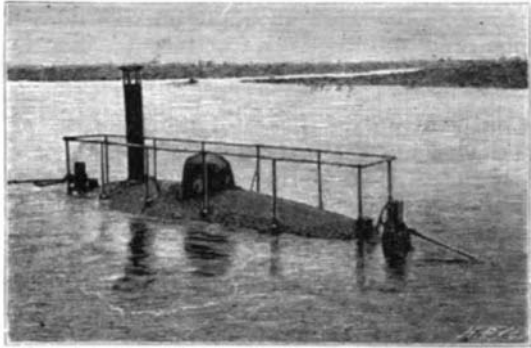


THE BAKER SUBMARINE BOAT.

During the past three months several trials have been made in the Detroit River, near Detroit, of the Baker submarine boat, shown in the accompanying illustrations, and, at the direction of Commodore Folger, of the Naval Ordnance Bureau, Mr. W. Scott Sims, an inventor well known in connection with the Sims-Edison torpedo boat, is looking into the capabilities of this new boat as affording a possibly valuable



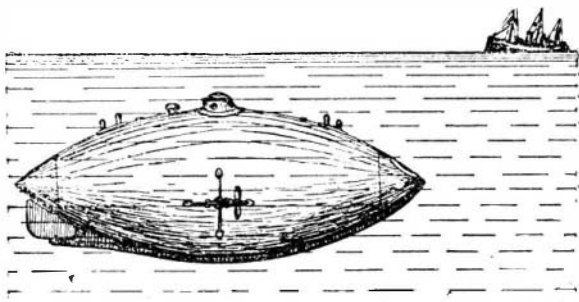
SUBMARINE BOAT—AFTER PARTIAL SUBMERGENCE.

addition to the navy. The boat has needed some repairs since its preliminary trials, and, as soon as these are effected, it is expected that it will be taken to Newport and placed under the supervision of government officials for further experiments.

Mr. George C. Baker, the inventor of the new craft, is a Chicago business man. The hull is designed to withstand the pressure of the water at a depth of eighty to a hundred feet, and with this view it is constructed of three-inch oak plank, six inches wide. Its dimensions are 40 feet over all, 9 feet beam and 14 feet deep, from top of conning tower to bottom of hull being 16 feet. The boat is self-contained throughout, and needs no shore connections to drive it. The driving power is in duplicate, an electric plant and a steam plant, the former for running under water and the latter for surface propulsion, the steam plant being so arranged that it can be used to generate electricity for charging the storage batteries.

The electrical equipment consists of a 50 horse power motor, built by C. D. Jenney, of Fort Wayne, Ind., and 232 Woodward storage cells of the "M. S." type. The motor was designed for a pressure of 220 volts and runs at a maximum speed of 900, turning the two screws, which are four-bladed, at a maximum speed of 300 revolutions per minute. This rate of revolution, it was calculated, would give the boat a speed of from eight to nine miles per hour. The gearing is very substantial and of steel. The motor is connected to run as a dynamo by the simple movement of convenient switches. When it is run as a generator it is speeded up to 1,025 revolutions per minute, so as to give a charging pressure of 220 volts. The cells are charged in four sets of 58 each and are discharged in two sets of 116 cells each, this arrangement giving at the motor an available pressure of 232 volts. In the top of the boat, within easy reach of the pilot's assistant, there is a convenient controlling switch connected with galvanized sheet iron resistance coils in the forward end of the boat. By this switch and a circuit breaker the speed may be varied as desired.

The steam plant consists of a 4½ by 5½ foot Roberts



SUBMARINE BOAT—AS IT APPEARS UNDER WATER.

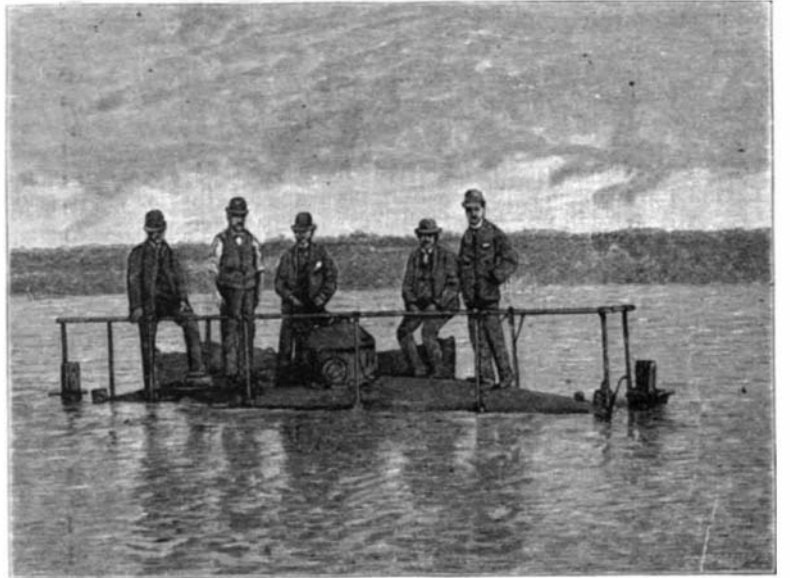
water tube boiler, with telescopic stack, which is lowered and the stack hole covered when fire is not required. The 7 x 7 inch Willard engine can be thrown in gear with the main shaft, and it can also be belted to the motor. There are two 24-inch propeller wheels, one on either side, connected with one shaft amidships. To the ends of the shaft are attached gear wheels, working in the gear attached to propellers,

which are turned in any position by means of a sleeve around the shaft. This sleeve is connected to a hand wheel with chain belting. By means of this hand wheel the propellers may be placed in any position. The propellers are protected by brackets from coming in contact with any obstruction. The rudder fits close to the hull and the boat answers to it readily.

It is expected that, ordinarily, only two men will be necessary to operate the boat, a pilot and an electrical engineer, and the air supply needed for their comfortable maintenance under water will, it is intended, be afforded by the quantity held by the hull itself at the time of submergence, this volume being equal to 1,500 cubic feet. In one of the trials two occupants were within the closed vessel two hours and forty-five minutes without experiencing any unpleasant effects. The boat has about 75 tons displacement, the hull weighing 20 tons, the ballast 30 tons, the storage battery cells 10 tons, engine and boiler and gearing 8 tons, and motor 3 tons, leaving 4 tons buoyancy. The normal draught of the boat leaves about two feet of the crown of the hull above water.

In starting, the pilot and electrical engineer enter through a man-hole in the conning tower, and the cover is drawn over and fastened, when the boat is airtight. The electrically-connected pump is started and two or three tons of water is pumped into the water bottoms, this additional weight leaving nothing of the

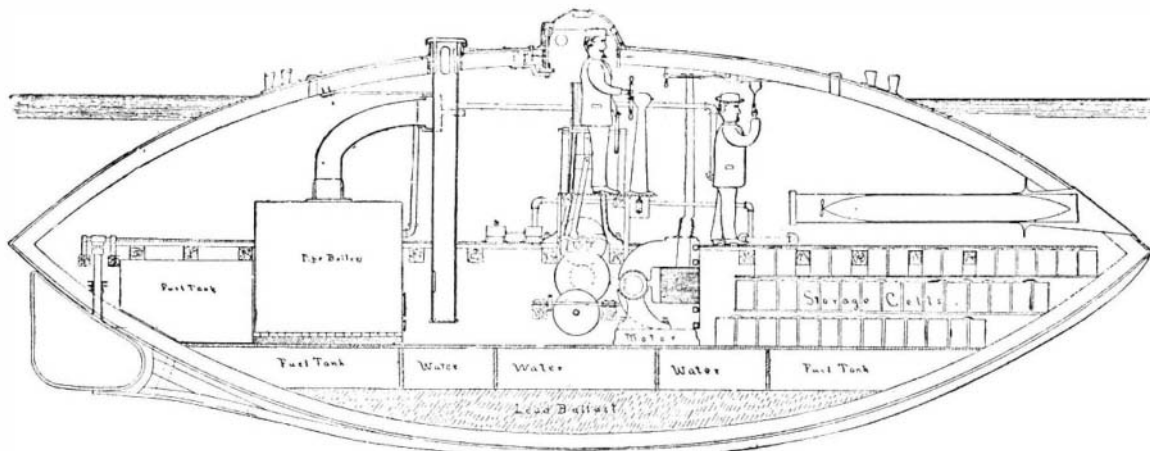
wheels are turned at an angle of about 45 deg. and the boat is propelled forward, neither rising or sinking unless the pitch of the wheels is changed. When the commander or pilot wishes to ascend, the machinery is stopped and the reserve buoyancy causes the boat to



SUBMARINE BOAT—JUST BEFORE STARTING.

rise to the surface. Any accident that would stop the machinery would also cause the boat to ascend. The storage battery plant is designed to contain enough power to run the boat three hours at a speed of eight miles an hour.

The torpedo boat of Mr. J. L. Tuck, and the method of operating it, represented in one of the views, was built at the Delamater Iron Works in 1885. It was 30 feet long, 7½ feet broad, and 6 feet deep. It had several small compartments to be filled with water when the boat was to be sunk, and a number of 6-inch iron pipes filled with compressed air to furnish a supply for its single occupant. Its propeller was turned by an ordinary dynamo, run by storage batteries, and it had a common rudder for horizontal steering, and a horizontal rudder for guiding it toward or away from the



THE BAKER ELECTRICALLY-DRIVEN SUBMARINE BOAT—SECTIONAL VIEW.

boat above the surface except the top of the hull and conning tower. To sink directly downward the wheels are turned perpendicularly to the shaft and the motor is started. The amount of spare buoyancy determines the amount of power necessary to sink the boat. When the desired depth is attained, then the propeller

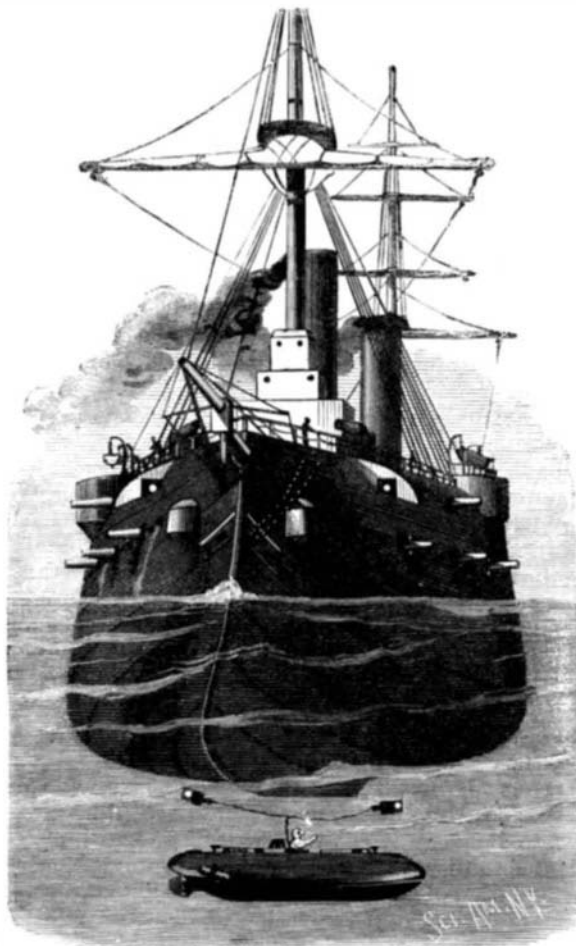
surface. A well-hole in the center of the deck was fitted with an air-tight hatch, from which an individual in a diver's suit, by means of suitable devices, might direct those inside in elevating, lowering and propelling the boat. It was designed with this boat to attach torpedoes to the bottom of a vessel, then run away to a safe distance and explode the torpedoes by means of wires paid out while moving away.

Irrigation in Washington.

Census Bulletin No. 198 has been prepared by Mr. F. H. Newell, special agent of the Census Office for the collection of statistics of irrigation, under the direction of Mr. John Hyde, special agent in charge of the statistics of all branches of agriculture, and relates to the State of Washington, in which there are 1,046 farms that are irrigated out of a total of 11,237 farms in the 13 counties in which irrigation is practiced. The total area of land upon which crops were raised by irrigation in the census year ending May 31, 1890, was 48,799 acres. The average size of the irrigated farms, or more strictly of irrigated portions of farms on which crops were raised, is 47 acres. The average first cost of water right is \$4.03 per acre, and the average cost of preparing the soil for cultivation, including the purchase price of the land, is \$10.27 per acre. The average present value of the irrigated land of the State, including buildings, etc., is reported as \$50 per acre, showing an apparent profit of \$34.45 per acre, less cost of buildings. The average annual cost of water is \$1.75 per acre, which, deducted from the average annual value of products per acre, leaves an average annual return of \$16.35 per acre.

Cause of the Unequal Wearing Away of Electric Light Carbons.

In an electric arc the positive pole is hotter than the negative, the positive showing a temperature of about 4,000° C., the negative showing a temperature of 3,000° to 3,500° C. This difference of temperature produces a counter electromotive force which acts like ohmic resistance. The cause of the positive pole wearing away twice as fast as the negative is due to this difference in temperature.



THE TUCK SUBMARINE TORPEDO BOAT OF 1885.

