

### THE SUBMARINE BOAT AND ITS FUTURE.

BY WALDON FAWCETT.

The success of the tests of the Holland submarine torpedo boat, recently made in the presence of an official trial board, composed of United States naval officers, at Peconic Bay, on the north coast of Long Island, assuredly marks the advent of a new era in the development of submarine craft designed for offensive operations in war. That the case of the advocates of the practicability of such an engine of destruction has been somewhat advanced by the showing made seems probable, but that the element of opposition which has all along existed in official circles has by no means been obliterated is equally certain.

Certain of the naval officers who witnessed the recent tests were so favorably impressed with the performance of the boat that they seemed disposed to believe that it would be wise for the Navy Department to build or purchase a number of the vessels for service in conjunction with harbor defenses on both the Atlantic and Pacific coasts. It must be admitted in all candor, too, that in many respects the showing was rather more favorable than any previously made by any other similar boat in any part of the world.

The vessel was on several occasions under water for intervals of more than twenty minutes, and demonstrated her ability to respond to a summons to sink beneath the surface, approach a ship, discharge a torpedo, wheel about in her course and return to a place of safety, all within a space of considerably less than half an hour. Tests were made at depths of about twenty feet, the deepest obtainable in the bay, and the boat demonstrated to the satisfaction of her builders her ability to remain submerged for a space of twenty-four hours without the crew of six men and the torpedo operator being subjected to any danger of asphyxiation, or even to inconvenience. Based on the result of the experiments is a claim that the radius of action under water is five miles per hour for almost six hours. The speed trial developed a speed of eight knots.

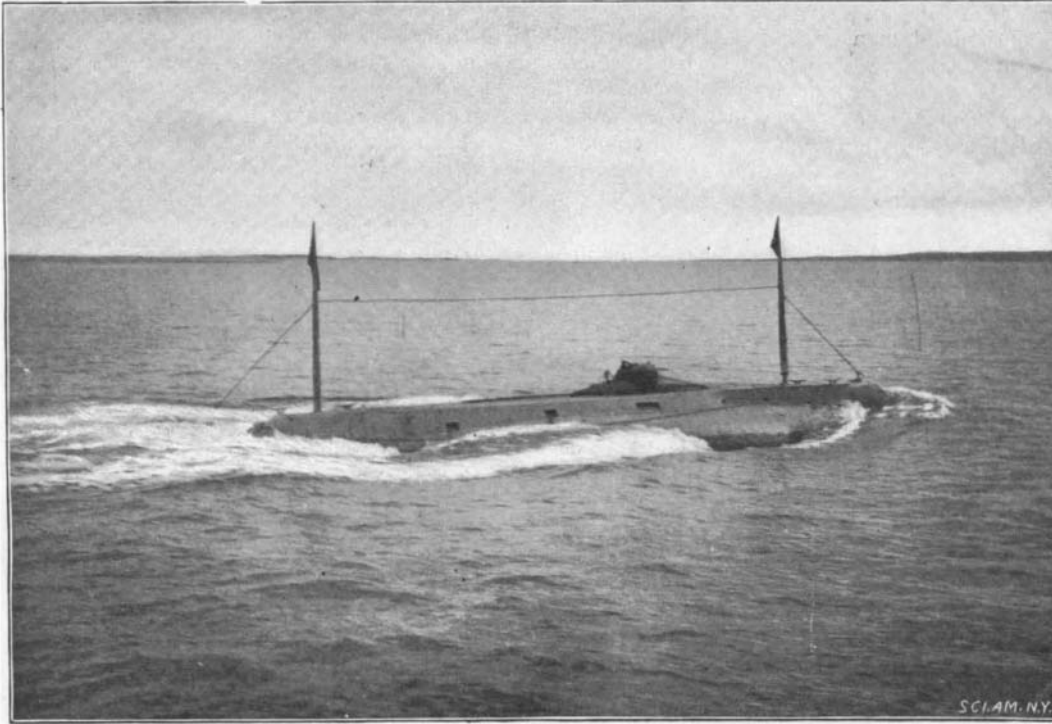
The Holland boat with which the experiments above outlined were made is 53 feet in length by 11 feet in width and weighs in the neighborhood of 11 tons. The storage battery, which is thoroughly insulated, is in a compartment amidships, while over this is the conning tower with steering gear, and under it the water tank. The air compressor and gasoline engine for driving the generator are located astern of the battery. Above is the dynamite torpedo tube. The generator may be either driven by the engine to charge the batteries or thrown on to the batteries, running as a motor while the boat is submerged. The motor-generator weighs two tons, and is capable of developing 50 horse power at 800 revolutions, or 150 horse power at 1,200 revolutions. There are small motors for the pumps, the air compressor, and ventilating apparatus.

The American boat, since the recent trials, has attracted renewed attention from several foreign naval attachés stationed in this country, and some of these officers have been sufficiently impressed to make the boat the subject of communications to their home governments. That the French authorities may seek to acquire one or more vessels of this type is much more likely than that Great Britain will take up the matter. The British Admiralty has al-

ways been strenuously opposed to submarine torpedo boats in general, and when the inventor of the American boat visited London some months ago, he was wholly unable to interest them in the subject.

For the French, however, the submarine boat has ever been an alluring one, and during the years which

have been consumed in bringing the American boat to its present stage of development they have experimented with upward of half a dozen distinct types of submarine craft. The more recent series of French experiments opened with those with the "Gustave Zédé," which aroused at the outset an immense burst of enthusiasm. It did not take long, however, to ascertain that the boat's range of action was limited in the extreme. Attention was next turned to the Goubet



OFFICIAL TRIAL OF THE HOLLAND SUBMARINE BOAT.

boat, but it proved thoroughly impracticable. Then the "Morse" was taken up, but investigation proved that her range of action was quite as restricted as that of the "Zédé."

The French government is now experimenting with the "Narvel," a submarine vessel of recent construction. The displacement of this craft is 160 tons and she is fitted with a Forest oil engine, which not only drives the propeller when the boat is either navigating at the surface or with only her lookout and chimney exposed, but also operates a dynamo for charging batteries and accumulators, these being utilized to propel the boat when she is entirely submerged and the chimney unshipped. Sailing at the surface at 12 knots, the "Narvel" promises a range of action of 252 miles, and at 8 knots the range will be 624 miles. When submerged, the accumulators will propel the boat 25 miles at 8 knots, or 75 miles at 5 knots. The "Narvel" is designed to carry two officers and nine men.

The sentiment of hostility to submarine craft of all kinds now so prevalent among British engineers has

The career of the submarine boat may be said to have extended over fully three centuries, even if no regard be paid to the rather vague assertion of some historians, that Alexander the Great was once a passenger in a submarine craft, the character of which unfortunately is not described. King James I., of England, made a trip in a submarine boat which a Hollander of the name of Van Drebbel built in London in 1664, but the first craft which can be rightfully so designated

was that designed in 1776 by a New Englander of the name of Bushnell. This boat, which was propelled by oars, was primitive in the extreme and was destroyed soon after going into commission by the shots of a British man-of-war.

Fulton wrestled with the problem and designed two different types of submarine boats, and there were numerous other attempts, all similarly unsuccessful, until, with the trial in 1887 of Prof. Tuck's "Peacemaker," the present era of experiment in submarine navigation may be said to have been inaugurated. The American boat last mentioned was by no means a marked success; but it served to direct to the subject more attention than it had previously been accorded.

The "Peacemaker" was cigar-shaped, 30 feet long, 8 feet wide and 7½ feet deep. She was lighted by electricity and propelled by a steam engine of fourteen horse power. The boat was submerged by filling her ballast tanks with water and raised by means of a rudder

which moved around a horizontal axis. The crew consisted only of an engineer and helmsman, the latter being stationed in a glass-enclosed dome which projected from the upper surface of the hull. There is no record of the boat's having attained a speed of more than 8 miles per hour when well submerged.

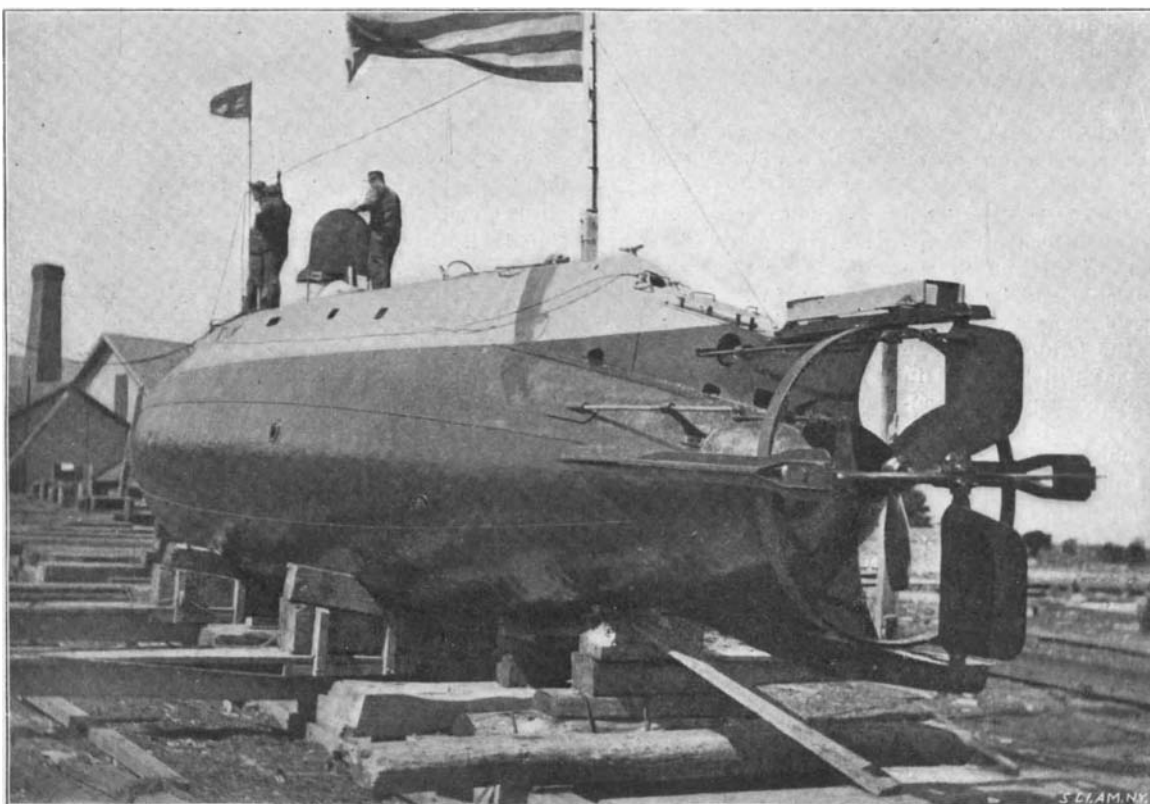
At about the same time the British engineers were watching with interest the experiments with the "Porpoise," a small electrically-propelled craft, and the various boats built by Nordenfeldt. The last of these was a vessel 121 feet in length and of 230 tons displacement, the 1,000 horse power engines of which were capable of giving her a speed of 15 knots when immersed, but a few years later she was broken up and sold as junk, and from that time forward British engineers had little faith in attempts at under-water navigation.

On probably no question are the officers of the United States navy more thoroughly divided in opinion than that of the utility of the submarine boat in warfare. The personality of the men who have ranged themselves on opposite sides of the discussion

makes it impossible to disregard the arguments of either. On the one hand we have the advocates of this class of craft, who declare that its judicious employment would make it practically impossible for an enemy to successfully attack any of our principal seaports by water. The opponents of submarine operations of the class proposed, on the other hand, base their claims of the impracticability of all submarine craft on the contention that the difficulty of keeping to a course when the boat is submerged would make it impossible to discharge torpedoes with an accuracy in any degree dangerous.

Supplementing this latter argument is that of the British engineers who declare that modern searchlights and other safeguards would insure the destruction of any submarine boat by rapid fireguns before it could approach sufficiently near to a war vessel to do any harm.

Lieut. A. P. Niblack, U. S. N., one of the best informed officers on the subject of torpedo warfare in the American or any other navy, recently declared that there was no real reason why the submarine boat should not be as successful as the automobile torpedo. This certainly does not seem like an irrational view



PROPELLER AND STEERING APPARATUS OF THE HOLLAND SUBMARINE BOAT.

been induced, of course, largely by the failure of the French boats and other craft constructed in Europe during the past decade, and it must be admitted that the whole history of submarine navigation has not been such as to render a naturally conservative class of men optimistic.

when it is remembered that all the things done by a Whitehead torpedo may be done by a submarine boat. Almost the only difference is that whereas in the torpedo the opening and closing of valves, the regulation of depth, the steering, the various safety devices and the length of the run are all automatic, in the submarine boat the corresponding things are all regulated by hand.

One point about the submarine torpedo boat which might almost be considered a disadvantage is the tireless, unremitting care which is an absolute necessity in order to keep the delicate apparatus in condition. Then there is the ever-present danger when the boat is making a trip submerged that the propeller will foul a buoy rope, or chain or mooring, in which event the fate of the crew would be sealed with tolerable certainty, since it would be well nigh impossible to make the needed repairs.

It is not generally known that the submarine torpedo boat "Plunger," building for the United States government at Baltimore, is of an entirely different pattern from the "Holland" (the trials of which at Peconic Bay are above described), although designed by the same inventor. The delivery of the "Plunger," which is a vessel 85 feet in length and of 1,500 horse power, has been delayed between three and four years by a series of unfortunate circumstances and she is not even yet completed. Several changes in the machinery are, however, to be made, and it is expected that the vessel will then be pushed to completion. A congressional appropriation made some time ago for the construction of two addi-

water, should be an adaptation of this discredited design. For though she has considerable free-board—about 20 feet in fact—forward, which will without doubt render her considerably more seaworthy and comfortable than a monitor pure and simple, yet from the foremost turret to her stern she is a very low freeboard vessel, with a long and high superstructure amidships.

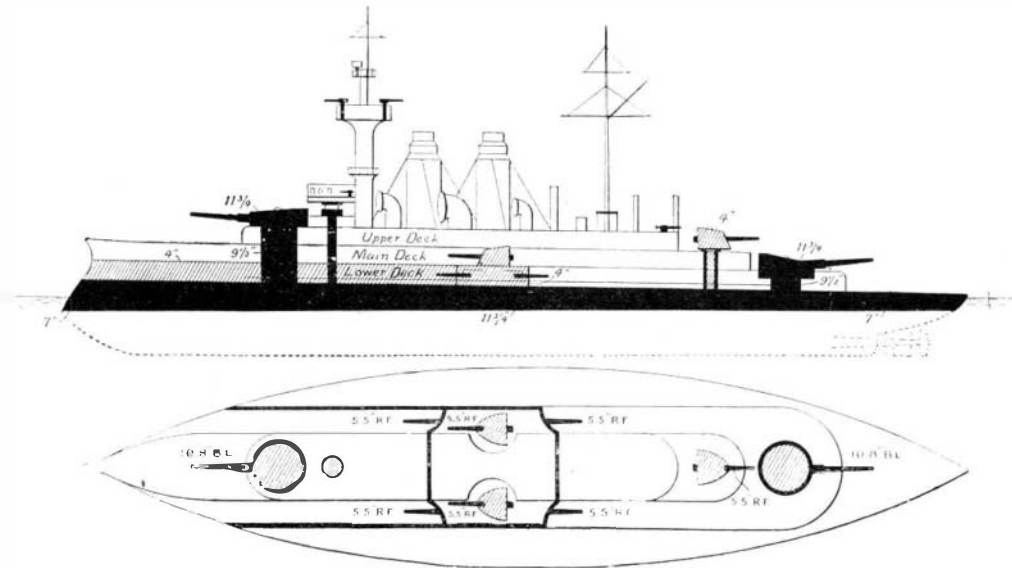
For her displacement—8,948 tons—she will no doubt be an exceptionally powerful vessel both in attack and defense. Her main armament will consist of two long 10-8-inch guns, one of which is to be mounted in a turret forward at a considerable height above the water, while the other, which will be similarly mounted aft, will be placed very much lower down. As a secondary armament she is to be equipped with seven 5-5-inch

according to some authorities are calculated to give a ship half a nautical mile an hour more speed than if she were fitted with twin screws. She is very much cut away under water aft, and the central screw will be much further aft than the others, being outside the rudder, which will probably be double.

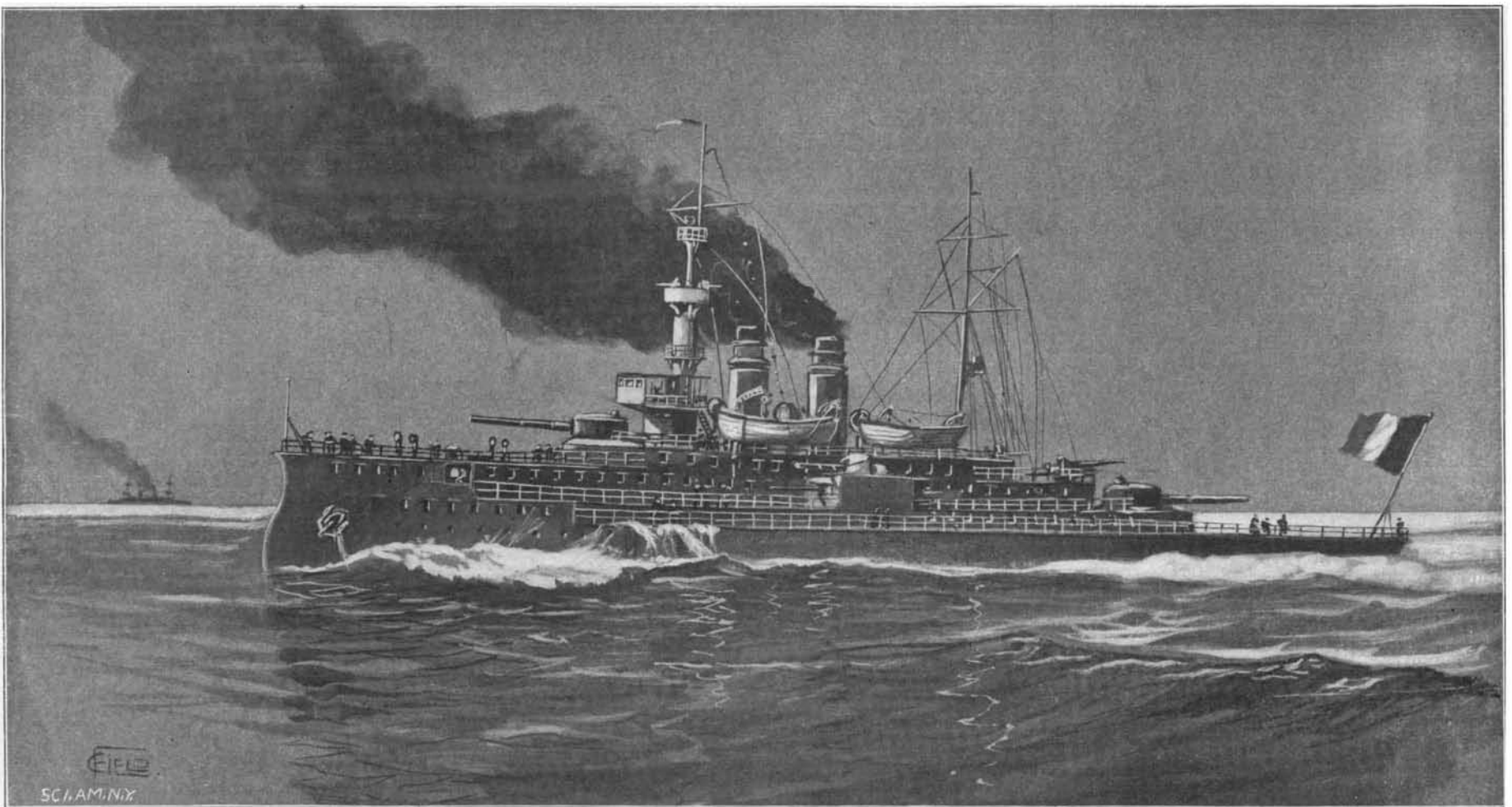
The boilers of the "Henri IV." are of the Nielausse type and her engines are expected to work up to 11,500 horse power and to give her a speed of 17 knots. Her normal coal supply will be 725 tons, but at a pinch she can carry 1,100, which is calculated to give her a radius of action of 7,580 miles. Her complement has been fixed at 26 officers and 435 men.

**Diamond Production of the Transvaal.**

According to the United States consul at Pretoria, the output of diamonds in the Pretoria district during 1898 amounted to 11,025 carats, valued at \$43,151. In December, 1897, the output was 166 carats, valued at \$710, and for the same month in 1898 the output was 3,100 carats, with a value of \$11,626. The largest stone found in 1898 was 38½ carats. Although the diamond industry is not developing with abnormal rapidity there is every cause for satisfaction, the first stone having been discovered at Reitfontein only in August, 1897. The average value of stones found in the Pretoria district is \$3.89 per carat, the average value of Kimberley diamonds \$6.33 per carat, and those found at Jagersfontein, in the Orange Free State, \$8.27 per carat. The diamonds in the Pretoria district are found in pipes, as on Schuller's mine and on Montrose. A similar formation has been



ARMOR DIAGRAMS OF THE "HENRI QUATRE."



**THE "HENRI QUATRE." LATEST TYPE OF FRENCH BATTLESHIP.**

**Displacement,** 8,948 tons. **Speed,** 17 knots. **Maximum Coal Supply,** 1,100 tons. **Armor:** Main belt, 11 3/4 inches; upper belt, 4 inches; barbettes, 11 3/4 inches; casemates, 4 inches. **Armament,** two 10-8-inch; seven 5-5-inch; twelve 3-pounders. **Torpedo Tubes,** two. **Complement,** 461. **Date,** 1899.

tional submarine boats will become available when the Navy Department shall have been thoroughly satisfied with a design.

**THE NEW FRENCH ARMOR-CLAD "HENRI QUATRE."**

Fine fleet as have the French, it has been compared by one of their own experts to a museum of warships, so many and so various are its types. The armor-clad "Henri IV.," launched on August 23 at Cherbourg to the strains of the Marseillaise and (to please France's reputed allies) the Russian National Hymn, will be yet another and a very unique "exhibit" for the collection of men-of-war which the French naval constructors have set afloat in their endeavors to find an ideal type before they commit themselves to any particular line of design. After the experiences of the American fleet in the late war with Spain in which the monitor class proved so very unsatisfactory, it is truly remarkable that this, the latest French man-of-war to take the

quick-firing guns. Four of these are to be placed in a casemate or "box battery" amidships, protected by 4 inches of armor, another aft under a shield, high enough up to fire over the roof of the after turret, while the remaining couple are to be placed one on either beam on the top of the casemates. The "Henri IV." will carry in addition twelve light rapid-firing guns and two torpedo tubes. Her flotation is well protected by a very nearly complete belt of 11 3/4-inch armor which commencing at her bow only stops short a little forward of her ensign staff. Above this from the bow to the after end of the box battery there is another belt of 4-inch plating. The armor on the two turrets has a maximum thickness of 11 3/4 inches. She has also an armored deck about 2 inches in thickness, and this is continued downward and inward below the belt with the object of affording some protection against torpedoes.

Like most of the newer French ships of any size the "Henri IV." is to be fitted with three propellers, which

found on Roodeplaats on the Pienaars River, and another is also reported at Kamelfontein and Buffelsduff. On the De Kroom farm, about 26 miles west of Pretoria, diamonds have been found, but according to the State geologist, not in a blue ground formation. At Byrnestpoort an alluvial deposit is being worked, also one on the adjoining portion of the Elandsfontein farm. The area of diamondiferous ground is very extensive, though its thickness is not considerable. The total quantity of diamonds found in 1898 in the Transvaal was 22,843 carats, valued at \$212,812. At the alluvial diggings 12,283 carats, valued at \$171,427, were found; while from the pipes 10,560 carats, valued at \$41,374, were obtained. The difference between alluvial and pipe diamonds consists in the fact that river stones are of a far better quality and are generally larger.

THE cost of repairing the damage caused by the recent collapse of the columns in the temple of Karnak and strengthening the edifice is estimated at \$250,000.