

## PLANT EFFICIENCY WITH OPEN AND CLOSED CIRCUIT TRANSFORMERS.

BY WILLIAM STANLEY, JR.

SEVERAL contributions on the relative merits of the closed and opened circuit transformers for the distribution of electrical energy, have lately appeared in *The Electrical Engineer*. In various letters, Mr. Swinburne has maintained that the open circuit transformer is more efficient than is its opponent of the closed magnetic circuit type, and that, consequently, American engineers were applying and advocating apparatus lacking maximum efficiency.

When, in 1885, I constructed the first closed transformer, and adapted it for commercial lighting, I had in mind the very differences which are now being discussed, and at the same time there seemed to me to exist certain objections to open circuit transformers which still appear to me to be of such magnitude that I believe, in America at least, the open circuit transformer is at a disadvantage. Of these objections I have seen no mention; they are briefly as follows:

In the open circuit transformer of the Ruhmkorff, the Gaulard and Gibbs, or the hedgehog type, high efficiency is due to the fact that the fluid (or air) portion of the magnetic circuit causes the current phase to lag behind the E. M. F. more than in the closed magnetic type, and in a well constructed transformer of the open circuit type this lag is nearly 90 deg. at no load, that is, when the secondary circuit is open. Now in these transformers the value of the primary current varies comparatively little with the load derived from the secondary circuit, and when such a transformer is gradually loaded, the primary current will remain, roughly speaking, constant, while the lag of the current behind its E. M. F. will diminish; the phases of current and E. M. F. more nearly coinciding as the energy taken from the transformer is increased.

In the closed circuit type of transformer, however, the *value of the primary current in amperes* is very nearly in direct proportion to the load upon the secondary circuit. Thus while the primary current in the open circuit type remains, roughly speaking, constant, possibly varying 10 to 20 per cent., the primary current in the closed type is proportional to the load.

Let us examine briefly the station requirements for the two contrasted types. With the open circuit type eight-tenths of the station plant, that is, eight-tenths of all the engines and dynamos, must run continual to supply the primary currents, for the ampere value of these currents is about constant; while with the closed circuit type of transformer, the engines and dynamos in service vary in proportion to the number of lamps burning. Thus, in a station having 10 dynamos and engines of equal size, in many places one dynamo and engine will easily supply all the energy necessary during twelve or fourteen hours out of the twenty-four, when the closed circuit or American type of transformer is used; while, with the open circuit type advocated by Mr. Swinburne, at least eight of such engines or dynamos would be required to do the same work. The question arises, therefore, Which system uses the least fuel, and costs the least?

For the sake of simplicity, we will allow Mr. Swinburne's transformer to have 100 per cent. efficiency. We will also allow the closed circuit transformer an efficiency of 95 per cent., which can be proven to be commercial practice in well designed transformers. Placing the engine losses at 10 per cent. and neglecting the losses in the mains, we find that with the open circuit type the loss is eight times as much as with the closed type, neglecting transformer losses; or 7.6 times, including these losses. In short, it requires about seven to seven-and-a-half times as much coal to maintain current for open circuit as for the closed circuit type, because, during the idle period of the day, approximately seven to eight times as many dynamos and engines have to be run, and the principal losses occur in these elements instead of in the transformers. During the remainder of the day, about one-half of the time, that is, a quarter of a complete day, the efficiencies of the systems employing these two types would be equal; and during the remaining quarter of the day the efficiency of the open type would be 5 per cent. greater.

I therefore dispute Mr. Swinburne's statement that an open circuit transformer is as efficient an element of a system of distribution as its American brother. With higher frequency the open circuit transformer will make a better showing, and prob-

ably will be used, providing we can arrange means to obviate the extra losses.

By the way, why use the words converter or transformer? Would not Cyclotrope or Ergotrope, meaning that which transfers from a circuit, and that which transfers energy, be more appropriate?

## WANTS TO BE THE FIRST SUBSCRIBER.

TORONTO, Nov. 25th, 1890.

Editor ELECTRICAL, MECHANICAL AND MILLING NEWS.

DEAR SIR,—Having learned that you are about to make some changes in your paper, and that you intend to devote your entire space to electricity and steam engineering, I hope such is the fact, and that we may be able to say we have a Canadian publication treating directly on these matters. I think I may say for the greater part of the engineers of Canada that they will endorse and support such a paper. Count me in as the first subscriber.

Yours fraternally,

A. M. WICKENS.

## SPARKS.

The town of Napanee has arranged with the Bell Telephone Co. for an electric fire alarm.

The Bell Telephone Co. are making extensive improvements in their system in Kingston. Mr. T. Wadlands has charge of the work.

It is said that 13 per cent. premium was offered for some new shares of its stocks which the Quebec and Levis Electric Light Company lately placed in the local market.

It is understood that owing to ill-health, Mr. E. O. Jones has resigned his position as Vice-President of the Bell T. L. Co., Toronto, and will go south for a time.

The boiler in McDonald's sash factory at Fergus, Ont., exploded recently. Pieces thereof and boards from the roof of the building were driven through the air in all directions, but luckily no one seems to have been killed.

A quick piece of cable service is reported from Montreal. A cablegram was sent from that city over the commercial cable to London at 10.27, and at 10.40, just thirteen minutes, a reply was received. The message had been sent from Montreal to Canso, thence to Ireland, and on to London. A transaction was effected on the London Stock Exchange, and the reply was written, sent, and received in the time named.

The Winnipeg Electrical Railway is completed and will go into operation at once. The electric motor car—the first ever brought into the Canadian Northwest—was constructed at St. Catharines, Ont. The company regard this line somewhat in the light of an experiment, but they little doubt that the motor will stand the cold of winter, which a few have been inclined to question. Providing the experiment proves entirely satisfactory there is every reason to believe that the company, having a prior right, will be granted permission by the City Council to extend their system to the main thoroughfares.

A simple method of removing magnetism from watches consists in the use of a compound horseshoe magnet placed with its poles upward, and a support about three feet above it. From this support the watch to be demagnetized is suspended in a cardboard tray which hangs by a twisted thread. As the end untwists the watch is gradually removed from the magnetic field. This is much handier than the ordinary way of demagnetizing watches, which entails the use of an electro-magnet energized from a battery or other source of current, or the employment of permanent horseshoe magnets.

The electric lighting company of Concord, is using a device by means of which, it is stated, a saving of 30 per cent. is effected in the cost of arc lamp carbons. The trimmers bring to the station on the short pieces of carbon collected on their daily rounds. These are sorted and matched together, to form a carbon about eight inches in length. These pieces are placed in a machine which forms a dowel on one piece and a socket in the other, and they are cemented at the joints. The cement with which they are joined is heat-proof and is a good conductor, so that there is no change in light indicated when the joint is reached. The spliced carbons are used only in the lower holder. Carbons thus joined have been used by the company for over a year, and the process is considered entirely successful.

A despatch from St. Catharines says a by-law to allow the Reliance Electric Light Company to erect poles and string wires in the city of St. Catharines in opposition to the present existing company was passed Monday night, the mayor being called upon to exercise his franchise, the vote at the third reading being a tie. The stockholders of the St. Catharines Electric Light Company at present in existence are all prominent citizens, and considerable feeling has been fomenting in the triangular fight between the two electric companies and the gas company. The last named company have been laying new mains. The St. Catharines Electric Light Company have purchased a 600 Thomson-Houston dynamo, and the Reliance are offering lights at 20 cents each per night, against the St. Catharines company's 30 cents each per night. In the meantime the city is blowing out the gas, and is almost asphyxiated with the clamorous vituperations of the ratepayers.