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(54) **Vehicle brakes**

(57) A combined disc and drum brake 1 for a light commercial vehicle comprises a disc portion (9) formed integrally with a drum portion (10) and a caliper member (17) which spans the inner periphery (13) of the disc portion and is slidably mounted by pins (18) on a carrier (14) which in turn is bolted to a flange (15) welded to the vehicle axle casing. Brake shoe(s) (29, 30) are provided for engaging the drum portion (10) and react against a surface (34) provided (on a boss 35) on carrier (14). As a result, no substantial loadings are applied to the back plate (41) which can thus be made of e.g. plastics material. Apertures (24, 25) in a support (6) and drum (10) facilitate radial removal of the brake pads (21, 22). The drum brake is used for parking—the shoes (29, 30) are moved by levers (37, 38) actuated by cable (39).

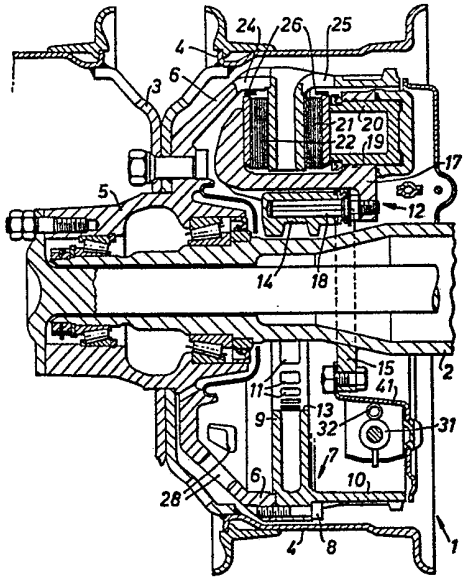

Fig. 2.

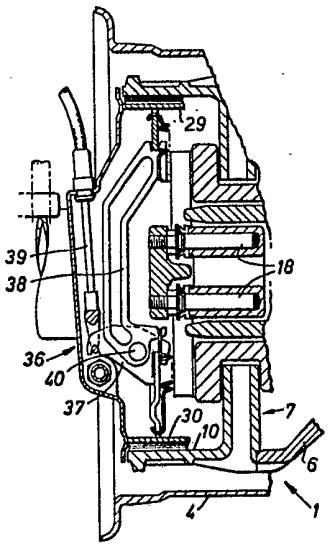

Fig. 4.

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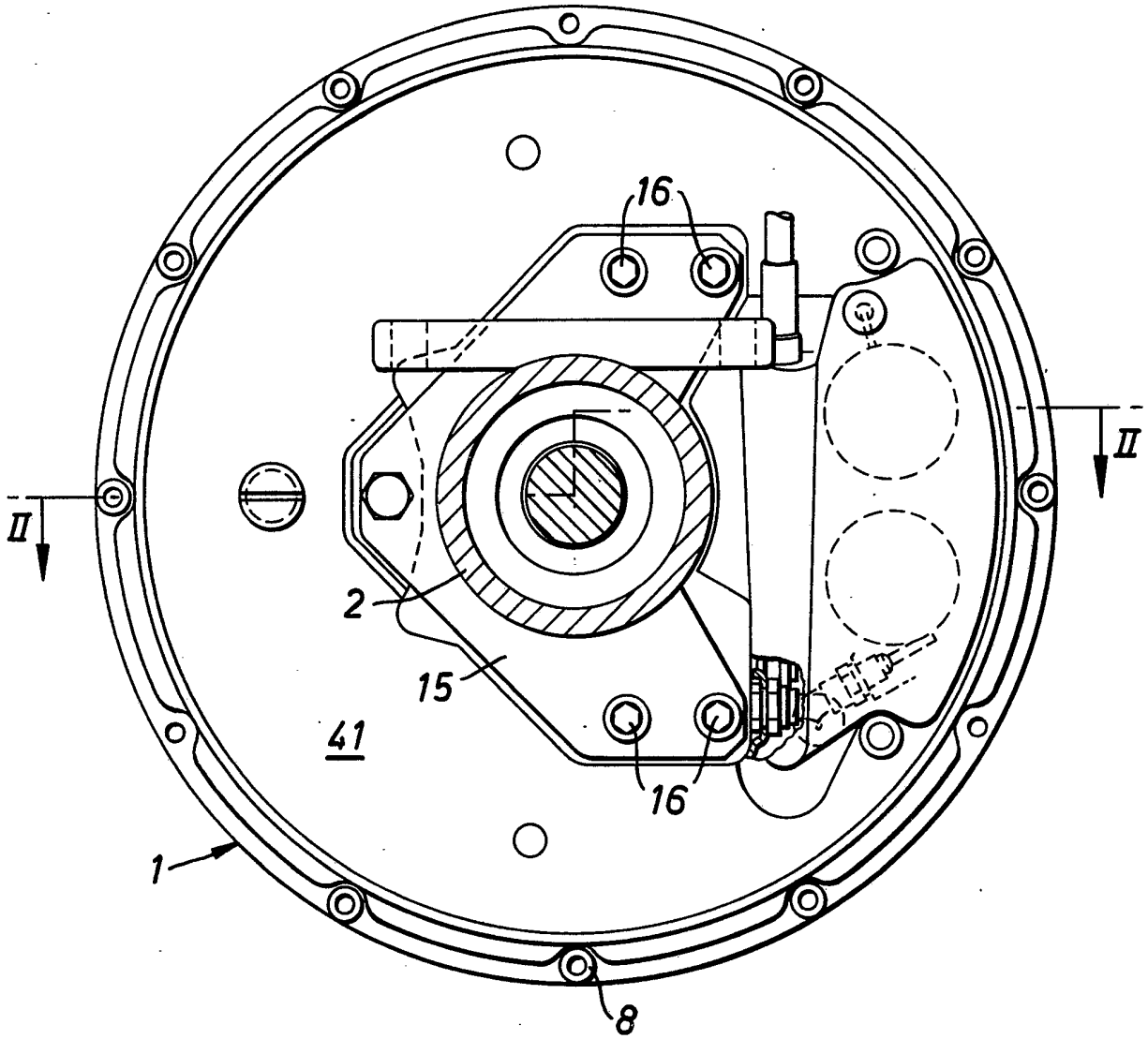

FIG. 1.

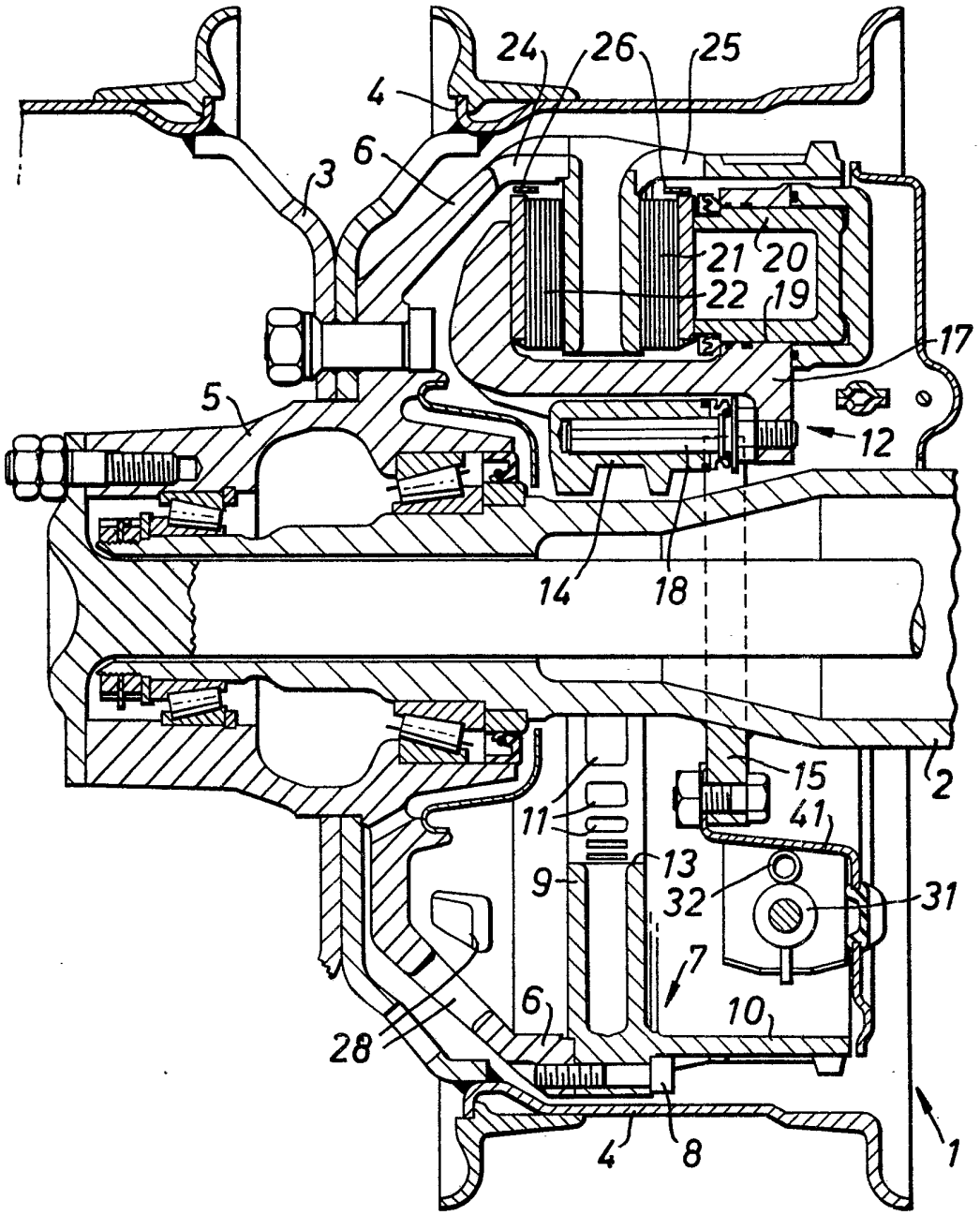

FIG. 2.

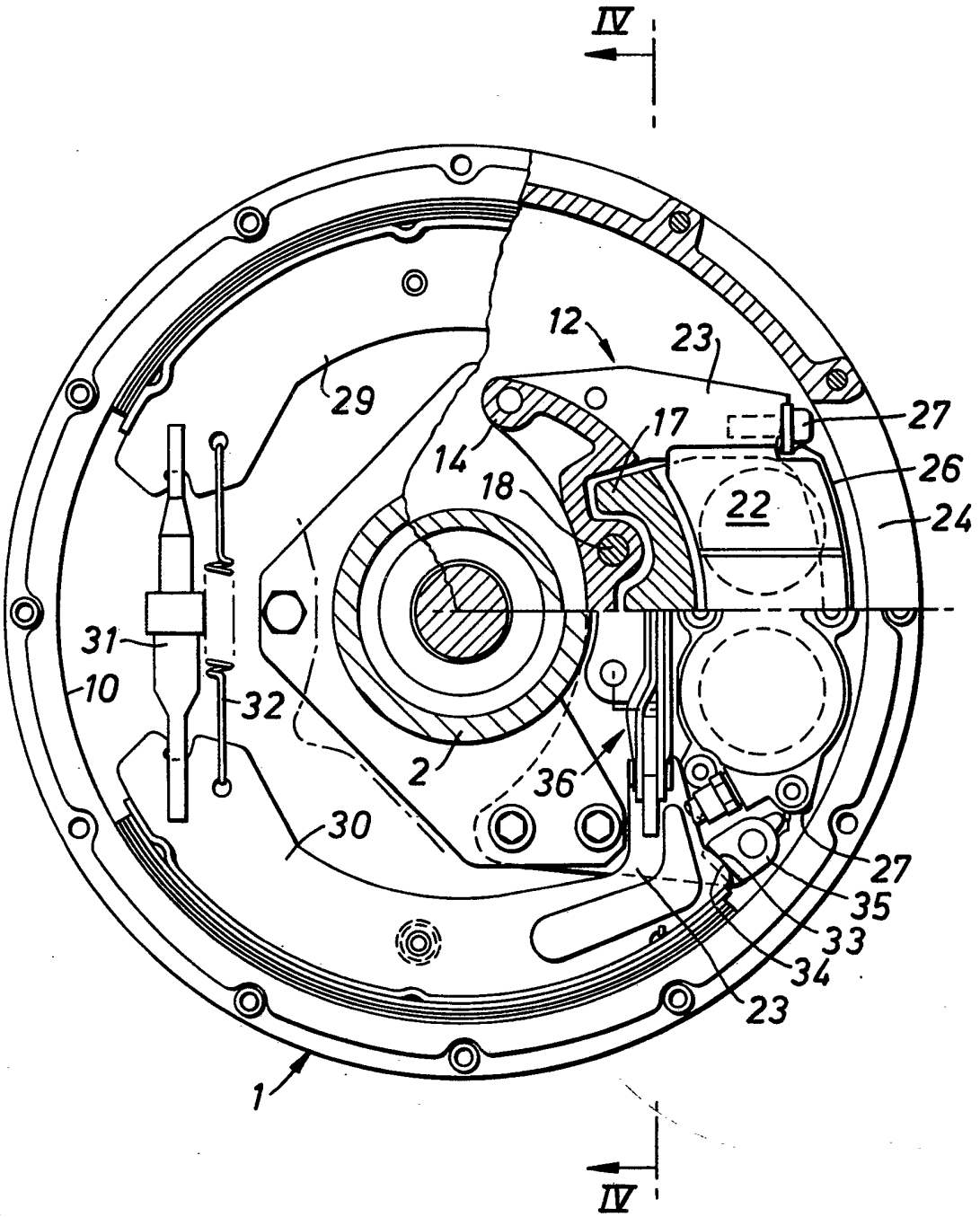

FIG. 3.

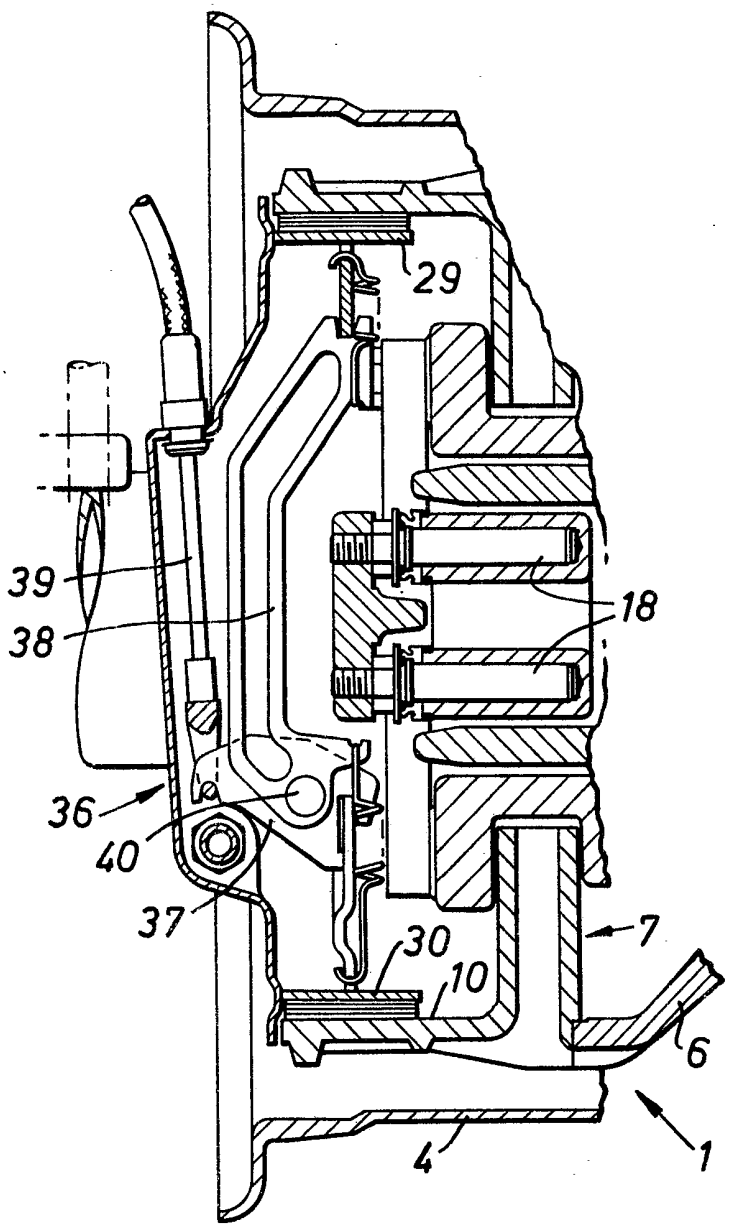

FIG. 4.

SPECIFICATION

Vehicle brakes

This invention relates to vehicle brakes, and in particular to a vehicle disc brake.

Whilst there are well recognised advantages to the use of disc brakes rather than drum brakes for motor vehicles, previously proposed disc brakes are not wholly satisfactory for use on commercial vehicles.

Commercial vehicles which are normally regarded as "light commercial vehicles" e.g. vans, may have a substantial laiden weight and yet have a relatively small amount of space available for braking equipment, especially if double wheels are used on the rear axle of the vehicle. the provision of double wheels tends to limit the outside diameter of the braking equipment provided on the axle to the space available within the confines of the rim of the wheel. With conventional disc brakes where a portion of the caliper spans the external periphery of a brake disc, this limited space means that a brake disc of small diameter must be used. With such a brake disc it is difficult to obtain satisfactory braking moment because of the small effective radius at which the pads engage the disc.

A further disadvantage to the use of disc brakes on commercial vehicles is that it is difficult to provide a mechanical actuation arrangement which can be used as a parking and emergency brake. The problem arises from the fact that in order to obtain an adequate force applying the pads to the disc it is necessary to use some form of externally powered servo unit, e.g. a vacuum servo unit. Whilst the use of a servo unit is satisfactory for ordinary braking, the servo unit cannot be used to assist a parking brake since the parking brake must be effective even when no servo power is available. Further, if the parking brake is to serve as an emergency brake for use in the event of total failure of the main service brakes, it must be independent of the operation of the servo.

According to one feature of the present invention there is provided a vehicle combined disc and drum brake comprising: an annular brake disc secured at its outer periphery to a support carried by a wheel hub; a brake caliper assembly comprising a torque taking carrier member which in use is secured to a fixed part of the vehicle, a caliper member spanning the inner periphery of the disc and a brake pad on each side of the disc; an internal brake drum brake having an internal diameter substantially equal to the maximum diameter of the brake disc; and at least one brake shoe for engaging the brake drum, the brake shoe having a reaction surface which abuts a reaction surface of the brake caliper assembly whereby torque forces imposed on the brake shoe in use are transferred to the brake caliper assembly.

The disc brake arrangement enables the maximum effective disc diameter to be employed within the confines of a restricted overall external diameter for the braking equipment. This is achieved by positioning the brake caliper straddling the inner periphery of the disc, rather than the outer periphery of the disc as in a conventional disc brake arrangement. The disc can, accordingly, extend outwardly to adjacent the radially outermost part of the brake assembly. The disc brake can be used for normal service braking, assisted by the use of a servo unit in conventional manner. The brake drum provides a parking and emergency brake having the maximum effective diameter within the limits of the overall diameter of the braking equipment. By positioning the or each brake shoe in engagement with a reaction surface on the caliper assembly the torque forces imposed on the brake shoe in use are transferred to the caliper assembly which can be designed to withstand such torque forces. Any suitable operating mechanism can be used to facilitate the application of the brakeshoes against the brake drum by means of a parking brake lever. The drum brake is preferably self-servo so that the operating mechanism is only required to produce of relatively small force. The mechanically operated parking brake is completely independent of the disc brake system, and accordingly can be used as an emergency brake.

According to another feature of the present invention there is provided a vehicle combined disc and drum brake comprising an annular brake disc secured at its outer periphery to a support carried by a wheel hub; an internal brake drum secured to the brake disc adjacent the outer periphery of the brake disc; a caliper assembly for applying a pair of brake pads against opposite sides of the disc; and at least one brake shoe for engaging the brake drum.

A substantial mass and surface area of metal secured to the outer periphery of the disc is provided by the support and the brake drum, and this assists in the dissipation of heat generated during disc braking. Further, because this mass of metal is spaced a considerable distance from the axis of rotation of the brake disc, it has a high peripheral velocity and is effectively cooled by the surrounding air. Even if the temperature of this mass of metal does become high this will not result in excessive heating of the wheel hub since it is spaced from the wheel hub.

In a preferred embodiment the brake disc is formed integrally with the brake drum and is detachably secured to the support. This arrangement has the advantage that the metal friction surfaces of the brake i.e. the disc surface and the drum surface are both formed on a single integral member. All the fine machining associated with friction surfaces can be carried out on this single integral member, and the support can accordingly be manufactured to less exacting tolerances. Further, this arrangement provides the maximum heat transfer from the disc to the drum.

Preferably the caliper assembly is secured to a flange provided on the axle casing of the wheel having the brake assembly. Torque forces induced in the caliper during braking are transferred via the

flange to the axial casing, and torque forces induced on the shoes during use of the parking brake are similarly transferred to the flange via the caliper assembly. With such an arrangement a back-plate can be provided on the brake assembly which has substantially no load-bearing function and serves merely to exclude dirt from the brake. Such a back-plate can be manufactured of thin gauge metal or plastics material in a relatively cheap manner. When such a back-plate is provided all the components of the brake assembly can be located within the brake, isolated from road dirt and protected from possible damage by stones, etc.

Preferably suitable apertures are provided in the support and in the brake drum to enable the brake pads to be withdrawn radially outwardly from the caliper assembly after the road wheel or wheels have been removed from the hub.

The above and further features and advantages of the invention will become clear from the following description of a preferred embodiment thereof, given by way of example only, reference being had to the accompanying drawings, wherein:

Figure 1 is a rear view of a combined disc and drum brake assembly, i.e. a view taken from the centre of the vehicle looking outwards;

Figure 2 is a section on the line II—II of Figure 1;

Figure 3 is a view corresponding to Figure 1 with certain parts broken away; and

Figure 4 is a section on the line IV—IV of Figure 3.

Referring to the drawings a combined disc and drum brake 1 suitable for use on a light commercial vehicle is illustrated. The brake 1 is in fact provided on the rear axle 2 of the vehicle, which axle carries double road wheels 3, 4 at each end. It will be appreciated that the maximum diameter available for the braking equipment of the axle is limited by the space within the wheel 4.

The rear axle 2 is provided with a hub 5 to which the wheels 3, 4 are secured in conventional manner. The hub 5 includes an integrally formed support 6 which extends radially outwardly from the axis of the axle and to which is secured a combined brake disc and drum 7 by means of suitable bolts 8. The combined disc and drum 7 includes an annular disc portion 9 which extends radially inwardly from the bolts 8, and a drum portion 10 which extends axially towards the centre of the vehicle from the region of the radially outer periphery of the disc portion 9. The disc portion 9 is formed with ventilating apertures 11 in conventional manner.

Housed substantially within the generally cup-shaped enclosure formed by the support 6 and the drum portion 10 is a brake caliper assembly 12 which spans or straddles the inner periphery 13 of the disc portion 9.

The caliper assembly 12 comprises a carrier 14 which is rigidly secured to a flange 15 welded to the casing of axle 2 by means of bolts 16. A caliper member 17 is slidably mounted on the carrier 14 by means of pins 18. The caliper member 17 defines a cylinder 19 in which is slidably mounted a piston 20 which is in direct engagement with a first brake pad 21. Introduction of hydraulic fluid under pressure into the cylinder 19 causes displacement of the piston 20 to bring the pad 21 into contact with the adjacent face of disc portion 9. The reaction force produced by this contact causes the caliper member 17 and pins 18 to slide on carrier 14 thereby bringing a second brake pad 22 into contact with the other side of the disc. Torque forces induced on the brake pads during breaking are transmitted to arms 23 integral with the carrier 14. It will be appreciated by those skilled in the art that the caliper assembly 12 is similar to a conventional design of pin-sliding caliper used in conventional disc brakes in which the caliper assembly straddles the external periphery of a brake disc.

It will be further appreciated that the effective diameter of the disc portion 9 is larger than the diameter of a disc which could be provided if a similar caliper assembly was provided straddling the outer periphery of a disc disposed within the wheel 4.

In order to permit servicing of the pads 21, 22 apertures 24 and 25 are provided respectively in the support 6 and drum portion 10. Each aperture 24, 25 is large enough to enable a respective pad 21, 22 to be withdrawn radially outwardly through the aperture after retaining spring 26 has been removed by releasing screws 27 from arms 23. Although the apertures 24, 25 are shown schematically in the drawings as being circumferentially overlapping, they are in practice preferably circumferentially spaced apart. Further, although only one aperture 24 is shown in the support 6 and only one aperture 25 is shown in the drum portion 10, preferably a plurality of apertures are provided in both the support 6 and the drum portion 10. For example, in a preferred embodiment, two apertures 25 are provided in the drum portion 10 spaced apart by 180°, and two apertures 24 are provided in the support 6, again spaced apart by 180° and 90° out of phase with the drum portion apertures 25. Such an arrangement provides effective ventilation of the space within the drum and enables the drum to be secured to the support by means of bolts in the four regions around the periphery of the drum portion where there are no apertures 24 or 25. Further ventilation is provided by cut-outs 28 provided in the support 6.

In use, normal vehicle braking is carried out using the disc portion 9 and caliper assembly 12 by supplying hydraulic fluid under pressure to the caliper assembly in conventional manner.

Referring now to Figures 3 and 4, two brake shoes 29, 30 are provided for engaging the drum portion 10 of the combined disc and drum 7. One end of each shoe 29, 30 abuts an adjuster 31 having a retaining and hold-off spring 32. The oher end of each shoe is formed with a reaction surface 33 in sliding contact with a further reaction

surface 34 machined on a boss 35 provided on the carrier 14 of the caliper assembly 12. Additionally, the brake shoes 29, 30 are provided with an operating mechanism 36 comprising two pivoted levers 37, 38. The end of brake cable 39 is connected to the lever 37 such that when tension is applied to the cable 39 the lever 37 pivots about axis 40 to apply the brake shoe 30 against the drum portion 10. During this application of the brake shoe 30 the axis 40 moves upwardly slightly (as viewed in Figure 4) and this upward movement is transmitted by lever 38 to the upper shoe 29, thereby applying the other shoe against the drum portion 10. Torque forces induced in the shoes 29, 30 due, for example, to the vehicle being parked on a gradient or to the parking brake being applied whilst the vehicle is still moving are transmitted to one of the bosses 35 formed on the carrier member. Because the carrier member is of necessity a substantial construction and rigidly secured to the axle casing, such torque forces can readily be accommodated and transferred directly to the axle casing.

It will be noted that the drum portion 10 is located adjacent the outer periphery of the disc 9 and is accordingly of substantial diameter. The provision of a drum having a diameter substantially equal to the maximum diameter of the disc is facilitated by the use of the bosses 35 on the carrier member to carry the torque loads induced in the shoes 29 and 30.

A back plate 41 is secured to the flange 15 by means of suitable fasteners and substantially closes the enclosure formed by the support 6 and drum portion 10. It will be appreciated then that the disc portion 10 and caliper assembly 12, together with the shoes 29, 30 and associated operating mechanism 36 are enclosed with in the cavity defined by the support 6, drum portion 10, back plate 41, and axle housing, and are thus protected from damage by stones etc. and direct contamination by road dirt, water, etc.

It will be noted that with the above described arrangement in addition to providing a large effective diameter for the disc brake, the disc portion 9 is located at an optimum position in the air flow within the wheel configuration. Further, the fact that the disc portion 9 is formed integrally with the drum portion 10 and is secured to the relatively heavy support 6 means that the disc 9 is rigidly braced and can be constructed in a relatively light, ventilated form. Further, the disc friction surface and the drum friction surface are both formed on the integral member 7, and accordingly relatively little machining is required on the support 6.

CLAIMS

1. A vehicle combined disc and drum brake comprising: an annular brake disc secured at its outer periphery to a support carried by a wheel hub; a brake caliper assembly comprising a torque taking carrier member which in use is secured to a fixed part of the vehicle, a caliper member spanning the inner periphery of the disc and a brake pad on each side of the disc; an internal brake drum secured to the brake disc, the drum brake having an internal diameter substantially equal to the maximum diameter of the brake disc; and at least one break shoe for engaging the brake drum, the brake shoe having a reaction surface which abuts a reaction surface of the brake caliper assembly whereby torque forces imposed on the brake caliper assembly whereby torque forces imposed on the brake shoe in use are transferred to the brake caliper assembly.

2. A vehicle brake according to claim 1 wherein the brake drum and the brake disc are an integral unit, and the integral unit is releasably secured to the support at the outer periphery of the integral unit.

3. A vehicle brake according to claim 1 or claim 2 wherein the support and the brake drum are provided with apertures, the apertures being sized to permit inspection of the brake pads and removal of the brake pads radially outwardly therethrough.

4. A vehicle brake according to claim 3 wherein a plurality of equi-angularly spaced apart apertures are provided in the support, and a plurality of equi-angularly spaced apart apertures are provided in the brake drum, the apertures in the brake drum being angularly displaced relative to the apertures in the support.

5. A vehicle brake according to any preceding claim wherein the disc is provided with radially extending ventilating passages.

6. A vehicle brake according to any preceding claim wherein the reaction surface of the brake caliper assembly comprises a surface on the carrier member.

7. A vehicle brake according to any preceding claim including mounting means for mounting the carrier member on a flange secured to the axle casing of a vehicle.

8. A vehicle brake according to any preceding claim including a back plate which together with the support and brake drum forms an enclosure in which is housed the caliper assembly, and the or each brake shoe, and an operating linkage for operating the or each brake shoe.

9. A vehicle brake according to claim 8 wherein the back plate provides an anchorage for the outer sheath of a brake shoe operating cable but performs no other loading bearing function.

10. A vehicle brake according to claim 8 or claim 9 wherein the back plate is made of plastics material.

11. A vehicle combined disc and drum brake, substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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