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(54) Title: START AND RUN DEVICE FOR SINGLE PHASE MOTORS AND START AND RUN SYSTEM FOR SINGLE PHASE MOTORS

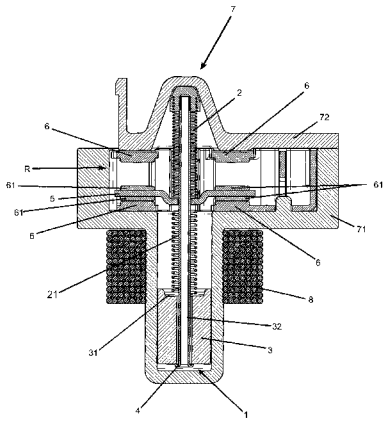

FIG. 1

(57) Abstract: The present invention refers to a start and run device for single phase motors, more specifically to be applied in refrigeration motors with CSR-type (Capacitor Start and Run, also known as CSCR Capacitor Start Capacitor Run) and RSCR-type (Resistance Start Capacitor Run) motors. Said start and run device for single phase motors in accordance with the present invention comprises an anchor 1 composed of springs 2 and 21, magnetic core 3, rivet 4 and a bridge containing a relay R defined by four fixed contact pads 6 and four mobile contact pads 61, wherein such contacts 6, 61 are subdivided into two pairs disposed in preferably parallel position, wherein said anchor is disposed inside a carcass 7 defined by casing 71, cover 77 and spool 73, wherein magnetic thread winding 8 of the device is disposed in the outer lower region of said carcass 7 so as to substantially wrapping the magnetic core 3.

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"START AND RUN DEVICE FOR SINGLE PHASE MOTORS AND START AND RUN SYSTEM FOR SINGLE PHASE MOTORS"

Field of the Invention

The present invention refers to a start and run device for single phase motor, more specifically, intended to be applied in refrigeration compressors using CSR-type (Capacitor Start and Run, also known as CSCR Capacitor Start Capacitor Run) and RSCR-type (Resistance Start Capacitor Run) motors.

The present invention also refers to a start and run system for a single phase motor, which is constituted by the presently disclosed start and run device for a single phase motor.

Background of the Invention

As known in the art, CSR-type motors use two types of capacitors: one of them is named "Start Capacitor" that generates a high initial torque and, thus, starts the motor; and the other is named "Functioning Capacitor or Run Capacitor) which generates benefits in the performance during the functioning regimen. Due to different needs for the motor at the starting time and in the functioning regimen, a "Start Capacitor" must be shut down from the circuit after starting. US Patent 4,012,678 refers to a circuit for single phase motor employing a start and run capacitor which carries out the switching of the electrical connections based on the motor shaft speed.

With regard to RSCR-type motors, they are only equipped with the so-called "Functioning Capacitors" or even with "Run Capacitors" in which, in order to be possible to provide a gain in the start torque, there could not occur current circulation through the Functioning Capacitor (by-pass) during the motor starting. Thus, in order to get the benefits of performance after the starting, a Functioning Capacitor should return to the motor circuit.

Nowadays, compressors/CSR-type motors use a motor starting key named "Voltage Relay or Potential Relay" which acts based on the voltage generated in auxiliary winding, disconnecting the Start Capacitor when this is no longer necessary. Nevertheless, this device presents the drawback of relative high costs, thereby making its use impracticable. US Patent 5,561,357 refers to a start capacitor to be electrically connected to the permanent capacitor of the motor, providing the use of a mix between voltage relay and current. Nevertheless, it contemplates using a conventional two-terminal relay, which, as mentioned, incurs in high costs of purchase and use, and in a piece of high dimensions, mainly due to the need for increasing electrical and mechanical robustness in function of the start current magnitude.

Other existing forms of "starting key" for these (CSR- and RSCR-types) motors are usually called PTC (Positive Temperature Coefficient) and RSP (Relay in series with PTC), made of a ceramic pad, which, when heated by a current passing therethrough, increases electrical resistance and decreases the current until same comes practically to zero, thereby

executing a function similar to that of voltage relays. Example of such a device is disclosed in US Patent 6,456,470. Said starting keys, however, present some drawbacks: they cause the start torque to decrease, require a high electric power consumption, need a reasonable time between the motor starts motor and incur considerable costs.

It is consensus that the costs for a "start key" named "Current Relay" applied to RSIR- and CSIR-type motors are substantially lower than that of "Voltage Relay" which, however, in function of its construction features comprising two contacts (used for relative low power) e due to its costs, is difficult to use in compressors, mainly in refrigeration systems.

The object of US Patent 4,313,076 is to provide a dynamoelectric machine (e.g. an electric motor) using a main winding and an auxiliary winding which is divided into a phase winding and two auxiliary windings, one in phase and the other in counter phase so as to adapt a motor functioning to torque demand using for that a four-contact relay. Nevertheless, such an embodiment also incurs high costs due to the number of additional elements required for its construction and functioning.

Finally, it is observed that the present state of the art lacks a start and run device for single phase motors which would allow for switching a start capacitor and run capacitor in a robust form and based on current variation of the main winding which, additionally, also can be provided at low costs and, thus, it can be widely used, mainly in the manufacture of refrigeration compressors.

Objects of the Invention

Therefore, one object of the invention is to provide a start and run device for single phase motors to be used, mainly, in refrigeration compressors having CSR- and RSCR-type induction motors.

Another object of the present invention is to provide a "starting key" having four contacts (2 pairs) suitably disposed to switch the start capacitor (with or without load resistor) and the functioning of the capacitor in a robust form and based on the variation of the main winding current.

A further object of the invention is to provide a starting key at relatively low costs.

Additionally, another object of the present invention is to provide a start device defined by a magnetic core comprising a differentiated physical and geometrical configuration capable of improving the overall equipment functioning.

Summary of the Invention

The above-mentioned objectives are achieved by means of a start and run device for single phase motor, which comprises at least an anchor disposed within at least a carcass and constituted by at least one magnetic core and at least a bridge containing at least a relay.

According to the present invention, said start and run device for single phase motor further comprises at least a magnetic thread winding and it stands out because its relay comprises at least four fixed contact pads and four mobile contact pads, subdivided into at least two pairs.

Therefore, it is verified that a start and run device for single phase motor, which is provided with means to allow a current relay to switch a start capacitor and functioning capacitor based on the current variation of the magnetic thread winding, is disclosed.

According to a preferred embodiment of the present invention, the start and run device for single phase motor comprises a magnetic core containing a central hole and an upper surface defined by a central recess. It additionally comprises at least a return spring and at least a buffer spring.

The objects, as outlined above, are also achieved by the start and run system for single phase motor, which comprises a single phase motor, at least a start capacitor, at least a functioning capacitor and a sole start and run device for single phase motor integrated by only one relay comprised of at least four fixed contact pads and four mobile contact pads, wherein said fixed contacts and mobile contacts are subdivided into at least two pairs.

According to the invention, in the system in question, the lower mobile contacts close the circuit of the lower fixed contacts during functioning at low current or unpowered. In this event, the functioning capacitor is actuated and the upper fixed contacts remain open to turn off the start capacitor.

On the other hand, the upper mobile contacts close the circuit of the upper fixed contacts during functioning in the starting or at high current. In this case, the start capacitor is actuated and the low fixed contacts remain open to turn off the functioning capacitor.

Brief Description of Drawings

A preferred embodiment of the present invention will be described in detail based on the figures listed below, wherein:

Fig. 1 illustrates a schematic longitudinal cross-cut view of the start and run device for single phase motors in accordance with the present invention;

Fig. 2 illustrates a perspective view of the device core represented in Fig.1;

Fig. 3 illustrates a longitudinal-cut view of the core of Figure 2;

Fig. 4 illustrates a schematic perspective view of a core with rivet for the device in accordance with the present invention; and

Figs. 5.1 and 5.2 illustrate electrical systems of the device in accordance with the present invention by using four contact relays in the compressors/CSR- and RSCR-type motors, respectively.

Detailed Description of the Invention

As can be seen from figures listed above, the start and run device and system for

single phase motor in accordance with the present invention are intended to switch the actuation between the CR start capacitor and CF functioning capacitor to allow the start and run of a single phase motor to occur.

Fig. 1 illustrates a preferred embodiment of the start and run for single phase motor, which is defined by anchor 1 composed of a return spring 2, a buffer spring 21, a magnetic core 3, a rivet 4 and a bridge comprising an R relay defined by four fixed contact pads 6 and four mobile contact pads 61, wherein said contacts 6, 61 are subdivided into two pairs, preferably in parallel position. Anchor 1 is disposed inside a carcass 7 defined by a casing 71, cover 72 and a spool 73, wherein a magnetic thread winding 8 of the device is disposed in the outer lower region of carcass 7 such that it substantially wraps magnetic core 3. Said magnetic core 3 of the present device has, in addition to a cylindrical central hole 32, a central recess 31 on its upper surface.

As depicted in Fig. 5.1, one may observe that, by means of electric schemes of CSR (start capacitor and functioning capacitor) motor comprising a BP start winding and a BF functioning winding, the starting "key" or device of the present invention contains four contacts 6 (two pairs) suitably arranged to switch the CR start capacitor (with ou without a Rd load resistor) and the CF functioning capacitor. Such suitable arrangement permits that during functioning in regimen (or during a period in which relay is not energized) two lower fixed contacts 6 are closed and two upper fixed contacts 6 are open. However, during start period, two upper fixed contacts 6 must be closed and two lower fixed contacts 6 are open. By this way, said two lower fixed contacts 6 act as a normally (NF) closed relay and said two upper fixed contacts 6 act as a normally (NA) open relay.

As to Fig. 5.2, the functioning is similar but for a RSCR (start with no capacitor and functioning with capacitor) configuration.

Thus, during functioning with low current or unpowered, lower mobile contacts (61) close the circuit of lower fixed contacts (6) to actuate the (CF) functioning capacitor wherein the upper fixed contacts (6) remain open to turn off the (CP) start capacitor.

Nevertheless, during the functioning in the starting or at high current, the upper mobile contacts 61 close the circuit of the upper fixed contacts 6 to actuate the (CP) start capacitor wherein said lower fixed contact remain open to turn off the (CF) functioning capacitor.

It should be clarified that an increase in the number of contacts 6, 61 acting in the device in accordance with the present invention imparts to it a robust switching based on the current variation of the relay winding 8, which is connected in series to the main winding.

Therefore, said device can be used for higher power motors with no need to raise costs to produce the equipment - for example, the costs to produce the device in accordance with the present invention is similar to that of a two-contact (pair)relay designated "current

relay", which is commonly used in compressors/low power motors of (start with no capacitor and functioning with no capacitor) RSIR-type and (start with capacitor and functioning with no capacitor) CSIR-type, wherein if four contacts 6 are used, the device will have the necessary strength to switch any of the start and functioning configurations used in (RSIR, CSIR, RSCR or CSR) motor/compressors.

Moreover, the present invention also exhibits other construction aspects (dimensions, actuation logics) similar to the current relay without, however, presenting the limitations of use inherent therein.

The principle of functioning of the start and run system for single phase motor will be described below.

During a start attempt, current in the main winding is relatively high and, under such conditions, winding 8 generates sufficient power to secure the core and thereby to initially and exclusively turn off the (CF) functioning capacitor and it will immediately and also exclusively turn off the (CP) start capacitor.

After starting and being at rotation new the normal functioning condition, the current in the lower main widening is at a level insufficient to keep the core grasping, thereby also initially and exclusively turning off the (CP) start capacitor, followed by exclusively turning on the CF functioning capacitor.

In brief, the "starting key" or start and run device for single phase motors of the present invention exhibits the following advantages when compared to the similar ones:

- "voltage relay" has significantly lower costs and reduced dimensions;

- "current relay (2 contacts)": switching robustness for CP start capacitor and CF functioning capacitor, individualized switches for each capacitor;

- "PTC and RSP starting keys": lower costs and with no residual power consumption – penalty at performance level characteristic of such devices.

Further, attention should be drawn to the fact that the big challenge in switching of systems with two capacitors – CP start capacitor and CF functioning capacitor – is the robustness of contacts. With the presence of the CF functioning capacitor the susceptibility to contact adherence and its wear due to voltage and current peaks (Inrush current, Voltaic arcs, etc.) are increased. Using the device of the present invention solves the problem of robustness by providing an additional pair of contacts 6, 61 such that each pair of contacts 6, 61 which individually switch each CP and CF capacitor end up minimizing the above-mentioned effects.

It should be further emphasized that the device in accordance with the present operates in the same way as that of a conventional "voltage relay" relative to the signal that causes actuation, that is, current of the main winding.

Additionally, since there are no semi-conductive devices as in the PTC and RSP

starting keys, there is no residual consumption characteristic of such devices during their functioning. Thus, one may note that development thereof has reduced problems observed in the present state of the art.

It should be pointed out that although preferred embodiments of the present invention have been provided, it is to be understood that eventual construction omissions, substitutions and modifications can be made by a person skilled in the art without diverting from the spirit and scope of the invention. It is also expressively predicted that all combinations of elements performing the same function in substantially the same form to achieve the same results are within the scope of the invention. Substitutions of elements of an embodiment described by others are also hereby intended and contemplated.

However, it is to be understood that the description given on the basis of figures above only refers to some possible embodiments of the system in accordance with the present invention, wherein its actual scope is provided by the appended claims.

CLAIMS

1. Start and run device for single phase motor, comprising at least an anchor (1) disposed within at least a carcass (7) and integrated by at least a magnetic core (3), and at least a bridge (5) containing at least a relay (R);

said start and run device for single phase motor further comprising at least a magnetic thread winding (8) and being specifically CHARACTERIZED in that said relay (R) comprises at least four fixed contact pads (6) and four mobile contact pads (61);

said fixed contacts (6) and mobile contacts (61) being subdivided into at least two pairs.

2. Device, in accordance with claim 1, CHARACTERIZED in that it comprises means to allow a current relay R to switch a (CP) start capacitor and a (CF) functioning capacitor based on the current variation of the magnetic thread winding (8).

3. Device, in accordance with claim 1, CHARACTERIZED in that said magnetic core (3) comprises a central hole (32) and an upper surface defined by a central recess (31).

4. Device, in accordance with claim 1, CHARACTERIZED in that it further comprises a return spring (2).

5. Device, in accordance with claim 1, CHARACTERIZED in that it further comprises at least a buffer spring (21).

6. Start and run system for single phase motor, comprising a single phase motor, at least a (CP) start capacitor, at least a (CF) functioning capacitor, and said system being CHARACTERIZED in that it further comprises a sole start and run device for single phase motor integrated by a sole relay (R), integrated by at least four fixed contact pads (6) and four mobile contact pads (61), wherein said fixed contacts (6) and mobile contacts (61) are subdivided into at least two pairs.

7. System, in accordance with claim 6, CHARACTERIZED in that during the functioning at low current or unpowered, the lower mobile contacts (61) close the circuit of the lower fixed contacts (6) to actuate the (CF) functioning capacitor whereby the upper fixed contacts (6) remain open, turning off the (CP) start capacitor.

8. System, in accordance with claim 6, CHARACTERIZED in that during the functioning of the start or at high current, said upper mobile contacts (61) close the circuit of the upper fixed contacts (6) to actuate the (CP) start capacitor, whereby the lower fixed contacts remain open, turning off the (CF) functioning capacitor.

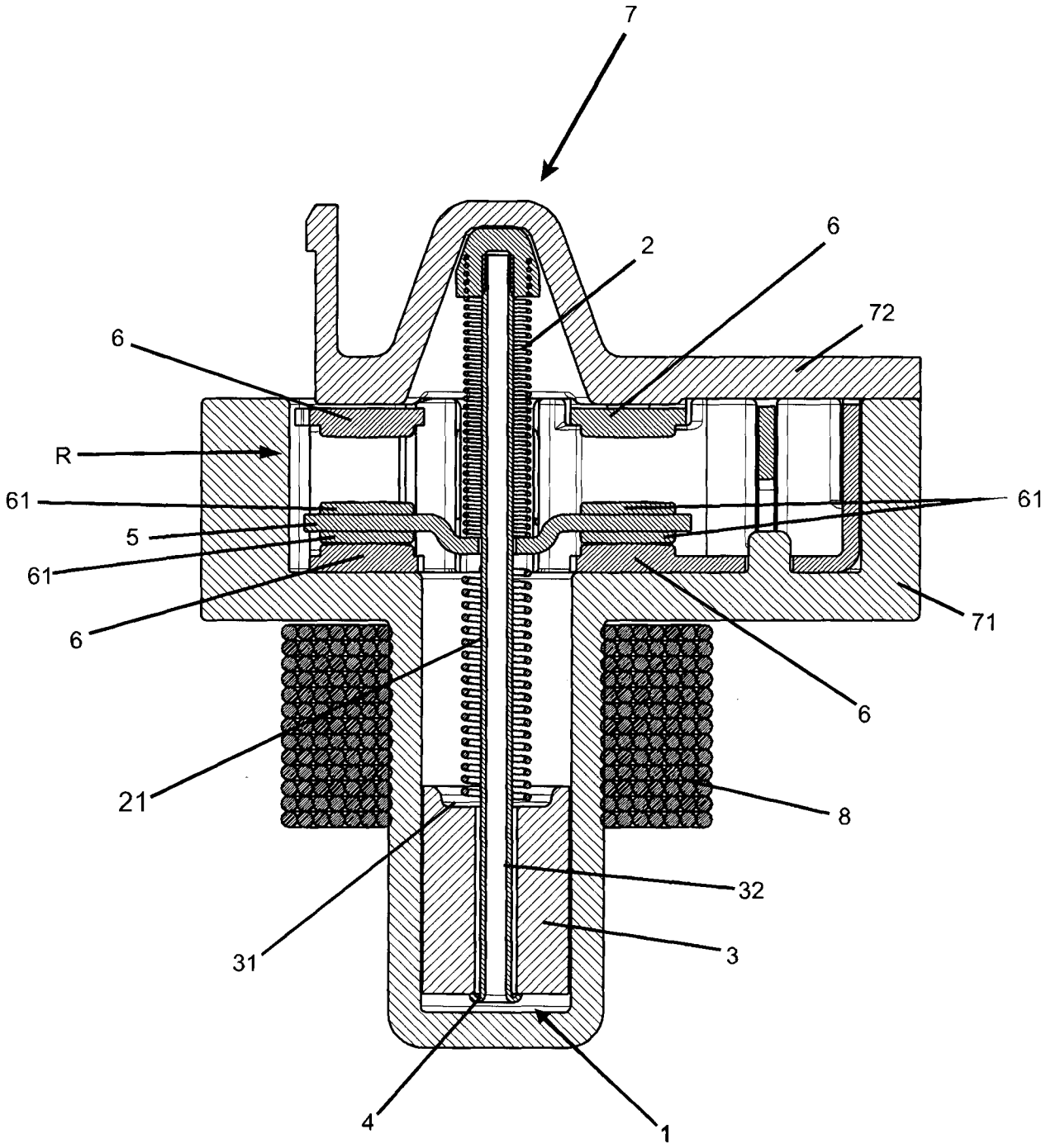

FIG. 1

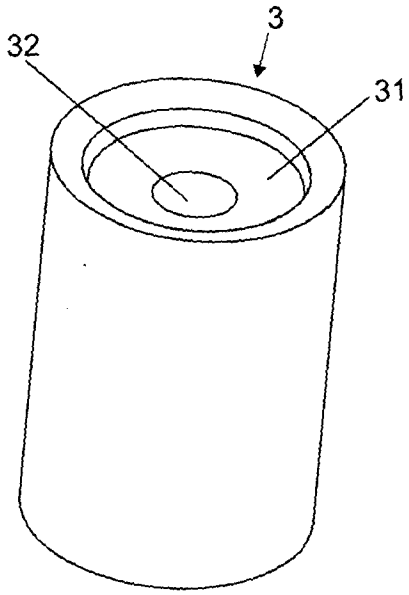

FIG. 2

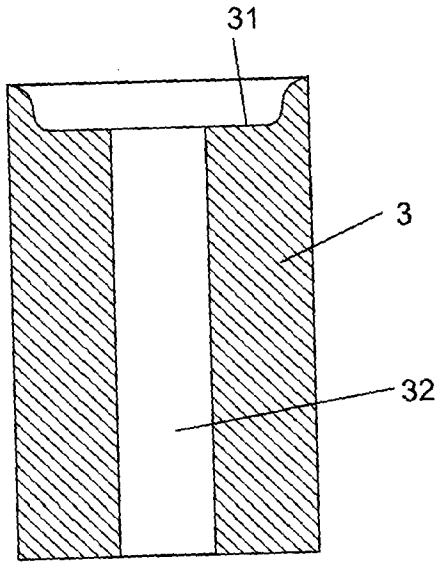

FIG. 3

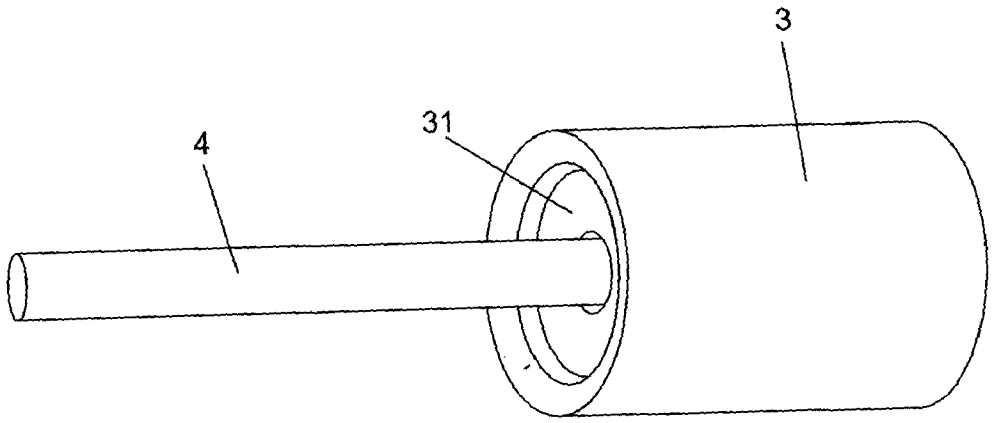

FIG. 4

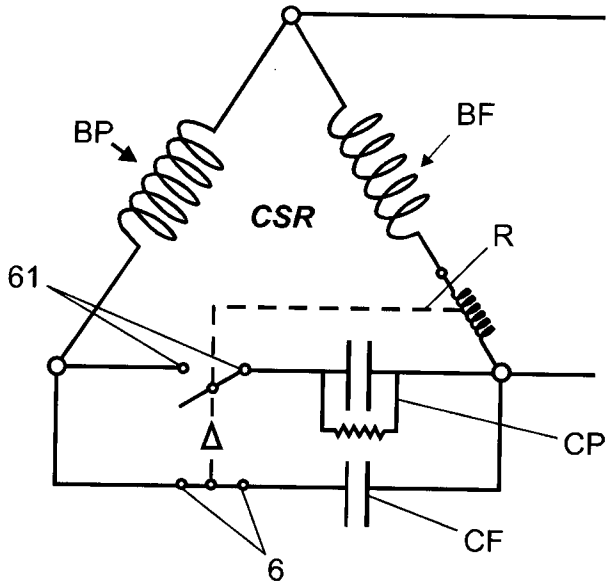

FIG. 5.1

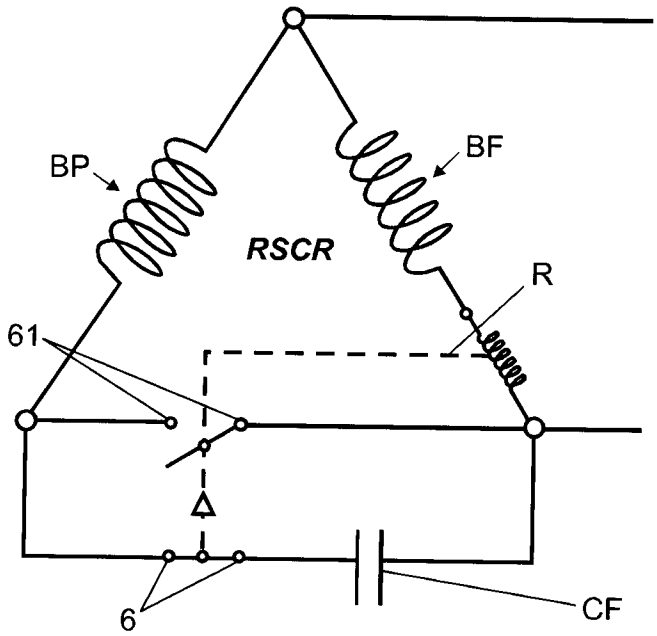

FIG. 5.2