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CONTROLLER OF A WASHING MACHINE

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AU 59916/90
AU 53805/86
AU 84595/75

(57) Claim

1. An operation controller of a washing machine comprising a washing tub, an agitating blade disposed in said washing tub rotatably, a motor for rotating said agitating blade and a control means for controlling operation of said motor, whereby a quantity of clothes is determined by resistance of clothes exerted on said agitating blade by rotation of said agitating blade which is measured plural times while a water level is changed from a low water level and calculation for said plurality of measured values is made to determine a kind of clothes.

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COMPLETE SPECIFICATION

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COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED:

Controller of a washing machine

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

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BACKGROUND OF THE INVENTION

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The present invention relates to operation control of a washing machine which detects a quantity and a kind of clothes and effects optimum operation control.

15 A conventional washing machine determines a flow of water and a washing time in accordance with only a quantity of clothes. For example, when the quantity of clothes is small, the flow of water is weak and the washing time is short, while when the quantity of clothes is large, the flow of water is strong and the washing time is long. Accordingly, when a small quantity of large-size clothes such as sheets and bath towels is washed, the washing force is weak, while when a large quantity of thin
20 clothes such as lingerie is washed, wear of the clothes is anxious. Thus, optimum operation control for the washing machine is not found.

SUMMARY OF THE INVENTION

25 In accordance with the present invention there is provided an operation controller of a washing machine comprising a washing tub, an agitating blade disposed in said washing tub rotatably, a motor for rotating said agitating blade and a control means for controlling operation of said motor, whereby a quantity of clothes is determined by resistance of clothes exerted on said agitating blade by rotation of said
30 agitating blade which is measured plural times while a water level is changed from a low water level and calculation for said plurality of measured values is made to determine a kind of clothes.



BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the present invention is hereinafter described, by way of example only, with reference to the accompanying drawings, wherein:

5 Fig. 1 is a sectional view of a fully-automatic washing machine according to an embodiment of the present invention;

 Fig. 2 schematically illustrates an operation panel;

 Fig. 3 is a circuit diagram schematically illustrating the whole configuration of a washing machine;

10 Fig. 4 is a circuit diagram for detecting a quantity of cloth;

 Fig. 5 shows an output of a quantity-of-cloth sensor; and

 Fig. 6 is a graph of measurement data showing detection of kinds of clothes.

DESCRIPTION OF THE PREFERRED EMBODIMENT

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An embodiment of the present invention is now described with reference to the drawings. A washing machine adopting the embodiment of the present invention, is, as shown in Fig. 1, includes an outer tank 4 of synthetic resins suspended in an outer frame 1 of steel plate by

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1 means of suspension rods 2 and vibration-proof devices 3
such as a coil spring or an elastic rubber. There are
four suspension rods 2 and four vibration-proof devices 3.

A washing and water-extracting tub 5 of
5 synthetic resins is rotatably disposed in the outer tank
in which washing water is accumulated. The washing and
water-extracting tub 5 is formed with a plurality of
water-extracting holes 5a and includes a rotator 6 such as
a pulsator or an agitator disposed at a center bottom
10 thereof. The washing and water-extracting tub 5 is
stopped from rotated or stands still in the washing and
rinsing operation and the rotator 6 is rotated clockwise
and counterclockwise. Further, the washing and water-
extracting tub is rotated unidirectionally in the water-
15 extracting operation. The rotator 6 and the washing and
water-extracting tub are rotated by a driving device 7.

The driving device 7 comprises a motor 8, a
transmission device 9 including a pulley 9a and a belt 9b
for transmitting rotation of the motor 8 to the rotator 6
20 or the washing and water-extracting tub 5, a clutch device
10 for rotating only the rotator 6 in the washing and
rinsing operation or for rotating the washing and
water-extracting tub 5 in the water-extracting operation,
a solenoid 7a for switching the clutch device 10 and a
25 drainage device 12 for draining water.

The driving device 7 is fixedly mounted on the
bottom of the outer frame 4 by means of a support steel
plate 15. The outer frame 4 is formed with an inlet 4c

1 connected to a P.S. tube 27 for transmitting a pressure of
water in the outer frame 4 to a water level sensor 26.

Disposed in an upper portion of the outer frame
1 is a top cover 19 of synthetic resins provided with an
5 opening 19a through which the washing is put into the tub
and an operation box 19b containing electric parts or
devices such as a controller and the like. The opening
19a is provided with a lid 20 of synthetic resin.

An operation panel 21 is mounted in the upper
10 surface of the operation box 19b and a solenoid-operated
type water supply valve 24 is provided in the operation
box 19b.

The water level sensor 26 disposed in the
operation box 19b detects a pressure of water in the outer
15 frame 4 to determine whether water is accumulated to a
prescribed water level or not. The water level sensor 26
includes a core, a coil, a spring and the like.

A controller for controlling the washing,
rinsing and water-extracting operation is disposed in a
20 container box 31.

A power switch button 29 and an external
operation switch 30 are disposed in the operation panel 21.

Fig. 2 shows the operation panel 21.

The operation panel 21 includes a display
25 portion 32, a ① operation portion 33 and a ② operation
portion 34. The display portion 32 displays information
concerning water level, water current, washing, rinsing,
water extraction and sensor monitor in response to the

1 state of operation. The ① operation portion 33 includes
selection switch buttons for selectively setting a water
level, a water current, a washing time, a rinsing course
and a water-extracting time. The ② operation portion 34
5 includes selection switch buttons for selectively setting
a bio-detergent course, a standard sensor level, a muddy
course and the like.

Fig. 3 shows a simplified circuit of the whole
configuration of the washing machine. A central process-
10 ing circuit 34 and a driving circuit 35 are integrated as
a controller and disposed within a container 31. There
are provided the motor 8, a drainage valve acting as the
drainage device 12, a selection switch for washing,
rinsing, water-extraction and the like, the water level
15 sensor 26 and a quantity-of-cloth sensor 37 for
determining a quantity of cloth.

Fig. 4 is a circuit diagram of the quantity-
of-cloth sensor 37 for determining a quantity of cloth.
The motor 8 for rotating the agitating blades and the
20 washing and water-extracting tub 5 of the washing machine
includes a phase leading condenser 8a connected there-
across. FLS's 38 and 39 are switches for switching the
rotation direction of the motor 8. A series connection of
resistors 40 and 41 and zener diodes 42 is connected
25 across the condenser 8a. A photo-transistor 43 is
connected in parallel with the resistor 41. An output of
the photo-transistor 43 is coupled with a base of a
wave-shaping transistor 44. An output of the transistor

1 44 is incorporated into a microcomputer of the central
processing circuit 34.

With the above configuration, when the power
switch button 29 is pressed to turn on a power switch and
5 the "standard sensor level" button of the external
operation switch 30 is pressed, the solenoid-operated
water supply valve 24 is energized in response to a signal
from the controller so that water is supplied into the
washing and water-extracting tub. At this time, the
10 solenoid 7a is also energized and the washing machine
becomes in a water-extraction state. The motor is driven
to be turned on for 0.5 second and turned off for 4
seconds so that the washing and water-extracting tub is
rotated slowly in one direction and the washing in the tub
15 is exposed to water uniformly.

When the water level sensor 26 detects that
water reaches the minimum water level, energization of the
water supply valve 26 and the solenoid 7a is stopped and
the motor 8 is energized for agitation. At this time,
20 since the clutch device 10 is in the water-extraction
state, the clutch device 10 is set in a washing state
exactly. Further, in order to prevent cloth from being
damaged or worn, the washing machine is operated for 8
seconds with reverse water current agitation stronger than
25 agitation for detection of a quantity of cloth and weaker
than normal agitation and turning on for 0.5 second and
turning off for 0.5 second, and the agitation for
detection of a quantity of cloth is then performed.

1 In the detection of a quantity of cloth, the
reverse agitation is made with turned on for 0.4 second
and off for 1 second and counter electromotive force of
the motor 8 generated when the rotator 6 is rotated by
5 inertia while the reverse agitation is off is detected as
a terminal voltage across the condenser 8a for driving the
motor 8. The counter electromotive force is converted
into a dc square pulse and a time t_1 between the pulses is
measured to determine a quantity of cloth. More parti-
10 cularly, when the washing is much, since a resistance to
the rotator 6 is large, the inertial rotation of the
rotator 6 is prevented and the time t_1 between the pulses
is long. On the other hand, when a quantity of the
washing is small, the time t_1 between the pulses is
15 short. The measurement of the time between the pulses is
made by measuring a time duration t_1 between rising edges
of a first pulse (A) and a third pulse (B) (Fig. 5)
full-wave detected by the circuit shown in Fig. 4. This
measurement is repeated 20 times and a total time thereof
20 is compared with times in a relation between washing
quantities and the times stored previously in the
microcomputer to determine a washing quantity so that
water level is automatically set in accordance with the
washing quantity and water is supplied to the water level.
25 Further, during the process of supplying water
to the optimum water level, a detection water level is
changed and the detection process of a quantity of cloth
is performed to measure a time duration t_1 between the

1 rising edges of the pulses. For example, when a washing
quantity of 4.0 kg is determined as a high water level,
the detection process of a quantity of cloth is performed
four times and the time durations t_1 between the rising
5 edges of pulses at various water levels for the washing
having different kinds of clothes (large-size clothes such
as sheet and bath towel and thin clothes of synthetic
fiber such as lingerie) are shown in Fig. 6.

(1) A difference ΔT between time durations t_1 of
10 the rising edges of pulses at the minimum water level and
the optimum water level is calculated.

(2) An average change rate m is calculated from an
approximate function of curves in the graph shown in Fig.
6.

15 Thus, the kind of clothes can be determined on
the basis of the difference ΔT between time durations t_1
of the rising edges of pulses and the change rate m in the
case when the detection water level is changed. For
example, since the values ΔT and m for the large-size
20 clothes such as sheet and bath towel are large whereas
those for the thin clothes of synthetic resin such as
lingerie is small, the values are compared with constants
in a table in accordance with kinds of clothes established
previously in the microcomputer in the controller to set a
25 strength of water current (an energization time for the
motor controlled by a ratio of on time and off time and a
rotational number of the motor), a washing time, a rinsing
time and a water-extraction time so that large-size

1 clothes are washed with strong water current for a long
time whereas thin clothes of synthetic resin are washed
with weak water current for a short time, so that washing
control can be made to match various clothes. Further,
5 since the difference ΔT and the change rate m calculated
by the determination method of a kind of cloth are
different depending on water levels (high, medium and low
water levels), the table constants for various cloths set
in the microcomputer of the controller can be set for each
10 water level to determine a kind of clothes with higher
accuracy.

In the foregoing description, a washing quantity
is determined by using the quantity-of-cloth sensor 37 and
a water level is automatically set in accordance with the
15 washing quantity. When a water level is set manually by a
user, the manual set has preference. Sensed data of a
quantity of cloth at the minimum water level is supplied
to the central processing circuit, while the washing
operation is made at the manually set water level. For
20 example, when a water level is manually set to a high
water level, supply of water is stopped at the minimum
water level to detect a quantity of cloth by the quantity-
of-cloth sensor 37 at its water level and water is then
added to reach a low water level to make the same
25 detection, and the same operation is repeatedly made at a
medium water level and a high water level. Further, when
the water level is manually set to the low water level and
the medium water level, the same operation is made until

1 the water level reaches the manually set water level.

According to the present invention, a quantity
and a kind of the washing can be detected to automatically
determine the optimum water current, washing time, rising
5 time and the like so that washing process can be set in
accordance with the quantity and kind of the washing to
improve washing force for large-size clothes and reduce
wear of thin clothes.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An operation controller of a washing machine comprising a washing tub, an
agitating blade disposed in said washing tub rotatably, a motor for rotating said
5 agitating blade and a control means for controlling operation of said motor, whereby
a quantity of clothes is determined by resistance of clothes exerted on said agitating
blade by rotation of said agitating blade which is measured plural times while a water
level is changed from a low water level and calculation for said plurality of measured
values is made to determine a kind of clothes.
10
2. An operation controller of a washing machine comprising a washing tub, an
agitating blade disposed in said washing tub rotatably, a motor for rotating said
agitating blade and a control means for controlling operation of said motor, whereby
a quantity of clothes is determined plural times, on the basis of a resistance of clothes
15 exerted on said agitating blade by rotation of said agitating blade, while a water level
is changed from a low water level to a predetermined water level and calculation for
said plurality of determination values is made to determine a kind of clothes.
3. An operation controller of a washing machine including a motor for driving
20 an agitating blade or a washing and water-extracting tub including an agitating blade
and control means for controlling energization to said motor, a quantity of clothes
being determined on the basis of a resistance of clothes exerted on said agitating blade
to determine an optimum water level, wherein detection for a quantity of clothes is
made plural times while a water level is changed from a minimum water level to a
25 maximum water level and the detected values are comparatively calculated to
determine a kind of clothes.
4. An operation controller of a washing machine according to claim 3, wherein
the detection for a quality of clothes is made at the minimum water level and the
30 maximum water level and a kind of clothes is determined on the basis of a difference
between the detected values at the minimum water level and the maximum water
level.



5. An operation controller of a washing machine according to any one of the preceding claims, wherein a kind of clothes is determined to control a strength of water current, a washing time, a rinsing time and a water-extraction time.

5 6. An operation controller of a washing machine substantially as hereinbefore described with reference to the accompanying drawings.

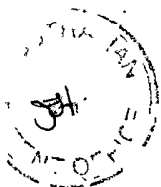
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DATED this 29th day of January, 1991

HITACHI, LTD.

By its Patent Attorneys

15 DAVIES COLLISON CAVE



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FIG. 1

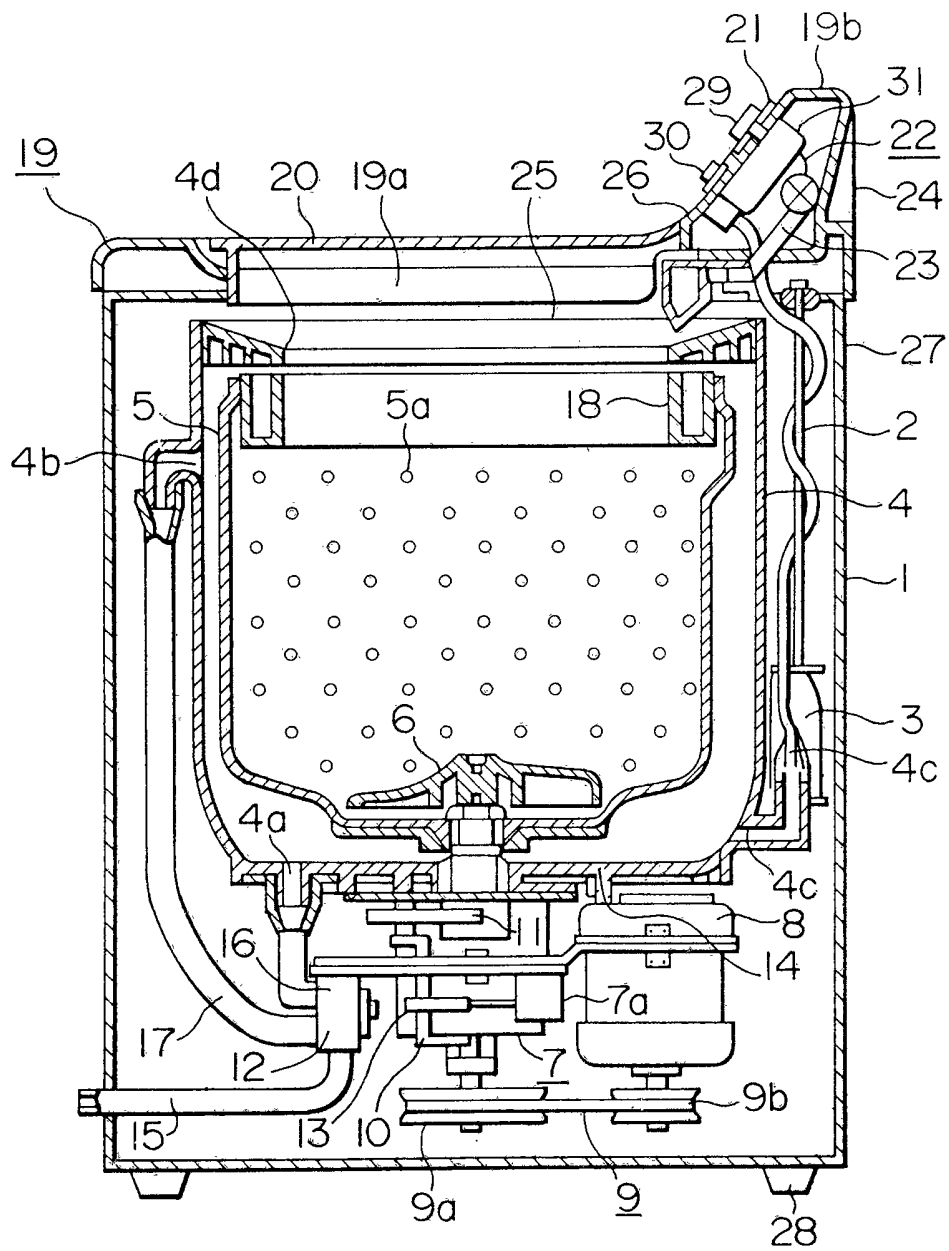
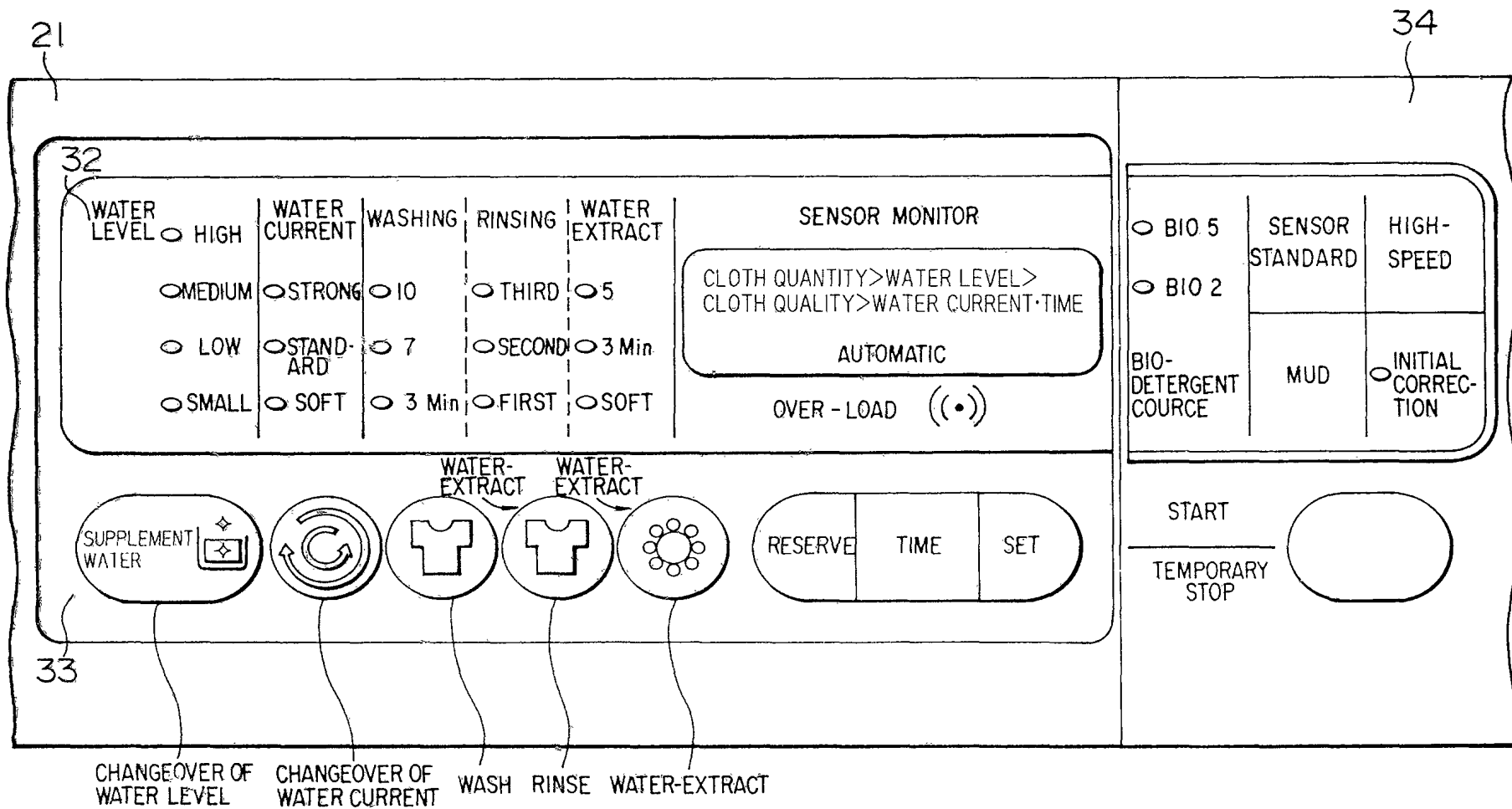


FIG. 2



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FIG. 3

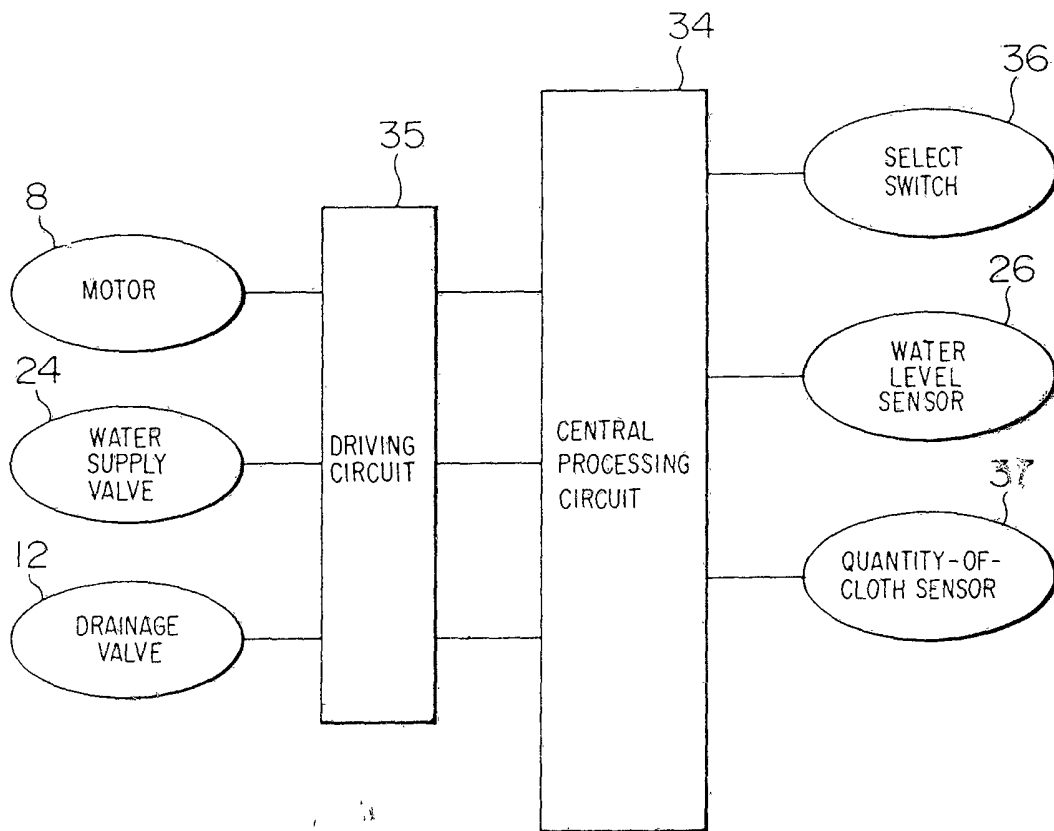


FIG. 4

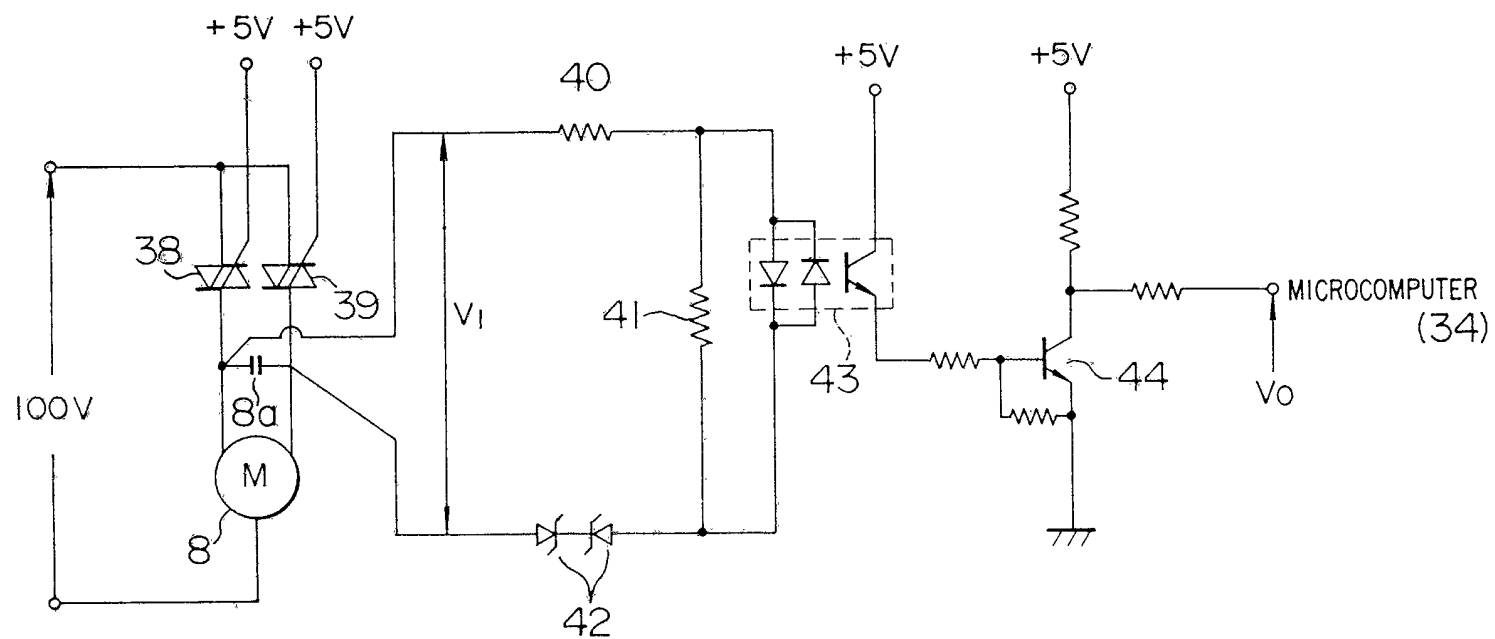


FIG. 5

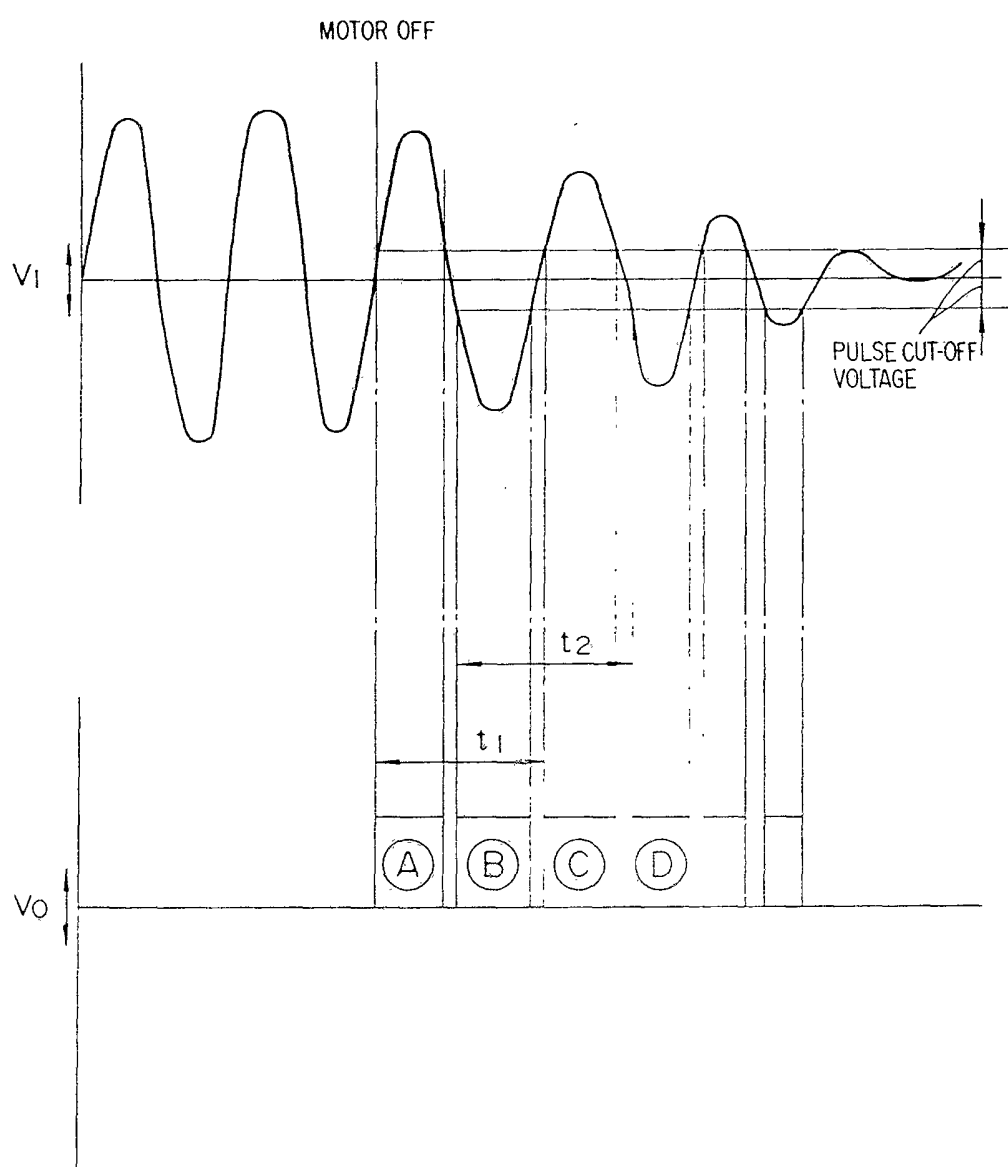


FIG. 6

