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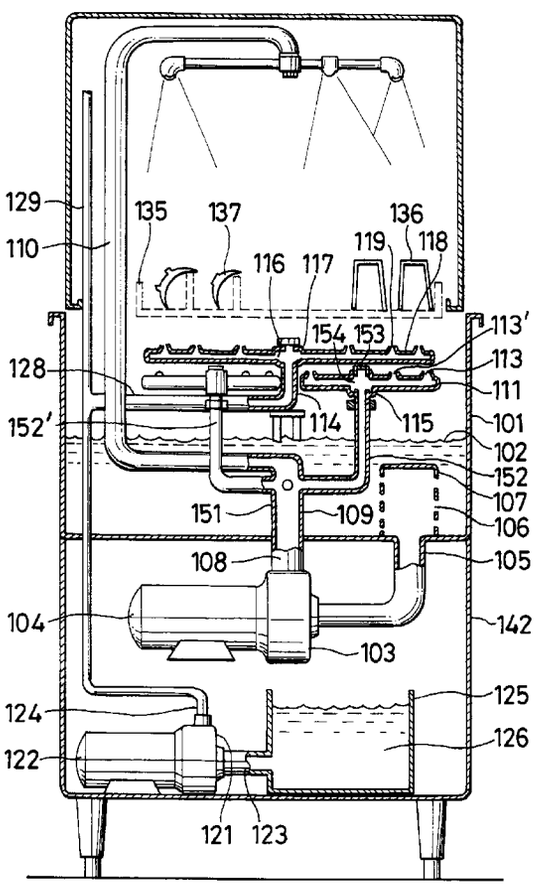
(54) Tableware washing machine.

(57) In the present invention, plural washing branch pipes (151,152,152') are disposed within a washing vessel (1), and rotatable nozzle arms (111) each having plural nozzle spouts (113') are rotatably connected to the washing branch pipes (151,152,152') respectively so as to be positioned approximately on the same plane.

FIG.10



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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a tableware washing machine suitable for business use.

2. Description of Related Art

About 90% of box type tableware washing machines presently in use for business purpose are based on the structure of a rotary nozzle injection type which was manufactured more than 50 years ago in the U.S.

A typical structural example of such "rotary nozzle injection type" will now be explained with reference to Figs. 1 and 2. The reference numeral 1 denotes a washing vessel, which is a square vessel about 60 cm in one side and which holds washing water 2 therein at a predetermined certain level and at a predetermined certain washing concentration. The upper edge of the washing vessel 1 is formed as a flange 20. Reference numeral 3 designates a washing pump, which is driven by a motor 4. A suction port 5 is connected to the bottom of the washing vessel 1, and above the suction port 5 is provided a strainer 7 having a large number of water passing holes 6 to prevent the passage of admixtures (leftovers) larger than a predetermined size contained in the washing water 2 which is sucked in from the suction port 5. The washing water 2 pressurized by the washing pump 3 flows from a discharge port 8 connected to the washing vessel 1 separately into a lower conduit 9 and an upper conduit 10 both in the washing vessel. Reference numeral 11 denotes a lower washing nozzle arm having an overall length of about 50 cm and having six to eight nozzle spouts as a total of both nozzle spouts 12 and nozzle spouts 13, 13' located close to the outer peripheral portion. The lower washing nozzle arm 11 is carried on a bearing 15 rotatable with a pipe 14 as a rotary shaft, the pipe 14 being located in the center of the lower conduit 9, to form a double conduit.

The upper end of the pipe 14 is closed with a blank plug 15a, with several openings formed in the pipe 14 in intermediate positions. Reference numeral 18 denotes a rinsing nozzle arm, which is engaged with the pipe 14 rotatable through a bearing portion 17. Six to ten rinsing nozzle tips 19 are implanted in the rinsing nozzle arm 18.

Reference numeral 21 designates a rinsing pump, which is driven by a rinsing pump motor 22. The rinsing pump 21 sucks in rinsing water 26 from a rinse tank 25 through a suction port 23, pressurizes the rinsing water to a discharge port 24 and introduces it into a lower rinse conduit 28 and an upper rinse conduit 29 through a rinse conduit 27 in the washing vessel 1.

The rinsing water 26 pressurized by the rinsing pump 21 passes through the rinse conduit 27 and is introduced into the lower rinse conduit 28, while a portion thereof passes through the upper rinse conduit 29 and is jetted from rinsing nozzle tips 32 provided in four upper corner positions.

The washing water 2 pressurized by the washing pump 3 passes through the lower conduit 9 and is introduced into the lower washing nozzle arm 11, while a portion thereof passes through the upper washing conduit 10 and is introduced also to an upper injection nozzle arm 30 disposed in an upper position, then is jetted from upper nozzle spouts 31.

Reference numeral 35 denotes a tableware rack, which has a basket structure so as not to be an obstacle to jetting of the washing water 2 from below. The tableware rack 35 has suitable partitions to prevent tableware glasses 36 and tableware bowls 37 from striking against each other, and some consideration is given thereto so as to hold it in a posture easy to be washed. The size of the tableware rack 35 is standardized to 50 cm x 50 cm, and there are various tableware racks, depending on purposes of use, including those for glasses, bowls, dishes and places.

Reference numeral 41 denotes a hood for preventing the washing water 2 from scattering to the exterior during washing. The hood 41 is lifted at the time of taking in or out of the tableware rack 35 containing the tableware articles 36 and 37. Reference numeral 42 denotes a base structure in which the washing pump 3, rinsing pump 21, rinse tank 25 and a control box (not shown) are accommodated, and which is supported by four legs 43. The washing water 2 pressurized by the washing pump 3 flows through the lower conduit 9, enters the washing nozzle arm 11 and is jetted from below to the tableware articles 36 and 37 through the nozzle spouts 12 and 13. In order to obtain a propulsive force for rotating the washing nozzle arm 11 by utilizing a reaction force of jet, the nozzle spouts 13, 13' positioned at the outer peripheral portion cause the washing water to be jetted in an inclined state of about 30° in the horizontal direction, while the washing water is jetted vertically from the other nozzles. As a result, the washing water 2 is jetted while the washing nozzle arm 11 rotates at a speed of one to two revolutions per second.

On the same principle as above, the upper injection nozzle arm 30 also jets washing water while it is rotating.

Also in the case where the rinsing water 26 pressurized by the rinsing pump 21 reaches the rinsing nozzle arm 18 and jets from the rinsing nozzle tips 19, the nozzle tips 19 located at the outer peripheral portion are inclined about 30° from the vertical direction to the horizontal direction to impart a propulsive force for rotation to the nozzle arm 18, whereby the rinsing water is jetted while the nozzle arm 18 rotates at a speed of one revolution or so per second.

The tableware washing machine of the above structure is for business use, and the time required for one washing and rinsing operation is greatly different from that in tableware washing machines for domestic use. The washing and rinsing process must be carried out automatically in about one minute.

Referring now to Fig. 3, right and left auxiliary tables 50 and 51 are engaged with the washing machine for performing the tableware washing operation efficiently. Stained tableware articles are packed into a tableware rack 35' beforehand using the auxiliary table 50, then the hood 41 of the tableware washing machine is opened up, the rack 35' is allowed to slide into the central portion of the washing machine, and the hood 41 is brought down. The hood 41 is pulled down in association with a start switch of the a washing machine, whereby the washing pump motor 4 is first operated. Consequently, the washing pump 3 pumps up the washing water 2 in the washing vessel 1 to the lower washing nozzle arm 11 through the discharge pipe 7. The washing water 2 jets from the Next nozzle spouts 12, 13 while the nozzle arm 11 is rotated by a propulsive force induced by the jets, thereby imparting a water current impact to the tableware articles 36 and 37. At the same time, the washing water 2 pressurized by the washing pump 3 flows through the upper washing conduit 10, reaches the upper washing nozzle arm 30 and jets from the nozzle spouts 31, whereby a water current impact is exerted on the washing water 2 from above the tableware articles 36 and 37, while the nozzle arm 30 rotates (in the same manner as the lower washing nozzle arm 11). The washing pump 3 is operated for about 45 seconds and then stops. Thereafter, after an interval of several seconds, the rinsing pump motor 22 starts operation automatically. The rinsing pump 21 sucks in the rinsing water 26 pre-stored in the rinse tank 25. The rinsing water 26 thus sucked in flows from the discharge port 24 through the conduit 28 and reaches the rinsing nozzle arm 18, which in turn jets the rinsing water from the nozzle tips 19 while it is rotating. In this way, rinsing is performed automatically. At the same time, the rinsing water 26 pressurized by the rinsing pump 21 passes through the conduit 29 and jets also from the rinsing nozzle tips 32 disposed in four upper corner positions to effect rinsing also from above. The operating time of the rinsing pump 21 is 10 to 15 seconds, and the completion of a series of washing and rinsing operations is advised to an operator by sounding of a buzzer, or the hood 41 is opened up automatically to terminate the operations. Thus, the total time is about one minute which is 45 seconds of washing plus several seconds of the rest plus 12 seconds of rinsing. When one process is over, the tableware rack is pulled out toward the table 51 in Fig. 3, then the tableware rack 35' with stained tableware articles 36 and 37 pre-contained therein is pulled into the washing machine and the hood 41 is brought down, whereupon the next washing and rinsing process starts.

Thus, since the stained tableware articles 36 and 37 must be washed clean in as short a period as only 45 seconds, the displacement and discharge pressure of the washing pump 3 as well as the number and shape of the nozzle spouts 12 and 13 with respect to the washing nozzle arm 11 are important factors.

As is seen from Figs. 1 and 2, the tableware rack 35 is provided with partitions or projections so that in the case where the stained tableware articles to be packed into the rack 35 are glasses 36, the glasses face downward, and in the case of the tableware bowls 37, the bowls face obliquely downward, to prevent overlapping of tableware articles.

As is seen from Figs. 1 to 3, the tableware rack 35 is located between the lower washing nozzle arm 11 and the upper washing nozzle arm 31, and therefore stained tableware articles are washed while being exposed to water jets from below and above. In the case of the tableware glasses 36 and bowls 37, the water jet from below has a very great influence on the result of washing. This is because the water jet from below directly strikes against the stain adhering to the openings of the glasses 36, and also in the case of the bowls 37, such water jet directly strikes the inside stain, while the washing water 2 jetted from the nozzle spouts 31 of the upper injection nozzle arm 30 merely washes the outside bottom portions of the glasses 36 or bowls 37.

Fig. 3 shows a washing style in which plates 52 are washed in an obliquely upward facing state. The plates 52 may be washed in such a posture, so in this case the water jet from the upper injection nozzle arm 30 greatly influences the removal of stain and can be considered more important than the water jet from the lower injection nozzle arm 11. Also in the case of the plates 52, however, if they are packed into the rack 35 in an obliquely downward facing state like the bowls 37, the water jet from the lower injection nozzle arm 11 becomes more important than the water jet from the upper injection nozzle arm 30. Anyhow, in the tableware washing machine, the water jet from the lower injection nozzle arm 11 exhibits a very important effect in comparison with the water jet from the upper injection nozzle arm 30. This can be understood also from the fact that in the case of a tableware washing machine of a simple structure for business use, an upper injection nozzle arm is not used, with only a lower injection nozzle arm being used and useful. In Japan, as compared with Europe and U.S.A., various shapes of tableware articles are used. In Europe and U.S.A., dishes and plates are mainly used, while in Japan bowls, wooden bowls, deep bowls, lunch-boxes and glasses are mainly used, so whether the lower water jet is good or bad greatly influences the result of washing.

As mentioned at the beginning of this specification, in Europe and U.S.A. there is a history of 50 years with respect to tableware washing machines, and also in Japan tableware washing machines of the structure illustrated in Figs. 1 to 3 occupy 90% of the tableware washing machines for business use now in use. This is presumed to be mainly because the structure is relatively simple and the washing pump 3 can be constructed small in size (1/2 to 1 horsepower).

However, such "rotary nozzle injection type" involves drawbacks as will be described later and its detergency is not always satisfactory for users.

Reference will now be made to the question of height of the tableware washing machine described above. The height of the tableware rack 35 from the floor surface is maintained at about 80 cm for horizontal engagement thereof with the work tables (85-90 cm in products manufactured in Europe and U.S.A.).

Therefore, it is necessary that the height of the upper edge of the washing machine body be also maintained at 80 cm. Within the range of this 80 cm height are received, as typical mean values, about 30 cm of the washing vessel 1, about 40 cm of the base structure 42 for accommodating therein the pumps 3 and 21 and the rinse tank 25, and about 10 cm of the legs 43, thus a total of 80 cm.

Within the washing vessel 1 are mounted, from above, the rinsing nozzle arm 18 and the lower injection nozzle arm 11, and the washing water 2 is stored below the arm 11. In general, the lower injection nozzle arm 11 rotationally jets the washing water at a distance of about 12 cm below the tableware rack 35. The washing water 2 jetted from the nozzle spouts 12 and 13 passes through the tableware rack 35 while expanding in a sectorial shape and strikes against the tableware articles 36.

Referring to Fig. 4, although it has been explained that the spacing between the tableware rack 31 and the lower injection nozzle arm 11 is generally 12 cm, if this spacing is increased to 20 cm or so, the water jet expands in a sectorial shape up to the tableware rack 35, that is, the range covered by the water jet increases and it becomes possible for the water jet to cover the four corners of the rack 35 though not to a thorough extent. For the foregoing reason, however, it is difficult to keep a distance of longer than 12 cm during rotation and water injection of the lower injection nozzle arm 11.

If the distance in question is increased to about 20 cm, the water jet will expand in a sectorial shape, resulting in increase of the area covered by the water jet, but the vigor of the water current weakens in inverse proportion to the square of the distance, so such an increase in distance cannot always be good when consideration is given mainly to detergency.

[Problems to be Solved by the Invention]

(1) In the rotary nozzle injection type, as shown in Fig. 5, tableware articles to be washed are washed by water jets from the lower and upper injection nozzle arms 11, 30 which are disposed below and above the tableware. This has already been mentioned. It has been already explained that the water jets from the lower injection nozzle arm 11 have a greater influence on the result of washing than the water jets from the upper injection nozzle arm.

If the tableware rack 35 is a square rack of 50 cm by 50 cm and the overall length of the lower injection nozzle arm 11 is also about 50 cm, since the lower injection nozzle arm 11 rotates at a distance of about 12 cm below the rack 35, the water jets from the nozzle spouts 13 located at both ends of the arm 11 does not fully reach the tableware articles placed at the four corners of the rack 35, and hence those tableware articles will not be washed to a satisfactory extent, as shown in Fig. 6. More specifically, the tableware articles placed in the hatched area in Fig. 6 will not be washed to a thorough extent. To avoid this inconvenience, if the lower injection nozzle arm 11 is made as long as about 70 cm and nozzle spouts 13 are provided at both ends in the arm 11, as in Fig. 7, water jets will also reach the tableware articles placed at the four corners of the rack 35, but in this case the water jets to the hatched area outside the rack 35 are unnecessary. Since the area of this hatched portion is about 50% of the area of the tableware rack 35, wasteful water jets are directed to as large an area as 50% and it is required to use a pump 50% larger in capacity. Besides, for rotating the lower injection nozzle arm 11 having a length of 70 cm, it is necessary for the washing machine body to be at least 80 cm square, and such a large size is not practical. In general, therefore, as shown in Fig. 6, the length of the lower injection nozzle arm 11 is set at about 50 cm, the machine body is sized to 60 cm by 60 cm, and a small-sized pump is used, in the full knowledge of insufficient washing of the tableware articles placed at the four corners of the tableware rack which is a square of 50 cm by 50 cm.

(2) In Fig. 5, if the pressure of the water jets from the lower injection nozzle arm 11 is increased, the amount of water injected and the injection impact will increase, resulting in that the detergency is enhanced. However, tableware articles of light weight will be blown off or wobble because the upper injection nozzle arm 30 does not rotate in synchronism with the lower injection nozzle arm 11.

For eliminating the above drawbacks (1) and (2), a fixed nozzle injection type has been put to practical use in which a large number of fixed nozzles are disposed above and below tableware to jet washing water 2 simultaneously, as shown in Fig. 8. According to this fixed nozzle injection type, jets of the washing

water 2 fully reach the four corners and the injection from above and that from below are always balanced to diminish the wobbling of tableware, but it is necessary to use a large-sized pump for effecting such simultaneous water injection from a large number of nozzles, and the product price is high because the arrangement of a large number of upper and lower nozzles makes the construction complicated. These points are a neck of wide use of the fixed nozzle injection type.

(3) In the rotary nozzle injection type, as shown in Fig. 9, if outer peripheral nozzles 61 and inner peripheral nozzles 63 both formed on a rotatable nozzle arm 65 eject water while rotating for a tableware rack 60, the ejected area by the outer peripheral nozzles 61 corresponds to a hatched area 62 and that by the inner peripheral nozzles 63 corresponds to a hatched area 64.

Therefore, the area of the hatched portion 62:

$$25^2\pi - 20^2\pi = 0.696\ m^2 \quad A$$

the area of the hatched portion 63:

$$10^2\pi - 5^2\pi = 0.235\ m^2 \quad B$$

$$A : B = 2.96 : 1$$

According to the above calculation results, if the injection range of each nozzle 61 (63) is set at 5 cm wide, the area covered by the outer peripheral injection nozzles 61 approximately trebles with respect to that covered by the inner peripheral injection nozzles 63. Assuming that the nozzles each ejects the same amount of water, the detergency is determined by the amount of water ejected per unit area, so it can be basically demonstrated that the detergency of the outer peripheral portion is weaker than that of the inner peripheral portion. Further, as explained previously, the outer peripheral nozzles 61 must also take charge of water injection for the tableware articles placed at four corner portions 66 of the tableware rack 60; therefore, there are basic drawbacks such that the washing effect at the four corners 66 is unsatisfactory and the detergency for the tableware placed at the outer peripheral portion of the hatched area 62 is weaker in comparison with the inner peripheral portion.

In an attempt to eliminate such drawbacks, a larger number of outer peripheral nozzles 67 are concentrated on the outer peripheral portion, but this is not a fundamental remedial measure.

Reference has been made above to the rotary nozzle injection type widely-put to practical use heretofore and also to drawbacks, etc. of the same type. A 4-rotor nozzle injection type according to an embodiment of the present invention, described later, compensates for the drawbacks of the rotary nozzle injection type and is far superior in structure and detergency to the conventional rotary nozzle injection type.

SUMMARY OF THE INVENTION

According to the invention defined in Claim 1 there is provided a tableware washing machine comprising a washing vessel; a plurality of washing branch pipes disposed within the washing vessel; rotatable nozzle arms each having a plurality of nozzle spouts and mounted rotatably to the washing branch pipes respectively so as to be positioned approximately in the same plane; a rinsing water conduit disposed centrally within the washing vessel; and a single rinsing nozzle arm having a plurality of rinsing water injection nozzles and connected rotatable to the rinsing water conduit.

In the invention defined in Claim 2 there is provided a tableware washing machine according to Claim 1 wherein the washing vessel is formed in a square shape on a horizontal plane, and the four washing branch pipes are disposed approximately in the center of quartered portions, respectively, of the washing vessel.

According to the invention set forth in Claim 1, a plurality of rotatable nozzle arms for washing are disposed on the same plane, so that the detergency becomes uniform over the whole area of the washing vessel. Besides, as to the structure of this tableware washing machine, it may appear to be more complicated than that of the old type, but the washing nozzle structure including rotational centers is realized as an extremely simplified structure, and the provision of a rinsing nozzle shaft in the central space permits the realization of such simple structure, not a complicated double shaft structure. This simple structure, in combination with plastic molding of the rotatable nozzle arms, permits the attainment of a tableware washing machine which, as a total construction, is less expensive and higher in performance than the old type.

Further, according to the invention set forth in Claim 2, it is rendered possible to make the most rational arrangement for the square washing vessel now in practice.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view in vertical section, showing an example of a conventional tableware washing machine;

Fig. 2 is a partially cut-away perspective view thereof;

Fig. 3 is a partially cut-away front view thereof as assembled as a set;

Fig. 4 is a front view showing a relation between a lower injection nozzle arm and tableware;

Fig. 5 is a perspective view showing a relation among the lower injection nozzle arm, tableware and an upper injection nozzle arm;

Fig. 6 is a plan view showing a relation between a rack and the lower injection nozzle arm;

Fig. 7 is a plan view showing another relation between the rack and the lower injection nozzle arm;

Fig. 8 is a perspective view of a fixed nozzle injection type;

Fig. 9 is a plan view showing an injection range of an inner peripheral portion and that of an outer peripheral portion;

Fig. 10 is a side view in vertical section, showing a first embodiment according to the present invention;

Fig. 11 is a perspective view of a portion thereof;

Fig. 12 is a plan view thereof;

Fig. 13 is an exploded perspective view of a rotatable nozzle arm;

Fig. 14 is a side view in vertical section, showing a state of injection;

Fig. 15 is a plan view showing areas covered by jets from one rotatable nozzle arm;

Fig. 16 is a plan view showing a second embodiment according to the present invention; and

Fig. 17 is a partially cut-away perspective view of Fig. 16.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

An embodiment according to the present invention will be described below with reference to Figs. 10 to 15. Fig. 10 is a structural diagram showing a principal section of a 4-rotor nozzle washing machine embodying the present invention, and Fig. 11 is a perspective view of a main portion of the washing machine.

In these figures, washing water 102 is stored in a washing vessel 101. In operation, the washing water 102 passes through a large number of small holes 106 formed in a strainer 107, reaches a washing pump 103 through a suction port 105, is pressurized by the same pump, passes through a discharge conduit 109 in the washing vessel 101, and flows from a 4-way branch pipe 151 into four riser pipes 152, 152'. An end portion 153 of each of the four riser pipes 152, 152' is formed as a blank cap, and three to four holes 154 are formed in the peripheral surface of each of the riser pipes 152, 152' in positions just under the blank cap. The washing water 102 passes through the holes 154 of those riser pipes and flows into the four rotatable nozzle arms 111.

Each rotatable nozzle arm 111 has two nozzle spouts 113 formed in outer peripheral positions and one nozzle spout 113' formed in the vicinity of the inner peripheral portion. The washing water 102 is ejected from the nozzle spouts 113, 113' and strikes as water jets against tableware articles 136 and 137 packed onto a tableware rack 135.

The washing water 102 pressurized by the washing pump 103 is branched from the upper portion of the 4-way branch pipe 151 and flows to an upper washing nozzle through an upper washing conduit 110 to effect jet washing from above. But in tableware washing, as noted previously, since the jet washing from below exerts an important influence on the result of washing in comparison with the jet washing from below, reference to the details of the upper washing nozzle structure is here omitted.

In Fig. 13, one of the two outer peripheral nozzle spouts 113 is set to eject water in an inclined state of about 30° from just above because of its self-rotation and it rotates at a rate of two to three revolutions per second.

The rotatable nozzle arms 111 shown in Fig. 13 are arranged to quarter the area of the tableware rack 135 on the same plane in such a manner as to avoid mutual collision of the four rotatable nozzle arms 111 even when rotating, when viewed front above the rack 135, as shown in Fig. 12. More specifically, the four rotatable nozzle arms 111 are disposed on the same plane approximately in the center of planarly quartered portions of the tableware rack 135.

In the case of the conventional nozzle injection described previously in connection with Figs. 1 and 2, the washing water 2 does not sufficiently reach the tableware articles 36 placed at the corners of the tableware rack 35 and hence the washing is not satisfactory. On the other hand, according to this embodiment according to the present invention, unsatisfactory washing areas at the four corners of the tableware rack 135 are extremely small as indicated by hatched portions 160 in Fig. 12, and since the washing water 102 ejected from the outer peripheral nozzle spouts 113 of the rotatable nozzle arms 111 is directed to the tableware articles 136 and 137 while expanding in a sectorial shape, there is no fear of the washing water 102 failing to cover the whole area and causing an unsatisfactory result of washing.

This is also the case with hatched portions 162. More particularly, the hatched portions 162 are covered by four nozzle spouts 113 of two rotatable nozzle arms 111, while a central hatched portion 163 is covered by eight outer peripheral nozzle spouts 113 of four rotatable nozzle arms, and thus the entire inside area of the tableware rack 135 can be covered sufficiently by jets of the washing water 102.

The above point will now be described in more detail. If the size of the tableware rack 135 is 50 cm by 50 cm, four rotatable nozzle arms 111 are rotated on the same plane at a distance of about 12 cm below the rack 135, the number of the outer peripheral nozzle spout 113 is two and that of the inner peripheral nozzle spout 113' is one, and the ejection angle of the washing water 102 from each nozzle spout 113, 113' is about 30°, and then, such a section of jet is obtained as shown in Fig. 14. Fig. 15 shows ranges of water jets striking against the bottom of the tableware rack 135, viewed from above the rack.

Consequently, if the overall length of each of the four rotatable nozzle arms 111 is 242 mm, the spacing between the nozzle spouts 113 is 225 mm and the distance of the nozzle spout 113' from the center is about 40 mm, then approximately one fourth of the tableware rack 135 is covered as seen from Figs. 14 and 15.

In Fig. 15, a doughnut-like portion is covered by two outer peripheral nozzle spouts 113, and since the area of that portion is 439 mm^2, one nozzle takes in charge of an area of 220 mm^2 . On the other hand, the area of the inner peripheral portion is 176 mm^2, which is covered by one inner peripheral nozzle spout 113'. Therefore, the ratio of the area, of which one outer peripheral nozzle spout 113 takes in charge, to the area, of which one inner peripheral nozzle spout 113' takes in charge, is 1.25 : 1.0, and thus, the area covered by the outer peripheral nozzle spout 113 is 25% larger. But this difference is a minor difference in comparison with the conventional rotary nozzle injection type, scarcely causing any obstacle in practical use. It is seen that jet washing is performed almost uniformly up to the outer and inner peripheral portions.

From the above result, it is understood that according to the 4-rotor injection type, almost uniform jet washing is attained over the whole area of the tableware rack 135 without incomplete washing at the four corners of the tableware rack unlike the conventional jet washing.

The overall length of the lower rotatable nozzle arm 11 shown in Figs. 1 and 2 is about 50 cm, while the four rotatable nozzle arms 111 used in this embodiment according to the present invention is about 25 cm in overall length, which is a half of the former. The nozzle arm 11 as long as 50 cm must be formed as a metallic cast or pressed arm to maintain a required mechanical strength, while the rotatable nozzle arms 111 used in this embodiment is short and small-sized, so even molded plastic arms can fully maintain the required strength. In the case of plastic arms, in Fig. 13, the upper portion of the riser pipe 152 is used as a rotating shaft, and a bearing portion 115 of the rotatable nozzle arm 111 is fitted to the upper portion 154 for rotation. The bearing portion 115 is also a plastic bearing and it rotates around a metallic central shaft without using any special rotating bush, so a durable rotation can be ensured. The injection of the washing water 102 from the nozzle spouts 113, 113' causes the rotatable nozzle arm 11 to undergo a downward reaction force, so that the arm 111 rotates while a thrust stopper 17a and a slide portion 170 formed on the lower side of the arm 111 are kept pushed against each other. In a metal-to-metal case, it is necessary to insert a plastic bushing for diminishing the resulting frictional force, but in this embodiment no special bushing is needed because the whole of the rotatable nozzle arm 111 is constituted of a molded plastic arm.

In this embodiment, therefore, each rotatable nozzle arm 111 may be small in size, and hence even a molded plastic arm ensures a sufficient mechanical strength, and a structure equal to an integral molding of the arm with a rotating bearing and a thrust bearing is obtained. Thus, with a simple structure it is made possible to effect a light rotation of the rotating part while maintaining durability. And this can be attained at a very low cost.

In the conventional tableware washing machine illustrated in Figs. 1 and 2, as mentioned previously, a double pipe system is adopted, in which the rinse introducing pipe 14 is concentrically disposed inside the washing water conduit 9. Each bearing portion requires a bearing bush for diminishing friction and preventing wear, and it is necessary to keep the bearing gap small for preventing wasteful water leakage. Consequently, the structure becomes complicated and the rinsing nozzle arm 18 must be removed before the mounting or removal of the nozzle arm 11. On the other hand, in this embodiment according to the present invention, as can be seen also from Fig. 13, the four rotatable nozzle arms 111 are each an integrally molded plastic component including the nozzle spouts 113, 113', bearing portion 115 and thrust bearing portion 170, and the riser pipe 152 which serves as a central rotational shaft for the nozzle arm and through which the washing water 102 is introduced, can be realized by a simple structure integral with the bearing portion 115. Also, as can be seen from Fig. 13, all that is required is a mere fitting of the nozzle arm 111 onto the riser pipe 152 from just above, thus facilitating inspection and cleaning of the nozzle arm 111.

In the case of a washing machine for business use, a rotatable nozzle arm and a rinsing nozzle arm are sure to be constituted of separate circuits and parts. In the conventional machine, as shown in Figs. 1 and 2, the nozzle arm 11 and the rinsing nozzle arm 18 are coaxially constituted centrally of the machine, thus requiring a double pipe structure. On the other hand, in this embodiment according to the present invention, as is seen from Fig. 15, the four rotatable nozzle arms 111 are located in four positions spaced a predetermined distance from the center of the washing machine, and the upper portion of the center which is indicated at 172 in Fig. 15 is an empty space, with only the 4-way branch pipe 151 being located in the bottom of the washing vessel 101. Since such empty central space is utilized as a rotational center of a rinsing nozzle arm 118, a lower rinsing conduit 114 shown in Fig. 10 can be mounted upright by a very simple structure.

A second embodiment according to the present invention will now be described with reference to Figs. 16 and 17. The portions corresponding to those in the previous embodiment will be indicated by the same

reference numerals as in the previous embodiment, and explanations thereof will be omitted. This second embodiment relates to a washing machine exclusive for a half-size tableware rack formed in a rectangular shape and having a short to long side ratio of 1:2 in a planar shape. Heretofore, it has been impossible to realize a single nozzle type of washing machine exclusive for a half-size tableware rack. Although such a washing machine can be realized by adopting a type in which water is ejected from above and below using fixed nozzles, this type involves a problem of an extremely complicated structure. The washing machine exclusive for a half-size rack in this embodiment is just half in size of the washing machine shown in Fig. 12. A concrete example thereof will now be described with reference to Fig. 17. A tableware rack 201 has a planar shape of 25 cm x 50 cm, which is half in size of the tableware rack 135 shown in the first embodiment. Such tableware rack 201 is in wide practical use as a half-size rack. Below the rack 201 are disposed two rotatable nozzle arms 111, and two rotatable nozzle arms 211 of the same shape as the rotatable nozzle arms 111 are disposed above the tableware rack 201.

Washing water is distributed to each rotatable nozzle arm 111 through a branch pipe 203, while to the upper rotatable nozzle arms 211 is fed washing water from a horizontal branch pipe 205 through a vertical branch pipe 204. Reference numeral 209 denotes a washing water tank, and washing water stored therein passes through a strainer 207 and reaches a suction port 208 of a pump 202, in which the washing water is pressurized. The washing water thus pressurized is conducted to the central portion of the washing vessel through a riser pipe 210. Then, within the washing vessel, the washing water flows through the branch pipes 203, 204, 205 and is ejected from the rotatable nozzle arms 111 and 211 disposed each two in lower and upper positions, respectively.

Reference numeral 206 designates a casing for preventing the washing water from scattering to the exterior. The casing 206 is provided with a door (not shown) for taking in and out of the tableware rack 201.

With the above arrangement, it is made possible to direct washing water jets effectively from above and below to the tableware on the tableware rack 201 having a planar shape of 25 cm by 50 cm, and the size of the casing 206 can be made approximately half the size of the full size rack type tableware washing machine shown in the first embodiment. Such a half-size washing machine is used for the washing of glasses and cups. It is desirable that glasses and cups be handled in a service area near guest seats without carrying them to a special washing place. In this point, the use of such half-size washing machine which is half in external size of the full-size rack type tableware washing machine permits the machine to be placed in such service area, that is, glasses and cups can be washed efficiently in a short working area without being carried to a special washing place.

According to the invention defined in Claim 2, since plural washing branch pipes are disposed within a washing vessel and rotatable nozzle arms having plural nozzle spouts are rotatably mounted to those washing branch pipes respectively so as to be positioned approximately on the same plane, plural rotatable nozzle arms for washing are arranged on the same plane, whereby the detergency over the whole area of the washing vessel can be made uniform. Further, according to the invention defined in Claim 2, a washing vessel is formed in a square shape on a horizontal plane and four washing branch pipes are disposed approximately in the center of quartered portions, respectively, of the washing vessel, so it is possible to make the most rational arrangement for the square washing vessel presently in practice. According to the invention defined in Claim 7, plural washing branch pipes are arranged in a washing vessel and rotatable nozzle arms each having plural nozzle spouts are rotatably mounted to those washing branch pipes respectively so as to be positioned approximately on the same plane, further a rinsing water conduit is disposed centrally within the washing vessel and a single rinsing nozzle arm having plural rinsing water injection nozzles is connected to the said rinsing water conduit, so the washing nozzles including the respective rotational centers are realized by an extremely simplified structure. Moreover, the provision of a rinsing nozzle shaft in the central space permits the adoption of a simple structure, not a complicated double shaft structure. Thus, in addition to plastic molding of the rotatable nozzle arms, it is possible to realize a tableware washing machine which is less expensive and higher in performance than the old type in view of a total structure. Additionally, according to the invention defined in Claim 3, since a washing vessel which is rectangular on a horizontal plane is used and two washing branch pipes are disposed nearly centrally of bisected portions respectively of the washing vessel, the tableware washing machine according to the invention of Claim 3 can be mounted in a place of a limited mounting space such as a service area or the like, that is, glass and the like can be washed near guest seats.

Claims

1. A tableware washing machine comprising:
   a washing vessel;
   a plurality of washing branch pipes disposed within said washing vessel; and
   rotatable nozzle arms each having a plurality of nozzle spouts and mounted rotatably on said washing branch pipes respectively so as to be positioned approximately on the same plane.

2. A tableware washing machine according to Claim 1, wherein said washing vessel is formed in a square shape on a horizontal plane, and four washing branch pipes are disposed approximately in the center of quartered portions, respectively, of said washing vessel.

3. A tableware washing machine according to Claim 1, wherein said washing vessel is formed in a rectangular shape on a horizontal plane, and two washing branch pipes are disposed approximately in the center of bisected portions, respectively, of said washing vessel.

4. A tableware washing machine according to Claim 1, wherein the number of nozzle spouts provided on an outer peripheral side of each rotatable nozzle arm is made larger than that of nozzle spouts provided on an inner peripheral side of each rotatable nozzle arm.

5. A tableware washing machine according to Claim 1, wherein one nozzle spout provided on an outer peripheral side of each rotatable nozzle arm is set to eject water inclinedly in a rotating direction of said rotatable nozzle arm.

6. A tableware washing machine according to Claim 1, wherein said rotatable nozzle arms are formed of a plastic material.

7. A tableware washing machine comprising:

a washing vessel;

a plurality of washing branch pipes disposed within said washing vessel;

rotatable nozzle arms each having a plurality of nozzle spouts and mounted rotatably on said washing branch pipes respectively so as to be positioned approximately on the same plane;

a rinsing water conduit disposed centrally within said washing vessel; and

a single rinsing nozzle arm having a plurality of rinsing water injection nozzles and connected rotatably to said rinsing water conduit.

FIG.1

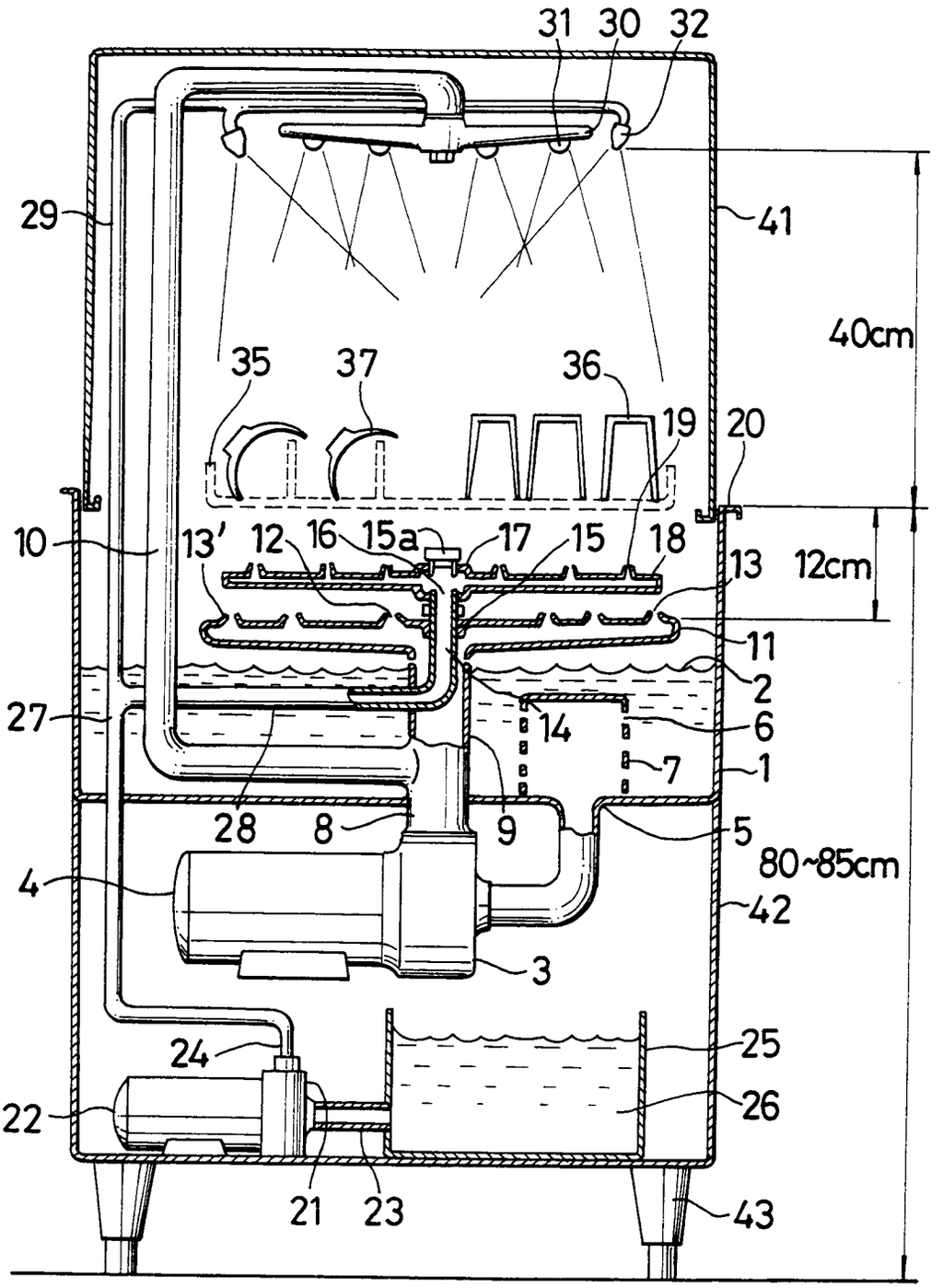

31
30
32
29
41
40cm
35
37
36
19
20
10
13'
12
16
15a
17
15
18
13
12cm
11
2
27
14
6
7
1
28
8
9
5
80~85cm
4
42
3
24
25
22
26
21
23
43

FIG.2

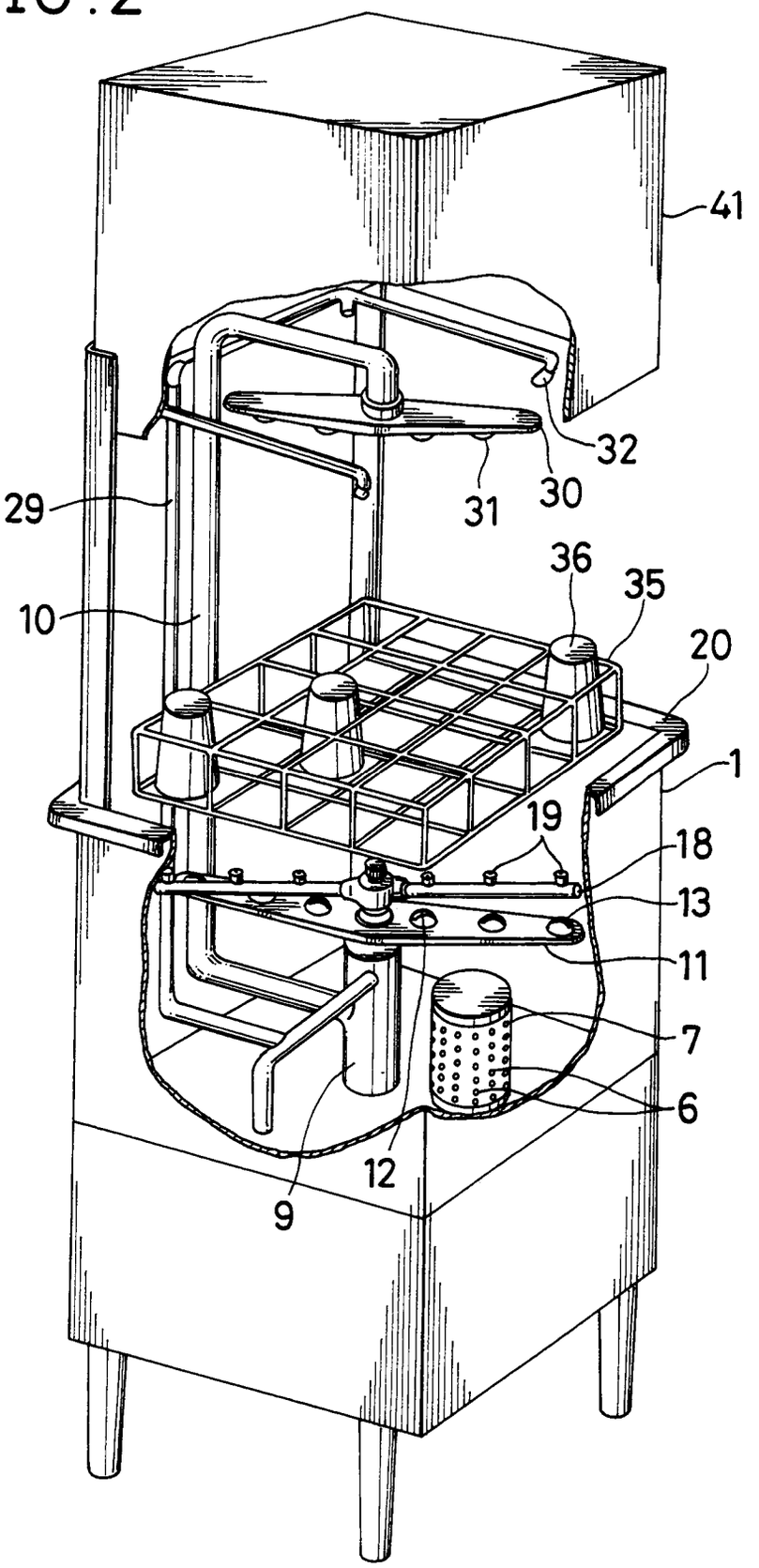


FIG.3

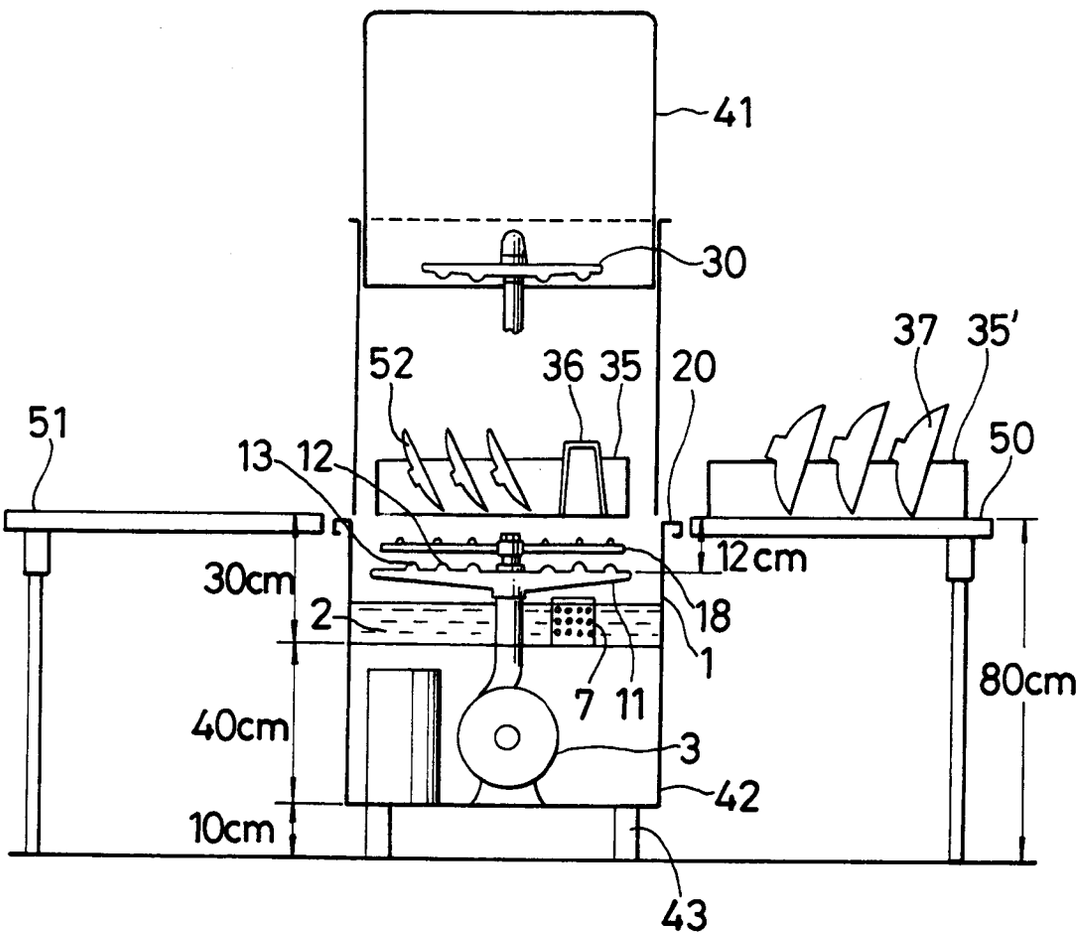

41
30
37
35'
52
36
35
20
51
50
13
12
12cm
30cm
2
18
1
7
11
80cm
40cm
3
42
10cm
43

FIG. 4

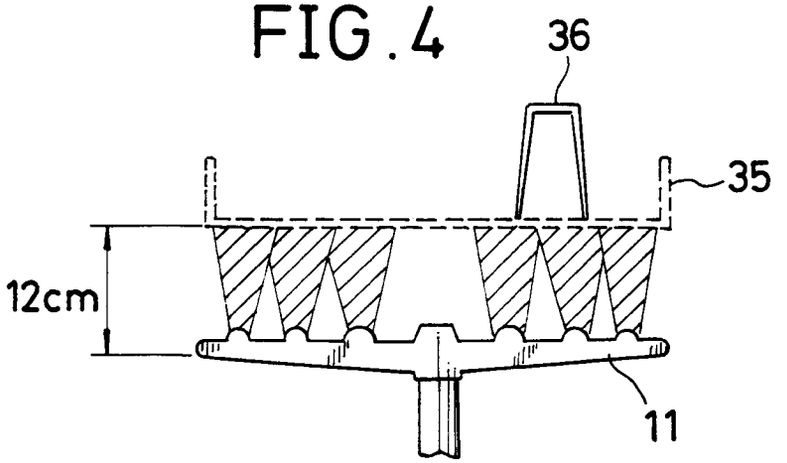


FIG. 5

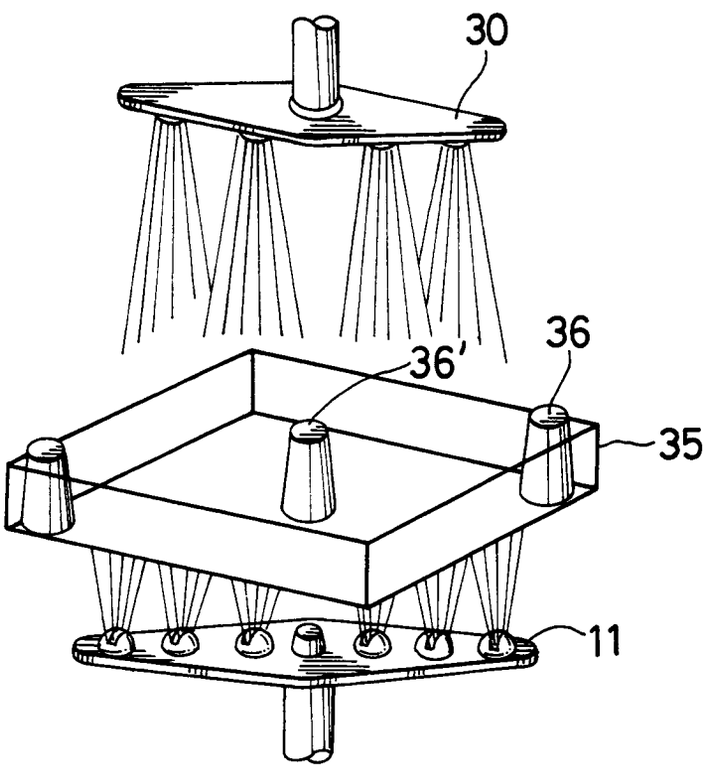


FIG.6

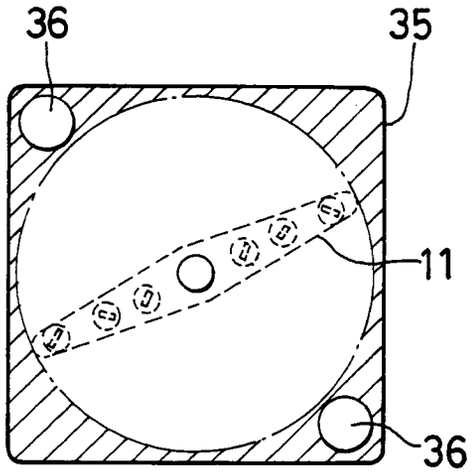


FIG.7

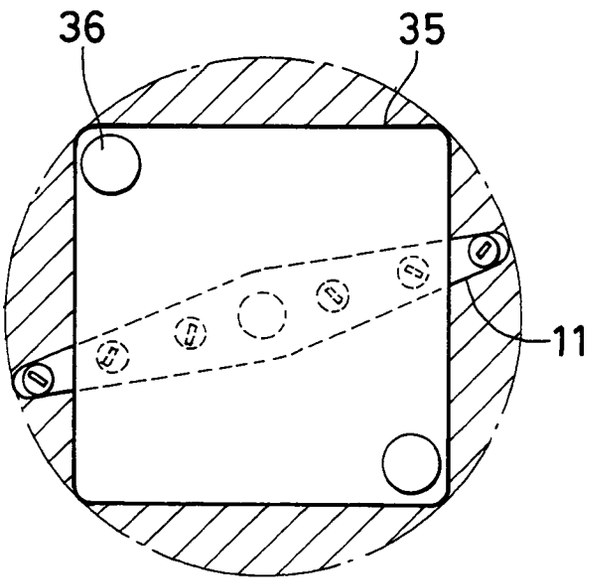


FIG.8

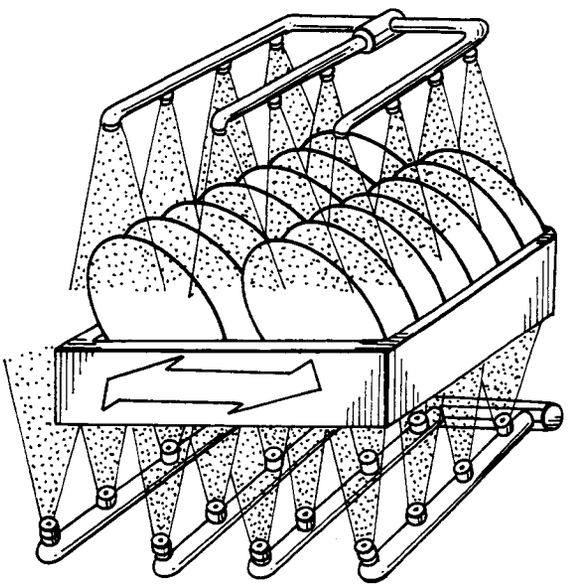


FIG.9

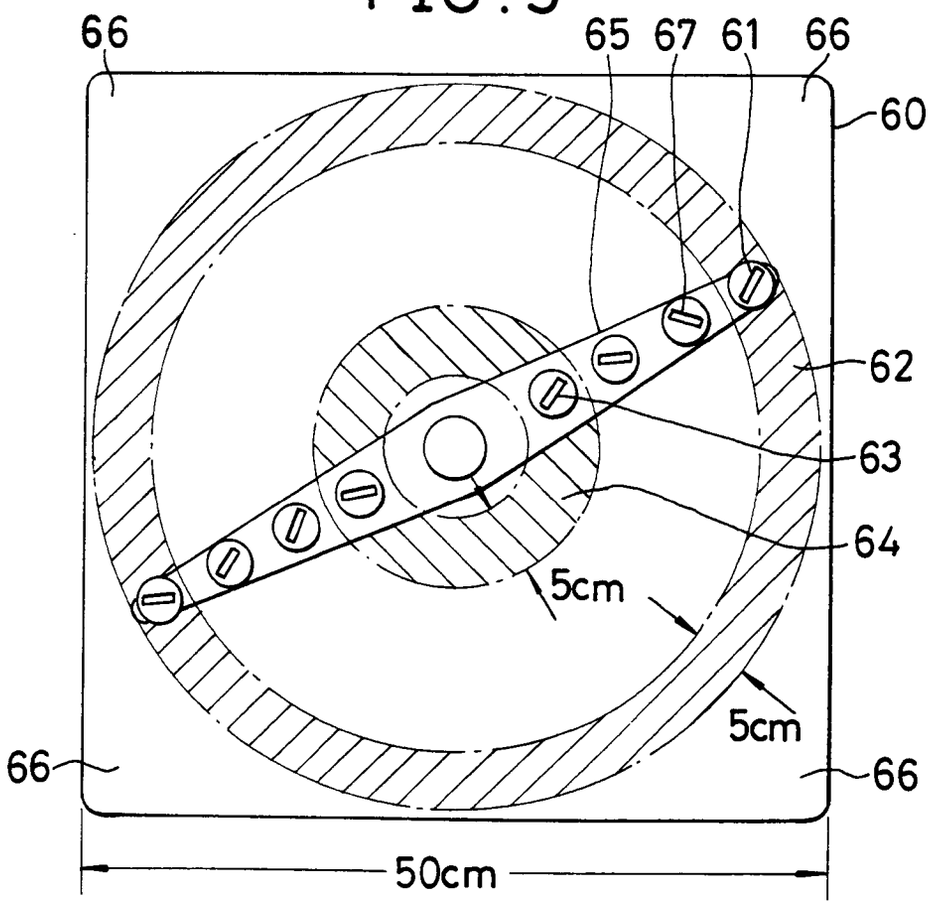


FIG.10

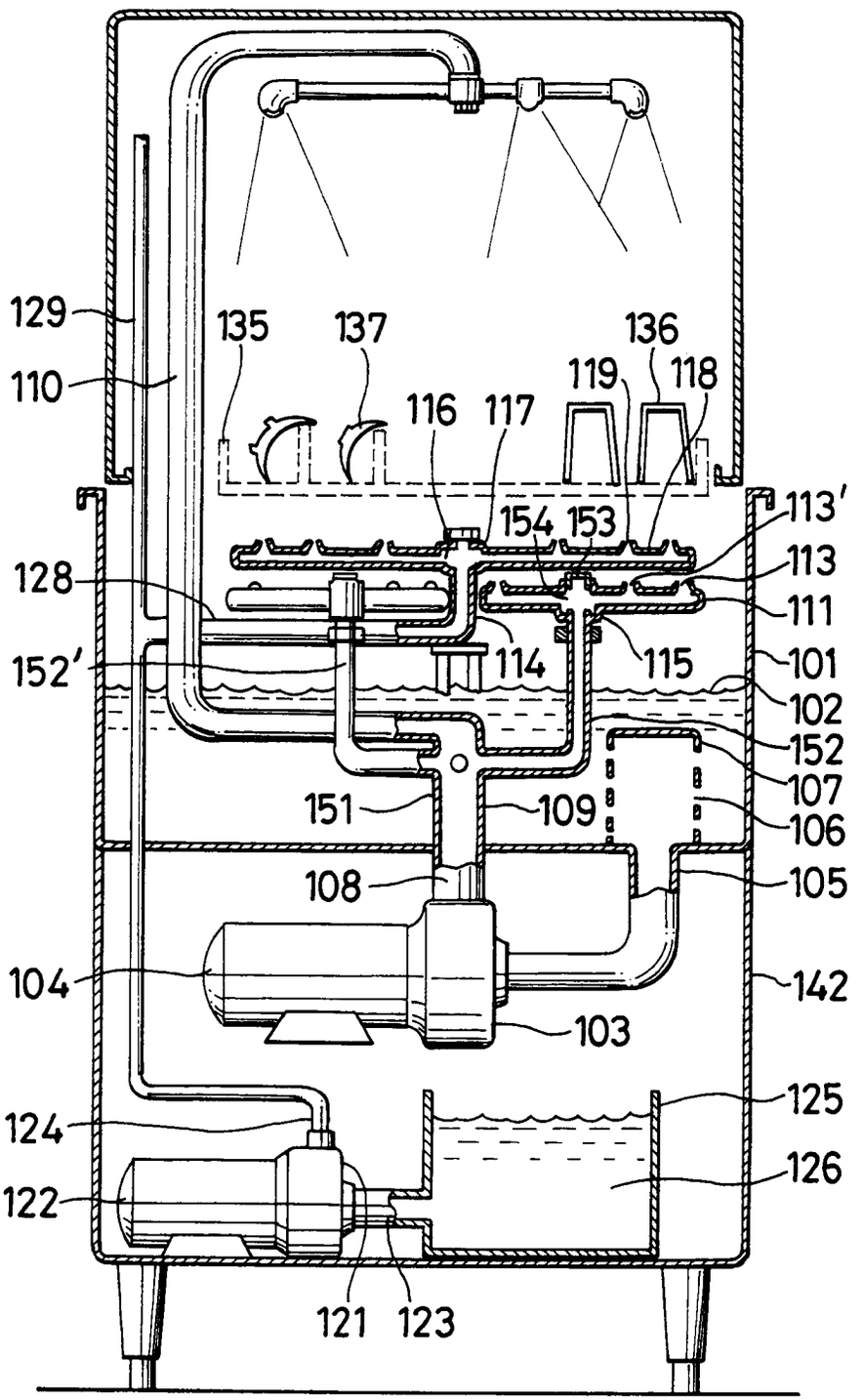

129
110
135
137
136
119
118
116
117
154
153
113'
113
128
111
152'
114
115
101
102
152
107
151
109
106
108
105
104
142
103
125
124
126
122
121
123

FIG.11

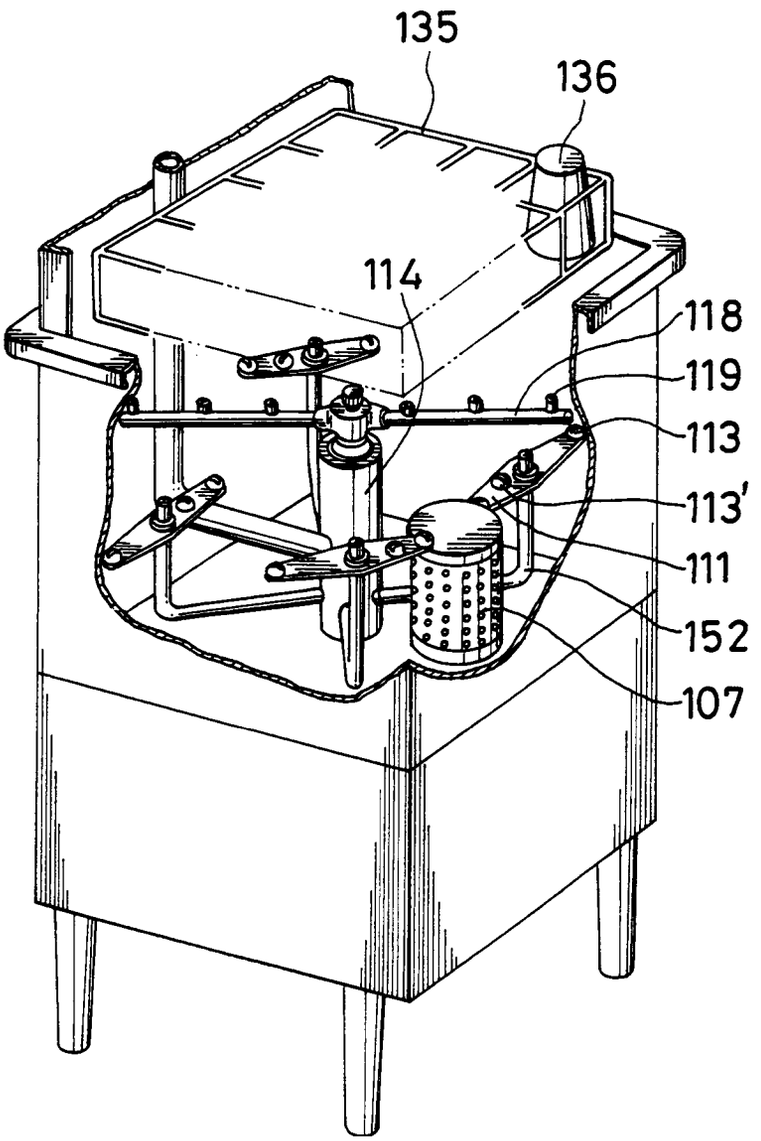


FIG.12

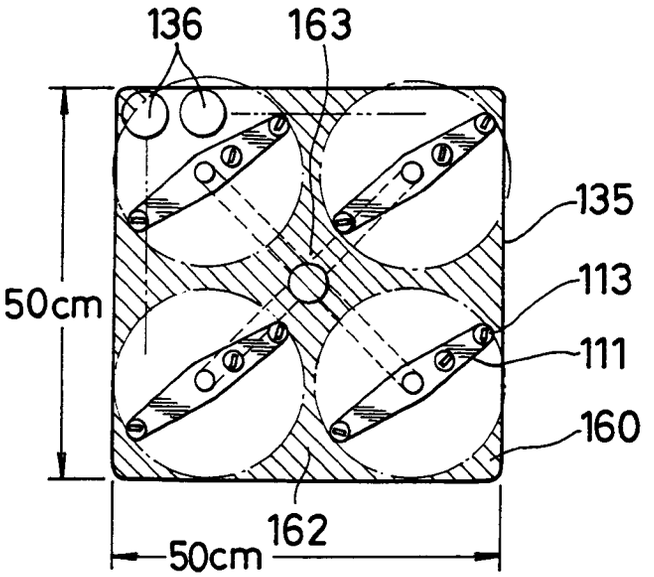

136
163
135
113
111
160
50cm
50cm
162

FIG.13

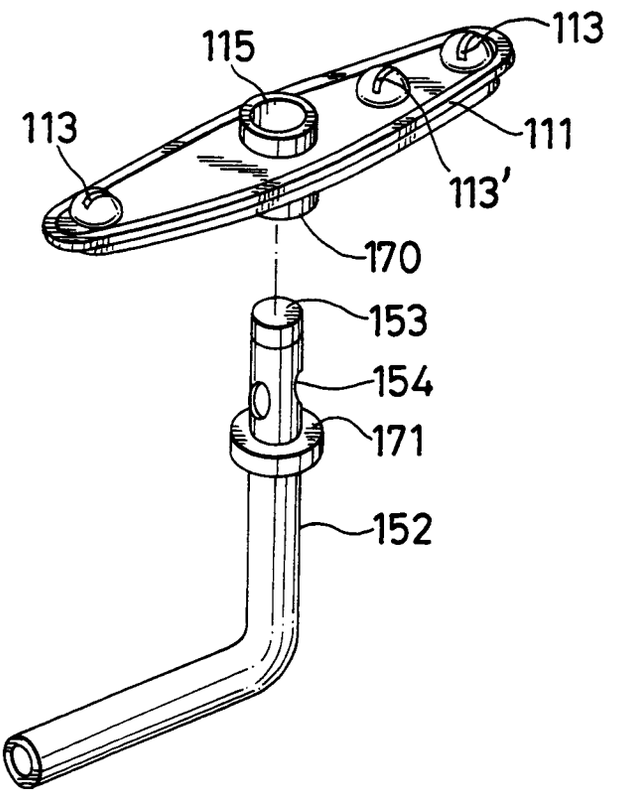

113
115
113
111
113'
170
153
154
171
152

FIG.14

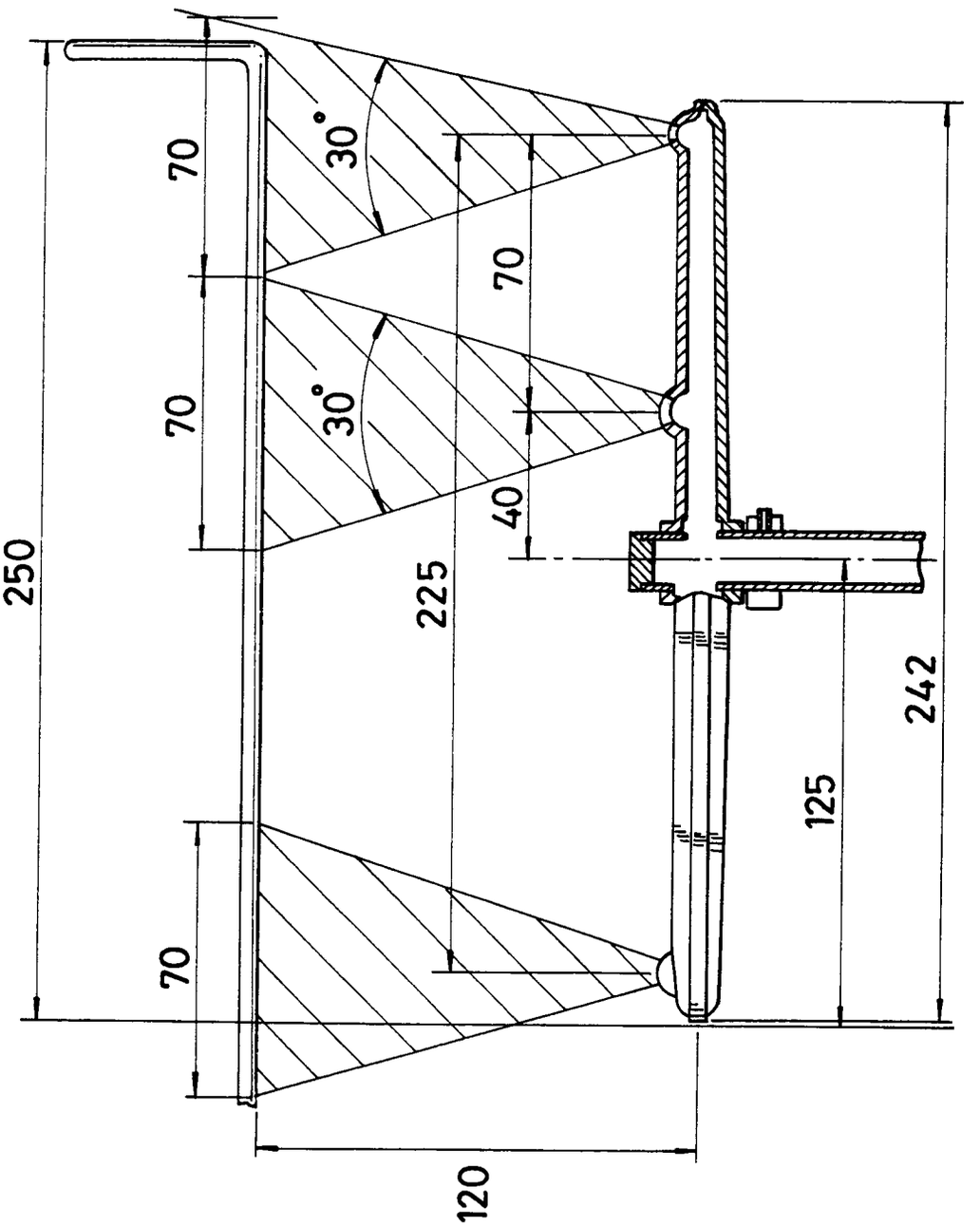


FIG.15

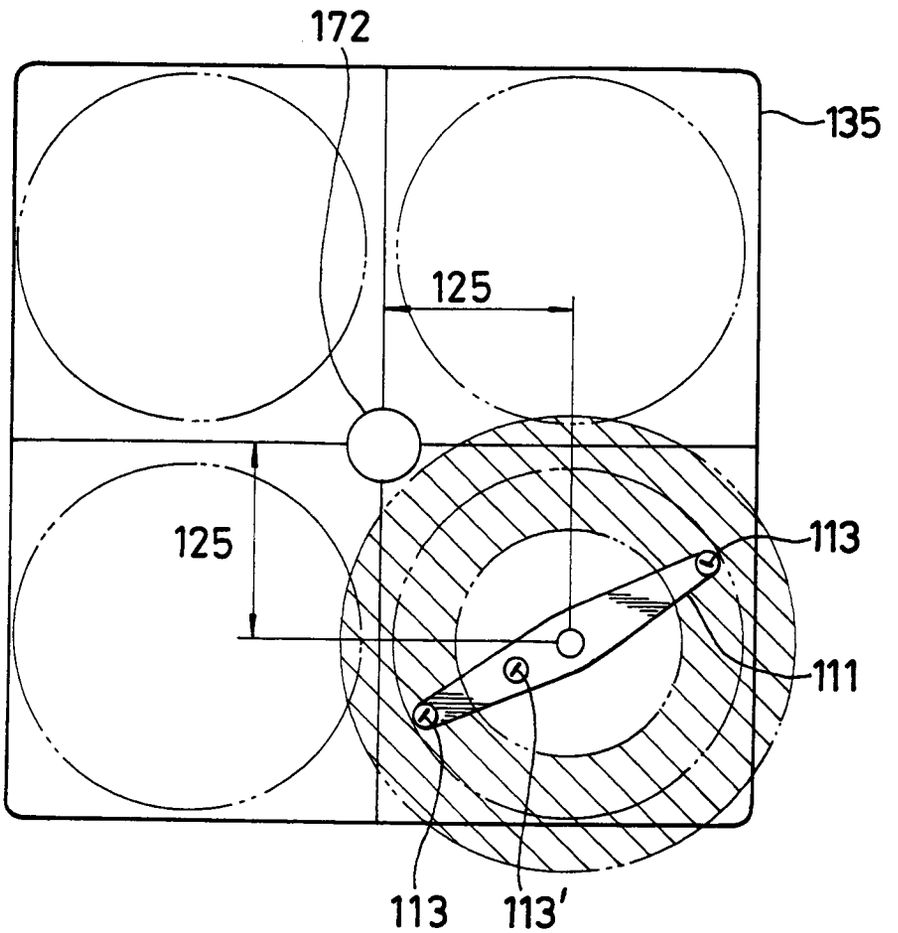


FIG. 16

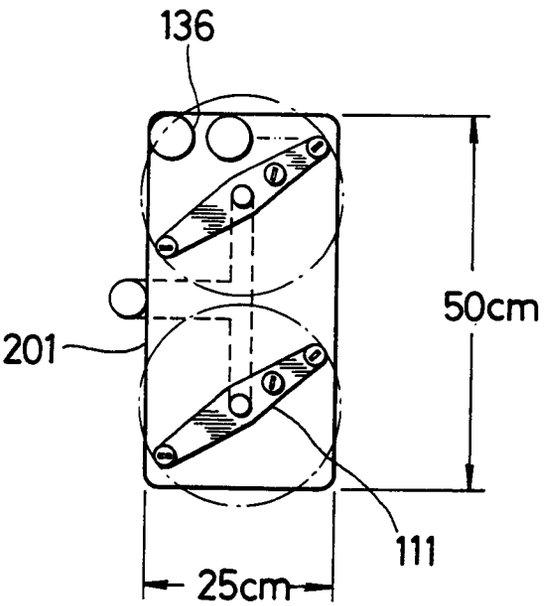
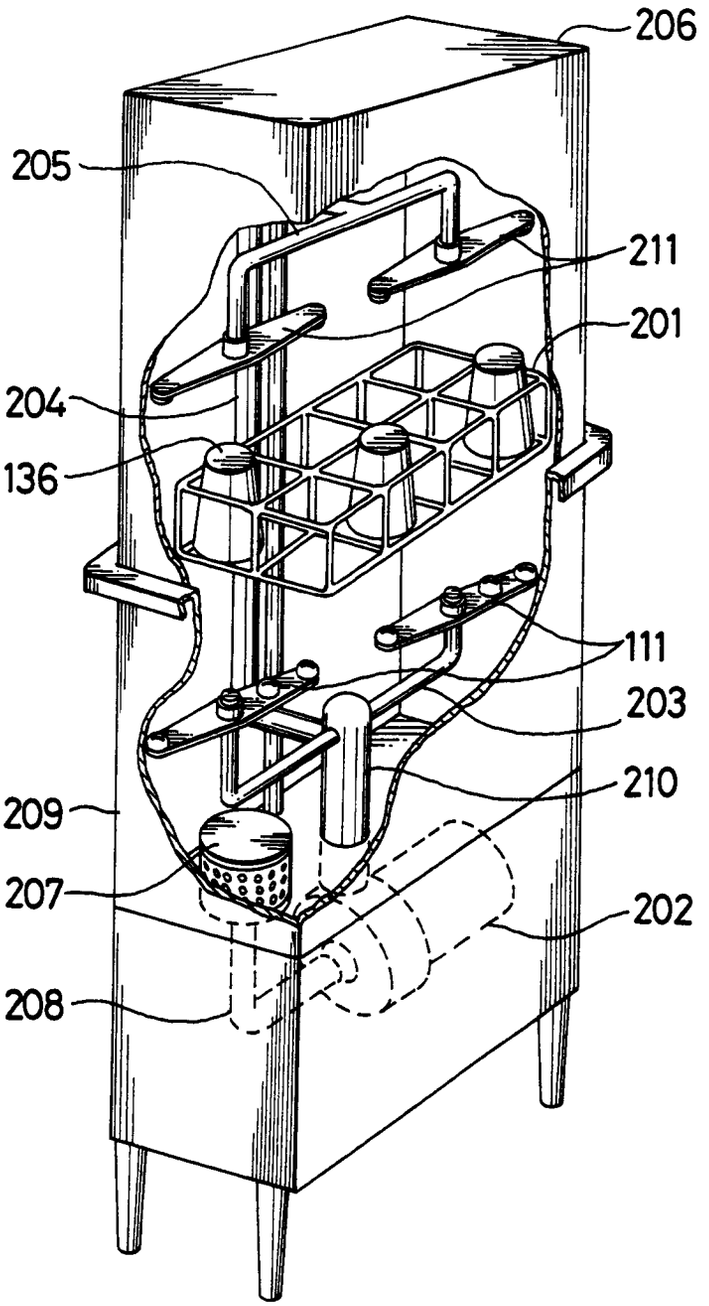


FIG.17



European Patent Office

EUROPEAN SEARCH REPORT

Application Number EP 93 30 1648

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.5)
X A	DE-A-1 628 548 (CONSTRUCTA-WERKE GMBH) * the whole document * ---	1 2,3,7	A47L15/23
X A	US-A-2 960 990 (J.P. JONES ET AL.) * the whole document * ---	1 5	
A	DE-B-1 183 214 (SIEMENS-ELECTOGERÄTE AKTIENGESELLSCHAFT) * the whole document * ---	1	
A	GB-A-307 285 (FRIEDLEY-VOSHARDT COMPANY) * the whole document * ---	1	
A	DE-A-1 628 547 (CONSTRUCTA-WERKE GMBH) * the whole document * ---	4,5,6	
A	GB-A-2 019 204 (LICENTIA PATENT - VERWALTUNGS - GMBH) * the whole document * ---	4	
A	FR-A-1 545 359 (CONSTRUCTA-WERKE GMBH) * the whole document * -----	6	TECHNICAL FIELDS SEARCHED (Int. Cl.5) A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 JUNE 1993	KELLNER M.

CATEGORY OF CITED DOCUMENTS

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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