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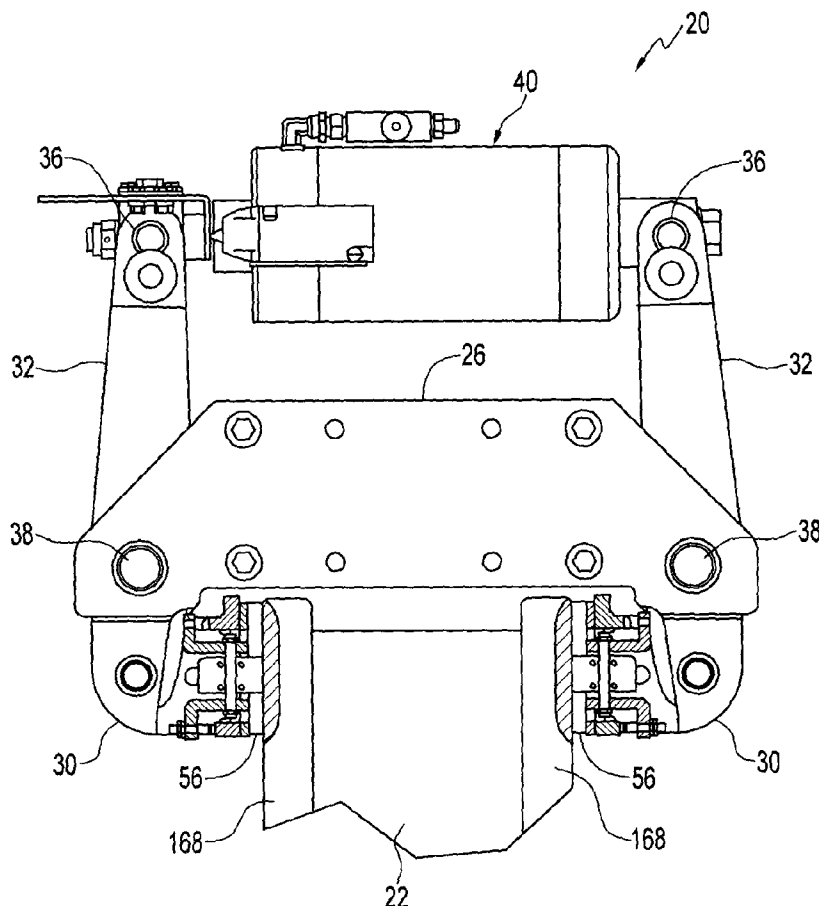
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(54) Title: WHEEL BRAKE CALIPER WITH BRAKE PAD ROLLER GUIDES



(57) Abstract: A crane wheel brake having a pair of brake shoes at opposite sides of a crane wheel. Each of the brake shoes has a brake pad, a brake pad guide roller and a spring for biasing the brake pad guide roller to project beyond the brake pad towards the wheel. The brake pad guide roller is located in a central portion of the brake shoe. The wheel brake includes a pair of brake levers and a braking force generator. Each of the brake levers has a first end pivotally connected to a respective one of the brake shoes and a second end pivotally connected to a respective side of the braking force generator. Each brake lever is pivotally mounted by a fulcrum intermediate its first and second ends. The wheel presses against the brake pad guide roller on either one of the brake shoes and causes the wheel brake to pivot about the fulcrums to maintain a clearance between the brake pads and the wheel.



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Description

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WHEEL BRAKE CALIPER WITH BRAKE PAD ROLLER GUIDESTechnical Field

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The present invention relates to wheel brakes for use e.g. with cranes and other material handling equipment and is useful, e.g., for wheel brakes used to retard the motion of cranes against wind loads, both dynamically and statically.

Background Art

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Conventional crane brakes, such as disclosed in US Patent No. 6,019,199, issued February 1, 2000 to David C. Heidenreich, are hydraulic caliper disk brakes that include brake pad self-activating wear adjusters to maintain a constant brake gap. These brakes prevent brake pad wear only when the wheel to which they are applying the braking force do not have significant lateral movement, or float. On many cranes, however, the wheels substantially float from side to side. What is required in these situations is a wheel brake that maintains the separation between the wheel and the brake pad as the wheel floats from side to side, and provides brake pad and side wheel surface alignment while braking.

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Disclosure of the Invention

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It is accordingly an object of the present invention to provide a novel and improved wheel brake caliper which, in use, reduces or even entirely eliminates wear of the brake pads while not braking and self-aligns the brake pads to a wheel for even wear while braking.

According to the present invention, there is provided a wheel brake comprising a caliper having a pair of brake shoes on brake levers, a pair of brake pads attached to

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5 respective ones of the brake shoes and having opposed surfaces, and a braking force generator operatively connected to the brake shoes for urging the brake pads against opposite sides of a wheel, characterized in that each of the brake shoes has a brake pad guide roller and a spring biasing the respective brake pad guide roller to project beyond the brake pad.

10 The brake pad guide rollers and the springs serve to maintain separation between the wheel, which can float laterally, and the brake pads while not braking, and further to align the brake pads substantially with the sides of the wheel while braking.

15 The brake pad guide roller is preferably located in a central portion of the brake shoe. When placed in this location, only one brake pad guide roller is required per brake shoe. Additionally, the brake pad guide roller in this location serves to provide a guiding means that keeps the brake pad parallel with the side of the wheel.

20 Each of the brake levers preferably has a first end pivotally connected to one of the brake shoes and an opposite end pivotally connected to the braking force generator, and each of the brake levers preferably further includes a fulcrum intermediate the brake lever ends and pivotally mounting the brake levers. In practice the wheel presses against either one of the brake pad guide rollers causing the wheel brake to pivot about the fulcrums to maintain separation between the brake pads and the wheel.

25 In a preferred embodiment of the present invention, each brake shoe has a surface facing a respective side of the wheel and each brake pad guide roller has a rotational axis and is located at a central location of the respective brake shoe. The rotational axis of each brake pad guide roller is parallel with the respective surface plane. In practice the wheel presses against either one of the brake pad guide rollers, thereby pivoting the respective brake shoe and bringing the rotational axis parallel with the side of the wheel.

30 Brief Description of the Drawings

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The present invention will be more readily understood from the following description of a preferred embodiment thereof given, by way of example, with reference to the accompanying drawings, in which:-

5 FIG. 1 is a side view of parts of a crane with a wheel brake mounted on a wheel;

FIG. 2 is a bottom view of the crane parts of FIG. 1;

FIG. 3 is a perspective view of a brake shoe of the wheel brake of Figure 1;

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FIG. 4 is a view in side elevation of the brake shoe of FIG. 3;

FIG. 5 is a view taken in cross-section along the line A-A of FIG. 4;

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FIG. 6 is a bottom plan view of the brake shoe of FIG. 3;

FIG. 7 is a view taken in cross-section along line B-B of FIG. 6; and

FIG. 8 is a top plan view of the brake shoe of FIG. 3.

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Description of the Best Mode

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In FIG. 1, there is shown a wheel brake, in the form of a lever-type caliper disc brake, indicated generally by reference numeral 20. The wheel brake 20 is connected to parts of a crane, indicated by reference numeral 24, by way of a mounting member 26 and is used to brake a wheel 22. In the present embodiment, the crane moves along rails, only one of which is illustrated and indicated by reference numeral 28.

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Referring now to FIGS. 1 and 2, the wheel brake 20 has a pair of brake shoes 30 and a pair of brake levers 32 at opposite sides of the wheel 22. A braking force generator, in the form of a spring-activated, hydraulically releasable piston and cylinder device, is indicated generally by reference numeral 40. Each of the brake levers 32 is pivotally connected to its respective brake shoe 30 by a pivot pin 34 extending through a bifurcated end 35 of the brake lever 32. At opposite bifurcated ends 37, the brake levers 32 are connected to opposite ends of the braking force generator 40 by a pair of pivot pins 36. Each of the brake levers 32 is connected to its respective mounting member 26 by a pivot pin 38, and the pivot pins 38 form fulcrums located between the pivot pins 34 and 36.

One of the brake shoes 30 is shown in greater detail in FIG. 3 and has an elongated member, known in the art as a brake plate 50. The brake plate 50 has a first surface 52 and a second surface 54. A brake pad 56 is attached, in two separate sections, to the first surface 52.

A pair of brake shoe mounting lugs or members 58 extend from the second surface 54 near opposite ends of the brake plate 50. Each of the mounting members 58 has a bore 59. The pivot pin 34 extends through the bores 59 of the brake shoe mounting members 58. To connect the brake shoe 30 to its respective brake lever 32.

Each of the brake levers 32 is therefore pivotally connected to its respective brake shoe 30 by the respective pivot pin 34. In the present embodiment, the bifurcated end 35 of the brake lever 32 has a pair of substantially parallel arms 45 (see FIG. 1), and the bifurcated end 37 has a pair of substantially parallel arms 47. The arms 45 have bores 49, and the arms 47 have bores 51. The pivot pins 34 extend through the bores 49 of the pair of arms 45 of the bifurcated end 35. Similarly, the pivot pins 36 extend through the bores 51 of the arms 47 so as to pivotally connect the braking force generator 40 to the brake levers 32.

Referring now to FIGS. 4-8, a spring assembly indicated generally in FIG. 5 by reference numeral 60 protrudes from one of the mounting members 58. The spring

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assembly 60 comprises a helical compression spring 62 and a U-shaped member 64. A first end 66 of the helical compression spring 62 abuts a spring retraining ring 68 (see FIG. 7) within a bore 63 in one of the mounting members 58, and a second end 70 of the helical compression spring 62 abuts a surface 72 of the U-shaped member 64.

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The surface 54 of the brake plate 50 has raised portions 96 on opposite sides of the brake shoe 30 and the raised portions 96 have a pair of bores 98. The U-shaped member 64 is pivotally mounted on a pivot pin 100 extending through the bores 98. Snap rings 102, of which only one is shown (FIG. 6), retain the opposite ends of the pivot pin 100 to the raised portions 96. The helical compression spring 62 biases the U-shaped member 64 to pivot about the pivot pin 100, as discussed in more detail below.

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The U-shaped member 64 has a pair of arms 76 (see FIG. 6), each having an L-shaped extension 78 (see FIG. 5) extending transversely of the respective arm 76. Each of the L-shaped extensions 78 has a bore 80 and at least one of the L-shaped extensions 78 has a bore 82 which is internally threaded and receives a bolt 92.

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A roller assembly, indicated generally in FIG. 5 by reference numeral 84, comprises a brake pad guide roller 86 rotatable about a pin 88 on ball bearings 90. The roller assembly 84 is connected to the L-shaped extensions 78 of the spring assembly 60 by the shaft 88, which extends through the bores 80 and is secured by nuts 89 in threaded engagement with opposite ends of the shaft 88.

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The spring assembly 60 biases the roller 86 to project beyond the brake pads 56 by pivoting the U-shaped member 64 about the pivot pin 100. The bolt 92 acts as a set screw which adjustably limits the amount of projection of the roller 86 beyond the brake pads 56 by abutting a surface 94 on one of the raised portions 96 of the second surface 54 of the brake plate 50.

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As best shown in FIGS. 4, 6 and 7, the brake pad guide roller 86 is in a central location of the brake shoe 30. This provides an advantage over placing the brake pad

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guide roller 86 at another region of the brake shoe 30, for instance, at either end of the brake shoe, since brake pad guide rollers located at either end of the brake shoe 30 would not be in a center of pressure and would create a moment about a shoe pin. This moment would cause shoe pivoting, and a guiding means, for example a pair of brake pad guide
5 rollers at opposite ends of the brake shoe, would be required to prevent such pivoting. By locating the roller in the center of the shoe, therefore, only one roller assembly is required per shoe instead of two.

Using one wide brake pad guide roller per shoe, as in the present embodiment of
10 the invention, or alternatively two brake pad guide rollers per shoe that are centrally located (not shown), provides a guiding means that keeps the brake pad 56 parallel with the side of the wheel in a free running condition. This prevents contact between the brake pad 56 and the wheel 22 and therefore prevents wearing of the brake pad 56 when the brake is released.

15 In the present embodiment, the spring assembly 60 is easily removable from the brake shoe 30. To remove the spring assembly 60, the snap ring 102 is removed and the pivot pin 100 is withdrawn so that the U-shaped member 64 and the spring 62 can be removed from the pivot pin 100.

20 The brake pad guide rollers 86 are easily retracted into the brake shoes 30 during braking, i.e. when the braking force generator 40, shown in FIG. 2, presses the brake shoes 30 against opposite sides of the wheel 22, because the braking force generated by the braking force generator 40 is sufficient to overcome the force of the springs 62. The
25 brake pad guide rollers 86 begin to retract until the brake pads 56 contact the opposite sides of the wheel 22. At this point the brake pads 56 and brake pad guide rollers 86 are in contact with the wheel 22, as shown in FIG. 2.

30 The brake pad guide rollers 86 have a rotational axis 104, i.e. the axis of the shaft 88, as shown in FIG. 5. The rotational axis 104 is parallel with the first surface 52 of the brake shoe 30 and correspondingly to a brake pad surface 106 of the brake pad 56. As

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the brake pad guide roller 86 contacts the wheel 22, as in the above situation, the rotational axis 102 of the brake pad guide roller brings the brake shoe 30 and consequently the brake pad 56 into alignment with a side of the wheel 108, as shown in FIG. 2. This prevents the brake pad surface 106 from contacting the side of the wheel 108 in an uneven fashion, that would cause uneven wear of the brake pad 56.

In another situation, the wheel 22 presses against only one of the brake pads 56. This situation occurs when the wheel 22 has enough lateral float due to the arrangement of wheel support bearings and manufacturing tolerances. In this instance, the wheel 22 presses against the brake pad guide roller 86 of that one of the brake shoes 30. The reaction force of the spring 62 towards the wheel 22 is sufficient to maintain the separation between the brake pad 56 and the wheel 22. The wheel 22 therefore presses sufficiently against the brake pad guide roller 86 to cause the whole wheel brake 20 to pivot about the pivotal connections 38, thus preventing the wheel from contacting the brake pads 56.

By adjusting the adjustment bolt 92, it is possible to maintain a minimum retracted clearance between the surface of the wheel 22 and the brake pads 56.

As will be apparent to those skilled in the art, various modifications may be made in the present invention within the scope of the appended claims.

PATENT CLAIMS

1. A wheel brake comprising a caliper having a pair of brake shoes (30) on brake levers (32) and a pair of brake pads (56) attached to respective ones of the brake shoes (30) and having opposed surfaces, and a braking force generator (40) operatively connected to the brake shoes (30). For urging the brake shoes (30) towards opposite sides of a wheel (22), characterized in that each of the brake shoes (30) has a brake pad guide roller (86) and a spring (62) biasing the respective brake pad guide roller (86) to project beyond the brake pads (56).

2. The wheel brake as claimed in claim 1, characterized in that the brake pad guide roller (86) is located in a central portion of the brake shoes (30).

3. The wheel brake as claimed in claim 1, characterized in that each of the brake levers (32) has one end (35) pivotally connected to a respective one of the brake shoes (30) and an opposite end pivotally connected to the braking force generator (40), and a fulcrum intermediate the first and second ends and pivotally mounting the levers, whereby pressure of the wheel against either one of the brake pad guide rollers (86) causes the wheel brake to pivot about the fulcrums to maintain separation between the brake pads (56) and the wheel.

4. The wheel brake as claimed in claim 3, characterized in that each brake shoes (30) has a surface (52) facing a respective side of the wheel and each brake pad guide roller (86) has a rotational axis and is located at a central location of the respective brake shoes (30), the rotational axis of each brake pad guide roller (86) being parallel with the respective surface (52), plane, whereby pressure of the wheel against one of the brake pad guide rollers (86) pivots the respective brake shoes (30) to bring the rotational axis parallel with the side of the wheel.

5. The wheel brake as claimed in any one of claims 1 - 4, characterized in that each brake shoes (30) comprises an elongate member having a first surface (52), a second surface

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(54) and an opening extending from the first surface (52) to the second surface (54), the brake pad being attached to the first surface, and the spring (62) biasing the guide roller (86) through the opening.

5 6. The wheel brake as claimed in any one of claims 1 - 5, characterized in that each of the brake shoes (30) includes a U-shaped member (64) pivotally connected to the brake shoes (30), the brake pad guide roller (86) being rotatably connected to the U-shaped member (64) and the U-shaped member (64) being pivotally biased by the spring (62) so that the brake pad guide roller (86) projects from the brake shoes (30).

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7. The wheel brake as claimed in claim 6, characterized by a pivot rod pivotally connecting the U-shaped member (64) to the brake shoes (30) and a set screw (92) for adjustably limiting the pivotation of the U-shaped member (64) relative to the brake shoes (30).

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8. The wheel brake as claimed in claim 6 or 7, characterized in that the U-shaped member (64) comprises a pair of arms (76) forming a U-shape and a pair of L-shaped extensions (78) each extending transversely of a respective one of the arms (76) near an end of said arm (76).

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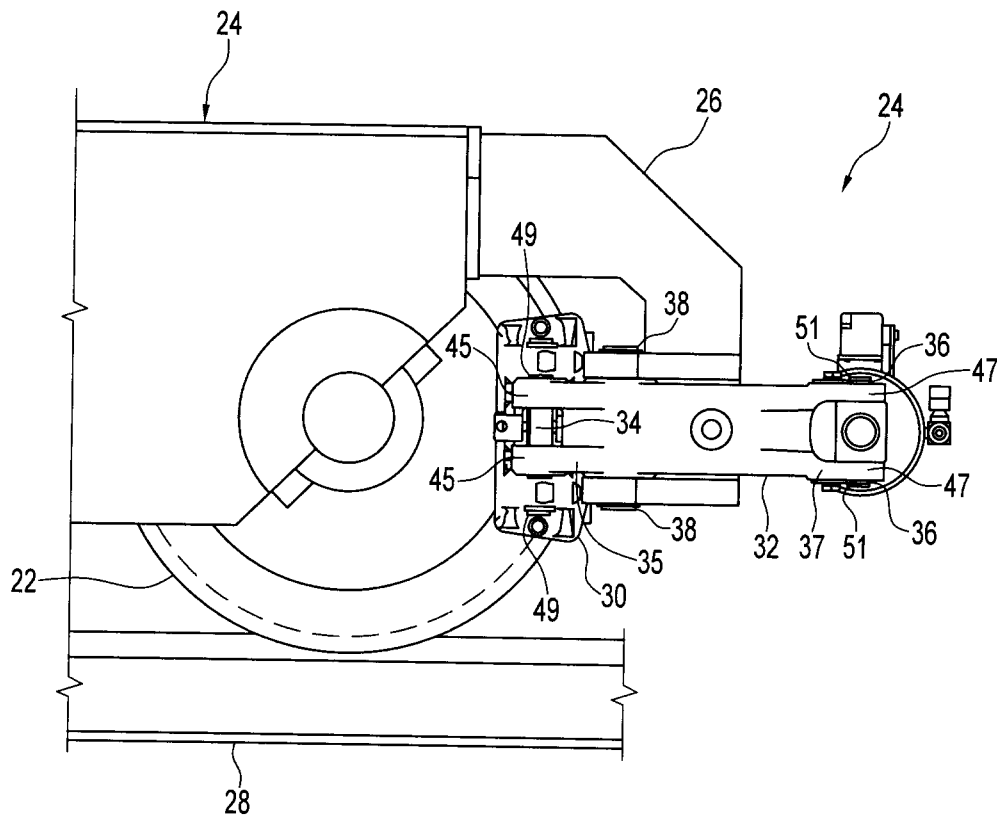


FIG. 1

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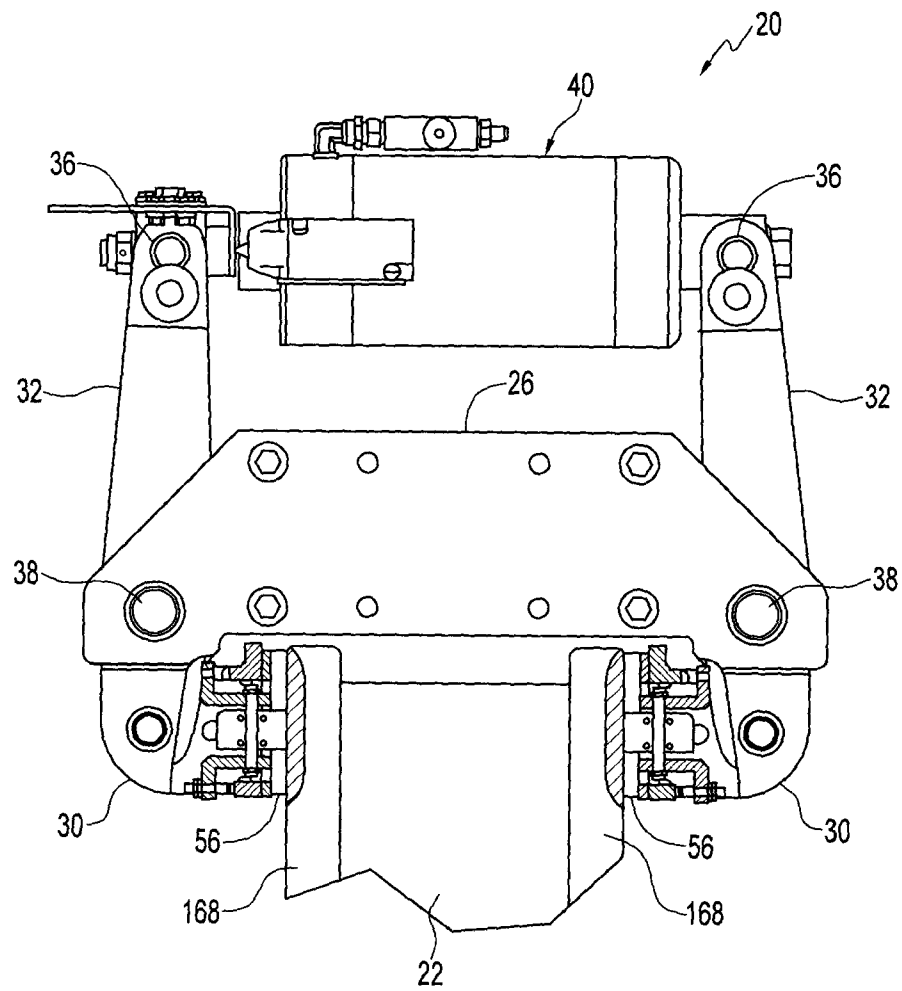


FIG. 2

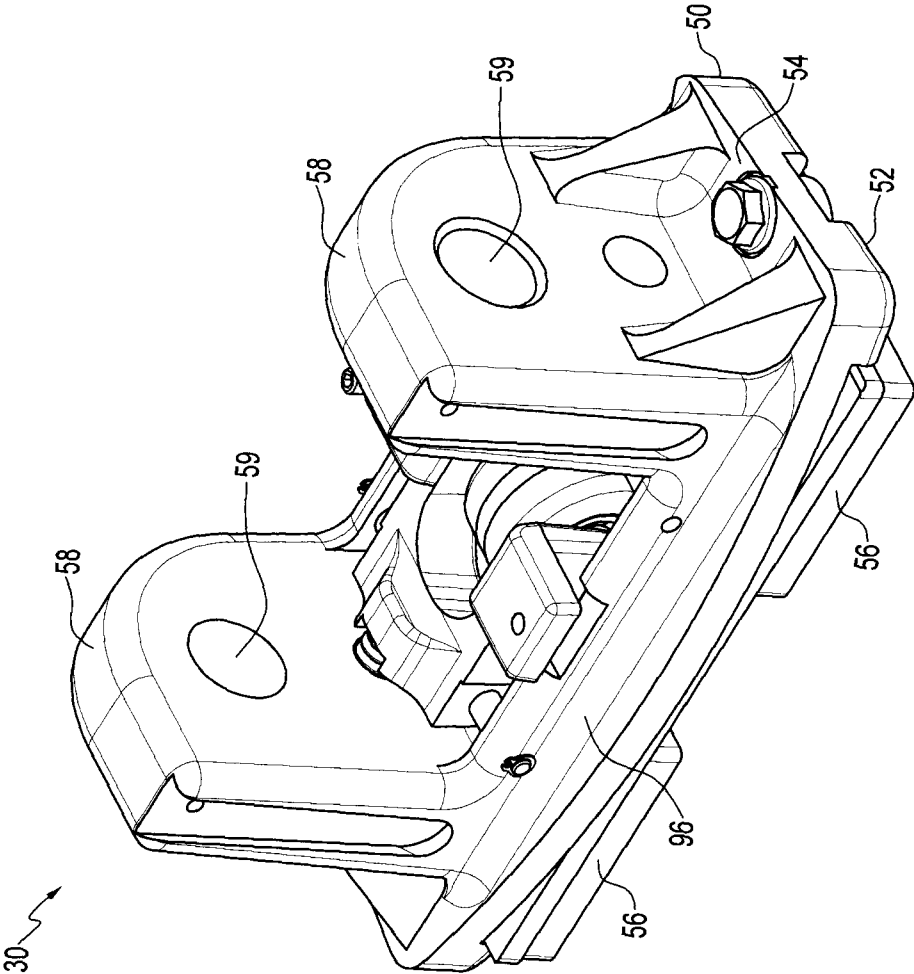


FIG. 3

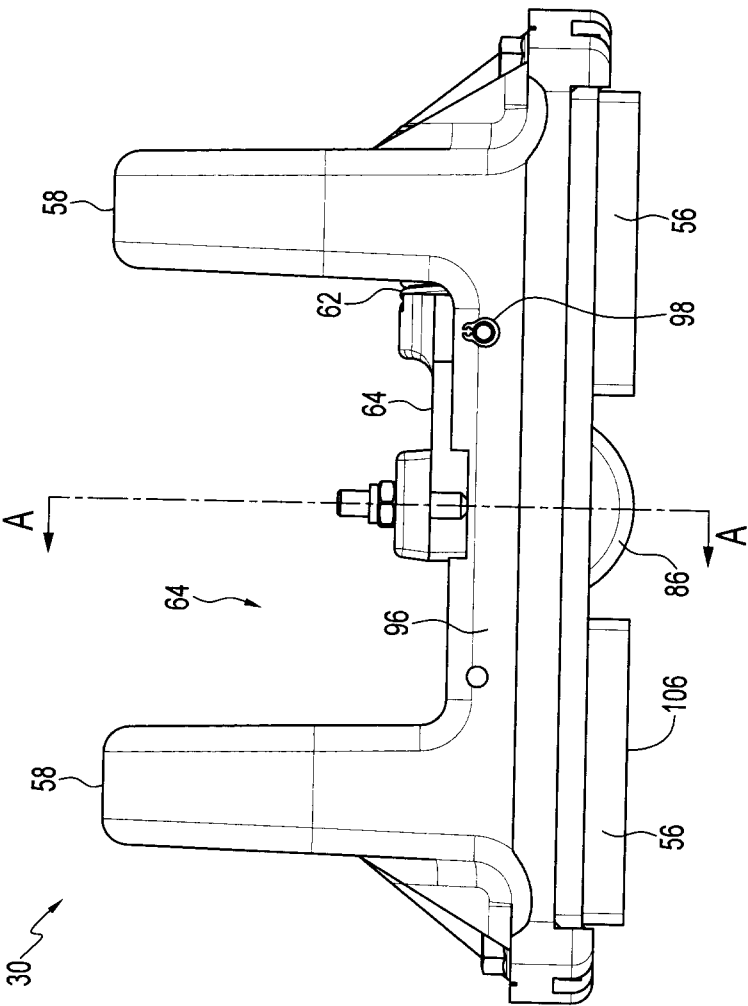


FIG. 4

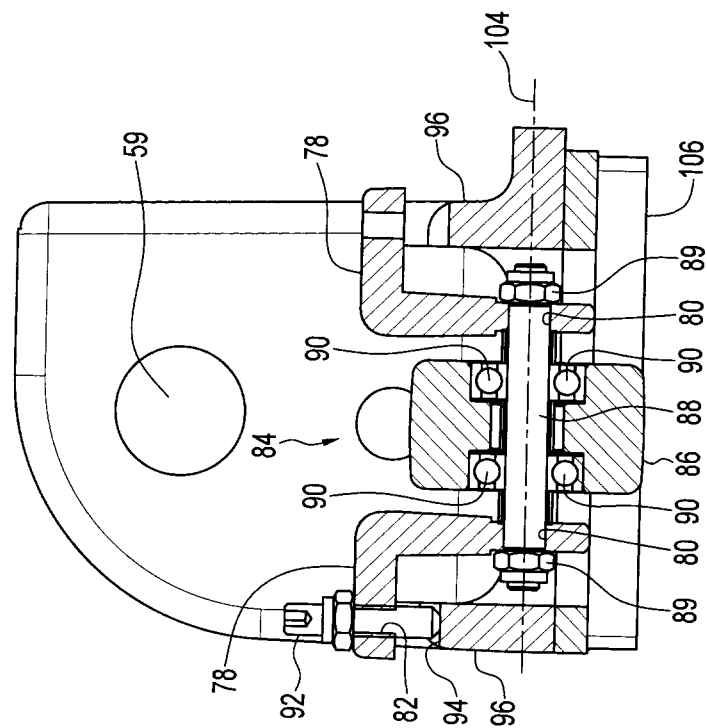


FIG. 5

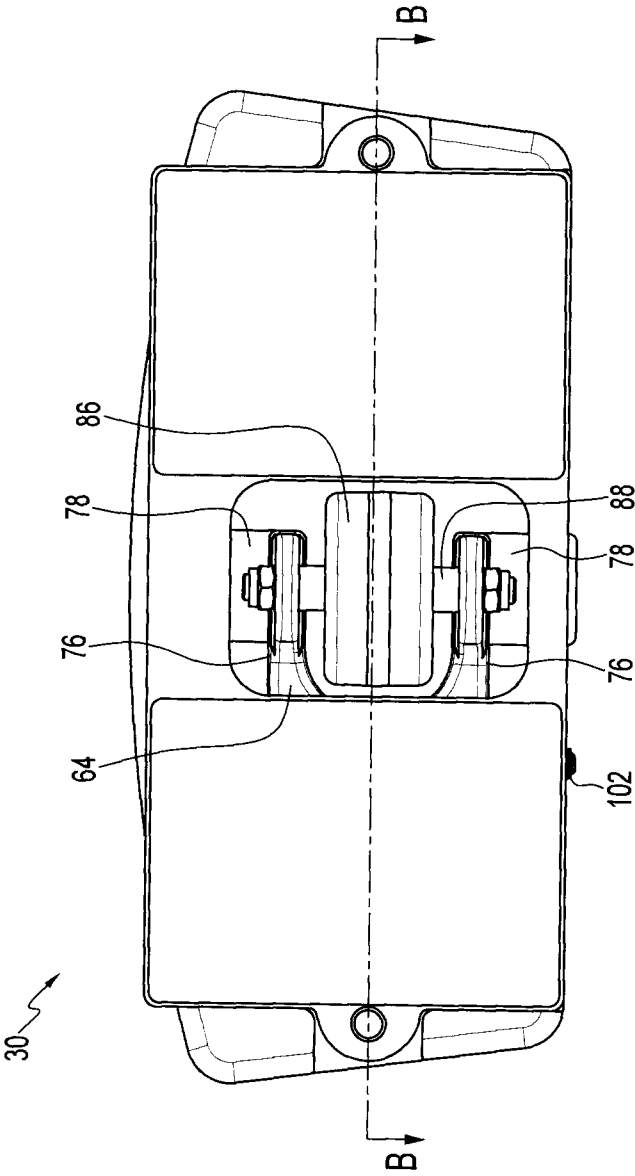


FIG. 6

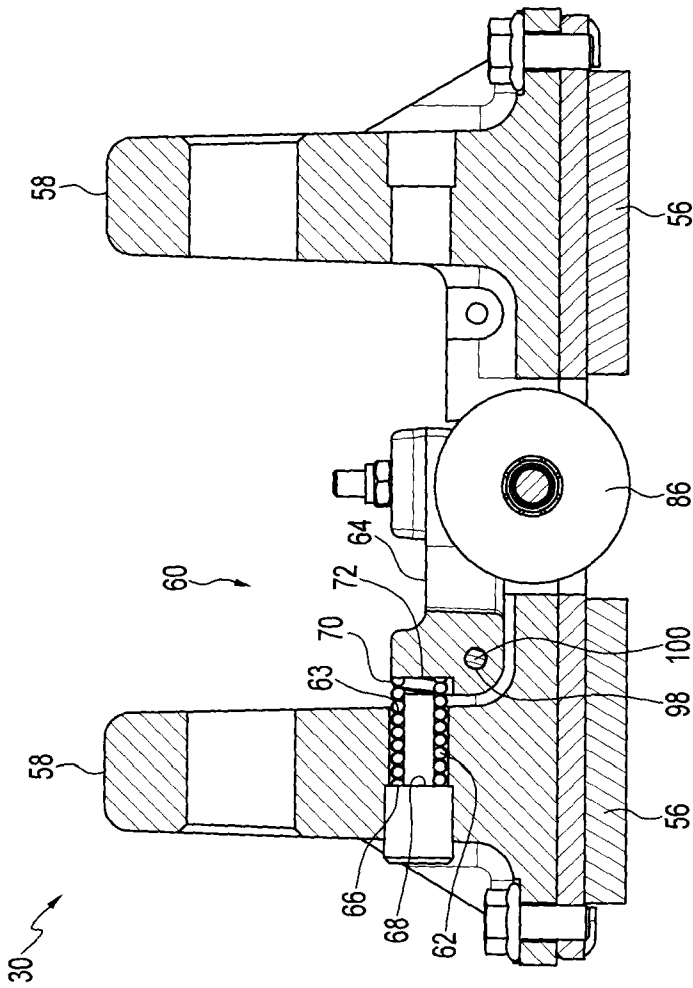


FIG. 7

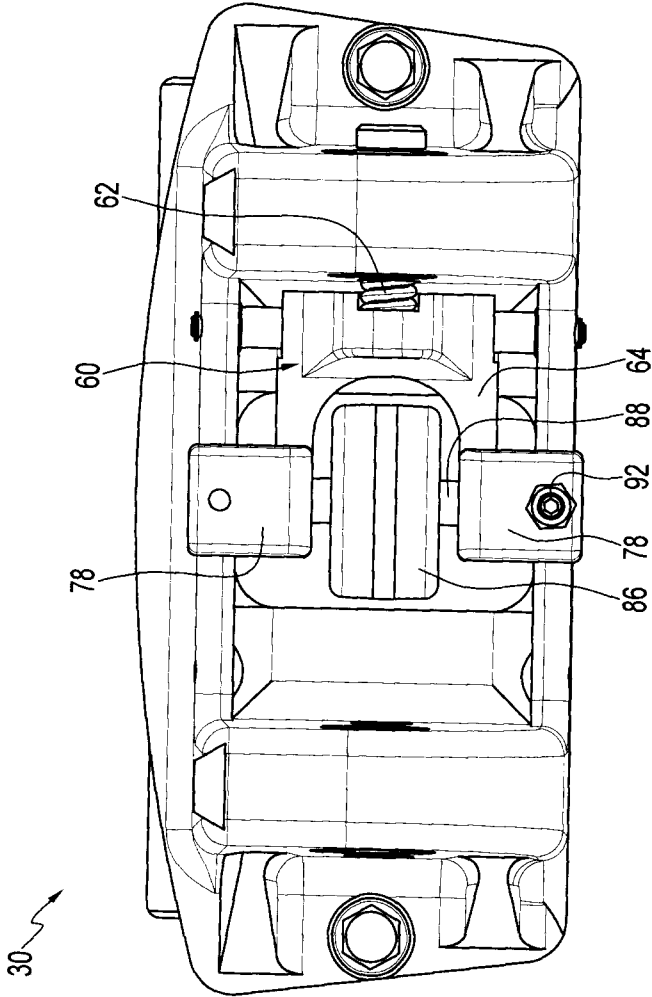


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2006/001191

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **F16D 55/225** (2006.01) , **F16D 65/04** (2006.01) , **F16D 71/00** (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC8: F16D

USPC: 188/*

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Delphion, Derwent, CPD.

Keywords: brake, disk, guide, roller, float*, lever, caliper, pad, lining, shoe,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,060,153 (KOBELT) 29 November 1977 (29-11-1977) *whole document*	1
A	EP 0 731 286 A1 (ELSTORPFF et al.) 11 September 1996 (11-09-1996) *whole document*	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2006/001191

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US4060153	29-11-1977	CA1069066 A1	31-12-1979
EP0731286	11-09-1996	DE19508034 A1	12-09-1996
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