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(54) **WATER LEVEL CONTROLLER FOR DISHWASHER OR THE LIKE**

WASSERSTANDSREGLER FÜR GESCHIRRSPÜLMASCHINE ODER DERGLEICHEN

CONTRÔLEUR DE NIVEAU D'EAU POUR LAVE-VAISSELLE OU SIMILAIRES

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(73) Proprietor: **Bonferraro S.p.A.**
**37060 Bonferraro (VR) (IT)**

(72) Inventors:
- **AMBROSI, Andrea**
  **37052 Casaleone VR (IT)**
- **PINAROLI, Eros**
  **37060 Castel d'Azzano VR (IT)**
- **TOSI, Mauro**
  **37051 Bovolone VR (IT)**

(74) Representative: **Concone, Emanuele et al**
**Società Italiana Brevetti S.p.A.**
**Via Carducci 8**
**20123 Milano (IT)**

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## Description

**[0001]** The present invention relates to a device for controlling the water level in a dishwasher or other machine that loads water, in particular a device comprising an air trap connected to a pressure switch. In the following, specific reference will be made to such a device applied to a professional dishwasher, but it is clear that the device can be applied to other types of machines that require a control of the level of water loaded therein, e.g. household dishwashers, washing machines, sterilizers, etc.

**[0002]** It is known that in a professional dishwasher it is important to load a precise quantity of water to obtain an adequate cleaning performance, while trying to limit the consumption of water and energy used to heat it. To this purpose, a conventional water level controller consists essentially in an air trap connected to a pressure switch that controls the opening and closing of the valves for the loading and draining of the water, so as to maintain the required level.

**[0003]** The air trap, which may be partly or completely immersed in water, is a container or a tube open at the bottom so that during the water loading the air inside it remains trapped and undergoes a pressure change proportional to the water level. This change in pressure is communicated from the air trap to the pressure switch through a tube that connects the two elements, so that the pressure switch can control the aforementioned valves on the basis of the detected level. In order to prevent foam from reaching the pressure switch, the air trap may also be provided with internal wall elements that form a sort of labyrinth between the air inlet and the air outlet as disclosed in DE 10 2013 101404.

**[0004]** This known solution, although quite effective, has however the drawback of a poor accuracy since the air pressure inside the air trap actually depends not only on the water level but also on the air temperature. In fact, the mass of air present in the air trap tends to expand when heated and to contract when it cools, causing corresponding pressure changes even with the same water level.

**[0005]** On the other hand the variation in the air temperature is linked to the operating cycle of the machine and the change in volume as a function of temperature is an intrinsic characteristic of air, therefore these pressure oscillations are unavoidable. Since the level controller is calibrated at a certain reference temperature, when the trapped air is at a temperature higher or lower than said reference temperature the detected level will be respectively higher or lower than the actual level, with an error proportional to the difference between the temperatures and therefore to the variation in volume of the trapped air.

**[0006]** This error can be significant since in traditional controllers the air trap has a cylindrical shape, the term "cylindrical" being understood in the general sense of a geometrical solid whose cross-section is constant along the axis (e.g. circular cylinder, parallelepiped, cube, etc.). Therefore a given percentage change in volume corresponds to an equal percentage change in the height of the level detected inside the air trap, since the volume corresponds to the cross-sectional area multiplied by the height.

**[0007]** For example, in a level controller with a typical air trap that consists of a circular tube if the reference temperature is that of the hot machine (70°C) but the machine is not used for some time and the air cools down to room temperature (20°C), when the machine is turned back on the pressure switch detects a pressure (and therefore a water level) in the air trap lower by about 18% due to the reduction of temperature of 50°C multiplied by the coefficient of thermal expansion of the air of 0,00366. As a consequence, the controller will load unnecessarily other water in the machine with a waste of water and energy to heat the water in excess. Conversely, if the reference temperature is below the maximum temperature reached by the air, for example due to prolonged use in a hot environment, the controller unnecessarily drains water that instead serves for a correct operation of the machine.

**[0008]** Moreover, in order to take into account these level variations the position of the overflow of the wash tank cannot be too close to the correct water level, whereby the dishwasher is higher or the useful loading space of the machine is reduced to the advantage of the tank bottom.

**[0009]** The object of the present invention is therefore to provide a water level controller which is free from said drawbacks. Said object is achieved by means of a controller of the above type in which the air trap is shaped in such a way that its cross-section decreases from the bottom upwards (e.g. pyramid, cone, truncated pyramid/cone, hemisphere, etc.), at least in its bottom portion affected by the possible variation in volume of the trapped air.

**[0010]** The main advantage of this controller is to be less sensitive to pressure changes induced by changes in volume of the trapped air, so that the reading error of the water level is correspondingly reduced.

**[0011]** A second advantage, deriving from the greater precision of this controller, is to be able to realize a more compact machine or a machine with a greater useful loading space for the same size, since it is possible to arrange the overflow closer to the correct water level thus reducing the overall dimensions of the wash tank.

**[0012]** Still another advantage of the present controller is that it maintains the characteristics of simplicity, inexpensiveness and reliability of the prior art controllers and it can be applied to any machine, even as an upgrade to an existing machine.

**[0013]** Further advantages and characteristics of the controller according to the present invention will become apparent to those skilled in the art from the following detailed description of an embodiment thereof with reference to the accompanying drawings, in which:

Figs.1 and 2 are schematic views illustrating the geometrical concept underlying the present invention; and
Fig.3 is a top perspective view of an air trap of a controller according to the invention.

**[0014]** Referring to Figures 1 and 2, there is seen that in the cylindrical shape of the prior art a volume reduction of 1/5 corresponds to an identical height reduction of 1/5 (Fig. 1), given that the cross-section remains constant, whereas in the pyramidal shape according to the invention the same volume reduction of 1/5 corresponds to a height reduction of 1/15 (Fig.2) given that the cross-section decreases and the volume is correlated to the height through a coefficient of 1/3, so that also the reading error of the level decreases by three times.

**[0015]** This geometrical property therefore finds application in an air trap 1 such as that illustrated in Fig.3, that aside from the shape for the rest is made and connected to the pressure switch in the same way as a cylindrical air trap of a prior art controller. Further embodiments not illustrated in the figures can be easily obtained, as previously mentioned, by varying the shape of the air trap with other geometric shapes, possibly even irregular and/or with non-vertical axis, whose cross-section decreases from the bottom upwards.

**[0016]** It should also be noted that the decrease of the cross-section is irrelevant above the bottom portion of the air trap affected by the possible change in volume of the trapped air, whereby the cross-section might also be constant above this bottom portion. In other words, the air trap 1 has the shape of a quarter of a truncated pyramid in the bottom portion 1a and of a parallelepiped in the top portion 1b.

**[0017]** The height of the bottom portion 1 a obviously depends on the maximum variation in temperature and therefore in volume of the trapped air, as well as from the gradient of variation of the cross-section. Indicatively, the minimum height of the bottom portion 1a is comprised between 5% and 50% of the overall height of the air trap, preferably between 10% and 30%.

## Claims

1. Water level controller comprising an air trap (1) connected to a pressure switch adapted to control the opening and closing of valves for the loading and draining of the water, **characterized in that** said air trap (1) is shaped in such a way that its cross-section decreases from the bottom upwards at least in its bottom portion (1a), wherein a height of the bottom portion (1a) is equal to at least 5% of the overall height of the air trap (1) and the height of the bottom portion (1a) is equal to not more than 50% of the overall height of the air trap (1), being preferably comprised between 10% and 30%.

2. Water level controller according to claim 1, **characterized in that** the air trap (1) is shaped, at least in its bottom portion (1a), according to a regular geometric shape or part thereof.

3. Water level controller according to claim 2, **characterized in that** the regular geometric shape is selected from cone, pyramid, hemisphere, truncated cone and truncated pyramid.

## Patentansprüche

1. Wasserstandsregler, umfassend eine Luftfalle (1), die an einem Druckschalter angeschlossen ist, der dazu ausgelegt ist, das Öffnen und Schließen der Ventile zum Befüllen und Entleeren des Wassers zu regeln, **dadurch gekennzeichnet, dass** die besagte Luftfalle (1) derart geformt ist, dass ihr Querschnitt von ihrer Unterseite nach oben wenigstens in ihrem unteren Bereich (1a) abnimmt, wobei die Höhe des unteren Bereichs (1a) wenigstens 5 % der Gesamthöhe der Luftfalle (1) entspricht, und wobei die Höhe des unteren Bereichs (1a) nicht mehr als 50 % der Gesamthöhe der Luftfalle (1) beträgt, bevorzugt zwischen 10 % und 30 % liegt.

2. Wasserstandsregler gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Luftfalle (1) wenigstens in ihrem unteren Bereich (1a) gemäß einer regelmäßigen geometrischen Gestalt oder als ein Teil von jener geformt ist.

3. Wasserstandsregler gemäß Anspruch 2, **dadurch gekennzeichnet, dass** die regelmäßige geometrische Gestalt ausgewählt ist aus einem Kegel, einer Pyramide, Halbkugel, einem Kegelstumpf oder Pyramidenstumpf.

## Revendications

1. Contrôleur de niveau d'eau comprenant un piège à air (1) raccordé à un commutateur de pression adapté pour contrôler l'ouverture et la fermeture des valves pour le chargement et l'évacuation de l'eau, **caractérisé en ce que** :

   ledit piège à air (1) est formé de sorte que sa section transversale diminue du fond vers le haut au moins dans sa partie inférieure (1a), dans lequel une hauteur de la partie inférieure (1a) est égale à au moins 5 % de la hauteur globale du piège à air (1), et
   la hauteur de la partie inférieure (1a) est égale à une valeur non supérieure à 50% de la hauteur globale du piège à air (1), qui est de préférence comprise entre 10 % et 30 %.

**2.** Contrôleur de niveau d'eau selon la revendication 1, **caractérisé en ce que** le piège à air (1) est formé, au moins dans sa partie inférieure (1a), selon une forme géométrique régulière ou une partie de cette dernière.

**3.** Contrôleur de niveau d'eau selon la revendication 2, **caractérisé en ce que** la forme géométrique régulière est choisie parmi un cône, une pyramide, un hémisphère, un cône tronqué et une pyramide tronquée.

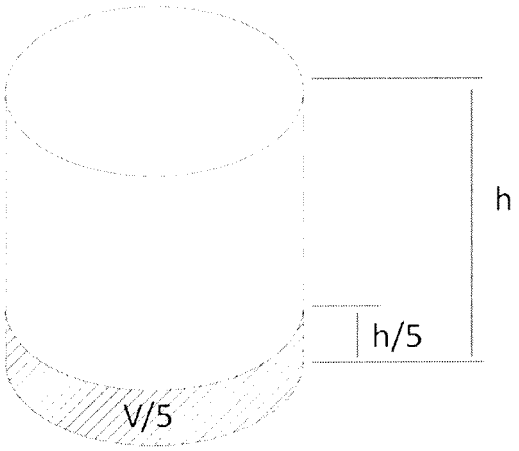


Fig.1

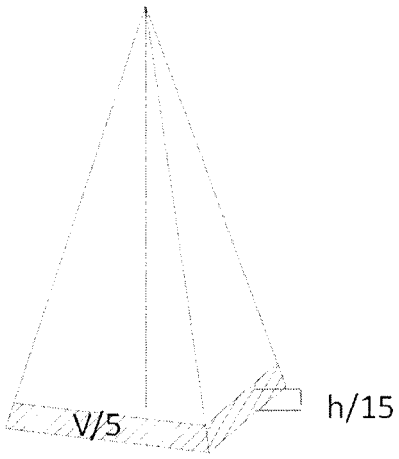


Fig.2

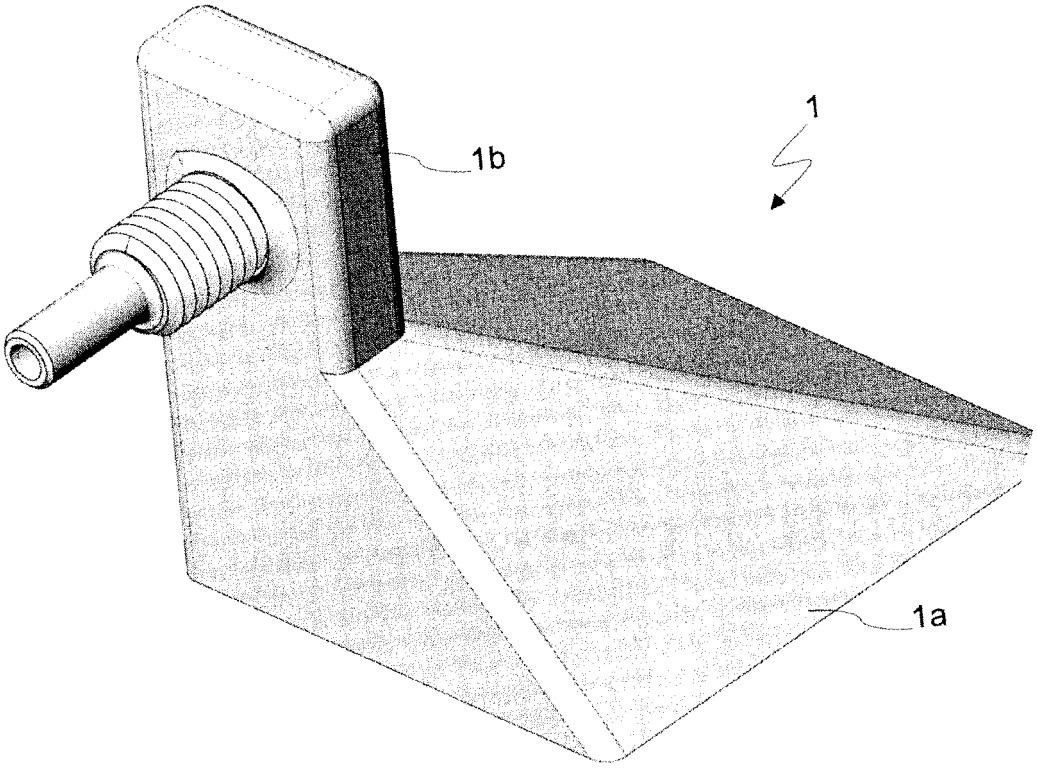


Fig.3

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


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