IMPROVED SYSTEM FOR NON-CONTACT COMMUTATION OF STARTING WINDING OF SINGLE-PHASE INDUCTION MOTOR

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In this report it is offered improved electronic system for non-contact commutation of power supply, passed to circuit of starting winding of induction motor. There is explanation of working principle of the circuit and there is illustration of it's special features. Original unit for temperature stabilization is used, which one improves, functional facilities and also increases the field of application of the system.

As is well-known electric traction systems for mechanism of specific class are based on single -phase induction motors . They are used for their high reliability, as well as for easy maintenance .Most commonly used induction motors are motors with short -circuited rotor.

Single- phase squirrel induction motors have one working winding and one starting winding. Power supply of the starting winding is realized with starting capacitor , which accomplishes dephasing of the current in the starting winding towards current in the working winding , with purpose to cause suitable torque.

One of the subgroups of the single induction motors is with constantly turned on starting winding through working capacitor /C_P/ , which is calculated for such value , that single induction motor is able to rich requested nominal torque/M_H/.When the single induction motor is with nominal power more than 1kW , it is hard to achieve ratio $M_П/M_H \geq 2$ and they have bad control characteristic .This ratio can be realized with grater current through starting winding . This current is provided by additional starting capacitor /C_P/ with great capacity . The capacitor must be switched off when nominal torque is reached. This capacitor is switched off by centrifugal circuit breaker until now. The circuit breaker ensures cutting of the circuit by dissolving of its contacts, when velocity of the rotor riches defined value.

Determined mechanisms classes driven by single induction motor with short -circuited rotor work in extreme conditions /damp ,corrosive medium, intermittent duty with fixed standard frequency of turning on on hour/ .These extreme work conditions cause accelerated crash of the centrifugal circuit breaker . This leads to burning of starting winding, in consequence of sticking of the contacts or impossibility to start the motor due to scaled which has been get on the contacts of the breaker. This defect can be eliminated just by non - contact electronic comutator offered in this report.

It has been given special attention to commutation of the starting winding. From that point of view, how the commutation in the starting winding has been realized, when the motor has been started , next classification could be made:

1. Circuits in which the control signal is in proportion to maximum ,effective and mean value of the current .

2. Circuits in which control signal is in functional dependence of the starting and working windings voltages.

3. Circuits where commutation signal is related to the phase difference of the current and voltage of the starting winding .

There are circuits where current in the starting winding is formed by two different loops for the two half-waves. This causes use of rectifiers elements . This leads to reduction of the reliability and additional expanse of the circuits .

Building of the single phase induction motors in different mechanisms determines variety of demands in the separate areas of application .The choice of new circuit solution of electronic breaker of the starting winding of such kind of motor requires reading of the static and dynamic parameters of the building electronic parts and also reading of requests of the object of control. These requests are:

- small dimensions , weight and prize of the unit
- compactness of the component blocks
- possibility for easy building in production mechanisms
- good coordination with I/O parameters of the existing electrical equipment
- constant work in increasing numbers of switching
- suitability for work in hard conditions
- stability of the commutation in wide temperature range

Most suitable for examined systems for control of single phase induction motor is
the principle of tracking of the current in the working winding of the motor. Information about current is received by converter - 1 , turned on series on the working winding . The converter is resistible or transformable realized . Further processing of the information is done by former - 2 /fig .1 / , which passes pulse sequence close by shape to rectangular ones , which are enough for closing of the electronic switch -3 / turning on of the starting winding /.

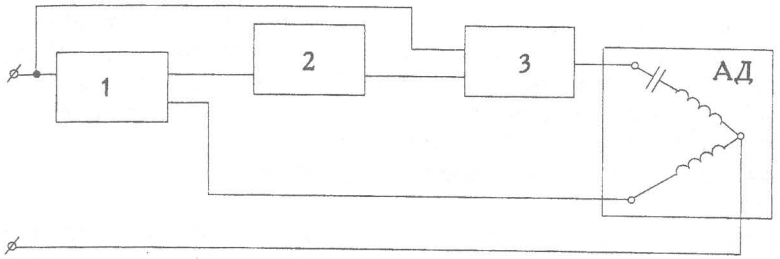

fig.1

The switch is parallel connected to the converter and former and series connected to the starting group. When pulse sequence is stopped full opening of the electronic switch is realized which leads to the turning the starting winding off . The described principle of current control is realized on the block scheme shown on the figure 1.

On the figure 2 there is principle electrical circuit of the presented unit.

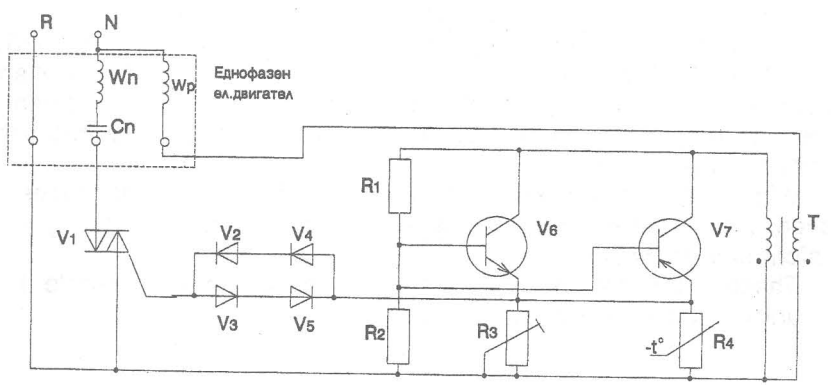

fig.2

The information block (on the fig. 1 it is marked as converter - 1) is build as a current transformer , working in a special regime. The amplitude of the secondary voltage of the last one is proportional on the current throughout the working winding of the motor .

The control block is realized as emitter follower and executes role as non - leaner resistor in the pulse control circuit.

The power block is build by triac , made by „Tesla" - Czech Republic.

When the motor is turned on , the information block works out control pulses , proportional to the current in the working winding of the motor . The last ones are passed to the control block , where they are stabilized by amplitude and from the exit of the control block , they enter in the control

electrode of the triac. After the motor has been rotated , the amplitude of the control pulses is falls down under the threshold of the limiter elements , connected to the exit of the control block. The entering of the pulses in the control electrode of the triac is stopped , the triac is turned off and the starting winding of the motor is switched off.

The use of thermistor furthers the stabilization of the working regime of the circuit.

That means that it will work constantly as when initial starting of the motor is performed as well as starting has been repeated , after its temperature has been set to the permanent value.

The described circuit has been tested at the „Department of Electronics and Microelectronics" in the TU - Gabrovo. The purpose is to receive more data for the working of the unit in the conditions closest to the working ones. The main interest are the values of the currents through starting and working windings when there is transient process and after it has been set . These currents are read by ammeters series connected to the two windings. By autotransformer the necessary voltage is set , which is controlled by voltmeter. For graphical results oscilloscope is used.

When the voltage on the output of the autotransformer /AT/ is $U_{вх}$=220V and the transient process of the rotation of the motor is not ended , in the secondary winding of the current transformer /1/ , the signal has shape and amplitude , shown on fig 3. , when oscilloscope has vertical timebase of 1V/cm.

When there are the same conditions , but the transient process has finished , the shape of the voltage in the secondary winding of the transformer is shown on fig 4.

These good results from the tests make the unit usable in the mechanisms with different resisting moment.

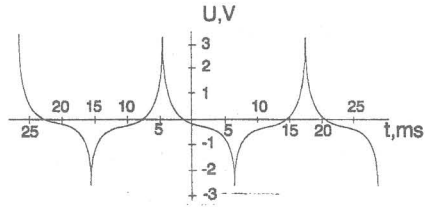

fig.3

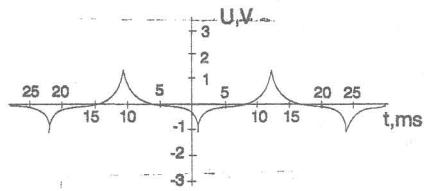

fig.4

Literature

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