plete by the addition of quite a large storage battery to carry the night load and to take the place of the second machine and engine during the heavy load.

The entire plant as above described was contracted for and installed by Mr. Edward Slade, of Quebec, upon whom it reflects much credit. It is one of the most interesting small installations yet carried out.

QUESTIONS AND ANSWERS.

"SUBSCRIBER" writes: "I am in charge of an alternator stamped by its makers 40 amperes, 1,040 volts. As I understand it, one ampere on primaries gives 20 amperes on secondaries, if so, 20 × 40 = 800 amperes, total secondary capacity. Now, some electricians calculate on 104 volts, ½ ampere per lamp, others 6 amperes to 10 lamps. The one would give 1,600 lamps, the other 1,440 lamps capacity. This must be wrong, for the manufacturers only claim 800 16 c.p. lamps as the total capacity of the machine. Will you kindly give me the proper system of figuring out a machine's capacity, also what size of wire should be used for primaries, it being 1,500 feet from machine to centre of distribution? Our transformers are banked in pairs, operating on a three-wire secondary system. What size of wire should be used to give the highest efficiency?"

ANSWER. You are making a serious error in your method of calculating the machine capacity. If you desire 20 amperes on the secondary for each ampere on the primary, you must have a "transforming ratio" of 20 to 1. This will give you 52 volts secondary pressure. If, on the other hand, you desire 104 volts secondary pressure, your transforming ratio must be 10 to 1, in which case you will have only 400 amperes on the secondaries, not 800; so that you will see that in your calculation you are multiplying a 20 to 1 ratio amperage by a 10 to 1 ratio voltage, thus getting, of course, a very wrong result. Whether you get 20 secondary amperes to every primary single ampere or not is a matter that depends on your transformers. It is not usual to-day to use 52-volt lamps; therefore, assuming you use 104-volt lamps, and have therefore 104-volt secondaries, with a transforming ratio of 10 to 1, the method of calculating your machine capacity is as follows: The primary capacity is, of course, 40 × 1,040 = 41,600 watts. The secondary capacity, as you probably know, is the same number of watts, but with different volts and amperes. Using 104 volt secondaries, divide 41,600 by 104, and the quotient 400 is the total secondary amperage (because 104 × 400 = 41,600 watts). How many lamps this 400 amperes will allow depends on the kind of lamp. You are aware that you can purchase in the market lamps requiring 3, 3½ or 4 watts per candle power, or per 16 c.p. lamp requiring 48, 56, or 64 watts. Probably the 3½ 56-watt lamp is what you use. This lamp takes 56 ÷ 104 amperes, or .538 amperes. The total number of lamps that the machine will supply can therefore be calculated by dividing 400 by .538, with the result 743 lamps. A 4 64-watt lamp would similarly require 64 ÷ 104 = .615 ampere, giving 400 ÷ .615 = 652 lamps. And again, similarly, a 3 48-watt lamp would require 48 ÷ 104 = .461 ampere, giving a total capacity of 400 ÷ .461 = 867 lamps. The foregoing gives the method of calculation in unnecessary detail, for the sake of explanation. The shortest method is: A machine with the primary voltage and amperage 1,040 and 40, has a capacity of 41,600 watts. The capacity of this in 56-watt lamps is evidently 41,600 ÷ 56 = 741 lamps. The size of primary wire to use is found by the formula,

$$\frac{21 \times 1{,}500 \times 40}{\text{volts in “ drop ”}}$$

Allowing 5% drop, or 52 volts, the wire is calculated at 24,231 c. m. = No. 6 B. & S. The proper size of wire for secondaries depends on the distance apart of transformers, but probably three No. 6 secondaries would be the best.

"J. M.," Toronto, writes: "I have read with interest your article in the November issue on the transmission to Arthur, Ont. As I, in common with a great many others of your readers, am interested in prospective transmissions, I would take it as a great favor if you would publish a full description of the plant; give length of line, size of wire, number of wires, voltage of transmission; state whether it is single or two phase, number of lights supplied, and the formulae by which the 6% loss was obtained."

ANSWER: The Grand Valley-Arthur transmission plant, referred to by our correspondent, has been in operation for some time. The plant is located at Grand Valley, and consists of a 75 h.p. high speed engine, manufactured by the Goldie-McCulloch Co., of Galt, and an 85 h.p. boiler. Fuel used is mill refuse and slabs. The electrical equipment was furnished throughout by the Royal Electric Co., and consists of a type R "S.K.C." two phase generator, with the the usual station instruments, mounted on a marble switchboard. One phase of the generator supplies incandescent street and house lights for the village of Grand Valley, to the number of about 350, and is distributed in the ordinary way, the primary voltage being 2,080 volts and the secondary 104 volts. The second phase of the machine is carried to the switchboard in the usual way. After passing through the switchboard, it enters a booster transformer, which has a range of 300 volts. This is sufficient to overcome the ohmic loss in the transmission of 9 amperes at 2,400 volts a distance of 13 miles, where it reaches the village of Arthur, and is there distributed in the usual way, 2,080 volts primary and 104 volts secondary. There are also operated at Arthur from this circuit three alternating current arc lamps of a nominal 2,000 candle power, and 15 32 c.p. street lamps, the balance being used up in store and house lighting. The regulation of the lights at Arthur is accomplished from Grand Valley by a regulator head set in the booster transformer, where the primary voltage can be regulated at 20 volts per step, or one volt in the secondary. There is also a telephone line erected on the transmission line, and if the light varies or the voltage raises or drops, the man in charge at Arthur immediately notifies the engineer at Grand Valley. Thus the pressure is kept practically constant. The heart of the entire system is, of course, the transmission line. Special care was taken in the construction of this line. The poles vary from 30 to 35 feet in length, with not smaller than 7 inch tops, set 5 feet in the ground, thoroughly tamped and properly guyed. Running through an open country as this line does, it is subject to severe lightning storms. It was, therefore, very essential that lightning should be guarded against. In constructing the line there was put underneath every fifth pole an iron plate one foot square, No. 16 Birmingham gauge. To this was attached a galvanized iron wire run to the top of the pole and there attached to a barbed wire, which is strung along the entire line on top of the poles, and which is also grounded at each end of the line. This protection has proven sufficient, as it passed through two very severe lightning storms late last fall without any damage. The cross-arms are made of seasoned pine fastened to the pole with two 7 inch lag screws. The pins are of the best white oak, and the insulators triple-petticoat glass. The transmission line consists of two No. 4 bare copper wires, which are fastened to the insulators in the usual way, with a side tie. Beneath this cross-arm is affixed a second one, which carries the telephone wires. The telephone line is constructed in the ordinary way, with the exception that it is transposed every fifth pole, or every 500 feet, to overcome the induction due to alternating current. This it does entirely, as the telephones are in use daily, and conversation can be carried on in an ordinary tone when the transmission line is carrying its full complement of current. That the above is a successful venture is evidenced by the fact that the proprietor of the plant is negotiating for a machine of a larger size, or one having a capacity of 1,000 lights.

The Leamington Electric Light Company, of Leamington, Ont., will increase its capital stock from $3,000 to $30,000.

The Board of Trade of Parry Sound, Ont., has recommended the construction of an electric railway to connect Parry Sound and Depot Harbor. The cost of the road is estimated at $25,000.

The Gurney Tilden Co., of Hamilton, are now operating their entire works by electric power. They have installed two 20-h.p. and one 30-h.p. S.K.C. two-phase motors, and get their current from the Cataract Power Co.

The gas and electric light works at St. Hyacinthe, Que., were badly damaged by fire on the 5th inst. The buildings, including engines and dynamos, were almost completely destroyed. The loss is estimated at $10,000, which is believed to be fully covered by insurance. The works are owned by Mr. Louis Brousseau.

The Hamilton Electric Light and Power Co. are installing in their lighting station two 240 k.w. S.K.C. synchronous motors. These are to drive the shafting from which is operated the arc machines and the motor power service. The current for these motors is to be supplied by the Cataract Power Co. It is expected that the steam plant will be entirely shut down by the first of February. The incandescent light has been furnished from the Cataract Power Co's current for the past three months, and has been very satisfactory.