PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) SELF-ADJUSTING DISC BRAKE

(71) We, LANCIA & C. FABBRICA AUTOMOBILI-TORINO S.P.A., an Italian Company of 27 Via Vincenzo Lancia, Turin, Italy, 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 self-adjusting disc brakes, that is, disc brakes having means for maintaining a constant predetermined clearance between a brake pad or pads and a brake disc which is frictionally engaged by the pad or pads on application of the brake, and for adjusting the initial position of the pad or pads with respect to the disc.

Self-adjusting disc brakes as heretofore known have employed sliding pin or sleeve friction couplings between the brake actuator and a respective brake pad, but in practice such brakes are unsatisfactory as the means for restoring the brake pads to their predetermined clearance with respect to the disc are generally unreliable, and manufacturing tolerances on the components tend to be severe.

According to the present invention there is provided a self-adjusting disc brake having a brake pad actuating piston movable within a fixed cylinder, resilient means urging the piston away from a brake disc into engament with a surface of an annular member surrounding a part of said piston to maintain, in the inoperative condition of the brake, a predetermined clearance between an abutment surface of the piston and a surface of the annular member facing away from the brake disc, said annular member engaging a split resilient ring which is in sliding frictional engagament with the cylinder, so that movement of the piston, upon actuation of the brake, through more than said clearance causes the annular member to displace the split ring in the cylinder towards the brake disc, whereby, upon subsequent release of the brake, a brake pad carried by the piston is spaced from the brake disc by said clearance.

The frictional resistance offered by the split ring to displacement in the direction of movement of the piston is increased, by virtue of the resilience of the ring, and consequently a relatively stronger resilient means for returning the piston to its inoperative positions can be used, permitting more reliable operation.

The split ring is preferably so dimensioned that the radially outward force exerted by the ring on the bore of said cylinder is substantially uniformly distributed around the circumference of the ring. Thus the split ring may have a varying cross-sectional area, tapering from a maximum mid-way between the ends of the split ring to a minimum at said ends.

The invention will be further described, by way of example only, with reference to the accompanying drawings, in which:—

Figure 1 is an axial cross-section through part of a disc brake according to one embodiment of the invention;

Figure 2 is an axial cross-section similar to that of Figure 1 of a modified version of the embodiment shown in Figure 1;

Figures 3 and 4 are respectively a plan and an elevation of a split ring constituting a stop member in the embodiments of Figures 1 and 2, and

Figure 5 is a cross-section on the line V—V of Figure 3.

Referring to Figure 1 a vehicle disc brake has a disc 1 (part only of which is shown) which is rotatable with a wheel to be braked (not shown) about an axis R—R. A yoke 2 is disposed astride part of the outer periphery of the disc 1 and is secured to a fixed frame (not shown). Two coaxial cylinders 3, both of which have open ends facing the disc 1, are formed integrally in the yoke 2 on opposite respective sides of the disc 1. Each cylinder 3 has a smaller diameter portion 4a adjoining its closed end, remote from the disc 1, and a larger diameter portion 4b adjoining its open end. A cylindrical piston 6 is mounted in each respective cylinder 3 and guided thereby for movement in a direction perpendicular to the plane of the disc 1.

Each piston 6 is formed with an integral piston head 6a which is a fluid-tight sliding fit in the respective cylinder portion 4a, an annular sealing member 5 received in a circumferential groove in the piston head 6a effecting a sliding seal with the wall of the cylinder portion 4a. Each piston 6 further has an integral stem portion 6c adjoining a respective brake pad 7 of friction material. An annular portion 6b is secured to each respective stem 6c by radially outwardly bending an integral circumferential lip 6d on the stem portion 6c. Each annular portion 6b is received with a small radial clearance in the respective cylinder portion 4b.

The two brake pads 7 are supported in position by flanges 6e at the radially inner edges of the respective pistons 6, radially outward movement of the pads 7 being prevented by a lock plate B fitted into an access opening 2a in the radially outer surface of the yoke 2 and engaging the radially outer surfaces of the pads 7.

In assembling each piston 6 an annular stop-engaging member 8 is trapped axially on the reduced-diameter portion between an annular shoulder 6f on the portion 6b and an annular abutment surface 9 formed on the piston head 6a and facing towards the brake disc 1. The annular member 8 is free to move axially within an annular space defined between the shoulder 6f and the abutment surface 9, the member 8 being urged towards the shoulder 6f by a resilient means in the form of helical axially extending thrust spring 10 housed within an annular recess 6g in the piston head 6a so that in the inoperative condition of the brake (Figure 1) there exists a predetermined clearance d between the abutment surface 9 and the surface of the annular member 8 facing away from the brake disc 1. A flexible sealing sleeve 11 is disposed between the radially outer surfaces of the shoulder 6f and the adjacent part of the annular member 8 to prevent access to the cylinder portion 4a of foreign bodies such as dust between the portion 6b and the annular member 8.

The annular member 8 is formed at its radially outer edge with a radially extending annular abutment surface 12 facing the respective brake pad 7 and urged by the spring 10 into abutment against a complementary annular abutment surface 14a provided on a split resilient ring 14 and facing away from the respective pad 7. A small axial clearance 13 is provided between the split ring 14 and the annular portion 6b of the respective piston 6.

The split resilient ring 14 is urged by its self-resilience radially outwardly to grip the bore of the cylinder portion 4b. The split ring 14 is shown separately in Figures 3 to 5. It will be seen from Figure 3 that the ring 14 has a varying radial thickness, and therefore cross-sectional area, tapering from a maximid-way between its ends (that is, diametrically opposite the split in the ring 14) to a minimum at each end. By so dimensioning the ring 14 it is arranged that the radially outward force exerted by the ring 14 on the bore of the cylinder portion 4b is substantially uniformly distributed around the circumference of the ring 14.

An annular resilient sealing member 15 is accommodated in a circumferential groove 14b provided in the radially outer surface of the ring 14, again with the object of preventing access of foreign bodies, and dust in particular, to the cylinder portion 4a.

Fluid pressure lines P, shown in broken lines, communicate with the ends of the cylinder portions 4a remote from the brake pads 7 and are arranged to supply hydraulic fluid under pressure to the portions 4a enclosed by the piston heads 6a from a common master cylinder (not shown). When the brake is applied the pistons 6 are moved towards each other, moving the brake pads 7 into engagement with the brake disc 1. If the brake pads 7 are disposed at a distance from the brake disc equal to or less than the clearance d the pistons 6 move by an amount equal to or less than d and the abutment surfaces 9 do not reach the annular members 8. The resilient rings 14 grip the bores of the portions 4b sufficiently tightly to prevent displacement of the rings 14 by the action of the springs 10 alone. Consequently the split rings 14 are not moved, and on releasing the brake the pistons 6 return to their initial positions, as shown in Figure 1, under the action of the springs 10.

If, however, either of the brake pads 7 is spaced from the brake disc 1 by a distance greater than the clearance d, due, for example, to wear of the friction material, the respective piston 6 is moved by the applied fluid pressure by an amount greater than d in operating the brake. After movement through the distance d the abutment surface 9 abuts the annular member 8, and the further movement of the piston 6 in moving the respective pad 9 to the brake disc 1 is accompanied by displacement of the member 8 and therefore of the split ring 14, towards the brake disc 1, the force exerted on the actuating member by the pressure fluid being sufficient to overcome the frictional grip of the ring 14 on the bore of the respective portion 4b. The ring 14 is therefore displaced towards the brake disc 1 by an amount equal, effectively, to the initial disc/pad clearance minus the predetermined clearance.

When the brake is now subsequently released, the spring 10 moves the respective piston 6 away from the disc 1 until the shoulder 6f again abuts the annular member 8, the latter being held in a new position corresponding to the new position of the split ring 14 by the respective spring 10. The piston 6 therefore adopts a new position relative to the yoke 2 in which it is closer to the brake disc 1 by the amount the split ring 14 has been displaced. The clearance between the respective brake pad 7 and the brake disc 1 is therefore reduced by the amount that the split ring 14 has been displaced: that is, the disc/pad clearance is adjusted to be subsequently equal to the predetermined clearance d.

Thus the split resilient rings 14 act effectively as adjustable stops for the brake pistons 6 and are adjusted automatically in operation of the brake to maintain a predetermined maximum clearance between the brake pads and discs equal to the distance d.

The modified disc brake shown in Figure 2 differs from that of Figure 1 only in the structure of the piston and cylinder actuators, and the same reference numerals as those used in Figure 1 are used to indicate the corresponding components.

Each cylinder 3 is formed with an integral annular recess 4c coaxially surrounding the cylinder portion 4a. The recess 4c is bounded by an outer cylindrical wall which is of slightly smaller bore than the portion 4b. An annular auxiliary piston member 6a′ formed integrally with each piston head 6a is slidable in the respective recess 4c and carries a piston ring 16 which makes a sliding seal with the cylindrical outer wall of the recess 4c. The annular fluid pressure spaces enclosed in the recess 4c by the piston members 6a′ are connected to supply lines P′ (broken lines) forming part of an auxiliary pressure fluid circuit which is separate from that connected to the lines P. This modification therefore has a safety feature in that, if one of the pressure fluid lines P, P′ should break, the brake would still be operable using the fluid circuit containing the other lines.

WHAT WE CLAIM IS:—

1. A self-adjusting disc brake having a brake pad actuating piston movable within a fixed cylinder, resilient means urging the piston away from a brake disc into engagement with a surface of an annular member surrounding a part of said piston to maintain, in the inoperative condition of the brake, a predetermined clearance between an abutment surface of the piston and a surface of the annular member facing away from the brake disc, said annular member engaging a split resilient ring which is in sliding frictional engagement with the cylinder, so that movement of the piston, upon actuation of the brake, through more than said clearance causes the annular member to displace the split ring in the cylinder towards the brake disc, whereby, upon subsequent release of the brake, a brake pad carried by the piston is spaced from the brake disc by said clearance.

2. A disc brake as claimed in Claim 1, in which the split ring is so dimensioned that the radially outward force exerted by the ring on the bore of said cylinder is substantially uniformly distributed around the circumference of the ring.

3. A disc brake as claimed in Claim 1 or Claim 2, in which the annular member is slidably located on a part of the piston of reduced diameter.

4. A disc brake as claimed in Claim 3, in which the resilient means comprise a helical spring disposed coaxially about the reduced diameter part of the piston and compressed between radially extending surfaces on the annular member and the piston respectively.

5. A disc brake as claimed in any one of the preceding claims, in which the piston is formed with an integral piston head which is slidably disposed in a part of the cylinder to which pressure fluid is supplied to operate the brake, the split ring being slidable in a part of the cylinder which is larger in diameter than the part accommodating the piston head.

6. A disc brake as claimed in Claim 5, in which the part of the cylinder accommodating the split ring is disposed closer to the brake disc than the part of the cylinder accommodating the piston head.

7. A disc brake as claimed in Claim 5 or Claim 6, in which an auxiliary pressure fluid pressure space of annular cross-section is arranged coaxially with and radially outwardly of the said cylinder, an annular auxiliary piston member, integral with the said piston head, being slidably mounted in said auxiliary fluid pressure space so that an auxiliary pressure fluid supply may be connected to said space to operate the brake independently.

8. A disc brake as claimed in any one of the preceding claims, in which a shoulder is formed on an annular portion of the piston which is disposed at the end of said cylinder adjacent the brake disc to confine the split ring in said cylinder.

9. A disc brake as claimed in Claim 2, or Claim 2 in combination with any of Claims 3 to 8, in which the split ring has a varying cross-sectional area, tapering from a maximum mid-way between the ends of the split ring to a minimum at said ends.

10. A disc brake as claimed in any one of the preceding claims, in which the radially outer surface of the split ring is formed with a circumferentially extending groove receiving an annular resilient sealing member which sealingly engages the bore of said cylinder.

11. A disc brake as claimed in any one of the preceding claims, in which a flexible sealing sleeve is disposed between adjacent radially outer surfaces of the annular member and the piston.

12. A disc brake substantially as herein

described with reference to and as shown in Figures 1, 3, 4 and 5 of the accompanying drawings.

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Fig. 1

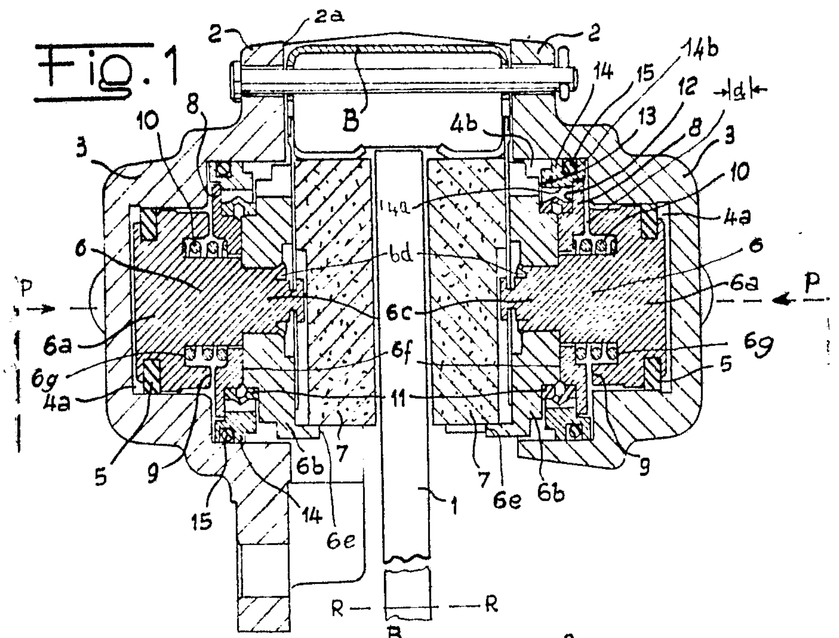
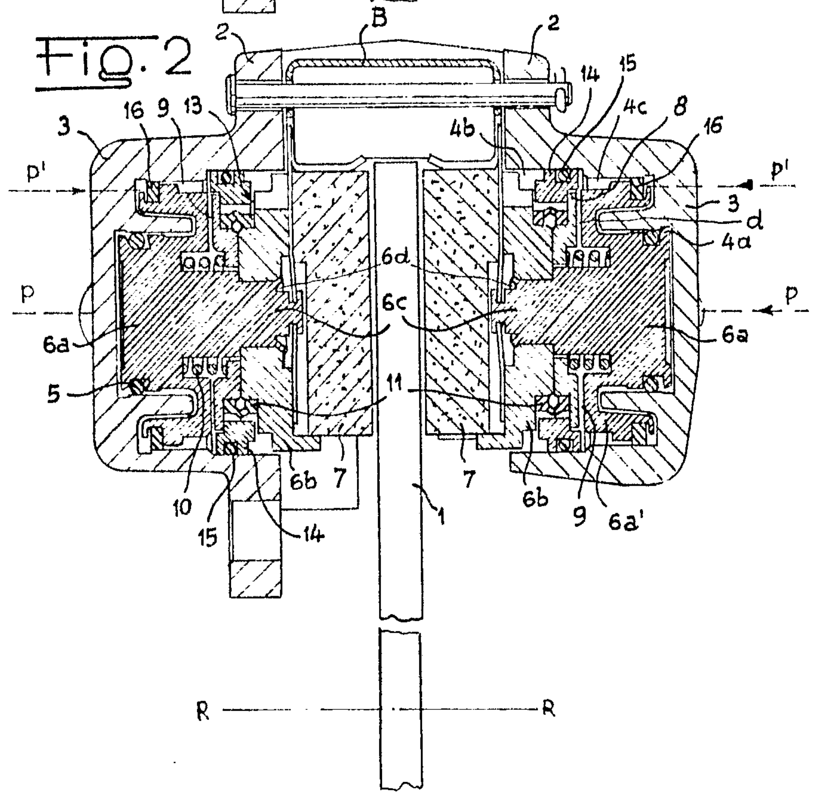


Fig. 2



1201314 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 2

Fig. 3

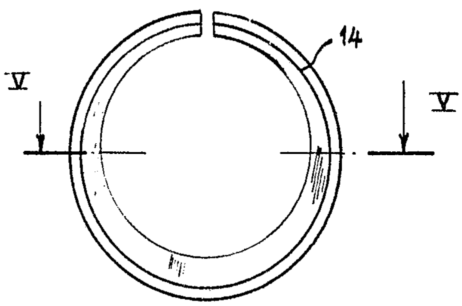


Fig. 5

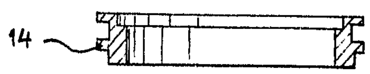


Fig. 4