Oct. 18, 1927. **1,646,052**

H. CAVE

DISHWASHING MACHINE

Filed Feb. 10, 1921 3 Sheets-Sheet 1

Fig. 1.

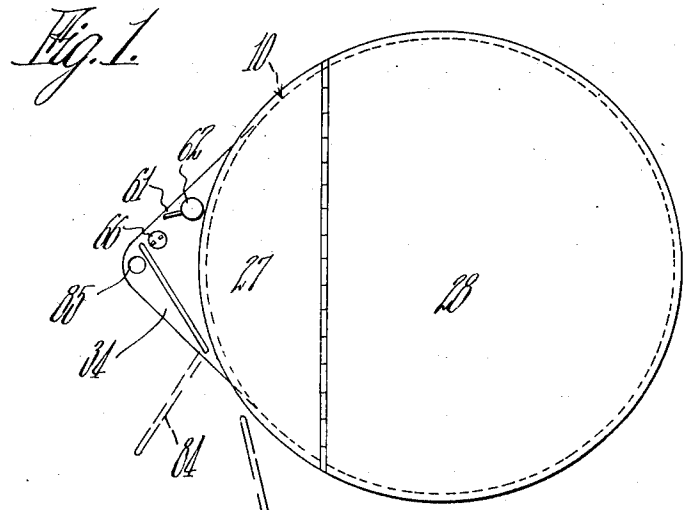


Fig. 2.

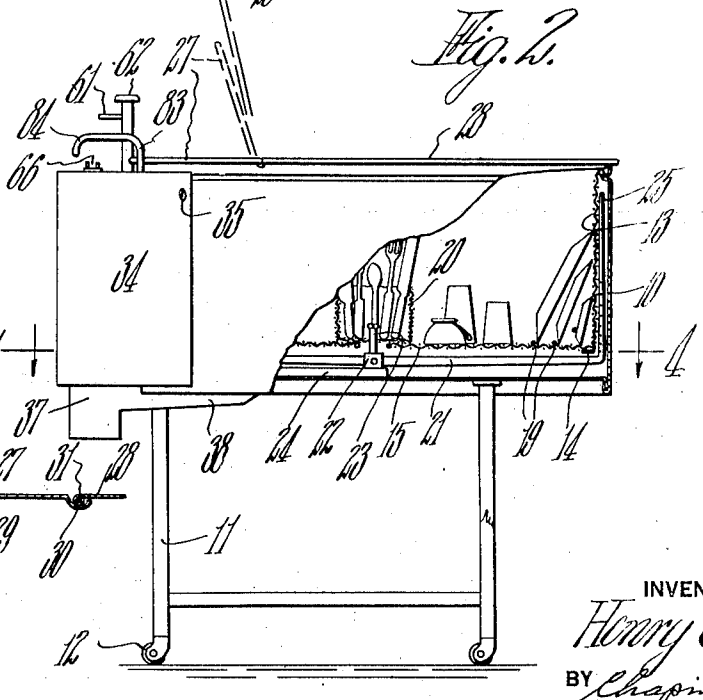
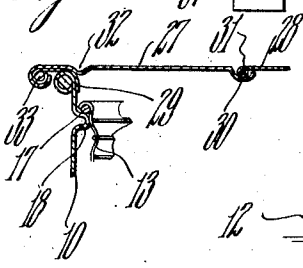


Fig. 3.



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Henry Cave.

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Oct. 18, 1927. 1,646,052

H. CAVE

DISHWASHING MACHINE

Filed Feb. 10, 1921 3 Sheets-Sheet 2

Fig. 4.

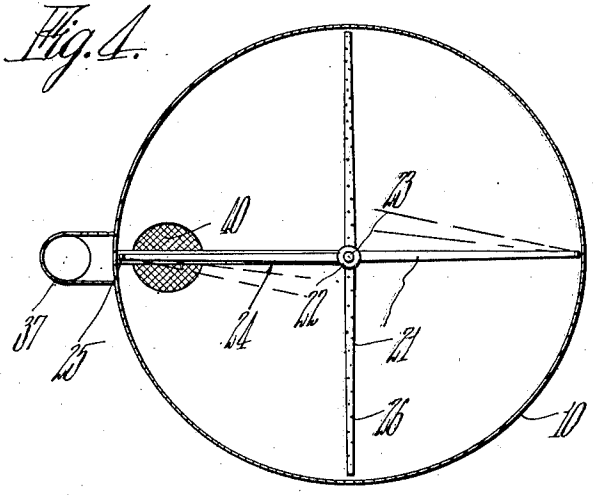
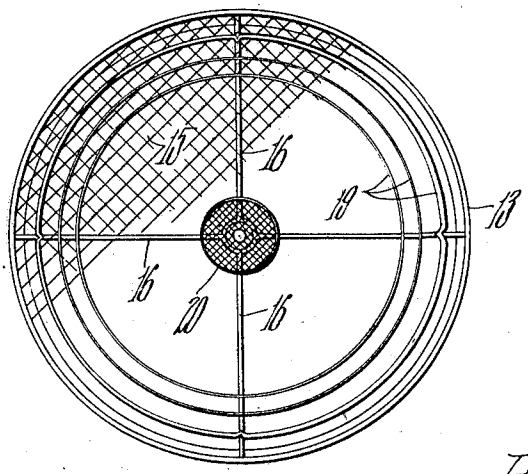


Fig. 5.



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DISHWASHING MACHINE

Filed Feb. 10, 1921 3 Sheets-Sheet 3

Fig. 6.

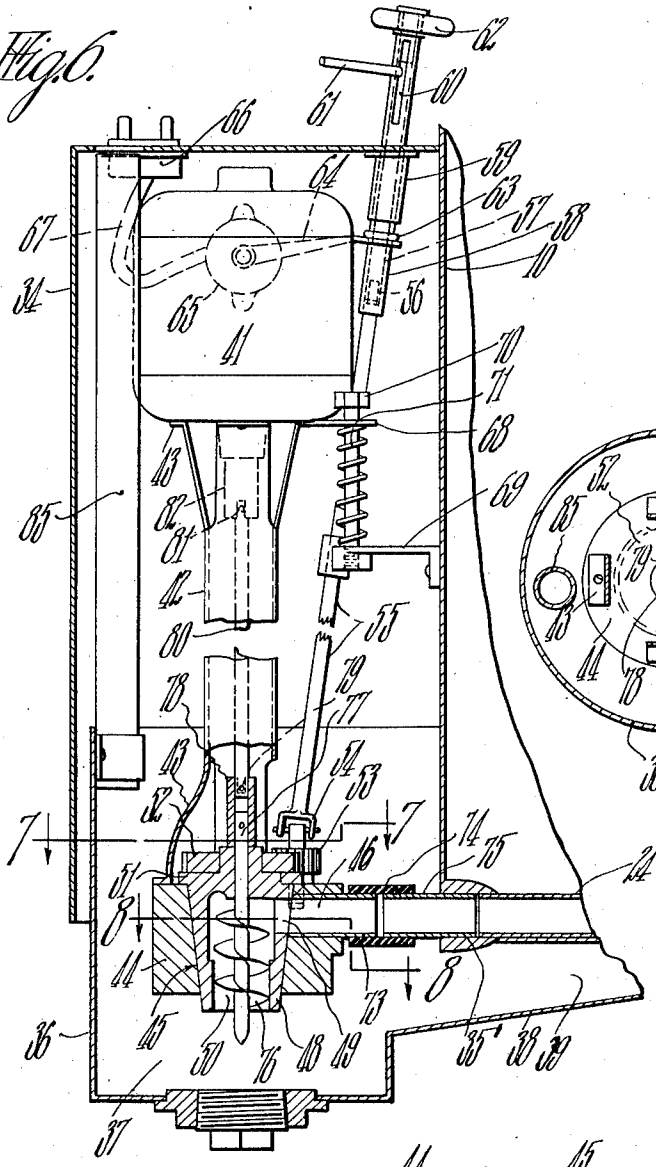


Fig. 7.

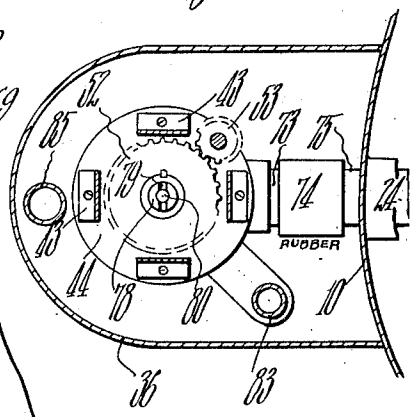


Fig. 9.

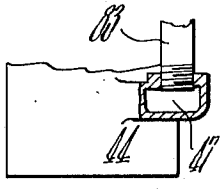
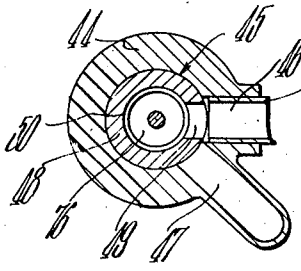


Fig. 8.



INVENTOR

Henry Cave.

BY Chapin & Neal

ATTORNEYS

Patented Oct. 18, 1927. 1,646,052

UNITED STATES PATENT OFFICE.

HENRY CAVE, OF HARTFORD, CONNECTICUT, ASSIGNOR, BY MESNE ASSIGNMENTS, TO GENERAL RAILWAY SIGNAL COMPANY, A CORPORATION OF NEW YORK.

DISHWASHING MACHINE.

Application filed February 10, 1921. Serial No. 444,022.

This invention relates to washing machines and particularly to machines adapted for household use in the washing of dishes and the like.

Among the general objects of the invention are to provide a machine which is neat in exterior appearance, portable, of light construction to permit convenient portability, efficient in the washing operation, and economical in power consumption.

More particularly, it is an object of the invention to provide in a washing machine a washing tank and a high speed power-pumping unit mounted on the tank in such a manner that the vibrations set up in said unit are prevented from being transmitted to the tank, which, due to its drum-like charactetr would intensify such vibrations and render the machine objectionably noisy in operation.

Another object of the invention is to provide, as a combined mechanism, a power plant and a pumping device driven thereby, such mechanism being an independent unit, attachable to and detachable from the rest of the washing machine as such, and being connected to the machine for convenient removal.

Another object of the invention is to provide a pumping mechanism which is designed to be driven at very high speeds and requires a relatively small amount of power. To this end, I utilize a screw rotatable in a casing, which has an outlet at right angles to the axis of the screw, whereby it may function not only in the usual way but in addition as a centrifugal pump.

Another object of the invention is to provide in a washing machine a cylindrical drum-like washing tank, a power-pumping unit exteriorly applied to the latter, and a casing to conceal the unit and including two sides which preferably are arranged in substantially V-shaped relation and tangentially to the periphery of the tank, although such sides may be otherwise disposed so long as they lie within the space defined by two such tangents intersecting at right angles and that portion of the periphery of the drum included by said tangents.

Other objects of the invention relate to improvements in the construction of the pump, the dish-holding basket, the mounting of the latter in the tank, and the covering means for the tank.

Other objects and advantages will appear in the following description and in the illustrative embodiment of the invention in the accompanying drawings, in which—

Fig. 1 is a top plan view of a washing machine embodying the invention;

Fig. 2 is a side elevational view thereof, with parts broken away to show the interior;

Fig. 3 is a fragmentary sectional view showing in detail the cover construction and the mounting of the cover and basket on the tank;

Fig. 4 is a sectional plan view taken on the line 4—4 of Fig. 2;

Fig. 5 is a top plan view of the basket;

Fig. 6 is an enlarged fragmentary sectional elevation showing in detail the power pumping unit of the machine;

Figs. 7 and 8 are sectional plan views taken on the line 7—7 and 8—8 respectively, of Fig. 6; and

Fig. 9 is a fragmentary elevational view with parts broken away, of the sump, or reservoir, portion of the machine.

Referring to these drawings; the machine includes a cylindrical or drum-like tank 10, the interior of which constitutes the washing chamber. Tank 10 is preferably portable in order that it may be moved to and from the dining room for conveniently loading and unloading it, and to this end the tank is shown as supported by a suitable framework 11 which is mounted in turn on casters 12.

Within the washing chamber, there is suspended a support or container for the articles to be washed, in this instance dishes and the like This container, preferably, consists of a basket of open work construction and may advantageously be made of wire mesh construction. Preferably, this basket comprises a cylindrical portion 13, open at both ends and having an inturned flange 14, at its lower margin. This flange 14 serves to support a circular base 15 so that it may be readily moved, or removed, for certain purposes, as will appear. The base 15, which like the portion 13 is of openwork construction, includes a plurality of relatively heavy reenforcing wires 16 which strengthen the light wire mesh of the bottom. The upper margin of the portion 13 of the basket is rolled around a circular wire 17 (Fig. 3), whereby a marginal flange is formed to rest on a corresponding flange

18 on the interior of tank 10 and support the basket. The flange 18 may, as shown, be formed by rolling up the metal of which tank 10 is formed.

Secured to the upper surface of the bottom 15 are a series of circular wires 19 arranged one within another in spaced concentrical relation. One of these wires,—the one of largest diameter,—is preferably spaced above the bottom 15 and between this wire and the adjacent portion 13 are placed small dishes, as saucers, sauce dishes, and so forth. The next wire 19 serves as a stop for the lower edge of somewhat larger dishes, which are tilted back against the portion 13. Similarly the next wire serves for other still larger dishes,—the three wires thus allowing a large number of dishes to be stacked around tank 10 and yet held spaced one from another so that washing water can reach all parts of each dish. Knives, forks and spoons are placed in upright position in a small central basket 20 mounted on the base 15. Hollow ware such as bowls, cups and glasses are inverted and arranged in the space between the basket 20 and the inner wire 19.

The distribution of washing water may, according to many features of the invention, be accomplished in any suitable manner. Preferably, however, a series of rotatable spray pipes are employed. For example, a series (four, as shown) of horizontal pipes 21, located between the base 15 of the basket and the base of tank 10, radiate from a central hub 22 rotatable about an axis 23 and always in communication with an inlet pipe 24. Two of the pipes 21 have at their outer ends vertical extensions 25, which are closed at their upper ends and are located between the peripheral wall of tank 10 and the portion 13 of the basket. The other two pipes 21 are provided with a longitudinal series of perforations 26 opening upwardly to direct water through the base 15. The two extensions 25 are provided with a corresponding vertical series of perforations to direct water through the portion 13 of the basket. The perforations, particularly in the extensions 25, are preferably such as to direct water from various angles (Fig. 4) and so that the reaction from some, at least, of the jets will be sufficient to rotate the series of pipes and thus distribute the water around the basket. By this arrangement, it is possible to distribute the water with great effectiveness and reach all portions of all the dishes.

The tank 10 is closed at its upper end by a cover, which includes two unequal sections 27 and 28 hinged together. This cover is removable in its entirety, being held merely by its weight to the tank, or either section 27 or 28 may be lifted, the remaining section serving to keep the cover in place on the tank. Ordinarily, section 28 would be opened to load and unload the dish holding basket but, when the machine is not in use, it is generally desired to allow a circulation of air within the washing chamber and for this purpose section 27 is raised. When not in use, section 28 may be used as a stand or table and section 27, being raised to allow the circulation described, serves as a back for the table thus formed.

The cover, considered as a whole, has a downwardly extending flange 29 (Fig. 3), which depends into the washing chamber in closely adjacent relation to the interior peripheral wall of tank 10 to prevent escape of water during the washing operation. Section 27 has a flange 30 which is curved about the hinge 31 for a like purpose. A circular bead 32, formed in the cover, and the reenforced rolled edge 33 thereof, cooperate with the reenforced rolled upper edge of tank 10 to position the cover thereon.

The machine is intended to present a neat and attractive external appearance so that its presence in the rooms of a home will be unobjectionable. To this end the power-pumping unit of the machine, is concealed within a casing 34, detachably secured to tank 10 by suitable means, indicated at 35. This casing has side walls which are bent to lie substantially at right angles, or in V-fashion, and, when the casing is in place, tangential, or substantially so, with the periphery of tank 10. This construction allows the presence of mechanism on the exterior of the machine and still allows the machine to fit nicely into the corner of a room, hence the mechanism utilizes space that would otherwise be unoccupied.

The tank 10, as described, is provided with an inlet pipe 24, and as shown in Fig. 6, such pipe extends to the outer wall of the tank and is provided with a socket 35'. Projecting outwardly from the side wall of the tank and secured thereto is a casing 36 forming a reservoir or sump 37. The base of tank 10 is connected to this sump by a sloping casing 38 which is hollow to form an outlet passage 39. The latter communicates with the interior of tank 10 by means of a screened drain opening 40 (Fig. 4), formed in the base of the tank. The movable bottom 15 of the dish holding basket may be lifted at one end, to permit access to the screened drain opening for cleaning without moving, or removing, the entire basket.

The power plant and pump are provided as a unit, which can be readily applied to and removed from the washing machine, when desired. The power plant preferably consists of an electric motor 41, which may be of small size but should preferably run at very high speeds. A motor, similar to that used on the ordinary vacuum cleaner,

has substantially the desired characteristics, —such motors running at speeds as high as 10,000 R. P. M. The axis of motor 41 is arranged vertically and, depending therefrom in concentrical relation with such axis, is a tubular casing 42, the upper and lower ends of which are split and bent to form feet 43 for attachment to the motor and pumping unit.

The latter includes a casing 44, to which the lower feet 43 are secured, and this casing has a central, vertically-disposed, frusto-conical chamber 45 from which two horizontal passages 46 and 47 radiate. Fitting into chamber 45 is a hollow frusto-conical casing 48, having an open lower end and a lateral opening 49 near its upper end to register with either passage 46 or 47,—the casing 48 thus functioning as a valve. The hollow interior of casing 48 forms a pump chamber 50. Casing 48 has a flange 51 at its upper end to rest on the upper face of casing 44 and is held in position by gravity.

Secured to flange 51 is a gear 52. Rotatably mounted on casing 44 and in mesh with gear 52 is a pinion 53, the shaft of which is connected by a universal joint 54 to an operating rod 55. Rod 55 extends upwardly within casing 34 and has at its upper end a squared portion 56, which is received in a corresponding socket formed in the lower end of a shaft 57. The latter lies within a sleeve 58, which is slidable in a bearing 59 on casing 34. Sleeve 58 has a longitudinal slot 60 and a rod 61, fixed to the upper end of shaft 57, protrudes through slot 60 and serves as a handle, whereby to turn valve 48 to either of its two positions. The connection between shafts 55 and 57 permits the casing 34 to be removed without removing the pumping unit.

The sleeve 58 has an operating knob 62, by means of which it may be conveniently depressed, and below bearing 59 it is provided with a circumferential flange 63. The latter overlies the forked end of a lever 64, which is arranged to operate a switch 65, by means of which the motor 41 may be connected to or disconnected from the electric supply wires. An attachment plug 66 is provided on casing 34 for connection to such wires and suitable electric connections, indicated in part at 67, are provided between the plug and switch and motor. It will be observed that sleeve 58 may be depressed in whatever position handle 61 occupies and that the latter can be turned without operating the switch 65. The return of the switch operating lever 64 is effected by the springs provided in connection with switch 65.

The combined power-pumping unit is removably connected to tank 10 and preferably mounted in such a way as not to transmit vibrations thereto. This unit, if rigidly connected to tank 10, would transmit vibrations thereto and such vibrations would be intensified by the drum-like character of the tank, making the machine tremendously noisy for, it must be remembered, motor 41 rotates at exceptionally high speeds. To prevent this action, the unit is flexibly, or otherwise, connected to tank 10 so that vibrations from the unit do not reach the tank, or at least not in sufficient volume to produce objectionable noise. To this end, one of the feet 43, attached to motor 41, is extended, as at 68, and below the member 68 is a projection 69 secured to tank 10. One or more bolts 70 pass loosely through member 68 and thread into projection 69, the head of the bolts 70 being spaced above, and free from, the member 68. Springs 71 are coiled around bolts 70 and serve to support member 68 from projection 69.

The pump casing 44 is provided with a short outlet pipe 73 for passage 46 and this pipe is connected by a flexible coupling 74 with another short outlet pipe 75, which fits into the socket 35′ in inlet pipe 24. The coupling 74 may, for example, consist of a rubber tube or hose. Thus, the connection between the lower end of the power-pumping unit and tank 10 is of such a character as not to transmit vibrations to the tank.

The pump consists of a screw 76 which is disposed within chamber 50. The shaft 77 of this screw passes through and is rotatably mounted in the described flange 51. No stuffing box is provided here for the reason that any leakage will be so slight, as compared with the volume of water pumped into inlet pipe 24, as to be negligible. No harm comes from any such leakage as the water, leaking by at this point, will return to the sump 37. The omission of the stuffing box is important because it eliminates considerable friction and allows a motor of much smaller power to be used to drive the pump and does away with the necessity for frequent expert adjustment of the stuffing box.

Shaft 77 is fixed to a sleeve 78 which has a pin and slot connection 79 with a shaft 80. The latter extends upwardly within the housing 42 and has a pin and slot connection 81 with a sleeve 82 which is fixed to the shaft of motor 41.

A pipe 83 (Fig. 9) has a threaded connection with the passage 47 of the pump casing and extends upwardly through the top of casing 34 where it is provided with a bent outlet portion 84. This portion 84 can be swung from the full line position to the dotted line position shown in Fig. 1 and is long enough to extend over the bowl of a sink when the machine is moved closely adjacent thereto. The pipe 83 can turn on its threaded connection with casing 44, or other suitable means may be provided, if desired, to permit this swinging movement.

Preferably, a pipe 85, secured to the cover of casing 34 extends downwardly therein and partially into the sump 37. This pipe is for convenience in supplying the sump with water, permitting as it does, the end of a hose to be inserted in its upper end and allowing the sump to be filled without removing the casing 34.

In operation, the sump 37 is filled with water through the fill pipe 85 to the desired level, the lower limit of which is at the lower end of valve 48 and the upper limit of which is preferably not above the level of the spray pipes 21. Dishes to be washed are placed, as described, in the basket 13—15 and the cover sections 27 and 28 moved into closed position. Valve 48 is turned, if necessary, by handle 61 to cause passage 46 to register with inlet pipe 24. The knob 62 is then depressed to start motor 41, whereupon the screw 76 is rotated at very high speed. This screw lifts water from sump 37 and expels it into the spray pipes 21. Some of the water expelled from the perforations in these pipes leaves at such angles that the reaction rotates the pipes in a clockwise direction, as viewed in Fig. 4. The sprays of water are thus distributed around the basket to reach all parts thereof. Water emitted from the spray pipes falls to the base of tank 10 and passes through the drain opening 40 and passage 39, back into the sump 37 to be again pumped to the spray pipes.

After the washing operation has continued for the desired length of time, the member 62 may be depressed to stop the motor, or the handle 61 may be turned to connect the outlet passage 49 to passage 47. This will permit the water in sump 37 to be ejected through pipe 83, the nozzle 84 of which shou'd be turned, as indicated in Fig. 1, to overlie the bowl of a sink or other suitable receiver. The sump may then be refilled with rinsing water, if desired, and the dishes sprayed therewith by turning handle 61 back to its original position.

When the handle 61 is turned to change the pump discharge from the spraying means to the out'et pipe 83, it may be adjusted to simultaneously connect the pump discharge with both the spraying means and outlet pipe 83 in any relative degree desired, so as to give a gradual discharge through the outlet pipe and thus avoid splashing of the water outside, which otherwise might occur by too great a force of the discharge if the change were made abrupt'y.

The pumping action is accomplished partially by the well-known action of an Archimedes screw but largely, I be'ieve, by the suction created in chamber 50 owing to the expulsion of the water by centrifugal force into passage 46. The screw rotating at such high speeds does, in any event, function very efficiently and circulates the desired volume of water, expe's it through the spray pipes with sufficient force, and yet requires comparatively little power to drive it. This type of pump, therefore, is particularly important for washing machines of the household type as it permits a small motor, requiring no more power than the usual vacuum cleaner, to be used. The arrangement of the outlet passage 46 at right angles to the axis of the chamber 50 contributes greatly, I believe, to the success of this type of pump by a'lowing centrifugal action in ejecting the water and the consequent suction effect in chamber 50 to aid in lifting the water from sump 37.

The unit construction of the power plant and pump is particularly advantageous from the manufacturing standpoint, allowing the parts to be separately assemb'ed with convenience and the assembled device to be applied as a unit to the tank. Its mounting, for ready removal, is desirable for convenience in cleaning, adjusting, or repairing parts. The flexible mounting of the unit on the tank is essential in a machine of this character where a tank, which functions much like a drum, is employed. Experiment shows that, without this flexible mounting, the machine would be too noisy for one to endure.

The invention has been disclosed herein, in an embodiment at present preferred, for illustrative purposes, but the scope of the invention is defined by the appended claims rather than by the foregoing description.

What I claim is—

1. In a washing machine, a drum-like washing tank, a pumping unit electrically driven at high speeds, and means for jointly conducting fluid to said washing tank and flexibly connecting said unit to the tank so as to prevent the vibrations incident to its high speed operation from passing to the tank and being intensified thereby.

2. In a washing machine, a drum-like washing tank, a power pumping plant operable at high speeds, and means for conducting fluid from said pump to said tank and for jointly supporting said plant from said tank whereby the vibrations set up in the former are prevented from being transmitted to and intensified by said tank.

3. In a washing machine, a drum-like washing tank, a combined power and pumping unit mounted thereon, and flexible shock absorbing means connecting said unit to the tank so as to prevent the vibrations set up in said unit from passing to the tank and being intensified thereby.

4. In a washing machine, a drum-like washing tank, a power pumping plant mounted in the periphery thereof and operable at high speeds, and flexible shock absorbing means supporting said plant from the tank so as to prevent the vibrations set

up in the former from being transmitted to and intensified by said tank.

5. In a washing machine. a washing tank, spraying means therein, an inlet provided to said means, a combined power and pumping mechanism constructed as a complete unit independent of said tank, and means for removably connecting said unit to the tank and the pumping portion of said unit to said inlet.

6. In a washing machine, a washing tank, spraying means therein, an inlet provided to said means. a combined power and pumping mechanism constructed as a complete unit independent of said tank, spring suspension means for removably connecting said unit to said tank, and means for connecting the pumping portion of said unit to said inlet.

7. In a washing machine, a washing tank, spraying means therein, an inlet provided to said means, a combined power and pumping mechanism, constructed as a complete unit independent of said tank, means for removably connecting said unit to the tank, and means for connecting the pumping portion of the unit to said inlet including a flexible coupling to damp the vibrations of said unit.

8. In a washing machine, a washing tank, spraying means therein, a reservoir for washing water associated with said tank, a pumping device having an inlet in communication with said reservoir and an outlet port, a casing in which said device is movably mounted having a port provided therein connected to the spraying means and being provided with a second port, a discharge pipe connected to the last named port, and means for moving the latter to bring its outlet port in registration with either of the other two ports, whereby water from the reservoir may be pumped to the spraying means or be removed therefrom by way of said discharge pipe.

9. In a washing machine, a washing tank, spraying means therein, a reservoir for washing water associated with said tank, a pumping device having an inlet in communication with said reservoir, a casing in which said device is movably mounted having a port provided therein connected to the spraying means and being provided with a second port, a swivelled discharge pipe connected to the last named port and having a spout which can be swung from a normal inactive position into another position for draining the reservoir.

10. In a washing machine, a washing tank, a reservoir associated therewith, spraying means in the tank, a pump casing having one end open and projecting into the reservoir, a high speed rotatable screw mounted in said casing, an outlet provided for said casing substantially at right angles to the axis of said screw, and means connecting said outlet to said spraying means.

11. In a washing machine, a washing tank provided with a reservoir, spraying means in said tank, pumping means to supply the spraying means from said reservoir, said pumping means comprising a casing having a vertical passage opening at one end into said reservoir and closed at the other end, an outlet from said passage for connection to the spraying means, a high speed screw rotatably mounted in said passage and having its shaft passing freely through the closed end thereof, and driving means for said shaft.

12. In a washing machine, a washing tank provided with a reservoir, spraying means in said tank, a pumping device to supply the spraying means from said reservoir and detachably connected to said means, a motor, a frame connecting the pumping device and motor into a single unit, detachable means for suspending such unit so that said device communicates with the reservoir, and driving connections between the motor and said device.

13. In a washing machine, a washing tank having a reservoir, spraying means in the tank having an inlet socket, and a unit power-pumping device detachably connected to the tank and mounted so as to suspend the pumping portion in said reservoir, said portion having an outlet pipe to slip into said socket.

14. In a washing machine, a washing tank having a reservoir, spraying means in the tank having an inlet socket, a unit power-pumping device detachably connected to the tank and mounted so as to suspend the pumping portion in said reservoir, said portion having an outlet pipe to slip into said socket, a housing detachably connected to the tank to encompass the sides and top of said unit, and a fill pipe depending from the top of said housing into said reservoir.

15. In a washing machine, a washing tank having a reservoir, spraying means in the tank, a combined motor and pump unit connected to the tank so that the pump is suspended in said reservoir, a housing detachably connected to the tank and encompassing the sides of said unit, a discharge pipe extending downwardly into said housing and connected to the pump, connecting means between the latter and said spraying means, a valve associated with the pump for connecting the latter to said discharge pipe or said spraying means, and an operating rod connected to said valve and extending outside the housing.

16. In a washing machine, a washing tank, a drain opening in the base of the tank and located eccentrically thereof, a dish-holding basket suspended in said tank and overlying said opening, the base of said basket be-

ing movable independently of the side walls thereof to permit access to said opening without removing the entire basket.

17. In a dishwashing machine, a washing tank for the dishes, spraying means within the tank adapted when supplied with water under pressure to clean the dishes, said tank having a reservoir to receive the water, a rotary pump disposed vertically outside of said tank and having its inlet end connecting with said reservoir, said pump having a screw impeller, and an electric motor above the pump and driving said impeller.

18. In a dish washing machine, a tank for the dishes, a pump outside of the tank receiving water from said tank, a motor outside of the tank for driving said pump, said motor being located above said pump and having a vertical axis, a discharge pipe having an outlet near the top of the tank in position to discharge into a suitable receptacle, spraying means within the tank, a supply pipe for said spraying means, and a manually operable valve device for alternately connecting the discharge of said pump to said supply pipe and said discharge pipe.

19. In a washing machine, a washing tank, spraying means in said tank, a reservoir connected to said tank located exteriorly of the tank and having an open upper end, a casing in said reservoir provided with a pump chamber, a movable pumping element in said chamber and adapted to operate said spraying means, driving means for said element including a motor supported above the said casing, and means connecting the motor to said element, said last-named means passing freely through said casing into said chamber whereby high pressure circulation of the washing fluid is effectively maintained.

20. In a washing machine, a washing tank, spraying means in said tank, a reservoir connected to said tank located exteriorly of the tank and having an open upper end, a casing in said reservoir having a closed upper end, a pump adapted to operate said spraying means having its movable pumping element in said casing, the drive shaft of said element passing freely through said upper end of said casing, said pump being so located that any leakage between said drive shaft and casing is received in said reservoir, and a motor for the pump located above the top of said reservoir out of range of such leakage whereby high pressure circulation of the washing fluid is effectively maintained.

21. In a washing machine, a washing tank, spraying means in said tank, an extraneous reservoir connected to said tank, a pump adapted to operate said spraying means in said reservoir, a rotary upwardly extending shaft for driving said pump, and an electric motor for directly driving said shaft supported at a distance above said pump whereby high pressure circulation of the washing fluid is effectively maintained.

22. In a dishwashing machine, a tank for the dishes, a pump outside of the tank receiving water from said tank, a discharge pipe having an outlet near the top of the tank in position to discharge into a suitable receptacle, pressure driven rotary spraying means within the tank, a supply pipe for said spraying means, and a manually operable valve device for simultaneously connecting the discharge of said pump to said supply pipe and said discharge pipe in inverse varying amounts according to the position of said valve device.

In testimony whereof I have affixed my signature.

HENRY CAVE.