April 10, 1928. 1,665,959

G. C. GRAHAM ET AL.

WASHING MACHINE

Filed Dec. 12, 1927 3 Sheets-Sheet 1

Fig. 1.

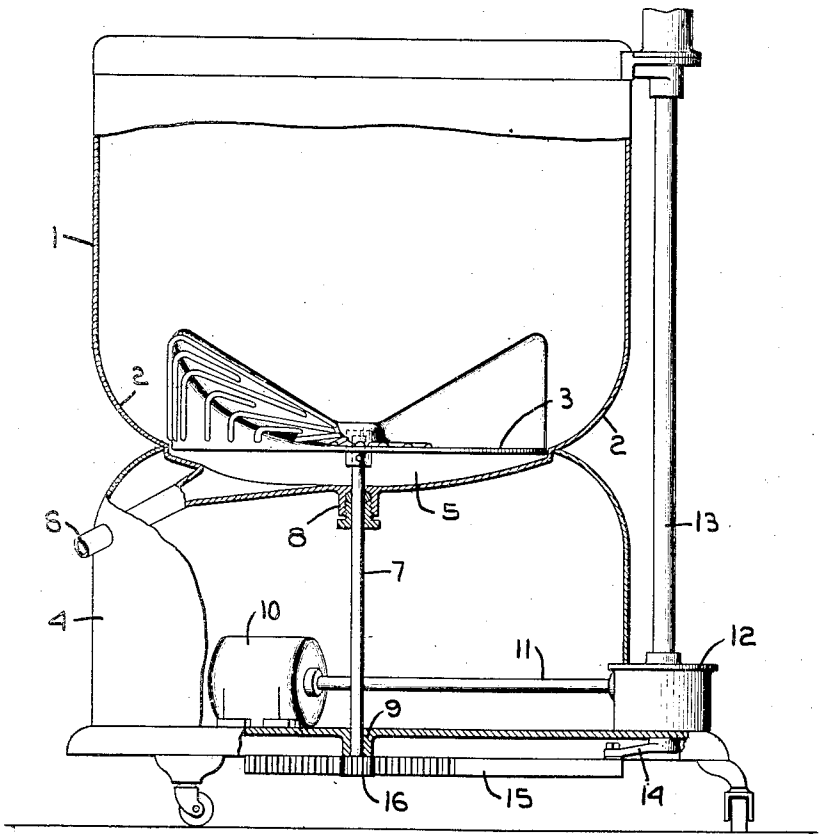


Fig. 2.

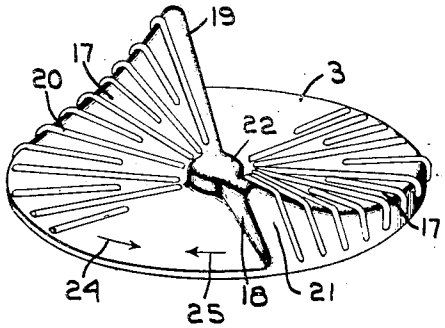
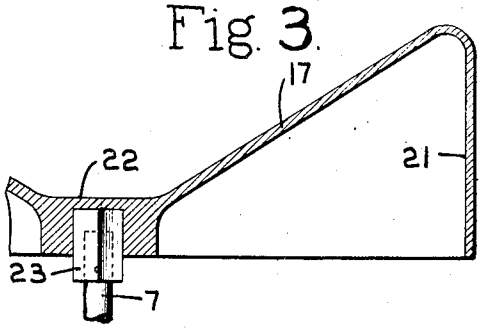


Fig. 3.



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Filed Dec. 12, 1927 3 Sheets-Sheet 2

Fig. 4.

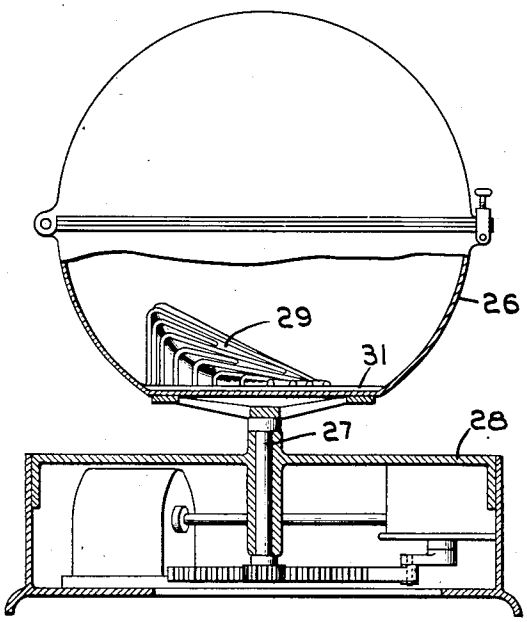


Fig. 5.

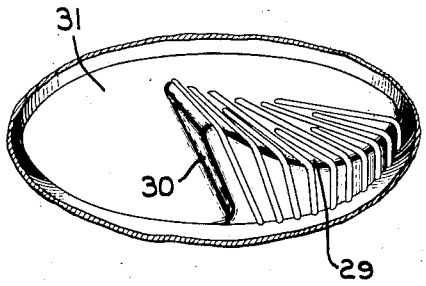


Fig. 6.

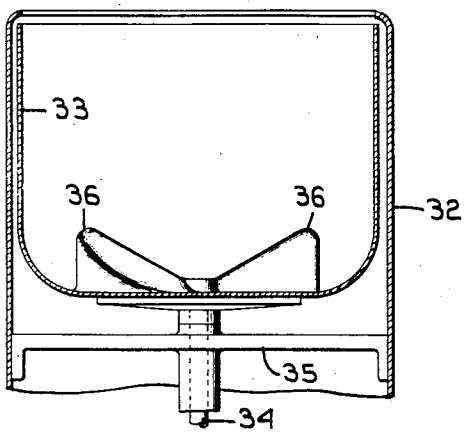
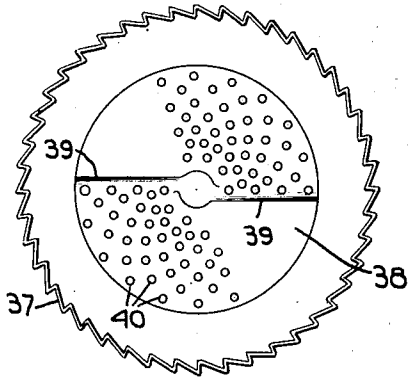


Fig. 7.



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Filed Dec. 12, 1927 3 Sheets-Sheet 3

Fig. 8.

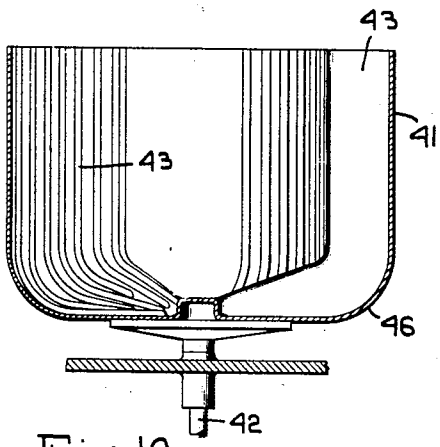


Fig. 9.

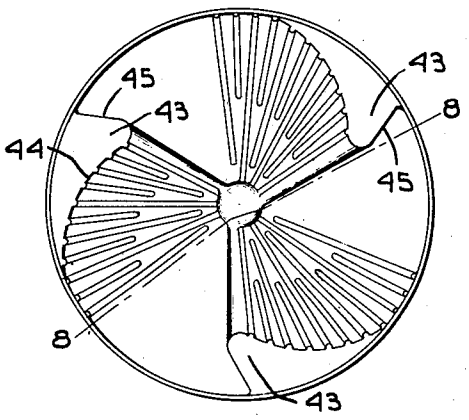


Fig. 10.

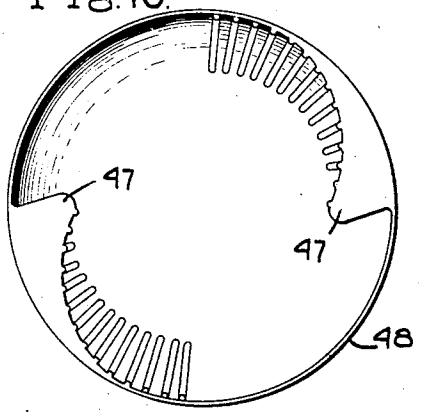


Fig. 11.

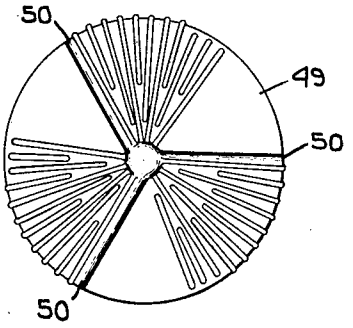


Fig. 12.

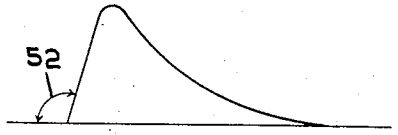
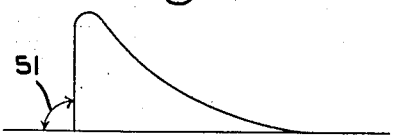


Fig. 13.



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Patented Apr. 10, 1928. 1,665,959

UNITED STATES PATENT OFFICE.

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WASHING MACHINE.

Application filed December 12, 1927. Serial No. 239,320.

This invention relates to a machine for washing clothes or otherwise treating them with a suitable cleansing, impregnating, rinsing or other fluid.

The principal object of the invention is to provide a simple, efficient and economical machine particularly adapted for laundry and household use in the washing of clothes.

It is the object of the invention to provide a machine of this character in which every article and part of the clothes shall be subjected to the washing action thus to insure uniformity of treatment.

The object of the invention is further to provide an agitating means which shall force the washing fluid thoroughly through the clothes and shall also preferably subject the clothes to a rubbing action to effect the desired results.

The object of the invention is further to provide one or more agitating blades in the tub and preferably projecting inward from the tub wall, which blades, either together with or independently of the tub, are oscillated sidewise and the side surfaces of which are so related to the tub wall or path of oscillation as to cause the blade to have an alternate scrubbing and engaging action upon the contents of the tub and in particular upon the mass of clothes. The principle of this action insures at each oscillation a contact between the agitator blade and a different portion of the clothes being washed. In the preferred forms of the invention, there is primarily a rubbing engagement between the blade surface and the clothes in one direction of oscillation, while in the other direction of oscillation the clothes are engaged and impelled by the blade and redistributed in the tub.

The object of the invention is further to provide a form of oscillating agitator blade adapted to secure the desired action on the tub contents when oscillating.

The object of the invention is further to disclose the principle of the oscillating agitator blade by which the blade may be adapted to different conditions of use, such, for example, as the extent to which the clothes are rubbed, the force with which the clothes are impelled or thrown about in the tub, and the frequency with which the operations take place.

These and other objects and features of the invention will appear more fully from the accompanying description and drawings and will be particularly pointed out in the claims.

As the main feature of the invention involves a broad principle of construction and operation, namely, the application of the alternating scrubbing and engaging action of an oscillating agitator in a washing machine, the drawings show a variety of applications of this principle to different types of washing machines. Furthermore, as the invention is only concerned with the handling or treatment of the clothes during the washing operation and as the general construction and operation of various types of washing machines are well known and familiar to those skilled in the art, it is only necessary here to illustrate and describe in detail those parts of the machine in which forms of the invention are embodied.

In the drawings:

Fig. 1 is a front elevation partially in vertical cross section of a washing machine embodying one form of the invention in which the tub is cylindrical and with an oscillating agitator in the bottom of the tub and oscillating independently of the tub.

Fig. 2 is a view in perspective of the oscillating agitator element shown in Fig. 1.

Fig. 3 is a detail in vertical cross section of a portion of the agitator showing its connection to the oscillating shaft.

Fig. 4 is a view in side elevation and partially in vertical cross section of another type of washing machine with a preferred form of the invention embodied therein and wherein the tub is spherical with the agitator rigid therewith.

Fig. 5 is a detail in perspective with the main portion of the tub broken away showing the agitator element of Fig. 4.

Fig. 6 is a view chiefly in vertical cross section of another form of washing machine embodying the invention and in which the tub is cylindrical and the agitating element is rigid therewith and located at the bottom of the tub.

Fig. 7 is a top plan view of the tub of a washing machine of the general type shown in either Fig. 1 or 6 to illustrate a further embodiment of the invention.

Fig. 8 is a view chiefly in vertical cross section of another form of machine embodying the invention in which the agitator

blades project inward from the side wall of a cylindrical tub and are shown as three in number.

Fig. 9 is a top plan view of the construction shown in Fig. 8.

Fig. 10 is a view similar to Fig. 9 showing a construction where but two agitator blades are employed and where the blades do not extend across the flat bottom of the cylindrical tub.

Fig. 11 is top plan view of a circular tub wall section with three agitator blades embodying the invention.

Fig. 12 is a diagram to indicate another angular relation between the side surfaces of the agitator blade from that shown in the preceding figures.

Fig. 13 is a view similar to Fig. 12 to indicate a third angular relation.

Referring first to the construction illustrated in Figs. 1, 2 and 3 disclosing a preferred form of the invention, the container or tub is shown as of the vertical, cylindrical type. The side wall 1 of the tub curves inwardly at 2 near the bottom and the bottom section 3 of the tub wall is circular and separate from the side wall portion. The tub is supported in any suitable manner, as upon the casing 4, and is formed beneath the bottom section 3 to present a shallow chamber 5 in which dirt and sediment is collected and from which the fluid contents of the tub are discharged through a suitable outlet 6.

The circular bottom section of the tub wall is supported upon the central, vertical shaft 7 which has a bearing and passes through a packing gland at 8 near its upper end and at its lower end has a bearing at 9 in the base of the casing. This shaft is given an oscillating movement by any suitable mechanism. As illustrated, an electric motor 10 mounted within the casing 4 drives a shaft 11 extending into a suitable gear box 12 from which a shaft extends upwardly at 13 to drive the usual wringer and from which a rotating crank 14 extends downwardly and is connected to and reciprocates a rack bar 15. This rack bar engages a pinion 16 on the lower end of the shaft 7.

This machine is shown as provided with two blades. Each blade projects inward, or in this case upward, from the bottom circular wall section 3 of the tub. These blades are of similar construction and are arranged radially of the central, vertical axis of the tub and are disposed symmetrically and in equi-spaced relation with respect to the axis. In this form illustrated, the blades are integral with the circular wall section 3 but, as pointed out, this section is separate from the remaining portion of the tub wall so as to oscillate independently of the tub when the shaft 7 is oscillated. The blades and the wall section 3 may conveniently be made as a single integral unit, as illustrated, being, for example, cast or stamped from aluminum or other suitable metal.

It will be observed that the blades are oscillated sidewise. The side surface 17 of each blade is much longer than the opposite side surface 18. The side surface 17 slopes downward from the upper edge 19 of the blade to the surface of the wall section 3 and in this case also extends concentrically of the vertical axis of oscillation. The opposite surface 18 also slopes downward to the surface of the wall section 3 and also extends concentrically of the axis. In the construction shown, the surface 18 of the blades forms an acute angle with the surface of the wall section 3 so that each blade may be said to be undercut. The blades are preferably formed with smooth and easy curves merging into the wall section 3. The surfaces of the blades may be smooth or rendered uneven by projections, corrugations or otherwise according to the extent of rubbing action which it is desired shall take place between the clothes and the blades. In this form, the relatively long surfaces 17 are shown as provided with smooth corrugations or ribs 20 extending transversely of the direction of oscillation of the blade and consequently in this case extending radially. These corrugations or ribs are also shown as extending down the outer or more or less vertical periphery 21 of the blades.

The inner ends of the blades are shown as merging into a small, smooth dome or knob 22 at the center of the circular wall section 3. This provides a solid hub which may be formed beneath with a polygonal recess to receive a corresponding polygonal cap 23 pinned to the top of the shaft 7. This enables the blade unit readily to be removed and replaced on the top of the oscillating shaft.

The clothes or the articles to be washed (the term clothes being herein used in a generic sense) and the washing fluid are placed in the tub in the usual manner and the machine set in operation. The blades therefore oscillate about the central vertical axis of the tub alternately in the direction of the arrows 24 and 25, see Fig. 2. The angle of oscillation may be fixed according to the results desired. An angle of about 180° in the case of a machine of the type shown in Figs. 1 and 2 having two blades has been found desirable for household laundry work. As the agitator element moves in the direction of the arrow 24, the longer surface 17 of each blade advances, rubbing past, or in this case beneath, the contents of the tub and consequently scrubbing that portion of the clothes thereabove. This scrubbing action may be as gentle or as vigorous as desired, depending upon the rapidity and extent of oscillation, the character of the

surface 17 and its angular relation to the path of oscillation. When the movement is reversed and the blades move in the direction of the arrow 25, the contents of the tub and, in particular, the clothes, are gripped by the shorter surfaces 18 and impelled therewith.

It will thus be seen that in the action of each blade the longer surface 17 slides beneath a portion of the clothes in one direction of oscillation and then the shorter surface 18 engages the clothes upon the reverse movement, but the vigor with which the clothes are engaged by the short surfaces and the force with which the impelling action takes place will depend upon the angular relation of the shorter surface 18 of the blade with the path of oscillation. When this surface presents an acute angle to the tub wall and to the path of oscillation, as shown in Fig. 2, and the blade is thus undercut, the action is most vigorous and a firm grip is taken on the clothes. Furthermore, with the blade thus undercut, suction is produced behind the surface 18 when the blade oscillates in the direction of the arrow 24, thus drawing the mass of clothes down behind the blade and causing an even more active engagement of the surface 18 with the clothes when the oscillation is reversed and the blade moves in the direction of the arrow 25.

The result of this action of the blades upon the tub contents is to bring every part of the clothes mass into contact with the blades, and to impel each section of the clothes vigorously through the fluid, thus forcing the fluid through the clothes and securing the cleansing action. The clothes are kept in constant agitation in the tub and at the same time are agitated and scrubbed by the surfaces of the blades increasingly when these surfaces are uneven or corrugated. While the action of the blades upon the clothes is vigorous and thorough, there is nothing in the construction tending to tear or injure the clothes and the parts may readily be proportioned to enable the machine to handle even the most fine and delicate fabrics.

The construction thus described has been selected as a simple and preferred form embodying the principle of the invention, but it will be observed that this principle is of wide application and may be embodied in a wide variety of types of machines. As indicating something of the scope of the invention, other forms of machines have been illustrated.

In Figs. 4 and 5 there is shown a machine where the tub is of the spherical type such as shown in the patent to Robe, No. 1,547,266, July 28, 1925. Here the spherical tub 26 is rigidly mounted on the vertical shaft 27 supported in a suitable base 28 and oscillated by mechanism similar to that already described. A single blade is here shown rigid with the central bottom wall section of the tub with the body of the blade extending across the central vertical axis. The relatively long downward sloping surface 29 and the oppositely disposed relatively short downward sloping surface 30 of the blade are in general similar to those already described. But in this case it will be seen that the blade receives its oscillation from the tub because it projects inward from an integral circular bottom portion 31 of the tub wall and the entire tub is oscillated by the shaft 27. The blade has a similar action to that already described upon the tub contents and similar results are secured.

In Fig. 6 a form of washing machine is shown in which there is an outside casing 32 and an inner cylindrical tub 33 mounted upon a central, vertical shaft 34 carried in the base 35. The shaft 34 is given an oscillating movement, as in the case of the previous machines. The blades 36 are herein shown as two in number and constructed and disposed similarly to the blades shown in Fig. 1, except that the side surfaces of the blades are smooth. Furthermore, in this case the blades are rigidly secured to or integral with the tub wall so that they oscillate with the tub after the manner of the blade of the tub in Fig. 4. The principle of action of the blades is the same as that already described, but with the smooth surfaces there is less rubbing of the clothes.

In addition, the vertical walls of the tub as, for example, of a cylindrical tub such as shown in Fig. 6, may be constructed both to rub the clothes and to retard the vertical rotary movement of the mass of clothes with respect to the vertical tub walls. In Fig. 7, the vertical portion of a tub wall is shown as formed with vertical teeth 37 for this purpose and the proportions of these teeth which constituted miniature blades may be varied as desired. The circular bottom wall section 38 of the tub in Fig. 7 is shown as provided with two symmetrically disposed equi-spaced blades 39. These blades here have the longer downward sloping surfaces roughened by means of small projections 40. The wall section 38 may either oscillate independently of, or with, the remainder of the tub.

In the constructions thus far referred to, the blades relied upon for the washing action and operating on the principle of this invention have been shown as located at the bottom wall section of the tub, but they may be otherwise located and may effectively be located on the side or vertical wall of the tub and may or may not be combined with similar blades in the bottom section of the tub.

In Fig. 8 there is shown a cylindrical tub

41 secured to the top of a vertical oscillating shaft 42. The tub is shown as provided with three similar blades 43 symmetrically disposed and equi-spaced about the central, vertical axis. Each of these blades projects inward from the wall of the tub and each presents the relatively long side surface 44 sloping downward to the cylindrical tub wall in one direction and the relatively short opposite side surface 45 sloping downward to the cylindrical tub wall. Preferably, as shown, the relatively long side surfaces 44 of the blades are roughened or corrugated. The surfaces of the blade are also shown at their lower ends as conforming to the curvature 46 of the bottom portion of the tub and extending well to the center of the tub.

It will be seen that the principle of action is the same as already set forth. When the tub is bodily oscillated with the shaft 42 about its central, vertical axis, the several blades oscillate with it. The longer surfaces 44 upon their advancing movement rub past the tub contents and the shorter surfaces 45 upon the reverse movement engage and impel the contents.

The number and disposition of the blades may be varied, as already pointed out. In Fig. 10 the construction is similar to that illustrated in Fig. 8, except there are but two blades 47 projecting inward from the vertical side wall of the cylindrical tub 48 and not extending over the flat bottom surface of the tub.

In Fig. 11 there is illustrated a circular bottom section 49 of a tub wall which may be either integral with or separate from the remainder of the tub wall. This section is shown as having three similar, symmetrically disposed, equi-spaced blades 50, otherwise constructed as shown in Fig. 2.

As already pointed out, the impelling action of the blades upon the clothes will vary considerably, depending upon the difference in the angular relation of the side surfaces of the blade with respect to the path of oscillation. The most vigorous action is obtained in the foregoing constructions by making one surface at an acute angle to the wall section, as shown at 18 in Fig. 2. If this side have a right angle with respect to the wall surface, as shown at 51 in Fig. 13, or an obtuse angle as shown at 52 in Fig. 12, the action will vary, but in all cases there will be the same alternate scrubbing and engaging action of the blade when the blade is oscillated.

The constructions illustrated are selected simply as preferred forms and showing something of the application of the principle, but in all cases it will be seen that the agitator blade is given an oscillatory movement either with or with respect to the tub, that this oscillatory movement takes place sidewise of the blade, that the blade projects inward relatively to a wall of the tub or container whether it extends to the wall or not and whether it oscillates with or separately from the wall, and that one of the two opposite agitating side surfaces is disposed at a greater angle than the other side surface relatively to the container wall and consequently with respect to the path of oscillation of the blade. In all the forms of the invention illustrated, the agitating blade or blades oscillate about an upwardly extending axis and in all but the forms illustrated in Figs. 8, 9 and 10 about an axis normal to the container wall relatively to which they project inward.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. A washing machine comprising a container adapted to contain the articles to be washed and the washing fluid, an agitating blade projecting inward relatively to a wall of the container and having opposite agitating side surfaces and means to oscillate the agitating blade sidewise about an upwardly extending axis, one of said side surfaces being disposed at a greater angle relatively to the container wall and being longer in the direction of oscillation than the other side surface whereby the articles slide over the side disposed at the greater angle when the said side is advancing and are caught and impelled by the opposite side upon the reverse movement.

2. A washing machine comprising the construction defined in claim 1 in which the side surface having the said greater angle is uneven to increase the agitating and scrubbing action on the contents of the container.

3. A washing machine comprising the construction defined in claim 1 in which the agitating blade is rigid with the container wall relatively to which it projects inward.

4. A washing machine comprising a container adapted to contain the articles to be washed and the washing fluid, an agitating blade extending from, and projecting inward relatively to, a wall of the container and having opposite agitating side surfaces, one of said side surfaces being disposed at an obtuse angle with the container wall and the other side surface at an acute angle and means to oscillate the agitating blade sidewise whereby upon the advancing movement of the former surface a suction action is produced behind the latter surface and upon the reverse movement the latter surface actively engages the container contents.

5. A washing machine comprising a container adapted to contain the articles to be washed and the washing fluid, a circular section forming part of, but separate from the remainder of the container wall, means for oscillating said circular section about a central axis normal thereto, an agitating blade

rigid with and projecting inward relatively to said wall section and having opposite agitating side surfaces, both of said side surfaces extending transversely of the arcuate path of oscillation and one of said side surfaces being disposed at a greater angle relatively to said wall section and being longer in the direction of oscillation than the other side surface.

6. A clothes washing machine comprising a tub to contain the clothes and washing fluid, a plurality of similarly shaped blades projecting inward from the tub wall, and means for simultaneously oscillating said blades about a central axis normal to the tub wall, each blade having one side longer in one direction of oscillation and at a greater angular relation to the arcuate path of oscillation than the opposite side.

7. A clothes washing machine comprising the construction defined in claim 1, in which there are a plurality of the said blades similarly disposed with respect to a common axis about which the blades oscillate sidewise simultaneously in a circular path.

8. A washing machine comprising the construction defined in claim 1 in which there are a plurality of the said agitating blades similarly disposed with respect to a common axis about which the blades oscillate sidewise simultaneously in a circular path and in which each agitating blade is rigid with the container wall relatively to which it projects inward.

9. A clothes washing machine comprising a tub to contain the clothes and washing fluid, a blade projecting upward from the bottom wall of the tub and presenting a relatively long side surface sloping downward to the bottom of the tub wall in one direction and a relatively short opposite side surface sloping downward to the bottom of the tub wall, and means for oscillating the blade sidewise about an upwardly extending axis to cause the longer surface upon its advancing movement to rub beneath the tub contents and the shorter surface upon the reverse movement to engage and impel the contents.

10. A clothes washing machine comprising the construction defined in claim 9, in which the said long side surface of the blade is provided with smooth corrugations extending transversely to the direction of oscillation of the blade to effect an increased agitating and scrubbing action on the clothes rubbing past said surface.

11. A clothes washing machine comprising the construction defined in claim 9, in which the shorter side surface of the blade forms an acute angle with respect to the tub wall whereby upon the said advancing movement said shorter surface produces a suction action and upon the said reverse movement actively engages the contents.

12. A clothes washing machine comprising a tub to contain the clothes and washing fluid, a plurality of blades projecting inward from a wall of the tub and each presenting a relatively long side surface sloping downward to the tub wall in the same direction and a relatively short opposite side surface sloping downward to the tub wall, the said long side surface being disposed at a greater angle relatively to the said tub wall than the short side surface, and means for simultaneously oscillating the blades sidewise about an axis extending centrally of the tub to cause the longer surfaces upon their advancing movement to rub past the tub contents in the same direction and the shorter surfaces upon the reverse movement to engage and impel the contents in the opposite direction.

13. A clothes washing machine comprising a tub to contain the clothes and washing fluid, a plurality of symmetrically disposed, equi-spaced blades projecting inward from a wall of the tub and each presenting a relatively long side surface sloping downward to the tub wall in one direction and a relatively short opposite side surface sloping downward to the tub wall, the said long side surface being disposed at a greater angle relatively to the said tub wall than the short side surface, and means for simultaneously oscillating the blades sidewise about an axis extending centrally of the tub to cause the longer surfaces upon their advancing movement to rub past the tub contents and the shorter surfaces upon the reverse movement to engage and impel the contents.

14. A clothes washing machine comprising a tub to contain the clothes and washing fluid, a circular section forming part of the tub wall, means for oscillating said circular section about a central axis normal thereto, a blade rigid with and projecting inward from said wall section and presenting a relatively long side surface sloping downward to the tub wall and extending concentrically of said axis and a relatively short opposite side surface sloping downward to the tub wall and also extending concentrically of said axis, the said long side surface being disposed at a greater angle relatively to the said tub wall than the short side surface, whereby upon the oscillation of said wall section the longer surface of the said blade upon its advancing movement rubs past the tub contents and the shorter surface upon the reverse movement engages and impels the contents.

15. A clothes washing machine comprising the construction defined in claim 14, in which the said circular wall section is separate from the remainder of the tub wall so as to oscillate independently thereof.

16. A clothes washing machine comprising a tub to contain the clothes and washing

fluid, a circular section forming part of the bottom of the tub wall and separate from the remainder of the tub wall so as to oscillate independently thereof, means for oscillating said circular section about a central vertical axis, a blade rigid with and projecting inward from said circular wall section and presenting a relatively long side surface sloping downward to the said wall section and extending concentrically of said axis and a relatively short opposite side surface sloping downward to the said wall section and also extending concentrically of said axis, whereby upon the oscillation of said wall section the longer surface of the said blade upon its advancing movement rubs beneath the tub contents and the shorter surface upon the reverse movement engages and impels the contents.

17. A clothes washing machine comprising the construction defined in claim 16, in which the shorter side surface of the blade forms an acute angle with respect to the said wall section whereby upon the advancing movement said shorter surface produces a suction action and upon the reverse movement actively engages the clothes.

18. A clothes washing machine comprising a tub to contain the clothes and washing fluid, a circular section forming a separated part of the bottom of the tub wall, means for oscillating said circular section about the central, vertical axis of the tub normal to said section, a plurality of blades rigid with said section and projecting upwardly therefrom, each blade presenting a relatively long side surface sloping downward in the same direction to said section and extending concentrically of said axis, and a relatively short opposite side surface sloping downward to said section and also extending concentrically of said axis, whereby when the said section is oscillated the longer surfaces of the said blades upon their advancing movement rub under the tub contents and the shorter surfaces upon the reverse movement engages and impels the contents.

19. A clothes washing machine comprising a tub to contain the clothes and washing fluid, a circular section forming a separated part of the bottom of the tub wall, means for oscillating said circular section about the central vertical axis of the tub normal to said section, a plurality of symmetrically disposed equi-spaced blades extending radially of said section, rigid with said section and projecting upwardly therefrom, each blade presenting a relatively long side surface sloping downward to said section and extending concentrically of said axis and a relatively short opposite side surface sloping downward to said section at an acute angle thereto and also extending concentrically of said axis, whereby when the said section is oscillated the longer surfaces of the said blades upon their advancing movement rub under the tub contents while the shorter surfaces produce a suction and upon the reverse movement the shorter surfaces engage and impel the contents.

20. A washing machine comprising a container adapted to contain the articles to be washed and the washing fluid, an agitating blade projecting inward relatively to a wall of the container and having opposite agitating side surfaces and means to oscillate the agitating blade sidewise about an axis normal to the said wall, one of said side surfaces being longer in the direction of oscillation and disposed at a greater angle relatively to the container wall than the other side surface.

21. A washing machine comprising a container adapted to contain the articles to be washed and the washing fluid, a plurality of agitating blades projecting inward relatively to the bottom wall of the container and having opposite agitating side surfaces, one of said side surfaces being disposed at a greater angle than the other side surface relatively to the container wall, the said blades being similarly disposed with respect to the vertical axis of the container and with the faces having the same angle facing in the same direction of oscillation, and means to oscillate the blades sidewise in a circular path about said axis.

In testimony whereof, we have signed our names to this specification.

GEORGE C. GRAHAM.
ROBERT S. ROBE.