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(54) Dishwashing machine with epicycloidal spray apparatus

(57) The dishwashing machine comprises an epicycloidal spray apparatus (4) which has a spray arm (6) mounted rotatably about an axis (8) on a tubular arm (11) that is in turn capable of rotating about an axis (13) passing through the centre of a washing vessel (3) with a rectangular plan outline. The spray arm (6) extends from the axis of rotation (8) of the spray apparatus for a radial length (R) that is equal to one fourth of the shortest inner side (L) of the washing vessel (3), and corresponds to the distance (A) between the two axis of rotation (8, 13).

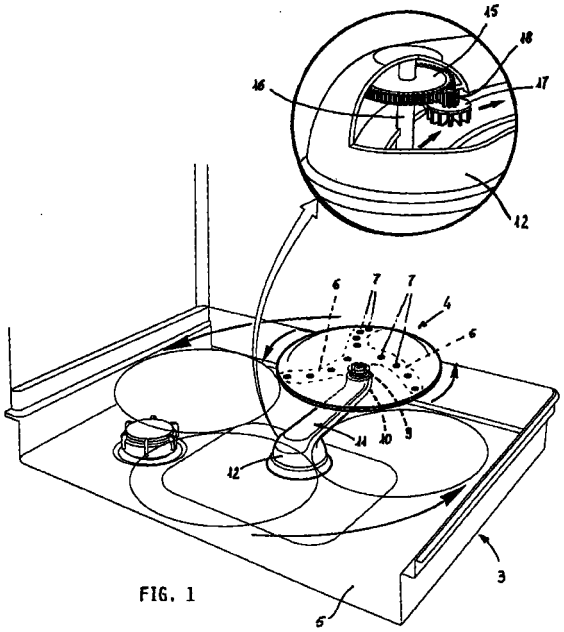

FIG. 1

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Description

[0001] The present invention relates to a dishwashing machine with at least a rotating spray apparatus adapted to spray, with an epicycloidal motion, the washload items arranged in a thereto associated support rack.

[0002] A dishwashing machine of the above cited kind is described for instance in IT-A-1 254 866, in which a rotating spray apparatus is mounted rotatably, about a vertical axis, on a water supply arm that is in turn capable of rotating about a vertical axis passing through the centre of the washing vessel of the machine. The axis of rotation of the spray apparatus is arranged to pass through an intermediate point of the water supply arm, at a free end of which there is provided at least a transversal propulsion nozzle. The spray apparatus is provided with radial arms that are substantially longer than the distance between the above cited axes, and comprises primary and secondary nozzles adapted to issue wash water jets directed at the washload items and transversal propulsion jets, respectively.

[0003] In other words, the spray apparatus is arranged to rotate in the washing vessel of the machine with an epicycloidal motion that ensures a particular effectiveness to the wash water jets being sprayed onto the washload items.

[0004] On the other hand, such a solution implies a whole set of drawbacks that limit in practice the washing performance capability of the dishwashing machine.

[0005] In the first place, the overall volume of the water distribution circuit formed by the rotating spray apparatus and the respective water supply arm turns out to be undesirably oversized owing mainly to the length of the spray apparatus (which on the other hand is necessary for the spray apparatus itself to be able to "scan", ie. cover the whole inner volume of the washing vessel) and the portion of the arm that extends from the axis of the spray apparatus the free end of the same arm carrying the propulsion nozzles. It is of course appreciated that even such a supplementary portion of the arm is necessary for an appropriate rotation moment to be able to be imparted to the same arm. In practice, anyway, such an oversizing of the water distribution circuit of the machine implies a need for an excess amount of water to be let into the washing vessel of the machine and this of course carries a correspondingly increased energy usage with it.

[0006] This drawback is further aggravated by the fact that the water jets used to propel the rotating spray apparatus the related aim practically constitute corresponding losses of pressurized water that is not used to actual dishwashing purposes.

[0007] It therefore is a main purpose of the present invention to provide a dishwashing machine with epicycloidal spray apparatus, in which the related water distribution circuit is optimised so as to enable a substantial energy saving effect to be obtained.

[0008] Furthermore, it is a purpose of the present invention to provide a dishwashing machine of the above cited kind, with which the dishes can actually be washed effectively in a versatile manner.

[0009] A further purpose yet of the present invention is to provide a dishwashing machine of the above cited kind, which is simple in its construction and capable of enabling a substantial noise reduction to be obtained.

[0010] According to the present invention, these aims are reached in a dishwashing machine with epicycloidal spray arm embodying the features as recited in the appended claims.

[0011] Anyway, characteristics and advantages of the present invention will become more readily apparent from the description that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is a schematical, partially perspective view of the bottom of the washing vessel of a dishwashing machine according to the present invention, in a preferred embodiment thereof, with an enlarged, cross-sectional view of a detail thereof; and

- Figure 2 is a schematical, cross-sectional top view of the dishwashing machine according to the present invention,

[0012] With reference to the Figures, the dishwashing machine comprises mainly a washing vessel 3 which is substantially in the shape of a parallelepiped having a substantially square or rectangular base.

[0013] In a per sé known manner, the washing vessel 3 shall be understood as accommodating at least a rack (not shown) adapted to support the washload items that are sprayed with wash liquor by at least an epicycloidal-motion rotating spray apparatus 4.

[0014] As illustrated in Figure 1, the rotating spray apparatus 4 is preferably arranged in a position adjacent to the bottom or base 5 of the vessel and may for instance be in the shape of a discoid with at least a water-carrying arm 6 provided with spray nozzles 7. In the example that is described here, three spray arms 6 are provided in the form of respective internal canalisations of the spray apparatus 4, which diverge from the centre thereof according to a curvilinear or rectilinearly radial pattern, as illustrated in Figures 1 and 2, respectively.

[0015] As described in greater detail further on, the nozzles 7 are adapted to issue towards the washload items respective jets of pressurized water, at least one of which is directed in such a direction as to be able to exert a tangential propulsion component capable of bringing about the rotation of the spray apparatus 4 about a substantially vertical central axis 8.

[0016] To this purpose, the spray apparatus 4 is hinged freely on said axis 8 by means of a rotating

hydraulic joint 9 substantially in correspondence of the free end 10 of a transversal water-supply tubular arm 11.

[0017] Substantially in correspondence of the opposite end 12 thereof, the arm 11 is in turn rotatably connected, by means of a respective rotating hydraulic joint, to a conduit provided to supply water under pressure. In a per sé known (and not illustrated) manner, said water supply conduit shall be understood as being in turn connected to the delivery side of a circulation pump controlled by the programme sequence control unit of the dishwashing machine, substantially as described for instance in IT-A-1 256 273.

[0018] Substantially in correspondence of said end 12 , in particular, the water-supply arm 11 is capable of rotating about a substantially vertical axis 13 extending to substantially pass through the centre of the washing vessel 3 of the machine.

[0019] As this will be explained in greater detail further on, when the circulation pump is operating, the spray apparatus 4 rotates about the axis 8, whereas the arm 11 in turn rotates about the axis 13. In practice, this means that the water distribution circuit formed by the arm 11 and the spray apparatus 4 is adapted to perform a composite rotation that determines the epicycloidal motion of the same spray apparatus.

[0020] According to a feature of the present invention, at least from a hydraulic point of view the water-carrying arm 6 (or the water-carrying arms 6, as the case may be) of the spray apparatus 4 extends from the axis of rotation 8 for a radial length R that is substantially equal to one fourth of the shortest inner side L of the washing vessel 3. It should be noticed that, in the example illustrated in Figure 2, said washing vessel is a square-plan one, so that the sides L of the vessel itself are of course equal.

[0021] Furthermore, the distance A of the axes of rotation 8 and 13 from each other is substantially equal to the above cited radial length R.

[0022] As a result, the water distribution circuit 4, 11 may be advantageously sized to feature the minimum inner volume as required to ensure that the water spray jets issuing from the nozzles 7 are able to "scan", ie. cover with an effective epicycloidal movement a cross-section of the washing vessel having as large an area as possible (delimited by the circumference 14 in Figure 2). Such a reduction in the overall volume in said water distribution circuit 4, 11 is of course effective in enabling the amount of water required to supply the hydraulic washing circuit of the machine to be reduced accordingly, so as to bring about a corresponding reduction in the overall energy usage (for instance, electric energy required to heat up the washing water).

[0023] According to a further feature of the present invention, such an optimum washing effectiveness of the water jets issued by the nozzles 7, which are in fact concentrated in an area defined by the radius R of the spray apparatus 4, may be advantageously used to reduce the power input rating of the circulation pump. In fact, for a same head of the water spray jets, the pressure of the water supplying the water distribution circuit 4, 11 can be reduced, by for instance selectively decreasing the revolving speed of the circulation pump itself as this is described in the afore cited IT-A-1 256 273. As a result, also the water-generated noise is advantageously reduced along with the mechanical noise of the machine.

[0024] Just to make an example, in view of carrying out a standard dishwashing cycle, the circulation pump may be operated to rotate at approx. 1400 rpm, whereas it may be selectively operated to rotate at approx. 2800 rpm (ie. a usual speed at which pumps generally rotate in traditional dishwashers) if an intensive dishwashing cycle has to be carried out, as required for example to clean heavily soiled pans.

[0025] In any case, the energy usage (and in particular the water usage) of the dishwashing machine can be further reduced by eliminating the need for auxiliary propulsion nozzles to be used in order to rotatably drive the tubular arm 11 about the axis 13.

[0026] As illustrated in the enlarged detail shown in Figure 1, in fact, according to a further feature of the present invention there is provided a turbine-like mechanism in correspondence of the end 12 of the tubular arm 11. Preferably, such a mechanism comprises a gearwheel 15 that is secured to the bottom 5 of the washing vessel by means of a rod 16 extending along the rotation axis 13. Through at least a reduction gear 18, a turbine vane 17, which is adapted to be rotatably driven by the flow of water under pressure passing along the tubular arm 11, is capable of co-operating with said gearwheel 15.

[0027] The vane 17 and the reduction gear 18 shall be understood as being capable of pivoting on a pin (not shown for reasons of greater descriptive simplicity) anchored on the arm 11 in a position which is offset with respect to said rotation axis 13.

[0028] As a result, when the water distribution circuit 11, 4 of the machine is supplied with water under pressure, the latter causes the vane 17 to turn, so that it is able, through the reduction gear 18, to exert a pushing action on the gearwheel 15 so as to determine the rotation of the arm 11 about the axis 13.

[0029] It should at the same time be noticed that said mechanism 15-18 is also effective in making more rigid and stable the water distribution circuit 4, 11 which, notwithstanding its asymmetrical structure, is therefore able to rotate about the axis 13 in a manner that is substantially free of mechanical cloggings or jammings.

Claims

1. Dishwashing machine, comprising a substantially parallelepiped washing vessel with a substantially square or rectangular plan outline, said vessel accommodating at least a rotating spray apparatus

having at least a spray arm and mounted rotatably about a first substantially vertical axis on a tubular aim which is in turn mounted rotatably in said vessel about a second axis that is substantially vertical and passes substantially through the centre of the vessel, said spray apparatus constituting jointly with said tubular arm an epicycloidally moving pressurized-water distribution circuit, characterized in that said spray arm (6) of the spray apparatus (4) extends from said first axis of rotation (8) for a radial length (R) which is substantially equal to one fourth of the shortest inner side (L) of the washing vessel (3), the distance (A) of said first and said second axis of rotation (8, 13) from each other being substantially equal to said radial length (R).

2. Dishwashing machine according to claim 1, characterized in that said tubular arm (11) extends between opposite end portions (10, 12) that are substantially arranged in correspondence of said first and said second axis of rotation (8, 13), respectively.

3. Dishwashing machine according to claim 1, characterized in that said water distribution circuit (11, 4) is adapted to be selectively supplied with water under a lower or higher pressure in view of performing a normal or an intensive dishwashing cycle, respectively.

4. Dishwashing machine according to claim 1, characterized in that it further comprises a turbine-like mechanism (15-18) adapted to be driven by the water under pressure flowing inside said distribution circuit (11, 4) so as to determine the rotation of the tubular arm (11) about said second axis (13).

5. Dishwashing machine according to claim 4, characterized in that said mechanism comprises a gearwheel (15) that is concentric to said second axis of rotation (13), secured to the washing vessel (3) and adapted to engage a turbine van (17) pivoting on a pin anchored on the tubular arm (11) in a position that is offset with respect to said second axis (13), said vane (17) being driven rotatably by the flow of water under pressure passing through the tubular arm (11).

6. Dishwashing machine according to claim 5, characterized in that said turbine van (17) engages said gearwheel (15) via at least a reduction gear (18).

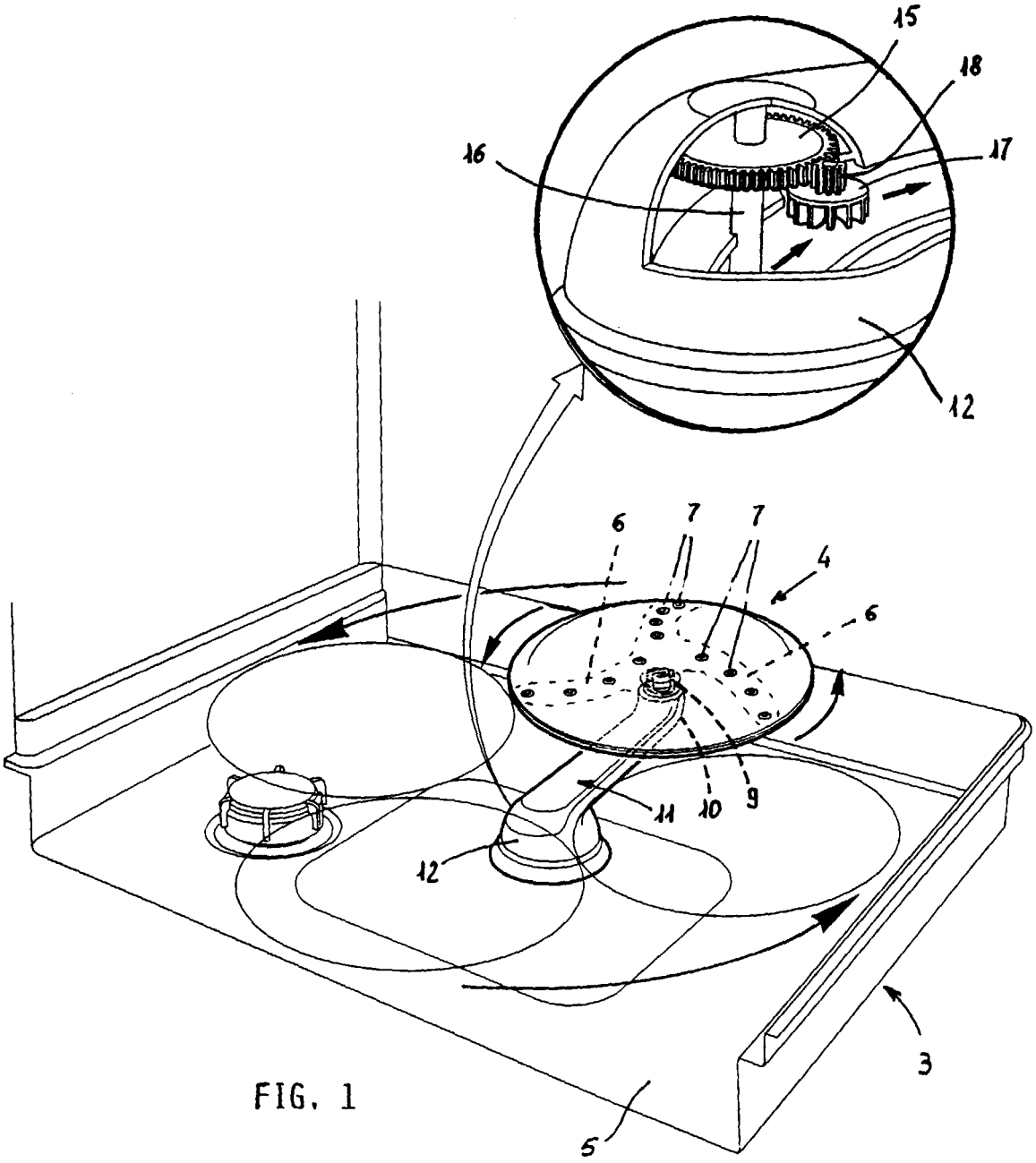

FIG. 1

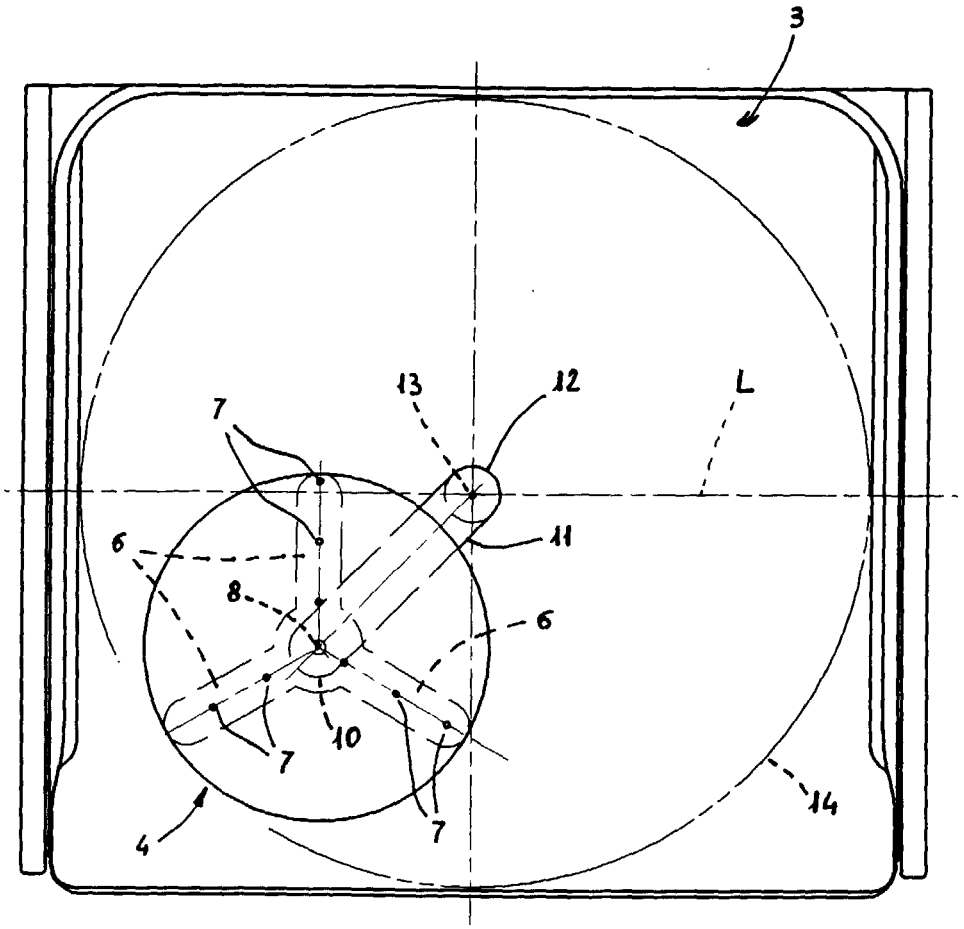

FIG. 2