A New Magnetic Earth Inductor for Field Use

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In field measurements with a conventional earth inductor a coil of some 1200 turns is rotated by hand with a flexible cable. A commutator on the coil shaft rectifies the induced sinusoidal current to pulsating direct current. Owing to parasitic voltages induced in the commutator by friction heating, the coil usually cannot be rotated in excess of 10 rps. The usual null detector is a tripod-mounted astatic galvanometer, with telescope and scale. To attain adequate sensitivity, instrumental vibrations must be minimized. In the field, a light breeze is sufficient to cause intolerable vibrations in the galvanometer suspension. It is therefore customary to set up the galvanometer and earth inductor tripods inside a tent.

Alternating-current earth inductor. Some years ago *Johnson* [1936] pointed out that if an ac null detector and slip rings were substituted for the galvanometer and commutator the contact potentials could be ignored, thus permitting appreciably faster coil rotations.

We describe a portable field-type earth inductor operating on the ac principle. Approximately 4700 turns of AWG 32 enameled copper wire are wound on an aluminum form of 27-cm² cross-sectional area. (See Figure 1.) The coil is enclosed in a cylindrical case, concentric with the axis of rotation, to minimize air resistance, and is mounted on a 20-cm rigid aluminum shaft supported by steel ball bearings. The extended shaft and symmetric position of the bearings with respect to the rotating coil result in no detectable magnetic influence from the steel of the bearings. The induced current is led off through gold slip-ring pins at each end of the shaft. These pins are 1/32 inch in diameter to minimize friction drag and contact noise. The coil is rotated by a double jet air turbine. With a light aluminum bicycle-type pump rotor speeds of 70 rps are easily maintained. The angular momentum of the rotor is such that a few strokes of the hand pump every two or three minutes are sufficient to maintain satisfactory rotor speed during operation.

The rotor mounting is securely fastened with aligning screws above the telescope of a Zeiss precision theodolite. Altitude and azimuth scales

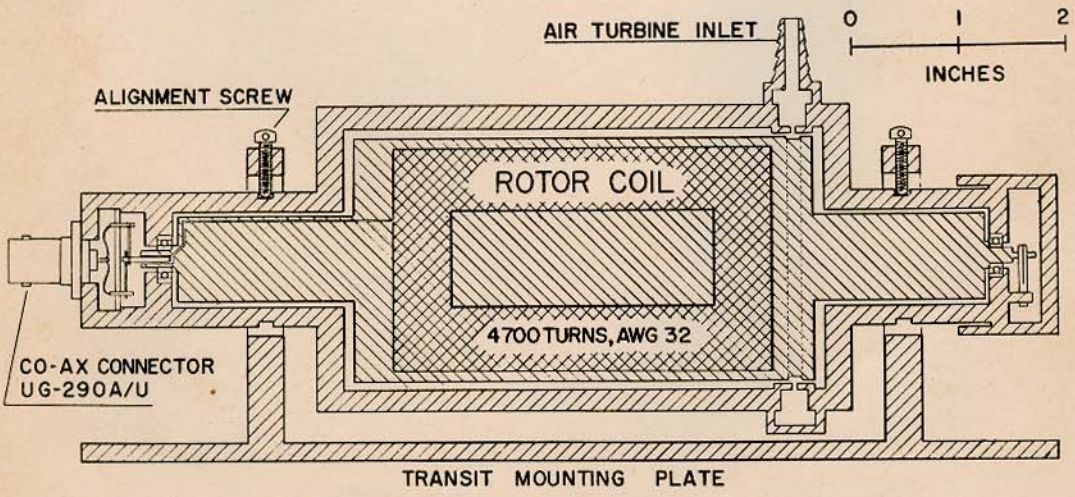

Fig. 1. Cross section of air-driven rotating coil.