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(54) **Device for adjusting the metering of liquid and/or powder detergent or the like, particularly for industrial dishwashers.**

(57) A device is described for adjusting metering of liquid and or powder detergent, particularly for industrial dishwashers, which is reliable, economical, and does not require frequent maintenance of its components. The device comprises at least one sensor (2, 4) connected with the electric valve (3, 5) which controls the inflow of the water and is sensitive to the magnetic field generated by the latter during opening. The sensor, which is normally open, is closed by the magnetic field associated with the electric valve, and controls a suitable driving circuit (12) for the liquid detergent metering pump, or for a powder detergent metering system (14). The sensor is associated with a suitable electronic holding circuit, which keeps the same sensor closed during water supply, eliminating disturbing external influences.

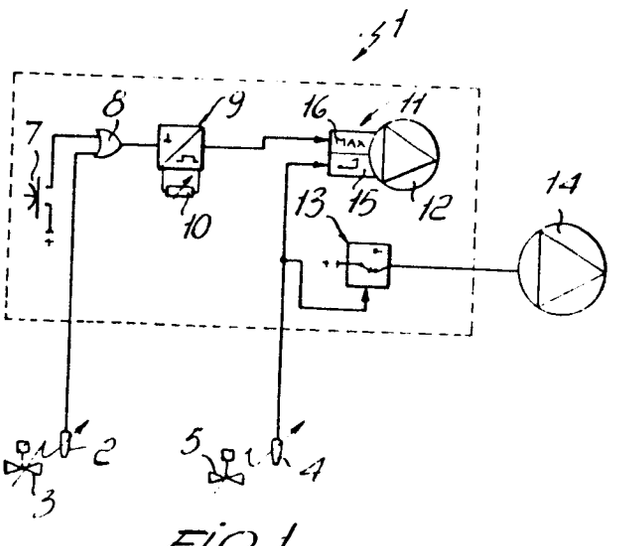

FIG. 1

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DEVICE FOR ADJUSTING THE METERING OF LIQUID AND/OR POWDER DETERGENT OR THE LIKE, PARTICULARLY FOR INDUSTRIAL DISHWASHERS

The present invention relates to a device for adjusting the metering of detergent or the like, particularly for industrial dishwashers.

As is known, two main types of industrial dishwashers are available: the first ones perform the entire washing process using only one tank, the second ones comprise a plurality of stations and tanks placed downstream of one another.

The washing cycle comprises at least two separate phases (washing and rinsing) which are performed in one or two tanks depending on whether a dishwasher of the first or of the second type is considered.

In the washing phase, it is necessary to have an adequate concentration of detergent, while in the rinsing phase metering of a shining agent or other additives is necessary. With dishwashers of the second type, the two meterings can both occur during the rinsing phase, by conveying the detergent directly to the washing tank, and the shining agent to the rinse water.

For each washing cycle there is a corresponding consumption of detergent, which must be compensated every time; one solution to automatically start the metering step can consist in synchronizing with opening of the electric valve of the rinse water. Currently for controlling the metering step several different systems are in use. A first system consists

of arranging in the washing water a number of sensors suitable for measuring the conductivity of the same. Since the conductivity of the water varies according to the amount of detergent introduced, from its measurement it is possible to deduce the amount of detergent which must be compensated. This system, though reliable, has however some disadvantages, due on one side to the complexity of the installation of such a system and on the other side to the continual and necessary immersion of the sensors in the washing solution. Indeed, these sensors easily become soiled, and therefore require frequent cleaning. This solution, therefore, is disadvantageous due to the high costs related to the need to frequently perform the maintenance of the sensors and to the work required for this purpose.

Another solution consists of starting feeding of detergent as soon as the water is feeded, continuing feeding for a preset time, independent from the single cycles, by means of an electric connection with the rinse electric valve.

Such a solution is disadvantageous since the installation of this system requires the intervention of a specialized electrical technician and the electrical connection with the electric valve is made troublesome by the fact that the supply voltage of the electric valve is not equal for all currently available dishwashers and at least five different voltages are presently used to which the metering system must adapt.

Finally, metering can be performed manually without the help of metering units, and is performed by the user, who pours in the tank an amount of detergent every time he deems this is necessary.

Therefore, the aim of the present invention consists of providing a device for adjusting the metering of detergent, particularly for dishwashers of the industrial type, which solves the above described disadvantages, and in particular ensures metering of amounts correlated with the existing needs, simplifying as much as possible the installation in order to allow the latter to be performed also by an electrically unskilled person.

Within the scope of this aim, a particular object of the present invention is to provide a device for adjusting the metering of detergent of the type described, capable of operating in a reliable manner, without requiring frequent maintenance of sections or components of the device itself.

Another object of the present invention is to provide an adjustment device as indicated which does not have excessive manufacturing and installation costs, so as to allow its use in dishwashers of every kind without having to perform electrical connections on the latter.

Not least object of the present invention is to provide a device for adjusting the metering of detergent of the type indicated, which does not interfere with the other components and elements of the dishwasher, compromising their operation.

The aim described, the objects referred to and others which will better appear hereinafter, are achieved by a device for adjusting the metering of liquid and/or powder detergent, in particular for dishwashers, of the type defined in the appended claim 1.

Further features and advantages will become apparent from the description of a preferred, but not exclusive, embodiment, illustrated by way of example only in the accompanying drawings, where:

Fig. 1 is a schematic overall diagram of the device according to the invention; and

Figs. 2a and 2b illustrate the detailed electrical diagram of the device according to Fig.1.

Fig. 1 shows a schematic explanatory diagram in the case of use for controlling an industrial-type dishwasher, in which in a first phase the dishes are treated with water mixed with detergent and in a second phase the dishes are treated with water mixed with a shining agent. With reference therefore to Fig. 1, the device has been indicated generally with the reference numeral 1. The device 1 comprises a pair of sensors, respectively 2 and 4, intended to detect the inflow of the washing and rinsing water, and to be mechanically anchored to the respective electric valves. The correct positioning of the sensor is indicated by the impulsive lighting of a LED warning light.

In particular, the sensor 2 for detecting the washing water is associated with the electric valve 3

arranged on the water line for filling the tank, while the sensor 4 is associated with the electric valve 5 for supplying the rinse water, which valve is also arranged on the water line. The sensor 2 is connected to a timing device 9, with interposed an OR gate 8 which also receives the signal supplied by a manual push-button 7. The timing device 9 includes a potentiometer 10, which can be operated from the outside, so as to allow variation of the detergent feed time. To this end, the device 9 generates an electrical signal which is supplied to a device 11 for controlling the detergent feed pump 12. This device 11 is divided into two sections, i.e. a section 16 for maximum detergent feed and a section 15 for adjusting the flow-rate of the detergent as required. This last section 15 is controlled by the sensor 4 which also controls an operating switch 13 for operating a shining agent feed pump 14, so as to allow feeding of the shining agent only during the time in which the rinse water inflows.

The device according to Fig.1 operates as follows. Initially, with the first washing of the day, feeding of detergent into the washing water is performed, either manually, by means of the button 7, or automatically by means of the sensor 2 associated with the electric valve 3 which allows direct feeding of water into the tank. In this case the amount of detergent fed is independent from the flow of water, but depends upon a fixed time, which is adjustable by means of the potentiometer 10. In this case detergent

feeding occurs at maximum frequency or flow-rate, since it is necessary to supply detergent from scratch. In the subsequent washing cycles, instead, only the sensor 4 is operative, which, when it detects the supply of rinse water in the respective station, controls compensation of the detergent used up in the washing tank and simultaneously feeding of shining agent in the rinse zone. It should be noted that the amount of detergent for compensating is related to the water fed for rinsing, since the more detergent is taken away by the dishes which pass from the washing station to the rinsing one, the more detergent is to be added for compensation in the washing station and the more water is required for rinsing the plates. In this manner, with a very simple solution, it is possible to correlate the amount of detergent to be metered to the inflow of water, eliminating the need to introduce appropriate sensors in the washing liquid, and thus eliminating the problems of frequent maintenance related thereto. Furthermore, the solution described allows the simultaneous control of the pump of the shining agent, correlating the latter as well to the amount of water fed.

To provide the sensors which detect the inflow of water, for washing or rinsing, reeds are appropriately employed which are sensitive to the magnetic field generated by the electric valves, and which are therefore suitable for closing at the inflow of water. However, due to the high sensitivity of these switches, they tend to vibrate, opening and closing, with the

frequency of the power supply voltage of the electric valves themselves, which are controlled by the mains voltage. Therefore, to avoid an early breakage of these reeds (which depends on the number of switchings of the same) it is necessary to provide a holding circuit which generates a magnetic field greater than the one generated by the electric valve, so as to keep the reed closed. Furthermore, to allow opening of the reed at the end of the water feed, a circuit is therefore provided which cyclically disconnects the holding circuit, so that the associated reed has the possibility of opening in case of lack of the magnetic signal generated by the electric valves, thus indicating the end of the water feed, and therefore also of the detergent and of the shining agent.

A circuital solution for implementing the holding circuit and the related disconnection device for controlling the state of the electric valve is shown in Figs. 2a and 2b, which also illustrate a circuital solution related to the entire device.

With reference to these figures, the device according to the invention can be thought of as being composed of a plurality of sub-units or sections 20-26 each suitable for performing a specific task. In particular, in Fig. 2a a unit 20 is shown, which operates as an oscillator and is suitable for generating the control impulses for the pump and for disconnecting the holding circuits for the sensors, indicated with the same reference numerals of Fig. 1. The device furthermore comprises a timer section 21, a

section 22 connected to the sensor 2, a section 23 connected to the sensor 4, a memory section 24 discriminating between feeding of the first washing water of the first cycle of the day and the subsequent ones, and the section 25 for pre-driving the pump. Furthermore, Fig. 2b shows the output section 26, comprising the supply circuits, and the control section for the shining agent feed pumps, as well as safety level sensors.

In detail, the section 20 comprises an oscillator, indicated in its entirety at 30, implemented through integrated circuits and suitable for generating sequences of impulses the duration of which can be varied by means of the potentiometer 33, through a pair of switches 31 and 32. These switches operate alternately so as to connect the two inputs indicated with x in the presence of a control signal on the input c. In particular, the switch 32 is closed at the first loading of washing water of the day, due to the reception of an adequate signal on the line 48 originating from the memory section 24. Practically, when the two inputs x-x are reciprocally connected, the potentiometer 33 is bypassed, thus obtaining maximum-duration impulses suitable for controlling the metering of detergent for the first washing of the day, when the entire amount of detergent must be fed to the washing water. In this case the switch 31 is open. Conversely, in the subsequent washing cycles the switch 32 is opened and on the c input of the switch 31 a suitable signal is sent which allows for the

connection of the two x inputs of 31, which thus inserts in the circuit the potentiometer 33 for adjusting the duration of the impulses. The actuation of the switch 31 occurs through the line 90 by the memory section 24, which sends on this line also the reset signal for the timing section 21. The latter essentially composed of an integrated circuit 34, the counting time of which depends on the adjustment of a potentiometer 35, which can be controlled from the outside.

As has already been described, each sensor is composed of a reed switch associated with a holding circuit. The sensor 2 comprises therefore the reed 36, around which a coil 37 is wound (although, for clarity sake, the reed 36 has been shown as extending near the coil 37), which coil is suitable for generating a holding magnetic field when it is appropriately fed. Indeed, one terminal of the reed 36 is connected to the positive power supply which, due to closure of the reed 36, is supplied at the NAND gate 38 which, if a positive impulse is present on the line 53 at the output of the oscillator 20, actuates an inverter 39 which in turn drives an amplifier stage 40 connected with the coil 37. In this way, feeding of the coil is obtained, which generates the holding magnetic field, and therefore the persisting of the closed condition of the reed 36. The water inflow detection signal thus generated by the reed 36 is thus sent to a pair of inverters 42 and 43 and then, through the transistor 44 and the line 45, to the memory stage 24.

It should be noted that the line 45 also receives the signal generated by closure of the push-button 7, if manual control of the detergent feed is desired.

The line 45 is connected to an input of the memory flip-flop 46 which memorizes the state of first washing water metering, generating a suitable signal on the output 48 which controls the switch 32, causing the behaviour already described of the oscillator 20 and simultaneously actuating a similar switch 61 in the pre-driving stage 25. Simultaneously the output 49 of the flip-flop 46 will assume an inverted state which, through the line 90, excludes the switch 31 and activates the counter 34. At the end of the time period programed by means of the potentiometer 35, the same will send a suitable signal on the line 57 which, through the inverter 58, will be supplied to the input 47 of the flip-flop 46, thus causing its switching. Consequently the switch 32 and the switch 61 will be disabled, while the switch 31 is closed, with the related insertion of the potentiometer 33 in the circuit, as well as the switch 60 in the pre-driving section 25. In this way the device is preset for the intervention of the sensor 4, for compensating the detergent in the washing zone and the shining agent feed in the rinsing zone.

The section 23, related to the sensor 4, is provided similarly to the section 22 related to the sensor 2. In particular, the sensor 4 is also composed of a reed switch 50 wound by a coil 51 and connected with one terminal to the positive power supply. Again,

the coil 51 has been shown as extending near the reed 50. The reed 50 is furthermore connected at the other terminal with an input of a NAND gate 52 which, as a consequence of receiving a positive impulse on the line 53 from the generator 20, sends a suitable control signal to the inverter 54 which drives the Darlington 55, thus allowing for the closing of the supply circuit for the coil 51 and therefore holding of the reed 50.

In this way, as in the preceding case, the reed 50 can be held closed in a reliable manner. However, to allow the occasional disconnection of the coil 51 and to check the state of the water inflow, the output signal to the generator 20 is fed to the holding circuits through the line 53. Therefore, when on this line a low signal appears, NAND 52 switches in the high state, and therefore the coil supply circuit opens. Consequently the reed 50 is no longer subject to the magnetic field generated by the coil and, in case the excitation of the electric valve 5 associated with the rinse water feed is ended, the reed 50 opens, with the consequent generation on the line 56 of a pump deactivation signal. As a consequence the switch 60, which is closed by the signal generated by the memory stage 24, sends on the input of the NAND 63 a signal which corresponds to the feeding or not-feeding status of the water. Consequently, the output of the gate 63 supplies a signal the polarity of which actuates or not feeding of the detergent metering pump, as will be explained hereinafter. It should be noted that the

gate 63 allows control of the detergent pump according to the impulses generated by the generator 20 and as supplied on the input 91 according to the enabling signal supplied from the switch 60 or from the switch 61, depending on the operating status of the machine. These impulses are then sent to the transistor 64 and then fed to the LED 65 (see Fig. 2b) which cooperates with a phototransistor 66. During the negative impulses of the signal fed to the phototransistor 66, the latter generates an ignition signal for the gate electrode 67 of an SCR 68 suitable for passing the supply voltage (fed on the terminals 69 and 70) to the output 78 which leads to the detergent metering pump. For this purpose, the A.C. voltage is rectified through the diode bridge 76 and sent in output through the SCR 68. The A.C. voltage is also supplied to the transformer 71, a secondary 73 of which is connected with the supply section, feeding the entire device, and another secondary 74 of which is connected to a filter circuit 75 and fed to the transistor 92 for driving the SCR 68.

The circuit furthermore comprises a stage for verifying the presence of detergent in the container, composed of a level sensor comprising a reed 80, suitably connected to the positive power feed through a related resistor 81 and associated with a system able to hold the reed 80 in the closed state in presence of a sufficient amount of detergent. In particular, when the amount of detergent is smaller than a preset level, the reed 80 opens and the LED 65 is fed. The positive

signal supplied by this reed then disables the driving stage of the detergent pump, preventing its operation in situations of lack of detergent. This condition is indicated by means of the LED 79, arranged so as to be visible from the outside.

The circuit of Fig. 2b is completed by the control stage of the shining agent pump. This stage substantially comprises a relay 84 arranged in parallel to the coil 51 of the sensor 4. Thus, when the reed 50 closes, the relay 84 is fed and consequently the contact 86 switches from the inactive position at 88 to the position of contact with the terminal 87, and therefore the A.C. voltage taken from the terminal 70 is fed towards the output terminal 89, and the related shining agent pump is fed power. As a result, as a consequence of the detection of the metering of the rinsing water, the shining agent pump is also fed power simultaneously, which pump meters the shining agent in the appropriate zone; it should be noted that the possible openings of the relay 50, caused by the temporary disabling of the holding circuit for controlling the water metering, are filtered out through the holding capacitor 87 which keeps the relay 84 excited until the relay 50 finally opens at the end of the water feed.

As can be noted from the preceding description, the invention fully achieves the aims proposed. Indeed, a device has been provided which allows to control in a reliable manner the feed of detergent in dishwashers and the like. Indeed, the device according to the

invention correlates the amount of detergent to be metered with the amount of water supplied, without requiring the use of elements immersed in the water itself and therefore subject to maintenance.

The control of the supply pumps for detergent and shining agent as a consequence of the detection of the magnetic field generated by the electric valves for controlling water metering is particularly reliable, without the possibility of errors, with a conceptually and productively simple solution.

The use of reeds for this purpose is extremely advantageous due to the simplicity of these elements and to their simple use.

The solution adopted to prevent the continuous switching of these switch elements due to the mains frequency also allows to obtain a device with a longlasting operative lifespan, which does not require frequent interventions by specialized personnel and the replacement of the sensors themselves.

The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept. In particular, though the device has been described with particular reference to an industrial-type dishwasher with numerous washing and rinsing stations for the dishes, it is possible to use the same concept for dishwashers, still of the industrial type but with only one treatment zone, in which, e.g., a same sensor meters the detergent in the washing water, and then meters the shining agent, or in systems where metering

of a substance should be related to the inflow of water or other liquids.

Furthermore, all the details may be replaced by other technically equivalent ones.

CLAIMS

1. Device for adjusting the metering of liquid and/or powder detergent or the like, in particular for dishwashers of the industrial type, characterized in that it comprises means (2, 4) for sensing a magnetic field generated by the opening of electric valves controlling the flow of water or the like, said means (2, 4) generating a feed signal to a metering device (12) for metering the detergent or the like during the water inflow period.

2. Device according to Claim 1, characterized in that said sensing means (2, 4) comprise switches (36, 50) sensitive to magnetic attraction, arranged proximate to the electric valves (3, 5) for controlling the inflow of water, said switches being normally open and closing for sending said feed signal to said metering device (16) as a consequence of the detection of the magnetic field associated with the actuation of said electric valves.

3. Device according to Claim 2, characterized in that said switches are composed of reeds (36, 50).

4. Device according to one or more of the preceding claims, characterized in that proximate to each of said reeds (36, 50) holding means (37, 51) are provided generating a magnetic field for holding said reed in the closed state and avoiding switching of said reeds at the frequency of the mains power supply.

5. Device according to one or more of the preceding claims, characterized in that it comprises timing means (30) temporarily and cyclically switching

off said holding means (37, 51), thereby allowing the possible opening of said reeds (36, 50) at the end of the water inflow.

6. Device according to Claim 1 or 2, characterized in that it comprises a first sensor associated with the electric valve (3) for the inflow of the washing water and a second sensor (4) associated with the electric valve (5) of the rinsing water, said first sensor (2) being connected to a timing element (9, 34) with an adjustable time constant (10, 35) controlling said detergent metering device (12) at the maximum flow-rate for a time interval equal to said time constant, and said second sensor (4) controlling said metering device (14) with an adjustable flow-rate, said second sensor (4) being furthermore connected to a switch (13, 86) allowing feeding of the metering device (14) for the shining agent during the rinse water metering period.

7. Device according to one or more of the preceding claims, characterized in that it comprises a section (30) for generating switching impulses for the detergent metering device, said section comprising means (33) for adjusting the duration of said impulses and switches (31, 32) for actuating and disabling said impulse duration adjustment means (33), a timer (21) connected to said first sensor (2) and having metering means of the time constant and suitable for generating an end-signal, said end-signal being fed to said switches (31, 32) for actuating said impulse duration adjustment means (33), a memory element (46), connected

to said first sensor (2) and to said timer (21) for receiving said end-signal, a pre-driving section (25) receiving said switching impulses and controlling an opto-electronic device (65, 66) actuating a solid-state static switch (68) allowing feeding of the supply voltage to said metering device (12) according to said switching impulses.

8. Process for adjusting metering of liquid and/or powder detergent or the like, in particular for dishwashers of the industrial type, characterized in that the detergent is metered for a time equal to the metering time of the water.

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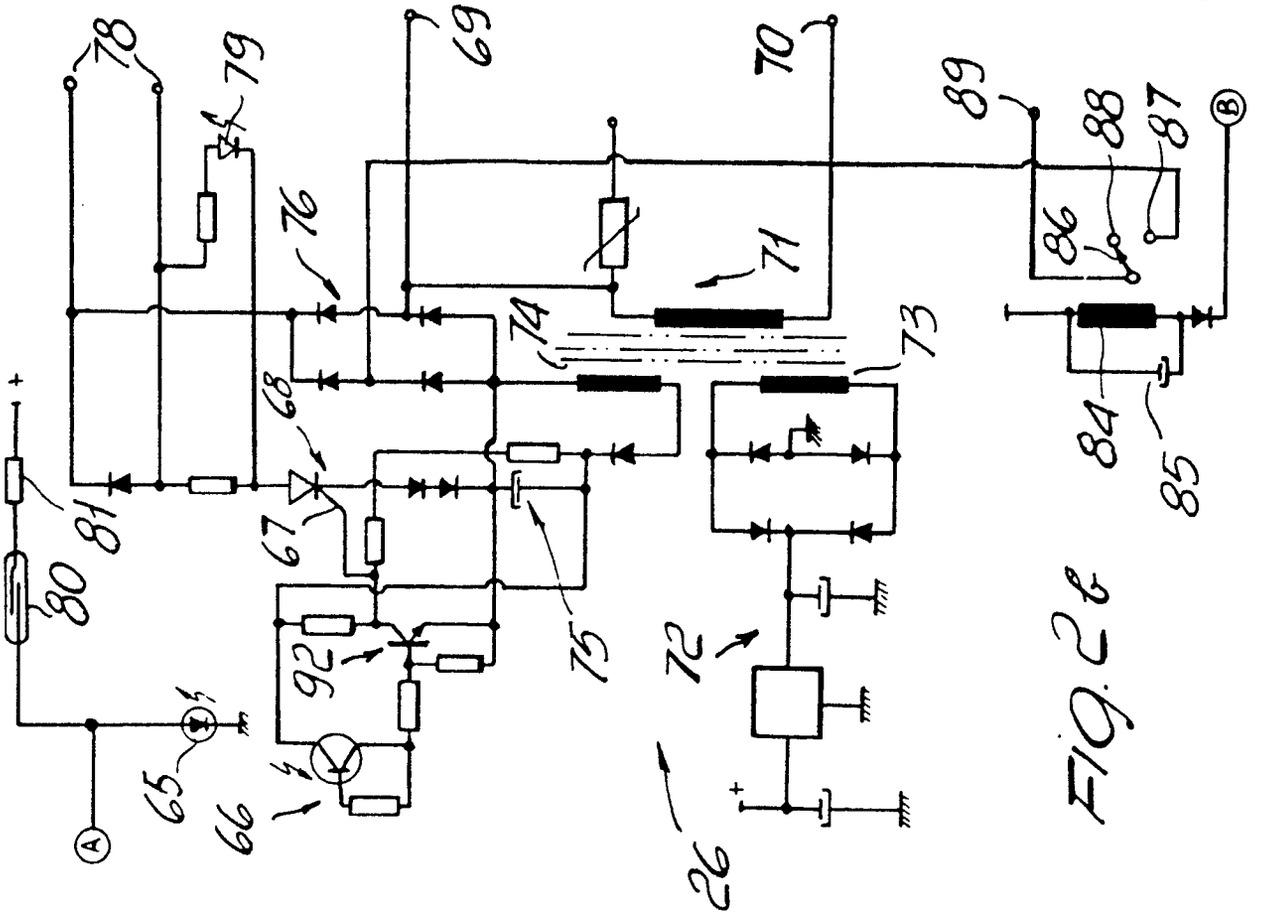

FIG. 2a

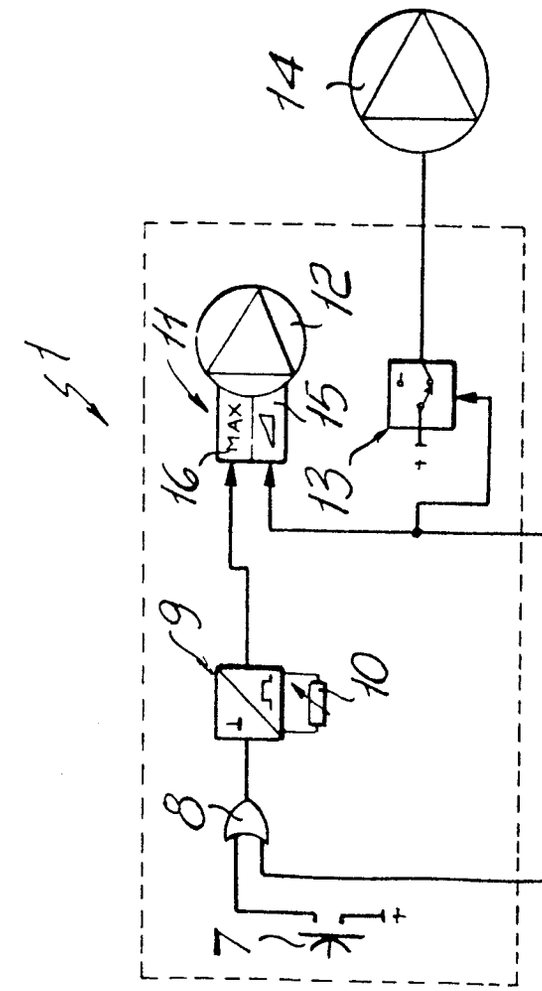

FIG. 1

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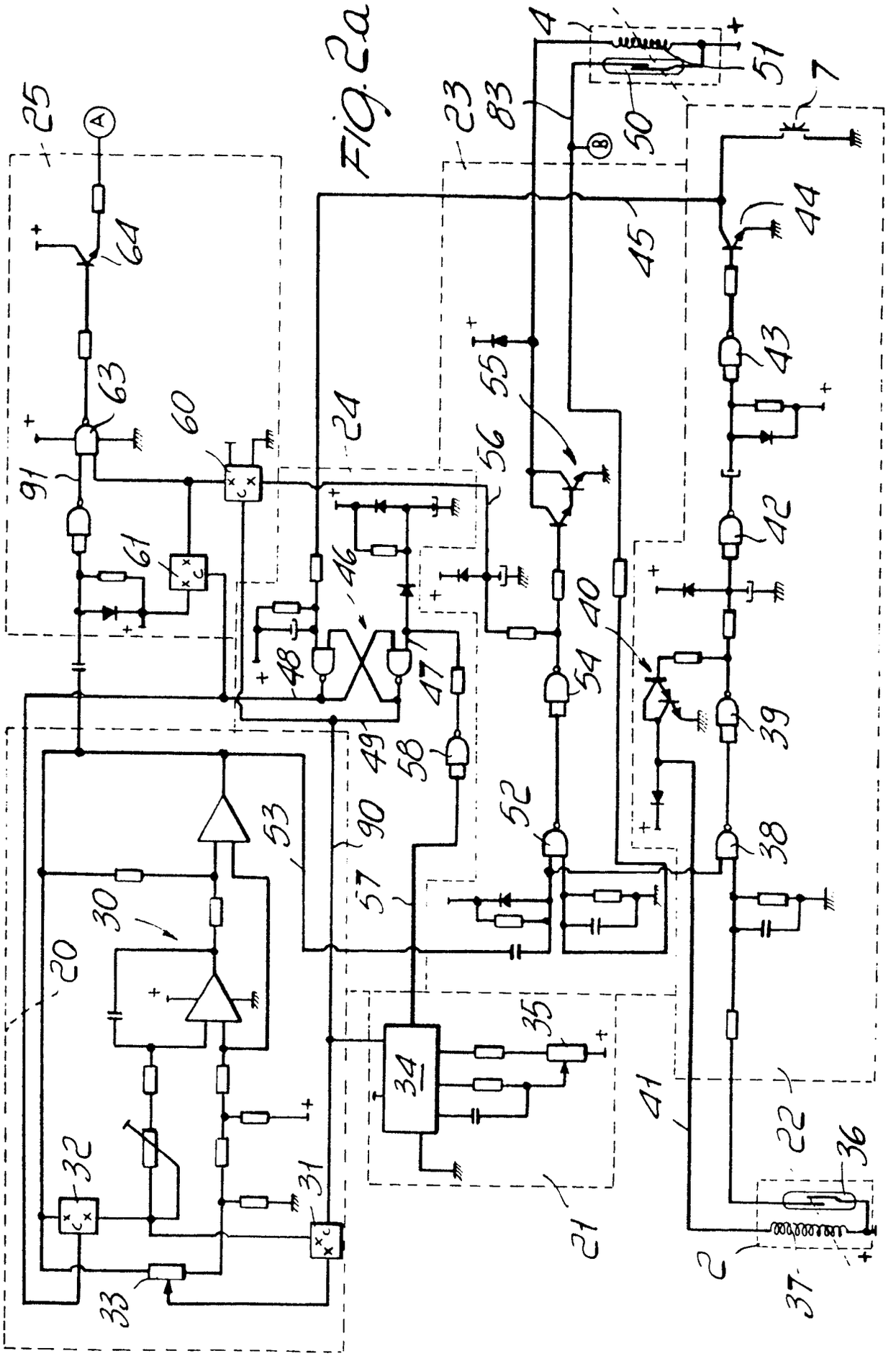
Fig. 2a
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