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(54) Brake pad wear measuring tool

(57) A tool 10, for measuring disk brake pads in situ on a motor vehicle, comprises rods 12, 14, connected to a support 16, the rod 12 having in slidable frictional gripping engagement therewith, a cup-shaped annular indicator member 18, and the other rod 14 having in similar slidable gripping engagement therewith, a cup-shaped annular indicator member 26 and an annular sleeve member 28 nestable therein. In a first measuring position the tool is applied to the brake assembly by threading measuring rod 14 into a hollow roll pin 42 supporting the brake pads until a foot 32 contacts the brake disc 38 and indicator member 18 contacts the caliper housing 44. In a second position the tool 10 is partially withdrawn and swung about roll pin 42 to bring the foot 32 into contact with the other brake pad 36.

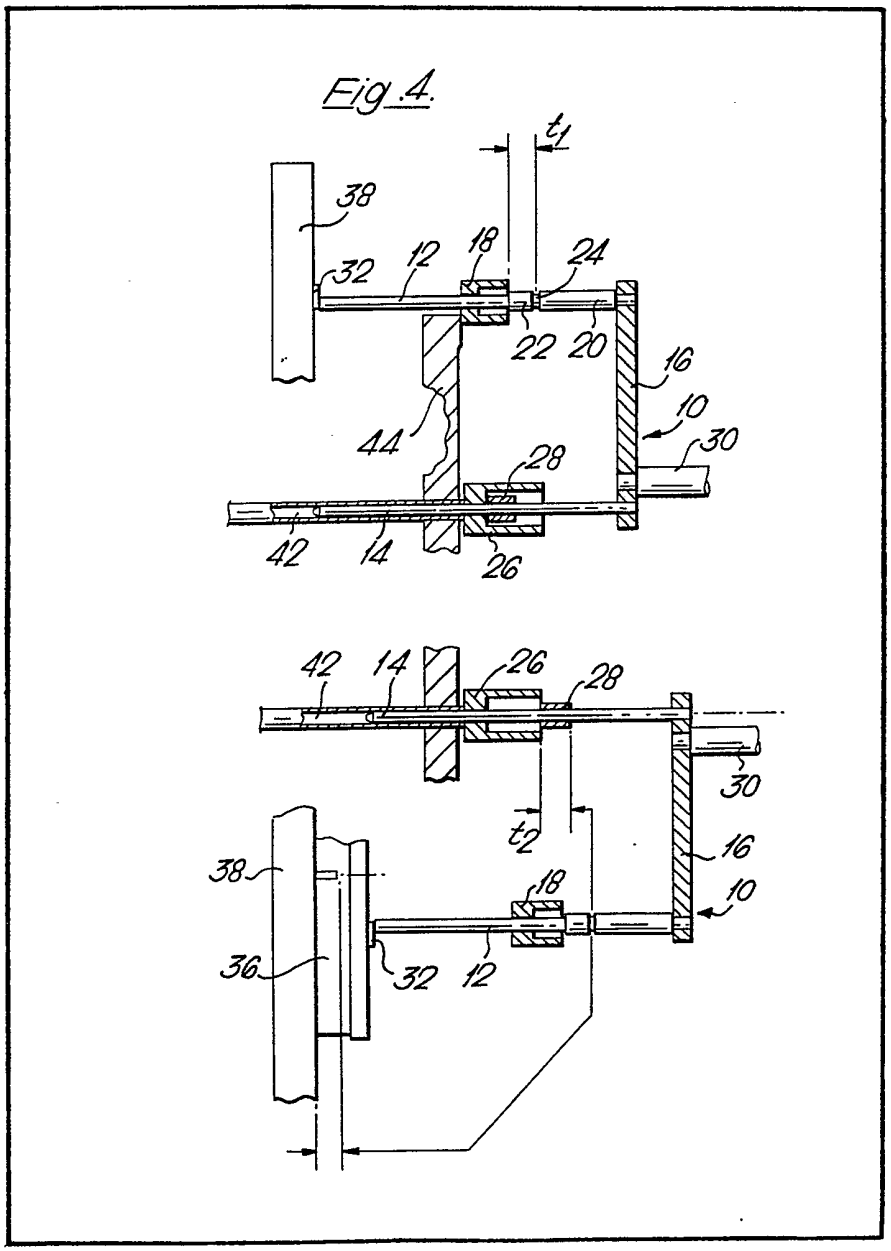

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Fig.1.

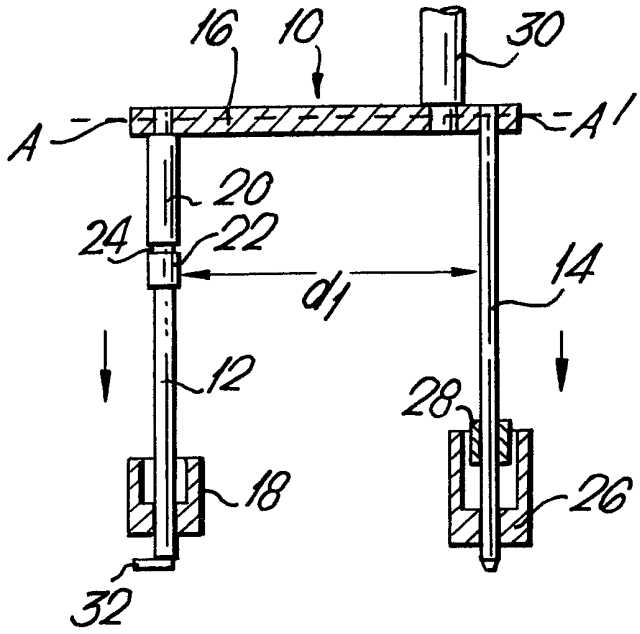

16
10
30
A
A1
20
24
22
d1
14
12
28
18
26
32

Fig.2.

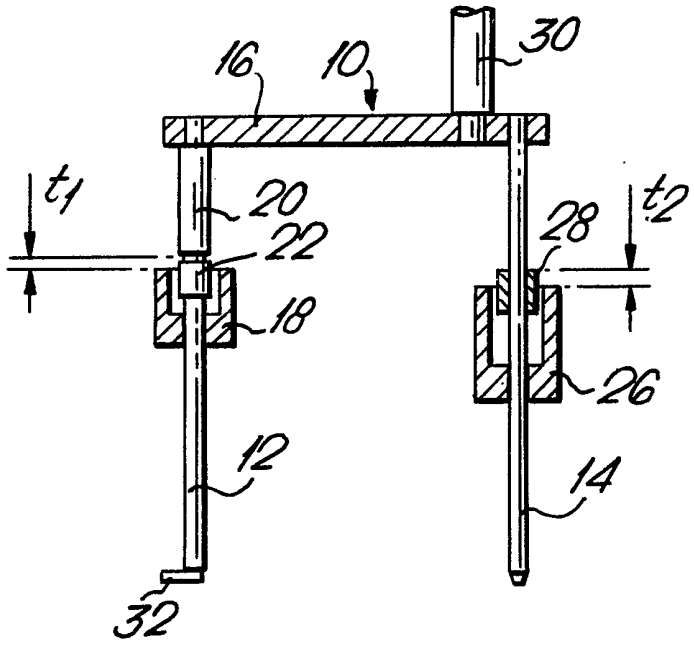

16
10
30
t1
20
22
28
t2
18
26
12
14
32

Fig. 3.

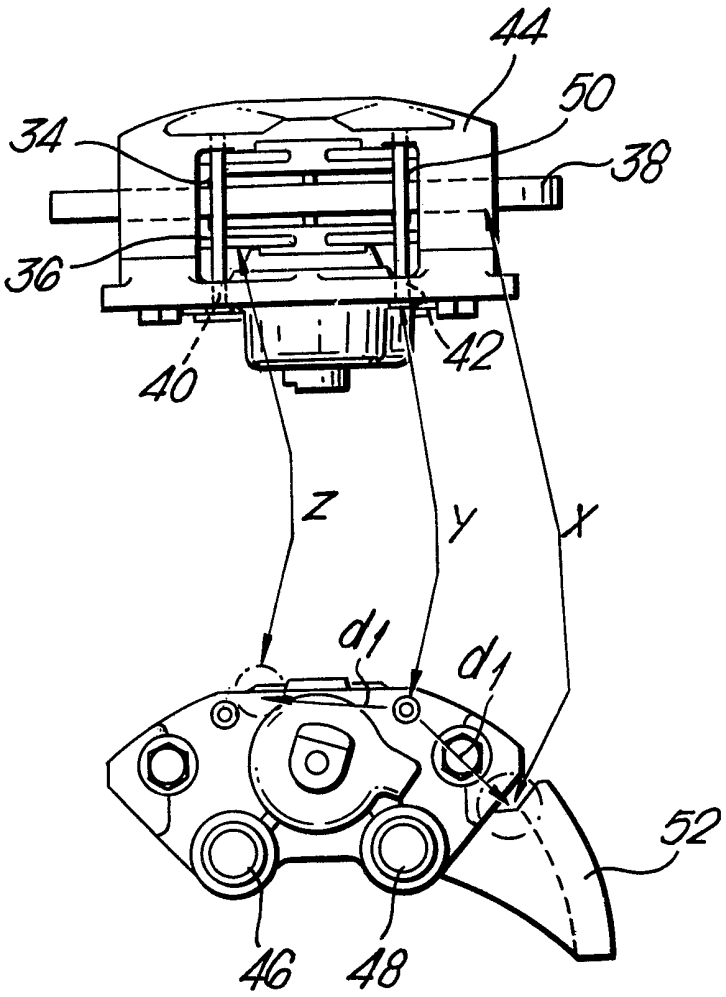


Fig.4.

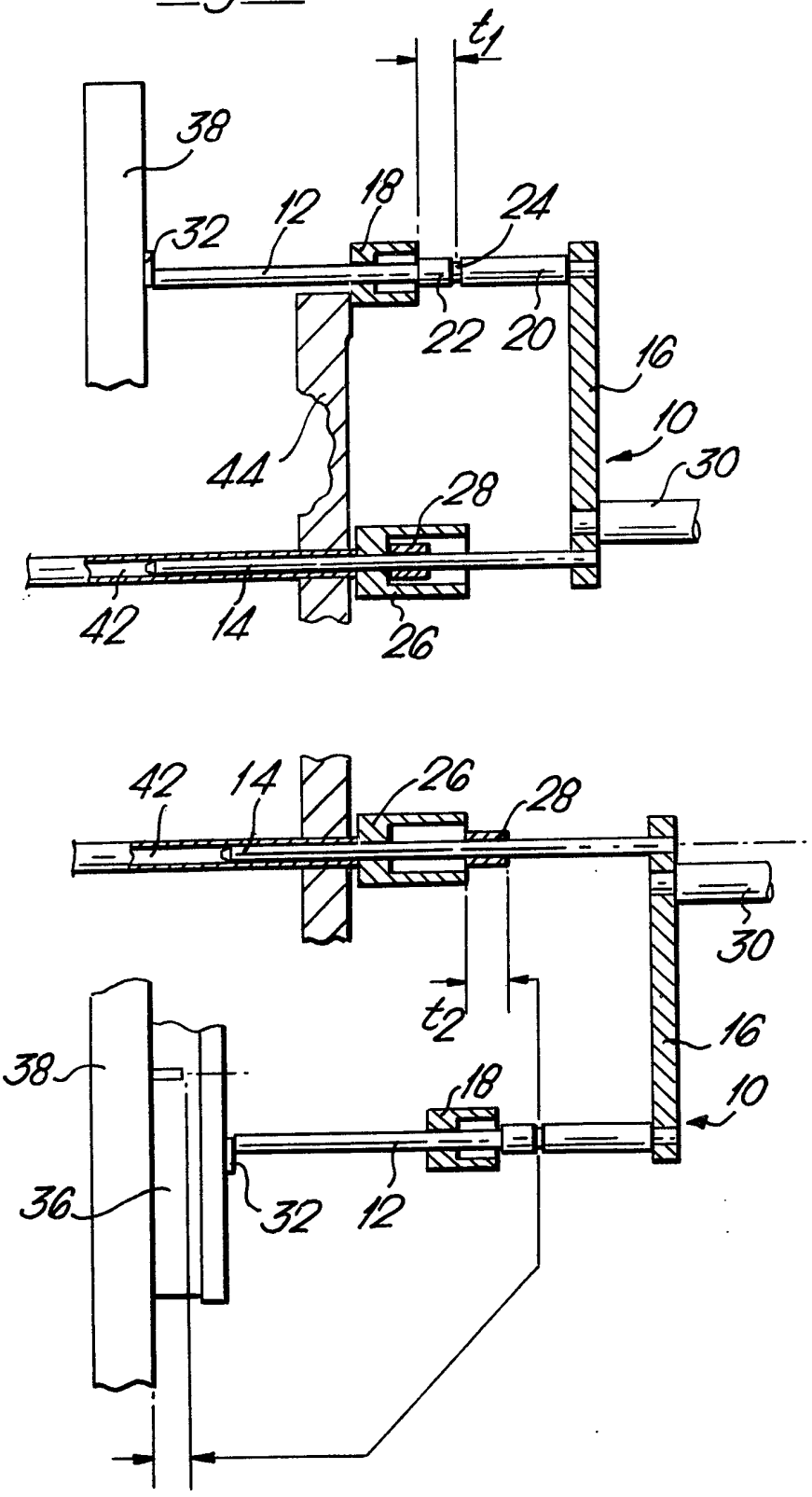
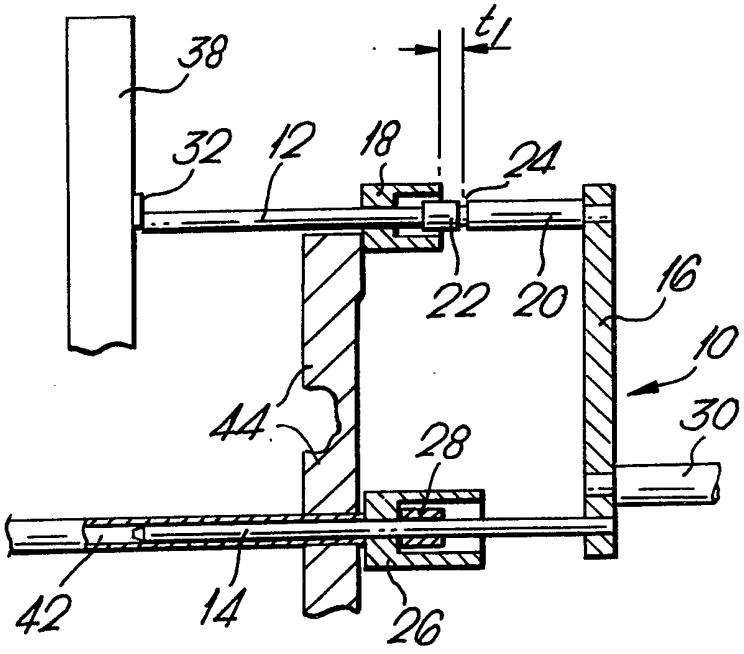

t1
38
32
12
18
24
22
20
16
10
30
44
28
42
14
26
42
14
26
28
30
t2
16
38
18
10
36
32
12

Fig. 5.


t1
38
32
12
18
24
22
20
16
10
30
44
28
42
14
26

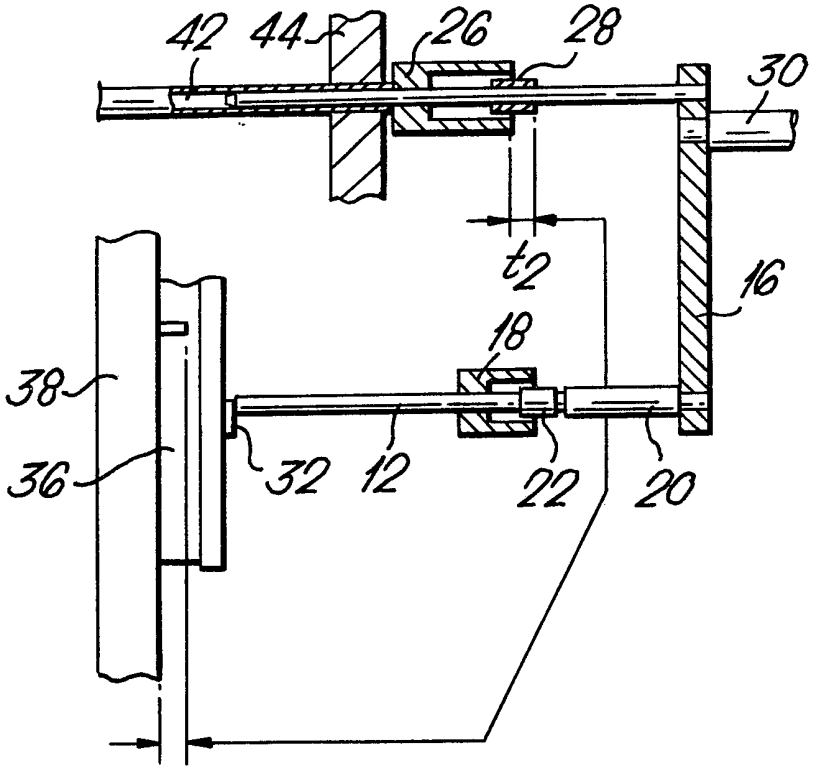

42
44
26
28
30
t2
16
18
38
36
32
12
22
20

Fig.6.

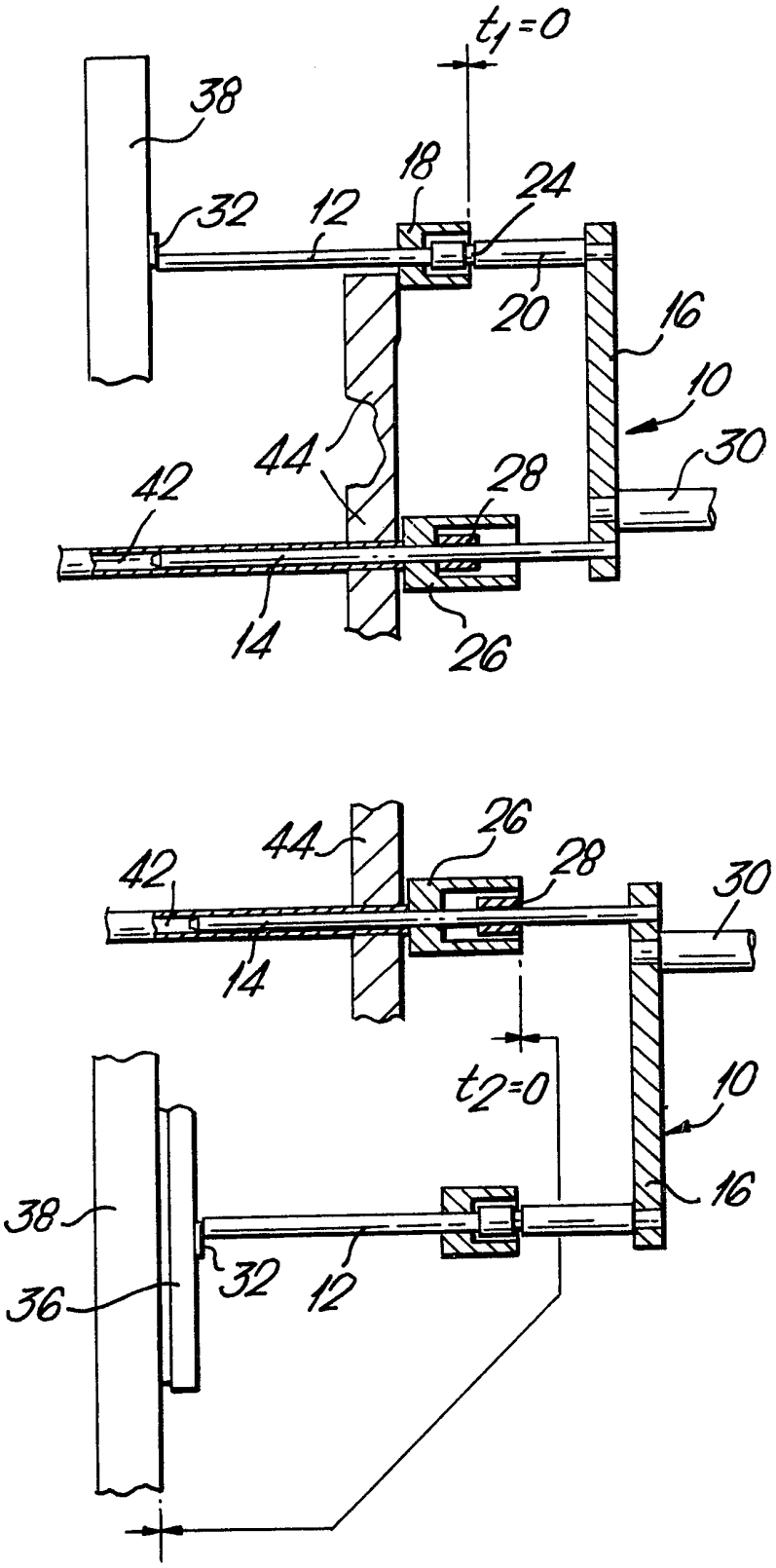

$t_1=0$
38
32
12
18
24
20
16
10
30
44
42
28
14
26
44
26
42
28
30
14
$t_2=0$
10
16
38
36
32
12

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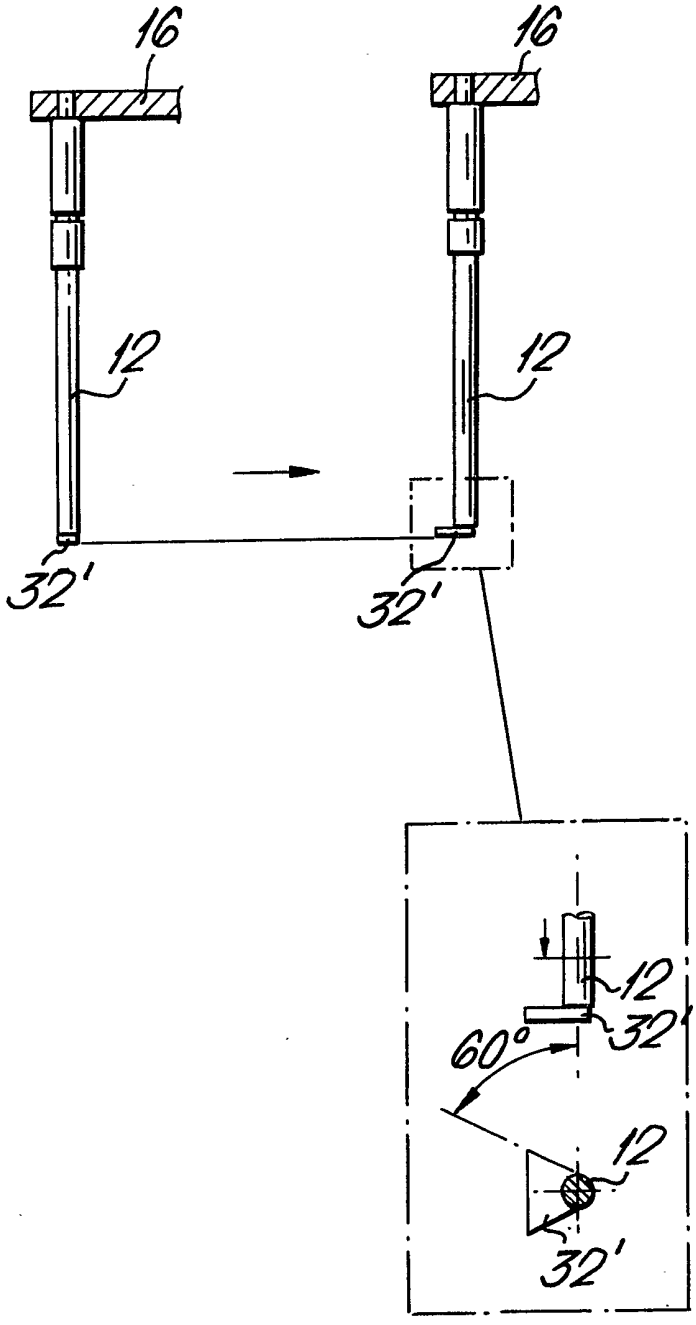
Fig. 7.



SPECIFICATION

Brake pad wear measuring tool

This invention relates to a brake pad wear measuring tool for the measurement of the degree of wear occurring in the brake pads of a disc brake assembly, and to a method of using such a brack pad wear measuring tool.

One type of conventional disc brake assembly for use in motor vehicles is the type in which opposed brake pads of friction material can be urged into contact with a brake disc directly coupled to a rotating wheel of the vehicle, the frictional engagement between the pads and the brake disc causing the rotating disc to slow down or stop. In such assemblies, wear of the brake pad material occurs to some degree during every application of the assembly to slow down or stop the brake disc, which wear causes a a reduction in thickness of the brake pads. Each of the brake pads is normally secured to a brake shoe by a suitable securing means such as clamping or riveting, and has a predetermined thickness when first mounted on the brake shoe. Under normal operating conditions, wear of the brake pads can be tolerated until their thickness decreases to a point at which the brake pads should be replaced to prevent damage occurring to the brake disc of the disc brake assembly. It is normal practice during servicing of motor vehicles fitted with disc brake assemblies to check the thickness of the brake pads in order to determine whether or not the brake pads shoud be replaced. This is commonly done by dismantling the brake assembly and then actually inspecting and measuring the thickness of the pads. Such a procedure is time consuming, and therefore expensive. Consequently, there is a need for devising some means for quickly and accurately measuring the thickness of the brake pads of a disc brake assembly without a requirement to remove the road wheel associated therewith and to dis-assemble the brake pad and brake shoes from the disc brake assembly.

A brake pad wear measuring tool according to the present invention, for the measurement of degree of wear in the brake pads of a disc brake assembly when in situ on a motor vehicle, comprises two measuring rods, each of which has one end thereof connected to a common support member so that the two measuring rods extend in the same direction, parallel to, and at a predetermined distance apart from, one another and at right angles to a longitudinal axis of the support member, one of said rods having mounted thereon, and in slidable frictional engagement therewith, an annular indicator member, and the other of said rods having mounted thereon, and in slidable frictional engagement therewith, two annular indicator members, both of said rods being provided with visible means of measurement of the degree of wear in said brake pads.

Preferably the two annular indicator members slidably mounted on the other of said rods comprise an annular cup-shaped member and an annular sleeve member nestable within said cup-shaped indicator member.

A preferred embodiment of the brake pad wear measuring tool according to the present invention is dimensioned specifically for use in determining the degree of wear of the brake pads in a disc brake assembly having the features disclosed in British Patent Specification Number 1 563 405 (General Motors France). In such a disc brake assembly, the brake shoes carrying the brake pads are suspended within an aperture in a caliper housing by means of hollow roll pins extending across said aperture and passing through respective bores in the brake shoes and the caliper housing. The preferred embodiment of the brake pad wear measuring tool for use with such a disc brake assembly when in situ on a motor vehicle has the measuring rod carrying the two annular indicator members of such a thickness as to be a sliding fit within the hollow roll pins of the disc brake assembly, and has the two measuring rods rigidly connected to the support member at a predetermined distance apart which allows the measuring rod carrying the two annular indicator members to be introduced into one of the hollow roll pins of the disc brake assembly so as to act as a pivot point for the tool, so that, whilst the brake pads are applied to the disc associated with the assembly, the measuring rod carrying the single annular indicator member can be swung between a first position in which the free end of the rod contacts one side of the disc adjacent the disc brake assembly and a second position in which the free end of the rod contacts a side of the brake shoe nearest the tool.

The preferred embodiment of the brake pad wear measuring tool according to the present invention is hereinafter particularly described with reference to the accompanying drawings, in which;

Figure 1 shows a view partly in section of the preferred embodiment of the brake pad wear measuring tool of the present invention, prior to the tool being used to carry out a measuring procedure upon a disc brake assembly;

Figure 2 is a similar view to Figure 1, showing the brake pad wear measuring tool of Figure 1 after such a measuring procedure has been carried out;

Figure 3 is a plan and elevational view of a disc brake assembly on which the brake pad wear measuring tool shown in Figure 1 is to be used;

Figure 4 shows a schematic view of the brake pad wear measuring tool of Figure 1 being used on a disc brake assembly as shown in Figure 3, where the brake pads of the assembly are unworn;

Figure 5 is a similar schematic view as shown in Figure 4, wherein the brake pads are partially worn;

Figure 6 shows a schematic view similar to Figure 4, in which the brake pads are worn to an extent requiring replacement; and

Figure 7 shows a modification to the structure

of the brake pad wear measuring tool shown in Figure 1.

Turning now to Figure 1 and 2 of the drawings, a brake pad wear measuring tool 10 comprises two measuring rods 12, 14, each of which has one end thereof connected to a common support member 16 so that the two measuring rods 12, 14 extend in the same direction, parallel to, and at a predetermined distance d_1 apart from, one another, and at right angles to a longitudinal axis A—A'. Measuring rod 12 has mounted thereon, and in slidable frictional engagement therewith, an annular indicator member 18, which takes the form of a cup-shaped member with the open end thereof facing the common support member 16, with the measuring rod 12 passing through the center of the base of the cup-shaped member 18. Cup-shaped member 18 is in frictional engagement with the surface of measuring rod 12, which means that cup-shaped member 18 can be moved manually from point to point along the measuring rod 12, but will not move from that position by itself. As can be seen in Figure 1, measuring rod 12 has a thickened portion 20, which carries an indicator zone 22. Indicator zone 22 is distinguished from the remainder of the thickened portion 20 by an annular indentation 24. The length of the indicator zone 22 is less than the depth of the cup-shaped portion of annular member 18.

Mounted upon measuring rod 14 is an annular cup-shaped member 26 having the open end of the cup facing the support member 16 and the measuring rod 14 passing through the center of the base of the annular member 26. Also mounted upon the measuring rod 14 is an annular sleeve 28 which is of diameter less than the diameter of the cup-shaped opening in annular cup-shaped member 26 and is of length less than the annular cup-shaped member 26. Both annular cup-shaped member 26 and annular sleeve 28 are in frictional engagement with measuring rod 14 so, like annular member 18, they can be moved manually from point to point along the measuring rod 14, but will not move by themselves on the rod. It will be realized that the size and shape of the annular sleeve 28 are such that the annular sleeve 28 can nest completely within the cup-shaped opening in annular cup-shaped member 26. The outer surface of annular sleeve 28 forms a second indicator zone. The brake pad wear measuring tool 10 is completed by a carrying handle 30 and a foot portion 32 on the end of measuring rod 12.

In Figure 1, the brake pad wear measuring tool 10 is in a prepared condition for use in which the annular cup-shaped members 18, 26 and the annular sleeve 28 are displaced manually towards the respective free ends of the measuring rods 12 and 14. The indicator zone 22 and the outer surface of annular sleeve 28 form visible means of measurement of the degrees of wear in the brake pads of a disc brake assembly on which the measuring tool 10 is to be used, the indicator zone 22 being used to monitor the degree of wear in one of the brake pads, and the outer surface of the annular sleeve 28 being used to monitor the wear in the other brake pad, in a manner which will be made clear hereinafter in the description.

Figure 2 shows the brake pad wear measuring tool of Figure 1 after the tool has been used in a measuring operation, and, as can be seen in Figure 2, the relative positions of the annular cup-shaped members 18, 26 and the annular sleeve 28 have changed from the positions they were in in Figure 1. The thickness of brake pad remaining on one of the brake pads of the disc brake assembly on which the measuring tool 10 has been used is shown by the distance t_1 on Figure 2, which distance is measured between the annular indentation 24 on rod 12 and the top of the annular cup-shaped member 18. Similarly, the thickness remaining of the other brake pad is shown by distance t_2, which is the distance between the upper edge of the annular sleeve 28 and the upper edge of the annular cup-shaped member 26.

Turning now to Figure 3 of the drawings, this shows a plan and elevational view of a disc brake assembly according to British Patent Specification Number 1 563 405, in which assembly two brake shoes 34 and 36 are suspended either side of a rotary brake disc 38 by means of hollow roll pins 40, 42 secured in opposed bores in a caliper housing 44 slidably mounted upon guide pins 46, 48. The brake shoes 34, 36 carry brake pads adjacent the sides of rotary brake disc 38, and can be inserted into position within the caliper housing 44 through an aperture 50 in the top of the housing. Associated with the disc brake assembly is a splash cover 52 which shields the rotary brake disc 38 from road dirt entrained by a wheel to which the disk brake assembly is attached. As can be seen in Figure 3 there is a gap between the edge of the caliper housing 44 and the cover 52 which is sufficiently wide to allow introduction therethrough of the measuring rod 12 of the measuring tool 10. This gap, represented by X on Figure 3, is one of the three measuring points on the brake assembly to which the measuring tool 10 is applied during the wear measuring operation for the disc brake assembly. The other two measuring points, Y, Z, are located respectively at the end of the roll pin 42 and at a point within the aperture 50 adjacent the other roll pin 40.

The method of operation of the measuring tool 10 will now be described with reference to Figure 4, in which the measuring tool 10 is being used to monitor the thickness of unworn brake pads in the disc brake assembly shown in Figure 3. To commence the measuring operation, a hydraulic circuit associated with the disc brake assembly is pressurised to apply the brake pads to the disc 38. The two annular cup-shaped members 18 and 26 and the annular sleeve 28 of the measuring tool 10 are then pushed into the position shown in Figure 1. The diameter of the measuring rod 14 is smaller than the diameter of the bore through the hollow roll pin 42 of the disc brake assembly

shown in Figure 3. Accordingly, it is possible to insert the free end of the measuring rod 14 into the bore in the hollow roll pin 42 and, holding the carrying handle 30 of the measuring tool 10 so as to keep the longitudinal axis A—A' of support member 16 substantially parallel to the end face of the caliper housing 44, and with the foot 32 of the measuring rod 12 within the gap X between the caliper housing 44 and the splash cover 52, it is possible to push the measuring tool 10 towards the caliper housing 44 until the foot 32 of measuring rod 12 contacts the side of the rotary brake disc 38. During this process, both the annular cup-shaped members 18 and 26 and the annular sleeve 28 are forced up their respective measuring rods 12, 14 by coming into contact with the relevant portions of the caliper housing 44 and the end of the roll pin 42. Once contact is made between the foot 32 and side of the rotary brake disc 38, it is possible to see immediately how much wear is remaining on the brake pad on brake shoe 34, since this is given by the distance t_1 between the annular indentation 24 on measuring rod 12 and the top of the annular cup-shaped member 18. This first measuring position is shown in the top section of Figure 4. The measuring tool 10 is then gradually moved away from the caliper housing 44, withdrawing the measuring rod 14 from the hollow roll pin 42 and the measuring rod 12 from the gap X, until the support member 16 can be swung about the measuring rod 14 to transfer the measuring rod 12 from position X to position Z, in which position the foot 32 of the measuring rod 12 is inserted in the aperture 50 behind the brake shoe 36. In this second position of the measuring tool 10, shown in the lower portion of Figure 4, the measuring tool 10 is pushed towards the brake caliper housing 44 until the foot 32 of measuring rod 12 contacts the back of brake shoe 36. In this position, holding the support member 16 substantially parallel to the end face of the caliper housing 44, the annular cup-shaped member 26 is pushed along the measuring rod 14 away from the support member 16 until the annular cup-shaped member 26 contacts the end of the hollow roll pin 42. In this position, the thickness of the brake pad remaining on brake shoe 36 is given by the distance t_2 between the end of the sleeve 28 closest to the support member 16 and the open end of the annular cup-shaped member 26.

It will be appreciated that it is possible to detect the amount of wear left in the brake pads of a disc brake assembly during the measuring process or, alternatively, the tool may be removed from the disc brake assembly after the measuring procedure has been carried out and the distances t_1 and t_2 then measured, provided that the relative positions of the annular cup-shaped members 18, 26 and the annular sleeve 28 are left undisturbed in this process.

Figure 5 illustrates exactly the same procedure as shown in Figure 4, when the measuring tool 10 is used to monitor the degree of wear in partly used brake pads of a disc brake assembly as shown in Figure 3. As can readily be seen in Figure 5, the distances t_1 and t_2 are reduced from those shown in Figure 4, the decrease in these distances being accommodated by portions of the indicator zone 22 and the annular sleeve 28, respectively, being obscured by the respective annular cup-shaped members 18 and 26. Similarly, Figure 6 shows the situation when the measuring tool is used to monitor the degree of wear in a disc brake assembly as shown in Figure 3 in which the brake pads are due for replacement. As can be seen in Figure 6, the distances t_1 and t_2 are effectively zero in both cases.

The indicator zone 22 and the outer surface of the sleeve 28 can be distinctively coloured in order to indicate visually the thickness of the respective brake pad remaining for use in a disc brake assembly. Alternatively, it is feasible to directly calibrate indicator zone 22 and the outer surface of sleeve 28 to give a direct reading of the thickness of the brake pad remaining for use. The modification of the measuring tool 10 shown in Figure 7 is one in which the foot 32 of the measuring rod 12 is pivotally connected to the end of measuring rod 12, so that it can be swung through a predetermined angle, such as 60°, in order to ensure adequate, accurate contact of the foot 32 with the back of the shoe 36 of the disc brake assembly shown in Figure 3.

The specific embodiment of the brake pad wear measuring tool of the present invention is one designed specifically for use with the disc brake assembly disclosed in and claimed in British Patent Specification Number 1 563 405. It will be appreciated, however, by a man skilled in the art that the measuring tool could readily be modified to monitor the degree of wear in the brake pads of disc brake assemblies of differing design. Thus, for example, if the disc brake assemblies to be checked were not of a design employing hollow roll pins to support the brake shoes, it would be possible to arrange for the connection of the measuring rod 14 to the support member 16 to be made a sliding one so that the accommodation in length of measuring rod 14 as the measuring tool 10 is moved from its first measuring position to its second measuring position can be accommodated by relative movement between the support member 16 and the measuring rod 14 rather than the corresponding movement between the caliper housing 44 and the measuring rod 14. Similarly, it would be possible to arrange for the support member 16 to be adjustable in length so that the predetermined distance apart of the two measuring rods could be adjusted to suit the distance apart of the measuring points X, Y, Z, of the disc brake assembly upon which the measuring tool is to be used.

The brake pad wear measuring tool of the present invention is a simple, effective tool for rapidly and effectively monitoring the degree of wear in the specific brake pads of a disc brake assembly without the need to remove the road

wheel associated therewith and to dis-assemble the disc brake assembly in order to remove the brake shoes carrying the brake pads from the assembly. The design of the tool, and the manner in which it is used, enables the thickness of each brake pad of the disc brake assembly to be determined accurately. Thus, for example, if one brake pad was wearing at a faster rate than the other brake pad, the measuring tool of the present invention could detect this discrepancy in wear and indicate immediately the brake pad undergoing the greater wear. The brake pad wear measuring tool of the present invention thus provides a means of quickly and effectively determining the degree of wear in the brake pads of a disc brake assembly in situ with a minimum of difficulty.

Claims

1. A brake pad wear measuring tool, for the measurement of degree of wear in the brake pads of a disc brake assembly when in situ on a motor vehicle, comprising two measuring rods, each of which has one end thereof connected to a common support member so that the two measuring rods extend in the same direction, parallel to, and at a predetermined distance apart from, one another, and at right angles to a longitudinal axis of the support member, one of said rods having mounted thereon, and in slidable frictional engagement therewith, an annular indicator member and the other of said rods having mounted thereon, and in slidable frictional engagement therewith, two annular indicator members, each of said rods being provided with a visible means of measurement of the degree of wear in a respective one of said brake pads.

2. A brake pad wear measuring tool according to claim 1, in which the two annular members slidably mounted on the other of said rods comprise an annular cup-shaped member and an annular sleeve member nestable within said cup-shaped indicator member.

3. A brake pad wear measuring tool according to claim 2, in which said one rod carries a distinctively coloured measuring zone and said annular sleeve member on said other rod has an outer surface thereof marked with a distinctively coloured measuring zone.

4. A brake pad wear measuring tool according to claim 2, in which said one rod carries a graduated measuring zone and said annular sleeve member on said other rod has an outer surface thereof marked with a graduated measuring zone.

5. A brake pad wear measuring tool according to any one of the preceding claims, in which the other end of said one measuring rod carries mounted thereon a foot portion.

6. A brake pad wear measuring tool according to claim 5, in which said foot portion is pivotally mounted upon the other end of said one measuring rod.

7. A brake pad wear measuring tool according to any one of the preceding claims, for use in measuring the degree of wear in the brake pads of a disc brake assembly wherein the brake pads are slidably supported on hollow roll pins, in which said other rod is of such a thickness as to be a sliding fit within a resepctive one of the hollow roll pins supporting the brake pads of said disc brake assembly.

8. A brake pad wear measuring tool substantially as hereinbefore particularly described and as shown in Figures 1 to 6 of the accompanying drawings.

9. A brake pad wear measuring tool substantially as hereinbefore particularly described and as shown in Figures 1 to 6, as modified by Figure 7, of the accompanying drawings.

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