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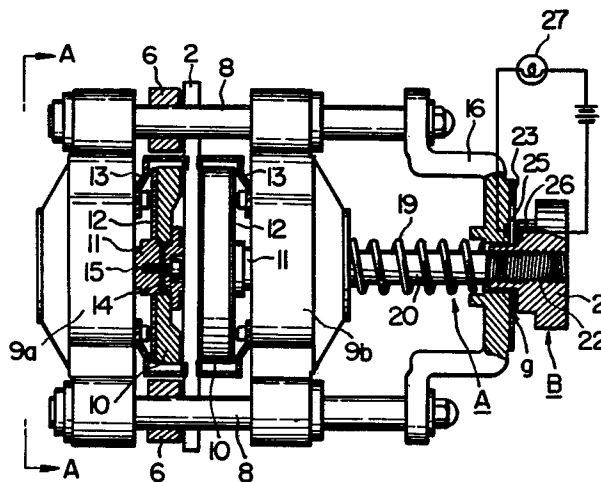
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## 54 Abrading device for a brake disc.

57 The abrading device for a brake disc of an automobile comprises a substantially horse-shoe-shaped bracket (6) mounted on a caliper supporting member in a manner interchangeable with the brake caliper. The bracket (6) projects towards the outer periphery of the brake disc (2) and is substantially parallel to the brake disc (2) mounted on an axle of the automobile. A pair of bearing frames (9a, 9b) is supported on the bracket (6), at least one of the bearing frames (9b) being slidably supported on a pair of guide rods (8) parallel to the axle. A pair of grinding stones (10) is rotatably held on the bearing frames (9a, 9b) and grinding stone urging means (A) cause the pair of grinding stones (10) to contact the brake disc (2) under a predetermined pressure. This abrading device is capable of accurately and automatically abrading the brake disc (2) for a predetermined quantity.



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" Abrading Device for a Brake Disc "

This invention relates to an abrading device (or an abrader), and more particularly, it is concerned with a device for abrading the frictional surface of a brake disc of an automobile provided with a disc-type brake on its wheels, when the brake disc gets rusted or stained with oil on its surface. The invention also relates to a device for improving working precision in the abrading device for the automobile brake disc.

In recent years, a disc-type brake has been widely adopted as the braking device for automobiles. Since, however, this type of the brake inevitably exposes the contact surface between the brake-disc and the brake shoe to the external air, it readily gets rusted on the surface thereof when it is left unused for one to two months, particularly in a cold district where salt is dispersed on the road as a non-freezing measure, with the consequence that smooth braking action becomes difficult to achieve. Therefore, it is highly desirable that, before the vehicle is actuated, the rust is removed and necessary adjustment is effected.

For this purpose, there has already been known an abrading device which, for avoiding trouble and complicity in removing the brake disc from the axle at every time the

brake disc is to be abraded, performs abrasion by urging a grinding stone to the frictional surface of the brake disc with its being mounted on the axle, and rotating the brake disc by an appropriate power source such as automobile engine, and so forth, while the grinding stone is also being rotated so as not to cause scratches due to cutting by the grinding stone to appear on the frictional surface of the brake disc.

There has also been known a structure, in which the abrading device is fitted by utilizing a caliper supporting member in a manner to be interchangeable with the caliper so that the abovementioned abrading device may be set in the neighborhood of the disc brake of the automobile at the time of abrading the brake disc.

However, the abovementioned conventional abrading device for the brake disc provides a fitting member for equipping the abrading device on the caliper supporting member and the supporting member for the grinder with respect to the fitting member in a cantilever type, with the consequence that the grinding surface of the grinding stone cannot be maintained in a mutually parallel manner with the frictional surface of the brake disc to cause the so-called unilateral contact between them, which apprehensively brings about scratches on the frictional surface of the brake disc.

Incidentally, there has been known so far most generally:

- (1) a method for removing the brake disc from the automobile for abrasion; and (2) a method for abrading the brake disc by fitting the abrading device in place of the brake shoe, and rotating the grinding stone, utilizing the rotation of the auto-

mobile engine as a drive power source.

With a view to attaining smooth braking action, very stringent requirements are imposed on the brake disc such as its surface smoothness, precision in its deflection, gauge, and so forth, hence the abrading device is required to be highly precise in its construction and operation.

While the precision in the disc per se can be secured, in the above-mentioned method not only the precision of the same in its state of being mounted on the axle is not guaranteed, but also the abrading device as a whole becomes expensive, and, moreover, much time is required for the brake disc to be removed from and mounted on the automobile axle, which results in a loss in economy. The method (2) suffers from the same problem as mentioned above in respect of its precision, even though the rust can be removed perfectly.

In view of such various problems inherent in the conventional abrading device as mentioned in the foregoing, it is a primary object of the present invention to provide an improved abrading device for a brake disc of an automobile, which is capable of accurately press-contacting the grinding stone and brake disc, even when the device is mounted on the caliper supporting member of the automobile in a manner interchangeable with the caliper.

According to one embodiment of the present invention an improved abrading device for a brake disc of an automobile is capable of automatically performing cutting of the

grinding stone to a predetermined degree.

Such an improved abrading device for a brake disc of an automobile should make it possible for an operator of the device to know the termination of the cutting work by an electrical signal.

According to another embodiment of the present invention an improved abrading device for a brake disc is provided with means aiming at increasing precis-

ion in the abrasion work by permitting horizontal deflection of the grinding stone following the surface of the brake disc within a certain predetermined limit through appropriate setting of a sliding resistance between the supporting cylinder of a bracket and a guide rod, thereby attempting to maintain uniform wear of the grinding stone on both sides of the brake disc.

According to the present invention, in general aspect thereof, there is provided an abrading device for a brake disc of automobile, which comprises in combination: a substantially horse-shoe-shaped bracket mounted on a caliper supporting member of the automobile in a manner interchangeable with the (particularly the caliper for the brake lining caliper), by utilizing a plurality of fitting holes formed at the distal end parts of the caliper supporting member, the bracket being projected toward the outer periphery of the brake disc in a manner to be substantially parallel with the brake disc mounted on the axle; a pair of bearing frames supported on the substantially horse-shoe shaped bracket, at least one of which is slidably supported on a pair of guide rods parallel to the axle; a pair of grinding stones rotatably

held on each of the bearing frames in a manner to hold the brake disc from its both surfaces; and grinding stone urging means positioned in a space between the bearing frame and the guide rod, causing the pair of grinding stones to contact the brake disc under a predetermined pressure.

There has thus been outlined, rather broadly, the more important feature of the present invention so that the detailed description thereof that follows may be better understood, and that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the concept upon which this disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent construction as far as they do not depart from the spirit and scope of the present invention.

Specific embodiments of the present invention have been chosen for the purpose of illustration and description, and are shown in the accompanying drawing, forming a part of the specification, in which:

Figure 1 is a front view showing the abrading device of the present invention in the state of its use;

Figure 2 is a side elevational view of the abrading device, when viewed from its left side;

Figure 3 is a rear view of the same abrading device;

Figure 4 is a front view of the main part of the embodiment according to the present invention constructed in a manual cutting type;

Figure 5 is a side elevational view, partly in longitudinal cross-section, of the abrading device according to the present invention;

Figure 6 is an enlarged side elevational view, partly in longitudinal cross-section showing a principal part of the manual cutting construction according to the present invention; and

Figure 7 is an enlarged side view, partly in longitudinal cross-section, of a sliding resistance adjusting mechanism with respect to a guide rod.

In the following, the construction of the abrading device according to the present invention will be described in specific details with reference to its preferred embodiments as shown in the accompanying drawing.

Referring first to Figures 1 <sup>to 3,</sup> the abrading device of the present invention is constructed with an axle 1 of the automobile, a brake disc 2 (hereinafter simply called "disc"), a disc cover 3, a caliper supporting member 4, a knuckle 5, and a substantially horse-shoe-shaped bracket 6 being fitted by bolts 7, 7 in a manner to be substantially parallel with the disc 2 and to protrude toward the outer periphery of the disc 2 by utilizing bolt holes remaining free after removal of the caliper from the caliper supporting member 4.

On the outer periphery of the disc 2, there are slidably supported a pair of upper and lower guide rods 8, 8 which are parallel to the axle 1 passing through each of the leg portions of the substantially horse-shoe-shaped bracket 6.

The abovementioned guide rods 8, 8 support thereon bearing frames 9a, 9b at both <sup>the</sup> left and <sup>the</sup> right side of the substantially horse-shoe-shaped bracket 6 (vide Figure 2). The guide rods 8, 8 pass through both end parts of the bearing frame 9a, 9b, one of the bearing frames (9a) being fixed at one end of the guide rods 8, 8, and the other of the bearing frames (9b) being slidable along the guide rods 8, 8.

Grinding stones 10, 10 are rotatably mounted on the opposing surfaces of the abovementioned bearing frames 9a, 9b through the shafts 11, 11. The rear surface of each grinding stone 10 is received on and held by a flange 12 having a substantially <sup>the</sup> same diameter as the grinding stone.

Incidentally, reference numeral 13 designates a cover for the grinding stone, numeral 14 refers to a stopper flange for the grinding stone, and 15 designates a fixing bolt for the grinding stone.

The end parts of the guide rods 8, 8 at the side of supporting the movable bearing frame 9b are joined with a fixed frame 16. Between the fixed frame 16 and the movable bearing frame 9b, there is provided a grinding stone urging device A for the cutting (abrading) operation. The urging device A may be either a manually operating means provided only with a tightening screw mechanism (i.e., a screw 17

and a pushing rod 18) as shown in Figure 4, or an automatic urging means as shown in Figure 2 utilizing a compression coil spring 19 or a tensile force of a dish spring. The automatic urging device A in Figure 2 is provided with means B for setting an abrading quantity, i.e., a moving quantity of the grinding stone.

A supporting rod 20 for the coil spring 19 compressed between the movable bearing frame 9b and the fixed frame 16 extends outwardly through the fixed frame 16. At the end part of the supporting rod 20, there is screwed an abrading quantity setting nut 21 by a left-threaded screw 22. The base part of the nut 21 is loosely fitted around the fixed frame 16.

Graduations 23 indicating the abrading quantity in its peripheral direction on the surface of the fixed frame facing the nut 21 and an index 24 to the dial 23<sup>are</sup> / provided on the nut 21 in correspondence to the dial 23.

Electrical contacts 25, 26 are provided on the opposite surfaces of the fixed frame 16 and the nut 21, both of which are connected to a signalling apparatus<sup>27</sup> / such as a pilot lamp, buzzer, bell, and so on.

In the following, operations of the abrading device according to the present invention will be explained. A brake caliper (not shown in the drawing) is removed from the caliper supporting member 4 and the nut 21 is turned to the left (vide: <sup>embodiments shown in</sup> the Figures 1 and 2) to thereby cause the bearing part 9b to retreat against force of a spring 19 and widen the space gap between the grinding stones 10, 10 and the brake disc 2.

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In the embodiment of Figure 4 a screw rod 17 is turned to the left to directly pull the bearing frame 9b backward, thereby widening the gap between the grinding stones and the brake disc.

Subsequently, the tip end parts of both legs in the substantially horse-shoe shaped bracket 6<sup>are</sup> overlaid on one surface side of the caliper supporting member 4, and fixed thereonto with bolts 7, 7, after which the screw rod (the Figure 4 embodiment) or the nut 21 (the <sup>embodiments of</sup> Figures 1 and 2)

is turned to the right to push forward the bearing frame 9b until the grinding stones 10, 10 contact both surfaces of the brake disc 2. Following this, when the brake disc 2 is rotated, the grinding stones 10, 10 also rotate with the disc 2 due to friction between them (it may be feasible to impart rotational drive power to the grinding stones), in which state the forwarding motion for cutting is applied to the grinding stones 10, 10.

That is to say, in the case of the manual operation of the abrading device as shown in Figure 4, the screw rod 17 is turned to the right so as to tighten it while continuing to <sup>urge</sup> the frictional surface of the brake disc with the grinding stones 10, 10, the abrading quantity of which is verified by monitoring with eyes. As soon as a required quantity of abrasion has been attained, the screw rod 17 is reversely turned to separate the grinding stones 10, 10 from the brake disc 2.

In the automatic operation as shown in Figures 1 and 2, the nut 21 is in contact with the fixed frame

the  
16 by / tensile force of the spring 19 until the grinding stones  
10, 10 come <sup>into</sup> contact <sup>with</sup> the brake disc 2. In this state, when  
the nut 21 is further turned to the right, it begins to retreat  
owing to inability of the bearing frame 9b and the supporting  
rod 20 to move forward any more with the consequence that a  
gap  $g$  is formed between the nut 21 and the fixed frame 16, as  
shown in Figure 2. This gap  $g$  stands for the quantity of cutting,  
i.e., abrasion, by the grinding stones, the distance being

represented by circumferential graduations 23 in terms of  
pitch of the screw 22. Accordingly, by turning the nut 21  
until the index 24 on it achieves a required value on the  
graduations 23, there can be established a gap  $g$  corresponding  
to a quantity of cutting which an operator is intending to  
perform. In this state, when the brake disc 2 rotates, the  
grinding stones 10, 10 also rotate, whereby the disc is cut  
by the force of the spring 19 until the nut 21 comes <sup>(in</sup> to contact  
<sup>with</sup> the fixed frame 16. In other words, both surfaces of the brake  
disc 2 are automatically abraded by  $g/2$  on each surface.  
Mutual contact of contact points 25, 26 causes <sup>(the</sup> signalling  
device to actuate, which notifies the operator of the termina-  
tion of the abrading operation.

Incidentally, it is also feasible to provide the urging  
means on each of the bearing frames 9a, 9b by fixing <sup>(together</sup> the guide  
rods 8, 8 and the substantially horse-shoe-shaped bracket 6,  
and then slidably supporting the bearing frames 9a, 9b on the  
guide rods 8, 8. In this case it is better to  
render the fixing position of the guide rods 8, 8 and the

bracket 6 to be adjustable. Further, it is better to dispose the guide rods 8, 8 on the extension of the diameter of the grinding stone 10 as shown in Figure 1. For instance, where the grinding stone 10 has a small diameter, it sometimes occurs that the center axial line of the grinding stone intersects the brake disc 2.

As stated in the foregoing, the abrading device for the brake disc according to the present invention is of such a construction that the substantially horse-shoe-shaped bracket 6 mounted on the caliper supporting member 4 of the automobile in a manner to be interchangeable with the caliper is protruded toward the outer periphery of the brake disc 2 substantially <sup>in</sup> parallel with the brake disc on the axle 1; then, at the outer periphery of the brake disc 2, there are provided a pair of bearing frames 9a, 9b, which are supported on the abovementioned horse-shoe-shaped bracket 6, at least one of which is slidably supported on the abovementioned substantially horse-shoe shaped bracket 6; the grinding stones 10, 10 are rotatably supported on the abovementioned bearing frame 9a, 9b in a manner to hold the brake disc 2 at both surfaces; and the grinding stone urging means A to the brake disc 2 is provided between the bearing frame 9b and the guide rod 8. Accordingly, the caliper supporting member 4 to hold the grinding stones 10, 10 on both surfaces of the brake disc 2 in a manner to contact thereto, the substantially horse-shoe-shaped bracket 6, the guide rods 8, 8, the bearing frames 9a, 9b, and so forth are mutually supported at two points. A reference numeral 12 designates the grinding stone receiving and holding member

integral with the shaft 11, numeral 14 refers to the stopper for the grinding stone, and numeral 15 indicates a stopper screw. As a consequence, there is no possibility of each of the abovementioned members to fall, but the grinding stones 10, 10 are accurately and <sup>(in a manner</sup> parallel <sup>)</sup> in contact with the brake disc 2, whereby the disc surface can always be abraded uniformly and smoothly for finishing.

Further, the grinding stone urging means A is constructed as an automatically operable means utilizing <sup>the</sup> force of the spring, to which there is additionally provided means B for presetting an abrading quantity, so that, if only the means B is manipulated beforehand, there follows automatic abrasion for the quantity set.

Furthermore, the device is so constructed that, as soon as the abovementioned abrasion completes, a notifying signal may be emitted, hence there is no necessity for watching the abrading quantity of the brake disc 2 with eyes, which effectively contributes to improving the working efficiency.

In the afore-described construction of the abrading device according to the present invention, the fixed frame 16 is fitted between the pair of the guide rods 8, 8, to which the pushing screw rod 18 to be gradually advanced by the manually operated knob 17a through the screw 17 is supported, then one of the bearing frames 9b is pushed in the axial direction of the grinding stone, and, at the same time, the other bearing frame 9a is pulled toward the bearing frame 9b, thereby performing the cutting of the brake disc 2 by the grinding stones 10, 10.

While the forwarding and retreating screw mechanism may be arbitrarily chosen, the embodiment illustrated in Figure 6 is of such a construction that the feeder 30 is rotatably fitted in the hole of the fixed frame 16, that the abovementioned knob 17a is fixed to the feeder 30 with the pushing screw 17b, and that the screw 17 of the pushing guide rod 18 is screwed in the hole of the feeder. Reference numeral 32 designates a metal, and numeral 34 refers to a thrust bearing.

does not uniformly  
On the other hand, rust / develop on the brake disc  
2 over its entire surface.

In most cases, it develops in local places, and, in particular, as shown in the side view of Figure 2, it sometimes develops and adheres onto its surface in a wavy shape. In such case, when the sliding resistance of the guide rod 8 to the guide rod holding cylinder of the bracket 6 is too small, both grinding stones 10, 10 deflect to the left and right following the wavy surface of the disc brake 2, and its abrading efficiency is low. Although the deflection depends on <sup>the</sup> magnitude of the sliding resistance, it is governed by the weight of the movable part as a whole.

On the other hand, when the sliding resistance is increased to suppress the abovementioned deflection, and restriction is imposed on the grinding stones 10, 10 so as to cause them to rotate following the flat surface of the brake disc, there are brought about various problems such that wear of the grinding stones 10, 10 becomes non-uniform, and others. Therefore, the deflection should be tolerated to some extent.

As the practical means, stepwise or cascaded holes 36, 38, 40 are formed inside the push rod 18 in its longitudinal direction, through which holes a spring receiving and holding rod 42 is inserted in such a manner that it may move forward and backward in and along the long hole 44 and without rotation avoided by a rotation stopping pin 46. A pushing knob 48 is fixed on the outer end part of the spring receiving and holding rod 42, and a coil spring 50 is accommodated in a space defined between the inner end of the pushing knob 48 and a stage 38a of the hole 38. Numeral 52 refers to graduations inscribed in the outer periphery of the pushing knob 48.

Further, as shown in Figure 7, a sleeve 54 is interposed between the holding cylinder 6a and a guide rod 8, and a degree of pressure contact to the guide rod 8 of the sleeve 54 is adjusted to regulate the sliding resistance between the guide rod 8 and the holding cylinder 6a. Incidentally, a rotation stopper is provided between the supporting cylinder 6a and the sleeve 54.

In Figure 6, a reference numeral 58 designates an O-ring, numeral 60 refers to a snap ring, numeral 62 denotes a ring to stop a flange 18a at the forward end part of the pushing rod 18, and 64 designates a fitting bolt for the stopper ring 62.

When the abrading device is mounted on the caliper supporting member 4 of the automobile and the pushing knob 48 is pushed in a state of causing the grinding stones 10, 10 not to contact the brake disc 2, the spring receiving and holding rod 42 also retreats interconnectedly. At this instant,

the pushing knob 48 pushes the coil spring 50 which, in turn, pushes the pushing rod 18 through a staged hole 38a. Since the pushing rod 18 is screw-connected with the feeder 30, the fixed frame 16 and the guide rods 8, 8 are pushed, along which the device as a whole begins to move leftward in the drawing. The condition at that time is in a relationship of: contracting resistance of spring 50  $>$  sliding resistance  $f$  between the supporting cylinders 6a, 6a and the guide rods 8, 8.

The sliding resistance of the sleeve 54 to the guide rod 8 is established by the pushing screw 56, through reading of a numerical value from the graduations 52 inscribed on the outer periphery of the pushing knob 48 at the start of its moving, in such a manner that the value as read out may substantially coincide with a value previously found by a test machine.

In the above-described manner, desired abrading time and precision can be attained.

What is claimed is:

1. Abrading device for a brake disc (2), particularly of an automobile, comprising:
  - a) a substantially horse-shoe-shaped bracket (6) projecting towards the outer periphery of the brake disc (2) and being substantially parallel to said brake disc (2) mounted on an axle (1),
  - b) a pair of bearings frames (9a, 9b) supported on said bracket (6), at least one of the frames (9b) being slidably supported on a pair of guide rods (8) parallel to said axle (1),
  - c) a pair of grinding stones (10) <sup>one each</sup> rotatably held on each of said bearing frames (9a, 9b) and holding said brake disc (2) from its both surfaces, and
  - d) grinding stone urging means (A) positioned in a space between said bearing frame (9b) and said guide rods (8), and causing said pair of grinding stones (10) to contact said brake disc (2) under a predetermined pressure.
2. Abrading device as claimed in claim 1, characterized in that said bracket (6) is mounted on a caliper supporting member (4) in a manner interchangeable with the caliper using a plurality of bolts (7) through holes formed at the distal end parts of the caliper supporting member (4).
3. Abrading device as claimed in claim 1 or 2, further comprising means (B; 17a, 48) for presetting the abrading quantity caused by the movement of said grinding stones (10).
4. Abrading device <sup>as</sup> claimed in any of claims 1 to 3, further including signalling means (27) which is actuated when said grinding stones (10) complete a predetermined quantity of abrasion on said brake disc (2).
5. Abrading device as claimed in any of claims 1 to 4, wherein the quantity of abrasion is determined automatically by

an electrical circuit (25-27).

6. The abrading device as claimed in any of claims 1 to 3, wherein the quantity of abrasion is determined manually by a manipulating knob (17a, 48).

7. Abrading device as claimed in any of claims 1 to 6, further including a mechanism for measuring a sliding resistance between said guide rods (8) and said bearing frame (9a, 9b) or said bracket (6), and a mechanism (54, 56) for regulating and adjusting the sliding resistance.

FIG. 1

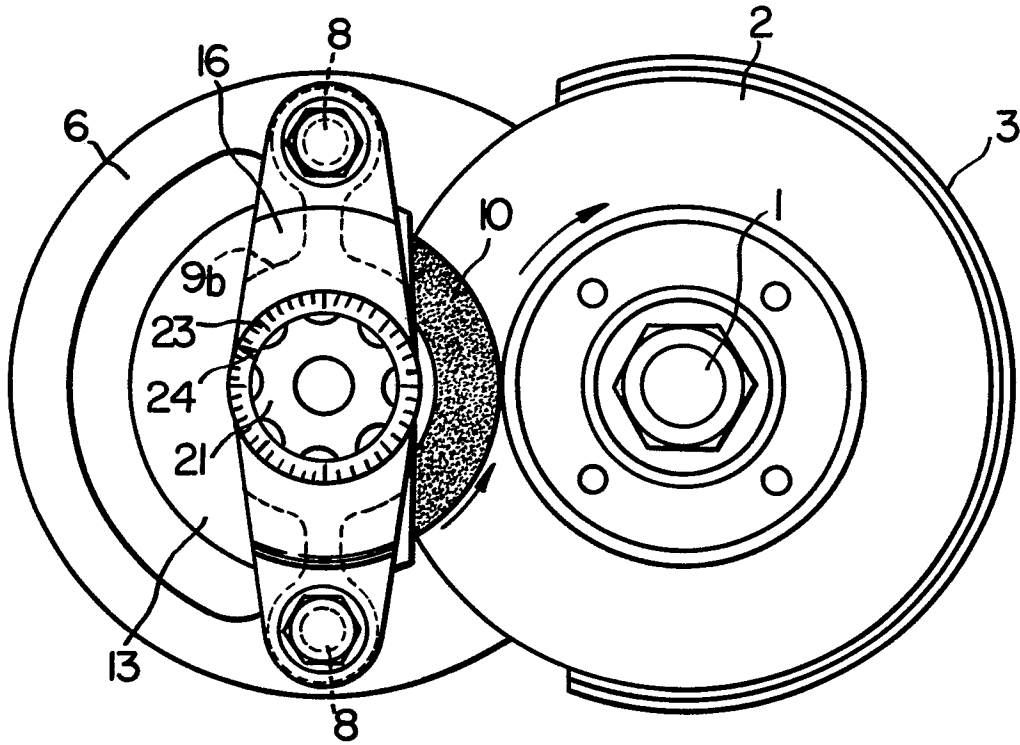


FIG. 2

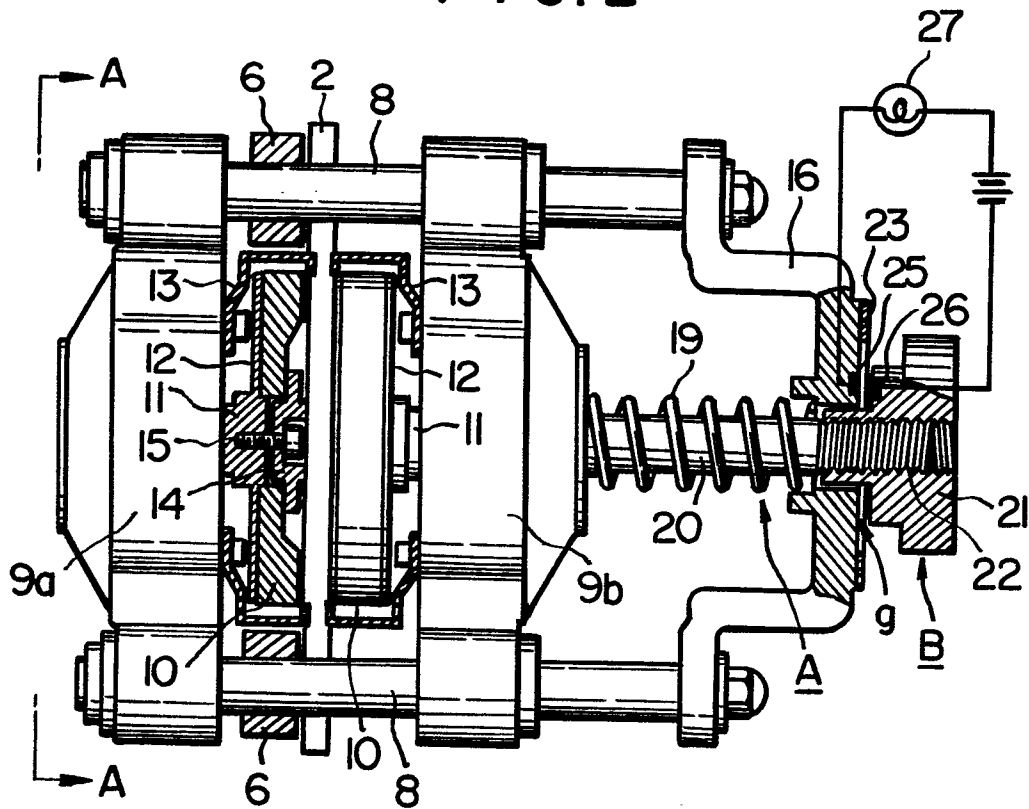


FIG. 3

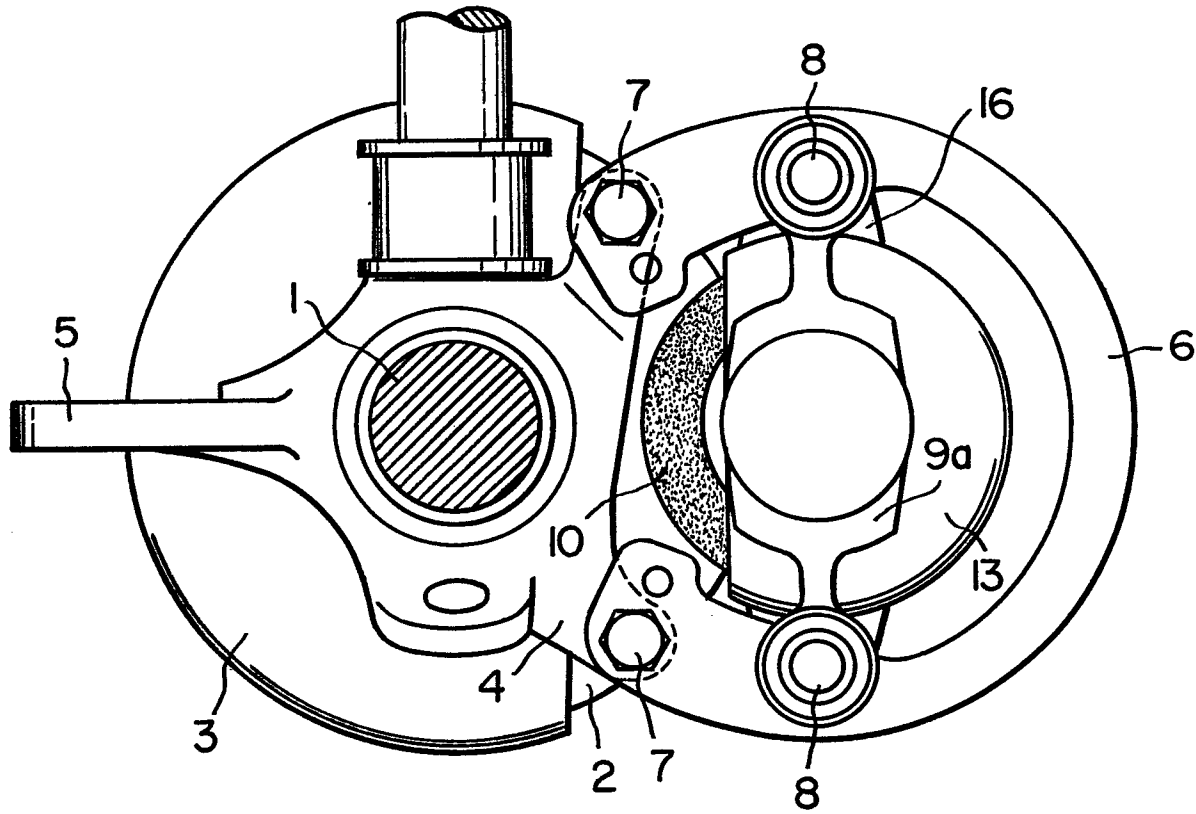


FIG. 4

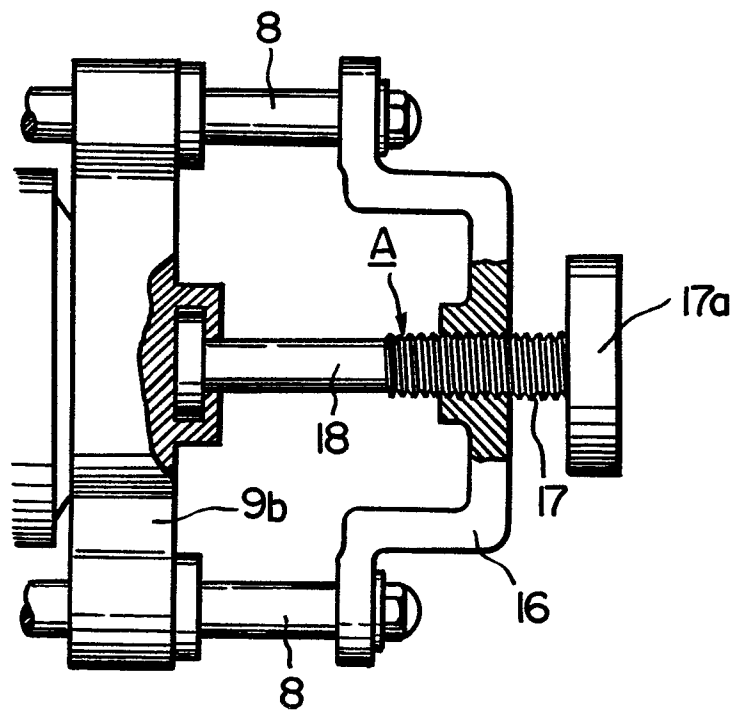


FIG. 5

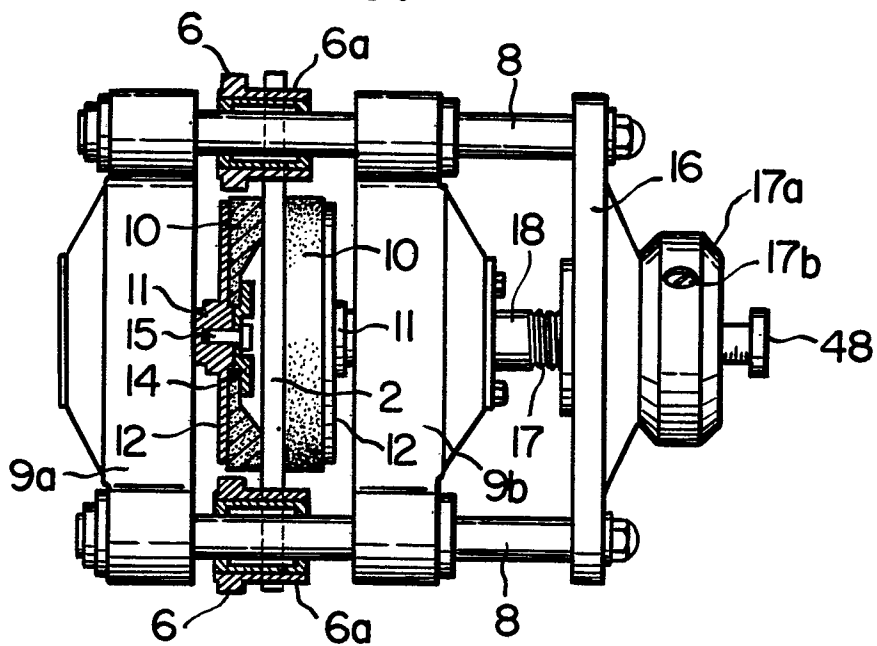


FIG. 6

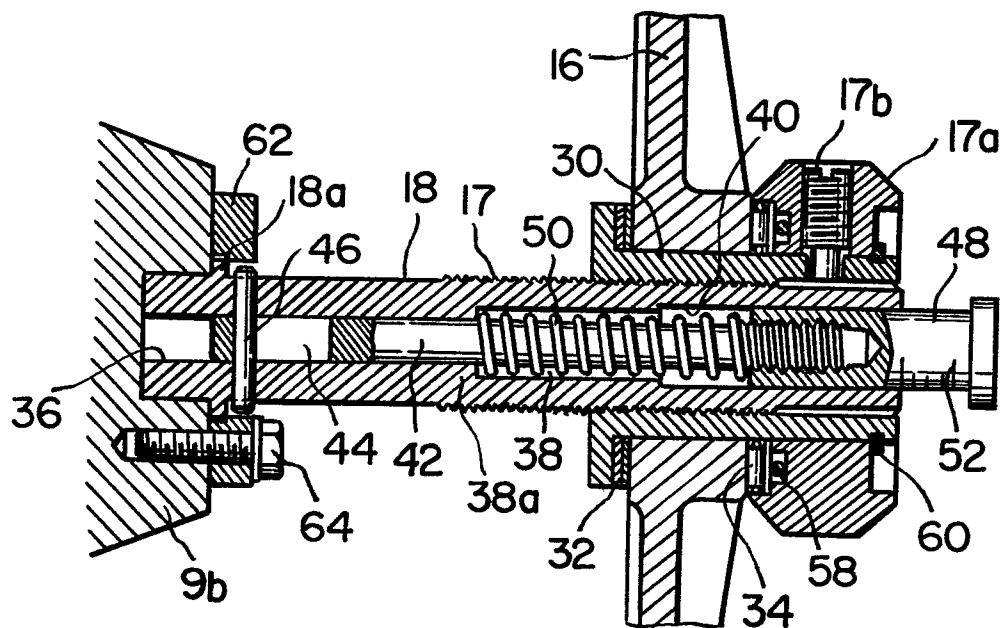
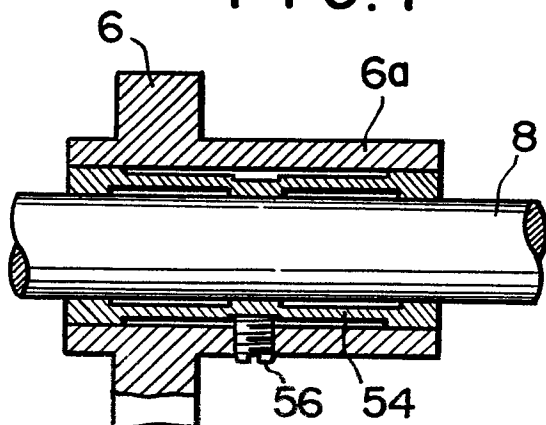


FIG. 7





European Patent  
Office

# EUROPEAN SEARCH REPORT

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Application number

EP 82 10 2824.8

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. <sup>3</sup> )
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
Y,A	<u>EP - A1 - 0 006 764</u> (H. GRAMLICH) * claims 4 to 7; page 4, line 25 to page 6, line 37; fig. 1, 2 *	1,2	B 24 B 7/16
Y,A	<u>DE - U - 1 905 891</u> (A. WANPOUILLE) * claims 1 to 5; fig. 1 *	1,3,6	
Y	<u>DE - A - 2 316 672</u> (H. GRAMLICH) * claims 1 to 3, 5; page 1, lines 8 to 21; fig. 1 *	1	TECHNICAL FIELDS SEARCHED (Int.Cl. <sup>3</sup> )
A	<u>GB - A - 1 184 718</u> (DUNLOP CO. LTD.) * claims 1 to 3; fig. 2 *	1	B 23 B 5/02 B 24 B 7/16
A	<u>FR - A - 1 352 248</u> (J.L. BRUNELLA)		
A	<u>FR - A - 1 440 267</u> (L.F. SCHMID)		
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons
			&: member of the same patent family, corresponding document
X	The present search report has been drawn up for all claims		
Place of search	Berlin	Date of completion of the search	09-12-1982
		Examiner	MARTIN