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

(11) **EP 1 992 728 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.11.2008 Bulletin 2008/47

(21) Application number: **08156117.7**

(22) Date of filing: **13.05.2008**

(51) Int Cl.:
D06F 37/10 *(2006.01)* ***D06F 37/28*** *(2006.01)*
D06F 39/14 *(2006.01)*

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

(30) Priority: **16.05.2007 IT TO20070344**

(71) Applicant: **Indesit Company, S.P.A.**
60044 Fabriano (AN) (IT)

(72) Inventors:
- **Somma, Pasquale**
  60044 Fabriano (AN) (IT)
- **Bombardieri, Giovanni**
  24021 Albino (BG) (IT)
- **Battaglia, Matteo**
  24036 Ponte San Pietro (BG) (IT)

(74) Representative: **Dini, Roberto**
Metroconsult S.r.l.
Via Sestriere 100
I-10060 None (Torino) (IT)

(54) Top-loading washing machine, in particular a laundry washing machine, and related method of operation

(57) The present invention relates to a top-loading washing machine (1), in particular a laundry washing machine, comprising:
- a control unit adapted to control the operation of said washing machine (1);
- a tub (10) having a top opening (11);
- a drum (20) fitted in a manner such that it can rotate about a substantially horizontal axis (A) inside the tub (10);
- at least one door (21, 22) secured to said drum (20) for allowing access to the inside of the drum (20).

The invention is characterized in that said washing machine (1) comprises a safety device (31, 32, 33) associated with said tub (10) and/or said drum (20), which allows said control unit to detect an open/closed condition of said at least one door (21, 22), in particular when said drum (20) is rotating inside the tub (10).

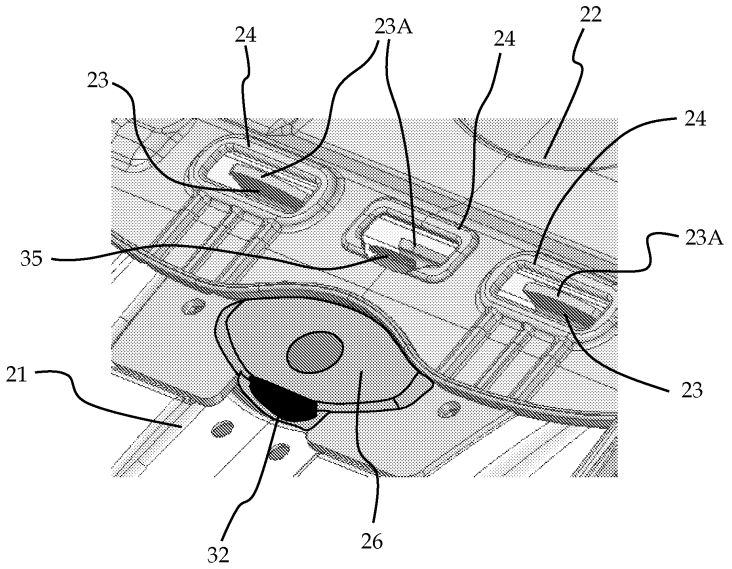

Fig. 2a

EP 1 992 728 A2

Description

[0001] The present invention relates to a top-loading washing machine, in particular a laundry washing machine, according to the preamble of claim 1. Furthermore, the present invention also relates to a method of operation of said top-loading washing machine, in particular a laundry washing machine.

[0002] Known washing machines are fitted with doors for closing an opening which allows access to the inside of a drum. Said washing machines usually comprise a pair of doors, each secured to the drum on one side of said access opening, in particular through spring-loaded hinges. The free portions of the doors, in particular the portions located on the side opposite to the spring-loaded hinges, are fitted with a closing system which comprises a plurality of hooks arranged on a first door and a plurality of slots arranged on a second door, the open ends of the hooks facing the outer portion of the drum. The springs of the hinges tend to open said first and second doors outwards; consequently, when the elements of the closing system are engaged, the hooks of the first door are pushed into the slots of the second door. In order to open the doors, it is necessary to exert direct pressure onto said first and second doors towards the inside of the drum.

[0003] However, it has been observed that the above-described system involves a number of drawbacks, in that the doors may open due to unintentional movements thereof, which are mostly caused by drum movements or by the friction and the hitting of the laundry against the inner wall of the doors themselves.

[0004] Doors have therefore been conceived which comprise stop means avoiding the disengagement of the hooks from the slots when the doors are closed.

[0005] Several stop means are known in the art which essentially comprise a stop that can be intentionally removed by the user of the washing machine by using an appropriate operation means; said stop obstructs the reciprocal motion of the doors when the latter are closed.

[0006] A first device of the above-described type has been disclosed in French patent No. FR2289659, wherein the stop is located on the end portion of a flat spring in the area corresponding to the second door fitted with slots, and wherein said stop can be removed by bending said flat spring, which is fitted with a push-button and which is pulled against the lower portion of a U-bolt that limits the outward movement of the flat spring.

[0007] A further safety device comprising a stop which can be intentionally removed by the user has been described in European patent No. EP0402252. In particular, in said European patent the stop consists of a push-button which is pulled out of a hollow socket by a spring; said push-button comprises a base bearing against a collar of the hollow socket for limiting the stroke of the push-button upwards and towards the bottom of a recess in which the hollow socket is secured in order to limit the downward stroke of the push-button.

[0008] However, these devices suffer from significant drawbacks as well, because it may happen that the doors open during a wash cycle, usually due to an imperfect engagement of the hooks into the slots, thereby causing serious damage to the washing machine and to the laundry contained therein. In fact, in such a situation the drum will keep turning and the doors will hit violently against the inner walls of the washing machine. Furthermore, the opening of the doors during a wash cycle may also put the user of the washing machine at risk, in particular should the doors open during a spin cycle, when the drum is turning at a particularly high speed.

[0009] In this frame, it is the main object of the present invention to overcome the above-mentioned drawbacks by providing a top-loading washing machine, in particular a laundry washing machine, which is so conceived as to prevent any damage to the washing machine itself and to the laundry contained therein should the doors accidentally open during a wash cycle, in particular said opening being due to drum movements, to the friction of the laundry against the inner walls of the doors, or to hooks incorrectly engaged into the slots.

[0010] It is a further object of the present invention to provide a top-loading washing machine, in particular a laundry washing machine, which is so conceived that no risks will be incurred by the user of the washing machine should the doors accidentally open during a wash cycle.

[0011] These objects are achieved by the present invention through a top-loading washing machine, in particular a laundry washing machine, and a related method of operation of said top-loading washing machine incorporating the features set out in the appended claims, which are intended as an integral part of the present description.

[0012] Further objects, features and advantages of the present invention will become apparent from the following detailed description and from the annexed drawings, which are supplied by way of non-limiting example, wherein:

- Fig. 1 is a perspective view of a portion of a top-loading washing machine, in particular a laundry washing machine, according to the present invention;
- Fig. 2a is a perspective view of a detail of a variant of a top-loading washing machine, in particular a laundry washing machine, according to the present invention;
- Fig. 2b is a perspective view of a detail of the safety device of Fig. 2a.

[0013] Referring now to Figs. 1 and 2a, reference numeral 1 designates as a whole a portion of a top-loading washing machine according to the present invention. Washing machine 1 may be a laundry washing machine, a clothes dryer, or a washing/drying machine.

[0014] Washing machine 1 comprises:

- a control unit (not shown in the drawings) adapted to control the operation of said washing machine 1;
- a tub 10 having a top opening 11;
- a drum 20 fitted in a manner such that it can rotate about a substantially horizontal axis A inside tub 10;
- at least one door 21, 22 secured to said drum 20 for allowing access to the inside of drum 20.

[0015] Said top opening 11 is preferably associated, in a known manner, with a top door (not shown).

[0016] According to the present invention, washing machine 1 comprises a safety device 31, 32, 33 associated with said tub 10 and/or said drum 20, which allows said control unit to detect an open/closed condition of said at least one door 21, 22, in particular when said drum 20 is rotating inside tub 10.

[0017] Said safety device comprises:

- a first element 31 associated with said tub 10, in particular with an inner edge 12 of said top opening 11;
- a second element 32 associated with said at least one door 21, 22, in particular with an outer surface of said at least one door 21, 22.

[0018] The position of first element 31 shown in Fig. 1 allows to obtain some advantages in terms of maintenance, because the association with inner edge 12 of top opening 11 allows easy access to said first element 31. However, it is clear that this explanatory representation should not be deemed to be a limiting one, in that first element 31 may be positioned anywhere on tub 10, e.g. at the top, at the bottom or on one side of drum 20.

[0019] In a preferred embodiment, said first element 31 and second element 32 comprise magnetic detection means for detecting an open/closed condition of said at least one door 21, 22; in particular, said first element 31 comprises a magnetic sensor, in particular of the Hall-effect type, which is adapted to detect the transit of a permanent magnet comprised in said second element 32.

[0020] As a result, said first element 31 supplies information about its distance from said second element 32 to the control unit of washing machine 1. Said information may be detected at each transit of said second element 32 during a wash cycle and, if the distance between said first element 31 and second element 32 does not match a preset value, the control unit of washing machine 1 will stop the rotation of drum 20 inside tub 10, thus stopping the wash cycle as well.

[0021] Advantageously, this allows to prevent washing machine 1 and the laundry contained therein from suffering any damage should said at least one door 21, 22 accidentally open during a wash cycle, while at the same time avoiding any risk for a user of washing machine 1 according to the present invention.

[0022] As shown in Figs. 1 and 2, said at least one door 21, 22 comprises:

- a first door 21 comprising a plurality of hooks 23,
- a second door 22 comprising a plurality of slots 24,

said hooks 23 and said slots 24 being so arranged that, when first door 21 and second door 22 are closed under the action of return springs 25, hooks 23 will engage into slots 24.

[0023] Said first door 21 comprises a push-button 26, in particular made of plastic material, which operates stopping means (not shown in the drawings) adapted to prevent said first door 21 and second door 22 from translating relative to each other and to make it more difficult for said hooks 23 to disengage from said slots 24.

[0024] In a preferred embodiment of washing machine 1 according to the present invention, said second element 32 is associated with said push-button 26. This facilitates the work for connecting second element 32 to first door 21 of the washing machine; in fact, especially when said push-button 26 is made of plastic material, second element 32 may be easily co-moulded into push-button 26.

[0025] Alternatively, second element 32 may be secured to push-button 26 through a joint or screws, or through any other means known in the art for obtaining a connection between mechanical components.

[0026] The arrangement of second element 32 shown in Figs. 1 and 2a is just a non-limiting example, since second element 32 may be applied anywhere on first door 21 or second door 22. However, second element 32 should advantageously be arranged on either door 21, 22 at the same depth as first element 31, said depth running in the direction of the axis of rotation A of drum 20, so as to decrease the distance between first element 31 and second element 32 and consequently improve the sensitivity of first element 31. In addition, second element 32 should be arranged to particular advantage on either door 21, 22 the most further away from return springs 25 of the door 21, 22 to which second element 32 is applied; in this manner, in fact, a predetermined angular movement of each of said doors 21, 22 will originate the maximum linear movement of second element 32, thus making it easier for first element 31 to detect an improperly closed condition of doors 21, 22.

[0027] As shown in particular in Figs. 2a and 2b, safety device 31, 32, 33 of washing machine 1 comprises an elastic element 33 which mechanically ensures that doors 21, 22 are properly closed.

[0028] Said elastic element 33 comprises:

- a first portion 34 adapted to be coupled to second door 22 through suitable fastening means, in particular said first portion 34 being secured to one side of second door 22 facing the inside of drum 20 when doors 21, 22 are closed;
- a second portion 35 comprising an arched flat spring, said second portion 35 being adapted to be inserted into slot 24 of second door 22.

[0029] Elastic element 33 ensures that doors 21, 22 close properly, even in the event that the user does something wrong when closing said doors 21, 22. As a matter of fact, it may happen that the user engages said doors 21, 22 incorrectly, so that hooks 23 of first door 21 are not pushed all the way into slots 24 of second door 22, and that a central tip 23A of said hooks 23 lies against an edge of slot 24; this would inevitably lead doors 21, 22 to open all of a sudden during the operation of washing machine 1. Instead, elastic element 33 will cause doors 21, 22 to open again distinctly if they are not closed correctly by a user.

[0030] A method of operation of a washing machine 1, in particular a laundry washing machine, will now be described, which comprises:

- a control unit adapted to control the operation of said washing machine 1;
- a tub 10 having a top opening 11 with which a top door (not shown) is associated in a known manner;
- a drum 20 fitted in a manner such that it can rotate about a substantially horizontal axis A inside tub 10;
- at least one door 21, 22 secured to said drum 20 for allowing access to the inside of drum 20.

[0031] According to the present invention, said method comprises the following steps:

A) activation of said drum 20 in order to rotate it inside tub 10 and start a wash cycle;
B) activation of a safety device 31, 32, 33 associated with said tub 10 and/or said drum 20 in order to allow said control unit to detect an open/closed condition of said at least one door 21,22.

[0032] In accordance with the present invention, said step B) of activating said safety device 31, 32, 33 comprises a step C) of activating a first element 31 associated with said tub 10, in particular with an inner edge 12 of said top opening 11, in order to detect the transit of a second element 32 and obtain information about the distance between said first element 31 and said second element 32.

[0033] Furthermore, said step C) may be followed by a step D) of activating said control unit in order to stop the rotation of drum 20 inside tub 10 if the distance between said first element 31 and second element 32 does not match a preset value. This interruption of the rotation of drum 20 allows to prevent washing machine 1 and the laundry contained therein from suffering any damage should said at least one door 21, 22 accidentally open during a wash cycle.

[0034] According to the present invention, said step A) of activating said drum 20 in order to start a wash cycle may be preceded by a test step comprising a step E), wherein drum 20 is started in such a manner as to make a limited number of revolutions (e.g. one or two revolutions) at a low speed, and a step F) of activating said first element 31 for the purpose of immediately obtaining information about the distance between said first element 31 and said second element 32.

[0035] Finally, said step E) of activating said first element 31 may be followed by either:

- a wash cycle, if the information about the distance between said first element 31 and said second element 32 substantially matches a preset value; or
- a step G) of activating the control unit of washing machine 1 in order to stop the rotation of drum 20, if the information about the distance between said first element 31 and said second element 32 does not substantially match a preset value.

[0036] Furthermore, said steps D) and G) of activating said control unit in order to stop the rotation of drum 20 may be supplemented with a step H) of activating signalling means (not shown in the drawings) adapted to warn the user about the fact that doors 21, 22 of washing machine 1 according to the present invention have not been properly closed.

[0037] The advantages of a washing machine, in particular a laundry washing machine, and of a related method of operation of said washing machine according to the present invention are apparent from the above description.

[0038] In particular, said advantages consist in the fact that the washing machine according to the present invention is so conceived as to prevent the washing machine itself and the laundry contained therein from suffering any damage should the doors accidentally open during a wash cycle, in particular due to drum movements, to the friction of the laundry against the inner walls of the doors, or to hooks incorrectly engaged into the slots.

[0039] Another advantage offered by the washing machine according to the present invention is that it is so conceived that no risks will be incurred by the user of the washing machine should the doors accidentally open during a wash cycle.

[0040] The washing machine and the method described herein by way of example may be subject to many possible variations without departing from the novelty spirit of the inventive idea; it is also clear that in the practical implementation of the invention the illustrated details may have different shapes or be replaced with other technically equivalent elements.

[0041] For example, among the many possible variations, said first element 31 and second element 32 may be so provided as to comprise optical detection means for detecting an open/closed condition of said at least one door 21, 22. According to such a variant, said first element 31 comprises an emitter/receiver diode adapted to emit a light beam which can be reflected by a reflective element fitted to second element 32, the light beam emitted by second element 32 being received by the diode in order to supply information about the distance between

said first element 31 and second element 32 to the control unit of washing machine 1.

[0042] It can therefore be easily understood that the present invention is not limited to the above-described washing machine and method, but may be subject to many modifications, improvements or replacements of equivalent parts and elements without departing from the inventive idea, as clearly specified in the following claims.

Claims

1. Top-loading washing machine (1), in particular a laundry washing machine, comprising:

- a control unit adapted to control the operation of said washing machine (1);
- a tub (10) having a top opening (11);
- a drum (20) fitted in a manner such that it can rotate about a substantially horizontal axis (A) inside the tub (10);
- at least one door (21, 22) secured to said drum (20) for allowing access to the inside of the drum (20),

characterized in that
said washing machine (1) comprises a safety device (31, 32, 33) associated with said tub (10) and/or said drum (20) in order to allow said control unit to detect an open/closed condition of said at least one door (21, 22), in particular when said drum (20) is rotating inside the tub (10).

2. Washing machine (1) according to claim 1, **characterized in that** said safety device comprises:

- a first element (31) associated with said tub (10), in particular with an inner edge (12) of said top opening (11);
- a second element (32) associated with said at least one door (21, 22), in particular with an outer surface of said at least one door (21, 22).

3. Washing machine (1) according to claim 2, **characterized in that** said first element (31) and second element (32) comprise magnetic detection means for detecting an open/closed condition of said at least one door (21, 22).

4. Washing machine (1) according to claim 3, **characterized in that** said first element (31) comprises a magnetic sensor, in particular of the Hall-effect type, adapted to detect the transit of a permanent magnet comprised in said second element (32), said first element (31) being adapted to supply information about its distance from said second element (32) to the control unit.

5. Washing machine (1) according to claim 2, **characterized in that** said first element (31) and second element (32) comprise optical detection means for detecting an open/closed condition of said at least one door (21, 22).

6. Washing machine (1) according to claim 5, **characterized in that** said first element (31) comprises an emitter/receiver diode adapted to emit a light beam which can be reflected by a reflective element fitted to the second element (32), the light beam emitted by the second element (32) being received by the diode in order to supply information about the distance between said first element (31) and second element (32) to the control unit of the washing machine (1).

7. Washing machine (1) according to claim 1, **characterized in that** said at least one door (21, 22) comprises:

- a first door (21) comprising a plurality of hooks (23),
- a second door (22) comprising a plurality of slots (24),

said hooks (23) and said slots (24) being so arranged that, when the first door (21) and second door (22) are closed under the action of return springs (25), the hooks (23) will engage into the slots (24).

8. Washing machine (1) according to claim 7, **characterized in that** said first door (21) comprises a push-button (26), in particular made of plastic material , which operates stopping means adapted to prevent a relative translational movement of said first door (21) and second door (22).

9. Washing machine (1) according to claims 2 and 8, **characterized in that** said second element (32) is associated with said push-button (26).

10. Washing machine (1) according to claim 7, **characterized in that** said safety device comprises an elastic element (33) which mechanically ensures that said first door (21) and second door (22) are properly closed.

11. Washing machine (1) according to claim 10, **characterized in that** said elastic element (33) comprises:

- a first portion (34) adapted to be coupled to the second door (22) through suitable fastening means, in particular said first portion (34) being secured to one side of the second door (22) facing the inside of the drum (20) when the doors (21, 22) are closed;

- a second portion (35) comprising an arched flat spring, said second portion (35) being adapted to be inserted into the slot (24) of the second door (22).

12. Method of operation of a washing machine (1), in particular a laundry washing machine, comprising:

- a control unit adapted to control the operation of said washing machine (1);
- a tub (10) having a top opening (11);
- a drum (20) fitted in a manner such that it can rotate about a substantially horizontal axis (A) inside the tub (10);
- at least one door (21, 22) secured to said drum (20) for allowing access to the inside of the drum (20),

said method being **characterized by** comprising the following steps:

A) activation of said drum (20) in order to rotate it inside the tub (10) and start a wash cycle;
B) activation of a safety device (31, 32, 33) associated with said tub (10) and/or said drum (20) in order to allow said control unit to detect an open/closed condition of said at least one door (21, 22).

13. Method according to claim 12, **characterized in that** said step B) of activating said safety device (31, 32, 33) comprises a step C) of activating a first element (31) associated with said tub (10), in particular with an inner edge (12) of said top opening (11), in order to detect the transit of a second element (32) and obtain information about the distance between said first element (31) and said second element (32).

14. Method according to claim 13, **characterized in that** said step C) may be followed by a step D) of activating said control unit in order to stop the rotation of the drum (20) inside the tub (10) if the distance between said first element (31) and second element (32) does not match a preset value.

15. Method according to claim 12, **characterized in that** said step A) of activating said drum (20) in order to start a wash cycle is preceded by a test step comprising a step E), wherein the drum (20) is started in such a manner as to make a limited number of revolutions at a low speed, and a step F) of activating said first element (31) for the purpose of immediately obtaining information about the distance between said first element (31) and said second element (32).

16. Method according to claim 15, **characterized in that** said step E) of activating said first element (31) is followed by a wash cycle, if the information about the distance between said first element (31) and said second element (32) substantially matches a preset value.

17. Method according to claim 15, **characterized in that** said step E) of activating said first element 31 is followed by a step G) of activating the control unit of the washing machine (1) in order to stop the rotation of the drum (20), if the information about the distance between said first element (31) and said second element (32) does not substantially match a preset value.

18. Method according to claims 14 and 17, **characterized in that** said steps D) and G) of activating said control unit in order to stop the rotation of the drum (20) are supplemented with a step H) of activating signalling means adapted to warn the user about the fact that the doors (21, 22) have not been properly closed.

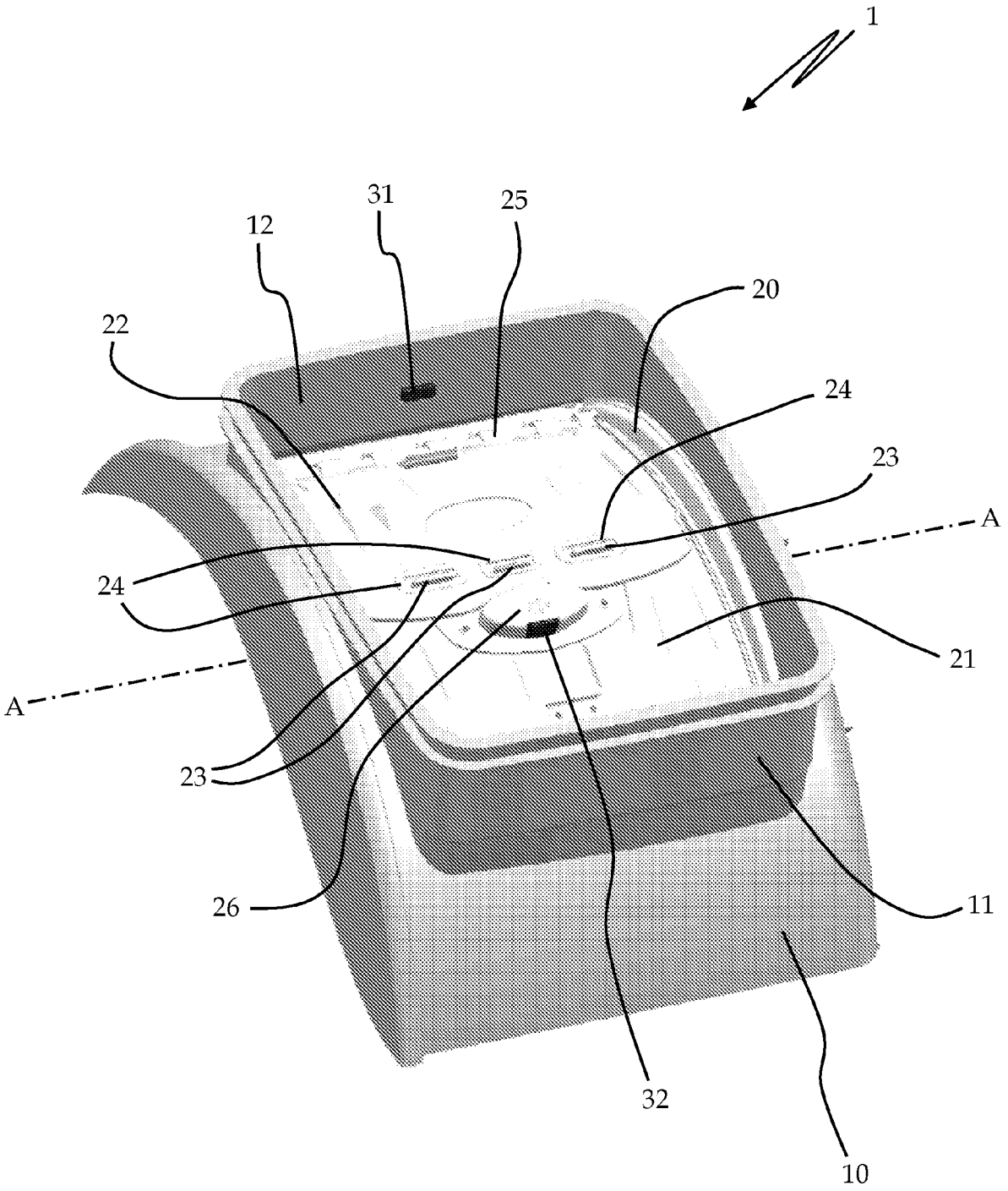

Fig. 1

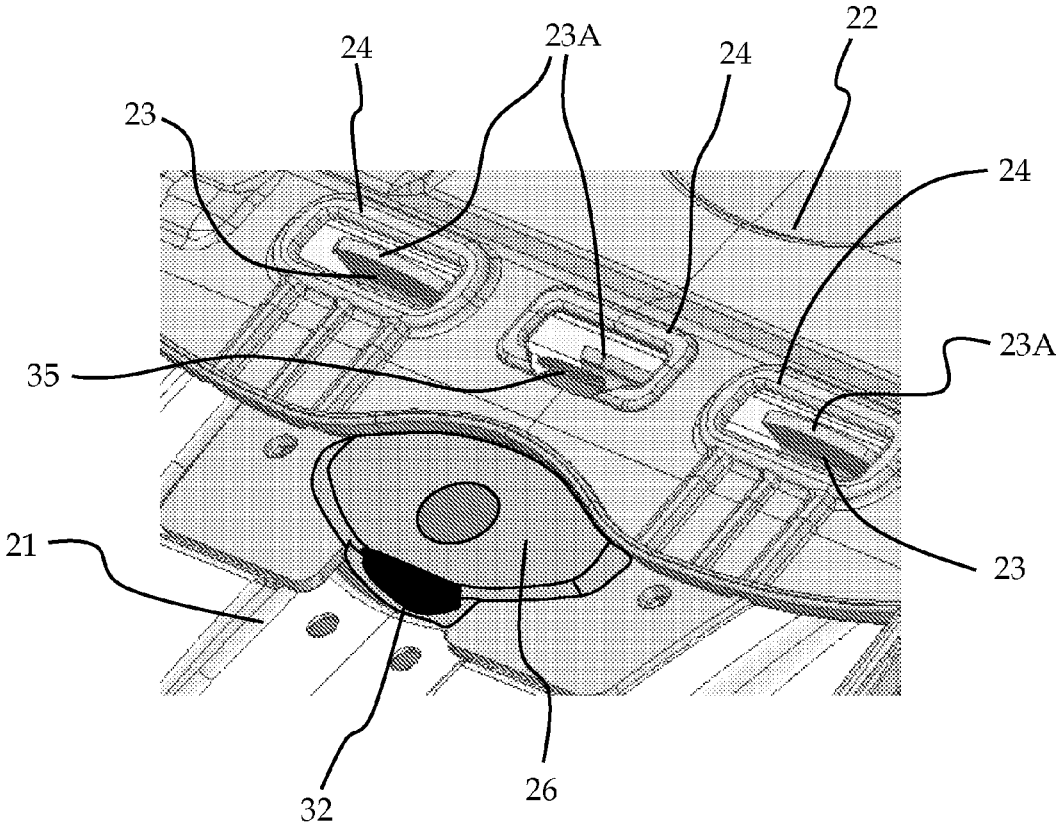

Fig. 2a

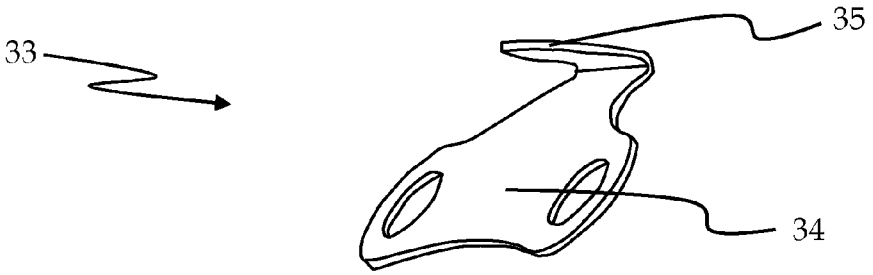

Fig. 2b

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- FR 2289659 **[0006]**
- EP 0402252 A **[0007]**