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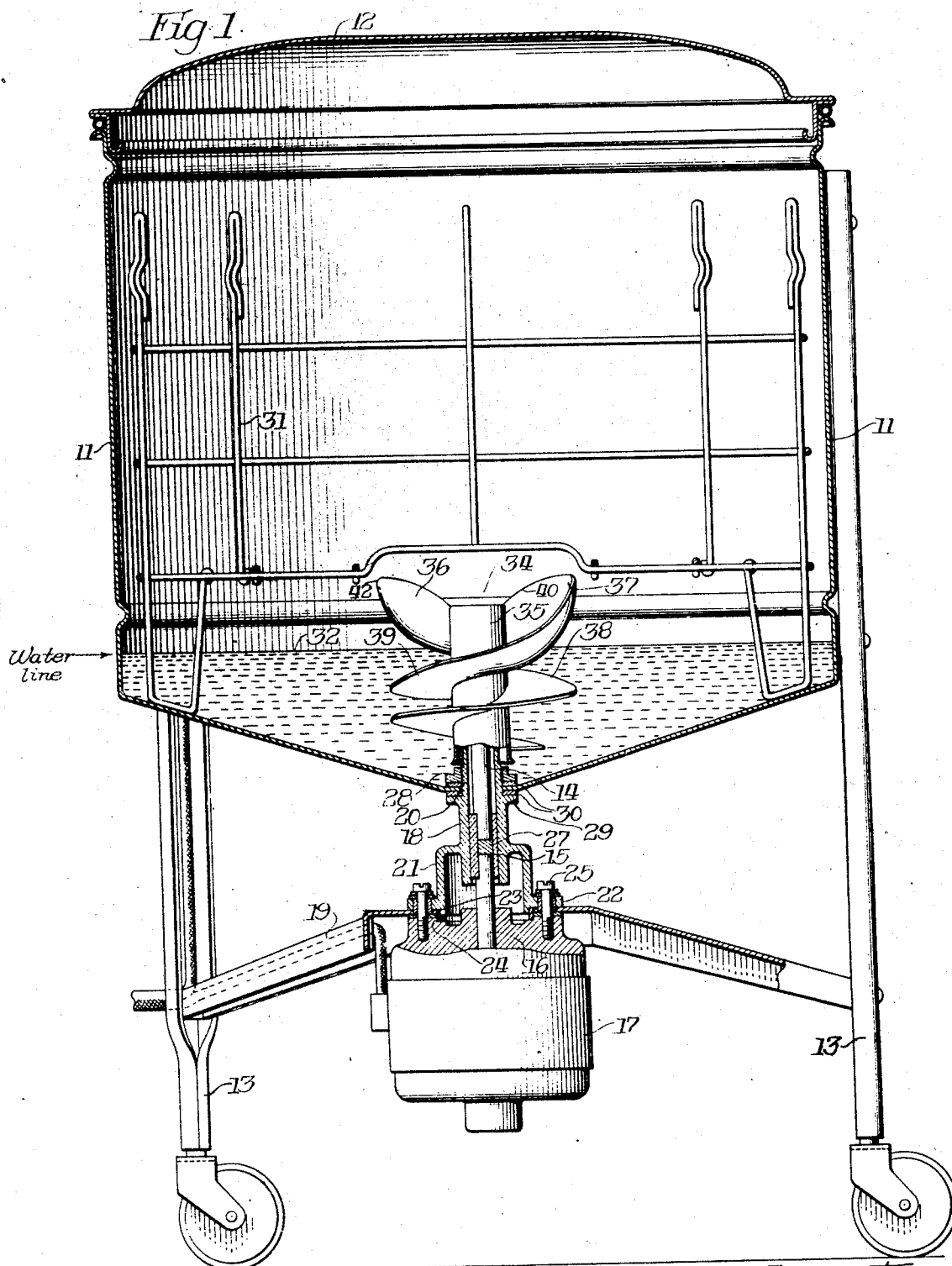
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DISHWASHING MACHINE

Filed July 5, 1928

3 Sheets-Sheet 1



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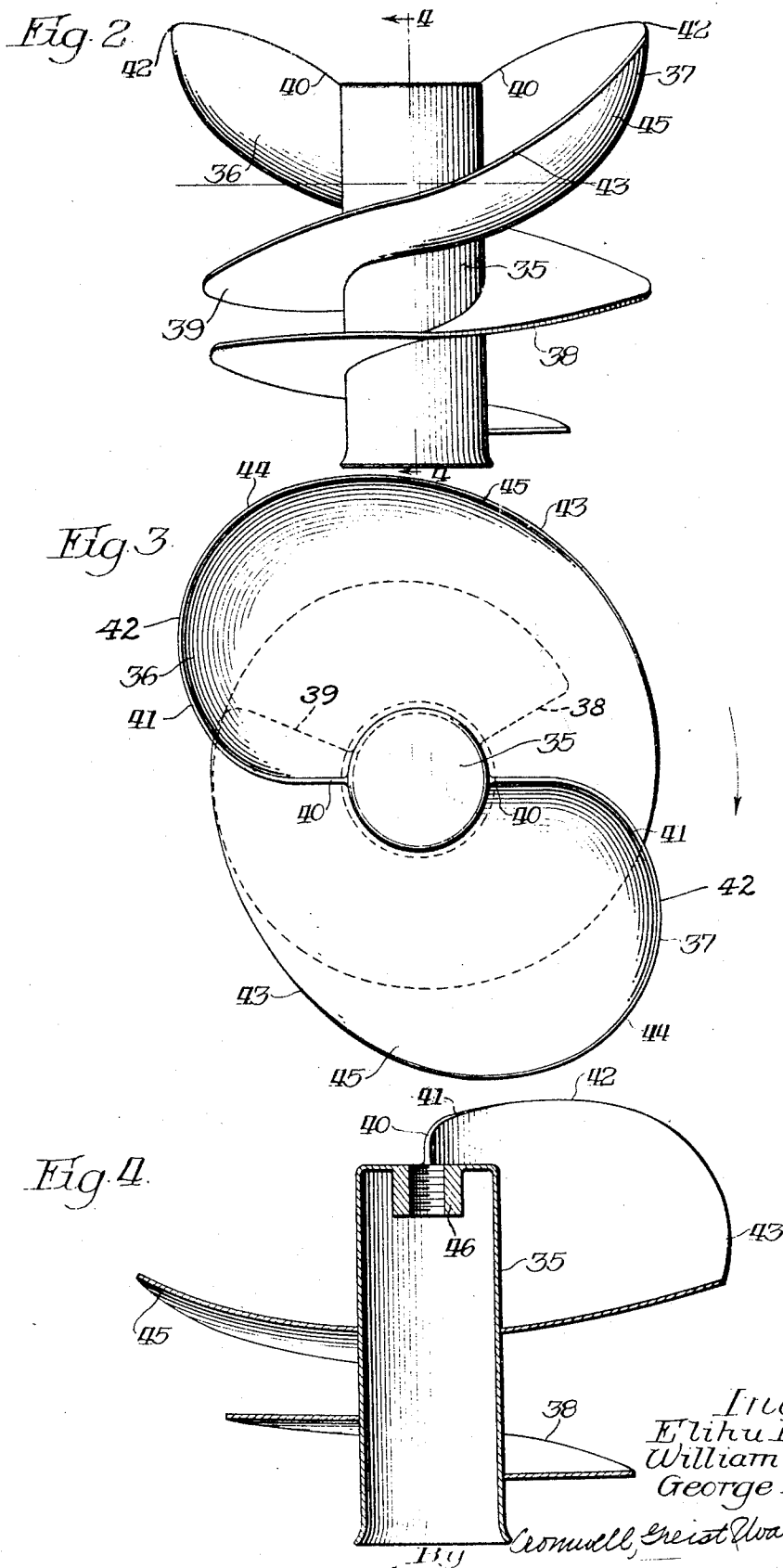
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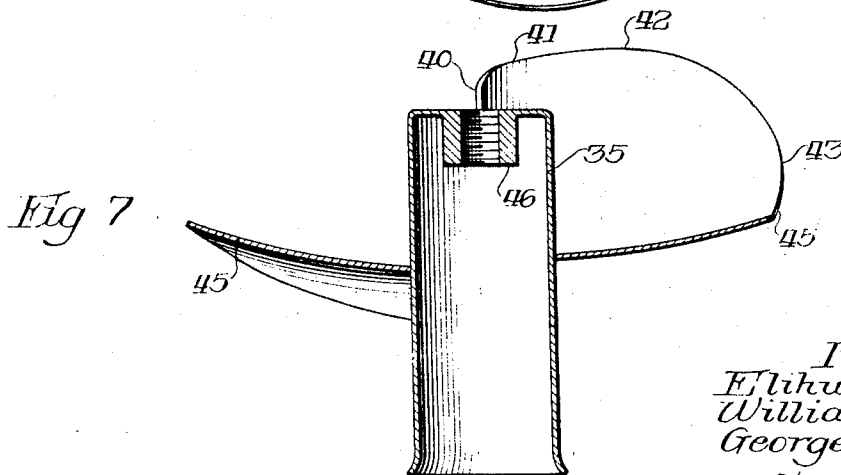
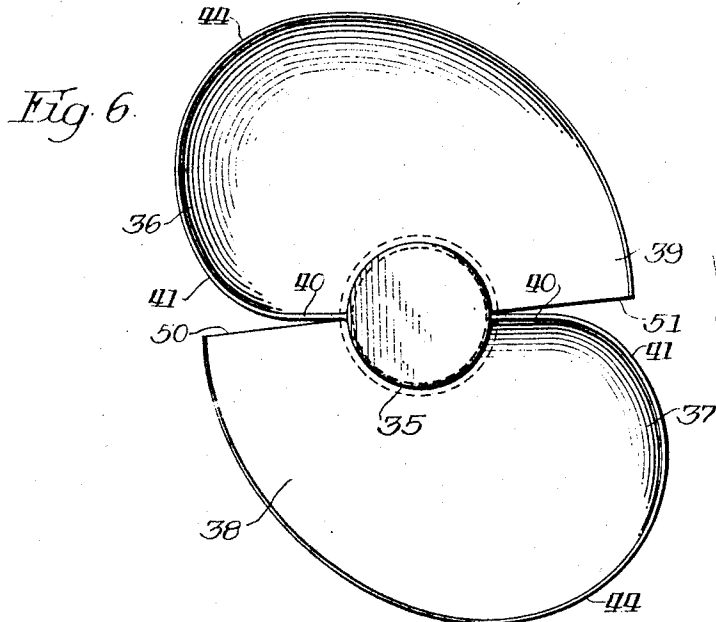
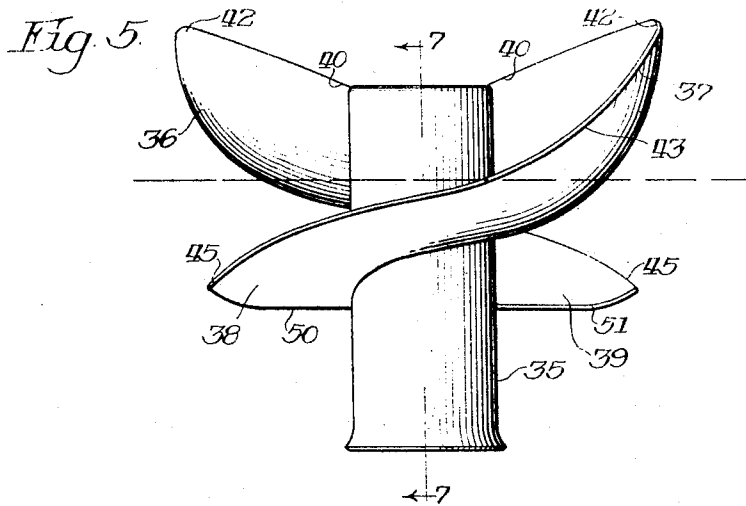
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UNITED STATES PATENT OFFICE

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DISHWASHING MACHINE

Application filed July 5, 1928. Serial No. 290,344.

The present invention relates to impellers for spraying liquids and particularly relates to impellers for use in the spray-projection type of dishwashing machines.

In these spray-projection machines it is desirable to utilize a small amount of a cleansing liquid and to throw the cleansing liquid radially upwardly and outwardly from a low level toward, and upon, dishes and similar objects at a high velocity. The dishes at all times are supported above the level of the pool of cleansing liquid in the bottom of the machine and the cleansing action is effected by the projected or reflected spray. It is desirable to project the liquid spray at such a velocity that it will have a force sufficient to dislodge the adherent dirt from the surfaces of the dishes and other objects.

The object of the present invention is to provide an improved liquid-projecting impeller which is particularly adapted for use in this type of washing machines.

Another object of this invention is to provide an impeller which is adapted to elevate and project effective quantities of cleansing liquid upwardly and outwardly at a sufficient velocity to cleanse the dishes and similar articles arranged within a considerable area thereof.

A further object of this invention is to provide an impeller for spray-projection type dishwashing machines which will uniformly distribute a small volume of cleansing liquid throughout the desired areas of the washing chamber of the machine.

The following drawings represent several embodiments of the invention to which the invention, however, is by no means restricted:

Figure 1 represents a vertical sectional view of a dishwashing machine with the impeller in position;

Figures 2, 3 and 4 represent enlarged side, top and sectional views of the embodiment of the impeller shown in Figure 1; and

Figures 5, 6 and 7 represent side, top and sectional views of a modified impeller.

In Figure 1 the tank of the dishwashing machine 11 is provided with a removable cover 12 and supported upon legs 13. The impeller is disposed centrally in the lower

portion of the tank 11 and is actuated by means of a vertical shaft 14 which extends through the bottom of the tank. The lower portion of the shaft 14 is connected by means of the insulating coupling 15 to the upwardly projecting shaft 16 of the motor 17. The motor 17 is suspended from the tank 11 by the bearing member 18 and is supported and centered by the spider 19 which is attached to the legs 13.

The bearing member 18 is provided with a central tubular bearing 20 which is adapted to extend upwardly into the tank to a position above the normal water level. A downwardly facing cup-shaped portion 21 is attached to the lower portion of the central tubular portion 20. At the lower side of the cup 21 is a circular flange 22 which is provided with a circular shoulder 23. The shoulder 23 is adapted to cooperate with the recess 24 in the end bell of the motor 17 to center the motor and its shaft. The bolts 25 are adapted to bind together the flange 22, the central portion of the spider 19 and the frame of the motor 17 and maintain the cooperating shoulder 23 and recess 24 in position. The end bell of the motor and the bolts 25 are insulated from the tank of the machine by a series of washers of insulating material. The motor shaft 16 is also insulated from the tank of the machine by the insulating coupling 15. The nut 46 into which the upper end of the shaft is screwed fits into the top of the tubular bearing 20 to form an upper bearing while the insulating coupling 15 which turns with the shafts 14 and 16 forms a lower guide. The coupling 15 preferably consists of a molded piece of bakelite or other insulating material feathered to the shafts 14 and 16 and surrounded by a steel shell. The shaft 16 is additionally insulated from the shaft 14 by a piece of insulating material 27 which is placed water-tight in the gap between ends of the shafts. The material 27 may be rubber. The bearing member 18 is held in position by means of a nut 28 which is adapted to coact with the flange 29 of the bearing member 18 to clamp the bottom of the tank 11 between the washers 30.

In the tank 11 is positioned a dish rack 31 composed of wires which may be of any suitable construction and is intended to support dishes or similar objects in the space above the impeller and above the pool level. The dishes or other similar objects are so supported by means of the rack 31 that the spray projected by the impeller will contact with them at such an angle as to cleanse them most effectually. Normal water level when the impeller is at rest is indicated at 32. It will be noted that the normal water level is so established that the impeller is only partially immersed.

The impeller, which constitutes a liquid-propelling or circulating device, is positioned in the lower central part of the tank and so designed as to elevate liquid from a small area of the pool at about the central axis of the machine, and then project the elevated liquid upwardly and outwardly at a high velocity in the form of sheets or coarse spray.

The impeller, shown in Figure 1 and more fully in Figures 2, 3 and 4 comprises a cylindrical hub or axial portion 35 and two upwardly concave spoon-shaped or concave-shaped projectors 36 and 37. Continuous with the lower inclined part of the spoon-shaped or concave-shaped projectors are the helical portions or elevators 38 and 39 which extend down to a point below the contemplated surface level of the liquid pool. The spoon shaped projectors and the downwardly extending helical elevators continuous therewith are attached to the outside of the cylinder 35. In the examples illustrated, the elevator 38 is shown continued downward considerably farther than the elevator 39, but it is obvious that the elevators may be made of equal length. As shown, the lower terminus of the elevator 39 is about 180° from the radial edge 40 of the conjoined projector 37, while the elevator 38 continues through about 540° from the radial edge 40 of the concave projector 36. The pitch of the upper inclined surfaces of the elevators 38 and 39 is such that the water will be elevated onto the upper portion of the concave projectors as the device is rapidly rotated. The upper terminal portion of the spoon-shaped projector, which is attached to the cylinder 35, extends approximately vertically for a short distance radially from the cylinder, and as it progresses farther from the cylinder, turns gradually from the vertical and assumes an inwardly inclined form, as indicated at 41 in Fig. 3. The height of the upper edge of the projector increases as it progresses away from the cylinder 35 until at 42 it reaches its maximum height, which is at a substantial elevation above the top of said cylinder. In the embodiment illustrated, this high point 42 is on approximately the median line of the projector blade, but its location will be governed to some extent with reference to the relative diameter and depth of the tank in which it is to operate. The height of the outer edge of the projector decreases rather rapidly from the high point 42, so as to form a rather sharply inclined margin 43. As the terminating upper edge of the inclined surface is approached, the horizontal width of the inclined surface increases so that at the point of about 45° horizontally in advance of the vertical termination 40 in the embodiment of the invention shown the impeller will achieve its maximum width as indicated at 44 (see Figure 3). From the place of maximum width 44, the horizontal width of the inclined surface very rapidly decreases until it coalesces with the vertical terminal part 40 and lower inclined parts 38 and 39. The vertical surface 40 projects radially from the cylinder 35. If desired, however, this vertical surface may be attached to the cylinder 35 at some other angle approaching a tangent. The inclined surface is so widened and provided with an upturned lip or edge 45 as to give the desired direction to projection of the spray under the centrifugal force tending to throw the water outwardly off the blade.

Both the concavity and the pitch of the elevating and deflecting surfaces increase as the top of the impeller is approached in the embodiment shown. If desired both the elevating surfaces and the spoon shaped deflectors may be made of approximately the same concavity and of approximately the same pitch or inclination. If the pitch is increased it is preferable to decrease the angle of turn around the cylinder 35 so as not to unduly increase the height of the impeller 34. The present pitch varies from about 10° to the horizontal at the bottom to 80° to the horizontal at the top. If desired the pitch of the entire elevating and deflecting surface may be caused to range from 45° to 70° to the horizontal. When the pitch is so increased, it is desirable to decrease the angle of turn from a range of 180° to 720° to a range of from 45° to 180°. To increase the concavity of the lower elevating and deflecting surfaces the outer terminating edge may be farther elevated and the center of the surfaces may be caused to be materially depressed below the outer terminating edges.

The position and shape of the deflecting portion may be considered to be determined by three helices or portions of helices. The inner helix will be the line of attachment of the deflecting portion to the axial portion or cylinder 35. The upper portion of this inner line will terminate substantially in a vertical line at the place of attachment of the vertical surface 40 to the cylinder 35. The outer helix is formed by the outer edge of the elevating and deflecting portions. In the modification shown, this outer edge forms a continuous curve which intersects the inner

line or helix at the upper point of attachment to the axial portion. The central helix or median line will be formed by the center line between the inner and outer lines. When the outer helix is a continuous curve the inner median and outer lines will meet at the highest point of attachment of the deflecting portion to the cylinder 35. As will be seen from the drawings, the inner median and outer lines diverge from their point of intersection to a maximum distance apart, and then converge toward the lower part of the deflecting portion. Considered conversely, the distance between the lines increases from the lower part of the deflecting portion until a maximum distance apart is reached, from which the lines converge. The concavity of the deflecting portion causes the outer line to be above the inner and median lines below the point of maximum distance apart. In the modification shown, this relation continues to the point of intersection.

The impeller 34 is so positioned in the pool that the lower portions of the spoon-shaped deflector will be immersed in the liquid pool whereas the upper portions will be unimmersed. The upper part of the cylindrical shell 35 is closed and is welded to a nut 46 into which the upper part of the shaft 14 is adapted to screw by means of a threaded portion of decreased diameter, the threads being arranged to set up in the direction of operating rotation of the impeller so that it will not tend to unscrew during operation. The cylinder shell 35 encloses and surrounds the upwardly projecting tubular bearing 20 (see Figure 1) and will maintain an air pocket about the place of entrance of the shaft 14 and into the tank 11 materially decreasing possibility of leakage.

Figures 5, 6 and 7 show a slightly modified embodiment of the impeller shown in Figures 1 to 4. In Figures 5 to 7 the downwardly-extending inclined surfaces constitute continuations of the concave projectors 36 and 37 and terminate about 180° from the point of attachment of the concave projectors 36 and 37 to the cylinder 35, the elevating surface thus being considerably shorter than in the other form. It may be desirable in certain instances to increase the pitch of such elevating surface. As shown in Figures 5 to 7 the elevating surface has the same pitch as the impeller shown on Figures 1 to 4, but if desired, the lower edges 50 and 51 may be caused to be in a position much farther down the shaft and they may extend from the upper terminus less than 180°.

The impeller device 34 preferably occupies but a minor portion of the horizontal internal area of the washing machine and preferably its largest diameter is less than one-third of the interior diameter of the tank. The impeller may be so positioned that about 50% of its height is immersed in the liquid

pool, but this may vary between 25 and 75%. The impeller is preferably rotated by a motor disposed below the tank and directly driven thereby at a rate of 1,000-2,000 revolutions per minute, preferably about 1,750 revolutions per minute.

For a tank 21" diameter the impeller may have a diameter of 5 to 6 inches outside diameter and the blade or inclined elevating and deflecting surface may have a maximum width of 2 to 2 1/4 inches. If it is assumed that this impeller is rotated at a speed of 1,750 R. P. M. the water projected from its maximum will have a speed of about 2,500 to 2,600 feet per minute. For a tank of 26" diameter, the impeller may have an outside diameter of 6 to 7 inches with a maximum width of deflecting surface of about 2 1/2 to 2 3/4 inches. If it is assumed that it rotates at 1,750 R. P. M. the peripheral speed of the projected water will be about 2,900 to 3,000 feet per minute. In general the diameter of the impeller will vary with the diameter of the tank. The impeller when in motion, traveling as it does faster than the water, increases the volume of water on the vanes. It will elevate the required amount of water without the necessity of walls or a casing to hold the water on the vanes. At the point where the water leaves the concave projector it will be radiated in fan shape along tangents to the circular path of elevation, the greatest volume being delivered at an approximate angle of 45° to the horizontal and to the axis of the machine.

The construction of the impeller 34 may be modified by eliminating the apron shell 35 and by attaching the elevating and deflecting surfaces directly to the central shaft 14. In this case it would be necessary to provide a bearing in the bottom of the tank and suitable stuffing box arrangements to prevent leakage. The impeller as shown is preferably constructed by first forming the inclined vanes into the desired shape and then attaching these inclined vanes to the cylindrical shell 35. The impeller or the vanes may also be made by casting or molding. The preferred embodiment of the invention utilizes two vanes. The number may be increased to more than two or only one vane may be utilized. The impeller should not extend above the normal static water level more than its maximum diameter and it preferably should not extend much more than one-half of its diameter. The top of the impeller should also be substantially below the dishes.

By the expression "spoon-shaped" as used herein in describing the surface contour of the impeller blade portions, is meant that they are of concave contour transversely with upwardly directed outer edges, by virtue of which the centrifugally propelled liquid is given an upward direction.

What is claimed is:

1. An impeller for dishwashing machines, comprising an axial portion and an upwardly progressing helicoidal vane extending outwardly therefrom and presenting a transversely concave upper surface, the width of said surface and the concavity thereof gradually increasing toward the top of the impeller.
2. An impeller for dishwashing machines adapted to elevate and project liquid from a pool, comprising an axial portion and an upwardly progressing helicoidal vane extending outwardly therefrom, the median line of the upper surface of said vane and the lines of its inner and outer edges being so related that the distance therebetween increases to a maximum distance apart as they ascend and then decreases to the upper extremity of the inner line, the median and inner lines being below the outer line.
3. An impeller for dishwashing machines adapted to elevate and project liquid from a pool, comprising a hub portion and helicoidal vanes projecting outwardly therefrom and extending part way around the hub portion, said vanes increasing in width and assuming a transversely concave contour as the top of the impeller is approached, the lines of attachment of said vanes to the hub portion forming helices, the upper continuations of which are approximately vertical, and the outer edges of said vanes being turned upwardly above said line of attachment of said vanes.
4. An impeller for dishwashing machines comprising a hub portion and a helicoidal vane extending outwardly therefrom, said vane having a continuously curved outer edge throughout its length and being of gradually increased width toward its upper end and having its upper surface transversely concave as it approaches its upper terminus.
5. A spray-projecting impeller of the upright type, comprising an axial portion, and a concave helicoidal deflecting portion mounted therearound, the traces of progressive vertical radial planes through said deflecting portion for an angle of at least substantially 90° from the upper terminus of said deflecting portion being curved upwardly at their outer ends.
6. A spray-projecting impeller of the upright type, comprising a vertical axial portion, a concave helicoidal deflecting portion of gradually increasing upward inclination mounted around said axial portion, said concave deflecting portion having an upturned outer edge forming a continuous curve which gradually increases in distance from said axial portion to a maximum, and then gradually decreases in distance to meet said axial portion at its upper end.
7. A spray-projecting impeller of the upright type, comprising a vertical axial portion, and a concave helicoidal deflecting portion of increasing upward inclination mounted therearound, the inner, median, and outer lines of said portion meeting adjacent the upper end of said axial portion and then declining therearound in continuous curves at increasing distances apart, to a maximum and then gradually approaching each other toward the lower part of said deflecting portion, the outer of said lines being above said inner and median lines below said point of maximum distance.
8. A spray-projecting impeller of the upright type, comprising an axial portion, and an inclined concave helicoidal deflecting portion having an outer edge which recedes from the upper part of said axial portion around said axial portion in a gradual and continuous curve reaching a maximum distance from the axial portion and then gradually approaching said axial portion, said outer edge being above the inner and median portions of said deflecting portion below the point of maximum distance from said axial portion.
9. A spray-projecting impeller of the upright type comprising a vertical axial portion, and a concave helicoidal deflecting portion mounted therearound, said concave deflecting portion having an upturned outer edge which increases in distance from the axial portion to a maximum, and then decreases in distance from said axial portion toward the top of said concave deflecting portion.
10. A spray-projecting impeller of the upright type, comprising a vertical axial portion, and a helicoidal concave deflecting portion mounted therearound, the inner, median, and outer lines of said concave deflecting portion diverging to a maximum distance apart, and then converging toward the top of said concave deflecting portion, said outer line being above the median and inner lines below the point of maximum distance apart.

In testimony whereof we have hereunto subscribed our names.

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