

Sept. 26, 1933.

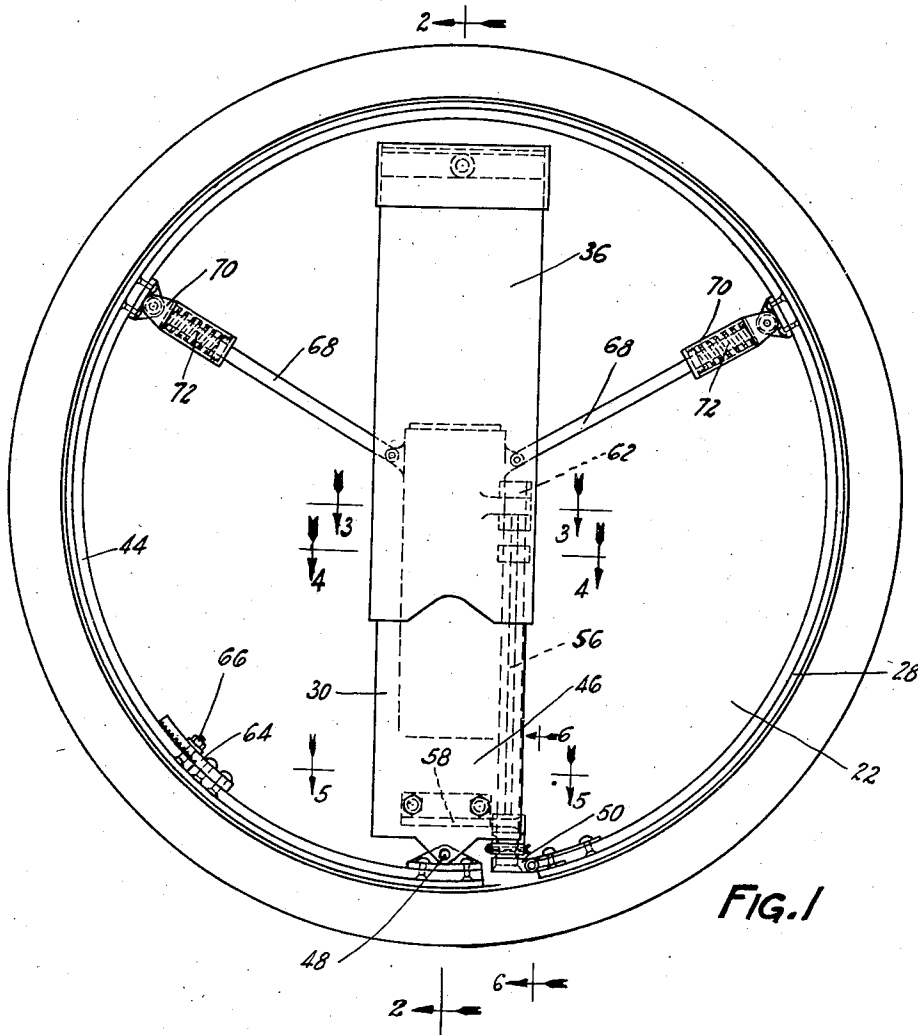
I. M. LADDON

1,928,061

WHEEL

Filed Nov. 21, 1927

7 Sheets-Sheet 1



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7 Sheets-Sheet 2

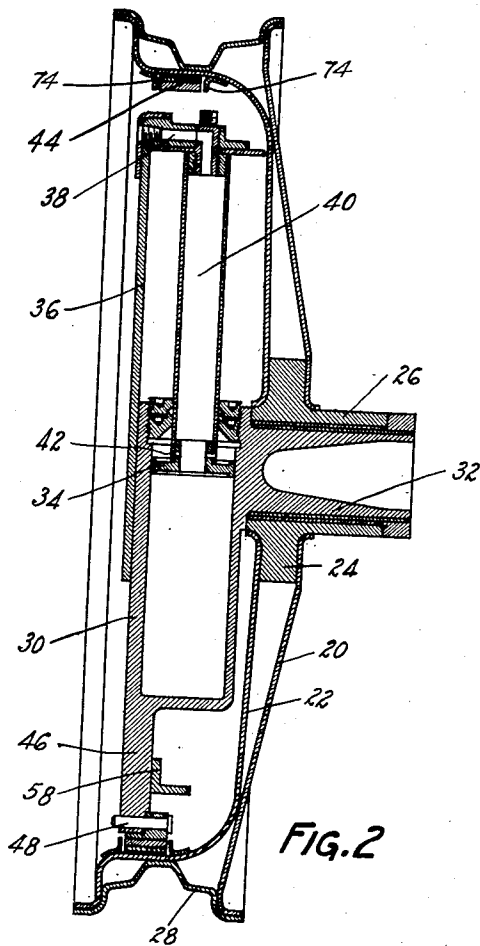


FIG. 2

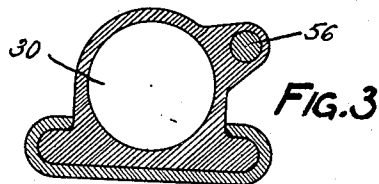


FIG. 3

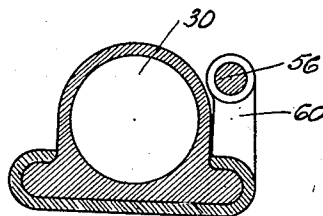


FIG. 4

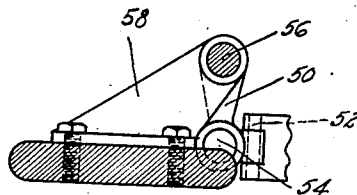


FIG. 5

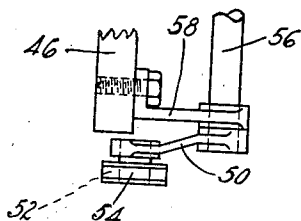


FIG. 6

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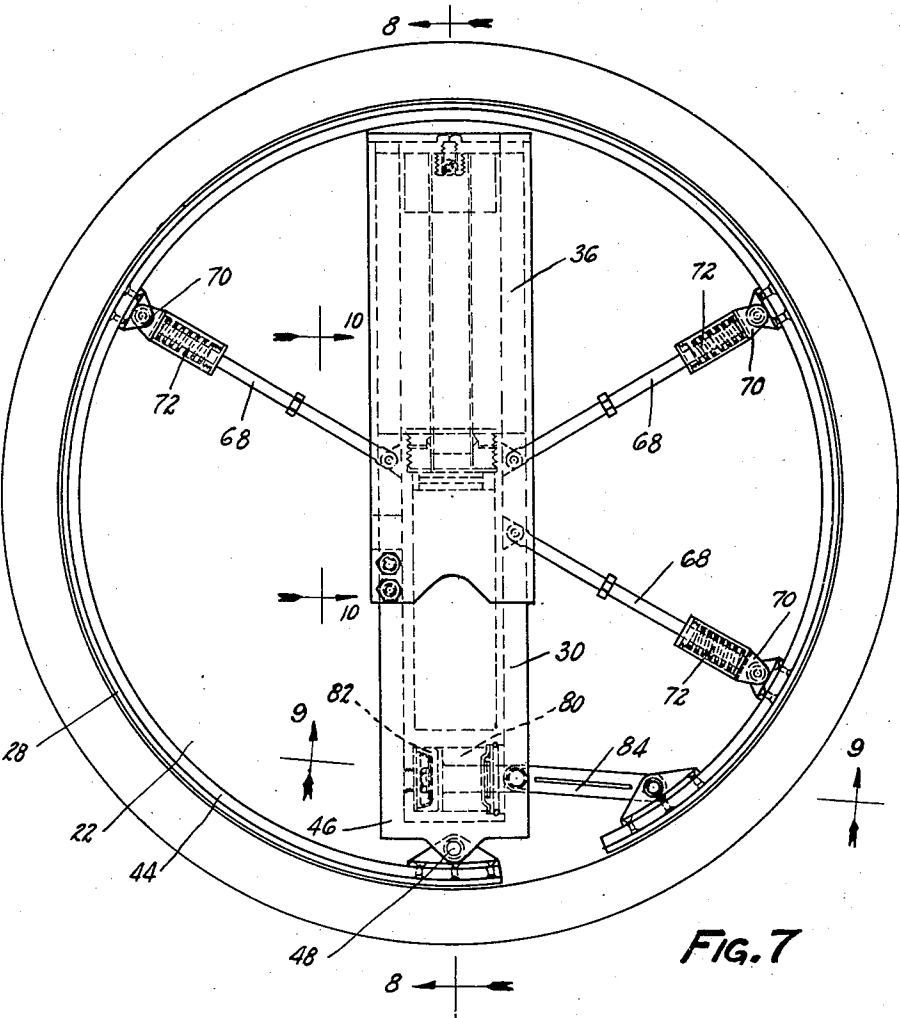
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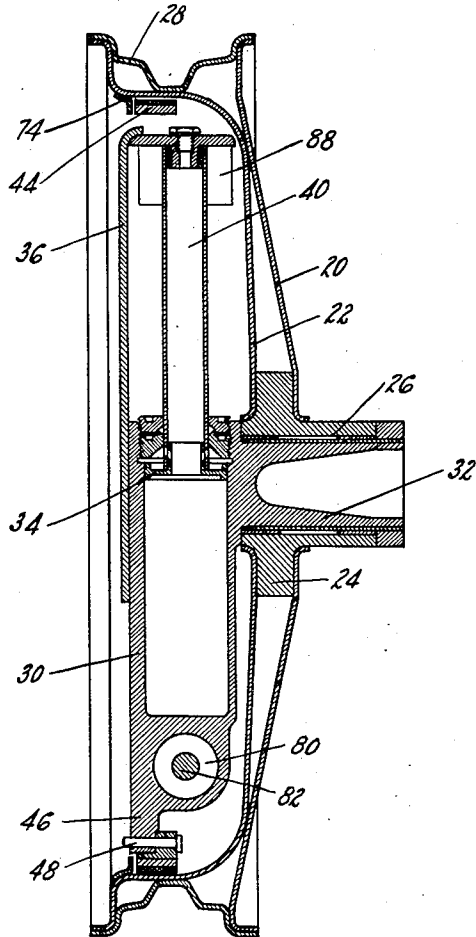


FIG. 8

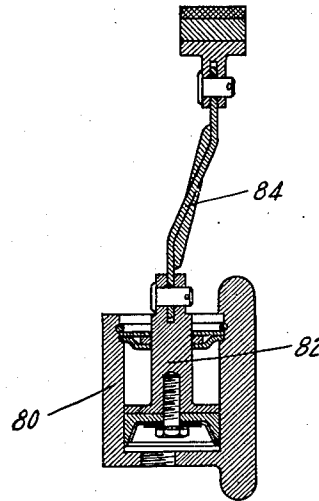


FIG. 9

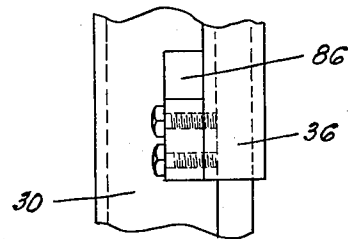


FIG. 10

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Filed Nov. 21, 1927

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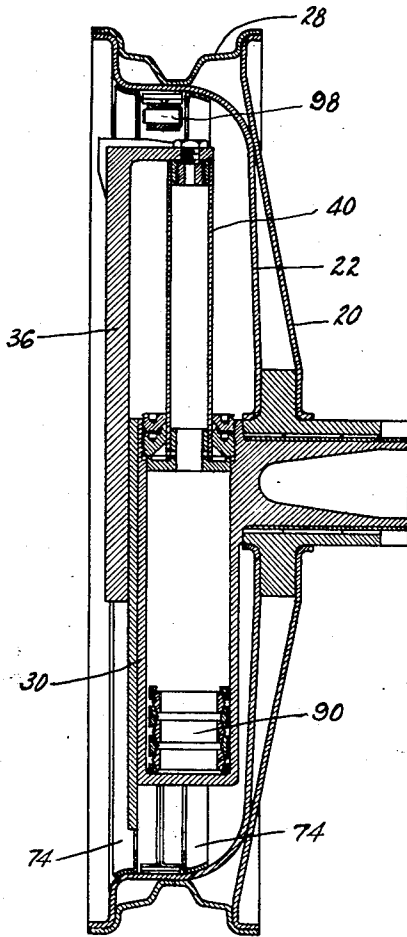


FIG. 12

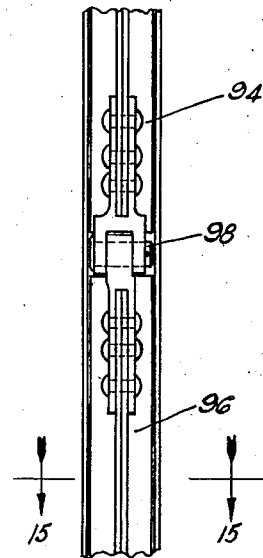


FIG. 13

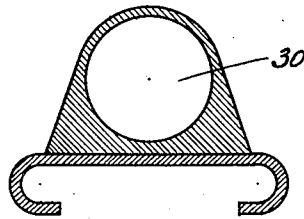


FIG. 14

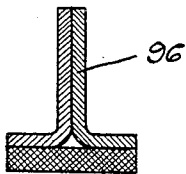


FIG. 15

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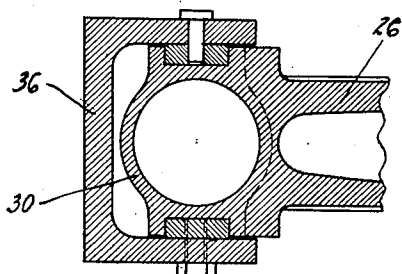
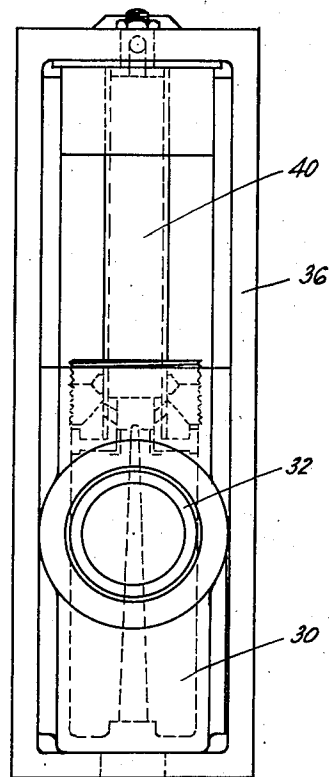
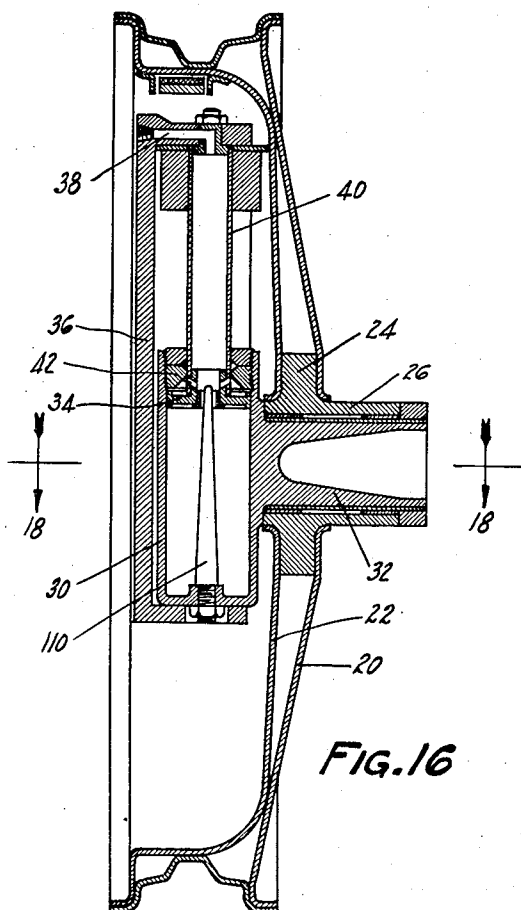
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UNITED STATES PATENT OFFICE

1,928,061

WHEEL

Isaac M. Laddon, Dayton, Ohio, assignor to Bendix Brake Company, South Bend, Ind., a corporation of Illinois

Application November 21, 1927
Serial No. 234,616

4 Claims. (Cl. 188—78)

This invention relates to wheels, and is illustrated as embodied in part of the landing gear of an airplane, which landing gear includes a wheel having a novel brake and shock absorbing structure.

An object of the invention is to provide the wheel with means for absorbing the shock of landing, preferably housed within the outline of the wheel to give a streamline effect, and which wheel is provided with a brake including a friction device encircling the shock-absorbing means and which is expansible against an outer cylindrical braking surface carried by the wheel. Thus the parts are all nested within one another, both brake and shock-absorbing means being arranged within the wheel outline.

Various other features of novelty relate to structural improvements in the brake, especially those adapting it for use on an aeroplane wheel, and including a novel wear adjustment, an improved fluid-power operating means, a new arrangement of links or the like to control the expansion of the brake, and other desirable particular constructions which will be apparent from the following description of several illustrative embodiments shown in the accompanying drawings, in which:

Figure 1 is a side elevation, looking from the inner side, of one wheel of an aeroplane and of the associated parts of the landing gear;

Figure 2 is a vertical section through the parts of Figure 1, on the line 2—2 of Figure 1;

Figures 3, 4, and 5 are sections through the shock-absorbing means, taken respectively on the lines 3—3, 4—4, and 5—5 of Figure 2;

Figure 6 is a partial elevation, looking in the direction of the arrows 6—6 in Figure 2;

Figure 7 is an elevation corresponding to Figure 1, but showing a modification;

Figure 8 is a vertical section through the modification of Figure 7, on the line 8—8 of Figure 7;

Figure 9 is a section through the hydraulic brake-operating mechanism, on the line 9—9 of Figure 7;

Figure 10 is a partial elevation of the inter-engaging parts of shock-absorbing means, looking in the direction of the arrows 10—10 of Figure 7;

Figure 11 is an elevation, corresponding to Figure 1, of another modification;

Figure 12 is a vertical section through this modification, on the line 12—12 of Figure 11;

Figure 13 is an inside or bottom plan view of the connected ends of the shoes making up the

brake friction means of Figure 11, looking in the direction of the arrows 13—13 of Figure 11;

Figure 14 is a section through part of the shock-absorbing means of this modification, on the line 14—14 of Figure 11;

Figure 15 is a section through one of the brake shoes of Figures 11 and 13, on the line 15—15 of Figure 13;

Figure 16 is a vertical section corresponding to Figure 2, but showing a modification of the shock-absorbing means;

Figure 17 is an elevation of the inner face of the shock-absorbing means of Figure 16; and

Figure 18 is a partial section through the shock-absorbing means, on the line 18—18 of Figure 16.

In the arrangement of Figures 1—6, the wheel comprises an outer disk 20 and an inner disk 22, secured to opposite sides of a flange 24 formed on a hub 26, and secured at their outer edges to the sides of a rim 28. Disk 22 is dished, so that substantially the entire space within the wheel is unobstructed, and in the form here illustrated the disk engages the bottom of rim 28, which is of the drop-center type. Thus the inner face of disk 22, near its outer edge, is internally-cylindrical and serves to provide a braking surface.

Within the dished disk 22 is arranged novel shock-absorbing means, preferably of the hydraulic type, and which absorbs the vertical shock when the aeroplane lands. This means includes a cylinder 30, shown as an integral extension of a spindle 32 on which the hub is mounted. A piston 34 within the cylinder is connected to a slide 36 secured to the aeroplane proper in any desired manner. Cylinder 30 is filled, through a passage 38 and through a hollow piston rod 40, with oil or other liquid which is forced, in landing the aeroplane, from below to above piston 34 through openings 42.

An important feature of the invention relates to the arrangement of a brake friction device for engagement with the braking surface of disk 22, in such a manner as to encircle the above-described shock-absorbing means without interfering with it. I prefer to use a somewhat flexible band 44, anchored on a flange 46 of the cylinder 30 by a pivot 48.

Band 44 is operatively connected at its other end to a thrust link 50, pivoted at one end to the band by a pivot 52 extending crosswise of the band, and carried by a pin 54 mounted in the end of the link 50. The other end of the link 50 is pivotally mounted on the lower end of a plunger 56, in such a manner that it can swing about the axis of the plunger.

Plunger 56 is guided for lengthwise movement in a bracket 58 secured to the flange 46, and in one or more guides 60 secured to or formed in the material of the cylinder 30. The upper end of plunger 56 forms a piston fitting in a small hydraulic cylinder 62 (Figure 1) connected by a suitable flexible conduit (not shown) to an operating cylinder and piston adjacent the pilot's seat.

In order to permit adjustment of the brake, the band 44 is made in two or more sections, a toothed clamp plate 64 riveted to the end of one section being clamped by a bolt or the like 66 to the end of the adjacent section. Links 68 pivoted to cylinder 30 serve to control the expansion and contraction of the band. Each link is shown with a head co-operating with a fitting 70 pivoted to the band 44, to confine between them a coil spring 72 which urges the band away from the brake drum surface on disk 22. Stampings 74 may be secured to disk 22 on opposite sides of band 44 to aid in housing it and to protect it.

The shock absorber as shown is intended to function as the sole shock absorbing device, not requiring any other supporting springs although of course, the tires on the wheels cooperate with the oleo shock absorber. After the oleo shock absorber has taken the relatively large shock of landing, either the ring spring (shown on Figure 12 at 90) or the rubber blocks (shown on Figure 16 at the top of the piston tube) will serve to provide the necessary resiliency for taxiing. The utilization of the shock absorber as a supporting spring for the airplane is considered preferable by me. However, if desired other types of springs could also be provided to give additional support.

The construction of Figures 7—10 differs from that described above, in that there are three links 68 instead of two, and there is a horizontal hydraulic cylinder 80 formed in the flange 46, and containing a piston 82 connected by a link or connecting rod 84 to the end of band 44. Figure 10 shows a detail of the shock-absorbing means in the attachment of a block 86 forming part of the slide on the lower end of part 36 which embraces the sides of the cylinder 30. As shown in dotted lines, a block 88 of rubber may be arranged to transmit the load to the wheel when piston 34 reaches its lowermost position,—i. e., when the aeroplane is on the ground.

In Figures 11—15, the load is taken when on the ground by a spring 90 in the cylinder 30, and coil springs 92 replace the links 68. The band 44 is replaced by two shoes 94 and 96, connected by a floating pivot 98. Shoe 94 is anchored to cylinder 30 by a pivot 100, and shoe 96 is operatively connected by a link or connecting rod 102 with a piston 104 in a cylinder 106 detachably bolted to the cylinder 30. Each shoe may be formed, as illustrated in Figure

15, of two L-section steel or duraluminum stampings riveted or otherwise secured back to back to form a T-section shoe, to which the lining is riveted or otherwise secured.

As shown in Figures 16—18, the hydraulic shock-absorbing means may include a tapered plunger 110, carried by the cylinder 30 and extending into a central opening in piston 34, and serving gradually to throttle the flow of liquid.

While several illustrative embodiments have been described in detail, it is not my intention to limit the scope of the invention to those particular embodiments, or otherwise than by the terms of the appended claims.

I claim:

1. Aeroplane landing gear comprising a wheel having an internally-cylindrical braking surface, a shock-absorbing device including vertically-movable parts, one of which moves with the wheel, and which are encircled by said surface, a brake friction device encircling the shock-absorbing device and expansible against the braking surface, and means for operating the brake friction device carried by a part of the shock-absorbing device.

2. Aeroplane landing gear comprising a wheel having an internally-cylindrical braking surface, a shock-absorbing device including vertically-movable parts, one of which moves with the wheel, and which are encircled by said surface, a brake friction device supported by and encircling the shock-absorbing device and expansible against the braking surface, and a fluid-power operator for the brake friction device which is carried by the part of the shock-absorbing device which moves with the wheel.

3. Aeroplane landing gear comprising a wheel having an internally-cylindrical brake drum surface, a shock-absorbing device including vertically-movable parts encircled by said surface and one of which moves with the wheel, a brake friction device supported by and encircling the shock-absorbing device and expansible against said brake drum surface, and means connected to one of the parts of the shock-absorbing device and arranged to control the position of the brake friction device.

4. Aeroplane landing gear, comprising a wheel having an internally cylindrical brake surface; a shock absorber device having a cylinder and a piston movable therein, one of which moves with the wheel, and which are both encircled by said surface; a brake friction device supported by and encircling the shock absorbing device and expansible against the braking surface; and a fluid power operator for the brake friction device comprising a cylinder and a piston in the cylinder, said cylinder being arranged substantially parallel with and secured to the shock absorbing cylinder.

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