

## SOME OBSERVATIONS ON A DIRECT-CONNECTED 300 K. W. MONOCYCLIC ALTERNATOR.

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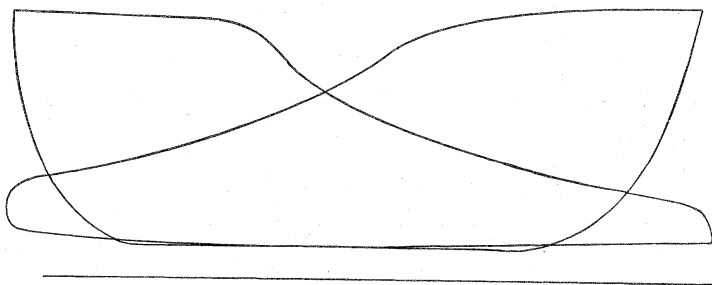
Before giving the results of the observations we have taken, it will probably be desirable to give a brief description of the machine.

The machine is the new monocyclic alternator, manufactured by the General Electric Company, of 300 k.w. capacity—1150 volts, 260 amperes—at a speed of 140 revolutions per minute. It is direct connected to a Russell, tandem-compound, high-speed condensing engine, which ran during the test about 15 revolutions more than the required speed. The armature is of the ironclad type, 110 inches in diameter,  $10\frac{1}{2}$  inches wide, with about  $\frac{3}{16}$  inch clearance, and is furnished with two sets of windings.

According to Dr. Louis Bell the cross-section of the main and teaser coils is the same, but the latter has fewer turns and is placed in shallower slots midway between the main coils. The pressure developed by the teaser coils was .7 of the pressure across the main terminals of the machine. There are 96 slots on the armature, one-half of these being used for the main coils and the other half for the teaser coils. Three collector rings are used, one being connected to each end of the main coil, and one to the free end of the teaser coil. These are made of brass, 2 inches wide and  $\frac{3}{4}$  inch thick, and each has two brushes,  $\frac{5}{16}$  inch thick, covering its full width. The rectifier for the series excitation is  $4\frac{3}{4}$  inches wide and has 48 segments  $1\frac{1}{4}$  inches in width. Two sets of brushes are used for both the positive and negative poles of the rectifier, each set consisting of two copper brushes  $1\frac{3}{4}$  inches wide by  $\frac{5}{16}$  inch thick. Only about .63 of the total cur-

rent is rectified in this machine. The magnet cores are laminated, 48 in number, and are 10 by  $4\frac{1}{4}$  inches face and  $10\frac{1}{4}$  inches deep, the outside dimensions of the field windings being about 12 by 6 inches. Each magnet spool carries a series coil, and a separately excited coil, all the series and separately excited coils being separately connected in series.

The series coils are formed of two flexible cables in parallel, having a total cross-section of about 98,000 cir. mils. while the cross-section of the separately excited coils is about 33,100 cir. mils.



Indicator Card from High Pressure Cylinder, 60 lb Spring. Speed 146. Total I. H. P., High Pressure 126.3 E. H. P. 190.

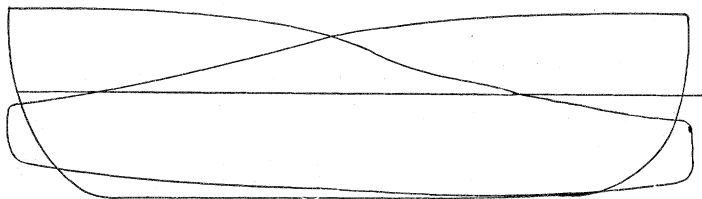


FIG. 1. Indicator Card from Low Pressure Cylinder, 20 lb. Spring. Speed 146. Total I. H. P. Low Pressure Cylinder 107.8 E. H. P. 190.

The exciter used was a four pole continuous current machine, of the new General Electric, slow-speed type, belted direct from the dynamo shaft, and therefore all power measurements include the power furnished to the exciter. The output of the exciter is 52 amperes at 125 volts, and its speed 850 revolutions per minute. Standardized Weston instruments were used, with the exception of the main ammeter in the generator circuit, this being the regular station instrument furnished by the General Electric Company. This instrument was quite sensitive, and, while no means were at hand for calibration, we think the results

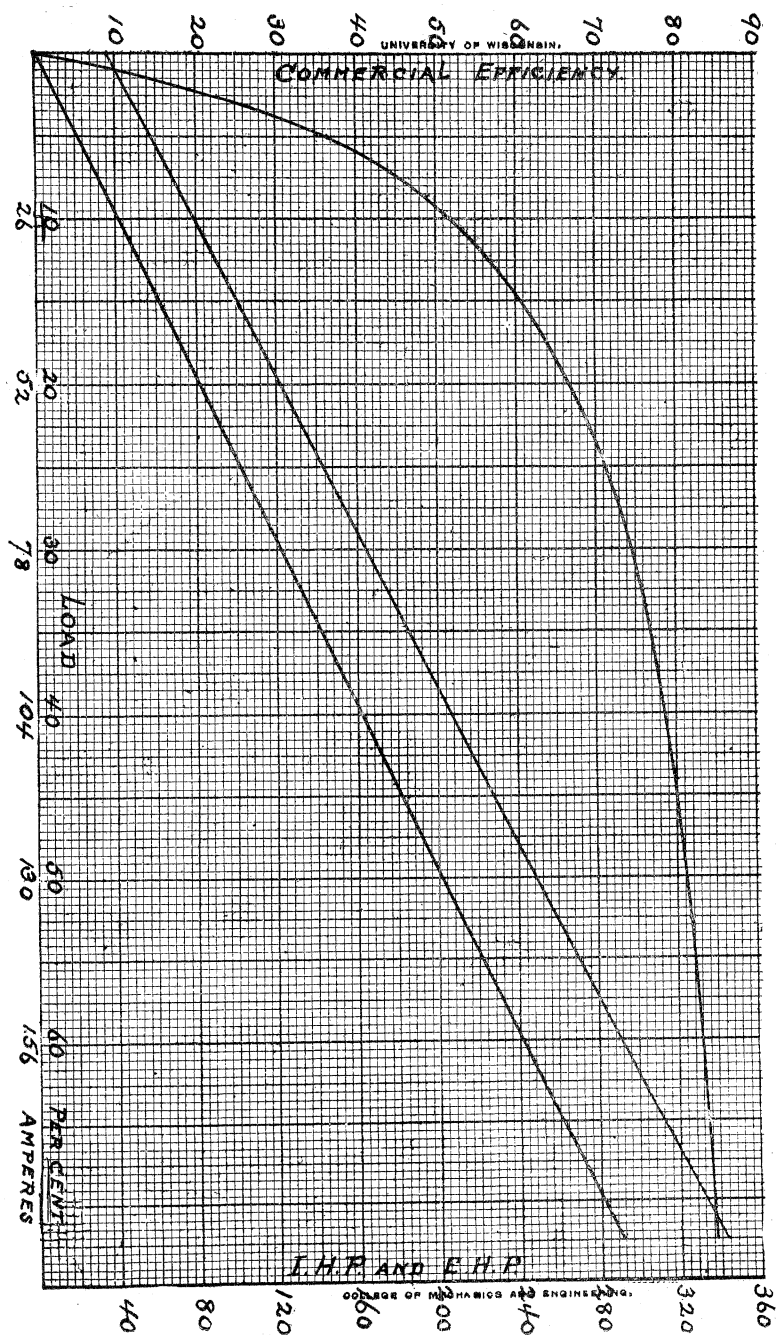


FIG. 2.

may safely be taken as a fair indication of the performance of the machine. The principal dimensions of the engine are as follows: Stroke 24 inches, diameter of high pressure cylinder 15 inches, diameter of low pressure cylinder 24 inches.

Figure 1 represents a set of cards taken from the engine and following are the electrical readings taken at the same time—124 amperes, 1144 volts, 146 revolutions per minute. The exciting current was 51 amperes.

In planning the test we fully expected to make a ten-hour continuous run at full load, and determine the heating, efficiencies, etc., but were unable to go farther than slightly above half load. In the first place the engine was piped to a single boiler of insufficient capacity, and secondly, the engine was too small to carry the full load of the generator, and in addition its regulation was defective, the total variation of speed being as much as 15 per cent. Figure 2 therefore shows an efficiency curve for slightly above half load, and from this it will be seen that the commercial efficiency of the generating set is about 81 per cent. at half load. When these observations were made, the machine was in commercial service with the regular transformer load. The commercial efficiency of the generating set is taken as the ratio of the electrical output to the I.H.P. The E.H.P. here used is taken as the product of amperes and volts, the power factor of the circuits therefore being assumed at 100. Actual measurements have shown that the power factor is at any rate over 98 per cent., and consequently the error made by this assumption is comparatively small. The diagonal lines in the figure show respectively the I.H.P. and the E.H.P. at different loads, the vertical scale for these being at the right hand of the figure. For the ordinary changes of load, the regulation of the alternator is not entirely effected by the series coils as the machine now stands, but requires considerable hand regulation. However, this can probably be improved by altering the shunts across the rectifier and series turns respectively, thus giving a greater number of ampere-turns in the series coils. This lack of regulation on the part of the alternator combined with the unsatisfactory regulation of the engine, makes the performance of the generating set somewhat below the standard for this class of machinery when under ordinary working conditions, but, as a whole, the unit is a magnificent piece of mechanical construction.