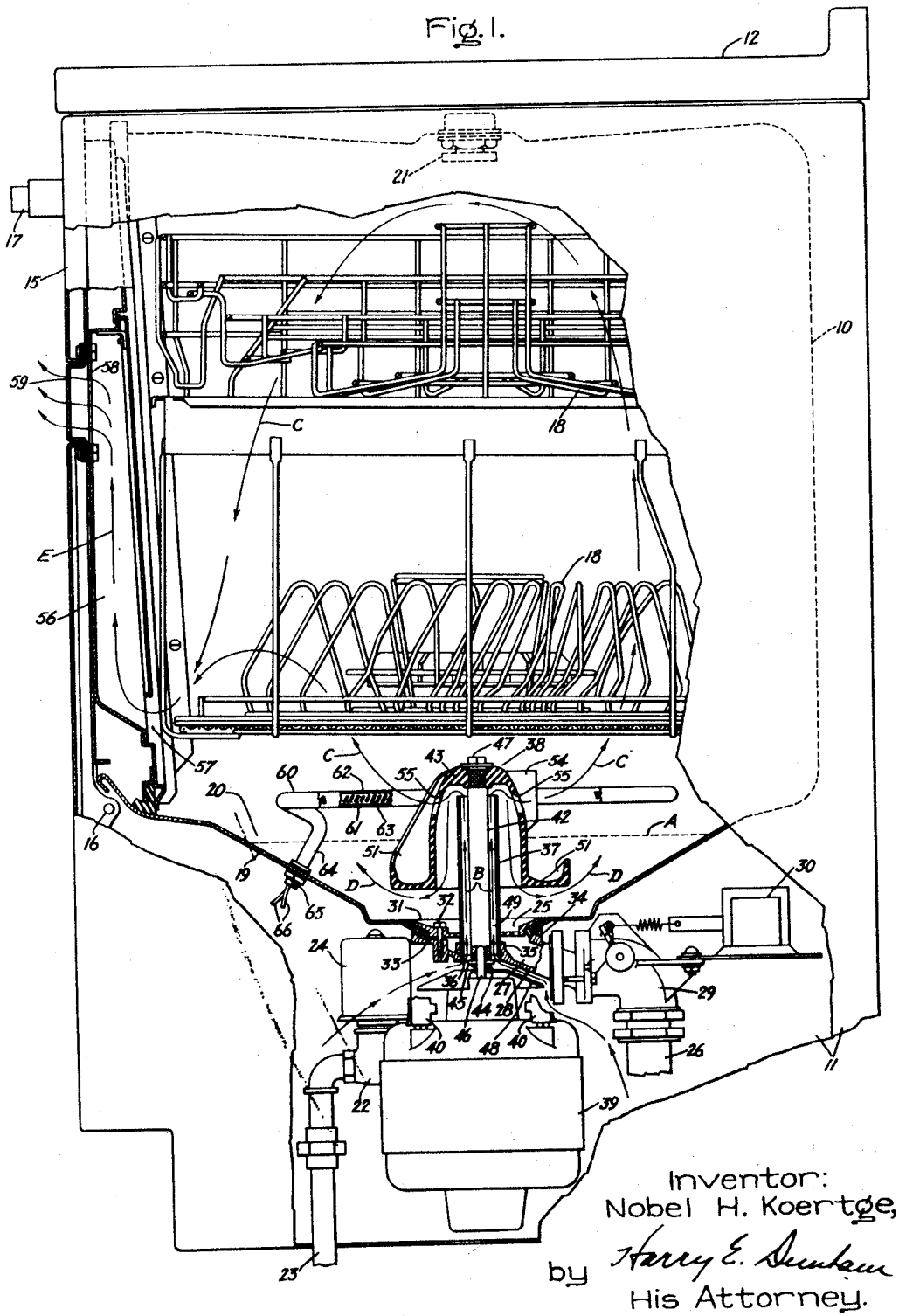
June 10, 1947. N. H. KOERTGE 2,422,022

DISH WASHING AND DRYING APPARATUS

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Fig. 1.



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Fig. 2.

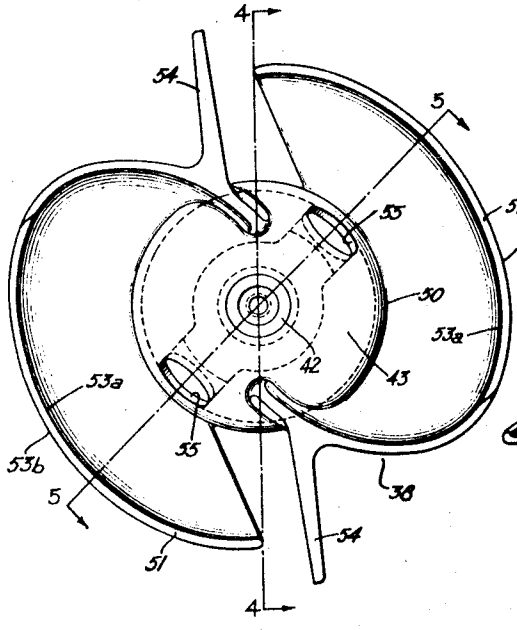


Fig. 4.

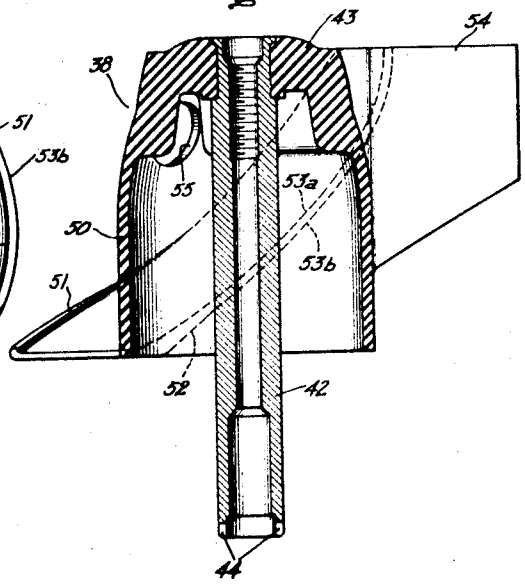


Fig. 3.

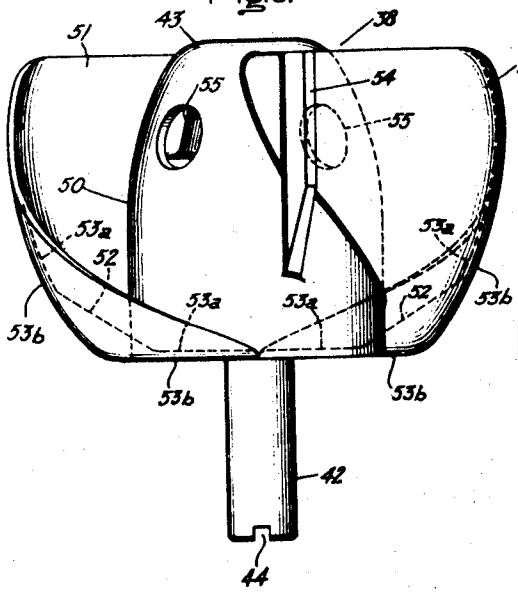
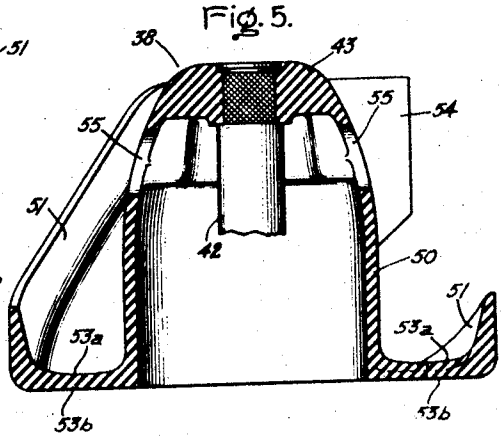


Fig. 5.



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UNITED STATES PATENT OFFICE

2,422,022

DISHWASHING AND DRYING APPARATUS

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Application January 15, 1942, Serial No. 426,889

7 Claims. (Cl. 134—94)

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This invention relates to washing apparatus and more particularly to dishwashing apparatus.

This invention has particular application to dishwashing apparatus wherein a washing fluid, such as water, is circulated or hurled through a washing vat by a suitable power-driven means, such as a motor-driven impeller, so as to effect a cleansing action on the dishes supported within the vat.

In dishwashing apparatus of this type it is customary to leave the dishes and other articles of tableware in the washing vat after the washing operation is complete so that they may dry by evaporation of water therefrom.

It is an object of my invention to provide a washing apparatus of the above type having improved means for drying the dishes quickly and uniformly after the completion of the washing operation.

A further object of my invention is to provide an improved dishdrying arrangement for a washing machine of this type which is very simple and inexpensive to construct and operate.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be set forth with particularity in the claims appended to and forming a part of this specification.

For a more complete understanding of this invention reference should be had to the accompanying drawings in which Fig. 1 is a side elevation of a dishwashing apparatus embodying this invention, a portion of the casing of the apparatus being broken away to illustrate certain details of the improved construction; Fig. 2 is a plan view of the fluid-circulating impeller; Fig. 3 is an elevation view of the impeller shown in Fig. 2; Fig. 4 is a sectional view of the impeller taken along the line 4—4 in Fig. 2 and looking in the direction of the arrows; and Fig. 5 is another sectional view of the impeller taken along the line 5—5 of Fig. 2 and looking in the direction of the arrows.

Referring to the drawing, this invention has been shown as applied to a dishwashing apparatus of the front-opening type which comprises a vat 10 supported in a suitable casing having side walls 11 and a top wall 12. Arranged to close the front opening of the washing vat 10 is a door 15 which may be swung about a pivot 16 to a horizontal open position by means of a handle 17.

Dishes are supported within the washing vat 10 by means of open work trays or racks 18 which are mounted so that they may be slid into

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and out of the vat when the door 15 is open for the purpose of loading and unloading dishes. The sliding rack construction may, for example, be of the type disclosed and claimed in the co-pending application of E. S. Stoddard, Serial No. 381,836, filed March 5, 1941, now Patent No. 2,290,653, dated July 21, 1942, and assigned to the same assignee as the present application.

As shown in Fig. 1, the vat 10 has a bottom wall 19 which slopes downwardly so as to define a receptacle 20 for receiving a washing fluid. Washing fluid, which is preferably hot water, is supplied to the vat 10 by means of a suitable spray device 21 which is supported in the central portion of the top wall of the vat. This spray device is connected by means of suitable piping (not shown) to the outlet side of the control valve 22, the inlet side of which is connected by means of piping 23 to a suitable source of washing fluid. The valve 22 controls the quantity of washing fluid supplied to the vat 10, and in the preferred form of this invention the valve 22 will be electromagnetically operated by means of a suitable solenoid 24.

Fluid is withdrawn from the vat 10 through a drain opening 25 and is conducted to a drain pipe 26 through a passageway 27 formed in a drain casting 28. The flow of waste fluid from the vat is controlled by means of a drain valve 29 which is operated by an electromagnet 30. This drain valve may be of any suitable type but is preferably of the type disclosed and claimed in the co-pending application of E. S. Stoddard, Serial No. 380,853, now Patent No. 2,271,993, dated March 3, 1942, and assigned to the assignee of the present invention.

The arrangement of the drain construction will be preferably the same as that disclosed and claimed in the co-pending application of E. S. Stoddard, Serial No. 380,849, filed February 27, 1941, now Patent No. 2,284,456, dated May 26, 1942, and assigned to the assignee of the present invention. Briefly described, this construction comprises a perforated drain plate 31 which is fastened by means of bolts 32 to the drain casting 28, the drain plate and the drain casting having flanges which are adapted to engage opposite sides of the bottom wall of the vat adjacent a central aperture 33, the joint being sealed by suitable gasket means 34.

The bottom wall of the drain casting 28 is provided with a circular flange portion 35 which defines a central opening 36. Extending upwardly through a central aperture in the drain plate 31 is a tubular member 37, the lower end of which

is fastened in fluid-tight relation to the flange portion 35 of the drain casting 28. The tubular member 37 is of sufficient length so that the upper end thereof is above the static water level A of the washing fluid in the receptacle 20.

Mounted for rotation in the lower part of the vat 10 which forms the receptacle 20 is an impeller 38, the constructional details of which are shown more particularly in Figs. 2 to 5 of the drawing. The impeller 38 is driven by means of a motor 39 on brackets 40 which are secured to the drain casting 28 by suitable fastening means not shown. In order to provide a driving connection between the impeller 38 and the motor 39 there is provided a hollow shaft or sleeve 42, the upper end of which is secured to a hub portion 43 of the impeller. The lower end of the sleeve 42 is provided with a pair of slots 44 which are adapted to fit over a pin 45 projecting through the motor shaft 46 to provide a driving connection between the shaft 46 and the sleeve 42. The sleeve 42 is held in position on the shaft 46 by means of a bolt 47, the lower end of which (not shown) is received in threaded engagement with the end of the motor shaft 46. A deflecting plate 48 is provided on the motor shaft 46 to deflect fluid away from the motor, should such fluid happen to splash into the tubular member 37. Normally this does not occur.

It is to be particularly noted that the hollow shaft or sleeve 42 is spaced from the inner surface of the tubular member 37 so as to provide a passageway connecting the interior of the vat with the exterior. The purpose of this passageway 49 will be described more fully below.

Referring now in particular to the construction of the impeller shown in Figs. 2 to 5 of the drawing, it will be noted that the hub 43 has an annular portion 50 which extends downwardly around and in spaced relation with the tubular member 37. Extending outwardly from the impeller hub are a pair of blades 51 which function, when the impeller is rotated by the motor, to circulate or hurl the washing fluid from the receptacle 20 around the dishes supported in the racks 18. Each of the blades 51 has a fluid-engaging face 53a curving downwardly and forwardly from the upper edge to the lower edge in the direction of rotation of the impeller, which direction is counterclockwise as viewed in Fig. 2. The inner and outer surfaces 53a and 53b of the fluid-circulating blades 51 are parallel, having substantially the same contours, with the exception of the lower leading edges. It will be noted that adjacent the lower leading edges there is provided a thickened section 52 which is formed by extending the lower surface 53b of the blades 51 backward in a horizontal direction before it is curved upwardly to parallel the upper surface 53a. It has been found that the provision of this thickened section adjacent the leading edge of the fluid-circulating blades of the impeller greatly increases the capacity of the impeller to circulate washing fluid, particularly around the dishes supported in the upper rack. The resulting improved washing reduces the tendency of water to stand in beads on the interior of hollow articles, such as glassware. Therefore, the subsequent drying action is improved since large drops of water clinging to the washed surfaces evaporate very slowly.

For the purpose of pumping drying air through the vat 10 and for agitating the air in the vat to effect a uniform drying action, the impeller is provided with a pair of air fan blades 54. As

shown, the air fan blades 54 are integrally formed with the impeller, being flat and extending substantially radially from the hub portion 50 adjacent the top of the hub and between the liquid circulating blades 51. Also, it will be observed that these blades 54 are located adjacent the rear of the circulating blades so as to offer substantially no restrictions to the free circulation of the liquid by the blades 51. While I have shown the impeller as provided with but two air fan blades, it will be understood that a greater number may be used if desired. The hollow portion of the hub 50 is provided with a pair of apertures 55 adjacent the top of the tube 37 and back of the fan blades 54, which openings enable the air fan blades 54 to circulate more air through the vat, as will be more fully described below.

For the purpose of discharging the air that is pumped into the vat by means of the air fan blades on the impeller a vertically arranged air discharge passage 56 is provided in the door 15 at the side of the vat, as shown. The air discharge passage 56 is formed by providing staggered openings 57 and 58 in the inner and outer walls, respectively, of the door 15. Thus, air discharged from the vat 10 enters the passageway 56 through the lower opening 57 and leaves through the upper opening 58. The opening 58 may be covered by suitable ventilating louvres 59, as shown.

In order to raise the temperature of the air circulated in the vat 10 and thereby expedite the drying operation, means may be provided for heating the circulated air. I have shown such heating means in the form of an electric heater 60. The heater 60 is preferably a sheathed type, such as described in the U. S. patent to C. C. Abbott #1,367,341, dated February 1, 1921. The heater construction comprises a helical resistance conductor 61 mounted within a metallic sheath 62 and supported in spaced relation with reference to the sheath 62 by means of a mass of electrically insulating heat conducting material 63, such as magnesium oxide. Heater units of this type may be easily bent to any desired shape and in the present invention the heater element 60 is bent in the form of a loop which surrounds the impeller 38. The loop is supported in spaced relation with the bottom wall 19 and above the static water level A by the two end portions 64, only one of which is shown. The end portions 64 of the heater extend through holes in the wall 19 and are held in place by any suitable fastening means, such as threaded bushings 65. Preferably, suitable gasket means will be provided to prevent fluid leakage at the points of emergence of the heater element from the vat. The terminal leads 66 of the heater coil 61 are connected to any suitable source of electric power supply (not shown).

In operation, the racks 18 are loaded with dishes and, after the racks have been slid into the vat 10, the door 15 is closed. The vat 10 is then substantially a closed receptacle except for the air inlet passage 49 and the air discharge passage 56. The inlet valve 22, the drain valve 29, the motor 39, and the heater 60 are controlled by any suitable control means to give the desired cycle of operation. If desired, an entirely automatic control means may be provided of the type disclosed and claimed in a co-pending application of L. A. Kempton, Serial No. 421,788, filed December 5, 1941, and assigned to the assignee of the present invention. Briefly, the washing cycle may be as follows: The inlet valve

22 is opened so that hot water is sprayed over the dishes in the rack for a preliminary rinsing operation. During this period the drain valve 29 is open. The drain valve 29 is then closed so that water accumulates in the receptacle 20. At the same time a suitable detergent is added and the motor 39 is energized to start rotation of the impeller 38. The blades 51 of the impeller then cause washing fluid to be circulated or hurled over the dishes in the racks 18 to effect a cleansing operation. At the termination of the washing operation the drain valve 29 is opened so that the washing fluid is drained from the vat and the inlet valve 22 is then opened for a final rinse. The inlet valve 22 is then closed and the washing cycle of operation is completed.

The manner in which the apparatus constructed in accordance with my invention functions to effect a rapid and uniform drying of the dishes previously washed in the vat 10 will now be described. After the washing operation is complete and the washing fluid has been drained from the vat, the motor remains energized and the impeller 38 continues to rotate. Due to the action of the air fan blades 54 there is a reduction of air pressure in the zone adjacent the hub of the impeller so that air is drawn upwardly through the passageway 49 from the exterior of the vat, as indicated by the arrows B. The air issuing from the upper end of the tubular member 37 is discharged into the hollow hub of the impeller and from there most of the air passes outwardly into the vat through the apertures 55 in the impeller hub, as indicated by the arrow C. Some of the air also passes into the vat through the annular passage between the hub portion 50 and the tube 37, as indicated by the arrows D. The air flowing outwardly through the apertures 55 in the impeller hub is agitated by the rotating air fan blades 54 whereby the air is distributed and circulated uniformly throughout the interior of the vat 10, effecting a uniform drying action on the dishes supported in the racks 18. During the drying operation the heater element 60 is energized so that it heats the air which is circulated by the action of the air fan blades. The heating of the air expedites the drying operation.

Due to the fact that the air fan blades cause air to be continuously pumped into the vat 10 through the inlet passage 49 the pressure of the air in the vat increases above that of the exterior so that moist air which has been circulated over the dishes is discharged from the vat through the air discharge passage 56, as indicated by the arrow E. It will be noted that the opening 57 is located in the lower portion of the door 15 so that air which is circulated upwardly by the blades 54 to the upper portion of the vat must return downwardly through the racks before it can escape from the vat through the opening 57. This arrangement insures complete air circulation and a uniform drying action in the upper portion of the vat even though it is more remote from the impeller 38 than the lower portion.

Due to the action of the blades 54 in continuously pumping air through the vat and in agitating the air in the vat so that it circulates uniformly therethrough, the dishes are quickly and efficiently dried. The motor 39 and the heater 60 are then deenergized, the washing and drying operations having been completed. The racks may then be slid out of the vat and the dishes removed therefrom, or the dishes may be left in the vat for storage.

It will be apparent from the foregoing that I have provided a very simple and improved arrangement for circulating heated air through the washing vat of a dishwashing apparatus for the purpose of drying the dishes. By providing the fluid-circulating impeller with air fan blades and arranging suitable air inlet and air discharge passages in the vat, an efficient drying arrangement is obtained without the necessity of providing additional, power-driven air circulating means. The arrangement is therefore very simple and inexpensive. Furthermore, the agitating action of the air fan blades causes the air to be distributed uniformly throughout the interior of the washing vat whereby a drying action is obtained which is much more uniform and rapid than has heretofore been obtainable. The more efficient circulation of air obtained with my arrangement enables the drying operation to be completed within the desired short interval of time without heating the circulated air to an excessively high temperature. Thus, with my improved arrangement it has been found possible to dry a batch of dishes in a relatively short time without heating the circulated air more than ten to fifteen degrees above the temperature of the rinse water which is usually in the neighborhood of 150 degrees Fahrenheit. This is very desirable since it permits the use of a relatively low wattage heating unit thereby cutting down the cost of operation. If the temperature of the circulated air is raised too high in an attempt to increase the rapidity of the drying action by increased heat rather than by improved air circulation, it has been found that certain articles of tableware are likely to be damaged. Considered in this light the advantage resulting from the improved air circulation obtained by my invention is apparent.

While I have shown and described particular embodiments of my invention, it will occur to those skilled in the art that various changes and modifications may be made without departing from my invention, and I therefore aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In dishwashing and drying apparatus, a receptacle, means for supporting dishes in said receptacle, an impeller mounted for rotation in the lower portion of said receptacle, means for driving said impeller, said impeller having a hub portion and air fan blades projecting therefrom, means forming an air inlet passage for conducting air from the exterior of said receptacle to a point adjacent said hub whereby rotation of said impeller causes air to be pumped into said receptacle through said air inlet passage, said blades acting to agitate the air drawn into said receptacle so that it circulates upwardly and outwardly throughout the interior of said receptacle to effect a uniform drying of the dishes supported therein, and discharge means for discharging the circulated air from said receptacle having a port located at the lower portion of said receptacle so that the air circulated to the upper portion of said receptacle must return downwardly therein for discharge from the receptacle.

2. In a dishwashing and drying machine comprising a vat and a dish supporting rack within said vat, a rotary liquid circulating impeller adapted to be operated within said vat below said

rack, said impeller comprising a hollow hub and a plurality of liquid circulating blades, and also flat air fan blades extending substantially radially from said hub into said vat, said hub being provided with apertures located between said air fan blades, means for conducting air from the exterior of said vat into said hollow hub whereby upon rotation of said impeller said air fan blades cause air to be pumped into said vat through said apertures, and means for discharging pumped air from said vat.

3. In a dishwashing and drying machine comprising a vat and a dish supporting rack within said vat, and a rotary liquid circulating impeller adapted to be operated within said vat below said rack, said impeller comprising a hollow hub, a plurality of liquid circulating blades spaced circumferentially around said hub, a plurality of flat air fan blades between said liquid circulating blades and extending substantially radially from said hub into said vat, said hub being provided with apertures located between said air fan blades, means for conducting air from the exterior of said vat into said hollow hub whereby upon rotation of said impeller said blades cause air to be pumped into said vat through said apertures, and heating means disposed to heat the air discharged from said hub to expedite the drying of dishes supported in said rack.

4. A washing and drying apparatus comprising a vat, open rack means for supporting articles in said vat, said vat having a bottom wall, a stationary tubular member extending upwardly from said bottom wall into said vat, the lower end of said tubular member communicating with the exterior of said vat and the upper end of said member being above the normal free liquid level of washing liquid in said vat, a motor mounted below said vat, a shaft connected to said motor and extending upwardly through said tubular member, said shaft being spaced from said tubular member so as to provide an air inlet passage which is permanently open so that air may flow through it from the exterior of said vat into the vat, a liquid circulating impeller having a hub mounted on said shaft adjacent the upper end of said tubular member in spaced relation thereto, said hub having a hollow portion extending downwardly around said tubular member and in spaced relation thereto, a plurality of spaced liquid circulating blades projecting outwardly into said vat from said hollow portion of said hub, a drain valve for said vat which, when closed, holds the washing liquid in said vat for circulation by said liquid circulating blades, and, when open permits said liquid to drain from the vat, a plurality of air fan blades between said liquid circulating blades projecting outwardly from said hollow portion of said hub into said vat, said hollow portion being provided with apertures substantially at the level of the upper end of said stationary tubular member forming air paths interconnecting said air inlet passage and said vat whereby upon rotation of said impeller air is drawn into said vat through said inlet passage, said blades acting also to agitate the air in said vat so that it is circulated around said rack means to effect a uniform and rapid drying of the articles supported therein, and means for discharging the circulated air from said vat.

5. In dishwashing and drying apparatus provided with a vat, a rotary liquid and air circulating impeller mounted for rotation in said vat, said impeller comprising a hub, a plurality of liquid circulating blades spaced circumferentially around said hub, each blade curving downwardly and forwardly from its upper edge to its lower edge in the direction of rotation of said impeller, and a plurality of substantially flat air fan blades for circulating drying air in said vat extending radially outwardly from said hub and located at the rear ends of the upper edges of said circulating blades so that they offer substantially no restriction to the free circulation of liquid by said liquid circulating blades.

6. A washing and drying apparatus comprising a vat, an open rack for supporting articles in said vat, said vat having a bottom wall, a stationary tubular member extending upwardly from said bottom wall into said vat, the lower end of said tubular member communicating with the exterior of said vat and the upper end of said member being above the normal free liquid level of the washing liquid in said vat, a motor mounted below said vat, a shaft connected to said motor and extending upwardly through said tubular member, said shaft being spaced from said tubular member so as to provide an air inlet passage which is permanently open so that air may flow through it from the exterior of said vat and into the vat, an impeller having a hub mounted on said shaft adjacent the upper end of said tubular member, said hub having liquid circulating blades and also air fan blades projecting therefrom into said vat, a drain valve for said vat which, when closed, holds the washing liquid in said vat for circulation by said liquid circulating blades and which, when opened, permits the liquid to drain from said vat, said air fan blades functioning to reduce the pressure in said vat in the zone adjacent said hub and thereby cause air to flow through said air passage into said vat irrespective of whether said drain valve is opened or closed, and said air fan blades also acting to agitate the air in said vat so as to circulate it around said rack to effect uniform and rapid drying of the articles supported thereon, and means for discharging the circulated air from said vat.

7. A washing and drying apparatus comprising a vat, open rack means for supporting articles in said vat, said vat having a bottom wall, a stationary tubular member fixed to and extending upwardly from said bottom wall into said vat, the lower end of said tubular member communicating with the exterior of said vat and upper end of said member being above the normal free liquid level of said washing liquid in said vat, a motor mounted below said vat, a shaft connected to said motor and extending upwardly through said tubular member, said shaft being spaced from said tubular member so as to provide an air inlet passage which is permanently open so that air may flow through it from the exterior of said vat into the vat, an impeller having a hub mounted on said shaft adjacent the upper end of said tubular member in spaced relation thereto, said hub having a hollow portion extending downwardly around said tubular member and in spaced relation thereto, a plurality of spaced liquid circulating blades projecting outwardly into said vat from said hollow portion of said hub, a drain valve for said vat which, when closed, holds the washing liquid in the vat for circulation by said liquid circulating blades and when opened, permits said liquid to drain from said vat, a plurality of air fan blades in the spaces between said liquid circulating blades projecting outwardly from said hollow portion of said hub into said vat, said hollow portion being provided

with an aperture adjacent the top of said tubular member and forming an air path interconnecting said inlet passage and said vat whereby when said drain valve is opened to drain the vat and said impeller continues to rotate, air is drawn into the vat by said fan blades through said inlet passage, said fan blades also acting to agitate the air in said vat so as to circulate it around said rack means to effect a uniform and rapid drying of the articles supported thereon, and means for discharging the air from said vat.

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