Oct. 16, 1951 A. H. GERHARDT ET AL 2,571,438

CONVERTIBLE DISHWASHING AND CLOTHES-WASHING MACHINE

Filed June 14, 1944 6 Sheets-Sheet 1

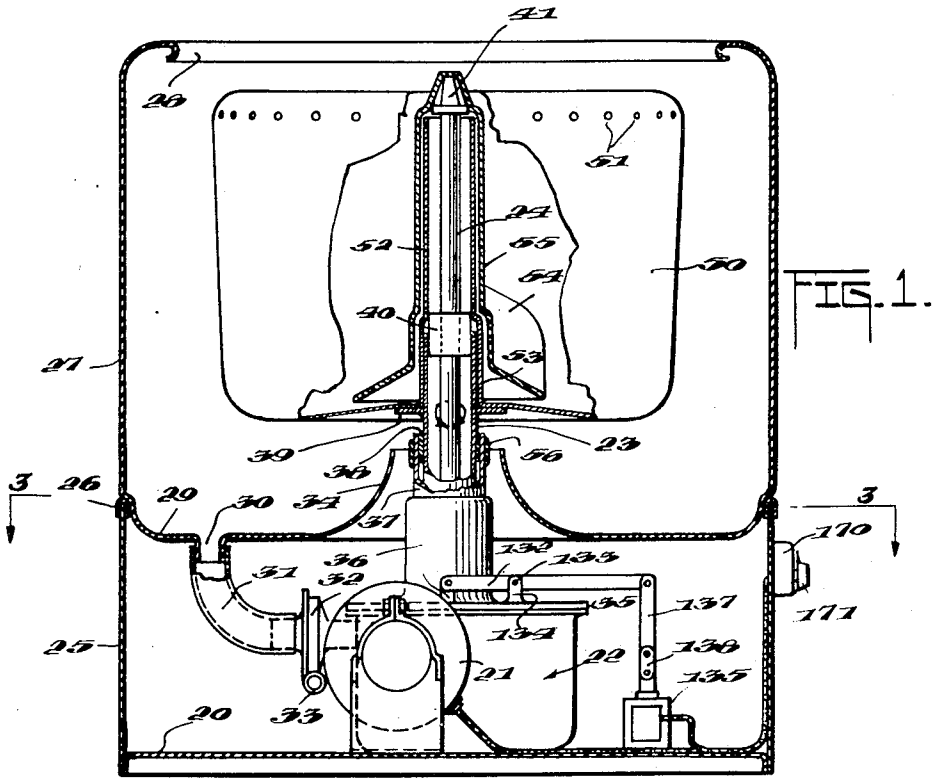

FIG. 1.

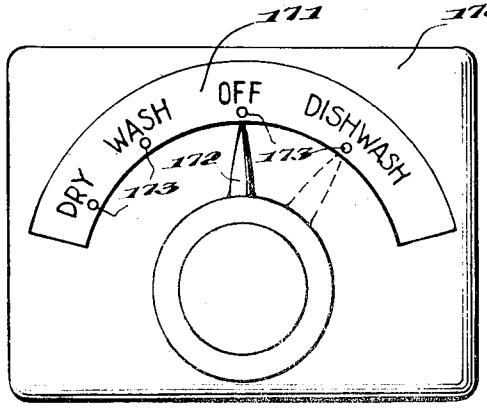

FIG. 2.

INVENTORS.
ANDREW H. GERHARDT
BY ARTHUR P. SCHULZ
Their Attorney

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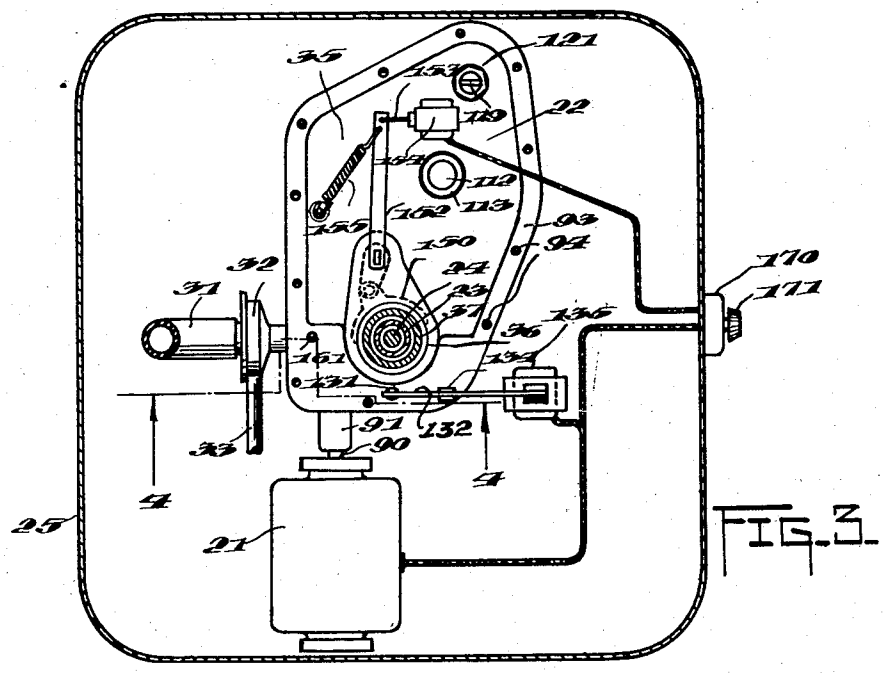
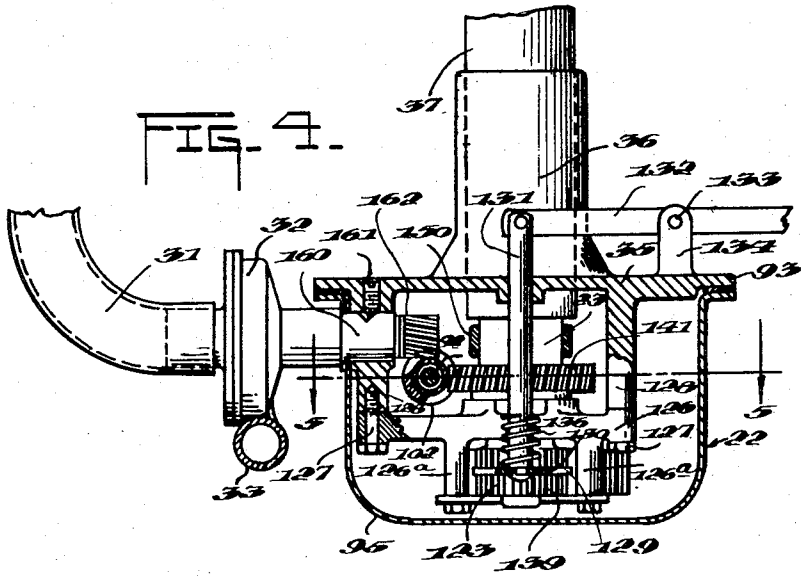


FIG. 3.

FIG. 4.



INVENTORS.
ANDREW H. GERHARDT
BY ARTHUR P. SCHULZ
A. W. Molumare
THEIR ATTORNEY

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FIG. 5.

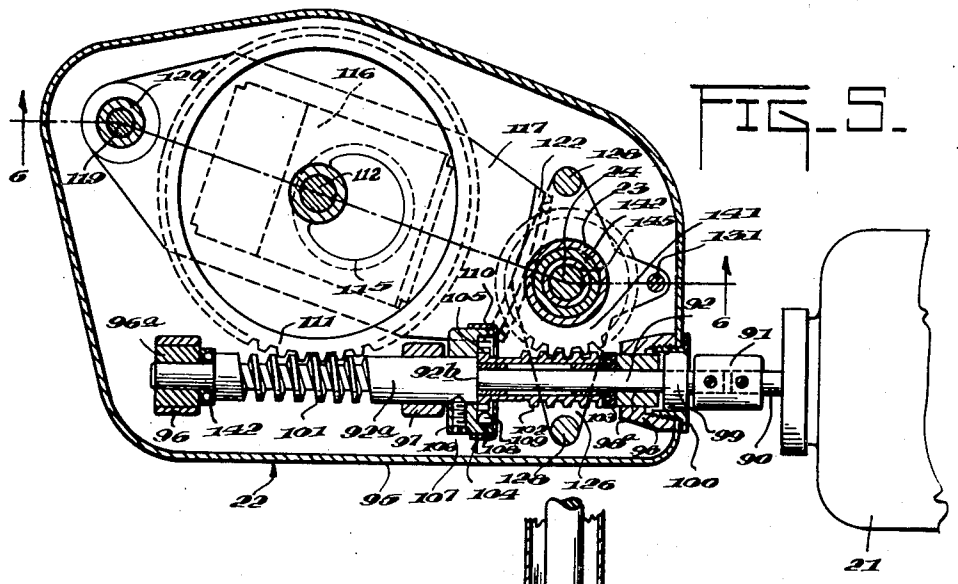
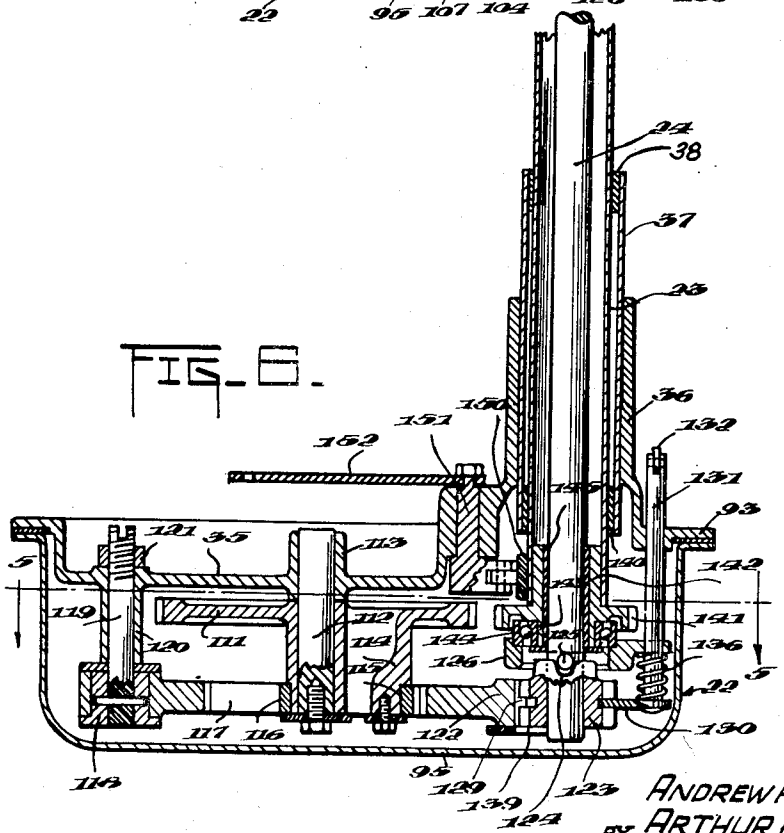


FIG. 6.



INVENTORS.
ANDREW H. GERHARDT
BY ARTHUR P. SCHULZ
A. V. Moliare
THEIR ATTORNEY

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CONVERTIBLE DISHWASHING AND CLOTHES-WASHING MACHINE

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FIG. 7.

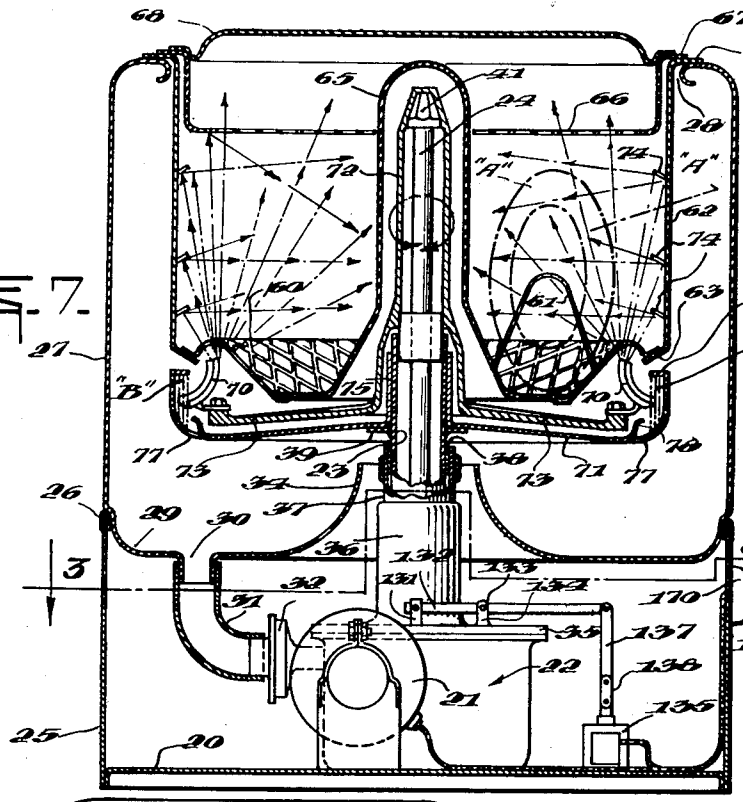

FIG. 10

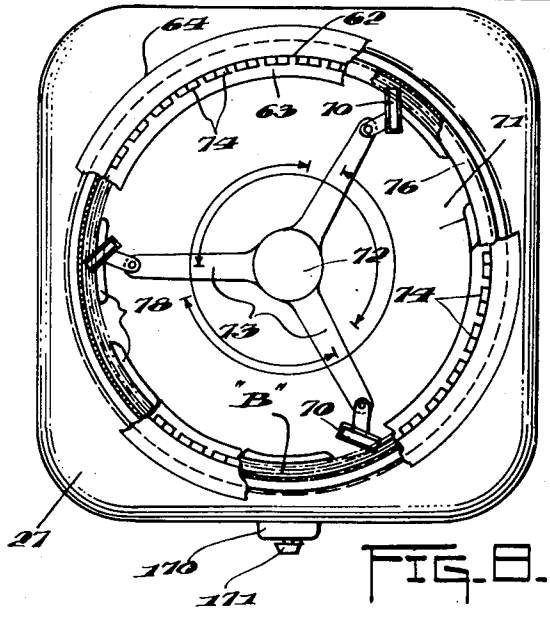

FIG. 8.

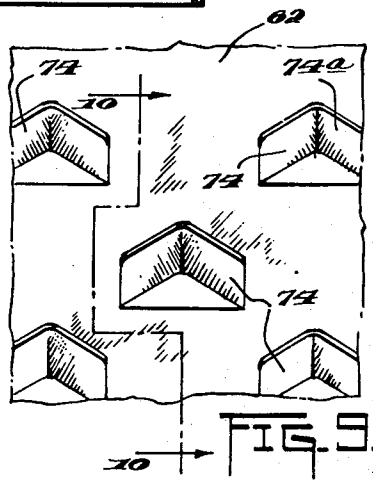

FIG. 9.

INVENTORS.
ANDREW H. GERHARDT
BY ARTHUR P. SCHULZ
A. W. Molinare
THEIR ATTORNEY

Oct. 16, 1951 A. H. GERHARDT ET AL 2,571,438

CONVERTIBLE DISHWASHING AND CLOTHES-WASHING MACHINE

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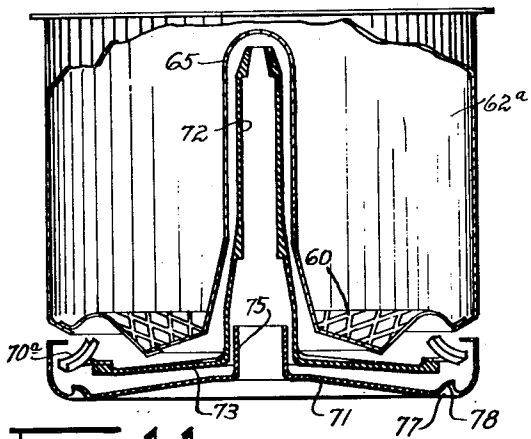
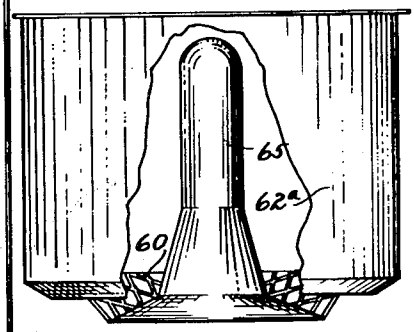
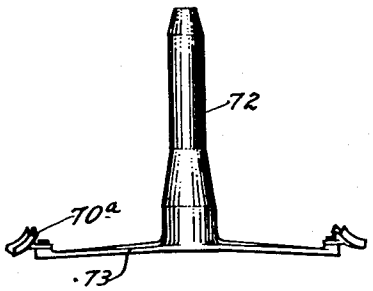


FIG. 11.





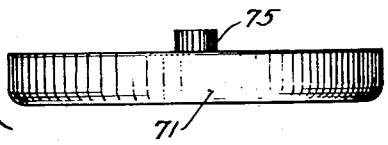


FIG. 12.

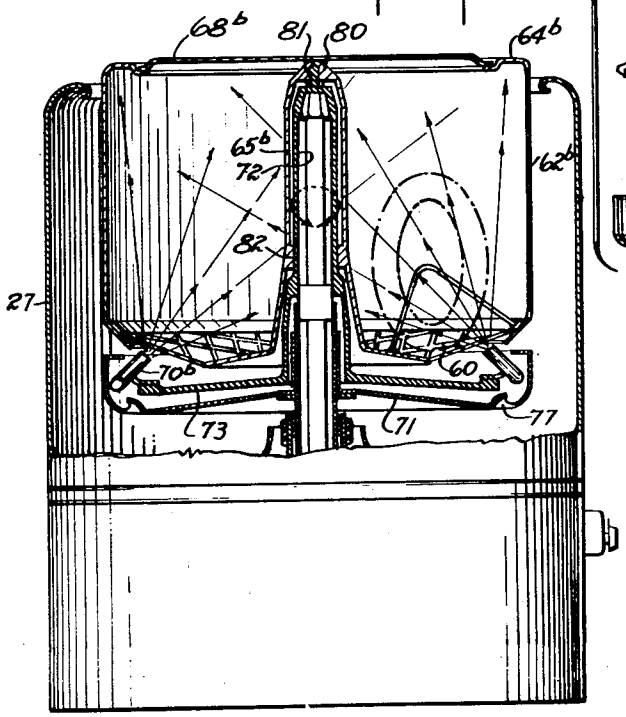


FIG. 13.

INVENTORS.
ANDREW H. GERHARDT
BY ARTHUR P. SCHULZ
Albert Molinare
THEIR ATTORNEY

Oct. 16, 1951 A. H. GERHARDT ET AL 2,571,438

CONVERTIBLE DISHWASHING AND CLOTHES-WASHING MACHINE

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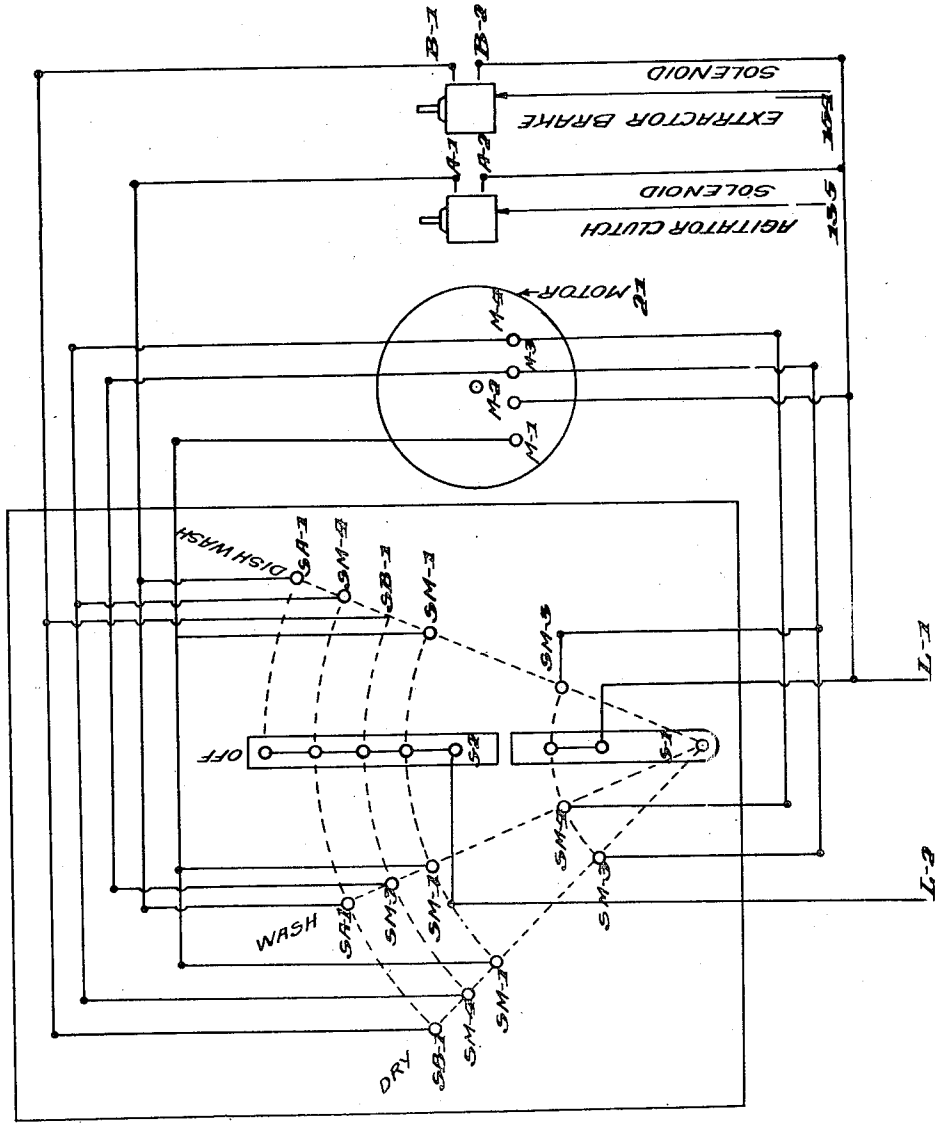

Fig. 14.

Inventors
Andrew H. Gerhardt,
Arthur P. Schultz,
By A. W. Molinare
THEIR Attorney

Patented Oct. 16, 1951

2,571,438

UNITED STATES PATENT OFFICE

2,571,438

CONVERTIBLE DISHWASHING AND CLOTHES-WASHING MACHINE

Andrew H. Gerhardt, Skokie, and Arthur P. Schulz, Hinsdale, Ill., assignors to Thor Corporation, a corporation of Illinois

Application June 14, 1944, Serial No. 540,332

28 Claims. (Cl. 134—115)

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This invention relates to article cleaning machines employing washing liquids for cleansing, and particularly to domestic washing machines such as those used in homes for laundering clothes, and for washing and rinsing dishes and like articles.

One primary object of the invention is to provide a multiple function convertible washing machine which is equally efficient in cleaning different types of articles, and wherein different modes of liquid circulation are employed according to the nature of the articles to accomplish thorough cleaning.

Our invention, in broad aspect, particularly contemplates as one of its objectives the provision of a single machine adapted to be utilized either as a clothes laundering machine or as a dish washing machine, and adapted to be readily converted from clothes laundering to dish washing purposes and/or from dishwashing to clothes laundering purposes. The machine may be produced as a portable piece of apparatus in a form complete with its own individual casing or cabinet and adapted to be placed in a suitable location in a kitchen or other room. The machine also may be produced in a form adapted to be installed in and completely housed by built-in cabinet and counter-top structures, preferably adjacent a kitchen sink so as to permit making convenient connections to sources of hot and cold water supply as well as to a drain or soil pipe.

A further object of the invention is the provision of a conversion unit or attachment in the form of new and improved dishwashing accessories, including a dish holding receptacle or rack and washing liquid circulating mechanism, which may quickly and easily be installed in conventional forms of clothes washing machines, usually in replacement of at least some of the clothes laundering parts, to convert them into an efficient dishwashing apparatus, and adapted readily to be removed from such machines for cleaning and replacement. The conversion unit may be supplied with new clothes laundering machines or supplied separately for use with existing machines.

While there are obvious practical advantages such as the saving of household space in providing one machine which will serve dual purposes, there may be instances where a person desires only, or initially, a dishwashing machine. It is a further object of the invention to provide a new and improved dishwashing machine which may be supplied in such character only,

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at a saving in cost from the omission of parts employed in clothes laundering, and which constitutes a novel and extremely efficient but simple dishwashing machine having important features adapting it to thoroughly clean dishes and easy to operate with a minimum of effort.

Because of their essentially different nature clothes and dishes require different modes of washing. Accordingly, clothes washing and dishwashing machines have been constructed along such essentially different lines that one machine is not adapted for the purpose of the other. For this reason, and likewise because of the space-saving compactness of present day machines, a serious problem is presented in providing a machine which will be equally efficient in cleaning both clothes and dishes. Prior attempts have been made to convert various forms of clothes washing machines to dishwashing purposes, but none of such machines have found public acceptance. In some instances such prior machines have been too bulky and complicated to be practical, but in the main their lack of success may be attributed to the fact that regardless of how satisfactory machines might be for clothes washing purposes the mechanism and mode of operation employed for dishwashing was inefficient and, in many instances, more or less make-shift in character.

Whereas clothes laundering machines are generally designed to immerse and agitate clothes in a deep body of washing liquid, satisfactory cleaning of dishes cannot be accomplished in this manner, since when immersed in a deep body of cleaning liquid the liquid cannot be circulated around the dishes with sufficient force to effect a thorough cleansing action because of the strong adherence of grease and food particles to the dish surfaces. Hence a different mode of operation must be employed in dishwashing, and the most efficient method we have found is a high pressure spray method in which the dishes are supported by a perforate holder and subjected to the blast of high velocity jets or streams of washing liquid projected from and draining back to a reservoir which can be, and for purposes of economy in soap or other cleaning agents employed with the liquid normally will be, of comparatively small liquid holding capacity, a gallon or less of washing liquid being adequate.

A major problem in converting a clothes washing machine into a dishwashing machine, and at the same time enabling the machine to be readily converted back to clothes washing purposes, involves the matter of securing high veloc-

ity circulation of the dishwashing liquid, whereas only relatively slow circulation between the clothes and washing liquid is required in clothes washing machines. However, we have solved this problem with the present invention to obtain a high velocity spray of washing liquid over the dishes by employing the power mechanism of clothes laundering machines to operate novel high velocity liquid distributing mechanism designed to take the utmost advantage of the liquid circulating potentialities of the power mechanism yet of such character as to be readily installed and avoiding the use of complicated mechanical parts such as might objectionably encumber the machine or make it difficult to operate.

A necessary factor in the clothes washing machine for dishwashing purposes is a high speed rotary motor driven shaft which can be employed for circulation of the dishwashing liquid. Clothes machines of the washer-extractor type satisfy this requirement since we have discovered that the extractor drive shaft of such machines is extremely well adapted to produce a high velocity circulation of dishwashing liquid. It is appropriate to state here that one of the specific but important objects of the invention is to adapt a washer-extractor type of clothes washing machine to efficient dishwashing purposes through the employment of the extractor drive, and preferably, though not essential to the production of a practical machine, through the combined employment of the extractor drive and an agitator or equivalent drive to obtain projection of high velocity liquid streams with a constant shift in position of the points of projection relative to the dishes and thus insure that each and every dish is thoroughly cleansed.

The dishwashing mechanism employs centrifugal force to effect high velocity projection of washing liquid over the dishes and in addition to a dish holder includes liquid circulating mechanism comprising a washing liquid reservoir or receptacle means and liquid diffusing jet or nozzle spray means to deliver streams of liquid with considerable force against the dishes in the holder. One of such parts of the liquid distributing means will be rotated at high centrifugal speed relative to the other, say in the range of 500 to 700 R. P. M. The second part may be stationary or may be, and preferably is, also driven but with a different motion from the cooperating part.

Great advantage is gained by driving the reservoir at high rotary speed since a high velocity moving annular body of liquid is built up around the inner periphery of the reservoir from which the liquid can be delivered to the dishes through the adjunctive nozzle or equivalent projecting mechanism. In conjunction with a power driven centrifugal liquid receptacle under this arrangement it is possible to use stationary cooperating liquid distributing elements with relatively good results, but it is preferable to mount such elements for movement in a fixed path relative to the liquid reservoir and the dish holder so as to project high velocity streams of liquid over the dishes from constantly changing points and angles and obtain a complete coverage of the entire area of the dish holder with a minimum number of distributing elements. The liquid distributing elements may have a rotary movement, in either direction, faster or slower than the movement of the annular body of liquid, or preferably, they may have an oscillatory movement as when the dishwashing mechanism is embodied in a clothes washing machine having in addition to a high speed rotary shaft an oscillatory agitator shaft which can be employed to actuate the liquid distributing elements.

While the high velocity distribution of liquid to the dishes is of the greatest importance in securing satisfactory cleaning of the dishes the construction of the dishwashing mechanism is such as to give various additional benefits. As previously mentioned it is necessary to use only a limited quantity of washing liquid, and the dishwashing mechanism advantageously is so designed as to automatically measure and retain the proper quantity of liquid for use and reject any excess liquid so that the operator of the machine is not required to predetermine the quantity to be introduced, or to carefully watch during the filling operation.

The dishwashing mechanism may also be constructed according to the invention to be self-draining at the termination of each cleaning and rinsing operation. It is unnecessary to employ drain cocks or equivalent devices which must be opened in order to discharge liquid from the liquid reservoir. Drain cocks or valves when employed in machines of this type frequently become clogged with food particles, and by devising suitable drain outlets which do not require the use of drain cocks or valve elements, the possibility of such clogging of the drain conduits or outlets by food particles is eliminated.

Still further, it is proposed to provide a self-cleansing, sanitary dishwashing mechanism which does not require scouring or other cleansing after each use, which is so constructed and operated as to minimize adherence to its operating parts of waste matter removed from the articles, and in which a flushing operation is automatically effective to insure elimination of waste matter from the mechanism.

The two last mentioned features together with the small quantity of liquid required and the automatic measuring feature are a great convenience and collectively they make operation of the machine remarkably easy and economical.

While in the case of clothes washing machines having centrifugal extractor receptacles which function as washing tubs during the washing stage it is possible to construct the receptacle to function additionally as a centrifugal liquid reservoir for dishwashing purposes, it is highly preferable to provide a separate reservoir and associated dishwashing parts, since for sanitary reasons it is undesirable to permit dishwashing liquid contaminated with grease and food particles to contact the operative parts of the clothes washing and/or extractor mechanism, or conversely to permit clothes washing liquid to contact operative parts of the dishwashing unit. Accordingly, the dishwashing conversion attachment is designed as a complete operative unit except for the driving mechanism which is formed as a built-in part of the power unit of the clothes washing machine, and the parts of the unit are so designed as to be readily insertable in and removable from the clothes washing machine. In the case of a combined washer-extractor clothes laundering machine having a combined clothes washing and extractor receptacle and clothes agitating parts, the dishwashing unit can and advantageously will be designed to replace such clothes mechanism and occupy the same position in the machine both to avoid increasing

the size of the machine and avoid complications in mechanical design.

From the above it will be understood that the invention aims to improve washing machines generally in a number of respects, and that while all of the novel features of the invention may be embodied in a single machine as hereafter pointed out various features may be employed without utilizing other of such features.

The invention which has heretofore been generally described will be more fully understood from the preferred forms thereof illustrated in the accompanying drawings hereafter to be explained in detail.

In such drawings:

Fig. 1 is a vertical section through our novel washing machine as arranged for laundering clothes;

Fig. 2 is a face view of a control panel for the machine;

Fig. 3 is a horizontal sectional view looking down upon the power mechanism, and taken substantially at lines 3—3 of Figs. 1 and 7;

Fig. 4 is a vertical view mostly in section showing certain parts of the main drive mechanism and also showing a pump and drive mechanism therefor, and taken substantially as indicated at line 4—4 in Fig. 3;

Fig. 5 is a horizontal sectional view through the drive mechanism taken substantially at lines 5—5 of Figs. 4 and 6;

Fig. 6 is a vertical sectional view through the drive mechanism, taken substantially at line 6—6 of Fig. 5;

Fig. 7 is a vertical sectional view through the machine substantially similar to Fig. 1, but arranged to function as a dishwashing machine;

Fig. 8 is a top view corresponding to Fig. 7, but with certain parts of the dishwashing mechanism removed, and with certain portions broken away and other parts in section to show details of construction;

Fig. 9 is a fragmentary elevational view of certain details shown in Fig. 7 sometimes employed as an auxiliary part of the dishwashing liquid distributing mechanism;

Fig. 10 is a vertical staggered sectional view of the same parts and taken substantially at the line 10—10 of Fig. 9;

Fig. 11 is a vertical view partly in elevation but mainly in section of the dishwashing mechanism conversion unit or attachment apart from the machine, the same representing a somewhat simplified form of the mechanism shown installed in the machine in Fig. 7;

Fig. 12 is an expanded view in vertical elevation of the dishwashing mechanism of Fig. 11 showing the individual parts disassembled;

Fig. 13 is a vertical section of a washing machine arranged for dishwashing and embodying a modified form of dishwashing mechanism; and,

Fig. 14 is a diagrammatic view of one form of selective control circuit for the power mechanism and designed to be operated through the control panel of Fig. 2.

The foundation unit of the washing machine as best shown in Figs. 1 and 3 to 6 includes a base frame 20, a power unit comprising an electric motor 21 and selective operative gear drive mechanism generally designated 22 through which the motor operates drive shaft means in a manner suitable for actuation of clothes laundering mechanism and dishwashing mechanism.

In the preferred form of washing machine two driving shafts are provided adapted to be operated with different motions and selectively through the gearing and control mechanism hereafter to be described. We prefer to provide two shafts because it is advantageous although not entirely necessary to actuate each of a plurality of operating parts of both clothes laundering mechanism and dishwashing mechanism. One shaft will be a low speed shaft and the other a high speed shaft. While some embodiments of our dishwashing mechanism, which are practical but without all the benefits of other embodiments, require only one drive shaft it must be a high speed shaft, whereas simpler one-operation forms of clothes washing machines employing only one shaft require that it be a low speed shaft and modification by the provision of a change speed drive would be necessary as a minimum to adapt the single shaft to dishwashing purposes. Further a single shaft with a two speed drive has the disadvantage that only one speed drive can be employed at a time, whereas with two shafts two speed drives are available for simultaneous employment in dishwashing.

Shaft 23 is adapted to be driven at high rotary speed, for example a speed of 600 R. P. M. more or less, and the same may be referred to as the centrifugal shaft since it can be employed to drive mechanisms for clothes laundering and dishwashing purposes which operate in dependency on centrifugal force. As employed in a clothes laundering machine of the preferred type herein illustrated and shortly to be described, shaft 23 may be specifically identified as the extractor drive shaft.

A second shaft, 24, can be rotated at a relative slow speed of 60 R. P. M. or less, but preferably will be oscillated on its axis at relatively slow speed of say 40 to 80 cycles per minute by the power mechanism through an arc of say 225° for clothes washing. With such motion the same is adapted to drive an agitator, and shaft 24 may conveniently be referred to specifically as the agitator drive shaft. Where, as preferable, shafts 23 and 24 are both employed for dishwashing purposes they are driven simultaneously to effect high velocity circulation of the dishwashing liquid, and both shafts can be operated with the same motions as employed when they drive parts of clothes laundering mechanism. On the other hand in the dishwashing operation shaft 24 may be given a rotary movement, in either direction, faster or slower than the movement of shaft 23, instead of the slow speed oscillatory motion which it has for driving the clothes washing agitator. The essential requirement is only that the two shafts shall have a marked differential in speed. In those cases where only one of the shafts is operated rotatively and the other remains stationary during dishwashing operation shaft 24 will preferably be the shaft to remain stationary since the high speed rotary drive of shaft 23 as employed for clothes extraction is well suited for dishwashing, employing the same speed and drive mechanism, through appropriate design of the dishwashing mechanism.

The auxiliary structure of the main unit in addition to the power mechanism drive shafts so far described will include a supporting structure upstanding from the base 20. The form of the invention illustrated in Fig. 1 represents a portable cabinet model washing machine, and in such form the supporting structure consists of a skirt 25 of sheet metal surrounding the base to a point above the power unit. Supported on the

upper marginal area of the skirt on a seat formed by a resilient gasket 26 is an upwardly open casing 27 which forms with the skirt an external cabinet for the machine. The upper end of the casing is formed with a relatively large opening 28 which is adapted to be normally closed by a suitable cover. For purposes of sanitation separate covers may be employed when the machine is employed for clothes laundering and dishwashing. Secured to the lower part of the casing is a water collector or drain pan 29 having a drain port 30 connecting with a flexible drain hose 31. It is advisable although not necessary in all cases to provide a rotary impeller or equivalent pump 32 for positively draining off the water from the drain pan, such pump being driven by the power unit and delivering the water from hose 31 to a discharge hose 33.

Casing 27 may be secured to the skirt 25 and/or base 20 by any suitable means such as bolts or the like. It may be dispensed with entirely when the machine is supplied in a form to be installed in built-in cabinet and counter-top structures, since it is preferable to employ washing receptacles independent of the casing. The skirt also may be dispensed with. The drain pan 29 and pump 32 will ordinarily be supplied for built-in installations, although any suitable form of drain pan could be installed in lieu thereof to catch washing liquid draining from the machine.

The drain pan 29 has its central area formed with a flanged upwardly projecting annulus 34 surrounding the drive shafts and their supporting structure in spaced-apart relation to permit lateral movement relative to the drain pan.

Integral with the cast top member 35 of the housing of the power unit 22 is tubular standard 36 from which extends a further tubular member 37 provided with a bearing 38 at its upper end which journals centrifugal tubular shaft 23. Such shaft is of relatively short length and provided at an intermediate position a short distance above member 37 with a driving flange 39 secured to the shaft by any suitable means such as welding. Shaft 24 is of greater length and is journaled at an intermediate point by a suitable bearing 40 within the upper end of shaft 23. The outer end of shaft 24 is provided with a driving block 41. Driving flange 39 and block 41 of the respective shafts may be of a frictional type, but preferably will be provided with driving elements, not shown, adapted to make interfitting engagement with parts of the washing mechanisms to be driven to avoid any danger of slippage.

The arrangement of the power unit, drive shafts and other parts so far described constitute the foundation structure of the machine as designed for operating a known type of clothes laundering mechanism now to be described. In passing it should be observed that no structural modification of the foundation mechanism is required to enable the same to serve equally well in the use of the machine for dishwashing. The motions of the respective drive shafts 23 and 24 have been indicated above as a sufficient basis for understanding operation of the machine in its several uses, and the details of the power unit through which the shafts are driven will be deferred until later as being only of collateral importance.

Clothes laundering machine

In the use of the machine for clothes washing purposes we prefer to utilize elements and structures which permit both washing and extracting operations, and as a labor saving convenience it is desirable that such operations be carried out in a single receptacle which functions as a washing tub during the washing operation and a centrifugal extractor to remove washing liquid from the clothes after they have been thoroughly washed. The washer-extractor mechanism is of known form and includes a receptacle 50 designed to hold clothes and adapted to function both as a wash tub and extractor. Such receptacle is imperforate throughout its major area in order to retain washing liquid in its capacity as a tub. To enable washing liquid withdrawn from the clothes to be removed a circumferential series of drain apertures 51 are provided in the receptacle in the upper marginal portion of the side wall, and such side wall is tapered slightly preferably in an upward and outward direction.

Centrally of the receptacle and extending upwardly from the bottom thereof substantially to the open top is a tubular standard 52 protecting the shafts from the washing liquid having an enlarged lower portion 53 adapted to receive centrifugal shaft 23. The receptacle is removably supported on driving flange 39 on such shaft as clearly shown in Fig. 1, and in driving engagement therewith.

Mounted within receptacle 50 is a conventional form of vaned agitator element 54 comprising a tubular body portion 55 spaced from tubular standard 52 and supported by and in driving engagement with driving block 41 of agitator shaft 24.

In the use of the machine for laundering, the clothes, washing liquid and suitable detergent material are placed within the receptacle 50 and shaft 24 is driven by the power unit at relatively slow speed, and preferably with an oscillatory motion through an arc of about 225°, more or less, to actuate the agitator. During the washing operation the receptacle 50 may remain stationary and centrifugal shaft 23 idle.

After the washing operation has been carried on a desired length of time to produce a proper cleansing of the clothes, the agitator and shaft 24 are disconnected from the drive, permitting free rotation and shaft 23 is then operated to rotate receptacle 50 at a centrifugal speed sufficient to effect removal of the washing liquid from the clothes and out of the receptacle. The speed is variable over a considerable range and will depend on factors such as the diameter of the receptacle, the time limit to be permitted for extraction, the tendency of the machine to vibrate and the presence or absence of vibration absorbing mechanism. A speed within range for shaft 23 of 500 to 700 R. P. M. is ordinarily satisfactory, and for a receptacle having a twenty inch top diameter and a nineteen inch bottom diameter we prefer to employ a speed of approximately 600 R. P. M. It will be evident that the centrifugal force created by the high speed of rotation of the receptacle causes the washing liquid to travel outwardly against and upwardly along the inclined inner wall of the receptacle until it reaches the drain apertures 51 through which it passes and thence drops to drain pan 29 from which it is discharged by pump 32. Extraction of the liquid from the clothes is accomplished in this manner to a degree at least equal to present day power driven wringers.

After completion of the washing operation, the clothes may be subjected to one or more rinsing operations, which consist in introducing fresh

liquid into receptacle 50 and repeating the agitating and extracting operations.

Because of the possibility of an out-of-balance load condition in the receptacle resulting from non-uniform distribution of the clothes around the axis of rotation, substantial vibration sometimes is caused to be set up in the machine during the extraction operation due to the high speed of rotation. It is desirable to provide suitable means to compensate for such vibration, and to effect a dampening or absorbing action thereof. No such means has been shown on the drawings, since it forms no part of the present invention. One method of accomplishing this effect consists in mounting the entire power unit including motor 21, driving mechanism housing 22 and drive shafts 23 and 24 independently of supporting base 20 on some suitable suspension means, such as disclosed in John P. Beattie Patent 2,334,858, granted November 23, 1943. With such an arrangement the mechanism indicated and the receptacle 50 are permitted a range of lateral movement relative to the casing 27 and drain pan 29. Because of such movement the opening in the central flanged portion 34 of the drain pan is made of relatively large diameter. To prevent excessive lateral movement under very unusual circumstances of out-of-balance load condition which will sometime arise when the receptacle is building up to or slowing down from its extracting speed, the portion of tubular member 37 in registry with the annular central portion 34 of the drain pan may be surrounded with a bumper member 56 of resilient material. If receptacle 50 tends to swing laterally in too large an orbit the bumper engages the wall of the upper portion of part 37 and confines the receptacle until the condition has been overcome with a change in speed of rotation. It is found that when the receptacle is operating at extracting speed it tends to balance itself against lateral motion.

Dishwashing conversion unit and machine

As previously stated the dishwashing mechanism is designed to spray high velocity streams of washing liquid over dishes and like articles to be cleansed, utilizing centrifugal force to accomplish this. A limited body of preheated washing liquid with detergent is continually recirculated during the cleansing operation and thereafter discharged with any accumulated grease and food particles removed from the articles, following which one or more further bodies of plain liquid may be introduced to effect rinsing of the articles. The mechanism is designed to operate entirely independently of line water pressure and is extremely economical in operation because of the small quantity of hot washing and rinsing liquid and detergent required.

While the invention contemplates a single function washing machine for dishwashing purposes only within its scope, the more important aspects of the invention consist in the discovery that conventional clothes laundering machines may be converted into efficient dishwashing machines and in the novel design of dishwashing mechanism serving to accomplish this purpose.

The dishwashing mechanism proper is extremely simple and consists of only a few parts designed for utmost efficiency yet involving a relatively low manufacturing cost. The same includes means for holding the dishes and means for continuously recirculating washing liquid in high velocity streams over the dishes. The washing liquid circulating or distributing mechanism comprises a washing liquid receptacle and liquid projecting means, and one or both parts of such circulating mechanism are designed to be driven by drive shaft means of a clothes laundering machine.

As earlier noted, it is desirable for reasons of sanitation that a separate receptacle be employed for dishwashing than for clothes washing and/or extracting so as to avoid contact with the receptacle and other operative parts employed for one operation by the washing liquid employed in the other operation. Preferably at least a part of the clothes operating mechanism including the agitator and ordinarily also the tub or extractor receptacle will be removed from the machine and replaced by the dishwashing unit since such arrangement not only satisfies sanitary considerations, but permits a construction providing the greatest dish holding capacity without increasing the overall size of the machine. However, it is possible, though not so desirable, to carry out the dishwashing operation within the tub or extractor receptacle either by employing a suitably constructed clothes receptacle for the dishwashing liquid or by locating a smaller separate dishwashing liquid receptacle within the clothes receptacle.

Referring to Fig. 7 a preferred form of the dishwashing mechanism is shown installed in the cloths laundering machine of Fig. 1 in the position occupied by clothes receptacle 50 and agitator 54. As part of such mechanism is included a perforated or open mesh reticulated rack or basket 60 constituting a dish holder, and having relatively large openings adapted to permit unimpeded projection of spray streams of washing liquid therethrough against the dishes. Desirably a series of wire or other dish supports such as 61 will be secured to the rack in upstanding relation at recurrent circumferential points to support the dishes with spaces between them such as to allow thorough coverage of all surfaces of each dish by the washing liquid. Preferably the arrangement of supports 61 will be such as to position the dishes such as A more or less radially of the rack, since such arrangement is calculated to best avoid interference by one dish with the projection of liquid stream against another dish.

Surrounding rack 60 is a spray shield 62. While not necessary such spray shield is secured to the outer periphery of the rack permanently or detachably through an inturned flange 63 at the lower end of the shield, and in such form the shield may be said to constitute part of the dish holder. In the particular arrangement shown the spray shield 60 provides support for the dish holder through an outturned flange 64 at the upper end of the shield adapted to engage the inturned flange surrounding the top opening 28 of the machine cabinet 27. However, the dish rack may be supported independently of the spray shield and the spray shield may be supported independently of the top of the machine casing or the top of a biult-in cabinet structure. In models where the casing is dispensed with, it will be evident that the main function of the spray shield is to prevent loss of washing liquid from the dishwashing mechanism during prolonged recirculation. In some cases the spray shield may be dispensed with entirely although this is not considered so desirable.

Upstanding from the central area of the rack 60 and preferably flared outwardly in its lower

portion as a drainage guide is an upstanding sheet metal thimble 65 functioning as a protective housing for the drive shaft means. An auxiliary perforate rack 66 may be located at greater than dish diameter above rack 60 adapted to hold inverted glasses and silverware to be cleansed. In the form shown rack 66 is cut out in its central area to receive the upper end of thimble 65 and is provided with an outturned flange 67 around its upper edge adapted to be supported by the upper flanged edge 64 of spray shield 62.

A top cover 68 is provided to close the dishwashing unit having a peripheral edge portion adapted to engage the top edge of cabinet 27 or the top edge of one of the previously described parts of the dish holder assembly.

The centrifugal washing liquid circulating or distributing mechanism comprises independent but interacting parts designed to produce high velocity projection of washing liquid in streams against dishes supported in racks 60 and 66 by employment of the drive mechanism of the washing machine and preferably, as previously indicated, with the drive shaft means operating under the same motion as employed during clothes laundering. Such mechanism includes projecting nozzle or scoop means 70 and a washing liquid receptacle or reservoir 71, one of which is adapted to be driven at high rotary speed and the other of which may be stationary but preferably also will be driven with a motion different from the first means and by a different drive shaft.

A plurality of circumferentially spaced nozzles or scoops 70 are employed, the number being variable, to insure projection of adequate volume of washing liquid in streams to all parts of the dish holder. In the embodiment of Fig. 7, and as best shown in Fig. 8, three such elements are employed being arranged at intervals of 120°. It will be understood, however, that from one to four or more elements may be employed, and the number selected in any case will depend on the size of the dish holder, the form of the elements, and whether the elements are mounted stationarily or are movable in a path, and if movable the speed of their motion and whether their path is merely an arc or a complete rotary path. The elements are here shown as being of U-shaped cross-section and of curving shape in a lengthwise direction, but tubular nozzles of various lengths and shapes have been found satisfactory. The main point is that the nozzles should be adapted to project the washing liquid in a sufficiently concentrated spray and limited diffusion that the velocity of the liquid shall not be so dissipated by the time it impinges upon the dishes as to have lost its cleaning force. It will be evident that the projection of the liquid as widely diffused individual droplets at random and without regard as to direction, while giving wide coverage which might serve for mere rinsing of the dishes, is not adapted to produce satisfactory cleansing of the dishes of adhering grease and food particles. Satisfactory coverage of the various areas of the dish holder is accomplished in the present mechanism through the use of a number of nozzle elements at spaced projection points, and by oscillating the elements over an arcuate path or rotating them the points of projection are continually changed so that a relatively small number of elements will adequately serve the entire area of the dish holder.

The scoop or nozzle elements 70 will be mounted with their inlet ends immersed in the body of washing liquid in receptacle 71 and with their discharge ends preferably located in fairly close proximity to the apertured areas of the dish holder. Where the elements are to remain stationary they may be mounted, preferably adjustably, from dish rack 60 or spray shield 62, but preferably and as shown in Figs. 7 and 8 they will be independently mounted for movement relative to the dish holder and receptacle on a movable mounting designed to be positively driven. Such mounting includes a central tubular member 72 adapted to surround the drive shaft means and having an upper end portion formed for driving engagement with the slow speed shaft 24 of the washing machine through driving block 41. Member 72 is provided with a series of relatively long radial arms 73 upon which the nozzle elements 70 are adjustably mounted through suitable bracket and bolt means with their intake ends adjacent the inner side wall of the washing liquid receptacle. Adjustability of the elements is desirable to regulate the extent of immersion of their inlet ends in the washing liquid and to control the velocity and direction of projection of the liquid into the dish holder.

The washing liquid receptacle 71 can be, and is here shown as being relatively shallow. Desirably it is of relatively large diameter so that centrifugal force may be utilized to best advantage in obtaining a high velocity circulation of the dishwashing liquid. It may underlie in whole or in part the dish rack 60 and spray shield 62, and preferably will be at least as large in diameter as the rack and spray shield, for example 20 inches, so that all liquid circulated will drain back into the receptacle.

As earlier stated great advantage is gained by employing receptacle 71 as an active element of the liquid circulating mechanism by rotating it at centrifugal speed through the power unit of the washing machine so that the body of washing liquid therein is forced outwardly from the axis of rotation to form a liquid annulus B against the inner side wall of the receptacle. Such annulus rotates with the receptacle at, or perhaps somewhat below, receptacle speed. Assuming that the receptacle has a twenty inch diameter and is rotated at 600 R. P. M., the speed adjacent the receptacle side wall will be approximately 52 feet per second, or between 2200 and 3142 feet per minute. It is evident, therefore, that regardless of whether the liquid projecting nozzles 70 are, or are not, themselves driven liquid scooped thereby from the liquid annulus will be projected at high velocity into the dish holder in a concentrated fan-like or other shape of stream depending on the form of nozzle 70.

The projecting of the liquid by the nozzles will be generally upwardly and inwardly when employing the arrangement of parts shown in Fig. 7 so that all articles in racks 60 and 66 will be thoroughly cleansed. The liquid will then drain back through rack 60 into receptacle 71, be thrown outwardly by centrifugal force to the annular body of liquid B at the periphery of the receptacle and again projected by the nozzle element 70. Continuous circulation is thus maintained as long as the machine is operated.

In some instances, depending upon the form and arrangement of nozzle element 70, a series of auxiliary liquid projecting elements 74 may be provided at various vertical and circumferential points of the inner wall of spray shield 62. Such elements may be arranged as vertically spaced tiers with the elements of the respective tiers dis-

posed in staggered and overlapping relation as seen in Fig. 9. Such elements are preferably formed of sheet metal, and each include a pair of oppositely disposed upwardly and inwardly inclined wing elements 74ª, connected together at their upper ends as will be understood from Figs. 9 and 10. The purpose of these auxiliary projecting elements is to deflect portions of the liquid streams projected upwardly in the region of the spray shield out of range of the dishes transversely inwardly against the dishes as indicated by certain of the directional arrows in Fig. 7. It is generally preferable that the main projecting elements 70 be so formed and arranged that the liquid be projected therefrom directly against the dishes, since it will be apparent that the velocity of such portions of the liquid passing upwardly out of range of the dishes adjacent the spray shield will largely be spent against the auxiliary projecting elements 74, and when deflected thereby the liquid will move with a much lower velocity and be in a more highly diffused state. Such deflected portions of the liquid do not have as high a cleansing action on the articles as the liquid projected from receptacle 71 by nozzle 70 directly against the articles.

Centrifugal rotation of receptacle 71 is obtained by removably mounting the same in driving engagement with a shaft in the washing machine which is rotatable at high speed. As seen in Fig. 7 the receptacle is provided with an elongated hub 75 adapted to surround the centrifugal or extractor drive shaft 23 with the receptacle resting on and in operative engagement with driving flange 39 of such shaft. Shaft 23 can be rotated at the same speed when driving the dishwashing receptacle 71 as when driving the extractor receptacle 50 in the clothes laundering operation, say about 600 R. P. M., although the purposes are different in the two instances in that centrifugal force is employed to produce high velocity circulation within the dishwashing unit, whereas it is employed to remove washing liquid from the clothes laundering unit.

The mounting of the projecting nozzles 70 for oscillating or other movement by the agitator shaft 24 simultaneously with the high speed centrifugal rotation of receptacles 71 by the centrifugal or extractor shaft 23 as shown in the embodiment of Fig. 7 serves to continually shift the location of projecting nozzle 70 relative to dish racks 60 and 66 so that each nozzle serves to cleanse dishes over a considerable circumferential area of the dish rack. Assuming that the regular oscillating drive of the agitator shaft is employed, producing movement through a path of approximately 225°, and further assuming that there are three nozzle elements 70, each nozzle element will oscillate back and forth through a path of 225° and therefore cover nearly two-thirds of the area. The paths of the nozzle would overlap one another as shown by the arcuate arrows in Fig. 8 with the result that substantially every area of the dish rack would be served by two nozzles. Thus with the relatively small number of nozzles and with a construction thereof calculated to produce relatively concentrated high velocity liquid streams there will be a relatively large volume of flow of washing liquid through all areas of the dish holder and a thorough cleansing action is obtained in a minimum of time. It should be emphasized that the oscillating drive of the nozzles through an arc is preferably adopted because such a motion is available from the agitator shaft 24 of the clothes laundering machine where the latter is oscillated instead of being rotated for clothes washing purposes, and that within the scope of the invention the nozzle elements may be driven rotatively in the same, but preferably in the opposite, direction of rotation as the direction of rotation of the centrifugal receptacle 71. Ordinarily, and as shown in Fig. 8, the nozzle elements will be adjustably mounted at an inclined angle to the liquid annular body or wall B with merely their intake ends projecting into the liquid and facing against the direction of rotation of the liquid in the receptacle.

Receptacle 71 is not only relatively shallow, but is designed to retain therein a quantity of liquid less than the cubic area of the receptacle as determined by its overall dimensions, since it has been found that the dishwashing mechanism will function very satisfactorily with a relatively small quantity of washing liquid. Because of the high speed of rotation employed for the receptacle the washing liquid is urged outwardly, and by locating the nozzle elements adjacent the periphery of the receptacle it is unnecessary to fill the receptacle with more than enough liquid to maintain a relatively thin annulus or liquid wall around the inner side wall. The inner area of the receptacle serves merely as a catch pan to receive liquid draining back from the dish rack 60, which liquid is immediately thrown outwardly. The bottom of the receptacle can be preferably formed upwardly convex with this point in mind.

In order that the receptacle 71 in its shallow form retain the quantity of washing liquid required for use a relatively narrow inturned flange 76 is provided around the upper edge of the receptacle. The width of such flange will generally determine the radial thickness of the annular liquid wall B, and any excess liquid inwardly of the inner periphery of the flange will be discharge from the receptacle at centrifugal speed either through the top of the receptacle over the flange and/or through drain openings 77 in the bottom of the receptacle which are preferably arranged with their outer limits in substantial vertical alignment with the inner edge of flange 76. Receptacle 71 is therefore self-measuring as to the quantity of washing liquid it will retain, regardless of how much washing liquid may be initially supplied to the receptacle. Thus no premeasuring of the liquid to be supplied is required, since any excess liquid rejected from the receptacle will be immediately discharged to drain pan 29 of the washing machine.

Drain openings 77 not only function to render receptacle 71 self-measuring during centrifugal rotation of the receptacle, but also are designed to automatically drain all washing liquid out of the receptacle after the drive is discontinued at the end of the dishwashing operation and the receptacle slows down and comes to a stop. As shown in Figs. 7 and 8 such openings are formed out of the bottom of receptacle 71 in relatively elongated form at recurrent circumferential points to provide shields or louvres 78 which face in a radially outward direction. When washing liquid is initially supplied to the receptacle, which will be done when the receptacle is being centrifugally driven, the liquid will pass outwardly under centrifugal force over louvre 78 to form the annular liquid wall B and only excess quantities of the liquid will be discharged

through opening 77 before rotation is discontinued. However, as soon as the receptacle stops, or slows down sufficiently that centrifugal force is no longer able to maintain the annular liquid wall, all liquid will be discharged downwardly through drain opening 77.

During dishwashing operation the washing liquid is maintained constantly in motion so there is little tendency for grease, food particles or other waste matter removed from the dishes and carried by the liquid to adhere to the dishwashing mechanism. Further, when the high speed rotation of receptacle 71 is discontinued by interruption of its drive at the termination of a washing operation, the liquid annulus, for a short interval of time, travels at a speed greater than the speed of the receptacle and gradually breaks down into a downwardly swirling motion against the inner wall of the receptacle to exert a flushing action which insures elimination of waste matter when the liquid discharges through drain openings 77. Such flushing action can be accentuated by bringing the receptacle to a stop relatively quickly from its high speed rotary motion, as by applying a braking force through extractor drive shaft brake mechanism such as hereafter referred to. Thus, the dishwashing mechanism is sanitary and self-cleansing, and does not require manual or other cleaning after each use of the machine for dishwashing operation.

The operation of the machine as shown in Fig. 7 may be briefly summarized. A quantity of washing liquid and detergent will be supplied to the receptacle after first starting the driving mechanism to actuate the liquid distributing parts 70 and 71 either by removing cover 68 of the dishwashing unit, or by supplying it through a suitable inlet port provided at any suitable point in the structure, as in the cover. The dishes and related articles will have been placed in rack 60 and 66 before the liquid is introduced. Operation of the machine is continued for an appropriate period to cause the washing liquid circulated to thoroughly cleanse the articles. Operation is then stopped. All of the washing liquid with accumulated grease and food particles will automatically drain out of the receptacle to drain pan 29 and be removed subsequently by operation of pump 32. One or more rinsings of the articles may then be effected by again starting operation of the machine and supplying clear rinsing liquid. When the machine is again stopped the rinsing liquid will automatically drain out, and thereafter the dishes and other articles may be removed from the dish holder at any time. It will be understood from what has been said that the construction and operation of the dishwashing mechanism is well adapted to efficient cleansing of dishes and related articles. Moreover, the mechanism is admirably adapted to installation in a clothes laundering machine to convert the same to dishwashing purposes. The simplicity of the dishwashing mechanism and its adaptability to be supplied in the form of a conversion unit or attachment for or as a part of a clothes washing machine is best visualized in Figs. 11 and 12, wherein the same is shown removed from operative position in the washing machine as in Fig. 7. The construction is the same as illustrated in Fig. 7 except that spray shield 62^a is not provided with auxiliary liquid projecting elements such as 74 previously referred to, and as illustrated the liquid projecting element 70^a in some cases may be formed and arranged to project the streams of washing liquid in a radially more inward area than nozzle elements 70 in Fig. 7.

The dishwashing conversion unit can be supplied merely with the parts illustrated in Figs. 11 and 12. As will be seen there are only three independent parts, and all of these are in a form which may be handled easily and quickly installed in the washing machine. Ordinarily an additional article holder or holders such as rack 66 of Fig. 7 will be supplied as a part of the unit, and preferably also a special cover such as illustrated at 68 in the latter figure will be supplied so that the usual cover of the clothes washing machine will not be contaminated by grease or food particles through employment during the dishwashing operation.

The form and mounting of the dish rack and spray shield, which here conveniently are secured together to form a relatively deep dish holder, may be varied considerably. Thus instead of being mounted stationarily by suspension from the top of the machine casing they may be supported centrally and for free movement about an axis so as to be independent of the machine casing, as indicated in Fig. 13, and such arrangement is particularly desirable for models lacking a casing and intended for installation in built-in cabinet or counter-top structures. Spray shield 62^b is formed at its top with an inturned flange 64^b adapted to support a dishwashing unit cover 68^b. The mounting comprises a central tubular standard 65^b upstanding from rack 60 having a top portion 80 adapted to be supported for free movement on a pivot pin 81 provided at the upper end of tubular standard 72 of the liquid projecting nozzle assembly. A bearing 82 is provided at an intermediate portion of the height of standard 65^b to further journal the same on standard 72. In this embodiment also the liquid projecting nozzles 70^b are of tubular form instead of U-shaped cross-section as elements 70 and 70^a of previous embodiments.

Conversion of machine

It will be seen that through the present invention a clothes laundering machine having a drive shaft rotatable at high speed can be quickly converted from a clothes laundering operation to a dishwashing operation. Known types of washer-extractor clothes laundering machines are particularly adapted for such conversion in that no essential change is required in the power driving mechanism and advantage may be taken of the drive provided by the agitator shaft as well as that provided by the extractor shaft to produce driving motion of both parts (liquid receptacle and projecting nozzles) of the dishwashing mechanism to give extremely satisfactory dishwashing operation, although quite satisfactory results may be obtained by employing the extractor shaft alone where the projecting nozzles of the dishwashing unit are stationarily mounted so as not to require use of the agitator drive in simpler embodiments of the invention.

No objection on sanitary grounds arises from the dual employment of the machine in the preferred embodiments shown since the dishwashing liquid receptacle and associated operative parts form a complete operative dishwashing unit separate and apart from the clothes receptacle and other operative parts of the clothes laundering unit.

As will be understood by a comparison of Figs. 1 and 7 conversion is effected by removing one

of the units from the machine and substituting the other therefor. The driven operative parts of each unit are so formed as to be quickly and easily applied to and removed from driving engagement with the shaft means of the washing machine.

While both the clothes unit and dishwashing unit are of adequate capacity for practical domestic use, they are nevertheless sufficiently compact that whichever one is removed from the machine at a particular time requires only a relatively small storage space, and the parts are sufficiently light and simple that they may be easily handled and installed by a woman.

Power unit

In the preferred forms of the invention hereinabove described, for clothes laundering use is made of the agitator shaft **24** alone in the washing stage, and the extractor shaft **23** alone during the extracting stage. For the dish washing operation, the extractor or centrifugal shaft **23** may be used alone in forms of the invention where only one part of the dishwashing liquid distributing mechanism is driven, but the extractor shaft and agitator shaft are required to be simultaneously driven in the preferred forms of the invention where both parts of the washing liquid distributing mechanism are driven.

While any suitable form of selective drive mechanism which will produce the required motions of the shafts for the different operations may be employed, we preferred to employ a drive mechanism such as shown in Andrew H. Gerhardt application, Serial No. 497,649, filed August 6, 1943, now Patent No. 2,494,436, dated January 10, 1950, since such mechanism is particularly well adapted to provide for the successive drive of the agitator and extractor shafts during the several stages of the colthes laundering operation and to produce simultaneous operation of the two shafts for the dishwashing operation without any change in the drive mechanism and merely through the provision of suitable control means. The driving mechanism is illustrated in detail in Figs. 3 to 6 and generally conforms to the mechanism of the aforesaid Gerhardt application except for the addition of an extractor shaft brake means which serves to hasten stopping of the extractor shaft and receptacle **50** at the end of an extracting operation and holds the receptacle against rotary movement during the clothes washing stage.

Electric motor **21** is of a reversible type and is adapted through the employment of suitable clutches in the driving mechanism to drive the agitator shaft when the motor rotates in one direction and to drive the extractor shaft alone, and also both shafts simultaneously, when rotating reversely.

Referring to Figs. 3 to 6 in conjunction with Fig. 1, the reversible electrically driven motor **21**, preferably of a split phase type with a starting coil, and having a drive shaft **90**, is connected by coupling **91** to a main drive shaft **92** of the driving mechanism **22**. The cast metal top member **35** of the driving mechanism housing, as will be presently described, serves to provide total support for the drive mechanism which effects oscillation of agitator shaft **24**, and rotation of centrifugal or extractor shaft **23**, and the parts of the clothes and dish units which are supported by such shafts.

The top housing member **35** also includes an upwardly offset marginal flange **93** disposed a substantial distance above the main area of the top member, and secured to said flange, by means of screws **94**, is a sheet metal upwardly-open, flanged housing receptacle **95** which serves to fully enclose the drive mechanism suspended from the top housing member **35**.

Depending from the top housing member **35** are three aligned bearing brackets **96**, **97**, and **98**, providing journal support for the main drive shaft **92**, and the bearing brackets **96** and **98** are provided with suitable bushings **96a** and **98a**, respectively. An oil seal **99** is mounted on shaft **92** within a threaded nut **100** having threaded connection with the interior of a recess in bearing bracket **98**.

The left hand portion **92a** of main shaft **92** between bearing brackets **96** and **97** is enlarged and formed with an integral worm gear **101** through which one of the agitator and extractor shafts **24** and **23** is driven. To drive the second of such shafts the right hand portion of shaft **92** carries a second worm gear **102** loosely journaled on the shaft intermediate bearing brackets **97** and **98** and engaged at one end by a thrust bearing **103** and being connected at its other end to shaft **92** through an overrunning one-way drive clutch indicated generally at **104**. Said clutch includes a ratchet **105** which at its left end abuts against a shoulder **92b** formed by the enlarged left hand portion of main drive shaft **92**. The second clutch part comprises a cylindrical body member **106** rigidly secured by a set screw **107** to the enlarged shaft portion adjacent shoulder **92b**, and housing ratchet **105**. The right hand housing portion of the body member **106** is provided with a plurality of circumferentially spaced apart jaws **108** disposed in transaxial alignment with the teeth of ratchet member **105**. Such jaws are so formed as to provide clearance pockets for accommodating steel balls **109** which are confined in position by a cup-shaped member **110** press-fitted on the body **106**. When shaft **92** is driven by the motor in a clockwise direction balls **109** seat in the clearance pockets formed between the jaws of clutch member **106** so that ratchet **105** is not engaged and no drive is provided for worm **102**. When shaft **92** rotates in a counter-clockwise direction certain of balls **109** wedged between teeth of ratchet **105** and inclined surfaces of jaws **108** to positively drive worm **102**.

Through mechanism now to be described left hand worm **101** is employed to drive agitator shaft **24** with an ocillating motion when the motor rotates shaft **92** in a clockwise direction, and worm **102** is employed to drive extractor or centrifugal shaft **23** with a high speed rotary motion when the motor rotates shaft **92** in a counter-clockwise direction to connect worm **102** to shaft **92** through the one-way clutch just described.

Meshing continuously with worm **101** is a gear **111** journaled on a stud **112** which is rigidly secured by a drive fit in a boss **113** formed integral with the top housing member **35**, as seen in Fig. 6. The underside of gear **111** is provided with an enlargement **114**, the bottom portion of which constitutes an eccentric **115**. Such eccentric is journaled in a rectangular block **116** slidably guided in a yoke member **117**. The yoke member is journaled at one end on a flanged bearing **118** pinned to the end of a vertical stud **119** supported in a depending boss **120** projecting from the underside of top housing member **35**. The upper end of the stud is threaded and provided with a nut **121** for supporting the yoke in proper relation to the other mechanism. The outer end

of the yoke opposite the pivot connection is formed with a segmental rack 122 which is continuously meshed with a pinion 123 journaled on the lower end of the agitator drive shaft 24, as seen in Fig. 6.

The outer end of the segmental rack is guided and supported for movement on a curved member 139 secured to two depending legs 126a of a bracket 126, as seen in Fig. 4. Bracket 126 in turn is connected by screws 127 to the lower ends of a plurality of spaced apart depending legs 128 formed as an integral part of the top housing member 35 as seen in Fig. 4.

Pinion 123 is adapted to be clutch-connected to the agitator drive shaft by upward axial movement of the pinion to engage a notch or jaw 124 on the hub of the pinion with a pin 125 secured to the lower portion of agitator shaft 24. Centrally of the face of pinion 123 is a circumferential groove 129 extending into the teeth and into the body portion of the pinion within the root diameter of the teeth. An actuating yoke 133 for clutching and unclutching the pinion extends into groove 129. Such yoke is attached to an upwardly extending rod 131 which is guided in the bracket member 126 and in the top housing member 35 as seen in Figs. 4 and 6. The upper end of rod 131 is pivotally connected to an operating lever 132 fulcrumed by pin 133 between a pair of upstanding lugs 134 formed on the upper side of the top housing member, as seen in Fig. 1. The outer end of the operating lever 132 is connected by links 137 and 138 to the core of a solenoid 135. The solenoid when energized through a control circuit such as hereafter to be described simultaneously with energization of the motor to rotate in a counter-clockwise direction will, through the actuating linkage just referred to, engage pinion clutch parts 124 and 125 and effect an oscillating drive of agitator shaft 24 through worm 101, gear 111, eccentric 115, yoke 117, rack 122 and pinion 123. When solenoid 135 is deenergized a coil spring 136 surrounding the lower portion of rod 131 and interposed between yoke 138 and bracket 126 expands to move pinion 123 in a downward direction to release clutch parts 124 and 125.

The tubular extractor or centrifugal shaft is journaled in the lower end of standard 37 by a bearing 140, and has a lower portion extending therebelow to which is rigidly secured a helical gear 141 having an upwardly projecting hub portion 142 press-fitted in the lower end of the drive shaft, and having a depending hub portion 143 journaled by a ball bearing 144 in the upper end of bracket 126. Press-fitted within gear 141 is a bearing 145 which journals agitator shaft 24. Ball bearing 144 thus serves to provide bearing support for agitator shaft 24 as well as bearing support for gear 141, and in addition, serves as an end thrust bearing for said gear and extractor drive shaft 23.

Gear 141 is in constant mesh with worm 102 on main drive shaft 92, and when the motor rotates such shaft in a counter-clockwise direction to secure worm 102 to the shaft through its one-way clutch 104, gear 141 serves to rotate shaft 23 at a high speed of preferably about 600 R. P. M. Under such conditions, for certain operations of the washing machine, the agitator shaft control solenoid 135 will be deenergized and the clutch between gear pinion 123 and agitator shaft 24 will be disengaged so that the agitator shaft will remain stationary while extractor shaft 23 is driven, whereas for other operations of the machine solenoid 135 will be energized to engage the clutch while the extractor shaft is driven so that the agitator shaft will be driven with its oscillatory motion simultaneously with high speed rotary drive of the extractor shaft under rotation of the motor in a counter-clockwise direction.

Brake means are provided to hasten stopping of the extractor shaft 23 at the end of a period of operation, and secure such shaft against rotation at times when the agitator shaft alone is being employed for a clothes washing operation and the extractor shaft is capable of free rotation through overriding of the one-way clutch 104 of worm 102 when the motor and main drive shaft 92 are rotating in a clockwise direction. Such means includes a brake shoe 150 pivotally connected to the lower end of a rotatable stud-like member 151 journaled in a boss formed on the top housing member 35. The upper end of member 151 projects beyond the boss, and is rigidly attached to an operating lever 152, the outer end of which is connected by a link 153 to the core of a brake control solenoid 154. A coil spring 155 is connected to the top of the housing at one end, and at its opposite end is connected to the outer end of operating lever 152. Such spring normally tends to press brake shoe 150 into braking engagement with the lower portion of extractor shaft 23 when the solenoid is deenergized and only the extractor shaft is to be driven, as will be understood from Figs. 1 and 8. Energization of solenoid 154 serves to release the brake shoe from braking engagement with the extractor shaft when such shaft is to be driven.

Pump 32 which serves to drain used washing liquid from drain pan 29 is operated from the power unit through driving means which, in the present instance, serves to drive the pump only when the extractor shaft is driven, as during clothes extracting operation and dishwashing operation of the machine, the pump remaining idle when only the agitator shaft is driven as during clothes washing operation of the machine. As shown in Fig. 4 the housing of pump 32 has a reduced neck portion 160 extending into the side of drive housing portion 95 and supported in the adjacent depending leg 128 by a set screw 161. The rotatable impeller member, not shown, of the pump is operatively connected to a helical pinion 162 which meshes with worm gear 102 which is driven through its one-way clutch only when the motor rotates main drive shaft 92 in a counter-clockwise direction.

If desired, the pump may be mounted with its pinion 162 in engagement with worm 101 instead of in engagement with worm 102, in which case the pump will function under all conditions whether the motor rotates drive shaft 92 either clockwise or counter-clockwise, and whether either or both of the agitator and extractor shafts are driven. Such arrangement may be desirable under certain conditions of operation, as in the event the machine is functioning in such manner that washing liquid is permitted to flow into drain pan 29 during the time agitator shaft 24 is operating and extractor shaft 23 remains stationary.

As indicated previously the entire power unit, including motor 21, driving mechanism 22 with the associated pump 32, agitator shaft control solenoid 135 and extractor shaft brake control solenoid 154 may be supported through a floating mounting for movement relative to the base member 20 in such manner as to dampen and absorb vibrations, as by employment of suspen-

sion means such as shown in John P. Beattie Patent No. 2,334,858, previously referred to.

Control device and circuit

Any suitable form of control mechanism and control circuit may be employed to selectively operate the drive mechanism to perform its clothes laundering and dishwashing functions.

In Fig. 2 I have shown a manual control device 170 having a dial 171 and a rotatable knobbed pointer 172 adjustable to four positions indicated by indicia 173 on the dial. When the pointer is opposite "Off" the machine is entirely inoperative. The pointer is turned to the left to "Wash," and in such position the power unit is adjusted to drive the agitator for clothes washing. When the pointer is set in "Dry" position the power unit drives the extractor shaft while the agitator shaft is free to rotate or remain stationary.

When the pointer is turned to "Dishwash" the power is set to simultaneously operate the agitator and extractor shafts with the dishwashing unit installed in the machine.

Control device 170 may be applied to any suitable part of the machine, for example at a convenient point of the cabinet as shown in Figs. 1 and 7.

A suitable control circuit for use with the control device 170 is shown in Fig. 14. Use is made of a switch arm rotatable by knobbed pointer 172 having independent inner and outer contact elements S–1 and S–2 respectively connected to lines L–1 and L–2 of an electric power source. The reversible electric motor 21 has two pairs of terminals, M–1 and M–2, and M–3 and M–4. The agitator clutch control solenoid 135 has two terminals A–1 and A–2, and the extractor shaft brake control solenoid 154 has two terminals B–1 and B–2. Terminal M–2 and terminals A–2 and B–2 of the respective solenoids are directly connected to power line L–1. The other motor and solenoid terminals are in circuits controlled by the rotatable switch. The switch contacts for motor terminals M–1, M–3 and M–4 are respectively designated SM–1, SM–3 and SM–4. The contacts for establishing the circuit to the agitator solenoid through terminal A–1 are designated SA–1, and the switch contacts for establishing a circuit to the extractor brake solenoid through terminal B–1 are designated SB–1.

In "Wash" position switch member S–1 engages motor contact SM–4, and switch member S–2 engages motor contact M–1 and M–3, also agitator contact A–1, to effect rotation of the motor in a clockwise direction and energize the agitator control solenoid to engage the agitator shaft to be driven by the power unit with an oscillating motion. The extractor brake solenoid is not energized so that the brake operatively engages the extractor shaft to prevent rotation.

With the switch set to "Dry" position inner switch member S–1 engages motor contact SM–3, and switch member S–2 engages motor contacts M–1 and M–4, and extractor brake solenoid contact SB–1. The motor is now rotated in a counter-clockwise direction to drive the extractor shaft through the automatic one-way clutch, the brake being released by energization of the brake control solenoid. The agitator control solenoid is not energized in this position so the agitator shaft remains unclutched to the power unit and inoperative. In "Dishwash" position inner switch member S–1 engages motor contact SM–3 as in "Dry" position instead of contact SM–4 as in "Wash" position, and switch member S–2 similarly engages motor contacts M–1 and M–4, and brake solenoid contact SB–1, and additionally engages agitator clutch solenoid contact A–1. The motor therefore rotates counter-clockwise, the agitator clutch control solenoid is energized to effect operation of the agitator shaft, and the extractor shaft is simultaneously driven by reason of the release of the brake through energization of the brake control solenoid and by reason of the driving connection of the extractor shaft with the power unit effected through the automatic one-way clutch under counter-clockwise rotation of the motor. Accordingly, with the dishwashing conversion unit positioned in the machine one part of the washing liquid circulating mechanism will be driven rotatively at high speed by the extractor shaft, and the other part of such mechanism with a slow speed oscillatory motion by the agitator shaft.

In the event only one part of the dishwashing liquid circulating mechanism is to be power driven while the other part remains stationary as contemplated in certain embodiments of the invention, a three position switch, instead of the four position switch shown in Fig. 14, can be employed. Under such conditions the agitator shaft will not be driven simultaneously with the extractor or centrifugal shaft. Accordingly, the right hand position of the switch designated "Dishwash" in Fig. 14 may be dispensed with. The far left position of the switch designated "Dry" employed for extracting in clothes laundering would then be employed also as the "Dishwash" position, since the same circuits would be appropriate in the two instances.

It is to be understood that the particular control device 170 of Fig. 2, and the control circuit of Fig. 14 are merely illustrative. Other forms of control devices could equally well be employed with the particular form of motor and selective drive mechanism herein shown and described. Obviously, also, other forms of motor and drive mechanism with any appropriate control devices and circuits might be employed to effect selective operation of the drive shaft means of the machine.

By virtue of the invention it is possible by the use of a conversion unit involving only a few accessory parts to quickly and easily convert a clothes laundering machine into a dishwashing machine, or to convert a dishwashing machine into a clothes laundering machine, utilizing the same power unit and supporting structure, but providing different methods of washing liquid circulation appropriate to effective cleansing of clothes and dishes in the light of their essentially different character. It is therefore possible by having available machines capable of such double usage to effect a substantial saving in cost of manufacture as compared with two separate machines. Another and relatively important consideration, moreover, is the fact that the dual machines embodying the present invention lends itself to use in homes, apartments, etc., when the matter of space is of major importance. It permits having a dual machine occupying the floor space of a single machine heretofore available for performing either clothes washing or dishwashing operations, but not both operations. Further it permits having available for use in a household a single machine for efficiently carrying on both clothes laundering and dishwashing operation which otherwise would require employment, with a greater space requirement, of two separate ma-

chines of essentially different mechanical construction.

Not only have we provided for the conversion of clothes laundering machine into a dishwashing machine, and dishwashing mechanism designed to be supplied as an attachment or conversion unit to accomplish such purpose, but we have further provided a novel dishwashing machine of simple mechanical construction designed to thoroughly clean dishes, and other articles which may be cleaned through the same expedients as dishes, and providing benefits which distinguished the same as a distinct improvement over dishwashing machines of the prior art.

Although we have shown and described certain preferred embodiments of our invention, it will be manifest that the invention is capable of modification and equivalency without departing from the spirit and scope thereof. The scope of the invention, therefore, is to be determined according to the appended claims.

We claim:

1. In a combination clothes and dish washing machine comprising an upright oscillatable shaft, an upright rotatable shaft surrounding the oscillatable shaft, means on the rotatable shaft constituting a seat for supporting interchangeably an upwardly open clothes washing receptacle and an upwardly open dish washing receptacle, the upper end of said oscillatable shaft being formed to provide a seat and driving conections for both an agitator for cooperative use with the clothes washing receptacle and a member for cooperative use with the dish washing receptacle, means for selectively operating said shaft singly when the machine is to be used for washing clothes, and means for altering said selective means to effect simultaneous operation of said shafts when the machine is to be used for washing dishes.

2. In a convertible clothes machine having a drive shaft adapted to drive a clothes agitator, and a high speed rotary drive shaft adapted to drive a clothes extractor, dishwashing mechanism comprising a rotatable receptacle detachably driven by said extractor shaft and adapted when driven to retain liquid therein, a dish holder removably mounted in the machine independently of rotation of the extractor drive shaft, and means operated by the agitator drive shaft for distributing liquid from the receptacle to the dish holder.

3. A convertible clothes washing and dish washing machine comprising a shaft adapted to drive a clothes agitator and a high speed rotary shaft, and dish washing mechanism including a dish holder and cooperative relatively movable liquid supply members for distributing washing liquid to the dish holder and driven respectively by said agitator shaft and said high speed rotary shaft.

4. In a convertible clothes washing and extracting and dish washing machine having separate power driven means for operating a clothes washing element and clothes extractor element, a dish washing unit comprising a dish holding member and a water-diffusing mechanism including a water-holding part adaptable for driving connection with one of said power-driven means and a relatively movable water-dispensing part adapted for driving connections with the other power driven means.

5. A dish washing attachment for a combined clothes washing and extracting machine having an agitator shaft and an extractor shaft; comprising a dish washing liquid receptacle and liquid distributing means, and means for removably mounting said receptacle and liquid distributor in cooperative relation in a clothes washing and extracting machine, one on each of the machine agitator and extractor shafts with at least one of said mounting means adapted to make detachable driving connection with one of the shafts.

6. A dish washing attachment for a clothes washing machine of the type having concentric shafts; comprising a dish holder having means for removably mounting the same in a clothes washing machine, and dish washing liquid receptacle and distributor means for circulating washing liquid in the receptacle through the dish holder, and means for detachably mounting said receptacle and said liquid distributing means on the respective concentric shafts of a clothes washing machine.

7. A dish washing attachment for a clothes washing machine of the type having concentric shafts; comprising a dish holder, a dish washing liquid receptacle and liquid spray means for circulating liquid from the receptacle to the dish holder, means for removably mounting the spray means on one of the concentric shafts of a clothes washing machine, and means for detachably securing said receptacle to another of the concentric shafts of a clothes washing machine in operative relation to the spray means and dish holder.

8. Dish washing mechanism including a rotatable washing liquid receptacle, a separate dish holder supported above said receptacle, spray means mounted in the receptacle for conducting washing liquid from the receptacle to the dish holder, and means for mounting said spray means for rotative movement in a fixed path relative to the dish holder and the receptacle.

9. Dish washing mechanism including a rotatable liquid retaining receptacle, a separate dish holder supported above said receptacle, a plurality of liquid distributing elements mounted in the receptacle and adapted to distribute liquid from the receptacle to the dish holder and means mounting the liquid distributing elements in circumferentially spaced relation to one another for rotative movement in a fixed path relative to the dish holder and the receptacle.

10. Washing mechanism including a rotatable washing liquid receptacle having means to be rendered operative in response to rotation at relatively high speed to retain a predetermined quantity of washing liquid in the receptacle and discharge any excess liquid, and having openings in the bottom wall, adapted in response to cessation of relatively high rotative speed of the receptacle to drain the receptacle of the predetermined quantity of washing liquid, said openings being entirely remote from the axis of rotation of the receptacle and at the lowest portion of said bottom wall of the receptacle.

11. A dish washing machine comprising an article receiving rack, liquid receiving means supported below said rack and adapted when rotated at a speed sufficient to create an annulus of liquid, means comprising a member mounted in the liquid receiving means and adapted to be positioned in the path of travel of the liquid annulus for deflecting liquid from the annulus and producing and directing a liquid spray against and around the articles on the rack, means for rotating said liquid receiving means, and means for causing rotative movement of the member relatively to the liquid annulus while said member is

disposed in the path of travel of the liquid annulus.

12. A machine comprising an article receiving rack, an annular liquid receiving receptacle supported below said rack, means for rotating said receptacle at a speed sufficient to create a rotating annulus of liquid against the interior wall of the receptacle, an upwardly open liquid collector receptacle disposed below said liquid receiving receptacle and rack, and means mounted for rotative movement in said liquid receiving receptacle and positioned in the path of travel of the liquid annulus for projecting liquid from the annulus and producing and directing a liquid spray against and around the articles on the rack.

13. A dish washing machine comprising an article receiving rack, an upwardly open liquid receiving receptacle supported below said rack, means for rotating said receptacle at a speed sufficient to create a rotating annulus of liquid against the interior wall of the receptacle, means mounted for rotative movement in said liquid receiving receptacle and positioned in the path of travel of the liquid annulus for projecting liquid from the annulus and producing and directing a liquid spray against and around the articles on the rack, and means for causing rotative movement of said projecting means relatively to the liquid annulus while disposed in said liquid annulus.

14. A machine comprising an article receiving rack, an upwardly open liquid receiving receptacle mounted below said rack, means for rotating said receptacle at a speed sufficient to create a rotating annulus of liquid against the interior wall of the receptacle, and means positioned in the path of travel of the liquid annulus for projecting liquid from the annulus and producing and directing a liquid spray against and around the articles on the rack, the bottom wall of said receptacle having one or more openings located so that the liquid when flowing in an outwardly direction under influence of centrifugal force created incident to rotation of the receptacle by-passes said openings, and adapted for discharging the liquid therethrough from the receptacle as the centrifugal force is reduced incident to retardation of the receptacle.

15. A machine for washing articles, comprising an article receiving rack, an upwardly open liquid receiving receptacle, mounted below said rack, means for rotating said receptacle at a speed sufficient to create a rotating annulus of liquid against the interior wall of the receptacle, and means positioned in the path of travel of the liquid annulus for projecting liquid from the annulus and producing and directing a liquid spray against and around the articles on the rack, the bottom wall of said receptacle having one or more openings located so that the liquid when flowing in an outwardly direction under influence of centrifugal force created incident to rotation of the receptacle by-passes said openings, and adapted for discharging the liquid therethrough from the receptacle as the centrifugal force is reduced incident to retardation of the receptacle, said openings being located relatively to the side wall of the receptacle so as to create and maintain a predetermined quantity of liquid in the liquid annulus.

16. A machine for washing articles, comprising an upright oscillatable shaft, an upright rotatable shaft surrounding the oscillatable shaft, an article receiving rack surrounding the upper ends of said shafts, an upwardly open liquid receiving receptacle mounted on and rotatable with said rotatable shaft, means for oscillating said oscillatable shaft, means for driving said rotatable shaft for effecting rotation of the receptacle at a speed sufficient to create and maintain a rotating annulus of liquid against the interior wall of the receptacle, and means connected to and oscillated with said oscillatable shaft, said means comprising a member positioned in the path of travel of the liquid annulus for projecting liquid from the annulus and producing and directing a liquid spray against and around the articles on the rack.

17. A machine for washing articles, comprising an upright oscillatable shaft, an upright rotatable shaft surrounding the oscillatable shaft, an article receiving rack surrounding the upper ends of said shafts, an upwardly open liquid receiving receptacle mounted on and rotatable with said rotatable shaft, said receptacle being of circular contour, means for oscillating said oscillatable shaft, means for driving said rotatable shaft for effecting rotation of the receptacle at a speed sufficient to create a rotating annulus of liquid against the interior wall of the receptacle, and means connected to and oscillated with said oscillatable shaft, said means comprising a member positioned in the path of travel of the liquid annulus for projecting liquid from the annulus for producing and directing a liquid spray against and around the articles on the rack, the bottom wall of said receptacle having one or more shielded openings for by-passing the liquid when flowing in an outwardly direction under influence of centrifugal force created incident to rotation of the receptacle, and adapted for discharging the liquid therethrough from the receptacle as the centrifugal force is reduced incident to retardation of the receptacle.

18. A machine comprising an upright oscillatable shaft, an upright rotatable shaft surrounding the oscillatable shaft, an article receiving rack surrounding the upper ends of said shafts, an upwardly open liquid receiving receptacle mounted on and rotatable with said rotatable shaft, means for oscillating said oscillatable shaft, means for driving said rotatable shaft for effecting rotation of the receptacle at a speed sufficient to create a rotating annulus of liquid against the interior wall of the receptacle, an upwardly open liquid collector tub disposed below said rack and receptacle, and means connected to and oscillated with said oscillatable shaft, said means comprising a member positioned in the path of travel of the liquid annulus for projecting liquid from the annulus and producing and directing a liquid spray against and around the articles on the rack.

19. A machine for washing articles, comprising an upright oscillatable shaft, an upright rotatable shaft surrounding the oscillatable shaft, an article receiving rack surrounding the upper ends of said shafts, an upwardly open liquid receiving receptacle mounted on and rotatable with said rotatable shaft, means for oscillating said oscillatable shaft, means for driving said rotatable shaft for effecting rotation of the receptacle at a speed sufficient to create a rotating annulus of liquid against the interior wall of the receptacle, the upper end of said receptacle terminating in an inturned marginal flange to create and maintain a predetermined quantity of liquid in the liquid annulus, and means connected to and oscillated with said oscillatable shaft and positioned in the path of travel of the

liquid annulus for projecting liquid from the annulus and producing and directing a liquid spray against and around the articles on the rack.

20. A machine for washing articles, comprising an upright oscillatable shaft, an upright rotatable shaft surrounding the oscillatable shaft, an article receiving rack surrounding the upper ends of said shafts, an upwardly open liquid receiving receptacle mounted on and rotatable with said rotatable shaft, means for oscillating said oscillatable shaft, means for driving said rotatable shaft for effecting rotation of the receptacle at a speed sufficient to create a rotating annulus of liquid against the interior wall of the receptacle, the bottom wall of said receptacle having one or more openings located so that the liquid when flowing in an outwardly direction under influence of centrifugal force created incident to rotation of the receptacle by-passes said openings, and adapted for discharging the liquid therethrough from said receptacle as the centrifugal force is reduced incident to retardation of the receptacle, said openings being located relatively to the side wall of the receptacle to create and maintain a predetermined quantity of liquid in the liquid annulus, and means connected to and oscillated with said oscillatable shaft and positioned in the path of travel of the liquid annulus for projecting liquid from the annulus and producing and directing a liquid spray against and around the articles on the rack.

21. A machine for washing articles, comprising an upright oscillatable shaft, an upright rotatable shaft surrounding the oscillatable shaft, an article receiving rack surrounding the upper ends of said shafts, an upwardly open liquid receiving receptacle mounted on and rotatable with said rotatable shaft, means for simultaneously oscillating the oscillatable shaft and driving the rotatable shaft, said latter shaft serving to rotate the receptacle at a speed sufficient to create a rotating annulus of liquid against the interior wall of the receptacle, and means connected to and oscillated with said oscillatable shaft and positioned in the path of travel of the liquid annulus for projecting liquid from the annulus and producing and directing a liquid spray against and around the articles on the rack.

22. A dish washing machine comprising driving mechanism, an electric motor for actuating said mechanism, upright shaft means operably connected to and driven by said mechanism, an upwardly open liquid-receiving receptacle removably mounted on and adapted to be rotated by said shaft means to build up an annulus of liquid, an article receiving rack removably mounted around said shaft means, an upwardly open liquid collector receptacle disposed below said liquid-receiving receptacle and adapted to receive liquid therefrom, said liquid collector receptacle having a drain outlet adapted to be connected to a discharge conduit, and means driven by said shaft means and extending into said annulus of liquid, for producing and directing a liquid spray against and around the articles on the rack.

23. A machine comprising an upwardly open liquid receiving receptacle, and means for rotating said receptacle at a speed sufficient to create a rotating annulus of liquid against the interior wall of the receptacle, the bottom wall of said receptacle having one or more openings located so that the liquid when flowing in an outwardly direction under influence of centrifugal force created incident to rotation of the receptacle by-passes said openings, and adapted for discharging the liquid therethrough from the receptacle as the centrifugal force is reduced incident to retardation of the receptacle.

24. A machine comprising an upwardly open liquid receiving receptacle, means for rotating said receptacle at a speed sufficient to create a rotating annulus of liquid against the interior wall of the receptacle, the bottom wall of said receptacle having one or more openings located so that the liquid when flowing in an outwardly direction under influence of centrifugal force created incident to rotation of the receptacle by-passes said openings, and adapted for discharging the liquid therethrough from the receptacle as the centrifugal force is reduced incident to retardation of the receptacle, and a liquid collecting receptacle disposed below said liquid receiving receptacle and having a continuously open outlet adapted to be connected to a drain, whereby liquid discharging from the liquid receiving receptacle into the liquid collecting receptacle is instantly discharged through the drain outlet.

25. A machine for washing articles in liquid, adapted when washing operation has been completed to allow the articles to be substantially free of the washing liquid, comprising a pair of concentric shafts driven independently of each other, means mounted on one of said shafts for directing circulation of washing liquid over and about the articles to be washed, and means operable by the other of said shafts adapted to substantially free the washing liquid by the force of gravity from the articles being washed when said other shaft becomes inoperative, and adapted to produce a substantially vertical wall of washing liquid surrounding the articles being washed when said other shaft means is operating.

26. A machine for washing articles in liquid and when the washing operation has been completed to allow the articles to be substantially free of the washing liquid, comprising a splash preventing outer casing, a pair of concentric shafts driven independently of each other, means mounted on one of said shafts for directing circulation of washing liquid over and about the articles to be washed, and means driven by the other of said shafts adapted to substantially free the washing liquid by the force of gravity from the articles being washed when said other shaft becomes inoperative, and adapted to produce a substantially vertical wall of washing liquid surrounding the articles being washed when said other shaft means is operating.

27. A washing machine comprising a relatively shallow, rotatably mounted washing liquid receptacle, a perforate article holding rack means stationarily supported above said receptacle, means for spraying washing liquid from the receptacle into the rack means, and means for collecting and redirecting washing liquid into said receptacle, comprising a stationary splash shield separate from the receptacle and surrounding said article holding rack means.

28. In combination in a clothes washing machine having power means adapted to drive clothes agitating means, an oscillatable shaft driven by said power means and a high speed rotary shaft operable by said power means, dish washing mechanism including receptacle means constituting a reservoir for dish washing liquid and nozzle means connected to and driven by the oscillatable shaft extending into the liquid in the receptacle means for diffusing liquid from the reservoir in forced streams, said nozzle means and receptacle being mounted for relative rota-

tion and said receptacle means being operatively connected to said high speed rotary shaft for high speed rotation to effect delivery of streams of liquid by the nozzle means, and a dish holder having a perforate wall portion through which streams of liquid are projected against dishes in the holder.

ANDREW H. GERHARDT.
ARTHUR P. SCHULZ.

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