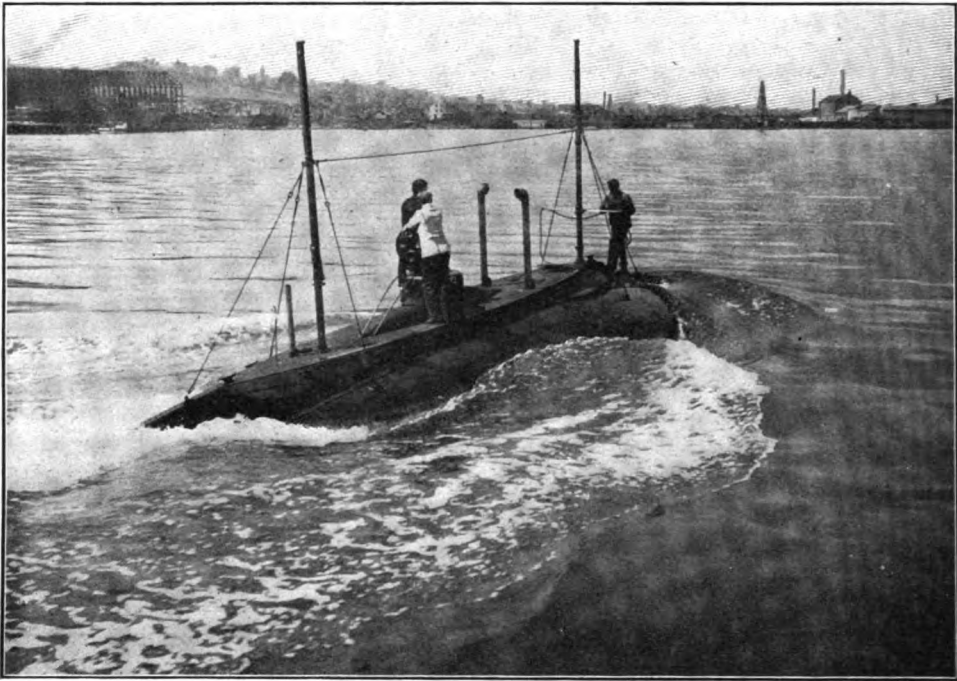


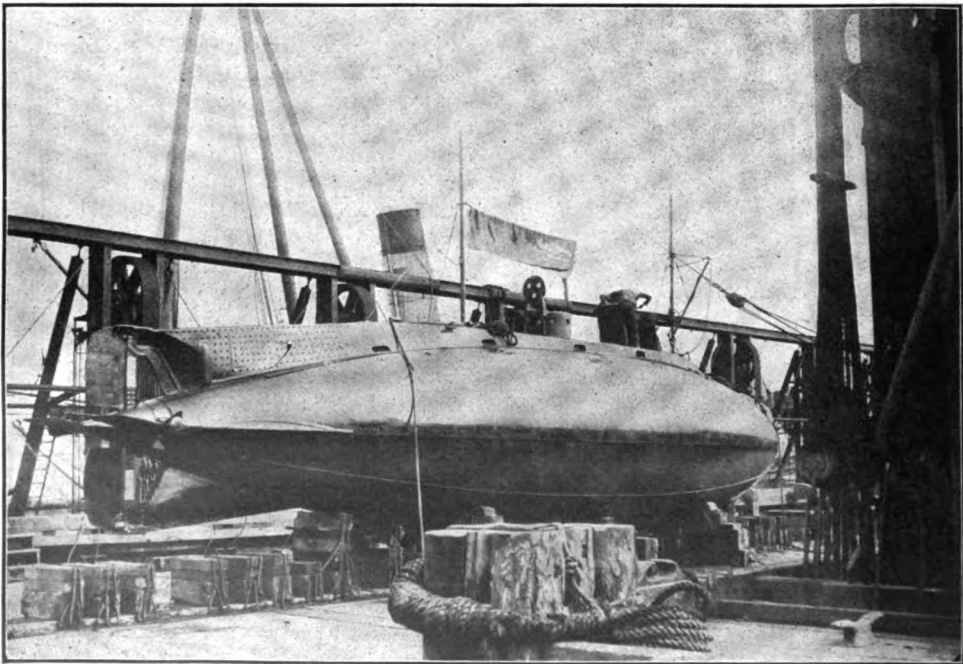
TRIALS OF THE SUBMARINE BOATS GRAMPUS AND PIKE.

The waters of San Francisco bay were recently ruffled by two most interesting craft, the first of their kind to be seen on the Pacific. They were the submarine torpedo boats *Grampus* and *Pike*, built at the Union Iron Works under contract with the J. P. Holland Torpedo Boat Company for the United States government.

First, considering the general dimensions of these boats, they are 63 feet 4 inches over all, 11 feet 9 inches in



STERN VIEW OF THE PIKE ON TRIAL.



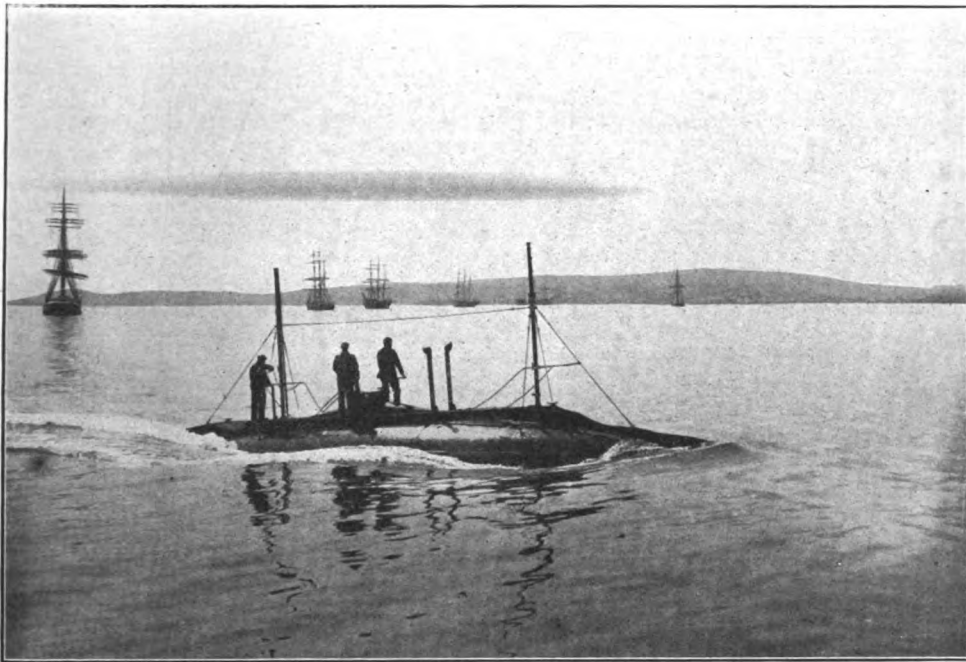
STERN VIEW OF THE HOLLAND SUBMARINE PIKE.

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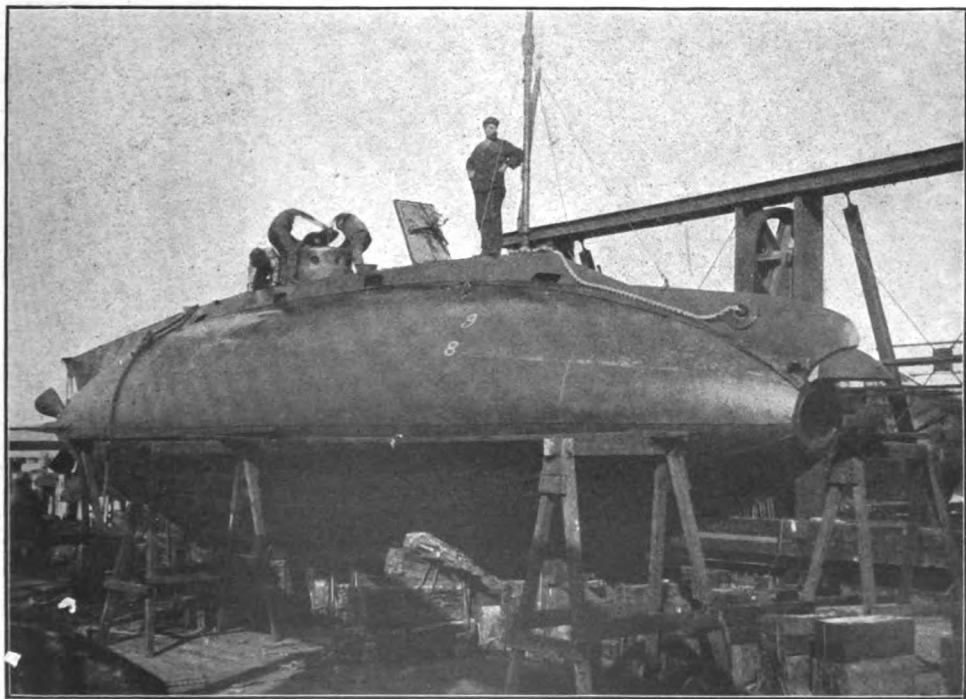
diameter, and, when submerged, displace 120 tons. Power for driving the craft when on the surface is supplied through gearing to a single screw by a four-cylinder Otto gasoline engine of 160 horse power; any

one or all the cylinders may be connected up at a time. When the boat is submerged, a 70 horse-power electric motor is geared to the propeller, the current being supplied from storage batteries rated at 1,840 ampere hours.

self is to be submerged these tanks are filled with water until there is a reserve buoyancy of but 300 pounds, and then submergence is secured by means of diving rudders—horizontal rudders placed at the stern. To bring the



THE PIKE RUNNING HER SURFACE TRIALS.



THE HOLLAND SUBMARINES. THE GRAMPUS ON DRY-DOCK, BOW VIEW.

This motor is also used for coming alongside and making landings, as the gasoline engine does not reverse. The trim of the submarines is secured by 3 ballast tanks, one forward, one aft, and one amidships. When the ves-

vessel to the surface the water is forced out of the tanks by compressed air, and by means of the diving rudders.

In surface and awash conditions the vessel is steered from the deck, while the degree of immersion is

controlled from below by the horizontal rudders. Ventilation for the long periods is reported to be rather bad, as might be expected.

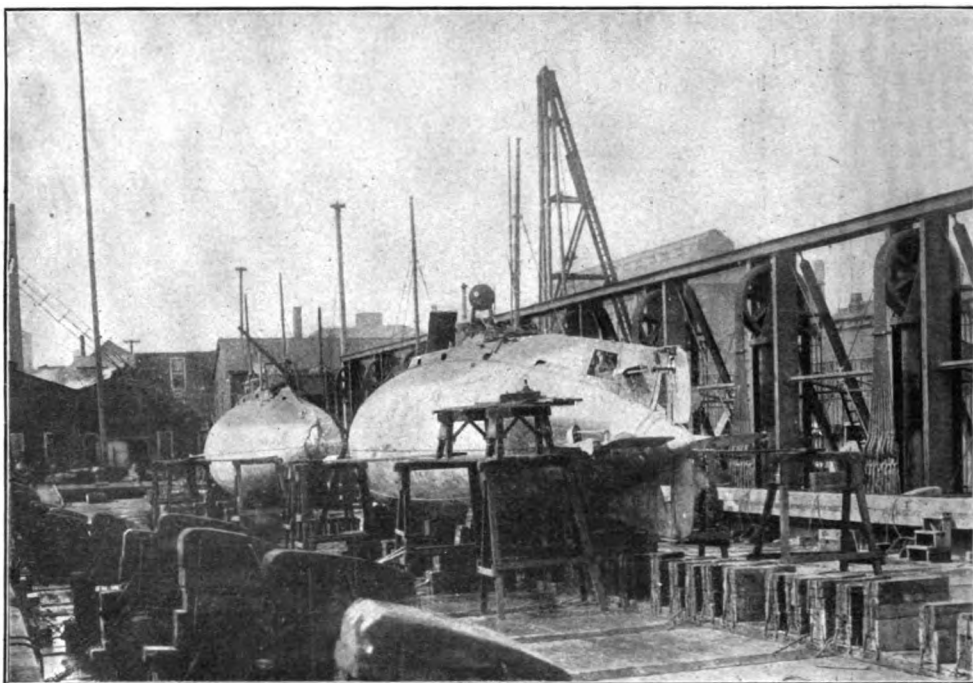
The course laid for the trial extended from a point near the Union Iron Works two miles across the bay toward Hunter's Point. Each vessel was first given standardization runs over one mile and half-mile divisions of the course. The trials, according to the contract, were most rigid, and were for testing the boat under all conditions of submergence. They first consisted, as already stated, of standardization surface runs in light condition, using gasoline engines alone. The contract speed was to be 8 knots, which was exceeded by about half a knot by each vessel. The weather conditions were perfect for these surface trials, as there was scarcely a ripple on the waters of the bay. A standardization run was next made by each awash, with

was evident that the craft was remarkably steady and kept in constant trim. At the end of the run the submarine would come to the surface like a duck, take her bearings, make a turn, and dive upon her return trip. The diving and emerging were controlled by the horizontal rudders.

The fourth trials consisted of a surface run over a course of ten miles, and at a speed of not less than 8 knots. In these trials the *Pike* made 8.55 knots and the *Grampus* 8.47.

Then followed an awash speed trial, when the *Pike* made a speed of 7.65 and the *Grampus* 7.54 knots.

The sixth trial was for testing the torpedo-firing qualities, and, as laid down, each little boat had to run submerged for two miles at an average speed of not less than 7 knots, and fire a torpedo at a target at the end of the run. On April 7 the *Grampus* started on this



THE GRAMPUS AND PIKE ON DRY-DOCK AT THE UNION IRON WORKS, SAN FRANCISCO, CAL.

two and three cylinders of the engine connected. The contract required a speed of 7 knots, while on both the *Pike* and *Grampus* the results gave a speed of about 7 1-2 knots. On these trials the boats were trimmed for diving, except that the main ballast tank was empty, the conning tower hatch cover was open, and the after ventilator in place.

The third trials consisted of standardization runs in completely submerged conditions, with the electric motor in operation. A speed of 7 knots was required, and this was exceeded at the first part of the run of each vessel, when the storage battery discharge was greatest. In making this run each submarine was trimmed, so that only the conning tower was visible, before starting on the run. Just as one reached the stake marks it would dive at an angle of about 8 degrees to a 16-foot depth. The course of the vessel could be followed by a little flag on the flagpole, and from this it

trial, rising twice en route for observation, and at the end of the run rose to the surface and 25 seconds later discharged her torpedo at the target, 175 yards distance. The torpedo moved in a straight track and passed between the buoys constituting the target.

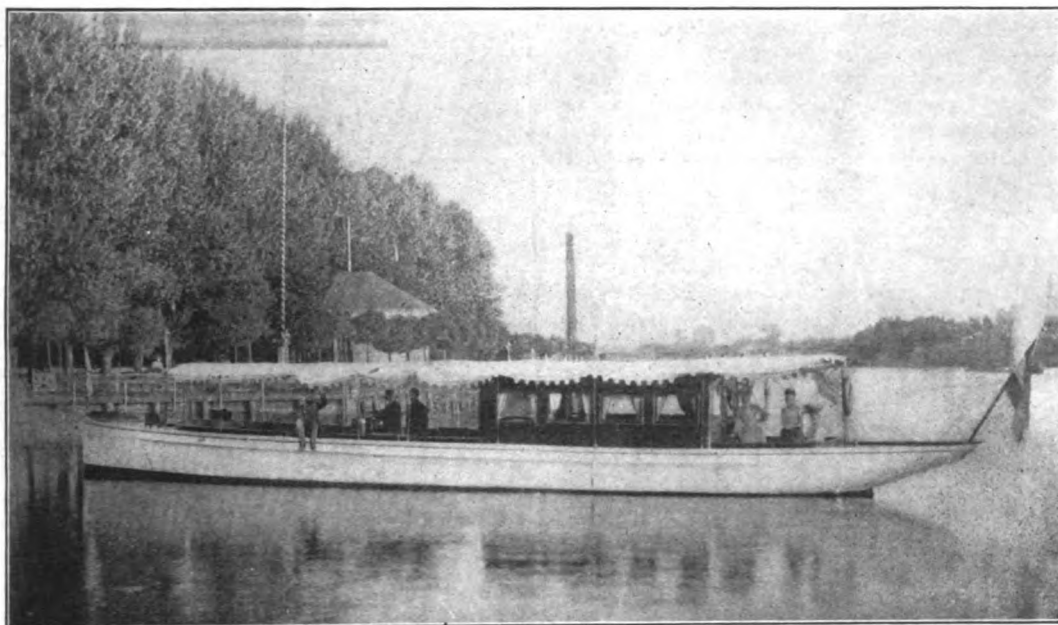
On April 4 the *Pike* was run through a similar trial, rising twice for observation, but failed to make a hit at the target, 200 yards distance.

For the two endurance trials the board selected the *Pike* to represent the *Grampus*, as the latter had given most satisfactory results. The trials consisted, first, of a 3-hour, completely-submerged run, under the electric motor only, and at a minimum speed of 7 knots, and then a 12-hour endurance trial for the gasoline engine. The boat was actually submerged 2 hours 31 minutes and 39 seconds, during which time the maintained speed was 7.07 knots; the rest of the time was required for surface observations, which took from 3-4 of a minute to

5 minutes each. The only part of the vessel visible during submergence was the periscope used for scanning the sea ahead. Mirrors are so set that objects ahead are reflected through a tube down below into the vessel, where they may be seen by the navigator.

The first part of the surface endurance run was made with the vessel under way, sailing on the surface, when the engine was disconnected and the electric motor thrown in gear to come alongside of dock. Then the trial was continued with the boat moored to the dock, with all cylinders of the gasoline engine in operation.

storage battery of 80 elements, with a capacity of 140-ampere hours at a 35-ampere discharge rate. This was a 2.8-ton boat. The *Zurich* was also built of steel, at Zurich, Switzerland, by Escher-Wyss and Company. This launch was 49.2 feet in length at the water line, 52.5 feet on deck by 10.2 feet beam, and was equipped with an 8-horse-power motor operating at a speed of 350 revolutions per minute. The storage battery consisted of 56 elements of the Oerlikon type in glass receptacles. The storage battery had a capacity of 450 ampere hours at an 80-ampere discharge rate, and the boat was able



ELECTRIC LAUNCH GERMANIA.

German, English, and American Electric Launches.

BY FRANK C. PERKINS.

I.

The electric boat and launch industry has been rapidly developing during the past decade, and has now reached a place of importance in Germany as well as in England and America. Many people do not realize the prominent place taken by the electric launch, considering this class of yacht only serviceable with modern expositions. It is true that the expositions have done much to show the beauties of these marvelously clean, rapid, and roomy little boats.

As far back as 1891, at the Elektro-Technischen Ausstellung in Frankfurt a. M., Germany, there were two large electric boats in operation. One of these boats was known as the *Elektra*, and was exhibited by Siemens and Halske, of Berlin, and the other, the *Zurich*, by the Maschinenfabrik Oerlikon, of Switzerland. These electric launches were used for carrying passengers on the river Main, at the Frankfurt exposition, and were much larger than those at any of the recent expositions at Paris, Chicago, or Buffalo.

The *Elektra* was of steel plate construction and was built by R. Holtz in Harburg a. d. E. It measured 37.7 feet in length and 6.6 feet in breadth, and was equipped with a 10-horse-power motor and a Tudor

to attain a speed of 5.4 knots per hour. After the Frankfurt exposition was over the *Zurich* was purchased by the Allgemeinen Elektrizitäts-Gesellschaft, and was re-named *Elektron*. The Oerlikon storage cells were then replaced by others of a capacity of 350 ampere hours built by the Accumulatoren Fabrik A. G. of Berlin.

Two smaller electric launches, the *Watt* and *Matilda*, were constructed for this concern, 28.9 feet in length, 6.2 feet beam, and each was equipped with a 3-horse-power motor; each battery consisted of 46 elements of a capacity of 150 ampere hours at a 30-ampere discharge rate.

It may be of interest to consider some of the details of construction, with drawings and photographs, as well as electrical connections, of some of the more modern boats constructed in Germany by the last-named company; in England by the Thames Valley Launch Company, Ltd., of Weybridge, Surrey; and in America by the Electric Launch Company of Bayonne City, N. J., showing characteristics, outlines of the yacht, and the arrangement of the electrical equipment. The German builders of electric launches adopted two or three methods for the control of the electric motors. One of these consisted of an electrical controller mounted in such a position that its shaft is horizontal, the wheel by which it is manipulated being mounted on a shaft which is