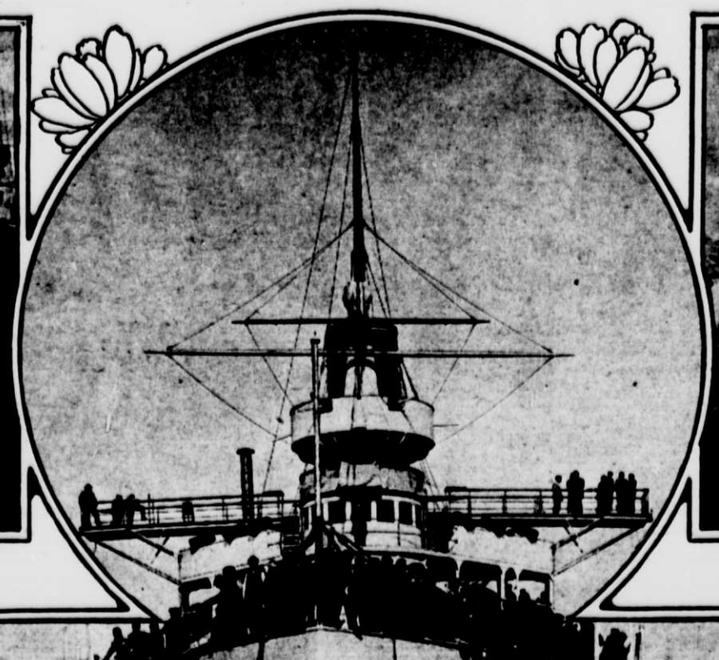
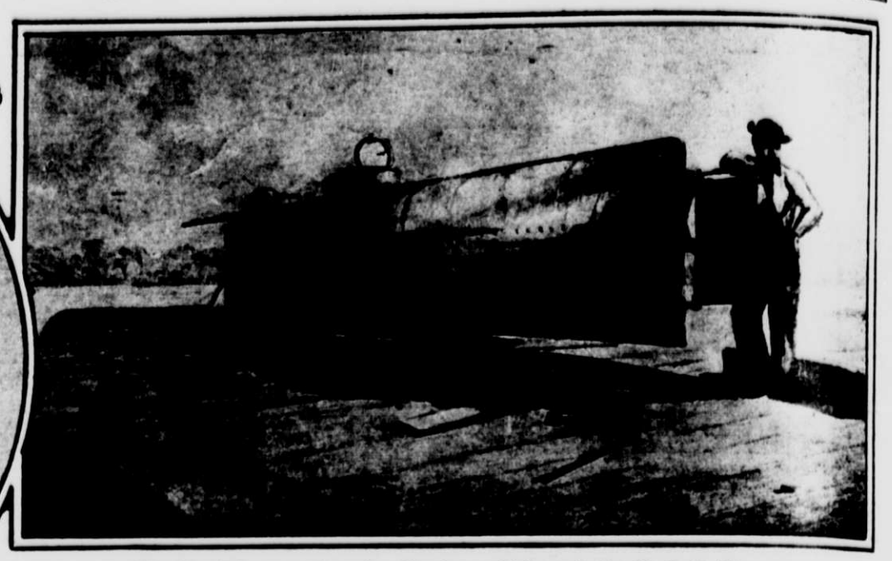
SUBMARINES WILL WIN WARS OF THE FUTURE

A Confederate submarine driven by hand power. The crew of negroes were drowned when the boat was given an experimental submergence.





The Confederate submarine Hunley, which sank the U. S. S. Housatonic on the 17th of February, 1864. The crew of the submarine perished at the time.

United States' Order of 1,000 Ton Undersea Offensive Craft Predicts Great Development for Type of Fighters

THE United States navy has ordered the building of a submarine of 1,000 tons displacement. Heretofore the biggest of our under water boats have not exceeded 500 tons displacement when submerged. At one stride, therefore, we are doubling the size of these subaqueous battle units.

But this is not the whole story by any means. It is only one stage in a definite line of development, which will shortly produce a still more formidable type of ocean going submarine torpedo vessel. The secret was disclosed at a recent hearing before the Committee on Naval Affairs of the House of Representatives. Commander Yates Stirling, Jr., who is in charge of the Atlantic submarine flotilla, made the following statement of what American naval strategists have planned in the way of an order for giant submarines:

"From the studies of officers at the War College there was developed what was considered the coming submarine, and called the ASm. It was a vessel of about 2,000 tons displacement. It carried armor, and it was capable of going at high speed, at about 25 knots. That was entirely theoretical of course. We played with them on the game board, and they accompanied the fleet and went with the fleet wherever it went, and it was a weapon of which a battleship was very much afraid. Of course it was only on paper."

Furthermore, Commander Stirling said: "My experience in the submarine flotilla and from talking to submarine officers as to what they could do with boats of that type has convinced me that the natural trend of development of the submarine is upward and not downward, not to the small defensive type, but rather to the larger fleet submarine, • • • an offensive submarine."

The thousand ton submarine just ordered will cost $1,350,000, and is designed to have a surface speed of twenty knots, a submerged speed of eleven knots and a cruising radius of more than 1,000 miles. It will carry anti-torpedo boat defence guns in addition to a powerful armament of torpedo tubes. While not as large as the theoretical vessel conceived at the Naval War College, still the new boat is an important development.

The first boat of our present day flotilla of submarines was the little Holland, purchased early in April of 1900, just fifteen years ago. She had been built as a speculative venture by the company back of the late John P. Holland. The boat was only a trifle more than 53 feet long and when entirely submerged represented a dead weight or total displacement of but seventy-four tons! Her speed on the surface was around six knots, and under water it was somewhat less.

There was not much of the craft to be seen above the waves when in the so-called light trim. The march of mechanical progress had helped Mr. Holland immensely, for it had developed the explosive engine and the storage battery, forms of motive power and propulsive energy which his predecessors had not had at their disposal conjointly.

Thanks to Mr. Holland's tireless efforts he proved at least that a submarine was practicable and that a vessel of that sort could be self-contained and capable of diving with a good chance of coming safely to the surface again. As a real instrument of warfare the Holland was not formidable, but she had great suggestive value.

But this inventor was not the only man in America to give impetus to the art of subaqueous navigation. Late in the year 1902 Simon Lake launched at Bridgeport, Conn., quite a different type of under water boat, after he had previously done some convincing experimental work in this field of mechanical endeavor. Mr. Lake believed that subaqueous craft should primarily be surface going vessels capable of submerging when necessary to approach unseen their targets in time of war. To meet the requirements of safety, combined with greater size, he elected to make his boats sink or rise upon an even keel, their height rather than their length determining the depth of water in which they could be manœuvred satisfactorily. Thus his idea of the submersible differed from the diving submarine of the late Mr. Holland's plan.

Mr. Holland and his contemporaneous workers in this field of naval architecture designed that their boats should in the lightest condition show very little of their hulls. In other words, only a moderate amount of water ballast, which could be taken in quickly, would then be needed in order to make the submarine ready to run beneath the waves. This meant that all of the crew would have to be shut up inside of the submarine when the sea was at all rough.

The submersible, on the other hand, as Mr. Lake evolved it had a superstructure which insured a large measure of reserve buoyancy when in the light or normal surface condition, and this made for seaworthiness and offered a chance for the crew to come out upon the deck or to stand upon the conning tower in all but extremely stormy weather. Because of the space thus obtained inside of the superstructure room was left within the pressure resisting shell of the submersible for comfortable bunking accommodations and space where the men could sit and rest or read when off duty. At once this put the under water boat in a class approaching the ordinary torpedo boat.

This reference to what the two American inventors have done is needful in order to make clear the developments that have followed both here and abroad. While some of the European countries have outstripped us in the size of their undersea boats much of their lead is undoubtedly due

The biggest commissioned submersible in the United States navy. The "GL," of 450 tons submerged displacement. A boat of the Lake type.

to the preliminary work done by Mr. Holland and Mr. Lake. But they were anticipated by another designer, an Irishman, who did some things in the way of building submarines that were truly remarkable. The genius in question was the Rev. George William Garrett, who was intended by nature to be an engineer.

Mr. Garrett's father was a minister, and the son served for a while as his assistant. To add to his all too slim salary the son gave boxing lessons in the back yard of a public house. He was anything but a typical parson, and his restless energies were later directed to the designing, building and testing of a submarine, known as the Resurgam, which was unfortunately lost off the Welsh coast when undertaking deep water experiments.

After experimenting on his own responsibility and at his own outlay, Garrett approached Nordenfelt, who was a rich man and ready to promote a good thing. Nordenfelt was won by Garrett's scheme, but would lend his financial aid only upon the understanding that the vessels should be known as Nordenfelt boats. It does not concern us to go into the details of the various submarines built agreeably to this compact, except to mention that several were built for Turkey and the biggest and last for the Russian Government in 1887. This boat for the Czar's service was 125 feet long and had a surface speed of more than 14 knots; in fact, it is said that she made in the neighborhood of 19 on a trial run; but she was not able to do more than 3 knots an hour submerged. At that time the submarine was in advance of contributive mechanical arts.

To begin with, Garrett had to have recourse to steam for motive power. Coal was used for fuel, and the stored up energy in superheated water was counted upon to provide the impulse for the engine. On the surface the fires were kept going, but when under water the furnaces were closed and only the latent heat could be counted upon. It took more than a day to store heat up in the special boilers provided for the purpose. Nevertheless, as a seagoing craft the so-called Nordenfelt IV. proved herself capable of a long run. While on her way to Kronstadt, and towing her consort, she went ashore and was somewhat damaged. For this reason the Russian Government declined to accept her.

To return to the latter day submarines. There was in the beginning a hazy notion among naval men as to just how these craft should be employed in time of war. Now it is recognized that their mission is to do in the daytime just what the destroyer seeks to achieve after nightfall, that is to get unobserved within torpedo range of the enemy.

But the increasing size of under water boats has brought in its train a manipulative problem. It was not long ago that one of the Kaiser's "U" boats was caught in the awash condition, and before she could take in enough water ballast to dive she was rammed by a speedy British destroyer and sent to the bottom. You must know that it is impossible for these subaqueous torpedo vessels to force themselves below the surface by their submerging rudders until their reserve of buoyance has been reduced to a certain point.

Much has been done, however, in the way of facilitating this operation, and in the most up to date submersibles not more than six minutes is needed in which to pass from the light surface state to readiness to dive, the craft then having a reserve buoyancy of probably not more than 500 pounds. But even so, this situation has its dangers in the presence of destroyers capable of making thirty odd knots an hour. Inside of six minutes at a speed of thirty knots a surface craft could cover three miles, and from a distance of five miles could soon get close enough to make certain of sinking a submarine by gun fire. This is one of the elements of weakness in the submersible which the designers are seeking to overcome.

One of the best solutions of the problem is that offered by the famous Italian firm the Fiat-San Giorgio of Spezia. Major Cesare Laurenti, the technical director of the company, has produced some notable boats and has lately finished the biggest vessels of this type afloat. Indeed, one of these was given her trial by Germany only a few days ago. The craft has a submerged displacement of about 1,300 tons—somewhat more than the seagoing submarine which we are to build.

Outwardly the boats are not unlike the general modelling of a typical surface torpedo craft, save that there is an absence of smokestacks. The designer has adopted a form of superstructure which, when closed at the surface, insures a measure of reserve buoyancy amounting to quite 50 per cent. of the surface displacement; being, in fact, a great deal more than that of the bulk of oceangoing commercial ships. And yet he makes it possible to flood this buoyancy space quickly by opening a number of vents and ports, controlled from within the submarine, while otherwise facilitating the taking in of water in the remaining ballast tanks inside the main hull itself. Accordingly, the Laurenti type is exceptionally seaworthy and speedy in light trim, and can be got under water from that surface state in a remarkably brief period. This achievement goes a long way toward making the submarine dreadnought possible, because the bigger the submersible the more water ballast must be handled in a short time.

Under water the vast majority of present submersibles are propelled electrically; the motors drawing their energy from storage batteries. The storage battery for a submarine boat is probably the most extravagant source of power, and pound for pound it is not nearly so efficient as the explosive engine used for surface travel. The Edison battery promises to help out in this particular. The biggest boats under construction abroad can now travel submerged at the rate of between ten and eleven knots for about three hours, and at a five knot speed can run under the water for 125 miles.

One of the greatest mechanical improvements in the art of submarine navigation has been the substitution of the heavy oil engine for the gasolene motor which was universally employed until the last few years. Gasolene as a fuel proved extremely dangerous because of the violently explosive nature of its heavy fumes and their insidious poisoning or asphyxiating properties. With the development of a suitable marine motor for under water craft there has come a gain in the direction of safety and flexibility, because the finer modern engines can be reversed and the heavy oil does not produce the same explosive gases.

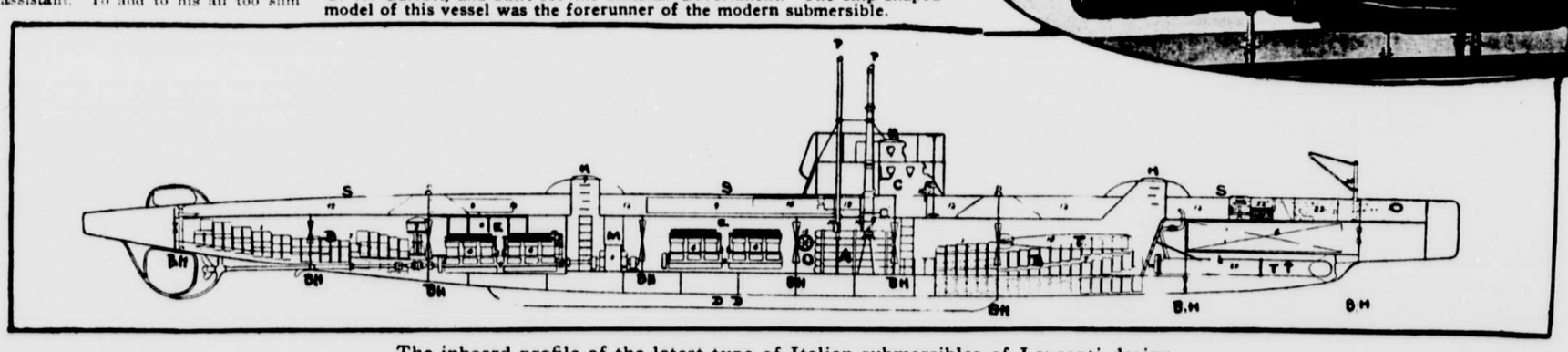
Some idea of the great mobility of the latest seagoing submersibles can be gathered from the fact that they carry enough liquid fuel to make it possible for them to cover more than 5,000 miles at a cruising speed of 10 knots an hour on the surface. In other words where the original submarine was purely a harbor defence craft of limited radius of action the present day submersible can take to the high sea and travel along with the battle squadrons of dreadnoughts. Therefore the enemy instead of being safe from under water attack when only a few miles off a foe's coast must now reckon with a submersible even in midocean.

Commander Stirling depicted the Naval War College theoretical craft, the ASm of 2,000 tons displacement, was armored. Now submarine boats to-day generally are not so protected, although some of those now building or just finished are said to be shielded. The bulk of the existing undersea craft count upon sinking below the waves and letting the superposed water guard them.

It is clearly evident from this expert's disclosure, as well as from the known trend in the art, that the submarine vessel of the future will have defensive steel plating upon the exposed parts of her upper hull and thus when partly out of the water will be able to face a foe's fire and run at high speed when advancing to torpedo range. As it is to-day the submarine must sink below the surface to escape well nigh certain annihilation from the hail of shells that can be brought to bear upon her from the rapid fire guns of a surface vessel. The moment she goes under the water

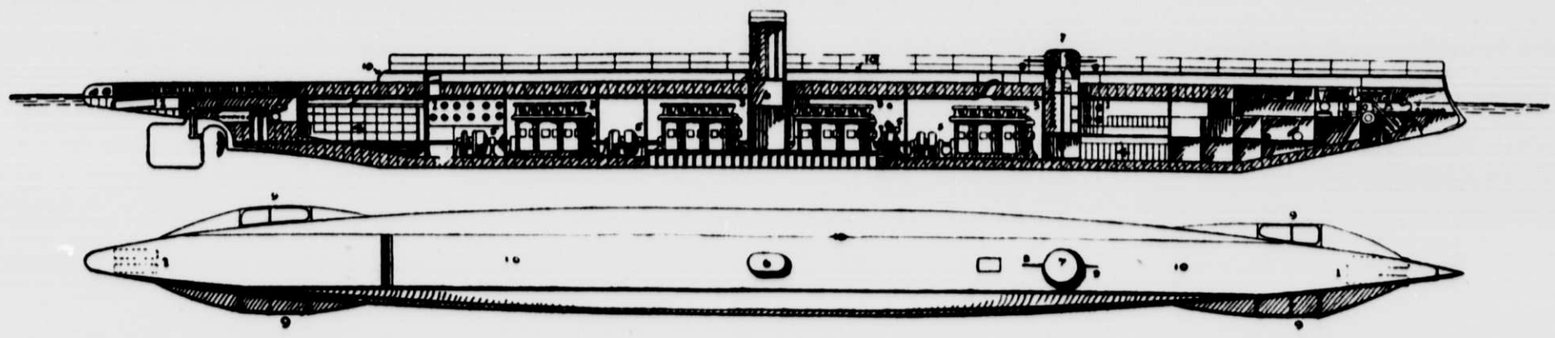
A battleship and the first of our submarines, the little Holland.

The Nordenfelt submarine Nordenfelt IV., designed by the Rev. G. W. Garrett, and built for the Russian Government. The ship shaped model of this vessel was the forerunner of the modern submersible.



The inboard profile of the latest type of Italian submersibles of Laurenti design.

S, S, S, the deck of the superstructure; H, H, hatchways leading into the pressure resisting hull; C, conning tower; P, P, periscopes; B, storage batteries; E, internal combustion engines; M, electric motor; O, controlling room; A, air flasks; T, torpedo; TT, torpedo tube; BH, BH, watertight bulkheads dividing the pressure resisting hull into separate compartments; DD, detachable keel or safety weight to be released in case of accident when the boat is submerged.



1, 1, torpedo tubes; 2, submarine mine room; 3, 3, 3, 3, heavy oil Diesel motors; 4, 4, storage batteries; 5, 5, 5, electric motors; 6, telescopic conning-tower; 7, armored turret, also capable of being elevated like the conning tower; 8, 8, anti-torpedo boat guns; 9, 9, 9, 9, submerging rudders; 10, armored superstructure.

Models of Laurenti submersibles, showing a boat of 200 tons and another of 1,200 tons submerged displacement. The big model is typical of the submarine dreadnoughts which the Fiat-San Giorgio has built and is building for certain European navies.

her speed drops to a mere crawl for then her storage batteries supply the motive energy. The power available is considerably less than that exerted by the oil engines.

This state of affairs has to face with another problem in art. The aim of the engineers develop a single or universal motor for undersea craft. That is, say, the desire is to get a storage battery, which is now too heavy in proportion to its power output, and to supply it with an engine that will suffice for surface and subsurface running.

One of the most ingenious so far advanced is that of the distinguished Italian, Del Proposto, who would use a universal motor in the form of a Diesel heavy oil engine, which, generating a large supply of compressed air while driving the submarine on the surface, in other words, part of the motive power of the engine, while turning the propeller, would be employed to charge a suitable air compressor.

In the space where the batteries are now installed he would stow air flasks capable of holding at very high pressure a large amount of air. When submerged this air would be fed to the oil engine instead of oil, the expansive force of the compressed air would work the pistons instead of the explosive oil utilized when running on the surface.

The principal drawback to the solution of the problem is the fact that the exhaust gases overboard would leave a tell-tale trail of bubbles upon the surface, as a torpedo now betrays its course. However, it may be possible to reduce this evil. The idea behind the scheme is that the fumes from the engines could be utilized when running submerged, and would make it possible to drive the submarine craft at a higher speed than is now attainable.

It is said that enough energy for surface propulsion could be stored in the high pressure flasks to drive the motive energy for several days. Metallurgy has already provided material for the making of the flasks or reservoirs, and the flasks, though no heavier than those manufactured a few years back, would hold air at a much higher pressure. With such a motor perfected a tremendous stride would be made toward the submarine dreadnought.