NOTES ON THE DESIGN OF MULTIPOLAR DYNAMOS.

(Continued from August Number.)

HAVING discussed the design of multipolar machines as influenced by both theory and practice, it remains to conclude this communication by calling attention to some of the ordinary forms of multipolar fields. The double wrought iron horseshoe (Fig. 4) is not very frequently used, being rather costly; but a similar machine with magnets of cast iron, was lately made by my firm for the National Line S.S. America. The armature core in this case was formed by winding square annealed iron wires on a gun-metal flanged cylinder. The winding was of the Gramme

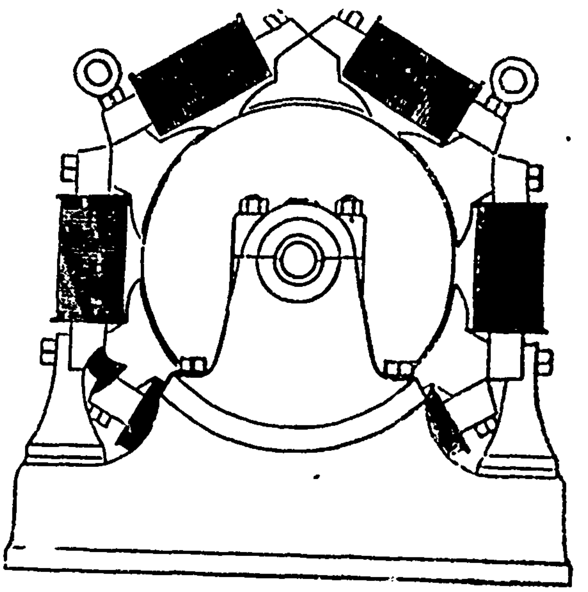

FIG. 7

type, and the machine was coupled direct to an inverted engine. This design, introduced by Gramme in 1869, generally gives place to the arrangement shown in Fig. 5, a form designed by the same inventor in 1885, and since adopted for cylinder-wound armatures by many makers, including Mr. Jasper, in Belgium, Mr. Brown, of the Œrlikon Works, in Switzerland, and Messrs. Patterson and Cooper, in England. Lately Mr. Knapp has used the same form for six and eight-pole machines with drum armatures. The magnets and octagonal yoke in Fig. 5 are of cast iron in two pieces, the lower limbs, the bottom half of the yoke ring and bed plate being one casting, and the top limbs and upper part of the yoke being another. Fig. 6 represents a similar field in which the magnet cores are of wrought iron, fitted with cast iron pole pieces, as used by Mr. Knapp in the

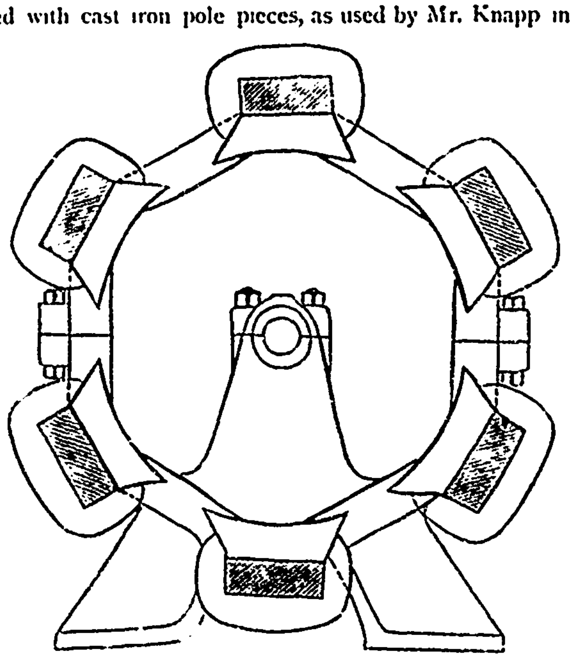

FIG. 8.

machines above mentioned. The decision as to whether cast iron or wrought iron should be used is arrived at in a very simple manner—by comparing the excess of copper required on one hand with the extra machining required on the other.

It will be observed that in the designs Figs. 5 and 6 the yokes are considerably longer than those shown in Fig. 4, and the weight of the former, if made of the same material, would be, roughly, twice that of the latter, though even then the complete magnet system would be but 75 per cent. of the weight of Fig. 3. The yokes being of cast iron, however, the system really comes about 20 per cent. heavier than Fig. 3, the less expensive character of the material compensating, of course, for the increased weight.

All these are examples of single magnetic circuits, where the lines of force from each pole remain undivided in their paths

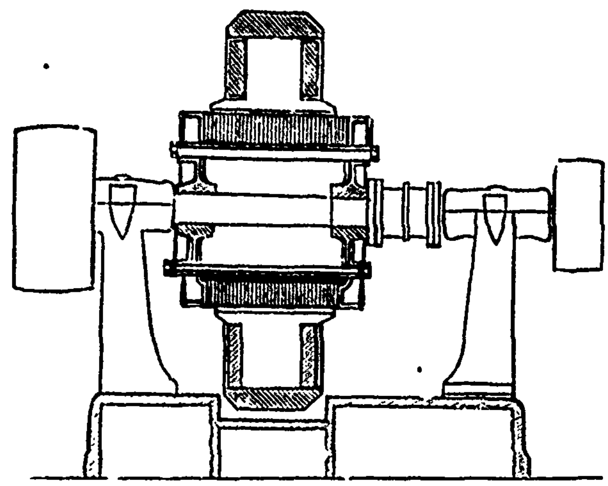

FIG. 9.

through the magnetizing coils; but in Figs. 7 and 8 are shown examples of double magnetic circuits, in which the lines from each pole take two paths through separate coils. Fig. 7 is a type of magnet used by Sautter-Lemmonier, of Paris, for Gramme-wound armatures, and by Cuenod-Sautter, of Geneve, for armatures having a Siemens winding as modified by Thury. The magnetizing coils are wound upon the parts of the system constituting in Fig. 6 the yokes, and a greater amount of copper is in consequence required. It looks at first sight as if the weight of copper was not very different in the two types, but in this respect appearances are deceptive, for, as a matter of fact, the field of a four-pole machine made according to Fig. 7 would require about 125 per cent. more copper than if made according to Fig. 6. It will be observed, however, that the magnet cores and pole pieces, which are made throughout of the softest wrought iron, are very light. In Fig. 8 the magnets are a series

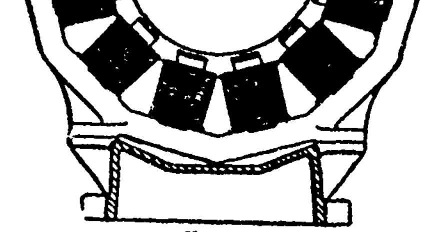

FIG. 10.

of wrought iron bars lying parallel to the armature, each fitted with a cast pole piece in the middle of its length, and having two magnetizing coils, one on each side of this piece. It is a structure which may be frequently met with, though not precisely in the form shown, and the observations regarding the copper made with reference to Fig. 7 apply equally here.

The cost of a four-pole machine is approximately represented by the cost of a couple of two-pole machines of the same efficiency, which give each half the output at twice the speed; the cost of a six-pole by that of three two-pole machines which give one-third of the output at three times the speed, and so on. For comparison, the fields must be in both the multipolar