INFLUENCE OF CONSTANT MAGNETS ON THE ORBITAL ANGULAR MOMENTUM

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The purpose of the article – the study of the effect of magnetic fields on the atoms of different natural elements. When making an atom in a magnetic field, the precession (change movement). This article will consider the introduction of an atom in two external magnetic fields of opposite poles.

Keywords: magnetic moment of the magnet, the precession, the pole, the atom, the induction field, the electron

Phenomena in which the momentum of the movement of the body is changing due to the influence of the magnetic field is called a magneto. Since the substance is in an external magnetic field, its magnetic permeability less than unity, the magnetic induction field in the material is less than the magnetic induction of the external field [1]. Therefore, to be considered one of the magnetomechanical phenomena – the precession of the magnetic moments in a magnetic field (Fig. 1)

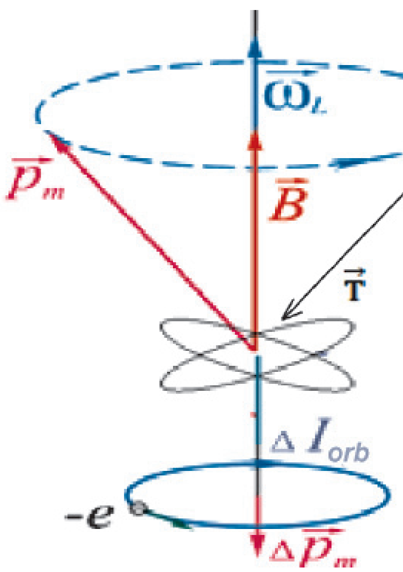

Fig. 1. The precession of the magnetic field

Suppose that an electron in an atom moves in a circular orbit, the plane of which is perpendicular to the vector of the magnetic field. Action on the electron Lorentz force will reduce the force of attraction of the electron to the nucleus. The centripetal force will be equal to the difference between the Coulomb force of attraction of the electron to the nucleus, and the Lorentz force [2]. As a result, change the angular velocity of the electron motion in a circular orbit. It will be different from that which the electron had in the absence of an external magnetic field. If an external alternating magnetic field (current generators), the change in the angular velocity of the electron motion occurs during growth of the magnetic field that is brought atom. The increase in the magnetic field acting on the atom, there is a finite time. Thus there is an induction eddy electric field acting on the electron in an atom. The intensity of this field is tangential to the electron orbit [3]. At an arbitrary location of the electron orbit with respect to the magnetic induction vector, orbital magnetic moment of the electron makes an angle α with the direction of the magnetic field. In this case, the orbit to precess around the direction of the induction vector. This means that the orbital vector perpendicular to the orbital plane, keeping unchanged the angle of inclination α to the pitch direction is rotated around the induction of an angular velocity different from the initial one. Such rotation of the vector around the direction of the magnetic induction at a constant angle α is called the Larmor precession. The influence of magnetic field on the orbit of the electron is reflected in the Larmor theorem: the only result of the influence of magnetic field on the electron orbit in an atom is the precession of the orbit of the vector and an angular velocity around the axis passing through the nucleus of an atom and parallel to the vector of the magnetic field [4]. Precession motion orbit leads to an additional current orbital and the corresponding induced orbital magnetic moment. Changed the orbital vector is directed opposite to the vector of magnetic induction. Thus, the electron orbits atom by an external magnetic field perform a precessional motion, which is equivalent t o a circular current.

Estimated effect of external magnetic fields on the ground

When making material in a magnetic field with induction $\vec{\mathbf{B}}$ on an electron moving in the direction of the orbital vector, torque acts on the part of the magnetic field $\vec{\mathbf{M}}$:

$$\vec{\mathbf{T}} = \overrightarrow{\mathbf{P}_{magn}} \times \vec{\mathbf{B}}, \qquad (1)$$

where $\overrightarrow{P_{magn}}$ – orbital vector;

$$\overrightarrow{\mathbf{P}_{magn}} = g\vec{\mathbf{L}}_e, \qquad (2)$$

where g – gyromagnetic ratio. The ratio $\mathbf{P}$ of the electron charge to its mass; $\vec{\mathbf{L}}_e$ – moment of the electron pulse

$$g = \frac{1{,}6\cdot10^{-19}}{9{,}1\cdot10^{-31}} = 175\cdot10^{-9}\ \frac{\text{Kl}}{\text{Kg}}. \qquad (3)$$

Such orbital vector under the influence of the magnetic moment will move in a circle about the magnitude of the magnetic induction, thus already created process. If the static magnetic field magnetic flux density 2,6 T (with respect to two back-directed magnets), to make a substance with the same gyromagnetic ratio, the magnetic moments will precess around the magnetic induction vector at an angular velocity:

$$\omega = g\cdot B = 175\cdot10^{-9}\cdot2{,}6 =$$
$$= 455\cdot10^{-9}\ \text{Kl}\cdot\text{T/kg} = \text{s}^{-1}; \qquad (4)$$

$$\text{Kl}\cdot\text{T/kg} = \text{A}\cdot\text{c Kg/(A}\cdot\text{s}^2\text{)/kg} = \text{s}^{-1}.$$

Precession of the orbital angular momentum of an electron in an atom manifests the appearance of additional orbital current directed opposite to the current I:

$$\Delta I_{orb} = e\frac{\omega}{2\pi} = 728\cdot10^{-28}\ \text{A}. \qquad (5)$$

At this point, additional current generates additional traffic [5]. In this case – the anti direction of the magnetic induction of the orbital magnetic moment:

$$\Delta\overrightarrow{P_{magn}} = -\Delta I_{orb}\cdot S = -S\cdot728\cdot10^{-28}\ \text{A}, \qquad (6)$$

where S – area of the projection of the electron orbit in the plane.

Experimental section

The study was conducted under standard conditions. The object of the experience of taking the wet loam, soil category – 2. With a certain distance, the magnetic field effect on the loam. The total number of experimental tests for each distance – 40 pieces, except for the fifth position. There were five such provisions. In the first position of no change is happening because of the lack of a magnetic field.

Second position – this position is close to the targeted one another eponymous poles (Fig. 2). The result of this arrangement, the ground will be more cohesive

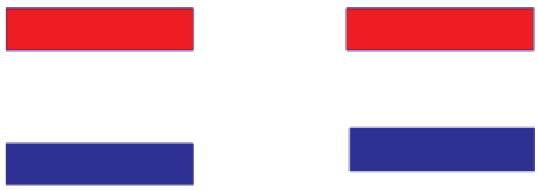

Fig. 2. Second position

Third position – this is the position of the proximity of opposite magnets

The result of this arrangement will be a multitude of adhesion primer in the arrangement of the magnets, not strange in places lack magnets cohesive soil does not occur. Fourth position – the position of the large distance between the permanent magnets (Fig. 3). With this arrangement proved the inadvisability of any installation of magnets. And the result of this will be the greatest concentration of soil.

The fifth position – a position of the optimal arrangement of the magnets, as loam becomes the most fragile (Fig. 4).

Dm = 0.7*length; (22×5×9). (7)

If the magnet will have a length, a width and a height of 22,5 and 9 mm, respectively, the distance between magnets should be approximately Dm seventh of the length of the magnet.

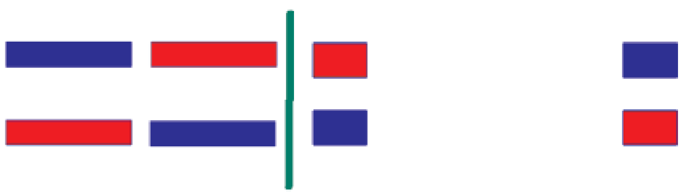

Fig. 3. Third position and Fourth position

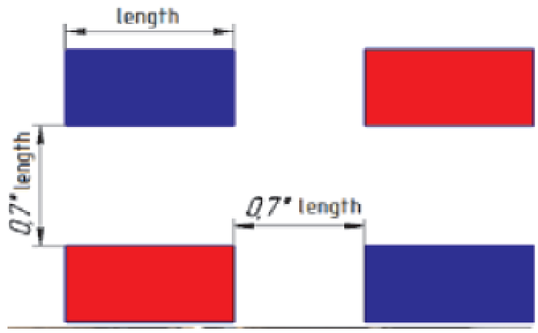

Fig. 4. A position of the optimal arrangement of the magnets

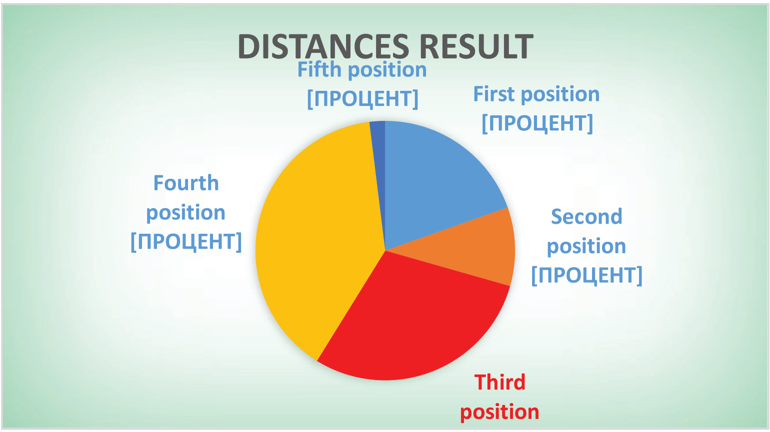

Fig. 5. Diagram of the results of experimentation. % – the percentage of adhering soil relative to the total volume

Thus, these studies have shown the effectiveness of magnets in the correct placement of the panel.

And in general, it proved experimental way, the theory of the precession of the magnetic moments in a magnetic field. Such an arrangement is appropriate and effective in the field of cleaning. As a result of charting studies (Fig. 5).

Conclusions: With the use of magnetic elements can achieve many effects, thereby producing completely new action with the soil.

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