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(54) Dishwashing machine with macerator filter caused to rotate by the wash liquid flow

(57) Dishwashing machine equipped with sump(3) for collection of the wash liquid and of rotably supported cylindrical microfilter (12), the latter housed in said sump, the microfilter being equipped with a series of helical blades(125) to be caused to rotate by an axial liquid flow, induced within the sump by a recirculation pump, the envelope profile of the outer edge of blades being matched to the sump profile, in order to develop a macerating action on solid soil particles conveyed by the liquid flow, and laminated between the blade edge and the sump wall.

A support with cutting spokes (21), integral with microfilter and jointly operating with a stationary large-meshed filtering plate(28), exerts an additional macerating action on soil particles passing through the filtering plate.

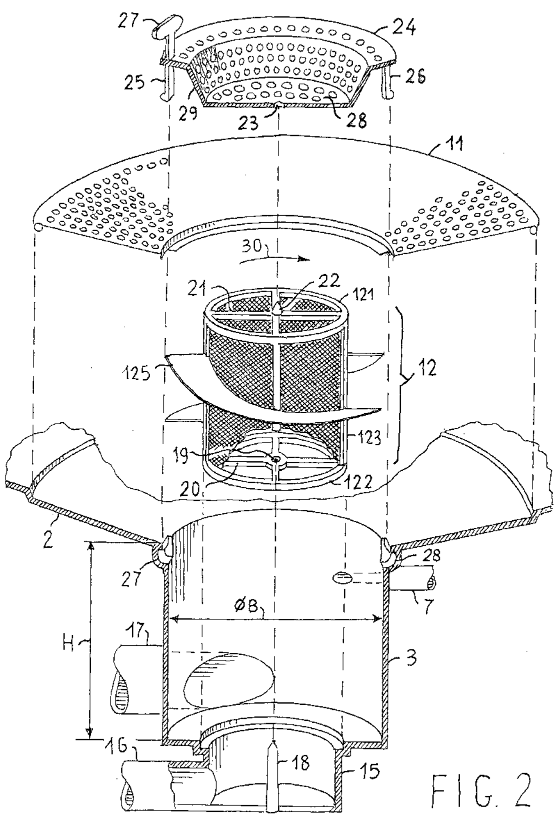

FIG. 2

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Description

[0001] This invention pertains to a dishwashing machine with macerator filter caused to rotate by the wash liquid flow.

[0002] It is known that in dishwashing machines various problems have to be faced and solved, in the meanwhile meeting manifold requirements. The latters are, as far as possible, rationally outlined hereinafter.

[0003] The first requirement is to have reduced consumption of water and detergent, hence of heating power, in the hot washing stages.

[0004] To meet this requirement, the water used in the different stages of a washing cycle (that may include, in this sequence, subsequent stages of prewash, wash, 1st rinse, 2nd rinse) is recirculated.

[0005] The washing tub is filled with a given volume of liquid, generally ranging 1 to 1.5 litres, next the latter is conveyed by a pump to one or several spray arms placed in the wash chamber.

[0006] The jets flowing out of the arms spray all over the dishes, the water falls within the tub, and is collected in a pan or sump. From there it is sucked out again by the recirculation pump.

[0007] At the end of each stage of the washing cycle, water is drained off by a drain pump.

[0008] The volume of water used in each stage cannot be less than a given amount: actually, it must be ensured that the recirculation circuit is filled up completely (this circuit has a remarkable capacity, mainly due to the collection pan size) in order to prevent pump cavitation.

[0009] Water recirculation permits to remove by dish spraying the food soil present on them. On the other hand, it calls for use of filters, to prevent soil from being recirculated as well. This might damage the recirculation pump and re-soil the dishes .

[0010] Two cascaded filters are generally used: one large-meshed, retaining the larger sized (>1-2 mm)food soil particles, the other one fine-meshed, the so-called microfilter, retaining the finer particles (ranging 0.2 to 0.3 mm).

[0011] Typically, the large-meshed filter, if appropriate connected with a small filter-basin, makes up the top closure of the collection sump, whereas the microfilter is housed inside the sump, upstream the recirculation pump.

[0012] Both the large-meshed filter and the microfilter are removable for hand cleaning, even if, as we will see, microfilter self-cleaning systems have been developed.

[0013] The microfilter fitted within the recirculation circuit produces considerable loss of pressure and it can even get clogged. This may block or significantly limit the recirculation flow.

[0014] This problem was approached in different ways.

[0015] The most frequently adopted solution provides for splitting the recirculation flow: only part of the flow passes through the microfilter, the rest is directly sucked by the recirculation pump, only passing through the large-meshed filter.

[0016] During recirculation the whole volume of liquid ends up with passing through the microfilter. Accordingly, the finest particles are gradually removed from the liquid.

[0017] Another approach is disclosed for instance in U.S. Pat. Nos. 3,310,243, 4,350,306, 3,434,671 and in EP-1,057,445. This approach provides for elimination of the microfilter and its replacement with a macerator assembly, i.e. a rotary blade, driven by the pump motor, joinly operating with a stationary element (large-meshed filter) to crumble the food soil, converting it into finer particles.

[0018] However, the problem arises, to avoid recirculating the crumbled soil between the dishes. To solve the problem, it was proposed to make use of a pressurized settling chamber fitted downstream the pump (U. S. Pat. No.4,350,306) or, as an alternative to the macerator, to make use of simple throwers driven by the recirculation pump, fitted upstream the latter, to concentrate the solid particulate matter featuring density higher than that of the liquid in a collecting chamber (U.S. Pat. Nos. 4,168,715, 4,243,431 and 4,150,680).

[0019] However, these solutions involve larger volumetric capacity of the circulation circuit, and accordingly increased water consumption, as well as design complications that make regular check and hand cleaning of macerator assembly and settling chambers harder.

[0020] Therefore, the use of microfilter would seem to be preferable.

[0021] To reduce to a minimum, or eliminate completely the regular hand cleaning of the microfilter; it was formerly proposed to wash it automatically in countercurrent, with respect to the recirculation flow, by means of a jet of clear water supplied by a rotary nozzle. The latter is caused to rotate by the same thrust of the jet, and progressively directed on different parts of a substantially cylindrical microfilter, as outlined for instance in DE-A-1,428,358.

[0022] As an alternative, it was proposed, as outlined in IT-1,197,983, to make use of a stationary jet of clean water ejected tangent to the microfilter, in countercurrent to the recirculation flow, in order to set microfilter in rotation, thus cleaning it throughout.

[0023] The solution put forward by the latter embodiment effectively solves the automatic filter cleanup problem, but it doesn't solve the problem of rotating the filter during the washing and rinsing stages, when the recirculation pump is operating, and no new liquid is let in.

[0024] This is desirable to ensure that during operation the food soil evenly settles onto the microfilter, increasing the filtration efficiency accordingly.

[0025] As disclosed in EP-752,231, this problem is partly solved, with no need for mechanical mating of filter with driving units, by making use of the vortex generated in a sump filled with liquid, as a result of a suction orifice oriented tangent to the peripheral section of sump and connected with the recirculation pump.

[0026] By placing within the sump a rotably supported filter at an eccentric position and fitting filter with external blades, the vortex produced in the liquid causes - at least in theory - the filter to rotate.

[0027] This system operation concept is the opposite of that one featured by a centrifugal pump.

[0028] In practice, the developed torque is small, and limited by the need to make use of a sump relatively large in size. This involves an increase in volumetric capacity of the recirculation circuit.

[0029] At any rate, the small developed torque can but cause the filter to rotate. In the practical conditions it was experimentally verified that the concerned torque can prove insufficient even for this purpose only.

[0030] This invention solves all the above mentioned problems and provides for a dishwashing machine with extremely reduced volumetric capacity of the recirculation circuit, removable microfilter automatically cleaned in counterflow to the recirculation flow and caused to rotate by the recirculation flow throughout the duration of the washing and rinsing stages, so to evenly distribute the soil deposit onto the microfilter.

[0031] As an additional advantage, the torque acting onto the filter is large enough to enable the latter to macerate and emulsify the soil particles passing through the large-meshed filter; the soil particle size is thus considerably reduced.

[0032] In this way the particles, reduced in size, once retained by the microfilter, are less likely to develop lumps and can be more easily detached from the filter meshes and kept in suspension in the liquid that is drained, without forming films, specially fat ones, adhering to the walls.

[0033] Reduction in particle size also involves reduction in particle size distribution provoked by the different density of the suspended particles, and hence the agglomeration of several particles of the same type.

[0034] Maceration ultimately has a synergetic effect on the use of a microfilter, in that it promotes self-cleaning, calling for less mechanical action to remove soil particles from the filter.

[0035] Although preferable, the mechanical action exerted by a countercurrent flow becomes unnecessary, and it is enough to flood the filter with a flow, even featuring low relative speed with respect to filtering wall.

[0036] These targets are achieved by a dishwashing machine integrating the characteristics defined by the attached claims.

[0037] The characteristics and the benefits of this invention will be cleared up by the hereinafter reported description of a preferred form of embodiment, and of variations thereof, implemented by making reference to the attached drawings in which:

- Figure 1 is a general cross-sectional schematic view of dishwashing machine;
- Figure 2 is cross-sectional, exploded perspective view of the innovative details only, of the machine shown in Figure 1;
- Figure 3 shows in cross-section a first variation of the details shown in Figure 2,
- Figure 4 shows in cross-section a second variation of the details shown in Figure 2.

[0038] Aimed at better understanding the invention, Figure 1 shows a schematic overall drawing of a dishwashing machine that, except the special features that will be stated, can be regarded as known art, such as for instance the one disclosed in IT-1,197,983 and EP-752,231.

[0039] The machine includes a wash chamber 1 ending at the bottom with a tub 2 extending below to form a collection sump 3, generally of a cylindrical form, with diameter ∅B ranging 100-120 mm and depth ranging 80-100 mm.

[0040] A given volume of water (approx. 1,2-1,5 litres) is admitted into the sump through an inlet valve 4, an air jump separator 5, required to comply with safety regulations, a resin water softener 6, and a supply pipe 7. This water fills the sump and the washing tub up to a L1 level.

[0041] A recirculation'pump 8 with the suction orifice open at the bottom or, as shown, at the sump side, in its bottom section, sucks water from the sump, feeding it to one (or several) spraying arms 9, housed in the wash chamber.

[0042] Water sprayed by the nozzles of spray arm 9, laps the dishes and falls into the tub 2 from where it is recirculated by pump 8.

[0043] Under these operating conditions, as a result of the recirculation circuit capacity, the liquid level in the tub falls. It is shown by level L2.

[0044] During the washing stages, different from the rinsing ones, detergents are automatically added to the washing water.

[0045] Upon completion of each stage of the washing cycle, the liquid contained in the tub is sucked by a drain pump 10.

[0046] To prevent that during the different cycle stages the soil removed from dishes is recirculated, with possible damage of the recirculation pump and thereafter of the drain pump, a large-meshed filtering plate 11 is placed in tub 2, the former aimed at separating collection sump from the wash chamber.

[0047] The filtering plate 11 can be equipped, at the sump, of a recess in the form of a basin, generally removable, in which the coarser fraction of the solid residues settle down.

[0048] Besides the filtering plate 11, provision is made for a fine-meshed filter 12, or microfilter, generally of a cylindrical form, housed in sump 3. This microfilter divides the sump volume in a center cylindrical section, and in a cylindrical annular crown.

[0049] The recirculation flow passing through filtering plate 11 partly enters the annular crown and partly flows into the center cylindrical section. Next it is sucked by the suction pump.

[0050] The liquid entering the central section and sucked by the pump passes through microfilter 12 from the inside to the outside and undergoes an additional filtration, whereas the liquid entering the circular crown is not further filtered, and conveys in itself the finest solid particles. However, during the subsequent recirculation this liquid as well, mixed with that further filtered, ends up passing through the microfilter, so that the whole recirculation flow is filtered by the microfilter, onto the wall of which the finest soil particles are deposited.

[0051] The coarsest particles, if present, are collected in the basin of filtering plate 11.

[0052] It should be remarked in Figure 1 that the suction orifice of drain pump 10 opens up at the inside of microfilter 12.

[0053] So, when the washing or rinsing liquid contained in sump 3 is drained out, the soil present on the inner wall of the microfilter is removed together with the liquid.

[0054] Actually, in this stage the liquid present in the annular crown of the sump, before being drained out must pass through the filtering wall of microfilter from the outside to the inside of it, i.e. in countercurrent to the direction of the recirculation flow.

[0055] This countercurrent flow promotes the removal of solid particles from the microfilter.

[0056] As disclosed by Patent IT-1,197,983, this action is enhanced by making provision, during the washing cycle, for the admittance of clean water into the sump via supply pipe 7.

[0057] The clean water jet from pipe 7 is adequately oriented in order to hit the filtering wall.

[0058] Furthermore, the filter is rotably mounted within the sump, and is caused to rotate by same spraying jet. Accordingly, the whole filtering wall is sprayed and passed through in countercurrent by the jet.

[0059] Even when drain pump 10 is not operative, to fill the internal volume of microfilter, the liquid present into the sump must pass through it in countercurrent, thus it tends to remove soil from the microfilter and to place it in suspension.

[0060] The same effect is achieved if the drain pump is actuated just after the sump filling up: the liquid present within the annular crown outside the filter must necessarily cross the filter in countercurrent.

[0061] This operation of water loading and immediately subsequent drain, with a cleaning action on microfilter, typically takes place during that special stage of the wash cycle when water softener resins are washed and purified by the regeneration brine.

[0062] The use of a rotably supported filter also provides an additional benefit: whenever during a washing cycle the filter may take a shifted position, different from the subsequent stages of the cycle, a more even distribution of the soil particles on the filtering wall can be achieved.

[0063] An even better effect is achieved if the filter continuously rotates throughout the washing and rinsing stages.

[0064] To this purpose, Patent EP-752,231 proposes to exploit the vortex induced within sump 3 by the recirculation flow suctioned through an orifice placed tangent to the circumferential wall of the sump.

[0065] To this aim, fitting filter 3 with circumferential paddles 13, the microfilter would be dragged into rotation by the vortex.

[0066] However, as previously mentioned, the action of the vortex proves inadequate to consistently produce this effect. Also, for the vortex to be produced, it is required to make use of a suitably sized sump, that increases the volumetric capacity of the recirculation circuit, calling for a larger volume of supply water and hence larger consumption.

[0067] Based on these considerations, this invention provides substantial enhancement: it cannot be denied that besides a possible vortex effect there is, in the sump, an axial flow from the top to the bottom, with an average speed determined by the flow rate of the recirculation pump and by the sump cross-section.

[0068] To achieve an effective washing, the pump flow rate typically ranges 80 to 120 litres/minute. For practical purposes let us assume the value of 90 litres/minute, equal to 1.5 l/s.

[0069] It is then clear that the average rate of the axial flow provoked by the recirculation pump is approximately equal to 0.15 m/s, provided that the diameter ∅B of the sump is equal to 120 mm. Nevertheless, it increases to approximately 0.3 m/s if diameter ∅B is reduced to 80 mm, and even to over 0.5 m/s if the diameter is reduced to 60 mm.

[0070] Moreover, if we consider that, as a result of the pressure loss taking place when microfilter is passed through, the axial flow mainly concentrates in the annular crown outside the filter, it is clear that - even with a sump diameter equal to 80 mm and a microfilter diameter indicatively equal to 60 mm, the axial velocity of the flow in the annular crown must range 0.3 m/s to 0.54 m/s and the closer to the upper limit, the larger the microfilter resistance to passing through it.

[0071] In practice it was experimentally verified that the average axial velocity of the flow into the annular crown, with the above mentioned sizes, is approximately equal to 0.4 m/s. This value increases, besides with the degree of microfilter clogging, along the axial direction of the sump, from the top to the bottom, except in the bottom area where the suction orifice opens up, where the average axial velocity becomes less meaningful, and where incidentally the average speed of the suctioned flow is much larger and is a function of the suction orifice diameter.

[0072] Actually, for an orifice diameter equal to 30 mm the average rate of suctioned flow is 2.15 m/s.

[0073] This consideration is all-important, due to the reasons we will mention hereinafter.

[0074] Hence, with axial velocities of this entity, only apparently small, the energy hold by the fluid (transferred to it by the pump) can be exploited to cause microfilter to rotate, causing the latter to act as a Kaplan propeller.

[0075] This development provides high conversion efficiency and considerable torque exerted onto microfilter. The latter is caused to rotate at relatively high speed, and it is in the meanwhile enabled to withstand counteracting torques that might hinder microfilter motion. Hence, as long as a recirculation flow is operating, the microfilter rotation is ensured.

[0076] Thus, as a further advantage, the rotating microfilter can also act as an emulsifying food soil macerator.

[0077] Fig. 2, an exploded perspective view, partly in diametral section, relevant to the concerned machine components only, identified by the same number references already used in Fig.1 shows a preferred embodiment of the invention 1. In Figure 2 the washing tub in the shape of a large tapered funnel, develops at its bottom section in a cylindrical sump 3, with smaller diameter than the conventional one, preferably approximately equal to 80 mm.

[0078] Depth H of sump is approximately the same, preferably somehow larger, for instance 100 mm.

[0079] The sump houses a cylindrical microfilter 12, consisting of a stiff frame formed by two end rings 121,122, joined by vertical uprights 123. Frame supports a cylindrical fine-meshed wire netting 124.

[0080] The frame can be easily made by plastic material moulding. The filtering wire mesh, made of metal or plastic, is fixed to frame by bonding or hot-sealing.

[0081] Two or more helical blades 125, preferably made of metal (or plastic as well), with outside diameter preferably slightly less than the sump, in order to form with the sump walls a given gap, preferably ranging 0.2 to 0.3 mm, and anyway not exceeding 0.5 mm, are fitted around the external circumference of the frame.

[0082] Blades 125 as well can be secured to frame by bonding, hot-sealing or forced fitting into special slits machined into uprights 123.

[0083] Based on the expected operating conditions, blades are adequately designed with a shape such as to provide maximum efficiency and maximum rotation speed.

[0084] For instance, with an angle of approx. 20°-25°, decreasing from the leading edge to the outlet, a peripheral speed coefficient can be achieved, larger than 2, and hence a rotation speed even up to 300 r.p.m.

[0085] For indicative purposes only, the outside diameter of microfilter frame can be 60 mm.

[0086] The bottom of sump 3 features a circular recess 14 with diameter slightly exceeding the frame outside diameter, designed for free housing of the frame bottom ring 12 forming with the latter a labyrinth sealing.

[0087] Beyond recess step 14, sump extends below to form a pan 15 in which a drain hole 16 is provided for connection with the drain pump.

[0088] Pan 15 can be cylindrical and closed at the bottom, as shown, or also hemispherical.

[0089] Drain hole 16 can be placed on the circumference of pan, as shown, or onto the bottom, or at any intermediate position as well.

[0090] A similar recirculation connection 17 with the recirculation pump is provided at the bottom of the circumferential sump wall.

[0091] The connection axis is oriented tangent to the sump.

[0092] In this way, as microfilter 12 is housed in the sump, the recirculation flow that - deflected to some extent by the microfilter blades - takes up a vortex motion (with average speed higher than inlet speed, achieved thanks to a pressure drop), is suctioned into connection 17 without substantial changes in direction and with minimum pressure loss.

[0093] Since microfilter is subject to an axial recirculation flow, due to the interference of blades 125 with the flow, it is subject to a relatively high axial thrust, ranging several hundred grams. At the same time microfilter is also subject to a tangential thrust of the same order of magnitude, that causes it to rotate (with blades arranged as shown in Figure 2 in the direction pointed by arrow 30). To avoid that the axial thrust locks, due to friction, the microfilter in the circular groove 14, microfilter does not rest into the groove. It is instead supported and centered within the sump by a support pin 18, the end of which fits into a mating seat 19 of a spoked support 20, integral with the lower ring 122 of microfilter, and coupled to the latter by forced fitting or hot sealing.

[0094] Provision is made for a similar support 21, with drive pin 22, integral with upper ring 22.

[0095] Support 21 should be preferably made of hard metal, i.e. stainless steel, for the reasons that will be hereinafter considered.

[0096] Drive pin 22 is fitted into a driving recess 23 of a filter-basin 24 equipped with a pair of diametrically opposed indented arms 25,26, for snap-on removable securing filter-basin 24 to the mouth of sump 3.

[0097] To this purpose, the sump mouth has suitable recesses 27,28 for fitting-in the indented ends of arms 25,26.

[0098] Snap-on engaging the indented arms into the applicable recesses ensures exact positioning, both axis and center-related, of the basin onto the sump, and accordingly of microfilter within the sump.

[0099] For more precise centering and axial positioning, basin 24 can be fitted with additional, circumferentially distributed arms, partly engaging the sump, thus ensuring perfect centering. The latter arms are complete with a shoulder for resting onto the edge of tub 2.

[0100] The assembly is completed by a filtering plate 11 resting onto the bottom of the wash tub 2,thus developing a space in-between.

[0101] The filtering plate features a central opening, flanged to accommodate the filter-basin 24, matched to plate, superimposed to the latter and forming with it a sealing labyrinth.

[0102] A catch lug 27, integral with filter-basin 27, provides for easy removal and subsequent microfilter pull-out of sump, for possible check and cleaning, with no need for removal of plate 11.

[0103] Nevertheless, filter-basin 24 can even make up a single piece with filtering plate 11.

[0104] When filter-basin is placed onto pan 3, its flat bottom 28 perfectly fits onto support 21, the spokes of which can be adequately knife-profile shaped, in order that during rotation of microfilter 12, food soil particles passing through the openings, featuring suitable size, of flat bottom 28, are crumbled and macerated.

[0105] To enhance this operation effectiveness, as well as to prevent flat bottom 28 from wearing, the latter as well can be made of hard metal, such as stainless steel.

[0106] A similar effect is achieved by microfilter blades 125 when microfilter is caused to rotate by the recirculation flow: coarse food soil particles passing through filtering plate 11, and the peripheral section 29 of filter-basin 24 and are conveyed by recirculation flow into sump 3, and namely into the cylindrical annular crown enclosed between the sump wall and the filtering wall 124 of microfilter, are somewhat cut by the leading edge of blades 125.

[0107] Furthermore, since some liquid flows through the gap between the peripheral blade contour and the sump wall, the blade ends as well exert this action on food soil particles, crumbled and emulsified within the washing liquid, conveyed by this flow.

[0108] This action is exerted throughout the washing and rinsing stages, hence it is performed several times on the same volume of liquid. Thereby an effective macerating action is ultimately achieved, even though the rotating speed of macerating elements, compared with the one of conventional macerators, directly driven by a motor, is lower.

[0109] It should be remarked that the same macerating effect is also achieved to a certain extent with a static structure, in which microfilter, equipped with helical profile blades matched to the peripheral wall of sump, does not rotate since it has no rotably mounted supports.

[0110] Actually, in that case the recirculation flow induced by the motor pump is partly forced to spin around the outer surface of microfilter, winding it, partly is converted into a laminar flow passing between the blades and the circumferential wall of sump. At any rate, the flow achieves an actual speed far higher than the typical speed of an axial flow.

[0111] Then, even in the case of a static filter, a macerating action is achieved.

[0112] Furthermore, the high speed of the flow outside the microfilter also promotes the drawing of a flow passing through the microfilter, from its inside to the outside.

[0113] Thus, the food soil particles progressively accumulating onto the microfilter filtering wall feature as an average a very small size, and can be more easily removed, brought into suspension and cleared out by the countercurrent flow developing during draining of the washing and rinsing water.

[0114] Even if food soil maceration makes a specific cleaning of filter by means of a jet of countercurrent liquid, as disclosed in IT-1,197,983, unnecessary, nothing prevents from combining, at no additional costs, both effects.

[0115] Actually, it was remarked already that, during a washing cycle, generally at the end thereof, provision is made for an operation of regeneration and washing of water softener resins.

[0116] As a result of this operation, a given volume of liquid, consisting of clean water, even if containing solved salts, is admitted, in one or several stages, into the sump. This water is immediately drained out.

[0117] The draining of the salt solution can take place at the same time as the liquid admittance (in which case the admitted volume is based on the measurement of the admission time duration) or immediately thereafter (in which case the admitted volume is based on the measurement of the filling level).

[0118] This volume of liquid can be used for further microfilter cleaning.

[0119] Making provision for the inlet duct 7 in pan 3 to be open and oriented tangent to microfilter, the latter can be caused to rotate by the thrust of the incident jet (in the same direction of rotation enforced by the axial flow, or preferably in the direction opposed thereto) in order to progressively expose different parts of the filtering wall to the incident jet passing through the wall in countercurrent , and thus cleaning it evenly.

[0120] Even in case the liquid draining does not take place at the same time with the admittance, but immediately thereafter, the incident jet, even though "flooded", creates at any rate a vortex of liquid that sets microfilter into rotation and partly flows through it in countercurrent to fill it up.

[0121] To the countercurrent flow, the turbulence effect adds, provoked by the rotation of the filter on the volume of liquid inside the microfilter. This turbulence detaches the food soil particles from the filtering wall, and brings them into suspension, so that they are cleared out with the immediately subsequent drain-off.

[0122] It should be remarked that, also if the inlet duct 7 is not arranged tangent to the pan, and even if duct is displaced with respect to pan, and for instance opening up into the wash chamber, in the liquid fill-up and draining stages there is at any rate a flow with some axial component that sets filter into a slow rotation, in a direction during the filling stage, and in the opposite direction during the drain off stage.

[0123] Even if slow and limited, this rotation affords the change in filtering surface at each stage of the wash cycle and ensures even distribution of food soil deposit on microfilter, preventing it from accumulating at specific areas, and assuring maximum filter efficiency.

[0124] The previously reported description covers a preferred embodiment, but clearly many changes can be brought about thereto.

[0125] For instance, instead of being cylindrical shape, pan 3 can be truncated-cone shape, with smaller diameter at the bottom and microfilter blades designed accordingly.

[0126] The filtering wall of microfilter as well, can be truncated cone in shape.

[0127] In this way, besides further reduction in volume of pan 3, a gradual increase in average fluid speed is achieved. This speed is closer to the one dictated by the suction orifice. The microfilter support pin 18, can be replaced by a pin passing through the full axial length of microfilter, or a part thereof, supporting microfilter by means of a shoulder placed either at the base, at the top or at both positions. Filter-basin 24 can extend with its peripheral wall 29 and its bottom 28 inside microfilter 12.

[0128] This solution is depicted in the cross-section shown in Figure 3, that also features a further variation: pin 18 supporting the microfilter 12 is hollow, and complete with spraying nozzles 31,32. It acts as inlet duct of the washing water that, in this case, sprays microfilter in the same direction of the recirculation water flow.

[0129] Other variations are also possible: for instance, in the diametral cross-section shown in Figure 4, filter-basin 24 is replaced by a cylindrical or truncated-cone extension 33 of filtering plate 11, partly protruding into microfilter 12, down to a large-meshed filtering plate 34, integral with microfilter. Plate 34 replaces the spoked support.

[0130] Above plate 34, integral and rotating with microfilter, a blade 35 is arranged. With its rotation, the latter crushes the soil particles that are collected in the cylindrical extension. This enables particles to pass through plate 34 and to gather within pan 15 (or to be catched by the microfilter).

[0131] To remove particles that possibly haven't been crushed, and that are retained by plate 34, upon wash end, filtering plate, as well as its extension 31, must be removed, and microfilter withdrawn from pan: in this case the top section of microfilter acts as collection filter-basin.

[0132] Instead of being integral with plate 34, blade 35 can be integral with extension 33: in this case, the relative motion between solid particles and crushing blade is provoked by the rotation of the plate and the vortex induced by the latter.

Claims

1. Dishwashing machine including a sump (3) with generally cylindrical or truncated-cone peripheral wall, and a central axle, an inlet opening (17) to a recirculation pump in the bottom section of said mentioned sump, a drain opening (16) in the bottom section of said sump, a microfilter (12) with generally cylindrical or truncated-cone filtering wall (124), housed in said sump, coaxial thereto, **characterized in that**:
said microfilter (12) comprises, on at least an axial portion, external to said filtering wall, a series of helical blades (125) with envelope profile matching the sump profile.

2. Dishwashing machine according to Claim 1, in which the envelope profile of said helical blades matches the sump profile, with clearance not exceeding 0.5 mm.

3. Dishwashing machine according to Claim 1 or 2, including means (18) for supporting said microfilter and allowing free rotation thereof within the said sump, said rotation being induced by an axial liquid flow in said sump.

4. Dishwashing machine according to Claim 3, in which said microfilter, rotably supported, is equipped with a support with cutting spokes (21), the former co-operating with a stationary large-meshed filtering wall (28) to macerate the solid soil particles passing through said stationary filtering wall(28).

5. Dishwashing machine according to Claim 4, in which said stationary filtering wall(28) makes up the bottom of a removable filter-basin(24) for collection of solid soil particles.

6. Dishwashing machine according to Claim 3, in which said microfilter (12) includes a large-meshed filtering plate (34), substantially perpendicular to the axis of said microfilter(12) and arranged inside said filtering wall (124).

7. Dishwashing machine according to Claim 6, including a rotary blade (35) superimposed to, and integral with said large-meshed filtering plate(34).

8. Dishwashing machine according to Claim 6 including a stationary blade (35) superimposed to said large-meshed filtering plate(34).

9. Dishwashing machine according to any one of the previous Claims, in which said sump(3) has a diameter not exceeding 80 mm.

10. Dishwashing machine according to any one of the previous Claims 3 to 9, including a pin (18) for rotary support of said microfilter(12), this pin being hollow and equipped with at least one outflow nozzle (31,32) to act as water inlet duct in the wash tub of said machine.

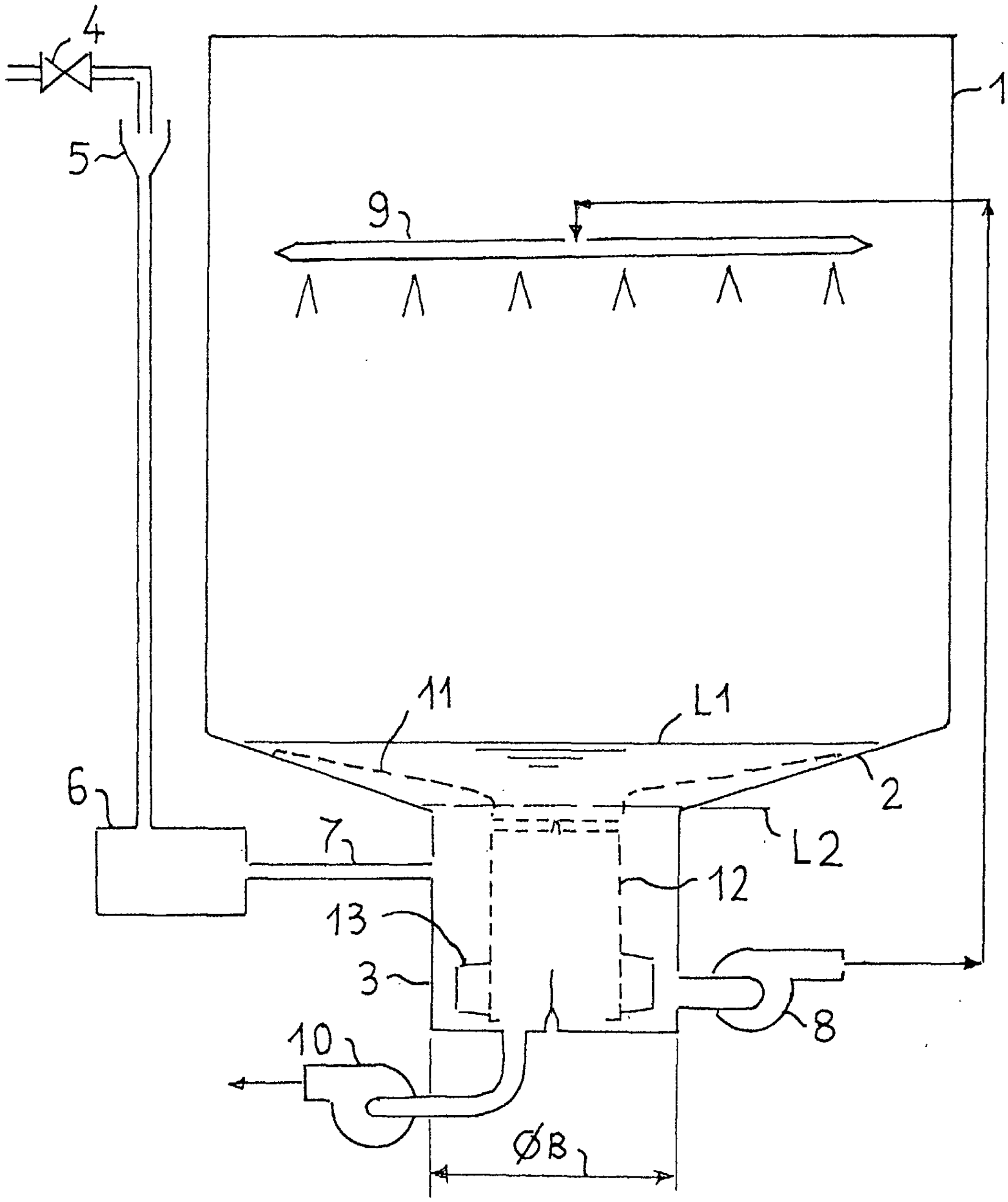

FIG.1

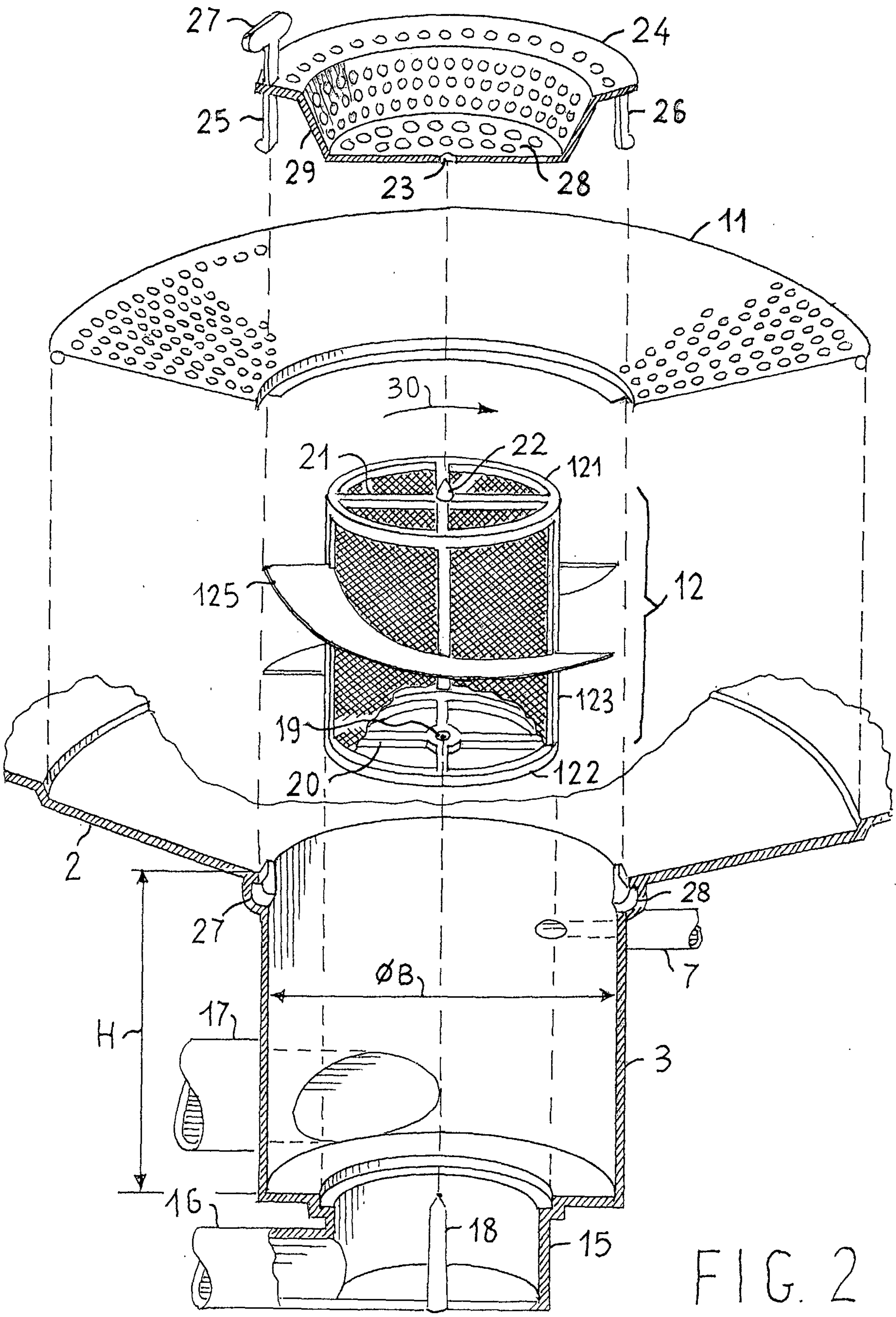
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FIG. 2

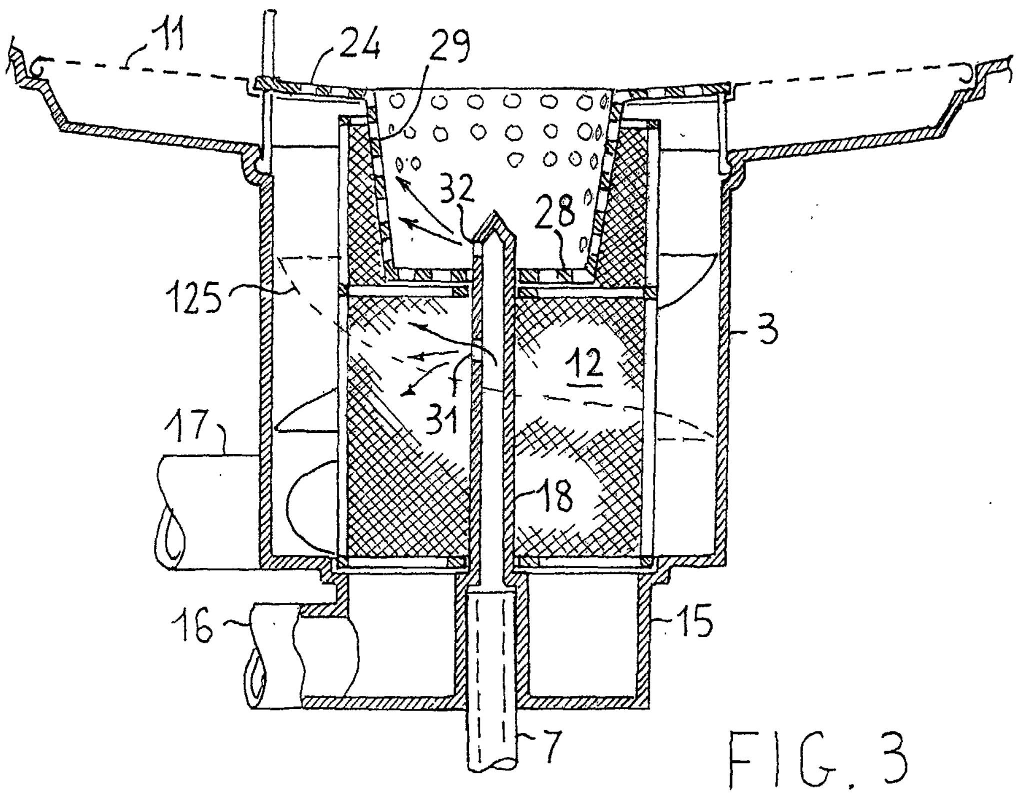

FIG. 3

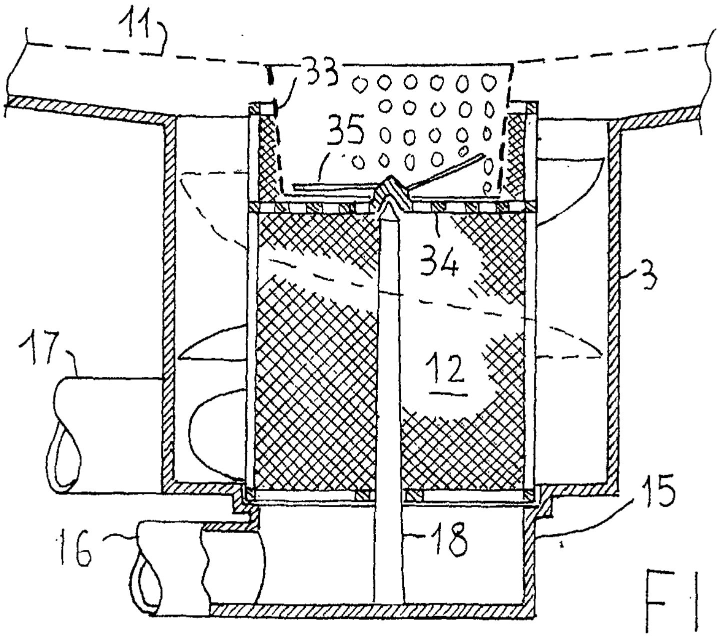

FIG. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 42 5497

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 January 2003	Ureta, R

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