75.—ANNUAL REPORT ON THE ELECTRIC LIGHTING OF THE UNITED STATES STEAMER ALBATROSS, DECEMBER 31, 1883.

By Passed Assistant Engineer G. W. BAIRD, U. S. N.

[Résumé of the quarterly reports.]

The steadiness and uniformity of brightness of the lamps depend largely (almost entirely), on the engine driving the dynamo, and the success of the system lies more in the attention paid to the engine, where the plant is correctly installed, than anything else. Uniformity of speed is the great object sought, and to secure this Mr. Edison has adopted a high-speed engine, with a sensitive governor, represented in Fig. 1.

This engine has a single steam-cylinder, 8½ inches in diameter of bore, and a stroke of piston of 10 inches; it runs 300 revolutions per minute

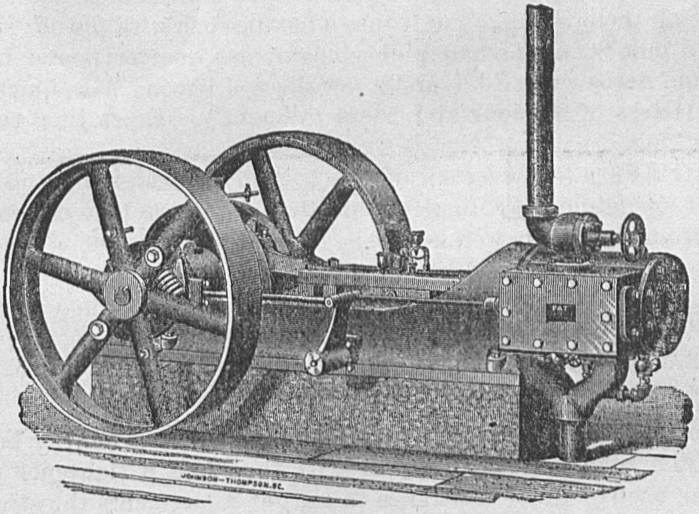

FIG. 1.

very uniformly, the automatic cut-off regulating the quantity of steam admitted to the load on the engine. This particular engine is larger than should be employed for this plant, as the short cut-off at high pressures and light loads causes great cylinder condensation, not only diminishing the economy of the engine, but causing such incessant hammering in the cylinder that I have been obliged to introduce a pressure-regulating valve (Fig. 2), which limits the pressure to what is desired. Previous to introducing this valve, two cross-head keys had been sheared off and one cross-head broken, by water in the steam-cylinder.

Had the smaller size of engine (6½ by 8) been used, as I recommended, this difficulty would have been avoided, but the Engineer of the Edison Company, fearing a possibility of our permitting the pressure to fall below 20 pounds, and the engine consequently failing to develop the required power, preferred to give us this large engine, even at a greater cost to his Company. The Edison Company furnished drawings for the setting of the engine and its foundation, which design I followed implicitly. The plant is so installed as to bring the driving side of the belt on top, so that the slack falls from the pulleys. This results in slipping, particularly as the belt stretches, and when the arc lamps are thrown in circuit the belt slips and the dynamo often slows down from

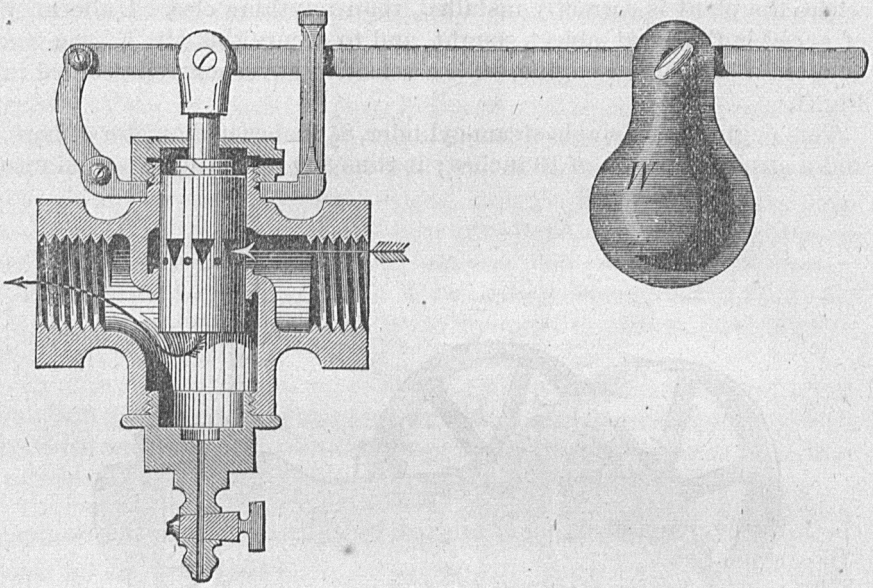

FIG. 2.

1,200 to 1,000 revolutions per minute. I procured a heavier belt, but the stretch soon permitted slipping. I then had a tightener put in. This has been of great assistance to us, but it augments the stretching of the belts very much. I have resorted to doubling the belts, *i. e.*, running one belt on top of the other; this has diminished the slipping, but the belts tend to separate and run off in opposite directions; to prevent this we have improvised guides. During the year the main valve of the dynamo engine broke—probably from water in the chest—and deprived us of the use of the plant about five days. With this exception the plant has been in operation every night when there was steam in the boilers.

The dynamo (Fig. 3) has given but little trouble. The armature has worn somewhat, and six brushes have been worn away during the year. A spare armature has been purchased and is ready for use in event of

any accident to the original one. Except occasionally adjusting the brushes, the running of the dynamo requires but little attention, and

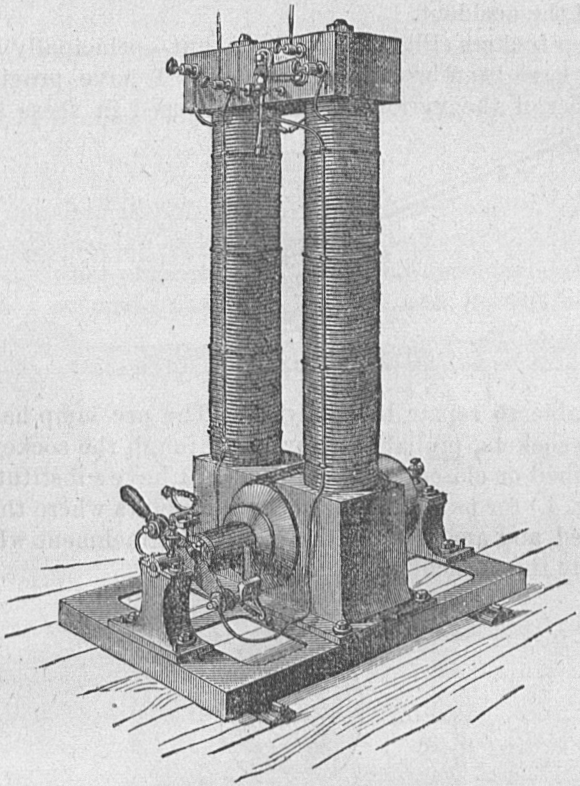

FIG. 3.

both the engine and dynamo are run by enlisted men in the Engineer Department.

The wiring has required but little attention; in several places the deck

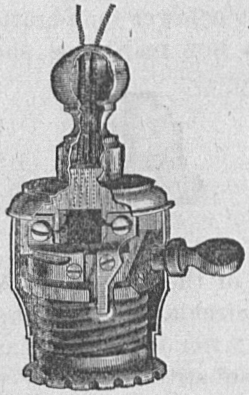

FIG. 4.

leaked and the salt water short-circuited but there have been no serious mishaps. The trouble from this cause, however, has resulted in the de-

struction of the nearest cut-out plug, thus preventing damage to the wire; in such cases I have added insulation to the wires to prevent a repetition of the accident.

A few lamp sockets (Fig. 4.) have burnt out—principally from arcing—and a few have been broken by accident. I have provided myself with a number of the various-sized screws used in these sockets and

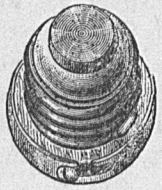

FIG. 5.

have been able to repair them myself. The arc lamp has destroyed two of these sockets, probably by arcing through the socket as the circuit was opened or closed. For this reason I have substituted two key sockets (Fig. 4.) for two ordinary sockets at points where the arc lamps were attached, and am now making a special attachment which I think will eliminate this difficulty.

FIG. 6.

The safety plugs, shown in perspective in Figs. 5 and 6, and in section in Fig. 7, have answered their purpose admirably. The piece of solder (*a*, Fig. 6.) melts at a lower temperature than the wires, and is destroyed in event of a low resistance short circuit on the wires.

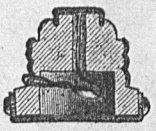

FIG. 7.

I have never known one of them to fail. When one of these safety plugs melts it breaks the circuit, and the lamps on that section are immediately extinguished. After discovering and repairing the damage, the circuit is restored by substituting a new plug in the cut-out block. Fig. 8.

By indicating the engine I find the economy to be practically uniform.

When using 45 lamps we get 7.77 per indicated horse-power; when using 50, we get 8.5 per indicated horse-power; and when using 70, we get 10.11. We have not, to my knowledge, ever used more than 70 lamps at one time, though there are 140 in the plant. The average number of lamps in daily use is about 47,* for which purpose we consume about 21 pounds of coal per hour, and use, on an average, two-thirds of a gill of oil. Since November we have been using a light oil manufactured by the Vacuum Oil Company of New York, and find that we can run our light machinery with a smaller quantity. As this oil is used on the exhaust fan as well as the dynamo and its engine, it is impossible to say what proportion each machine receives; but from short experiments I conclude that the dynamo and its engine (when the

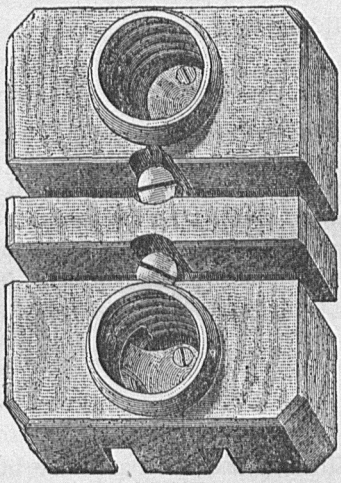

FIG. 8.

journals are in good order) will use about one-half a gill per hour. Assuming this to be correct, the cost of running the lights for the year has been as follows:

The dynamo was in operation 1,592 hours and 45 minutes, during which time the consumption of coal for this purpose was 14 tons 2,082 pounds, at a total cost of $68.67.

The oil used during the same period and for the same purpose is estimated to be 67 gallons, the mean cost of which was 72½ cents per gallon, making the total cost for oil $48.57.

The cost for repairs, preservation, and restoration has been as follows:

2 K brushes, at $2.50	$5 00
4 Z brushes, at $1	4 00
2 cut-out blocks, at 32 cents	64

*As lamps are so frequently turned on and off in different parts of the ship, at all hours, it would be impossible to keep an accurate record.

34 3-light safety plugs, at 8 cents	$1 92
6 6-light safety plugs, at 8 cents	48
4 20-light safety plugs, at 8 cents	32
2 40-light safety plugs, at 8 cents	16
5 key sockets, at 92 cents	4 60
1 wire shade-holder, at 10 cents	10
1 pound insulation compound, at 12 cents	12
2 deep-sea lamps, at $1	2 00
2 attachment plugs, at 40 cents	80
3 pounds No. 14 insulated wire, at 40 cents	1 20
1 pound No. 20 insulated wire, at 40 cents	40
6 cigar-lighter plugs, at 55 cents	3 30
1 new valve	5 00
1 pressure regulating valve	55 00
1 new cross-head	25 00
Shortening the belt	3 95
Amounting in the aggregate to	231 23

This does not include the cost of lamps and shades, which do not come in my department. Deducting the cost of the piston valve, pressure regulator, and cross-head [incident to an original error], and also the cost of the deep-sea lamps, cigar-lighter plugs, and attachment plugs, which do not form part of the ship's illumination, leaves the cost of the light, in candle-power, per hour $\left(\frac{14013}{1592.75\times47\times8}=\right)$ 0.0234 cents. This is less by about 40 per cent. than the bare cost of an equivalent amount of gas-light in Washington City.

The steadiness, brilliancy, and convenience of the light is all that can be desired, while its hygienic advantages over gas or oil-lamps is very great. When it is remembered that an ordinary gas-jet consumes about as much air as six men, and that the breathing-room *per capita* on board ship is so contracted, there ceases to be any comparison between our incandescent electric light and all other means of illumination viewed from a hygienic point. The convenience of being able to light a lamp without fire is great, and the safety of the system, especially at sea, makes it very valuable. The cheerful appearance of the interior of the ship when thus illuminated, as compared with the interior of other ships lighted with oil-lamps, marks a most agreeable contrast and goes far towards lightening the burden and easing the yoke of a life at sea.

Our sub-marine lamps have been useful in attracting amphipods, squid, young blue-fish, silver-sides, &c., into the nets, when used near the surface.