March 6, 1951

J. STANITZ ET AL

2,543,993

DISHWASHING MACHINE

Filed May 3, 1945

6 Sheets-Sheet 1

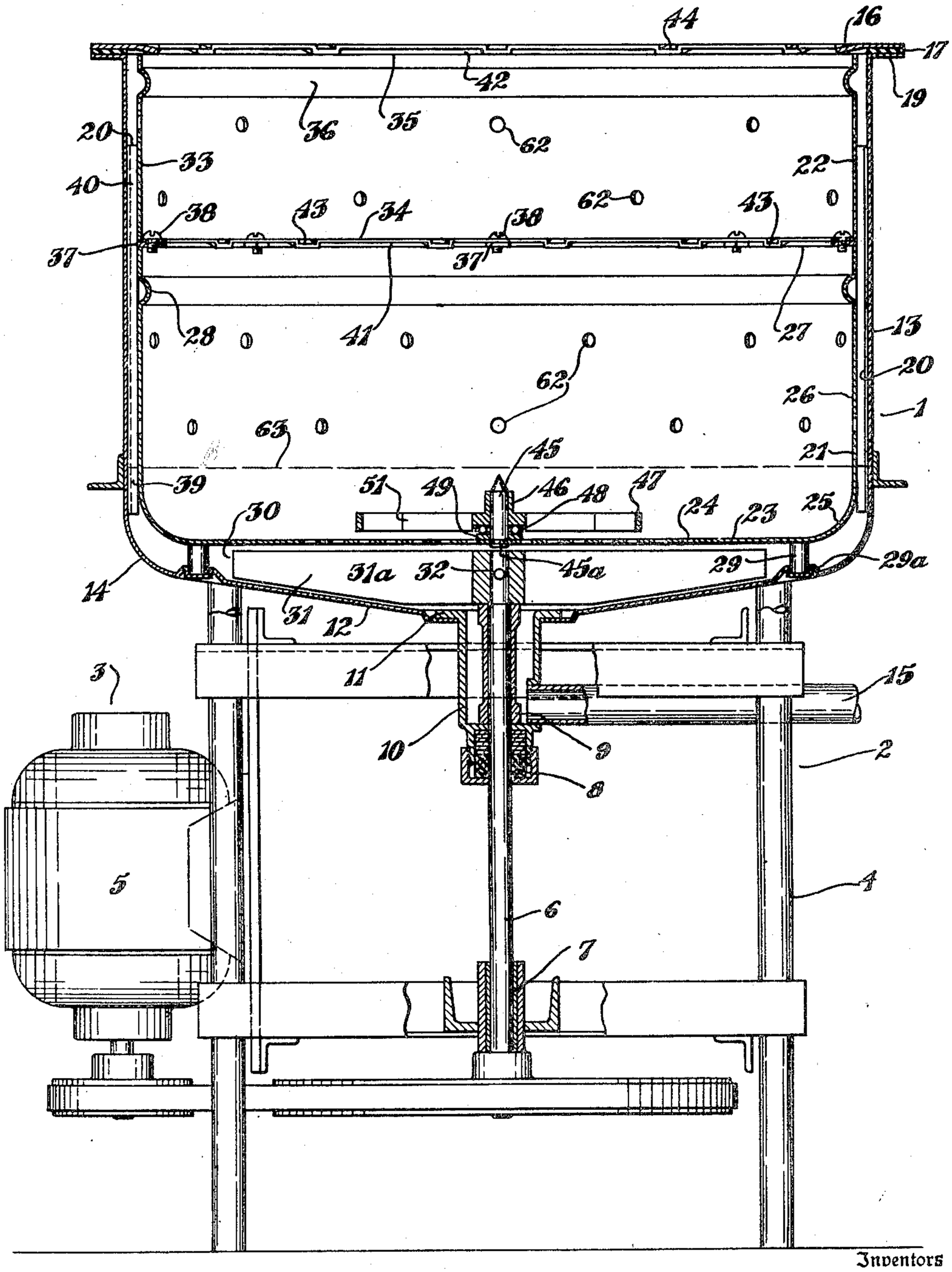

Fig. 1

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DISHWASHING MACHINE

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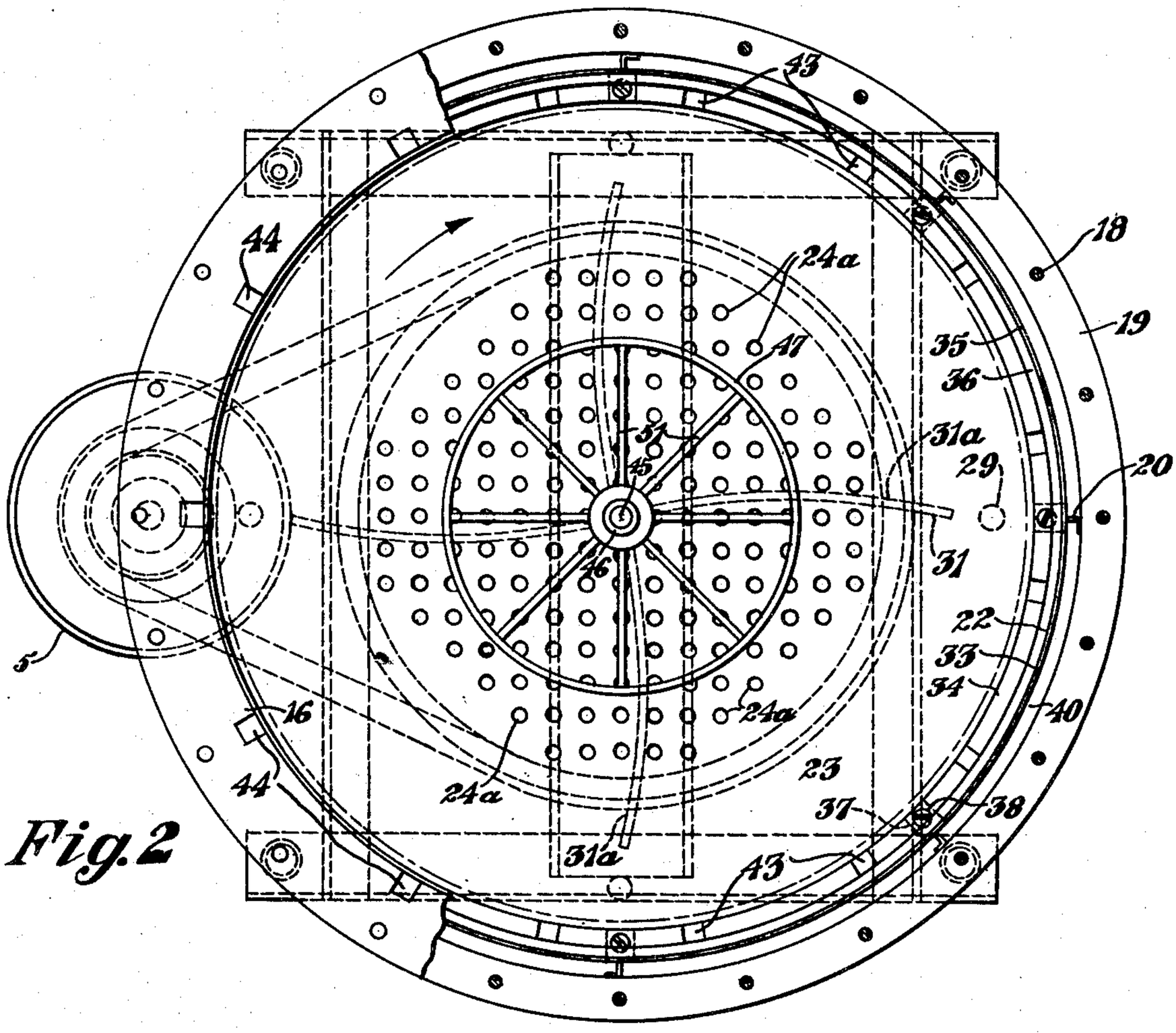

Fig. 2

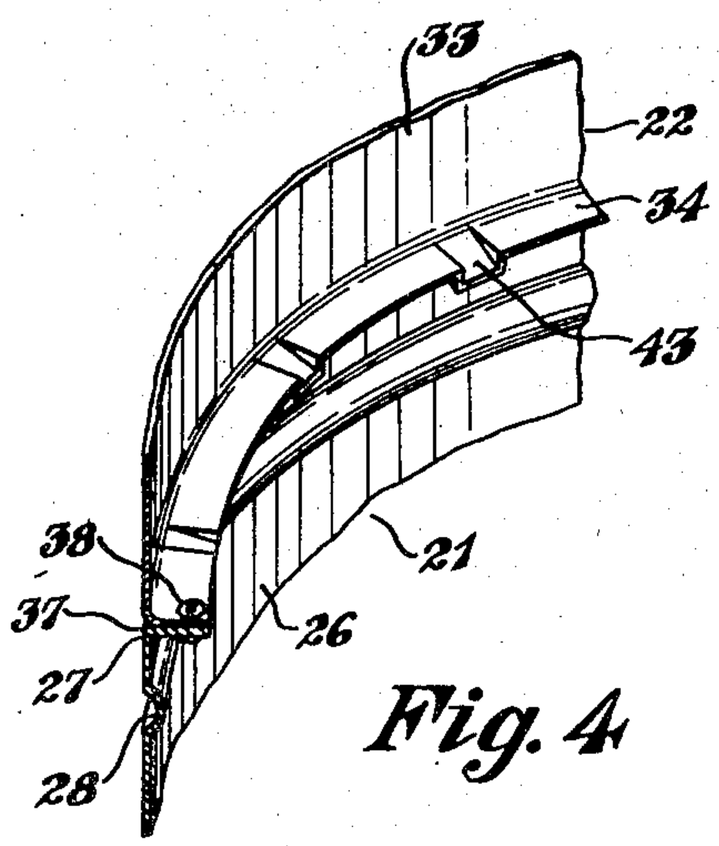

Fig. 4

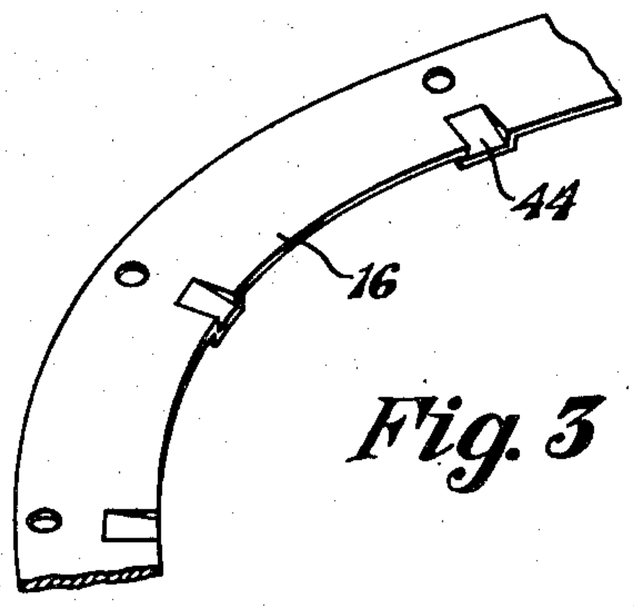

Fig. 3

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DISHWASHING MACHINE

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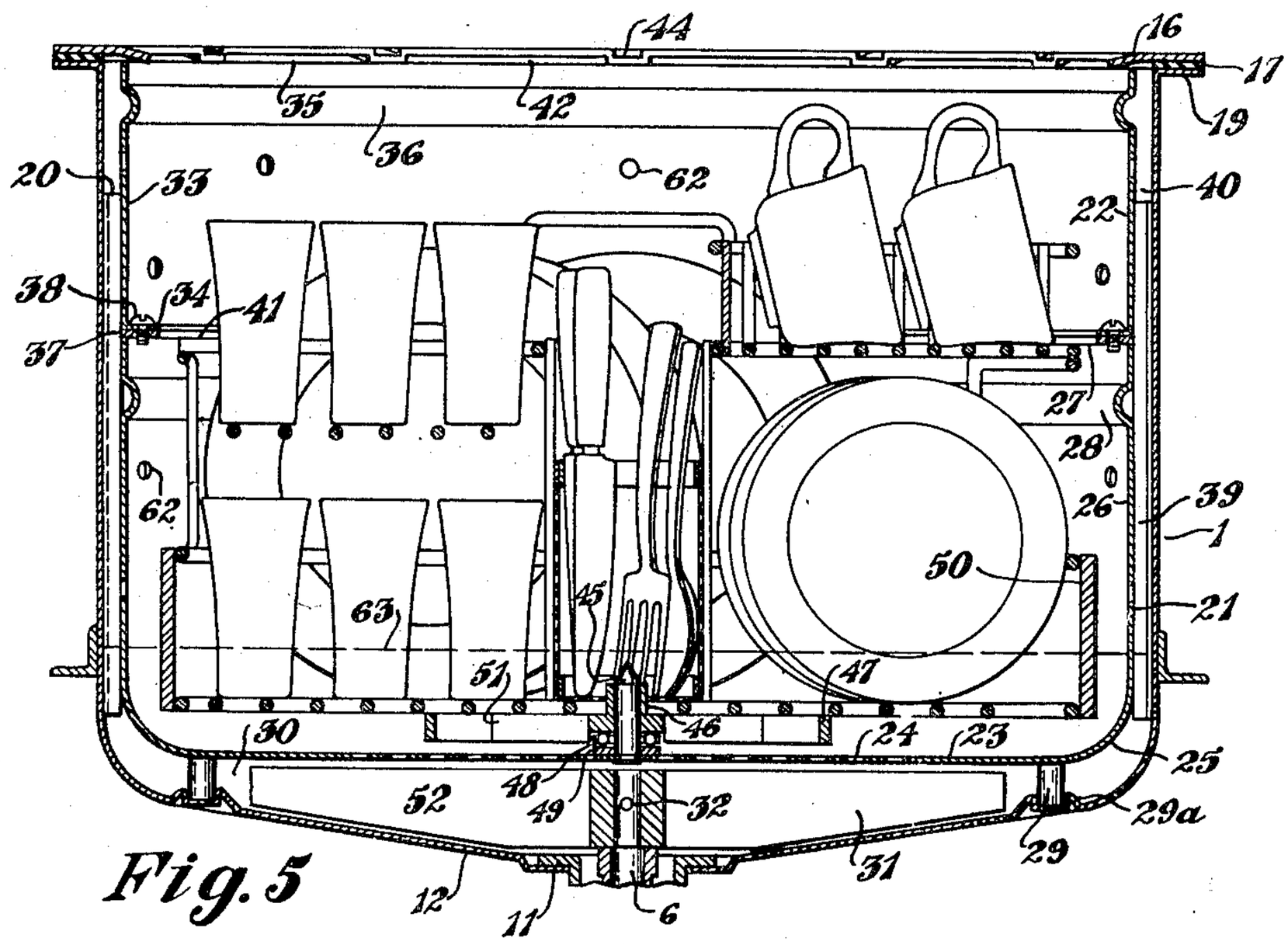

Fig. 5

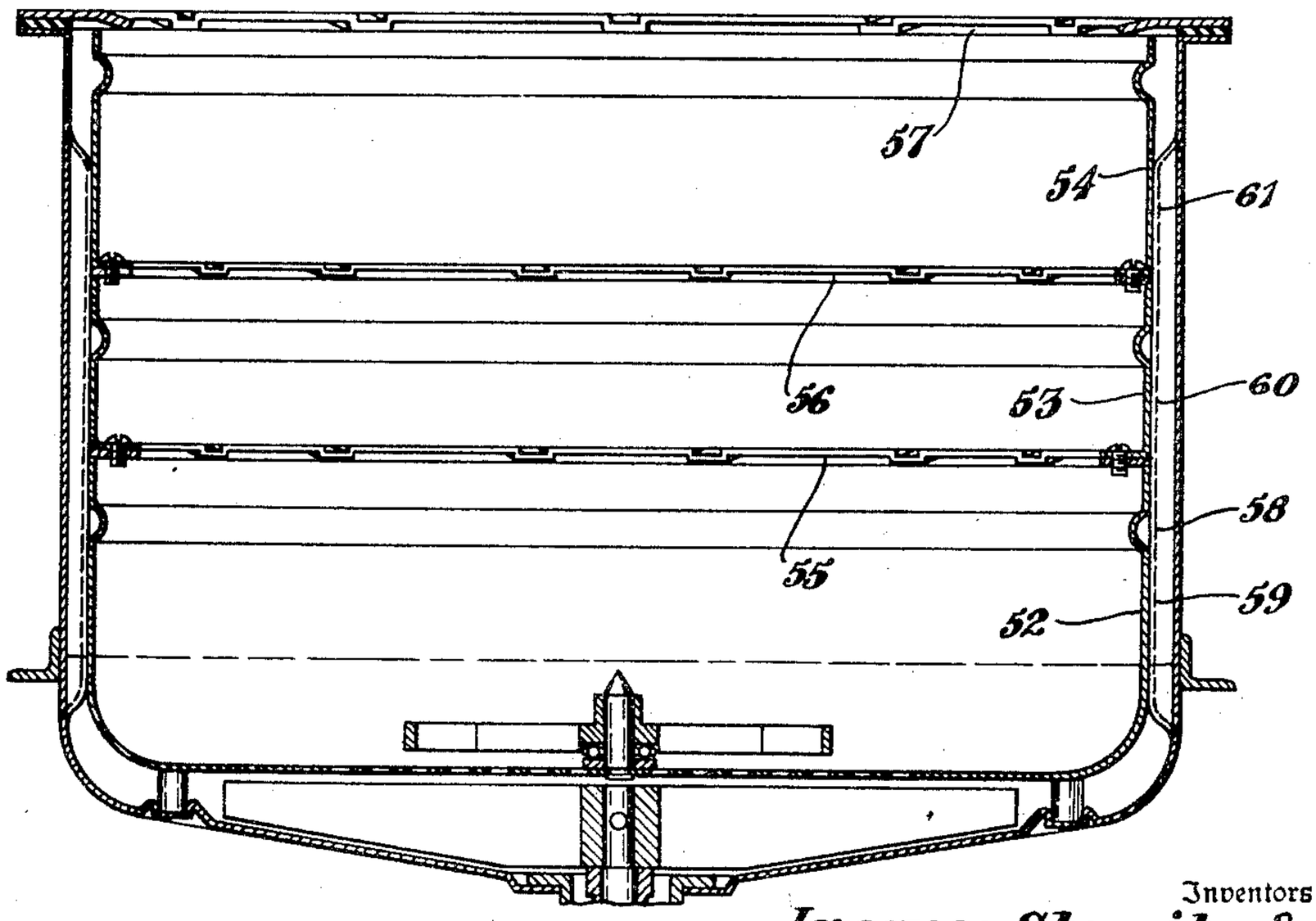

Fig. 6

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DISHWASHING MACHINE

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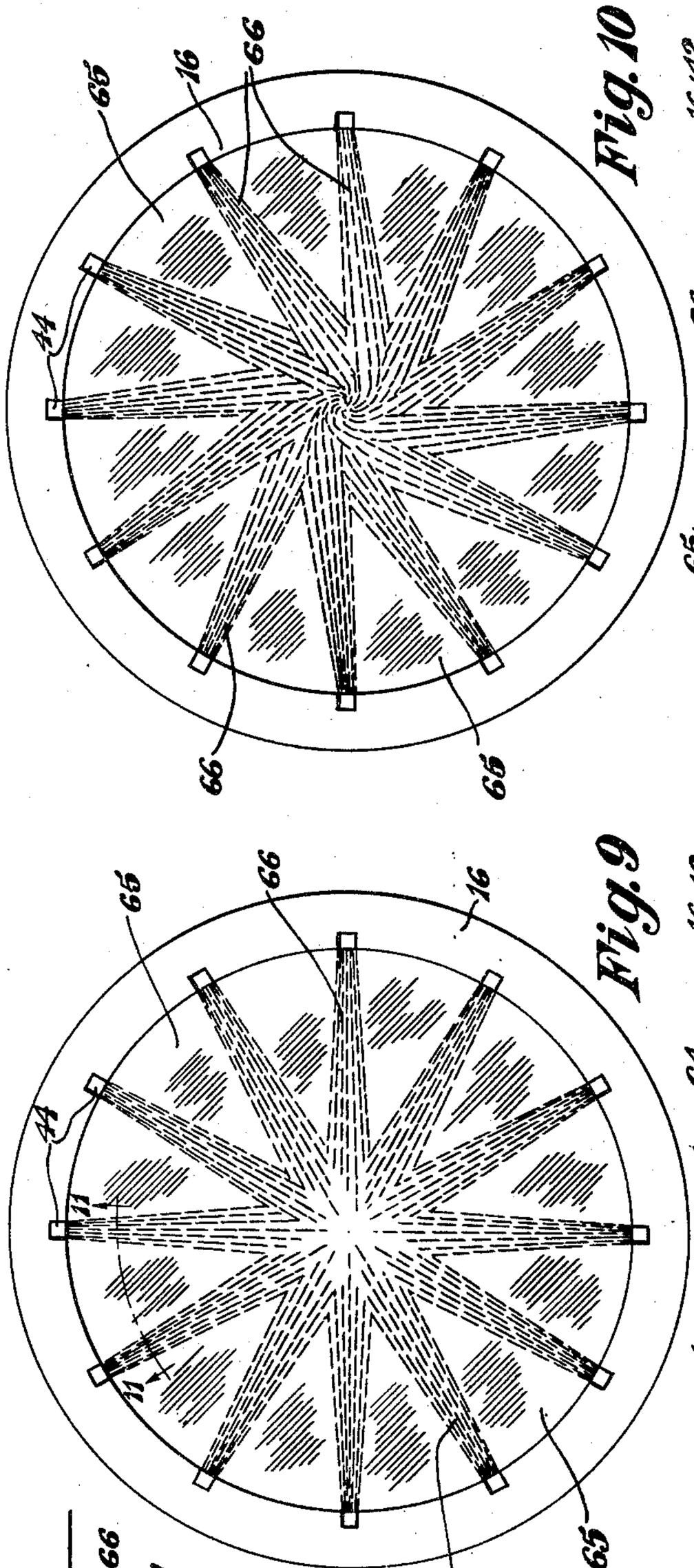

Fig. 10

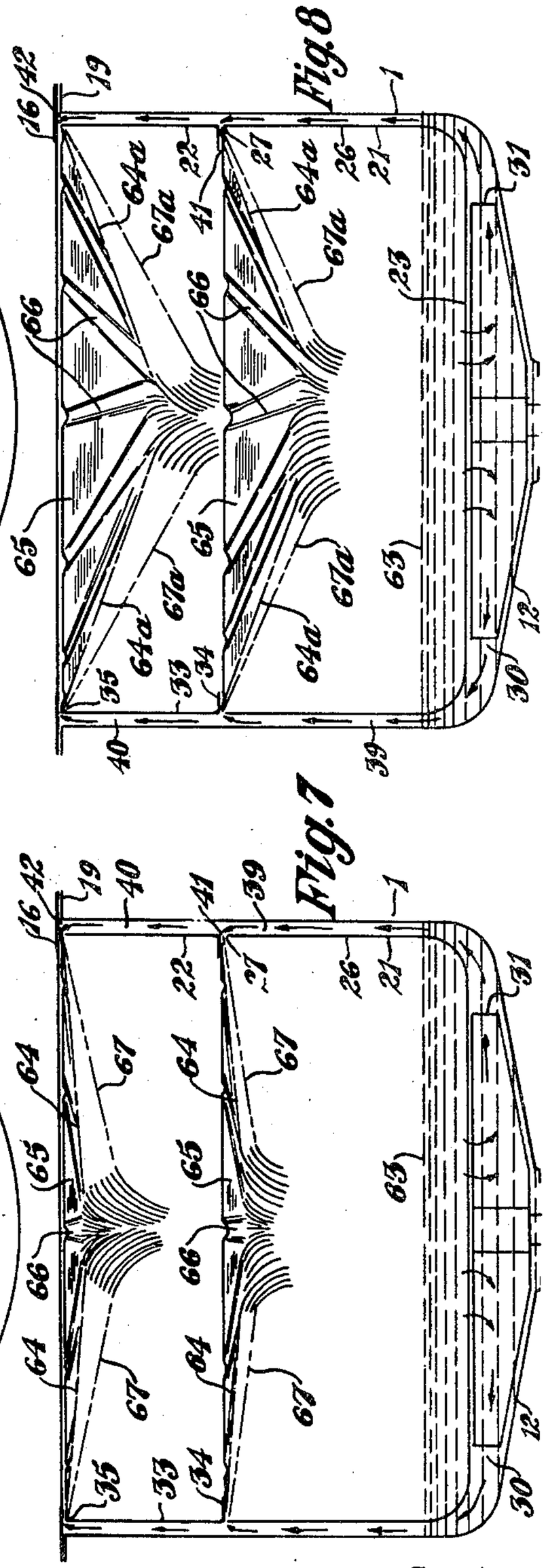

Fig. 8

Fig. 9

Fig. 7

Fig. 11

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DISHWASHING MACHINE

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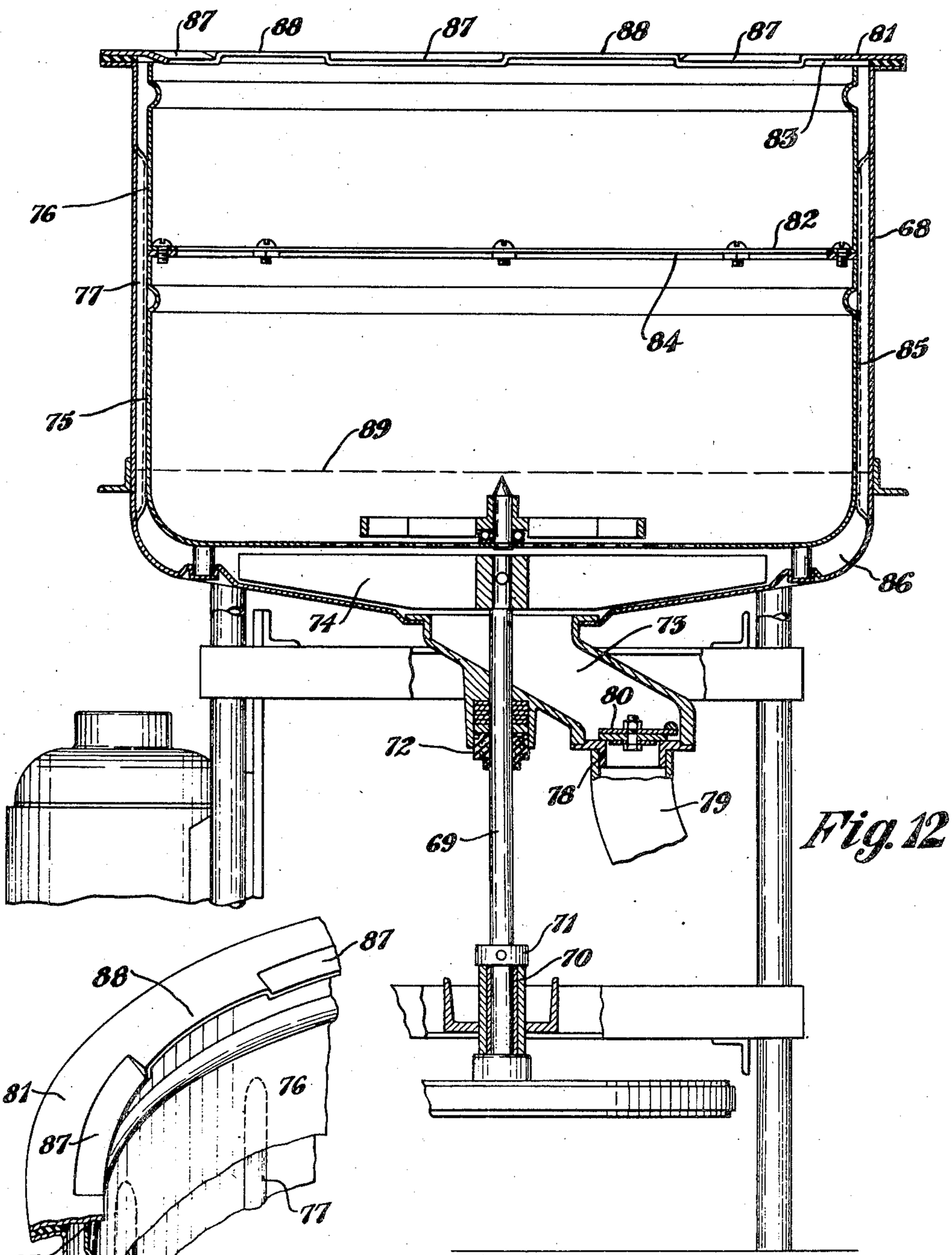

Fig. 12

Fig. 13

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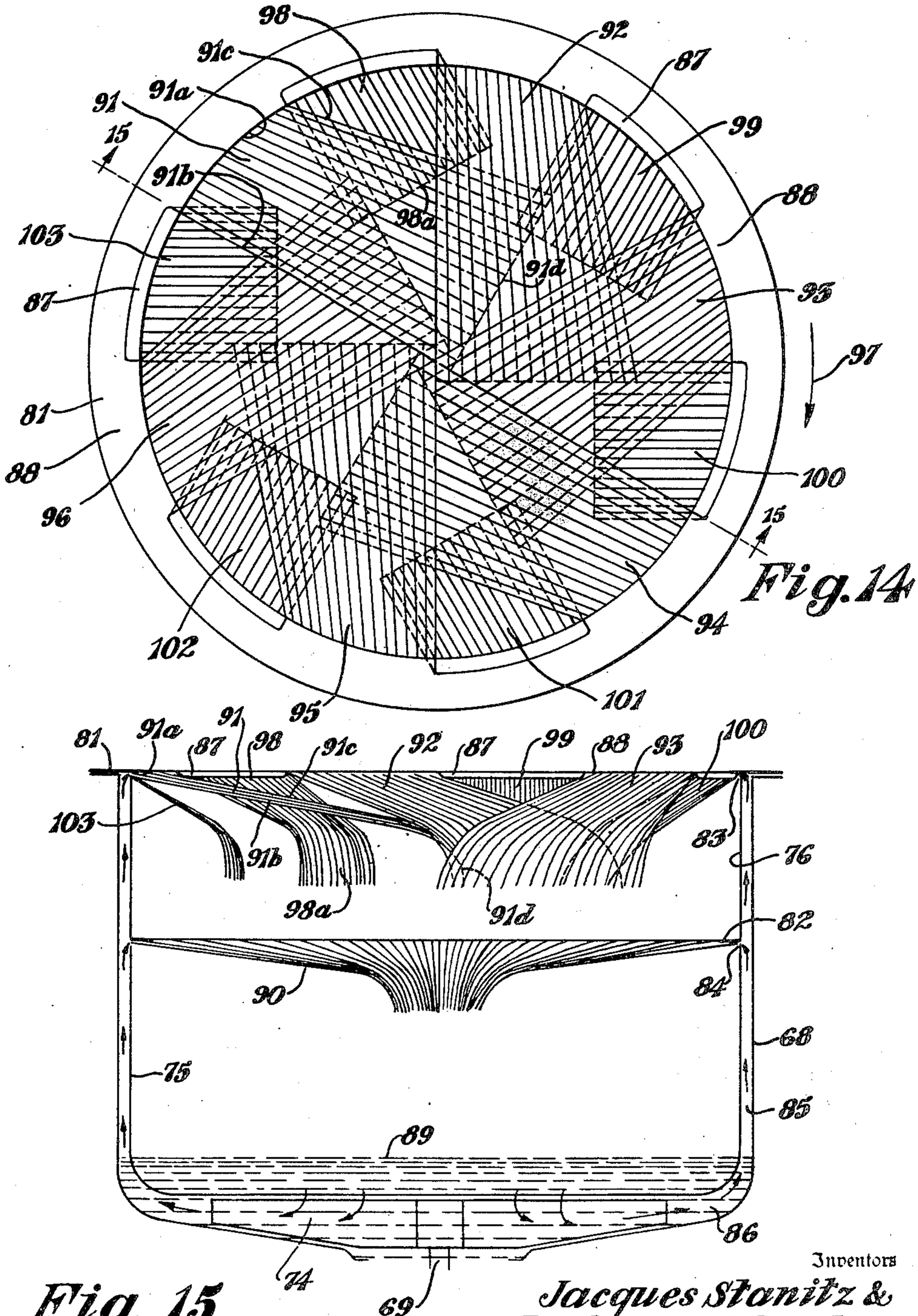

Fig. 14

Fig. 15

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UNITED STATES PATENT OFFICE

2,543,993

DISHWASHING MACHINE

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Application May 3, 1945, Serial No. 591,644

10 Claims. (Cl. 134—141)

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The invention relates to dishwashing machines and more particularly to a domestic or household type of dishwasher and to the construction of and the cooperative relation between elements thereof for obtaining complete and uniform washing of dishes placed in a removable basket therein.

There are prior art dishwashers in which washing liquid is jetted through holes in an inner tub from a body of liquid forced upward between the inner and an outer tub by a rotary impeller at the bottom of the outer tub below the inner tub. The jets strike dishes contained in a basket within the inner tub and may satisfactorily wash some of the dishes located adjacent the outer periphery of the basket but the jets do not penetrate to the mass of dishes within the central portion of the basket except by casual splashing. Moreover, such jets do not provide sufficiently forceful liquid sprays to dislodge and completely remove food particles and the like from the dishes, particularly if the dishes have been permitted to stand soiled for any appreciable time.

There are other prior art dishwashers in which a body of liquid is forced upward between inner and outer tubs by a rotary impeller at the bottom of the outer tub below the inner tub and overflows at the top of the inner tub in an inwardly directed sheet-like stream substantially radially toward the center of the tubs. The central convergence of the sheet-like stream forcefully strikes dishes at the top of the central portion of a basket within the inner tub and may satisfactorily wash some of the dishes in the central core of the mass of dishes within the basket. However, the mass of dishes located annularly around the outer periphery of the basket is not washed by the centrally converging overflow stream, except by occasional splashing.

Holes are sometimes provided in the inner tub of such a dishwasher to provide jets of washing liquid directed against dishes immediately adjacent the jets. When such a dishwasher is relatively small, the mass of dishes in the basket has a small diameter and is shallow in depth, and a satisfactory dishwashing operation may be carried out. However, the capacity of the basket for such a small washer is very limited and can only accommodate few dishes in performing a washing operation. When the capacity of a dishwasher thus constructed is increased to accommodate the dishes, say for a dinner for four to six people, the washing action is insufficient to properly wash the annular mass of dishes at and adjacent the periphery of the basket.

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There are still other prior art dishwashers in which dishes are placed in a basket in a tub above a relatively large rotary impeller. The spray, agitation or turbulence of washing fluid is very forceful at the bottom of the tub of such a dishwasher and may satisfactorily wash and clean the dishes in a zone at the bottom of the basket. The impeller also acts as a fan and creates a mist-like condition in the remainder of the tub but the mist at the top does not satisfactorily wash and clean the dishes in the upper zone of the basket.

Accordingly, there has existed and continues to exist in the art the problem of providing a domestic or household dishwasher which will adequately and completely wash and clean a complete load of dishes and at the same time have sufficient capacity to accommodate the dishes required for a dinner for say six persons.

It is relatively easy to wash and clean certain types of foods from dishes; but other types of food are very difficult to dislodge and remove from soiled dishes particularly when the food particles have dried on the surfaces of dishes. Thus, dried food particles on dishes ordinarily cannot be dislodged and removed by a stream or jet of water striking the dish in a direction normal to the surface of the dish; but can only be dislodged and washed away by a jet or spray striking the surface of the dish at an acute angle and preferably as nearly tangentially to the dish surface as is possible.

Moreover, the water jet or spray must strike the dish surface with considerable force, and not by mere splashing, in order to properly dislodge food particles from and clean the dish surfaces. The problem of jetting forceful sprays in the proper direction against every surface of every dish in a large mass of dishes contained in a basket is complicated because the dishes of necessity, by reason of their various sizes and shapes, must be somewhat haphazardly arranged in the basket and they therefore present dish surfaces located in an infinite number of different positions.

Accordingly, it is necessary, in order to properly wash dishes in a dishwasher, to establish conditions whereby dish surfaces extending in an infinite number of directions can each and all be struck throughout their entire surfaces with forceful liquid jets or sprays at an acute angle to each such dish surface.

In other words, provisions must be made for

directing forceful sprays against dishes contained in a basket throughout the entire volume of the basket, and at an acute angle to the dish surfaces, irrespective of the dish arrangement within the basket.

Accordingly, it is a primary object of the present invention to provide an improved household or domestic dishwasher construction in which a large number of dishes may be uniformly washed.

Furthermore, it is an object of the present invention to provide a new dishwasher construction in which forceful liquid jets or sprays may be directed against every surface of every dish of a large number of dishes in the dishwasher wherein the dish surfaces are located in an infinite number of positions.

Likewise, it is an object of the present invention to provide a new dishwasher construction having relatively few parts of simple construction in which forceful spray coverage is obtained over the multi-surfaces of the dish mass.

Also, it is an object of the present invention to provide a new dishwasher construction in which forceful spray coverage is obtained over the multi-surfaces of the dish mass and in which the dish-containing basket may be readily placed into or removed from the dishwasher.

We have discovered that a large number of dishes may be completely and uniformly washed in a dishwasher generally of the overflow type modified by providing a plurality of overflows, one above another, by deflecting the centrally converging sheet jet from at least one and preferably the top overflow at a plurality of zones spaced a substantial distance apart around the periphery of the inner tub, and by rotating the dish-containing basket.

We have further discovered that the basket of a dishwasher may be rotated within the dishwasher tub without any positive driving connection between the basket and the driving means for the liquid impeller.

It is therefore a further object of the present invention to provide a new dishwasher construction in which the dish-containing basket is rotated during operation of the dishwasher without direct driving connection between the basket and dishwasher drive means, thereby eliminating difficulties in supporting the basket within the dishwasher for ready placement and removal.

Likewise, it is an object of the present invention to provide a new dishwasher construction in which the dish-containing basket is rotated by the liquid currents in the dishwasher.

Finally, it is an object of the present invention to incorporate the foregoing desiderata in the construction of a dishwashing machine.

These and other objects and advantages apparent to those skilled in the art from the following description and claims may be obtained, the stated results achieved, and the described difficulties overcome, by the devices, constructions, arrangements, combinations, sub-combinations, parts elements, discoveries and principles which comprise the present invention, the nature of which is set forth in the following general statement, preferred embodiments of which—illustrative of the best modes in which the applicants have contemplated applying the principle—are set forth in the following description and shown in the drawings, and which are particularly and distinctly pointed out and set forth in the appended claims forming part hereof.

The nature of the improvements in dishwashing machines of the present invention may be

stated in general terms as preferably including in an overflow-type dishwashing machine, an outer container or tub, an inner container or tub, an impeller in the chamber between the inner and outer tub bottoms, means for rotating the impeller to withdraw liquid from the inner tub through perforations in the bottom thereof into the impeller chamber and to then force the liquid outwardly against the side walls of the outer tub and thence upwardly along the annular space between the inner and outer side walls, means forming a plurality of substantially endless annular slit orifices in the inner tub side walls communicating with said annular space, deflector means for at least one of the slit orifices at spaced intervals annularly therearound, a dish-containing basket mounted for rotation about a vertical axis within the inner tub, means associated with said basket for rotating the basket, said means preferably being actuated by rotary liquid currents set up in the bottom of the inner tub by the impeller means, the impeller drive means including a drive shaft extending through the bottom wall of the outer tub, a sump formed in the outer tub bottom wall around said drive shaft, and drainage means for the dishwasher communicating with said sump.

By way of example, preferred embodiments of the improved dishwashing machine are illustrated in the accompanying drawings forming part hereof, wherein:

Figure 1 is a vertical sectional view taken through a dishwashing machine of the overflow type incorporating the improvements of the present invention;

Fig. 2 is a plan view, with parts broken away and in section, of the improved dishwashing machine illustrated in Fig. 1;

Fig. 3 is a fragmentary perspective view of the upper overflow directing ring of the machine of Fig. 1, illustrating the deflector means thereon;

Fig. 4 is a similar view of the directing ring and deflector means thereon for an intermediate overflow slit orifice of the machine of Fig. 1;

Fig. 5 is a view similar to a portion of Fig. 1 illustrating a dish-containing basket with a load of dishes therein placed in the dishwasher;

Fig. 6 is a view similar to a portion of Fig. 1 of a modified form of construction;

Figs. 7 and 8 are diagrammatic sectional views illustrating the water or liquid action in the improved washing machine of Fig. 1;

Figs. 9 and 10 are diagrammatic plan views further illustrating the water or liquid action in the machine of Fig. 1;

Fig. 11 is a sectional view taken on the line 11—11, Fig. 9;

Fig. 12 is a view similar to a portion of Fig. 1 of a further modified form of construction;

Fig. 13 is a view similar to Fig. 3 of the upper overflow directing ring of the machine of Fig. 12, illustrating the deflector means thereon;

Fig. 14 is a diagrammatic plan view similar to Figs. 9 and 10 illustrating the water or liquid action of the machine illustrated in Fig. 12; and

Fig. 15 is a diagrammatic sectional view taken as on line 15—15, Fig. 14 similar to Figs. 7 and 8 further illustrating the improved water or liquid action of the machine of Fig. 12.

Similar numerals refer to similar parts throughout various figures of the drawings.

Referring first to the machine of Figs. 1 through 5, an example of improved dishwashing machine comprises an outer tub generally indicated at 1 supported in any desired manner on an under

base structure 2 upon which the driving mechanism generally indicated at 3, is mounted. The base 2 may be provided with legs 4 which may rest directly on a floor or may be supported on casters, not shown. Any desired type of drive mechanism may be used including a motor 5 and mechanism for transmitting rotary movement to the impeller drive shaft 6. The drive shaft 6 may be journaled in a lower bearing 7 and extends through a packing gland or stuffing box 8 and is journaled in an upper bearing 9 located within the sump 10 mounted at 11 centrally of the bottom wall 12 of the outer tub 1.

The tub 1 preferably includes a cylindrical side wall 13 connected by a rounded corner wall 14 with the bottom wall 12; and the bottom wall 12 is preferably formed to have a shallow conical shape, as shown, so that it drains to the sump 10. A drain pipe 15 is connected to the sump 10 and may be suitably connected with the drain pipe of a household plumbing system.

The upper end of the side wall 13 of the tub 1 is provided with an inturned annular directing flange 16 for a purpose to be later described. The flange 16 is illustrated as comprising a separate ring secured with a gasket 17 by suitable means such as bolts or rivets 18 to the outturned flange 19 at the upper end of the tub side wall 13.

Although the dishwasher, as illustrated, only includes a tub assembly and a base for the same, it is understood that the machine may be housed in a suitable cabinet, or housed in association with a kitchen sink. Irrespective of the manner in which the dishwashing machine is supported or housed, a suitable source of hot and cold water, not shown, is intended to be associated therewith.

The interior of the lower portion of the side wall 13 of the outer tub 1 is provided with a series of annularly spaced vertically extending projections 20 for directing washing fluid upward between the outer tub 1 and the inner tub composed of a lower tub member 21 and an upper tub member 22 within the outer tub 1. These projections may be formed as vertical corrugations in the side walls of the outer tub 1 or, as shown in Figs. 1 and 2, may be formed by vertically extending angle members 20 secured by any suitable means to the interior of the outer tub 1. The projections, either corrugations or the angle members 20, also assist in centering the inner tub within the outer tub.

The lower inner tub member 21 includes a bottom wall 23 provided with a series of perforations 24, a rounded corner wall 25 and a cylindrical side wall 26 terminating at an upper edge 27 and formed preferably with a bead 28 adjacent the upper edge 27.

A plurality of feet 29 may be secured in any desired manner to the bottom 23 of the lower inner tub member 21. The feet 29 may be engaged with or secured to the bottom wall 12 of the outer tub 1 in any desired manner as by engaging the same with or securing them to bosses 29*a* on the bottom wall 12 of the outer tub 1 to space the tub bottom wall 23 of the inner tub a fixed distance above the bottom wall 12 of the outer tub 1 so as to form an impeller compartment generally indicated at 30 in which a rotary impeller 31 is located mounted at 32 on the upper end of impeller shaft 6. The engagement between the feet 29 and bosses 29*a* also prevents the inner tub from rotating within the outer tub 1, and centers the inner tub within the outer tub 1.

The upper section 22 of the inner tub is preferably formed with a cylindrical side wall 33, a lower inturned flange 34, and terminates in an upper free edge 35 with a bead 36 formed in the side wall 33 below the upper free edge 35. A plurality of spacer members 37 are secured by any suitable means such as by screws 38 to the inturned flange 34 at the bottom of the upper section 22 of the inner tub. The upper section 22 of the inner tub is thus spaced from the upper edge of the lower section 21 of the inner tub and supported thereon by the spacer members 37; and the upper inner tub section 22 is centered within the outer tub 1 by the projections 20 on the side walls 13 of the outer tub 1.

When the inner tub sections 21 and 22 are thus assembled within the outer tub 1, an annular channel or chamber 39 is formed around the lower inner tub section 21, interrupted by the vertically extending inner tub projections 20; and a similar annular chamber 40 is formed around the upper inner tub section 22 communicating with the chamber 39. The chamber 39 likewise communicates with the impeller chamber 30.

Likewise, when the inner tub sections 21 and 22 are assembled within the outer tub 1, as shown, an annular slit orifice 41 is formed between the upper edge 27 of the lower tub section 21, and the lower face of the inturned flange 34 of the upper tub section 22. The annular slit orifice 41 is interrupted at certain places around its periphery by the spacer members 37 by which the upper tub section 22 is supported on the lower tub section 21.

A similar annular slit orifice 42 is formed between the upper edge 35 of the upper tub section 22 and the lower surface of the annular inturned flange 16 in the upper end of the outer tub 1.

A series of depressions or indentations 43 (Fig. 4) are struck downward in the inturned flange 34 at the bottom of the upper tub section 22, and a similar series of indentations or depressions 44 (Fig. 3) are struck downward at the inner edge of the inturned flange ring 16.

A center post 45 is mounted at 45*a* on the bottom 24 of the lower inner tub section 21; and the post 45 journals the hub 46 of a spider-like platform or turntable 47, a thrust bearing 48 preferably being interposed between the hub 46 and a washer 49 resting on the tub bottom. A dish-containing basket 50 (Fig. 5) may be placed within the inner tub of the dishwasher and rest upon the turntable 47 after dishes, as illustrated in Fig. 5, have been placed therein for being washed. Upon completion of a dishwashing operation, the basket 50 may be removed from the dishwasher.

As shown, the turntable 47 includes spider-like flat radial blades 51 for a purpose to be later described. It is understood, however, that the turntable element 47 may be permanently incorporated as a part of the construction of the basket 50, if desired, in which event, the hub member 46 is placed over or removed from the center post 45 in placing the basket 50 in or removing it from the dishwasher.

We have discovered that the shape and arrangement of the blades 31*a* of the impeller 31 is important for efficient operation and for most satisfactory water action to be later described. Thus, a four-bladed impeller is indicated in Fig. 2 because the same appears to be somewhat more efficient than a three bladed impeller or an impeller having some other number of blades. However, it is understood that the invention is

not limited to the use of a four-bladed impeller because a different number of blades gives satisfactory results.

In prior art dishwashers, involved twisted shapes for the impeller blades have been indicated as being important; but we have discovered that for efficient operation, the blades may be flat in any vertical section, without any curvature giving a lead at the bottom or top edge of the blades. Furthermore, the blades are each preferably slightly curved, as indicated in Fig. 2, from the impeller hub to the outer ends of the blades 31*a*. Finally, the blades are curved concave in the direction of rotation of the impeller 31 as indicated by the arrow in Fig. 2. Tests have shown that an impeller thus constructed and rotated requires less power than when operated in the opposite direction; contrary to the usual mode of operation of curved bladed impellers which are usually rotated with the blades convex in the direction of rotation.

Although the improved impeller construction is desirable because it is inexpensive and efficient in operation, the operation of the improved dishwasher is not dependent upon the use of the specific impeller shown and described. Any form of impeller may be used which will force washing liquid upward between the inner and outer tubs and discharge the liquid from the annular slit orifices 41 and 42 with considerable force; and which will also set up a swirling liquid current at the bottom of and within the inner tub in a manner to be later described.

A modified form of construction is illustrated in Fig. 6 in which the inner tub is composed of three sections, rather than two sections, and includes a lower section 52, an intermediate section 53 and an upper section 54 constructed in the same manner as the upper and lower inner tub members 21 and 22 of Fig. 1. In the modified construction of Fig. 6, an annular slit orifice 55 is provided between the lower and intermediate tub sections 52 and 53, a second annular slit orifice 56 is provided between the intermediate and upper inner tub sections 53 and 54, and a third annular slit orifice 57 is provided at the top of the inner tub section 54.

The tub sections 52, 53 and 54 may be assembled within the outer tub in the same manner as described in connection with the construction illustrated in Fig. 1; and projections, such as vertically extending corrugations 58 may be provided in the side walls of the outer tub, similar to the angle members 20, to direct the liquid flow upward between the inner and outer tubs. Thus, the three channels 59, 60 and 61 around the inner tub sections 52, 53 and 54, respectively, are interrupted annularly by the vertical corrugations 58.

A series of holes may be placed in the side walls of any one or in all of the inner tub sections as indicated at 62 in the construction illustrated in Figure 1, or these holes may be omitted as shown in Figure 6.

In operating the dishwashing machine, the tubs are filled with hot washing liquid to the approximate liquid level indicated at 63 in Figs. 1 and 5. The washing liquid usually comprises hot water and soap and the like, to which may be added, if desired, a water softening compound or surface tension reducing agent. The soiled dishes to be washed are placed in a dish-containing basket 50, usually removed from the dishwasher, and the same are disposed in the most favorable positions in the basket to be readily

impinged from all angles by jetted liquid streams. As shown in Fig. 5, plates, dishes and the like are preferably placed on edge around the periphery of the basket, cups and glasses may be placed in movable supplementary trays or shelves, and silverware may be disposed in a central compartment. When the term "dishes" is used herein and in the appended claims, that term is intended to include chinaware, glasses, silverware, pots, pans, and the like.

After the soiled dishes have been thus placed in a most favorable position in the basket 50, the basket is inserted in the dishwasher and placed upon the turntable 47. Thereupon, a cover may be placed upon the dishwasher although the use of a cover is not absolutely essential. The driving mechanism 3 is then started which rotates the impeller 31 in the direction indicated in Fig. 2. Rotation of the impeller 31 forces the washing liquid outward in the impeller chamber 30 and thence upward along annular chambers 39 and 40 from which the liquid is jetted with considerable force through annular slit orifices 41 and 42 and strikes the soiled dishes contained in the basket 50.

Washing liquid flows into the impeller compartment 30 through bottom openings 24 in the inner tub to the central portion of the impeller 31. It has been discovered that upon rotation of the impeller 31, some washing liquid is forced upward thereby through outermost holes 24*a* (Fig. 2) in the inner tub bottom wall 23 and this liquid tends to swirl within the bottom of the inner tub in the direction of rotation of the impeller. The swirling liquid current strikes the flat radial blades 51 of the turntable 47 and rotates the turntable, thus automatically rotating the basket 50 and dishes contained therein.

When plates and the like are disposed in the basket 50 in the manner illustrated in Fig. 5, the swirling liquid current also strikes the plates and imparts rotary movement to the basket through the plates. Thus, the basket is automatically rotated by means including the swirling liquid current in the bottom of the inner tub set up by the rotary impeller, the force of which is imparted to blades on the basket, or blades on a turntable upon which the basket rests, or to dishes contained within the basket.

Thus, the basket rotates during operation of the dishwasher and the surfaces of the dishes therein have constantly changing positions or locations with respect to the sheet sprays of liquid jetted under considerable force from the annular slit orifices 41 and 42, so that the washing liquid strikes the soiled dish surfaces from every direction with sufficient force to cleanse the soil and dislodge food particles from the dish surfaces.

The cross-sectional areas of compartments 39 and 40 and of annular slit orifices 41 and 42 are such that when the proper amount of washing liquid is contained within the dishwasher and the impeller 31 is rotating, continuous sheet-like sprays are jetted continuously under considerable force from the orifices 41 and 42. We have discovered in operating the dishwasher of the present invention that a pressure surge seems to occur in the body of liquid forced upward by the rotary impeller 31 in annular chambers 39 and 40.

While the reasons for the occurrence of this pressure surge are not clear, a possible explanation for the occurrences thereof is that a constant volume of washing liquid is contained within the dishwasher. As the impeller 31 rotates and forces washing liquid upward along cham-

bers 39 and 40, pressure is built up therein momentarily and the pressure head of the remaining liquid in the inner tub is momentarily reduced. As the liquid is jetted through orifices 41 and 42, the pressure in chambers 39 and 40 is momentarily reduced and the water lever in the inner tub momentarily rises. This cycle continues repeated and may account for the repeated pressure surges occurring in the annular chambers 39 and 40 which cooperate with the director rings 16 and 34, and the indentations 44 and 43, respectively therein, to obtain the remarkable and characteristic resulting water action of the dishwasher of the present invention.

If the flanges or director rings 16 and 34 were not provided with the deflector means or indentations 44 and 43, the annular streams of liquid jetted from the slit orifices 41 and 42 would be substantially flat or slightly dished downward, converging to the center, as indicated diagrammatically by the dot-dash lines 64 in Fig. 7. However, the deflector indentations 43 and 44 at spaced intervals around the flanges 16 and 34 deflect or contract each jetted liquid sheet spray 65 (Fig. 11) without breaking the continuity of the sheet, to form spaced rounded or trough-like spray portions 66 directed generally radially inward as indicated in Fig. 9. The locations of the bottoms of the trough-like spray portions 66 are indicated diagrammatically in dot-dash lines at 67 in Fig. 7.

We have discovered that if the deflector indentations 43 and 44 have a substantially sharp-cornered, angularly directed, flat shape, as illustrated in Figs. 3 and 4, the wavy trough-like spray formations 66 in the jetted sheet streams 65 have a shape suited to produce the best washing action. The indentations 43 and 44 must not be too close together. Twelve indentations are shown for the ring 16 in Fig. 9 where the ring has an approximate inner diameter of 19 inches. If twenty-four indentations 44 are provided in the ring 16 rather than twelve, there would be twenty-four trough-like formations 66 which would diverge and meet each other very close to the inner edge of the ring 16 thus substantially destroying the flat sheet stream portions 65 which intervene between the trough-like portions 66 as illustrated in Fig. 9. In other words, the indentations 44 are spaced far enough apart that the diverging trough-like spray portions 66 do not meet each other until they reach the central one-third portion of the dishwashing machine as illustrated in Fig. 9.

When the pressure surges to a maximum in chambers 39 and 40 as previously described, a sheet stream 65 is jetted from each annular slit orifice 41 and 42 at approximately the level and in the direction indicated at 64 in Fig. 7; and the unbroken spray or trough portions 66 are directed substantially radially inward as indicated in Fig. 9 and at the approximate location and level indicated at 67 in Fig. 7.

However, when the pressure of the liquid in chambers 39 and 40 drops, as previously described, the locations of the sheet streams 65 change from those indicated at 64 in Fig. 7 to those indicated at 64*a* by dot-dash lines in Fig. 8 with an accompanying drop of the locations of the bottoms of the troughs from the locations indicated at 67 in Fig. 7 to the locations indicated at 67*a* in Fig. 8. Thus, the characteristic constantly repeating pressure surges occurring in operation of the dishwasher result in a constantly repeating raising and lowerming of the sheet

stream jetted from the annular slit orifices 41 and 42 between the locations diagrammatically illustrated in Figs. 7 and 8.

The raising and lowering of the locations of the jetted sheet streams, and the pressure surges, are also accompanied by a change in the directions of the unbroken trough-like spray portions 66 of the sheet streams 65 which switch back and forth between the substantially radial directions thereof shown in Fig. 9 and the deflected locations thereof shown diagrammatically in Fig. 10.

Thus, the liquid sheet stream jets 65 and the spray portions 66 thereof, in moving up and down, and the spray portions 66 in deflecting back and forth in the sheet streams 65 as the sheet streams 65 move up and down, and the provision of a plurality of sheet streams 65 at a plurality of levels within the dishwasher, results in liquid striking the dishes contained in the basket which is rotating within the dishwasher in an infinite number of directions; and the liquid streams and spray portions traverse the dishes up and down and sideways while the dishes are moving so that every surface of every dish in the entire mass of dishes contained in the basket 50 is completely and thoroughly washed by the action of washing liquid jetted under considerable force against such surfaces.

The operation of the dishwashing machine is continued for from say two to six minutes if the soil on the dishes is not of a character difficult to remove, or if it has not dried on the dishes for a substantial length of time; and may be continued for a somewhat longer period of time if the soil is of a character difficult to remove. Thereafter, the washing liquid may be drained from the dishwasher through drain pipe 15, and rinse water may be introduced into the dishwasher and the dishwasher operated for a short period of time to rinse the dishes.

By providing a central drain sump 10 around the impeller driving shaft 6, complete drainage of the dishwasher is readily obtained and a sump is provided where food particles can settle so that the washing fluid circulated by the impeller is cleared of such food particles.

The provision of a plurality of overflows for jetting sheet streams of washing liquid against the dishes gives a more complete and uniform coverage of jetted liquid throughout the entire volume of the mass of dishes being washed, than is obtained in a dishwasher having only one top overflow merely converging to the center and which only properly washes the central upper core portion of the mass of dishes.

The provisions for obtaining a plurality of levels of jetted sheet streams moving up and down and having spray portions moving sideways, combined with a rotating basket which exposes substantially every part of every dish to forceful liquid spray action directed thereagainst from constantly changing directions results in complete and uniform washing action upon all dishes contained in the basket never heretofore to our knowledge obtained in any prior art dishwasher.

Moreover, because the moving dish surfaces present themselves from every angle to the action of the jetted liquid and because the jetted liquid has constantly changing directions, the liquid at some time or other strikes substantially every portion of every dish surface nearly tangentially to the dish surface, thus obtaining the optimum conditions for soil removal.

Although side jets of liquid from holes 62 may be provided to supplement the sheet stream jets,

as indicated in Fig. 1, the action thereof is merely cumulative or secondary to the primary and complete washing accomplished by the moving jetted sheet streams striking the moving dishes.

It is understood that the basket can be positively rotated, if desired, but the provision of positive driving connections merely increases the cost of construction and maintenance of the dishwasher; and the necessary rotation of the dish-containing basket is obtained automatically, without added cost by the liquid currents set up in the inner tub by the impeller.

The dishwashing machine shown in Figs. 12 through 15 comprises an outer tub **68**, supported in any desired manner, and having any desired type of drive mechanism to transmit rotary movement to the impeller drive shaft **69** journaled in a lower bearing **70** and supported thereon by a collar **71**. The shaft **69** extends through a packing gland or stuffing box **72**, and then through sump **73**; and an impeller **74** is mounted at the upper end of the shaft **69**. Inner tub sections **75** and **76** are mounted within the outer tub **68** in the same manner as the inner tub sections of the machine illustrated in Fig. 1, except that the directing projections on the outer tub **68** may take the form of inwardly projecting vertically extending corrugations **77**. The sump portion **73** may be shaped to form a drain outlet **78** with which a drain pipe **79** is connected, controlled by a valve **80**; and the drain pipe **79** may be suitably connected with the drain pipe of a household plumbing system.

The upper end of the side wall of the outer tub **68** is provided with an annular directing flange **81** and the upper inner tub section **76** is likewise provided with an inturned directing flange **82**; and the tub sections when assembled together with their directing flanges **81** and **82** form annular slit orifices **83** and **84** similar to the annular slit orifices in the machine illustrated in Fig. 1. The inner and outer tubs are spaced so that a compartment **85** is formed therebetween, interrupted by the projections **77**, and communicating between the impeller chamber **86** and the annular slit orifices **83** and **84**.

A series of indentations or depressions **87** are struck downward in the upper directing flange **81**, as illustrated in Fig. 13, to form deflector means; and as illustrated in Figs. 12 through 15, six director means **87** are formed with six intervening flats **88**. The indentations **87** and flats **88** each preferably have the same circumferential length. Thus, the inner circumference of the directing flange **81** is divided into twelve spaces having approximately equal length, alternating as flats and depressions.

With the proper amount of washing liquid, indicated by the water level **89** in Fig. 12, the machine may be loaded and operated in a manner generally similar to that described for the operation of the dishwashing machine of Fig. 1, to completely, rapidly and satisfactorily wash dishes.

In the operation of the modified form of dishwashing machine illustrated in Figs. 12 through 15, washing liquid flows into the impeller compartment **86** through bottom openings in the inner tub, and some washing liquid is forced upward by the impeller back into the outer periphery of the inner tub and swirls therein in the direction of rotation of the impeller thus rotating the dish-containing basket in a manner previously described.

Likewise, the impeller **74** forces washing liquid outward in impeller chamber **86**, thence upward along compartment **85** from which the liquid is jetted with considerable force through annular slit orifices **83** and **84**. The directing flange **82** for the lower annular slit orifice **84** (Fig. 15) is not provided with any deflector means so that the liquid is jetted from lower orifice **84** in an inwardly directed sheet-like stream converging radially toward the center of the washing machine as indicated at **90**.

However, the alternating flats **88** and deflector depressions **87** in the upper directing ring **81** for the upper annular slit orifice **83** produce quite a different, unusual and characteristic water action or pattern illustrated diagrammatically in Figs. 14 and 15. At each flat **88**, an unbroken primary sheet stream is jetted from the annular slit orifice **83** generally inward. These primary sheet streams are indicated at **91**, **92**, **93**, **94**, **95** and **96** in Figs. 14 and 15. The sheet stream **91** diverges somewhat from its zone of discharge **91***a* from the orifice **83** to present one substantially radial edge **91***b* and another edge **91***c* diverging toward the inner circumference of the directing ring **81** in the direction of rotation of the impeller **74** indicated by the arrow **97**. The jetted sheet stream **91** finally forms a falls indicated at **91***d* extending somewhat radially of the machine. Each of the other jetted sheet streams **92**, **93**, **94**, **95** and **96** is similarly formed, directed and located.

Because of loss of pressure head, the inner zone of the sheet stream **91**, and the falls **91***d* thereof, are at lower levels than the level of the intermediate zone of the next adjacent primary sheet stream **92**; so that the falls **91***d* of sheet stream **91** passes below, is located beneath and does not disturb the pattern of the sheet stream **92**. Likewise, the falls of sheet stream **92** is below and beneath sheet stream **93**; the falls of sheet stream **93** is below and beneath sheet stream **94**; the falls of sheet stream **94** is below and beneath sheet stream **95**; the falls of sheet stream **95** is below and beneath sheet stream **96**; and the falls of sheet stream **96** is below and beneath sheet stream **91**.

At the same time, another series of smaller secondary sheet streams is jetted from the annular slit orifice **83** at the deflector portions **87**, the secondary sheet streams being indicated at **98**, **99**, **100**, **101**, **102**, and **103** in Figs. 14 and 15. Each secondary sheet stream is projected at a greater angle downward from the horizontal than the angle of projection of the primary sheet streams, and forms a smaller water falls, indicated at **98***a* for secondary sheet stream **98**. In this manner, each secondary sheet stream passes below and beneath the primary sheet streams located at either side thereof.

Any surging, described in connection with the operation of the machine of Fig. 1, which may occur in operating the machine of Figs. 12 through 15, seems to have little effect upon the direction and location of the primary sheet streams, but may cause the secondary sheet streams to switch back and forth beneath the primary sheet streams.

Meanwhile, the dish-containing basket is rotating within the dishwasher in a direction also indicated by the arrow **97** so that the dishes therein pass successively below and are impinged by each of the water falls formed by the primary and secondary sheet streams in constantly changing positions or locations with respect to the liquid; and the considerable force of the sheet

streams and the falls thereof, strikes the soiled dish surfaces from substantially every direction, and completely cleanses the soil and dislodges food particles from the dish surfaces.

At the same time, the washing liquid is jetted from the lower level annular slit orifice 84 in sheet stream 90 toward the mass of dishes contained in the basket so that substantially every surface of every dish in the entire mass of dishes is completely and thoroughly washed by the action of washing liquid jetted with considerable force against substantially all of such surfaces. With the water action and characteristic pattern produced by the alternating flats and depressions on the upper directing ring 81, it is unnecessary to form a similar water pattern by alternating flats and depressions at the lower annular slit orifice 84, although the directing flange 82 thereof may be formed with alternating flats and depressions if desired; or it may be formed with depressions such as shown in Fig. 4.

In its fundamental concept, the improved dishwashing action and results of the present invention are obtained by providing an annular slit orifice construction from which washing liquid is jetted under considerable force in a plurality of definite different sheet streams, each directed in a different direction and at a level avoiding collision, intersection or interference with other sheet streams, so that a multi-directional jetted liquid pattern is maintained striking the surfaces of the dishes being washed from many different directions.

The improved dishwashing action and results are enhanced by rotating the dish-containing basket, while subjecting the dishes to the multi-directional jetted sheet streams, to strike the dish surfaces from an infinite number of directions.

The improved dishwashing action and results are further enhanced by providing a plurality of liquid jetting annular orifices, one above another, to enable the capacity of the machine to be increased, and to insure completely uniform washing in the shortest possible time of substantially all surfaces of all dishes where a large number of dishes are being washed at one time.

Accordingly, the dishwasher construction and arrangement of the present invention eliminates prior art difficulties, solves a complicated problem which has existed in the art, provides for adequate, complete and thorough washing and cleansing of a complete load of dishes of considerable size, provides for jetting washing liquid with considerable force against substantially every surface of every dish of a large volume of dishes from an infinite number of directions, provides for automatically rotating the dish-containing basket without direct driving connection, provides an improved impeller construction, and provides for accomplishing each of the foregoing objects in a simply constructed machine.

In the foregoing description, certain terms have been used for brevity, clearness and understanding; but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such words are utilized for descriptive purposes herein and not for the purpose of limitation and are intended to be broadly construed.

Moreover, the embodiments of the improved construction illustrated and described are by way of example and the scope of the present invention is not limited to the exact details of construction of the various parts.

Having now described the features of the invention, the construction and operation of preferred embodiments of the improved dishwashing machine, and the advantageous, new and useful results obtained thereby; the new and useful devices, constructions, arrangements, combinations, sub-combinations, parts and elements, and reasonable mechanical equivalents thereof, obvious to those skilled in the art, are set forth in the appended claims.

We claim:

1. In a dishwashing machine of the overflow-type wherein rotary impeller means between the bottoms of an inner and an outer tub draws washing liquid through the perforate bottom of the inner tub and forces it upwardly between the inner and outer tub walls, annular directing flange means spaced from the top of the inner tub and forming therewith an annular slit orifice from which washing liquid is jetted, and deflector means on the lower surface of the directing flange means at spaced intervals around the directing flange means forming the jetted liquid into a plurality of non-interfering sheet streams each directed in a different direction.

2. In a dishwashing machine of the overflow-type wherein rotary impeller means between the bottoms of an inner tub and an outer tub draws washing liquid through the perforate bottom of the inner tub and forces it upwardly between the inner and outer tub walls, flange means projecting inwardly of the periphery of the inner tub wall and forming with the inner tub wall an annular slit orifice extending around the inner tub at the top thereof from which washing liquid is jetted, and means projecting downward from said flange means within the periphery of the inner tub wall deflecting the washing liquid jetted from said orifice into multi-directional non-intersecting sheet streams.

3. In a dishwashing machine of the overflow-type wherein rotary impeller means between the bottoms of an inner and an outer tub draws washing liquid through the perforate bottom of the inner tub and forces it upwardly between the inner and outer tub walls, annular directing flange means spaced from the top of the inner tub and projecting inwardly of the periphery of the inner tub wall and forming therewith an annular slit orifice from which washing liquid is jetted, deflector means projecting downward from and at spaced intervals around the directing means forming the jetted liquid into a plurality of non-interfering sheet streams each directed in a different direction, dish-containing basket means within the inner tub, and means for rotating the dish-containing basket means.

4. In a dishwashing machine of the overflow-type wherein rotary impeller means between the bottoms of an inner and an outer tub draws washing liquid through the perforate bottom of the inner tub and forces it upwardly between the inner and outer tub walls, a plurality of inwardly directed annular flanges spaced one above another associated with the inner tub and forming therewith a plurality of annular slit orifices from which washing liquid is jetted, and deflector means at spaced intervals around each flange forming the liquid jetted from each orifice into a plurality of non-interfering sheet streams each directed in a different direction.

5. In a dishwashing machine of the overflow-type wherein rotary impeller means between the bottoms of an inner and an outer tub draws washing liquid through the perforate bottom of the inner tub and forces it upwardly between the

inner and outer tub walls, a plurality of inwardly directed annular flanges spaced one above another associated with the inner tub and forming therewith a plurality of annular slit orifices from which washing liquid is jetted, and deflector means at spaced intervals around at least one of the flanges forming the liquid jetted from the adjacent orifice into multi-directional non-intersecting sheet streams.

6. In a dishwashing machine of the overflow-type wherein rotary impeller means between the bottoms of an inner and an outer tub draws washing liquid through the perforate bottom of the inner tub and forces it upwardly between the inner and outer tub walls, annular directing flange means spaced from the top of the inner tub and forming therewith an annular slit orifice from which washing liquid is jetted, deflector means at spaced intervals around the directing means dividing the directing means into a plurality of equally spaced alternating flats and deflectors and forming the liquid jetted from said orifice into a series of primary sheet streams flowing from said flats and another series of secondary sheet streams flowing from said deflectors, said primary sheet streams each flowing in a path discharging below the next adjacent primary sheet stream, and said secondary sheet streams each flowing in a path discharging below the primary sheet streams.

7. In a dishwashing machine of the overflow-type wherein rotary impeller means between the bottoms of an inner and an outer tub draws washing liquid through the perforate bottom of the inner tub and forces it upwardly between the inner and outer tub walls, annular directing flange means spaced from the top of the inner tub and projecting inward of the periphery of the inner tub wall and forming therewith an annular slit orifice from which washing liquid is jetted, and deflector means projecting downward from said annular flange contracting the orifice at spaced intervals annularly therearound.

8. In a dishwashing machine of the overflow-type wherein rotary impeller means between the bottoms of an inner tub and an outer tub draws washing liquid through the perforate bottom of the inner tub and forces it upwardly between the inner and outer tub walls, said inner tub wall having formed therein a first series of annular slit orifices extending around the tub and a second series of annular slit orifices extending around the tub above the first series, annular directing flange means projecting inwardly of said inner tub wall immediately above each series of slit orifices, said orifices each communicating with the space between the inner and outer tubs, and the washing liquid forced upwardly between the inner and outer tubs being jetted in sheet streams from said orifices.

9. In a dishwashing machine of the overflow-type wherein rotary impeller means between the bottoms of an inner tub and an outer tub draws washing liquid through the perforate bottom of the inner tub and forces it upwardly between the inner and outer tub walls, annular directing flange means spaced above the top of the inner tub and projecting inwardly of the periphery of the inner tub wall and forming therewith an annular slit orifice, there being a second annular slit orifice formed in the inner tub spaced below the first annular slit orifice and having another associated annular directing flange above said second slit orifice and projecting inwardly of the periphery of the inner tub wall, said orifices each communicating with the space between the inner and outer tubs, and the washing liquid forced upwardly between the inner and outer tubs being jetted in sheet streams from said orifices.

10. In a dishwashing machine of the overflow-type wherein rotary impeller means between the bottoms of an inner tub and an outer tub draws washing liquid through the perforate bottom of the inner tub and forces it upwardly between the inner and outer tub walls, said inner tub wall having formed therein a first series of annular slit orifices extending around the tub and a second series of annular slit orifices extending around the tub above the first series, annular directing flange means projecting inwardly of said inner tub wall immediately above each series of slit orifices and having downward depressions therein forming multidirectional sheet streams in the washing liquid forced upwardly between the inner and outer tubs and jetted from said orifices.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
516,103	McCausland	Mar. 6, 1894
706,473	Low	Aug. 5, 1902
858,522	Low	July 2, 1907
2,151,354	Osuch	Mar. 21, 1939
2,250,314	Rocke	July 22, 1941
2,275,411	Ashe	Mar. 10, 1942