THOMAS ALVA EDISON

By CHALLENOR W. RAINEY, E.E. 2

It would be hard indeed to compute the worth of Thomas Edison's gifts to the world. We hear this great name again and again without realizing just how much it affects us. The work of this marvelous practical inventor has helped, indirectly though it may be, to hasten our modern industry and comforts more than the average person realizes. The reason Edison's inventions were so successful may be summed up in his own words, "I have made it a practice never to work on any line not purely practical and useful."

Of Edison's early life little need be said. However, it should be noted how active were his youthful days. First, a newsboy, journalist, and editor; then, a chemical and physical experimentor; and next, an expert telegrapher, we have his early preparation for the life which was to follow. We first hear of him in his new life when on October 13, 1868, he was granted his first patent (an electro-graphic vote recorder).

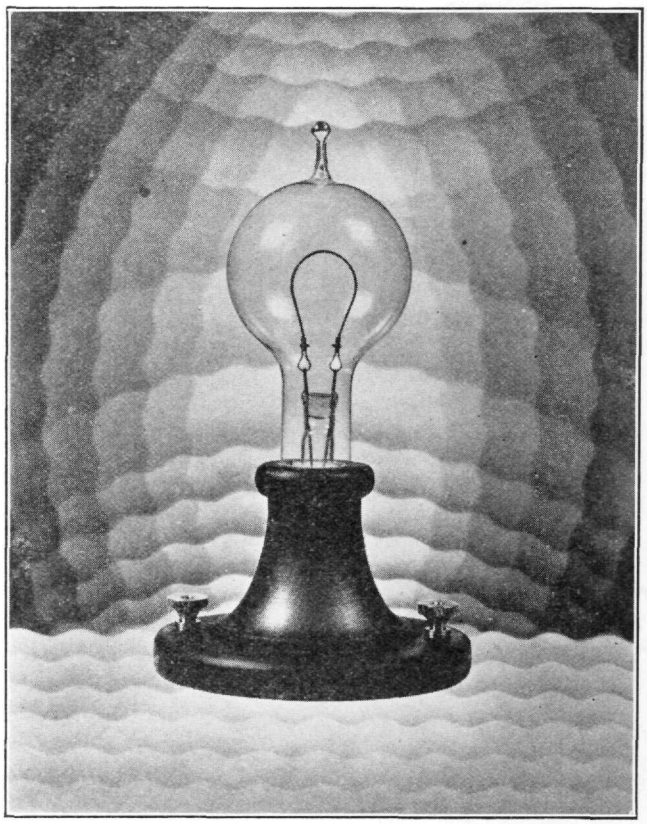
His first important accomplishments were in telegraphy. In this line he invented a district and chemical telegraph, a stock printer, the duplex system, and the marvelous quadruplex transmitter system which allows four messages to be sent over the same wire at the same time. The quadruplex gave rise to an invention which startled the world—the phonograph. While listening to the audible sounds of a quadruplex machine and noting the musical sounds which came from its revolving disc, he got one of his great ideas, that of reproducing sound. Hurriedly he drew up the plans for an experiment and gave them to a co-worker who made the apparatus. This consisted of a wax cylinder, grooved and covered with tinfoil, fixed on a threaded shaft so that it could have a rotary as well as a horizontal motion. When the apparatus was completed Edison shouted into the diaphragm the memorable words, "Mary had a little lamb." The reproduction of this was so clear that witnesses of this experiment were amazed. The development of this device has brought pleasure and profit to untold millions.

Late in 1877 Edison improved Alexander Graham Bell's telephone by using a carbon button transmitter. This instrument, which greatly improved telephone conversation, is still in use today. On October 15, 1878, Edison made his first plunge into the field of electric lighting when he invented a thermostatic regulator designed to keep the current to a safe value in the platinum-iridium lamp.

When Edison seriously considered electric illumination, there was, already, a practical gas system in use in the cities where industry demanded it. It is small wonder, then, that only a few men were working on the problem of an electric lamp.

Edison saw the limitations of the arc lamp and was fired by the idea of producing an incandescent lamp. He made a complete analysis of the problem and commenced to develop it. Edison described this occasion as follows:

"We soon saw that the subdivision (of electric light) never could be accomplished unless each light was independent of the others. Now it was plain enough they would not burn in series. Hence they must burn in multiple arc. It was with this conviction that I started. I was fired with the idea of the incandescent lamp as opposed to the arc lamp, so I went to work and got some very fine platinum wire drawn. Experiment with this, however, resulted in failure, and then we tried mixing in with the platinum about 10 per cent of iridium, but we could not force that high enough without melting it. After that came a lot of experimenting—covering the wire with the oxide of cerium and a number of other things.



Edison's First Successful Incandescent Lamp.

"I then took a cylinder of zirconia and wound about a hundred feet of the fine platium wire, coated with magnesia, on it. What I was after was getting a high resistance lamp, and I made one that worked way up to 40 ohms. But the oxide developed the phenomena now familiar to electricians, and the lamp short-circuited itself. After that we went fishing around and trying all sorts of shapes and things to make a filament that would stand. We tried silicon and boron, and a lot of things that I have forgotten now. I never thought in those days that a carbon filament would answer, because a fine hair of carbon was so sensitive to oxidation. Finally, I thought I would try it because we had got a very high vacuum.

"We sent out and bought some cotton thread, carbonized it a,nd made the first filament. We had already managed to get a pretty high vacuum

and so we thought the filament would not oxidize. We built the lamp and turned on the current. It glowed, and in the first few breathless minutes we measured its resistance quickly and found it was 275 ohms—all we wanted. Then we sat down and looked at that lamp. We wanted to see how long it would burn. The problem was solved—if the filament would last. The day was—let me see—October 21, 1879. We sat and looked, and the lamp continued to burn, and the longer it burned the more fascinated we were. None of us could go to bed, and there was no sleep for any of us for forty hours. We just sat and watched it with anxiety growing into elation. It lasted 45 hours, and then I said, 'If it will burn 45 hours now, I know I can make it burn a hundred.' We saw that carbon was what we wanted. I then began to try various things, and finally I carbonized a strip of bamboo from a Japanese fan, and saw that I was on the right track."

Now came the great task of putting the lamp on the market. The gas lighting industry had gained a strong foothold and was affording illumination at reasonable rates. In order to compete with gas lighting, Edison had to perfect a system that would give better service. Edison said of his problem:

"A complete system of distribution for electricity had to be evolved, and as I had to compete with the gas system this had to be commercially efficient and economical. A commercially sound network of distribution had to permit being placed below or above ground and had to be accessible at all points and be capable of being tapped anywhere.

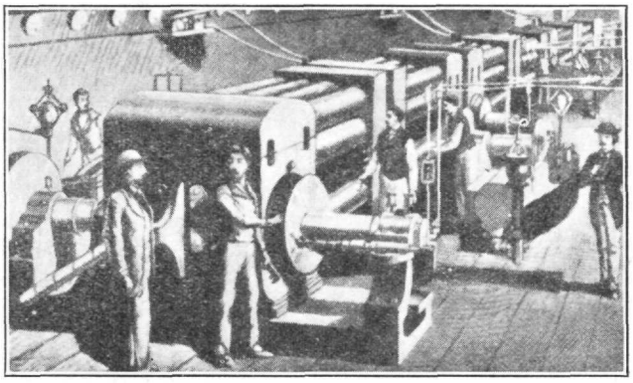
"I had to devise a system of metering electricity in the same way as gas was metered, so that I could measure the amount of electricity used by each customer. These meters had to be accurate so that we could charge correctly for the current used, and also they had to be cheap to make and easy to read and keep in working order.

"Means and ways had also to be devised for maintaining an even voltage everywhere on the system. The lamps nearest the dynamo had to receive the same current as the lamps farther away. The burning out or breaking of lamps must not affect those remaining in the circuit, and means had to be provided to prevent violent fluctuations of current.

"One of the largest problems of all was that I had to build dynamos more efficient and larger than any then made. Many electrical people stated that the internal resistance of the armature should be equal to the external resistance; but I made up my mind that I wanted to sell all the electricity I made and not waste half in the machine, so I made by internal resistance small and got out 90 per cent of salable energy.

"Over and above all these things, many other devices had to be invented and perfected. Devices to prevent excessive currents, proper switching gear, lamp holders, chandeliers, and all manner of details that were necessary to make a complete system of electric lighting that could compete, successfully, with the gas system. Such was the work to be done in the early part of 1878. The task was enormous, but we put our shoulders to the wheel, and in a year and a half we had a system of electric lighting that was a success."

Such was the thoroughness with which Edison attacked this gigantic problem. Here we have one element of his greatness: that of completeness.



Interior of Pearl Street Station, Edison Electric Illuminating Company, New York, 1882, showing six generators, total capacity 750 h. p.

From the very beginning Edison proceeded unhampered by the influence of other men's work. The Pearl Street Station, the first electric station built by Edison, was the forerunner of the great network of electric power station which now cover the world. When it first went into operation, 400 lamps were lit, but the system could supply 85 buildings containing a total of 2300 lamps.

Since the successful production and demonstration of the electric lamp Edison has continously been engaged in many types of experiments.

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