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(54) IMPROVEMENTS IN DISC BRAKES

(71) We, TOKICO LTD., a Japanese body corporate, of 6-3, Fujimi 1-chome, Kawasaki-ku, Kawasaki-shi, Kanagawa-ken, Japan, 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 by the following statement:—

This invention relates to disc brakes and in particular to disc brakes of the type comprising a caliper member slidably supported on a non-rotatable toque member.

In known disc brakes of this type, the non-rotatable member straddles a portion of the periphery of a rotatable disc and an actuator is mounted on the caliper member for applying a first brake pad against one side of the disc and applying a second brake pad against the opposite side of the disc by way of the caliper member. The known brakes include at least one guide rod received slidably in a guide bore for mounting the caliper member on the non-rotatable member.

The guide rod may comprise a pin, secured to the caliper member for co-operating with a guide bore formed in the non-rotatable member, or the guide rod may comprise a pin secured to the non-rotatable member and received in a guide bore formed in the caliper member. In either case, it has been known to fit the pin loosely in the guide bore so that, to prevent vibrations of the caliper and to attain stable sliding movement of the caliper, at least one resilient ring has usually been mounted between the pin and the guide bore. Since the pin or the guide bore moves slidably relative to the resilient ring during application of the brake, a separate dust cover or a boot has been provided for preventing ingress of dust and water from the sliding portion between the pin and the guide bore, particularly, from the portion outward of the resilient ring. However, to provide a vibration preventing resilient ring and a separate dust preventing boot between the pin and the guide bore is expensive and troublesome to assemble and disassemble.

The caliper is often formed of two elements secured rigidly to one another by a pair of bolts extending respectively in the direction of the axis of the disc. One of the elements is disposed on one side of the disc and incorporates an actuator or a hydraulic cylinder piston therein, and the other caliper element is disposed on the opposite side of the disc and carries the indirectly operated brake pad. In such case, the bolts securing the two caliper elements together may also act as guide rods for guiding the sliding movement of the caliper relative to the non-rotatable member. Since the bolts act not only as tension members securing the two caliper elements together but also as sliding members guiding the sliding movement of the caliper, it has been necessary to form the bolts with ample strength and precision surface finishes resulting in a high manufacturing cost.

According to the present invention there is provided a disc brake comprising a caliper member slidably supported on a non-rotatable torque member by means of at least one guide assembly secured to one of said members and extending through a guide bore formed in the other of said members, said guide assembly comprising a tie rod which is rigidly connected to said one of the members and whose shank is surrounded by a sleeve whose outer peripheral surface is received with radial clearance in the guide bore in the other of said members, a respective resilient ring disposed at each end of the guide bore and interposed between the guide bore and the outer peripheral surface of the sleeve, and a respective dust boot integrally formed with each resilient ring for covering a respective portion of the sleeve projecting from the guide bore.

The present invention will be further described, by way of example, with reference to the accompanving drawings in which:

Figure 1 is a plan view showing one em-

bodiment of a disc brake in accordance with the present invention;

Figure 2 is a front view of the disc brake of Figure 1;

Figure 3 is a partial cross-sectional view taken along line VI–VI in Figure 2; and

Figure 4 is an enlarged cross-sectional view showing a portion of Figure 3.

The illustrated embodiment comprises a non-rotatable torque member 1 which is adapted to be secured to a vehicle body (not shown) and has a pair of guide bores 2 (only one of which is shown in Figs. 3 and 4). The torque member 1 carries a pair of brake pads 4, 9 disposed on the two sides respectively of a brake disc (not shown), the brake pads being supported so that they can slide relative to the brake disc in directions perpendicular to the disc. Slidably mounted on the torque member 1 is a caliper 5 formed by two caliper elements 6 and 7 rigidly connected together by tie rods in the form of circumferentially spaced tie bolts 18 which extend through the two bores 2 respectively. The caliper element 7 contains a hydraulic piston 11 slidably received in a cylinder 10 and engageable with the brake pad 4 to directly urge the latter pad into contact with one side of the brake disc, the reaction forces thereby generated displacing the caliper relative to the torque member to bring the brake pad 9 into contact with the opposite side of the disc. A seal 12 in the cylinder wall prevents leakage of oil from the cylinder. A flexible boot 13 is provided between the piston 11 and cylinder 10 for excluding dust and dirt from the sliding surface of the piston.

The two caliper elements 6 and 7 are connected rigidly by the pair of circumferentially spaced tie bolts 18 having washers 22 and nuts 21 on the opposite ends thereof and sleeves 20 surrounding the shank portion of the bolts 18 respectively. The sleeves 20 extend through the guide bores 2 formed in the non-rotatable member 1 with a radial clearance therebetween. Thus, the sleeves 20 provide cylindrical surfaces on which the caliper can slide relative to the non-rotatable member 1. Each tie rod 18 and the surrounding sleeve 20, which are rigidly secured to the caliper member 5, thus constitutes a respective guide assembly for slidably supporting the caliper members on the non-rotatable torque members. In the illustrated embodiment the opposite ends 20*a* of each sleeve 20 are formed frusto-conically and engage respectively with corresponding frusto-conically shaped recesses or tapered bores formed in the caliper elements 6 and 7 to attain the desired alignment between the caliper elements 6 and 7. Thus, in addition to providing the sliding surfaces, the sleeves 20 act partly as structural members connecting the caliper elements together. However, it will be noted that the bolts 18 may be formed with stepped portions on the opposite end portions thereof which engage with correspondingly shaped stepped portions formed in the bores in the caliper elements receiving the bolts therein such that the function of connecting the two caliper elements together is performed only by the bolts 18, the sleeves serving solely to provide the sliding surfaces.

Resilient rings 15 are provided at the opposite open end portions of the guide bores 2, each of the rings 15 being retained in position by an annular retainer 16 having a generally L-shaped cross-section and engaging with a pressure fit in a larger diameter bore portion formed in each of the opposite end portions of the guide bores 2, whereby axial and radial displacement of the rings 15 is prevented. The rings 15 contact resiliently the outer periphery of the sleeves 20 to prevent vibrations of the caliper 5, and have a radial thickness sufficient to control or damp the vibrations. Each ring 15 has an integral dust cover portion or dust boot 14 which extends outward of the bore 2 and covers a portion of the sleeve projecting out of that guide bore. The free end 14*a* of the portion 14 engages the adjacent frusto-conical portion of the sleeve.

Since the caliper elements 6 and 7 in the illustrated embodiment are secured mainly by the bolts 18 which may be formed of a high strength material, and the sliding movement of the caliper is effected by the sliding movement of the sleeves 20 in the resilient rings 15, this enables the sleeves to be formed of a material having good machinability to form a desired surface finish on the outer periphery of the sleeves 20.

In the illustrated embodiment, the brake pads 4 and 9 are guided slidably in the non-rotatable member 1 which straddles a portion of the periphery of rotatable disc and receives braking torque directly from the brake pads 4 and 9 when the brake is applied. Thus, the caliper 5 can be floatingly mounted on the non-rotatable member 1, which reduces the resistance to the sliding movement of the sleeve 20 in the resilient ring portion 15 and reduces wear of the resilient ring. A pair of circumferentially spaced bolts 23 is mounted between the caliper elements 6 and 7 to extend through openings (not shown) formed in back plates 4′, 9′ of the brake pads respectively so as to guide the movement of the brake pads toward and away from the rotatable disc and to retain the brake pads in their proper position in the disc brake.

Each of the free ends 14*a* of dust cover

portions 14 of the resilient rings 15 engages with the adjacent conically shaped tapered portion 20*a* of the sleeve 20 and adjacent surface of the caliper elements 6 or 7, so that the entire surfaces of the sleeve 20 projecting out of the bore 2 are covered by the resilient rings 15 and the dust cover portions 14 thereof.

With a disc brake having a construction as described above, it is possible to prevent vibrations of the caliper and to attain a stable sliding movement of the caliper 5 relative to the non-rotatable member 1, and also to protect the portions of the sleeves 20 extending outward of the guide bores 2 from dust and water without increasing the number of parts constituting the disc brake. Further, even when the dust cover portion 14 of a resilient ring 15 is damaged, the ingress of dust and water into the interior of the guide bore 2 can be prevented by the annular ring portion 15, and a stable sliding movement of the caliper 5 can be assured. Preferably, oil or grease is enclosed in the annular spaces between the guide bores 2 and the sleeves 20, the opposite ends of the spaces being sealed by the annular rings 15.

WHAT WE CLAIM IS:—

1. A disc brake comprising a caliper member slidably supported on a non-rotatable torque member by means of at least one guide assembly secured to one of said members and extending through a guide bore formed in the other of said members, said guide assembly comprising a tie rod which is rigidly connected to said one of the members and whose shank is surrounded by a sleeve whose outer peripheral surface is received with radial clearance in the guide bore in the other of said members, a respective resilient ring disposed at each end of the guide bore and interposed between the guide bore and the outer peripheral surface of the sleeve, and a respective dust boot integrally formed with each resilient ring for covering a respective portion of the sleeve projecting from the guide bore.

2. A disc brake as claimed in claim 1 wherein the caliper member comprises two caliper elements and wherein two said guide assemblies are provided which rigidly secure the two caliper elements together, the respective tie bolts of the two guide assemblies being circumferentially spaced relative to one another.

3. A disc brake as claimed in claim 2 in which the two sleeves have tapered ends which are wedged into the ends of tapered bores in the caliper elements which the tie bolts enter.

4. A disc brake as claimed in claim 3 in which the end of each dust cover portion remote from the associated resilient ring is fitted over an exposed portion of the adjoining tapered end of the sleeve and in abutment with the adjacent caliper element.

5. A disc brake constructed substantially as herein described with reference to and as illustrated in Figs. 1 to 4 of the accompanying drawings.

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Sheet 1

Fig. 1

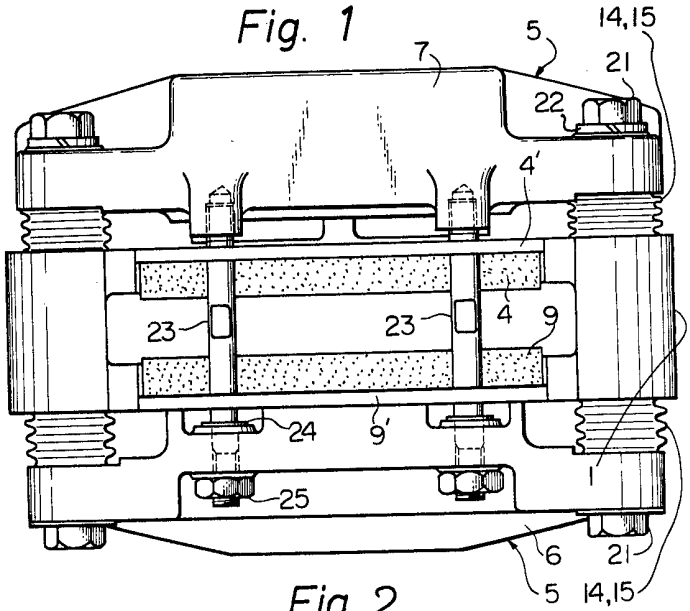
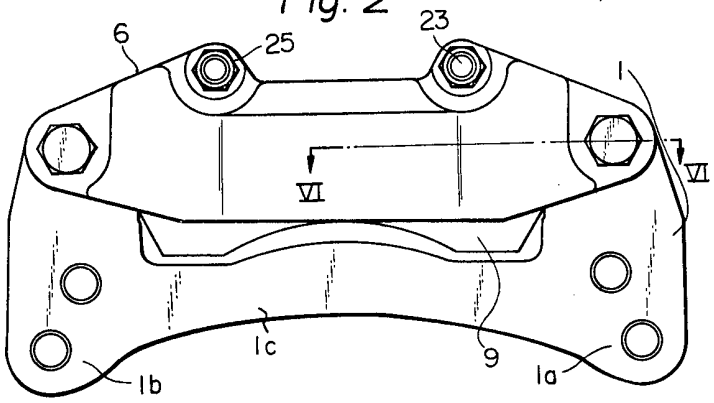


Fig. 2



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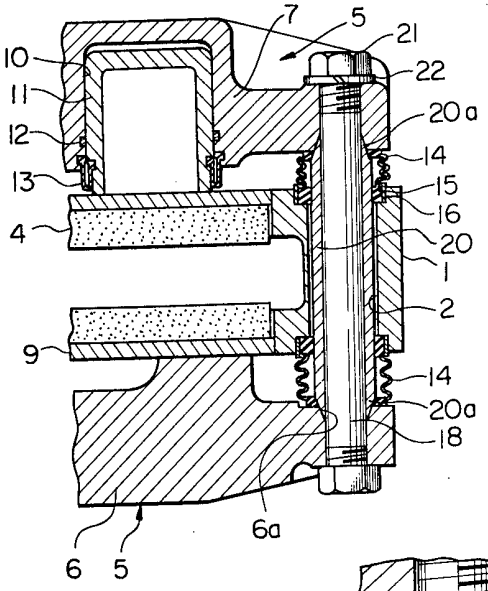

Fig. 3

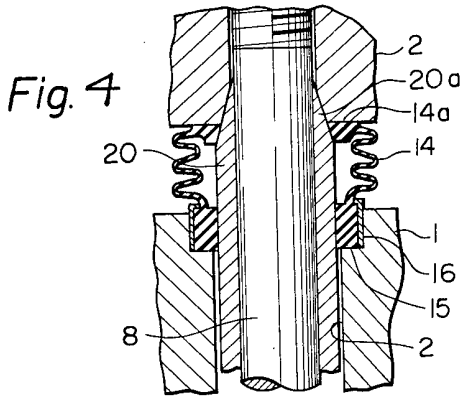

Fig. 4