

[54] DISC BRAKES FOR VEHICLES

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[21] Appl. No.: 485,106

[22] Filed: Apr. 14, 1983
(Under 37 CFR 1.47)

Related U.S. Patent Documents

Reissue of:

[64] Patent No.: 4,261,443
Issued: Apr. 14, 1981
Appl. No.: 946,213
Filed: Sep. 27, 1978

U.S. Applications:

[60] Division of Ser. No. 802,809, Jun. 2, 1977, Pat. No. 4,151,899, which is a continuation of Ser. No. 626,184, Oct. 18, 1975, abandoned.

[30] Foreign Application Priority Data

Nov. 5, 1974 [GB] United Kingdom 47710/74

[51] Int. Cl.⁴ F16D 65/14

[52] U.S. Cl. 188/73.44; 74/18.2;
188/73.39; 277/212 FB

[58] Field of Search 188/73.45, 73.44, 73.43,
188/73.39, 322.7; 308/3.5; 277/212 FB;
74/18.2

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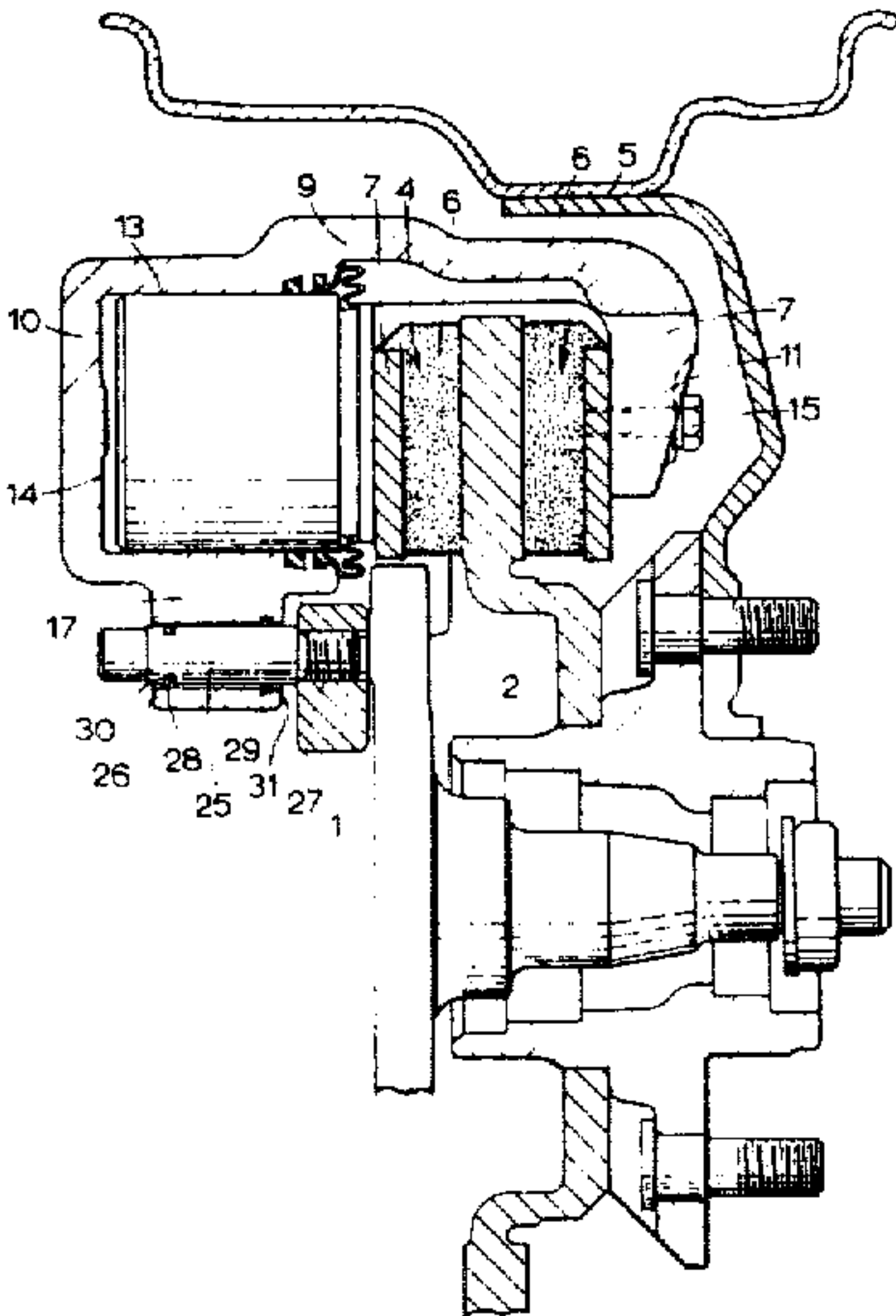
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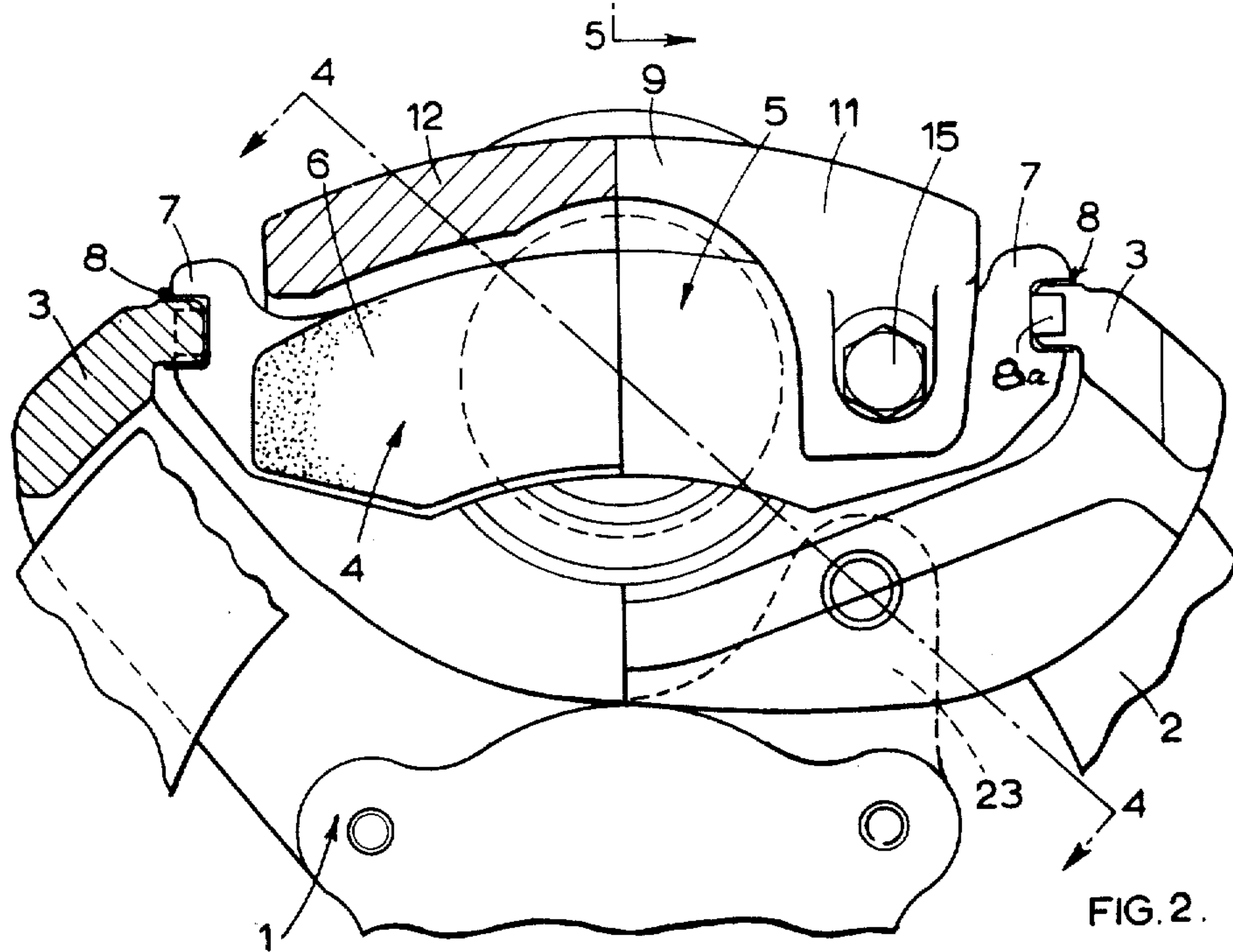
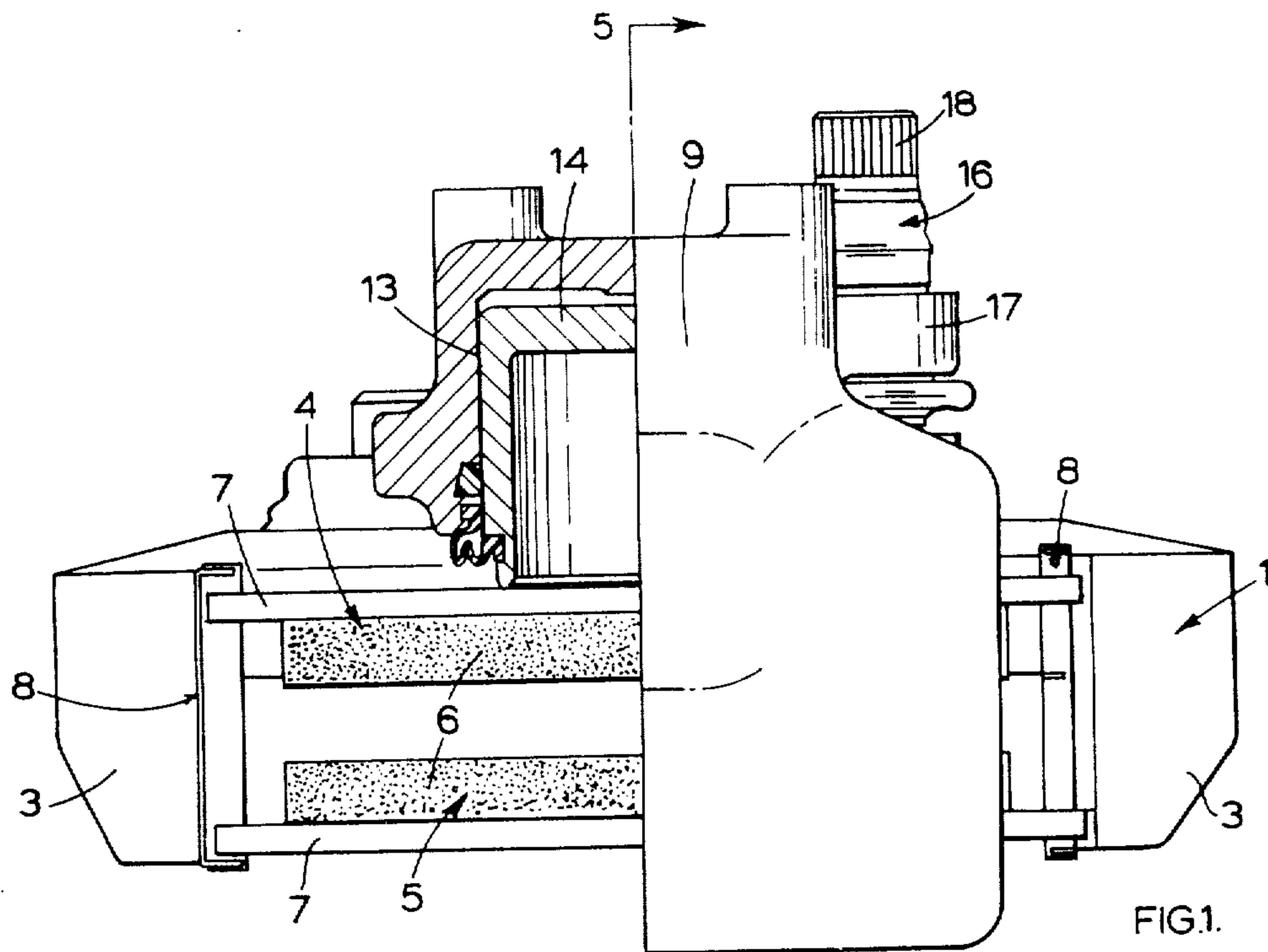
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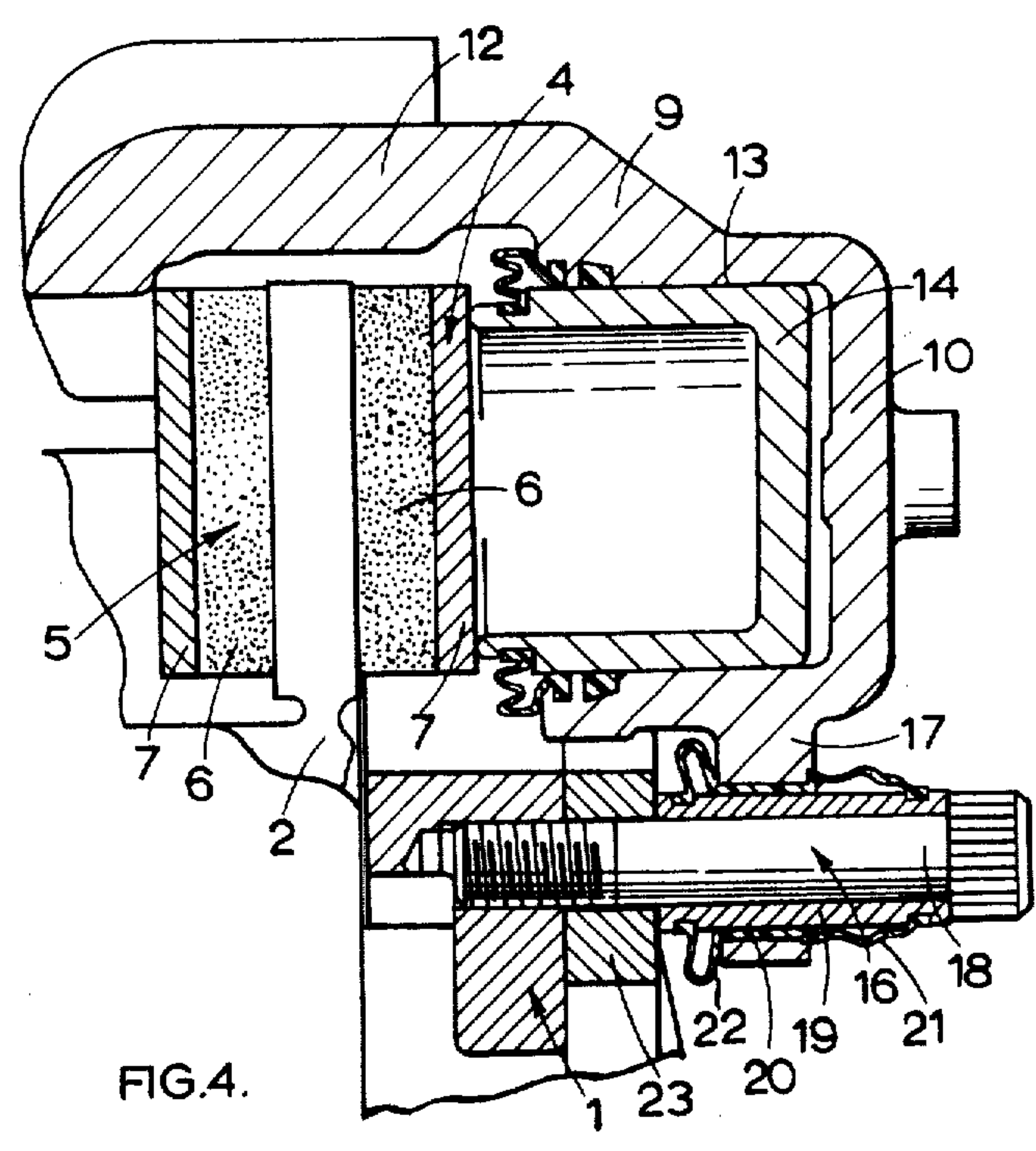
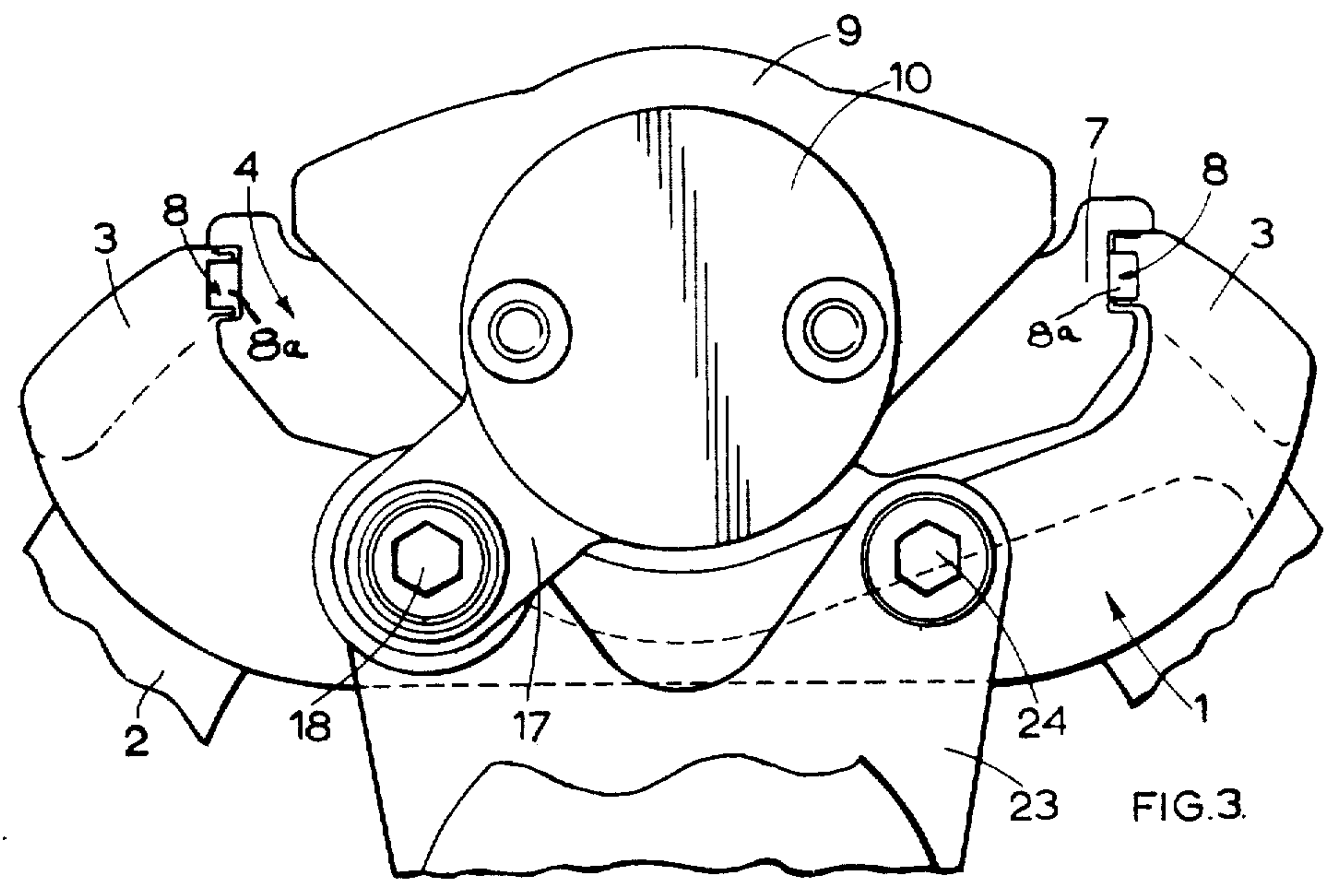
[57] ABSTRACT

In a vehicle disc brake of the single sided sliding reaction caliper type the drag on the friction pad assemblies is taken by a drag-taking member. The caliper is slidably mounted for movement relative to the disc on a guide in the form of a single pin which is located on the same side of the disc as that on which an actuator for the brake is located.

13 Claims, 9 Drawing Figures







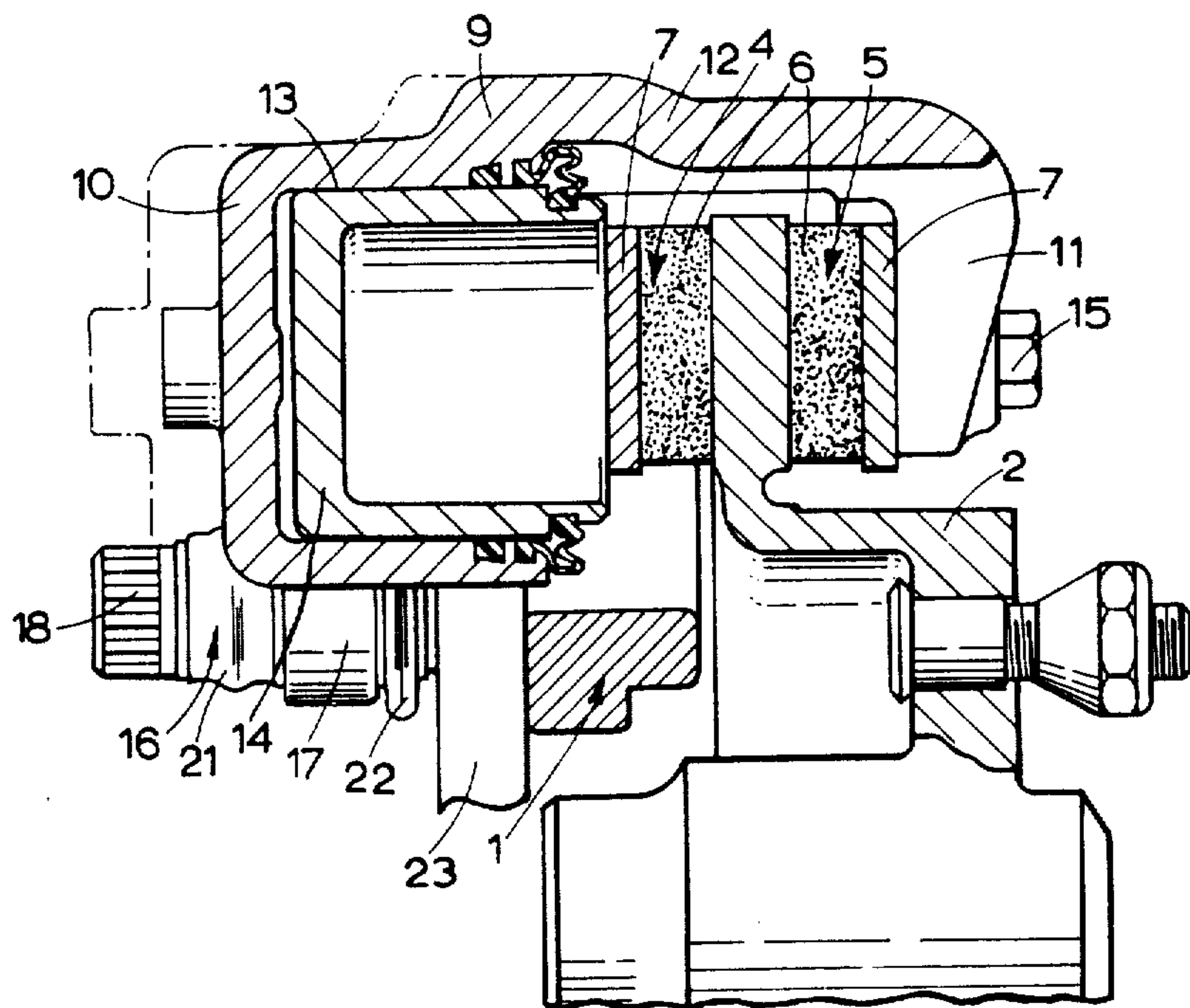
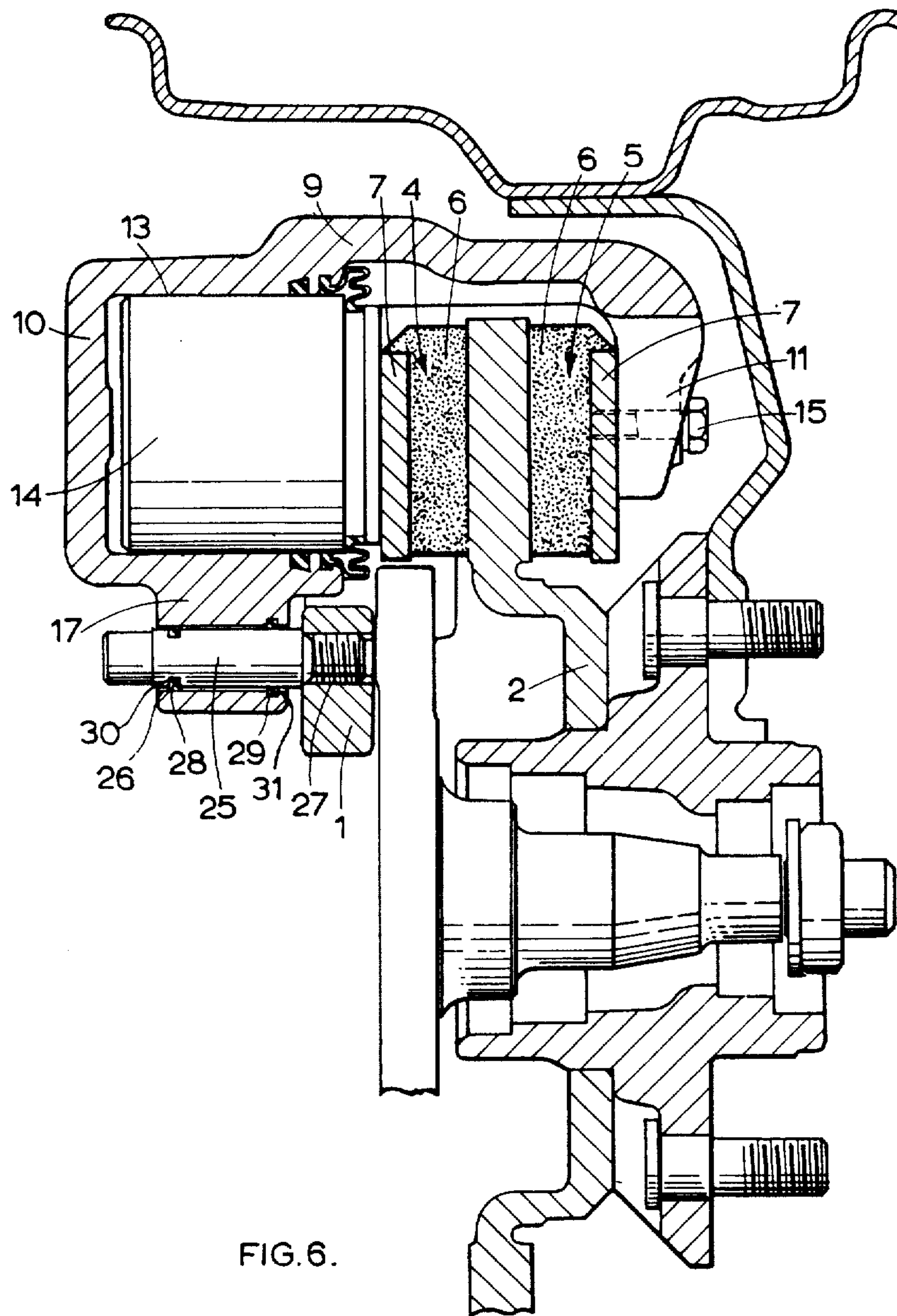


FIG. 5.



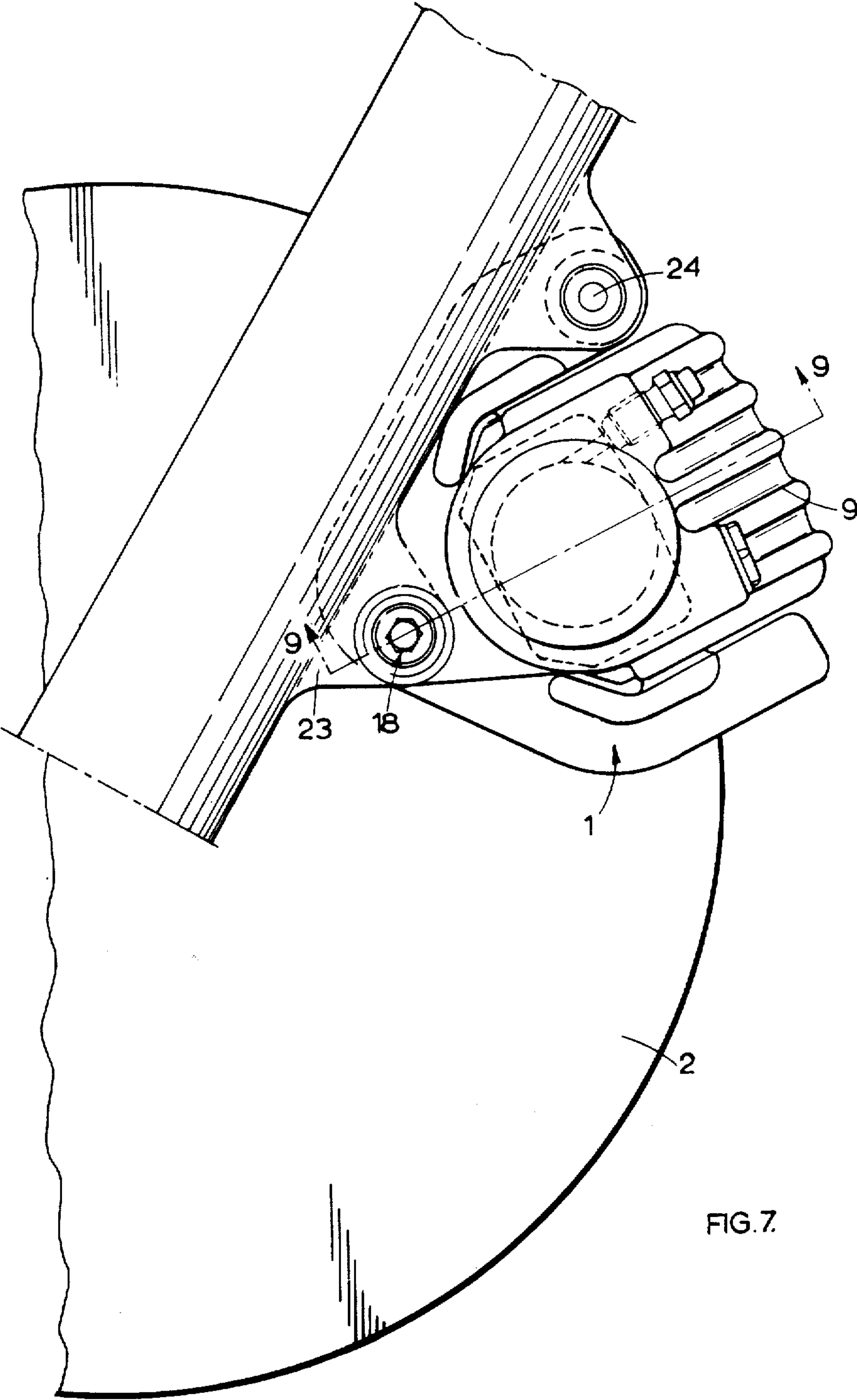
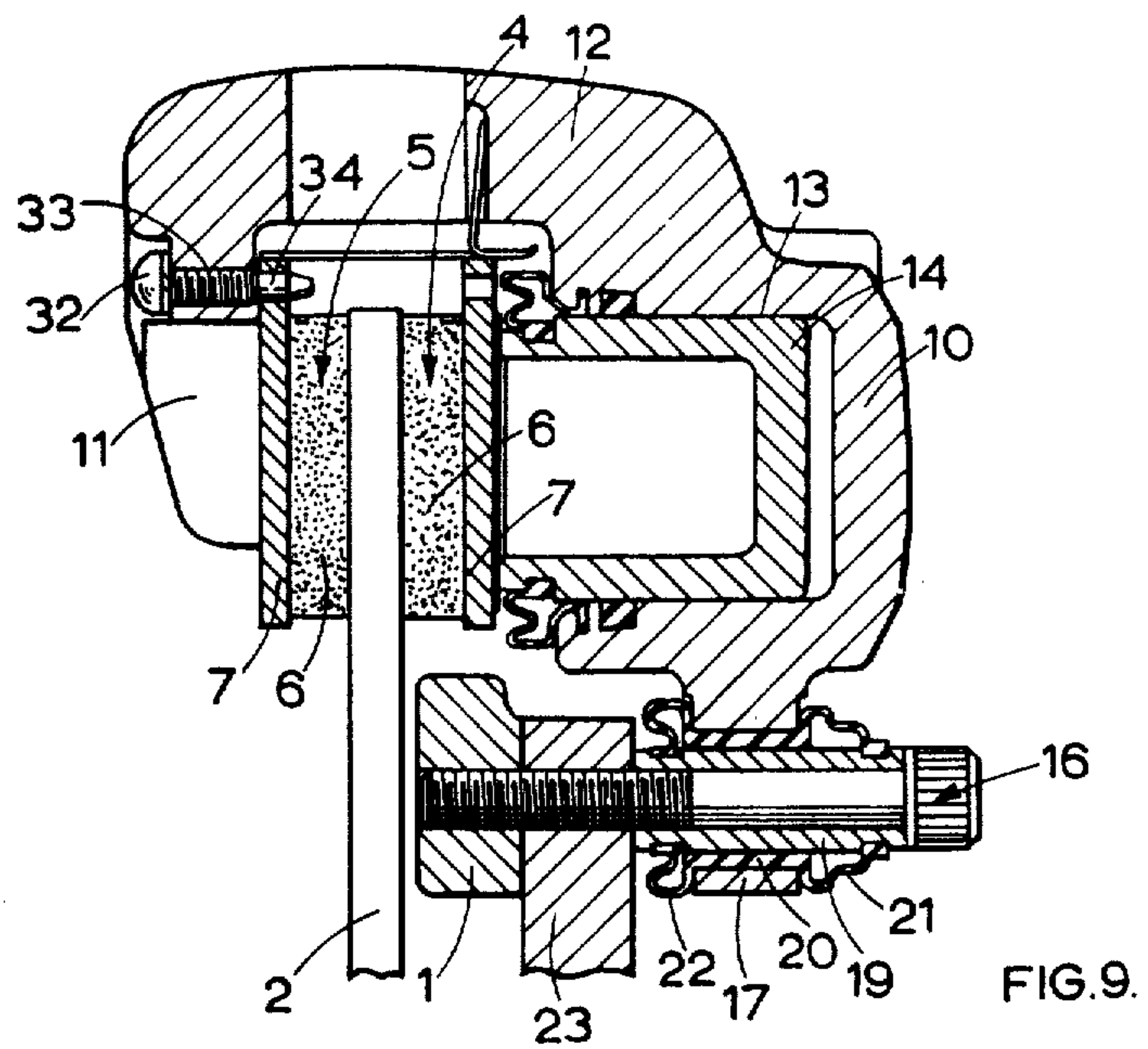
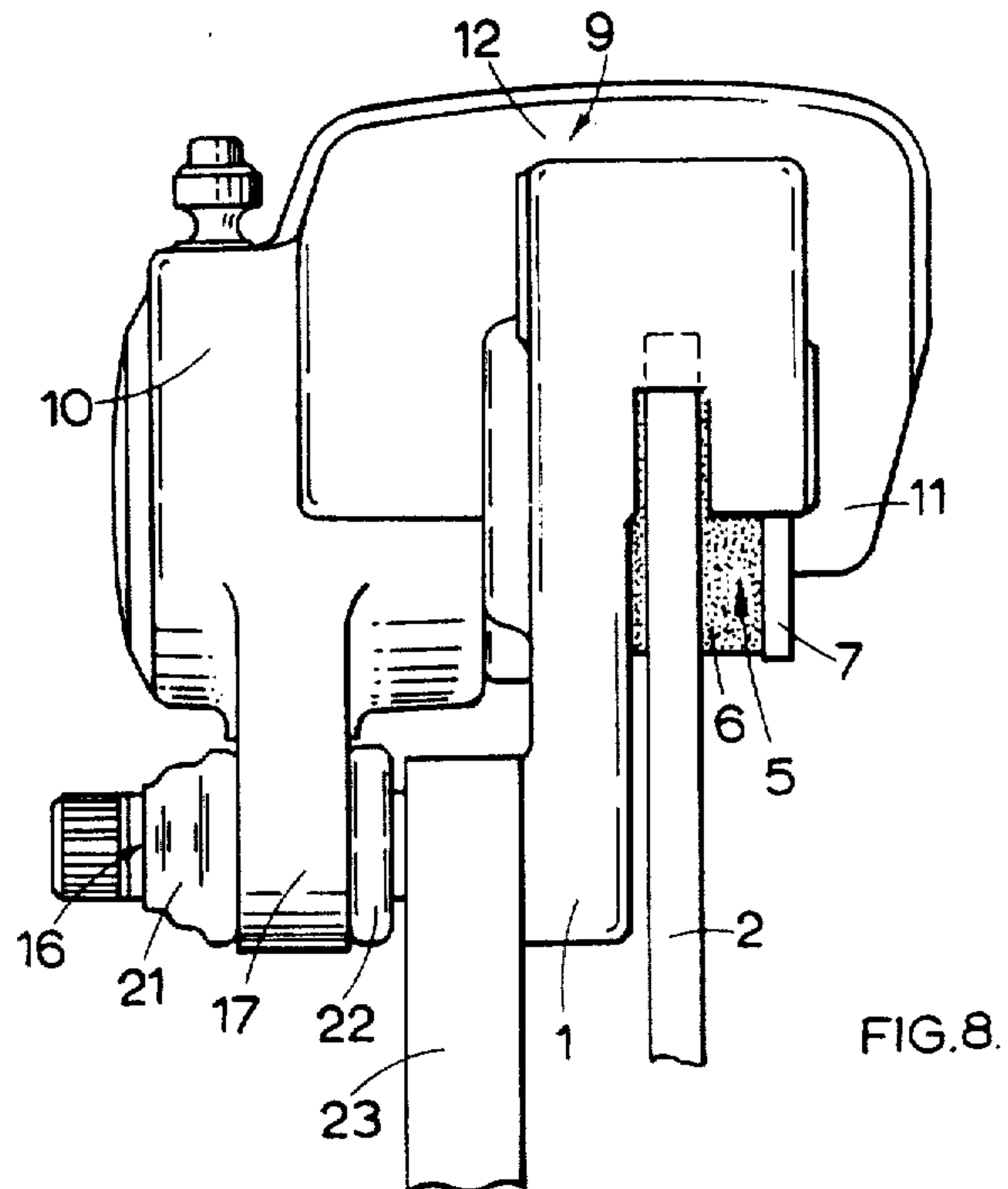


FIG. 7.



DISC BRAKES FOR VEHICLES

Matter enclosed in heavy brackets [] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This is a divisional application Ser. No. 802,809 filed June 2, 1977, now U.S. Pat. No. 4,151,899. Which is a continuation of Ser. No. 626,184 filed Oct. 18, 1975 and now abandoned.

This invention relates to disc brakes for vehicles of the kind in which a caliper is adapted to straddle both the peripheral edge of a rotatable disc and friction pad assemblies for engagement with opposite faces of the rotatable disc which are guided for movement with respect to the disc on spaced drag-taking abutment surfaces in a relatively stationary drag-taking member and actuating means housed in the caliper on one side of the disc are adapted to supply the adjacent friction pad assembly known as the "directly actuated friction pad assembly" directly to the adjacent face of the disc, the other friction pad assembly known as the "indirectly actuated friction pad assembly" being applied to the opposite face of the disc by the reaction on the caliper which is adapted to cause the caliper to move in a direction substantially parallel to the axis of the disc to transmit the force from the actuating means indirectly to the actuated friction pad assembly.

In one known disc brake of the kind set forth the actuating means and the caliper itself are positively coupled to the directly and indirectly actuated friction pad assemblies respectively. In the application of the brake the caliper and the pad assemblies are moved in a circumferential direction and, due to the relatively high inertia forces dependent upon the mass of the caliper, the engagement of the pad assemblies with the abutment surfaces in the drag-taking member is liable to be noisy, particularly when the pad assemblies move from the abutment surfaces at one end of the brake to the abutment surfaces at the other end of the brake due to a change in the direction of disc rotation. Also, unless the caliper is symmetrically arranged on both sides of the disc, there is a tendency for the caliper to rattle and pivot with respect to the disc in the "off" position of brake. Any such movement is transmitted to the pad assemblies and may cause tapered wear of the pad assemblies to occur. Also when the actuating means comprises a piston working in a hydraulic cylinder in the caliper, such movement of the caliper may cause the piston to be "knocked back" into the bore with the result that an increased pedal travel is required on a subsequent brake application. Again, since the sole support for the caliper comprises the couplings with the friction pad assemblies, as the pad assemblies wear, the effective distance between the supports decreases progressively, thereby reducing the stability of the caliper and increasing any tendency for the caliper to rattle and pivot with respect to the disc as described above. Where tapered wear of the pad assemblies occurs, since there is thus no restraining effect to prevent such tapering which may be excessive, the caliper itself may tilt with respect to the disc by a corresponding excessive amount. Furthermore, when the actuating means comprise a piston working in an hydraulic cylinder in the said one limb, the support length of the piston decreases with wear of the pad assemblies and the inertia effects of

the mass of the caliper progressively increase any tendency for the piston to be displaced in a direction inclined with respect to the axis of the cylinder, which may displace the material of a piston seal and allow the ingress of air into the cylinder and, in consequence, into the hydraulic fluid of the system.

According to our invention in a disc brake of the kind set forth for vehicles the caliper is slidably mounted for movement relative to the disc on a guide located at one circumferential position on one side only of the disc, the said one side being the same side of the disc as that on which the actuating means is located.

Preferably, the caliper is guided on the said one side of the disc on a single pin located in the drag-taking member in which it may be rigidly secured. Conveniently the pin is position within the peripheral edge of the disc.

By locating the caliper on one side of the disc directly with respect to the drag-taking member serves to minimize rattle and swinging movement of the caliper in the "off" position of brake to eliminate substantially accidental uneven wear of the pad assemblies.

Conveniently the caliper itself is connected to the indirectly actuated friction pad assembly by means of a suitable coupling so that the engagement of that pad assembly with one of the drag-taking abutment surfaces defines the guide location for that side of the disc.

The effective distance between coupling and the guide remains constant throughout the wear life of the pad assemblies.

The guide incorporates resilient means constructed and arranged to permit the indirectly actuated friction pad assembly to move from one abutment surface to the other when the brake is applied with the direction of disc rotation reversed. The resilient means absorbs a high proportion of the inertia effects due to the mass of the caliper when the brake is applied so that the operation of the brake is less noisy than in constructions in which the whole inertia of the caliper is transmitted to both friction pad assemblies.

The pin may comprise a sleeved bolt with resilient means comprising a resilient bush being disposed between the sleeve and the caliper. Conveniently the bush is also sealingly connected to the sleeve by means of sealing boots to protect the slide and maintain the seal when the bolt is withdrawn from the sleeve for brake maintenance, for example friction pad replacement. In a modification the sleeve may be omitted and the bolt projects through the resilient bush. In another construction the bush may be replaced by at least one annular resilient ring.

When the drag-taking member is mounted on a separate stationary part adjacent to the disc, conveniently the bolt passing through the sleeve may form one of a pair of circumferentially spaced mounting bolts for securing the drag-taking member to the stationary part. This has the advantage that the drag-taking member is still held in position when the caliper is removed for brake maintenance.

Some embodiments of our invention are illustrated in the accompanying drawings in which:

FIG. 1 is a plan view of a caliper type disc brake for a motor car with a portion of the caliper omitted for clarity;

FIG. 2 is an end view of the brake showing alternate constructions of drag-taking member;

FIG. 3 is a view of the opposite ends of the brake;

FIG. 4 is a section on the line 4—4 of FIG. 2;

FIG. 5 is a longitudinal section through the brake, substantially on the line 5—5 of FIG. 1;

FIG. 6 is a section similar to FIG. 4 but through another brake;

FIG. 7 is an end view of a further brake for a motor cycle;

FIG. 8 is a side view of the same; and

FIG. 9 is a section substantially on the line 9—9 of FIG. 7.

In the caliper-type disc brake illustrated in the drawings 1 is a drag-taking member of cast construction which is disposed adjacent to one face of a rotatable disc 2 and includes a pair of circumferentially spaced parallel arms 3 which extend over the peripheral edge of the disc by a substantial distance. In a modification the drag-taking member may be of pressed-metal construction.

Friction pad assemblies 4 and 5 for engagement with opposite faces of the disc 2 are mounted in the gap between the arms 3. Each friction pad assembly 4, 5 comprises a pad 6 of friction material carried by a rigid backing plate 7, and the lugs at the ends of the backing plates are provided with outwardly directed notches which slidably receive the arms 3. Anti-rattle blade springs 8 enclose the arms 3 and serve to bias the friction pad assemblies away from the arms 3 which comprise drag-taking abutment surfaces. The blade springs 8 are of channel section to embrace the sides of the arms, and lugs 8a at the ends of the channel sections are bent over to engage with the ends of the arms.

A rigid caliper 9 of generally U shaped outline fits over the pad assemblies 4 and 5 and straddle the peripheral edge of the disc 2. The caliper 9 comprises space limbs 10 and 11 which are interconnected by an integral bridge piece 12. The limb 10 includes an hydraulic cylinder 13 in which works a piston 14 comprising actuating means for applying the directly actuated friction pad assembly 4 directly to the adjacent face of the disc, and the limb 11 acts on the friction pad assembly 5 to apply it to the opposite face of the disc by the reaction on the caliper 9 which causes it to move in a direction parallel to the axis of the disc.

In accordance with our invention the caliper 9 is slidably mounted for movement relative to the disc 2 on a guide located on the same side of the disc 2 as the cylinder 13. The guide comprises a pin assembly 16 on which a radial boss 17 integral with the limb 10 is slidably guided. The pin assembly 16 comprises a bolt 18 projecting through a sleeve 19 and screwed into the drag-taking member 1. A resilient bush 20 is disposed between the sleeve 19 and the boss 17 and the bush 20 incorporates oppositely extending boots 21 and 22 which make seals with parts of the sleeve 19 on opposite sides of the lug 17.

When the drag-taking member 1 is separate from a stationary part 23 of the vehicle to which it is attached, as shown in the drawings, the bolt 18 also comprises one of a pair of circumferentially spaced bolts of which the other is shown at 24 for attaching the drag-taking member 1 to the stationary part 23. Thus upon removal of the bolt 18 for brake maintenance the bolt 24 will still provide a mounting for the drag-taking member 1.

The drag-taking member 1 may be integral with the stationary part so that, as shown in the left hand view of FIG. 2, the bolt 24 can be omitted.

The limb 11 is [positively connected to] indirectly mounted on the drag-taking member through the indirectly actuated friction pad assembly 5 which is con-

nected to the limb 11 by circumferentially spaced bolts 15 [which are] screwed into tapped holes in the backing plate 7. Thus a guide location on the side of the disc remote from the cylinder 13 comprises the sliding engagement between the backing plate 7 of the friction pad assembly 5 and the arms 3.

When the brake is applied the friction pad assemblies 4 and 5 are carried around with the disc and into engagement with the arm 3 at the forward end of the brake. This movement of the indirectly actuated friction pad assembly 5 is accompanied by a corresponding movement of the caliper 9 which takes place against the loading of the resilient bush 20 which, in turn, at all times to maintain the caliper 9 in a position parallel to the axis of the disc.

The coupling between the pad assembly 5 and the caliper 9 prevents the caliper from rotating relative to the stationary member when the brake is applied.

Small radial and circumferential clearances are provided between the arms 3 and the notches in the backing plates 7. The clearances are chosen to minimise rattle in the "off" position of brake and to enable the pad assemblies 4 and 5 to change drag-taking abutments with a change in the direction of disc rotation. This has the advantage that the arms 3 forming the guides for the pad assemblies 4 and 5 are self-cleaning.

When the brake is installed in a vehicle the bolt 18 is mounted in an inboard position chosen so that only a minimum amount of metal is necessary in the boss 17.

Preferably the bush 20 has a splined engagement on the sleeve 19. This has the effect of varying the resilient resistance to movement as the material of the bush deforms.

In a modification the sleeve 19 may be omitted and the pin assembly 16 comprises a bolt projecting through the resilient bush 20.

In either construction, the caliper may be disposed between a part of the stationary member and the disc so that the bolt is disposed in the opposite direction.

In the brake illustrated in FIG. 6 the pin assembly 16 comprises a pin 25 which projects through a clearance opening 26 in the boss 17 and is screwed at its threaded inner end into a tapped opening 27 in the drag-taking member 1. As shown, the clearance of said opening is of a size to provide a clearance space between the wall of opening and the pin. A pair of axially spaced resilient annular rings 28 and 29 replace the bush and are disposed between the pin 25 and the opening 26. The abutment ring 28 projects radially from a groove 30 in the pin 25 and extends through the clearance space to engage the wall of the opening 26, and the innermost ring 29 projects radially from a groove 31 in the wall of the opening 26 and extends through the clearance space to encircle the pin 25 with which it engages.

The construction and operation of the brake of FIG. 6 is otherwise the same as that of FIGS. 1 to 5 and corresponding reference numerals have been applied to corresponding parts.

In the brake illustrated in FIG. 7-9, the limb 11 of the caliper 9 is coupled to the indirectly actuated friction pad assembly by means of circumferentially spaced bolts 32 which are screwed through tapped holes 33 in the limb 11 and are received at their free plane ends in openings 34 in the backing plate 7. Thus a small degree of limited movement may be permitted between the caliper 9 and the indirectly actuated friction pad assembly due to any clearance between the bolts and the openings 34.

The pin assembly 16 is disposed on a disc diameter passing through the axis of the cylinder 13.

The construction and operation of the brake of FIGS. 7 to 9 is otherwise the same as that of FIGS. 1 to 5 and corresponding reference numerals have been applied to corresponding parts.

In the brakes illustrated above the arms 3 are spaced widely apart. This improves the location of the pad assemblies 4 and 5 and, through the indirectly actuated friction pad assembly 5, improves the location of the caliper 9. Since the arms are spaced widely apart the points of contact between the pad assemblies 4 and 5 and the arms 3 lie on tangents passing substantially through the centres of pressure of the friction pads 6.

Since the caliper 9 is coupled to the indirectly actuated friction pad assembly 5 the arms 3 can simply extend over the peripheral edge of the disc and it is not necessary for them to be provided with radial extensions which otherwise might be necessary to support the indirectly actuated friction pad assembly 5 in the brake. This has the advantage that installation of the brake is facilitated since there are no arm extensions which otherwise might impede assembly, particularly when it is desired to form the drag-taking member 1 as part of the same component as the suspension structure, usually called the "upright".

I claim:

1. A disc brake for a vehicle comprising a rotatable disc, a relatively stationary drag taking member located adjacent said disc and having circumferentially spaced arms extending over the periphery of said disc and each including a drag taking abutment surface, first and second friction pad assemblies for engagement with opposite faces of the disc, each of said assemblies having circumferentially spaced parts slidably engaging the respective arms of said drag taking member and being guided for movement with respect to said disc between said arms on said abutment surfaces which take the drag on both said pad assemblies when said brake is applied, means cooperating with said stationary drag taking member and with said friction pad assemblies for preventing substantial radial movement of said assemblies relative to said arms when said assemblies are engaged with said arms, a caliper member straddling both the peripheral edge of said disc and said friction pad assemblies, a limb of said caliper member acting on said second friction pad assembly, actuating means housed in said caliper member on one side of said disc for applying said first friction pad assembly directly to an adjacent face of said disc, guide means on said one side of said disc for slidably mounting said caliper member on said drag taking member, *said guide means being the only means by which said caliper is directly and slideably mounted on said drag-taking member* for movement relative to said disc, said guide means comprising [only] a single element located at one circumferential position on said one side of said disc and within the periphery thereof, said caliper member being slidably mounted on said single element for movement relative to said disc in a direction parallel to the axis thereof whereby said second friction pad assembly is adapted to be applied to said disc through said limb by the reaction of said caliper member to said actuating means, and said element being secured to one of said members and extending into a clearance opening in the other of said members, resilient means disposed between said element and said opening to permit relative movement in a radial direction between said element and said opening to

occur in response to movement of said second friction pad assembly from one of said abutment surfaces to the other when the brake is applied with the direction of rotation of said disc reversed, said resilient means complementing said guide means while being free of any drag on either of said friction pad assemblies when said brake is applied irrespective of said direction of rotation of said disc, and guiding and anti-rotation means for said caliper member on the side of said disc opposite said one side comprising a coupling between said limb of said caliper member and said second friction pad assembly.

2. A disc brake as claimed in claim 1, wherein said element is located in said drag-taking member, a boss is provided on said caliper member through which said element extends into said drag-taking member, and said resilient means acts between said element and said boss.

3. A disc brake as claimed in claim 2, wherein said resilient means comprises a bush of resilient material.

4. A disc brake as claimed in claim 3, wherein said bush is sealingly connected to said element by means of sealing boots integral with said bush and disposed on opposite sides of said boss.

5. A disc brake as claimed in claim 2, wherein said resilient means comprises at least one annular ring of resilient material.

6. A disc brake as claimed in claim 5 wherein two axially spaced annular rings of resilient material are disposed between said element and said boss.

7. A disc brake as claimed in claim 6, wherein one of said rings is partially received in a groove in said element and the other of said rings is partially received in a groove in said boss.

8. A disc brake as claimed in claim 7, wherein the one of said rings adjacent to said disc is received in said groove in said boss, and the said other ring is received in said groove in said element.

9. The disc brake as claimed in claim 1 wherein said resilient means extends radially through the clearance space between the wall of said opening and said element and engages said wall and said element, the clearance space being of a size and said resilient means being constructed and arranged to permit said relative movement in a radial direction between said element and said opening.

10. The disc brake as claimed in claim 1 wherein each pad assembly includes a backing plate, said radial movement preventing means comprising lugs at the respective ends of the backing plates, and outwardly directed notches carried by the respective lugs, each slidably receiving an arm of the stationary drag taking member.

11. *A disc brake for a vehicle comprising a rotatable disc having an annular periphery and first and second opposite faces, a relatively stationary drag-taking member located adjacent to said disc and having arms extending over the periphery of the disc and circumferentially spaced with respect to the periphery of said disc, each arm including a drag taking abutment surface, first and second friction pad assemblies for engagement with said opposite faces of the disc, each of said pad assemblies having circumferentially spaced parts slidably engaging with the respective arms of the drag taking member and being guided for movement with respect to said disc between said arms on said abutment surfaces which take the drag on both said pad assemblies when said brake is applied, a caliper member straddling both the periphery of said disc and said friction pad assemblies and having first and second axially spaced limbs, said second limb of said caliper member acting on said second friction pad assembly, actuating means housed*

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in first limb of said caliper member for applying said friction pad assembly directly to an adjacent face of said disc, guide and anti-rotation means for slidably mounting said caliper member on said drag taking member for movement relative to said disc only in a direction substantially parallel to the axis thereof, said guide and anti-rotation means including an element on which, said caliper member is slidably mounted for movement relative to said disc in a direction parallel to the axis thereof whereby said second friction pad assembly is adapted to be applied to said disc through said second limb by the reaction of said caliper member to said actuating means, and said element being secured to one of said members projecting through a clearance opening in the other of said torque taking and caliper members, and resilient means disposed between said element and said opening, said resilient means complementing said guide and anti-rotation means while being free of any drag on either of said friction pad assemblies when said brake is applied irrespective of said direction of rotation of said disc, wherein said element comprises a bolt having a head carrying a threaded shank, a threaded opening is provided in the said one of said members and into which said shank is screwed, a sleeve passing through said clearance opening in said other of said members and surrounding said shank and being clamped at opposite ends between said head and the said one of said members, and wherein said resilient means comprises a bush of resilient material disposed between said sleeve and said opening and having

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first and second opposite ends projecting from opposite ends of said clearance opening, a first annular sealing boot projecting from said bush towards the said one member, a second annular sealing boot projecting from said bush towards said head of said bolt, said first boot having a first end integral with said first end of said bush and a second end, said second boot having a first end integral with said second end of said bush and a second end, a first radial bead integral with said second end of said first boot engaging sealingly with said sleeve at a first position disposed between the said one of said members and the said other of said members, and a second radial bead integral with said second end of said second boot engaging sealingly with said sleeve at a second position disposed between the said other of said members and said head of said bolt.

12. A disc brake as claimed in claim 11, wherein said element is located in said drag-taking member, a boss is provided on said caliper member through which said bolt extends into said drag-taking member, and said bush acts between said sleeve and said boss, said sealing boots being sealingly engaged with said sleeve at positions spaced from opposite sides of said boss.

13. A disc brake as claimed in claim 12, wherein portions of said sleeve spaced from opposite sides of said boss are provided with radial grooves adapted sealingly to receive said radial beads at said outer ends of said boots.

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