CONSIDERATIONS CONCERNING THE CURRENT STAGE AND DEVELOPMENTAL VIEWS IN THE MOTIVE ELECTRIC AREA WITH MOBILE COIL

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Abstract. *The paper is destined for presentation of current stage and of developmental views in the motive electric area with mobile coil. In the beginning, these are presented the realizations in the area in Japan and Germany, these are mentioned applications of current solutions for realization of tear-off and riveted devices as well as to the realization of experimental stands to shock mechanic and vibrations It is presented the contribution of author to realization of electric motor with mobile coil in short-circuit, and realization of fittings for setting in evidence of principle of operate of a such motors. Last, it is presented the conclusions of the author related to the views of electric motors with mobile coil in short-circuit utilization.*
Keywords: *electromotor with translational motion limited, electromotor with mobile coil, linear electromotor, pendular electromotor, rotative electromotor.*

1. The current stage of the solutions for realization some electric motors with mobile coil

The alternating motion is much more connected with the human being than the rotation motion. In this context, some of electric motors with alternative motion will gain in importance. But then, motors of this kind are used-up lately all frequent maul in different industrial applications, such as the tear-off devices, the devices of riveted, numerous types of pumps, standings of attempts to shock and flutters the mechanics, firing pins, actuators for electric apparatus, linear motors, screamingly machines, the actuators of the electro-hydraulic or electro-pneumatique valves, the adding technique, etc.
Most simple mode for obtain an alternating motion, is, certainly, that to make a magnetic armature to displaced in an alternating field. When in an application, who requires a motor with alternating motion, the answer time is fixed, is preferred the motor with mobile bobbin, the electromagnetic core with his big mass be maintained fixed. The motors from [3] offer a typical example in this sense.
A kindred solution is rendered in [4] where is sketchy a motor with alternating motion destine for utilization in the adding technique.

2. Schematic solution for the realization of motors with mobile coil in short-circuit

The mechanical forces produced by short-circuit currents are a consequence of electrodynamics forces which appear between conductors of same circuit or between conductors of two or many else separate circuits crawled from current. These forces tending to displace the elements of the circuit or the ensemble of the circuit so that the rezultant flux will be maximum. The electrodynamics forces exist in case of normal function, but they are little and therefore envisaged. Only to short-circuit, these forces are bigger and can produce damages to the motor, they depending on the current amplitude, not of the efficacious value.
The shock current, to sudden short-circuit to the seconds terminals is:

$$I_{km} = k_A \frac{100\sqrt{2} I_{N1}}{u_k} \text{ [A]} \quad (1)$$

where:
$k_A = 1 + e^{-\pi(u_{ka}/u_{kr})}$ is the coefficient of increase current by reason of the aperiodic component.
u_k is the short-circuit tension, in percents.

The electrodynamics forces for rejection among winding-ups can be haggard in the radial components, F_{x1} and F_{x2}, which carry operates so that he seeks to stretches the exterior winding and to compress the interior winding, and in the axial components, F_{y1} and F_{y2}, which carry tending to displace the winding-ups in axial direction, operating therefore to the elements of axial consolidation of winding-ups. In the motive case are capitalized the axial forces F_{y1} and F_{y2}.

The radial force, in the concentric winding-ups case, is:

$$F_r = \mu_0 \frac{(w_1 I_{km})^2 l_{med1} k_R}{2H_B} \text{ [A]} \qquad (2)$$

The inside force that operates in axial direction on each winding-ups is:

$$F_i = -\frac{\delta'}{2H_B} F_r \text{ [A]} \qquad (3)$$

δ' is:

$$\delta' = a_{ji} + \frac{a_{ja} + a_{ia}}{4} + \frac{a_j + a_i}{3} \text{ [cm]} \qquad (4)$$

a_{ja} and a_{ia} – the extensiveness heights of the channels of refrigeration, or

$$\delta' = a_{ji} + \frac{h_h + h_i}{3} \text{ [cm]} \qquad (5)$$

The axial force, because of unsymmetrical winding-ups (if the heights of those two concentric winding-ups crawled by currents aren't equal) is obtained with the expression:

$$F_a \approx \frac{x}{80} F_r \text{ [N]} \qquad (6)$$

where x is the relative unsymmetrical winding-ups

$$x = \frac{X}{H_B} 100 \text{ [cm]} \qquad (7)$$

X, being the geometric unsymmetrical winding-ups.

The figure 1 presents the case of two concentric winding-ups, one primary, the other secondary, having same height, when there are seated displaced one against the other. Because the currents in these two bobbins have opposite senses, between the mechanical forces that take place exists the relation: $F_1 = -F_2$.

The case presented in the figure 2 represents the applied variant in concrete mode in the case of motor that we studied. As in the previous case, the axial forces play the main role in the operation of the motor.

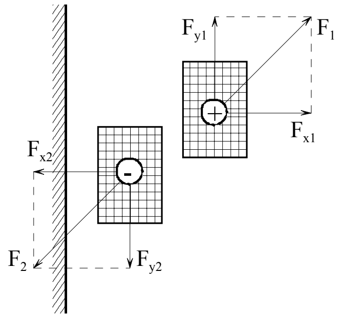


Figure 1. Electrodynamics forces developed in an electromechanical system with winding-up in short-circuit, the case identical winding-ups and displaced

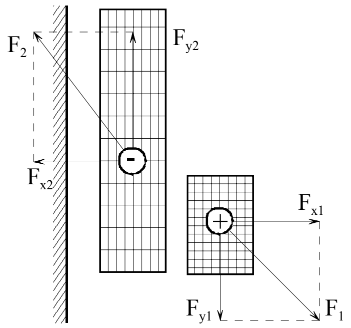
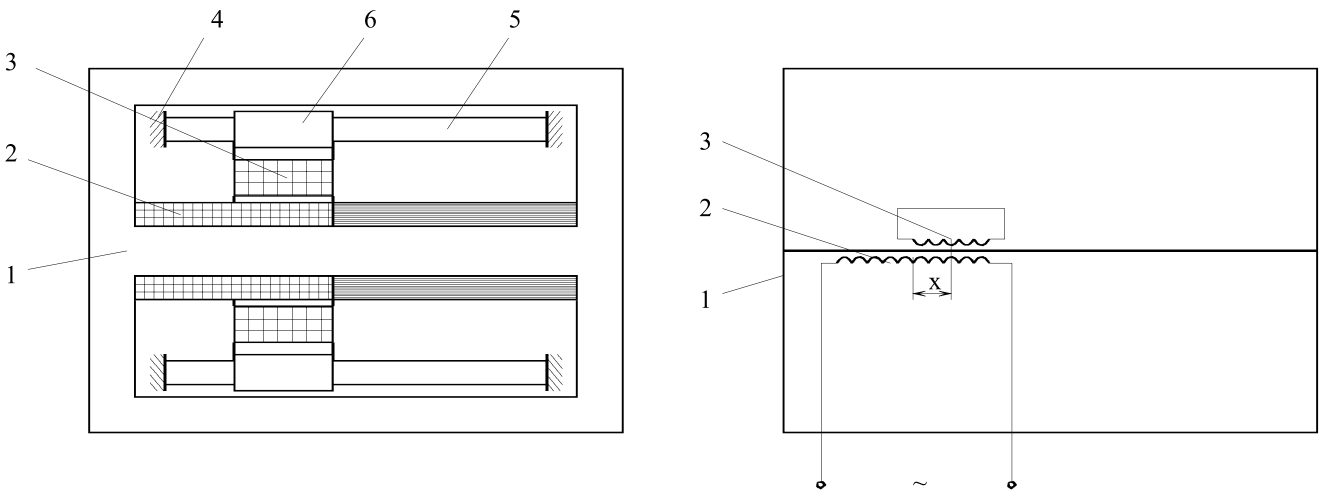


Figure 2. Electrodynamics forces developed in an electromechanical system with winding-up in short-circuit, the case winding-ups with different heights and displaced.

Afterwards the author presents some schematic solutions for the realization of some electric motors with mobile coil in short-circuit.

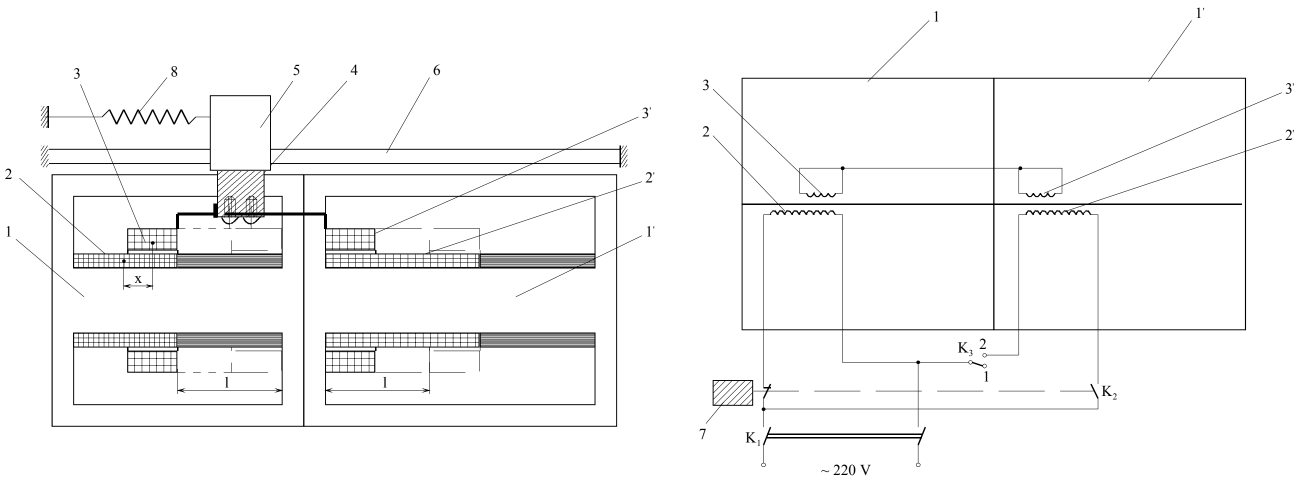
The motor with mobile coil [5], presented in the figure 3, has limited race and commanded sliding frequency. This is constituted in principle from a magnetic single-phase core 1 achieved from electrotechnical metal sheet on which is placed a fixed winding-up 2. Concentric with it is settled a mobile coil in short-circuit 3, build from a single whorl and obtained through fount. The mobile coil is displaced between two stops 4, on an axis of guide 5, on which glide a slide 6 who make common part with the bobbin and with the operated element.



a) b)

Figure 3 - Electric motor with mobile coil
a) longitudinal section; b) electrical scheme of the principle:
1 - magnetic core; 2 - fixed bobbin; 3 - mobile bobbin in short-circuit;
4 - stop; 5 - axis of guide; 6 - slide

A related solution is the motor with mobile bobbin [6] from the figure 4, constituted from two electromagnetic single-phase actuators, each is mature from the ferromagnetic core, and a fixed bobbin and a mobile bobbin in short-circuit.

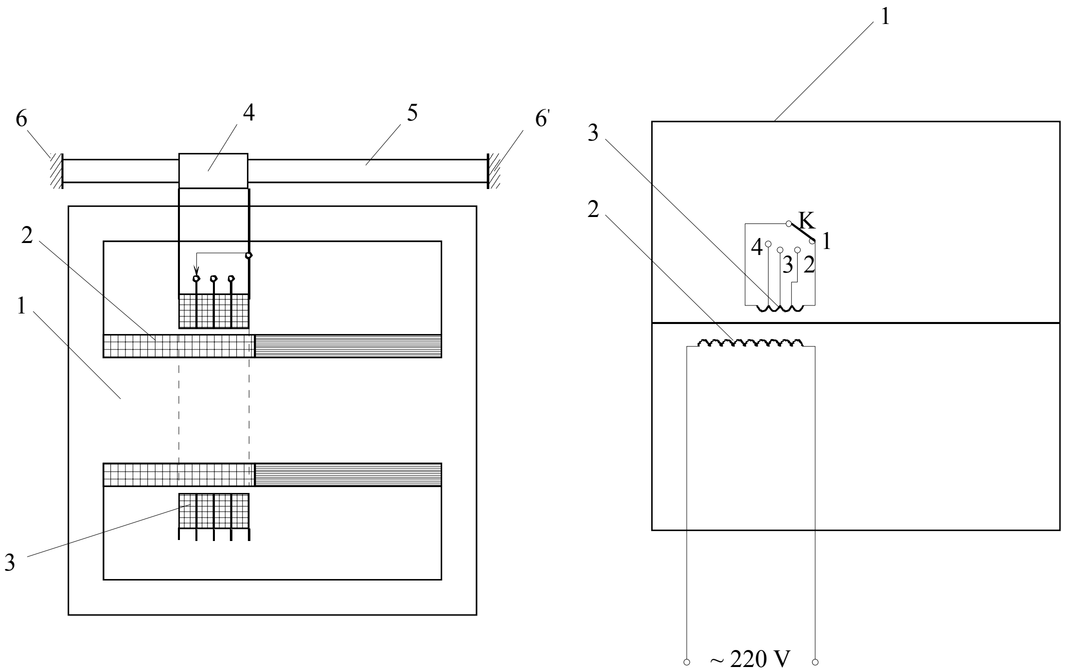


a) b)

Figure 4. Electric motor with mobile bobbin
a) scheme of the principle; b) electrical scheme
1- magnetic core; 2, 2' - fixed bobbins; 3, 3' - mobile bobbins in short-circuit;
4 - spur; 5 - part; 6 - slide; 7 - transducer of position; 8 - resort

The two mobile bobbins act about a part that glides on two slideways, one from bobbins operating through push, and the other bobbin through drawing. Is obtained thus a race two times bigger than the one that was to the engine presented previously. The function of the engine can be programmed either for a big race, or for a reduced one.

An another race solution is the electric motor with mobile bobbin with variable height [7], presented in the figure 5. The motor has settled on the column a fixed bobbin which deals just half from the height of the column and which operates by intermedium of the electrodynamics forces about of a mobile bobbins in short-circuit, materialized from several boulder stones, mount butt, existing the possibility of intake or take-out these boulder stones, what modifies the height of mobile bobbin and therefore, the eccentricity among the fixed bobbin and the mobile bobbin too.



a) b)

Figure 5. Electric motor with mobile bobbin with sliding height
a) scheme of the principle; b) electrical scheme
1 - magnetic core; 2 - fixed bobbin; 3 - mobile bobbin in short-circuit;
4 - slide; 5 - axis of guide; 6 - stop

An another related example is the pendular electric motor [8], presented in the figure 6, constituted from an circular magnetic core, on which are placed, on a half from circumference, two fixed fed successive winding-ups, successively supplied from same source of alternating current and which reacts of a mobile bobbins in short-circuit, concentric with the fixed bobbins. The other half from circumference is completed with insulating material. The change of primary fed bobbin is achieved with two transducers of position, placed to the heads of race and excited by a mobile bobbin. The mobile bobbin is fixed to the extremity of an arm, mechanical coupled with an arbor who can turned in two bearings and which gets thus an angular motion in a sense or in other.

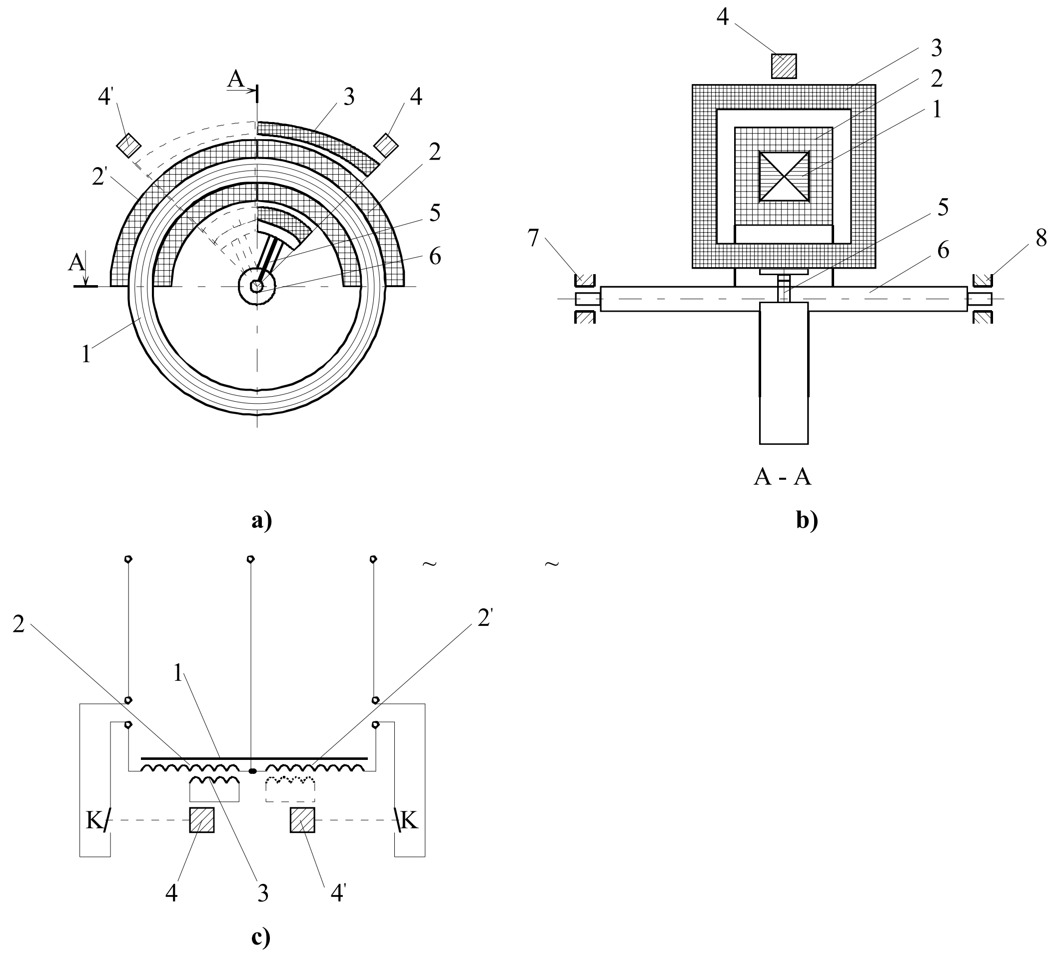


Figure 6. Pendular electric motor
a) scheme of the principle; b) section after the axis A-A; c) electrical scheme of the principle
1 - magnetic core; 2, 2' - fixed bobbins; 3, 3' - mobile bobbins in short-circuit; 4, 4' - transducers of position; 5 - arm; 6 - arbor; 7, 8 - bearings.

3. Contributions to the realization of experimentally stand for the study of the schematic solutions for electric motors with mobile coil

Afterwards it is presented two experimentally stands for the study of the schematic solutions for the electric motors with mobile coil.
In the figure 7 is presented an experimental stand [9], for the study of transitory regimes to over currents, in alternating current.

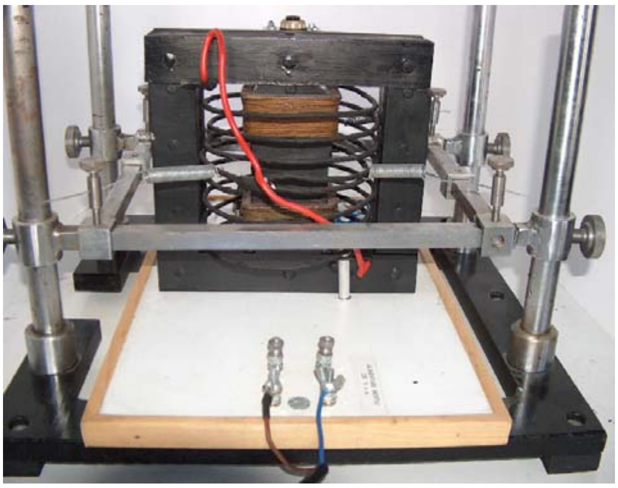


Figure 7. Experimental stands for the study of principle to operate the electric motors with mobile coil.

The stand is constituted from a magnetic three-phase system, with columns, the superior yoke is demountable. On the central column are mounted different fixed bobbins, putted concentric with different mobile bobbins in short-circuit. To the input standing, the mobile bobbins accomplish a translational motion on vertical, the sense of movement depending on the sizes of fixed and mobile bobbins.

In the figure 8 is presented an experimental suggested stand of author for the study of motive electric operation with mobile bobbin in direct current.

Figure 8. Experimentally stand for the study of motive electric operation with translational limited motion

4. Developmental views of electric motors with mobile coil

The last decades technique tends to put all dense maul in chat through the alternating motion movement, on aside by reason of the conquest of the space, but then by reason of development of the electronics and the automatics, carry permit the realization made to order systems and superior check. The machines from the motive class with mobile pendular elements drive to systems of very simple actuation, therefore secure in operation, in near all exigent of applications an alternating motion. Even in the case which actuation's advertising a motion of rotation, chiefly when he is the word of reduced revolutions and input to 50 Hz, I seemed that the engines of this kinds will have in future an word to say.

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