New Type of the Earth Inductor and its Use for the Prospecting of the Underground Structure

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NEW TYPE OF THE EARTH INDUCTOR AND ITS USE FOR THE PROSPECTING OF THE UNDERGROUND STRUCTURE.

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We designed a new type of the Earth Inductor, and used it for the prospecting of the underground structure of the magnetic deposits at Kaneyamamachi, Igunsun, Miyagi Prefecture.

1. The structure of the Earth Inductor
This instrument constructed from three parts, namely rotor, coil and drum shaped magnetic inducing parts, constructed from high permeability metal of Sendust. The diamagnetic coefficient in the magnetic induced parts becomes change according to the axis of rotor coincides with the direction of the outer magnetic field, or not.

\[ H_0: \text{outer magnetic field} \]
\[ H_1: \text{effective magnetic field} \]
\[ \mu: \text{apparent magnetic permeability} \]
\[ K: \text{susceptibility} \mu = 1 + 4\pi K \]
\[ N_1: \text{diamagnetic coefficient} \]

(a) when the axis of the rotor coincides with the direction of the outer magnetic field, induced magnetic force is as follows:

\[ B_1 = \frac{\mu H_1 H_0}{1 + N_1 K} = \frac{1 + 4\pi K}{1 + N_1 K} H_0 \]

(b) When the axis of the rotor is perpendicular to the direction of the outer magnetic field, similarly,

\[ B_2 = \frac{\mu H_2}{1 + N_2 K} = \frac{1 + 4\pi K}{1 + N_2 K} H_0 \]

Accordingly, as the rotor rotates, the induced magnetic force in the induced parts alternate between \( B_1 \) and \( B_2 \). Then, the induced electric potential in the coil becomes as follows:

Now \[ \frac{1 + 4\pi K}{1 + N_1 K} = \mu_1, \quad \frac{1 + 4\pi K}{1 + N_2 K} = \mu_2 \]

\[ E = \frac{1}{c} \frac{d}{dt} \int B_0 df = \frac{1}{c} H_0 \frac{d\mu}{dt} \times \int df = \frac{1}{c} H_0 n f \frac{d\mu}{dt} \]

\[ n: \text{number of the coil} \]
\[ f: \text{cross section of the coil} \]
\[ \omega: \text{number of the rotation} \]
\[ H_0: \text{magnetic force in} \Gamma \]

\[ E: \text{electrical potential in volts} \]

Consequently

\[ E = \frac{1}{10^5} n f H_0 (\mu_1 - \mu_2) \sin \omega t \]

We can read the alternate electrical potential by the millivoltmeter after using the rectifier. We compensate the induced electric potential to zero by using the auxiliary magnet. By knowing magnetic moment of the magnet and its distance from the rotor we can calculate the outer magnetic field. The sensibility of this instrument is \( 10^7/\mu \) amp. The
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The drum shape of the induced magnetic parts is made up along the B-shape, because to minimize the diamagnetic coefficient. The relation between B and H in the case of the axis of the rotor coincide with the direction of the outer field or perpendicular to it, is illustrated in Fig. 2.

2. Application for the prospecting of the underground structure
We prospected the magnetic deposits at Kaneyamamachi, Igun, Miyagi-Prefecture by using this apparatus, and found that the results was coincides with the surveyed geological structure. The geological structure of the observed district is as illustrated in Fig. 3, and it is situated at the northern margin of Abukuma Range and is formed by the intrusion of the granit group accompanied with the mountain movements to the limes-

![Geological Map](image-url)
tone at the last stage of Paleozoic or at the first stage of Mesozoic. The distribution of this magnetic field is illustrated in Fig. 4.