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ON A DYNAMO FOR MAINTAINING ELECTRICAL VIBRATIONS OF HIGH FREQUENCY.

WITH SOME NOTES ON THE TRANSMISSION OF WAVES IN WIRELESS TELEGRAPHY.

BY

SIR OLIVER LODGE.

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On a Dynamo for maintaining Electrical Vibrations of High Frequency. With some notes on the Transmission of Waves in Wireless Telegraphy. By Sir OLIVER LODGE.

I DESIRE not so much to put on record, since that has in some sort been already done, but to welcome the achievement of what many physicists in years past desired to attain, namely the construction of an alternating arrangement capable of maintaining electrical vibrations of sufficiently high frequency to give a continuous train of waves of moderate length; comparable for instance to four miles or even less. It may be that this problem will give way, as problems so often do, in several directions at once; and that the result may be—possibly has been—achieved by several different methods. At present, however, my attention has been called to the ingenious device introduced by Dr. Goldschmidt of Berlin, an ex-Professor of Electrotechnics at Darmstadt.

A method of achieving the desired end by a series of alternating dynamos had already been suggested, and will be found referred to in Professor G. F. FitzGerald's Collected Papers, page 280, where a discussion between himself and Dr. Sumpner, involving also Professor Trouton, is reported as having occurred at the Physical Society of London on 22nd January, 1892; with myself, as it happened, in the chair. It is reported also in *Nature*, vol. xlv. p. 358.

The plan then mooted was to use the alternating current from one dynamo to excite the field magnets of another, that

other to excite a third; and so on. By this means it was clearly perceived that the frequency could be made to mount up in arithmetical progression with the number of machines. But the obvious cumbersomeness and wastefulness of the arrangement, although it was true that all the dynamos might run on the same shaft, caused the idea to be promptly abandoned.

Dr. Goldschmidt, however, has now made the interesting discovery that all these steps can be taken in a single machine, with some manifest and some unexpected advantages, and apparently with sufficient economy for practical purposes even at high power, so long as the final frequency does not exceed say 50,000 per second.

The fact that iron is used, and to all appearances necessarily used, in attaining this result, although its magnetization should not be pushed beyond a permeability of 100 or something below the steep part of a magnetization curve, necessitates many instrumental precautions, much careful design, and considerable constructive skill; but designers of the Firm of Messrs. C. Lorenz, and Engineers of the Firm of Messrs. Bergmann, both in Berlin, have been able to execute machines which certainly work in the way expected.

So far as I am aware Physicists in this country have not made themselves generally acquainted with the device employed, and inasmuch as its ingenuity commands admiration, I venture

(1) to expound the principle briefly,
(2) to attempt a theory.

The features of the machine and the laws utilised may be all considered known when taken separately, some of them well known; and yet, in combination, they work in a way which at first sight seems puzzling and might readily have been pronounced fanciful.

The separate points on which the invention is based may be thus stated :—

(1) That when the field magnet of an alternating dynamo, with a number of poles distributed round a circle, is itself excited by an alternating current, its field may be considered as revolving equally in two opposite directions; *i. e.*, its magnetism revolves although the iron is mechanically stationary. This is merely because each North pole changes sinuously into a South pole, and each South pole into a North; thus virtually changing places in a continuous cyclical manner.