EDISON'S ELECTRICAL GENERATOR

When Mr. Edison said he was about to produce a practical economical electric light for general use, the entire business world took it for granted that it was forthcoming. Gas stocks tumbled both in this country and in Europe, and the people waited for the coming light. Scientists having had experience in this direction shook their heads, but for the most part suspended judgment.

Delay on the part of Mr. Edison comforted the holders of gas stocks, and confirmed the scientists in their belief that he had undertaken not only a task of great magnitude and difficulty, but one that would require more time and means than could be controlled by most experimenters. But Mr. Edison, flushed by his scientific victories, was undaunted and determined to yield to no obstacles.

Unfortunately, however, the daily papers from time to time printed reports of progress in electric lighting, which, from their extravagance and inaccuracy, placed Mr Edison, to say the least, in an extremely embarrassing position as regards his alleged promises and the expected fulfillment of them, besides misleading the public as to the true nature of the problem to be dealt with, resulting in a reaction of feeling prejudicial to Mr. Edison's just fame.

At present little is said by Mr. Edison concerning his electric light, excepting that he considers it an assured success, and that he is perfecting the details of his electric lighting system as rapidly as possible.

It is not our purpose just now to enter into a description of Mr. Edison's electric lighting system as a whole, but to describe his new electric generator—one of the most important factors of the system—and also to describe his new electrical motor used in driving light machinery for domestic and industrial purposes.

The new generator resembles in some respects other well known forms, but it differs from them all in several very important particulars; for instance, the field magnets are immense, being about 54 inches high, and weighing about 1100 lb. The magnet cores—of wrought iron—are 6 inches in diameter, and 36 inches long; they are mounted upon heavy cast iron blocks, 10¾ inches high and 9 inches wide, and are connected at the top by a wrought iron yoke, 6 inches high and 7 inches wide. The cores are wound with 3 layers of No. 10 cotton covered wire, the ends of which are connected with binding posts on the base of the machine. The two blocks upon which the cores rest, as well as the bearings of the armature, are supported by a cross-shaped brass casting.

The armature which revolves in the cylindrical space between the poles of the field magnet is shown in section in Fig 2. It consists of a wooden cylinder, A, mounted on a 1½ inch shaft, and having attached to its ends soft iron plates, B, between which there are several layers, D, of No. 20 soft iron wire wound circumferentially. Outside of the iron disks, B, there are vulcanized-fiber disks, C, having their peripheries notched to receive the several coils, E, of insulated wire wound lengthwise on the cylinder and connected with copper bars, F, of the commutator cylinder, G. There are 41 $\frac{12}{1000}$ in. wires in each strand, and each strand passes lengthwise around the cylinder on diametrically opposite sides, the opposite ends of all of the wires in each strand being soldered to commutator bars on opposite sides of the commutator cylinder. There are 40 strands surrounding the armature, and the commutator cylinder is pressed on opposite sides by copper wire brushes which take off the current. The armature shaft has a 10 inch pulley with a 5 inch face, and the speed of the machine is about 500 turns per minute. Although the current from the armature may be used to excite the field magnet, Mr. Edison finds it more economical to charge the field magnet by means of a separate machine. In fact, he intends to charge a battery of such generators with a single Faradic machine of this form.

An important fact has been developed in the course of Mr. Edison's experiments with this generator. He finds that by connecting the ends of the field magnet by a copper wire for a moment when the machine is started, the field magnet soon attains its maximum charge, which it retains so long as the generator is in continuous operation. It requires a minute or more to fully charge the immense magnets, and when charged their influence is far reaching and powerful. The internal resistance of the armature is only ⅛ ohm, and Mr. Edison claims that he realizes 90 per cent of the power applied to this machine in effective external current. It requires but 0 horse power to drive it, and the current generated is sufficient to produce lights of sixteen candles each. The economy of this machine is shown by the fact that one man may turn it with sufficient rapidity to maintain the electric arc of a Jablochkoff candle.

While this generator in general principle is the same as in the best of the well known forms, still there is an all-important difference, which is, that it will convert and deliver for useful work nearly double the foot-pounds of energy that any other machine will under like conditions. It has been shown by Hopkinson that the Siemens machine, which is generally recognized as the best form yet devised, converts from the belt to the circuit 92 per cent of the energy, but later corrections reduce this to 83 per cent; from these results many scientists have inferred and stated that there was little margin for improvement in the generating machine. Now the energy converted is distributed over the whole resistance; hence if the resistance of the machine be represented by 1, and the exterior circuit by 9, then of the total energy converted, $\frac{9}{10}$ will be useful, as it is outside of the machine, and $\frac{1}{10}$ lost in the resistance of the machine.

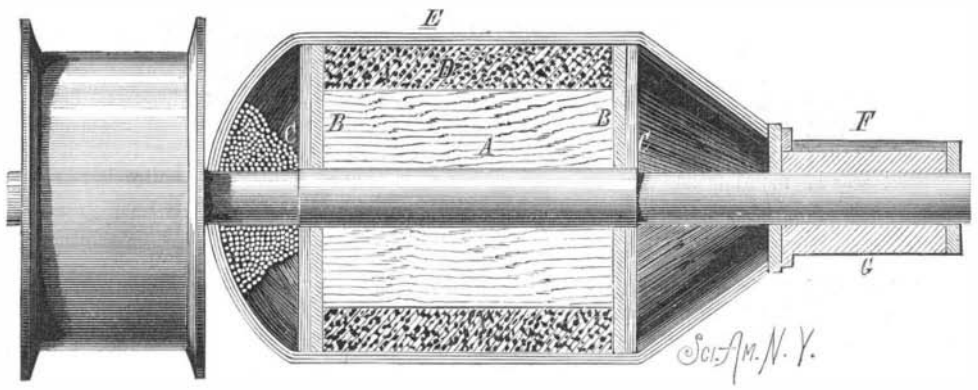

FIG. 2.—THE ARMATURE.

The Siemens machine, and nearly all other machines in use, make the external resistance equal to that of the machine; hence one half of the energy only is useful, and any attempt by these inventors to increase the exterior resistance, so as to change the distribution of energy to obtain more exterior work, results in reducing the power of the machine to convert energy. Therefore, efforts toward economy in one direction are met in the other direction by loss in the interest account due to the necessity of using a greater number of machines to convert a given amount of power.

In Mr. Edison's generator 5 horse power is transferred upon a resistance of 5 ohms, of which a ½ ohm is in the machine, thus delivering $\frac{9}{10}$ of the total current upon a circuit exterior to the machine; thus nearly the maximum economy is attained when other machines, under like conditions, will scarcely give any current at all.

In dealing with the electric light problem, Mr. Edison has very properly devoted a large share of time and attention to the production of an economical generator, as it is the very foundation of the system. It bears the same relation to electric lighting that the cheap production of gas does to gas lighting. It is as important to generate electricity cheaply as to use it economically. Mr. Edison meets squarely both ends of the question, and is carrying on his experiments on a gigantic scale; being encouraged by new developments he continues his researches in expectation of still better things. His electric generator he considers complete; his electric lamp, although in good usable form, is slowly improving, and will not be introduced to the public so long as Mr. Edison thinks it can be improved.

The lower view in our large engraving represents one end of the Menlo Park machine shop, showing the 80 horse power engine in the engine room beyond. One of the new electric generators is shown on the right, and the dynamometer with which the power tests are made is shown on the left. Not far from the generator is placed an electric dynamometer, shown in one of the smaller views at the top of the page.

This electrical dynamometer is the invention of Prof. J. W. Trowbridge. Mr. Edison has, however, improved it and adapted it to his own purposes. As there is neither iron nor magnets in the apparatus it may be used in the vicinity of the generator without being influenced by its magnets.

The electrical current traverses the two large spirals of copper ribbon, and also the smaller spiral, whose bifilar suspension keeps it at right angles to the larger spirals when no current passes. The smaller spiral carries a small mirror, and the readings are taken from a distant scale, the light spot serving as an index. The circuit is completed through the smaller spiral by means of mercury cups kept cool by water running through their hollow walls.

The galvanometer tests are made in a distant building where neither jars nor magnetic influence can affect the accuracy of the readings. The galvanometer (Thomson's reflecting) is placed on a table resting on a brick foundation and is inclosed by a dark chamber having apertures for viewing the scale. The development of the new electric generator has required months of careful investigation by aid of these two instruments, and it is only after making hundreds of alterations and experiments that the improvement has been wrought.

Fig. 3 shows Mr. Edison's new electric motor intended for running sewing machines, small elevators, lathes, and other light machinery, by connecting it with the same wires that furnishes the current for the electric lamps. Its construction differs but slightly from the electric generator. The armature is arranged parallel with the magnet instead of transversely, and the magnet is formed of a single casting. In other respects it is like the generator, having the same form of armature, also commutator cylinder and brushes. The engraving represents the motor about one fourth of its real size.

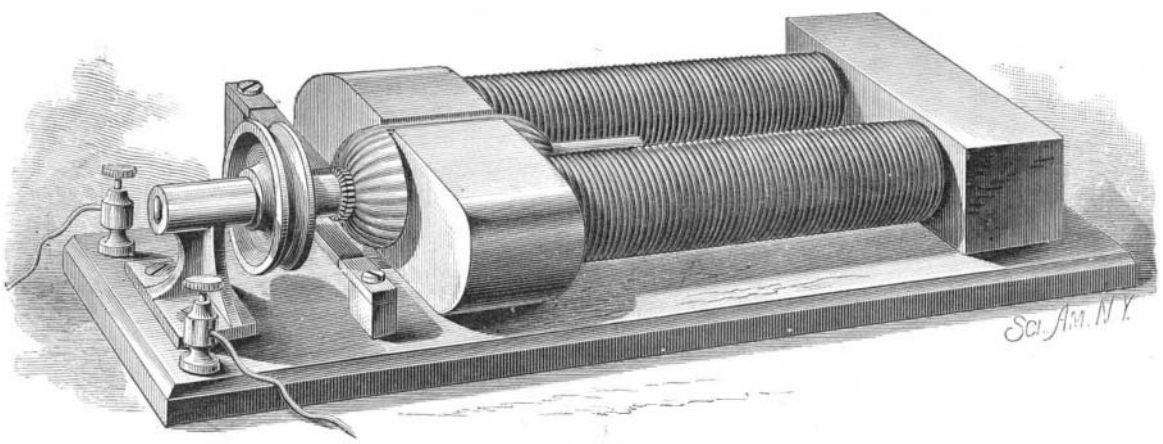

FIG. 3.—EDISON'S ELECTRIC MOTOR.

Whatever may be said or thought in regard to Mr. Edison's progress in electric lighting, it cannot be denied that he has made important discoveries which must tend to cheapen the electric light generally, and when he shall have completed his electric lighting system we hope he will reap the reward merited by his untiring perseverance.

MECHANICAL INVENTIONS.

An improvement in counter stiffeners for boots and shoes has been patented by Mr. Frank Avery, of Garden Prairie, Ill. The object of this invention is to provide a counter stiffener that will be durable, stiff, and waterproof, and that can be easily applied in the manufacture of all kinds of boots and shoes.

Mr. John W. King, of Huntingdon, Tenn., has invented an improvement in washing machines. The invention consists in a simple arrangement of mechanism for driving pounders or cups.

Mr. Lyman H. Blend, of Oneonta, N. Y., has patented an improved machine for use in the treatment of paralysis in its various forms, curvature of the spine, and their kindred diseases, by producing a passive motion of the feet and legs similar to the natural step in walking, and by the partial suspension of the body from the waist or head.

Mr. Jacob Obrist, of Au Sable Forks, N. Y., has patented an implement for holding and entering tacks in putting down carpets, trimming and covering furniture, and other similar purposes. It consists in providing the lower jaw of the pinchers with a V-shaped notch to receive the shank of the tack, while the upper jaw bears upon the head and holds it securely while being entered; also, in curving the handles, so as to permit the lower jaw to rest upon the floor and leave space for the hand under the handle.

An improvement in detachable table legs has been patented by Mr. James W. Bullock, of Boston, Mass. The object of this invention is to construct tables, stands, chairs, and other articles of furniture, so that they can be readily taken apart and packed in compact form for transportation; and the invention consists in the attachment of the legs by dovetail joints and spring friction devices, so that they can be easily removed and adjusted.

Mr. Eli Hancox, of Troy, N. Y., has patented a lap ring for chains of all kinds. It consists of diagonally overlapping and interlocking ring sections, that are connected by a central transverse stay, secured by a fastening screw, and, in addition thereto, by cross pins or rivets.

A device for sawing logs into boards or joists, etc., of any desired thickness and width at one and the same time at one operation, has been patented by Mr. John W. Morris, of Moss Point, Miss.