THE GRISSON CONTINUOUS-ALTERNATING CURRENT TRANSFORMERS.

BY A. FREDERICK COLLINS.

The evolution of the circuit-breaker or interrupter for induction coils has been slow, owing to the lack of commercial utility of large coils prior to the introduction of the X-rays as an accessory in surgery. After Roentgen's great discovery, an impetus was given to the art of constructing induction coils and the necessary device with which to operate them, and this was greatly added to upon the advent of wireless telegraphy.

Probably the first attempt to make and break the circuit of a primary coil, by which alternating currents would be induced in the secondary coil, was by sliding one terminal of a copper wire over a coarse file. Sturgeon, the inventor of the electromagnet, exhibited his coil in 1837 equipped with this primeval device. Various forms of mechanical contact breakers were then constructed, by means of a ratchet and spring, and operated by hand.

These finally gave way to forms better adapted for the purpose, one of which was the revolving contact breaker of Barker, who employed a star-shaped wheel or spur to dip in mercury.

Dr. C. S. Page invented the first automatic contact breaker, which he described in 1838. Wagner and Neef improved upon the mercurial breaker by constructing one operated automatically and having the vibrating armature arranged with platinum points where the break took place. This simple electromechanical arrangement is now used on all coils of small size. From that time to the discovery of the X-rays many different forms of contact breakers were designed to give a long make and a short break, but no very wide divergence in the design or construction of interrupters was made until the mercurial turbine and Wehnelt electrolytic interrupters were brought out. In the former, a hollow spindle containing a steel worm, when revolved, draws the mercury from a well below up to two diametrically opposite, lava-tipped steel tubes, by centrifugal force; it is then projected against a pair of sheet-iron sectors, where the circuit is completed. In this way the interruptions may be varied from 10 to 10,000 per minute.

In the electrolytic interrupter 1,000 to 10,000 per minute. It consists in its usual form of a small surface platinum anode and a large surface lead cathode immersed in a solution of one part of commercial sulphuric acid and five parts of water. When connected in series with the primary coil or inductor, bubbles of a non-conducting gas are formed on the anode by electrolytic action, and bursting, complete the circuit. In wireless telegraphy it has been found that continued working produces a heating loss of more than three or four amperes, and forty or fifty volts—the E. M. F. required to operate it—are used.

In the mercury turbine interrupters, especially of foreign manufacture, the deposits require frequent cleaning of the apparatus, and this has called forth fresh effort on the part of inventors to introduce a form that would eliminate the objectionable features and retain the good qualities of both. This is the purpose of the Grisson transformer.

In the SCIENTIFIC AMERICAN of December 28, 1901, I described the wireless telegraph system designed by Dr. A. Slaby and Count d'Arco, and which is now manufactured by the General Electric Company of Berlin. This company has recently placed on the market a substitute for the electrolytic and turbine interrupters in the form of the Grisson continuous-alternating current transformer, shown in the engraving and diagram. This apparatus changes a direct continuous current into a pure alternating current, hence its name. Its periodicity or frequency of alternation may be varied from 900 to 6,000 per minute, and, though this is less than in the electrolytic and turbine forms, currents of any amperage may be easily employed. Different from other interrupters in the Grisson transformer, there is no interruption of the current at the maximum value, and consequently there is particularly no sparking of the brush, B^3, at U^1U^2. The use of heavy currents for feeding the inductor is thus made possible, besides reducing the size of the condenser in shunt with the interrupter, if not dispensing with it entirely.

Referring to the diagram, Fig. 2, it will be observed that in the development of this system the inductor or primary coil, $P^1P^2P^3$ (the secondary coil and iron core is not shown) has besides its principal terminal, which is common to all induction coils and transformers, a leading-in wire, L, joined to the middle convolution of the inductor at P^3. The terminals, L and L^1, are connected directly to the source of energy. By means of a shunt from the leads, L and L^1, current is supplied to a small motor, M, of which C is the commutator and R a variable resistance, whereby the speed of the rotating transformer or contact disks, V^1V^2, may be varied between comparatively wide limits.

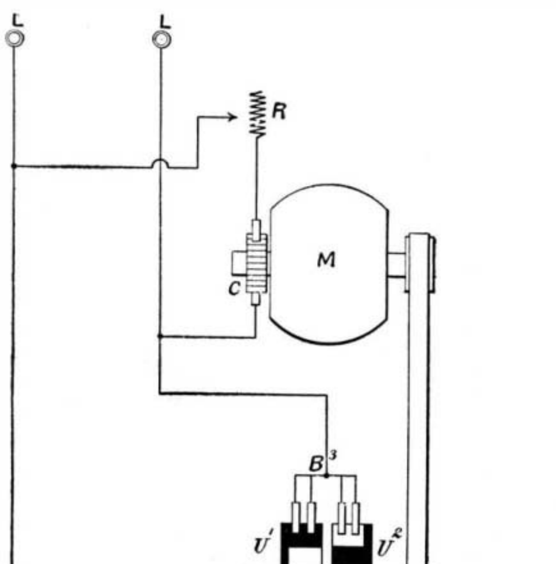

Fig. 2.—DIAGRAM OF TRANSFORMER.

The main current from L^1 is divided at the brush, B^2, on U^1U^2, which alternately make and break contact on the commutator segment of the contact disks; these disks, U^1U^2, are fastened on a common shaft, but are isolated one from the other and send forth two continuous currents from the leads, B^1 and B^2; the brush, B^3, on the opposite side slides interchangeably on the *lamella* or thin layers of V^1V^2, or temporarily unites them as the case may be. The shaft upon which the contact disks are keyed is fitted with a pulley and is driven by the motor, M, belted to it.

The principle of the Grisson transformer will now be easily understood. The current is transmitted to the inductor, p^1p^2, directly from the continuous flow for the length of time the brush, B^3, rests on the metal segment and the insulating segment of the contact disks, and the circuit, including the source of energy and the inductor, is thus closed, and the maximum value of the current is therefore effectual; but the instant this critical value is reached, the contact disks will have reversed the flow of current and p^1 and p^3 is cut off. As both portions of the inductor have a common iron core, i. e., the same core, and are magnetized in an opposite sense, a counter-electromotive force is produced by means of isolating the current, p^2p^3, in the first current circuit when the primary current strength is lessened, and as the beginning of one segment approaches and the other leaves the brush, B^3, the value of the current is brought to 0.

At the moment the first circuit is interrupted, the current quickly reaches a critical maximum value in p^2p^3. This is accomplished by the automatic closing of one or the other circuit, or both, at the same time by the contact disks, which, as the illustrations show, are arranged like a continuous-current dynamo commutator, except that the metal segments are insulated by insulating segments of equal peripheral width instead of thin sheets of mica.

The General Electric Company (Berlin) recommend this type of transformer especially for their standard station wireless telegraphy sets and the equipments they supply for armored war vessels.

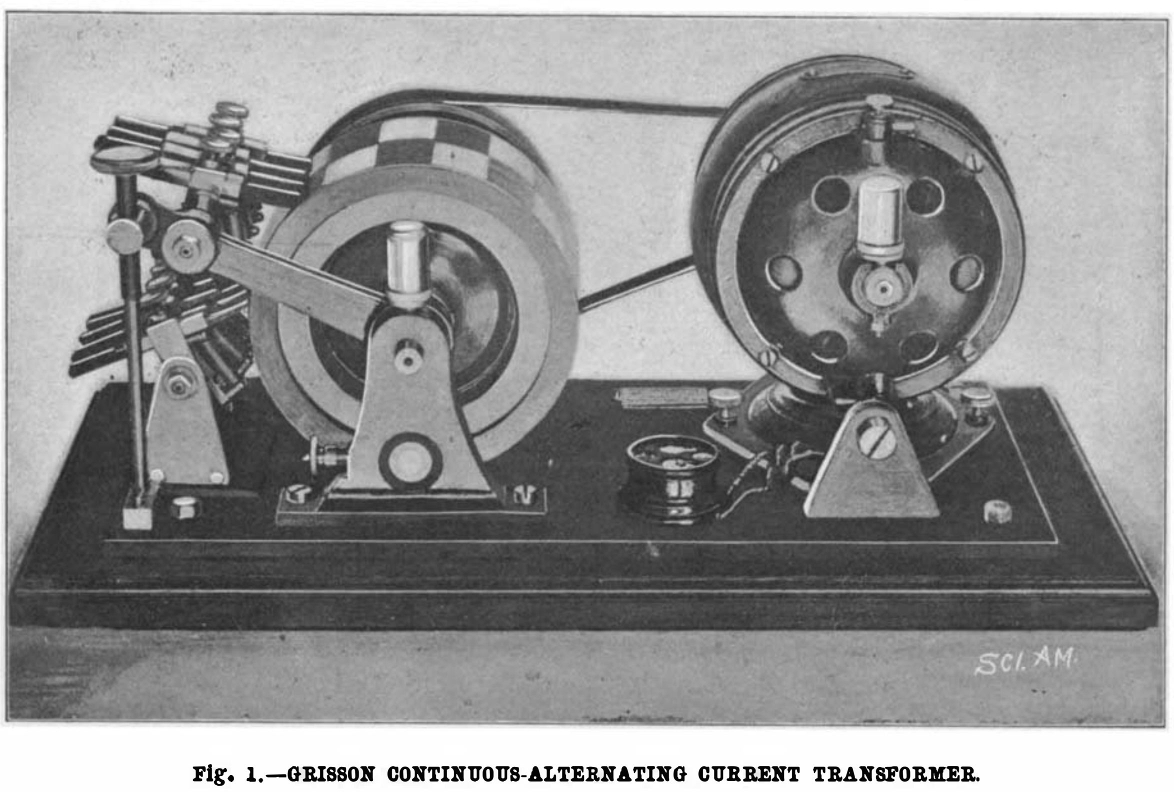

Fig. 1.—GRISSON CONTINUOUS-ALTERNATING CURRENT TRANSFORMER.

Ozone for Sterilizing Water in Germany.

Ozonized air has long been known to be a very efficient sterilizer for water, although the dry gas has been found to possess little bactericidal power. Its use has, therefore, been suggested for the purification of potable waters, but the early experimental installations, which were erected at Blankenburg, Oudshorn, and Paris, are reported to have been abandoned, and, at present, the process is only known to be in operation at Lille in France, at Bole in Mexico, and at Moscow in Russia. The method is a simple one, but hitherto the cost has been a considerable factor against it. One of the London water companies is at present conducting experiments with a view to introducing the process there. Considerable interest, therefore, attaches to the publication of details regarding the working of the small experimental installation which was erected by Siemens & Halske, at Martinikenfelde, near Berlin, in 1898.

The ozonizers employed here are of the Siemens & Halske plate and tube type, and yield from 20 to 25 grammes of ozone per E.H.P. hour, with an E.M.F. of 12,000 volts. Air is first forced through a drying chamber, and then passes into the ozonizers, on leaving which it contains from 2.5 to 3 grammes of ozone per cubic meter. It is then led to the base of the sterilizing tower, a square structure packed with flints, and as it rises through these, it meets a descending stream of the water to be sterilized, which has undergone preliminary filtration through sand. The plant in question is capable of treating 240 cubic meters of water in 24 hours (1 cubic meter is equal to about 220 gallons), and the results of the exposure to ozonized air will be seen from the following tests made with water from the River Spree. With a consumption of 2 grammes of ozone per cubic meter of water, the number of bacteria per cubic centimeter was reduced from 600,000 to 10; the permanganate absorption figure was diminished by 18 per cent, and the aeration of the water was increased from 10 to 12 per cent.

The capital outlay for an installation capable of treating 150 cubic meters of water per hour is estimated to be $33,750, of which total the ozonizers and sterilizing tower absorb $18,750. The actual cost of treatment for a plant of this size is given as 1.736 pfg. per cubic meter, and the total cost, including interest and depreciation, amounts to 5.031 pfg. per cubic meter, the latter figure being equivalent to about $55 per million gallons. In addition it may be noted that Siemens & Halske have recently patented a method of clearing turbid water by the combined action of ozone and iron.

Trial of a Motor Fishing Boat.

The first completely equipped motor fishing boat has recently made her trial trip most satisfactorily at Lowestoft. This is the first fishing craft which will rely upon petrol to generate the force required for all purposes —hauling her nets, hoisting sails, working the capstan, and driving her pumps. The motor is of 24 horse power, and is fitted in a case 4 feet by 2½ feet. It is only 3 feet high, and the top cover serves for a table. The motor is of the three-cylinder, two-cycle type, and self-starting and reversing.