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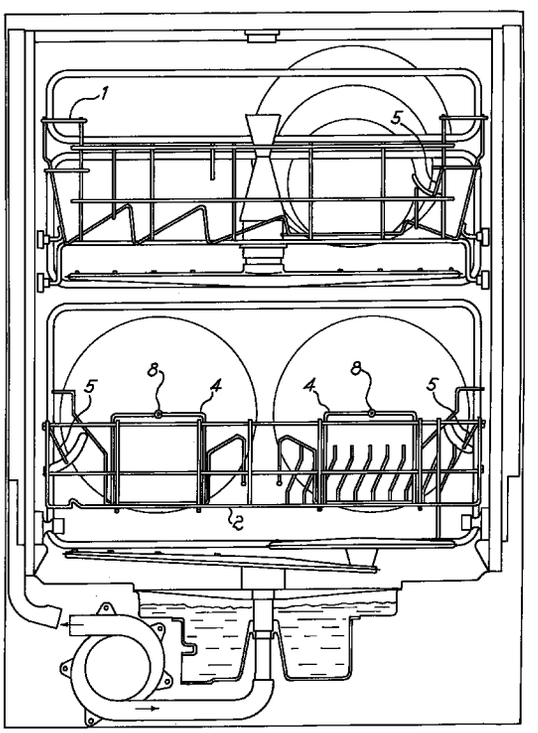
## (54) Apparatus for detecting the presence of dishes in the basket of a dishwashing machine

(57) An apparatus for detecting the presence of dishes in the baskets (1, 2) of a dishwashing machine includes mobile profiles (5) pivoted to the structure of the baskets and resiliently kept in such a position as to require the displacement thereof in order to introduce the dishes in the baskets, said mobile profiles (5) being provided with end portions (7) extending upto the rear wall, and also includes a plurality of sensors located behind said wall along the travel of the end portions (7) and capable to detect the position thereof. The lower basket (2) also includes removable inserts (4) provided with an end portion (8) at which a further sensor is located which is capable to detect the presence of the insert (4). The sensors consist of electric circuits capable to detect, and transform into electric signals, the displacements of magnetic elements contained in the end portions (7, 8), said sensors being preferably reed relays. Several different possible arrangements of the crockery load are obtained from the combination of the signals from the sensors, thus allowing the automatic selection of the most suitable washing cycle.

Fig.1

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## Description

The present invention relates to apparatuses for dishwashing machines, and in particular to an apparatus for detecting the presence of dishes in the baskets of a dishwasher.

It is known that such an apparatus makes easier the programming operations of the machine by the user and/or optimizes the performance/consumption ratio according to the load. For example, the machine can detect the absence of dishes in one of the baskets and accordingly automatically set the program for a reduced load (½ load), or it can change the program parameters (steps, times, temperatures, amount of detergent, etc.) according to the amount and kind of dishes actually present, or it can distribute the amounts of water and detergent differently between the upper and lower basket.

Prior art detecting apparatuses are essentially divided into direct and indirect apparatuses. The typical direct apparatus detects the weight of the crockery load, while examples of indirect apparatuses are those which detect the amount of removed dirt or the decrease of the water temperature occurring in a beginning step of the washing. This second type of detecting apparatus implies quite complicated and expensive devices, for example capable of detecting the turbidity of the rinsing water, or a precise change in the temperature thereof or the amount of dirt remaining in the filter after the rinsing. Moreover, these apparatuses have a low reliability, since the detected data are heavily affected by the parameters of the starting washing step and by the kind of dirt on the dishes. For example, a substance which is easily removed from the dishes but causes a great turbidity of the water, such as tomato sauce, would cause an indication of "hard" dirt which is completely the opposite of the actual situation.

The weight detecting apparatuses have less problems of reliability, however they still imply rather complicated and expensive devices. In fact, some members such as springs, load cells and the like are necessarily present in that they must interact with the baskets for detecting the weight thereof. This requires that the basket supporting devices be made so as to include the above-mentioned weight detecting devices, or the supports be connected to the walls of the washing chamber through said devices. Since the basket supports typically consist of guides formed by drawing directly on the plates which make up the walls, it is apparent that such modifications involve a manufacturing operation much more complicated and expensive than a conventional one.

Therefore, the object of the present invention is to provide an apparatus for detecting the presence of dishes in the baskets which overcomes the above-mentioned drawbacks of prior art apparatuses.

This object is achieved by means of an apparatus having the characteristics cited in claim 1.

A first fundamental advantage of the detecting apparatus according to the present invention is its structural simplicity, which results in low manufacturing cost and high operating reliability.

A second advantage of the present apparatus comes from the fact that all its members do not require interaction with any structural member of the dishwasher other than the baskets, thus leaving the greatest freedom in the choice of the position thereof and/or in the type of supporting device.

These and other advantages and characteristics of the detecting apparatus according to the present invention will be apparent to those skilled in the art from the following detailed description of an embodiment thereof referring to the annexed drawings wherein:

Fig.1 is a schematic sectional front view of a dishwasher including the detecting apparatus of the invention;
Fig.2 is a schematic sectional side view of the dishwasher of fig.1;
Fig.3 is a front view sketch showing the travel of the mobile profiles which make part of the apparatus, with respect to the position of the sensors which detect the displacements of said profiles; and
Fig.4 is a sectional side view showing a second embodiment of said sensors.

Referring to figs.1 and 2, there is seen that a conventional dishwasher includes an upper basket 1 and a lower basket 2 provided with parallel supports 3 arranged in two rows, wherein the plates are placed in an almost vertical position. Since the lower basket 2 is generally used to arrange not only plates but also pots and the like, each of its two rows of supports 3 is united into a removable insert 4 which can be removed from basket 2 so as to house the pots easily without the obstacle of supports 3. It is apparent that the same kind of structure can be adopted also for the upper basket 1, however the latter is generally used for plates on the right side and for glasses and cups on the left side, as illustrated in fig.1.

The detection of the presence of dishes in baskets 1 and 2 is carried out by means of mobile profiles 5 arranged longitudinally along the sides of the baskets, next to supports 3. Each mobile profile 5 essentially consists of a rod pivoted at its ends to the basket structure, and kept in an almost horizontal position by return springs 6. This embodiment is illustrated in fig.2 with reference to the upper basket 1 only, while the mobile profiles 5 of the lower basket 2 have been omitted for the sake of clarity.

As clearly shown in fig.1, the angular position of the mobile profiles 5 is defined by the presence or absence of the dishes, and particularly by the size of the plates inserted between supports 3. The arcs illustrated in fig.1 which indicate the angular travels of profiles 5, are schematically shown in fig.3, together with the positions of the sensors which detect the displacement of profiles 5. These sensors are located behind the rear wall of the washing chamber (rearspace), therefore each mobile

profile 5 is provided with a rear end portion 7 which takes the information about the angular position thereof to the rearspace. Similarly, each removable insert 4 is provided with a rear end portion 8 which takes to the rearspace the information about the presence thereof in the lower basket 2.

The above-illustrated arrangement is clearly referred to conventional baskets wherein the plate supports 3 are arranged longitudinally so that the plates are essentially parallel to the dishwasher door. With said arrangement, the sensors may also be located behind the front wall, i.e. inside the door, obviously providing the mobile profiles 5 with end portions 7, 8 at the front rather than at the rear. In case supports 3 are arranged transversally, it is obvious that the mobile profiles 5 will be transverse and the sensors will be located behind one of the chamber side walls instead of the rear wall.

In the sketch of fig.3, the angular travel arcs indicated by SD, IS and ID are respectively referred to the upper right, lower left and lower right mobile profile. For the above-cited reasons, a left mobile profile has not been provided in the upper basket, but it could obviously be provided in combination with the right one or in place thereof.

The sensors located in the rearspace at the lower basket 2 in order to detect the presence of the left and right removable inserts 4, are respectively indicated by S and D. At the upper ends of arcs IS and ID, A and A' indicate the sensors detecting the presence of the mobile profiles 5 in "rest" position, i.e. in the absence of dishes. On the contrary, at the only mobile profile 5 of the upper basket 1, there are located two sensors M and G, positioned in the lower half of arc SD, suitable to detect the angular position of said profile caused by the presence of medium and large diameter plates, respectively.

From the above, it is apparent that any angular position of the lower mobile profiles within arcs PP denotes the presence of dishes in the lower basket 2. On the contrary, an angular position of the mobile profile 5 of the upper basket 1 within arc R denotes the absence of dishes, or the presence of small-size plates which cause little or no displacement of the mobile profile.

These indications about the angular positions of the mobile profiles 5 are combined with the indications of sensors S and D about the presence of the removable inserts 4, in order to obtain the arrangement of the dishes in the two baskets. For example, the presence of inserts 4 together with the activation of sensors A, A' denotes that the lower basket is empty or contains only small-size plates: in fact there are neither pots (since inserts 4 are present) nor plates having such a size as to move the lower mobile profiles and thus deactivate sensors A, A'. In case inserts 4 were not present (sensors S and D not activated), then the basket would be empty or contain just small crockery such as small pots, bowls and the like. In both cases, the ½ load operation can be taken into consideration.

The following table contains, for exemplificative purposes, some of the most meaningful combinations obtained from the signals of the sensors, wherein 1 indicates the activated sensor condition (closed circuit) and 0 indicates the not activated sensor condition (open circuit).

| N. | Lower basket | | | | Upper basket | |
|---|---|---|---|---|---|---|
| | S | D | A | A' | M | G |
| I | 1 | 1 | 1 | 1 | 0 | 1 |
| II | 0 | 0 | 1 | 1 | 0 | 1 |
| III | 1 | 1 | 0 | 0 | 1 | 0 |
| IV | 0 | 0 | 0 | 0 | 0 | 1 |
| V | 0 | 1 | 0 | 0 | 0 | 0 |
| VI | 1 | 1 | 0 | 1 | 1 | 0 |

The first two combinations (I and II) of the table above are the two previously mentioned examples of half load, while combination III suggests a normal washing (large plates down and medium plates up), number IV suggests a strong washing (pots down and large plates up), number V suggests to send more water to the lower basket (pots+large plates down and small plates up), number VI suggests a light/normal washing (large+small plates down and medium plates up), and so on.

It is clear that not all possible combinations have a practical usefulness, some of them being "meaningless" (e.g. complete absence of dishes) and others being redundant (e.g. swapping the signals from S and A with those from D and A'). The total number of possible combinations is equal to $2^n$ where n is the number of sensors used. In fact, nothing stops from using other sensors (e.g. along arcs PP) in order to increase the detecting precision. Therefore, in the illustrated embodiment employing six sensors the obtainable combinations are 64. Even considering that a certain amount thereof is eliminated for the above-explained reasons, the high number of remaining combinations leads to the use of a microprocessor control unit which can combine the information about the load arrangement with the information from other sensors (temperature, water and detergent level, etc.). However, a simple application is always possible in a machine controlled by an electromechanical timer, obviously providing in such case much less information. For example, the half-load switch could be triggered by the simultaneous activation of sensors S, D, A, A' as in combination I of the table above.

As far as the nature of the sensors employed in the present detecting apparatus is concerned, these are preferably of electromagnetic type. This means that they consist of electric circuits suitable to detect, and to transform into electric signals, the changes in the distribution of the magnetic field caused by the displacement of mag-

netic elements contained in the end portions 7, 8 of the mobile profiles 5 and of the removable inserts 4. Sensors suitable for this purpose are, for example, reed relays, proximity switches, Hall effect sensors, etc. According to the type of sensor selected, the signals may be of the on/off kind, as those considered above, or continuos variations of one or more quantities of the detecting circuit (voltage, current), possibly usable with a "fuzzy" logic processing. For example, it would be possible that sensors M and G are simultaneously activated, thus denoting the presence in the upper basket 1 of plates having a diameter between medium and large.

An essential advantage of this type of sensor is that the passage of the signal outside the washing chamber does not require making a hole therein, thus avoiding further machining and risks of leaks. However, it is possible to employ less sophisticated sensors such as common microswitches 9 as those illustrated in fig.4. In this case, the rear wall 10 must have openings closed by membranes 11 suitable to prevent water leaks but sufficiently deformable as to allow the activation of microswitches 9. In order to assure said activation even at intermediate positions of the mobile profile 5, the latter is provided with a deformable end portion 12 which is guided by shaped members 13 converging towards membranes 11.

It is clear that the above-described and illustrated embodiment of the detecting apparatus according to the invention is just an example susceptible of various modifications. In particular, the number, arrangement and type of the sensors located behind one or more chamber walls may be freely adapted according to the desired precision of detection. Similarly, the number and arrangement of the mobile profiles 5 may be changed according to the kind of baskets wherein they must be mounted, as far as the introduction of the dishes causes the displacement of the profiles in proportion to the size of the dishes.

## Claims

1. An apparatus for detecting the presence of dishes in the baskets (1, 2) placed in the washing chamber of a dishwashing machine, characterized in that it includes one or more mobile profiles (5) each being pivoted to the structure of a basket (1, 2) and resiliently kept in such a position as to require the displacement thereof in order to introduce the dishes in the basket, said mobile profiles (5) being provided with end portions (7, 12) extending upto the wall of the washing chamber, and also includes a plurality of sensors (A, A', M, G) located behind said wall, at least one sensor along the travel of each end portion (7, 12), which are capable to detect the position of the relevant end portion (7, 12).

2. A detecting apparatus according to claim 1, characterized in that at least one of the baskets (1, 2) includes one or more rows of plate supports (3) united into a removable insert (4) provided with an end portion (8) extending upto the wall of the washing chamber, and a further sensor (S, D), located behind said wall at said end portion (8), which is capable to detect the presence of said insert (4).

3. A detecting apparatus according to claim 1 or 2, characterized in that each mobile profile (5) consists of a rod pivoted at its ends and kept in a substantially horizontal position by springs (6), each profile (5) being arranged along one side of the basket (1, 2).

4. A detecting apparatus according to one or more of the preceding claims, characterized in that the sensors (A, A', M, G, S, D) consist of electric circuits capable to detect, and transform into electric signals, the changes in the distribution of the magnetic field caused by the displacements of magnetic elements contained in the end portions (7, 8) of the mobile profiles (5) and of the removable inserts (4), said sensors (A, A', M, G, S, D) being preferably reed relays.

5. A detecting apparatus according to one of claims 1 to 3, characterized in that the sensors (A, A', M, G, S, D) consist of microswitches (9) located at openings in the chamber wall, said openings being closed by membranes (11) capable to prevent water leaks but sufficiently deformable as to allow the activation of said microswitches (9) by deformable end portions (12) which are guided by shaped members (13) secured to said chamber wall and converging towards said membranes (11).

6. A dishwashing machine characterized in that it includes a detecting apparatus according to one or more of the preceding claims..

Fig.1

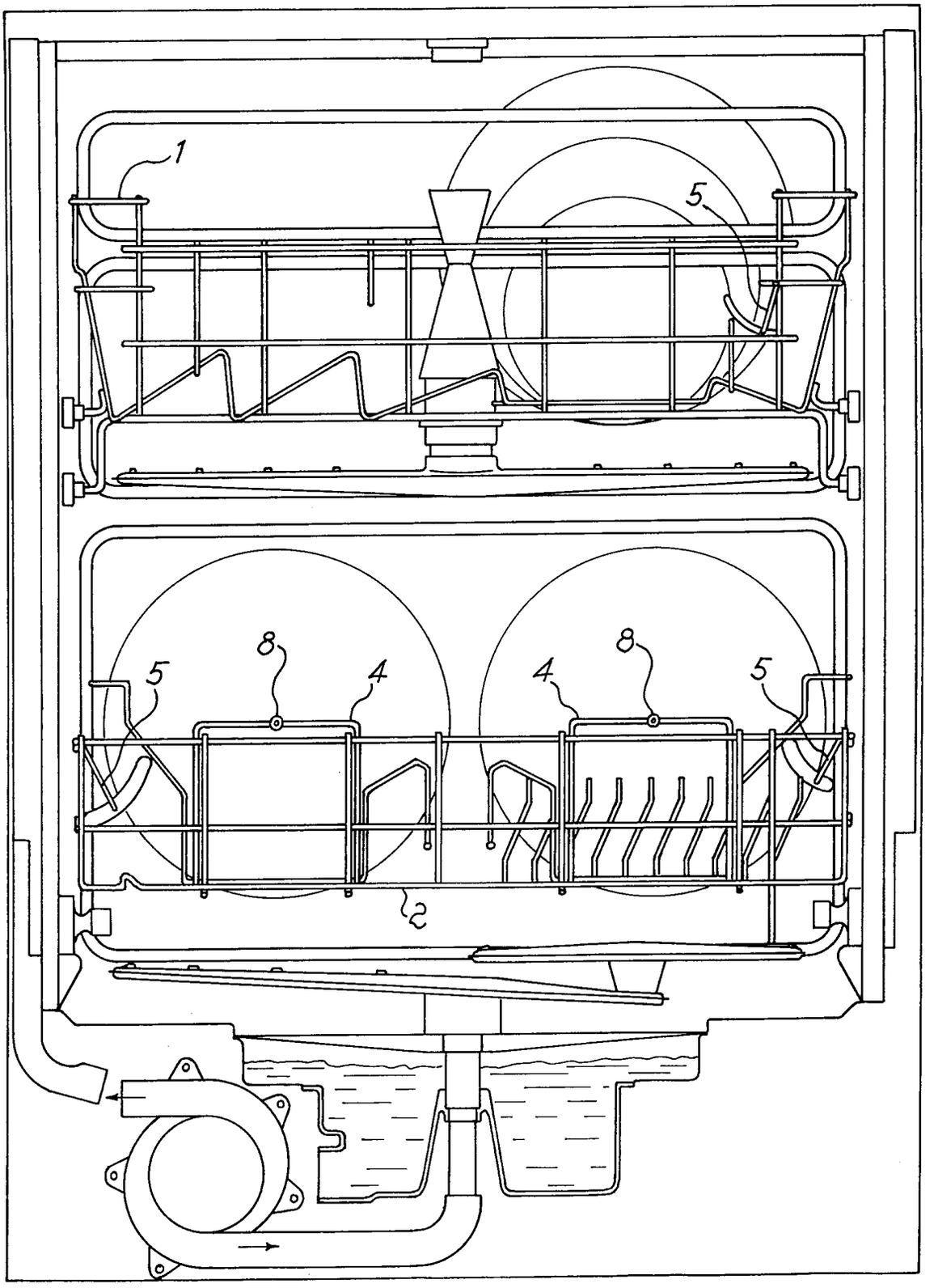


Fig.2

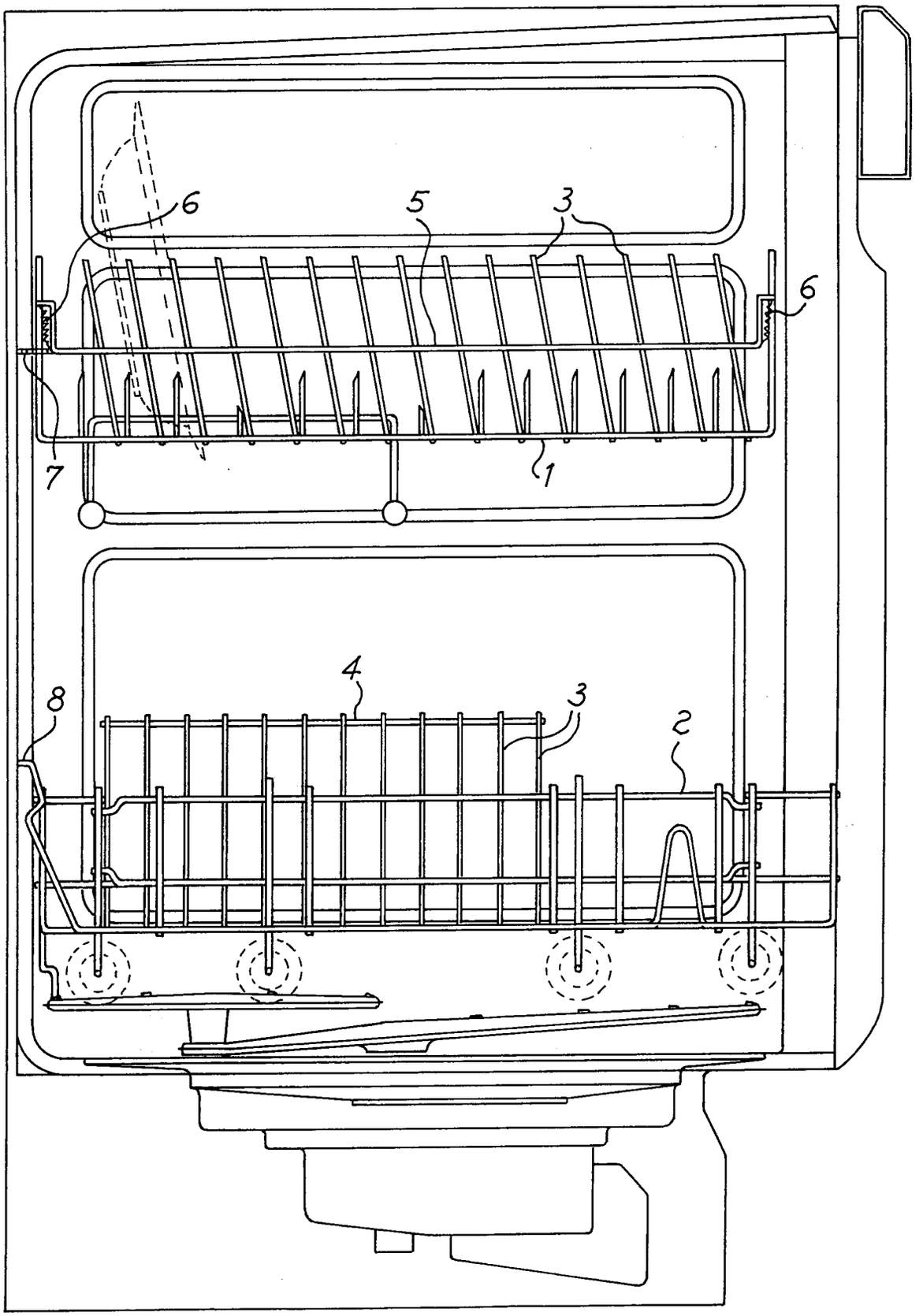


Fig.3

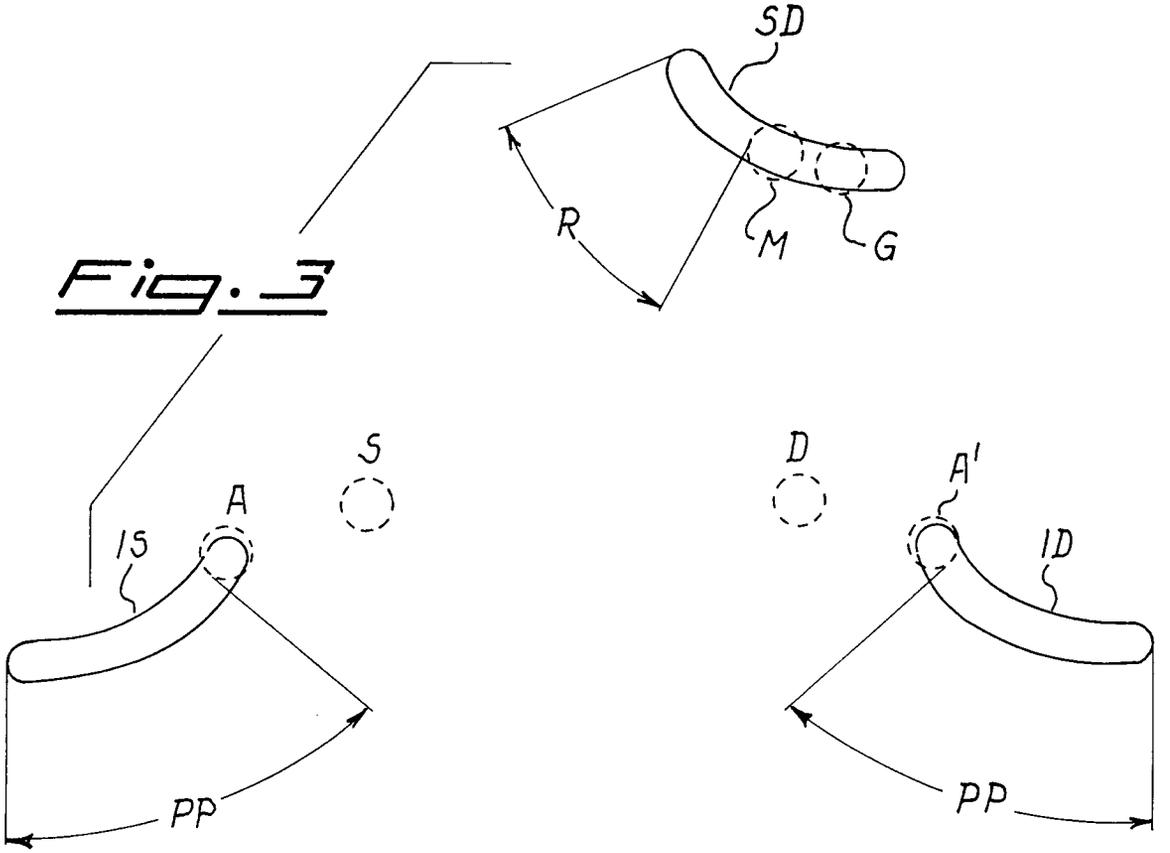
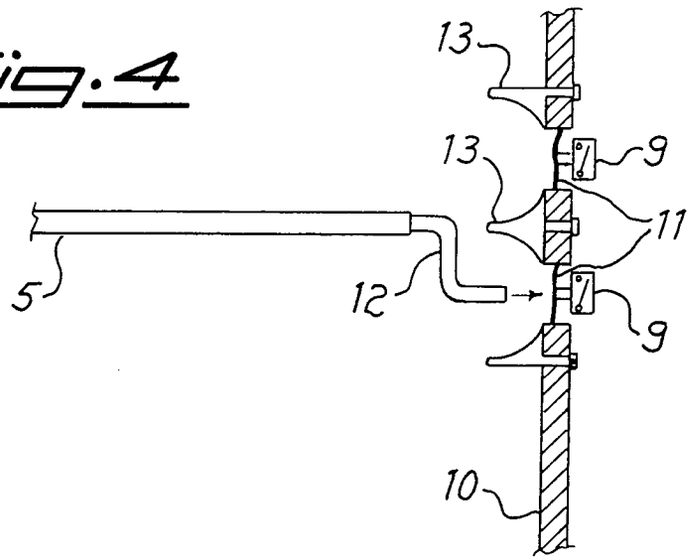



Fig.4



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# EUROPEAN SEARCH REPORT

Application Number
EP 95 83 0529

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
|---|---|---|---|
| A | PATENT ABSTRACTS OF JAPAN vol. 14 no. 236 (C-0720) ,18 May 1990 & JP-A-02 060624 (MATSUSHITA SEIKO CO. LTD.) 1 March 1990, * abstract * --- | 1 | A47L15/46 A47L15/50 |
| A | DE-A-27 01 879 (R. KINNE) * the whole document * ----- | 1,2 | |

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A47L

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 3 April 1996 | Courrier, G |

CATEGORY OF CITED DOCUMENTS

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