(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 875 448 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.11.1998 Bulletin 1998/45

(51) Int. Cl.[6]: **B63B 23/42**, B66D 5/04, B66D 5/14

(21) Application number: **98107306.7**

(22) Date of filing: **22.04.1998**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **30.04.1997 IT MI971009**

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(54) Braking device, particularly for braking the descent of a life-boat

(57) A braking device, in particular for braking the descent of a life-boat when lowered from a ship, of the type comprising a pair of braking discs (2, 9), of which a first disc (2) is connected to a fixed member (1) and the other (9) is connected to a rotating member to be braked, for example a winch, and brake means (13, 24; 23) arranged to urge the discs one against the other so as to brake said rotating member. The brake means comprise static braking means (13, 24) arranged to exert a constant thrust on the discs such as to maintain them in mutual contact and maintain the rotating member braked, means (17; 28) for at least partly counteracting the action of the static braking means and enabling the discs to be separated when it is required to enable the braking member to rotate, and dynamic braking means connected to the rotating member and comprising a loose mass (23) arranged to exert, by centrifugal effect, a thrust on the discs proportional to the rotational speed of said rotating member such as to bring the discs into mutual contact and brake the rotating member, cooling means (18, 19) being provided at least for the braking discs (2, 9).

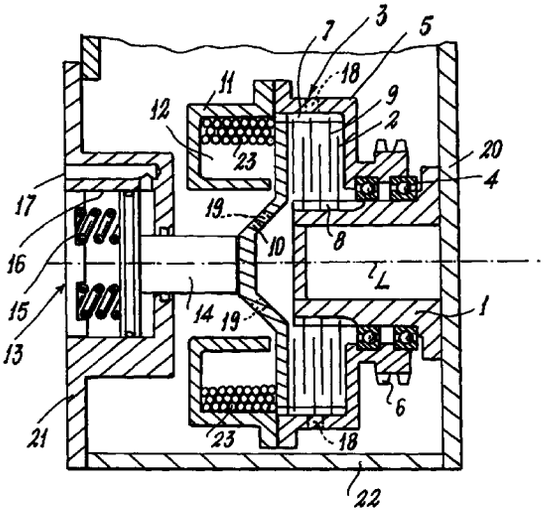


Fig. 1

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Description

This invention relates to a braking device, in particular for braking the descent of a life-boat lowered from a ship.

To limit the descent speed of a life-boat loaded with passengers, it is known to brake the winch or winches, about which the cables to chains required for lowering the life-boat pass, by usual brakes of shoe type. This type of brake presents however numerous drawbacks.

As is well known to the expert of the art, the ship systems for lowering life-boats into the sea must be frequently tested (for example every two weeks), to be certain of their efficiency. At each test the shoes of the braking systems have to be subjected for a relatively short period (of the order of a few tens of seconds) to veryy high stresses, which often compromise their subsequent efficient use.

Consequently, after each test the braking system has to be carefully checked. Generally, as a result of these tests the shoes have to be replaced, this operation being relatively lengthy, complicated and costly, and requiring the stocking of spare shoes on the ship. A further drawback of known braking devices is related to the fact that they have always to be activated and regulated by an operator who, for example, during the descent of a life-boat has to regulate the braking action of the device on the basis of the life-boat descent speed, and which in a panic and/or danger situation can be difficult and uncomfortable.

In the field of friction clutches, centrifugal disc clutches are known (see for example patent EP0443149 filed by the present applicant) comprising means for transmitting movement from a drive shaft to a driven shaft via a mass consisting of a loose material, possibly in fluid or powder form, which by the centrifugal effect urges a friction disc connected to the drive shaft and a friction disc connected to the driven shaft into contact with each other.

It has never been considered up to the present time to also use the known friction disc centrifugal engagement means for braking devices.

An object of this invention is to provide a braking device which ensures perfect efficiency even after repeated periods of operation, for example after repeated tests involving life-boat lowering into the sea, and which requires neither frequent maintenance nor frequent replacement of its components.

A further object is to provide a braking device the effect of which can also be regulated automatically, proportionally to the speed attained by the braking member, without the intervention of an operator.

These and further objects which will be apparent to an expert of the art are attained by a braking device in accordance with the main claim.

The invention will be more apparent from the accompanying drawings, which are provided by way of non-limiting example and on which:

Figure 1 is a schematic section through a braking device of the invention; and

Figure 2 is a schematic section through a modification thereof.

With reference to Figure 1, a braking device according to the invention comprises a hub 1, rigidly secured to a wall 20 and carrying one or more (three in the example shown in Figure 1) braking discs 2, and an element 3 rotating about the hub and connected thereto by usual bearings 4. For the engagement of the discs 2 the hub 1 comprises a toothing 8 which enables the discs to partially slide axially. The rotating element 3 comprises a first member 5 with a part 6, shown in the example in the form of a pinion for connection to a rotating member (not shown) to be braked, and a toothing 7 with which three usual braking discs 9 are engaged in an axially slidable manner. Both the discs 2 and the discs 9 are of usual type and advantageously comprise an outer sintered layer. The rotating element 3 also comprises a second member 10 of discoidal shape, rotatably connected to the first via a toothing 7 which also enables it to slide axially, so as to be able to move the discs 9 and 2 into mutual contact.

The rotating element 3 also comprises a third annular member 11 which together with a portion of the member 10 defines a chamber 12 partly filled with loose material 23, such as metal balls.

The device also comprises, secured to a wall 21, reaction means 13 arranged to exert on the discoidal member 10 a force such as to urge said member against the discs 9 and these latter against the discs 2, so as to maintain the pinion braked. The reaction means 13 comprise a piston 14 movable within a cylinder 16 housing conventional springs 15 arranged to exert an axial thrust on the discoidal member 10, such as to maintain the piston 6 braked. The cylinder 16 is connected via a conduit 17 to a conventional hydraulic or pneumatic system (not shown) arranged to feed into the cylinder a pressurized fluid able to exert on the piston a force counteracting that of the springs 15.

The device is advantageously completely immersed in a cooling liquid, such as oil. To enable the oil to enter into contact with and cool the braking discs 2 and 9, both the member 5 and the discoidal member 10 comprise apertures 18, 19 for the circulation of oil within the rotating element 3.

Advantageously, the device could also comprise a reservoir for the oil and a conventional system for forced oil circulation.

Advantageously the device is housed in the lower part of a closed box casing (partly shown) comprising the side walls 20, 21 and the base wall 22, and which upperly houses a portion of the rotary shaft of the member to be braked, this being engaged with the pinion 6 via a chain or a series of gearwheels (partly shown in the lower part of Figure 2).

When in its rest condition the device maintains in a

locked state the member to be braked, which in the case of a ship's life-boat is the rotary part of the winch. In this situation the springs 15 (Figure 1) urge the piston 14 against the discoidal body 10, which maintains the discs 9 locked against the discs 2. The axial thrust is absorbed by the bearings 4. In this manner a static braking effect is achieved, which via the pinion 6 maintains in a locked state the load connected to the winch. When the load is to be released, pressure is fed into the conduit 17 of the cylinder 16 so as to reduce or eliminate the axial thrust of the springs 15 on the piston 14 and consequently on the discoidal member 10. In this manner the braking action of the discs 2, 9 is reduced or nullified, and the pinion and the member connected to it are free to rotate, dragged by the descending load. By centrifugal effect proportional to the r.p.m. of the rotating element, the loose mass 23 exerts an axial thrust on the discoidal member 10 in the direction of the discs 2, 9, this on approaching the discs causing "dynamic" braking of the pinion 6 and consequently of the rotating member.

On the basis of the load to be braked and its path of travel, the mass of the material 23 can be chosen such as to obtain the desired descent speed of the load.

To halt the load during its descent, the axial thrust on the member 10 and hence on the discs 2 and 9 must be increased by reducing or annulling the fluid pressure within the cylinder 16.

In this manner the action exerted by the material 23 on the member 10 is increased by the thrust of the springs 15. By regulating the fluid pressure within the cylinder 16, the deceleration of the load can be regulated to achieve its stoppage.

It should be noted that because of the cooling effect provided by the liquid in contact with the discs 2, 9, these latter undergo no significant damage during the descent of the load. Consequently the braking system does not require to be checked and maintained after each use, its parts, in particular the discs, requiring replacement only after a lengthy period of operation.

Figure 2 shows a modification of the embodiment heretofore described (those parts in common with Figure 1 being indicated by the same reference numeral and not being further described).

The modification of Figure 2 differs from the aforedescribed embodiment only in the reaction means which maintain the pinion 6 braked and the means for counteracting the action of said reaction means. The reaction means, indicated overall by 24, comprise a piston or pin 30, coaxial to the hub 1 and arranged to slide axially within the hub which hence acts as a cylinder. On the pin there presses a first spring 25, arranged to maintain the head 26 of the pin in contact with a bush 27 rigidly secured to the discoidal member 10, and to exert a force such as to maintain the braking discs 2, 9 in mutual contact. The hub 1 is connected (as in the case of the cylinder 16 of Figure 1) to a conventional hydraulic or pneumatic system (not shown) via a conduit 17. In this manner a pressurized fluid can be fed into the hub 1 capable of exerting on the pin 30 a force able to counteract that of the springs 25. The counteracting means, indicated overall by 28, comprise a shaft 29 rigid with the pin 30 and able to rotate coaxially to the pin 30 and to the hub 1.

One end of the shaft 29 is connected to the pin 30 via a metal ball 31, a connecting element 32 and a spring 33. The ball 31 is partly housed in two hemispherical seats provided in the end of the shaft 29 and of the connecting element 32. The other end of the shaft is rigidly connected to a lever 34 which can be moved angularly only through a short distance as its rotation is locked by limit screws 35. To counteract the action of the spring 25, it is sufficient to rotate the lever 34 through a short distance. This also moves the ball 31, which urges the element 32 towards the spring 25 and consequently, overcoming the action of the spring 25, moves the pin 30 such that its head 26 separates from the bush 27. Consequently there no longer acts on the discoidal member 10 a force able to maintain the braking discs 2, 9 in mutual contact.

In should be noted that by suitably positioning the device, the lever 34 can also be operated from the inside of the life-boat to be lowered, for which purpose it is necessary merely to fix a cord to the lever and pull the cord or release it during the descent of the life-boat.

The operation of the device is substantially identical to that heretofore described.

It should be noted that in this description the device has been described with reference to its application in the naval field, however it could also be applied in other fields, for example in the lift or hoist sector.

Finally, it should be noted that the embodiments heretofore described are provided by way of non-limiting example and that numerous modifications are possible, all falling within the same inventive concept, for example the reaction means and counteracting means could be of different type from those described, or the braking discs could be positioned differently from that shown in Figures 1 and 2, for example such that the member 10 comes into contact with a disc connected to the hub 1, rather than with a disc connected to the rotating element.

The device could moreover be provided with a plurality of springs (not shown in the drawings) acting on the outer edge of disc member 10 in such a way that the effect of the loose mass 23 on said member 10 starts only when said mass exerts a thrust greater than that exerted by said springs. In order to realize this modification, disc member 10 and the annular member 11 should be prolonged toward the outside. The plurality of springs (for example three) could be arranged symmetrically between the opposite walls of the disc member 10 and the first member 5 without interfering with the discs 9 and 2. This modification is very useful in many cases when it is needed that the brakes start acting only when a certain velocity is reached.

Claims

1. A braking device, in particular for braking the descent of a life-boat when lowered from a ship, of the type comprising at least one pair of braking discs (2, 9), of which a first disc (2) is connected to a fixed member (1) and the other (9) is connected to a rotating member to be braked, for example a winch, and brake means (13, 24; 23) arranged to urge the discs one against the other so as to brake said rotating member, characterised in that the brake means comprise static braking means (13, 24) arranged to exert a constant thrust on the discs such as to maintain them in mutual contact and maintain the rotating member braked, means (17; 28) for at least partly counteracting the action of the static braking means and enabling the discs to be separated when it is required to enable the braking member to rotate, and dynamic braking means connected to the rotating member and comprising a loose mass (23) arranged to exert, by centrifugal effect, a thrust on the discs proportional to the rotational speed of said rotating member such as to bring the discs into mutual contact and brake the rotating member, cooling means (18, 19) being provided at least for the braking discs (2, 9).

2. A braking device as claimed in claim 1, characterised by comprising a fixed central member (1) carrying a first braking disc (2) at least partly slidable along the member parallel to a longitudinal axis (L) of said member, an element (3) rotating about the longitudinal axis (L) of the fixed member and comprising a first part (6) to be connected to the rotating member to be braked, a discoidal second part (10) rotatably connected to the first and axially slidable in opposition to the static braking means (13; 24), a second braking disc (9) rotatably connected to the first part and partly slidable coaxial to the first disc (2), said second disc (9) being cooperable with said first disc (2), and a third part (11) rotatably connected to the first to define with at least one portion of said second part (10) a chamber (12) at least partly filled with the loose material (23), the static braking means (13, 24) exerting on said second part (10) a force able to maintain the first and second disc (2, 9) in mutual contact and brake the first part (6) of the rotating element (3), the means (17; 28) for counteracting the action exerted by said static braking means (13; 24) enabling the two braking discs (2, 9) to at least partly separate, consequently allowing the first part (6) to rotate.

3. A device as claimed in claim 1, characterised in that the cooling means comprise a cooling circuit (18, 19) for circulating a cooling liquid at least in correspondence with the braking discs (2, 9).

4. A braking device as claimed in claim 1, characterised in that the static braking means (13; 24) and the counteracting means (17; 28) exert on the braking discs (2, 9) an action in a directed coaxial to the axis of rotation of the rotating braking disc (9).

5. A device as claimed in claim 1, characterised in that the static braking means are of spring type (15; 25).

6. A device as claimed in claim 1, characterised in that the counteracting means (28) are of mechanical type and comprise a manually operated lever (29, 34) arranged to generate a force directed in the opposite direction to that exerted by the static braking means (24).

7. A device as claimed in claim 6, characterised in that the lever (29, 34) is connected to the static braking means (24) via a ball (31) and a spring (33).

8. A device as claimed in claim 6, characterised in that the lever (29, 34) is connected to a rope so as to be operable from the inside of the life-boat.

9. A device as claimed in claim 2, characterised in that the static braking means (24) comprise a pin coaxial to the fixed member (1) and partly housed in said member.

10. A device as claimed in claim 3, characterised by being completely immersed in the cooling liquid.

11. A device as claimed in claim 3, characterised in that the cooling liquid is oil.

12. A device as claimed in claim 1, characterised in that the static braking means (13) and the counteracting means (17) comprise a piston (14) movable within a cylinder (16).

13. A breaking device as claimed in claim 2, characterised by comprising a plurality of springs acting on the discoidal second part (10), said springs being arranged in such a way that the effect of the loose mass (23) on said member (10) starts only when said mass exerts a thrust greater than that exerted by said springs.

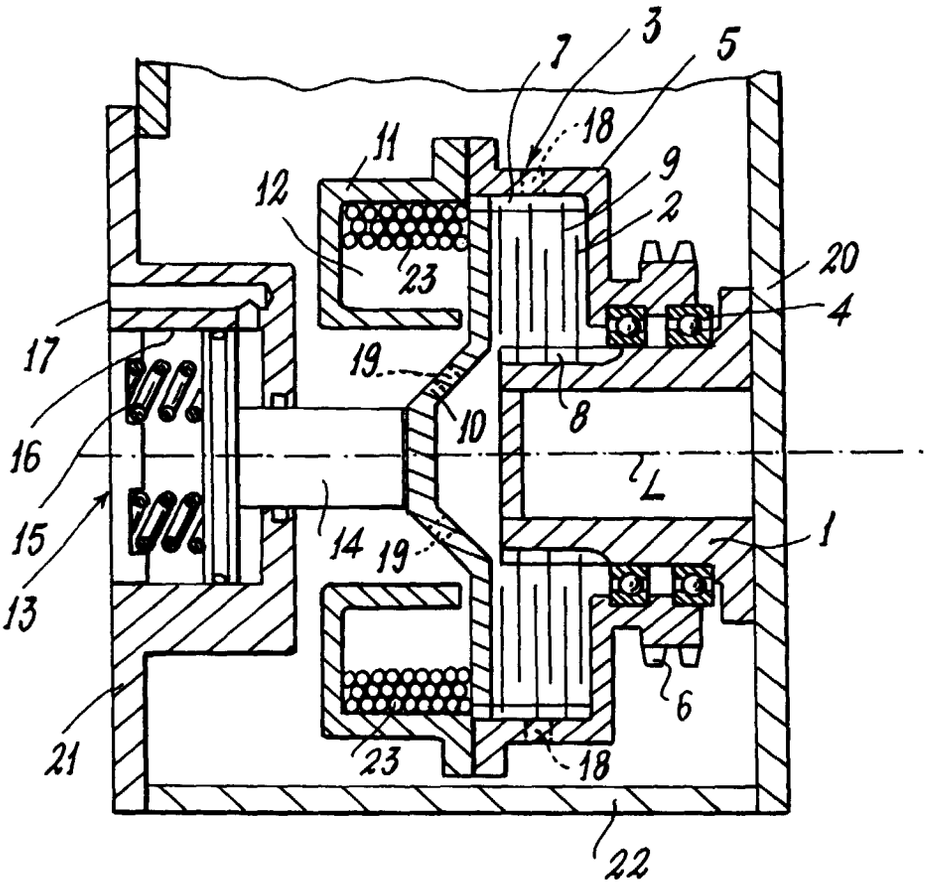


Fig. 1

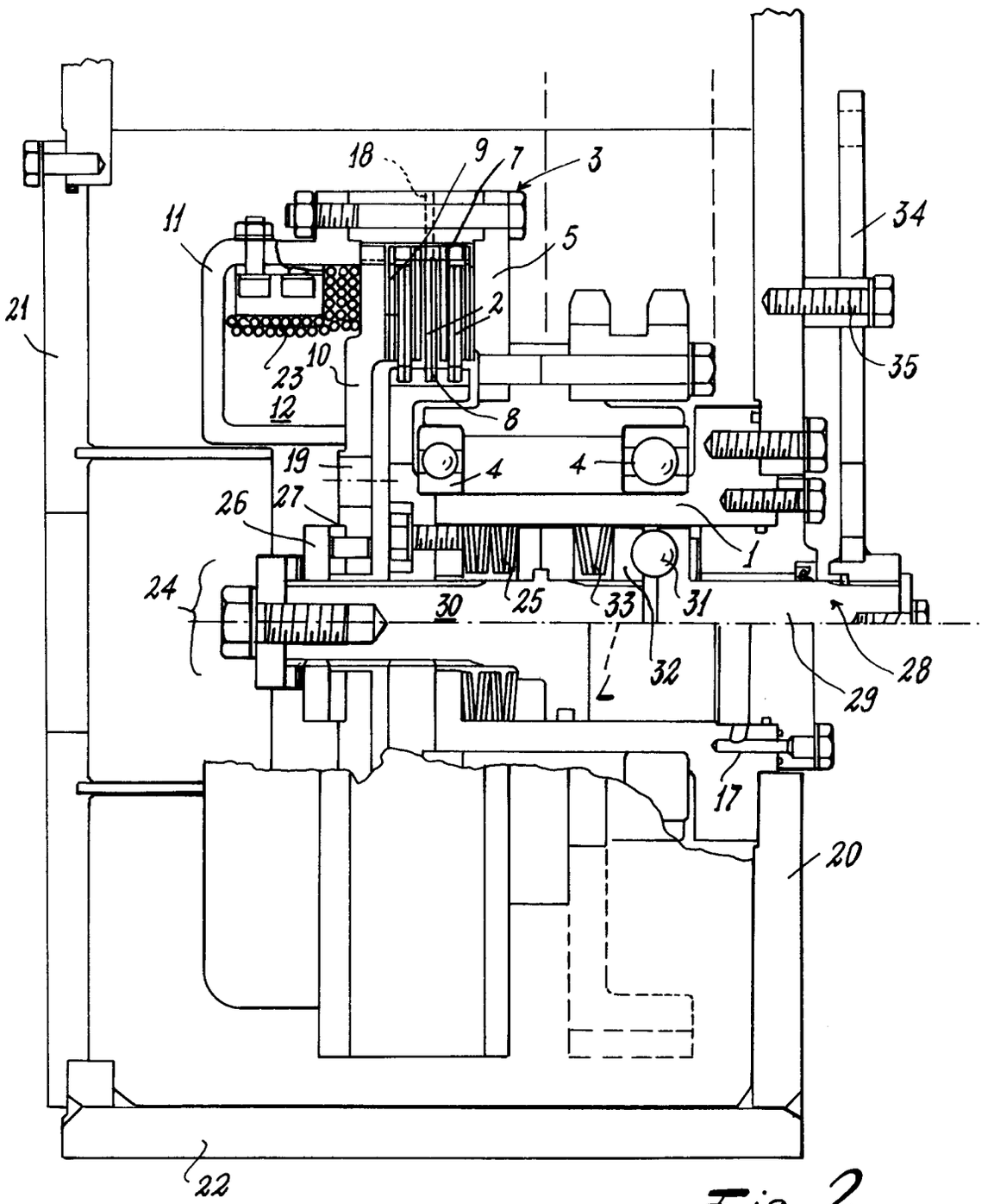

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Fig. 2