

Sept. 17, 1968

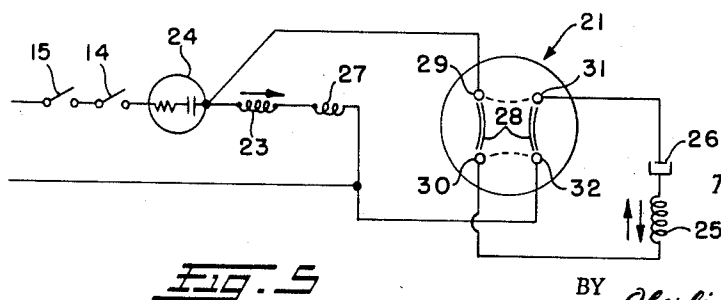
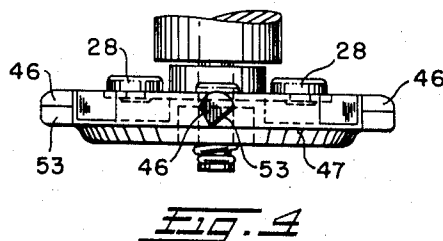
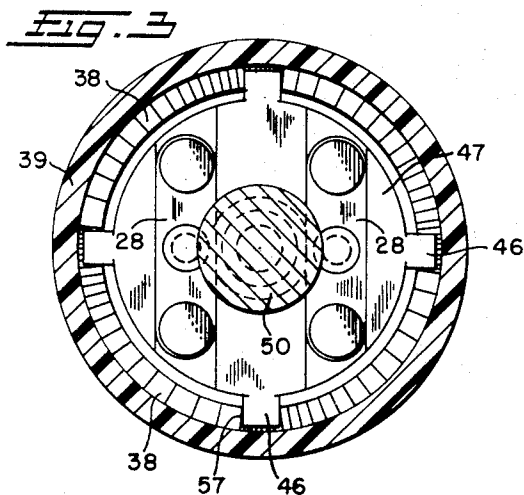
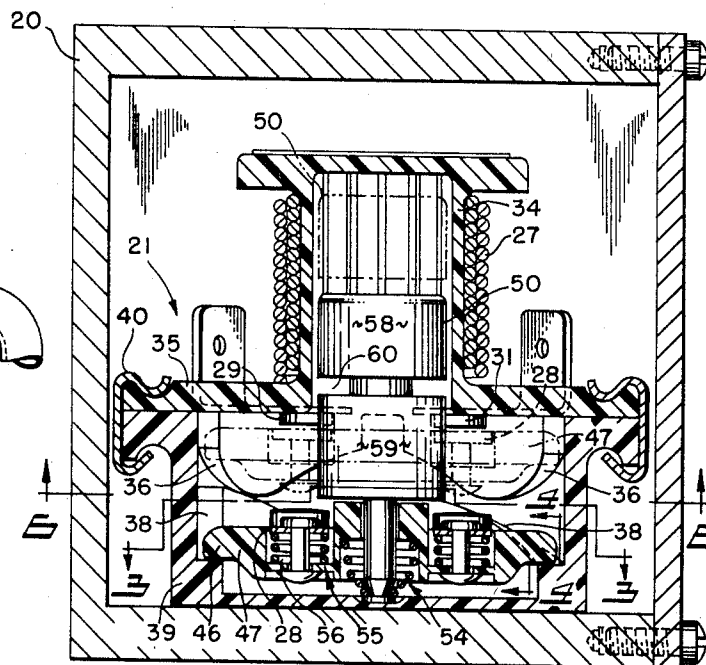
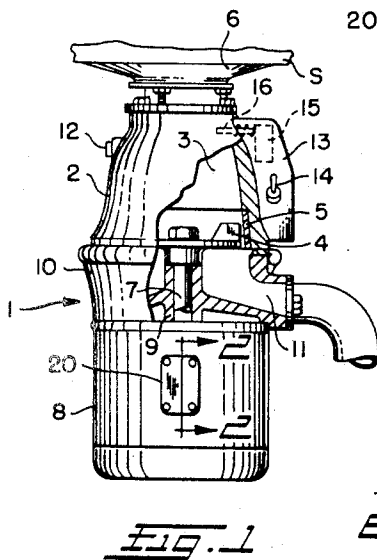
T. F. MEYERS

3,401,892

WASTE DISPOSER WITH AUTOMATIC MOTOR REVERSING MEANS

Filed April 29, 1965

2 Sheets-Sheet 1



INVENTOR
THEODORE F. MEYERS

BY *Oberlin, Maky & Donnelly*
ATTORNEYS

Sept. 17, 1968

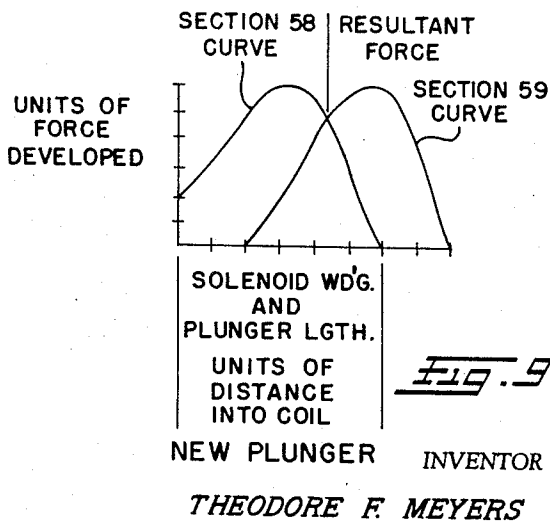
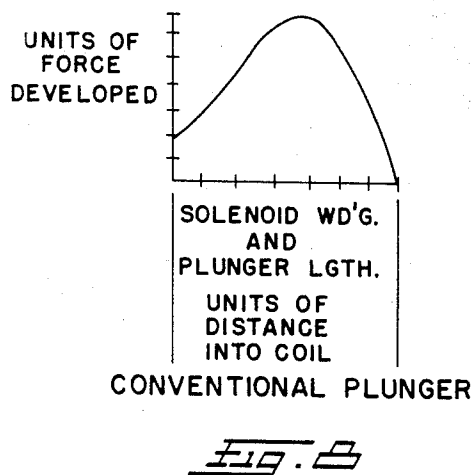
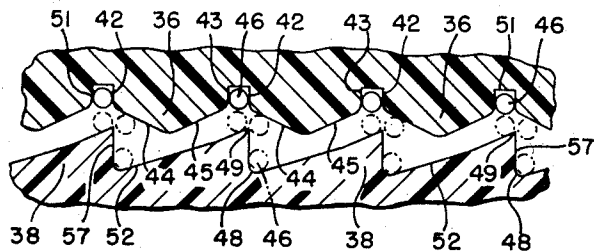
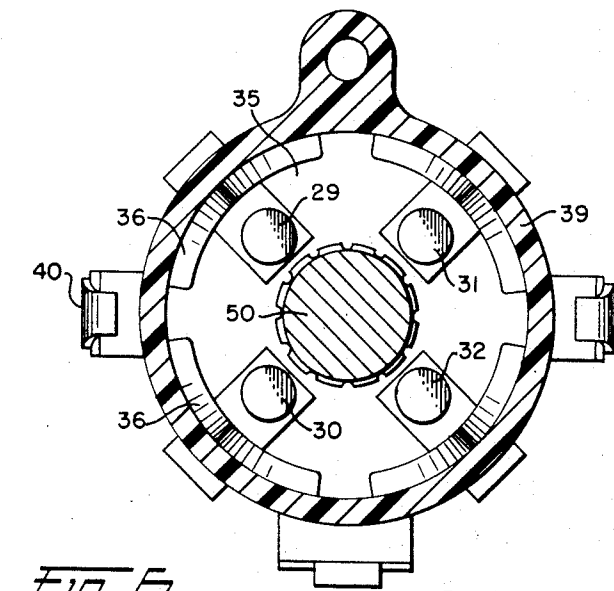
T. F. MEYERS

3,401,892

WASTE DISPOSER WITH AUTOMATIC MOTOR REVERSING MEANS

Filed April 29, 1965

2 Sheets-Sheet 2



BY *Olerlin, Maky & Donnelly*
ATTORNEYS

1

3,401,892

WASTE DISPOSER WITH AUTOMATIC MOTOR REVERSING MEANS

Theodore F. Meyers, Wadsworth, Ohio, assignor, by
mesne assignments, to The Hobart Manufacturing Com-
pany, Troy, Ohio, a corporation of Ohio
Continuation-in-part of application Ser. No. 299,216,
Aug. 1, 1963. This application Apr. 29, 1965, Ser.
No. 451,844

15 Claims. (Cl. 241—36)

ABSTRACT OF THE DISCLOSURE

An automatic motor reversing switch for a waste dis-
poser and the like including a stationary contact plate and
a movable contact plate which is progressively rotated by
axially spaced cam members during movement of the
movable contact plate toward and away from the sta-
tionary contact plate alternately to establish contact be-
tween two pairs of contacts every time the movable con-
tact plate is brought into engagement with the stationary
contact plate.

The present invention is a continuation-in-part of ap-
plicant's copending application Serial No. 299,216, filed
August 1, 1963, now abandoned, and relates generally, as
indicated, to a waste disposer having means by which the
drive motor thereof is alternately driven in opposite direc-
tions each time that it is started.

Hitherto, it has been one common practice in the
waste disposer field to provide a starting switch to con-
trol energization and deenergization of the disposer drive
motor, and to provide on the motor housing, or elsewhere,
a reversing switch to effect motor reversal thus to unjam
the impeller when waste matter is wedged between the
impeller vanes or cutting blades and the surrounding
shredder ring in the bottom of the waste hopper. It is
known also to provide waste disposers with automatic
reversing controls, but those that are available are com-
plicated and expensive and require precision adjustment.

Accordingly, it is a principal object of this invention
to provide a waste disposer having an inexpensive and
simple reversing relay for the drive motor thereof which
requires no adjustments and which, because it reverses
the direction of rotation of the motor each time that
the motor is started, greatly enhances the life of the
cutting edges of the impeller vanes and shredder ring.

Another object is to provide a waste disposer with such
a reversing relay which has a unique cam arrangement
that permits the relay to operate at high speed under rel-
atively low pulling power.

Still another object is to provide such a reversing relay
with a movable contact plate having pins projecting there-
from which are guided by a cam arrangement during axial
movement of the movable contact plate to cause rotation
thereof.

Yet another object is to provide such a reversing relay
with a cam arrangement which causes the movable con-
tact plate to rotate only a few degrees when moved in
one direction, but to rotate a substantially greater num-
ber of degrees when moved in the opposite direction.

Another object is to provide a waste disposer with a
reversing relay having a movable contact plate and a
solenoid plunger spring-mounted thereon to permit vibra-
tion of the plunger in the solenoid coil with little trans-
mission of such vibration to the movable contact plate.

A further object is to provide a waste disposer with
a reversing relay including spring loaded movable con-
tacts which are thus resiliently held in engagement with
stationary contacts when brought into contact therewith
upon energization of the solenoid coil, thereby preventing

2

the transmission of vibrations of the movable contact plate
which carries the movable contacts to the movable con-
tacts.

Another object is to provide a reversing relay of the
type discussed above with a novel plunger which is sub-
jected to a greater pulling force by the solenoid coil
than a conventional plunger after the plunger has moved
a specified distance into the coil, whereby a shorter coil
and thus a shorter relay may be utilized to move the
novel plunger the desired distance.

Other objects and advantages of the present invention
will become apparent as the following description pro-
ceeds.

To the accomplishment of the foregoing and related
ends, the invention, then, comprises the features herein-
after fully described and particularly pointed out in the
claims, the following description and the annexed draw-
ing setting forth in detail a certain illustrative embod-
iment of the invention, this being indicative, however, of
but one of the various ways in which the principle of the
invention may be employed.

In said annexed drawing:

FIG. 1 is a side elevation showing a waste disposer
suspended from the drain opening of a kitchen sink or
the like, a portion of the housing being cut away to show
the cooperating waste comminuting elements of the rotary
vaned impeller and surrounding shredder ring;

FIG. 2 is a vertical section taken substantially along the
line 2—2, FIG. 1, showing a preferred form of motor
starting and reversing relay in accordance with the present
invention;

FIG. 3 is a horizontal section taken substantially along
the line 3—3 of FIG. 2 through the solenoid plunger and
relay housing looking downwardly on the movable con-
tact plate and cam surfaces on the relay housing;

FIG. 4 is a side elevation of the movable contact plate
of the reversing relay as viewed from the line 4—4 of
FIG. 2;

FIG. 5 is a schematic wiring diagram showing a waste
disposer drive motor embodying the present starting and
reversing relay, whereby the motor is driven alternately
in opposite directions each time that the main winding
thereof is energized by a manually operated "off-on"
switch;

FIG. 6 is a horizontal section taken substantially along
the line 6—6 of FIG. 2 looking upwardly at the fixed
contact plate;

FIG. 7 is a development of a detail of the cam ar-
rangement for the reversing relay;

FIG. 8 is a graphic showing of the change in pulling
force exerted on a conventional solenoid plunger by the
solenoid coil as the plunger advances into the coil; and

FIG. 9 is a graphic showing similar to FIG. 8, except
that it shows the change in pulling force exerted on a
solenoid plunger constructed in accordance with the pre-
sent invention as it moves into the solenoid coil.

Referring now more particularly to the drawings, and
first to FIG. 1, the reference character S denotes the
bottom of a sink from which the waste disposer 1 is
suspended. The waste disposer 1, as well known in the
art, comprises a tubular, upper housing 2 which provides
a waste-receiving chamber 3 therewithin. Extending across
the lower end of the chamber 3 is a rotary vaned impeller
4 that is operative in cooperation with a surrounding
internally grooved shredder ring 5 to comminute waste
introduced into the grinding chamber 3 through the sink
flange 6 in the sink drain opening. The impeller 4 is
mounted on the drive shaft 7 of an electric motor 8.
The motor housing 9 is hung from the bottom of the
upper housing 2 as by means of a screw actuated split
clamp 10. The motor housing 9 is formed with a discharge

port 11 through which comminuted waste is conducted into the sewer with the assistance of water that flows from the sink S into the waste disposer 1 during the grinding operation.

The upper housing 2 is provided with a port 12 to which the drain hose of a dishwashing machine is adapted to be connected, and such upper housing 2 usually has mounted thereon a switch box 13 provided with a manually operated "on-off" switch 14. In series with the switch 14 there is a normally open control switch 15 that is designed to be actuated as by means of a radially movable plunger 16 which has its inner end extending into the housing 2.

A disclosure of a waste disposer 1 of the type just described including a control cover for actuating the aforesaid plunger 16, will be found in the patent to John Drew, No. 2,657,397, dated November 3, 1953. Thus, in the Drew disposer when the aforesaid control cover is turned so as to move the plunger 16 outward, the control switch 15, in conjunction with the manual switch 14 which is normally left in "on" position, will energize the motor 8.

The quick-connect sink mounting of the waste disposer 1 may be of the type disclosed in the patent to Charles Thierer, No. 2,946,525, dated July 26, 1960.

In the present case, in addition to the manual switch 14 and the control switch 15, there is mounted on the motor 8, or elsewhere, a terminal box 20 containing the reversing motor starting relay 21 according to the present invention.

Before referring in detail to FIGS. 2-4 and 6-9, reference will be made to the schematic diagram of FIG. 5, and as evident therefrom, the electric drive motor 8 is of the capacitor-start type having a main winding 23 arranged for connection with an electric power source via the manual switch 14, the control switch 15, and an overload protecting device 24. An auxiliary winding 25 connected in series with a capacitor 26 constitutes the capacitor phase of the motor 8 and is in the circuit during the starting period. In series with the main winding 23 is the coil 27 of the current operated relay 21, the contactors 28 of which either bridge the contacts 29-30, and 31-32 (full lines), or contacts 29-31 and 30-32 (dotted lines), thus causing current flow through the auxiliary winding 25 and capacitor 26 in opposite directions to effect rotation of the drive shaft 7 of the motor 8 in opposite directions.

Referring now in detail to FIGS. 2-6, the reversing motor starting relay 21 comprises the coil 27 wound around a tubular insulating extension 34 of an upper fixed contact plate 35 on which there are mounted the contacts 29, 30, 31, and 32 as aforesaid, and which are connected to the motor and power circuit as depicted in FIG. 5. Depending from the fixed contact plate 35 are a plurality of circumferentially spaced cam members 36, preferably four in number.

Circumferentially offset with respect to the cam members 36 are cam members 38 formed on the inner surface of the housing 39 of the reversing relay 21 to which the fixed contact plate 35 is secured as by means of retainer clips 40. As clearly shown in the development of the detail of the cam members 36 and 38 in FIG. 7, the cam members 36 have axially extending end cam surfaces 42, 43 and downwardly sloping intermediate cam surfaces 44, 45 which intersect approximately at the axial center of the cam members. The end cam surfaces 42, 43 of adjacent cam members 36 are spaced apart by a distance sufficient to receive and guide pins 46 which project radially outwardly from a movable contact plate 47 disposed within the housing 39 on which the contactors 28 are mounted for axial and rotational movement therewith, as will be more fully explained hereafter. The cam members 38, on the other hand, are of generally saw tooth form with the root 48 and crest 49 of each cam member 38 being in substantially axial alignment with the trailing end cam surface 42 of the preceding cam member 36.

The movable contact plate 47 is carried by the relay

armature or solenoid plunger 50 for the solenoid coil 27 for reciprocation within the housing 39 upon energization and deenergization of the solenoid coil, during which the contactors 28 carried by such movable contact plate 47 move into and out of engagement with the fixed contacts 29-32 mounted on the fixed contact plate 35.

As perhaps best seen in FIGS. 2 and 7 of the drawing, when the solenoid coil 27 is deenergized below a predetermined value, as when the motor 8 is running or stopped with no power applied, the weight of the solenoid plunger 50 and movable contact plate 47 will cause the movable contact plate to drop downwardly until the pins 46 of the movable contact plate 47 are brought to rest on the roots 48 of the cam members 38. Conversely, when the solenoid coil 27 is energized above this predetermined value, as when the motor 8 is first energized but not yet turning, enough magnetic flux is created by the coil to lift the solenoid plunger 50 and thus the movable contact plate 47. During such upward movement, the pins 46 engage the intermediate cam surfaces 44 of the cam members 36 and are guided thereby, causing rotation of the movable contact plate 47 a few degrees to bring the contactors 28 carried by the movable contact plate into axial alignment with one or the other of the pairs of fixed contacts 29-30, 31-32, 29-31, or 30-32, after which the pins 46 are lifted up into the slots 51 between the ends 42, 43 of the adjacent cam members 36 for continued axial movement of the movable contactors 28 into engagement with such fixed contacts.

It is preferred that the movable contact plate 47 be rotated only a few degrees during its movement toward the stationary contact plate 35 and that such rotation occur after the plunger 50 and movable contact plate 47 have been raised sufficiently to gain some momentum, or otherwise the small lifting force of the solenoid coil 27 may not be sufficient to lift these movable parts and rotate them. It has been found that if the movable contact plate 47 and pins 46 carried thereby have to rotate more than a few degrees, the operation of the relay 21 may be quite slow, delaying the start of the motor 8 by approximately one second. Moreover, the motor 8 makes an objectionable humming sound during such delayed starting. Or the operation of the motor may be erratic, sometimes starting and sometimes not, and dirt and normal wear will substantially affect its operation. Also, it is desired that contact between the stationary contacts 29-30, 31-32, 29-31, or 30-32 and movable contactors 28 occur only during axial movement of the movable contactors in order to ensure that the stationary and movable contacts mate with sufficient force to establish good electrical contact without causing significant wear of such contacts. Accordingly, the speed at which the reversing relay 21 of the present invention operates is quite high, and it will operate even when there is a very low pulling force, of say approximately one ounce.

Of course, if the movable contactors 28 are to engage a different pair of stationary contacts 29-30, 31-32, 29-31, or 30-32 to reverse the direction of rotation of the motor 8 each time that it is started, the movable contact plate 47 must be rotated 90° each time the solenoid coil 27 is energized. Accordingly, since the movable contact plate 47 is rotated only a few degrees during its movement toward the fixed contact plate 35, it must rotate in the same direction a substantially greater number of degrees when moved away therefrom, enough such that the total rotation during movement toward and away from the fixed contact 35 is 90°. This is accomplished by providing the cam members 38 with relatively long sloping cam surfaces 52 which cause the pins 46 to rotate during movement away from the stationary contact plate.

As perhaps best seen in FIG. 4, such pins 46 are provided with surfaces 53 having a slope substantially equal to the slope of the cam surfaces 52 of the cam members 38, whereby good sliding contact is established between such surfaces during movement of the movable contact

5

plate 47 away from the stationary contact plate 35 as aforesaid.

By way of example, when the motor 8 is started, as by closing the control switch 15, the manual switch 14 being normally left in "on" position, the main winding 23 current is relatively high, that is, approximately 35 amperes for a one-half horsepower, 115 volt, 60 cycle capacitor-start motor. With a 20 turn coil 27, this causes a high magnetic density, that is, 700 ampere turns, which is sufficient to lift the plunger 50 and the movable contact plate 47 to which it is secured. As the plunger 50 and contact plate 47 move upwardly, the pins 46 carried by the movable contact plate engage the intermediate cam portions 44 of the cam members 36 to cause turning of the contact plate 47, after which the pins 46 are guided in the spaces 51 between the end cam surfaces 42, 43 of the adjacent cam members 36 for vertical movement of the contact plate 47 and movable contacts 28 into engagement with the contacts 29-32 of the fixed contact plate 35, as shown in phantom lines in FIG. 2.

Referring further to FIG. 2, there is a resilient spring connection 54 between the solenoid plunger 50 and the movable contact plate 47 which permits the solenoid plunger 50 to be pulled completely into the solenoid coil 27 upon energization thereof, even though continued movement of the movable contact plate 47 is precluded due to engagement between the movable and stationary contacts. Accordingly, the vibration of the solenoid plunger 50 due to the separate lifting forces caused by alternating current used to energize the solenoid windings 27 will substantially be absorbed by the spring connection 54 so that very little of such vibration is transmitted to the movable contact plate 47. This is quite important, since otherwise contact between the stationary contacts 29-32 and movable contacts 28 would be established some 120 times per second when 60 cycle alternating current is used, resulting in severe burning and extremely short life of the contacts.

To ensure further against the transmission of vibrations from the solenoid plunger 50 and movable contact plate 47 to the movable contacts 28, it is desirable that there also be a spring connection 55 between the movable contacts 28 and the contact plate 47. Reference may be had to FIGS. 2 and 3 in this respect. Accordingly, when the movable contacts 28 and stationary contacts 29-32 are brought into engagement as shown in phantom lines in FIG. 2, the springs 56 of the spring connections 55 are compressed, thereby holding the stationary contacts 29-32 and movable contacts 28 firmly together. This will absorb any vibrations which might have otherwise been transmitted to the contactors 28 from the movable contact plate 47 and solenoid plunger 50.

As evident, upward and rotational movement of the contact plate 47 as described above will cause the motor 8 to turn in one direction, and as the speed of the motor increases, the current draw of the main winding 23 decreases until the current flow through the relay coil 27 is insufficient to hold the plunger 50 at its "up" position. For example, the current draw of the main winding 23 may drop to 12 amperes, at which time the movable contact plate 47 and plunger 50 will drop down by gravity, or if desired, with the assistance of a coil spring or the like. As the contact plate 47 moves down, the pins 46 thereof ride down the cam surfaces 52 until they engage the stops 57 adjacent the roots 48 of the cam members 38. Accordingly, the next time that the contact plate 47 is raised, it will then be turned so that its movable contacts 28 will make contact with the other pairs of fixed contacts 29-32, thus to start the motor 8 in the opposite direction.

As clearly shown in FIG. 8 of the drawing, the amount of pulling force exerted by the solenoid coil 27 on a conventional solenoid plunger gradually increases until the plunger is moved approximately half the distance into the coil, after which the force rapidly drops during further

6

movement of the plunger into the coil until the plunger has been moved completely into the coil. Then, of course, the force exerted on the plunger by the coil is zero. However, it has been found that if the plunger 50 is made in two sections 58 and 59 as illustrated in FIG. 2 with an annular slot or groove 60 between such sections, each of the sections 58 and 59 will be pulled independently of the other by the solenoid coil 27. The force exerted on each of the sections 58 and 59 at various distances into the coil is graphically illustrated in FIG. 9. As the graph indicates, the resultant force for the slotted plunger 50 is beyond the center of the solenoid coil 27. Accordingly, the slotted plunger 50 increases the available pulling force thereon by the solenoid coil 27 at a fixed distance into the solenoid coil. Thus, a shorter solenoid coil 27 can be utilized to develop the same pulling force, thereby permitting a reduction in the total height of the reversing relay 21.

From the foregoing, it can be seen that the motor 8 reverses every time it is started, thereby doubling the life of the cutting elements of the disposer. Thus, in the event that the impeller 4 becomes jammed in the upper housing 2, as by wedging of a bone fragment or sliver between the outer edges of the impeller vanes and the interior of the shredder ring 5, the overload unit 24 will open the motor circuit until such time that a temperature sensitive element therein cools to allow reclosing of the thermostat operated switch therein. Now, when the overload unit 24 recloses, there again will be the relatively large starting current draw of the main winding 23, whereby relay coil 27 pulls the plunger 50 and contact plate 47 upwardly to attempt to start the motor 8. Usually such jammed condition will be eliminated when the impeller 4 is first attempted to be rotated in a direction opposite the jamming direction. However, if the jammed condition is not then relieved, the overload unit 24 opens and recloses as many times as necessary to eliminate the jammed condition.

Although the reversing motor starting relay 21 is herein shown only with a capacitor-start motor, it can be employed in connection with other types of motors, such as resistance-start split-phase motors. Likewise, the coil 27 may be a potential coil and the relay 21 would then be employed as a potential relay. The potential relay would have utility, for example, in reversing the direction of rotation of a three-phase motor as by connecting the coil 27 across, say Phases A and B, and the reversing contacts across Phases B and C, and in this case the contact plate 47 would not be permitted to drop out until the line switch is opened.

Other modes of applying the principles of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

I, therefore, particularly point out and distinctly claim as my invention:

1. An automatic reversing switch comprising a stationary contact plate means, a solenoid coil fixed with respect to said stationary contact plate means, a solenoid armature means mounted for movement toward said coil upon flow of a predetermined amount of current through said coil and mounted for movement away from said coil when the current is below such predetermined amount, a movable contact plate means carried by said armature means for movement from a position spaced from said stationary contact plate means when said armature means is moved away from said coil to a position in contact with said stationary contact plate means when said armature means is pulled toward said coil, spring means resiliently mounting said movable contact plate means to said armature means for permitting continued movement of said armature means toward said coil after engagement of said movable contact plate means with said stationary contact plate means whereby vibration of said armature means will be substantially absorbed by said spring means, said

movable contact plate means having a pair of bridge contactors carried thereby for engagement with contacts carried by said stationary contact plate means, and additional spring means resiliently mounting said bridge contactors to said movable contact plate means for yieldably holding said bridge contactors in engagement with said contacts on said stationary contact plate means when brought into engagement therewith so as to absorb any vibrations which might have otherwise been transmitted to said bridge contactors from said movable contact plate means and said armature means.

2. The reversing switch of claim 1 wherein there is only one of said spring means mounting each said bridge contactor to said movable contact plate means as aforesaid, said additional spring means being located adjacent the center of each bridge contactor.

3. An automatic reversing switch comprising a stationary contact plate means, a solenoid coil fixed with respect to said stationary contact plate means, a solenoid armature means mounted for movement toward said coil upon flow of a predetermined amount of current through said coil and mounted for movement away from said coil when the current is below such predetermined amount, a movable contact plate means carried by said armature means for movement from a position spaced from said stationary contact plate means when said armature means is moved away from said coil to a position in contact with said stationary contact plate means when said armature means is pulled toward said coil, said armature means being provided with two sections separated by an annular groove, each of said sections being adapted to be pulled by said solenoid coil independently of the other, thus increasing the total force exerted on said armature means by said coil at a fixed distance into said coil, whereby a shorter coil may be utilized to develop the same pulling force.

4. A waste disposer comprising a housing having a chamber open at its upper end for introduction of waste matter therinto and for flow of water therethrough to a drain opening at its lower end; an electric motor driven impeller in said chamber having comminuting elements cooperating with like elements in said housing to comminute such waste matter for flow to said drain opening; said drive motor being of the capacitor-start type having a main winding adapted for connection across an electric supply line, and an auxiliary winding and capacitor in series connected across the line in parallel with said main winding; and a current-operated reversing relay having a solenoid coil in series with said main winding, a solenoid armature pulled upwardly by said coil upon energization of said main winding-solenoid coil circuit to close said auxiliary winding-capacitor circuit and dropping downwardly upon reduction of current flow through said main-winding-solenoid coil circuit as said motor approaches synchronous speed to open said auxiliary winding-capacitor circuit, and reversing contact means in said auxiliary winding-capacitor circuit alternately closed each time that said armature is pulled upwardly thus to alternately drive said motor and impeller in opposite directions, said reversing contact means comprising a fixed contact plate having two pairs of contacts corresponding respectively with the line and the leads of said auxiliary winding and said capacitor, and a movable contact plate constituting a part of said armature having a pair of contact blades thereon which, upon successive rotary advancements of said movable contact plate, reversibly connects the line with said auxiliary winding-capacitor circuit, said plates having complementary cam surfaces effective to rotatably advance said movable contact plate a part turn each time that said armature is pulled upwardly spring means resiliently mounting said movable contact plate to said armature for permitting continued movement of said armature toward said coil after engagement of said movable contact plate with said stationary contact plate, whereby vibration of said armature will be substantially absorbed by said spring means,

and additional spring means resiliently mounting said contact blades to said movable contact plate for yieldably holding said contact blades in engagement with said stationary contact plate when brought into engagement therewith so as to absorb any vibrations which might have otherwise been transmitted to said contact blades from said movable contact plate and armature.

5. The waste disposer of claim 4 wherein said movable contact plate has a plurality of circumferentially spaced projections around its outer periphery which are guided by cam surfaces on a cam sleeve depending from said fixed contact plate during upward movement of said movable contact plate to cause at least a portion of such rotary advancements.

6. An automatic reversing relay for a capacitor-start motor driven waste disposer comprising a solenoid coil in series with the main winding of said motor, a solenoid armature pulled upwardly by said coil upon flow of starting current through said main winding-solenoid coil circuit to close the auxiliary winding-capacitor circuit of said motor and dropping downwardly upon reduction of current flow through said main winding-solenoid coil circuit as said motor approaches synchronous speed to open said auxiliary winding-capacitor circuit, and reversing contact means in said auxiliary winding-capacitor circuit alternately closed each time that said armature is pulled upwardly thus to alternately drive said motor in opposite directions and to eliminate jamming of said disposer in use, said reversing contact means comprising a fixed contact plate and a movable contact plate constituting a part of said armature, cam means depending from said fixed contact plate, and a plurality of circumferentially spaced projections extending directly radially outwardly from the outer periphery of said movable contact plate, said cam means being adapted to be engaged by said projections during upward movement of said armature and said movable contact plate to cause rotation thereof during continued upward movement.

7. In an automatic reversing switch, a first cam member, a second cam member mounted directly beneath said first cam member and spaced therefrom, a stationary contact plate fixed with respect to the upper end of said first cam member, a solenoid coil fixed with respect to said stationary contact plate, a solenoid armature pulled upwardly by said coil upon flow of a predetermined amount of current through said coil and dropping downwardly when the current is below such predetermined amount, a movable contact plate secured to said armature for movement from a position below said stationary contact plate when said armature drops downwardly to a position in contact with said stationary contact plate when said armature is pulled upwardly, said movable contact plate being provided with radial projections, and said first and second cam members being provided with cam means for guiding the movement of said radial projections and thus said movable contact plate into and out of contact with said stationary contact plate.

8. The reversing switch of claim 7 wherein said radial projections are provided with sloping surfaces, and said cam means on said second cam member have a sloping surface substantially equal to the slope of said radial projections, whereby good sloping contact is established between said radial projections on said second cam member during downward movement of said movable contact plate.

9. The reversing switch of claim 7 wherein said solenoid coil is wound around a tubular extension of said stationary contact plate.

10. The reversing switch of claim 7 wherein there are two pairs of contacts on said stationary contact plate and a pair of resiliently mounted contact blades on said movable contact plate which resiliently engage said pairs of contacts on said stationary contact plate when said armature is pulled upwardly as aforesaid, and said cam means on said first and second cam members are operative to

rotate said movable contact plate to cause said resilient contact blades resiliently to engage a different pair of contacts each time said movable contact plate is raised.

11. The reversing switch of claim 7 wherein said cam means on said first cam member is effective to rotate said movable contact plate only a few degrees when engaged by said radial projections during upward movement of said movable contact plate.

12. The reversing switch of claim 10 wherein said pairs of contacts on said stationary contact plate are fixed thereto.

13. The reversing switch of claim 7 wherein means are provided for resiliently mounting said movable contact plate to said armature for permitting continued movement of said armature toward said coil after contact is established between said stationary and movable contact plates, whereby vibrations of said armature will be substantially absorbed by said spring means.

14. The reversing switch of claim 13 wherein said movable contact plate has a pair of bridge contactors carried thereby for engagement with contacts carried by said stationary contact plate, and spring means are provided for resiliently mounting said bridge contactors to said movable contact plate, said last-mentioned spring means being adapted resiliently to hold said bridge contactors in engagement with said contacts on said stationary contact plate when brought into engagement therewith so as to absorb any vibrations of said movable contact plate, thus precluding such vibrations from being transmitted to said bridge contactors.

15. An automatic reversing switch for a motor having a main winding and an auxiliary winding, comprising a solenoid coil connected in series with said main winding, a solenoid armature means mounted for axial movement toward said coil when said coil is energized above a predetermined value during starting of said motor and away from said coil when deenergized below said predetermined value during running periods of said motor, a movable contact plate mounted on said armature means for movement therewith, a stationary contact plate disposed adjacent said movable contact plate for engagement by said movable contact plate when said armature means is moved toward said coil and for disengagement from said movable contact plate when said armature is moved away from said coil, both said stationary and movable contact plates having a plurality of contacts thereon, and means for rotating said movable contact plate during movement thereof toward and away from said fixed contact plate to cause

said contacts on said movable contact plate to engage a different pair of stationary contacts every time said coil is energized above said predetermined value, said last-mentioned means comprising a first cam means for rotating said movable contact plate only a few degrees during movement of said movable contact plate toward said stationary contact plate and a second cam means axially spaced from said first cam means for rotating said movable contact plate a substantial number of degrees in the same direction when said movable contact plate is moved in the opposite direction for effecting sufficient rotation of said movable contact plate to cause such engagement of a different pair of stationary contacts every time said coil is energized as aforesaid, said first cam means including a plurality of circumferentially spaced cam members, each of said cam members having a pair of vertically extending end cam surfaces and a pair of intermediate cam surfaces which slope outwardly in opposite directions from said end cam surfaces to intersect at the axial center of said cam members, the end cam surfaces of adjacent cam members being spaced apart by a distance sufficient to receive and guide pins projecting radially outwardly from said movable contact plate, said second cam means also including a plurality of circumferentially spaced cam members circumferentially offset with respect to the cam members of said first cam means, said cam members of said second cam means being of generally saw tooth form having long sloping cam surfaces which extend from the root of one saw tooth to the crest of the next preceding saw tooth and vertically extending stop surfaces which interconnect said long sloping cam surfaces between the crest and root of each saw tooth, said stop surfaces being in substantially axial alignment with the trailing end face of the preceding cam member of said first cam means.

References Cited

UNITED STATES PATENTS

2,203,630	6/1940	Keen	200—104
2,447,890	8/1948	Alvino	200—116
2,851,646	9/1958	Williamson	318—207
2,701,855	2/1955	Hammes	318—283
2,775,729	12/1956	Curtis	318—221
3,009,088	11/1961	Prouty.	

WILLIAM W. DYER, JR., *Primary Examiner.*

F. T. YOST, *Assistant Examiner.*