

Nov. 13, 1951

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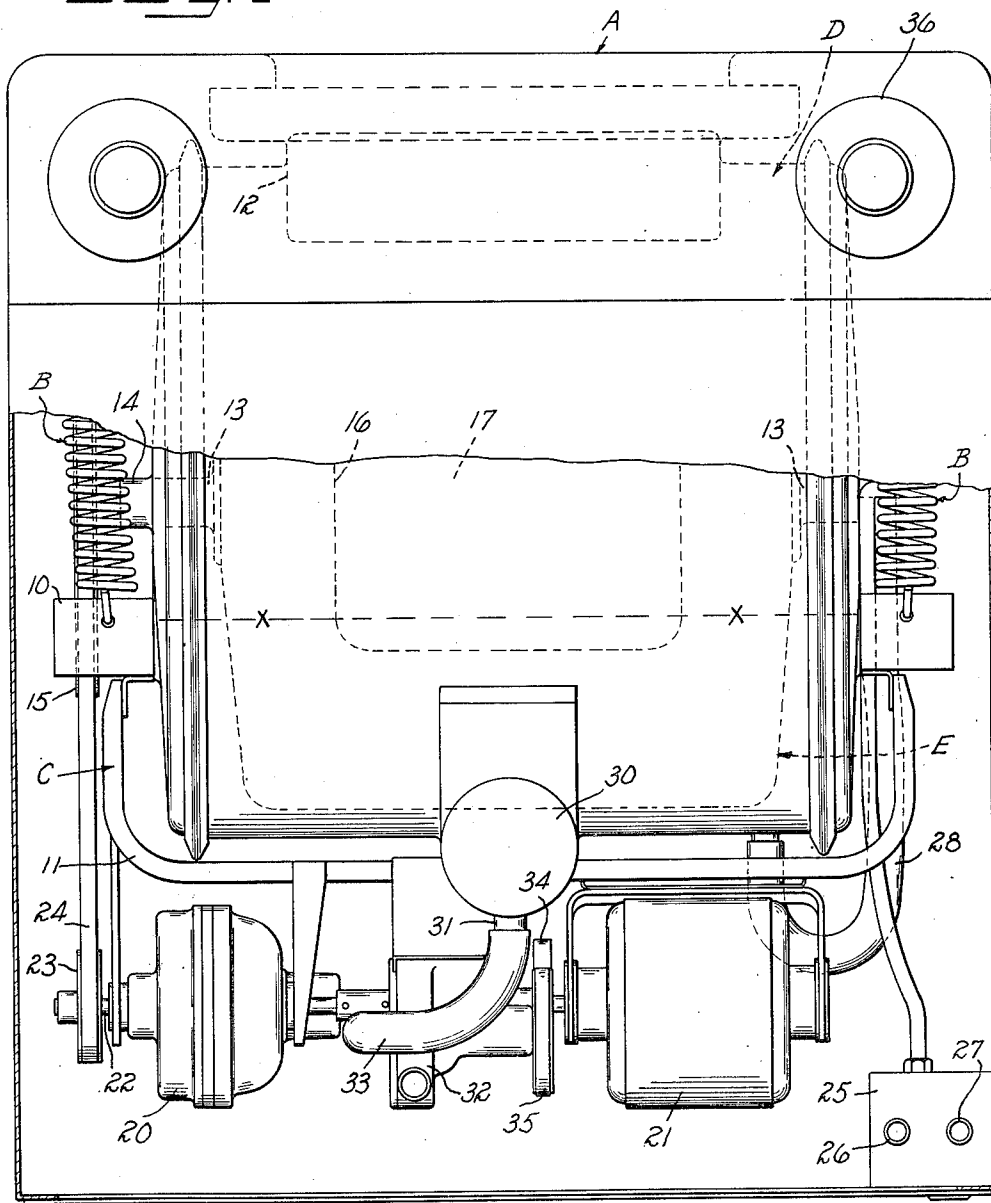
2,574,985

CLOTHES WASHING MACHINE UTILIZING A TUMBLING DRUM

Filed April 14, 1948

4 Sheets-Sheet 1

Fig. 1



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4 Sheets-Sheet 2

Fig. 2

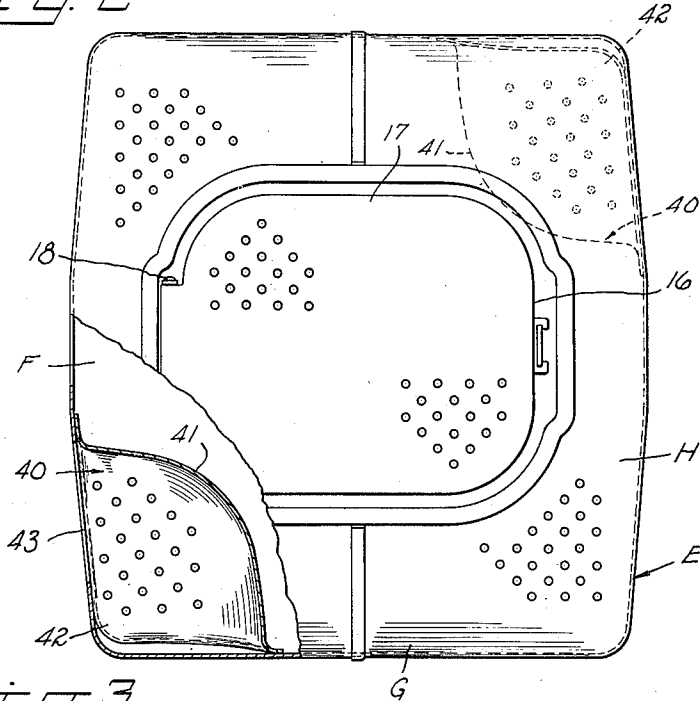
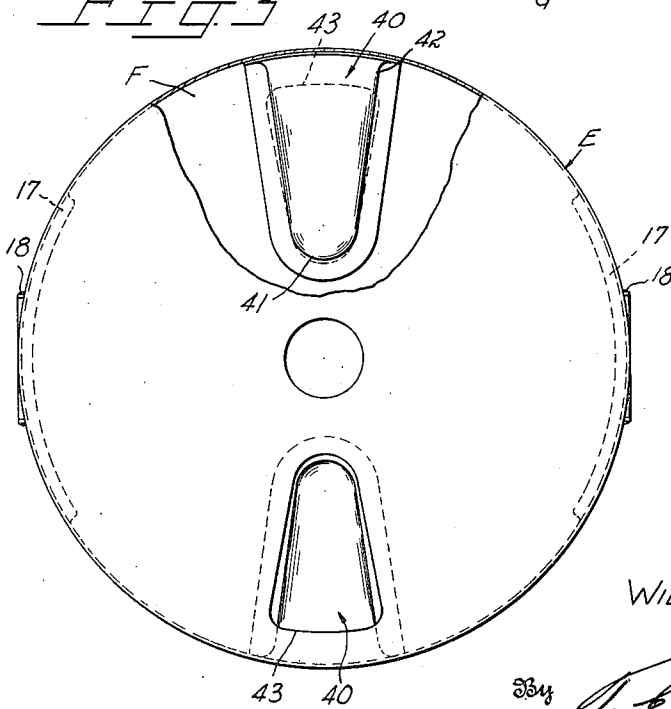


Fig. 3



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4 Sheets-Sheet 3

Fig. 4

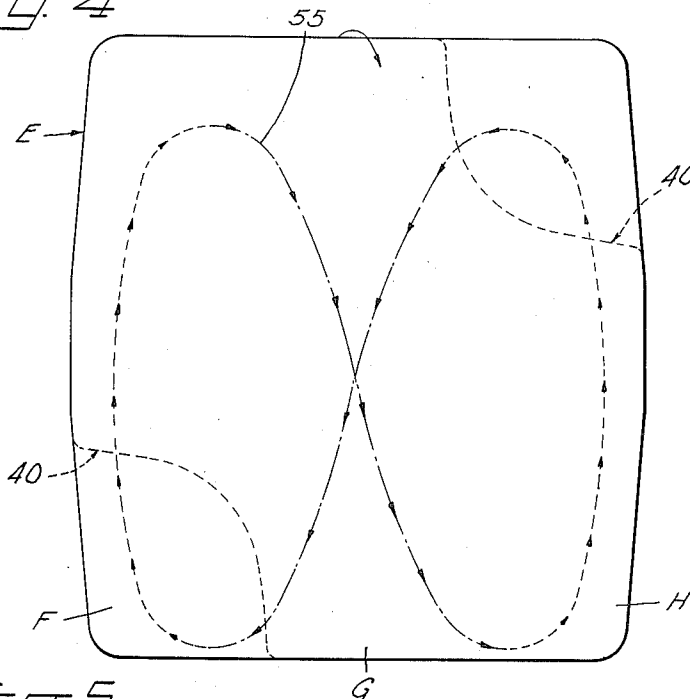
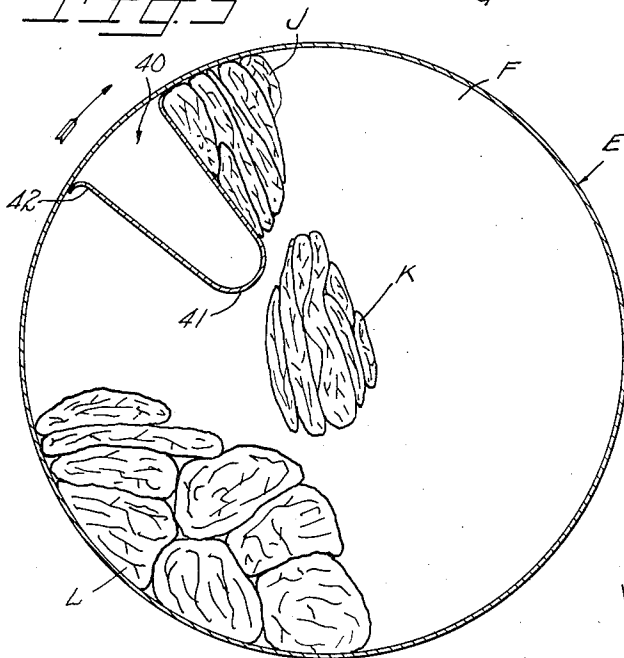


Fig. 5



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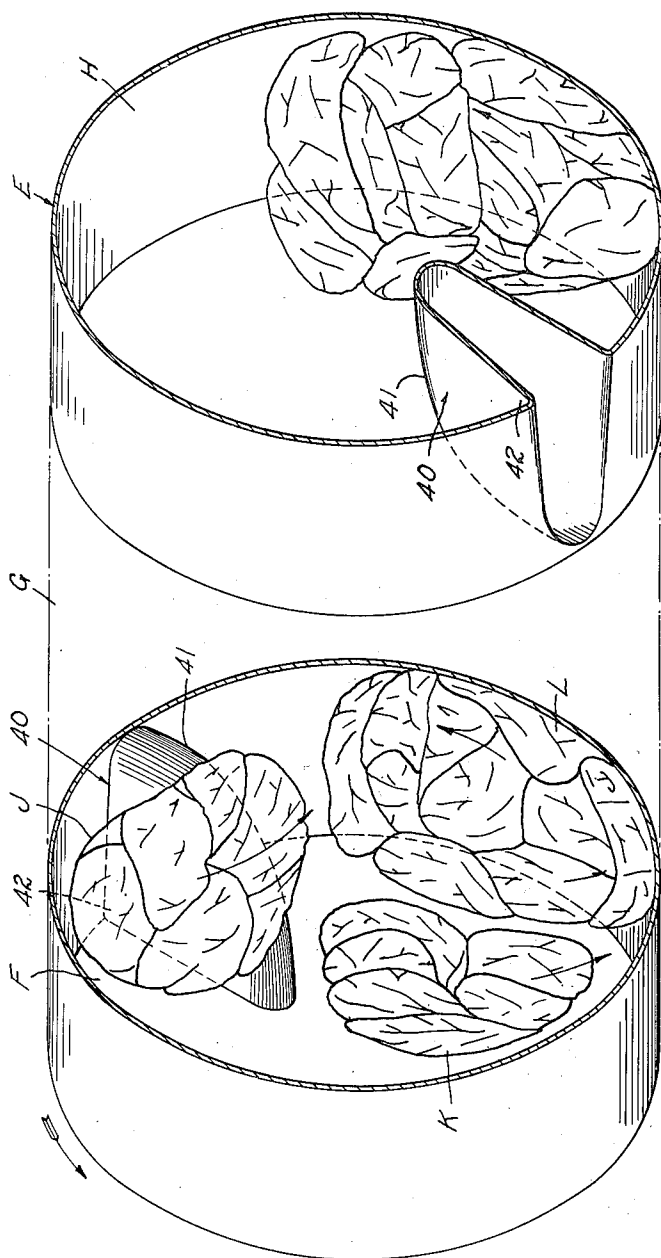
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4 Sheets-Sheet 4

Fig. 6



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UNITED STATES PATENT OFFICE

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CLOTHES-WASHING MACHINE UTILIZING
A TUMBLING DRUM

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Application April 14, 1948, Serial No. 20,937

2 Claims. (Cl. 68—139)

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The present invention relates to washing machines for cleaning and drying clothes and similar textile materials, and more particularly to washing machines for such use of the domestic or household type.

An object of the present invention is to provide a washing machine of the type referred to which will wash a maximum load of clothes when constructed within the practical limitations of power input and size for a domestic appliance adapted to be connected to a conventional household electric power outlet and to be installed in a kitchen or laundry room, for example, adjacent to other household appliances.

Another object of the invention is to provide a washing machine of this type which will wash clothes cleaner and more efficiently than has been possible heretofore with conventional washing machines. Included in this object is the desideratum of more thorough dirt removal in a reasonable length of time and without damage to the materials being washed.

Another object of the invention is to provide a washing machine which will be unidirectional or continuous in movement thus simplifying the construction and operation of the machine and eliminating the use of oscillating or gyrating parts. As a result, the load on the motor may be maintained substantially uniform, stresses and strains on the machine elements are reduced, and the operating parts are kept to a minimum in number and weight.

A further object of the invention is to provide an improved and novel washing action in a continuously or unidirectionally operating washing machine such that the principal cleaning action which is believed to be a relative movement of the clothes within the cleaning liquid is greatly increased, this being accomplished by causing the clothes to travel in a multidirectional or tortuous path and at inconstant speeds such that the moving contact of the clothes and the cleaning liquid is prolonged and maintained at a maximum.

A further object of the invention is to provide such an improved washing action which will be unaccompanied by a tangling or balling up of the clothes irrespective of the character of the wash load, such tangling and balling up of the clothes being substantially inherent in the operation of unidirectionally operated washing machines of the prior art, particularly under certain loads or other operating conditions.

Another object of the invention is to provide such a washing machine which will function ef-

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ficiently with a relatively small amount of water so that a greater percentage of the power utilized for operating the machine may be applied to the movement of the clothes and so that the cost of using a fresh charge of water and discarding the old after one washing operation will not be disadvantageous.

A further object of the invention is to provide a washing machine of the character described which is of rugged and simple construction, which will provide efficient and satisfactory service over long periods of time without likelihood of breakdowns or malfunctioning, which will be economical and easy to fabricate and assemble so that the same may be manufactured at a reasonable cost at least comparable to that of competitive machines, which is convenient to operate, and which will have a pleasing appearance and economical size for its intended use.

Another object of the invention is to provide a washing machine having the characteristics referred to which is particularly adapted for automatic operation.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claims.

Referring to the drawings—

Figure 1 is a front view partially in cross section showing a specific embodiment of an automatic washing machine embodying the present invention;

Fig. 2 is a plan view partially in cross section to show the vane structure of the rotatable basket of the machine shown in Fig. 1;

Fig. 3 is an end view partially in cross section of the basket;

Fig. 4 is a diagrammatic view of the basket showing the general path of movement of the clothes during a washing operation;

Fig. 5 is a partially diagrammatic cross sectional view taken from one end of the basket with the end wall removed; and

Fig. 6 is a diagrammatic perspective view of the basket with the same partially cut away to show the distribution of the clothes therein at an instant of the washing operation.

Before taking up the embodiment shown in the drawings in detail, the following general observations in regard to the invention may assist in the understanding of the same. As previous-

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ly mentioned, the present invention is particularly intended for embodiment in washing machines of the domestic or household type and it is desired in such machines to be able to connect the motor unit to an outlet of an ordinary household electric lighting circuit. The maximum size of motor which normally can be connected to an ordinary household circuit is generally of the order of $\frac{1}{4}$ to $\frac{1}{3}$ horsepower. The invention will therefore be described more particularly hereinafter with particular reference to washing machines having such a maximum power input.

Having in mind the limitation of a power input of the order of $\frac{1}{4}$ – $\frac{1}{3}$ horsepower, the washing machine of the present invention is designed to permit the washing of the greatest amount of clothes for this power input. Commercially available washing machines of the various well known types in general have a rated load capacity of the order of about 8 or 9 pounds of clothes by dry weight. A few characterized by slow movement of the clothes are rated at 10 pounds. It is generally agreed that the obtaining of good washing results with a load of 10 pounds is about the maximum which can be expected within the power limitations previously described and provided the cleaning fluid load is also limited. The embodiment of the washing machine of the present invention which is shown in the drawings and which will be more particularly described hereinafter will adequately handle this maximum load of 10 pounds of clothes and obtain good washing results. It also is possible to operate the machine with very much lesser or even with greater loads. A washing machine with a rated load of 10 pounds of clothes per washing is believed to be a desirable size for domestic use inasmuch as the average wash for an average family will approximate 40 pounds per week, that is, four washing loads in the machine of the present invention.

Also, as previously mentioned, it is desirable in washing machines intended for domestic use to design same for installation in kitchens, etc. in alignment with other household appliances or equipment. It therefore is deemed desirable to limit the external dimensions of the machine to one which will not substantially exceed the dimensions of other kitchen utilities.

Within the limitations of power input and external dimensions described, the washing machine of the present invention is designed to provide a better washing performance, that is, to do a better cleaning job and is intended to avoid tangling or balling up of the clothes. At the same time, it is desired to construct the machine so that it will be rugged and foolproof in operation and will operate preferably automatically without any stalling or overloading of the motor.

While the present invention is particularly concerned with the construction and arrangement of the washing element which comprises a horizontally mounted perforated basket and a washing action which results from such construction under specific predetermined conditions of operation, there is shown in Fig. 1 for illustrative purposes, and only in part, a washing machine in which my improvements are incorporated. Referring to this figure generally, A designates a cabinet or casing within which is suspended by means of springs B a frame C having side bars 10 and a cradle 11. The upper ends of the springs are suitably anchored to the casing A in a manner not shown and the lower ends are connected to

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the side bars 10, the purpose of these springs being to absorb the shocks and vibrations during the operation of the machine so that the same will not be transferred to the casing and the floor on which the casing rests and so that it is unnecessary to bolt or otherwise fasten the casing to the floor. Suitable damping means (not shown) may be provided for restraining the amplitude of vibration of the tub structure.

Fixed within the frame is a horizontally disposed, generally cylindrical tub D having an opening 12 (shown in dotted lines) at its upper portion through which the clothes may be passed into and from a perforated basket or drum which is designated by the letter E, the basket E having in its periphery an opening 16 adapted to be registered with the opening 12 of tub D when it is desired to load and unload the machine. This opening 16 is normally closed by a perforated door 17 hinged to the basket as at 18. The perforated basket has, at its ends, trunnions or stub shafts 13 suitably journaled in bearings 14 in the end walls of the tub D and fixed to the protruding end of the left-hand stub shaft 13 as viewed in Fig. 1 of the drawings is a driven pulley 15.

Mounted on and supported by the tub frame C are means for driving the basket and for filling and draining the tub. These instrumentalities are shown only diagrammatically in the drawings as they may be of any suitable or accepted construction and the specific constructions thereof do not form a part of the present invention. The driving means may comprise a two-speed transmission 20 and an electric motor 21 connected thereto. An output shaft 22 of the transmission 20 carries a pulley 23 and passing about this pulley and the driven pulley 15 is a belt 24. As hereinafter described more in detail, the transmission 20 is such that during a washing operation the basket is driven at a speed within a critical range to effect the desired washing action and during a drying or spinning operation the basket is driven through the transmission at a very much higher speed.

Water to the desired level, indicated by the line X—X in Fig. 1, may be introduced into the tub through a mixing valve 25 having inlets 26 and 27 adapted to be connected respectively to hot water and cold water supplies. The mixed water is delivered to the bottom of the tub through a hose 28. The numeral 30 designates a lint trap associated with an outlet opening 31 at the bottom of the tub and leading from the trap 30 to a water pump 32 is a hose 33. The water pump, which may be of the impeller type, is driven by the electric motor 21 as, for example, through the friction disks or wheels 34 and 35 respectively connected to the motor shaft and to the pump shaft. In order to have an automatic operation, if such is desired, the machine may be provided with any suitable arrangement to accomplish that purpose. In the present instance, there is shown in the upper right-hand corner of Fig. 1 a control switch 36 through which the desired sequence of operation may be accomplished. It is here sufficient to say that a desired sequence of operation may be as follows: After the clothes to be washed are placed in the basket E, the motor 21 is energized and the basket E is driven at a predetermined washing speed within the critical range through the transmission 20. The mixing valve 25 is then energized to permit the entrance of hot water into the tub D until the desired level (line X—X of Fig. 1)

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is attained, whereupon the valve 25 is closed. Rotation of the basket E at washing speed is then continued for a suitable period of time, for example, 5-20 minutes, to complete the washing of the clothes. It will be understood that a suitable detergent may be added at any desired time such as with the clothes or after the tub has been filled with water. When the washing period is completed, the pump 32 is energized to withdraw the dirty wash water from the tub. When drainage is completed, the transmission 20 may be briefly shifted into high gear to further extract wash water from the clothes. Following the washing and draining operations and while the basket is driven at washing speed, the clothes may be given a plurality of rinses, such as by a deep rinse which is accomplished by introducing fresh water into the tub while the pump 32 remains idle and/or by a spray rinse which comprises admitting water to the tub while the pump 32 is in operation. After each rinse, the pump 32 is energized if it is not already operating so as to withdraw the rinse water from the tub whereupon the transmission may be shifted into high gear to cause more complete removal of the rinse water. After the completion of the rinses, the transmission is operated at high speed for a desired period, such as 3-10 minutes, while the pump 32 is operating, thereby causing water to be centrifugally extracted from the clothes and leaving them at the end of this period in a damp-dry condition. It will be understood that the foregoing sequence of steps has been given merely by way of illustration and it is contemplated that any other desired sequence of operations may be carried out within the scope of the invention.

As mentioned above, the invention is concerned principally with a design and construction of the basket E such that, when the basket is operated under prescribed conditions in accordance with the invention, the objects of the invention are obtained, particularly a novel and improved washing action with the avoidance of balling up or tangling of the clothes in a machine which can be constructed within the practical size or dimensional limitations of a domestic washing machine and which can be utilized for washing a load of 10 pounds of clothes or the like without overloading the power source when it is driven by an electric motor connected into an ordinary household lighting circuit.

The basket design or construction shown in the drawings is that of an actual commercial model and, for convenience, will be referred to hereinafter as the preferred embodiment. In order that the invention may be fully understood and practiced by one skilled in the art, there will be first presented a detailed description of the construction and operation of the preferred embodiment, following which variations in the construction and operation which may be possible within the scope of the invention, and particularly insofar as they may be critical, will be discussed hereinafter.

Referring to the drawings and particularly to Figs. 2 and 3 thereof, the basket E is shown as being slightly elongated at the center or axis, but this has been done merely for constructional reasons and the inclination or conical shape of the ends of the basket is so slight (about 5°) that it has no appreciable effect upon the operation of the basket and the basket may be considered, for practical purposes, as having flat ends. The inside diameter of the basket E in

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the preferred embodiment is exactly 19 inches while the axial length at the center of the basket is 18½ inches, the mean axial length being approximately 18 inches. The foregoing dimensions of the basket E are such that the preferred load of 10 pounds of clothes to be washed may readily be inserted into the basket and it is possible to house the tub in which the basket is rotated within a casing of average size while at the same time providing ample space to permit gyrational movements of the tub by reason of its mounting by the spring supporting members B.

As previously mentioned, the basket is perforated throughout its periphery to permit the free entry and egress of washing liquid. In the preferred embodiment, the perforations comprise a plurality of ¼ inch holes spaced 9/16 inch between diameters. The number and spacing of the perforations in the basket and vanes in general is not critical although, it will be observed, the presence of the perforations which increases the roughness of the inner surface of the basket and the surfaces of the vanes will increase the lifting action of these surfaces. The presence of the perforations in the vanes 40 tends to carry off any liquid film between the clothes and the vane, thereby causing less sliding action of the clothes relative to the vane. The presence of detergent in the cleaning liquid also will have an effect presumably by increasing the slippage between the load and the surfaces of the basket and vanes.

The basket E is provided, in accordance with the invention, with a plurality of vanes 40 which, in the specific embodiment, are positioned diametrically from each other at opposite ends of the basket. As shown in the drawings, the vanes 40 are formed with generally rounded or stream-lined surfaces, the vanes being somewhat thinner at the outer extremity 41. To state it another way, each vane 40 is of greatest thickness at its inside corner 42 and decreases in thickness both longitudinally and radially of the basket to a minimum thickness at its free edge 41. As a result, the outer surface of the vane 40 at any part thereof is sloped toward the center of the basket both in a radial and in a longitudinal direction. The inner extremity or free edge of the vane 40 at 41 is a smooth uniform convex curve as best shown in Fig. 6.

In the preferred embodiment, i. e., in a basket having a diameter of 19 inches and an axial length of 18 inches, the height of the vanes 40 measured by the distance that the vane extends along the inner surface of the end wall of the basket is about ⅓ the diameter of the basket while the length of the vane as measured by the distance that the vane extends longitudinally along the inner cylindrical surface of the cylindrical wall of the basket is approximately ⅓ the axial length of the basket.

For convenience in fabrication and assembly of the vane 40, the same may be formed as shown in the drawings of a single sheet of material such as sheet steel which is secured to the basket by any suitable means such as by welding along the straight edges of the vane. Openings 43 in the basket E facilitate the release of cleaning liquid through the perforations in the vanes, the vanes 40 being perforated in the same manner as the basket.

Although the outer surfaces of the vanes are sloped inwardly of the basket, it will be observed that the central cross sectional plane of the vane

is substantially in a radial plane of the basket.

For ease and simplicity in describing the operation of the invention in connection with the preferred embodiment, a first zone of the basket E extending longitudinally from one end of the tub and including the vane 40 at that end of the tub will be referred to as a first impeller zone F; the central zone extending longitudinally from the first zone and which is free of any vane surfaces and otherwise unobstructed will be referred to as the central free zone G, and the zone at the opposite end of the basket will be referred to as the second impeller zone H. Each of these three zones comprises substantially $\frac{1}{3}$ of the length of the basket, as shown in Fig. 6.

In accordance with the invention, it has been found that by driving a basket having the specific design and dimensions as described above at a unidirectional constant speed within the range of 64-67 R. P. M., i. e., at such a speed that the centrifugal force at the periphery of the basket exceeds the force of gravity by 11-22%, and in the presence of a quantity of cleaning liquid sufficient to immerse the lower portion of the basket to the height of approximately $\frac{1}{3}$ of the diameter of the basket, there is caused the improved and unique washing action of the present invention as described more fully hereinafter and as illustrated in part in Figs. 4-6 of the drawings.

As will be apparent, the clothes in the first impeller zone F will be in position to be intermittently acted upon by the vane 40 of that zone as the basket is rotated. During each revolution of the basket E, the vane 40 is driven thereby in an orbit which causes the vane to descend rapidly into the contents of the basket at the front of that zone and then carry or propel the clothes and water in its path upwardly at the rear of the basket as more particularly described hereinafter. In the intermediate free zone G comprising a similar substantial portion of the tub, the clothes are out of the orbit of either of the vanes and therefore will not be acted upon directly by the vane. In the second impeller zone H an action similar to that occurring in the first impeller zone F occurs but out of time phase therewith so that the action of the vane 40 in impeller zone H alternates in timed relationship with the action of the vane in the first impeller zone F. It will be understood that there is a certain amount of friction between the perforated surface of the basket and the clothes and washing liquid, which is effective to some degree in imparting movement to the contents as the basket is rotated, but the main effect of the movement of the clothes is provided, of course, by the vanes 40.

In accordance with the invention, the above design or construction of the basket E combined with the conditions under which it is operated create a novel treatment of the clothes being washed such that continued and prolonged and thorough contact of all of the clothes with the cleaning liquid is assured, with a consequent marked improvement in the washing efficiency, and, at the same time, the clothes are so spread out and distributed that they do not ball up or tangle.

By driving the basket of the preferred embodiment at the washing speed of 64-67 R. P. M. whereby the centrifugal force exceeds the force of gravity as mentioned above, there is accomplished a movement of the clothes in each of the impeller zones F and H which, as illustrated in

part in Figs. 5 and 6 of the drawings, causes an agitation and movement of the clothes throughout the basket including the free zone G which is different from that encountered in any prior art washing machine heretofore and which is believed to be responsible for the unique advantages of the washing machine constructed in accordance with the invention.

Referring to Fig. 5 and the left-hand portion of Fig. 6, a wash load in one of the impeller zones has been diagrammatically illustrated as segregated into three groups which, for convenience, are designated by the reference letters J, K and L. The separation of these groups of clothing has been exaggerated for purposes of illustration and it will be appreciated that in actual practice the demarcation between the three groups may not be as readily apparent and that there will be an overlapping to some extent, particularly where the articles being washed are of considerable size such as in the case of bed sheets. In Figs. 5 and 6, it is assumed that the vane 40 is being driven into the clothes and cleaning liquid at the speed of the basket as previously set forth. The group of articles being washed denoted by the letter L, when viewed from the end of the tub, appears to follow the vane 40 in its circumferential orbit to about half the height of the basket while spaced slightly therefrom, whereupon the clothes appear to lose their momentum and are tumbled back to the bottom of the basket by force of gravity. This group of clothes L enters the impeller zone behind the vane 40 from the central free zone G as the vane 40 passes through the lowermost part of its path of travel.

The groups J and K are initially a single group of clothing which were in the impeller zone F prior to the time that the vane 40 reaches the lowermost portion of its path of travel and this combined group of the clothes is caught by the vane 40 and rapidly carried along with the vane 40 in the path of travel around the periphery of the basket. The portion K of the clothes which, in general, appears to be the portion nearest the axis of the tub and apparently because it is traveling in an arc of reduced radius and therefore is not subjected to as high a degree of centrifugal force, will fall back into the cleaning liquid in the impeller zone to join the group L and be tumbled about in the cleaning liquid. The group J of the clothes which, in general, appears to be closer to the periphery of the basket, is hurled forwardly and longitudinally of the basket and enters the free zone G where they are permitted to spread out and reorient themselves so that they become opened up and separated within the cleaning fluid and so that any tangling or balling up which may have been initiated in the impeller zone is permitted to be corrected. A portion of the group J of the clothes, by reason of the relatively great force with which they are hurled forwardly and longitudinally of the basket, may be carried entirely through the free zone G into the opposite impeller zone while a part thereof may remain in such free zone for several revolutions of the basket. In either event, the clothes in the central free zone G will eventually continue on to the second impeller zone H where these clothes are again acted upon as set forth in connection with the action in the first impeller zone F. As viewed from the front of the machine, the clothes and cleaning liquid in the central free zone appear to travel in a sequence of waves originating alternately from opposite ends of the basket, being highly turbulent in appearance and creating a

thorough dispersion of the clothes in the cleaning liquid.

This sequence of actions in connection with the clothes being washed insures that any particular piece of the wash will be agitated and tumbled in one of the impeller zones following which it will be given a period of spreading and orientation in the central zone, after which it enters the second impeller zone H where it is again subjected to tumbling and agitation in the cleaning liquid, following which the clothes are returned to the central free zone G for a period and eventually the clothes reenter the first impeller zone F to complete the cycle. In other words, the net result of the path of travel may be illustrated as a deformed figure 8 as shown in Fig. 4 wherein the clothes follow the line 55 in the direction of the arrows, the dotted portion of line 55 being utilized to denote when the clothes are in the rearmost half of the basket. It will be understood, in view of the foregoing description, that the path 55 is merely illustrative and that no piece of clothes will be likely to take such an exact path during rotation of the basket and that the time required for a given piece of clothes to complete the cycle may be many revolutions of the basket.

The combination of impeller zones and an unobstructed dispersing or free zone and the novel operation of the basket such that the clothes are alternately tumbled about and agitated in the cleaning liquid and then given an opportunity to rearrange and reorient themselves, this being done without stopping or reversing the machine, apparently explains why the washing machine of the present invention will wash a greater load of clothes within practical household size and power limitations and will do a better washing job without tangling or balling up the clothes.

In practicing the invention, it is not necessary and it may not be desired to follow exactly the specific embodiment hereinbefore described and for this reason the following observations as to certain variations in construction and operation are set forth, all of such variations, of course, being within the scope of the invention.

As to the size of the basket, it will be appreciated from the foregoing disclosure that the criteria are the load which it is desired to wash in the machine, the practical limitations as to the external dimensions of the machine, and the obtaining of the desired washing action as above described. For domestic purposes, a washing machine having a basket whose diameter is within the range of about 17 to 22 inches will generally be preferred. A basket of such size will readily accommodate the preferred load of 10 pounds of clothes and can be mounted within an outer casing of such size that it will correspond to the size of other utilities commonly found in household kitchens and the like. If desired, the diameter of the basket may be made to exceed the upper limit of 22 inches, but it will be appreciated that the size of the washing machine casing would have to be correspondingly enlarged and that the load on the motor would be increased. If the diameter of the basket were reduced below the range specified, it would be found that the preferred washing action is seriously interfered with and that the clothes would not be readily transferred from the impeller zone to the free dispersing zone and vice versa.

With the diameter of the basket determined as above described, it then is preferred to limit the axial length of the basket to the smallest length for that diameter which will provide the

desired washing action and accommodate the preferred load of 10 pounds of clothes. In general, it has been found that the axial length of the basket cannot be reduced more than about 10% less than the diameter of the basket. If economy of size and cost of manufacture are not a consideration, it may be possible, if desired, to increase the length of the tub substantially without interfering with the washing action. Too great an increase in length, however, would tend to overload the motor and there might be a tendency on the part of the user to overload the machine with clothes to be washed.

As to the vanes 40, it is believed to be essential that the vanes 40 be situated in approximately a radial plane of the basket, that is, so that the vane 40 does not tilt toward or away from the sides of the basket and does not point away from the center or axis of the basket. Material deviations from such positioning of the vanes 40 have been found to interfere with the desired washing action or to cause overloading of the motor.

In the preferred embodiment, the number and relative positioning of the vanes has been shown as two vanes diametrically positioned, this being an economical arrangement and being inherently balanced. However, the number of vanes and their positions relative to each other may be varied without departing from the teaching of the invention provided that the free dispersing zone G is not affected. It is not necessary to space the vane equidistantly about the periphery of the basket although, in general, it is desired to have vanes at opposite ends of the basket act in sequence instead of simultaneously upon the clothes being washed.

As to the speed at which the basket is driven, it is essential to drive the basket at such a speed that the centrifugal force exerted on the clothes at the periphery of the basket materially exceeds the force of gravity. At speeds which are less than this critical amount, there results a mere tumbling of the clothes which quickly causes tangling and balling up of the clothes and prevents successful washing. In some instances, this is so serious as to require stopping of the machine. Such lower speeds, in general, are insufficient to cause the desired periodic interchange of clothes between the impeller zone and the free zone and the clothes are not hurled forwardly and longitudinally of the basket by the vane as it ascends in its peripheral orbit in the basket. On the other hand, if the speed of rotation of the basket becomes excessive, the clothes will be carried entirely around the basket with the vane and will not be hurled longitudinally of the basket with the result that the washing action is unsatisfactory. In general, it is found that the speed of the basket must be such that the centrifugal force at the periphery of the basket falls within the range of 111-122% of gravity or, in other words, the centrifugal acceleration must be 35.7 to 39.3 ft./sec.² The speed of the basket in revolutions per minute to obtain such centrifugal force at the periphery can readily be calculated from well known formulae when the diameter of the basket is known.

The amount of cleaning liquid admitted to the tub should be such an amount which is sufficient to provide a water level X—X in the basket when the basket is at rest which is of the order of $\frac{1}{3}$ of the diameter of the basket. When the amount of water present is reduced materially below this range, there is a marked decrease in the washing efficiency of the machine and when the amount

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is materially increased beyond this range the load on the motor becomes excessive and there results a flotation of the clothes which prevents the attainment of the desired washing action. The amount of cleaning liquid is dependent to some extent upon the rated capacity of the machine for, as will be apparent, a greater amount of clothes will absorb a proportionately greater amount of water which, in turn, directly affects the amount of flotation which will result from a given charge of water.

By following the above disclosure, it is possible to accomplish the objects of the invention as hereinbefore set forth and particularly in the attainment of an improved washing efficiency with a maximum load in a washing machine of practical dimensions operable by power derived from an ordinary household lighting circuit. The washing machine is pleasing in appearance, simple to operate, economical in cost, efficient in operation, and will provide improved service over long periods of time.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim as my invention:

1. In a machine for washing clothes and the like, a horizontally disposed cylindrical basket having spaced end walls and a cylindrical perforated wall therebetween, means for supporting said basket for rotation about its horizontal axis, a radially disposed vane secured at each end of the basket contiguously to an end wall and a portion of the cylindrical wall between the end walls, said vanes being angularly displaced 180 degrees from each other, each of said vanes extending approximately one-third of the length of the cylindrical wall and one-third of the diameter of the end walls, said vanes having perfora-

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tions communicating with the exterior of said basket, said basket having between said vanes a central zone at least as long as said vanes, said central zone being substantially free of projections, and means for driving said basket at a substantially constant speed at which the centrifugal force acting upon clothes at the internal periphery of the basket has a value of 111%-122% of the force of gravity.

2. In a machine for washing clothes and the like the combination comprising a horizontally disposed generally cylindrical tub, a horizontally disposed cylindrical basket, means for supporting said basket within said tub for rotation about its horizontal longitudinal axis, said basket comprising end walls and a perforated cylindrical wall therebetween, the length of said basket between the end walls being not less than 90% of the diameter of the end walls, a radially disposed vane secured to each end wall and a section of the adjacent cylindrical wall, said vanes being angularly displaced 180 degrees from each other and having rounded corners convexly curved in the plane of the vanes, said vanes being formed to define perforations in communication with the interior of the basket and the space within said tub exteriorly of the basket, said basket having between said vanes an uninterrupted central zone at least as long as said vanes, and means for driving said basket at a constant speed at which the centrifugal force acting on material at the inner periphery of the basket is equal to 111%-122% of the force of gravity.

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