THE SMALLEST WORKING MODEL OF A TRIPLE-EXPANSION ENGINE.

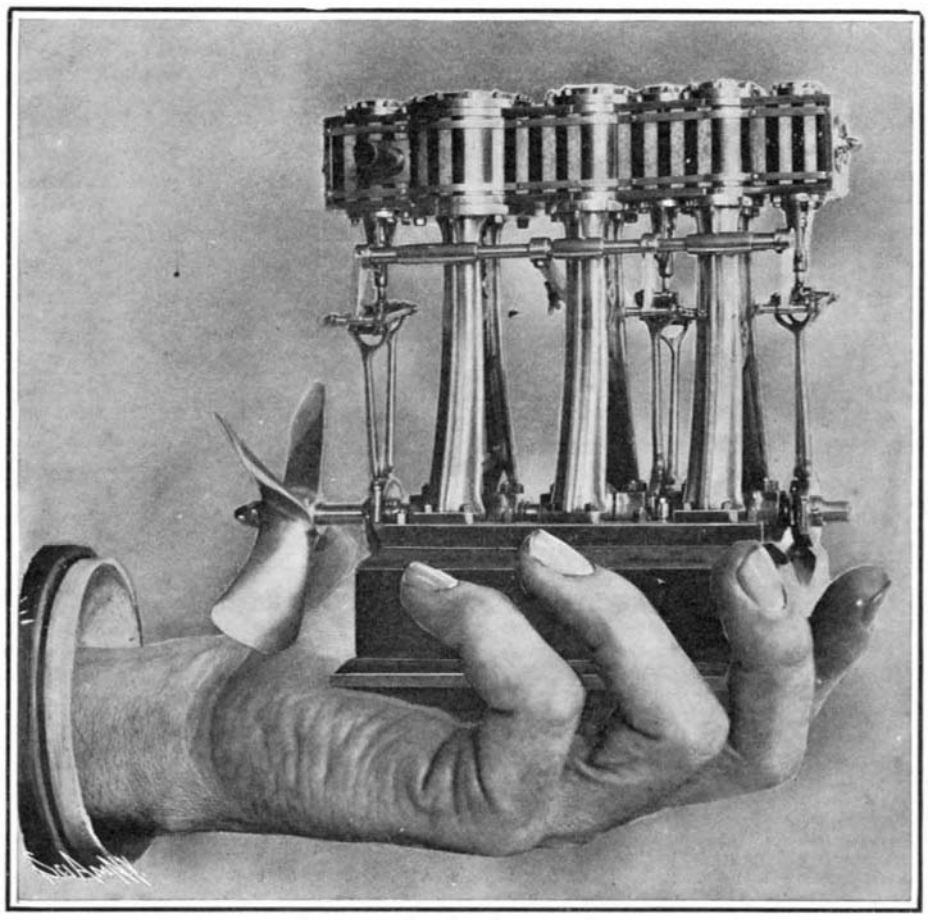
The model of the engine illustrated in the accompanying engraving is, perhaps, the finest piece of skilled work of its kind that has ever been brought to our attention. The little engine, which is of the marine triple-expansion type, was built by Mr. Robert Bunge, of New York city, an expert on machinery, who has made the construction of miniature machines his pastime.

The engine here shown measures 3½ inches across the bedplate, and stands 3¼ inches from the bottom of the bedplate to the top of the cylinder covers. Every part is perfect. It is even equipped with the link reversing motion. With a steam pressure of 100 pounds, 7,260 revolutions per minute are made, turning a screw 2½ inches in diameter by 7 inches pitch.

The high-pressure cylinder is 5-16 of an inch in diameter, the intermediate cylinder 8-16, and the low-pressure cylinder 10-16 of an inch. Something of the wonderful refinement and precision with which this model has been made may be gathered from the fact that the valves are of the regular piston type for all cylinders, and measure five, seven, and nine thirty-seconds of an inch in diameter. The shaft, the cranks, and crank-pins are all turned from one piece of steel, which in itself is a rather neat piece of work.

The eccentrics are split, and are exact miniature duplicates of those used on engines actually in service. The smallness of the studs and nuts used to hold down the cylinder covers is almost incredible. The nuts used in the construction of the model are for the most part a fraction less than 1-16 of an inch in diameter; and yet each is perfectly hexagonal in shape. The studs are a little less than 1-32 of an inch in diameter, and are threaded at both ends, one end screwing into the machine, and the other receiving the nuts.

The crossheads are made of steel, and are fitted with brass shoes that can be taken up whenever wear occurs. The steam pipe is 1-8 of an inch in diameter, and the exhaust is 3-16 of an inch in diameter. The maker may well claim for this model that it is the smallest triple-expansion engine in the world. To appreciate its diminutive perfection at its true worth, it must be seen in actual operation.



THE SMALLEST WORKING MODEL OF A TRIPLE-EXPANSION ENGINE.

An accompaniment of the introduction on shipboard of surface condensation, which was at first supposed to be a result of it, but which as a matter of fact was not, was a tremendous increase in the corrosion of the boilers and a shortening of their life. This was especially noticeable in the tubes which, as the thinnest part of the boilers, give out first. All sorts of theories were advanced to account for it, some of which we can now see to have been utterly ridiculous. Probably one of the most fanciful was that which regarded the boiler and condenser as forming a gigantic galvanic battery, the copper condenser tubes forming one pole, and the boiler the other. The real facts were developed as a result of the investigation by the Admiralty Committee on boilers in the 70's, which showed that boiler corrosion was simply rusting and had been due to gross but unintentional neglect. It had been a very common practice, particularly in naval boilers, when they were not in use, to blow out the water and take off the manhole plates "to let them air." It was this "airing" which caused the corrosion. Now when boilers are laid up, they are filled with water which is made slightly alkaline, and this effectually prevents corrosion.

A LIGHTHOUSE OF REINFORCED CONCRETE.

BY EMILE GUARINI.

A lighthouse of reinforced concrete has recently been constructed at the mouth of the Boug, a river flowing into the Black Sea. It is situated 115 feet from the river shore and serves, with an existing but lower lighthouse, to guide vessels in the direction of the maritime canal excavated in the river and connecting with the sea the city of Nikolaew, which is situated about 100 versts from the mouth of the Boug.

The construction of the lighthouse of reinforced concrete was decided upon after a comparative study of other projects, some calling for the use of bricks and others of iron. Reinforced concrete was found to give a saving of about 40 per cent with an equal stability.

The system consists of a tower of which the walls are from 5 to 10 inches in thickness and are constructed upon a foundation, likewise of reinforced concrete, and imbedded in the sandy soil to the depth of 10 feet.

The stability is assured by the weight of the sand resting upon the foundation. The maximum of pressure upon the ground is about 7 pounds to the square inch. The coefficient of stability at the level of the ground is 4.

The frame is formed of round iron bars of 1¼-inch diameter. The calculation is so made that it shall be able, without the concrete, to resist a wind pressure of 55 pounds to the square foot. The height up to the lantern is 110 feet.

The diameter of the tower is 21 feet at the base and 6½ at the lantern.

The lantern is divided into two parts, one of which serves as the dwelling of the keeper, while the other is arranged for the lighting apparatus.

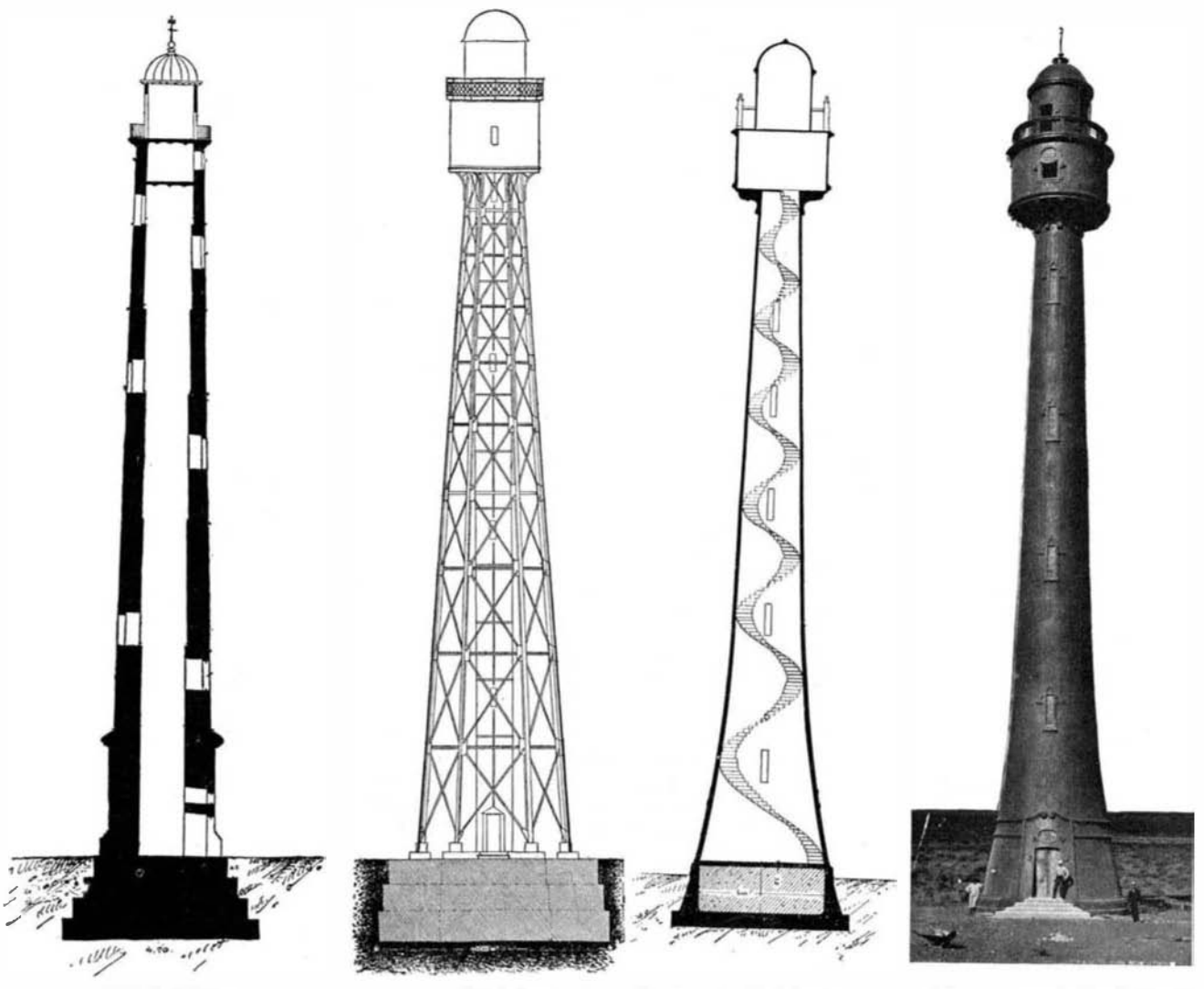
For the concreting there was constructed an external wooden wall having exactly the form of the tower. The concreting was done from the interior. The concrete was formed of sea gravel, coarse sand, and Portland cement in the proportion of 1:2:4.

The concreting was done in winter, in the space of two weeks, with the aid of heat in the interior. The external woodwork required two months for its construction.

The external woodwork was removed in the spring of 1904, and, up to the present, although the tower has been submitted to the action of very high winds, no evidence of strain has been detected.

The cost of the structure, exclusive of the lighting apparatus, was about $6,000.

The project, the calculations, and the execution are due to M. N. Piatnitsky, engineer of ways of communication, and the architecture is the work of M. A. Bauchnikow, likewise engineer of ways of communication.



Brick Lighthouse. Iron Lighthouse. Concrete Lighthouse. Armored Concrete Lighthouse.

A COMPARISON OF THE CONSTRUCTION OF SEVERAL TYPES OF LIGHTHOUSES.

Report on the Sleeping Sickness.

A valuable report concerning the dreaded "sleeping sickness," which infests the East Africa Protectorate, has been prepared by Dr. C. A. Wiggins, principal medical officer at Nairobi. The disease, he finds, is propagated by the tsetse fly; this insect is found in trees or bushes near the lake coast line. The difficulties and dangers of poisoning by this pest during a journey in these parts are exemplified in Dr. Wiggins's account of the passage of the Yala swamp. This is an extensive expanse of huge masses of papyrus, or large tracts of black mud, with stagnant, ill-smelling water, both reaching to the waist. Papyrus, it was observed, does not shelter the flies. In Mageta Island an epidemic had raged, and out of 500 inhabitants not one survived, and the place is now deserted.