May 3, 1966 I. M. POPE 3,248,908

WASHING MACHINE

Filed May 14, 1963 4 Sheets-Sheet 1

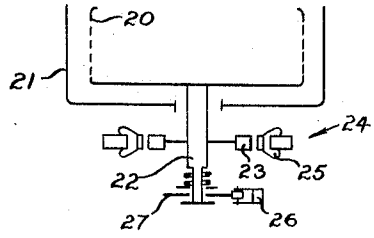

FIG 1

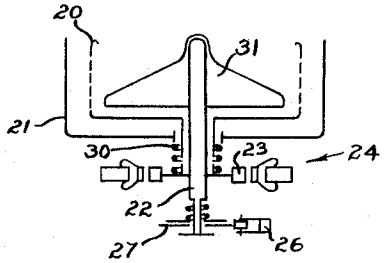

FIG 2

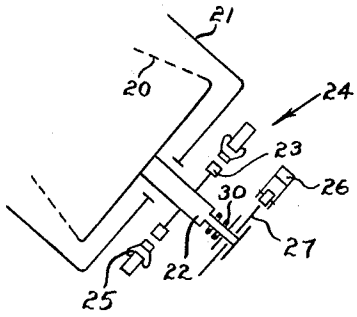

FIG 3

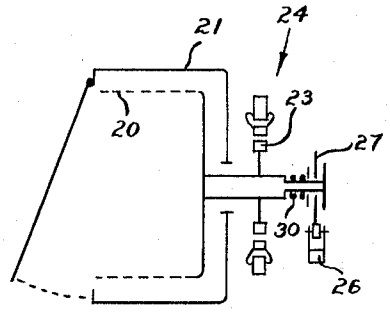

FIG 4

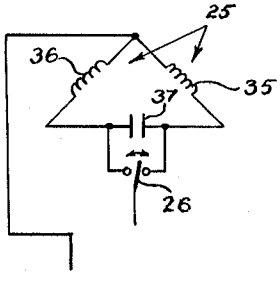

FIG 5

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WASHING MACHINE

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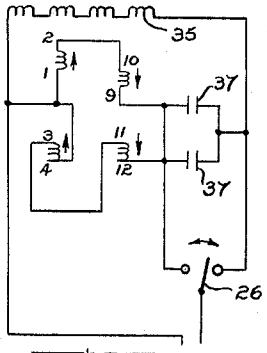

FIG 6

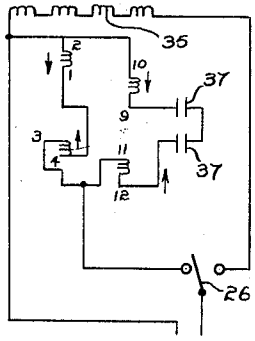

FIG 7

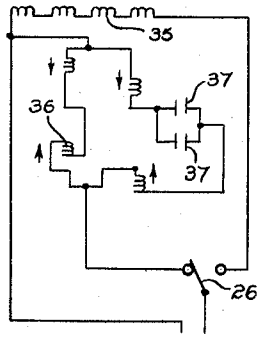

FIG 8

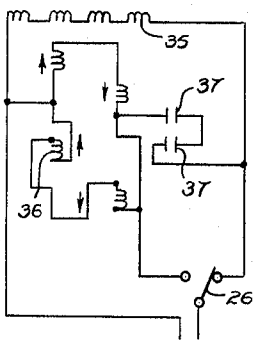

FIG 9

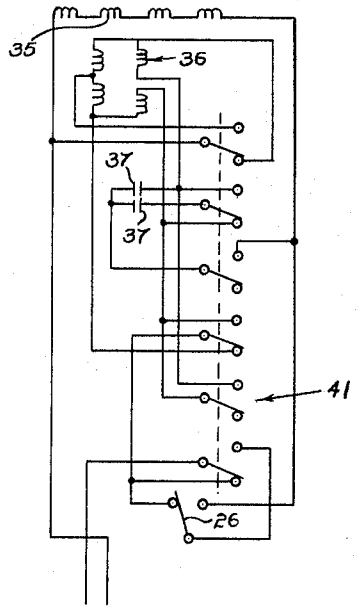

FIG 11

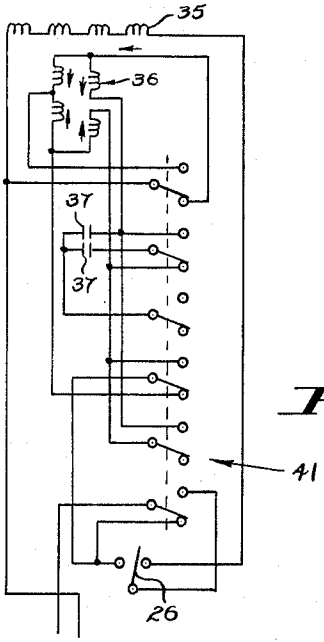

FIG 10

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WASHING MACHINE

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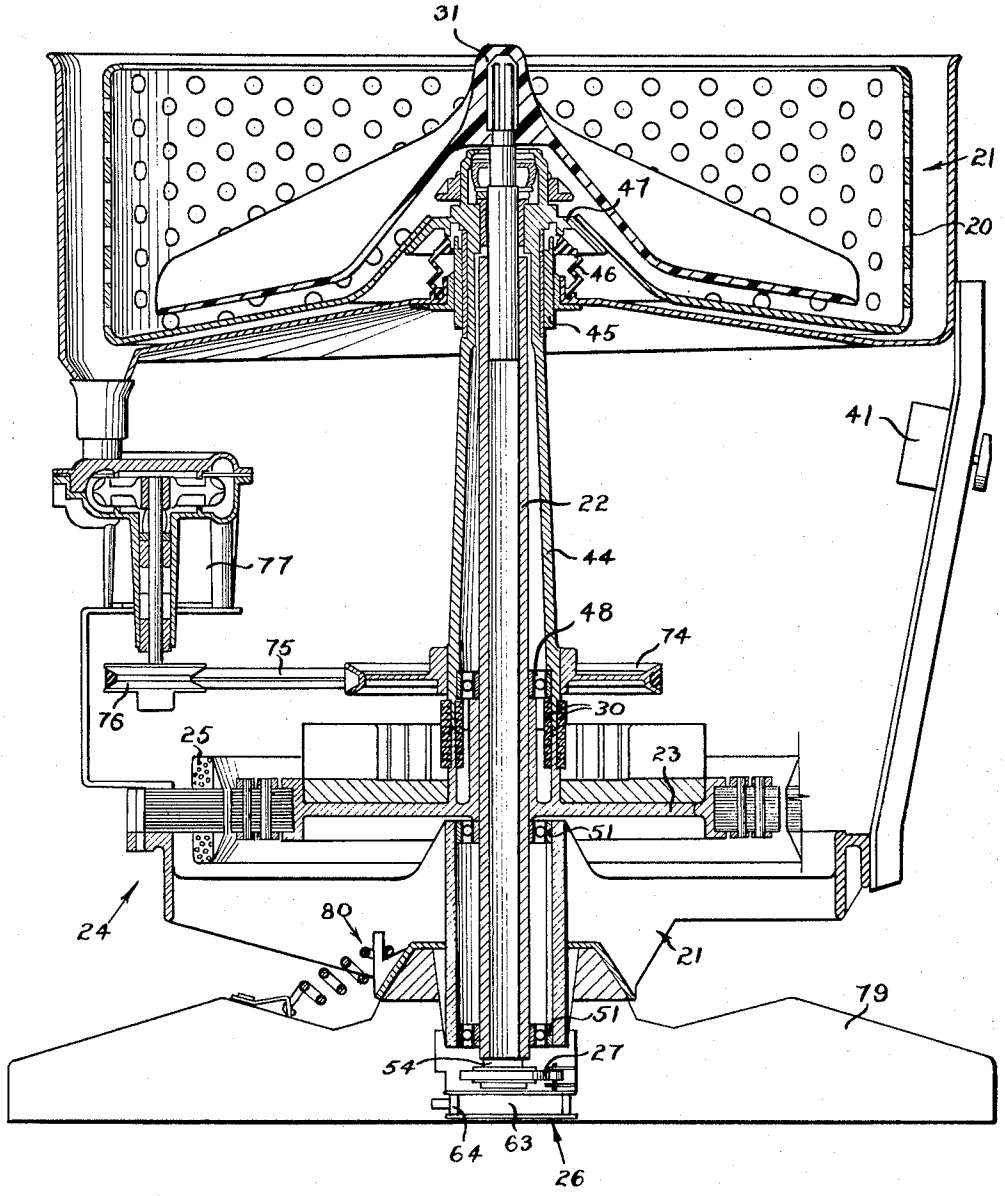

FIG 12

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WASHING MACHINE

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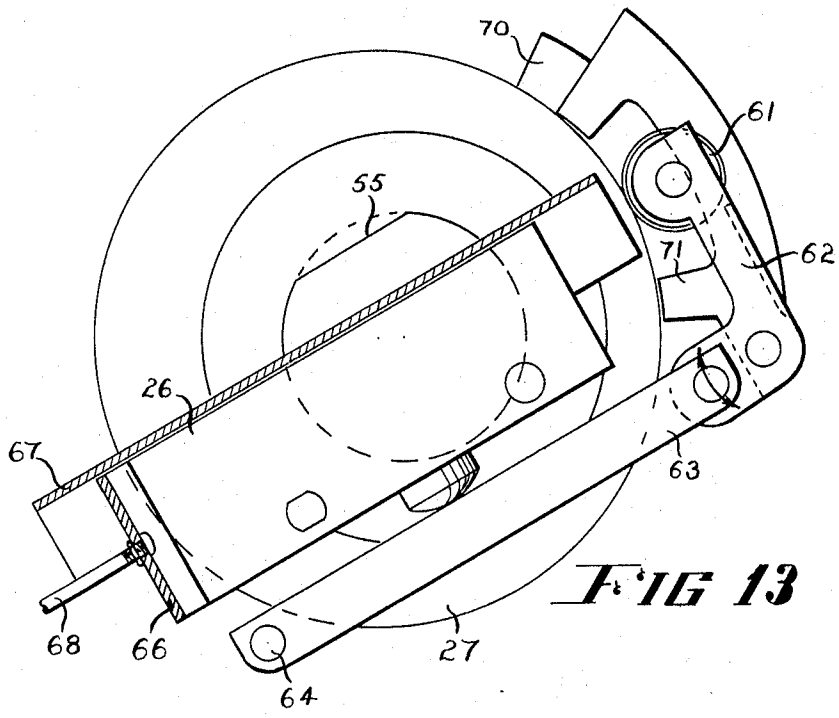

FIG 13

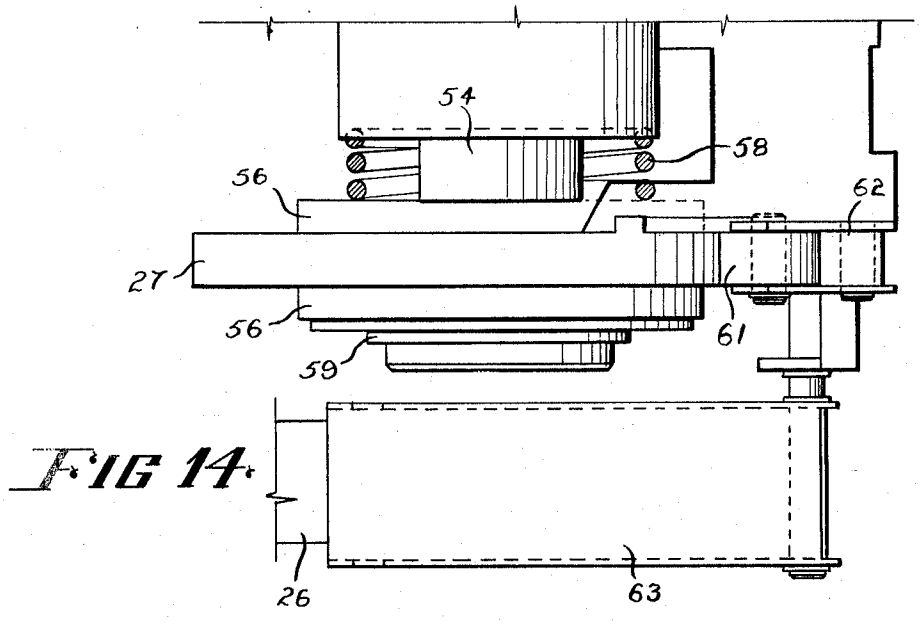

FIG 14

United States Patent Office

3,248,908
Patented May 3, 1966

3,248,908

WASHING MACHINE

Ian M. Pope, Wattle Park, South Australia, Australia, assignor to Sidney B. Pope, South Australia, Australia

Filed May 14, 1963, Ser. No. 280,311
Claims priority, application Australia, May 18, 1962, 17,855/62
8 Claims. (Cl. 68—12)

This invention relates to a laundering machine of the kind which employs an agitating motion for its washing cycle and a continuous rotary motion for its drying cycle, and includes a clothes containing bowl journalled to a frame and driven by an electric motor. Thus the invention may be applied, for example, to a clothes washing or drying machine or a dry cleaning machine.

Washers of the above general type are in common use, and can be sub-divided conveniently into washing machines of the first type wherein the clothes containing bowl is mounted and journalled within an outer container, the configuration of the clothes containing bowl being such that upon oscillation the clothes and water within the bowl are agitated to effect a washing cycle, but upon spinning the clothes are damp dried. The second type is somewhat similar to the first but includes in addition a separate agitator within the clothes containing bowl, the agitator oscillating for the washing cycle and the bowl spinning for the damp dry cycle. The third general type is the washing machine of the inclined drum type, and this is continuously driven at low speed to "tumble" wash and at high speed to spin dry. The fourth general type is somewhat similar to the third general type except that the clothes containing bowl is rotatable about a horizontal axis, and again rotates continuously at low speed to "tumble" the clothes for washing and at high speed to damp dry the clothes by spinning the water outwardly therefrom under centrifugal force. Besides these are the impeller machines. It is known that machines of the fourth general type have been constructed wherein the clothes containing bowl rotates a certain number of revolutions or part of revolution in one direction and then a certain number of revolutions or part of revolution in a reverse direction so as to prevent the tendency for the clothes to tangle, but the change of direction is usually effected either by mechanical means, for example by the introduction of a reverse drive, or alternatively by utilizing a standard motor driving through a reduction unit which is switched off at the end of a period of rotation in one direction, and then switched on in reverse at the commencement of a period of rotation in a reverse direction. In both cases reduction units have been used to reduce the motor speed to a speed suitable for tumbling the clothes for washing, and in both cases the devices required to effect the reversal are complicated, either mechanically or electrically or both.

The main object of this invention is to provide a simplified drive which can be used for the laundering of clothes, wherein the usual oscillating mechanism and speed reduction gearbox or other mechanism can be dispensed with, and replaced with a simpler drive which is less likely to require maintenance.

A series of tests have now established that the stroke angle for a washing machine is of considerable importance, and in given machine the stroke angle should be varied to suit different washing requirements. Thus a heavy wash requires a greater stroke angle than a light wash. A further object of this invention is to provide a drive wherein the change of oscillator stroke can be effected by simple means.

It has previously been thought necessary to utilize one type of drive for the vertical agitator type of washer and a second type of drive for the inclined or horizontal bowl

type of washer, and a still further object of this invention is to provide a simplified drive which can be used for different types of clothes washing machines.

In its simplest form this invention may be said to consist of, in a clothes laundering machine of the kind defined, a motor which includes its rotor in concentric with and coupled to a clothes washing bowl, reversing means electrically connected to the windings of the motor stator, reversing cancelling means operatively connected to the reversing means, and a hand control on the frame of the washing machine operatively connected to the canceling means.

By arranging the rotor concentric with and coupled to the clothes containing bowl, it will be seen that the need for speed reduction units can be eliminated. The coupling can be either direct, as in the case of an oscillating bowl, or may be through a clutching arrangement, as in the case of a separate agitator within the bowl, wherein it is desired to oscillate the agitator but not the bowl, but spin the bowl for the damp drying cycle.

By having the reversing switch mechanically operated by the rotor and electrically connected to the stator windings, it will be seen that any one of a number of means can be simply applied to vary the stroke angle of the rotor when the reversing switch functions to drive the rotor with an oscillatory motion. Thus the reversing switch can be of the type which is cam operated through a bell crank or by means of a push rod, can be directly cam operated, can be of the limit bumper type, can be of the thread type wherein a block moves axially upon oscillation of the motor, a "wind up" cable can be used in lieu of the cam, or use may be made of sliding cam operated means, mercury switches, brushes, contacts and relays, or electronic switches, these being merely examples of the many types which can be used in this invention, and the use of which will be immediately apparent to those skilled in the art.

When a reversing switch is used to give the required oscillatory motion to the motor rotor, it immediately becomes apparent that any cancelling means operatively connected to the reversing switch will be effective in allowing continued rotation in one direction. Thus for example if the reversing switch is held in one position by an arm, quite clearly the rotor will continue to move in the direction which is determined by the position in which the reversing switch is held, and will not reverse since the reversing switch is thereby rendered inoperative. The reversing switch cancelling means can also be the electrical type, wherein the circuit of which the reversing switch forms part may be either opened or closed to effect continued rotation of the rotor in a desired direction. In this invention, the control for cancelling the effect of the reversing switch is a control on the frame of the machine, which in the case of an automatic machine is of course an automatic control, controlled by a timer or a counter operated by the rotor, or in the case of a manual machine the control is of course a hand control which is simply operated at the end of the washing cycle to commence the spinning cycle. It will of course be seen that the invention can be used as part of a more complex washing, rinsing and spinning cycle if this is desired by having the control for cancelling the reversing switch itself operated for periods determined by the sequence of cycles of the machine, for example by a timer mechanism.

It will be appreciated by those skilled in the art that the torque required from the rotor will be high upon oscillation but only a low torque is required for spinning the clothes containing bowl, and of course the simplest reversible electric motor consists of a single phase squirrel cage induction motor with a permanent split capacitor

in one branch of two windings where the capacitor stays in the cricuit during running condition. Thus in this invention there is no need for any centrifugal device to disconnect the starting winding. By utilizing a motor of this type, the reversal of the motor during oscillation is most conveniently effected, in that it is merely necessary to change the capacitor from one set of windings to the other, whereupon the phase angle between the windings reverses and reverse direction is achieved. The use of a capacitor also simplifies control of torque, in that the capacitor can be of large capacity for oscillation, and this in turn reduces the torque on spinning, so that the desirable low acceleration of the clothes containing bowl can be effected without resorting to mechanical drive means.

When the rotor is oscillating, quite clearly the frequency through the rotor is much higher than when it is spinning, and torque compensation can be readily achieved by use of a double squirrel cage arrangement, the high resistance squirrel cage being closer to the periphery of the rotor than the lower resistance squirrel cage, so as to ensure sufficient torque to bring the rotor up to speed in the spinning cycle. It is found in practice that control of capacity and control of the squirrel cage characteristics provides a means whereby any one of a large number of torque speed curves can be obtained, and this provides a designer with means whereby the most desirable combination is readily achieved.

In order to get the best torque conditions for oscillation it is desirable to use a full pitched winding with a high number of poles, and to leave it as a short pitched winding for a lower number of poles for high speed spinning. It is found, for example, that a combination of sixteen-eight or twenty-four-eight poles are suitable for ordinary conditions of oscillation and spinning, and this can conveniently be achieved by a double wound motor or a tap wound motor, using parallel poles for the high flux high number of poles condition at agitation, and a part winding series connection (which reverses half the number of poles for eight pole condition) for spinning. This is satisfactory since spinning is usually a very light load.

In order to avoid any electrical locking when the motor is oscillating, it is essential that the rotor and stator core be spiralled, and a correct slot combination for the stator to rotor must be chosen for the particular number of poles selected. For example a slot combination sixty-four-eighty-eight is suitable for an eight-sixteen pole motor.

Since the heaviest load is applied to the motor during agitation when the rotor is oscillating, cooling becomes of considerable importance, and should be either of the large fin type for large diameter rotors, or of a separate rotor journalled on to the main rotor shaft and self-containing a squirrel cage and a fan and operated by the main motor windings, which can be biased if necessary either mechanically or electrically to give the small amount of power required to drive the separate fan. Alternatively, an umbrella type fan extending over the entire motor and arranged to stir the air around it, and at the same time protect it from any leaking water, may be used.

When a separate agitator is used, it becomes desirable to insert a clutch between the agitator shaft and the clothes containing bowl so that the clothes containing bowl does not itself agitate during the agitation cycle. It has been found that any one of a number of types of clutches can be used, for example the belt winding type of clutch, the bumper dog type, the thread operated disc-faced type, the fluid type, the band or cone type, or the spring type, the latter being preferred because of its simplicity.

It will be clear from the above that this invention can be applied in any one of a large number of ways, but in order for it to be more clearly understood it is described in some detail with reference to and is illustrated in the accompanying drawings, in which:

FIG. 1 shows diagrammatically a vertical oscillating bowl type of washing machine,

FIG. 2 shows diagrammatically a vertical agitator type of washing machine,

FIG. 3 shows diagrammatically an inclined tumble and spin dry type of washing machine,

FIG. 4 shows diagrammatically a horizontal tumble and spin dry type of washing machine,

FIG. 5 shows diagrammatically the electrical representation of the motor and reversing switch in its simplest form,

FIG. 6 shows the electrical circuit of the washing machine according to this embodiment during its agitaion cycle,

FIG. 7 shows the circuit arrangement of a washing machine according to this embodiment when it is in its spin cycle,

FIG. 8 shows an alternative spin circuit to the circuit shown in FIG. 7,

FIG. 9 shows a further alternative for low speed spinning indicating a means whereby spinning can be effected in either direction,

FIG. 10 shows the circuit arrangement of FIG. 6 but includes the switching mechanism which constitutes reversing switch cancelling means in the position where the washing machine will agitate,

FIG. 11 shows the circuit of FIG. 7 including the switch which constitutes the cancelling means in the position where the washing machine will spin dry,

FIG. 12 is a cross-section through the washing machine of this embodiment,

FIG. 13 is an underside view of the reversing switch and the operating mechanism therefor, and

FIG. 14 is a partly sectioned side elevation of FIG. 13.

FIGS. 13 and 14 are drawn to a larger scale than FIG. 12.

FIG. 1 shows the simplest arrangement wherein an oscillating bowl **20** is journalled to an outer frame **21**, the oscillating bowl **20** being on one end of a stem **22** to which is secured a rotor **23** of a motor **24**. The windings **25** of the motor **24** are under control of a reversing switch **26** which is mechanically operated by a cam **27**. When the washing machine is to pass through its oscillating cycle, the motor **24** is operated as an oscillatory motor and the reversing switch **26** reverses the phase angle of windings **25** near the end of each stroke in each direction, while when the spin drying is to be effected, this is achieved by cancelling the effect of the reversing switch **26** and spinning the bowl **20**.

FIG. 2 shows a preferred arrangement which is substantially similar to FIG. 1, except that the oscillating bowl **20** is coupled to the rotor **23** through a spring type clutch **30**, and an agitator **31** is direct coupled to the rotor **23**.

FIG. 3 is substantially similar to FIG. **1**, except that the outer frame **21** and the oscillating bowl **20** journalled within it are disposed at an angle to the vertical.

FIG. 4 is again similar to FIG. 1, except that in this case the frame **21** and the oscillating bowl **20** within it are disposed about a horizontal axis. Both embodiments of FIG. 3 and FIG. 4 are of course of the "tumble type" wash cycle, but bear the distinct advantage over previously proposed tumble type washers in that the oscillating bowl **20** oscillates for less than three hundred and sixty degrees, so that tangling of the clothes is substantially eliminated.

FIG. 5 shows in its simplest form the electrical circuit, wherein the windings **25** of the motor **24** constitute a branch **35** and a branch **36** disposed at ninety electrical degrees thereto, and are interconnected with a capacitor **37**. The capacitor **37** is shifted from circuit with each of the branches **35** and **36** consecutively by the reversing switch **26** which is a make-before-break type. When however the reversing switch **26** is retained

in one of its two positions, or has the effect of being retained in one of its two positions electrically, quite clearly the motor **24** will continue to run in the one direction, that is, it will continue to spin the bowl to which it is coupled.

FIG. 6 illustrates in more detail the arrangement of FIG. 5, showing the circuit condition during agitation, and from FIG. 6 it will be seen that the branch **35** is coupled with the branch **36** so as to form a sixteen pole motor, if each coil shown in the drawings is to be considered as representing four poles. The arrows alongside the coils of branch **36** indicate an instantaneous flux direction through these coils.

The operation of motor reversal in FIG. 6 can be readily seen by reference to FIG. 5 (which is operatively identical to FIG. 6). With the switch **26** in the right-hand position (both FIG. 5 and FIG. 6), the branch **35** is directly connected across the line and the branch **36** is connected across the line through the phase angle shifting capacitors **37**. The reverse occurs when the switch **26** changes position (before the end of an oscillation), and the motor is thereby reversed.

FIG. 7 shows the arrangement when the reversing switch **26** is cancelled so as to remain in the position shown, and the circuit is changed to give eight poles for the purpose of continual running. This is achieved by utilizing a full pitched winding for the highest number of poles and arranging it to be a short pitched winding for the lower number of poles for the high speed spinning. It will be noted that in FIG. 6 the capacitors **37** are in parallel, while in FIG. 7 the capacitors **37** are in series, and this gives an increased torque for spinning, although of course the feature is not essential since the spinning torque can be controlled to some extent by the rotor construction.

FIG. 8 is similar to FIG. 7 but shows the capacitors in parallel instead of in series.

FIG. 9 is also similar to FIG. 7, but shows a high number of poles and the capacitors in series. FIGS. 8 and 9 do not form part of this embodiment but clearly indicate the type of variations which can be introduced at the discretion of the designer when making use of this invention.

In order to simply effect the changeover from agitating to spinning, it is necessary either to hold the reversing switch mechanically in one position, or alternatively to change the electrical circuit so as to thereby cancel the reversing switch **26**. It is preferred to change the electrical circuit, because at the same time the number of poles in the motor which are effective for spinning can be halved, thereby giving a higher spinning speed than the maximum speed which is obtainable upon oscillation of the motor, and accordingly the cancelling switch **41**, which is shown in FIGS. 10 and 11, is used for the purpose of cancelling the reversing switch **26** (shown cancelled in FIG. 11) and at the same time for decreasing the number of poles, in this embodiment, halving them. FIG. 10 shows an arrangement which is utilized to give the circuit of FIG. 6, and FIG. 11 an arrangement which is utilized to give the electrical circuit of FIG. 7. In each case the cancelling switch **41** is a two-way five bank switch which is, in this embodiment, hand operated. In the case of a fully automatic machine it is desirable that the cancelling switch **41** be a relay which is controlled by a timer.

If the switch **26** is to the right (FIG. 6) directly energizing branch **35** when the cancelling switch **41** changes over from its FIG. 10 to its FIG. 11 position, then oscillation will continue in the normal way under the energizing of coil **35** until the switch **26** is reversed to occupy the position shown in FIG. 7. The branch **35** is then disconnected from circuit, and the motor commences and continues spinning entirely under the control of branch **36**, which is divided into two portions one of which includes capacitors **37** to provide the required phase difference to commence the motor spinning. The FIG. 8 circuit functions similarly, but if the contacts of switch **41** are connected to give a FIG. 9 circuit or its equivalent, then branch **35** is made use of and its phase is shifted from branch **36** as for oscillation. Other alternative circuits will be clear to those skilled in the art. In all cases it will be seen that reversal of spin direction, if desired with a difference in pole numbers (and corresponding speed variation) can be achieved by simple switching means similar to that shown in FIGS. 10 and 11.

A study of FIGS. 6 to 11 will indicate that during spin the switch **26** is preset in a reverse direction circuit condition, so the re-energizing through switch **26** upon change of switch **41** from FIG. 11 condition to FIG. 10 condition will then first brake and then commence rotation in a reverse direction. Further it will be seen that upon de-energizing the electrical circuit is in a "brake" condition, even without re-energizing.

Referring now to the mechanical arrangement which is illustrated in FIGS. 12, 13 and 14, the bowl **20** is on a tubular spindle **44** which is journalled in bearings **45** to the outer frame **21**. A seal **46** is disposed between the inner boss **47** of the bowl **20** and the outer frame **21**, in accordance with usual practice. The lower end of the spindle **44** is journalled through a ball race **48** to the stem **22** which carries the agitator **31**, and is coupled to the rotor **23** of the motor **24** by means of an inner and outer helical spring type clutch **30**, both elements of which are secured to the rotor **23** and frictionally engage the lower end of the tubular spindle **44** when the rotor **23** rotates in either one direction more than, say, two revolutions. Each spring of this spring type clutch **30** functions in the normal way with its "free" end free to rotate relative to the end secured to the rotor **23**. This enables the rotor to oscillate without imparting any appreciable rotation to the bowl.

The stem **22** which carries the agitator **31** extends down to be journalled at its lower end in a pair of spaced bearings **51** in the outer frame **21**, the stem **22** being journalled at its upper end in the top end of the tubular spindle **44**. The stem **22** is secured to the rotor **23** of the motor **24**, the lower end of the stem **22** being journalled in a pair of spaced bearings **51** which are carried in the outer frame **21**.

The lower end of the stem **22** has a reduced diameter portion **54** (see FIG. 14) the reduced diameter portion **54** being of generally circular shape but having a flat **55** on one side. A pair of spaced washers **56** are urged together on each side of the cam **27** by a compression spring **58**. A circular spring clip **59** retains the space washers **56**, the cam **27** and the spring **58** on the reduced diameter portion **54**. The washers **56** are each of complementary shape to the reduced diameter portion **54**, slidably but non-rotationally engaging the portion **54** by engagement on the flat **55**, while the central aperture in the cam **27** is circular, so that the assembly forms a very light slipping clutch. The peripheral edge of the cam **27** engages a roller **61** on one end of a bell crank **62**, the other end of the bell crank **62** engaging one end of a switch operating bar **63** which is pivoted at its other end on a pin **64** on the outer frame **21**. The reversing switch **26** is carried on a sliding frame **66** in a guide **67**, and can be moved along the guide **67** by means of a control rod **68**. The switch **26** is of the type which has "over travel" so that by simply moving the sliding frame **66** along the guide **67** the switch **26** can be made to function to reverse the direction of the motor **24** for different angles of oscillation of the cam **27**. When the rotor **23** is on "spin," a stop lug **70** on the cam **27** engages a complementary stop lug **71** which is fixed relative to the frame **21**, so that the cam **27** is retained stationary, maintaining the switch **26** in a position determined by the direction of spin, and is frictionally engaged by the two washers **56**, but since the spring pressure of the spring **58** is only small, it will be

seen that the amount of heat generated is also small, the device simply functioning as a slipping clutch.

The lower end of the tubular spindle **44** has secured to it a "V" belt pulley **74** which is connected for drive by a "V" belt **75** to a driven pulley **76** on a pump **77**. The pump **77** is arranged so that when spinning at centrifuging speed in one direction it pumps out water discharged from the outer frame **21** surrounding bowl **20** into a suds saving reservoir (not shown). If switching is provided to effect reversal of direction of spin at reduced speed, the water can be pumped back into the bowl **20** and the outer frame **21**.

While it is not essential that the outer frame **21** be movable in relation to a base frame **79**, in this embodiment some movement is allowed with a usual type of snubbing arrangement **80**. This assists in the absorbing of vibration caused by out-of-balance loads during the spinning cycle of the bowl **20**.

The above embodiment relates to a simple device wherein the oscillatory motion is obtained by switch means. This motion can, if desired, alternatively be obtained by an electrical pendulum, thereby eliminating the mechanical switching entirely and instead obtaining alternating oscillating leading or lagging currents in the two winding branches by, for instance, using in front of or parallel to the windings one or several capacitors and saturated reactors connected in parallel or series, the currents of which are controlled by the currents or voltages of the two windings, which again are controlled by the speed of the rotor, that is, the slip frequency.

In the instance of using the electrical pendulum, the reverse cancelling means can conveniently consist of a switch across a capacitor or across a reactor.

What I claim is:

1. A clothes laundering machine of the kind employing an agitating motion for a laundering cycle and a spinning motion for a drying cycle, comprising a frame, a clothes containing bowl journalled to the frame, an electric motor constituted by a rotor and a wound stator on the frame, said rotor being concentric with said clothes containing bowl, a friction clutch having one portion on said rotor and another portion operatively coupled to a spindle on said clothes containing bowl, a reversing switch on the frame, mechanical operating means on the rotor operatively coupled to the reversing switch, an electrical connection between the reversing switch and the windings of said stator, and reversing switch cancelling means operatively connected to said reversing switch.

2. A clothes laundering machine of the kind employing an agitating motion for a laundering cycle and a spinning motion for a drying cycle, comprising a frame, a clothes containing bowl journalled to the frame, an electric motor consituted by a rotor and a wound stator on the frame, said rotor being concentric with said clothes containing bowl, a tubular spindle concentric with and supporting said clothes containing bowl journalled in bearings and in said frame, a stem concentric with and journalled in bearings within said tubular spindle, an agitator on the stem disposed within said clothes contaning bowl, said rotor firmly engaging on said agitator stem, a clutch consisting of a pair of concentric springs each anchored to said rotor, one of said springs frictionally engaging the outer surface of said tubular spindle, and the other frictionally engaging the inner surface of said tubular spindle, reversing switch means electrically connected with the windings of said stator, and reversing switch cancelling means operatively connected to said reversing switch means.

3. A clothes laundering machine of the kind employing an agitating motion for a laundering cycle and a spinning motion for a drying cycle, comprising a frame, an electric motor constituted by a rotor and a wound stator on the frame, said rotor being concentric with said clothes containing bowl and coupled thereto by a clutch for a drive in a 1:1 speed ratio, a reversing switch on the frame electrically connected to the windings of said stator, a cam rotatable on the shaft of said rotor but lightly restrained against rotation on said shaft by a spring loaded friction clutch, said cam being operatively connected to said reversing switch, and reversing switch cancelling means operatively connected to said reversing switch.

4. A clothes laundering machine of the kind employing an agitating motion for a laundering cycle and a spinning motion for a drying cycle, comprising a frame, a clothes containing bowl journalled to the frame, an electric motor constituted by a rotor and a wound stator on the frame, said rotor being concentric with said clothes containing bowl and coupled therto by a clutch, a reversing switch on the frame electrically connected to the windings of said stator, a cam rotatable on the shaft of said rotor, a friction clutch consisting of a pair of spaced washers slidably but non-rotatably retained on said rotor shaft by a spring clip, and engagaing one on each side of said cam under spring pressure exerted by a spring disposed around said rotor shaft, thereby lightly restraining said cam against rotation on said rotor shaft, and reversing switch cancelling means operatively connected to said reversing switch.

5. A clothes laundering machine of the kind employing an agitating motion for a laundering cycle and a spinning motion for a drying cycle, comprising a frame, a clothes containing bowl journalled to the frame, an electric motor constituted by a rotor and a wound stator, said rotor being concentric with said clothes containing bowl and coupled thereto by a clutch, a reversing switch on the frame electrically connected to the windings of said stator, a cam on the shaft of said rotor operatively connected to said reversing switch, a bell crank pivotally mounted on said frame, a roller on said bell crank engaging the peripheral cam face of said cam, a switch operating bar pivotally mounted at its one end on said frame and its other end pivotally connected to said bell crank, and reversing switch cancelling means operatively connected to said reversing switch.

6. A clothes laundering machine of the kind employing an agitating motion for a laundering cycle and a spinning motion for a drying cycle, comprising a frame, a clothes containing bowl journalled to the frame, an electric motor constituted by a rotor and a wound stator on the frame, said rotor being concentric with said clothes containing bowl and coupled thereto by a clutch for a drive in a 1:1 speed ratio, a cam on the shaft of said rotor operatively connected to said reversing switch, an electrical connection between said reversing switch and the windings of said stator, adjustment means on said frame adjustably positioning said reversing switch relative to said cam thereby adjusting the switch cut in and cut out point when operated by said cam, and reversing switch cancelling means operatively connected to said reversing switch.

7. A clothes laundering machine of the kind employing an agitating motion for a laundering cycle and a spinning motion for a drying cycle, comprising a frame, a clothes containing bowl journalled to the frame, an electric motor constituted by a rotor and a wound stator on the frame, said motor being concentric with and coupled to said clothes containing bowl with a clutch, a reversing switch on the frame electrically connected to the windings of said stator, a cam rotatable on the shaft of said rotor but lightly restrained against rotation on said shaft by a spring loaded friction clutch, said friction clutch consisting of a pair of spaced washers slidably but non-rotatably retained on said rotor shaft by a spring clip and engaging one on each side of said cam under spring pressure exerted by a spring disposed around the shaft, a stop lug extending outwardly from the periphery of said cam, a complementary stop lug on said frame en-

gageable by said cam stop lug upon rotor spin, an arm pivotally mounted on said frame, a roller on said arm engaging the peripheral cam face of said cam, a switch operatively connected to said arm, adjustment means on said frame adjustably positioning said reversing switch relative to said arm thereby providing switch cut in and cut out control means, and reversing switch cancelling means operatively connected to said reversing switch.

8. A clothes laundering machine of the kind employing an agitating motion for a laundering cycle and a spinning motion for a drying cycle, comprising a frame, a clothes containing bowl journalled to the frame, an electric motor constituted by a rotor and a wound stator, said rotor being concentric with and coupled to said clothes containing bowl for drive in a 1:1 speed ratio, a reversing switch on the frame, mechanical operating means on the rotor operatively coupled to the reversing switch whereby the reversing switch is mechanically operated by said rotor once per revolution, said stator having a pair of windings joined at one end to a common point and coupled at the other end with a capacitor, said reversing switch being a single pole double throw make before break switch electrically connected across

said capacitor, and reversing switch cancelling means operatively connected to said reversing switch.

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WALTER A. SCHEEL, *Primary Examiner.*

WILLIAM I. PRICE, *Assistant Examiner.*