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(54) **Washing machine with a wash drum lighting device**

Waschmaschine mit einer Beleuchtungseinrichtung für eine Trommel

Machine à laver avec un dispositif d'éclairage pour un tambour

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Description

[0001] The present invention relates to a washing machine with a wash drum lighting device.

[0002] As is known, last-generation household washing machines are equipped with a lighting device, normally located inside the wash chamber of the machine to illuminate the drum, so that the laundry inside the drum is visible to the user during and/or at the end of the wash cycle. An example is disclosed in EP 1048775.

[0003] More specifically, the lighting device comprises a halogen or incandescent lamp located inside the wash chamber, at the door opening of the machine, and oriented to light the inside of the drum; and an electric control circuit for supplying the lamp with a given electric power.

[0004] The washing machine lighting device described above has various drawbacks.

[0005] Firstly, in addition to requiring a large amount of electric power, with obvious drawbacks in terms of consumption, the incandescent or halogen lamps of lighting devices of the above type also have the major drawback of high operating temperature. As a result, to keep the lamp at a stable temperature below a given danger threshold, highly complex electronic control circuits are required to control power supply to the lamp as a function of the temperature of the lamp, and so prevent overheating and the risk of fire.

[0006] Secondly, halogen or incandescent lamps indiscriminately illuminate all the space surrounding the lamp, as opposed to producing a light beam directed solely onto the drum area to be illuminated. In point of fact, a large percentage of the light beam emitted by the lamps of currently used lighting devices is wasted.

[0007] Finally, the working life of lamps of lighting devices of the above type is seriously affected by the degree of machine vibration and the number of switching operations of the electric control circuit. As a result, the lamp is frequently damaged when subjected to severe vibration or when a given switching threshold is reached.

[0008] It is an object of the present invention to provide a washing machine comprising a wash drum lighting device designed to eliminate the drawbacks of known lighting devices.

[0009] According to the present invention, there is provided a washing machine comprising a wash drum lighting device as claimed in the accompanying Claims.

[0010] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows, schematically, a washing machine comprising a wash drum lighting device and in accordance with the teachings of the present invention; Figure 2 shows a schematic detail of the Figure 1 lighting device;

Figure 3 shows a block diagram of the electronic control unit of the Figure 1 lighting device.

[0011] Number 1 in Figure 1 indicates as a whole a household washing machine substantially comprising a substantially parallelepiped-shaped outer casing 2, one outer face of which has an opening 3 to which a door (not shown) is hinged.

[0012] Washing machine 1 also comprises a wash chamber 5 housed inside casing 2 and connected to opening 3 by a tubular seal or bellows 6; and a wash drum 7 housed inside wash chamber 5 and rotated, in use, by a drive unit (not shown) about a substantially horizontal axis of rotation A.

[0013] Washing machine 1 also comprises a lighting device 8 for lighting wash drum 7 and which, unlike the wash drum lighting devices of known washing machines, comprises one or more LEDs 9 for emitting one or more light beams towards the opening of wash drum 7 to illuminate the inside of the drum.

[0014] In the Figure 1 and 2 example, lighting device 8 comprises a substantially ogival casing or shell 10, which has a lens 11 at one end 10a and fits stably, but in easily removable manner, inside a seat 12 formed in bellows 6, so that lens 11 faces wash drum 7 (Figure 1).

[0015] Lighting device 8 also comprises a supporting rod 13, which has LED 9 at one end 13a and fits axially inside a tubular cavity 14 formed in shell 10, so that LED 9 is positioned facing lens 11 of shell 10. Lens 11 provides for concentrating the light beam from LED 9 onto wash drum 7, and, in the example shown, is designed to produce a light-emitting cone with an angle α of about 80°.

[0016] In an alternative embodiment employing a number of LEDs 9, lens 11 provides for appropriately collimating the light beams from LEDs 9 onto wash drum 7.

[0017] In the Figure 2 example, shell 10 is made of preferably transparent plastic material, and, in addition to the optical function described above, also protects LED 9 on rod 13 against water.

[0018] More specifically, shell 10 is provided on the end with a number of axially spaced lock seals 15, which, on the one hand, seal the end of seat 12 facing wash drum 7, to protect LED 9 against water, and, on the other, assist in locking shell 10 axially inside seat 12.

[0019] Shell 10 also has two longitudinal anchoring flanges 16, which project from the opposite end of shell 10 to lens 11, are positioned facing and parallel to each other, and the free end of each of which has a supporting edge 16a which, when shell 10 is fitted inside seat 12, rests on the end edge of seat 12 opposite wash drum 7 to prevent axial movement of shell 10 towards wash drum 7.

[0020] Supporting rod 13 is substantially cylindrical, is made of metal, such as aluminium or any other similar metal material, and provides for dissipating into the outside atmosphere the heat generated by LED 9.

[0021] The body of rod 13 has two longitudinal grooves 17 (only one shown in Figure 2), each for housing a portion of conducting wire of LED 9; and two anchoring tabs 18 (only one shown in Figure 2) which fit inside respective

seats (not shown), formed in the inner walls of tubular cavity 14 of shell 10, to mechanically connect rod 13 and shell 10 into one body.

[0022] Seat 12 is substantially complementary in shape to the outer shape of shell 10, and is preferably integrated in the top portion of bellows 6 to reduce exposure of lighting device 8 to water.

[0023] In the Figure 2 example, seat 12 extends along an axis B preferably lying in a vertical diametrical plane of bellows 6 and substantially sloping with respect to horizontal axis A of the wash drum.

[0024] In an alternative embodiment, axis B is substantially parallel to axis A, and seat 12 extends substantially on the inner wall of bellows 6.

[0025] With reference to Figure 3, lighting device 8 also comprises an electronic control unit 19 connected to and for supplying electric operating power to LED 9.

[0026] Electronic control unit 19 substantially comprises a power block 20 for generating the current/voltage supply of LED 9; a detecting block 21 for detecting the junction temperature T_G of LED 9; and a control block 22 for controlling power block 20 as a function of the temperature T_G reading.

[0027] More specifically, power block 20 may be defined by an electronic PWM (Pulse Width Modulation) circuit connected to the two input terminals of LED 9 to supply electric power to the LED, and having an input supplied with a control signal S_{COM} indicating the electric power to be supplied to LED 9.

[0028] Detecting block 21 is input-connected to the two input terminals of LED 9, and has an output supplying a current/voltage signal S_T proportional to the junction temperature T_G of LED 9; and control block 22 receives and processes signal S_T to produce, as a function of the junction temperature T_G reading, signal S_{COM} coding the value of the electric power to be supplied to LED 9.

[0029] More specifically, control block 22 may be defined by a microprocessor, which compares the temperature T_G reading with a predetermined maximum temperature threshold T_S , and, in the event the temperature T_G reading exceeds the predetermined maximum temperature threshold T_S , provides for controlling power block 20 to reduce the electric power supply to LED 9 and so reduce the junction temperature of LED 9.

[0030] In other words, electronic control unit 19 acts as an electronic closed-loop circuit, which controls LED 9 to keep its junction temperature stable below the predetermined maximum temperature threshold T_S .

[0031] LED 9 of lighting device 8 may be defined by a one-colour LED to generate a light beam of one predetermined colour; or by a multicolour RGB diode for generating a number of light beams of different colours, i.e. a number of light beams of different frequency spectrums; or by a number of LEDs, each emitting a light beam of a different colour.

[0032] If lighting device 8 comprises a multicolour RGB diode or a number of LEDs of different colours, the colour of the light beam directed onto wash drum 7 can be varied

as a function of the operating conditions and/or operating status of washing machine 1.

[0033] Electronic control unit 19 is able to control the multicolour RGB diode to generate a light beam with a frequency spectrum, i.e. a colour, associated with a given operating condition or a given operating status of the washing machine.

[0034] More specifically, electronic control unit 19 may control the multicolour RGB diode or the LEDs to generate a light beam of a predetermined first colour, e.g. red, when the operating status corresponds to the start of the wash cycle; and/or to generate a light beam of a predetermined second colour, e.g. green, when the operating status corresponds to the end of the wash cycle; and/or to generate a light beam of a predetermined third colour, e.g. yellow, when washing machine 1 is in an intermediate wash cycle status.

[0035] Emission of different-coloured light beams may be activated by control block 22 on the basis of an information signal S_{INF} supplied to control block 22 by an additional external control module for controlling and monitoring the operating status of washing machine 1.

[0036] Lighting device 8 of washing machine 1 described above has numerous advantages.

[0037] Firstly, using LED 9 provides for : reducing electric power consumption in use; and reducing the heat produced during emission of the beam, also by virtue of the heat-dissipating function performed by supporting rod 13.

[0038] Secondly, using LED 9 advantageously provides for concentrating the projected beam solely on the opening of wash drum 7, thus reducing light dispersion outside the drum.

[0039] Thirdly, lighting device 8 has the major advantage of coding the operating status of washing machine 1 by means of a predetermined colour, thus enabling the user to determine the current operating condition of washing machine 1 quickly and easily, even at a distance from the machine, simply on the basis of the colour of the light projected onto the drum.

[0040] Clearly, changes may be made to the washing machine and lighting device as described and illustrated herein without, however, departing from the scope of the present invention as defined in the accompanying Claims.

Claims

1. A washing machine (1) comprising an outer casing (2); a wash chamber (5) housed inside said outer casing (2); a wash drum (7) housed inside the wash chamber (5) and which rotates about an axis of rotation (A); and a lighting device (8) located inside said outer casing (2) to light the wash drum (7); **characterized in that** the lighting device (8) comprises at least one LED (9), and electric control means (19) for varying the electric power supply to said at least

one LED (9) as a function of the temperature (TG) measured on the junction of said at least one LED (9).

2. A washing machine as claimed in Claim 1, wherein said electric control means (19) comprise measuring means (21) connected to said at least one LED (9) to generate a signal (ST) related to the junction temperature (TG) of said at least one LED (9); power means (20) for varying the electric power supply to said at least one LED (9); and control means (22) which receive said temperature signal (ST) and control said power means (20) as a function of the measured junction temperature (TG). 5
3. A washing machine as claimed in Claim 2, wherein said control means (22), via said power means (20), command a reduction in the power supply to said at least one LED (9) when the measured temperature (TG) is above a predetermined temperature threshold (TS). 10
4. A washing machine as claimed in any one of the foregoing Claims, wherein said outer casing (2) has an opening (3), and said wash chamber (5) is connected to said opening (3) by a seal (6); said lighting device (8) comprising a shell (10), which has a lens at one end (10a) and fits stably, but in easily removable manner, inside a seat (12) formed in said seal (6) of said washing machine (1). 15
5. A washing machine as claimed in Claim 4, wherein said lighting device comprises a supporting rod (13), which has said at least one LED (9) on one end (13a) and fits axially inside said shell (10) so that said at least one LED (9) faces said lens (11) on the shell (10). 20
6. A washing machine as claimed in Claim 5, wherein said supporting rod (13) is made of metal material to dissipate the heat generated by said at least one LED (9). 25
7. A washing machine as claimed in any one of the foregoing Claims, wherein the lighting device (8) comprises a number of LEDs (9) for generating, on command, respective light beams of corresponding frequency spectrums; said electric control means (19) selectively commanding turn-on of each said LED (9) to emit onto the wash drum (7) a light beam of a given frequency spectrum depending on the operating status of said washing machine (1). 30
8. A washing machine as claimed in any one of Claims 1 to 6, wherein the lighting device (8) comprises a multicolour LED (9) for emitting, on command, a number of light beams of corresponding frequency spectrums; said electric control means (19) commanding said multicolour LED (9) to emit a light beam 35

of a given frequency spectrum onto said wash drum (7), depending on the operating status of said washing machine (1).

Patentansprüche

1. Waschmaschine (1), umfassend ein Außengehäuse (2); eine Waschkammer (5), die in dem Außengehäuse (2) untergebracht ist; eine Waschtrommel (7), die in der Waschkammer (5) untergebracht ist und die um eine Rotationsachse (A) rotiert; und eine Beleuchtungsvorrichtung (8), die innerhalb des Außengehäuses (2) angeordnet ist, um die Waschtrommel (7) zu beleuchten; **dadurch gekennzeichnet, dass** die Beleuchtungsvorrichtung (8) mindestens eine LED (9) und elektrische Steuerungsmittel (19) zum Variieren der elektrischen Energieversorgung der mindestens einen LED (9) als Funktion der an der Sperrschicht der mindestens einen LED (9) gemessenen Temperatur (TG) umfasst. 40
2. Waschmaschine nach Anspruch 1, wobei die elektrischen Steuerungsmittel (19) umfassen: Messmittel (21), die mit der mindestens einen LED (9) verbunden sind, um ein Signal (ST) zu erzeugen, das auf die Sperrschichttemperatur (TG) der mindestens einen LED (9) bezogen ist; Strommittel (20) zum Variieren der elektrischen Energieversorgung der mindestens einen LED (9) und Steuerungsmittel (22), die das Temperatursignal (ST) empfangen und die Strommittel (20) als Funktion der gemessenen Sperrschichttemperatur (TG) steuern. 45
3. Waschmaschine nach Anspruch 2, wobei die Steuerungsmittel (22) über die Strommittel (20) eine Reduzierung der Energieversorgung der mindestens einen LED (9) veranlassen, wenn die gemessene Temperatur (TG) über einem vorbestimmten Temperaturgrenzwert (TS) liegt. 50
4. Waschmaschine nach einem der vorhergehenden Ansprüche, wobei das Außengehäuse (2) eine Öffnung (3) aufweist und die Waschkammer (5) mit der Öffnung (3) durch eine Dichtung (6) verbunden ist; wobei die Beleuchtungsvorrichtung (8) eine Hülle (10) umfasst, die an einem Ende (10a) mit einer Linse versehen ist und stabil, aber leicht herausnehmbar in einen Sitz (12) passt, der in der Dichtung (6) der Waschmaschine (1) ausgebildet ist. 55
5. Waschmaschine nach Anspruch 4, wobei die Beleuchtungsvorrichtung eine Haltestange (13) umfasst, an deren einem Ende (13a) sich die mindestens eine LED (9) befindet und die axial in die Hülle (10) passt, so dass die mindestens eine LED (9) der Linse (11) auf der Hülle (10) zugewandt ist.

6. Waschmaschine nach Anspruch 5, wobei die Haltestange (13) aus metallischem Material gefertigt ist, um die von der mindestens einen LED (9) erzeugte Wärme abzuführen.
7. Waschmaschine nach einem der vorhergehenden Ansprüche, wobei die Beleuchtungsvorrichtung (8) eine Anzahl von LEDs (9) umfasst, um auf Befehl jeweilige Lichtstrahlen mit entsprechenden Frequenzspektren zu erzeugen; wobei die elektrischen Steuerungsmittel (19) selektiv das Einschalten jeder LED (9) veranlassen, um abhängig vom Betriebszustand der Waschmaschine (1) einen Lichtstrahl mit einem bestimmten Frequenzspektrum auf die Waschtrommel (7) abzugeben.
8. Waschmaschine nach einem der Ansprüche 1 bis 6, wobei die Beleuchtungsvorrichtung (8) eine Mehrfarben-LED (9) umfasst, die auf Befehl eine Anzahl von Lichtstrahlen mit entsprechenden Frequenzspektren abgibt; wobei die elektrischen Steuerungsmittel (19) die Mehrfarben-LED (9) veranlassen, abhängig vom Betriebszustand der Waschmaschine (1) einen Lichtstrahl mit einem bestimmten Frequenzspektrum auf die Waschtrommel (7) abzugeben.

Revendications

1. Machine à laver (1) comprenant un carter extérieur (2) ; une chambre de lavage (5) logée à l'intérieur dudit carter extérieur (2) ; un tambour de lavage (7) logé à l'intérieur de la chambre de lavage (5) et tournant autour d'un axe de rotation (A) ; et un dispositif d'éclairage (8) disposé à l'intérieur dudit carter extérieur (2) pour éclairer le tambour de lavage (7) ; **caractérisée en ce que** le dispositif d'éclairage (8) comprend au moins une LED (9) et des moyens de commande électrique (19) pour faire varier la fourniture d'énergie électrique à ladite au moins une LED (9) en fonction de la température (TG) mesurée sur la jonction de ladite au moins une LED (9).
2. Machine à laver selon la revendication 1, dans laquelle lesdits moyens de commande électrique (19) comprennent des moyens de mesure (21) connectés à ladite au moins une LED (9) pour générer un signal (ST) relatif à la température de jonction (TG) de ladite au moins une LED (9) ; des moyens d'alimentation en énergie (20) pour faire varier la fourniture d'énergie électrique à ladite au moins une LED (9) ; et des moyens de commande (22) qui reçoivent ledit signal de température (ST) et commandent lesdits moyens d'alimentation en énergie (20) en fonction de la température de jonction (TG) mesurée.
3. Machine à laver selon la revendication 2, dans laquelle lesdits moyens de commande (22), via lesdits moyens d'alimentation en énergie (20), commandent une réduction de la fourniture d'énergie à ladite au moins une LED (9) lorsque la température (TG) mesurée est supérieure à un seuil de température (TS) prédéterminé.
4. Machine à laver selon l'une quelconque des revendications précédentes, dans laquelle ledit carter extérieur (2) comporte une ouverture (3), et ladite chambre de lavage (5) est raccordée à ladite ouverture (3) par un joint d'étanchéité (6) ; ledit dispositif d'éclairage (8) comprenant une enveloppe (10), qui comporte une lentille à une extrémité (10a) et est montée de façon stable, mais de manière facilement amovible, à l'intérieur d'un siège (12) formé dans ledit joint d'étanchéité (6) de ladite machine à laver (1).
5. Machine à laver selon la revendication 4, dans laquelle ledit dispositif d'éclairage comprend une tige support (13), qui comporte au moins une LED (9) sur une extrémité (13a) et se monte axialement à l'intérieur de ladite enveloppe (10) de manière que ladite au moins une LED (9) est disposée face à ladite lentille (11) sur l'enveloppe (10).
6. Machine à laver selon la revendication 5, dans laquelle ladite tige support (13) est faite d'un matériau métallique pour dissiper la chaleur générée par ladite au moins une LED (9).
7. Machine à laver selon l'une quelconque des revendications précédentes, dans laquelle le dispositif d'éclairage (8) comprend un certain nombre de LED (9) pour générer, sur commande, des faisceaux lumineux respectifs à spectres de fréquence correspondants ; lesdits moyens de commande électrique (19) commandant sélectivement la mise en service de chaque dite LED (9) pour émettre, sur le tambour de lavage (7), un faisceau lumineux d'un spectre de fréquence donnée, selon l'état de fonctionnement de ladite machine à laver (1).
8. Machine à laver selon l'une quelconque des revendications 1 à 6, dans laquelle le dispositif d'éclairage (8) comprend une LED (9) à plusieurs couleurs, pour émettre, sur commande, une pluralité de faisceaux lumineux à spectres de fréquence correspondants ; lesdits moyens de commande électrique (19) commandant ladite LED (9) à plusieurs couleurs pour émettre sur ledit tambour de lavage (7) un faisceau lumineux d'un spectre de fréquence donnée, selon l'état de fonctionnement de ladite machine à laver (1).

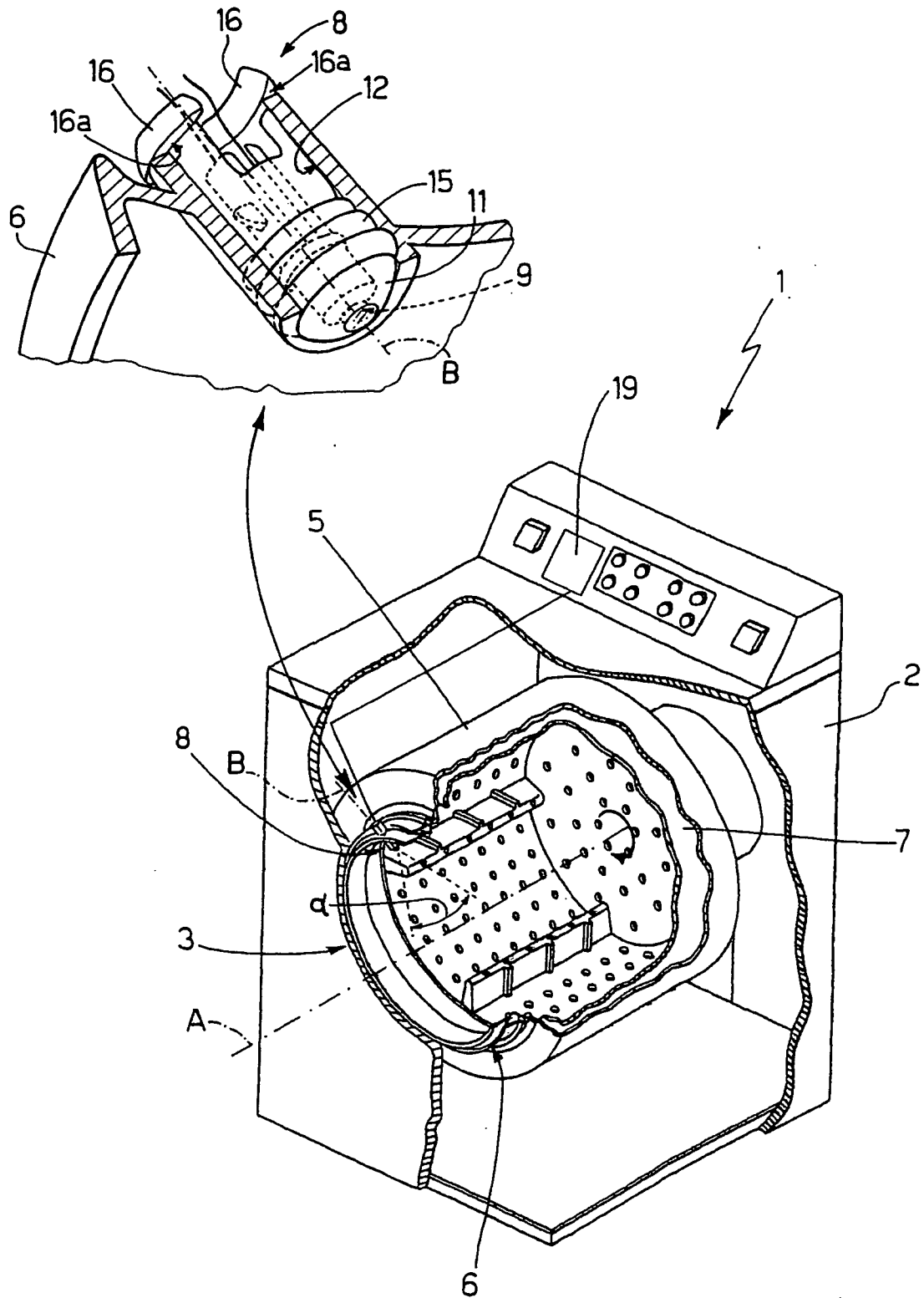


Fig.1

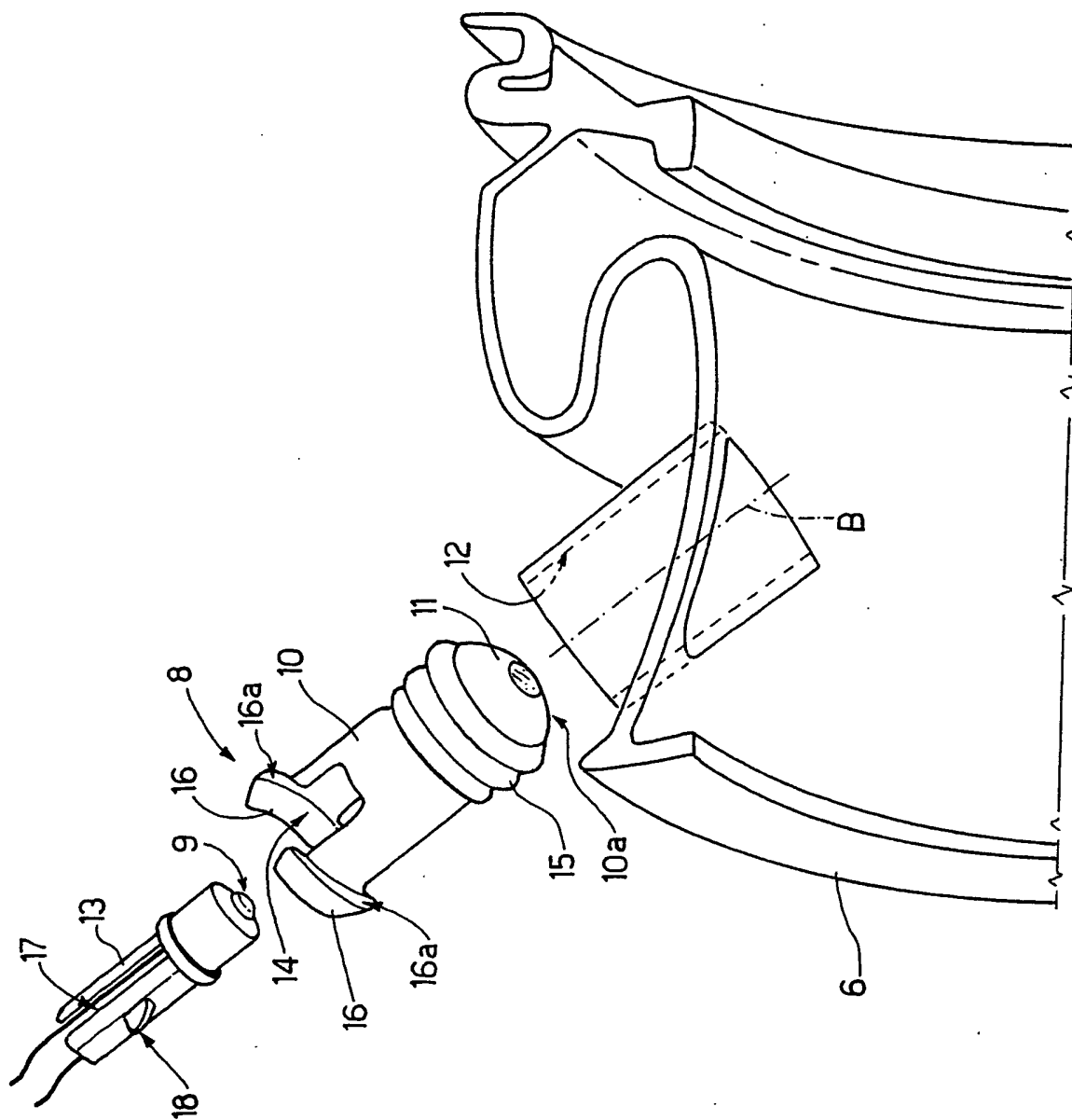


Fig.2

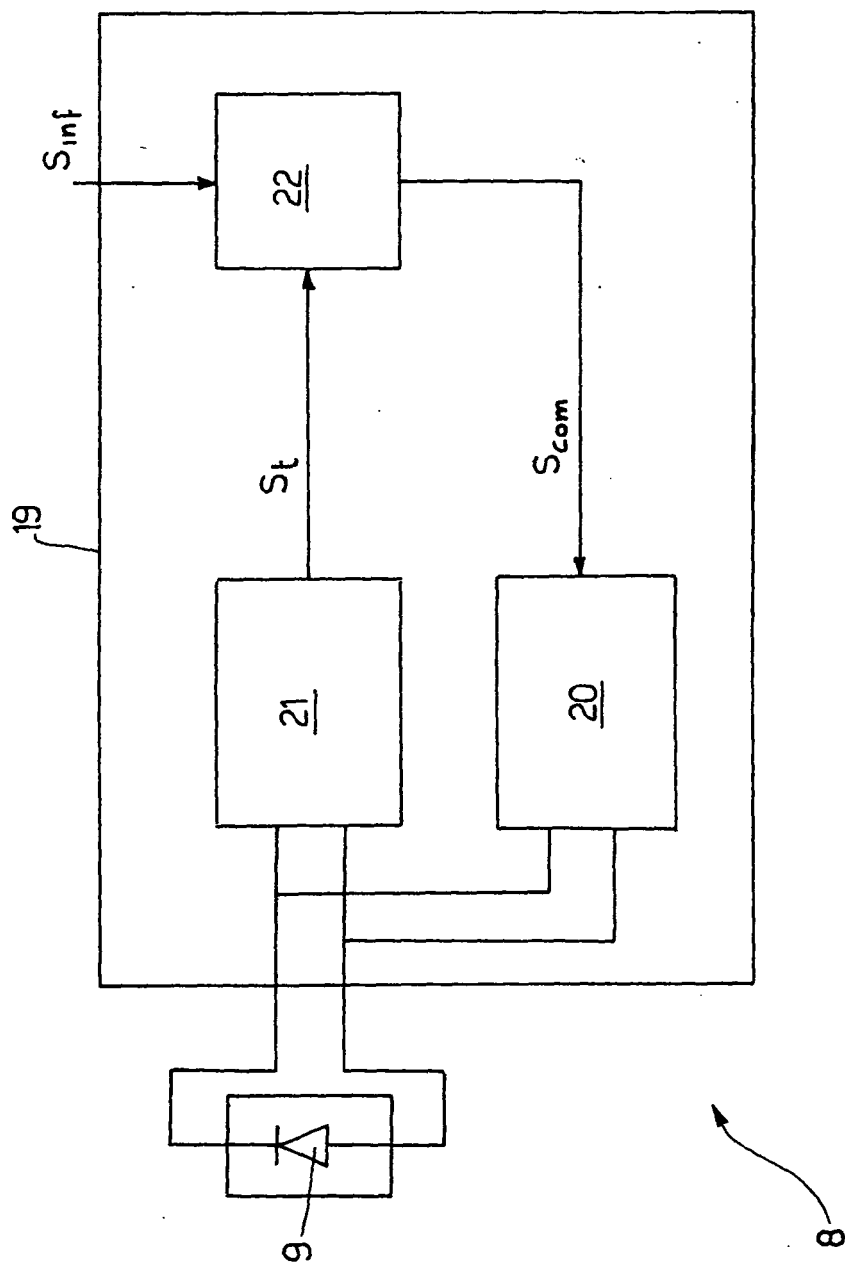


Fig.3

REFERENCES CITED IN THE DESCRIPTION

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