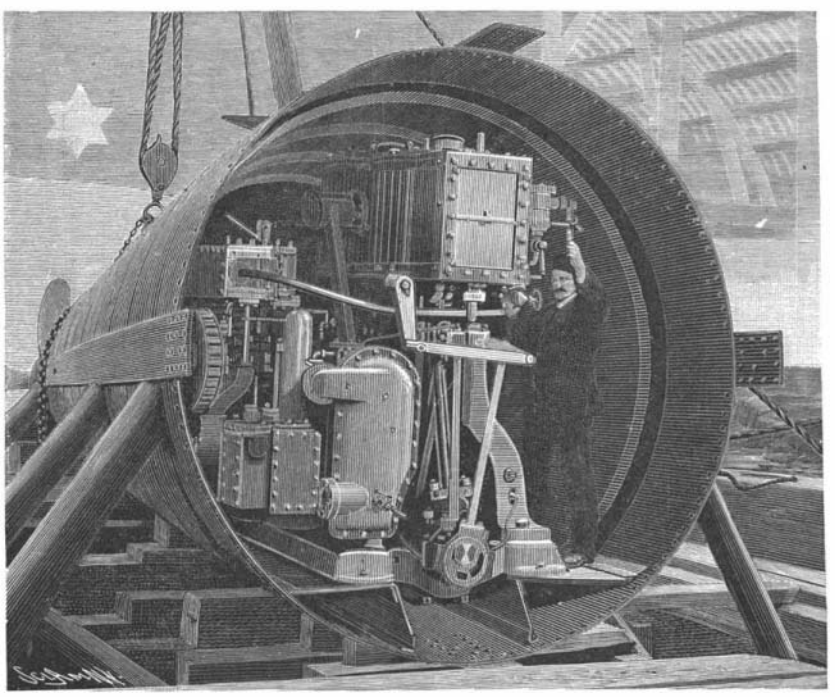
TURKISH SUBMARINE BOAT OF THE NORDENFELDT TYPE.

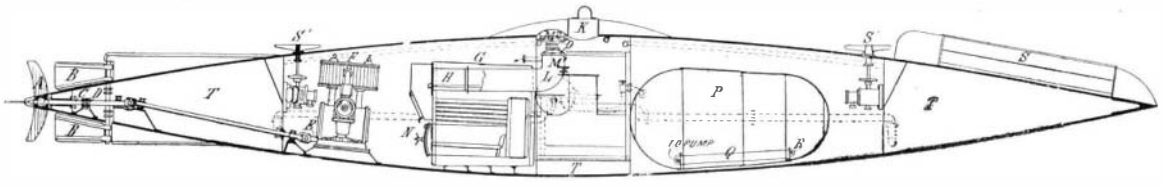
At the present time, when so much attention is being paid to the submarine boat, and several of this type are being constructed for our own navy, it is of interest to turn to an early series of experiments, carried out by the British Admiralty, which, in the opinion of our contemporary, The Engineer, to whom we are indebted for our illustrations, "has left them in such a position that there is practically nothing more to be learned on the subject from such experiments as France, going over very old ground, is now conducting."

Referring to the French experimental work now being carried on, the same authority says that between the year 1886 and September, 1888, a series of experiments in the construction and use of submarine boats was carried on in this country and abroad, beside which the French experiments now going on are mere child's play. Mr. Garrett, a gentleman in holy orders, and extremely ingenious, devoted the greater part of his life and fortune to the development of the submarine boat; and with him was associated Mr. Nordenfeldt, the inventor of the well-known Nordenfeldt gun. The vessel was designed to run near to the vessel to be attacked, then sink 20 feet below the surface, and proceed submerged to within striking distance, when she would discharge her torpedoes and return. For the purpose of propulsion steam was used in the ordinary way on the surface. When going to sink, the chimney was removed, and air-tight stopper fitted on the opening to the up-take. The furnace mouths were similarly closed by doors like those of a gas retort, and the boat sank. Power was then supplied on Lamm's system by the hot water in the boiler. The experimental boat quite realized all Mr. Garrett expected. A second boat was constructed, and after elaborate and prolonged experiments full of incident, the little vessel was bought by the Turkish government.



CROSS-SECTION OF TURKISH SUBMARINE BOAT.

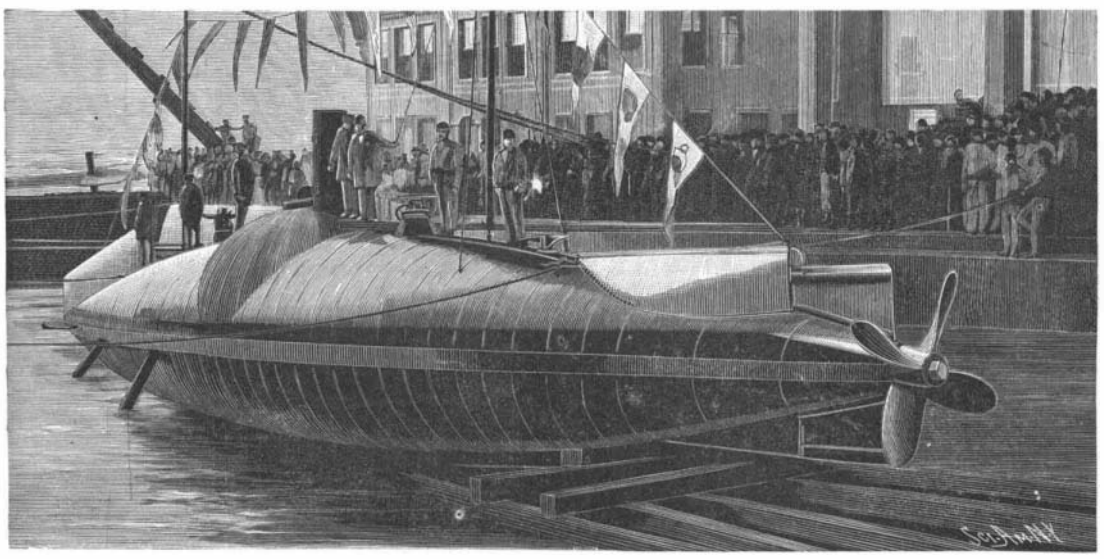
The accompanying illustrations show two sectional views and a view from the quarters of one of the Turkish boats, whose description and principal dimensions, as given in The Engineer, are as follows: Length 100 feet, beam 12 feet, and displacement 160 tons. The engines are of the ordinary surface-condensing compound type, with two cylinders, and are estimated to indicate, at a pressure of 100 pounds of steam, 250 horse power. There is nothing particularly to remark about these engines, except that the circulating and air pumps are worked by a separate cylinder. The main engine is thus left free to work or not, while vacuum is always maintained to assist the various other engines with which the boat is fitted. The boiler, marked *G* in the longitudinal section, is of the ordinary marine return-tube type. It has two furnaces, and the heating surface is about 750 square feet. A novel feature about it is, however, that after the products of combustion have passed through the tubes, they again pass through a large pipe, marked *H*, in the steam space of the boiler before they reach the funnel. The object of this is threefold: First, the economy of heat and fuel; secondly, to enable the funnel to be as near the center of the boat as possible, and thirdly, that the inboard portion of the same might be kept the cooler by thus lengthening the passage to it of the heated air. The hot-water cistern is seen at *P*, and the power to operate all the separate engines during a submarine voyage is the heat, as previously mentioned, which is stored up in its contents, as also in those of the boiler. In all there are some 30 tons of water, the vapor of which has a maximum tension of 150 pounds per square inch when the boat is first submerged; and this, with the assistance of the vacuum, is sufficient to drive her from thirty to forty miles without lighting any fire on board or using any air for the generation of heat. The pressure is raised in the hot-water cistern as follows: Live steam from the boiler enters a series of tubes which have a superficial area, in all, of some 500 square feet, and after parting with its latent heat to the contents of the cistern, being then in the aqueous form, is taken off by a small double-acting pump and carried back to the boiler. The propeller, *A*, is placed abaft the rudder, *B*, and it will be noticed that although the shaft is central, working on the thrust-block, *D*, the coupling connecting the crankshaft of the engine, *E*, is placed low down in the boat. It is this feature in the arrangement which admits of the use of a marine engine of ordinary type. The engines which operate the vertically-acting screws are of the three-cylinder type. This is in order that there may be no dead center, as it is highly important that they should start the moment steam is turned on. By the use of a special valve the captain is enabled to vary the speed of the propellers and to stop them both together or separately, at will, and thus to arrange the depth at which his craft is to operate. As seen in the engraving, these propellers in the Turkish boats are placed in the fore-and-aft line.



VERTICAL LONGITUDINAL SECTION.

The maintaining of the vessel in a horizontal position is controlled by two bow-fins. By a very ingenious arrangement of a plumb-weight, with other mechanism extending to the conning-tower, the action of these fins is rendered both automatic and controllable, and perfect command is thus insured over the movements of the boats, as far as the vertical plane is concerned. To touch now upon the manner in which the "Nordenfeldt" is operated, it should be understood that the boat has two distinct conditions of existence as a torpedo craft—that of a surface boat, and a submarine one. When performing the functions of a surface boat, the air which is sucked into the boat through the conning tower, *K*, by the fan, *L*, is forced by the said fan into the engine-room. From here, having no other outlet, it passes into the furnaces, and after supporting combustion reaches the atmosphere by way of the tube, *H*, as previously described, and the funnel. The connecting link between the inner and outer portions of the funnel, *M* and *M*¹, is not seen, it should be mentioned, in the engraving. In this position, with more or less of her bulk immersed, as may be thought necessary, according to the nature of the service upon which she is engaged, the boat can proceed upon voyages only limited in extent by her coal-carrying capacity. This in the Turkish boat is estimated to suffice for the fuel to drive her 900 knots at a moderate speed. The immersion of the boat in her surface condition is regulated by the admission or otherwise of water into the ballast tanks. Of these there are three, one at each end and a third under the center compartment, *T T T*, in the engraving. The two first mentioned contain about fifteen tons of water each, and the central one seven, when the boat is at her proper draught for descending. At this draught there is very little of the craft visible beyond the conning tower, and knowing even in which direction to look, it is not an easy matter to make her out at any great distance, the eye being unassisted by the ear on account of the noiselessness of the engines. All those who have witnessed the running of the boat here have been particularly struck with this feature of her performance, as also the little disturbance at the surface occasioned by the screw.

Before the boat can assume her condition as a submarine craft, it is necessary to hermetically close the furnaces, which is done by the doors marked *N*, upon which combustion is soon brought to an end. The piece of funnel connecting the boiler with the outboard portion is then removed, and the doors, *O* and *O*¹, placed in position, as shown in the engraving. While these changes are being effected, water is allowed to run into the ballast tanks, to reduce the buoyancy to its proper limit, and this arrived at, nothing remains but to close up the conning tower. The vertically-acting screws may then be set in motion to place the boat quite out of sight, or she may proceed with nothing but the glass cupola of the conning tower showing above the surface.



SUBMARINE BOAT IN DOCK AT CONSTANTINOPLE.

SIBERIA IN THE GLACIAL AGE.

Prof. G. Frederick Wright, of Oberlin College, recently returned from a trip around the world made in the interests of the science of geology. The main object of the trip was to settle, if possible, what has long been a disputed question among geologists—that is, whether Siberia has ever been covered with ice as North America and parts of Europe were during the glacial period. The view which is generally accepted is that Siberia was covered with ice, and a great many geologists still hold this view.

As a result of his trip Prof. Wright believes that at the time when North America was covered with ice, Siberia was covered with water. He found no signs of glacial phenomena south of the fifty-sixth degree. North of that he did not go, but he is convinced that the land was never covered by ice as was our own. According to The New York Sun, Prof. Wright says:

"We did find indications of an extensive subsidence of all that region, which puts a new light on everything here. At Trebizond, on the south shore of the Black Sea, there was evidence of a depression of 700 feet. This was shown by gravel deposits on the hills. In the center of Turkestan the waters reached their greatest height, for there we found these deposits over 2,000 feet above sea-level. Southern Russia is covered with the same black earth deposit that we found in Turkestan. There were still other evidences of the waters having covered this portion of the globe. One of these is the presence yet of seals in Lake Baikal, in Siberia, 1,600 feet above sea-level. The seals which we found are of the Arctic species, and are the same species as found in the Caspian Sea.

"The only theory, therefore, is that they were caught there when the waters receded. Perhaps the most wonderful discovery of all was at the town of Kief, on the Nippur River, where stone implements were found fifty-three feet below the black earth deposit, showing that the water came there after the age of man. This enabled us, therefore, to determine the