

DEHYDRATING-RINSING APPARATUS

The present invention relates to dehydrating-rinsing apparatus wherein a so-called dehydrating-rinsing operation is executed by immersing clothes contained in a dehydrating basket in water and removing the water permeated in the clothes by centrifugal force.

Figs. 23 and 25 illustrate prior art dehydrating-rinsing apparatus of the type described above, respectively. Referring to Fig. 23, a showering cylinder 2 extends upwardly from the central bottom of a dehydrating basket 1. A peripheral side wall of the showering cylinder 2 is formed by sintering the pulverized plastics and accordingly, is porous, thereby allowing water to pass there-through. The dehydrating basket 1 is arranged to be driven by an electric motor (not shown). The dehydrating-rinsing apparatus is provided with a water supply valve (not shown) comprising an electromagnetic valve for supplying water into the showering cylinder 2. As shown in Fig. 24, the dehydrating basket 1 is intermittently driven by intermittently energizing the motor (the upper oblique lines show the motor energizing periods in Fig. 24) and the water supply valve is continuously actuated to continuously supply water into the showering cylinder 2 (the lower oblique line show the period during which the water supply valve is energized in Fig. 24). Thus, the water contained in the showering cylinder 2 is discharged

through the perforations of the peripheral wall thereof so that the water permeates the clothes and subsequently, the water permeated is removed from the clothes by means of centrifugal force, thereby performing the dehydrating-
5 rinsing operation.

Referring now to Fig. 25 illustrating another prior dehydrating-rinsing apparatus, cylindrical members 4 each having a generally rectangular wave-shaped cross section are provided on the inside of the peripheral wall of the
10 dehydrating basket 3. These cylindrical members 4 define grooves 5 vertically extending over the inside of the peripheral wall of the dehydrating basket 3. A plate member 6 is attached to the upper opening of the basket 3. The plate member 6 has perforations in the lower portion
15 thereof. The dehydrating basket 3 is arranged to be driven by an electric motor (not shown). The dehydrating-rinsing apparatus shown in Fig. 25 is provided with a water supply valve (not shown) comprising an electromagnetic valve for supplying water to the dehydrating basket
20 3. As shown in Fig. 26, the dehydrating basket 3 is intermittently driven by intermittently energizing the motor. The water supply valve is actuated with an interval after deenergization of the motor, thereby supplying water to the plate member 6. The water flowing through the
25 perforations of the plate member 6 directly permeates the upper portions of the clothes. The water from the plate member 6 also permeates the lower portions of the clothes

through the grooves 5. The water permeated is removed from the clothes by means of centrifugal force.

According to the dehydrating-rinsing apparatus of the former type, the water permeating the clothes is supplied only from the showering cylinder 2 placed in the center of the dehydrating basket 1. Consequently, since the water discharged from the showering cylinder 2 permeates the clothes from the peripheral wall of the showering cylinder 2 toward the peripheral wall side of the dehydrating basket 1, the water having passed through the clothes placed near the showering cylinder 2 usually permeates the clothes placed near the peripheral wall of the dehydrating basket 1. Since the water having passed through the clothes near the showering cylinder 2 has a high level of detergent content, much time is required to obtain desired rinse effect or the rinse efficiency is reduced. Furthermore, there may be difference of rinse effect between the clothes placed in the center of the dehydrating basket 1 and those placed near the peripheral wall of the basket 1.

According to the dehydrating-rinsing apparatus of the latter type, the water permeating the clothes is supplied only from the upper side of the dehydrating basket 3. Although the water may be guided to the lower portion of the basket 3 through the grooves 5, the clothes placed at the center receive less water than those placed near the peripheral wall of the basket 3, opposite to the case of the former type. Accordingly, there may be difference in

rinse effect between the clothes placed at the center of the basket 3 and those placed near the peripheral wall thereof.

In each of the above-described prior dehydrating-rinsing apparatus, when the water pressure of the domestic water supply system is regionally low or when the water pressure is decreased depending on time in the region where the normal water pressure is secured, a quantity of water supplied per a unit time period is decreased. As a result, the rinse effect is reduced.

Therefore, an object of the present invention is to provide a dehydrating-rinsing apparatus wherein occurrence of difference in rinse effect can be reduced together with improvement of the rinse efficiency.

Another object of the present invention is to provide a dehydrating-rinsing apparatus wherein reduction of the rinse effect can be prevented in the case where an amount of water supplied to the dehydrating basket in a unit time period is rendered small.

According to the invention, there is provided a dehydrating-rinsing apparatus comprising: a) a dehydrating basket driven by an electric motor and having a plurality of grooves formed on the inner peripheral wall thereof and extending from the upper end thereof to the bottom thereof; b) a showering cylinder vertically extending from the approximately central bottom portion of said dehydrating basket, said showering cylinder having a peripheral side wall allowing the fluid to pass therethrough, an opened upper end, and a closed lower end; c) water supply means for supplying water to said showering cylinder from the opened upper end thereof; and d) operation control means for controlling an dehydrating-rinsing operation by alternately reiterating a first control mode wherein the motor is energized and the water supplying operation of said water supply means is stopped and a second control mode wherein the motor is deenergized and the water supplying operation of said water supply means is executed.

In an apparatus according to the invention, water is discharged through the perforated side wall of the showering cylinder. Also, the water overflowing from the opened upper end of the showering cylinder flows through the grooves formed on the inner wall of the

dehydrating basket. The water supplied permeates the clothes both from the central side and the peripheral side.

The dehydrating-rinsing apparatus preferably comprises water flow rate detecting means and water supply mode selecting means for selecting the total operation period of the second control mode in the dehydrating-rinsing operation. The water supply mode selecting means may respond to the result of detection of the water flow rate detecting means. As a result, since the total amount of water supplied may be set, it is not decreased even though the water flow rate is small.

In an alternative arrangement, the dehydrating-rinsing apparatus comprises water flow rate detecting means and operation mode selecting means for selecting both the operation period of the first control mode and the operation period of the second control mode.

The operation mode selecting means may respond to the result of detection of the water flow detecting means. Consequently, since the total amount of water supplied and the speed of the motor may be selected, the total amount of water supplied to the clothes and the amount of water passing through the

clothes are not changed even though the dehydrating basket is eccentrically loaded when the water supply rate is small.

The invention will be described, merely by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a longitudinal section of the twin tub washing machine embodying the dehydrating-rinsing apparatus of a first embodiment in accordance with the present invention;

Fig. 2 is a partially enlarged longitudinal section of the dehydrating basket;

Fig. 3 is an enlarged transeverse section taken along line III-III in Fig. 2;

Fig. 4 is a longitudinal section of the dehydrating basket;

Fig. 5 is a perspective view of the upper portion of the dehydrator side of the twin tub washing machine;

Fig. 6 is a longitudinal section of the upper portion of the dehydrator side of the twin tub washing machine;

Fig. 7 is a front view of the operation panel of the twin tub washing machine;

Fig. 8 is a block diagram illustrating the electrical arrangement of the washing machine;

Fig. 9 is a time chart explaining the control mode of the control means;

Fig. 10 is a view similar to Fig. 9 showing another

control mode of the control means;

Fig. 11 is a time chart illustrating the changes of the motor speed;

Fig. 12 is a longitudinal section of the dehydrating basket employed for showing the water flow at a given time;

Fig. 13 is a view similar to Fig. 12 showing the water flow at another given time;

Fig. 14 is also a view similar to Fig. 12 showing the water flow at a further another time;

Fig. 15 is a view similar to Fig. 10 showing the second embodiment;

Fig. 16 is a view similar to Fig. 1 showing the third embodiment;

Fig. 17 is a block diagram illustrating the electrical arrangement of the dehydrating-rinsing apparatus;

Fig. 18 is a flowchart explaining the control operation of the control means;

Fig. 19 is a time chart showing patterns of energizing and deenergizing the motor and the water-supply valve employed in the dehydrating-rinsing apparatus of a fourth embodiment, respectively and a time chart showing the rotation speed of the dehydrating tub;

Fig. 20 is an another patterns of the energization and deenergization of the motor and the water supply valve respectively in relation to the rotation speed of the dehydrating basket;

Fig. 21 illustrates the relation between the maximum rotation speed of the dehydrating basket and the rinse ratio under a given amount of water;

Fig. 22 is a view similar to Fig. 21 under the condition of a smaller amount of water;

Fig. 23 is a longitudinal section of a prior art dehydrating-rinsing apparatus;

Fig. 24 is a time chart showing the control manner in accordance with the prior art dehydrating-rinsing apparatus in Fig. 23;

Fig. 25 is a longitudinal section of another prior art dehydrating-rinsing apparatus; and

Fig. 26 is a time chart showing the control manner in accordance with the prior art dehydrating-rinsing apparatus in Fig. 25.

Several embodiments will now be described with reference to the accompanying drawings. The dehydrating-rinsing apparatus in accordance with the present invention applied to the twin-tub washing machine throughout the embodiments.

Referring first to Fig. 1 showing the first embodiment, the twin-tub washing machine includes a cabinet 11 and a base plate 12 secured to the lower edge of the cabinet 11. The cabinet 11 encloses a wash tub 13 and a water receiving tub 14. The water receiving tub 14 has a central bottom opening 14a which is closed by bellows 15. An electric motor 16 is mounted on resilient support legs

17 secured to the base plate 12 so as to be positioned nearly beneath the water receiving tub 14. A dehydrating basket 18 is provided within the water receiving tub 14. An integral connecting shaft 19 extends downwardly from
5 the outer bottom of the dehydrating tub 18 through the bellows 15, as viewed in Fig. 1 and is connected to a rotation shaft (not shown) of the motor 16 through a connector 20.

The dehydrating basket 18 is formed from plastics and
10 a balancing ring 21 is provided around the upper open edge thereof. Ribs 23 are provided on the inner wall of the dehydration tub 18 and define grooves 22 extending from the upper end of the inner peripheral wall of the basket 18 to the inner bottom thereof. As shown in Fig. 2, each
15 groove 22 is formed so that the depth D_b of the lower end portion thereof is larger than the depth D_a of the upper end portion thereof. More specifically, each groove 22 is rendered deeper as the groove goes downwardly, as viewed in Fig. 2. The forming of the grooves 22 in the above-
20 described manner prevents the grooves from being filled up with the clothes contained in the dehydration basket 18, otherwise the grooves 22 are filled up with the clothes owing to the weight thereof. Furthermore, as shown in Fig. 3, the depth D of each groove 22 is determined to
25 take a value of at least 0.4 times the width thereof or more in its every transverse section, whereby each groove 22 is prevented from being closed by the clothes. Each

groove 22 has a plurality of dehydrating apertures 24 at its recessed wall or bottom thereof, as shown in Fig. 4. The intervals of the dehydrating apertures 24 are rendered smaller at the upper end side of the dehydrating basket

5 18.

A showering cylinder 25 is secured to the inner bottom of the dehydrating basket 18 with a suitable attachment member 26 so as to extend vertically, as viewed in Fig. 4. The showering cylinder 25 has an upper opened end and a closed lower end. The showering cylinder 25 is formed by sintering pulverized plastics such that the cylinder 25 is provided with many apertures through which water passes. A plate member 27 made of soft plastics is detachably attached to the dehydrating basket 18 so as to close the upper opening thereof. The plate member 27 includes an annular plate portion 28 and a central short cylindrical portion 29 through which the showering cylinder 18 extends. A plurality of openings 30 are formed in the cylindrical portion 29 of the plate member 27 so as to be positioned over the plate portion 28 thereof. The plate member 27 has a plurality of recesses 31 circumferentially aligned and each recess 31 has, at the bottom, a plurality of apertures 32 allowing the water to pass therethrough and at the outer circumferential wall a plurality of apertures 33 allowing the water to pass therethrough.

Referring again to Fig. 1, a water supply valve 35 as

water supply means is provided in an operation box 34 disposed on the cabinet 11. The water supply valve 35 comprises an electromagnetic valve. The water supply valve 35 is opened when energized and closed when
5 deenergized. An inlet of the the water supply valve 35 is connected to a faucet of domestic water supply system through a hose 36. An outlet of the water supply valve 35 is connected to one end of a water flow case 37 extending from the inside of the operation box 34 to the
10 water receiving tub 14. The other end of the water flow case 37 communicates to a water supply recess 38a of an inner cover 38 fit into an opening 39a (see Fig. 6) of a cover 39 mounted on the upper end of the water receiving tub 14. The water supply recess 38a of the inner cover 38
15 has a water feed opening 40 facing the upper opening of the showering cylinder 25. Accordingly, when the water supply valve 35 is energized to execute the water supplying operation, the water is supplied from the domestic water supply system to the showering cylinder 25
20 through the water flow case 37, the recess 38a and the opening 40.

The recessed portion 38a of the inner cover 38 has a stepped portion 41a (see Fig. 5) higher than the bottom of the inner cover 38 and another stepped portion 41b higher
25 than the stepped portion 41a. The stepped portions 41a and 41b and the opening 40 constitute a water flow detector 42 as water flow detecting means. The water flow

detector 42 detects a quantity of water supplied in a unit time period. More specifically, when a quantity of water supplied to the recessed portion 38a in the unit time period is smaller than the maximum quantity of water passing through the opening 40 (depending on the area of the opening 40), the water flows through the opening 40 without remaining in the recessed portion 38a. When the quantity of water supplied to the recessed portion 38a in the unit time period is larger than the maximum quantity of water passing through the opening 40, part of the water supplied remains in the recessed portion 38a. The level of the water remaining in the recessed portion 38a increases as an amount of water supplied in a unit time period increases. When the water level in the recessed portion 38a is lower than the first stepped portion 41a (including the case where no water remains in the recessed portion), it is determined that a quantity of water supplied in a unit time period is less or that the water pressure of the water supply system is lower. When the water level in the recessed portion 38a is higher than the first stepped portion 41a, it is determined that the water is normally supplied.

Referring now to Fig. 7, the operation panel 43 provided on the front side of the operation box 34 includes a course selecting switch 44, a dehydration period setting switch 45, an operation mode selecting switch 46, a start switch 47 also serving as a momentary

stop switch, and display means 48-56 each comprising a light emitting diode (LED). Each of the switches 44-47 is a pushbutton switch of the momentary action type.

Referring now to Fig. 8, a control circuit 57 comprising a microcomputer serves as a rinse operation control means and a water supply mode selecting means. An on signal is supplied from each of the switches 44-47 to the control circuit 57 when each of the switches 44-47 is operated. The control circuit 57 is provided with a built-in memory for storing data of a dehydrating-rinsing operation program for controlling the dehydrating-rinsing operation and a dehydrating operation program for controlling the dehydrating operation. The dehydrating-rinsing operation program includes a water supply mode selecting program. The control circuit 57 supplies drive circuits 58 and 59 with a motor control signal S_m and a valve control signal S_w , respectively, in accordance with these programs and supplies each of the display means 48-56 with a control signal so that each display means emits light.

When the drive circuit 58 is supplied with the motor control signal S_m , the control circuit 58 operates to energize the motor 16. The motor 16 is not energized when the drive circuit 58 is supplied with no motor control signal S_m . When the drive circuit 59 is supplied with the valve control signal S_w , the electromagnetic water supply valve 35 is energized. The water supply valve 35 is deenergized when the drive circuit 59 is supplied with

no valve control signal Sw.

Control functions of the control circuit 57 will now be described in detail.

(A) Initial state:

5 An initial state refers to a condition of the control circuit 57 immediately after an electrical power is supplied thereto or when the operation of the washing machine is completed. Neither of the signals Sm, Sw are produced in the initial state. Nor is produced the
10 control signal to be supplied to each of the display means 48-56.

(B) Function of controlling the dehydrating operation:

When the dehydrating period setting switch 45 is manually operated by an operator, the on signal is
15 supplied to the control circuit 57, which selects the dehydrating operation program as a program to be executed. Simultaneously, the control circuit 57 operates to set one of "FIVE MINUTES," "THREE MINUTES," "ONE MINUTE" and "A
20 QUARTER MINUTE" as an dehydrating operation period in accordance with the number of the on signals supplied to the control circuit 57 and further operates to actuate one of the display means 53-56 corresponding to the dehydrating operation period mode set, thereby illuminating the same. When the start switch 47 is operated to thereby
25 supply the control circuit 57 with an on signal, the dehydrating operation is controlled in accordance with the dehydrating operation program. In the dehydrating opera-

tion, the motor control signals Sm are continuously supplied to the drive circuit 58 for the period set, thereby energizing the motor 16. The water supply valve 35 is kept deenergized.

- 5 (C) Function of controlling the dehydrating-rinsing operation in accordance with the invention (see Fig. 9):

The built-in memory of the control circuit 57 stores data of a "CAREFUL" course program, a "STANDARD" course program, and an "ECONOMY" course program. When the course
10 selecting switch 44 is operated, one of these course programs is selected in accordance with the number of operation times of the switch 44. The control circuit 57 produces the control signals supplied to the display means corresponding to the selected course program, whereby
15 light is emitted from the display means, denoting the selected course program. Assume now that the "STANDARD" course program is selected. When the on signal is supplied from the start switch 47 to the control circuit
20 57, the control circuit 57 operates to control the dehydrating operation in accordance with the "STANDARD" course program as follows. In an initial cycle (for two minutes, for example), the valve control signals Sw are continuously supplied to the drive circuit 58 so that the valve is kept opened for the initial cycle, and the motor
25 control signals Sm are continuously supplied to the drive circuit 59 for a first one minute so that the motor 16 is energized. First and second control modes are alternately

executed cyclically after the initial cycle. In the first control mode, the motor control signals Sm are supplied to the drive circuit 59 for forty-five seconds, for example, thereby energizing the motor 16. Output of the valve control signals Sw is stopped while the motor 16 is being energized for the period C (45 seconds), thereby closing the water supply valve 35 or stopping the water supply operation. In the second control mode, the motor 16 is deenergized for one minute and forty seconds and subsequently the water supply valve 35 is energized. The valve control signals Sw are outputted for the motor deenergizing period D, thereby opening the valve and executing the water supply operation. A unit cycle including the first and second control modes are reiterated at a predetermined number of times (three times, for example). Subsequently, the motor control signals Sm are supplied to the drive circuit 59 for a predetermined time period, thereby energizing the motor 16 to execute the dehydrating operation. In the "CAREFUL" course program, the above-described unit cycle is reiterated four times, while the unit cycle is reiterated two times in the "ECONOMY" course program.

(D) Function of the control circuit 57 as water supply mode selecting means in accordance with the invention (see Fig. 10):

When the mode selecting switch 46 is operated in the midst of the above-described dehydrating-rinsing opera-

tion or when the mode selecting switch 46 is operated under the condition that any one of the "STANDARD," "CAREFUL," and "ECONOMY" course programs is selected by operation of the course selecting switch 44 in the initial
5 state, the course program previously selected is cancelled and a new course program is selected so that the total operation time period of the second control mode is protracted. In the embodiment, the operation time period of the second control mode in each unit cycle is selected
10 to be, for example, three minutes and twenty seconds, as shown in Fig. 10.

Operation of the dehydrating-rinsing apparatus will now be described. When the dehydrating-rinsing operation is executed with the control circuit 57 functioning as the
15 operation control means, the motor 16 is energized and driven and the water supply valve 35 is energized and opened in the initial state, as shown in Fig. 9. The dehydrating basket 18 is rotated at high speed by the motor 16 and simultaneously, the opening of the water
20 supply valve 35 allows the showering cylinder 25 to be supplied with water from the faucet through the water flow case 37, recessed portion 38a, and the opening 40. During an initial one minute (period A) for which the dehydrating basket 18 is being driven by the motor 16, the rotational
25 speed of the basket 18 is raised as shown in Fig. 11. When the motor 16 is deenergized, the dehydrating basket 18 is rotated owing to inertia and the rotational speed is

decreased (period B). While the dehydrating basket 18, including the showering cylinder 25 is rotated at relatively high speed, rotational centrifugal force causes water in the showering cylinder 25 to be discharged through the perforations formed in the peripheral side wall thereof. The water thus discharged from the showering cylinder 25 permeates the clothes in the dehydrating basket 18 and is then removed from the clothes together with detergent. In this case, the water supplied from the domestic water supply system pours into the recessed portion 38a and the water level exceeds the stepped portion 41a.

Upon completion of the initial cycle, the unit operation cycle is reiterated three times. In each unit operation cycle, the motor 16 is energized and the water supply valve 35 is deenergized in the period of the first control mode (period C). Subsequently, the motor 16 is deenergized and the water supply valve 35 is energized in the period of the second control mode (period D). Accordingly, the water containing detergent is discharged out of the basket 18 owing to the rotational centrifugal force due to rotation of the basket 18 during the operation period in accordance with the first control mode in the dehydrating-rinsing operation. Water is supplied to the showering cylinder 25 with the basket 18 rotated owing to inertia during the operation period in accordance with the second control mode. In an initial stage of the rotation of the basket 18 owing to inertia (stage F in

Fig. 11), the rotational speed of the basket 18 is relatively high and accordingly, a strong centrifugal force acts on the water. As a result, a large amount of water is discharged only through the perforations of the showering cylinder 25, as shown in Fig. 12. Therefore, the water discharged from the cylinder 25 firstly permeates the clothes placed near the center of the basket 18, then permeating the clothes placed near the inner peripheral wall of the basket 18. In a middle stage (stage G in Fig. 11) wherein the rotational speed of the basket 18 owing to inertia is decreased, an amount of water discharged through the perphorations of the cylinder 25 is reduced and the showering cylinde 25 is gradually filled with water. As shown in Fig. 13, the water starts to overflow the upper peripheral edge of the showering cylinder 25 as the amount of water discharged throught the perphorations thereof is reduced. When the rotational speed of the basket 18 owing to inertia is further decreased in a next stage H shown in Fig. 11, almost all the supplied water overflows the upper peripheral edge of the showering cylinder 25. The water overflowing the upper edge of the cylinder 25 flows through the openings 30 of the plate member 27 and the plate portion 28 of thereof into the grooves 22, formed on the inner peripheral wall of the dehydrating basket 18. Part of the water flowing through the openings 30 flows into the recessed portions 31 of the plate member 27. Some of the

water in the recessed portion 31 flows through the openings 32 into the grooves 22 and the other flows through the openings 33 into the grooves 22. The water thus flowing into the grooves 22 then permeates the upper
5 clothes. Even when the plate member 27 is eliminated, part of the water overflowing the upper peripheral edge of the showering cylinder 25 flows into the grooves 22 and the other water permeates the upper clothes, though less effective. Subsequently, the dehydrating basket 18 is
10 driven by the motor 16 in accordance with the first control mode. The water having permeated the clothes is removed therefrom to be discharged out of the basket 18. Water is then supplied to the showering cylinder 25 in accordance with the second control mode. The dehydrating-
15 rinsing operation is thus executed by reiterating the above-described unit operation cycle.

As understood from the invention as far as described, the water supplied to the showering cylinder 25 permeates the clothes through both the perforations of the cylinder
20 25 and the grooves 22 by alternately reiterating the first and second control modes cyclically by means of the control circuit 57. Consequently, since clean water containing no detergent may uniformly permeate all the clothes contained in the dehydrating basket 18 and then
25 be discharged, lack of uniformity in the rinsing of the clothes does not occur substantially.

Necessity of the control circuit 57 serving as a

water supply mode selecting means consists in such a case where a quantity of water supplied in a unit time period is decreased. When a quantity of water supplied from the faucet in a unit time period is decreased in the initial
5 cycle of the above-described dehydrating-rinsing operation, the water level in the recessed portion 38a is decreased below the stepped portion 41a of the water flow detector 42. In such a case, it is desirable that the mode selecting switch 46 is manually operated. When the
10 mode selecting switch 46 is operated, the on signal is supplied from the switch 46 to the control circuit 57, which operates to change the operation period of the second control mode from one minutes and forty seconds to three minutes and twenty seconds. The motor deenergizing
15 period may be increased and the water supply valve energizing period may be increased, as shown in Fig. 10. Consequently, an amount of water supplied to the washing machine is increased as compared with the state of condition before the mode selecting switch 46 is operated.
20 As a result, the total amount of water contributing the rinsing operation is not decreased even when a quantity of water supplied in a unit time period is decreased, and accordingly, the rinsing effect is not decreased. When the operator knows from experience when the water pressure
25 is decreased, operation of the mode selecting switch 46 may follow operation of the course selecting switch 44 under the initial stage of the dehydrating-rinsing operation.

The second control mode is changed as described above when the start switch 47 is operated.

A second embodiment of the invention will now be described with reference to Fig. 15. The total operation
5 period of the second control mode is attained by protracting the operation period of the second control mode of each unit operation cycle in the foregoing embodiment. In the second embodiment, the total operation period is attained by increasing the number of times of
10 the unit operation cycle, as understood from Fig. 15. That is, the number of times of each unit operation cycle is changed from the three times to the six times in the "STANDARD" course program. The number of times of each unit operation cycle is changed from the four times to the
15 eight times in the "CAREFUL" course program. The number of times of each unit operation cycle is changed from the two times to the four times in the "ECONOMY" course program. The same effect may be attained in the embodiment as in the foregoing embodiment.

20 Figs. 16-18 illustrate a third embodiment of the invention. Instead of the water flow detector 42 employed in the first embodiment, a water pressure sensor 61 is employed as the water flow detecting means in the third embodiment. Furthermore, the mode selecting switch 46 is
25 eliminated and instead, the control circuit 57 is provided with a function of discriminating whether or not the second control mode is changed. The water pressure

sensor 61 is provided at the outlet side of the water flow valve 35 to sense the pressure of water supplied through the water supply valve 35. The water pressure sensor 61 produces an electrical signal the level of which is in accordance with the value of water pressure sensed. The signal is supplied to an interface 62 shown in Fig. 17. Upon receipt of the signal from the water pressure sensor 61, the interface 62 operates to detect a digital value of the amount of water proportional to the value of the water pressure in accordance with the level of the electrical signal supplied thereto. The digital signal is supplied from the interface 62 to the control circuit 57. During the initial cycle of the dehydrating-rinsing operation, the control circuit 57 operates to discriminate whether or not the level of the digital signal supplied from the interface 62 is higher than a predetermined level. When the level of the digital signal from the interface 62 is higher than the predetermined level, the operation period D of the second control mode in each unit operation cycle is changed to "one minute and forty seconds." When the level of the digital signal from the interface 62 is lower than the predetermined level, the operation period D is changed to "three minutes and twenty seconds." The unit operation cycle is reiterated by a predetermined number of times with the operation period of the second control mode selected as described above, as in the first embodiment. In this embodiment, the number of times of the reiterated

unit operation cycle may be changed so that the total operation period of the second control mode may be protracted, instead of changing the operation period D of the second control mode in each unit operation cycle.

5 According to the third embodiment, a quantity of water supplied in a unit time period is automatically determined and the operation period D of the second control mode may be automatically changed, thereby simplifying the operation.

10 Although the initial cycle independent of the first and second control modes is executed at the initial stage of the dehydrating-rinsing operation in the foregoing embodiments, the first and second control modes may be executed with the initial cycle skipped over.

15 Figs. 19-22 illustrate a fourth embodiment of the invention. The fourth embodiment differs from the first embodiment in that the control circuit 57 has a function of operation control mode selecting means instead of the water supply mode selecting means. The control circuit 57
20 serves as an operation control mode selecting means when the mode selecting switch and the like are operated. In the selection of the operation control mode, the operation periods D and C of the first and second control modes are protracted, respectively. Fig. 19 shows a time chart with
25 respect to the normal dehydrating-rinsing operation, while Fig. 20 shows a time chart with respect to a dehydrating-rinsing operation in the case where both of the operation

periods D and C are protracted.

According to the fourth embodiment, the rinsing effect may not be reduced even where the dehydrating basket 18 is eccentrically loaded when a quantity of water supplied in a unit time period is decreased. Assume, for example, that the normal dehydrating-rinsing operation is started without operation of the mode selecting switch 46, as shown in Fig. 19. As the basket 18 is eccentrically loaded, the rotation speed of the basket 18 is increased only to 1350 r.p.m. as shown by broken line in Fig. 19, while the rotation speed of the basket 18 is increased to 1500 r.p.m. when the basket 18 is concentrically loaded, as shown by solid line in Fig. 20. Accordingly, the rate at which the water is removed from the clothes is decreased. However, the rinsing ratio as a criterion of the rinsing effect does not change so long as the quantity of water supplied in the unit time period is maintained at a predetermined value, as shown in Fig. 21. When the total amount of water supplied is decreased with the decrease of the quantity of water supplied in the unit time period, an amount of water permeating the clothes and removed therefrom is decreased. Consequently, the rinsing effect is reduced, as shown in Fig. 22. In the embodiment, however, the water flow detector 42 allows the operator to confirm that the quantity of water supplied in the unit time period is decreasing. Subsequently, when the mode selecting switch

46 is operated by the operator, the operation period C of
of the first control mode is protracted as shown in Fig.
20, thereby extending the period for which the motor 16 is
energized. As a result, the rotational speed of the
5 dehydrating basket 18 may be increased to the value of
1500 r.p.m. as shown by broken line in Fig. 20 and
accordingly, the dehydration ratio may be improved. Addi-
tionally, since the operation period D of the second
control mode is also protracted as shown in Fig. 20, the
10 water supply period may be extended. Furthermore, since
the total amount of water supplied is thus increased, the
rinsing effect may not be reduced even when the dehy-
drating basket 18 is eccentrically loaded in the case of
reduced amount of water supplied in a unit time period.

15 The foregoing disclosure and drawings are merely
illustrative of the principles of the present invention
and are not to be interpreted in a limiting sense. The
only limitation is to be determined from the scope of the
appended claims.



CLAIMS

1. A dehydrating-rinsing apparatus comprising:

- 5 a) a dehydrating basket driven by an electric motor and having a plurality of grooves formed on the inner peripheral wall thereof and extending from the upper end thereof to the bottom thereof;
- 10 b) a showering cylinder vertically extending from the approximately central bottom portion of said dehydrating basket, said showering cylinder having a peripheral side wall allowing the fluid to pass therethrough, an opened upper end, and a closed lower end;
- 15 c) water supply means for supplying water to said showering cylinder from the opened upper end thereof; and
- 20 d) operation control means for controlling an dehydrating-rinsing operation by alternately reiterating a first control mode wherein the motor is energized and the water supplying operation of said water supply means is stopped and a second control mode wherein the motor is deenergized and the water supplying operation of said water supply means is executed.

2. A dehydrating-rinsing apparatus as defined by claim 1, which further comprises water flow



rate detecting means, and water supply mode selecting means for selecting the total operation period of the second control mode in the dehydrating-rinsing operation.

3. A dehydrating-rinsing apparatus as defined by claim 2, wherein the water supply mode selecting means responds to the result of detecting operation of said water flow rate detecting means.

4. A dehydrating-rinsing apparatus as defined by claim 1, which further comprises water flow rate detecting means, and operation mode selecting means for selecting the operation time periods of the first and second control modes, respectively.

5. A dehydrating-rinsing apparatus as defined by claim 4, wherein the operation mode selecting means responds to the result of detecting operation of said water flow detecting means.

6. A dehydrating-rinsing apparatus as defined by claim 1, wherein each groove formed on the peripheral inside wall of said dehydrating basket has a depth as large as at least 0.4 times the width thereof.

7. A dehydrating-rinsing apparatus as defined by claim 1, wherein the depth of each groove formed on the peripheral inside wall of said dehydrating basket is



-30-

increased as each groove goes downwardly.

8. A dehydrating-rinsing apparatus as defined by
claim 1, which further comprises a plate member detachably
fitted around the inner upper end of said dehydrating
5 basket, said plate member including a plate portion and a
cylindrical portion coupled to said showering cylinder,
said cylindrical portion of the plate member being
provided with an opening placed above the plate portion.

9. A dehydrating-rinsing apparatus as defined by
10 claim 8, wherein said plate member has a recess formed in
the plate portion thereof, said recess having at the
bottom thereof perforations through which the water
passes.

10. A dehydrating-rinsing apparatus, substantially as
15 herein described with reference to the accompanying
drawings.
