WADDINGTON'S ELECTRIC SUBMARINE TORPEDO BOAT.

Mr. J. F. Waddington's submarine torpedo boat has the spindle shape that necessarily characterizes such vessels. It is a boat of small dimensions, capable of carrying one or two persons, and is 36 feet in length and 6 in width. It is divided into three compartments by two bulkheads. The end chambers are filled with compressed air, which may be used as needed for respiration or for furnishing motive power.

The central chamber, which the officer occupies, contains enough air to allow two persons to remain in it for six consecutive hours. The foul air is expelled through special valves, that open automatically as soon as the internal pressure becomes greater than the external. It might be possible, however, to absorb the disengaged carbonic acid by means of chemical reagents, in order to keep the air from getting foul. The central chamber is provided above with a small lookout, containing large light ports, and which can be closed hermetically by a hatch that, at the same time, gives access to the interior. Movable hand rails can be put in place around the lookout when the boat is not submerged.

The electricity that furnishes the motive power is derived from accumulators of 600 amperes-hour each, the boxes of which, 45 in number, are arranged at the bottom of the central chamber. These accumulators are assembled in series and attached to the electric machine that directly actuates the propeller. The latter makes 750 revolutions per minute.

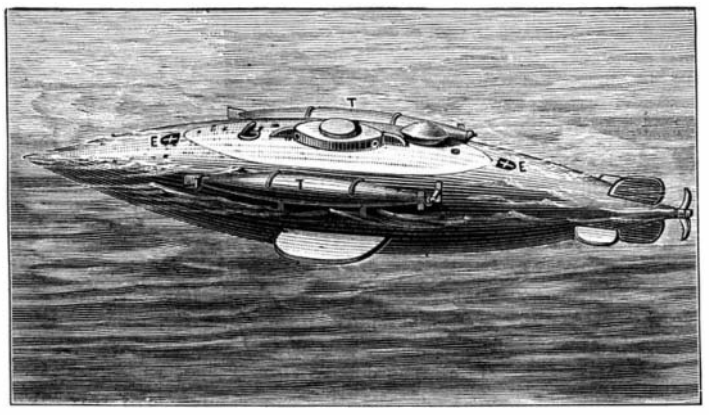
According to data published in the *Yacht and Industries*, a power of 7·96 electric horses, corresponding to a current of 66 amperes and 90 volts, permits of a trip of 80 miles being made at full speed, say for 10 hours at the rate of 8 miles per hour, without any necessity of recharging the accumulators. On diminishing the speed, 110 or even 115 miles might be attained. It is interesting to compare these figures with the results obtained by Capt. Krebs.

The boat is likewise provided with a well arranged system of connecting devices, submersion screws, counterpoises for ballast, etc.

Submersion is effected and regulated by means of two vertical helices contained in tubes resting against the bulkheads of the air chambers. Each of these is actuated by a special motor, and can thus be driven separately. The boat is provided, too, with two plates with counterpoises movable around a horizontal axis. These are situated on the outside, and can be maneuvered from within in order to effect a submersion while running. The boat has, in addition, four submersion rudders, two of them horizontal and two vertical, designed to assure a horizontal position. These rudders act automatically under the impulsion of a special electromotor, controlled by a sort of pendulum, and which enters into play as soon as the boat inclines the least bit. Finally, care has been taken to see that the boat can be at once brought to the surface in case of pressing danger, and, to this effect, it is provided beneath with a heavy weight that can be immediately detached. Two large boxes at the sides of the central chamber can be filled with water when the boat is on the surface and it is desired to prepare for submersion. By reason of its special destination the boat carries three torpedoes attached externally, but held merely by hooks that can be maneuvered from the interior. Two of them are self-moving topedoes, whose propeller begins to run automatically when they are detached from the boat. The third is a mine torpedo, fixed on the deck back of the lookout, and serves for attacking ships at anchor provided with their protecting nets. This the boat sets free under the enemy's ship, and then moves away, but remains in communication with the torpedo through electric wires that permit it to explode the latter at the proper moment.

As shown in Fig. 1, all the maneuvering levers are grouped in the central chamber within reach of the officer, who can, without exertion, effect all the necessary movements. Upon filling the side reservoirs with water at the surface, the buoyancy is diminished. The submersion of the boat while running is assured by acting, preferably, upon the lateral plates, so as to incline them. The speed then reaches five knots per hour. Recourse may be had also to the vertical screws, that serve to regulate the depth of submersion by their velocity; but they are especially employed to effect a submersion *in situ*.

From this description, it will be seen that all the details of this boat have been carefully elaborated, and there is reason to think that, without being yet definitive, this new type is destined to give important results in practice. The English journals, moreover, inform us that very encouraging trials of it have been made at Liverpool in the presence of delegates from various naval powers.—*La Nature.*



T T. Lateral torpedocs.

Fig. 2.—EXTERNAL VIEW OF THE BOAT.

Value of Gas Residuals.

Mr. Page, in a recent speech before the Ohio Gas Light Association, said: When I tell you that my associates and myself have marketed, in one contract, within the last four months, $200,000 worth of aqueous ammonia for ice making, you will have an idea of the extensive use of this residual in that industry. Twenty-one firms in this country are engaged exclusively in making refrigerating apparatus, the annual value of the work thus turned out being between three and five million dollars. One of the largest and most extensive cold storage warehouses (Boston, Mass.) in the world, costing a quarter of a million dollars to erect, recently finished putting in many thousands of tons of ice, at a cost of 85 cents per ton, but the proprietors are now examining the subject of artificial refrigeration by ammonia, with a view of displacing all that ice next year.

The steamship City of Para, running to Aspinwall, has been using for the last two and a half years a little ice machine for all the purposes of refrigeration. All the food used on the table (all the butter, cheese, beef, eggs, etc.) during the entire round trip of 21 days is preserved in that way, and what is left over comes back into New York harbor in a really better condition than it was when the voyage was commenced some weeks before. Prior to the introduction of artificial refrigeration on that vessel, their fresh meat would only last seven days.

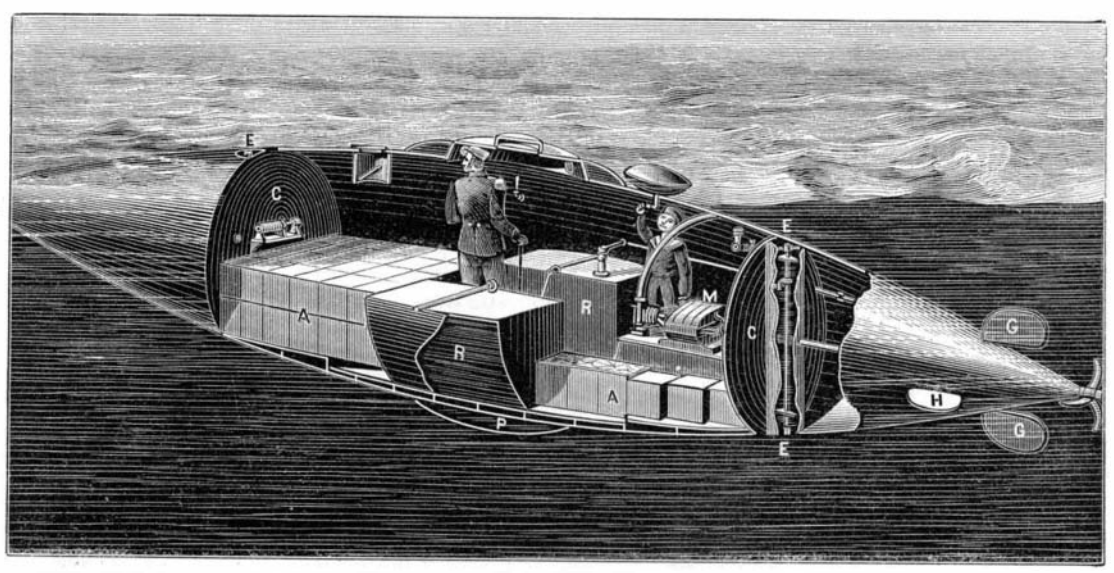
On 23d Street, New York City, they are fitting up a house where not only every appliance for using ammonia in refrigeration will be shown, but where they will furnish you a can of anhydrous ammonia that will keep a bachelor's refrigerator going for 30 days; and all the ammonia used is recovered, caught, and taken back to be again converted into the anhydrous article.

In the great refrigerators of the market houses, strawberries from Florida are being received and placed in the cold storage rooms (which are kept at the exact temperature wanted, all being governed by a thermostat), so that it matters not whether you want your strawberries now or next fall. You can have them when you wish. The 23d Street house is being fitted up so that if you chance to come to New York in hot weather and want to find a cool place, you can have it there. No matter how hot it may be outside, you can go in there and sit down to cool off. "What temperature would you like?" "Give me 10° below zero, and give it to me quick." You will get it, in about two minutes. All that, and a thousand times more, I might tell you is being done with ammonia.

I have made a contract to-day for the ammonia to come from the carbonization of 1½ million tons of coal, all for the use of refrigeration. I will to-day contract with you, gentlemen, at the English price, for the ammonia product of any number of tons of coal. There is a starter on your fuel product. Now as to the demand. In the last three years there has been no time when the ammonia tanks have not been cleaned out, because of this demand for it for artificial refrigeration.

There is no need of any doubt, then, as to what will become of the products. As to tar, not a barrel of it in any tank in this country to-day ought to be unsold. There never has been a time in the history of our business when tar products sold as well as at present—with the exception of 1873, when anthracene was at a very high price. The demand for these products is increasing with greater rapidity even than the increase in the demand for ammonia for artificial refrigeration. The streets can be kept perfectly clean with pitched blocks—blocks with pitch between and pitch underneath; and that kind of pavement is to-day taking from one-half to three-quarters of all the pitch being made from tar. Then look at the roofing business, look at the demand for tar-saturated paper.

One Philadelphian said that his sales last year amounted to 25,000 rolls of 2 and 3 ply paper. This proves that any man can put on a perfectly tight roof, for it only costs 2½ cents per square foot laid on the roofing boards. Then take creosote oil. Every gallon of creosote oil made this year has been sold—in fact, my impression is that some cargoes were imported from the other side to be used in wood preservation. Wood-preserving works are being built rapidly. The demand will grow faster for creosote oil than it can be made from all the tar from fuel gas. Take carbolic acid. The price has risen nearly 100 per cent in the past eight weeks. Why? Because they are making an acid from it forming the base of an explosive which is being used very largely. It would take almost a day to merely enumerate the uses of these products which come exclusively from the two residuals—tar and ammonia.



C C. Bulkheads. A A. Accumulators. M. Dynamo machine. R R. Reservoirs. G G and H H. Rudders. P. Weight. E E E. Tubes inclosing the shafts of the vertical screws.

Fig. 1.—THE WADDINGTON ELECTRIC SUBMARINE TORPEDO BOAT.

Gasoline Stoves and How to use Them.

This is the season, says the *American Artisan*, when consumers are buying and beginning to use gasoline stoves. Stove dealers should spare no pains to explain to purchasers of vapor stoves the nature of gasoline and to impress upon them the importance of care in the use of it as fuel. Most stoves are now so made that it is impossible to fill them while the burners are lighted, but if a stove is sold not so constructed, the purchaser should be urged never to fail to turn out all burners before filling. With lay-down tanks and other devices it is possible to overflow the tank or to spill oil on the floor. If this is done, the burners should not be lighted until the fluid has been wiped up and doors and windows opened, and the room thoroughly aired, so there should be left in the room little or no gas from evaporation. It is only by the grossest carelessness or most willful refusal to adhere to instructions in the operation of gasoline stoves that an accident is possible in their use. But accidents may happen where fire is present, whatever the form of fuel or construction of stoves.

Occasional complaints are made that ovens of gasoline stoves do not bake well. When they do not bake well, it is more than likely to be the fault of the operator. A frequent trouble in baking with gasoline stoves is that the bread, meat, or pastry is put in as soon as the burner is lighted, instead of waiting until the oven is thoroughly warm. It is impossible to obtain good results when this is done. It does not take nearly so long to heat a gasoline oven as it does that of a coal or wood stove, but it is no less important that it should be well heated.

Glycerine Soap.

Stearine	13 pounds.
Palm oil	22 "
Glycerine	13 "
Lye 28°	17 "
Alcohol, methyl	26 "

Carolina Clay Eaters.

A short time ago Dr. Frank H. Getchell, of 1432 Spruce Street, Philadelphia, went on a gunning expedition to North Carolina. His quest for game led him into the wild country back of Salisbury, which is inhabited, for the most part, by a miserable race of beings with only just enough energy to eke out a wretched existence. These creatures are nearly all veritable living skeletons, and with few exceptions are addicted to the habit of clay eating.

While shooting wild turkeys and other game in this wild region, Dr. Getchell made an incidental study of this peculiar habit or vice among the inhabitants. It is a mountainous country, and in the spring little rivulets start out from the caps of snow on the mountain, and as the days grow warmer, the little rivulets become torrents, and great washouts are made along the mountain side.

The soil is of a heavy, clayey nature, but there are strata of clay that is heavier than the rest, and when the water rushes down, this clay is formed into little pellets and rolls and accumulates in heaps in the valley. These little pellets and rolls are what the clay eaters devour with as much avidity as a toper swallows a glass of whisky.

"Among the poor people of this section," said Dr. Getchell, "the habit of eating clay is almost universal. Even little toddlers are confirmed in the habit, and the appetite seems to increase with time. While investigating the matter, I entered a cabin occupied by one of these poor families, and saw a little chap tied by the ankle to the leg of a table, on which was placed a big dish of bread and meat and potatoes within easy reach. The child was kicking and crying, and I asked his mother why she had tied him up. She replied that she wanted him to eat some food before he went out to the clay, and he refused to do so. The woman confessed that she ate the clay herself, but explained that the child's health demanded that it eat some substantial food before eating any earth. Almost every one I met in this section was addicted to this habit. They were all very thin, but their flesh seemed to be puffed out. This was particularly noticeable about the eyes, which had a sort of reddish hue.

"All of the clay eaters were excessively lazy and indolent, and all of these conditions combined led me to the conclusion that there must be some sedative or stimulating qualities, or both, in the clay, and I determined to find out whether there was or not. I consequently brought a lot of the clay home with me, and Professor Tiernan and myself made an analysis of the stuff, and discovered that instead of clay eaters the inhabitants of central North Carolina should more properly be called arsenic eaters. All of this clay contains arsenic, but exactly in what proportion we have not yet discovered. Arsenic eating is common in many parts of the world, and is practiced to a greater or less extent throughout the world. It acts as a sedative, and also as a stimulant. The mountaineers of Styria, Austria, are habitual arsenic eaters. They give as their reason for eating it that they are better able to climb the mountains after eating the poison, and their explanation is a perfectly reasonable one, as arsenic acts as a sedative to the heart's action. The habit is also prevalent in the Tyrol and in the Alps.

"It is also said that the peasant girls of Switzerland and parts of Germany and in Scandinavia eat arsenic to give luster to their eyes and color to their cheeks; but this is a matter I have not investigated. It has been shown that arsenic or arsenical fumes are a sure cure for intermittent fever. The inhabitants of a section of Cornwall, England, at one time suffered with this type of fever, but when the copper works were established there the fever disappeared. This was accounted for by the arsenical fumes created in the treatment of copper. As to whether arsenic eating shortens life I am not yet prepared to say, but I intend investigating the matter thoroughly."—*The Clay Worker.*

A New Island.

The government of Batavia has made known to the Admiralty that the commander of the ship Samarang, of the royal navy of the Netherlands, reports the existence of a low, wooded island, which up to the present has never been marked upon any map, and which is situated to the west of Selaroo, one of the Timor Laout Islands.

This island appears to be about two miles long from N.N.E. to S.S.W., and nearly two-thirds of a mile wide. Its position, calculated approximately, from the center of the island, is 8° 15′ south latitude and 130° 39′ east longitude.—*Gazette Geographique.*

THOMAS SILVER.

Among the most serious difficulties which at first attended the use of steam machinery at sea was the excessive straining of the engines for lack of a highly sensitive governor or regulator. By the rolling or pitching of the vessel the wheels or propellers were thrown out of water, and the engines, thus relieved of duty, would instantly start off with terrific speed, shaking the ship from stem to stern, injuring the machinery, and endangering the lives of all on board. Among the vessels disabled and lost at sea from this cause was the steamship San Francisco, in 1854.

The world is indebted to the genius of Thomas Silver for an invention which proved an almost perfect remedy for this trouble. Silver's marine governor soon came into extensive use. Its adoption was ordered on American and British ships, as well as those of other nations.

It was placed on the engines of the steamer Atlantic, of the old Collins line; also on engines at the United States Mint, Philadelphia Arsenal, and on the printing presses of the *Public Ledger*, of Philadelphia, and *Tribune* and *Herald*, of New York, which reported it as "operating more quickly and correctly, even for stationary engines, than the old two-ball governor, which depended upon gravity." Mr. Silver's greatest success with it was in Europe. Admiral Pairs introduced the

THOMAS SILVER.

governor in the French navy in 1855, maintaining "it was just what always had been needed." Vessels on the Continent soon adopted it. John Hamilton and, later, Osborne & Co., engineers on the Clyde, became the manufacturers, realizing large fortunes, though opposition was continual, one house in Glasgow confessing candidly as a reason for not using it that they realized $25,000 yearly by repairing engines on which it was not used.

At the Royal Institute, of London, it was resolved that "Mr. Silver had done as much as any man living to facilitate steam navigation, enabling steam vessels to weather all gales without danger of broken shafts, wrecking, and consequent loss of life." Prince Albert said: "Mr. Silver, it is too common sense a thing; engineers *must* use it." The British Admiralty ordered it into general use in 1864, and so did all the naval authorities of the world, excepting that of his own country, the United States.

Thomas Silver, civil engineer and inventor, died in New York, April 12, 1888. He was born June 17, 1813, in Cumberland County, New Jersey, of American parents, belonging to the "Society of Friends." When a boy he developed mechanical ingenuity, and at the age of nine years his little boat, with hidden propeller wheel and other devices, was the wonder of the country village. Models of his many subsequent inventions are at the Patent Office, Washington, Kensington Museum, London, and the Conservatoire des Arts, Paris.

He was a member of the Franklin Institute, of Philadelphia, and of different societies in Europe, and awarded several medals. His latest inventions were a mechanical lamp, and a lamp burner made to dispense with glass chimneys, which is a great economical success. Our portrait is from a photograph by Tourtin, Paris.

Advantages of Good Water Supplies.

All time saved from hard labor is a gain. The convenience in cities and towns is a great advantage. In estimating the returns to be secured from a water supply for a place, consideration must be had for items not appearing on the company's books, but which have a value inestimable in dollars. These are:

First—Promotion of health. Water from a supply system averages much purer than from wells. It is stated that typhoid fever has practically become a country disease. In certain New England counties the lowest average mortality is in districts where there are many cities and towns, most of which have water supplies and sewerage systems. The highest mortality is in sparsely settled towns having no public works of this nature. Without a water supply we can scarcely have any sewerage system. The sprinkling of streets and decrease of repairs on gravel and macadamized roads are worthy items.

Second—By saving property. A supply of water for fire purposes can best be provided in connection with the domestic supply, and the power to prevent a widespread conflagration lies usually in the proper arrangement of the water supply system, where the hydrants should not be located too near large wooden buildings.

Third—By reducing insurance. The insurance companies of New England are always ready to recognize the introduction of water by a very substantial reduction of their rates, generally from twenty to fifty per cent.

Fourth—By encouraging manufactures. Many mills have private fire appliances, but all need external protection, and a reliable water supply and a consideration of its provisions and the consequent insurance rates often determines the location of great manufactories.

President Fanning stated that he had found that, for five years after the water supply was introduced in a certain city, the saving in insurance over the rates that prevailed before had been greater than the cost of the supply during that period. —*F. L. Fuller.*

Garnets on Manhattan Island.

The occurrence of garnets on our island is well known, and their development at places has often attracted the attention of mineralogists. The very large and impressive specimen obtained by Mr. I. I. King, and now in possession of Mr. G. F. Kunz, is perhaps the most famous example of this species from within the limits of our city. Numerous specimens of considerable beauty and fair growth were obtained during the excavations and blastings necessitated by the prosecution of the work of sinking the tracks of the N. Y. Central R.R. below the surface of Fourth Avenue, and the gneissic and schistose beds of the island have afforded this interesting mineral in great numbers, but of imperfect character and usually of small and inferior size.

Recently Mr. Gilman S. Stanton, a young and alert mineralogist, has disclosed the presence among our rocks of a very elegant crystallographic combination of this mineral (trapezohedron truncating edges of the rhombic dodecahedron), which, symmetrically developed and deeply colored, attain sizes varying from a little over an inch to one quarter of an inch in axial diameter, and form very pretty groups. This habit, justly admired by mineralogists, characterizes the Alaskan variety, which these in that respect resemble. They do not, however, possess the hyacinthine hue of the Alaskan examples, and are less translucent. In texture they are minutely fractured. They occur in a vein of coarse granite, are generally implanted in or near the feldspar elements, and when taken out present blurred or dull faces arising from a thin film of ferruginous clay deposited by infiltration. They have been formed in all probability slowly, and have not suffered distortion to any extent from disturbance during their formation, or by vein motion. They belong to the almandite variety of garnets (iron alumina), so far as can be judged, and present red to brown-red internal reflections.

EXTENDED observations at Paris and at Munich indicate that the sanitary condition of a locality depends on the amount of water contained in the ground. The years in which there has been a large quantity of ground water present have invariably been the healthiest, while those in which there has been a smaller quantity have invariably been the unhealthiest.