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(54) FLOATING CALIPER DISC BRAKES

(71) We, AKEBO BRAKE INDUSTRY CO. LTD., a Japanese Company, of No. 2-3, 1-chome, Koami-cho, Nihonbashi, Chuo-ku, Tokyo, 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 and by the following statement:—

This invention relates to disc brakes of the floating caliper type, and more particularly to an improvement in the caliper support arrangement.

Known forms of disc brakes often are of the floating caliper type, and with these it is usually necessary for the capiler to be removed from the support therefor when the friction pads are to be exchanged. Sometimes, the support is arranged to allow the caliper to be pivotted to a position in which the friction pads may be removed, after the connection of the caliper to the support partially has been dismantled. In either case, however, it often happens that the guide pins on which the caliper floats axially become exposed to grit, dust, mud and other harmful materials. When re-assembled, the floating action no longer properly operates because the guides therefor tend to bind, owing to the presence of the harmful material.

According to this invention, there is provided a disc brake assembly of the floating caliper type, comprising a support member for a pair of friction pads to be positioned one adjacent each face of a brake disc, a caliper for urging the friction pads into engagement with the faces of the disc, the caliper being mounted on the support member by means allowing sliding movement of the caliper parallel to the axis of the disc, the caliper mounting means including a first guide pin secured on the support member and slidably mounted in the caliper and a second guide pin also slidably mounted in the caliper and releasably securable within an open slot provided in the support member, whereby when the second guide pin is released, the guide pin can be moved out of its associated slot through the opening thereof to be free of the support member whereafter the caliper can be pivotted about the first guide pin to allow access to the friction pads.

With the arrangement of this invention, it is possible to gain access to the friction pads without having to dismantle completely the means mounting the caliper on the support member. Because of this, the sliding surfaces of the mounting means need not be exposed when changing friction pads and can be protected against the ingress of foreign matter, leading to greater reliability.

It will be appreciated that the slot can be regarded as having a hole portion in which the guide pin is normally located when secured to the support member and comprising the base of the slot, and an open slot portion communicating the hole portion to an adjacent edge of the support member and through which the guide pin moves to become free of the support member. Thus, in the following, references will be made to the "hole portion" and the "slot portion" of the slot in the support member.

The slot portion may extend in a direction normal to a line joining the centres of the guide pins when the second guide pin is located in its associated hole portion and secured to the support member, whereby the second guide pin, when released, moves through the slot as the caliper is pivotted. Alternatively, the slot portion may extend in a direction parallel to a line joining the centres of the guide pins when the second guide pin is located in its associated hole portion and secured to the sup-

port member, the second guide pin being movable laterally when released to become free of the support member whereafter the caliper may be pivotted to allow access to the friction pads.

In the latter construction the second guide pin is preferably located within a receptor provided in the caliper, the pin being slidably journalled in a flexible annular rib provided within the receptor so as to allow the end of the pin to be moved laterally, out of the slot portion.

So as to align the second guide pin and the support member automatically as the guide pin is secured thereto, it is advantageous for the support member to be provided with a tapered annular surface around the hole portion of the slot for the second guide pin and for the second guide pin to be provided with a shoulder defining a tapered annular surface adapted to mate with the tapered surface of the support member. When the securing means for the second guide pin comprises a nut screwed on a threaded portion, in addition or instead of the just-described arrangement, the nut may be provided with a tapered annular surface adapted to mate with a corresponding tapered surface provided on the support member around the hole portion of the slot, whereby the alignment between the second guide pin and the support member will automatically be effected as the nut is tightened.

Preferably, protective flexible boots are provided around the guide pins to seal the pins to the caliper in order to prevent the ingress of foreign matter to the sliding surfaces. Of course, these need not be dismantled when the caliper is to be pivotted to gain access to the friction pads.

By way of example only, four specific embodiments of this invention will now be described, reference being made to the accompanying drawings, in which:—

Figure 1 is a side view, partly in section, of one embodiment of disc brake of the floating caliper type, according to the present invention;

Figure 2 is a fragmentary bottom view of the disc brake of Figure 1, showing the support plate having a laterally slotted hole;

Figures 3A and 3B are fragmentary side views, partly in section, of a second embodiment of disc brake according to the present invention;

Figure 4 is a bottom view of the disc brake of Figure 3, showing the support plate having a longitudinally slotted hole;

Figure 5 is a side view, partly in section, of a third embodiment of disc brake according to the present invention;

Figure 6 is a fragmentary bottom view of the disc brake of Figure 5, showing the support plate having a laterally slotted hole provided with a bevelled portion; and

Figure 7 is a fragmentary side view, partly in section, of a fourth embodiment of disc brake according to the present invention.

Referring to Figures 1 and 2, there is shown the first embodiment of disc brake according to this invention. This brake comprises an axially-located rotating member or disc 1, for instance suitably connected to a wheel of a road vehicle, for rotation therewith. A caliper 2 has an acting portion and a reacting portion located respectively on the two sides of the disc 1 and serves to urge the friction pads 6 and 7 into engagement with the disc when the brake is operated. A support member 3 is provided for the brake friction pads 6 and 7 and is suitably mounted on a fixed part, such as a suspension part of the vehicle. The support member 3 is constructed from first and second plates 4 and 5 so as to be generally T-shaped when viewed end-on. The first plate 4 has left and right arms 4*a* and 4*b*, and the second plate has left and right arms 5*a* and 5*b* to each side of a central portion 5*c*. The arms 4*a* and 4*b* are respectively rigidly attached to the arms 5*a* and 5*b* such that the general planes of the first and second plates are at right-angles, arms 5*a* and 5*b* being positioned centrally on arms 4*a* and 4*b*. The friction pads 6 and 7 are mounted respectively on plates 4 and 5 such that their faces are parallel to the plane of the disc 1, and a guiding mechanism is provided to support the caliper 2 for sliding movement axially of the rotor.

The guiding mechanism comprises a pair of guide pins 8 and 9 rigidly secured at their one ends respectively to the arms 4*a* and 4*b* of the first plate 4. Pin 8 is directly screw-threaded at 10 into a tapped hole in arm 4*a*, whereas pin 9 is threaded and attached to the arm 4*b* by means of a nut 11. The pins extend into receptors 12 and 13 respectively, there being associated resilient air-tight boots 14 and 15.

In accordance with this invention, the hole 4*d* (Figure 2) of the first support plate 4 through which the threaded section of the guide pin 9 extends is slotted outwardly in the radial direction of the disc 1, as indicated at 4*e*, so that when the nut 11 is loosened on pin 9, the caliper 2 can be pivotted about the guide pin 8 to reveal the friction pads 6 and 7. During this pivotting, the guide pin 9 moves through the slotted portion 4*e* away from the hole portion 4*d* toward the outer edge of the first support plate 4 and eventually the pin 9 comes free of the plate 4. In this way, it is possible to exchange the friction pads by new ones without the necessity of com-

pletely removing the guide pin 9 from its receptor 13, and therefore without allowing foreign matter (such as grit or mud) to enter the sliding interspace between the guide pin 9 and its receptor 13. Thus, the operation of exchanging the friction pads 6 and 7 is greatly facilitated.

Figures 3A and 3B and Figure 4 show another embodiment of a disc brake according to the present invention, which is generally similar to that described above, and like parts are given like reference characters. In this embodiment, however, guide pin 9 slides within an over-bored receptor 16 having a flexible central annular projection 16*a* which fits closely around the guide pin 9. Also, the first support plate 4', having arms 4'*a* and 4'*b*, is provided with a hole portion 4'*d* for the pin 9, the hole portion joining a slot portion as shown at 4'*e* in a direction aligned with the centre line connecting hole portion 4'*d* and the hole provided for pin 8 (not shown in Figures 3 and 4). To release the caliper 2, the nut 11 is loosened, and then the pin 9 can be inclined as shown in Figure 3B to move through the slot portion 4'*e* and come free of the plate 4'; thereafter the plate 4' can be rotated as in the first embodiment. An advantage of this second embodiment is that the angular adjustment of the caliper 2 relative to the support member 3 is automatically effected, because the hole portion 4'*d* is slotted outwardly in the radial direction of the disc.

Figures 5 and 6 show a third embodiment of disc brake according to the present invention, and again like parts with the first embodiment are given like reference characters. In this third embodiment, a device is provided for automatically effecting the angular adjustment of the caliper 2 relative to the support member 3 when the guide pin 9 is rigidly secured in the correct position with respect to the first plate 4. The hole portion 4*d* has a slot portion as shown at 4*g*, in a manner similar to that shown in connection with the embodiment of Figures 1 and 2. The aforementioned device comprises first and second tapered annular surfaces arranged to mate when the nut 11 is tightened to secure the pin 9 to the first plate 4, whereby the angular adjustment of the caliper relative to the support plate 4 is established with a high degree of accuracy. The first tapered annular surface 4*f* is formed around the hole portion 4*d* on the surface of the first plate 4 remote from plate 5, and the second annular tapered surface 9*b* is formed on the mating surface of a flanged portion 9*a* of the guide pin 9. The provision of such a device gives several advantages, one of which is that once properly established, the correct angular disposition is maintained stably without accidental slippage, which might otherwise occur were these tapered surfaces 4*f* and 9*b* not provided.

A modification of the above arrangement is shown in Figure 7, in which the first tapered surface 4*f'* is provided on the surface of the first plate 4 nearer the second plate 5, while the second tapered surface 11'*a* is provided on the mating surface of the nut 11'. In a similar way, a tapered surface may be provided between the head of the guide pin 8 and the first plate 4, correctly to align this pin.

As will be appreciated from the foregoing, the present invention provides a disc brake of floating caliper type which has an improved caliper-supporting mechanism, insofar as difficulties in assembling the parts of the complete brake and exchanging old friction pads by new ones are reduced, without introducing disadvantages on the braking action.

WHAT WE CLAIM IS:—

1. A disc brake assembly of the floating caliper type, comprising a support member for a pair of friction pads to be positioned one adjacent each face of a brake disc, a caliper for urging the friction pads into engagement with the faces of the disc, the caliper being mounted on the support member by means allowing sliding movement of the caliper parallel to the axis of the disc, the caliper mounting means including a first guide pin secured on the support member and slidably mounted in the caliper and a second guide pin also slidably mounted in the caliper and releasably securable within an open slot provided in the support member, whereby when the second guide pin is released, the guide pin can be moved out of its associated slot through the opening thereof to be free of the support member whereafter the caliper can be pivotted about the first guide pin to allow access to the friction pads.

2. A disc brake assembly according to claim 1, wherein the second guide pin is releasably securable to the support member by means of a nut co-operating with a threaded portion of the second guide pin.

3. A disc brake assembly according to claim 1 or claim 2, wherein the slot extends in a direction normal to a line joining the centres of the guide pins when the second guide pin is located in the slot and secured to the support member, whereby the second guide pin, when released, moves through the slot as the caliper is pivotted.

4. A disc brake assembly according to claim 1 or claim 2, wherein the slot extends in a direction parallel to a line joining the centres of the guide pins when the second guide pin is located in the slot

and secured to the support member, the second guide pin being movable laterally when released to become free of the support member whereafter the caliper may be pivotted to allow access to the friction pads.

5. A disc brake assembly according to claim 4, wherein the second guide pin is located within a receptor provided in the caliper, the pin being slidably journalled in a flexible annular rib provided within the receptor so as to allow the end of the pin to be moved laterally.

6. A disc brake assembly according to any of the preceding claims, wherein the support member is provided with a tapered annular surface around the slot for the second guide pin and the second guide pin is provided with a shoulder defining a tapered annular surface adapted to mate with the tapered surface of the support member such that the alignment between the second guide pin and the support member is automatically effected as the guide pin is secured thereto.

7. A disc brake assembly according to claim 2 or any claim appendent thereto, wherein the nut is provided with a tapered annular surface adapted to mate with a corresponding tapered surface provided on the support member around the slot, whereby the alignment between the second guide pin and the support member is automatically effected as the nut is tightened.

8. A disc brake assembly according to any of the preceding claims, wherein protective flexible boots are provided around the guide pins to seal the pins to the caliper in order to prevent the ingress of foreign matter to the sliding surfaces.

9. A disc brake assembly substantially as hereinbefore described with reference to and as illustrated in Figures 1 and 2, or in Figures 3 and 4, or in Figures 5 and 6 or in Figure 7 of the accompanying drawings.

10. A disc brake comprising the combination of an assembly according to any of the preceding claims, a pair of friction pads slidably mounted on the support member and a rotatable brake disc arranged with the friction pads one to each face respectively of the disc.

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6 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 1

FIG.1

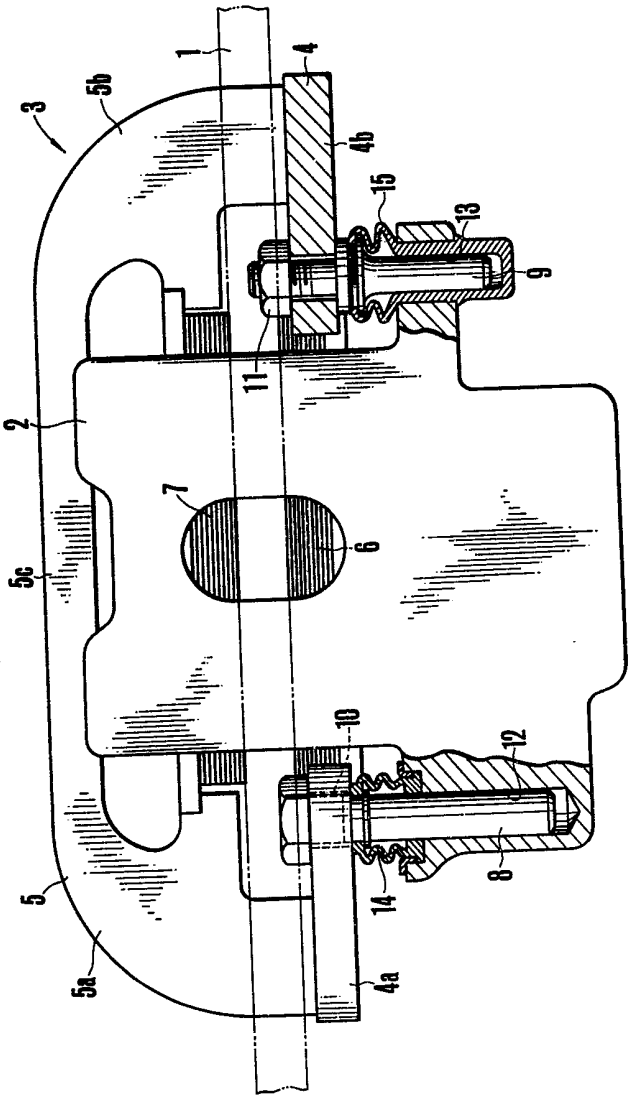

FIG.2

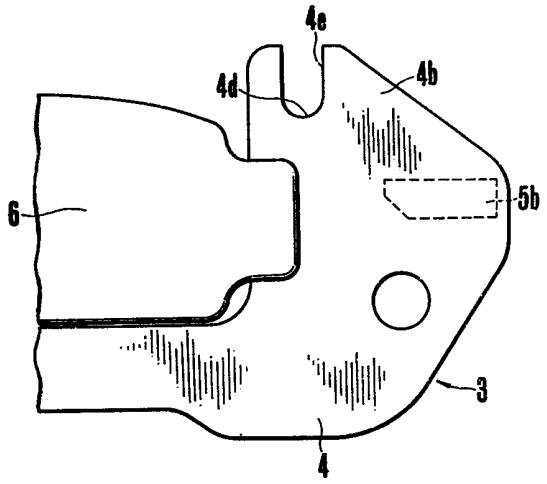

FIG.3

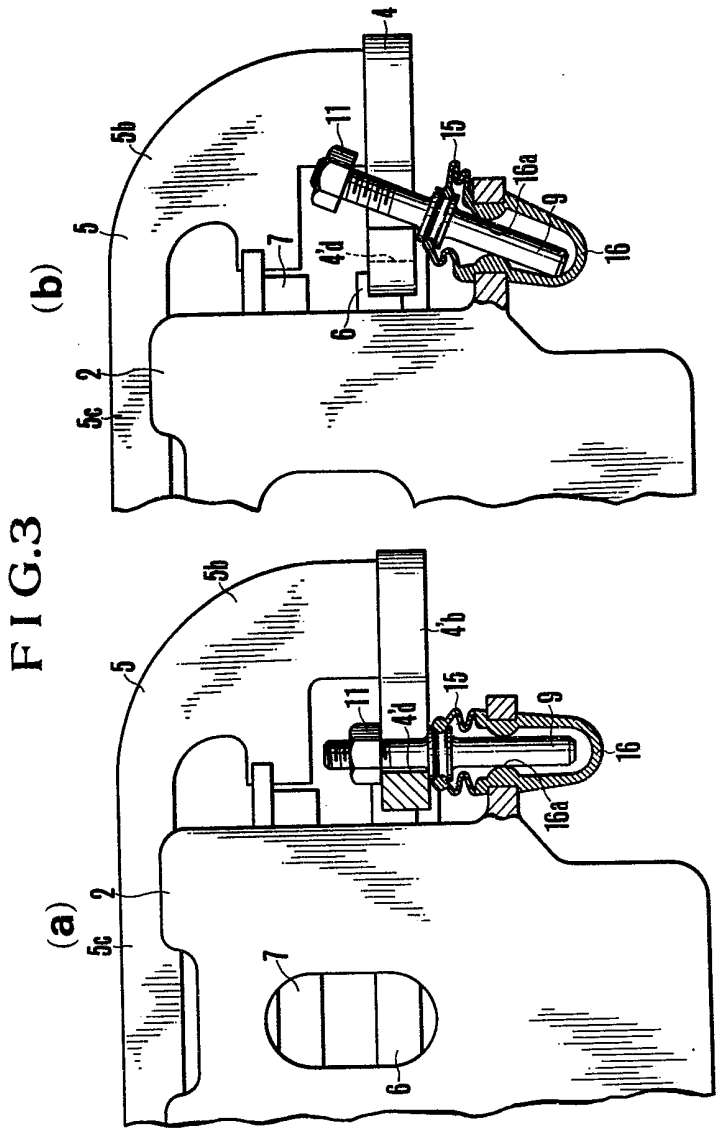

FIG.4

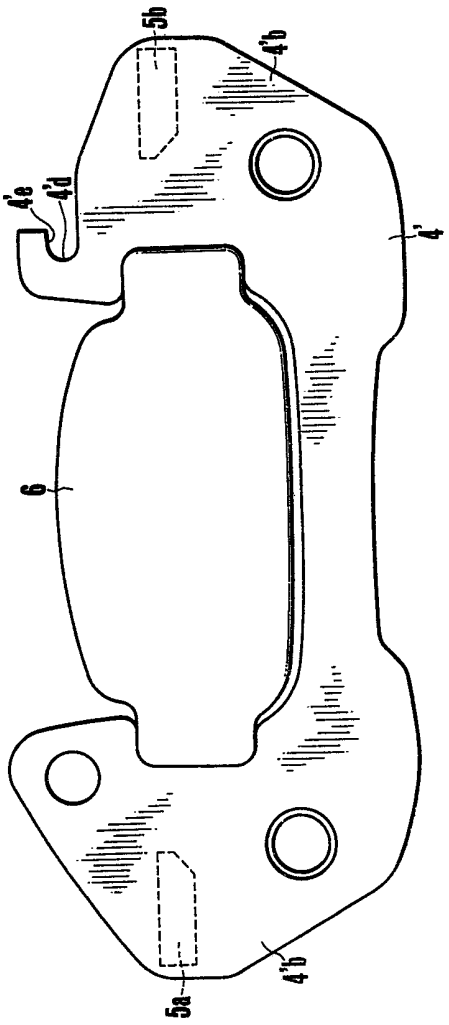

FIG.5

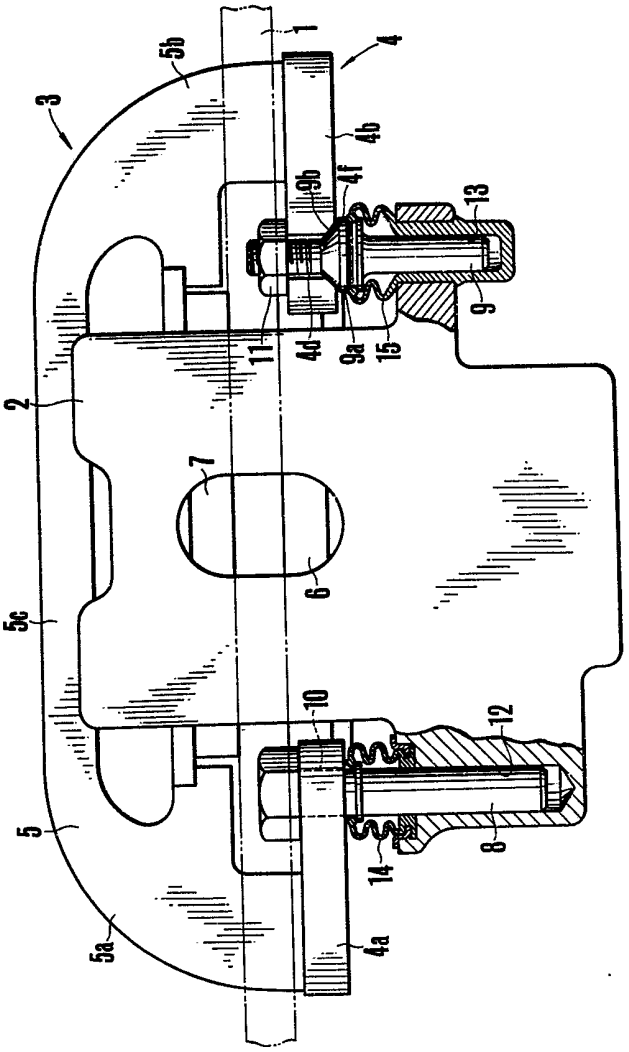

FIG.6

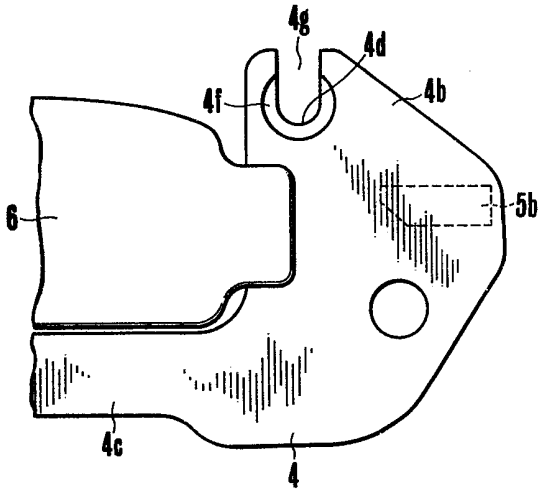

FIG.7