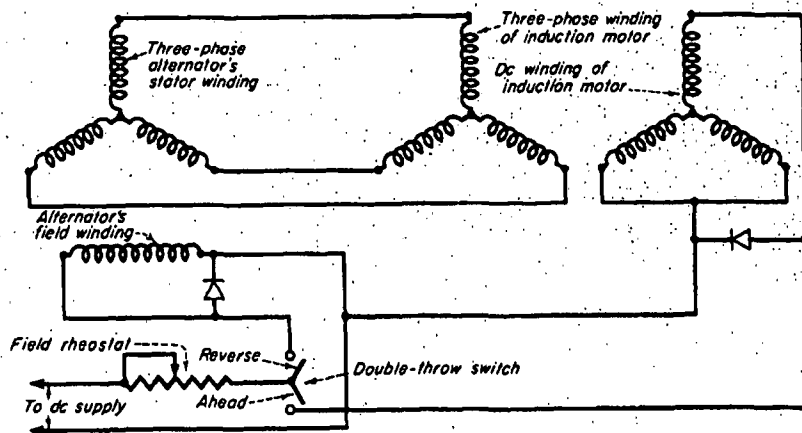




15 Diagram of reversible magnetic drive that includes a synchronous alternator and an induction motor, as shown in 16. The motor has two distributed field windings

REVERSIBLE DRIVES

A cross-section of a reversible magnetic drive described in *Engineering* (London) Oct. 17, 1941, is shown in Fig. 16. It consists of an alternator and a magnetic coupling, the equivalent of an induction motor. The alternator's field poles *P* and the rotor *R* of the induction motor are fixed to the input shaft. The alternator's stator is supported in a frame bolted to the unit's bedplate. Field core and windings *W* for the induction motor are mounted on a spider keyed to the output shaft. This core is slotted on its outer periphery and has

two 3-phase star-connected windings. For one direction of rotation one winding is excited by dc, and for the other direction the other winding is excited by 3-phase ac, as indicated in Fig. 15.

For the output shaft to operate in the same direction as the input one, and at practically the same speed, the power unit is started and brought up to about half speed. Then, excitation is applied to the magnetic drive's dc winding, which produces magnetic poles in core *W* as with a salient-pole winding. As the squirrel-cage winding in core *R* rotates through the magnetic field, current is generated in it that reacts on the latter to produce torque as in an induction motor. This torque accelerates the output shaft in the same direction and up to about the same speed as the input shaft. In this direction of rotation, operation is the same as for the other 2-element magnetic drives described previ-

ously, the alternator remaining inactive.

For reverse direction of the drive, the dc winding of the induction motor is disconnected, the alternator's field is excited and its windings connected to the ac winding on the induction motor rotor. Current from the alternator generated at a frequency that produces a rotating magnetic field in the induction motor's rotor of twice the speed of the input shaft and in the opposite direction. This is necessary for reverse rotation, since mechanically the outer member of the magnetic coupling continues to rotate at input speed. A reversed magnetic field of twice input speed imposed on this motion then results in a reversed field of normal speed so that the output shaft runs at normal speed in reverse direction.

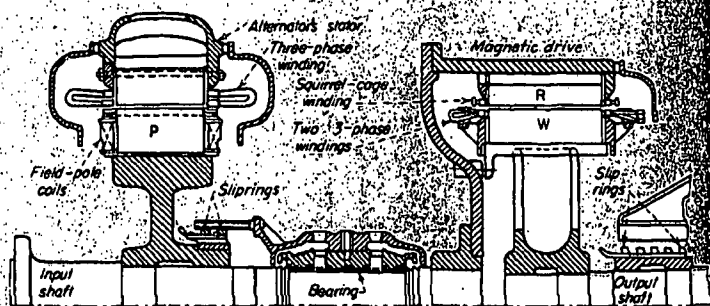
If the outer member connected to the input shaft has ten poles and is driven at 300 rpm when excited with dc, it produces a 25-cycle forward-rotating magnetic field. To generate a corresponding field in reverse direction it is necessary to apply a 50-cycle rotating magnetic field in relation to the outer member. However, owing to the forward rotation of the outer member, the over-all effect relative to the rotor is a 25-cycle reverse field and a corresponding speed.

Mechanically the coupling elements may be arranged in different ways. For simplicity the alternator has been shown separate from the magnetic coupling, but a commoner arrangement is a combination of the two in a single unit. This drive may be considered as a normal magnetic coupling in which an alternator on the input shaft supplies an induction motor on the output shaft. However, it has the advantage that the alternator is seldom used, and is idle during forward rotation of the propeller. Therefore it can be rated on a short-time basis and be considerably smaller than for the usual continuous-duty electric drive.

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16 Reversible constant-speed magnetic drive, with synchronous alternator on the left and an induction motor on the right with two windings on rotor