Jan. 6, 1953 H. M. RUMBAUGH 2,624,356

SMOOTH IMPELLER DISHWASHER

Filed Jan. 9, 1950 7 Sheets-Sheet 1

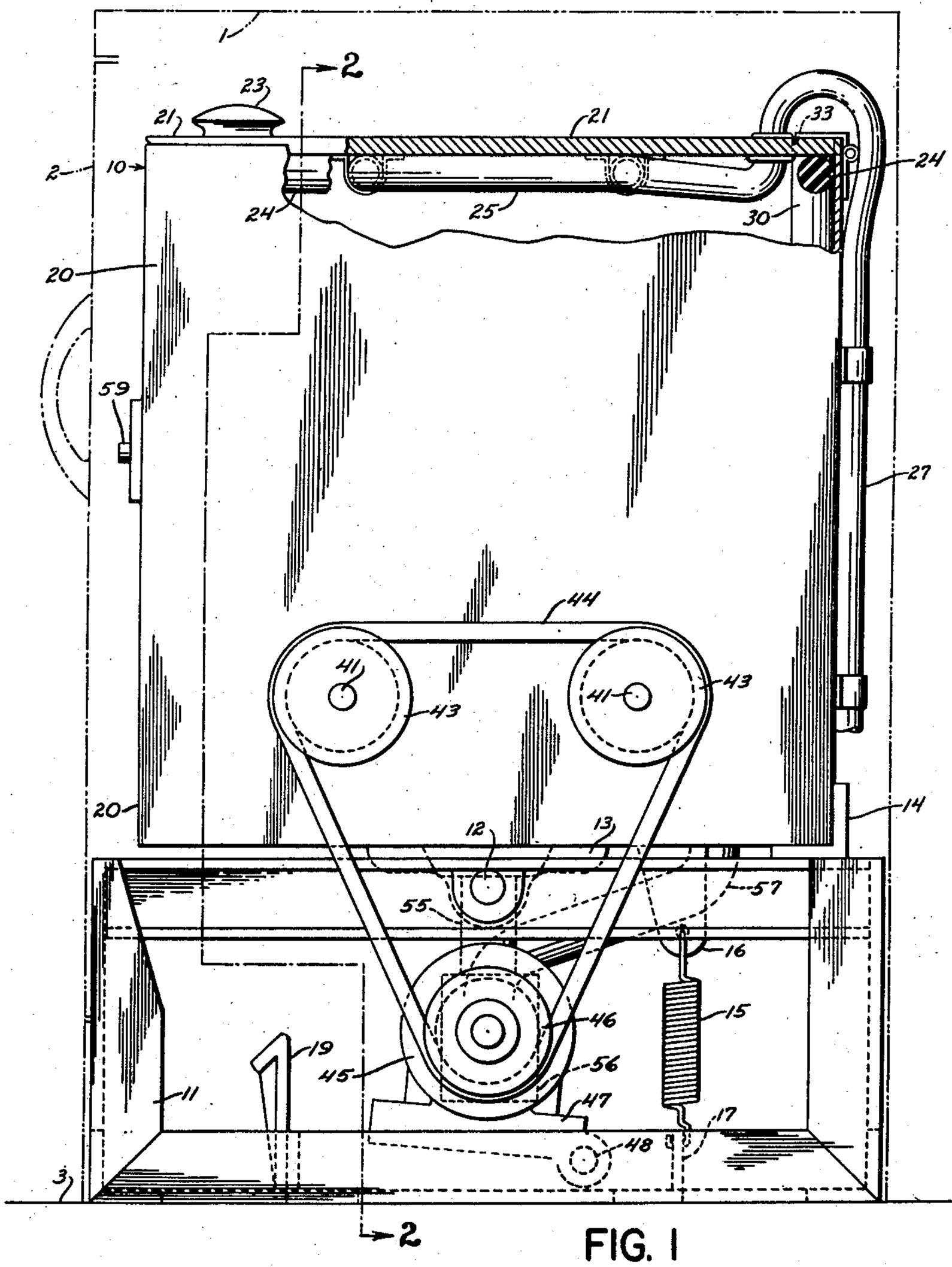

FIG. 1

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SMOOTH IMPELLER DISHWASHER

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7 Sheets-Sheet 2

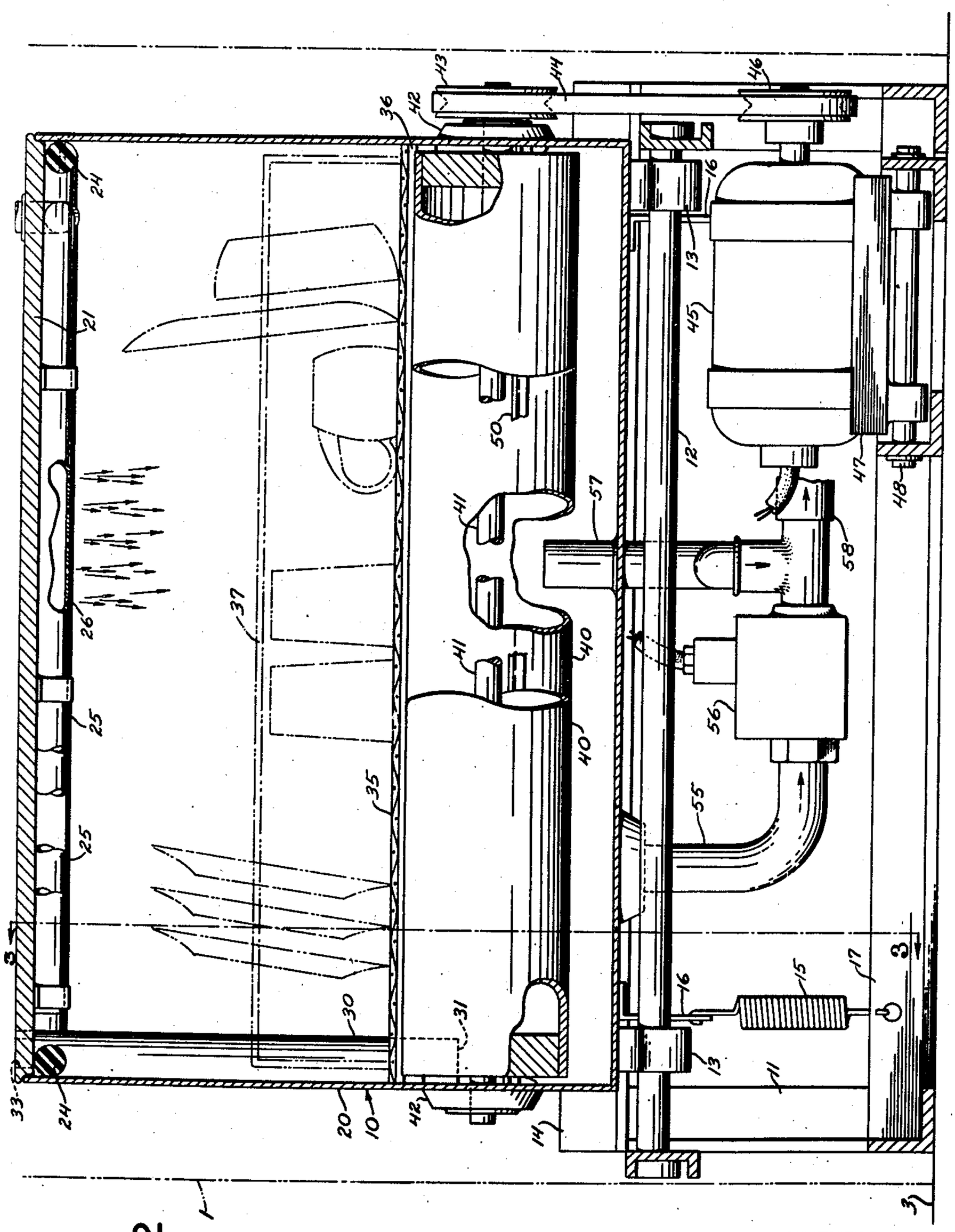

FIG. 2

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SMOOTH IMPELLER DISHWASHER

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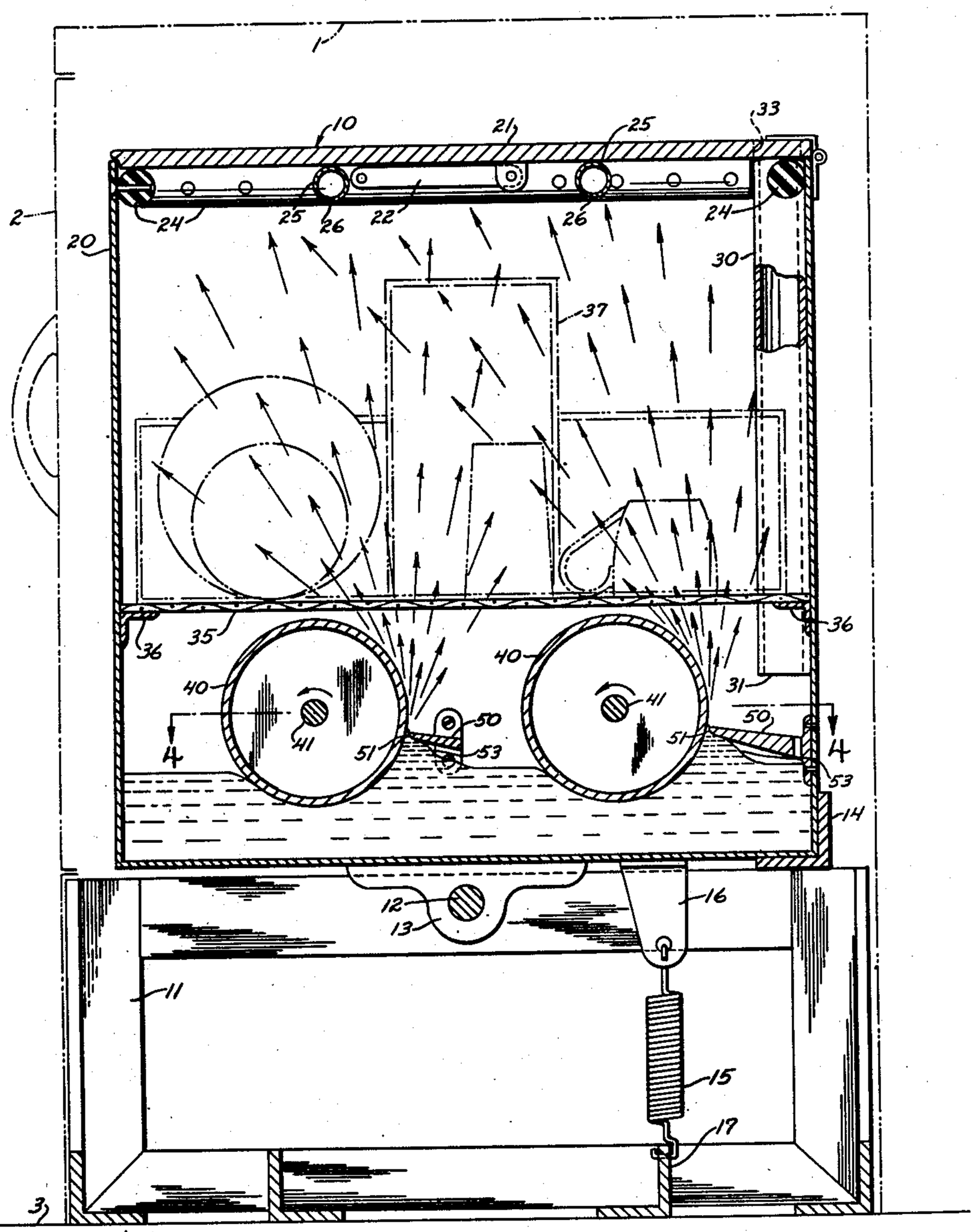

FIG. 3

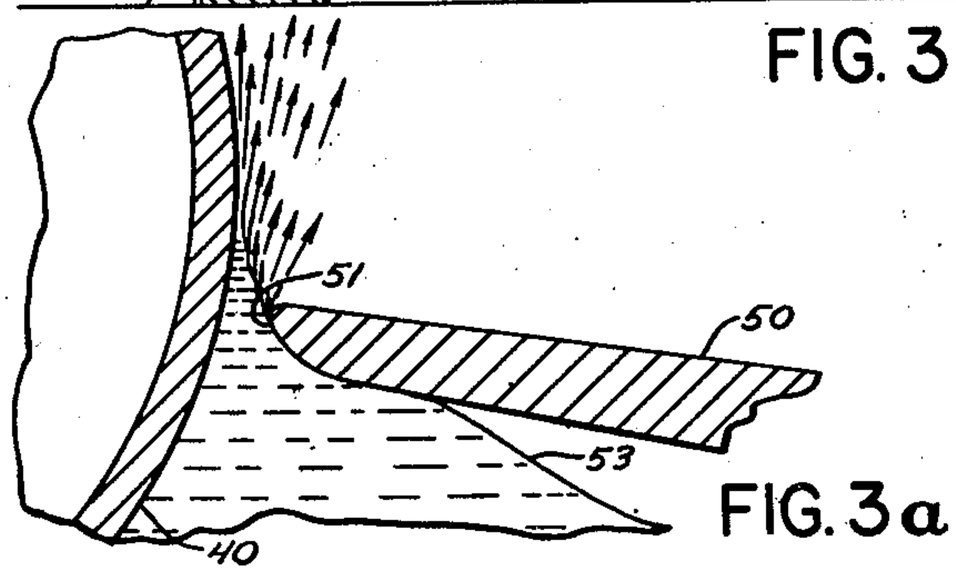

FIG. 3a

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SMOOTH IMPELLER DISHWASHER

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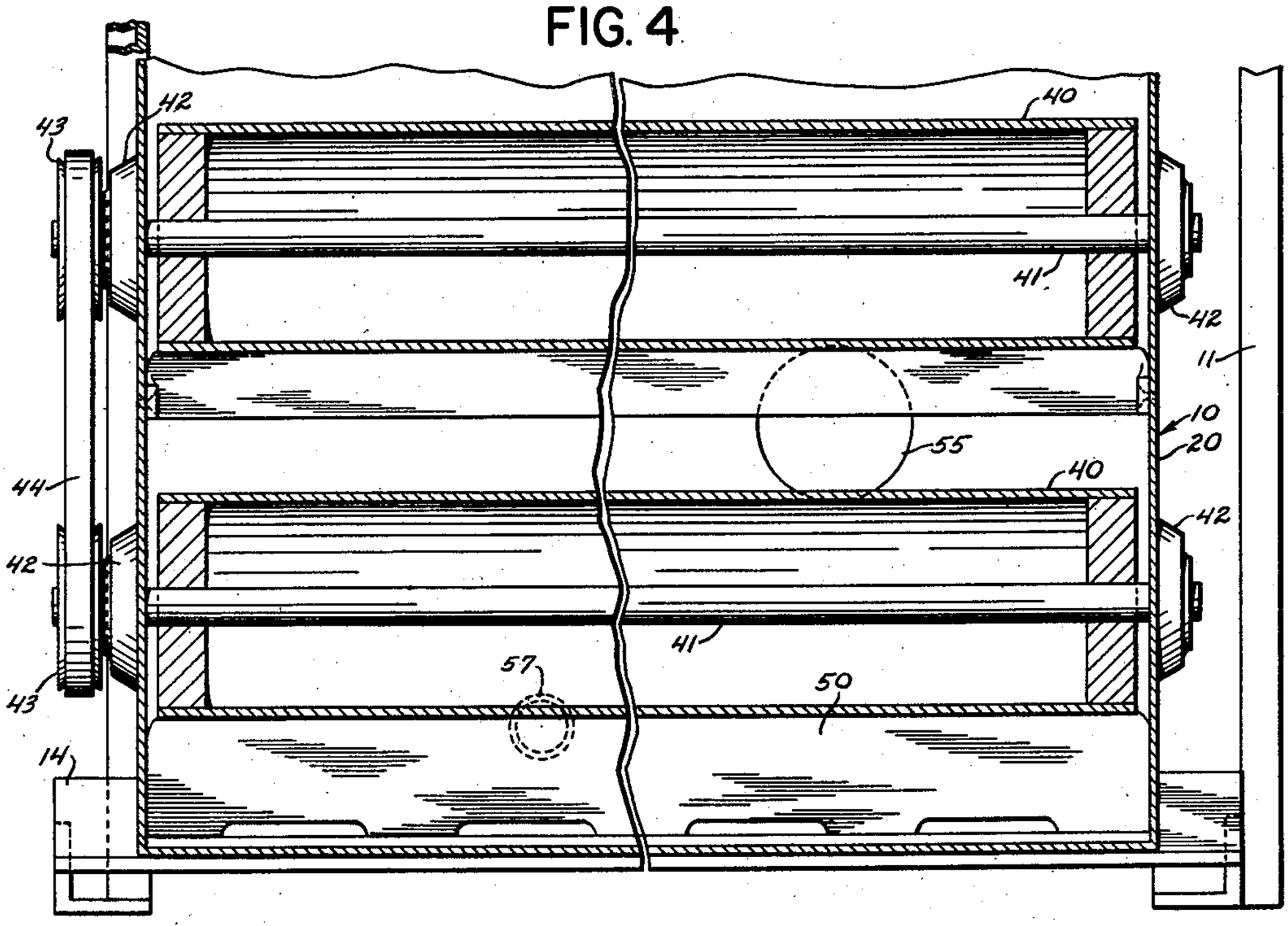
FIG. 4



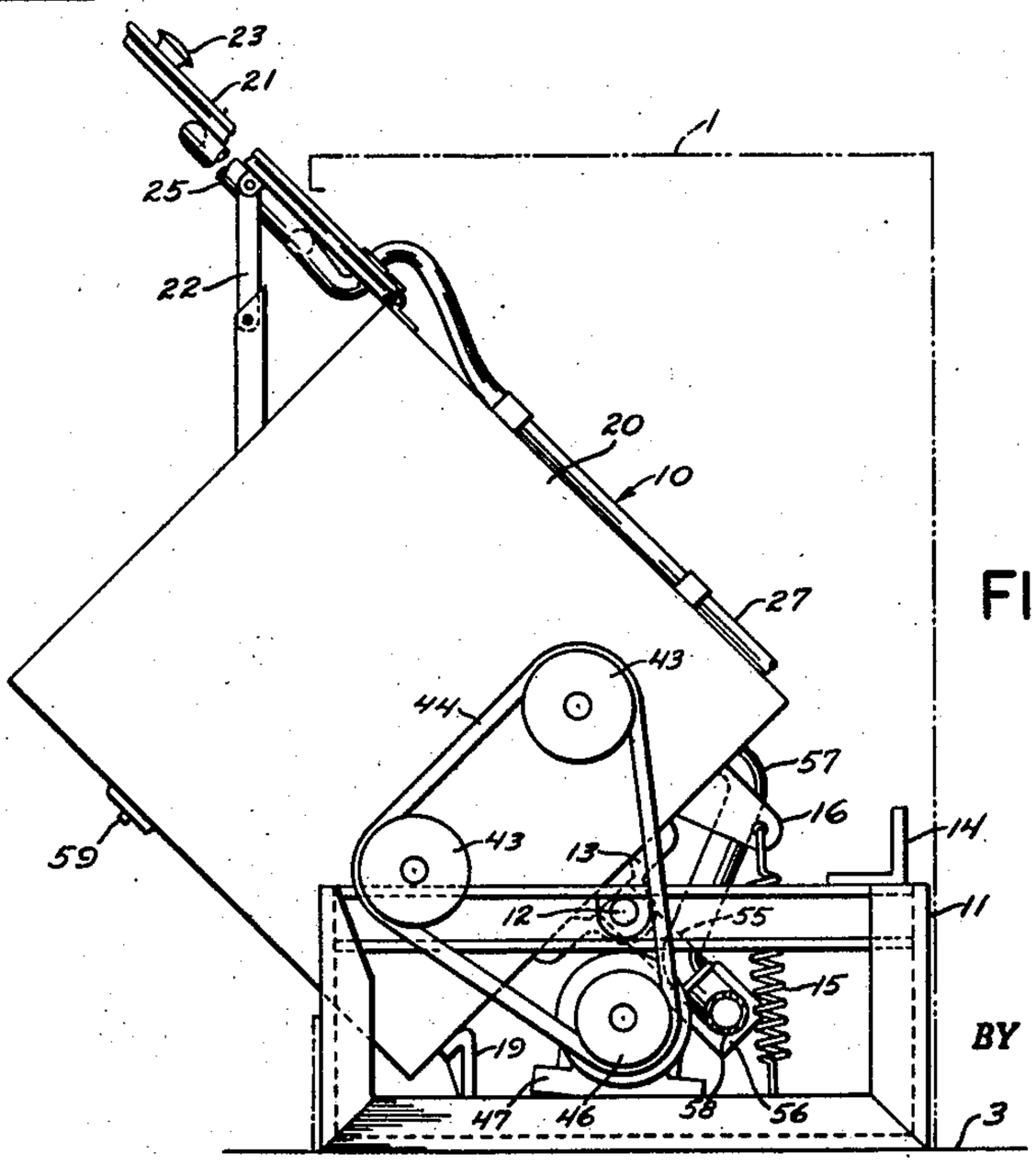


FIG. 5

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SMOOTH IMPELLER DISHWASHER

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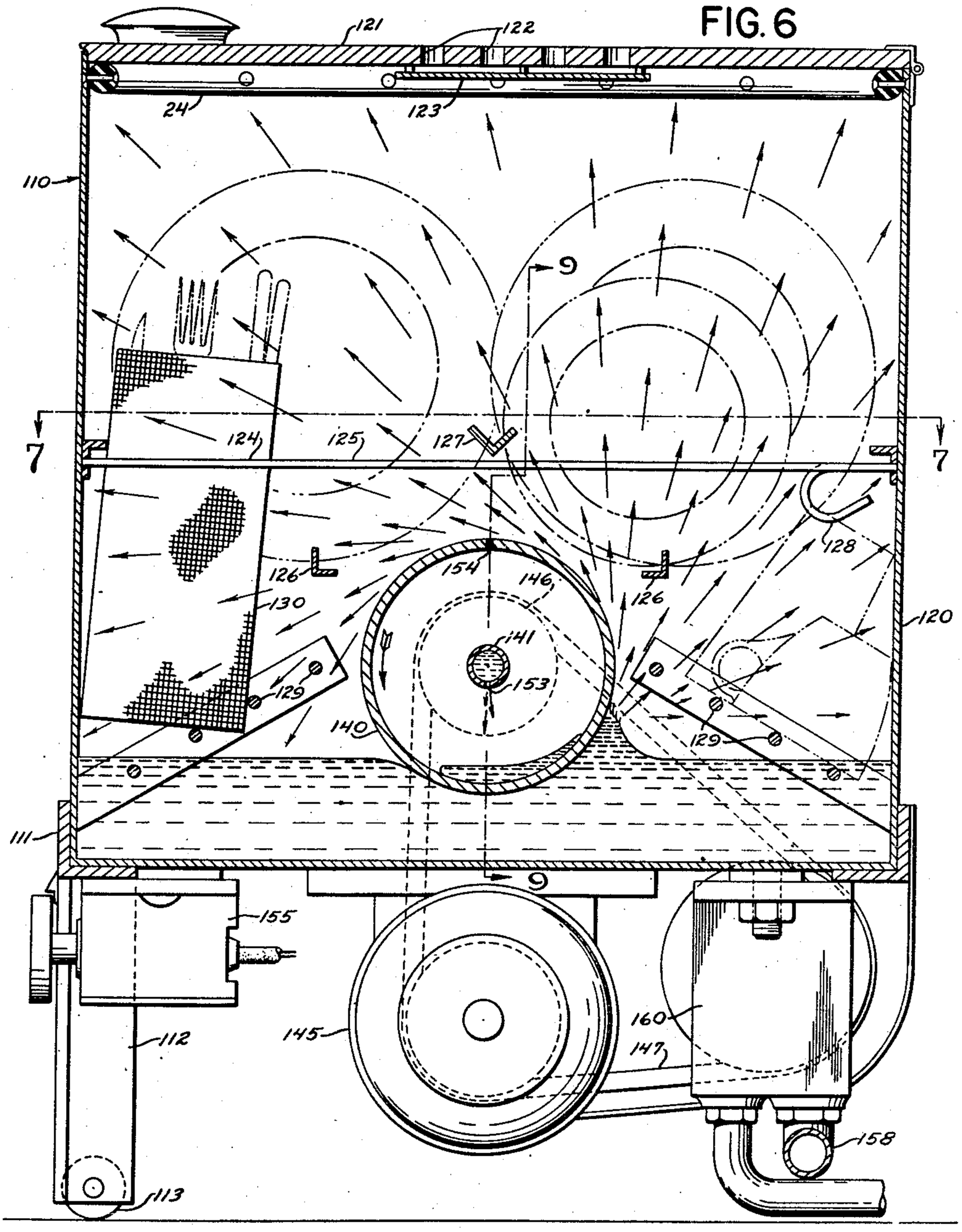
FIG. 6



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SMOOTH IMPELLER DISHWASHER

Filed Jan. 9, 1950 7 Sheets-Sheet 6

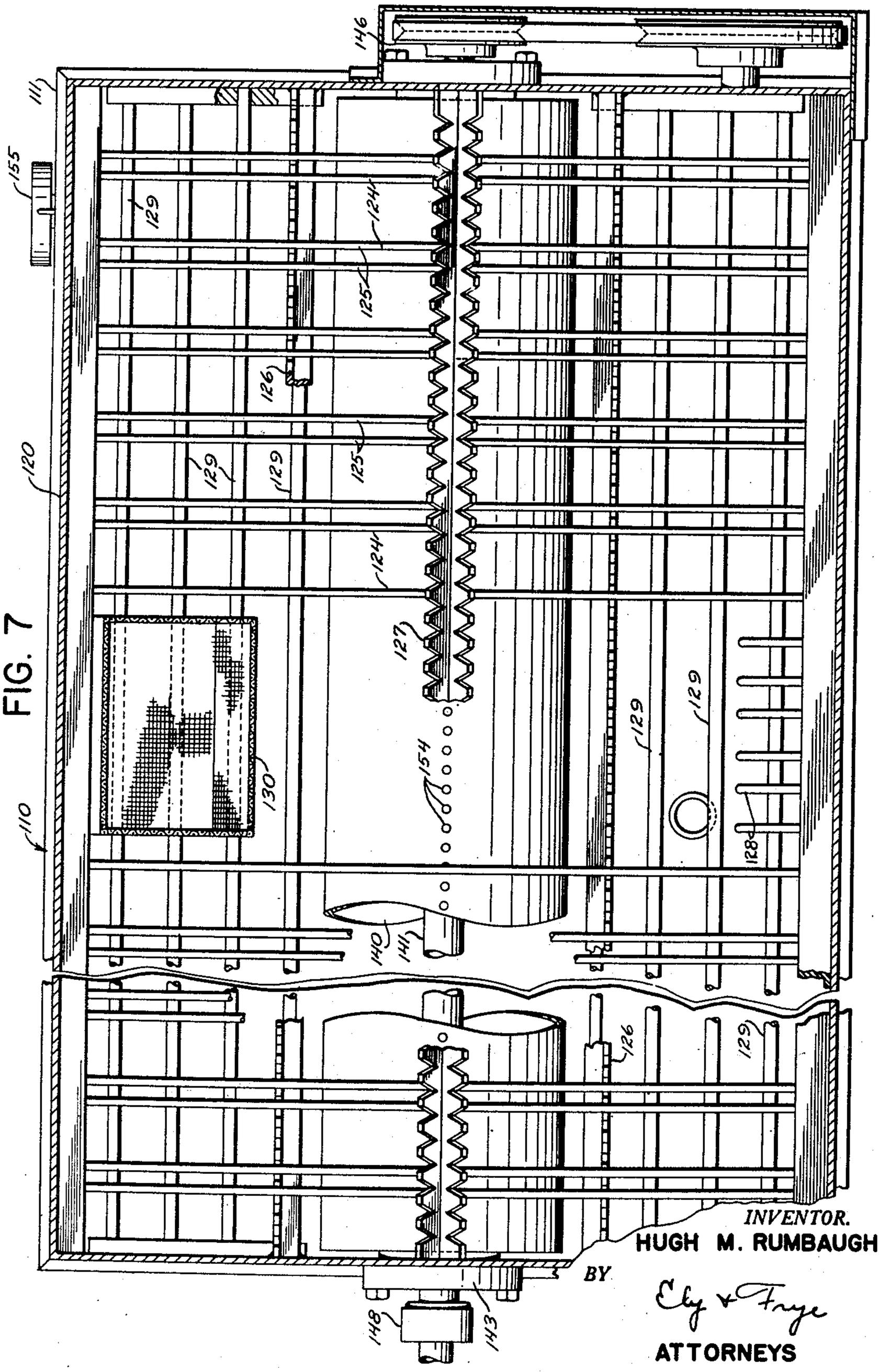

FIG. 7

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SMOOTH IMPELLER DISHWASHER

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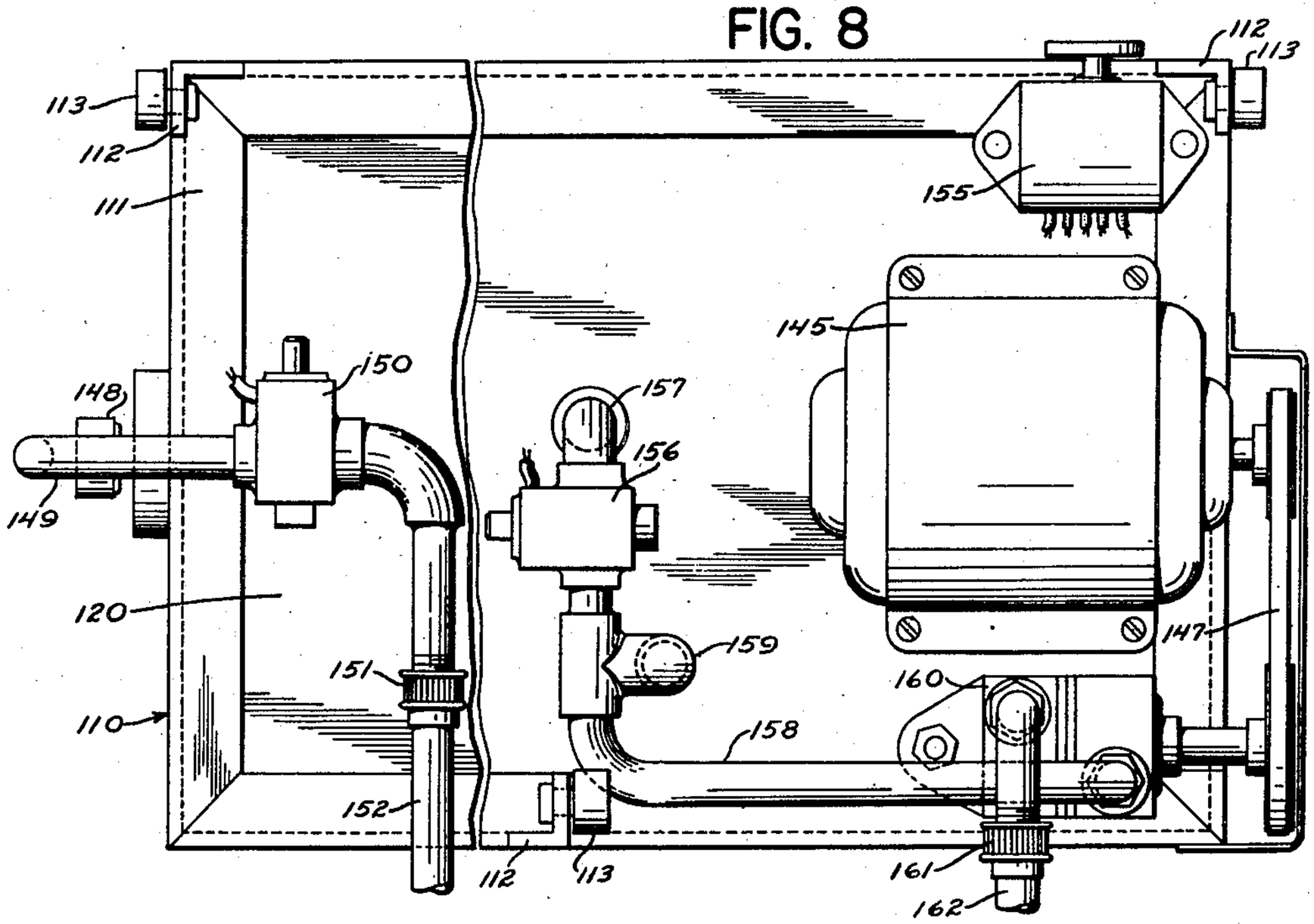
FIG. 8



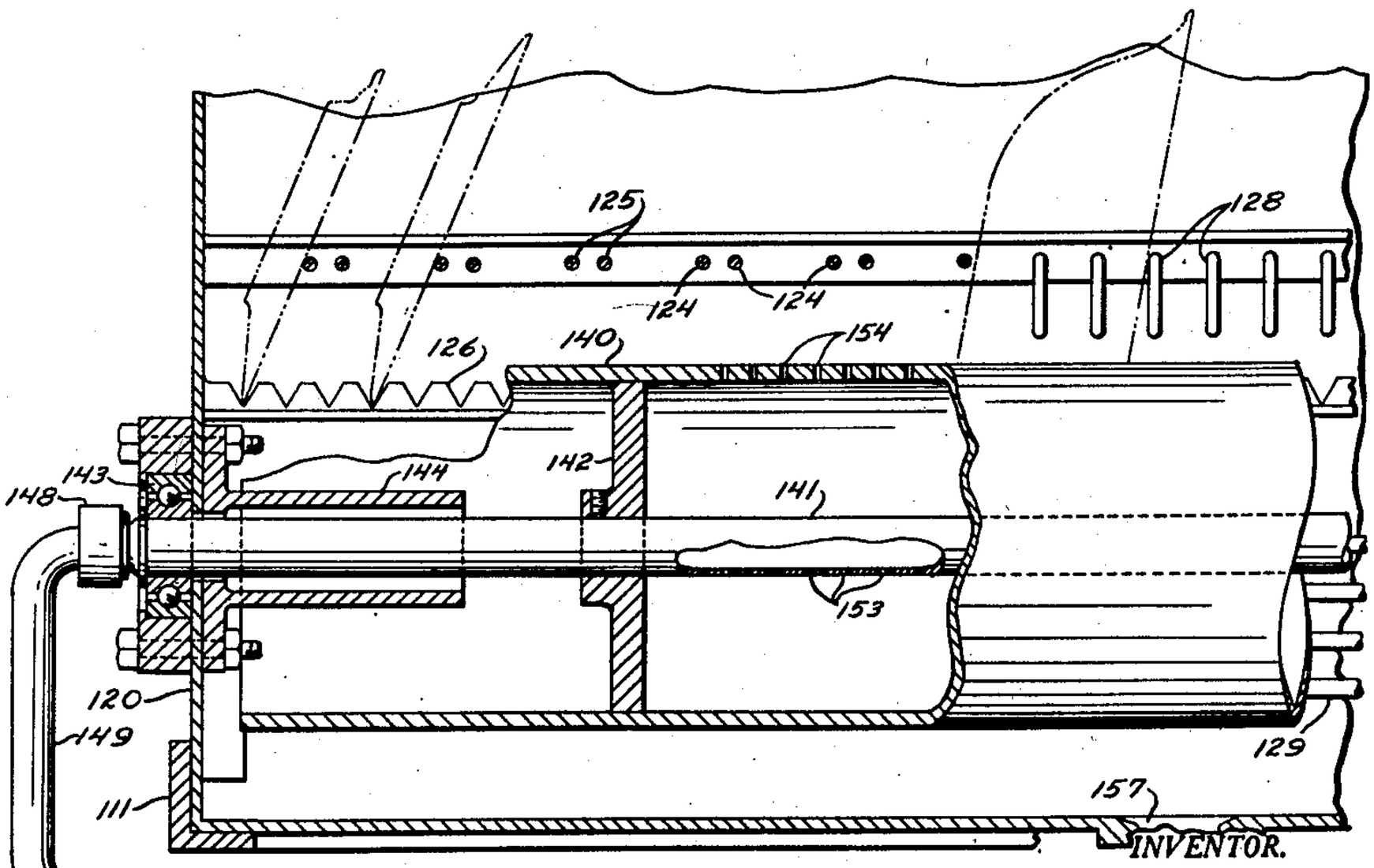


FIG. 9

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UNITED STATES PATENT OFFICE

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SMOOTH IMPELLER DISHWASHER

Hugh M. Rumbaugh, Bath, Ohio

Application January 9, 1950, Serial No. 137,509

9 Claims. (Cl. 134—194)

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This invention relates to improvements in dishwashers and, more particularly, to simple and efficient dishwashers of the domestic type.

Heretofore, domestic dishwashers have been relatively complex in construction and difficult to install and, as a consequence, have been among the more expensive and less widely used household appliances. One reason for relatively poor reception of dishwashers was the failure of early commercial models to wash the dishes clean; while substantial improvement in this respect has been made, part of such improvement is due to improvements in available detergents, the balance being due to development of relatively complex impeller constructions. To an extent, however, the commercially employed prior art impeller constructions have been self-defeating, since they are used in conjunction with fine mesh screens to prevent recirculation of solid matter and to prevent accidentally dislodged ware from being bent or broken in the impellers.

Another reason for the relatively restricted use of dishwashers has been that they have been difficult to load and unload, requiring special cabinets which increased the cost of manufacture and installation and frequently decreased the amount of usable counter space available in a kitchen if installed adjacent counter-height cabinets. Such counter-height dishwashers that have a fixed counter top are customarily provided with front-opening doors which are difficult to seal and sliding racks which require a relatively complex sliding suspension. A final disadvantage of prior art domestic dishwashers is that, despite the claims of the manufacturers, none are too efficient and depend in most instances upon a splash type of rinsing by detergent solutions for their cleaning action.

It is an object and advantage of this invention to provide a simple, efficient and relatively inexpensive domestic dishwashing unit which requires no special cabinet but which may be housed in conventional counter-height stock kitchen cabinets, either by removing the shelves or drawers in previously installed cabinets (preferably those having vertically hinged door fronts) or, if the kitchen is being remodeled or being built at the time of installation, by employing conventional prefabricated, doored units from which the shelves have been omitted. It is to be understood that a dishwashing unit made according to this invention is particularly adapted to be installed under the drainboard portion of most sink units.

It is a further object of this invention to provide a dishwashing chest construction which is effectively sealed and which is provided with a simple suspension permitting the chest to be projected for easy loading and unloading, but supporting the unit within a counter-height housing during the dishwashing operation and other times.

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It is a still further object and advantage of this invention to provide a simple and efficient means for scouring the ware being washed in the unit, whereby the washing and rinsing water and detergent solution impinge at a high velocity directly upon the ware throughout the length of the racks supporting the ware, rather than in zones or by deflection from the walls of the housing, as in prior art devices. Another object is to provide a dishwashing unit utilizing a water impeller which subjects the entire volume of the washing chamber, other than that portion of the volume occupied by the impeller, to a scouring throw of water, thereby eliminating dead spots and inefficient use of space in the chamber.

Still another object of this invention is to provide a simple and effective water-tight bearing seal for the impeller which is substantially frictionless and requires no packing.

Other and further objects and advantages of this invention will be apparent from the following specification, claims, and drawings, in which:

Fig. 1 is a side elevation, partly broken away, of a dishwashing unit made according to this invention.

Fig. 2 is a vertical section taken along line 2—2 of Fig. 1.

Fig. 3 is a vertical section taken along line 3—3 of Fig. 2.

Fig. 3*a* is a greatly enlarged sectional detail of the impeller and vane shown in Fig. 3.

Fig. 4 is a detail section taken along line 4—4 of Fig. 3.

Fig. 5 is a reduced side elevation similar to Fig. 1, but showing the chest in the loading and unloading position.

Fig. 6 is a vertical section showing a simplified modification of a dishwasher made according to my invention.

Fig. 7 is a horizontal section taken along line 7—7 of Fig. 6.

Fig. 8 is a plan view, looking up toward the bottom of the unit shown in Figs. 6 to 9.

Fig. 9 is a detail vertical section taken along the line 9—9 of Fig. 6.

As shown in Fig. 1 of the drawings, the dishwashing unit 10 is adapted to be mounted within a conventional counter-height cabinet 1, shown

in construction lines, having a front-opening door or doors 2 out from which the usual shelves or sliding drawers have been removed. Thus, my unit may be installed in existing kitchens without necessitating extensive remodeling and rebuilding of the counter. For new construction or where the entire kitchen counter is being remodeled or replaced, inexpensive stock cabinets without shelves may be employed. By providing a unit which may be housed in an existing cabinet structure without requiring extensive remodeling, this invention overcomes one of the major objections to prior domestic dishwashers, for in many instances the installation and remodeling costs equaled or exceeded the cost of the dishwasher, per se.

As shown in the drawings, the dishwasher unit 10 comprises a suitable frame 11 adapted to be placed within the cabinet 1 and leveled on the floor 3. The frame 11 is provided with a transverse main supporting shaft 12 upon which the chest 20 is pivotally mounted by means of the bearings 13 carried at the bottom of the chest 20 and journaled on the shaft 12. In its normal vertical position, as shown in Fig. 1, for example, the bottom of the chest also rests on a transverse supporting bar 14 located to the rear of the shaft 12 and is held on said bar 14 by means of the counter-balancing tension spring 15 connecting a clevis 16 carried by the bottom of the chest and a clevis 17 carried by the frame 11.

The chest 20 is provided with a lid 21, hinged to the rear wall of the chest and provided with a suitable elbow linkage 22 for holding the lid open when the lid is manually raised by means of the knob 23. The joint between the upper edges of the chest walls and the lid is simply and effectively sealed by a hydrostatic seal comprised simply of rods or tubes 24 of resilient material, such as soap and grease resistant synthetic rubber, secured to the upper inner margin of the walls of the chest so that the inner margin of the lid 21 will rest upon the upper surfaces of the cylindrical rods 24. It is to be noted that the rods 24 are made of resilient material only to insure that a continuous line of tangency between the lid and the rods will be maintained rather than to depend upon a distortion of the rods to effect a water-tight seal. As will be evident from the portion of the rods 24, shown in section in Figs. 1 to 3, the hydrostatic seal is effected by a miniscus of water which will be held between the rod 24 and the undersurface of the lid 21 by the bight between the adjacent surfaces of these two members.

The lid 21 also preferably carries the incoming water distributor comprised of a grid of pipes 25 provided with spray jet orifices 26 to distribute incoming wash or rinse water over ware in the chest 20. The grid of pipes 25 is connected by the flexible conduit 27 to hot and cold water lines through timer controlled valves (not shown).

Mounted in a corner of the chest 20 is the vertical vent pipe 30 having a lower opening 31 in the lower part of the chest but above the maximum liquid level therein. The upper open end of the pipe 30 extends through a suitable opening 33 in the top 21 to vent steam from the chest to the atmosphere. The length of the tube effectively baffles entrained moisture, and, being straight, is easily cleaned.

The lower portion of the chest is provided with a removable grid 35 resting upon the angles 36. The grid 35 is preferably quite open to permit the high velocity wash water to pass therethrough without substantial diminution of velocity or interference, but is of sufficiently close mesh to retain small pieces of silverware or the like which might fall through or be displaced from the removable rack 37 which supports the dishes and other ware to be washed. The use of mesh to retain silverware, it should be pointed out, is primarily for convenience to avoid having to retrieve the ware from the bottom of the chest 20, since the smooth surface of the roll 40 has no projections to break or bend ware, as in conventional dishwasher impellers of the paddle, disk, or propeller type. In this connection, it should also be pointed out that the specific construction and arrangement of the racks and the location of the ware thereby are primarily a matter of choice except that, to obtain maximum effect from the scouring action of the high velocity wash water, the racks are preferably arranged to hold dishes and like flatware in a generally vertical plane extending from the front to rear of the chest and slightly tilted transversely to the cylinder 40, as shown in Fig. 2, for example.

Wash and rinse water and detergent solutions are directed on the ware carried above the grid 35 by means of one or more high speed spray cylinders 40, two being shown in the embodiment of Figs. 1 to 5. The cylinders 40 are preferably hollow and provided with smooth outer surfaces adapted to be partly submerged in the liquid carried in the lower portion of the chest 20, the liquid level in the lower or sump portion of the chest being maintained by the overflow pipe 57 connected to the main drain pipe 58 for discharge to the sewage system. The overflow pipe preferably maintains the height of the water in the sump portion of the chest 20 so that from approximately one-third to one-sixth of the surface of the cylinder is submerged.

The cylinders 40 extend transversely across the width of the chest 20 and are mounted on the shafts 41 journaled in conventional packed and sealed bearings 42 carried by the side walls of the chest 20. At one end the shafts 41 carry the V-belt pulleys 43 driven by the V-belt 44 which, in turn, is driven by the pulley 46 of the motor 45. The motor 45 is mounted on a base block 47 pivoted at one side on the base block pivot 48 supported by the frame 11. As shown in Fig. 1, for example, the length of the belt 44 is such that, in passing around the cylinder pulleys 43 and the motor pulley 46, the motor 45 and block 47 are lifted and the tension on the belt 43 is a component of the weight of the hinged motor and block.

It has been found that the velocity of the water thrown by the cylinders 40 is greatly increased and the included angle of such water may be controlled by directing vanes 50 generally tangent to but not touching the outer surface of the cylinders 40. The edges 51 of the vanes 50 adjacent the cylinders 40 are preferably curved so that, in section, the adjacent surfaces of the cylinder and the vanes constitute the throat of a nozzle, and each cylinder and its associated vane thereby constitute a continuous elongated jet extending transversely of the chest 20. The effective nozzle cross-section provided by the cylinder 40 and vane edge 51 is shown in Fig. 3*a*. The very noticeable increase in velocity of the liquid thrown by the cylinders 40, when the vanes 50 are employed, over the velocity when such vanes are omitted is attributed to the in-

stantaneous pressure head (developed between the cylinder surface and the vane edge 51 as the liquid is drawn by its viscosity into the bight between the surfaces) becoming converted to a high velocity head due to the nozzle throat effected by the convergence of the adjacent surfaces of the cylinder 40 and the vane edge 51. Another evident factor contributing to the efficiency of the cylinder and vane connection is that turbulence developed as the cylinder surface leaves the liquid level, when no vane is present, is absent or greatly minimized when a vane 50 is employed. Without the vane 50, the cylinder 40 will lift a volume of liquid which is not thrown as a spray but falls back to the liquid level in the sump, creating useless turbulence. With a vane 50, instead of such uselessly turbulent water being present, a relatively constant, non-turbulent, large miniscus 53, as indicated in Fig. 3, is maintained. In addition to the nozzle effect of the vane edges 51, therefore, the vanes 50 also apparently control the weight of water thrown by the cylinder 40 and eliminate the loss of energy which occurs when a substantial volume of liquid is simply lifted above the liquid level and then falls back without being thrown against the ware.

It should also be apparent from the foregoing that another advantage of the cylinder 40 is that they throw a continuous, uninterrupted high velocity jet of water across the width of the chest. Dead-spots or zones of varying intensity, such as are developed by impellers of the paddle, propeller or disk-type, are eliminated and, due to the high velocity of the spray particles, the ware against which they are directed is scoured rather than rinsed, thereby efficiently removing adhered food particles. Further, because the included angle of the high velocity spray from the cylinders may be determined, the ware in the racks 37 may be located with respect to the cylinder 40 so that the initial impact of liquid thrown by the cylinders 40 is against the ware, rather than against the walls of the chest 20 which, with a consequent loss of kinetic energy, deflect the spray against the ware. In short, the cylinders 40 permit the washing energy to be expended largely against the ware, rather than dissipated against the walls of the chest containing the ware.

At various times during the washing operation and at the end thereof, the washing liquid is drained from the sump portion of the chest 20 by means of a drain 55 opened and closed at predetermined intervals by the valve 56. Beyond the valve 56, the overflow pipe 57 and drain 55 connect with a main drain pipe 58 connected to the sewage system through a trap with conventional swinging fittings (not shown). The inlet and draining of wash and rinse water as well as the operation of the motor 50 are all preferably controlled through a suitable and conventional cyclic timer (not shown), the operation of the timer for a cycle being initiated by the starter button 59 located on the front of the chest 20.

To load and unload the washing unit 10, the doors 2 of the housing cabinet 1 are opened and the entire chest is tilted outwardly by pivoting the chest 20 about the shaft 12 against the effect counterbalancing spring 15. As shown in Fig. 5, when the center of gravity of the chest is carried forward of the shaft 12, the chest will continue to tilt until the bottom rests against the stop 19, in which position the lid 21 may be raised and the chest opened for convenient and accessible loading and unloading. In the loading and unloading positions shown in Fig. 5, the motor 45 is raised by the belt 44 by operation of the floating suspension of the motor afforded by the pivoted block 47. Connection of the inlet and drain piping is maintained by means of flexible tubing or swinging connections (not shown).

It should be apparent from the foregoing that the advantages of the tilting chest construction are not confined to the preferred cylinder and vane type of water impeller as shown in the preferred embodiment, but the chest 20 may be provided with any other type of water impeller mechanism. Likewise, a dishwasher having advantages of the foregoing embodiment does not require a plurality of impeller cylinders but may employ a single cylinder, with or without jet directing vanes. Likewise, the advantages of a dishwashing chest which may be projected from a standard counter-height cabinet is not dependent upon the particular tilting suspension shown in Figs. 1 to 5, but other means may be employed, as shown in Figs. 6 to 9, illustrating a dishwasher embodying a number of modifications of the elements of the embodiment shown in Figs. 1 to 5.

As illustrated in Figs. 6 to 9, the particular modified dishwasher unit 110 shown comprises a chest 120 having a suitably hinged lid 121. The lid 121 is sealed with sealing rods 24, as in the embodiment shown in Figs. 1 to 5, but venting is accomplished by a plurality of vent holes 122 extending through the lid and shielded by a splash shield 123, preferably removably mounted for ease of cleaning. The chest 120 is mounted in a frame 111 supported by legs 112, preferably three in number to provide a stable support for the chest. Each leg carries a suitable caster 113. The over-all height of the unit 110 is somewhat less than counter height or sink height, depending upon whether the unit is designed for storage beneath a counter or beneath a sink or counter drawer. To load and unload the unit, it is simply rolled out from its storage place on the casters 113.

In the lower portion of the chest 120 and extending longitudinally thereof is the single hollow impeller cylinder 140 mounted concentrically on a hollow axle 141 by means of the internal spacer disks 142 recessed within the ends of the cylinder 140. The ends of the axle 141 extend through the side wall of the chest 120, where they are journaled in conventional anti-friction bearings 143. As shown in Fig. 9, to provide an unpacked seal for the bearings 143, a sleeve 144, concentric with the axle 141, is mounted on the inside wall of the chest 120 and extends into the open ends of the cylinder 140. The length of the sleeve 144 effectively baffles any spray that might enter the open inner end of the sleeve. The bearing 143 and sleeve 144 thereby provide a frictionless, unpacked seal for the axle 141.

At one end the axle 141 is suitably plugged and carries a V-pulley 146 driven by the motor 145 by means of the V-belt 147, which also drives the drain pump 160. The other end of the axle 141 is connected through a rotary joint 148 to the inlet line 149 which, in turn, is connected by a conventional hose coupling 151 to a flexible hose 152 connected to a source of hot water, a solenoid-operated inlet valve 150 being interposed in the line 149. Water is supplied to the unit 110, therefore, by the opening of the valve 150, which admits water to the hollow axle 141.

The axle 141 is provided with a number of drilled openings 153 which admit water to the interior of the cylinder 140 between the spacer disks 142. The cylinder 140 is, in turn, provided with a plurality of drilled openings 154, through which the incoming water is thrown by centrifugal force at a high velocity against the ware in the chest. The advantages of this means of admitting water to the unit are that incoming hot water is somewhat chilled by the cylinder 140 and the ware in the chest is initially subjected to a scouring, detergentless, relatively cool spray which is effective in rinsing milk, eggs, and similar albuminous food from the ware.

The balance of the water control system comprises a manually started timer 155 which controls the starting and stopping of the motor 145 and, at timed periods during the operation of the motor 145, the opening and closing of the inlet valve 150 and opening and closing of the drain valve 156. Drainage is effected by a drain 157 connected by the line 158 to the drain pump 160. The maximum water level in the chest 120 is controlled by an overflow pipe 159 connected to the drain 157 between the drain valve 156 and the pump 160. The discharge pipe of the pump 160 is connected by a suitable hose coupling 161 to a flexible drain hose 162.

The particular advantage of the above described water control system, and particularly the drainage, is that the unit 110 may be installed with a minimum or even complete absence of plumbing. The inlet hose 152 is usually connected to a T inserted in the hot water line to a sink, although a slipover flexible coupling may be employed to connect the inlet hose to the sink faucet and thus eliminate any plumbing in this connection. While the drain hose 162 may be connected by a T above the sink trap under some building codes, usually it is more convenient to provide the drain hose with a molded hook end so that the unit may be drained into a sink. Under no circumstances is it necessary to install the unit 110 so that it becomes a permanent fixture, thereby rendering a unit made according to this invention feasible for demonstration sales and also for purchase by persons living in rental dwellings.

It is to be noted that the single impeller cylinder 140 in unit 110 does not employ a vane 50, as does the cylinder 40 in the unit 10. While the omission of the vane 50 decreases the velocity of the water thrown by the impeller cylinder as well as the efficiency of the cylinder, the effective angle through which water is thrown is increased and permits a thorough washing of ware racked on either side of the cylinder. Due to the decrease in velocity of water thrown by the cylinder 140, as compared with that thrown by a cylinder and vane combination, it is advisable to use such vaneless cylinders in combination with racks which will insure an adequate spacing of the ware and slight tilting of dishes and similar flat ware in a generally vertical plane transverse to the cylinder.

A preferred system of racks to effect the desired arrangement of ware above the cylinder 140 is shown in Figs. 6, 7, and 9 and comprises a plurality of pairs 125 of rods 124 transverse to the length of the cylinder 140, the rods 124 in each pair being spaced too close together to permit a dish to be inserted between them, but the pairs 125 being spaced far enough apart to permit a dish to be inserted between the pairs. Dishes inserted between the pairs 125 rest upon

notched angles 126 extending parallel to the cylinder 140 and dishes loaded on either side of the cylinder 140 are spaced from each other by the notched divider angle 127. To permit bowls or like deep dishes and pans to be racked, several pairs 125 are omitted and replaced by simple hooks 128, as shown in Fig. 9. Supplemental racks 129 are provided beneath the rods 124 to receive glasses, cups and the like and a basket 130 is preferably employed for receiving silverware.

It is to be understood that my invention is not limited to the specific embodiments disclosed but may be variously modified to include any one or more of the several features as claimed in the appended claims.

What is claimed is:

1. A dishwashing unit comprising a chest, rack means in said chest, a substantially horizontal smooth cylinder extending transversely across said chest, journal means for supporting said cylinder, means to maintain a maximum water level in said chest below said rack means and the axis of said journal means and to maintain said cylinder sufficiently submerged in said water to produce a scouring throw of water, and power means to drive said cylinder at a rate of speed to throw a longitudinally continuous spray of water against ware supported in said racks.

2. A dishwashing unit as defined in claim 1 in which at least one end of said journal means extends through a wall of said chest, said unit including a bearing for said journal means carried by said wall of said chest, and an elongated sleeve concentric with said journal means and extending inwardly from the wall of said chest above said water level, whereby said sleeve will baffle said journal means and maintain a protective seal for said bearings.

3. A dishwashing unit as defined in claim 1 in which said rack means comprises a longitudinal member extending parallel to said cylinder and transverse rods alternately spaced relatively closer together and farther apart and adapted to receive ware between said farther spaced rods, whereby such ware will be maintained in a generally vertical plane transverse to said cylinder.

4. A dishwashing unit as defined in claim 1 including a fixed vane having an edge adjacent the surface of said cylinder and supported above the water level in said chest, whereby said vane directs the jet of water thrown by said cylinder.

5. A dishwashing unit as defined in claim 4, in which the edge of said vane is curved so that the bight between said cylinder surface and said edge defines a longitudinal nozzle.

6. A dishwashing unit comprising a chest, a horizontal substantially smooth cylinder extending transversely across said chest, rack means in said chest adjacent a major portion of the periphery of said cylinder, journal means for supporting said cylinder, means to maintain a maximum water level in said chest below said rack means and the axis of said journal means and to maintain said cylinder sufficiently submerged in said water to produce a scouring throw of water, power means to drive said cylinder at a rate of speed to throw a longitudinally continuous spray of water against ware supported in said rack means.

7. A dishwashing unit comprising a chest, a horizontal substantially smooth cylinder extending transversely across said chest, rack means in said chest, journal means for supporting said

cylinder, means to maintain a maximum water level in said chest below said rack means to submerge from one third to one sixth of the periphery of said cylinder, and power means to rotate said cylinder whereby a high velocity high volume scouring throw of water is projected throughout said chest against ware held in said rack means.

8. A dishwashing unit comprising a washing chamber, rack means in said chamber, rotatable water slinging means in said chamber, said water slinging means having an outer periphery of substantially constant radius in any given plane of rotation whereby ware may harmlessly come into contact with said water slinging means while it is rotating, the axis of rotation of said water slinging means extending transversely across said chamber, means to supply water along the length of said water slinging means whereby water is thrown outwardly from points throughout the length of said water slinging means to scour ware supported in said rack means.

9. A dishwashing unit comprising a washing chamber, rack means in said chamber, rotatable water slinging means in said chamber, said water slinging means having an outer periphery of substantially constant radius in any given plane of rotation whereby ware may harmlessly come into contact with said water slinging means while it is rotating, the axis of rotation of said water slinging means extending transversely across said chamber, means to supply water along the length of said water slinging means whereby water is thrown outwardly from points

throughout the length of said water slinging means to scour ware supported by said rack means, means to drain water from said washing chamber, said rack means extending longitudinally along said water slinging means and including means to hold spaced ware at an acute angle to the plane of rotation of said water slinging means, the sine of said angle being substantially equal to the spacing between adjacent pieces of ware divided by the ware diameter.

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