Inductor Alternators.—In this class of alternator both armature and field magnets are stationary, a current being induced in the armature winding by the action of a so called inductor in moving through the magnetic field so as to periodically vary its intensity.

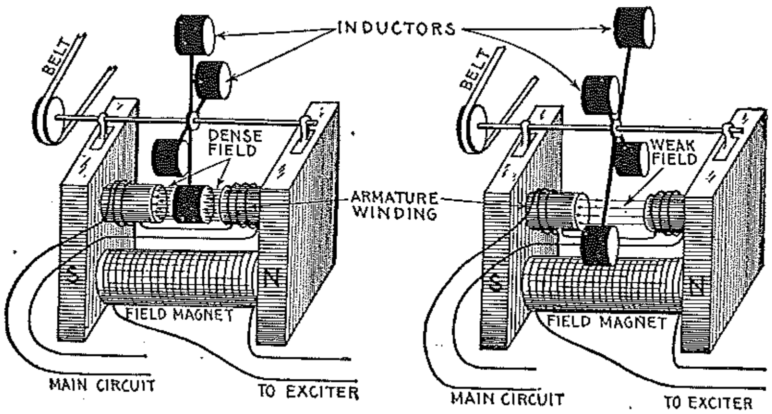


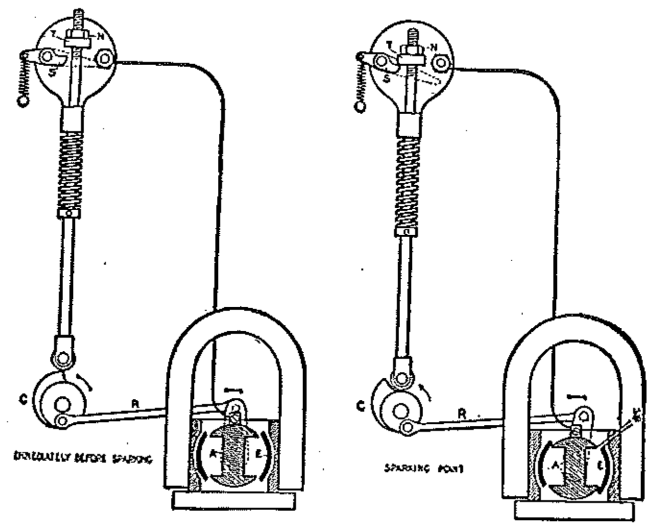
FIG. 1,396 and 1,397.—Elementary inductor alternator; diagram showing principle of operation. It consists of a field magnet, at the polar extremities of which is an armature winding both being stationary as shown. Inductors consisting of iron discs are arranged on a shaft to rotate through the air gap of the magnet poles. Now in the rotation of the inductors, when any one of them passes through the air gap as in fig. 1,396, the reluctance or magnetic resistance of the air gap is greatly reduced, which causes a corresponding increase in the number of magnetic lines passing through the armature winding. Again as an inductor passes out of the air gap as in fig. 1,397, the number of magnetic lines is greatly reduced; that is, when an inductor is in the air gap, the magnetic field is dense; and when no inductor is in the gap, the field is weak; a variable flux is thus made to pass through the armature winding, inducing current therein. The essential feature of the inductor alternator is that iron only is revolving, and as the design is usually homopolar, the magnetic flux in its field coils is not alternating, but undulating in character. Thus, with a given maximum flux through each polar mass, the total number of armature turns required to produce a given voltage is just twice that which is required in an alternator having an alternating instead of an undulating flux through its field windings. The above and the one shown in figs. 1,398 and 1,399 are examples of real inductor alternators, those shown in the other cuts are simply so called inductor alternators, the distinction being that, as above, the *inductor* constitutes no part of the field magnet.

Ques. What influence have the inductors on the field flux?

Ans. They cause it to undulate; that is, the flux rises to a maximum and falls to a minimum value, but does not reverse.

Ques. How does this affect the design of the machine as compared with other types of alternator?

Ans. With a given maximum magnetic flux through each polar mass, the total number of armature turns necessary to produce a given pressure is twice that which is required in an alternator having an alternating flux through its armature windings.



FIGS. 1,398 and 1,399.—A low tension ignition system with an inductor magneto of the oscillating type. The inductor E is rotated to and fro by means of a link R, one end of which is attached to the inductor crank, and the other to the igniter cam C. Two views are shown: immediately before and after sparking. S is the grounded electrode of the igniter; T an adjustable hammer which is secured in position by a lock nut N.

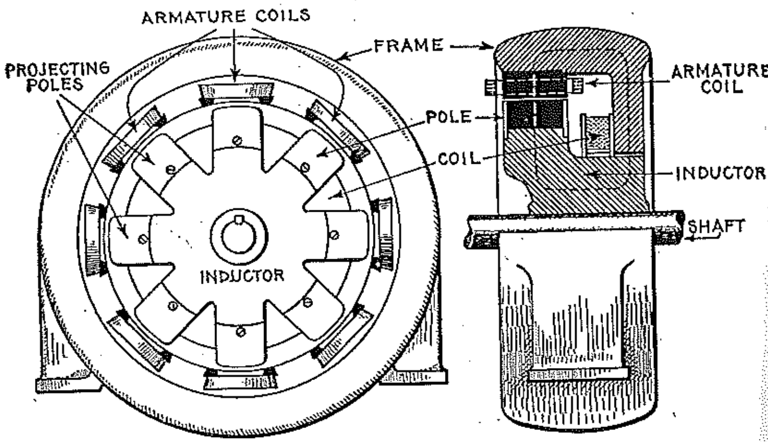
Ques. Is the disadvantage due to the necessity of doubling the number of armature turns compensated in any way?

Ans. Yes, the magnetic flux is not reversed or entirely changed in each cycle through the whole mass of iron in the armature, the abrupt changes being largely confined to the projections on the armature surface between the coils.

Ques. What benefit results from this peculiarity?

Ans. It enables the use of a very high magnetic flux density in the armature without excessive core loss, and also the use of a large flux without an excessive increase in the amount of magnetic iron.

The use of a large flux permits a reduction in the number of armature turns, thus compensating, more or less, for the disadvantage due to the operation of only one-half of the armature coils at a time.

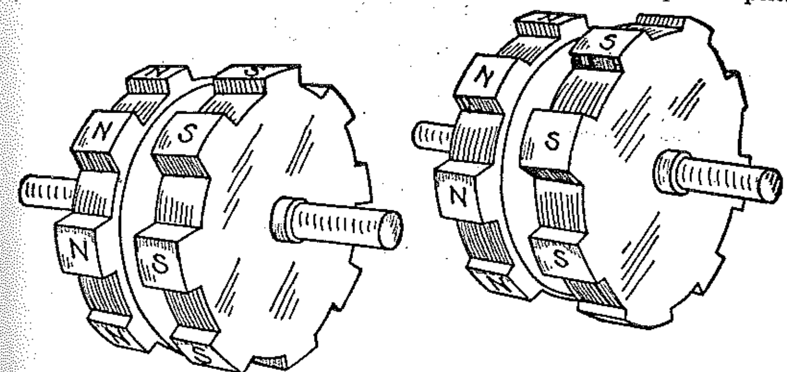


FIGS. 1,400 and 1,401.—One form of inductor alternator. As shown, the frame carries the stationary armature, which is of the slotted type. Inside of the armature is the revolving inductor, provided with the projections built up of wrought iron or steel laminations. The circular exciting coil is also stationary and encircles the inductor, thus setting up a magnetic flux around the path indicated by the dotted line, fig. 1,401. The projecting poles are all, therefore, of the same polarity, and as they revolve, the magnetic flux sweeps over the coils. Although this arrangement does away with collector rings, the machines are not so easily constructed as other types, especially in the large sizes. The magnetizing coil becomes large and difficult to support in place, and would be hard to repair in case of breakdown. Inductor alternators have become practically obsolete, except in special cases, as inductor magnetos used for ignition and other purposes requiring a very small size machine. The reasons for the type being displaced by other forms of alternator are chiefly because only half as great a pressure is obtained by a flux of given amount, as would be obtained in the ordinary type of machine. It is also more expensive to build two armatures, to give the same power, than to build one armature. This type has still other grave defects, among which may be mentioned enormous magnetic leakage, heavy eddy current losses, inferior heat emissivity, and bad regulation.

Classes of Inductor Alternator.—There are two classes into which inductor alternators may be divided, based on the mode of setting of their polar projections:

1. Homopolar machines;
2. Heteropolar machines.

Homopolar Inductor Alternators.—In this type the positive polar projections of the inductors are set opposite the negative polar projections as shown in fig. 1,402. When the polar projections are set in this manner, the armature coils must be "staggered" or set displaced along the circumference with respect to one another at a distance equal to half the distance from the positive pole to the next positive pole.



FIGS. 1,402 and 1,403.—Homopolar and heteropolar "inductors". Homopolar inductors have their N and S poles opposite each other, while in the heteropolar type, they are "staggered" as shown.

Heteropolar Inductor Alternators.—Machines of this class are those in which the polar projections are themselves staggered, as shown in fig. 1,403, and therefore, do not require the staggering of the armature coils. In this case, a single armature of double width may be used, and the rotating inductor then acts as a *heteropolar magnet*, or a magnet which presents alternatively positive and negative poles to the armature, instead of presenting a series of poles of the same polarity as in the case of a *homopolar magnet*.

Use of Inductor Alternators.—Morday originally designed and introduced inductor alternators in 1866. They are not the prevailing type, as their field of application is comparatively narrow. They have to be very carefully designed with regard to magnetic leakage in order to prevent them being relatively too heavy and costly for their output, and too defective with respect to their pressure regulation, other defects being heavy eddy current losses and inferior heat conductance.

Hunting or Singing in Alternators.—Hunting is a term applied to the state of two parallel connected alternators running out of step, or not synchronously, that is, " see sawing." When

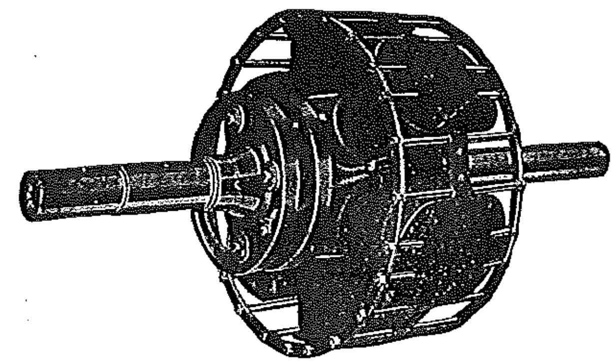


FIG. 1,404.—Revolving field of Fort Wayne alternator equipped with *amortisseur winding.* The object of this winding is to check any tendency toward *hunting* when the alternator is to be run as a synchronous motor, either for rotary condenser or power service. The amortisseur winding consists of heavy copper bars, placed around and through the pole faces and short circuited at the ends by heavy copper rings; it serves as a starting winding to bring the rotor up to speed as an induction motor, and also serves as a damping device to neutralize any tendency toward "hunting" caused by variation in speed of the generator supplying the current.

the current wave of an alternator is peaked and two machines are operated in parallel it is very difficult to keep them in step, that is in synchronism. Any difference in the phase relation which is set up by the alternation will cause a local or synchronizing current to flow between the two machines and at times it becomes so great that they must be disconnected.

Alternators which produce a smooth current wave and are maintained at uniform speed by properly designed governors,