

COLLECTOR – BRUSH ASSEMBLY IN THE STARTER – GENERATOR COMPLEX

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ABSTRACT

The work of collector – brush assembly, which is one of the main constructive processing of the system of one machine electromechanical rotating system that formed for application of freely acting objects in the scheme of electric equipment had been investigated by being based on the theory of the electric machine and apparatus. The working process had been given in the general electric scheme of the elements which are included into the assembly construction. The physical features of the factors that may abnormally effect in the collector-brush assembly in directing relay that acts in the working process of internal-combustion engine had been explained.

Keywords: starter-generator, collector-brush, electromechanical rotating system.

I. INTRODUCTION

The work of starter-generator complex in the [1] normal higher technical-economical level, substituting modern starter and generator two machine system would ensure to create a large sum of material reserves, would cause getting the extra volume in the placing field of electric equipment. In order to make it work reliably without working in the resource period the collector-brush assembly must be projected and must meet with the modern demands from constructive point of view.

The matter of projecting of collector – brush assembly for starter-generator is discussed in the article and the working process is investigated for both two regimes.

It is known that the processes that happened in the collector-brush system of stabile current machines are distinguished by their higher complication. By this reason there appear negative cases in used construction and the developing process had been approached to the working regime in the contact-brush system of the stabile current machines. Projecting had been implemented according to the acceptance of below mentioned terms:

- Making relation and ceasing with collector and brush with starter regime takes place in the zero value.
- The element of generator had been insulated from rectifier block network in the starter regime.
- The passage period between the end of starter regime and the beginning of generator regime is so little

that, there appear very little tension difference between the contact ring and brushes; this may not cause to the formation of passage process.

- Passage operations are implemented by spending insignificant energy.

II. CONSTRUCTIVE DESIGNING OF THE ASSEMBLY

Collector-brush assembly is not used in generator regime that has long-term work for establishing construction. During the starter regime, working currents of the anchor of stabile current machine is larger than lower tension, therefore copper-graphite brushes are used in order to decrease the falling of tension in the collector-brush passage. Usage of these brushes for long-term generator is not expedient. Therefore special construction had been projected in order to reject the collector-brush anchor in the generator regime (Fig.1a,b).

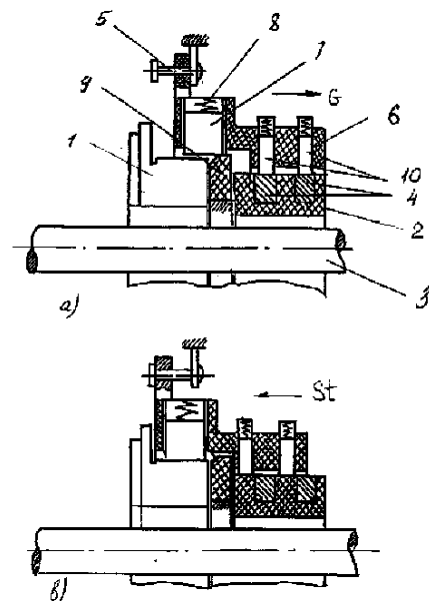


Fig 1. Scheme of collector-brush assembly: 1- Collector; 2- contact ring clutch; 3- shaft; 4- contact rings; 5- switch; 6- brush clutch; 7- brush; 8 – spring; 9 – bearing; 10 – brush

Construction is projected in the field together with the collector: collector and contact rings that prepared by plastic mass are closely connected with hard mechanic on the shaft of stabile current engine. Contact disks are electrically connected with the rectifier block that installed to the anchor windings of stabile current machine with three stages scheme. Here brush clutch, which placed on the switch and may independently move, made from plastic mass, had been installed for starter-generator regime. For starter regime, the boxes had been considered in the brush clutch for generator regimes and for their direction in the collector direction and in the contrary direction, for copper-graphite brushes in the sum combined to the number of poles. The springs had been considered for installation of brushes by necessary pressure power. After implementing of starter regime, the support from isolation material in order to move the brushes; the angle of the little part of the field of support in the collector is 30° , the more energy is not demanded in lifting the brushes. Brush clutch has boxes for placing two brushes for the aim of transmitting electric acting force into the ledge network after rectifying changeable electric acting forces that has been induced in the anchor winding. The brushes installed in these boxes had been supplied by pressing springs.

III. WORKING PRINCIPLE IN THE TWO REGIMES OF ASSEMBLY

The tension is transferred via directing key (it is shown in the Fig.) into the starter-generator directing relay in order to make ICE (internal-combustion engine) work. The brush clutches on the switches will act towards the collector related with the connection of relay and anchor. The brushes that installed on the clutches are replaced onto the collector by sliding from the support (Fig 1b). After completely sitting of the brushes, the tension is transferred from relay contacts (corresponding to the working regime of relay) and stabile current machine rotates the crankshaft of ICE in the engine regime. The working principle of starter-generator is not distinguished from the work of an ordinary stabile current engine. The only difference between them is the sitting process of brushes onto the collector while the tension is being transferred. This process is realized in the condition when the tension is not transferred into the anchor winding, and the analysis of the mechanical resistance force between collector and brush assumes a great importance. At the initial period of the beginning of starter regime, the brushes of generator regime slide together with the brush clutch and are transferred onto the isolation rings, which are at the same level with the contact rings.

After completely implementing of the starter regime the tension is taken out of the working relay and the brush clutch together with the brushes are lifted onto the supports from the collector by the help of counteraction springs (Fig.1.a). During lifting from the supports no any processes happen related with the brushes. At the same time the brushes of the generator regime is subject to a short passage process and begin to locate on the contact

rings; as a result collector – brush system passes into the long-term working regime – generator regime.

Let's look through the factors that may spoil the validity of collector-brush system.

One of the main factors that may cause to the disfunction working in the mentioned problem may be the disorder that may born in the contact system of the relay – contacts' not being able to transfer the tension from the brushes; at this case the direction of the collector-brush system in this or other direction may be arose in the condition if there is no tension between the collector and brush. But during the inconstant working of contact system of the working relay, satisfactory work of brush system must ensure the validity of all the operation. Not being able to take tension from the brush system for any reason (fusing and sticking of relay contact, decreasing of the hardness of contact system, disfunction the mechanical relation between anchor and contact bridge) may aggravate the commutation process between the collector and the brush; and this may cause abnormal condition. Let's analyze the effect of this case to the work of starter-generator: usually, during connecting stabile current contacts (when the brush is put onto the collector), they abnormally vibrate. This vibration may cause the erosion of collector surface during the connection. But the vibration may not occur because of the implementing of the process of putting the brush onto the collector not perpendicularly, but sliding under a small angle. At this time the negative effect of sparking discharge to the relation of collector-brush will be slight. The tension's being very little decreases the process of arc discharge to zero. A small tension between collector and brush gives a chance to decrease the value of space looseness to 1-2 mm between them [2]. So, it is possible to decrease the difference between the surface of support and the surface of collector minimum to 2mm (if there will not be a constructive deviation); the operation of lifting the brush from the collector by the way of sliding is implemented without any accident, because the tension between collector and brush is small ($\sim 12\div 14V$) and there are two spaces between them, and it will have sparking discharge, which is not much intensive; and in this abnormal working condition even collector-brush system will be able to hold its working ability.

The above mentioned investigations show that in order to ensure both regimes, collector-brush system can be developed in two directions:

- Putting and taking the brushes onto and from the collector without any tension;
- The operation is realized when the brushes are under complete tension.

In both two cases the guarantee for the higher validity can be confirmed theoretically.

III. CONCLUSION

1. In the system of ledge electric equipment of freely acting objects, the constructive structure of the system with one machine – starter-generator-collector-brush assembly that may be formed had been used.

2. The working process of collector-brush assembly in the starter and generator regimes of starter-generator had been investigated by taking into consideration the effect of managing system.
3. In the abnormal working process of managing relay that put in the equipment system, the accident cases that may born in collector-brush assembly had been investigated and the valid work of assembly had been based.

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