

Submarine Torpedo Boats.

EXTRACTS from the REPORTS of CAPTAIN JACKSON, R.N., and others, dated
22 January 1899, 28 February 1899, and June 1896.

Owing to the successful experiments described in this report, and the value attached to them by French officers, the subject of submarine warfare is likely to be developed by the employment of such craft in the French Navy.

Gustave Zédé.

The following information relative to the details of design and results of the trials recently carried out with the submarine torpedo boat "Gustave Zédé" have been obtained from trustworthy sources. Description.

The hull 148 feet long and 10 feet 9 inches maximum diameter, is built of bronze, and has the form of a torpedo boat with extremely slender ends, in which the upper works have been cut away and replaced by a turtle-back deck.

Her displacement when entirely submerged is 262 tons.

When at the surface the deck is awash, and only the armoured cupola (which serves as a post of observation for the captain) is visible.

Accumulators of Laurent-Cely type, joined up in groups of 250 to give 500 volts, supply the current for the propelling and auxiliary motors. Motive power.

The maximum development is 1,100 ampères, corresponding to 750 h.p., which should give 15 knots on the surface, capable of being kept up during eight hours without over-discharging the cells. The acid is covered with a layer of heavy oil to prevent liberation of gases.

Two Sautté-Harlé electric motors, multipolar and very compact, are mounted on the propeller shaft; they work at 500 volts, and each develops 400 h.p. Engines :
(1.) For moving horizontally.

There is only one three-bladed propeller.

Different speeds are obtained by manipulating the coupling of the motors, and by introducing resistances in the circuit. The maximum speed attained is 11 knots on the surface and 8.5 when submerged.

(2.) For moving vertically. Diving and submergence

The principle employed for submerging the vessel is "change of displacement," supplemented by horizontal rudders, which latter *can* be worked by hand and most probably also work automatically in addition, to correct small inclinations of the boat from the horizontal.

Pumps worked by electric motors empty or fill reservoirs of water destined to modify the statical immersion of the boat.

After the proper trim has been obtained, by the introduction or expulsion of water, the vertical displacement of the boat is brought about by the variable inclination of two fins placed on the sides of the boat, about two-thirds of her length from the bow. These fins are composed of narrow metallic plates of great strength, and the variation of their inclination is affected by means of a hydraulic press, the pressure being maintained by a pump worked by an electric motor.

A man keeps his eye on a pendulum and on a pressure manometer, and works two levers--one controlling the fin-working mechanism, the other the pumps for injecting or discharging water.

The pendulum shows him the inclination of the axis of the boat in a vertical plane, the manometer the variations in submersion with reference to the submersion required.

The actual mechanical details of the diving mechanism are kept very secret.

The depth at which the boat can proceed can be regulated at will; the usual depth is stated to be with the axis of boat submerged 10 feet.

Steering apparatus.

A vertical rudder is actuated by a wheel placed vertically below the cupola in which the commanding officer keeps his head.

It is believed that a hydraulic servomotor is inserted between the wheel and the rudder.

The difficulty was to steer straight and, above all, to knowingly change direction under water. Leakage of the accumulators caused parasite currents in the hull, which disturbed the compasses.

A gyroscope, set in motion by a small electric motor, has been tried to indicate any deviation from a straight course.

The conning tower (cupola) is of sufficient thickness to be proof against machine-gun fire at all ranges.

Only the necessary levers for steering, stopping, diving, and discharging the torpedo are fitted in this tower.

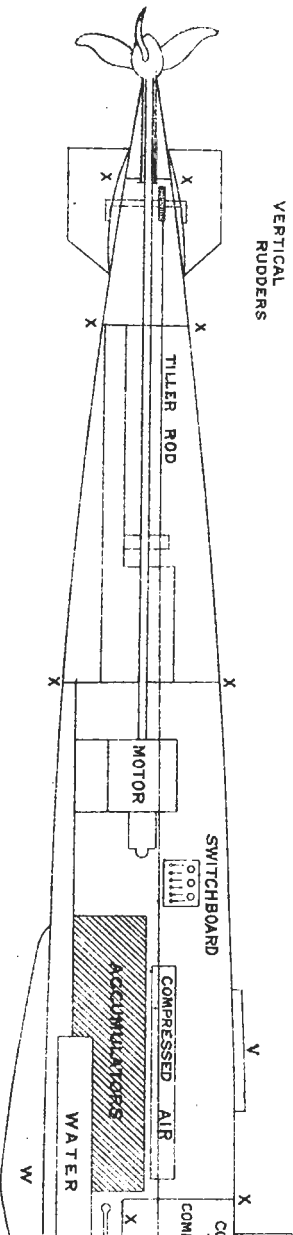
The limit of vision under water is 6 metres, but an optic tube is fitted to the top of the conning tower. This apparatus is of little use in a seaway on account of the spray, but under favourable conditions it is very useful in keeping the position of the boat known, and for firing the torpedo.

A flying bridge is fitted for navigation and observation purposes. It can be lowered flush with the hull, when so desired, in a few seconds. When raised, this bridge stands about 10 feet above the hull, just before the cupola, and will accommodate four persons.

PLAN SHOWING THE GENERAL GUSTAVE

LONGITUDINAL

SCALE 1" = 12'



C. IS AN ELECTRICALLY DRIVEN AIR COMPRESSOR

P " " " PUMP FOR FILLING

OR EMPTYING THE WATER TANKS FOR RAISING

OR SINKING THE BOAT WHEN UNDER WEIGH.

V. ARE ESCAPE HOLES FOR THE CREW.

XX ARE WATERTIGHT BULKHEADS.

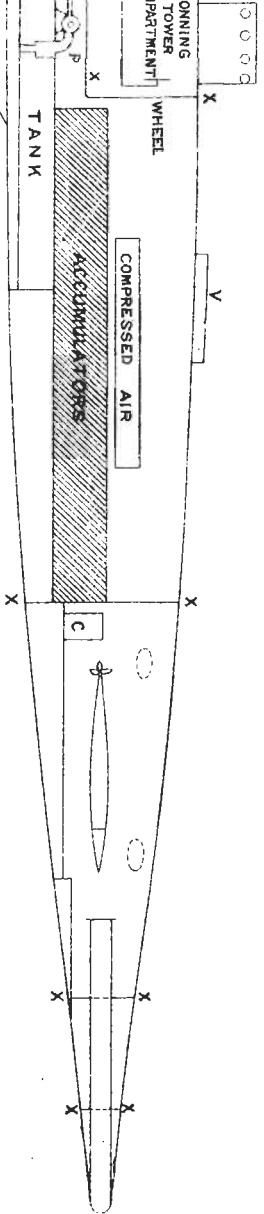
W IS A DETACHABLE WEIGHT WHICH ALSO

ACTS AS A KEEL.

INTERNAL ARRANGEMENTS OF THE ZÉDE.

SECTION.

FEET. APPROX.



THE CONNECTIONS FOR WORKING THE HORIZONTAL
RUDDERS ARE NOT SHOWN IN THE SKETCH,
NEITHER IS THE FLYING BRIDGE SHEWN.
THE DETAILS AT PRESENT ARE NOT PROCURABLE.

In a heavy sea the bridge is untenable, and is folded back, and the boat completely battened down.

Excellent ventilating arrangements are fitted to ventilate the boat when on the surface through the cupola door and escape hatches. Ventilation.

For air supply when submerged, air pumps electrically driven and large capacity air reservoirs are provided, which, when fully charged, carry sufficient air to enable the full crew of 13 men to live for five hours totally submerged.

Successful experiments have been carried out in purifying the foul air in the boat.

Water is dropped on to binoxide of sodium, which then decomposes, giving off 25 per cent. of its weight of pure oxygen and absorbs the carbonic acid.

The accommodation for the crew is good, and little inconvenience is experienced when submerged.

The vessel is armed with one torpedo tube in the stem.

Armament.

Three Whitehead 15" torpedoes are carried, one is in the tube, the other two in reserve. These torpedoes have a speed of 27 knots for 400 metres. They can all be discharged without returning to port. Air impulse is used.

The radius of action is about 90 miles, but this can only be obtained by a judicious management of the accumulators and with a speed of 4 to 5 knots. Radius of action.

Special towing arrangements are fitted, and a hawser with an electrical conductor in the core is used, so that the boat can be towed and her accumulators charged up at the same time.

The plan shows the general internal arrangements of the boat.

All the fittings mentioned have been practically tried at sea under various conditions of weather, including a strong gale in the Gulf of Lyons, and the boat has passed through her trials with such success as to thoroughly satisfy numerous experienced naval officers who witnessed them.

Captain Jackson in his report points out that one of the most important results of the trials has been to demonstrate that a vessel of this type, if towed for two-thirds of the way, would be capable of crossing and recrossing the channel from Cherbourg to Portland, and a vessel with a larger radius of action, say 180 miles, could do so unaided.

Four more boats propelled on the same principle are at once to be built secretly in the dockyards, and every effort is to be made to have the first one ready for trial in six months. Other boats.

The construction of another six will then be proceeded with as laid down in the Estimates. They will be of the same dimensions as the "Narval," displacing 106 tons and 116 feet long.

The "Narval" class will carry liquid fuel for use in boilers when on the surface. Their speed will be about the same as the "Zédé."

All these vessels are designated "defensive" boats only, but those of the "Narval" class, with steam for cruising, will be called "offensive."

Method of
attack.

An idea of the method of attack can be gathered from Captain Jackson's report of the trial attack against the "Magenta" at anchor.

Attacking an enemy under way appears at present to be impracticable.

Experiments have been carried out in the Mediterranean with the captive balloons used for naval purposes, to ascertain the chance of discovering these submerged boats, at a long range, by observers in the cars of the balloons.

The results have not been encouraging.

For every 1,000-foot elevation of the balloon the horizontal distance from the vertical at which the boat could be seen was 174 feet, a distance of no practical use except for watching the entrance of a narrow channel.

The boat was found to be most invisible when painted a bluish grey colour. It could then only be seen down to 2 metres deep within a field of vision of 10° from the vertical.

Types.

A distinction must be drawn between the terms Submarine and Submersible.

A submersible boat is intended to be brought down in the water by suitable arrangements, and run with a very small target exposed, but is not intended to dive.

The "Narval" class are of this type.

The "Zédé" and "Goubet" are both submersible and submarine.