



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.06.2013 Bulletin 2013/25

(51) Int Cl.:
D06F 39/02 (2006.01)

(21) Application number: **12197097.4**

(22) Date of filing: **13.12.2012**

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

(30) Priority: **15.12.2011 IT TO20111154**

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

(72) Inventors:
• **Arteconi, Leonardo**
60044 Fabriano (AN) (IT)
• **Ciarletta, Annalisa**
67035 Pratola Peligna (AQ) (IT)
• **Bossi, Luca**
61040 Serra Sant'Abbondio (PU) (IT)

(74) Representative: **Santonicola, Paolo**
Indesit Company S.p.A.
Industrial Property Management Team
Via Lamberto Corsi, 55
60044 Fabriano (AN) (IT)

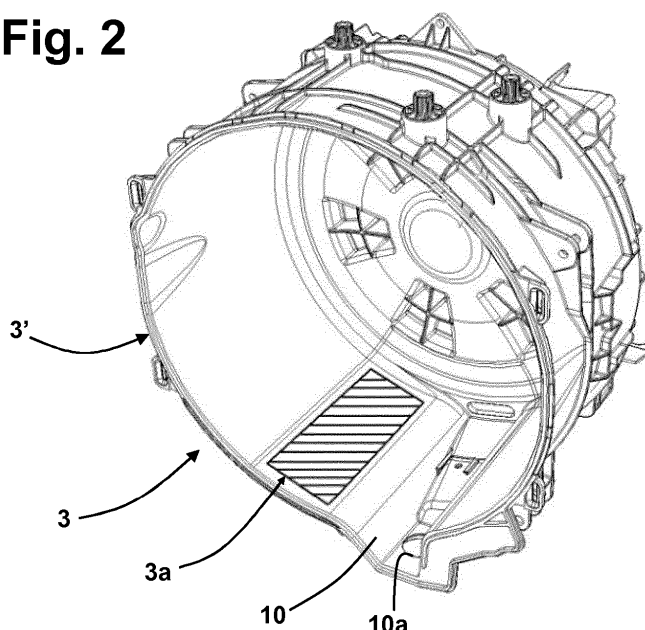
(54) **Laundry washing machine**

(57) A laundry-washing machine (1) comprises a wash tub (3), a laundry basket (4) mounted in the tub (3) and drivable in rotation via motor means (M), loading means (6, 7, 8) for delivering a liquid into the tub (3), a washing agent dispenser (6) for adding at least one washing agent to the liquid, heating means (11) for heating the liquid, discharge means (10, 12, 13) for draining the

liquid from the tub (3) and a control system (15, 16).

The machine (1) further comprises a catalyst designed to promote transformation into peracids of oxidizing agents possibly present in the washing agent, the catalyst being associated to a component of the machine (3; 4; 5; 6; 7; 10; 11; 12a) that, during operation of the machine itself, is in contact with the liquid containing the washing agent.

Fig. 2



DescriptionField of the invention

5 **[0001]** The present invention relates to laundry-washing machines and has been developed with particular reference to improvement of exploitation of the washing agents used in said machines for carrying out the washing treatments.

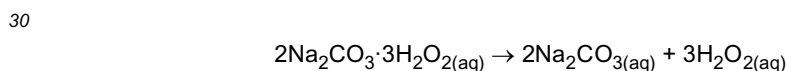
Technological background

10 **[0002]** Washing agents used in laundry-washing machines commonly include five main groups of components, namely, surfactants, fillers, buffering-softening agents, oxidizing or whitening agents, and enzymes. In general terms, a detergent for a laundry-washing machine can comprise the following active ingredients, grouped by components: surfactants (such as anionic surfactants, cationic surfactants, non-ionic surfactants), oxidizing agents (such as peroxide, photo-oxidizing agents, percarbonates, perborates), enzymes (such as lipase, amylase, cellulase, protease), softening agents (such as
15 soaps, zeolites, silicates, citrates), polymers (such as polycarbonates, polyethylene glycol, cellulose derivatives), other ingredients (such as buffers, perfumes, optical-whitening agents, foam suppressors, chelating agents).

[0003] Irrespective of the specific composition, the ingredients of the detergent are aimed at achieving two main functions in aqueous solution:

- 20 i) physical removal of dirt and stains from the garments and their chemical modification by hydrolysis or oxidation (bleaching), which gives rise to solubilization and/or decoloration of dirt and stains; and
ii) protection of the fabrics by using polymers, protection of the colours thanks to colour-lock technology or inhibition of transfer of the dyes, elimination of dirt, and ease of ironing.

25 **[0004]** Amongst the active components of the detergent of particular importance are the oxidizing agents, such as sodium percarbonate and sodium perborate. These bleaching agents basically have the role of decolouring stains by degrading the structure of the corresponding coloured substances. For example, percarbonate has a good bleaching power in so far as - when it is dissolved in water - it is dissociated into sodium carbonate and peroxide according to the reaction:



[0005] However, its action takes place prevalently at temperatures higher than 40-50°C.

35 **[0006]** To overcome said problems, in the formulations of detergents in the last few years there have been added oxidizing-agent activators, such as the TAED (tetraacetylenediamine). This molecule is an activator that enables creation of new oxidizing molecules starting from peroxide, i.e., peracids. Peracetic acid, or more generically an acid belonging to the family of the peracids, which is formed as product of reaction, is an oxidizing agent that is much more powerful than peroxide and enables a good bleaching action to be obtained at a temperature of around 25-35°C. TAED, however, is a reagent that is exhausted during the reaction.

40 **[0007]** A possible way to improve the bleaching action is to provide the washing machine with dedicated means, for adding to the washing water an additional bleaching agent, such as a perborate or a chemical carbonate in liquid or powder form, or for generating the peroxide directly. The use of an additional bleaching agent imposes, however, a certain complication in the production of the machine and/or in its use by the user. The presence of possible means for directly generating peroxide (for example, an electrochemical cell that is able to dissociate water and air in order to
45 release peroxide) certainly facilitates the use of the machine by the user, but complicates production thereof and management of the operating programs.

[0008] Irrespective the aspects of construction and use of the machine, it should be considered that the addition of bleaching agents in the washing solution that already contains the normal commercially available detergent can determine an excess of oxidizing substances, such as to cause "destruction" of other active components of the detergent, for
50 example enzymes, and also damage to the garments being treated.

Summary of the invention

55 **[0009]** In view of what has been set forth above, the aim of the present invention is to provide a laundry-washing machine in which the exploitation of oxidizing components that may be present in the washing detergent is improved in a simple and inexpensive way.

[0010] The above and other aims still, which will emerge more clearly hereinafter, are achieved, according to the present invention, by a laundry-washing machine having the characteristics specified in Claim 1. Particularly advanta-

geous characteristics of the invention are specified in the dependent claims. The claims form an integral part of the technical teaching provided herein in relation to the invention.

Brief description of the drawings

[0011] Further purposes, characteristics, and advantages of the present invention will emerge clearly from the ensuing detailed description, with reference to the annexed drawings, which are provided purely by way of non-limiting example and in which:

- Figure 1 is a schematic cross section of a laundry-washing machine according to the present invention;
- Figure 2 is a partial and schematic perspective view of a first component of the machine of Figure 1; and
- Figure 3 is a perspective view in partial cross section of a second component of the machine of Figure 1.

Description of preferred embodiments

[0012] The reference to "an embodiment" or "one embodiment" in the framework of the present description is meant to indicate that a particular configuration, structure, or characteristic described in relation to the embodiment is comprised in at least one embodiment. Hence, phrases such as "in an embodiment" or "in one embodiment" and the like that may be present in various points of the present description do not necessarily all refer to one and the same embodiment. In addition, the details, configurations, structures, or characteristics can be combined in any adequate way in one or more embodiments. The references used in what follows are provided only for convenience and do not define the sphere of protection or the scope of the embodiments.

[0013] The idea underlying the present invention is to provide the washing machine with a catalyst that is able to perform an action similar to that of TAED already normally present in detergents available on the market, i.e., to transform oxidizing substances that may be present in the detergents into active oxygen, in the form of peracids, during the washing action. For this purpose, the catalyst in question is associated to at least one component that is in any case already normally provided on the machine, said component being chosen from among the ones that, during operation of the machine itself, are in contact with the washing solution, i.e., water and detergent.

[0014] The activity of the catalyst thus enables a better bleaching of the fabrics and oxidation of their stains, without this entailing any significant complications of construction of the machine or of its control logic, without in any way complicating the activity of the end user, and without entailing risks of damage to the garments being treated.

[0015] The catalyst in question acts in a way synergistic with TAED or possible other activators - such as for example NOBS (nonanoyloxybenzene sulphonate), nitriles or the like - that may already be present in the detergents used, enabling increase of the active oxygen in the solution, transforming perborates and percarbonates into a peracid, such as peracetic acid. Advantageously, the catalyst used according to the invention enables increase in the formation of active oxygen from perborates and percarbonates even at low temperatures, in particular in the range between 20°C and 35°C.

[0016] In the preferred embodiment of the invention, the catalysts used in the machine according to the invention comprise transition metals (group "d" or else group "f" of the periodic table of elements), oxides of transition metals, and insoluble salts of transition metals, provided that they present insoluble during the washing conditions, i.e., in aqueous solutions with pH comprised between 3 and 12, temperature lower than 75°C in the presence of enzymes, surfactants, and all the various chemical agents present in the formulations of the detergents.

[0017] In a preferred embodiment of the invention, the transition metal in question is cerium, and preferably the catalyst has a base of cerium oxide, more preferably with a base of cerium-oxide platinate (0.5% platinum).

[0018] The principle on which operation of the present invention is based is that of heterogeneous catalysis (where by the term "*heterogeneous*" is meant that the catalyst has a phase different from that of the reagents that constitute the main reaction) and presupposes that the solution containing the washing agent is in contact with the catalyst. For this purpose, as will emerge more clearly hereinafter, the catalyst may be associated to a stationary component of the machine according to the invention, or else to a movable component thereof or a component belonging to a movable member, it being understood that - during the steps of treatment carried out with the aid of detergent - at least the part of the component that carries the catalyst is in contact with the water-detergent mixture.

[0019] Irrespective of the type of component, in the preferred embodiment of the invention, the catalyst is located in a corresponding point of the machine that is not reached by the garments agitated in the course of the treatment and contained in the basket of the machine. Practical tests conducted by the present applicant have ascertained that said characteristic in no way reduces the activity of the catalyst aimed at transforming oxidizing substances such as perborates and percarbonates into peracids, enabling instead the integrity of the catalyst itself to be safeguarded in time. Thanks to said characteristic, the catalyst is not exposed to any rubbing and friction with the garments being treated: consequently, on the one hand, it is not subject to wear and risks of removal and, on the other hand, there is prevented the risk of the

catalyst possibly abrading the garments undergoing treatment.

[0020] In one embodiment, the component to which the catalyst is associated is made at least in part of synthetic material, for example a thermoplastic material, and the catalyst coats at least said part. With this type of solution, the material can be deposited on the surface of the synthetic component, even locally, in a very simple way, using any technique suitable for the purpose, for example selected from among painting, PVD (Plasma Vapour Deposition), CVD (Chemical Vapour Deposition), PECVD (Plasma Enhanced Chemical Vapour Deposition), cold-spraying, and the like.

[0021] In one embodiment, the catalyst can be compounded or integrated directly in a synthetic material that constitutes at least part of the component in question, at its surface. Also said solution is very simple to implement and can be obtained, for example, by mixing the catalyst and the synthetic material during moulding of the component in question or of its part of interest. Said embodiment is particularly advantageous in the case of components obtained via moulding of plastic material, in particular thermoplastic material.

[0022] In one embodiment, the component to which the catalyst is associated includes at least a metal part, and the catalyst itself coats the aforesaid metal part at least partially on its surface. Also in an embodiment of this sort the catalyst can be deposited on the surface of the metal part, using any technique suitable for this purpose, for example selected from among enamelling, painting, PVD, CVD, PECVD, cold-spraying, electrophoresis, and the like.

[0023] For a better understanding of the invention some possible embodiments thereof will now be described.

[0024] Figure 1 is a schematic representation of a laundry-washing machine, designated as a whole by 1. In the case exemplified, the machine 1 is a laundry-washing machine that comprises a cabinet 2, supported in a known way inside which is a tub 3. Rotatably mounted inside the tub 3 is a laundry basket 4, which can be driven in rotation via an electric motor M. The basket 4 has a cylindrical wall associated to which are members for agitation of the laundry, or paddles, designated by 5. The inside of the basket 4 is accessible to the user via an opening made in the cabinet 2 and closed, during operation of the machine 1, by a door, according to the known art. The machine represented schematically is a front-loading machine, but it will be appreciated that the invention can be applied also in the case of top-loading machines.

[0025] Designated as a whole by 6 is a dispenser for washing agents, of the type comprising a drawer container, for example divided into a plurality of compartments. The aforesaid drawer container is slidably housed in a hopper, having a lower outlet that is connected, via a pipe 7, to the tub 3. Alternatively, the dispenser of washing agents can be housed inside the door of the machine 1, according to a technique in itself known.

[0026] Designated by 8 are valve means, having an inlet designed for connection with a domestic water mains supply 9. The dispenser 6 and the valve means 8 are provided for causing passage of a flow of water coming from the mains 9 through the drawer container of the dispenser 6, according to a technique in itself known, in order to remove the washing agent and deliver it into tub. For example, if the drawer container is divided into a plurality of compartments, the flow of water is made to pass selectively and in a controlled way in one of the compartments of the aforesaid drawer, according to the operating step of the machine 1. After the water has traversed the compartment of interest, it exits from the aforesaid hopper container entraining the washing agent, and then reaches the tub 3 via the pipe 7. According to a technique widely known in the sector, the valve means 8 may comprise a single solenoid valve, and the dispenser 6 may be provided with a movable nozzle, which can be controlled for directing selectively the flow admitted by the solenoid valve towards one of the aforesaid compartments; in another possible embodiment of a known type, the valve means may comprise a system of a number of solenoid valves in parallel.

[0027] Designated by 10 is a bottom sump of the tub 3, where means are mounted for heating the washing liquid, comprising a resistance 11. The sump 10 has an outlet (visible in Figure 2, reference 10a) where a drain sleeve 12 is mounted, connected to the intake branch of a discharge pump 13, the outlet branch of which is for connection to the drains 14. The machine 1 can also comprise, in an inlet region of the sleeve 12, a device aimed at reducing waste of detergent, i.e., at preventing passage into the drain sleeve 12 of powdered detergent that has not yet dissolved in the water. Such a device, designated as a whole by 12a, may be of any known type; for example, it may comprise a floating body, such as a hollow body or a partition (see, for example, WO 87/02078).

[0028] Designated as a whole by 15 are the means for manual programming of the machine 1, i.e., its user interface, comprising a control panel. Designated as a whole by 16 is a control unit, for example of the microcontroller type, which comprises, or to which are associated, non-volatile memory means. Stored in the aforesaid memory means are the operation or management programs, which supervise execution of the treatment cycles that can be carried out by the machine and can be selected via the user interface 15. In said memory means, there are obviously encoded also the instructions regarding the general functions of the machine 1. The machine 1 also comprises of course all the further components necessary for its normal operation (level sensors, filters, door, safety devices, etc.), which are not represented and described herein in so far as they are not of immediate interest for the purposes of an understanding of the present invention.

[0029] As mentioned previously, the catalyst used in the machine according to the invention - here assumed as comprising cerium oxide - may be associated to a stationary component of the machine 1, provided that this component - or at least its part carrying the catalyst - comes into contact with the water-detergent solution.

[0030] Figure 2 exemplifies for this purpose the case of application of the catalyst to the tub 3, and more precisely on

the corresponding inner side, which is to come into contact with the washing liquid. In this case, the catalyst is preferentially in a lower region of the tub 3, i.e., the area that tends to be occupied by the washing bath. In the example represented, designated by 3a is an insert that is partially embedded in a plastic material - for example, polypropylene with fillers - of a body 3' that forms the peripheral wall of the tub 3. The upper surface of the insert 3a is directly exposed towards the inside of the tub 3, and deposited at least on said surface of the insert is the catalyst, for example via a technique selected from among enamelling, painting, PVD, CVD, PECVD, cold-spraying, electrophoresis, and the like. The aforesaid insert 3a may for example be made of stainless steel.

[0031] The catalyst may also be deposited directly on the plastic material constituting the body 3', for example in the same area that in Figure 2 is occupied by the insert 3a. The catalyst deposited or an insert carrying the catalyst may also be located in the region of the sump 10. In the case where the tub 3 is made totally or in part of metal material, for example steel, the catalyst may be deposited superficially on said material.

[0032] Other stationary components of the machine 1, to which the catalyst may advantageously be associated, belong to the means for loading the liquid into the tub, for example the hopper of the dispenser 6, in its part underlying the drawer container, and the pipe 7. The catalyst can be associated also to components of the discharge means, for example the part of the sleeve 12 that directly faces the inside of the tub, at the hole 10a of Figure 2. Another stationary component that may advantageously function as substrate for the catalyst is the heating resistance 11, on which the catalyst itself can be deposited using techniques similar to those used for application of anti-lime coatings, for example selected from among enamelling, painting, PVD, CVD, PECVD, cold-spraying, electrophoresis, and the like.

[0033] It will be appreciated that in the examples of positioning provided above, the washing liquid containing the detergent comes at least temporarily into contact with the catalyst, in the course of operation of the machine 1, in order to carry out its own action. Instead, the catalyst does not come in contact with the laundry contained in the basket 3.

[0034] On the other hand, a possible movable member of the machine to which the catalyst may be associated is the basket 4, which in the course of its rotation passes into the washing bath present on the bottom of the tub. As has been said, in the preferred embodiment of the invention, the catalyst is positioned so as never to come into contact with the garments being treated, and for this reason, the catalyst will preferably be set on the outside of the basket 4. Also in this case, the catalyst can be deposited superficially on plastic or metal parts of the basket, or else applied on inserts of the type previously designated by 3a.

[0035] The catalyst may also be positioned within the basket 3, but in a position shielded with respect to the garments. Possible advantageous embodiments in this sense are exemplified in Figure 3.

[0036] Given that the drum paddles 5 have a generally hollow section, the catalyst can be conveniently provided inside them in order not to come into contact with the laundry. In this perspective, the catalyst can be deposited on an inner surface of the body 5' of the paddles, such as the one designated by 5a in Figure 3, irrespective of whether said body is made of metal or - as more commonly is the case - of plastic material. As for the case already cited of other components, the catalyst may also being integrated in the plastic material constituting the body 5' of the paddle 5. As an alternative or in addition to deposition on an inner surface of the body of the paddle 5, within its cavity 5c there can be housed a metal plate 5b, on the major surfaces of which the catalyst is deposited, as is also exemplified in Figure 3.

[0037] It will be appreciated that, in the course of rotation of the basket 4, the paddle 5 will be at least partially in contact with the washing liquid present on the bottom of the tub, as normally occurs in any laundry-washing machine. The general structure of the paddle 5 is of a generally known conception, and in said perspective it is coupled to the peripheral wall of the basket 3 in the absence of particular seals. In this way, part of the water-detergent mixture can penetrate into the cavity 5c of the paddle and come into contact with the catalyst, which thus can carry out its own function. In a preferred embodiment, the body of the paddle 5 has a plurality of holes 5d, through which the mixture that penetrates into the cavity 5c can sprinkle onto the laundry in the course of rotation of the basket. In one embodiment, in order to favour entry of water into the cavity 5c of the paddle 5, the peripheral wall of the basket 3 may be provided with one or more openings in the area where the paddle 5 is mounted. Obviously, all the paddles 5 of the machine can include the catalyst in question.

[0038] In the case where the machine is equipped with a detergent-antiwaste device, the catalyst may be deposited or integrated in the part of a corresponding component directly facing the inside of the tub 3, such as for example the floating body already referred to (whether this be of a hollow or partition type).

[0039] Previously, reference has been made to the possible direct integration of the catalyst in the plastic material that forms at least part of a component normally in contact with the water-detergent mixture. Said measure is particularly advantageous in the case of thermoplastic materials, such as polypropylene. For this purpose, it is sufficient to mix to the granules of the material used for moulding the chosen catalyst, in granular or powdered form, to constitute a sort of additive thereof. It has been found that, in the course of melting at high temperature of the thermoplastic material that occurs in the moulding step, the catalysts used - based, as has been said, on transition metals - tend to migrate towards the surfaces of the metal die used so that they consequently come to be located at the surface of the component thus formed. Said surface will be distinguished by some degree of roughness, due to the presence of the particles of the catalyst, which partially project from the moulded plastic material, and hence with the catalyst in a suitable position for

being lapped by the water-detergent mixture.

[0040] It is also clear that, by exploiting widely known moulding technologies, it is possible to produce the components of interest with two different plastic materials, and thus with a part containing the catalyst and a part that does not contain it. Of course, according to the cases, the part containing the catalyst may be an external part of the body of the component (for example, in the case of the basket 4) or else an internal part (for example, in the case of the tub 3).

[0041] It is clear that numerous other variants to the machine described by way of example are possible for the person skilled in the art, without thereby departing from the scope of the invention as defined of the ensuing claims.

[0042] The catalyst according to the invention can of course be provided also in parts of the hydraulic circuit of the machine different from the ones exemplified previously. It is pointed out, for example, that, in the case of machines equipped with a circuit for recirculation of the washing liquid, the catalyst may be applied along a duct of said circuit. It is then clear that the catalyst may be provided also inside the drawer container of the dispenser 6, and in particular in its compartment or compartments that are dedicated to containing the usual commercially available washing agents, which contain, as has been said, perborates and/or percarbonates.

[0043] The catalyst according to the invention may also be applied to a container of detergent of the type designed to be set inside the basket, directly between the laundry being treated (the so-called "detergent balls"). In such a case, the catalyst will be applied inside the cavity of the aforesaid container so as not to be reached by the laundry.

Claims

1. A laundry-washing machine, comprising a wash tub (3), a laundry basket (4) mounted in said tub (3) and drivable in rotation via motor means (M), loading means (6, 7, 8) for delivering a liquid into said tub (3), a washing agent dispenser (6) for adding at least one washing agent to the liquid, heating means (11) for heating the liquid, discharge means (10, 12, 13) for draining the liquid from the tub (3) and a control system (15, 16), **characterized in that** it comprises a catalyst adapted to promote transformation of oxidizing substances that may be present in the washing agent into peracids, the catalyst being associated to a component of the machine (1) that, during operation of the machine, is in contact with the liquid containing the washing agent.
2. The machine according to Claim 1, wherein the catalyst comprises at least one of a transition metal, an oxide of a transition metal and an insoluble salt of a transition metal.
3. The machine according to Claim 1, wherein the transition metal is cerium.
4. The machine according to one of the preceding claims, wherein said component is a stationary component (7; 3; 10; 12).
5. The machine according to one of Claims 1 to 3, wherein said component is a movable component (4, 5, 12a), or belongs to a movable component (3).
6. The machine according to Claim 4 or Claim 5, wherein the catalyst is arranged in such a way that it does not come into contact with the laundry contained in the basket.
7. The machine according to Claim 4, wherein said stationary component comprises at least one from among:
 - the wash tub (3), the catalyst being associated to the inside of the tub (3), particularly in a lower region thereof;
 - a duct (7) which belongs to said loading means (6, 7, 8);
 - a sleeve (12) which belongs to said discharge means (10-13);
 - a resistance (11) which belong to said heating means.
8. The machine according to Claim 5, wherein said movable component comprises at least one from among:
 - the laundry basket (4), the catalyst being associated to the outside of the basket (4);
 - an agitation member (5) mounted inside the laundry basket (4), the catalyst being associated to the inside of the agitation member (5);
 - a movable body (12a) forming part of a detergent-antiwaste device associated to a drain sleeve (12) of the tub (3).
9. The machine according to any one of the preceding claims, wherein said component has at least one part made of synthetic material and the catalyst superficially coats at least partially the part made of synthetic material.

EP 2 604 745 A2

10. The machine according to any one of the preceding claims, wherein said component has at least one part made of synthetic material and the catalyst is compounded in the synthetic material at least at its surface.
- 5 11. The machine according to any one of the preceding claims, wherein said component (3; 5) includes at least one metal part (3a; 5b) and the catalyst coats at least partially the metal part (3a; 5b).
12. The machine according to Claims 6, 7, and 11, wherein the metal part (3a) comprises an insert of the tub (3).
- 10 13. The machine according to Claims 6, 8, and 11, wherein said agitation member (5) has an internal cavity (5c) and the metal part (5a) is inside said cavity (5c).
14. The machine according to Claim 6, wherein said component comprises a washing agent container.

15

20

25

30

35

40

45

50

55

Fig. 1

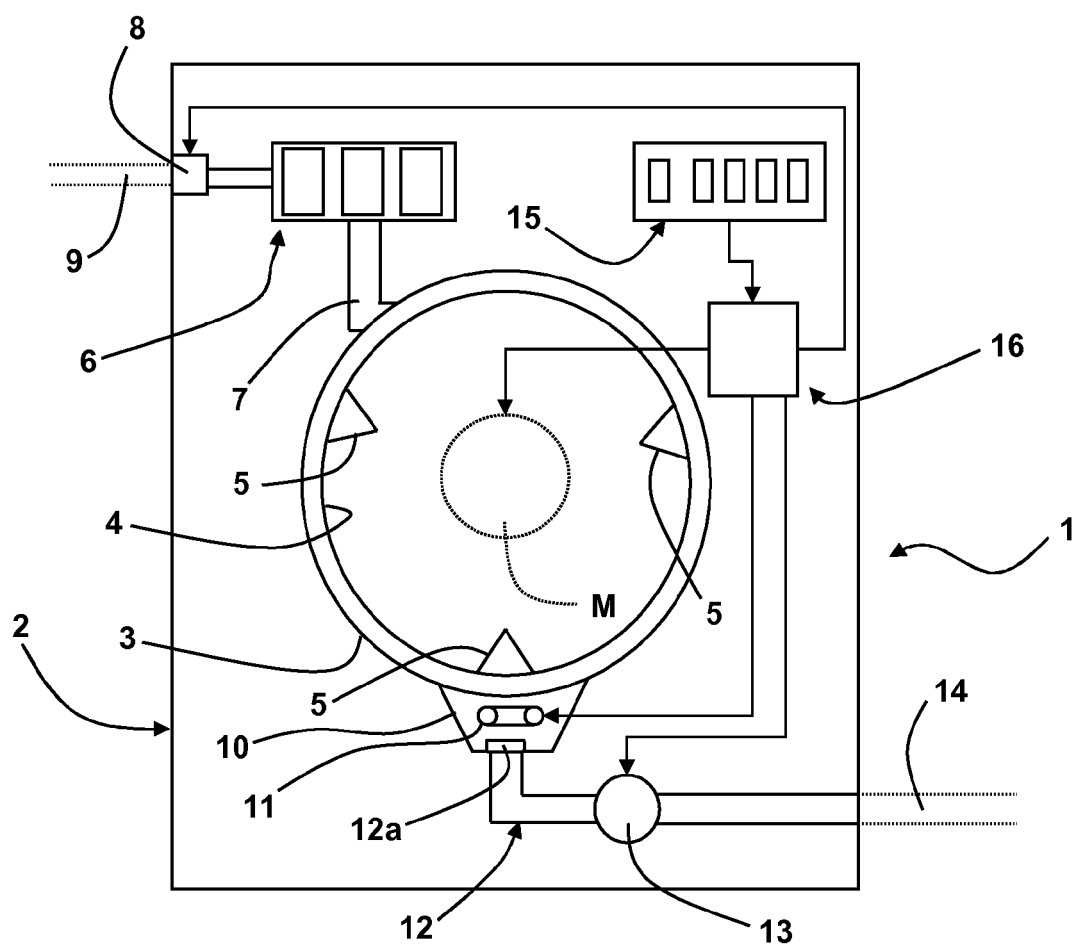


Fig. 2

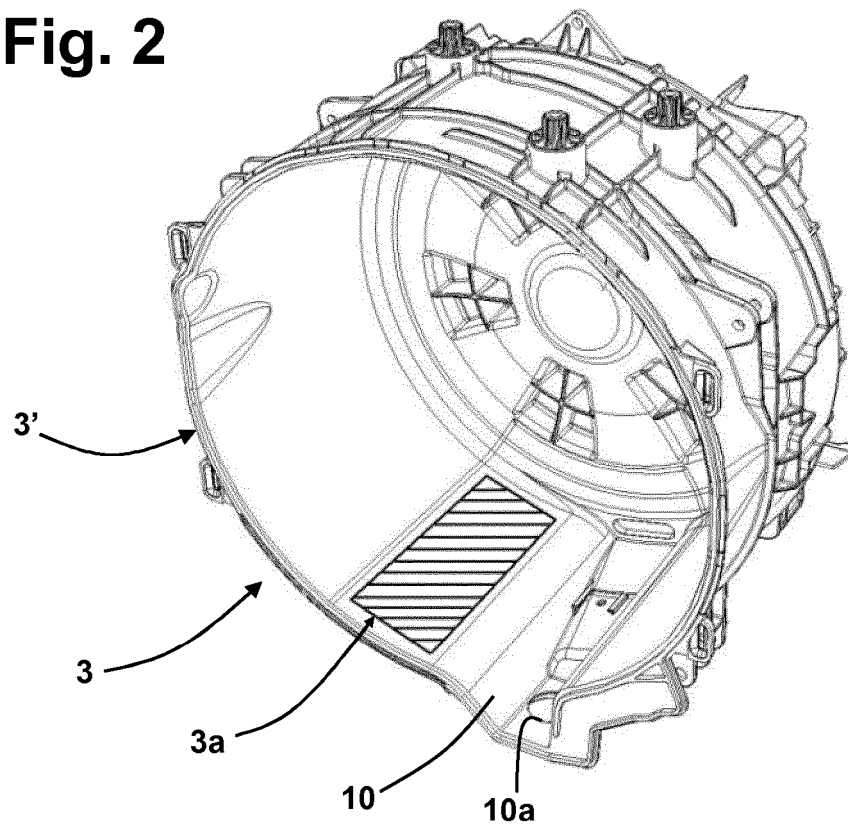
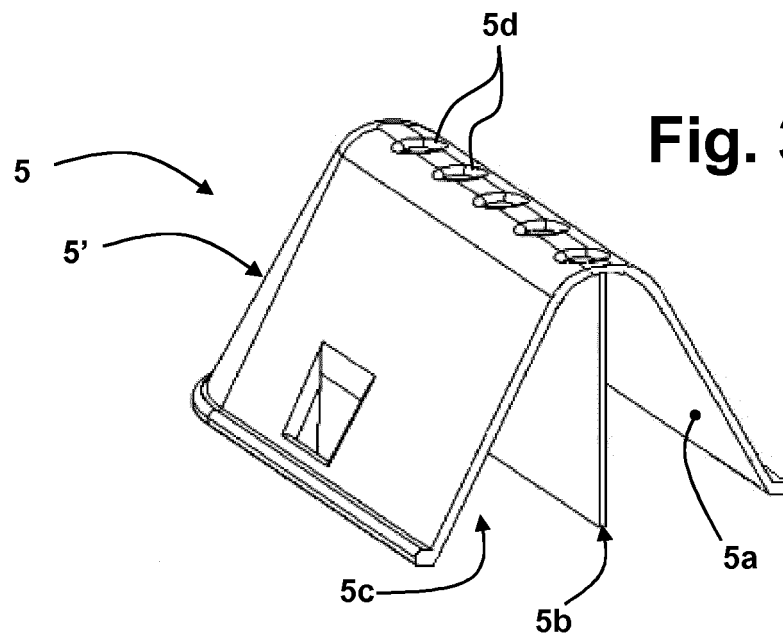


Fig. 3



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

- WO 8702078 A [0027]