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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in Brake Systems for Vehicles

We, ROBERT BOSCH GMBH, a German Company of 4, Breitscheidstrasse, Stuttgart-W, Germany, 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:—

The present invention relates to a brake system for a vehicle, particularly a motor vehicle and of the kind having a device to supply the pressure medium, a control valve and brake cylinder mounted on the vehicle to cooperate with the wheels, and a control device for automatically preventing the braking power from rising in the brake cylinder if one wheel locks.

Systems of this kind are known for hydraulic brakes in which a piston is arranged to move in the brake cylinder, the braking pressure acting on the front of the piston and the releasing pressure acting on the rear when a wheel is locked. The pressure fluid fills the entire cylinder and any alteration in the pressure in the front of or behind the brake piston acts immediately on the brake piston and, consequently, also on the brake by reason of the fact that pressure is propagated in a fluid without delay. In the case of hydraulic brakes it is therefore possible to release the brakes easily and without loss of time if a wheel locks. Reference may be had to French Patent Specification 1137971 Supplement 68746.

A system of this kind cannot be used for compressed air brakes since compressed air always requires a certain time in order to build up pressure in a given space. Owing to the variation in the counter-pressure area depending on the position of the brake piston at any given time, it would be impossible to avoid differing filling and acting times. As a result, the braking or releasing intervals would be of varying duration according to the position of the brake piston in the brake cylinder, which is dependent upon the wear of the brake linings or the setting of the brake.

[Price 4s. 6d.]

However, it is known that a system to prevent wheel-locking must ensure a rapid change-over between braking and releasing of the brakes, i.e. short braking and release times, once the locking limit of the wheel which is to be braked is reached.

An object of this invention is to provide a braking system of the kind referred to in which a device is fitted in the brake cylinder for ensuring approximately uniform response and short change-over intervals for safe-guarding against wheel locking, even in the case of compressed air brakes and irrespective of the position of the brake piston.

Accordingly, the present invention provides a vehicle brake system of the kind referred to which is usable with compressed air as the pressure medium in the brake cylinder and comprises a trailing piston coupled to the brake piston, said trailing piston being provided with clamping elements actuated by the pressure medium for retaining the piston in position in the cylinder, in which a working chamber situated adjacent to the clamping elements communicates with a pressure chamber through a valve controlled by the control device, said pressure chamber being under pressure at least during the braking operation.

The invention is further described with reference to the accompanying drawings which illustrate two embodiments by way of example only and in which:—

Fig. 1 is a diagrammatic illustration of a brake system in simplified form,

Fig. 2 A part-sectional elevation of a brake cylinder of the brake system with a control device associated with it, the cylinder being drawn to an enlarged scale, and

Fig. 3 is a fragmentary view of a brake cylinder of another embodiment.

Referring to the drawings, an air compressor 1, is connected by a conduit 2 to a pressure regulator 3 to which an air reservoir 5 is connected via a conduit 4. From the reservoir 5

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a conduit 6 leads to a control valve 7 which, in turn, is connected via a brake conduit 8 to a brake cylinder 9 which has a control device 10 and is coupled to the wheel brakes 11. The brake cylinder for the other wheels are arranged in parallel to this cylinder; for the sake of simplicity, only one brake cylinder and only one wheel brake are illustrated.

From Fig. 2 it can be seen that the brake conduit 8 leading to the brake cylinder 9 extends to a connection point 12 arranged in the base 13 of the cylinder 9.

The brake cylinder 9 is in the form of a single chamber cylinder and consists of a cup-shaped section, the open side of which is closed by a cover 14. The cylinder 9 has a cylindrical internal wall 15 over which a brake piston 17 carrying a sealing ring 16 can slide, the piston being permanently connected to a piston rod 18. The piston rod 18 extends from the brake cylinder 9 through a clearance opening 19 in the cover 14 and is connected to a rod linkage which actuates the wheel brake as will be appreciated from Fig. 1.

A trailing piston 20 is arranged to move on the piston rod 18 and is connected to the brake piston 17 by means of four tension springs 21 which are uniformly spaced apart around the piston. A number of distance pieces 22 are disposed between the two pistons 17 and 20 so as to maintain them at a certain minimum distance from each other. A central bore 23 of the trailing piston 20 contains two grooves 24 and 25 which retain two sealing rings 26 and 27, respectively, which cooperate with the piston rod 18. The trailing piston 20 is spool-shaped and comprises a hollow, cylindrical inner portion 28 with outwardly extending flanges 29 and 30 at its ends. The flange 29 which is adjacent to the brake piston 17 has a sealing ring 31 on its periphery. In the annular space between the flanges 29 and 30 there is rigidly secured a ring 32 which divides this space into two compartments 33 and 34 which are in concentric relation and communicate with each other through a throttle point 35 in the form of a contracted bore.

The outer compartment 34 serves as a working chamber and its outer wall is defined by an annular diaphragm 36. The side edges of the diaphragm at the opposite ends thereof are supported by two annular projections 37 and 38 which provide a seal and which are secured to the opposite internal surfaces of the flanges 29 and 30. Three clamping elements in the form of segments 39 are distributed over the periphery of the external surface of the diaphragm 36. When there is no pressure in the working chamber these segments are spaced at a slight distance from the cylinder wall 15 of the brake cylinder 9. The chamber formed by the inner compartment 33 is connected via a bore 40 to a chamber 41 which communicates with the surrounding atmosphere through the clearance between the opening 19 and the pis-

ton rod 18. The outer chamber 34 communicates with the area 42 between the flange 29 and the brake piston 17 through a number of holes 43, only one of which is shown. The area 42 will be referred to below as the counter-pressure chamber. It must not be large, in other words the tension springs 21 must draw the trailing piston 20 as close as possible to the brake piston 17; the distance pieces 22 are therefore only of shallow depth.

A larger bore 45 is provided in the piston rod 18 on its side 44 situated in the region of the brake piston 17. This bore 44 receives a sleeve-shaped slide 46 which is provided with a control bore 47. During longitudinal movement of the slide 46, the control bore 47 moves across a lateral bore 48 in the piston rod 18, and the edges of the two bores, in effect, form a slide valve 47/48. The slide 46 is secured to a rod 49 which extends through the centre of the piston rod 18 with a tight sealing effect. The rod 49 extends beyond the cover side of the brake cylinder 9 and is connected to an armature 50 of an electro-magnet. A spring 51 serves to hold the slide 46 in a position in which access through the bores 47 and 48 is closed. The armature 50 is located in a coil 52 of which one side is connected to earth while the other side is connected to a contact of a switch 53. The other contact of the switch is connected to a current supply source. A switch element 54 of the switch 53 is arranged in such a manner that when one wheel of the vehicle becomes locked it is actuated either by the brake shoes, which are suspended to yield in the direction of rotation, or by an inertia mass. Thus, the switch element 54 reaches a position in which it connects the two contacts of the switch 53 so that current can flow through the coil 52.

The system described above functions as follows:

When the brakes are applied, compressed air flows from the reservoir 5 through the control valve 7 and the conduit 8 to the brake cylinder 9. Compressed air enters the brake cylinder 9 through the connection 12, acts on the brake piston 17 and displaces it together with its piston rod 18 and the trailing piston 20 in the braking direction. The wheel brakes 11 are applied and the vehicle is retarded accordingly. The slide valve 47/48 remains closed.

If the braking power is too high for the prevailing condition of the roadway the wheel of the vehicle will lock. The switch element 54 is now actuated to close the circuit. Current flows through the coil 52 and the armature 50 is drawn into the coil 52. The slide 46 is actuated through the rod 49 and the slide valve 47—48 shunts over so that the two control bores 47 and 48 are brought into alignment. Part of the compressed air acting on the brake piston 17 now flows into the counter-pressure chamber 42 between the brake piston 17 and the trailing piston 20. From the counter-pres-

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sure chamber 42, the compressed air quickly passes through the bore 43 into the chamber 34 behind the annular diaphragm 36 and forces the latter radially outwardly together with the clamping segments 39 which are forced against the internal wall 15 of the cylinder 9. The trailing piston 20 is consequently held in position in the cylinder 9. As a result, pressure is able to build up quickly in the relatively small counter-pressure chamber 42. This pressure counteracts further movement of the brake piston 17, preventing further movement in the braking direction, and then causes the brake piston 17 to be pushed back slightly. The locked brake is then released. A small part of the pressure then flows off through the throttle point 35. However, the clamping segments 39 are still pressed firmly against the cylinder wall 15 so that the trailing piston 20 cannot move.

When the brakes are released, the locked wheel of the vehicle is freed again and the current to the coil 52 is interrupted by the switch element 54. Current ceases to flow through the coil 52. The armature 50 then exerts no further force on the rod 49 and the spring 51 is able to move the slide valve 47/48 back to its initial position. The slide valve 47/48 is closed. The compressed air present in the counter-pressure chamber 42 and in the chamber 34 flows through the throttle point 35 to the chamber 33 and from the latter via the bore 40 and the chamber 41 to the outside atmosphere. The pressure which again builds up in the brake cylinder 9 moves the two pistons and again actuates the brake. If the brake again locks the process described above will be repeated. These cycles take place very quickly and may occur several times when the brake is actuated once.

The clamping segments 39 may be fixed to the diaphragm 36 or held in some other manner which may be conventional. The counter-pressure chamber 42 and the chamber 34 may be connected to a different pressure medium source through a valve similar to valve 47/48, instead of being connected to the brake pressure chamber. Compressed air may also be supplied separately to each of these two chambers.

The clamping segments 39 and the diaphragm 36 may be replaced by a magnetic powder clutch adapted to hold the trailing piston 20 in the brake cylinder when the electro-magnet 50/52 is switched over. Moreover, an electro-magnetically actuated valve, controlled directly by the electrical switch element 54, may be used in place of the throttle point 35. Finally, the trailing piston may be constructed in a much shallower form and as a complete disc. Such a construction is shown in Fig. 3, in which the components which correspond to those shown in Fig. 2 are given the same reference numerals. A trailing piston 55 is associated with the brake

piston 17 and has a peripheral groove 56 which receives a sealing ring 57, the outer diameter of which can be increased to enable it to serve also as a clamping ring. The base of the groove 56 communicates with the counter-pressure chamber 42 by an appropriate passage 58 which also communicates with an oppositely directed passage 59 containing a throttle 60. To enhance the clamping effect, the sealing ring 57 may be formed with a surface different from the smooth, cylindrical peripheral surface, for example a saw-toothed or serrated surface. The mode of operation of this second embodiment is substantially similar to that illustrated in Fig. 2, and therefore does not require any further description.

WHAT WE CLAIM IS:—

1. A brake system of the kind referred to, in which the system is usable with compressed air as the pressure medium in the brake cylinder, and comprises a trailing piston coupled to the brake piston, said trailing piston being provided with clamping elements actuated by the pressure medium for retaining the piston in position in the cylinder and in which a working chamber situated adjacent to the clamping elements communicates with a pressure chamber through a valve controlled by the control device, said pressure chamber being under pressure at least during a braking operation.

2. A brake system as claimed in claim 1, in which the two pistons form between them a counter-pressure chamber which is under the control of the valve communicating with the working chamber, said counter-pressure chamber being connectible to the air inlet to the brake cylinder when the brake locks.

3. A brake system as claimed in claim 2, in which a piston rod carrying the brake piston of the brake cylinder also carries the trailing piston, the two pistons being coupled together by tension springs.

4. A brake system as claimed in claim 2 or 3, in which the trailing piston is made in several sections and has two annular chambers extending between opposed flanges, the outer working chamber being connected to the counter-pressure chamber and the inner chamber to the outer via a throttle point which retards the through-flow of the pressure medium, as well as to the external atmosphere.

5. A brake system as claimed in claim 4, in which the outer working chamber is sealed in the peripheral direction on the outside by an annular diaphragm and in which segments which serve as the clamping elements are distributed over the external surface of the diaphragm for contact with the wall of the brake cylinder.

6. A brake system as claimed in any of the preceding claims, in which the trailing piston is maintained at a slight distance from the brake piston by means of distance pieces.

7. A brake system as claimed in any of the

preceding claims, in which the valve has an actuating element which is influenced by an electro-magnet associated with an electrical control device which is responsive to locking of a vehicle wheel.

5 8. A brake system as claimed in claims 3 and 7, in which the valve is fitted in the piston rod and its actuating element is provided with an actuating rod which is guided outwardly
10 through a bore in the piston rod.

9. A vehicle brake system constructed, arranged and adapted to operate substantially as

herein described with reference to and as illustrated in Figs. 1 and 2 of the accompanying drawings. 15

10. A vehicle brake system constructed, arranged and adapted to operate substantially as herein described with reference to and as illustrated in Figs. 1 and 3 of the accompanying drawings. 20

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This drawing is a reproduction of the Original on a reduced scale

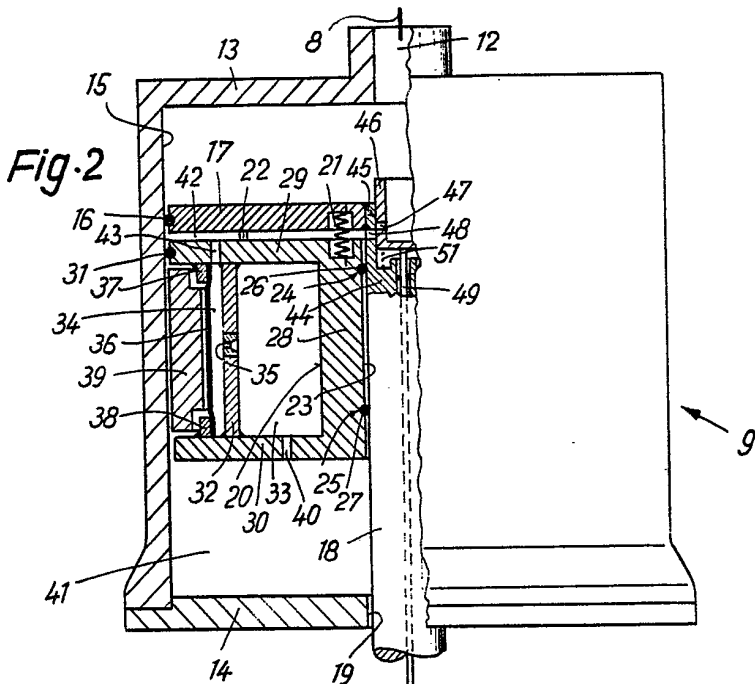


Fig. 2

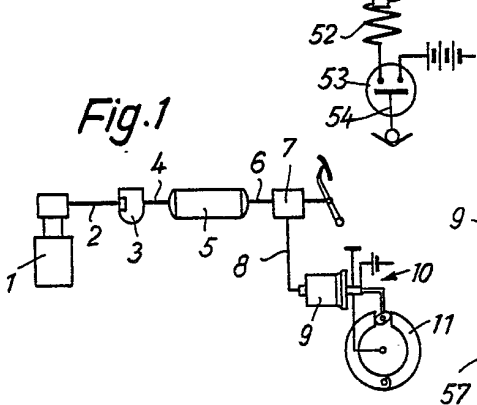


Fig. 1

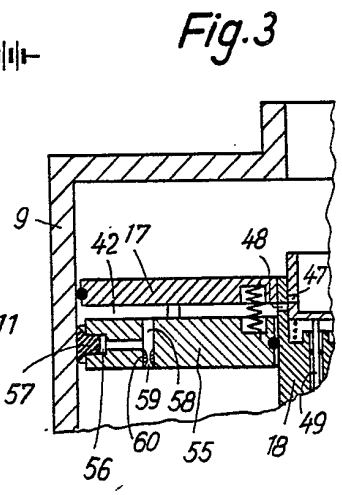


Fig. 3