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# Device for Measuring Scattered Magnetic Field of Stator Winding Head Asynchronous Motor for General Industrial Application

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**ABSTRACT:** This article proposes a device for measuring the magnetic stray field of the frontal part of the stator winding of an asynchronous motor for general industrial use.

In this device for experimental study of the electromagnetic stray field in the area of the frontal parts of the stator winding, including a winding made of copper wire and supplied with an alternating voltage of 50 Hz, as well as a stray magnetic field meter fixed in the stator, a meter (measuring conductor) of the stray magnetic field of the frontal part of the stator winding, installed in the frontal part of the stator winding in the form of an arc with a length equal to the pole division and a radius equal to the radius of the location of the heads of the frontal parts of the stator winding, while the measuring conductor for measuring the magnetic stray field of the frontal part of the stator winding is installed in the frontal parts of the stator winding.

**KEY WORDS*:*** stator, stray magnetic field of the frontal part of the stator winding, air gap, asynchronous motor.

## I.INTRODUCTION

The magnetic field in the area of the end parts of the stator winding of electrical machines has a complex distribution. It is due to many factors, the main of which are: the type of winding used in an electric machine, the configuration of the frontal parts and their spatial distribution, the angle of inclination of the frontal parts to the axis of the machine, the presence of surfaces surrounding the frontal part with different magnetic and electrical permeability. Knowledge of the field pattern is necessary to determine the electrodynamic forces acting on the end parts of the stator windings and the structures surrounding them, to determine the inductive resistance of the end parts, to determine the losses in the end parts of the stator core and in the massive structural elements of the end zone of the machine.

There is a known method for modeling the magnetic stray field of the frontal part of the stator winding and the rotor of a synchronous machine [1].

Modeling of the magnetic field of frontal scattering of windings of synchronous machines in operating modes is carried out by dividing the process into two stages. At the first stage, the magnetic field of one turn of the stator section and the rotor winding coil with a current I = 1 A is simulated. In the calculations, the stator section is considered symmetrical. Then, according to the known distribution of the magnetic field of one turn, the location of the sections in the stator core, the superposition method simulates the magnetic field from the frontal part of the stator phase.

At the second stage, according to the known dependences of the induction Byl.v (X) and Bzl.v (X), the magnetic field from the frontal part of the stator phase of the synchronous machine is determined.

The disadvantage of this method is the complexity and inaccuracy, since the results of calculating the magnetic field induction by this method do not satisfy the boundary conditions due to the asymmetry of the currents.

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There is a known method for modeling the magnetic field of leakage of the frontal part of the stator winding of AC machines with a compact stator winding [2].

To study electromagnetic processes in the active and end parts of AC machines with a compact stator winding, 2D field models were created in Elcut.

The disadvantage of this method is the inaccuracy, since in the model three conductors in the stator slot layer are replaced by one equivalent one.

It is also known a device for experimental study of the electromagnetic field in the area of the frontal parts of the stator winding in the presence of conductive screens [3].

The studies were carried out on a static model of the end part of the stator of a two-pole shock generator with a single-phase concentric winding, the frontal parts of which are 900. The modeling winding consisted of two coil groups connected in series, six coils in each group. The coils were wound with rectangular copper wire 10x2.5 mm in size and had one turn each. Power was supplied by alternating voltage with a frequency of 50 Hz. For the convenience of measuring the stray magnetic field and subsequent processing of the experimental results, a special probe with three Hall sensors was made.

## II. EXPERIMENTAL RESULTS

The disadvantage of this method is the complexity of the design of the modeling winding and the inaccuracy of measuring the magnetic stray field of the frontal part of the stator winding of the machine.

The objective of this article is to simplify the measuring conductor and improve the accuracy of measuring the magnetic stray field of the frontal part of the stator winding of an asynchronous motor for general industrial use.

The problem is solved by the fact that in this device for experimental study of the electromagnetic stray field in the area of the frontal parts of the stator winding, including a winding made of copper wire and fed with an alternating voltage of 50 Hz, as well as a stray magnetic field meter, fixed in the stator, according to useful models, a meter (measuring conductor) of the stray magnetic field of the frontal part of the stator winding, installed in the frontal part of the stator winding in the form of an arc with a length equal to the pole division and a radius equal to the radius of the location of the heads of the frontal parts of the stator winding. At the same time, the measuring conductor for measuring the magnetic stray field of the frontal part of the stator winding is installed in the frontal part of the stator winding.

The proposed device differs from the known ones in that the meter (measuring conductor) of the magnetic stray field of the frontal part of the stator winding is installed in the frontal part of the stator winding and is made in the form of an arc with a length equal to the pole division and a radius equal to the radius of the location of the heads of the frontal parts of the stator winding. At the same time, the measuring conductor for measuring the magnetic stray field of the frontal part of the stator winding is installed in the frontal part of the stator winding, which leads to a simplification of the measuring conductor and an increase in the accuracy of measuring the magnetic stray field of the frontal part of the stator winding of an asynchronous motor for general industrial use.

Hand fig.1 shows the location of the measuring conductor and in fig. 2 - change in the magnetic field of leakage of the frontal part of the stator winding of an asynchronous motor for general industrial use.

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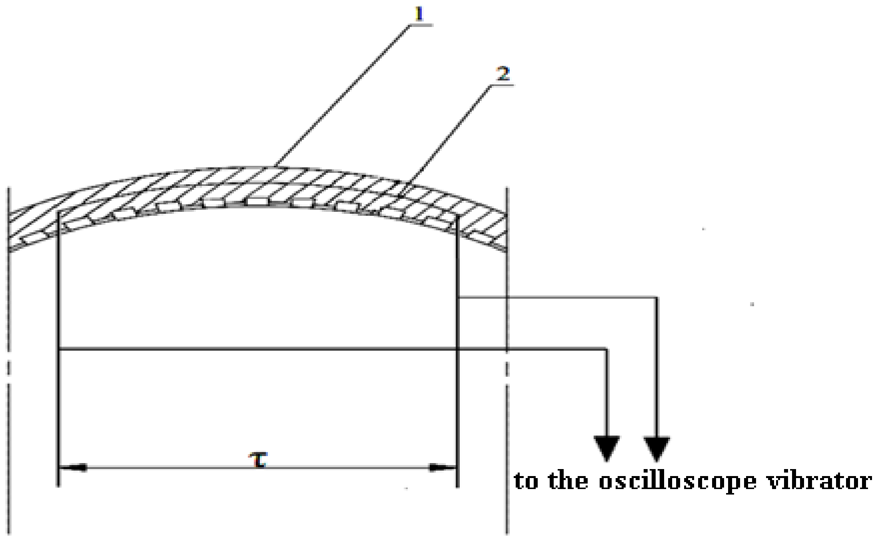


Fig.1. Location of test lead

According to Fig.1, the device contains the frontal part of the stator winding 1, on the frontal part of the stator winding 1 there is a measuring conductor 2, in the form of an arc with a length equal to one pole division $\tau$ and a radius equal to the radius of the location of the frontal parts of the stator winding 1.

To measure the magnetic stray field of the frontal part of the stator winding 1, the input ends of the measuring conductor 2 are connected to the vibrator of the oscilloscope.

Figure 2 shows the oscillogram of the EMF of the magnetic stray field 3 of the frontal part of the stator winding 1 of an asynchronous motor for general industrial use.

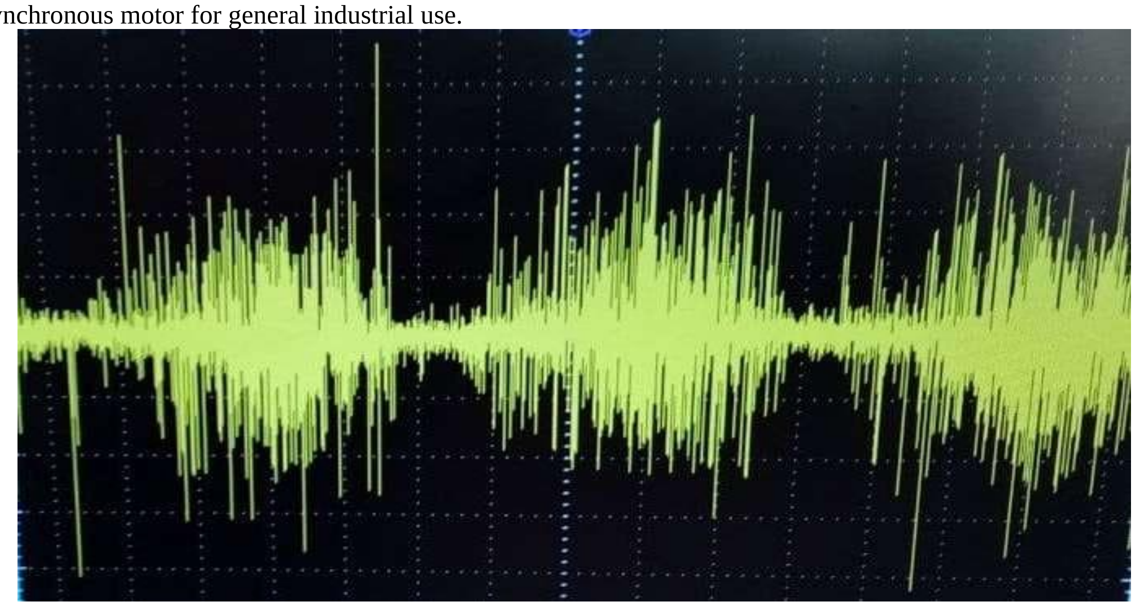

Fig.2. Oscillogram of the EMF of the magnetic field of leakage of the frontal part of the stator winding of an induction motor

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## III CONCLUSION AND FUTURE WOR

This device works as follows. When a three-phase power supply is connected to the terminals of the stator winding, a stray magnetic field of the frontal part of the stator winding 1 arises in the frontal part of the stator winding 1. In this case, the stray magnetic field of the frontal part of the stator winding 1 induces an EMF in the measuring conductor 2, if necessary, oscillography of the stray magnetic field of the frontal parts of the stator winding 1, the output ends of the measuring conductor 2 are connected to the vibrator of the oscilloscope.

Therefore, it can be concluded that the proposed device allows, along with expanding its scope, to simplify the measuring conductor and increase the accuracy of measuring the magnetic stray field of the frontal part of the stator winding of an asynchronous motor for general industrial use, which corresponds to the task.

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