THE WAYS OF IMPROVEMENT OF DYNAMOELECTRIC FREQUENCY CONVERTERS

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ABSTRACT

The electric equipment demands carrying out of tests at high and low frequencies. Converters of frequency used with this purpose are characterized with excessive bulkiness and essential metal consumption. The report deals with dynamoelectric converters of simple design allowing to change values of frequency in a wide range.

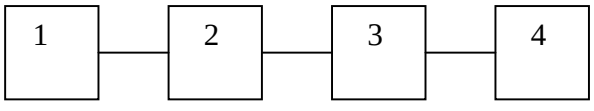
Keywords: Dynamoelectric frequency converter, electromagnetic sliding muff, gear wheels, transmission factor.

I. INTRODUCTION

As known, the industrial frequency of voltage of an alternating current in electric systems of the Azerbaijan Republic makes 50 Hz. This point is taken into account for manufacture of an electric equipment produced in the country. At the same time, in some cases there is a necessity of carrying out of tests of electrical equipment both as at higher (for example, 60 Hz), and lower frequencies. With this purpose the special dynamoelectric converters of the frequency consisting of two aggregates connected in series are used. [1]. Each of aggregates, in turn, includes two electric machines (Fig.1).

II. MAIN PART

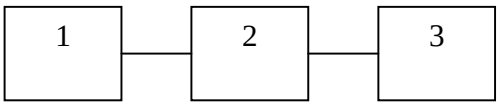
1. The asynchronous motor and the generator of a direct current connected on the same shaft.
2. The motor of a direct current and the synchronous generator connected on the same shaft.



1- asynchronous motor.
2- generator of direct current.
3- motor of direct current.
4- synchronous generator.

Fig.1. Dynamoelectric frequency converter.

Alongside with known advantages the given converters have such a lacks as essential metal consumption of construction design as well as high cost efficiency. In this connection it is offered to simplify a design of the converter down to two electric machines at the expense of mechanical gear between two units. In this case the dynamoelectric converter consists of the asynchronous motor and the synchronous generator connected by gearing. (Fig. 2)



1- asynchronous motor.
2- gear wheels.
3- synchronous generator

Fig.2. Dynamoelectric frequency converter with gearing.

The rotor of the asynchronous motor rotates with speed

$$n_1 = \frac{60 f_1}{p} \qquad (1)$$

here

p - number of pair of poles.
f - frequency of a voltage.

Frequency of a voltage produced by generator 2 is determined as follows

$$f_2 = \frac{p n_2}{60} \qquad (2)$$

Connection between motor and generator is carried out by means of contacting gear wheels with corresponding

number of cogs. The ratio of cogs numbers determines the transmission factor.

If $$K = \frac{n_2}{n_1} = 1.2$$

that frequency of a voltage on the generator output

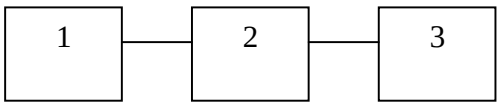
$$f_2 = \frac{p1.2n_1}{60} = 60Hz$$

If $$K = \frac{n_2}{n_1} = 0.1$$

that frequency of the voltage decreases accordingly

$$f_2 = \frac{p0.1n}{60} = 5Hz$$

Hence, by variation of transmission factor it is possible to increase or to reduce the initial frequency of a voltage.
However, the above mentioned way does not allow to carry out required in some cases smooth regulation of frequency. With that purpose replacement of mechanical gearing between shafts of machines by use of electromagnetic sliding muff is of interest. (Fig. 3)



1- asynchronous motor
2- electromagnetic sliding muff
3- synchronous generator

Fig.3. Dynamoelectric frequency converter.

The muff is mounted between the motor and the generator and carries out the transfer of the rotation moment from a shaft of the motor to a shaft of the generator. The led part of the muff including clawlike poles and winding of excitation is rigidly fixed on the shaft connected to a flywheel of the motor.

The driven part consists of an anchor, a disk and sprocket wheel to connect to the shaft of the generator. Special contact rings serve for reception of a current in the winding of excitation from the generator of a direct current. At start of the motor and switching on the generator of a direct current in poles of the winding the magnetic stream is formed. Thus, the currents through the anchor begin to circulate and as a result of interactions between the streams of inductor and anchor the last one starts to rotate. Changing the value of a constant voltage fed to inductor it is possible to vary speed of rotation of a rotor of the synchronous generator and frequency of a voltage smoothly in a required range.
To keep the frequency stability on the converter output the special tachogenerator of direct current hardly connected with the shaft of driven mechanism can be used. If speed of motor rotation undesirably increases growing EMF on the tachogenerator"s output brought in a winding of electromagnetic sliding muff reduce speed of rotation of the muff anchor and as a consequence restore former value of frequency. If necessary the signal from tachogenerator output before being sent to the muff winding can be amplified in two-cascade transistor amplifier with common base.

III. CONCLUSIONS

1. The design of the dynamoelectric frequency converter distinguished with low metal consumption and construction simplicity is offered.
2. To provide a smooth variation of voltage frequency the electromagnetic sliding muff between the motor and the generator can be mounted.

REFERENCES

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