end thereof opposite to the end adjacent said discharge opening of said casing, said hub dividing said casing into a low pressure chamber and a high pressure chamber, said hub having a central bore there-through and a system of longitudinal grooves along the inner periphery of said bore extending from said low pressure chamber to said high pressure chamber, whereby hydraulic fluid may flow from said low pressure chamber into said high pressure chamber along said grooves, an annular sealing ring having a central aperture and extending radially inwardly from said sleeve and seated against said base, said aperture coinciding with said hub base, spring means positioned in said high pressure chamber between said sealing ring and said cap for urging said ring against said base, the inner diameter of said ring being approximately equal to the diameter of said bore at the portion adjacent thereto and smaller than the diameter of said bore at the portion facing said cap, a dual piston reciprocally mounted in said low pressure chamber, said piston comprising a first low pressure portion adjacent to the inlet opening of said casing and slidably positioned therein and an integral elongated concentric high pressure portion of a diameter smaller than that of said first portion projecting axially from said first portion for movement from a retracted position in said low pressure chamber to a protracted position in said high pressure chamber through the hub bore and into said ring aperture, the diameter of said high pressure portion of said dual piston being of such a dimension that said portion will slidably fit into said hub bore and said ring to make a fluid tight seal with said ring at the smaller diameter portion thereof, said hub being a guiding means for said high pressure portion of said piston, an annular locking ring at the inlet opening of said casing and secured therein adjacent said low pressure portion of said piston, said locking ring acting as a stop means for said piston, a deformable liquid-sealing washer positioned around said high pressure portion of said piston and adjacent to said low pressure portion of said piston, spring means in said low pressure chamber positioned between said liquid-sealing washer and the sleeve end adjacent said hub for urging said low pressure portion of said piston into contact with said annular locking ring, a reservoir on the exterior of said casing, port means for connecting said reservoir with said low pressure chamber, check valve means associ-

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ated with said reservoir for permitting fluid to flow from said reservoir into said low pressure chamber and for preventing fluid from moving in the reverse direction until a predetermined pressure in said low pressure chamber is exceeded, whereby when said piston is moved toward the high pressure chamber said low pressure portion of said piston and said annular sealing ring form a fluid tight seal.

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