

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
17 February 2005 (17.02.2005)

PCT

(10) International Publication Number
WO 2005/014349 A1

(51) International Patent Classification⁷:
F16D 65/14, 63/00

B60T 7/20,

(74) Agent: **MACKENZIE, Colin**; Adams & Adams, Adams
& Adams Place, 1140 Prospect Street, Hatfield, PO Box
1014, 0001 Pretoria (ZA).

(21) International Application Number:

PCT/IB2004/002539

(81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(22) International Filing Date: 6 August 2004 (06.08.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

2003/6047 6 August 2003 (06.08.2003) ZA
2003/2261 6 August 2003 (06.08.2003) ZA

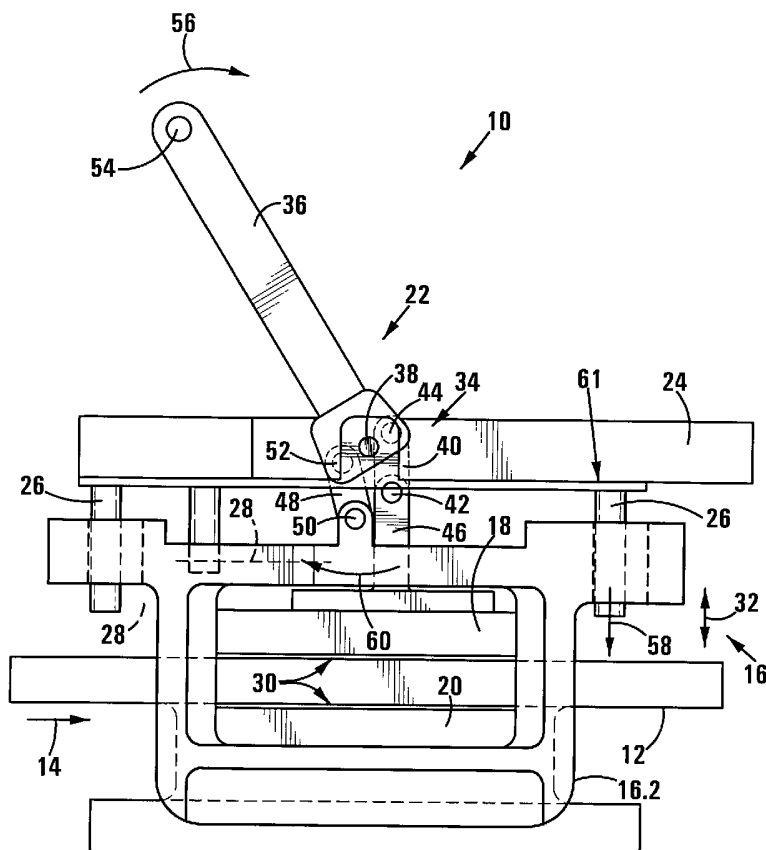
(71) Applicant and

(72) Inventor: **VAN DER LINGEN, Theophilus, Wilhelm**
[ZA/ZA]; 43 Herbert Baker Street, Groenkloof, 0181 Pre-
toria (ZA).

(84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,

[Continued on next page]

(54) Title: DISC BRAKE



(57) Abstract: A disc brake (10) which includes a calliper (16), and a pair of transversely spaced apart pads (18, 20) mounted to the calliper (16). The pads (18, 20) define opposed inwardly directed friction surfaces for contacting opposed sides of a brake disc (12) which passes between the pads (18, 20). The brake (10) includes actuation means (22) for displacing the brake pads between a released position in which the brake disc (12) can pass freely therebetween and an actuated position in which the pads (18, 20) are displaced into contact with the disc (12) to brake the disc (12). The brake (10) has a first operative condition in which the actuation means (22) can displace the pads (20) into their actuated position to brake the brake disc (12) and a second operative condition in which braking of the brake disc (12) is inhibited.



FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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.

Published:

— *with international search report*

DISC BRAKE

5 THIS INVENTION relates to a disc brake.

In towed vehicles such as caravans, trailers and the like, which are connected to a draught vehicle by means of a tow bar, use is often made of a so-called run-on coupling to activate the brakes of the towed vehicle.

10

The run-on coupling is typically configured such that when a compressive load, in excess of a predetermined minimum compressive load, is applied to the tow bar, e.g. as would result when the draught vehicle is being braked, the towed vehicle's brakes are applied. When the
15 draught vehicle is reversing, a compressive load is applied to the tow bar. Under these circumstances it is desirable that the brakes of the towed vehicle not be applied.

Hitherto, towed vehicles of this type made use of drum brakes
20 capable of inhibiting braking in reverse.

According to one aspect of the invention there is provided a disc brake which includes

a calliper;

25 a pair of transversely spaced apart pads mounted to the calliper, the pads defining opposed inwardly directed friction surfaces for contacting opposed sides of a brake disc which passes between the pads; and

actuation means for displacing the brake pads between a released
30 position in which the brake disc can pass freely therebetween and an

actuated position in which the pads are displaced into contact with the disc to brake the disc, the brake having a first operative condition in which the actuation means can displace the pads into their actuated position to brake the brake disc and a second operative condition in which braking of
5 the brake disc is inhibited.

Braking of the brake disc may be inhibited by inhibiting operation of the actuation means.

10 The invention may be particularly suitable for use on a towed vehicle, the actuation means then typically including a run-on coupling.

The brake may be biased towards its first operative condition. The brake may be displaced towards its second operative condition when the
15 brake disc is moving in a predetermined direction, typically when the vehicle is moving in a backward direction. Hence, when the vehicle is a towed vehicle which is towed in its forward direction or is stationary, the brake will be displaced towards its first operative condition and will operate in the normal fashion. However, when the vehicle is reversed, the brake
20 will be displaced, against the bias, to its second operative condition thereby inhibiting braking action.

In one embodiment of the invention the disc brake may include a bracket to which the calliper is mounted, at least part of the calliper being
25 displaceable relative to the bracket generally in the circumferential direction of the brake disc between a first position corresponding to the first operative condition of the brake and a displaced position corresponding to the second operative condition of the brake, and bias means acting between the calliper and the bracket to bias the calliper

towards its first position. The bracket will typically be connected to a component such as a wheel spindle, relative to which the brake disc is rotatable.

5 The calliper may have an inner leg and an outer leg, one of the brake pads being fixed to the inner leg and being displaceable relative to the outer leg of the calliper in a direction transverse to the brake disc, the other pad being fixed to the outer leg of the calliper which is displaceable relative to the bracket transversely to the brake disc.

10

 The actuation means may include a link arrangement which is connected or connectable to an actuator, the link arrangement including a lever arm pivotally connected to the bracket, a first link pivotally connected at its ends respectively to the lever arm and to said one brake pad, and a
15 second link which is pivotally connected at its ends respectively to the lever arm and to the outer leg of the calliper, the ends of the links connected to the lever arm being connected on opposite sides of the pivotal connection of the lever arm to the bracket. The connection of the lever arm to the bracket may be such as to permit limited linear movement
20 relative to the bracket transverse to the disc, for the purpose of allowing the brake pads to centre on the disc.

 In the first position of the calliper, the first link may extend at an angle relative to the brake disc which is more nearly normal to the brake
25 disc than the angle at which the second link extends relative to the brake disc. In the displaced position of the calliper the second link may extend at an angle relative to the brake disc which is more nearly normal to the brake disc than the angle at which the first link extends relative to the brake disc.

In a second embodiment of the invention the brake pads may be displaceable generally in a direction transverse to the brake disc, at least one of the brake pads further being displaceable relative to the calliper
5 generally in the circumferential direction of the brake disc between a first position, corresponding to the first operative condition of the brake and a displaced position corresponding to the second operative condition of the brake, the brake including bias means whereby the or each of the brake pads are urged towards their first position.

10

Low or no friction resistance is provided in the circumferential direction between the displaceable brake pad or pads and the calliper.

The calliper may have a first leg to which a brake pad is fixed and a
15 second leg relative to which the other pad is displaceable in a circumferential direction, the actuation means including a link arrangement which is connected or connectable to an actuator, the link arrangement including a lever arm which is pivotally connected to the first leg of the calliper and a link which is pivotally connected to the lever arm and, at a
20 position spaced from the connection of the lever arm to the first leg of the calliper, to the second leg of the calliper.

When the brake pads are in their first position, the link may extend at an angle relative to the brake disc which is closer to normal to the brake
25 disc than the angle at which it extends when the brake pads are in their second or displaced position.

The disc brake may include a stop arrangement for inhibiting the operation of the actuation means when the brake is in its second operative condition thereby inhibiting actuation of the brake.

5 The stop arrangement may include a ratchet mechanism.

The invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings.

10 In the drawings:

Figure 1 shows a schematic plan view of a disc brake in accordance with the invention in a first operative condition;

Figure 2 shows the disc brake of Figure 1 in a second operative condition;

15 Figure 3 shows a schematic plan view of a second embodiment of a disc brake in accordance with the invention in a first operative condition; and

Figure 4 shows the disc brake of Figure 3 in its second operative condition.

20

Reference is now made to Figures 1 and 2 of the drawings, in which reference numeral 10 refers generally to a disc brake in accordance with the invention.

25 The disc brake 10 includes a brake disc 12 which is connected, in a conventional fashion, to a vehicle wheel for rotation therewith. The wheel is connected to a body of a vehicle (not shown) by means of a conventional suspension arrangement (not shown). When the vehicle moves in a forward direction, the wheel and hence near the rim of the

brake disc 12, as viewed in the drawings, rotates in the direction of arrow 14. Naturally, when the vehicle reverses, the wheel and the brake disc will move in the direction opposite to the direction of arrow 14.

5 The brake 10 includes a calliper 16 which straddles the brake disc 12, a pair of pads 18, 20 and actuation means, part of which is generally indicated by reference numeral 22. The caliper 16 has an inside leg and an outside leg 16.2. The inside leg is used in compression and the outside leg 16.2 is used in tension.

10

 The calliper 16 is connected to a bracket 24 which in turn is suitably connected to a support, e.g. a suspension component or wheel spindle of the vehicle such that the disc 12 is rotatable relative to the bracket 24. The calliper 16 is connected to the bracket 24 by means of a pair of connecting
15 elements or pins 26. The pins 26 act as slides to permit the pads to centre. Further, the pins 26 extend through slots in the calliper 16 to permit displacement of the calliper between a first position (shown in Figure 1 of the drawings), corresponding to the first operative condition of the brake, and a displaced position (shown in Figure 2 of the drawings)
20 corresponding to the second operative condition of the brake 10. The calliper 16 is urged towards its first position by means of a compression spring 28 acting between the calliper 16 and one of the pins 26 or the bracket 24. If desired, the pins 26 can extend through both the inside and outside legs of the calliper.

25

 The pads 18, 20 define oppositely disposed transversely spaced friction surfaces 30 for contacting opposed sides of the brake disc 12. The pad 18 is typically positioned to contact an operatively inner surface of the

brake disc 12 and the pad 20 is positioned to contact an operative outer surface of the brake disc 12.

The pad 20 is fixed to the outside leg 16.2 of the calliper 16. In contrast, the pad 18 is fixed to the inside leg of the calliper which is slidably displaceable relative to the outside leg 16.2 of the calliper 16 transversely relative to the brake disc 12 in the direction of arrow 32. Similarly, the outside leg 16.2 of the calliper 16 is displaceable on the pins 26 transversely relative to the brake disc 12 in the direction of arrow 32.

10

The actuation means 22 includes a link arrangement, generally indicated by reference numeral 34. The link arrangement 34 includes a lever arm 36 an end of which is pivotally connected via a pivot pin 38 to a slide 61. The slide 61 has transverse movement relative to the bracket to allow the lever to accommodate proper centering of the brake pads. The link arrangement 34 further includes a first elongate link 40 having a pair of ends which are pivotally connected via pins 42 and 44 respectively to an apertured lug 46 fast with the brake pad 18 and the lever arm 36. A second elongate link 48 has a pair of ends which are pivotally connected via pins 50, 52, respectively to the outside leg 16.2 of the calliper 16 and the lever arm 36.

The free end 54 of the lever arm 36, i.e. the end remote from the pin 38 is connected or connectable to an actuator. In this regard, the actuator may be a run-on coupling which can be connected to the free end 54 of the lever arm mechanically, hydraulically, pneumatically or in any other suitable fashion. Naturally, however, any other kind of actuator could be connected to the lever arm 36. Further, the long travel of the

25

lever arm 36, being in the circumferential direction, enables it to compensate for brake pad wear.

When the lever arm 36 is in the position shown in Figure 1 of the drawings, the brake pads 18, 20 are in their released positions in which the brake disc 12 can pass freely therebetween. In this position, it will be noted that the first link 40 extends generally perpendicular to the brake disc 12. Further, the second link 48 extends at an acute angle relative to the brake disc 12. Further, the pins 44, 52 are positioned on opposite sides of the pin 38 and the pin 44 is positioned further from the brake disc 12 than the pin 38 and the pin 52 is positioned closer to the brake disc 12 than the pin 38.

When the vehicle of which the disc brake 10 forms part is moving in a forward direction which causes the disc to move between the pads 18, 20 in the direction of arrow 14, the calliper is in the position shown in Figure 1 of the drawings. When the brake is to be actuated, the lever arm 36 is displaced in the direction of arrow 56 causing the lever arm 36 to pivot about the pin 38. In view of the spacing between the pin 44 and the pin 38, the brake pad 18 is displaced in the direction of arrow 58 into contact with the surface of the brake disc 12. This simultaneously results in the displacement of the outside leg 16.2 of the calliper 16 in the direction opposite to the direction of arrow 58 thereby bringing the brake pad 20 into contact with the outer surface of the brake disc 12 such that the disc 12 is braked between the pads 18, 20. When the brake is released, the lever arm 36 is displaced in a direction opposite to the direction of arrow 56 thereby returning the calliper and the pads to the position shown in Figure 1 of the drawings.

If, however, the vehicle of which the disc brake 10 forms part is displaced in a reverse direction, the brake disc 12 moves between the pads 18, 20 in a direction opposite to the direction of arrow 14. As a result of frictional forces between the brake disc 12 and the pads 18, 20, when
5 the brake is applied the calliper is displaced in a direction opposite to the direction of arrow 14 into the position shown in Figure 2 of the drawings.

It is to be noted that, in this position, the links 40, 48 have been pivotally displaced in the direction of arrow 60 relative to their pivotal
10 connections via the pins 44, 52 with the lever arm 36. This results in the outside leg 16.2 of the calliper being displaced in the direction of arrow 58. Further, the brake pad 18 is displaced in a direction opposite to the direction of arrow 58. In other words, the spacing between the brake pads 18, 20 and hence the lever travel required in order to actuate the disc
15 brake 10 has increased substantially. This in essence prevents operation of the disc brake 10 when the vehicle is reversing. If not already inherent in the braking linkage and if desired a stop can be provided mechanically to prevent displacement of the lever arm beyond a point which would result in actuation of the brake when in its second operative condition.
20 This stop may be overridden by a handbrake or parking brake.

When the vehicle moves in a forward direction, i.e. the brake disc 12 moves in the direction of arrow 14, the calliper is returned to its first position (shown in Figure 1 of the drawings) at first under the action of the
25 spring 28 and after contact is made between the pads 18, 20 and the disc 12 by the friction of the pads 18, 20 on the brake disc 12, thereby permitting operation of the disc brake in the manner described above. As mentioned above, the spring 28 serves to displace the caliper towards its first position. The links 40, 48 are then close enough to normal relative to

the disc 12, in comparison with the friction angle, to allow friction forces to pull in the brake against actuating forces on the lever. This is requisite on a towed vehicle when starting downhill after reversing.

5 It will be appreciated, from the above, that displacement of the calliper between its first position and its displaced position is achieved, at least partially, by frictional forces between the brake disc 12 and one or both of the pads 18, 20. Accordingly, to ensure that at least one of the brake pads is lightly in contact with the brake disc in order to sense the
10 direction of movement of the brake disc, a spring may be provided to urge the pad towards the disc.

Reference is now made to Figures 3 and 4 of the drawings, in which reference numeral 100 refers generally to a disc brake in
15 accordance with a second embodiment of the invention and, unless otherwise indicated, the same reference numerals used above are used to designate similar parts.

In this embodiment of the invention, the calliper 16 has a first or
20 inner leg and a second or outer leg. The brake pad 18 is displaceable relative to the outside leg of the calliper 16 and hence also the brake disc 12 in the direction of arrow 102. The inside leg of the calliper with the brake pad 18 and the brake pad 20 are displaceable relative to the calliper 16 in the direction of arrow 104 between a first position (shown in Figure 3
25 of the drawings), corresponding to the first operative condition of the brake and a displaced position (shown in Figure 4 of the drawings) corresponding to the second operative condition of the brake.

In this embodiment of the invention, the lever arm 36 is pivotally connected via a pin 106 directly to the apertured lug 108 fast with the brake pad 18. An elongate link 110 is connected respectively at its ends via pins 112, 114 to the lever arm 36 and the outside leg of the calliper 16.

5

A tension spring 116 extends between the lever arm 36 and the bracket 24 to retract the lever arm in the direction of arrow 118.

In use, when the vehicle of which the disc brake 100 forms part is being displaced such that the brake disc 12 moves between the pads 18, 20 in a forward direction, i.e. in the direction of arrow 14 and it is desired to brake the vehicle, the lever arm is displaced in a direction opposite to the direction of arrow 118. The lever arm pivots about the pin 112 thereby displacing the brake pad 18 in the direction of arrow 56 and the outside leg of the calliper in the opposite direction thereby to bring the pads 18, 20 into frictional contact with the surfaces of the brake disc 12. When the lever arm 36 is released, it returns under the bias of the spring 116 in the direction of arrow 118 to the position shown in Figure 3 of the drawings, thereby releasing the brake.

20

If, however, the vehicle is displaced in a reverse direction so that the brake disc moves between the pads 18, 20 in a direction opposite to the direction of arrow 14, by virtue of frictional forces, the brake pads 18, 20 are displaced in a direction opposite to the direction of arrow 14 into their second positions (shown in Figure 4 of the drawings). In this regard, the outer surface of the brake pad 20 and/or opposed surface of the calliper 16 may be coated with a friction reducing coating to permit displacement of the brake pad 20 relative to the outside leg of the calliper 16 between its first and second positions.

25

It will be noted that, in the second positions of the brake pads 18, 20, the lever link 110 has pivoted about the pin 114 resulting in the displacement of the pin 106 and hence also the brake pad 18 away from the brake disc 12. This results in greater travel of the lever arm being required in order to actuate the brake. In order to limit the travel to less than that now required and thus inhibit operation of the disc brake 100 when the brake disc is moving in a direction opposite to the direction of arrow 14, a stop arrangement, generally indicated by reference numeral 120 is provided. In this embodiment of the invention, the stop arrangement 120 comprises an arcuate member 122 having a radially outer surface on which a plurality of spaced apart teeth (not shown) is provided. The stop arrangement 120 further includes a complementary tooth engaging element 124 mounted on one end of an arm 126, the other end of which carries a follower running on a cam attached to the outside leg of the calliper so that the tooth engaging element 124 is brought into engagement with the teeth on the radially outer surface of the member 122 thereby inhibiting further displacement of the lever arm as the pad 18 moves forward. A spring 130 is mounted in compression between a collar 132 provided on the arm 126 and a stop 134 protruding from the lever arm 36. The spring, which is in compression, urges the tooth engaging element 124 away from the member 122 such that, in order to bring the tooth engaging element 124 into engagement with the teeth on the member 122, it is necessary to further compress the spring 130. Hence, the teeth on the member 122 and the tooth engaging element 124 function in the manner of a ratchet to inhibit displacement of the lever arm.

When the vehicle then moves in a forward direction and the brake disc 12 moves in the direction of arrow 14, with the tooth engaging

element 124 stationary, spring 116 serves to return the brake pads in the direction of their first operative condition until they contact the brake disc. The angle of link 110 is then sufficiently close to normal in comparison with the friction angle of the pads to pull in the brake pads to their first
5 positions (shown in Figure 3 of the drawings). In this position, the tooth engaging element 124 is displaced radially outwardly under the influence of the spring 130 permitting operation of the lever arm and hence the brake in the manner described above.

10 It will be appreciated that in both embodiments described above the brake may be activated by a run-on coupling. In addition, the brake may be actuated manually in a conventional fashion to function as a parking brake. If necessary the handbrake or parking brake may override the stop.

15

A disc brake in accordance with the invention may be particularly suitable for use on a towed vehicle such as a caravan or the like, particularly one which is connected to a draught vehicle by means of a run-on coupling. However, it is to be appreciated, that the disc brake in
20 accordance with the invention may also be suitable for use in other applications.

CLAIMS

1. A disc brake which includes
a calliper;
5 a pair of transversely spaced apart pads mounted to the calliper, the pads defining opposed inwardly directed friction surfaces for contacting opposed sides of a brake disc which passes between the pads; and
actuation means for displacing the brake pads between a released
10 position in which the brake disc can pass freely therebetween and an actuated position in which the pads are displaced into contact with the disc to brake the disc, the brake having a first operative condition in which the actuation means can displace the pads into their actuated position to brake the brake disc and a second operative condition in which braking of
15 the brake disc is inhibited.
2. A disc brake as claimed in claim 1, in which the brake is biased towards its first operative condition, the brake being displaced towards its first operative condition when the brake disc is stationary or moving in one
20 direction and the brake being displaced, against the bias, towards its second operative condition when the brake disc is moving in the opposite direction.
3. A disc brake as claimed in claim 1 or claim 2, which includes a
25 bracket to which the calliper is mounted, at least part of the calliper being displaceable relative to the bracket generally in the circumferential direction of the brake disc between a first position corresponding to the first operative condition of the brake and a displaced position corresponding to the second operative condition of the brake, and bias

means acting between the calliper and the bracket to bias the calliper towards its first position.

4. A disc brake as claimed in claim 3, in which the calliper has an
5 inner leg and an outer leg, one of the brake pads being fixed to the inner leg and being displaceable relative to the outer leg of the calliper in a direction transverse to the brake disc, the other pad being fixed to the outer leg of the calliper which is displaceable relative to the bracket transversely to the brake disc.

10

5. A disc brake as claimed in claim 4, in which the actuation means includes a link arrangement which is connected or connectable to an actuator, the link arrangement including a lever arm pivotally connected to the bracket, a first link pivotally connected at its ends respectively to the
15 lever arm and to said one brake pad, and a second link which is pivotally connected at its ends respectively to the lever arm and to the outer leg of the calliper, the ends of the links connected to the lever arm being connected on opposite sides of the pivotal connection of the lever arm to the bracket.

20

6. A disc brake as claimed in claim 5, in which, in the first position of the calliper, the first link extends at an angle relative to the brake disc which is more normal to the brake disc than the angle at which the second link extends relative to the brake disc and in the displaced position of the
25 calliper the second link extends at an angle relative to the brake disc which is more normal to the brake disc than the angle at which the first link extends relative to the brake disc.

7. A disc brake as claimed in claim 1 or claim 2, in which at least one of the brake pads are displaceable in the circumferential direction of the brake disc between a first position, corresponding to the first operative condition of the brake and a displaced position corresponding to the
5 second operative condition of the brake, the brake including bias means whereby the brake pads are urged towards their first position.
8. A disc brake as claimed in claim 7, in which the calliper has a first leg to which a brake pad is fixed and a second leg relative to which the
10 other pad is displaceable in a circumferential direction, the actuation means including a link arrangement which is connected or connectable to an actuator, the link arrangement including a lever arm which is pivotally connected to the first leg of the calliper and a link which is pivotally connected to the lever arm and, at a position spaced from the connection
15 of the lever arm to the first leg of the caliper, to the second leg of the calliper .
9. A disc brake as claimed in claim 8, in which, when the brake pads are in their first position, the link extends at an angle relative to the brake
20 disc closer to normal than the angle at which it extends when the brake pads are in their second position.
10. A disc brake as claimed in any one of the preceding claims which includes a stop arrangement for inhibiting the operation of the actuation
25 means when the brake is in its second operative condition.
11. A disc brake as claimed in claim 10, in which the stop arrangement includes a ratchet mechanism.

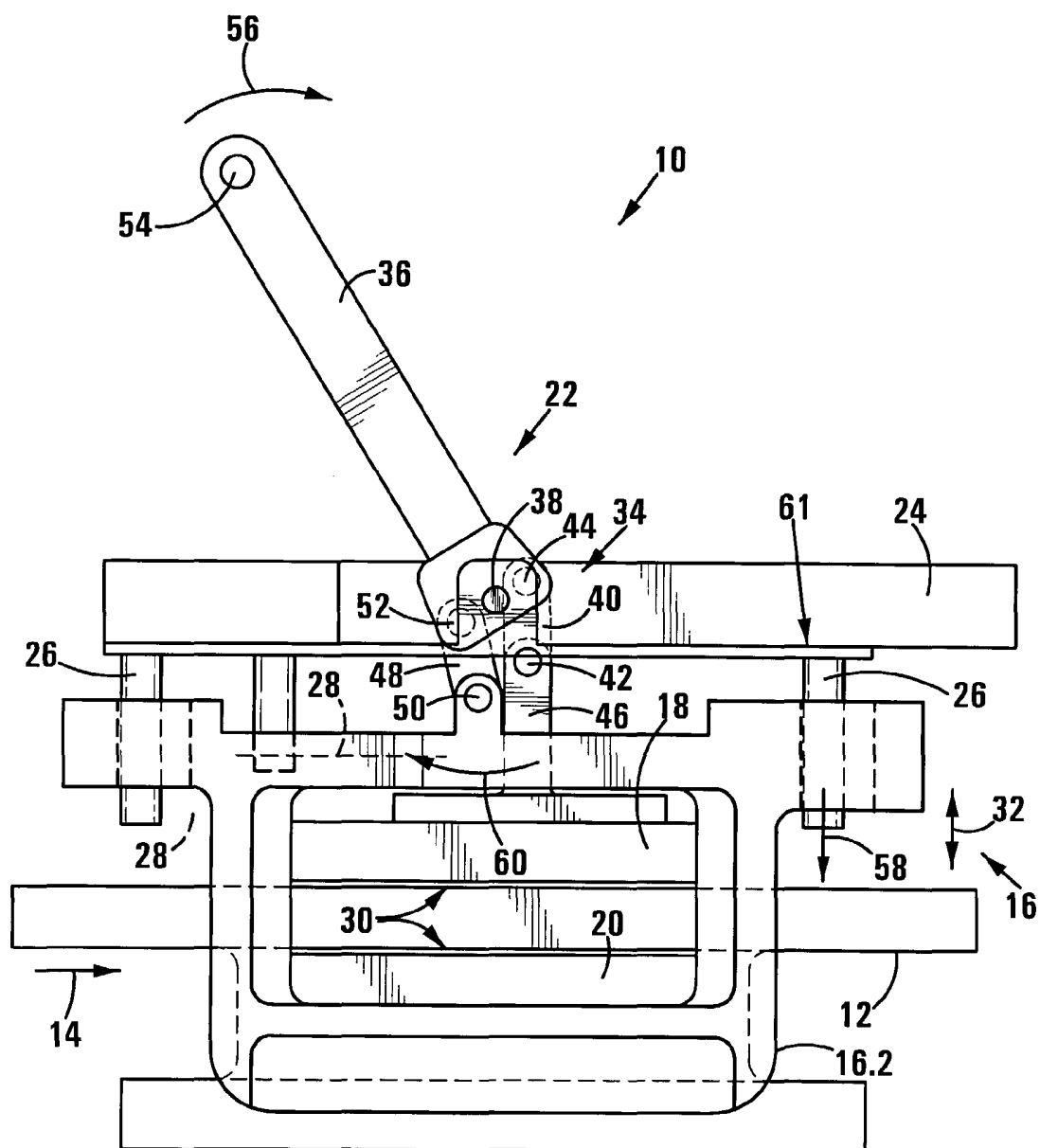
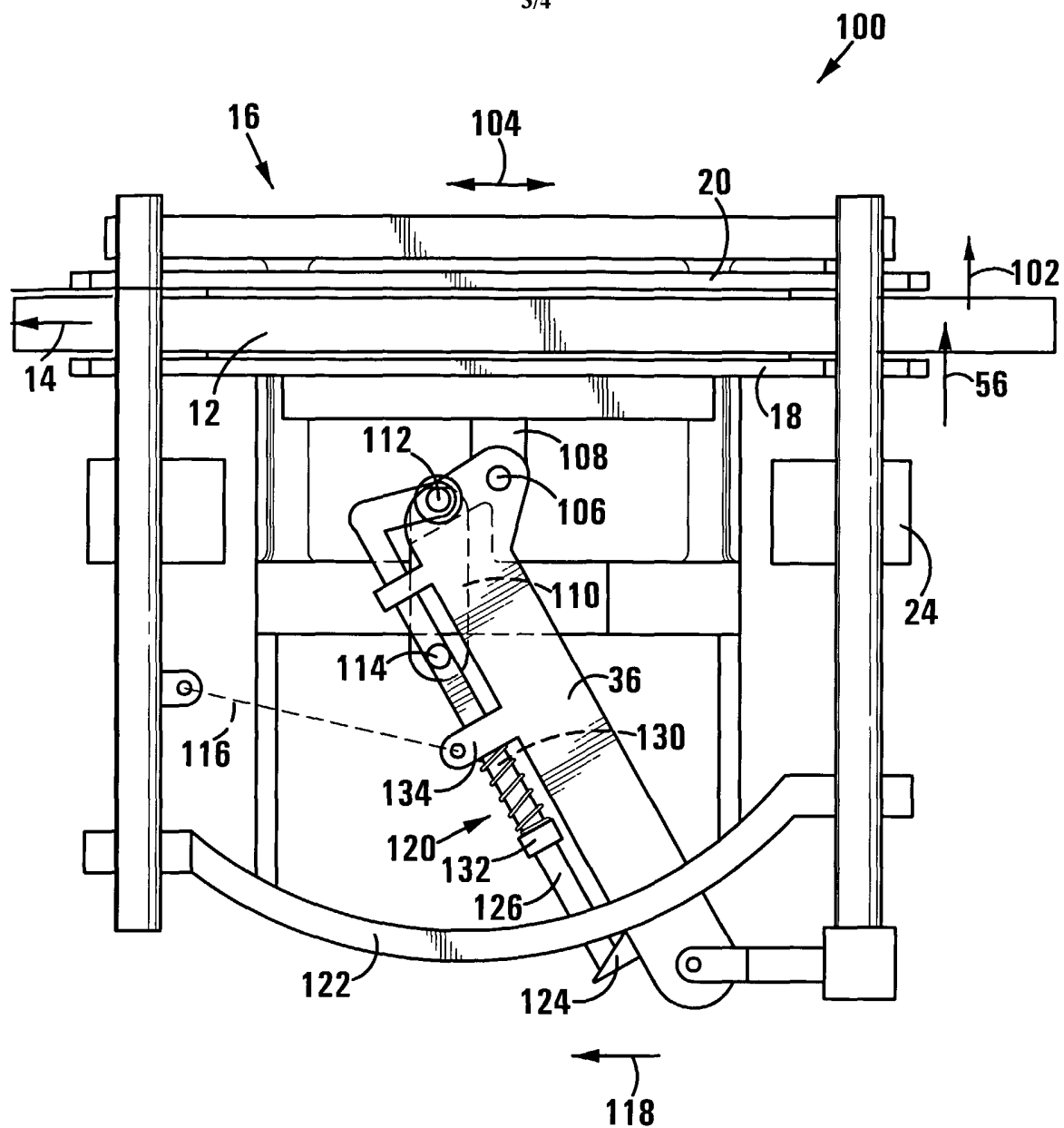


FIG 1



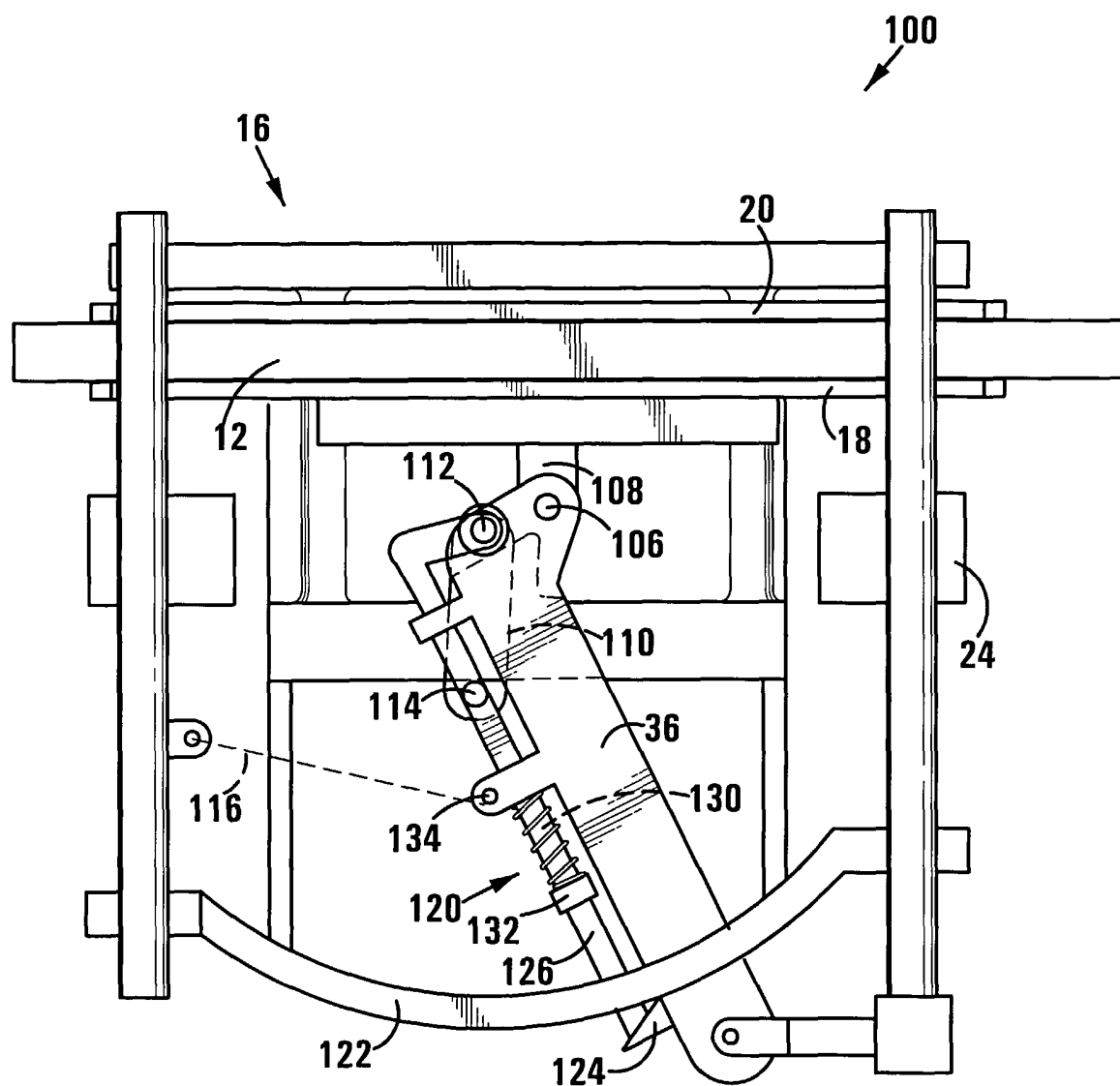


FIG 4

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB2004/002539

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B60T7/20 F16D65/14 F16D63/00

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)

IPC 7 B60T F16D

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 87/02108 A (SIMONEN TENHO RAIMO JUHANI) 9 April 1987 (1987-04-09) page 2, paragraph 4 page 4, paragraph 7 - page 3, paragraph 1; figures 1-4 -----	1,2,7
X	DE 33 25 776 A (PEITZ JOSEF FAHRZEUG) 24 January 1985 (1985-01-24) page 8, paragraph 4 page 14, paragraph 2 - page 17, paragraph 5; figures 7,9,10,20-24,28-42 -----	1-4,7
X	DE 92 17 449 U (KNOTT GMBH) 18 February 1993 (1993-02-18) page 3, paragraph 1 page 10, paragraph 2 - page 11, paragraph 1; figure 3 -----	1,2,7

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

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

"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

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

23 November 2004

Date of mailing of the international search report

01/12/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

HERNANDEZ, R

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB2004/002539

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 8702108	A	09-04-1987	FI 72293 B	30-01-1987
			WO 8702108 A1	09-04-1987
			DE 3569277 D1	11-05-1989
			EP 0247028 A1	02-12-1987
			FI 841268 A	30-09-1985
DE 3325776	A	24-01-1985	DE 3325776 A1	24-01-1985
DE 9217449	U	18-02-1993	DE 9217449 U1	18-02-1993