

numbers, $12,000 d L$. Substituting for N and v their values, the output becomes for cylinder armatures

$$W = .048 d^2 L n \quad (5)$$

and for drum armatures

$$W = .072 d^2 L n \quad (6)$$

This applies to all direct-current machines, whether bi-polar or multi-polar; though it will be understood of course, that the induction in the gap may be greater or less than what has been assumed. In that case the coefficients .048 and .072 would be altered, without changing, however, the form of the expression.

4.—OUTPUT OF ALTERNATING-CURRENT ARMATURES.

The armature loads for alternators, though producing a cross magnetization, as in direct current machines, raise no considerations, of course, as regards sparking. But on account of the greater proximity of the poles, and the greater stray field resulting, it is desirable to make the layer of copper on the armature core as thin, and the air gaps as short as possible. As a consequence, probably, of the increased ratio of stray to useful field, the induction is less in the gaps of alternating than in those of direct-current machines. Here it will be assumed that the virtual induction is 4,000 C.G.S. units per square centimetre, meaning that this represents the induction to which the resultant E.M.F. is due. The impressed E.M.F. is greater than the resultant, and the induction due to the field magnets alone is greater than 4,000; but what I am dealing with is the field resulting from the inter-action of the magnet and armature fields; it is the field to which the resultant E.M.F. = $C R$ is due, this and the current being coincident in phase. Usually the poles cover a fraction of the circumference = $1.5 d$, the value of N for alternators being then $6,000 d L$. About half the circumference being covered with wire, under usual conditions of temperature and efficiency we have for v a mean value of 400, which gives for the product of mean resultant E.M.F. and mean current $.024 d^2 L n$. In some cases, as in the Westinghouse machine, the conductors cover more than half the circumference, and v is therefore greater. But here, on account of the differential effect produced on the separate wires of the same section, the added turns have nothing like a proportionally increased value, and the expression will give approximately the value of the product of mean resultant E.M.F. and mean current, even in these machines. Assuming that the E.M.F. is a sine function of the time, to get the watts we must multiply by $\frac{\pi^2}{8}$, which

gives us, therefore, as the output of the alternator

$$W = .0296 d^2 L n \quad (7)$$

or rather over 40 per cent. of the work done by a drum wound direct current machine having an armature of the same external dimensions. Some comparisons have been made of the output of direct and alternating machines of the same weight, but these, in the nature of things, must be misleading. The two types are quite unlike in their proportions, as Figs. 1 and 2 show, and no one would think of making them the same. Fig. 1 represents the magnetic system of a four pole direct, and Fig. 2 that of a twelve-pole alternating machine of the same output; and while it will be observed that the iron parts—core and yoke rings—are much heavier in the former, it will be noticed that the copper in the magnet coils is much heavier in the latter. In fact, though the iron in the alternator is only 55 per cent. of that in the direct current machine, the copper required is no less than 250 per cent. It is difficult, then, to understand what useful purpose is served by comparisons such as I have alluded to.

(To be Continued.)

The Royal Victoria Hospital, Montreal, is being wired for some 600 incandescent lights. This will be one of the most complete installations made in Canada and the first interior conduit work. The Royal Electric Company of Montreal have received the contract for doing the work.

The Queen's Hall, which was opened in Montreal under new auspices last week, is lighted throughout with electricity. The arrangements are very perfect. All the stage, border, foot, bunch and proscenium lights are controlled by separate switches, and have kicking coils or reducers for dimming the lights. This work was installed by the Royal Electric Company, of Montreal, and reflects credit on them for the novel features. The proprietors state that the electric light is far more flexible than gas, and there is much saving effected in insurance, besides entirely doing away with any heat in the building.

WAYSIDE NOTES.

(By a Travelling Correspondent.)

The town of Mitchell is now well lighted with electricity, Mr. John Byers being superintendent.

It is a pity more of the engineers in Berlin do not try and read English. They don't know what they lose.

Wallaceburg has now its electric light, the plant being under the superintendence of Mr. Martin Markins.

The town of Preston, comprising one street, is well lighted. The plant is owned by Mr. Tenwick, who also superintends.

The man who wanted a "certificate" with his paper still runs a plant in Guelph. He'll get one, if he reads the I. N. & S. E. J.

The branch of the C. A. S. E. in Stratford is now reduced to very few members. It is time the engineers outside took advantage of the Society.

Clinton is now a well lighted town, the plant being under the superintendence of Mr. Jonathan Brown and his assistant, Mr. Marshall Morvish. Clinton to a man takes the News. Other towns and cities please copy.

Goderich is now well lighted, having 33 street lights and 40 arc lights in the stores, supplied by the town's Electric Light Co. Mr. W. H. Smith is superintendent, and the light gives great satisfaction to the town and store keepers.

The Stratford Water Works have now the whole of their pumps in working order, having a capacity of 374 million gallons per day. The plant is under the superintendence of Mr. Thos. Clark and his two assistants, Messrs. Corrie and Evans.

It is about time, with the material in the City of Guelph, that a branch of the C. A. S. E. was inaugurated. It was mooted, but seems to have died owing to the apathy of some of the men. There are still quite a few who want it if they could get a leading hand.

Engineer Thos. McCoughland, of the St. Clair Tunnel, is now prepared to pump fresh or bad air, or light the tunnel. The plant is now in working order and waiting for the completion of the tunnel. He has under his charge two 20 h. p. high speed engines, air and water pumps, and two Ball dynamos supplying 250 incandescent lights.

The Berlin Electric Light Co. are now in successful working order. They have two 25 light Ball dynamos, and will soon have a four ampere machine for incandescent and arc lighting, for which the Ball Electric Light Co. have the contract. They have 52 arc lamps in the city and stores. The plant is under the able supervision of Mr. Wm. Aldrich, who has many improvements of his own make on the plant.

The Stratford Electric Light Co.'s plant, which is under the able superintendence of Mr. Robert Wells, is now in full working order. The Company have the best supplied power in the county, consisting of a 75 h. p. Wheelock engine (Goldie & McCulloch's make), a gas engine and water power. They have three 35 and two 25 light machines, and now have in use 129 lamps, including 30 private contractors.

The Guelph Electric Lighting Co. have now one of the neatest and best equipped engine and dynamo houses in the Dominion. They have one Royal and two Ball dynamos, which are worked by a turbine wheel (when there is sufficient water in the river). Failing this, the engine (Goldie & McCulloch) runs the plant, which is under the supervision of Mr. C. J. Jorden. The whole plant works successfully, and the city, stores, and hotels are well lighted.

The Chatham Gas Co. supply the town with electric light. The company have one Royal arc dynamo, 40 light, and one 500 incandescent light; one Ball dynamo, 25 arc light, and one Brush machine, 30 arc light. They have in operation 90 street lights and 300 incandescent lights. The plant is in charge of Mr. Albert Frott, with Mr. Lamon as general manager. The engineers here have a good chance of getting a branch of the C. A. S. E. Many men express a wish to this effect. The president of the Toronto branch will give them all the assistance necessary.

The St. Mary's Electric Light Co. is owned and run by Mr. L. H. Reesor, with W. T. Brown as electrician. They borrow their power, and have three Ball dynamos for incandescent lighting, and a 35 arc light dynamo. They supply 60 arc and 145 incandescent lights to the town and stores. They had a curious incident happen to the poles and incandescent lamps during a thunderstorm. Whilst the current was turned off, the lightning seems to have struck the wires, entirely burning out two lamps and splintering the poles. The St. Marys men don't seem to understand how it happened.

The thanks of this paper are due to the engineers in all the cities and towns visited for the very courteous treatment accorded to its representative. Many of them have gone out of their way to get him subscribers.