PATENT SPECIFICATION

DRAWINGS ATTACHED

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977,268

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Date of filing Complete Specification Sept. 12, 1963.

Application Date Sept. 29, 1962. *No. 37003/62.*

Complete Specification Published Dec. 2, 1964.

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Index at acceptance:—F2 F1A2C

International Classification:—B 62 d

COMPLETE SPECIFICATION

Improvements in Master Cylinders for Hydraulic Braking Systems

We, GIRLING LIMITED, a British Company of Kings Road, Tyseley, Birmingham 11, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to improvements in master cylinders for hydraulic braking systems, and relates more particularly to master-cylinders of the kind known as tandem master cylinders in which liquid under pressure is supplied to brakes on one pair of wheels of a vehicle from a pressure space between a positively actuated main piston and a floating or secondary piston and to the brakes on another pair of wheels from a second pressure space between the floating or secondary piston and one end of the cylinder.

In the off position of the brakes, when the pistons are in their fully retracted positions, the two pressure spaces are in communication with a reservoir or reservoirs for liquid through valves which are controlled by one or both pistons, the valves being opened when the pistons are retracted and being closed or allowed to close when the main piston is advanced to apply the brakes.

According to our invention, in a tandem master cylinder communication between the first pressure space in the cylinder and a reservoir is controlled by a tilting spring-loaded valve of which the stem is adapted to be engaged by a part of one of the pistons, while communication between the second pressure space and the same or another reservoir is controlled by an axially movable valve adapted to engage a seating around a port in the end wall of the cylinder and coupled to the floating or secondary piston.

When the brake is off, and the pistons are in their fully retracted positions, both valves are open so that both pressure spaces in the cylinder are in communication with the reservoir or with separate reservoirs, and in the application of the brake both valves close as soon as the pistons move away from their retracted positions.

Two forms of tandem master cylinder embodying our invention are illustrated by way of example in the accompanying drawings in which:—

Figure 1 is a longitudinal section of one form of master cylinder;

Figure 2 is a similar section of another form of master cylinder;

Figure 3 is a section on a larger scale of the tilting valve used in the master cylinder shown in Figures 1 and 2.

In the arrangement shown in Figure 1, 10 is the body of the master cylinder in which works a main piston 11 and a floating or secondary piston 12. The main piston carries a seal 13 and is adapted to be moved axially into the cylinder by a push-rod 14 actuated by a pedal and having a part-spherical head 15 engaging in a part-spherical recess in the outer end of the piston. The piston has a forward axial extension 16 of reduced diameter, and adjacent to the forward end of the extension there is an annular radially projecting flange 17.

A compression spring 18 is located between the main piston and the secondary piston 12 which is relatively short axially and is provided with an annular seal 19.

The pressure space 21 between the pistons is adapted to be connected to the slave cylinders of the brakes on the front or rear wheels of a vehicle and the pressure space 22 in front of the secondary piston 12 is connected

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to the slave cylinders of the brakes on the other wheels.

Communication between the pressure space 21 and a reservoir (not shown) is established in the off position of the brake through a port 23 in the cylinder wall leading into a chamber 24 in which is mounted a valve seat 25 controlled by a tilting valve. The valve, as shown more particularly in Figure 3, comprises a rubber or other head 26 having on its upper face an annular rib 27 adapted to engage the underside of the seating. The head is mounted on a stem 28 which is urged upwardly by a spring 29 located between the seat and an abutment collar 31 fixed on the upper end of the stem. The lower end of the stem extends downwardly through the port 23 into the path of the flange 17 on the main piston, and when the piston is in its fully retracted position, as shown in Figure 1, the flange 17 engages the lower end of the valve stem and holds the valve in a tilted position so that the pressure space 21 is in free communication with the reservoir.

The pressure space 22 communicates with the same or another reservoir through a port 32 in the forward end of the cylinder leading into a passage 33 connected to the reservoir. The port 32 is adapted to be closed by a washered valve head 34 mounted for limited axial movement in a cage 35 located in a recess in the end of the cylinder concentric with the port 32. The valve has an axially extending stem 36 at the rear end of which is an enlarged head 37 slidably engaged in an axial bore 38 in a reduced forward extension of the secondary piston 12 in which it is retained by inturned fingers or an inturned flange 39 on a resilient clip 41 mounted on the extension. The clip is retained on the extension by bending a tongue 42 pierced from the clip into an annular recess in the extension. A Belleville washer or other spring may be located between the valve head and the cage, the washer acting in a direction urging the head towards the closed position. A compression spring 43 is located between the valve cage 35 and the secondary piston, the distance to which the piston can move away from the end of the cylinder being limited by the engagement of the head 37 on the valve stem with the clip on the piston.

When the main piston is advanced to apply the brake it allows the tilting valve 26 to close and applies pressure to the liquid in the first pressure space 21 and at the same time, through the spring 18, it advances the secondary piston. The spring 43 is thus compressed, and as the secondary piston moves forwardly the valve stem 36 can move with it and the valve 34 closes so that pressure can build up in the second pressure space 22.

Preferably the two springs 18 and 43 are so arranged that substantially simultaneous closing of the valves is obtained.

In the modification shown in Figure 2, the two valves are of the same construction as described above and the same reference numerals have been applied to corresponding parts.

In this master cylinder however, both valves are controlled by the secondary piston 46 which is of sufficient axial length for its rear end to engage and tilt into the open position the valve 26 when the piston is fully retracted.

A primary compression spring 47 is located between the secondary piston and the main piston 48 which is relatively short in an axial direction. A secondary spring 49 of less strength than the spring 47 is located between the secondary piston 46 and the forward end of the cylinder so that when the main piston is advanced to apply the brake the secondary piston moves forwardly with it and both valves close substantially simultaneously.

Preferably an axially extending plunger 51 is fixed at its rear end in the main piston 48 and has at its forward end a head 52 adapted to slide in an axial recess 53 of limited length in the rear end of the main piston so that the secondary piston can be advanced mechanically by the main piston in the event of failure of the primary spring 47 or failure of a pipe line leading to brakes actuated by liquid from the pressure space 22.

The primary spring 47 fits over the plunger 51 and abuts at its forward end on a washer 54 bearing against the rear end of the secondary piston around the recess 53 for the plunger head, so that the spring is prevented from entering the recess when the main piston moves towards the secondary piston.

One advantage of our improved master cylinder is that the overall length of the unit may be reduced as the main piston does not have to be extended forwardly to actuate the second valve.

Another advantage is that bleeding is facilitated, particularly when the master cylinder is mounted with its axis vertical or close to the vertical.

While we have referred in this specification to tandem master cylinders having two pressure spaces from which fluid is supplied to brakes on two pairs of wheels, it will be appreciated that our invention can be applied to master cylinders having two or more secondary pistons and three or more pressure spaces.

WHAT WE CLAIM IS:—

1. A tandem master cylinder of the kind set forth for hydraulic braking systems in which communication between the first pressure space in the cylinder and a reservoir is controlled by a tilting spring-loaded valve

to the slave cylinders of the brakes on the other wheels.

Communication between the pressure space 21 and a reservoir (not shown) is established in the off position of the brake through a port 23 in the cylinder wall leading into a chamber 24 in which is mounted a valve seat 25 controlled by a tilting valve. The valve, as shown more particularly in Figure 3, comprises a rubber or other head 26 having on its upper face an annular rib 27 adapted to engage the underside of the seating. The head is mounted on a stem 28 which is urged upwardly by a spring 29 located between the seat and an abutment collar 31 fixed on the upper end of the stem. The lower end of the stem extends downwardly through the port 23 into the path of the flange 17 on the main piston, and when the piston is in its fully retracted position, as shown in Figure 1, the flange 17 engages the lower end of the valve stem and holds the valve in a tilted position so that the pressure space 21 is in free communication with the reservoir.

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1. A tandem master cylinder of the kind set forth for hydraulic braking systems in which communication between the first pressure space in the cylinder and a reservoir is controlled by a tilting spring-loaded valve

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of which the stem is adapted to be engaged by a part of one of the pistons while communication between the second pressure space and the same or another reservoir is controlled by an axially movable valve adapted to engage a seating around a port in the end wall of the cylinder and coupled to the floating or secondary piston.

2. A tandem master cylinder as claimed in Claim 1 in which the stem of the tilting valve extends into the path of and is engaged by a flange on a forward extension of the main piston.

3. A tandem master cylinder as claimed in Claim 1 in which the stem of the tilting valve extends into the path of and is engaged by the rear end of the secondary piston.

4. A tandem master cylinder for hydraulic braking systems substantially as described with reference to Figure 1 of the accompanying drawings.

5. A tandem master cylinder for hydraulic braking systems substantially as described with reference to Figure 2 of the accompanying drawings.

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Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1964.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

I certify this, including the Drawing forming part thereof, to be a True Copy of the Specification as accepted.

27 SEP 1965

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