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INFORMATION FROM ABROAD.

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NOTES

ON THE

YEAR'S NAVAL PROGRESS.

JULY, 1896.

NAVY DEPARTMENT,
OFFICE OF NAVAL INTELLIGENCE.

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INTRODUCTION.

This number of the General Information Series contains the usual notes on *matériel* and manœuvres; also some information in regard to cellulose and voice tubes that may be of interest to the service.

While material was arranged for a more technical account of the Japan-China war, the data were not sufficiently satisfactory to warrant the publication of a volume in the War Series.

RICHARD WAINWRIGHT,
Chief Intelligence Officer.

NAVY DEPARTMENT, *July 1, 1896.*

I.

NOTES ON SHIPS AND TORPEDO BOATS.

By Ensign SUMNER E. W. KITTELLE, United States Navy.
Staff Intelligence Officer.

The building policies of foreign powers for this year show that Great Britain is earnest in her intention to maintain the command of the sea by her liberal additions to her armored fleet and torpedo boats, while France and Russia contemplate the addition of but one armored vessel each, and few torpedo boats. Russia, however, has shown increased activity in her shipyards, expediting work on the many vessels now in hand, and providing many powerful additions to the fleet. The growth of the German navy is steady and healthy. Italy is moving slowly, owing to her war expenses, and Austria is making a slight increase. Spain has been more active than for many years, hastening to completion vessels that have lingered on the ways for nearly a decade, and purchasing abroad many vessels of small displacement to strengthen the blockade of Cuba. In the East, Japan contemplates a building program that will lift her high on the list of first-rate naval powers. China has not yet awakened from her defeat. The South American Republics, Argentina, Chili, and Brazil, are all developing their fleets on modern lines.

Breech-loading rifles of 6-inch caliber or less are out of date. Up to and including that caliber the rapid-firing gun reigns supreme. The 12-inch breech-loading rifle seems to be the largest caliber now installed afloat, but its efficiency has been increased by lengthening the bore and also, in the case of Great Britain, constructing the guns on the wire-wound principle. The French have taken to a few rifled mortars for high-angle fire, and their latest battleship will have two. Where above-water torpedo tubes can not be protected by armor, it seems to be the policy to omit them; this especially applies to France. Electrically controlled turrets and ammunition hoists seem to be advancing in favor.

As regards internal fittings on shipboard, the late war between Japan and China has taught the danger of woodwork for bulkheads, decks, etc., and in consequence all woodwork that can possibly be spared is being removed from ships under construction or refitting, and steel decks and bulkheads substituted, with a covering of linoleum, cork, asbestos, canvas, or wooden panels rendered incombustible by chemical treatment. The British admiralty has adopted for several new

cruisers a material composed principally of asbestos, to take the place of woodwork in the living spaces. It is molded into any decorative pattern desired and is claimed to be fire and weather proof, not affected by salt water, and will not splinter.

In many cases the furniture has also been made of metal, but aluminum for this purpose has been found unable to stand the bending stresses due to the motion of the vessel. As a material for the construction of the hulls of torpedo boats aluminum has also turned out badly, but experiments are in progress to determine its value for certain internal fittings.

Triple screws are gaining in favor abroad, especially in France, Germany, and Russia. The triple-expansion engine is universal, but there seems to be no tendency to increase the number of expansions. The field of water-tube boilers widens daily, and for torpedo boats they have come into general use, a system of automatic feed adding greatly to their efficiency and safety.

In ship construction there is a tendency toward fewer openings in water-tight bulkheads and more effective means of closing them quickly. Magazines are being lined with heat-excluding material, and frigorific machines have been installed in the magazines of several vessels. Direct and rapid ammunition supply is souglit after and considered of primary importance. Torpedo nets are omitted in many of the new ships. Means of interior communication on shipboard are improving, and masting is fitted to meet the needs of modern signaling.

In the matter of torpedo boats the speed is creeping upward yearly. A French boat broke the record with a speed of 31.029 knots, and now England is contracting for two boats to make 32 knots and many more at 30 knots. Mr. J. A. Normand, designer and builder of the *Forban*, shows theoretically, under the laws governing speed and displacement, that for a vessel of 300 tons displacement the propulsive efficiency is at a minimum when the speed is about 23.3 knots, so that above this speed the performance of the vessel improves, and he believes that by retaining less reserve buoyancy and correspondingly increasing the power, the speed of torpedo boats of 300 tons may exceed 34 knots. The hull in this case would be more submerged and the vessel navigated from a flying bridge. The submarine boat has taken a new lease of life, and in France prizes have been offered for competitive designs meeting certain fixed requirements.

The use of petroleum as an auxiliary fuel is spreading, nearly all the foreign powers giving it extensive trials, and some permanently installing it on board of certain classes of vessels.

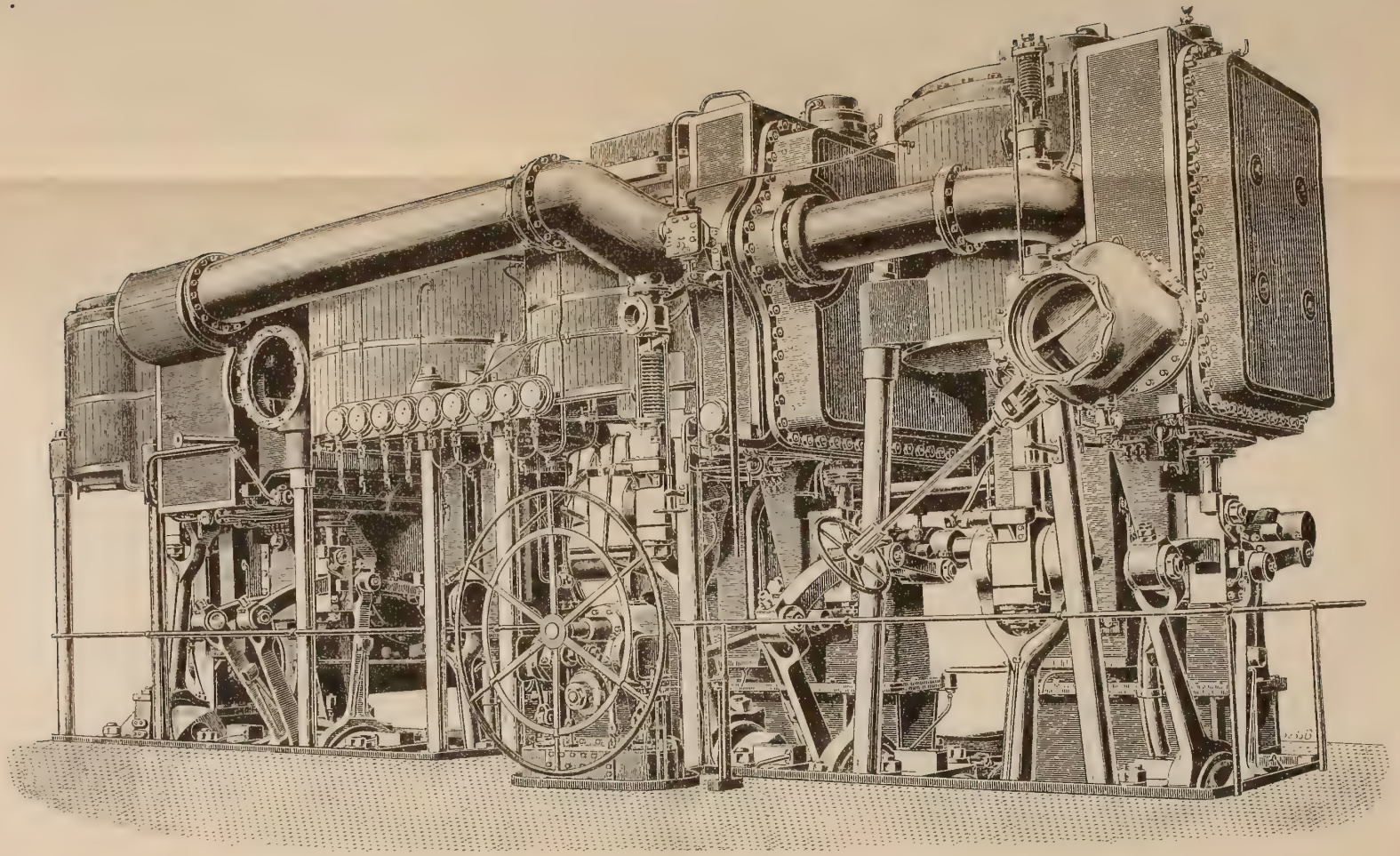
ARGENTINA.

No program of new construction has been reported. The *Buenos Aires* has been completed in England, and another cruiser slightly smaller has been laid down there. The *José Garibaldi* retains her



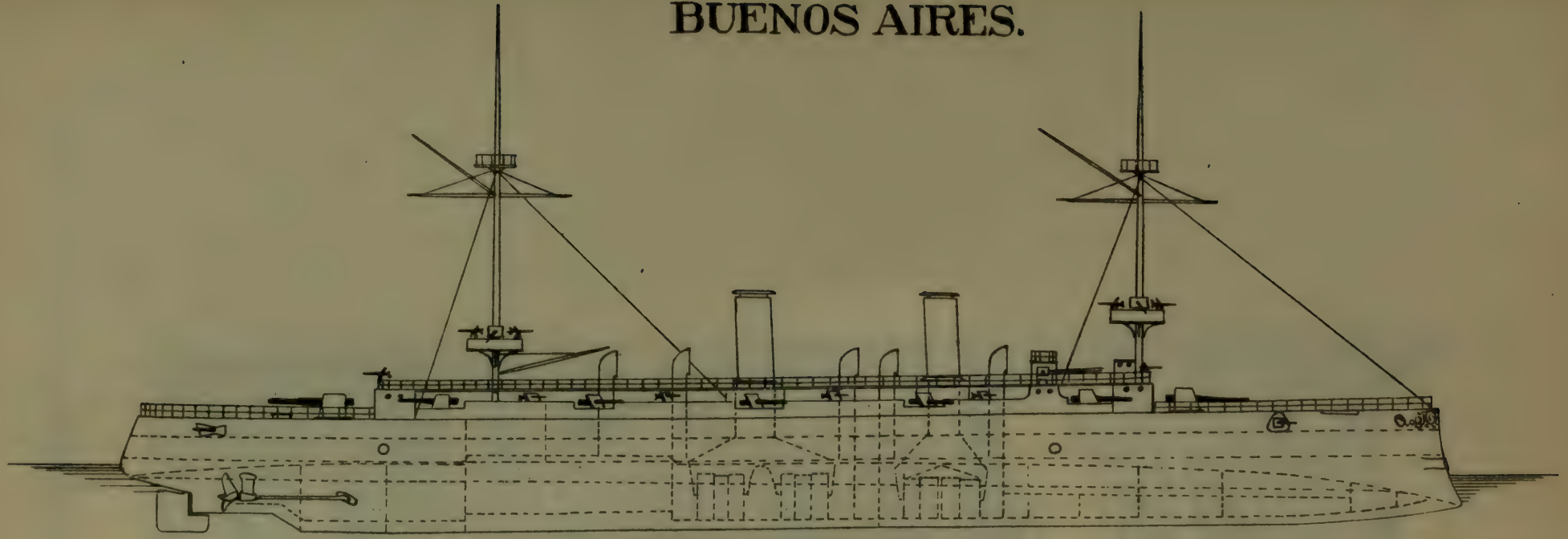
JOSÉ GARIBALDI.

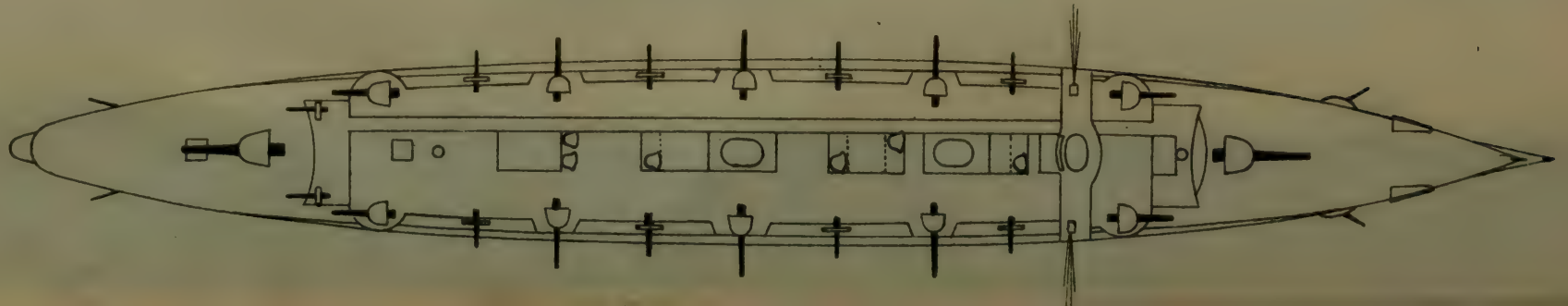




ENGINES OF THE BUENOS AIRES.

BUENOS AIRES.







BUENOS AIRES.

name, and her sister ship, the *Varese*, has been also purchased in Italy, and named the *San Martin*. Both vessels will be fitted with two additional torpedo tubes.

VESSELS PROPOSED, AUTHORIZED, OR BUILDING

SARMIENTO.

(Page 9, No. XIV.)

The 2,500-ton school ship has been named *Sarmiento*.

SAN MARTIN.

Sister ship to the *José Garibaldi* (*see* p. 9, General Information Series No. XIV, and p. 61, General Information Series No. XIII), purchased from Messrs. Ansaldo Brothers, Sampierdarena, Italy, in March, 1896. She is still on the ways. She will have four 8-inch B. L. R., instead of two 10-inch B. L. R., and the two forward and two after 5.9-inch R. F. G. will be mounted in the corners of the citadel with an arc of fire of 110 degrees, while the sponsons of the forward and the after 4.7-inch R. F. G. will be built out more. No bow or stern torpedo tube will be fitted. All vertical armor is to be face hardened.

STEAM TRIALS.

JOSÉ GARIBALDI.

(Page 61, No. XIII; page 9, No. XIV.)

This vessel underwent her preliminary steam trial at Genoa, February 18, 1896. The result was a speed of 21.7 knots. Her secondary battery now consists of ten 6-pounder R. F. G.; ten 1-pounder R. F. G., and two Maxim machine guns. A forced-draft trial on July 6, 1896, gave a mean speed of 19.98 knots and a maximum speed of 20.36 knots.

BUENOS AIRES.

(Page 10, No. XIV.)

This vessel, partially described in No. XIV, has the following additional characteristics, viz:

Armament.—Four 6-inch R. F. G., one at each corner of the superstructure, and instead of ten 4.7-inch R. F. G. she carries only six, arranged three in each broadside. The sixteen 3-pounders are disposed: four on the main deck, two forward and two aft in embrasured ports; two on the forward bridge, two on the after bridge, and eight in broadside. There are eight 1-pounders instead of six. The torpedo tubes are all above water, one in bow and four in broadside. For views of the mounts of the guns of the main battery *see* pp. 90–91, General Information Series, No. XIII, and figs. 26, 27, 28 of No. XIV.

Motive power.—The machinery was supplied by Messrs. Humphreys, Tennant & Co. The engines are inverted direct-acting triple-expansion

and the diameters of cylinders are, H. P., 40 inches; I. P., 60 inches, and two L. P., 66 inches, with a stroke of 36 inches. There are four double-ended and four single-ended return-fire tubular boilers.

Protection.—The conning tower is of 6-inch steel. The hull is sheathed with teak and copper. The stem, sternpost, rudder frame and casing and propellers are of manganese bronze.

The steam trials took place early in November, 1895, the vessel drawing a little over 4 inches more water than the mean contract draught called for. The conditions of the trial required a 6-hour run under natural-draft, during which time the vessel must make 6 consecutive runs over the measured mile with and against the tide. The speed was determined from the number of revolutions which were first standardized on the measured-mile course. The measured-mile runs were made during the first part of the trial, the first two averaging 22.435 knots and the remaining four 22.975 knots, after which she headed away for the remainder of the six hours with the ultimate result of 23.202 knots mean speed for the whole run, developing 14,000 I. H. P. The revolutions averaged 151 port and 151.5 starboard, and the steam pressure was 155 pounds with a vacuum of from 28 to 29 inches. In the fire rooms 0.4-inch air pressure was carried and allowed as natural-draft. As the ship exceeded the contract forced-draft requirement of 22.75 knots on her natural-draft trial no forced-draft trial was necessary, but it is believed that with 2-inch air pressure she can exceed 24 knots.

Successful gunnery trials were held December 4, 1895.

VESSELS RE-ARMING, REFITTING, ETC.

ALMIRANTE BROWN.

The muzzle-loading Armstrong guns on board of this battleship are to be replaced by rapid-firing guns.

SANTA CRUZ.

The steamship *Ohio*, of the Bremen and Baltimore Line, has been purchased and refitted as a transport.

TORPEDO BOATS.

So far only four torpedo boats have been ordered from Messrs. Yarrow & Co., the first one of which was launched in May, 1896. These boats differ from all others in carrying armor.

Armament.—One 14-pounder R. F. G. mounted on the conning tower forward; three 6-pounder R. F. G. on deck; two Maxim automatic guns, and three 18-inch torpedo tubes, one in bow and two on deck.

Protection.—Steel armor 0.5 inch. thick is worked all around the engines and boilers to keep out the rain of machine-gun bullets. The Japanese torpedo boat *Kotaka* was so protected, and during the late war in the East she suffered much less damage than the unprotected boats.

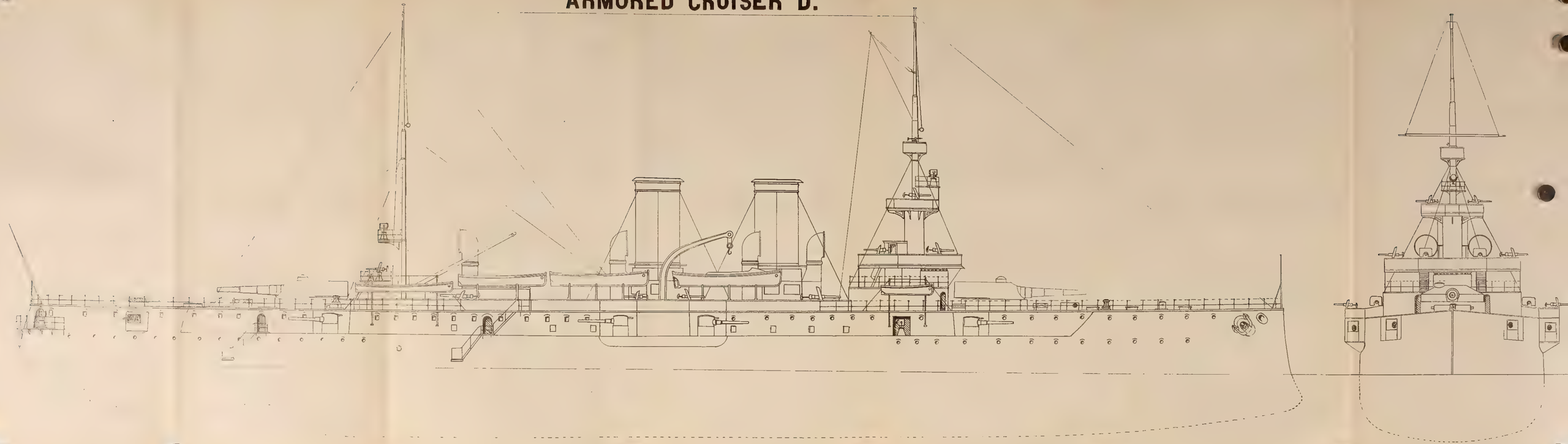
Motive power.—Two sets of triple-expansion engines with cylinders



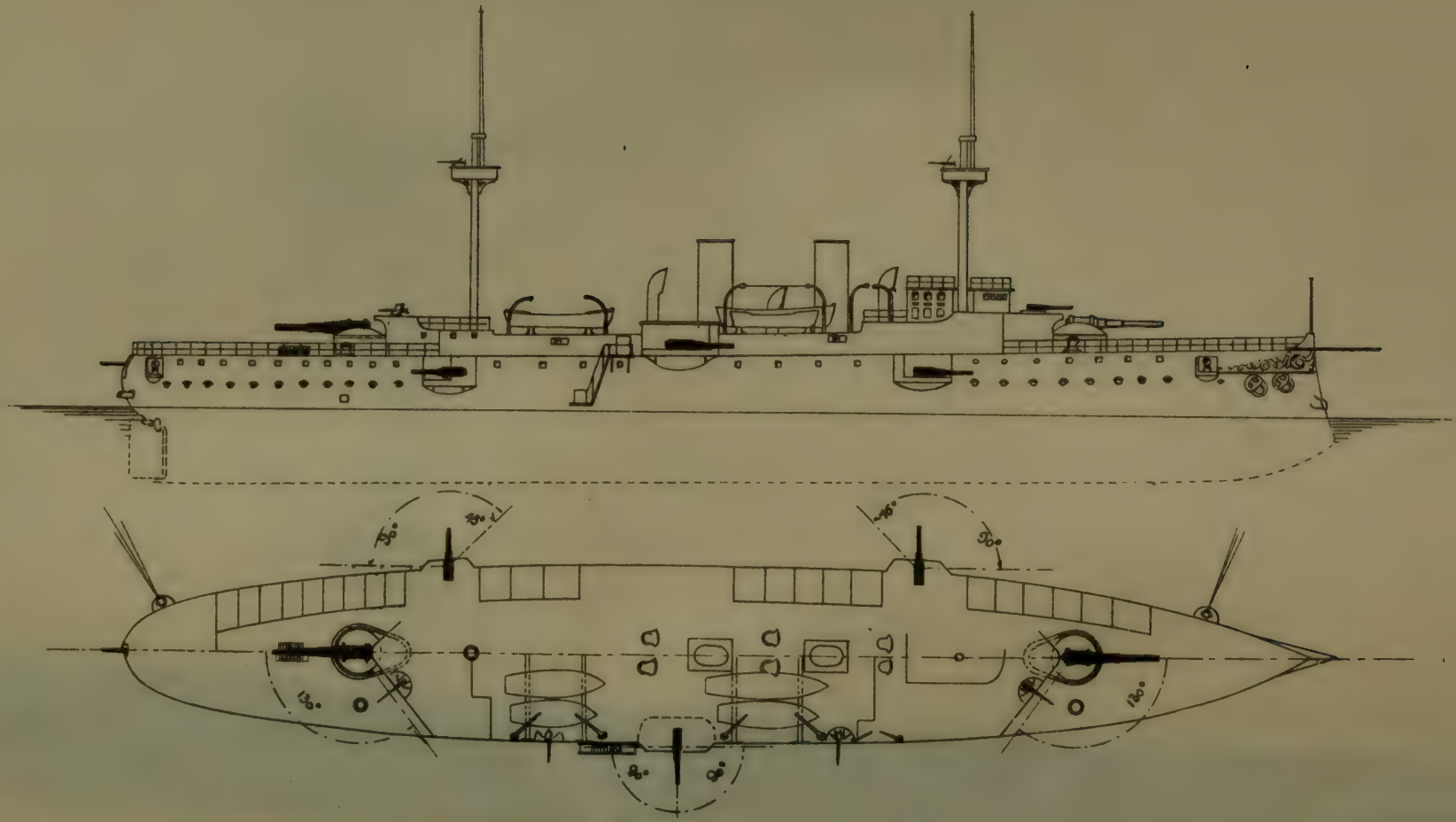
SANTA FÉ.



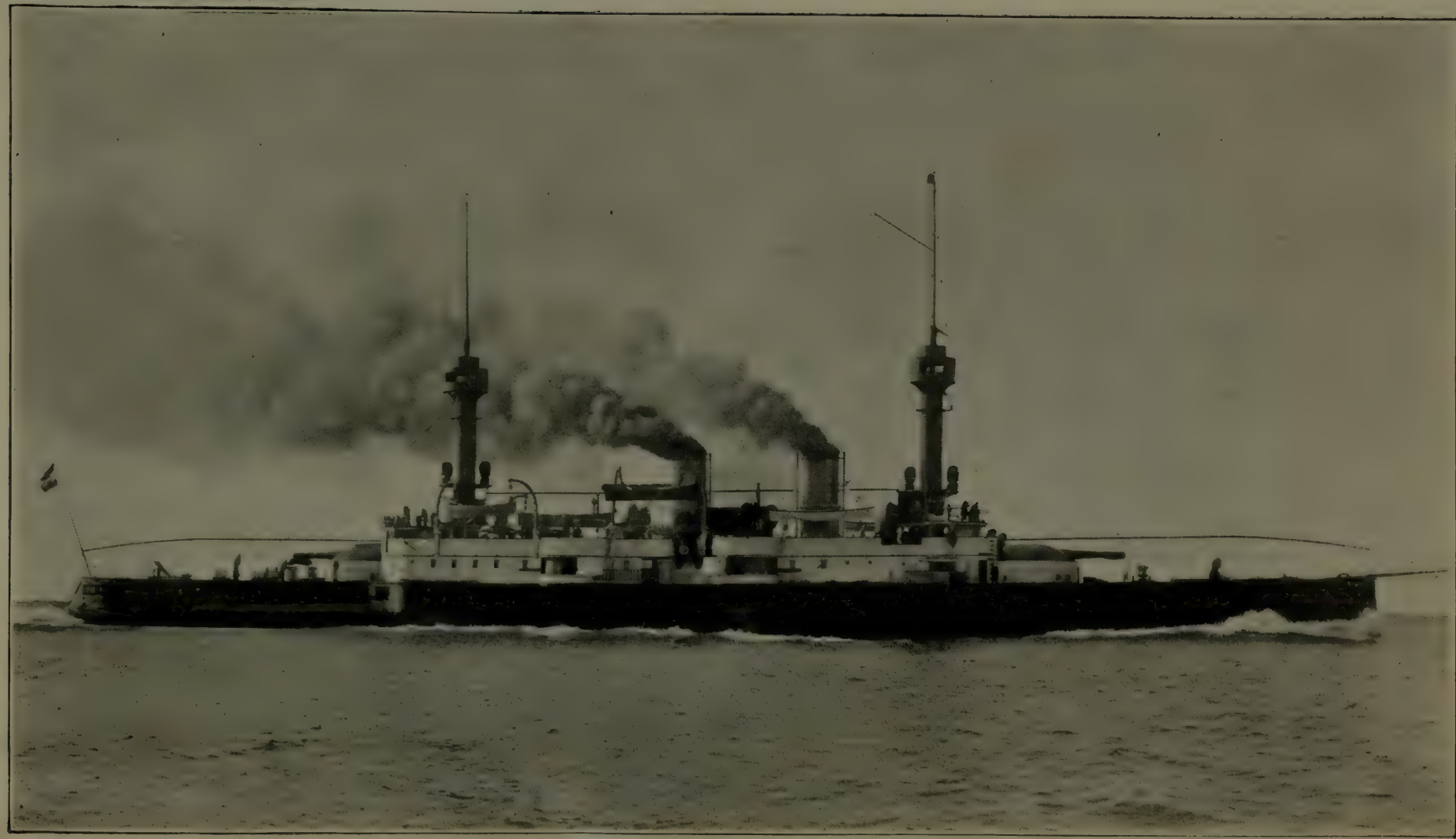
ARMORED CRUISER D.



KAISER FRANZ JOSEPH.



(Page 45, No. IX.)



MARIA THERESIA.

of 18, 26, and 39.5 inches in diameter and a stroke of 18 inches. There are six Yarrow boilers fitted with automatic feed apparatus, the water being strained through flannel. I. H. P. 4,000 and speed 26 knots.

Dimensions.—Length, 190.8 feet; beam, 19.5 feet; draught, 5 feet; displacement, 250 tons.

The first of these torpedo boats was launched May 16, 1896, and named *Santa Fe.*

AUSTRIA.

The total estimates for 1897 amount to $6,738,967.32, exceeding the budget for 1896 by $241,000.

Estimates for 1897, construction items, ordinary:	
Coast-defense vessel *Monarch*	$216,900
Ersatz *Greif*	212,080
Ersatz *Helgoland*	19,280
New boilers for ships	41,452
Construction items, extraordinary:	
Coast-defense vessel *Wien*	289,200
Coast-defense vessel *Buda-Pest*	313,300
Six torpedo boats	67,480
Cruiser *D*	313,300

VESSELS PROPOSED, AUTHORIZED, OR BUILDING.

FIRST-CLASS CRUISER D.

(Page 12, No. XIV.)

This vessel, of the type of the *Kaiserin und Königin Maria Theresia*, will be built by the Stabilimento Tecnico Triestino, at San Rocco, and will have the following characteristics, viz:

Armament.—Two 9.45-inch (40 caliber) Krupp B. L. R. in turrets, one forward, one aft, worked by electricity; eight 5.9-inch (40-caliber) Krupp R. F. G., four in each broadside, the waist pair on either side being in sponsons; four 2.75-inch (42 caliber) R. F. G.; fourteen 3-pounder R. F. G.; two 0.3-inch machine guns; two 2.75-inch field pieces, and three torpedo tubes.

Protection.—There will be an armor belt of Harveyed nickel steel with a maximum thickness of 8.6 inches, and transverse bulkheads at its ends 7.9 inches thick forward and 6.9 inches aft. Side armor above belt 3 inches thick. The armor on the turrets and redoubt will be 7.9 inches, and over the 5.9-inch guns 3 inches thick. The armored deck varies from 4 inches to 1.3 inches in thickness. Glacis plates 4 inches thick protect the hatches over the machinery.

Motive power.—Two triple-expansion engines and water-tube boilers, developing 12,300 I. H. P. and a speed of 20 knots. Coal capacity, 790 tons. Radius of action at 9 knots speed, 5,000 miles.

Dimensions.—Length, 367.5 feet; beam, 56.5 feet; draught with 250 tons of coal on board, 20.5 feet; displacement, 6,100 metric tons.

ERSATZ GREIF.

(Page 12, No. XIV.)

This vessel will have the following characteristics:

Armament.—Eight 4.7-inch (40 caliber) R. F. G.; eight 3-pounder (44-caliber) R. F. G.; two 3-pounder (33-caliber) R. F. G.; two 0.3-inch machine guns, and four torpedo tubes.

Protection.—A protective deck from 1.97 inches to 0.98 inch in thickness.

Motive power.—Two triple-expansion engines and fourteen boilers, to develop 7,200 I. H. P. and give a speed of 20 knots. The coal capacity will be 400 tons normal and 472 tons maximum. The radius of action at 12 knots will be 4,000 miles.

Dimensions, etc.—Length, 302 feet; beam, 38.4 feet; draught, 12.6 feet; displacement, 2,326 tons. The total complement will be 248 officers and men.

TORPEDO VESSEL OF 500 TONS.

(Page 12, No. XIV.)

To have a length of 219.8 feet; beam, 26.9 feet; mean draught, 7.5 feet; I. H. P. 5,700; speed, 24 knots; and a battery of six 4.7 R. F. G., besides torpedo tubes.

ERSATZ HELGOLAND.

A torpedo vessel of 2,350 tons to replace the *Helgoland*, provided for in the estimates of 1897.

VESSELS LAUNCHED.

WIEN (B) AND BUDA-PEST (C).

(Page 146, No. XII; 5, No. XIII; 12, No. XIV.)

These vessels, sister ships of the *Monarch*, were launched at the Stabilimento Tecnico Triestino, the former on July 7, 1895, and the latter on April 27, 1896. The *Buda-Pest* is to be fitted with Belleville boilers, by Messrs. Maudslay, Sons & Field, with a total grate area of 720 square feet and total heating surface of 22,500 square feet. The *Monarch* and *Wien* have cylindrical boilers.

MAGNET.

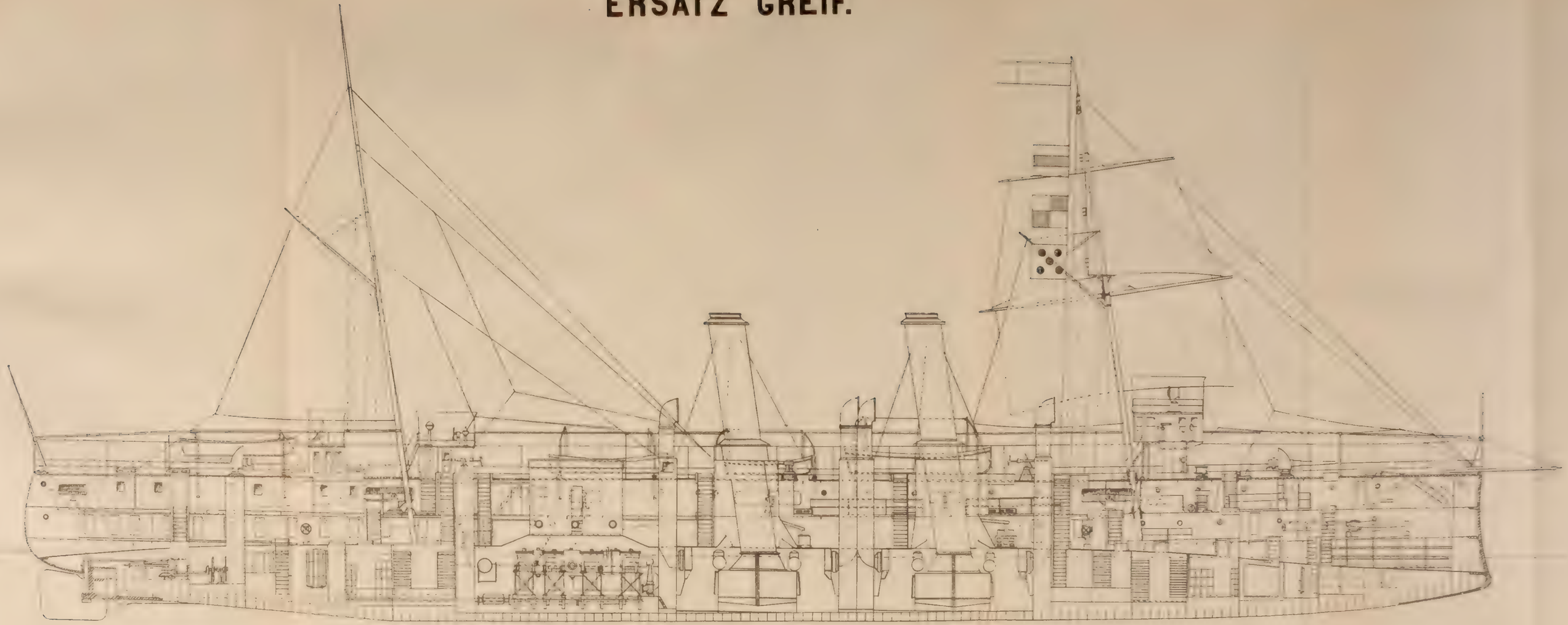
This torpedo vessel was launched at Elbing on March 21, 1896. She is of the torpedo-boat type, and her principal characteristics are:

Armament.—Six 3-pounder (44-caliber) R. F. G., and three 18-inch torpedo tubes.

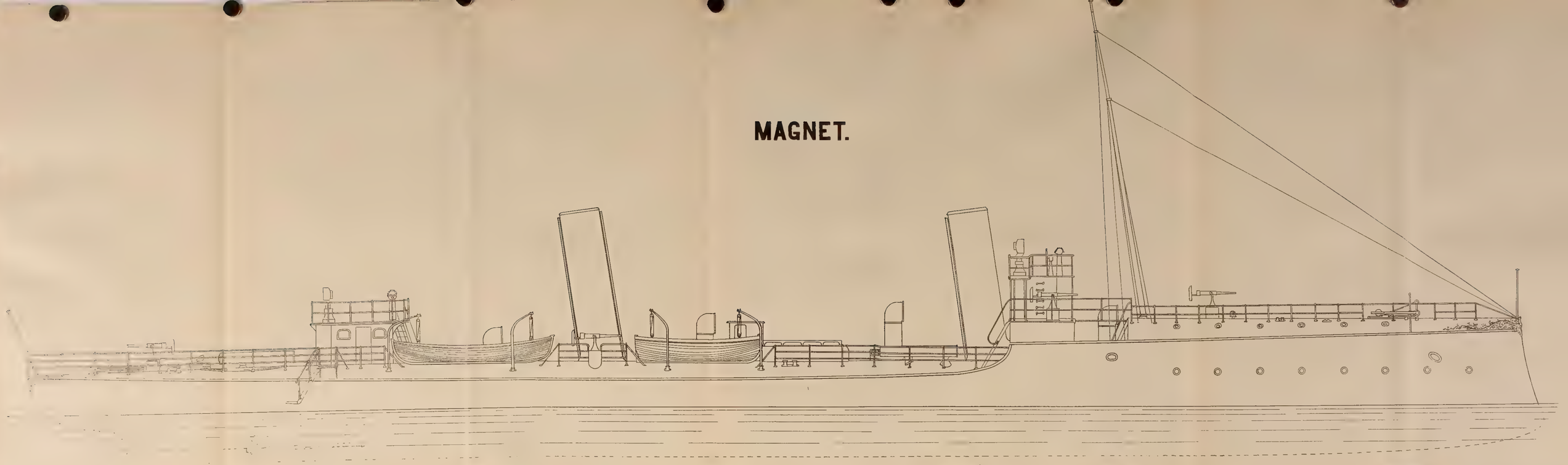
Motive power.—To develop 3,700 I. H. P. and give a speed of 26 knots. The coal capacity is 100 tons, and the radius of action at 12 knots 4,000 miles.

Dimensions.—Length, 221.4 feet; beam, 26.9 feet; maximum draught, 10.8 feet; displacement, 473 tons.

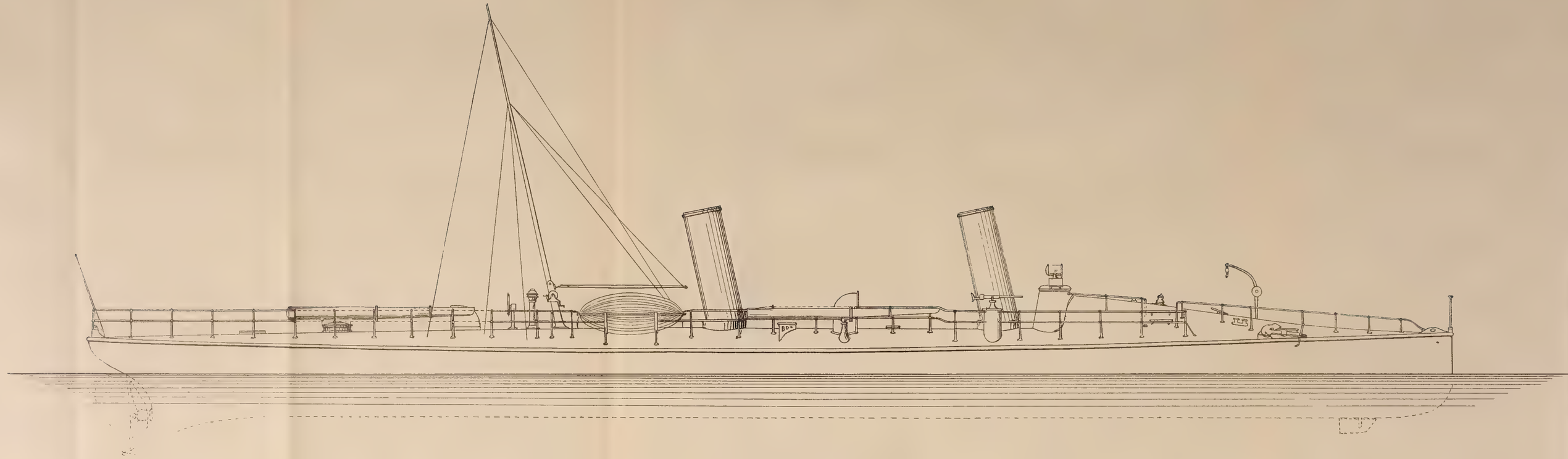
ERSATZ GREIF.



MAGNET.

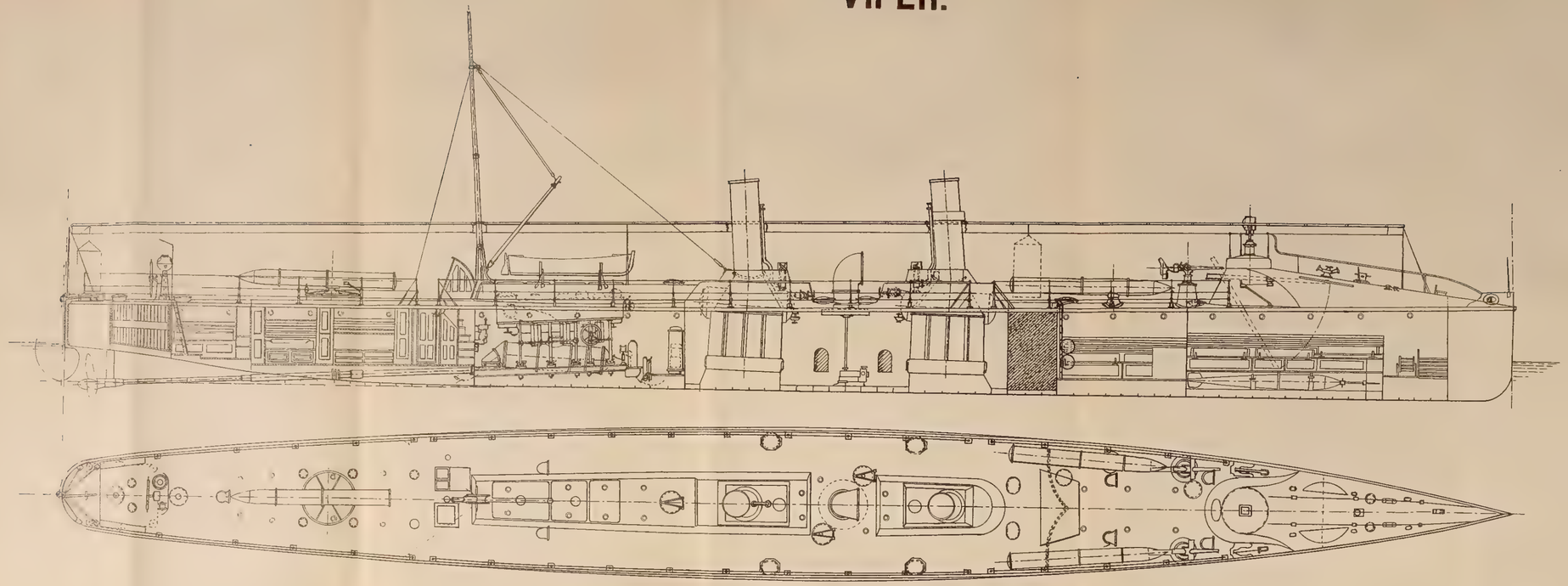


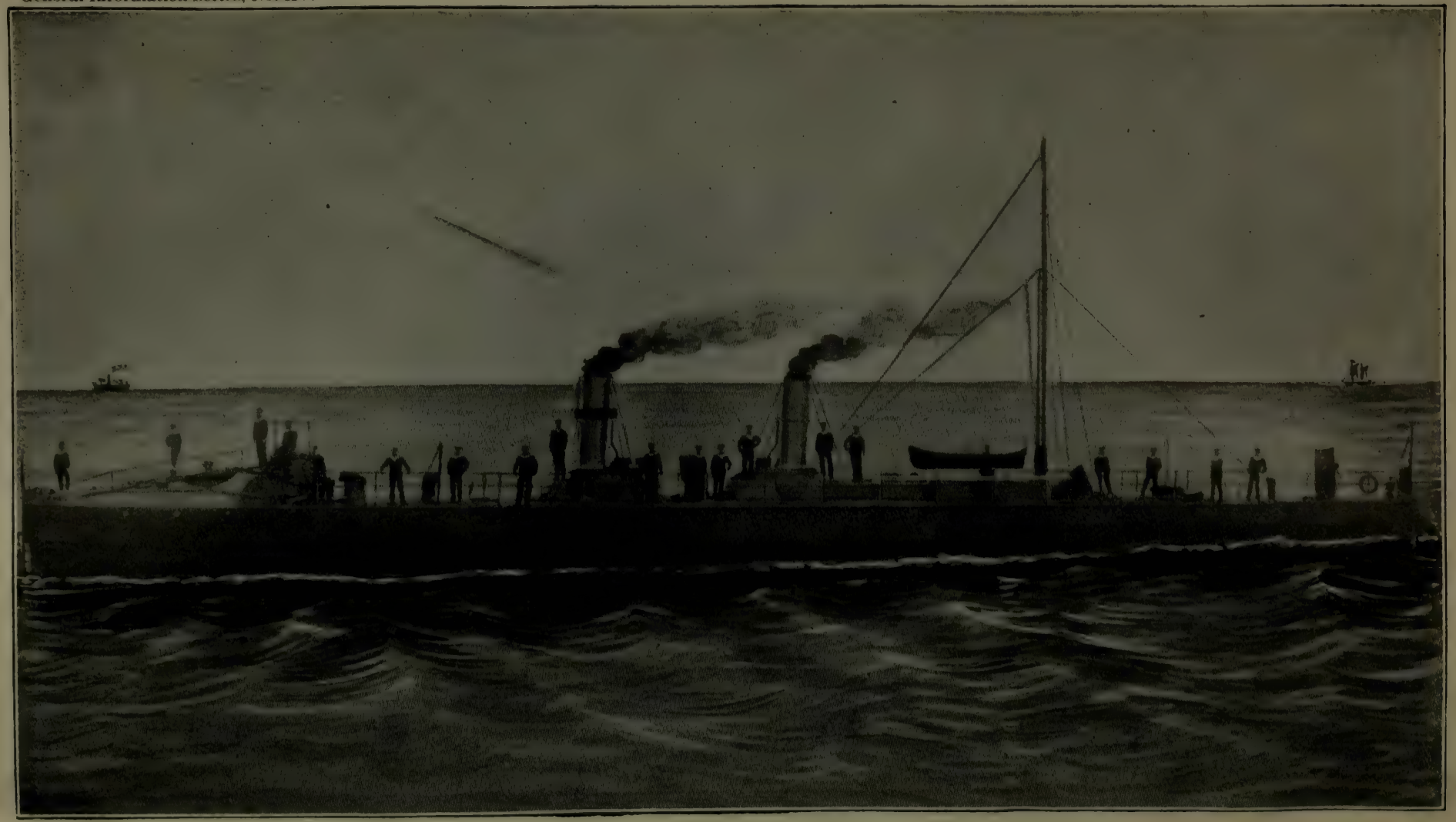
NATTER.





VIPER.





VIPER.

VESSELS SOLD.

GREIF.

This side-wheel dispatch vessel has been stricken from the navy list.

GRILLE.

An old-type gun vessel, also stricken from the list.

TORPEDO BOATS.

Two of the six torpedo boats building have been launched, one by Messrs. Yarrow & Co., and named the *Viper*.

The *Viper* is 147 feet 6 inches long and 14 feet 9 inches beam, and was guaranteed to attain a speed of 24 knots when fully equipped and in the loaded condition. With 26 tons dead weight on board to represent her armament, etc., the vessel left Poplar at 10 a. m., and on arriving at Thames Haven about noon commenced a three hours' continuous trial, during which six consecutive runs were made on the measured mile. A speed was attained on these runs of 26.633 knots. The boilers of the *Viper* are of the Yarrow water-tube type.

The scheduled particulars of the run are given in the following table:

Hour.	Steam in boilers.	First run.	Second run.	Vacuum.	Air pressure.	Revolutions per minute.	Time.		Speed.	Mean.	Second means.	Notes.
							Mins.	Secs.				
1.36	175	69	11	25	0.875	379.84	2	10	27.692	26.703		Lower Hope.
1.43	175	69	16	25	.875	378	2	20	25.714		26.650	
1.51	173	68	10	25	.875	382.86	2	11	27.480	26.597	26.786	
1.57	173	68	10	25	.75	386.46	2	16	26.470	26.975	26.674	26.633. Slip 11.3 per cent.
2.3	173	68	10	25	.75	362.19	2	17	26.277	26.373	26.422	
2.10	175	70	11	25	1	390	2	15	26.666	26.471		I. H. P. 1,940.
Means	174	69	10.5	25	.875	379.89	.....	.....	26.716	.....	.....	

After these runs the *Viper* went down to the Maplins and back. The accepted mean revolutions for the three hours were 379.888 per minute; and the accepted mean speed, 26.638 knots.

The *Viper* has since safely made her passage from the Thames to Pola. Her seagoing qualities were thoroughly tested on the voyage out, as she experienced excessively rough weather in the Bay of Biscay.

The *Natter*, one of the torpedo boats under construction at Elbing, has also been completed. Her principal characteristics are:

Armament.—Two 3-pounder R. F. G., and three 18-inch torpedo tubes.

Motive power.—To develop 2,300 I. H. P. and give a speed of 26 knots. Coal capacity 33 tons, and radius of action at 12 knots 2,500 miles.

Dimensions.—Length, 150.5 feet; beam, 15.5 feet; draught, 8.8 feet; displacement, 152 tons.

Six seagoing boats are to be laid down this year under the new budget.

BRAZIL.

The program for 1896 contemplates two coast-defense vessels, four protected cruisers, three torpedo vessels, eight first-class torpedo boats, six smaller torpedo boats, and five Goubet submarine torpedo boats. Of these vessels it is reported that the following have been ordered in Europe: Two coast-defense vessels, four cruisers, three torpedo vessels, two first-class torpedo boats, and five smaller torpedo boats. Two Goubet submarine torpedo boats have been delivered.

VESSELS PROPOSED, AUTHORIZED, OR BUILDING.

TWO COAST-DEFENSE VESSELS.

(Page 14, No. XIV.)

The secondary batteries of these vessels will include four 6-pounder R. F. G., two 1-pounder R. F. G., two 1-inch machine guns, and two torpedo tubes.

THREE PROTECTED CRUISERS.

These vessels are reported to have been ordered in Italy. They are to be of 4,000 tons displacement, built of steel, sheathed with wood and copper, and protected by an armored deck and coal. The speed is to be 19 knots under natural-draft and 20 knots under forced-draft, and the coal supply will give them a radius of 10,000 miles at 10 knots speed. They will have a heavy armament for bow and stern fire, together with a number of rapid-fire guns and three torpedo tubes.

PROTECTED CRUISER.

This vessel is being constructed by Messrs. Armstrong, Mitchell & Co. of steel, sheathed with wood and copper, and will have a displacement of about 3,500 tons.

Armament.—Six 6-inch R. F. G., four 4.7-inch R. F. G., ten 6-pounder R. F. G., four 1-pounder R. F. G., four Maxim machine guns, and three torpedo tubes.

Protection.—Steel protective deck from 3.5 to 1.2 inches thick.

Motive power.—To give 7,000 I. H. P. and 20.5 knots.

Dimensions, etc.—Length, 320 feet; beam, 43 feet; mean draught, 17 feet; coal capacity, 850 tons.

THREE TORPEDO VESSELS.

(Page 14, No. XIV.)

These vessels have been ordered from the Germania Company, Kiel, Germany, and will have a displacement of 1,030 tons.

Armament.—Two 4-inch R. F. G.; six 6-pounder R. F. G.; four 1-pounder R. F. G., and three torpedo tubes.

Protection.—Machinery and boilers protected by coal and by a protective deck.

Motive power.—Two triple-expansion engines intended to give a speed of 20 knots natural-draft and 22 knots forced-draft. The steaming radius to be 3,000 miles at 10 knots speed.

Dimensions.—Length, 259 feet; beam, 30.8 feet; draught, 10 feet; displacement, 1,030 tons.

EIGHT TORPEDO VESSELS.

(Page 7, No. XIII.)

It is proposed to build eight vessels of the *Gustavo Sampaio* type to have a speed of from 23.5 to 26 knots.

GUNBOAT.

Messrs. Yarrow & Co. are building a gunboat for Brazil to have a length of 80 feet, a beam of 12 feet, and a speed of 12 knots.

VESSELS LAUNCHED.

CARAMURU.

One of the three torpedo vessels described above was launched at the works of the Germania Company on April 1, 1896.

VESSELS RE-ARMING, REFITTING, ETC.

TONELERO.

Formerly called the *Trajano.* Her battery was thrown overboard by the rebels and now she is to refit at La Seyne, France. It was reported in August, 1895, that a boiler had exploded on board killing or wounding 16 persons.

VINTE E QUATRO DE MAIO.

(Page 15, No. XIV.)

This vessel was sent across and docked at Southampton, England, in November, 1895, and her guns were landed and sent to Elswick to be overhauled. She then proceeded to Stettin, Germany, to undergo a thorough refit. Her new boilers made by the Forges et Chantiers de la Méditerranée have been forwarded to Germany.

VESSELS RENAMED.

The *Guanabara* is to be called *Paysandu;* the *Liberdade* becomes the *Trinidade,* and the *Republica* is renamed *Quinze de Novembro.*

TORPEDO BOATS.

PEDRO IVO, SILVADO, PEDRO AFFONSO, PANNÉ, PERNAMBUCO.

(Page 9, No. XIII.)

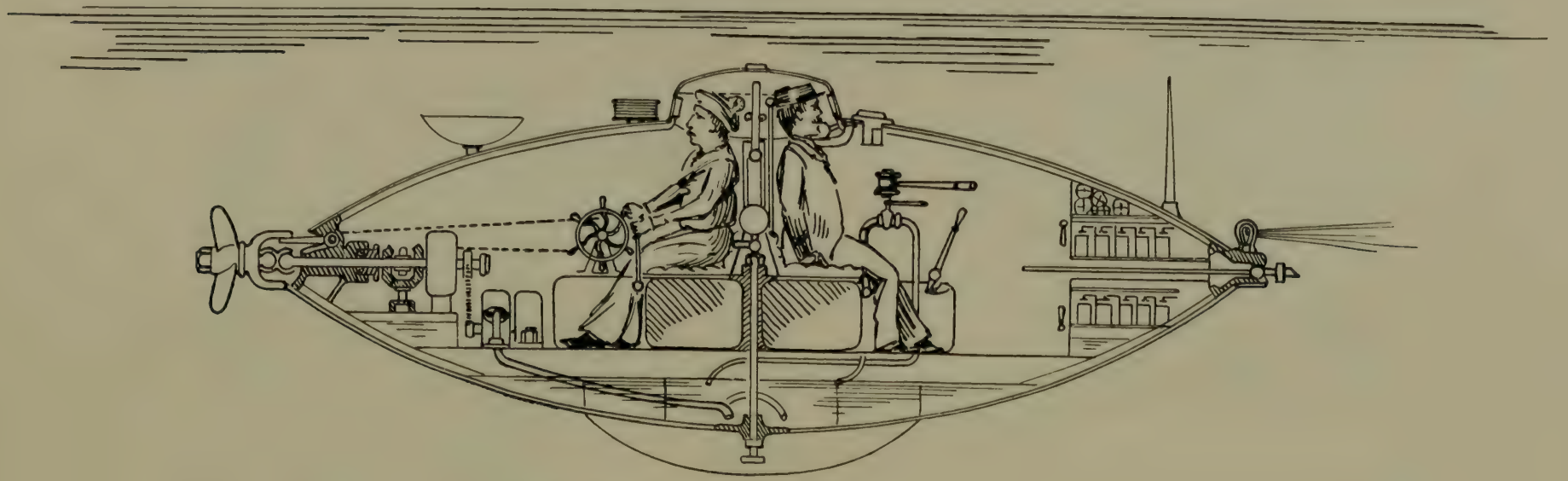
The five boats bought from Mr. Schichau, Elbing, were named as above.

SIX TORPEDO BOATS.

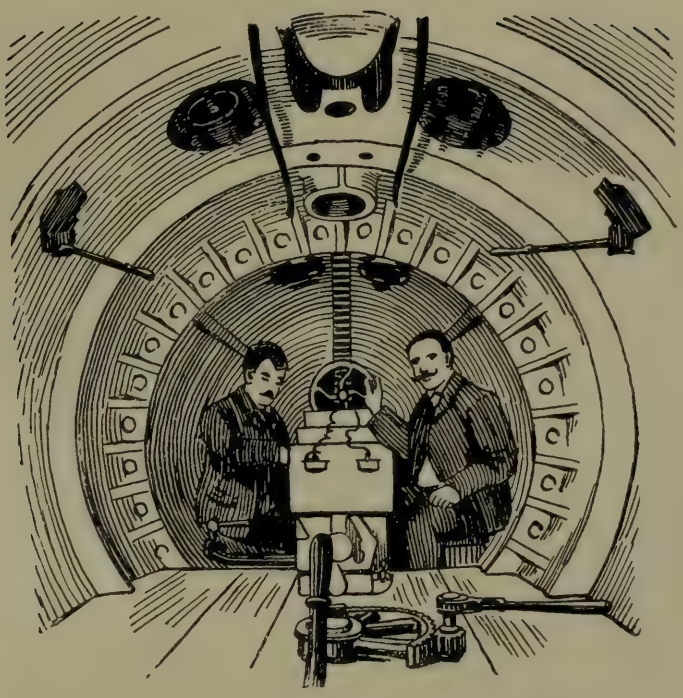
To be ordered under the program for 1896; their characteristics have not been made known, but at least three of them will be built in Germany.

FIVE SUBMARINE TORPEDO BOATS.

Five boats of the Goubet type (p. 454, No. VIII; 33, No. IX; 40, No. X; 40, No. XI) are to be constructed in France for Brazil. Two of these have been completed, one of them being conveyed to Brazil on board of the *Riachuelo*. This new type is known as the *Goubet II*, and, like the first, is a spindle-shaped vessel 26.2 feet long, 5.7 feet in diameter; the hull being formed of a series of broad rings, with flanges for bolting them together. On top, midway of the length, is a circular hatch or manhole 14 inches high, with a dome-shaped cover. There is a fin keel at the bottom, and side keels as well, the latter supporting skeleton discharge tubes for automobile torpedoes. Oars working through universal water-tight joints afford a means of propulsion in case of accident to the motive power. A screw propeller projects from the stern, completing the list of external features of the hull. The hull plating is of bronze, varying from 0.27 to 0.86 inch in thickness. The vessel rises or sinks with the expulsion or admission of water, the reservoirs being in what might be called the double bottom. The amount of water in the reservoirs is controlled automatically by means of a hydrostatic apparatus set for some particular depth, which controls the electric current driving the dynamos that fill or empty the reservoirs. If the bouyancy should be suddenly altered by the loss of the detachable weight from the keel, or other cause, the original plane of immersion would be restored automatically by the admission of water. A similar device maintains the longitudinal stability, even when the crew move forward or aft. With crew and stores on board the boat is awash, but additional buoyancy can be obtained by detaching the weight at the keel. The propeller works in a system of ball-and-socket joints, enabling its use for steering, as well as for propulsion. A telescope can be projected upward through the dome, when near the surface of the water, for about 10 feet. It is fitted with reflecting mirrors, enabling the captain to see above the surface. Fresh air is furnished by reservoirs of oxygen, and the accumulation of foul air may be pumped out. The torpedoes carried at the side are balanced for a certain depth, and are started by a lever from within the boat, which acts on a strong spring and on the tripping lever of the torpedo, and so sets the screws of the torpedo in motion. There is also an apparatus for cutting cables or nets and for removing obstructions under water. The boat weighs about 9 tons, and can be driven at a speed of 7 knots by 1.5 H. P. The steaming radius is 40 miles, and it must be habitable for eight hours. Cost, $48,250.



THE GOUBET SUBMARINE BOAT. LONGITUDINAL SECTION.



THE GOUBET SUBMARINE BOAT. VIEW OF AFTER END, SHOWING MECHANISM.



THE GOUBET SUBMARINE BOAT. VIEW OF FORE END, SHOWING THE VENTILATING LEVERS, ETC.

BULGARIA.

The Bulgarian navy now consists of the paddle-wheel yacht *Alexander I*, built of steel, 800 tons displacement, 183.7 feet long, 32.7 feet beam, 4.8 feet draught, 700 I. H. P., and a speed of 11 knots; the yacht *Krum*, of 650 tons displacement; the steamers *Asjen*, of 400 tons, and *Simeon Velïkii*, 600 tons displacement; the steam launches *Boris*, *Ljuben Karavelof*, *Raina Rakovski*, *Stefan Karadjo*, and *Voevoda*, of from 2 to 5 tons, and the *Hadzi Demeted*, of 15 tons; two spar torpedo launches; and two sailing transports, of 400 tons displacement.

CHILE.

VESSELS PROPOSED, AUTHORIZED, AND BUILDING.

O'HIGGINS.

The second armored cruiser building at Elswick for Chile will probably be named the *O'Higgins*. The general characteristics of the ship are:

Armament.—Four 8-inch B. L. R., ten 6-inch R. F. G., four 4.7-inch R. F. G., eight 12-pounder R. F. G., ten 6-pounder R. F. G., four Maxim machine guns, and four submerged 18-inch torpedo tubes.

Protection.—A belt of Harveyed nickel steel 6 inches in thickness.

Dimensions, etc.—Length, 400 feet; beam, 62 feet; draught, 22 feet; displacement, 8,400 tons. Speed, 21 knots.

VESSELS LAUNCHED.

ESMERALDA.

A new vessel to replace the one sold to Japan was laid down by Messrs. Armstrong, Mitchell & Co., at Elswick, to perpetuate the name in the Chilean navy, and launched April 14, 1896. Her principal characteristics are as follows:

Armament.—Two 8-inch B. L. R. with shields, one forward, one aft; sixteen 6-inch R. F. G. with shields; eight 12-pounder R. F. G.; ten 6-pounder R. F. G.; four Maxim machine guns, and five torpedo tubes, of which two are submerged.

Protection.—There is a water-line belt of steel about 350 feet long, 7 feet wide, and 6 inches thick, joined at the ends by 6-inch transverse bulkheads. The protective deck has a thickness of 1.5 inches behind the armor and 2 inches at the ends. The usual coal protection is afforded.

Motive power.—The machinery is designed to give a speed of 21 to 22 knots under forced draft. The boilers will be cylindrical.

Dimensions, etc.—Length, 436 feet; beam, 53.2 feet; draught, 20.5 feet, displacement, 7,000 tons. The sheathing will be of wood and copper.

MINISTRO ZENTENO.

This protected cruiser was launched at Elswick, February 1, 1896, by Messrs. Armstrong, Mitchell & Co. She has the following characteristics:

Armament.—Eight 6-inch R. F. G., ten 6-pounder R. F. G., four 1-pounder R. F. G., two field guns, four machine guns, and five torpedo tubes.

Protection.—She has a complete protective deck varying in thickness from 1.25 inches on flat to 3.5 inches on slopes. The bases of the smoke pipes are protected by 4-inch glacis plates. An additional protection to the machinery spaces is given by the coal bunkers at the side extending to a height of 6 feet above the water line. The conning tower is of 4-inch steel.

Motive power.—The engines develop 7,500 I. H. P., and drive twin screws. The total coal capacity is 800 tons, giving the ship a radius of 8,000 miles at economical speed.

Dimensions.—Length between perpendiculars, 330 feet; beam, 43.75 feet; mean draught, 16.83 feet; displacement, 3,450 tons. Speed, 20 knots.

ALMIRANTE SIMPSON.

A torpedo vessel of an improved *Almirante Lynch* type, building by Messrs. Laird Bros. at Birkenhead, was launched April 16, 1896. The general characteristics of this vessel are:

Armament.—Two 4.7-inch R. F. G., four 3-pounder R. F. G., two Maxim-Nordenfelt machine guns, and three 18-inch torpedo tubes.

Protection.—The sides and deck in wake of the machinery and boilers are increased in thickness, probably to 1 inch; there is also extensive coal protection.

Motive power.—Two sets of triple-expansion engines to develop 4,500 I. H. P. and give a speed of 21 knots. There will be four Normand water-tube boilers to carry a pressure of 200 pounds. The radius of action will be 4,000 miles.

Dimensions.—Length, 240 feet; beam, 27.5 feet; depth, 16 feet; displacement, about 800 tons.

ACCIDENTS.

HUASCAR.

The main steam pipe of this vessel burst early in April, 1896, killing 8 men and wounding 4 others. The vessel was lying at Valparaiso at the time of the accident.

VESSELS RE-ARMING, REFITTING, ETC.

ALMIRANTE COCHRANE.

(Page 54, No. X.)

This vessel is undergoing a refit at Talcahuano. All masts have been removed and one military mast substituted, and four 4-inch R. F. G. will be added to the battery.

AQUILA AND SPARTAN.

(Page 54, No. XI.)

The machinery of these vessels has been protected by fitting 3-inch plating in wake of it, and rearranging the coal protection. A number of 4.7-inch R. F. Armstrong guns are to be mounted on each vessel.

PRESIDENTE ERRAZURIS AND PRESIDENTE PINTO.

(Page 56, No. X.)

The Canet guns on board these vessels are to be replaced by Armstrong guns, the latter type having been regularly adopted by the Chilean Government.

TORPEDO BOATS.

CAPITAN MUNIZ GAMERO, CAPITAN ORELLA, TENIENTE SERRANO, AND GUARDIA MARINA REQUELME.

Three of these four torpedo boats building at Birkenhead have been launched. Their characteristics are as follows:

Armament.—One 12-pounder R. F. G., five 6-pounder R. F. G., and two torpedo tubes.

Motive power.—Engines driving twin screws give 6,000 I. H. P. Normand boilers.

Dimensions.—Length, 210 feet; beam, 21.6 feet; displacement, 300 tons; speed, 30 knots.

SIX TORPEDO BOATS.

Six torpedo boats of the type of the Austrian boat *Viper* have been ordered of Messrs. Yarrow & Co. They will be 152.5 feet long, have a beam of 15.3 feet, and a speed of 25.5 knots. The usual triple-expansion engines will be fitted to make 2,000 I. H. P. The coal capacity will be 40 tons.

CHINA.

It has been reported that the Viceroy at Nanking has about $4,866,700 with which he intends to strengthen the Chinese navy. The authorities at Pekin have protested against the expenditure of this money for the navy, and nothing has yet been done beyond consulting with several European shipbuilders. The proposed program included two battleships of 8,000 tons each, two armored cruisers of 5,000 tons each, four partially protected cruisers of 3,000 tons each and several torpedo boats.

VESSELS PROPOSED, AUTHORIZED, OR BUILDING.

THREE PROTECTED CRUISERS.

On the 8th of June, 1896, the Chinese Government awarded the contract for three protected cruisers to the Vulcan Works, Stettin, Germany, to be completed in eighteen months. Their principal characteristics will be:

Armament.—Three 5.9-inch R. F. G.; eight 4.13-inch R. F. G.; six

1-pounder R. F. G.; six Maxim machine guns; one 2.4-inch boat gun; and three torpedo tubes, one of them submerged.

Dimensions, etc.—Length, 328 feet; beam, 41 feet; draught, 16.3 feet; displacement, 2,950 tons; I. H. P., 7,500; speed, 19.5 knots.

FEI YING.

This torpedo vessel was built at Stettin, Germany, for the Chinese Government, and arrived in China in December, 1895. She is built of steel, the hull being subdivided by many water-tight bulkheads. She has a topgallant forecastle and poop, four smoke pipes, two pole masts, ram bow, electric lighting, mechanical telegraphs, and speaking tubes; also two search lights.

Armament.—Two 3.94-inch Krupp R. F. G. on slide mounts, with one-half inch curved steel shields, one on forecastle and one on poop, each having an arc of fire of 12 points on either side of the keel; six 6-pounder Krupp R. F. G. in sponsons on pedestal mounts, with three-eighths-inch shields and an arc of fire of 14 points; two 1-pounder Hotchkiss R. F. G. on crinoline mounts; three torpedo tubes, for which six 14-inch Schwartzkopf torpedoes are carried.

Protection.—This vessel is practically without any protection, although there is about 5 feet of coal at the water line in wake of the engines and boilers. The boilers are below, but the engines are above the water line, and would be easily disabled.

Motive power.—Two quadruple-expansion engines in the same compartment on opposite sides of the midship line. Eight Yarrow water-tube boilers arranged in four water-tight compartments.

Dimensions, etc.—Length over all, 280 feet; draught forward, 9 feet; displacement, 850 tons; coal capacity, 180 tons.

The *Fei Ying* had her steam trials before leaving Germany, and with eight boilers working under three-quarters-inch air pressure and 4,500 I. H. P., she made an average speed of 21.3 knots in four runs. During a 5-hour continuous run she made 20.5 knots, and her sea going qualities are reported as excellent.

KIN CHING.

This school ship was launched at the Fuchau Navy-Yard, China, in the summer of 1895. She is a single-screw unarmored steel vessel of 1,800 tons displacement, with rounded bow and stern, topgallant forecastle and poop, and two military masts. Her armament consists of two 5.9-inch Krupp R. F. G., one each side abaft the break of the forecastle, and five 4.7-inch Krupp R. F. G., one on poop and two in each broadside. Her estimated speed is 15 knots.

TRANSPORT.

This vessel, as yet unnamed, is being constructed at the Fuchau yard. She is to have a displacement of 750 tons and an estimated speed of 12 knots.

TORPEDO BOATS.

Of the four new torpedo boats mentioned on page 16 of General Information Series No. XIV, two were built by the Vulcan Works at Stettin and two were Schichau boats Nos. 558 and 559. The latter have a length of 127.9 feet, beam 15.6 feet; I. H. P. 1,200; and are fitted with locomotive boilers. The armament consists of two 37 millimeter Hotckhiss R. C., one bow torpedo tube, and two launching carriages.

COLOMBIA.

GENERAL NERINO.

This vessel has been built by Mr. Hugh Ramsay, Perth Amboy, N. J., for the Colombian Government. She is a side-wheel, light-draught gunboat built in sections and was so transported to Colombia. There are ten water-tight compartments in the hull, and a single military mast carries a rapid-fire gun and a search light. The principal characteristics are as follows:

Armament.—Three rapid-fire guns.

Protection.—The engines, boilers, deck house, and conning tower are protected by bullet-proof nickel-steel plating.

Motive power.—Engines of the inclined triple-expansion type. One Roberts water-tube boiler, I. H. P. 430.

Dimensions, etc.—Length over all, 140 feet; beam, 9 feet at water line and 35 feet at guards; depth, 7 feet; speed, 15 knots.

CORDOVA.

Formerly the British steamer *Neptuno*, built at Sunderland, England, in 1891, and refitted at Perth Amboy, N. J., as a transport to carry 1,000 men. She carries one search light and her armament consists of two 6-pounder R. F. G. and two Colt automatic machine guns, fitted with bullet-proof shields. The dimensions are: Length, 222 feet; beam, 27 feet; depth, 14 feet.

DENMARK.

The proposed budget for 1896 provides $228,295.26 for ordinary purposes, and $167,821.60 for extraordinary charges. For continuing the work on the *Skiöld* $53,600 is provided, also $53,600 for commencing work on the new coast-defense vessel of the *Lindormen* type. For building two first-class torpedo boats and four vedette boats $48,240, and $231,364.40 for repairs to the school ship *Ornen*, new boilers and a new 4-inch deck for the *Helgoland*, repairs to the *Dagmar* and *Hanch*, and new boilers for the gunboat *Falster*.

VESSELS LAUNCHED.

SKIÖLD.

(Page 10, No. XIII.)

This coast-defense vessel, launched May 8, 1896, has the following characteristics, viz:

Armament.—One 9.45 inch B. L. R. in Canet electric turret, three

4.72-inch R. F. G. in Canet electric turrets, four 3-pounder R. F. G., one machine gun, and four torpedo tubes. These Canet turrets are closed and the electric gear is supplemented by hand gear. In the 9.45-inch turret the ammunition hoist is also electric, but in the 4.72-inch it is manual. The control of these turrets is said to be very complete; they can be stopped instantly and moved through one-fortieth of a degree of arc at will.

Protection.—A partial belt of from 9 to 12 inches in thickness; the turrets are 8.2 inches thick; the bulkheads 11 inches, and the protective deck 2 inches.

Motive power.—The machinery is designed to produce 2,200 I. H. P., giving a speed of 15 knots. The coal capacity is 250 tons.

Dimensions, etc.—Length, 226.5 feet; beam, 38 feet; mean draught, 13.4 feet; displacement, 2,160 tons; twin screws.

TORPEDO BOATS.

The Danes have experimented with specially fitted torpedo boats submerged so that only the conning tower shows above water, and have obtained a speed of 15 knots. Their idea is to obtain a substitute for the submarine boat.

HAJEN.

This torpedo boat has just been completed at the navy-yard at Copenhagen. The displacement is 143 tons and the I. H. P. 2,200.

ECUADOR.

COTOPAXI.

The *Seis de Deciembre* is now called the *Cotopaxi*. She was built in England in 1884, and is used as a transport. The armament consists of four small Armstrong B. L. R. and two small R. C., and she has a speed of 10.5 knots.

VESSELS REFITTING, ETC.

NUEVE DE JULIO.

This vessel has been chiefly used as a transport. Her hull and engines are in bad condition, and she is laid up for repairs when the necessary money becomes available. The armament now consists of only two 32-pounder S. B. G. and two machine guns.

TUNGURAHUA.

This is the only torpedo boat belonging to Ecuador, and she has been hauled out for repairs, for which $5,000 has been appropriated. Her three pole masts have been removed, and repairs to machinery and boilers are in progress. She was built by Yarrow, and has a length of 125 feet; beam, 13 feet; mean draught, 5 feet. The armament consists of one 4-inch Krupp R. F. G. mounted on a steel tower and two machine guns. Her speed is 16 knots.



MARCEAU—SHOWING NEW MASTINGS.

FRANCE.

In 1891 a program of new construction for the French navy to extend into 1902 and to include 81 vessels was decided upon. Later consideration of the subject led to an extension of time, making the year of completion 1905. The development of this program has been interfered with from year to year, owing to the failure of the French Parliament to make the necessary appropriations, but the administration has followed the general lines of the progam in making its yearly recommendations for new ships. The total program, if carried out, would cost about $170,000,000, which distributed over a dozen years would really amount to a yearly increase of only $1,800,000 over the present annual expenditures.

The estimates for 1896, submitted to the Chamber on May 14, 1896 (p. 18, No. XIV), were cut down by that body, and only eight vessels allowed, four of which are torpedo boats. The original estimate was $52,614,675.31, and the amount allowed $51,323,986.27.

The following vessels will be built:

Vessel.	Where to be built.	Estimated cost.
Henri IV, battleship	Cherbourg Navy-Yard	$3,022,395
Jeanne d'Arc, armored cruiser	Toulon Navy-Yard	4,260,237
Dunois, torpedo vessel	Cherbourg Navy-Yard	595,326
La Hire, torpedo vessel	do	595,326
Torpedo vessel, Havock type	Private yard	321,353
Cyclone, ex-Tenare	do	190,008
Two small torpedo boats	do	162,511

There has been much complaint in France over the great delay in completing ships under construction, and it has been found that the time necessary to build various types of large vessels is approximately for battleships five years, and for cruisers from three to four years. The following table will show how the dates of completion are extended from time to time:

Vessels.	Where built.	Estimated time of completion in 1895.	Estimated time of completion in 1896.
Carnot, battleship	Navy-yard	Beginning of 1896	Beginning of 1897.
St. Louis, battleship	do	End of 1898	End of 1899.
Bruix, armored cruiser	do	March, 1895	May, 1896.
Fleurus, torpedo vessel	do	June, 1895	August, 1896.
Jauréguiberry, battleship	Private yard	April, 1895	1896.

The estimates for 1897 carry a total of $46,163,405.32, of which $1,216,600 is to be expended on account of fourteen new vessels, whose total estimated cost will be $18,769,208.80.

The fourteen vessels proposed are as follows, viz, one battleship A^3 at Brest; one first-class cruiser D^2 at Lorient; one first-class cruiser C^1

by contract; one first-class cruiser C^3 at Toulon; one third-class cruiser K^1 at Rochefort; two torpedo vessels by contract; one gunboat by contract; six 85-ton torpedo boats at Cherbourg and Toulon, and by contract.

VESSELS PROPOSED, AUTHORIZED OR BUILDING.

HENRI IV.

(Page 45, No. XIII; 18, No. XIV.)

This battleship is to be laid down at Cherbourg, this year, and the date of completion is fixed at April 1, 1900. Her plans, by M. Bertin, are not yet perfected but the original ideas will be greatly modified. The principal characteristics already decided upon are:

Armament.—One 12-inch B. L. R.; ten 5.45-inch R. F. G.; two large caliber rifled mortars for high-angle fire; eight 3-pounder R. F. G.; two Maxim machine guns.

Dimensions, etc.—Length, 278.8 feet; beam, 65.6 feet; mean draught, 22.96 feet; displacement, 7,000 tons. She has twin screws and is to make 15 knots. The coal capacity is 700 tons, giving a radius of action of 6,000 miles at 10 knots speed.

JEANNE D'ARC.

(Page 18, No. XIV.)

This vessel, originally intended to be like the *D'Entrecasteaux*, has also been completely modified, and will likewise be designed by M. Bertin on the lines of great speed and coal endurance, and is laid down at Toulon to be completed October 1, 1899.

Armament.—Two 7.64-inch B. L. R., eight 5.45-inch R. F. G., twelve 3.94-inch R. F. G., sixteen 3-pounder R. F. G., eight 1-pounder R. F. G., two Maxim machine guns, and two under-water torpedo tubes.

Protection.—A complete water-line belt of hardened steel 5.9 inches thick amidships and tapering to the extremities protects the hull and extends 2.3 feet above the water. Above this is worked a second complete belt, beginning with a thickness of 2.9 inches and tapering upward. The main protective deck has a maximum thickness of 3 inches, and the weight of the armor will amount to about 2,000 tons. The coal protection is extensive.

Motive power.—Three vertical triple-expansion engines develop 28,500 I. H. P. and produce a speed of 23 knots. Normand boilers. The normal coal capacity is 1,400 tons and the total capacity is 2,100 tons. With these amounts of coal the radii of action at 10 knots speed will be 10,000 and 15,000 miles, respectively, and at full speed 1,200 and 1,800 miles, respectively.

Dimensions, etc.—Length, 469.2 feet; beam, 63.6 feet; mean draught, 26.6 feet; displacement, 11,000 tons. Her complement will be 578 men and 48 officers.



CHASSELOUP LAUBAT.



JEMMAPES.

DUNOIS AND LA HIRE.

These torpedo vessels are designed by M. Trogneux and are laid down at Cherbourg to be completed September 1, 1898. The following are the published details:

Armament.—Six 2.56-inch R. F. G., six 3-pounder R. F. G.

Motive power.—Two vertical triple-expansion engines will develop 6,400 I. H. P. and give a speed of 23 knots. Normand boilers. The coal capacity is 137 tons, which will give a radius of action of 560 miles at full speed and 5,000 miles at 10 knots speed.

Dimensions, etc.—Length, 255.9 feet; beam, 27.9 feet; mean draught, 12.7 feet; displacement, 896 tons. The complement will be 120 men and 8 officers.

TORPEDO VESSEL M.[1]

The plans of this vessel are still under consideration. She will have a displacement of 375 tons, Normand boilers, and twin screws, a speed of 26 knots, and a radius of action of 2,500 miles at 10 knots. Her battery will consist of one 2.56-inch R. F. G.; seven 3-pounder R. F. G., and one above-water torpedo tube. Total complement 60 officers and men.

CHÂTEAURENAULT AND GUICHEN.

(Page 19, No. XIV.)

The former will be built at La Seyne, and will be fitted for petroleum fuel for auxiliary combustion. The latter is to be constructed at St. Nazaire, and will differ from the *Châteaurenault* in the arrangement of poop and forecastle and in the disposition of machinery and boilers.

VESSELS COMPLETED.

During 1895 the following-named vessels have been completed for service, viz: *Brennus*, *Jemmapes*, *Valmy*, *Bouvines*, *Dupuy de Lôme*, *Latouche-Tréville*, *Amiral Charner*, *Chanzy*, *Chasseloup-Laubat*, *Friant*, *Linois*, and *Forban*.

VESSELS LAUNCHED.

CHARLEMAGNE.

(Page 155, No. XII; 45, No. XIII.)

This battleship was successfully launched at Brest October 17, 1895. Her only remaining sister ships are the *St. Louis* and *Gaulois*, the *Henri IV* having been so completely modified that she is no longer a sister. The eight 5.46-inch R. F. G. in the central casemate are arranged each in a separate compartment with 3-inch steel external protection, but an unprotected space on the side between the regular belt and this 3-inch steel will allow shells to penetrate just below the battery deck. The main armor belt rises 20 inches above the water line and extends 4 feet 11 inches below it. At a point 8 inches below the water line the armor belt begins to taper down to 9.8 inches. The 3-inch belt is 3.3 feet wide and rises well forward to protect the forward

above-water torpedo tubes, while the other above-water tubes are protected by carrying a section of the 3-inch belt up and around them. Resting on the armor deck and within the 3-inch belt is a cofferdam extending completely around the ship and 3.3 feet high. The turrets are 15.7 inches thick. She carries twenty sets of Belleville boilers, eighteen in four water-tight compartments fitted to burn liquid fuel, and two auxiliary on the armor deck. The free board forward is 25.5 feet and aft 19 feet. Her complement will consist of 31 officers and 600 men.

MASSÉNA.

(Page 28, 29, No. XI.)

This battleship was launched at St. Nazaire in July, 1895, and on July 25, soon after the launching, she grounded on the rocks near Tourteaux and was successfully rescued only with great difficulty. She is the first battleship to be fitted with triple screws and two armored decks.

Armament.—Two 12-inch B. L. R. in turrets, one forward, one aft; two 10.8-inch B. L. R. in side turrets; eight 5.45-inch R. F. G., in pairs, in turrets on bows and quarters; eight 3.94 R. F. G., twelve 3-pounder R. F. G., twelve 1-pounder R. F. G., and six torpedo tubes, two of which are submerged.

Protection.—A complete water-line belt of steel, tapering from 17.7 inches to 9.8 inches; the large turrets 13.8 inches and their barbettes 15.8 inches; the 5.45-inch turrets 3.9 inches thick, and the armored deck 3.5 inches thick; also protection by cofferdams.

Motive power.—There are three independent vertical triple-expansion engines to develop 13,500 I. H. P., and twenty-four Lagrafel-D'Allest water-tube boilers. The coal supply is fixed at 630 tons, which will give a radius of action of 4,000 miles at 10 knots speed and 800 miles at full speed, i. e., 17.5 knots.

Dimensions, etc.—Length, 383.9 feet; beam, 66.5 feet; draught, 26.8 feet; displacement, 11,924 tons. The complement comprises 32 officers and 610 men.

BOUVET.

(Page 29, No. XI.)

This battleship, similar to the *Masséna*, was launched at L'Orient April 27, 1896.

POTHUAU.

(Page 28, No. XI; 153, No. XII.)

The first attempt to launch this vessel at the Graville Yard on August 22, 1895, resulted in failure, the ship sticking on the ways when partly launched owing to the insufficient lubrication of the ways and to their lack of proper inclination. She was immediately secured in place by shores and temporary keel blocks and on the following morning at high tide a second attempt was made with the aid of eight tugs, which was also ineffectual. The launch was then



POTHUAU.

postponed until the September spring tides, and in the meanwhile extensive preparations were made. The ship was carefully secured free from strain, the ways were lined up accurately, the cradle removed piece by piece, reslushed and replaced, and additional capstans fitted for heaving. Finally, on September 19 at high water, with the aid of four tugs, she was successfully floated.

The *Pothuau* is a modification of the *Latouche-Tréville* type, without bilge keels, but with a false keel of wood covered with sheet iron for the ship to take on in case of grounding. The use of woodwork is avoided and the steel decks are covered with linoleum. Her principal characteristics are:

Armament.—Two 7.64-inch (40 caliber) B. L. R. in closed turrets, electrically controlled, one forward, one aft; ten 5.45-inch (45 caliber) R. F. G. in echelon in the superstructure, with circular shields; ten 3-pounder R. F. G. on top of superstructure; eight 1-pounder R. F. G. distributed on bridge, stern walk, and in tops; four above-water torpedo tubes in broadside, training 60 degrees; six search lights.

Protection.—A complete water-line belt extending 8.2 feet above the water to the main deck, 2.4-inches thick amidships, and tapering to 1.3 inches at the extremities, provides practically complete side armor, backed by two thicknesses of side plating. The lower edge of this belt projects from the side, and is beveled. The turrets have from 7 to 5.5 inches of armor laid on two thicknesses of plating. The protective deck is curved, having a thickness of 3.3 inches on slopes and 1.4 inches on flat. Extensive cofferdams are fitted.

Motive power.—Two sets of 4-cylinder vertical triple-expansion engines develop 10,000 I. H. P., and give a speed of 19 knots under forced-draft, the power developed under natural-draft being 6,500 I. H. P. There are eighteen Belleville boilers in three compartments. The coal supply is 538 tons, which is calculated to give a radius of 4,500 miles at 10 knots and 900 miles at full speed.

Dimensions, etc.—Length, 370.7 feet; beam, 50.2 feet; draught, 21 feet; displacement, 5,360 tons. Complement, 20 officers and 441 men.

D'ENTRECASTEAUX.

(Page 30, No. XI; 153, No. XII; 46, XIII.)

This protected cruiser was launched at La Seyne June 11, 1896.

DU-CHAYLA.

(Page 154, No. XII.)

This protected cruiser was launched at Cherbourg November 18, 1895. She is of the *Bugeaud* type, though somewhat larger, and is the first cruiser of her size and type to be fitted with submarine torpedo tubes. Her characteristics are as follows, viz:

Armament.—Six 6.5-inch R. F. G., four 3.94-inch R. F. G., ten

3-pounder R. F. G., eleven 1-pounder R. F. G., and two under-water torpedo tubes.

Protection.—Complete protective deck with a thickness of 3.1 inches on slopes and 1.2 inches on flat. A cofferdam to contain cellulose is worked around the water line.

Motive power.—Two sets of vertical triple-expansion engines develop 6,000 I. H. P. under natural-draft and 9,500 I. H. P. under forced-draft, giving a maximum speed of 19.25 knots. Twenty Lagrafel-D'Allest water-tube boilers are arranged in three compartments. The coal capacity is 624 tons, giving a radius of 6,000 miles at 10 knots and 1,000 miles at full speed.

Dimensions, etc.—Length, 325.6 feet; beam, 44.8 feet; draught, 20.5 feet; displacement, 3,952 tons. Complement, 14 officers and 371 men.

D'ASSAS.

(Page 154, No. XII.)

This vessel, of the *Du-Chayla* class, was launched at St. Nazaire March 28, 1896.

CASSARD.

(Page 46, No. XIII.)

This vessel, also of the *Du-Chayla* class, was launched at Cherbourg May 27, 1896.

PASCAL.

(Page 28, No. XI; 154, No. XII.)

A protected cruiser, launched from the Mourillon Yard at Toulon September 26, 1895, possessing the following characteristics, viz:

Armament.—Four 6.5-inch R. F. G., ten 3.94-inch R. F. G., eight 3-pounder R. F. G., four 1-pounder R. F. G., and two torpedo tubes.

Protection.—Protective deck having a thickness of 1.97 inches on slopes and 1.38 inches on flat. Complete double bottom, and cellular construction along the water line.

Motive power.—Two sets of 4-cylinder vertical triple-expansion engines with piston valves to develop 8,500 I. H. P. and give a speed of 19 knots. There are sixteen Belleville boilers in four compartments. The coal capacity of 650 tons will give a radius of 5,500 miles at 10 knots and 1,000 miles at full speed.

Dimensions, etc.—Length, 326.1 feet; beam, 42.2 feet; draught, 21.4 feet; displacement, 3,988 tons. Complement, 14 officers and 364 men.

GALILÉE.

(Page 154, No. XII; 240, No. XIII.)

Cruiser of an improved *Surcouf* type launched April 28, 1896, at Rochefort Navy-Yard.

Armament.—Four 6.5-inch R. F. G. in sponsons on main deck; ten



FOUDRE.

3.94-inch R. F. G., ten 3-pounder R. F. G., four 1-pounder R. F. G., and two torpedo tubes.

Protection.—A complete protective deck 1.6-inches thick, upon which is stowed coal in bunkers out at the side. Complete cofferdams along the water line.

Motive power.—Two sets of 3-cylinder vertical triple-expansion engines, with auxiliary machinery in a separate compartment, are designed to develop 6,400 I. H. P. and give a speed of 20 knots. There are sixteen Belleville boilers in four compartments. The coal supply is 226 tons, giving a radius of 3,000 miles at 10 knots and 600 miles at full speed.

Dimensions, etc.—Length, 330 feet; beam, 35.1 feet; draught, 17.9 feet; displacement, 2,317 tons. Complement, 11 officers and 237 men.

FOUDRE.

(Page 29, No. XI.)

This torpedo-depot vessel was launched at Bordeaux by the Chantiers de la Société de la Gironde October 20, 1895. She has high free board and was built to correspond with the *Vulcan* of the British navy, although she is slightly smaller. The torpedo workshop is fitted with a complete set of manufacturing and repairing machinery driven by electric power, and a testing tank is provided. The usual supply of torpedoes, mines, and explosives is carried in roomy storerooms. Provision is made for stowing ten torpedo boats in two rows on gallows frames. The torpedo boats have a length of 62.3 feet and a displacement of 14.25 tons; their horsepower is 210, giving them 16.3 knots speed. One of the boats (p. 28, No. XIV) was constructed of aluminum by Messrs. Yarrow & Co., and was allowed to lie in a basin at Toulon pending the completion of the *Foudre*. The plates became so corroded in consequence that the hull had to be reconstructed of steel. In the spring of 1896 it was determined to convert this ship into an ordinary cruiser at the Toulon Navy-Yard and to utilize her torpedo boats for the protection of the fisheries. This change in the plans is severely criticised, as it will make the *Foudre* a more costly ship than the *Depuy de Lôme* has been, without attaining anything like the same fighting efficiency. Her principal characteristics at present are:

Armament.—Eight 3.94-inch R. F. G., one on poop, one on forecastle, and three in each broadside in sponsons; four 2.55-inch R. F. G., two on poop, two on forecastle, and four 1-pounder R. F. G. She will carry no torpedo tubes, but there will be six search lights.

Protection.—A heavy armored deck 4.6 inches thick on the slopes and 2.6 inches on the flat is composed in its transverse section of inclined plane surfaces instead of the usual curve. Above this deck along the water line, and extending 3.9 feet above the water, are extensive cofferdams. A débris deck is worked over the machinery and boiler spaces. The conning tower is protected by 4 inches of armor. There is a complete double bottom.

Motive power.—Two sets of 3-cylinder triple-expansion engines, to develop 11,500 I. H. P. and give a speed of 18.5 knots. There are twenty-four Lagrafel-D'Allest water-tube boilers in groups of four in six separate compartments. The coal capacity is 840 tons, which gives a radius of action of 6,000 miles at 10 knots speed and 1,300 miles at full speed.

Dimensions, etc.—Length, 380.6 feet; beam, 51.2 feet; draught, 23.5 feet; displacement, 6,090 tons. Complement, 18 officers and 392 men.

CASABIANCA.

(Page 154, No. XII; 46, No. XIII.)

Torpedo vessel of the *Cassini* class launched by the Chantiers de la Société de la Gironde at Bordeaux, September 21, 1895. The hull is divided into many water-tight compartments and there are ten complete transverse bulkheads. The following are the principal characteristics:

Armament.—One 3.94-inch R. F. G. on forecastle; three 2.55-inch R. F. G., one on poop and two in sponsons in waist; five 3-pounder R. F. G. on forecastle, poop, and in cabin; four 1-pounder R. F. G. on bridge. All torpedo tubes have been removed in accordance with the present custom in the French service which favors the removal of all above-water tubes that can not be properly protected by armor. Four searchlights.

Protection.—The machinery and boilers are protected by three courses of plating, in all eight-tenths of an inch thick, and by coal bunkers. The conning tower is protected by 1.6 inches of special steel.

Motive power.—Two sets of 4-cylinder vertical triple-expansion engines develop 5,000 I. H. P., and give a speed of 21.5 knots. There are eight Lagrafel-D'Allest water-tube boilers. The coal supply is 116 tons, giving radii of action of 4,500 and 500 miles at 10 knots and full speed, respectively.

Dimensions, etc.—Length, 262.4 feet; beam, 26.9 feet; draught, 11.5 feet; displacement, 960 tons. Complement, 8 officers and 135 men. The deadwood of this vessel is cut away sharply astern to give better turning qualities.

STEAM TRIALS.

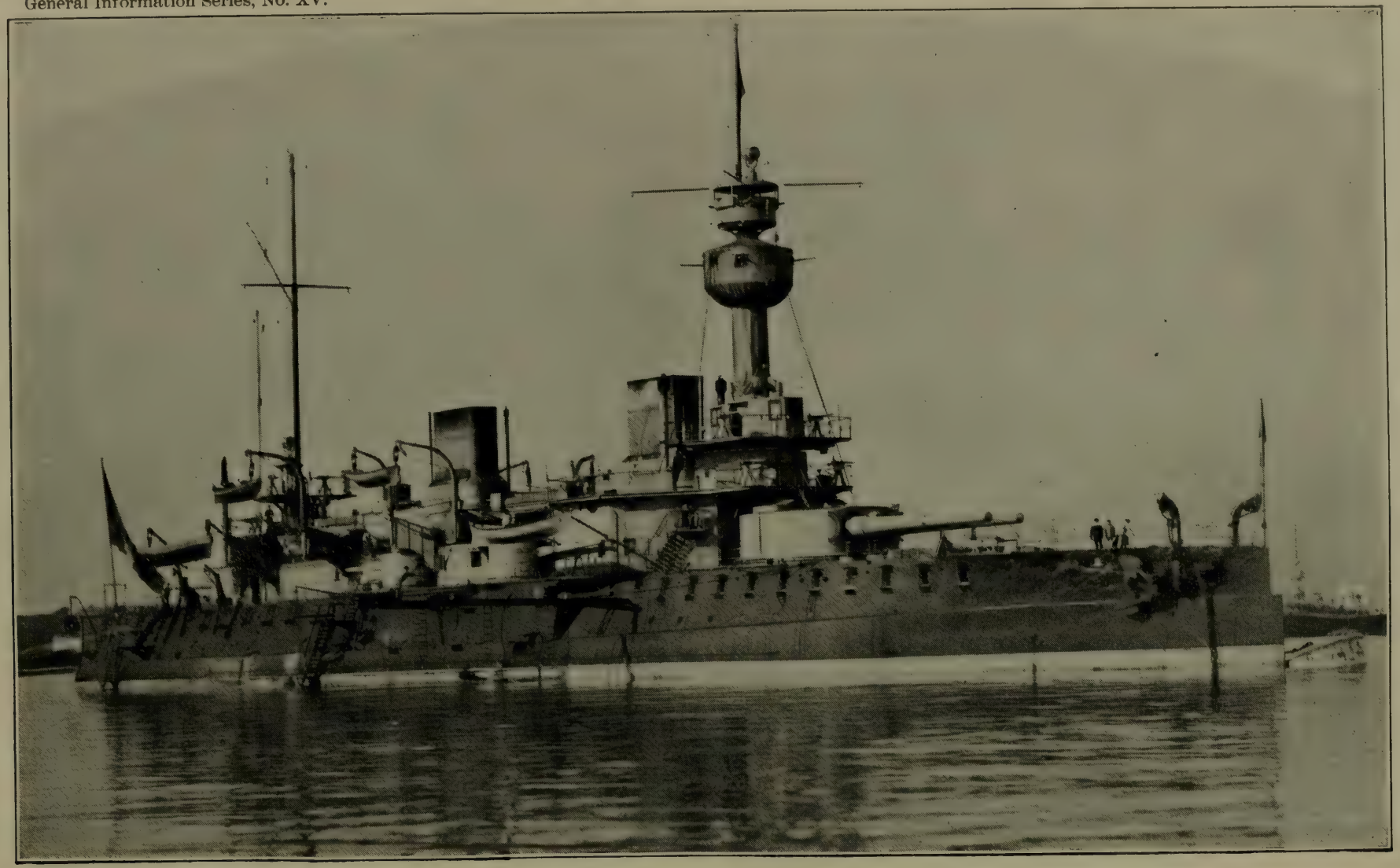
BRENNUS.

(Page 312, No. VII; 31, No. XI; 240, No. XIII; 24, 155, No. XIV.)

The modifications undergone by this vessel to increase her stability consisted in lowering the superstructure and conning tower one story, shortening the boat davits 5 feet, replacing the after military mast by a light wooden signal mast, shortening the foremast 12 feet and removing its lower top, and removing much of the superstructure plating. In addition to the above the lower topside plating was built out flush with the armor belt, using the cofferdam armor, and forming a caisson



CASABIANCA.



BRENNUS.



JAUREGUIBERRY.

abreast the casemates; this increased the stability at angles greater than 5 degrees, and resulted in a saving of 150 tons weight as well. These alterations increased the metacentric height about 10 inches. Her 6.5-inch guns of the model of 1887 were replaced by ten of the same caliber of the model of 1891. After these changes a series of steam trials followed. In September, 1895, off Brest, she made 15 knots with 6,245 I. H. P. On the 6th of the same month she made 17 knots with 13,200 I. H. P. In October an attempt to hold a full-power trial was interrupted by the heating of the head of one of the connecting rods.

In November, during a trial, while making 16.7 knots, the force of the sea drove in the deck at the bow, owing to the supports giving way, and the trial was abandoned. Later in the month a 6,000 I. H. P. trial gave a speed of 14.4 knots. In January, 1896, a full-power trial off Brest gave 17.12 knots with 14,060 I. H. P., 92.4 revolutions, and resulted in a consumption of 2.18 pounds of coal per I. H. P. per hour.

BOUVINES.

(Page 32, No. X; 32, No. XI; 24, No. XIV.)

The severe criticism undergone by this vessel caused the minister of marine to order another 4-hour full-power trial in March, 1896, which resulted in a mean speed of 15.3 knots. The full-power trials in July, 1895, gave a maximum speed of 16.05 knots.

AMIRAL TRÉHOUART.

(Page 341, No. VIII; 32, No. X; 156, No. XI.)

This battleship had her steam trial off Brest February 22, 1896. During two hours' run under forced-draft a speed of 15.4 knots was maintained on 7,590 I. H. P. and 108 revolutions. With 110 revolutions the speed was 15.8 knots. On May 1 a second trial gave results as follows: I. H. P., 6,700; revolutions, 105; speed, 15 knots; coal consumption per I. H. P. per hour, 2 pounds. A trial on May 6 gave: I. H. P., 8,350; revolutions, 112; speed, 15.8 knots; coal consumption, 2.4 pounds; this being a 24-hour trial at maximum power. Another similar trial May 12 gave: I. H. P., 5,220; revolutions, 96; speed, 14 knots, and coal consumption per I. H. P. per hour, 1.6 pounds.

JAURÉGUIBERRY.

(Page 31, No. X; 48, XIII.)

The preliminary trials of this vessel were temporarily delayed at Toulon owing to an accident to the starboard propeller, but were finally held in April, 1896. With 95 revolutions an average speed of 17.65 knots and a maximum speed of 18.07 knots were obtained and 15,800 I. H. P. developed. It is hoped that she will attain an average speed of 18 knots on her official trial. The electric turret-turning gear worked

with an ease and rapidity that excited admiration. A natural-draft trial May 20, 1896 gave: I. H. P., 13,820; revolutions, 96; speed, 17.6 knots, and coal consumption per I. H. P. per hour, 1.74 pounds.

A fatal accident occurred during the last trial of this battleship in June. A tube in one of the boilers ruptured lengthwise for a distance of 16 inches. The furnace doors were open at the time and the escaping steam which also drove the flame out into the fire room seriously burned and scalded ten firemen, six of them fatally. The boiler pressure was not excessive at the time, and the break in the tube was found to be due to defective make and not to defective metal.

CHARLES MARTEL.

(Page 31, No. X; 47, No. XIII.)

The preliminary trial of this vessel took place May 28, 1896. The I. H. P. developed was 2,056 and the revolutions 48, which gave a speed of 9.5 knots. Coal consumption per I. H. P. per hour, 1.7 pounds.

CARNOT.

(Page 27, No. IX; 31, No. X; 20, No. XIV.)

The preliminary trial of the *Carnot* June 11, 1896, gave 8,000 I. H. P. and a speed of 16 knots.

AMIRAL CHARNER.

(Page 27, No. IX; 156, No. XII; 240, No. XIII.)

This armored cruiser was at first fitted with a system of induced-draft which gave most unsatisfactory results, and a change was made causing a delay of eighteen months in the delivery of the vessel. The following table gives the results of her trials in 1895, the air pressure at full power being one-half inch:

	May 31.	June 13.	June 18.	July 5.
Number of boilers used	6	12	16	16
Total I. H. P	2,019	7.483	9,076	7,810
Revolutions	81	120	125	120
Duration of trial.....hours..	6	4	2	8
Speed .....knots..	13.5	18	18.4	.....
Coal per square foot of grate.....pounds..	12.42	32.14	23.68	18.35
Coal per I. H. P. per hour .....do....	1.62	2.16	1.79	1.6

The principal characteristics of this ship are as follows, viz:

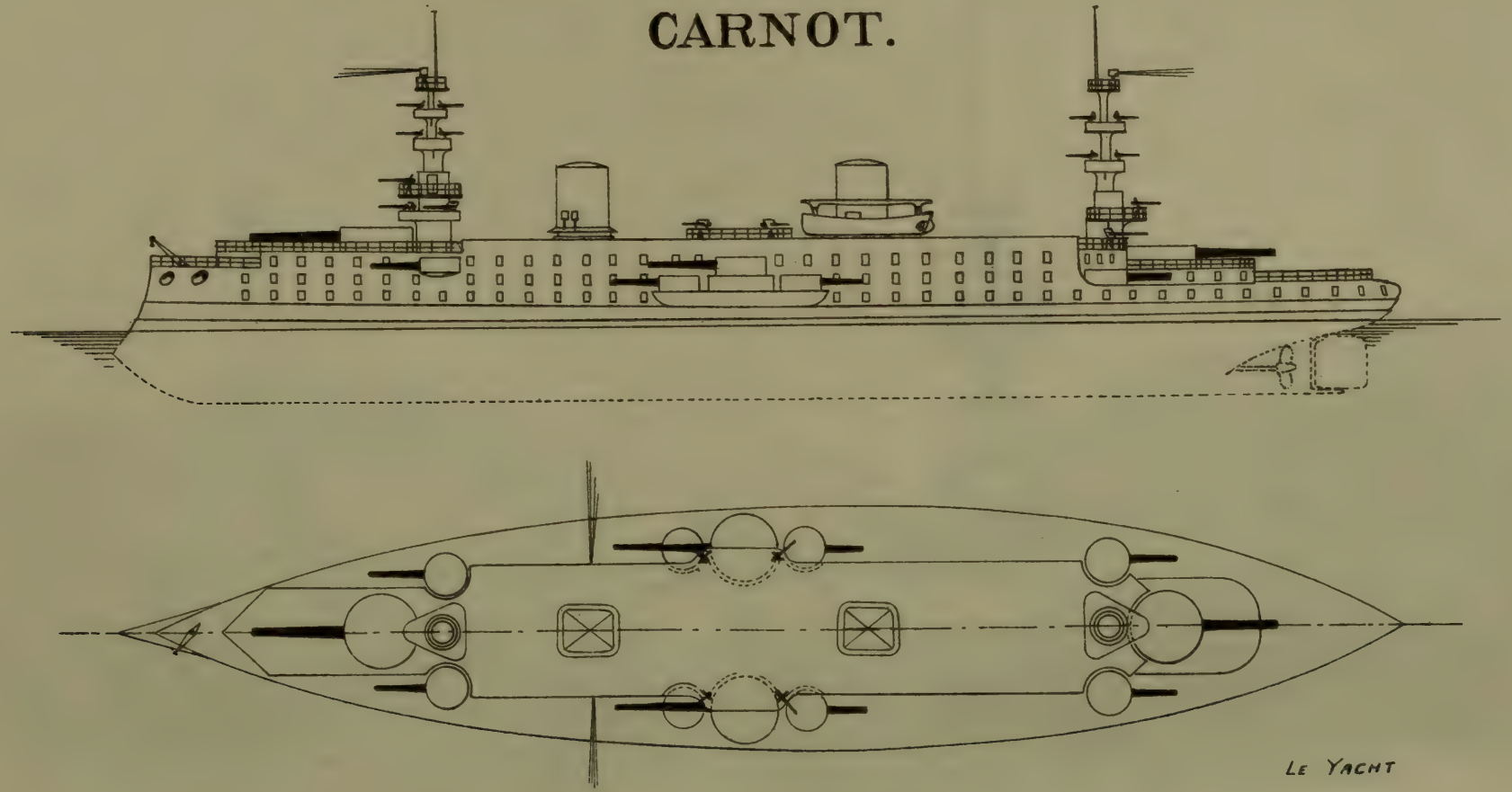
Armament.—Two 7.48-inch B. L. R. in closed hydraulic turrets, one forward, one aft; six 5.5-inch R. F. G. in closed hydraulic turrets, three in each broadside; four 2.56-inch R. F. G., six 3-pounder R. F. G., six 1-pounder R. F. G., and four torpedo tubes. Six search lights.

Protection.—A complete belt 4.7 inches thick extends from the edge of the armored deck below the water line up to the main deck. The



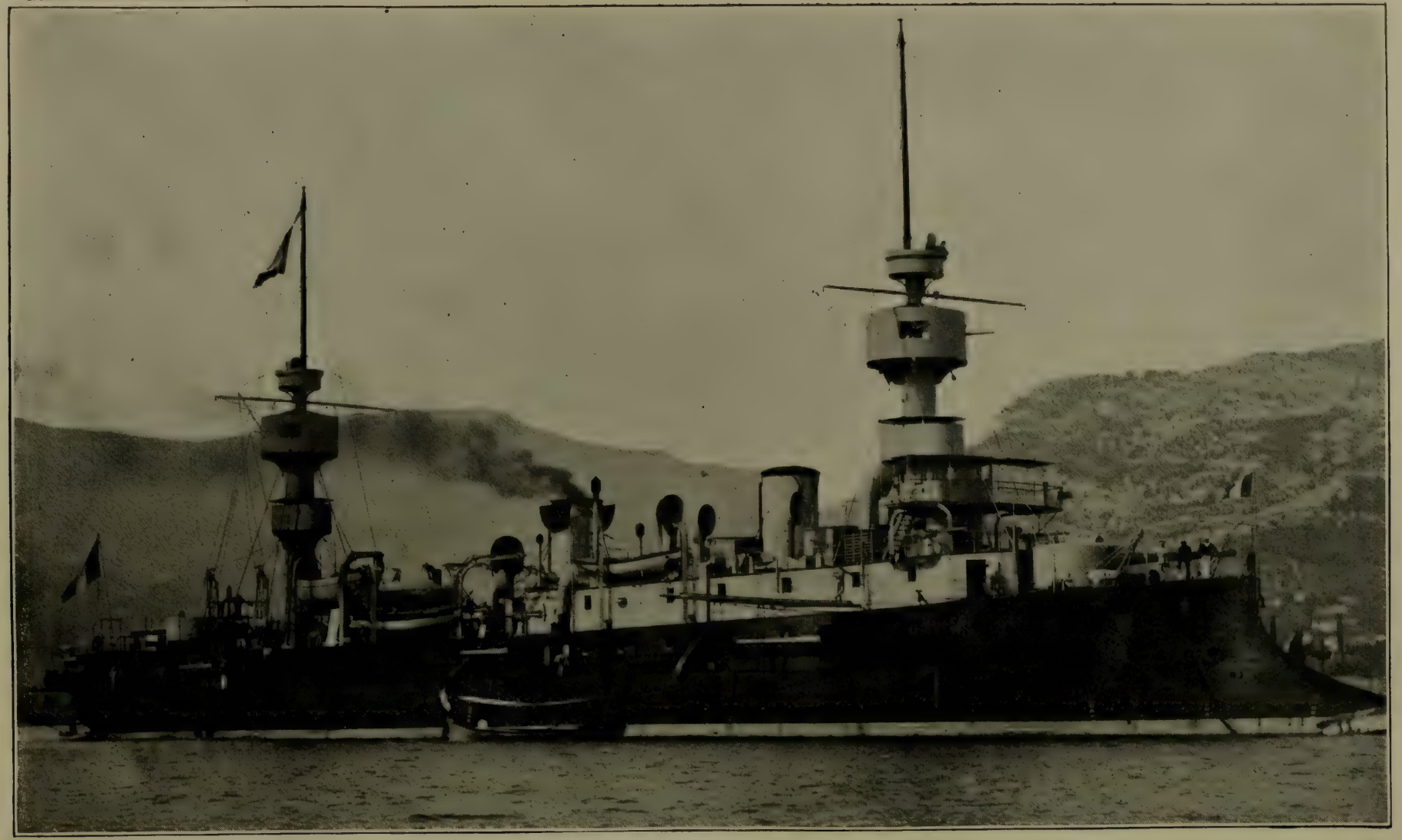
CARNOT.

CARNOT.



LE YACHT

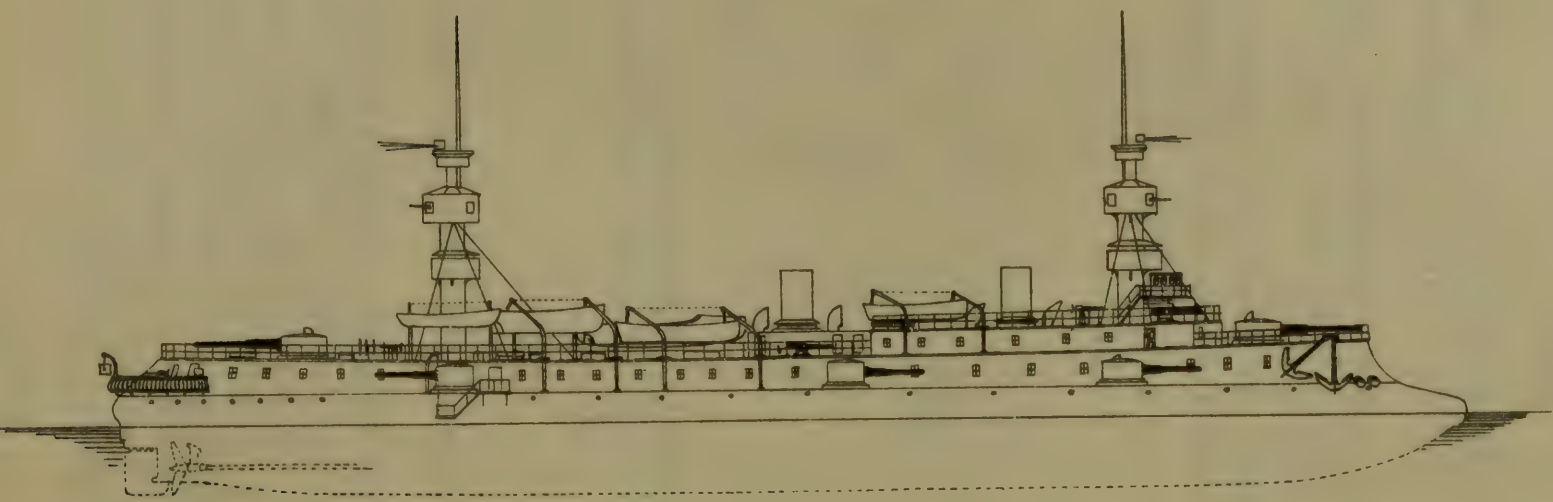


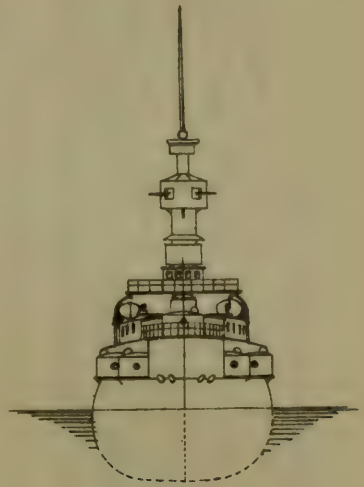


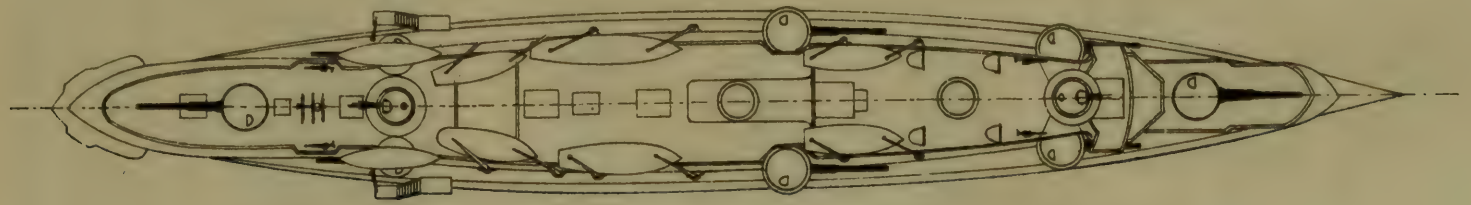
AMIRAL CHARNER.

AMIRAL CHARNER

AND CLASS.







LE YACHT

armored deck, from 3.2 inches to 2.4 inches in thickness, curves from 4 feet below the water line at the side to 2 feet above it on top. There is a débris deck over the machinery. Cofferdams containing cellulose furnish additional protection to the water line. The turrets are armored with 3.6 inches of steel and the ammunition tubes with 4.3 inches.

Motive power.—Two 3-cylinder horizontal triple-expansion engines develop 9,076 I. H. P., and give a speed of 18.4 knots. Steam is furnished by sixteeen Belleville water-tube boilers in four compartments. Coal capacity, 413 tons.

Dimensions.—Length, 347.8 feet; beam, 45.8 feet; draught, 19.6 feet; displacement, 4,750 tons.

CHANZY.

(Page 27, No. IX.)

A sister ship of the *Amiral Charner*, whose steam trials were carried on in 1895 in like manner, with the following results:

	June 6.	June 11.	June 15.	June 20.	June 25.
Number of boilers	12	16	8	16	16
Total I. H. P	7,360	8,398	2,328	7,825	5,056
Revolutions	112.3	118	80.4	115	104
Duration of trials ....hours..	3	2	0	8	24
Speed ....knots..	17.1	17.8	.....	17.5	16.1
Coal per square foot of grate ....pounds..	30.73	26.22	10.08	19.32	13.39
Coal per I. H. P. per hour ....do...	2.15	2.06	1.45	1.70	1.63

DESCARTES.

(Page 28, No. XI; 154, No. XII; 22, No. XIV.)

On May 2, 1896, a preliminary trial gave the following results: I. H. P., 8,600; revolutions, 134; speed, 19.75 knots; and coal consumption per I. H. P. per hour, 2 pounds.

On May 15 a trial at reduced power gave: I. H. P., 1,164; revolutions, 80; speed, 11 knots; and coal consumption per I. H. P. per hour, 14 pounds.

On May 19 another trial gave: I. H. P., 3,660; revolutions, 103; speed, 16 knots; and coal consumption per I. H. P. per hour, 1.36 pounds.

BUGEAUD.

(Page 27, No. IX; 32, No. X; 48, No. XIII; 172, No. XIV.)

After modifications in her system of ventilation this vessel had preliminary trials off Cherbourg, in which the engines developed 9,000 I. H. P. and the mean speed reached 18.9 knots. At later full-power trials in April, 1896, a speed of 19 knots was attained and the previous I. H. P. slightly exceeded. The coal-consumption trial April 4 resulted in the use of 1.34 pounds of coal per I. H. P. per hour, with I. H. P., 3,500; speed, 15.5 knots; and revolutions, 102.

LINOIS.

(Page 28, No. XI; 49, No. XIII; 26, No. XIV.)

An 8-hour official run off Toulon in July, 1895, gave an average speed of 15.6 knots, with 3,400 I. H. P. and 128 revolutions. The coal consumption was 1.64 pounds per I. H. P. per hour. In August a 6-hour run resulted in 18.4 knots and 147 revolutions.

SURPRISE.

(Page 30, No. XI; 23, No. XIV.)

In December, 1895, the trial under natural-draft gave 12.5 knots, with 700 I. H. P., and under forced-draft 13 knots, with 900 I. H. P. In March, 1896, off Cherbourg, 1,000 I. H. P. gave 13.6 knots speed.

CASABIANCA.

A 4-hour trial of this vessel in March, 1896, gave a speed of 21.22 knots.

CASSINI.

(Page 29, No. XI; 49, No. XIII; 26, No. XIV.)

After undergoing repairs the *Cassini* had another preliminary trial in November, 1895, during which the speed was 19 knots and the I. H. P. 3,800. In March, 1896, the official trials were held, and under forced-draft the engines developed 5,594 I. H. P., and a speed of 21.17 knots resulted. An 8-hour progressive trial in April gave 3,600 I. H. P. and 20 knots speed.

This vessel has undergone many changes from the original design as represented by the *D'Iberville*, and her principal characteristics are given below:

Armament.—One 3.94-inch R. F. G. on forecastle; three 2.56-inch R. F. G., one on poop and two in sponsons in waist; seven 3-pounder R. F. G., two on forecastle, two in waist, two on poop, and one in cabin; four 1-pounder R. F. G. on bridge. No torpedo tubes. Four search lights.

Protection.—A strake of 0.5-inch hardened steel is worked over the side in wake of the machinery and boilers, and the outer and inner plating of the side together make an additional thickness of 0.5-inch, making a total of 1 inch. There is a double bottom under the machinery and boilers which can be used for water ballast; there is also extensive coal protection. Conning tower 2 inches thick.

Motive power.—There are two sets of 4-cylinder vertical triple-expansion engines which were intended to develop 5,000 I. H. P. and give the vessel a speed of 21.5 knots. The steam is supplied by eight Lagrafel-D'Allest water-tube boilers. The auxiliary machinery is in a separate compartment.

Dimensions.—Length, 262.3 feet; beam, 26.8 feet; draught, 11.5 feet; displacement, 943 tons.



LINOIS.



D'IBERVILLE.

VESSELS RE-ARMED, REFITTED, ETC.

The following-named vessels are to be fitted for the use of petroleum as auxiliary fuel, viz: *Charlemagne*, *Gaulois*, *Caïman*, *Indomptable*, *Fulminant*, *Terrible*, *Tage*, *Sfax*, and *Vautour*.

Changes in the motive power of vessels, either proposed or already accomplished, include the following: *Amiral Baudin*, a set of new direct-tube boilers and a new conning tower; *Tempête*, to have a new set of boilers; *Indomptable*, to have a new set of single-ended cylindrical boilers; *Vauban*, new return-tube boilers; *Surcouf* and *Forbin*, to receive new sets of Niclausse boilers at Rochefort; *Formidable*, new boilers; *Condor* has received new boilers and her machinery has been put in perfect condition; *Dupuy de Lôme* will probably receive a new set of boilers in the near future; *Couleuvrine* new D'Allest boilers; *Troude*, new direct-tube boilers; *Bombe* class, new Normand boilers.

The following changes in armament or protection have been made: *Fulminant* to receive an additional 3-pounder R. F. G. on a platform in rear end of superstructure. *Requin*, at Cherbourg, has had part of her heavy armor belt removed, and two 16.5-inch B. L. R. are to be replaced by two 13.3-inch (35 caliber) B. L. R., the reduction in caliber being compensated by an increase in initial velocity. *Jemmapes* and *Valmy* are to have their systems of ventilation improved; to have steam heat installed in the turrets as well as to provide proper drainage for them; and to have the 37-millimeter H. R. C. used to arm boats replaced by 1-pounder R. F. G. The six 37-millimeter H. R. C. not used in boats will be retained. *Furieux* has undergone extensive alterations at Cherbourg. A band of her belt armor 19.7 inches wide has been removed for the length of the ship, and four 2.55-inch and 3.94-inch R. F. G. installed. There is a new conning tower and greater protection for the guns. *Dupuy de Lôme* landed her 6.5-inch R. F. G. which were sent to Ruelle where they will be fitted with viroles and then installed on board of the *Du Chayla*. The *Depuy de Lôme* received in return guns that were already so fitted and which originally belonged to the *Brennus*. Modifications were also made in the piping for emptying the water ballast, and the ventilation about the auxiliary machinery improved. *Jean Bart* will probably be sheathed. Two of her torpedo tubes will be removed and racks fitted for torpedoes. *Duquesne* will be fitted with new crank shafts. *Friant* will probably be overhauled, signs of weakness having become apparent in the displacement of stanchions in the fire rooms, probably due to some structural weakness. The *Amiral Duperré*, *Dévastation*, *Courbet*, and *Redoubtable* to have new conning towers. The *D'Iberville* has landed all torpedo tubes and mounted 3-pounder R. F. G. in their places. The tubes have been removed from all vessels of the *Vautour* class and from many of the *Forbin* class.

VESSELS LOST, SOLD, OR STRUCK FROM THE LIST.

The *Richelieu*, *Colbert*, *Trident*, and *Suffren* will be condemned in the near future and turned over for use in some other department of the

public service, a custom that now prevails in the French service. The following ships are to be sold, viz: *Marengo*, *Vétéran*, *Bélier*, *Bouledogue*, *Néréïde*, *Magon*, *Finistère*, *Vengeance*, *Ablette*, *Canard*, *Zéphyr*, *Saumon*, *Dorade*, and torpedo boats *Nos. 17*, *20*, and *47*. The following have been struck from the list: *Djoué*, *Mirmidon*, *Hugon*, *Topaze*, *L'Épée*, and *Teverer*.

TORPEDO BOATS.

In the budget for 1896 the following boats are appropriated for in part: *M*, 375 tons; *Aquilon*, 120 tons, finished December, 1895; *Mangini*, 129 tons; *Cyclone* (*ex-Tenare*) *Forban*, 136 tons, finished August, 1895; *Nos. 201* to *205*, 85 tons; P^{25}, P^{26}, 85 tons; *D* to *I*, 14 tons; *Morse* and *Gustave Zédé*, submarine boats.

The estimates for 1897 provide for one large torpedo boat and six 85-ton boats. Cherbourg will become the port for repairs to torpedo boats.

FORBAN.

(Page 53, No. XIII.)

The preliminary trial of this torpedo boat was held off Havre in August, 1895, and a mean speed of 29.26 knots obtained; during part of the trial 30 knots was exceeded.

The official trials were held off Cherbourg. On September 17, 1895, an 8-hour trial at 14-knots speed resulted in the consumption of 423.3 pounds of coal per hour. On the 26th of the same month the full-power trial was held and the displacement was then about 125 metric tons, including torpedo tubes, torpedoes, battery, coal, complement with their effects, provisions, water, and electric plant. The trial consisted of three runs over the measured course, one hour's steaming at large, and three more runs over the course. The speed during the hour's run at large was estimated from the mean revolutions, the speed corresponding to the revolutions being ascertained by the two series of runs over the measured course, the middle run of each series being given double weight in the calculation. The speed attained was 31.029 knots, beating the world's record, and the coal consumption was 5941.3 pounds per hour. The twin screws of this boat both revolve the same way and their blades overlap; both are right-handed. Mr. Normand claims that this system gives half a knot greater speed than the usual way of fitting one right-handed and one left-handed screw.

AQUILON.

(Page 53, No. XIII.)

This torpedo boat completed her trials off Cherbourg in February, 1896, and won for M. Normand a premium of $3,860. At the preliminary trial a mean speed of 25.8 knots was obtained on 360 revolutions. The official trial resulted in a speed of 26.17 knots.



FORBAN.



GEFION. (Page 42, No. XIV.)

TORPEDO BOAT NO. 187.

(Page 53, No. XIII.)

This boat, built by M. Normand, in her official trial in November, 1896, made a mean speed of 25.73 knots, exceeding the contract requirements by 2.73 knots.

Torpedo boats *Nos. 17* to *21* have been sold. *No. 62* was injured in a collision with *No. 189*.

SUBMARINE BOATS.

The ministry has invited public competition for designs for a submarine torpedo boat. The conditions to be filled are: A speed of 12 knots; a radius of 100 miles at 8 knots; a radius when submerged of 10 miles at 8 knots; limit of displacement 200 tons, and to have two torpedoes ready to discharge. Very complete plans must be submitted and a prize of $1,930 will be awarded for the best, and lesser prizes for others possessing merit. A second set of prizes, amounting in all to $1,930, will be awarded for the best solutions of special features of submarine navigation, as follows: (1) The motive power and its control; (2) the regulation of the immersion, stability and directive force under water; (3) safety apparatus of all sorts; (4) means of sighting and keeping lookout; (5) offensive and defensive apparatus.

GERMANY.

The estimates for 1896–97 furnished by the Government provided as follows: For the battleship *Kaiser Friedrich III* (third payment), for a battleship to replace the *Friedrich der Grosse* (first payment), for machinery and boilers for *Sachsen* class (last payment), for a cruiser to replace the *Leipzig* (second payment), for cruisers *K*, *L*, and one to replace the *Freya* (second payment), for cruisers *M*, *N*, and *G* (first payment), for a division torpedo boat (first payment), for other torpedo boats (first payment), and for a stationnaire for Constantinople. Total, $13,279,382.31. Of the above all items for carrying on work already begun were allowed by the Reichstag, and the following new ships authorized, viz: A battleship to replace the *Friedrich der Grosse* to cost $3,401,625; two cruisers, *M* and *N*, to cost each $1,809,375; one cruiser, *G*, to cost $627,250; one torpedo division boat to cost $210,611.25, and eight torpedo boats to cost in all $434,250.

The estimates for 1897–98 contemplate the building of three battleships to cost about $5,114,500 each, and seven cruisers to cost from $1,447,500 to $3,184,500 each.

KAISER FRIEDERICH III (ERSATZ PREUSSEN).

(Page 29, No. XIV.)

This vessel, which was launched July 1, 1896, differs from the *Wörth* class in having three screws, the middle one to be protected by a curved steel shield under water. The general characteristics are as follows, viz:

Armament.—Four 9.45-inch (40 caliber) B. L. R. in barbette turrets;

twelve 5.9-inch R. F. G. in battery and six 5.9 inch R. F. G. in turrets; twenty-four smaller R. F. G.; eight 3-inch machine guns, and six torpedo tubes, of which four are submerged.

Protection.—An armor belt of Harveyed steel extends from the stem aft for four-fifths of the ship's length with a thickness of 11.8 inches tapering to 5.9 inches. Barbette-turret armor 9.8 inches thick and smaller turret and casemate armor 5.9 inches thick. The conning towers are 11 inches and 5.9 inches thick. Protective deck 2.6 inches thick over belt and 2.9 inches thick abaft belt. Débris deck 0.78 inch thick. The cofferdams will contain conglomerate cork filling.

Motive power.—Three sets of 3-cylinder vertical triple-expansion engines develop 13,000 I. H. P., and give a speed of 18 knots. There will be eight cylindrical and six Dürr water-tube boilers. Coal capacity, 650 tons.

Dimensions, etc.—Length, 377.9 feet; beam, 66.9 feet; draught, 25.7 feet; displacement, 11,050 tons. Complement, 655 men.

BATTLESHIP (ERSATZ FRIEDRICH DER GROSSE).

This battleship will probably be of the same type as the *Kaiser Friedrich III*, and will be built at Wilhelmshaven.

ARMORED CRUISER (ERSATZ LEIPZIG).

(Page 30, No. XIV.)

The principal characteristics of this vessel, building at the navy-yard, Kiel, are:

Armament.—Four 9.45-inch B. L. R. in turrets; twelve 5.9-inch R. F. G., six in casemates and six in turrets; ten 3.5-inch R. F. G.; ten 1-pounder R. F. G., and several 3-inch machine guns. Five submerged and one above-water torpedo tubes.

Protection.—Steel belt 7.8 inches thick amidships and 3.9 inches at the ends. Large turrets 7.8 inches thick, smaller ones 3.9 inches thick. The thickness of the protective deck will be 1.9 inches in the middle above water, at the ends above water 1.3 inches, and under water 1.9 inches. Splinter deck, 0.7 inch thick. Conning tower, 7.8 to 3.9 inches thick.

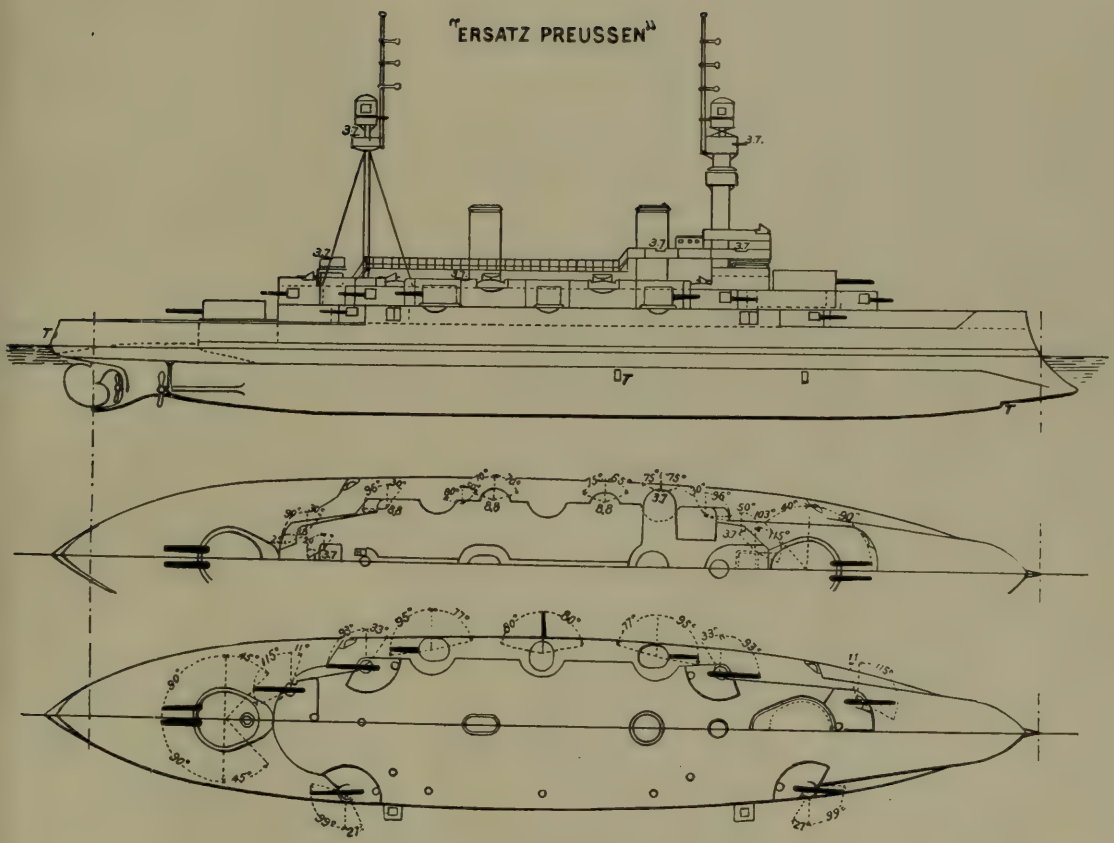
Motive power.—Three sets of 4-cylinder vertical triple-expansion engines driving triple screws to develop 13,500 I. H. P., and give a speed of 18.5 knots. There will be eight cylindrical boilers and six water-tube boilers of either Dürr or Niclausse type. Coal supply, 1,000 tons.

Dimensions, etc.—Length, 393.7 feet; beam, 66.8 feet; draught, 25.8 feet; displacement, 10,650 tons. Complement, 565 men. Hull sheathed with wood and Muntz metal.

PROTECTED CRUISERS K, L, ERSATZ FREYA, M, N.

(Page 30, No. XIV.)

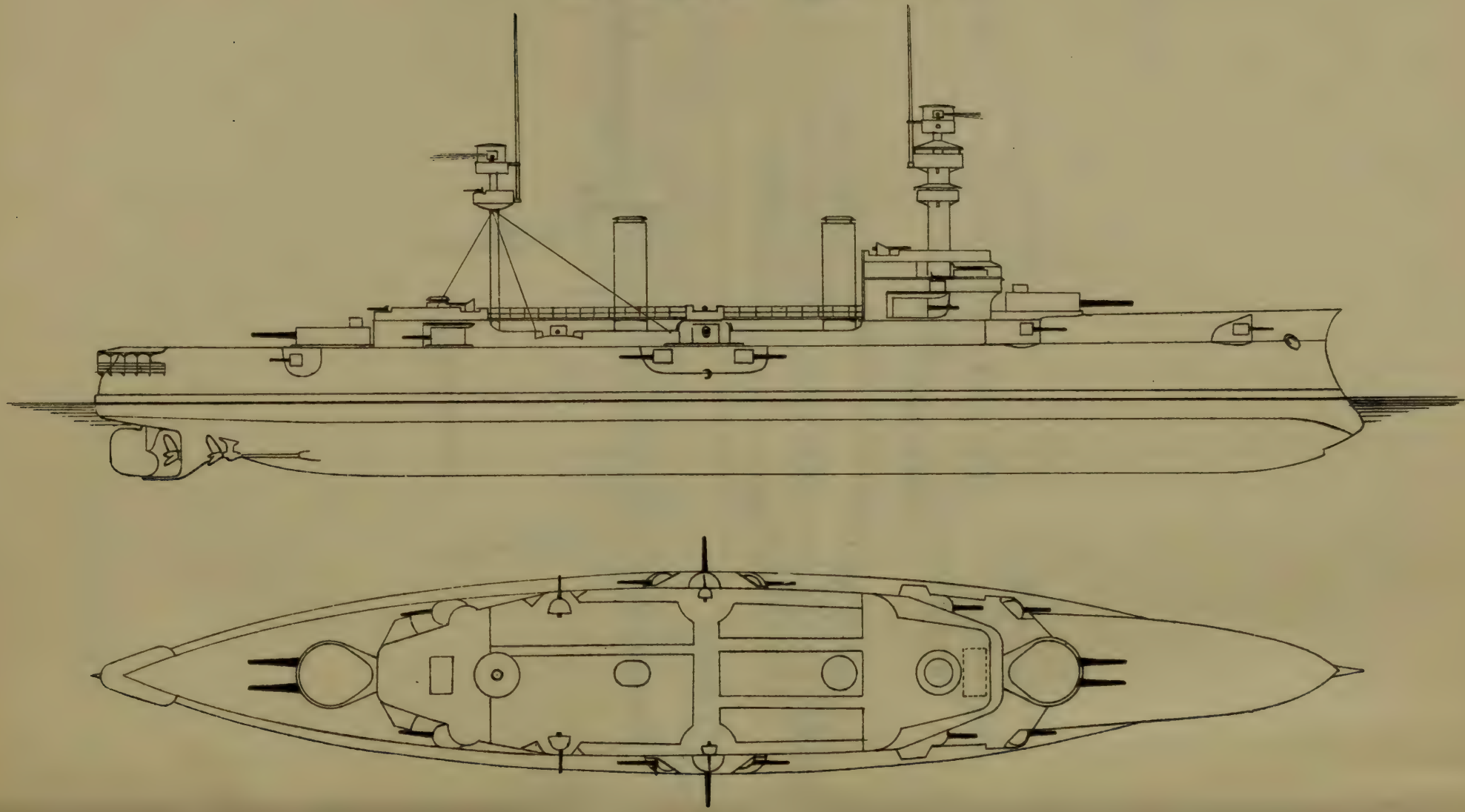
Cruisers *M* and *N* allowed in this year's budget will be of the same type as the other three, except that their torpedo armament will be

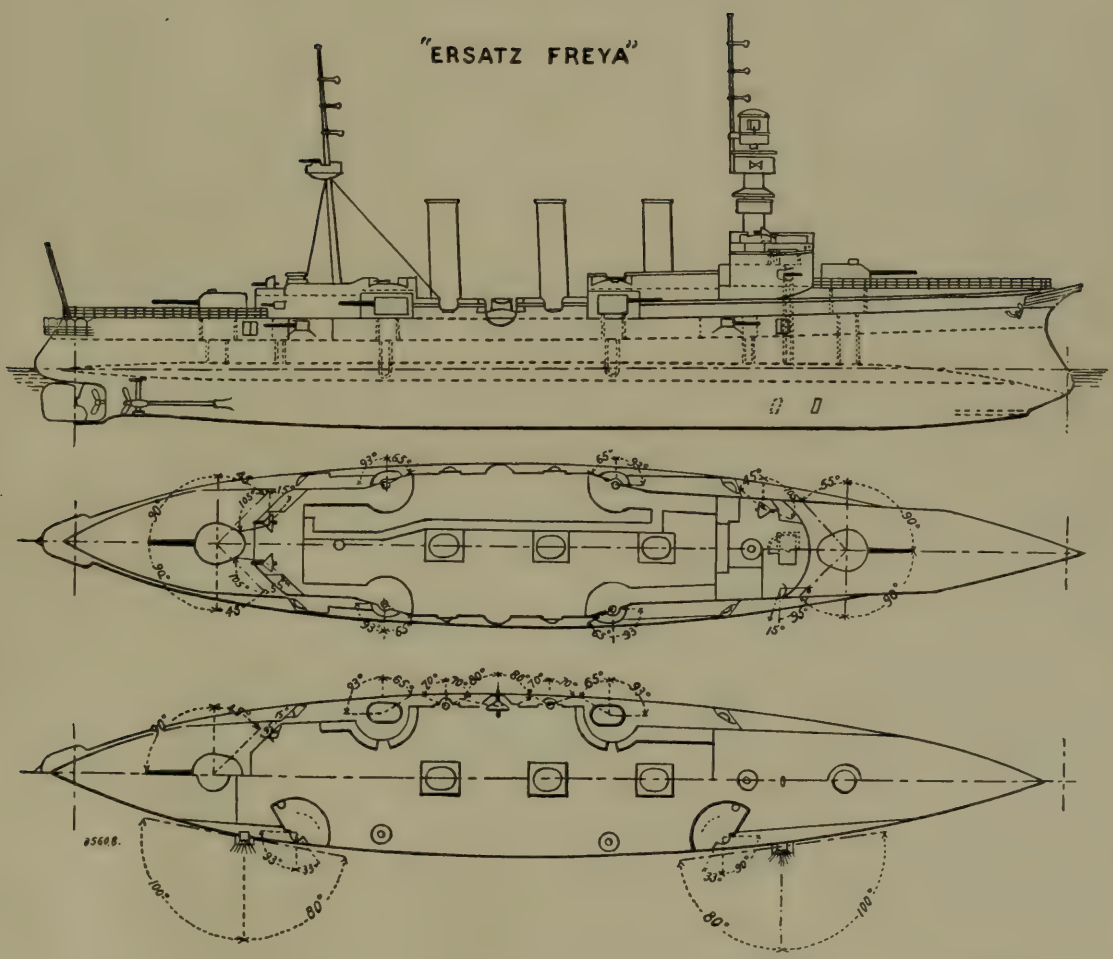


KAISER FREIDERICH III.

Engineering.

ERSATZ LEIPZIG.





Engineering.



HELA.

more extensive. The first three are being constructed, one at Stettin, one at Bremen, and one at Dantzic. *M* and *N* will be laid down, the former at the navy-yard at Dantzic, and the latter by the Vulcan Works at Stettin. Their principal characteristics are as follows:

Armament.—Two 8.27-inch (40 caliber) B. L. R. in turrets; eight 5.9-inch (40 caliber) R. F. G., four in side turrets and four in broadside armored casemates; ten 3.47-inch (30 caliber) R. F. G., with shields; ten 1-pounder R. C.; four 0.3-inch machine guns, and three 18-inch torpedo tubes all submerged, one in bow and two in broadside. *M* and *N* will have more.

Protection.—At a draught of 20.5 feet the armored deck comes 4.9 feet below water and its middle point 1.8 feet above water. Its thickness varies as follows: On the slopes amidships for half the length 3.9 inches, forward of this from 2.75 to 2 inches, abaft it 2.75 inches, and on top 1.6 inches. A cofferdam 229.6 feet long, 8.2 feet wide, and 27.6 inches thick protects the side. The turrets are 4 inches thick, so are the casemates, and the ammunition tubes vary from 3 to 4.7 inches. The forward conning tower is 6 inches thick and the after one has 5-inch Krupp steel armor. The bases of the smoke pipes are protected by 4-inch armor. The bulkheads of the engine and fire rooms are carried up to the armor deck without a break of any kind.

Motive power.—Three sets of 3-cylinder vertical triple-expansion engines in separate compartments drive triple screws and will develop 10,000 I. H. P., and give a speed of 18.5 knots. Water-tube boilers in six water-tight compartments are assigned as follows: *K*, 16 Belleville; *L*, 12 Dürr; *Ersatz Freya*, 12 Niclausse, and *M* and *N* not yet decided.

Dimensions, etc.—Length, 344.5 feet; beam, 57.1 feet; draught with 500 tons of coal, 20.5 feet, and with 950 tons of coal 21.8 feet. Corresponding displacements, 5,650 and 6,100 tons. The foremast has two inner spiral stairways, two tops and one search-light stand, and the mainmast one top. Two of these vessels are fitted as flagships.

HELA.

(Page 31, No. XIV.)

This dispatch vessel has six 1.97-inch R. F. G. instead of five. There are also three torpedo tubes, one being submerged. The protection is given by a protective deck and cofferdams. The speed is to be 20 knots with 6,000 I. H. P. and the coal capacity 360 tons.

FOURTH-CLASS CRUISER, G.

This cruiser will be a sister of the *Geier*, and will be built by contract.

STEAM TRIALS.

KAISERIN AUGUSTA.

(Page 46, No. X; 48, No. XI; 56, No. XIII.)

In an official 6-hour full-power trial off Kiel, in July, 1895, the average I. H. P. developed was 13,800, and the maximum I. H. P. was 14,800.

This was after the pitch of the middle screw had been reduced below that of the others, and the average speed attained was 22.5 knots. A second trial in December, under forced-draft, gave a speed of 22.8 knots.

GEIER.

(Page 42, No. XII; 31, No. XIV.)

The trials of this vessel were completed in January, 1896.

Trial.	Draught.	Displacement.	Speed.	Steam pressure per square inch.	I. H. P.	Revolutions.	Number of boilers.	Air pressure.	Coal used per I. H. P. per hour.
	Feet.	*Tons.*	*Knots.*	*Pounds.*				*Inches.*	*Pounds.*
6-hour forced	15.4	1,759	16.29	175	2,884	139.1	4	.25	1.99
3-hour forced	15.3	1,751	16.29	176	2,960	137.6	4	.28	2.14
24-hour natural	15.2	1,730	14.97	173	1,854	121.3	4	.....	1.76
24-hour natural	15.4	1,760	10.47	172	608	83.9	2	.....	2.15

COMET.

(Page 56, No. XIII.)

In a 2-hour trial under forced-draft this vessel attained a mean speed of 20.8 knots.

TURNING TRIALS.

KAISERIN AUGUSTA.

(Page 46, No. X; 48, No. XI; 56, No. XIII.)

The following are the very valuable results attained on the system of complete turning trials undergone by this vessel in 1895:

	All three engines ahead.		Outer and middle engines ahead, inner engine stopped.		Outer and middle engines ahead, inner engine same speed astern.		Outer and middle engines ahead, inner engine slow speed astern.	
Number of circle	1	2	3	4	5	6	7	8
Helm angle	39° S.	39° P.	39° S.	39° P.	39° S.	39° P.	39° S.	39° P.
Revolutions:								
Port—								
Ahead	68	68	(*a*)	68	.....	68	.....	68
Astern	.....	.....	.....	.....	68	.....	20	.....
Middle—								
Ahead	68	68	68	68	45	68	68	68
Astern	.....	.....	.....	.....	.....	.....	.....	.....
Starboard—								
Ahead	68	68	68	(*a*)	68	.....	68	.....
Astern	.....	.....	.....	.....	.....	52	.....	25
Speed ..... knots	12	12	12	12	12	12	12	12
Tactical diameter ..... yards	800	798	765	746	774	679	779	778

a Stopped.



GEIER.

Turning trials—Continued.

	All three engines ahead.		Outer and middle engines ahead, inner engine stopped.		Outer and middle engines ahead, inner engine same speed astern.		Outer and middle engines ahead, inner engine slow speed astern.	
Number of circle	1	2	3	4	5	6	7	8
Turning through:								
4 points—								
Time	1m 20s	1m 3s	1m 7s	1m 5s	1m 10s	1m 8s	1m 9s	1m 6s
Speed knots	10	9	8	8	8	8	8	8
Heel	1¼° S.	1° P.	½° S.	¾° P.	1° S.	½° P.	¾° S.	½° P.
8 points—								
Time	2m 25s	2m 0s	2m 20s	2m 10s	2m 33s	2m 18s	2m 28s	2m 16s
Speed knots	8	8	7	7	6	6	6	6
Heel	1½° S.	1° P.	1° S.	¾° P.	½° S.	½° P.	½° S.	¼° P.
16 points—								
Time	4m 36s	4m 8s	5m 2s	4m 31s	6m 28s	5m 20s	5m 50s	5m 6s
Speed knots	7	7	6	6	3	2	4	4
Heel	¾° S.	½° P.	¼° S.	¼° P.	¼° S.	0°	0°	0°

	Middle engine stopped.						Both side engines stopped, middle engine ahead.		Outer and middle engines full speed ahead, inner engine slow speed ahead.
	Both side engines ahead.		Outer engine ahead, inner engine stopped.		Outer engine ahead, inner engine same speed astern.				
Number of circle	9	10	11	12	13	14	15	16	17
Helm angle	39° S.	39° P.	39° S.	39° P.	39° S.	39° P.	39° S.	39° P.	39° S.
Revolutions:									
Port—									
Ahead	68	68	(a)	68	.....	68	(a)	(a)	20
Astern	.....	.....	.....	.....	47	.....	.....	.....	.....
Middle—									
Ahead	(a)	(a)	(a)	(a)	(a)	(a)	68	68	103
Astern	.....	.....	.....	.....	.....	.....	.....	.....	.....
Starboard—									
Ahead	68	68	68	(a)	68	.....	(a)	(a)	102
Astern	.....	.....	.....	.....	.....	50	.....	.....	.....
Speed knots	12	12	12	12	12	12	12	12	12
Tactical diameter yds	936	926	973	913	762	746	722	728	749
Turning through:									
4 points—									
Time	1m 30s	1m 18s	1m 30s	1m 32s	1m 33s	1m 22s	1m 14s	1m 14s	1m 5s
Speed knots	9	9	8	8	7	7	8	8	11
Heel	¾° S.	¾° P.	½° S.	½° P.	¼° S.	½° P.	¾° S.	¾° P.	1° S.
8 points—									
Time	2m 50s	2m 46s	3m 17s	3m 16s	3m 50s	3m 9s	2m 39s	2m 39s	1m 49s
Speed knots	8	8	6	6	4	3	5	4	11
Heel	¾° S.	¾° P.	¾° S.	½° P.	0°	½° P.	½° S.	½° P.	½° S.
16 points—									
Time	6m 19s	5m 30s	7m 55s	7m 37s	10m 39s	8m 14s	6m 16s	5m 49s	3m 18s
Speed knots	6	6	4	4	1	1	2	2	10
Heel	½° S.	¼° P.	½° S.	¼° P.	¼° P.	0°	0°	0°	1¾° S.

a Stopped.

Turning trials—Continued.

	All three engines ahead.		Outer and middle engines ahead, inner engine stopped.		Outer and middle engines ahead, inner engine same speed astern.		Outer and middle engines ahead, inner engine astern slow.	
Number of circle	18	19	20	21	22	23	24	25
Helm angle	39° S.	39° P.	39° S.	39° P.	39° S.	39° P.	39° S.	39° P.
Revolutions:								
Port—								
Ahead	102	102	(*a*)	102	.....	102	.....	102
Astern	.....	.....	.....	.....	50	.....	15	.....
Middle—								
Ahead	102	102	102	102	102	102	102	102
Astern	.....	.....	.....	.....	.....	.....	.....	.....
Starboard:								
Ahead	102	102	102	(*a*)	102	.....	102	.....
Astern	.....	.....	.....	.....	.....	70	.....	30
Speed.....knots	18	18	18	18	18	18	18	18
Tactical diameter.....yards	902	891	765	744	754	722	744	727
Turning through:								
4 points—								
Time	0m 50s	0m 45s	0m 50s	0m 44s	0m 45s	0m 44s	0m 45s	0m 51s
Speed.....knots	14	14	12	13	12	12	12	12
Heel	1¾° S.	2° P.	1° S.	2° P.	1½° S.	1¾° P.	1¾° S.	2° P.
8 points—								
Time	1m 30s	1m 27s	1m 35s	1m 21s	1m 30s	1m 32s	1m 32s	1m 31s
Speed.....knots	13	13	10	11	9	9	9	9
Heel	2° S.	2¼° P.	¾° S.	¼° P.	1° S.	1½° P.	½° S.	1° P.
16 points—								
Time	2m 59s	2m 53s	3m 10s	3m 0s	3m 23s	3m 19s	3m 21s	3m 15s
Speed.....knots	12	12	8	9	6	6	7	7
Heel	1¾° S.	1¼° P.	1° S.	¼° P.	¼° S.	0°	¾° S.	½° P.

a Stopped.

Turning trials—Continued.

	Middle engine stopped.						Both side engines stopped, middle engine ahead.	
	Both side engines ahead.		Outer engine ahead, inner engine stopped.		Outer engine ahead, inner engine same speed astern.			
Number of circle	26	27	28	29	30	31	32	33
Helm angle	39° S.	39° P.	39° S.	39° P.	39° S.	39° P.	39° S.	39° P.
Revolutions:								
Port—								
Ahead	102	102	(a)	102	.....	102	(a)	(a)
Astern	.....	.....	.....	.....	76	.....	.....	.....
Middle—								
Ahead	(a)	(a)	(a)	(a)	(a)	(a)	102	102
Astern	.....	.....	.....	.....	.....	.....	.....	.....
Starboard—								
Ahead	102	102	102	(a)	102	.....	(a)	(a)
Astern	.....	.....	.....	.....	.....	79	.....	.....
Speed ..... knots	18	18	18	18	18	18	18	18
Tactical diameter ..... yards	973	956	946	940	853	825	738	792
Turning through:								
4 points—								
Time	0m 57s	0m 59s	0m 50s	1m 6s	0m 45s	1m 4s	1m 13s	0m 51s
Speed ..... knots	13	13	12	11	10	10	10	11
Heel	1° S.	2° P.	½° S.	1¾° P.	¼° S.	1¼° P.	¾° S.	1¼° P.
8 points—								
Time	1m 47s	2m 0s	1m 54s	2m 19s	2m 0s	2m 10s	1m 38s	1m 51s
Speed ..... knots	12	11	8	8	6	6	7	7
Heel	1¼° S.	1½° P.	0°	1¼° P.	0°	1° P.	½° S.	1¼° P.
16 points—								
Time	3m 46s	3m 54s	4m 22s	4m 53s	5m 44s	5m 23s	3m 46s	3m 56s
Speed ..... knots	10	10	7	6	2	2	5	5
Heel	1° S.	¾° P.	½° S.	½° P.	¼° P.	¼° S.	0°	¼° P.

a Stopped.

Complete steam trials were also held, and the results are given in the following table:

Steam trials of the Kaiserin Augusta.

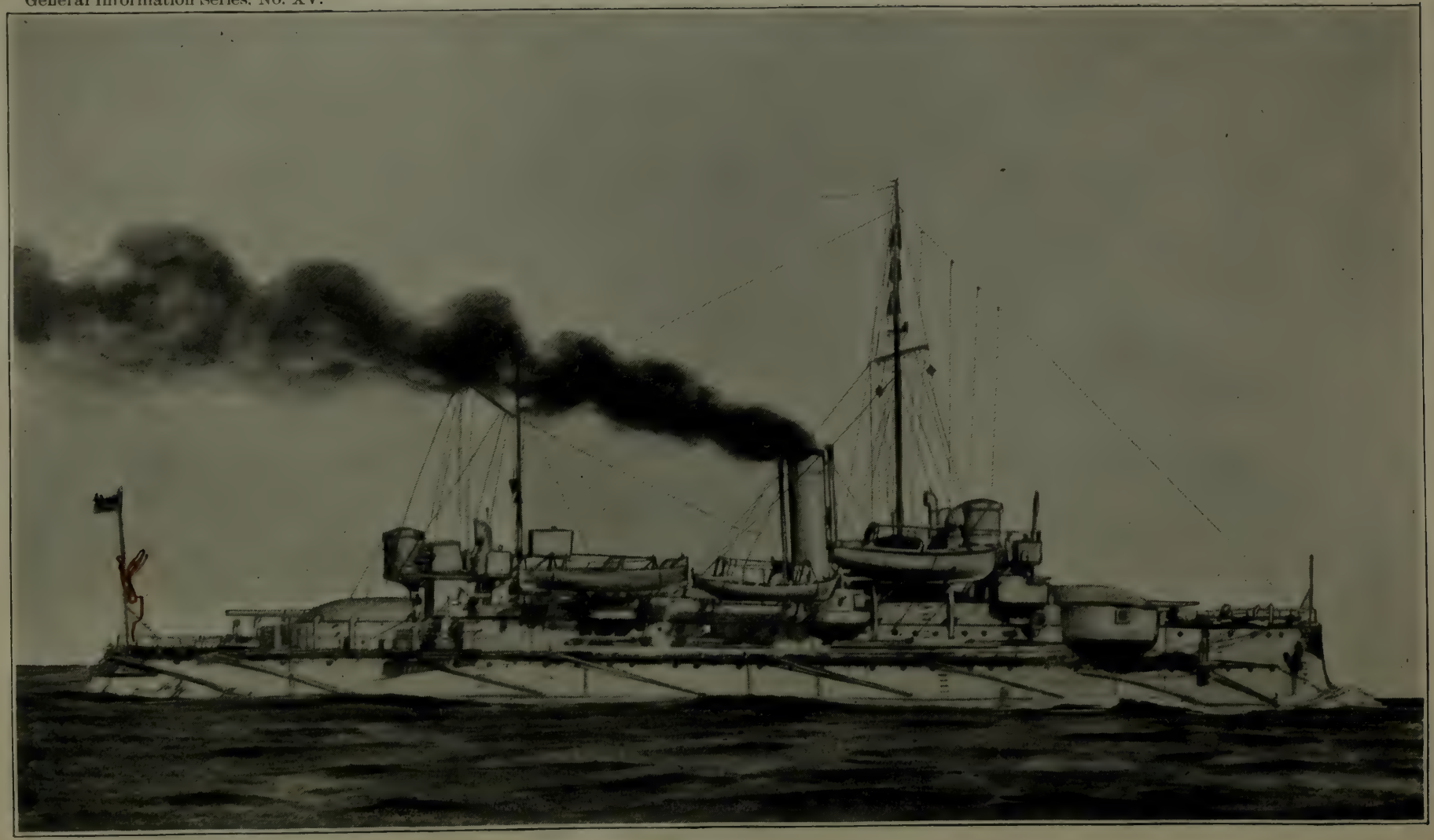
Kind of trial, mile runs.	Dates.	Total I. H. P.	Revolutions.		Speed.	Mean draught.	Displacement.	Coal consumption, per I. H. P. per hour, main engines.	Radius of action with 860 tons coal.	Remarks.
			Mean of both side engines.	Middle engine.						
					Knots.	*Feet.*	*Tons.*	*Pounds.*		
Highest results with three engines	2, 12, 95	13,612	125.8	127.1	21.589	21.1	5,721	.....	.....	
Six hours forced-draft, three engines and 1.2 inches air pressure	22, 11, 95	14,092	126.4	127.8	21.508		5,994	2	.....	Coal consumption for auxiliaries per hour, 246.8 pounds.
	11, 11, 95	12,736	123	123.3	21.022	22.6	6,312			
Three hours, forced-draft, three engines, with .47 inch air pressure	11, 11, 95	11,428	119.1	119.1	20.478	22.8	6,318	1.8	.....	Same per hour, 771.5 pounds.
Twenty-four hours, $\frac{3}{5}$ maximum power, three engines, greatest endurance, .47 inch air pressure	13, 11, 95	7,170	102	102	17.751	22.4	6,229	1.7	2,622	Do.
	22, 11, 95	6,971	101.6	102	17.669	21.8	5,994			
Twenty-four hours, $\frac{3}{5}$ maximum power, two side engines, greatest endurance, .47 inch air pressure	8, 11, 95	7,197	109.8	*a* (71)	17.588	22.5	6,267	1.8	2,543	Do.
	22, 11, 95	6,970	109.3	*a* (71)	17.541	21.8	5,994			
Twenty-four hours, three engines, making from 3,000 to 4,000 I. H. P.	13, 11, 95	4,510	86.8	86.5	15.196	22.5	6,267	1.9	3,350	Same per hour, 725.2 pounds.
	22, 11, 95	4,237	86	86.5	15.167	21.8	5,994			
Twenty-four hours, $\frac{1}{5}$ maximum power, middle engine only, cruising speed	13, 11, 95	2,367	*a* (51)	91.1	11.688	22.5	6,261	1.9	4,222	Same per hour, 806.7 pounds.
	25, 11, 95	2,337	*a* (51.5)	90.5	11.663	21.8	5,994			
Twenty-four hours, $\frac{1}{5}$ maximum power, side engines only, cruising speed	12, 11, 95	2,638	78.5	*a* (50.5)	12.792	22.5	6,267	2	4,277	Same per hour, 672.3 pounds.
	25, 11, 95	2,373	76.3	*a* (49)	12.506	21.8	5,994			
Results with two side engines, middle screw uncoupled	13, 6, 95	8,889	116.6	*a* (74)	18.677	22.5	6,267	.....	.....	The dimensions of the screws used during the screw trials were: *Side screws*, diameter, 14.76 feet; pitch, 20.3 feet. *Middle screw*, diameter, 13.8 feet; pitch, 19.4 feet.
Results with two side engines, middle screw removed	8, 6, 95	8,944	117.8	(*b*)	19.321	22.3	6,188	.....	.....	
Results with middle engine, side screws uncoupled	2, 10, 95	3,952	*a* (61)	109	14.135	22.4	6,226	.....	.....	
Results with middle engine, side screws removed	25, 9, 95	4,003	(*b*)	111.4	15.252	22.4	6,226	.....	.....	

a Uncoupled. *b* Removed.

NOTE.—The dimensions of the regular screws are: *Side screws*, diameter, 14.76 feet; pitch, 20 feet; *middle screw*, diameter, 13.8 feet; pitch, 19 feet.



WEISSENBURG.



HAGEN.

VESSELS RE-ARMING, REFITTING, ETC.

Petroleum for auxiliary fuel has been used experimentally on board of the *Carola*, *Siegfried*, and several torpedo boats with so much success that it has been determined to definitely adopt it for the *Weissenburg*, *Odin*, *Aegir*, and perhaps for the *Kaiser Friedrich III* also.

BADEN.

(Page 33, No. XIV.)

The refit in the case of the *Baden*, besides new boilers, includes remodeling the quarters, reducing the smoke pipes to two, and supplying a new torpedo outfit.

HAGEN.

(Page 55, No. XIII.)

This vessel, like the preceding ones of her class, carries her two 9.45-inch B. L. R. bow guns, not on the center line as stated on page 55, No. XIII, but in separate hoods on each side of the center line and within a common barbette.

KÖNIG WILHELM.

The wooden decks and bulkheads of this vessel were replaced by those of steel, additional transverse bulkheads were put in and worked as high as the gun deck, and a new conning tower fitted. The old type 9.45-inch guns have been replaced by 5.9-inch R. F. G.

DEUTSCHLAND.

The changes in this vessel will be the same as in the case of the *König Wilhelm*, with the exception that the old 10.2-inch guns will be retained and eight 5.9-inch R. F. G. added.

VESSELS PURCHASED.

LORELEY.

A steam yacht, the *Mohican*, has been purchased in England for service as station vessel at Constantinople. She will be known as the *Ersatz Loreley* until the old *Loreley* is struck from the list, when she will regularly succeed to the name.

CASUALTIES.

KURFÜRST FRIEDRICH WILHELM.

(Page 354, No. VIII; 47, No. XI; 31, No. XIV.)

The day after the Kiel fêtes, while handling submarine mines on board of this vessel, a mine exploded prematurely, killing a midshipman and four men, seriously wounding two men, and slightly wounding a lieutenant and two men.

In July, 1896, in the Baltic, the *Baden* and the *Kurfürst Friedrich Wilhelm* came into collision, with the result that the ram of the former

pierced the latter's side to a depth of several feet. The water-tight doors were immediately closed and the *Kurfürst Friedrich Wilhelm* was docked soon after. It was found that had the blow been struck slightly higher up the ship would have been sunk.

TORPEDO BOATS.

A torpedo boat like the British boat *Fame* has been ordered at the works of Messrs. Thornycroft & Co. The boat will carry 40 tons on her trial, and the estimated speed is 28 knots. This is probably division boat *D 10*, referred to below.

On August 28, 1895, torpedo boat *No. 41*, while bound from Wilhelmshaven to Kiel, capsized and was lost, together with thirteen persons. In April, *S. 46* and *S. 48*, while under trial, collided. The latter sank, drowning five men, and the former boat was badly damaged.

Torpedo division boat *D 10* (p. 33, No. XIV) will be similar to *D 9*, and it is reported that she will be built by Thornycroft. The armament will consist of four 6-pounder (40 caliber) R. F. G. and four 18-inch torpedo tubes. The dimensions are: Length, 213.2 feet; beam, 22.9 feet; draught, 9.8 feet; displacement, 380 tons. Speed, 26 knots. All of the division boats are single screw.

The six torpedo boats building by Mr. Schichau, and the two building at the Germania Works, are to be constructed of nickel steel.

GREAT BRITAIN.

The naval estimates for 1896–97 amount to a net total of $106,205,100, which exceeds the original estimates of 1895–96 by $15,193,060 and those of 1894–95 by $21,689,899.85. This increase is due to the acceleration of shipbuilding work in hand, and to the consequent necessity for the earlier delivery of *matériel* and for the increase of the personnel. This policy of pushing all work to an early completion will be vigorously carried out. So far, contract-built ships have surpassed in rapidity of construction those built at navy-yards, but the force employed at the navy-yards has been increased, and the Government is determined that they shall equal the private firms in rapidity.

The new shipbuilding program comprises the following, viz: 5 battleships, 4 first-class cruisers, 3 second-class cruisers, 6 third-class cruisers, and 28 torpedo boats of the 30-knot type, 8 of which were ordered before the estimates were submitted. Of the above vessels 3 battleships, 1 first-class cruiser, and 1 third-class cruiser will be built at navy-yards, and the remainder will be constructed by contract.

For the fiscal year 1896–97 the following vessels will be under construction, many of which hold over from previous programs, the vessels of the naval defense act, however, being all completed: 13 first-class battleships, 10 first-class cruisers, 16 second-class cruisers, 7 third-class cruisers, 48 torpedo boats.

The following vessels will be repaired and refitted, viz: *Sauspareil*,

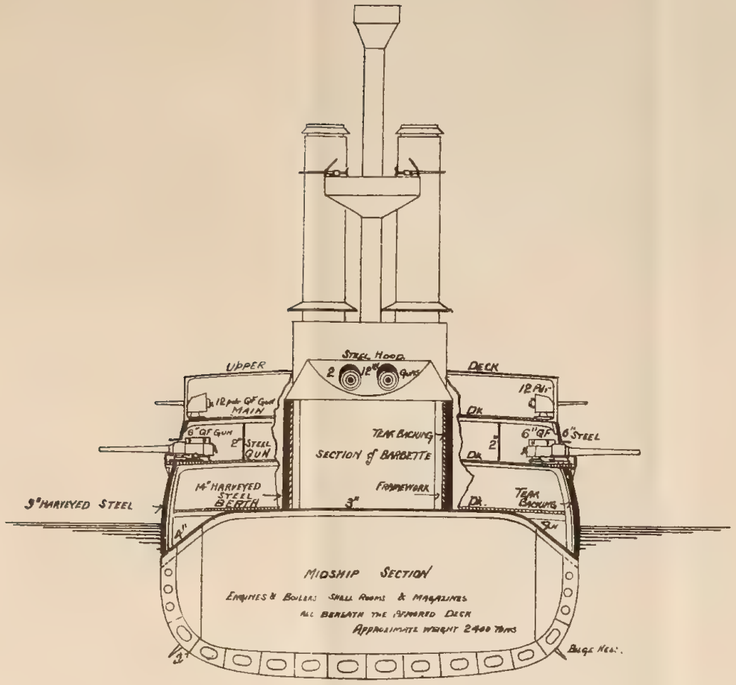


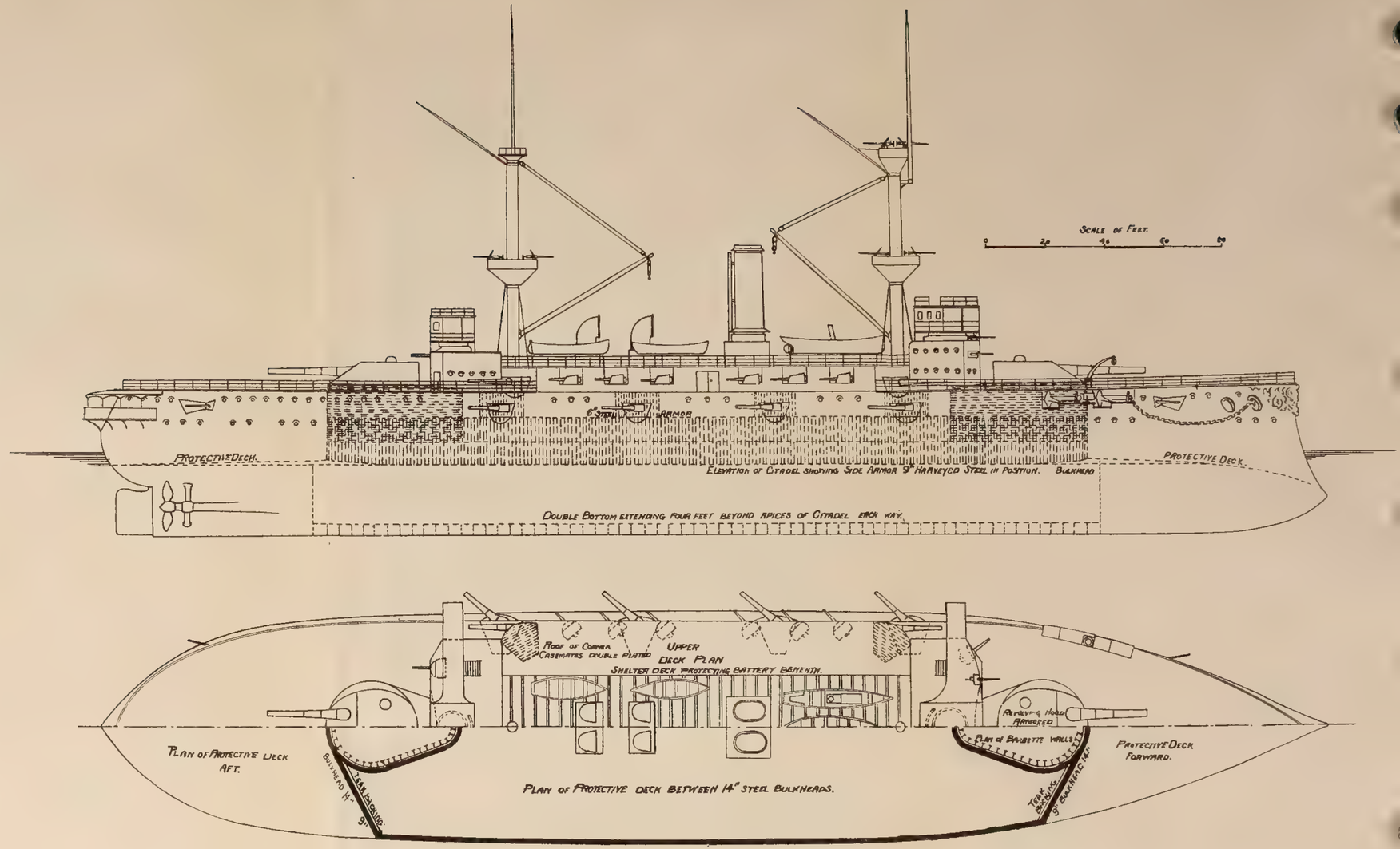
GERMAN TORPEDO BOATS.



GERMAN TORPEDO BOATS.







'MAGNIFICENT" AND "MAJESTIC."



MAGNIFICENT.

Sultan, *Monarch*, *Blake*, *Narcissus*, *Immortalité*, *Severn*, *Sirius*, *Phaeton*, *Cordelia*, *Comus*, *Champion*, *Curacoa*, *Cleopatra*, *Blanche*, *Melpomene*, *Pallas*, and *Racer*.

The *Britannia* is to be abolished and a naval college established at some suitable site ashore, with a practice vessel attached to it for use of the naval cadets.

An increase of 4,900 officers, men, and marines has been made in the personnel.

VESSELS PROPOSED, AUTHORIZED, AND BUILDING.

CANOPUS AND FOUR OTHER BATTLESHIPS.

These vessels are to be improved *Renowns* (p. 9, No. XI; 149, No. XII; 38, No. XIV). The three to be built at navy-yards will be laid down at Portsmouth, Devonport, and Chatham, the last named to be completed in twenty months. Their designs are not yet settled, but the principal features are reported as follows:

Armament.—Four 12-inch B. L. R., twelve 6-inch R. F. G., sixteen 12-pounder R. F. G., twelve 3-pounder R. F. G., two machine guns, and five torpedo tubes, four of which are submerged.

Protection.—Side armor 6 inches thick of Harveyed nickel steel, bulkheads 8 inches, turrets 12 inches, and armored deck 3 to 2 inches.

Dimensions, etc.—Length, 390 feet; beam, 74 feet; maximum draught, 25.4 feet; displacement, 12,900 tons. They are to develop 15,000 I. H. P. and have a speed of 18.75 knots. The coal capacity is to be 1,850, and the complement 700.

FOUR FIRST-CLASS CRUISERS.

These vessels are to be armored cruisers of the type of the *Andromeda* and will be built on the same plans. The description on page 35, No. XIV, should be modified to read sixteen 6-inch R. F. G. instead of fifteen. One will be constructed at the navy-yard, Pembroke.

THREE SECOND-CLASS CRUISERS.

These are protected cruisers of the *Talbot* class and will be constructed on the same plans. (P. 149, No. XIII; 40, No. XIV.)

PERSEUS, PROMETHEUS, PEGASUS, PYRAMUS, PACTOLUS, AND ONE OTHER.

These six third-class cruisers are of the *Pelorus* class (p. 36, No. XIV) and are built on the same plans. The *Perseus* and *Prometheus* are building by the Earle Shipbuilding Company at Hull; the *Pegasus* and *Pyramus* by Palmers at Jarrow-on-Tyne; the *Pactolus* by Armstrong at Elswick; and one other will be constructed at the navy-yard, Sheerness.

VESSELS LAUNCHED.

PRINCE GEORGE, VICTORIOUS, HANNIBAL, MARS, AND JUPITER.

(Page 9, No. XI; 146, No. XII; 14, No. XIII; 36, No. XIV.)

These vessels, sister ships to the *Magnificent*, were launched or floated out of dock as follows, viz: The *Prince George*, at the Portsmouth Navy-Yard, on August 22, 1895, having been laid down September 10, 1894;

the *Victorious*, at the Chatham Navy-Yard, October 19, 1895, having been laid down May 29, 1894; the *Hannibal*, at the Pembroke Navy-Yard, April 28, 1895, the keel having been laid May 1, 1895; the *Mars*, at Birkenhead, by Messrs. Laird Bros., March 31, 1896, having been laid down June 2, 1894; and the *Jupiter*, at Glasgow, by Messrs. J. & G. Thomson, November 18, 1895, the keel having been laid April 26, 1894.

The Admiralty have in view the adoption of the Temperley transporter for battleships and large cruisers. It has been under trial for two years, and great speed in coaling ships has been attained through its use.

POWERFUL.

(Page 15, No. XIII; 39, No. XIV.)

This sister ship to the *Terrible* was launched at Barrow by the Construction and Armaments Company July 24, 1895. It has been decided to supply this class of vessels, as well as the *Magnificent* class, with a splinter net of wire, to be used in action to arrest the flight of splinters.

MINERVA, VENUS, DIANA, JUNO, DORIS, ISIS, AND DIDO.

(Page 149, No. XIII; 40, No. XIV.)

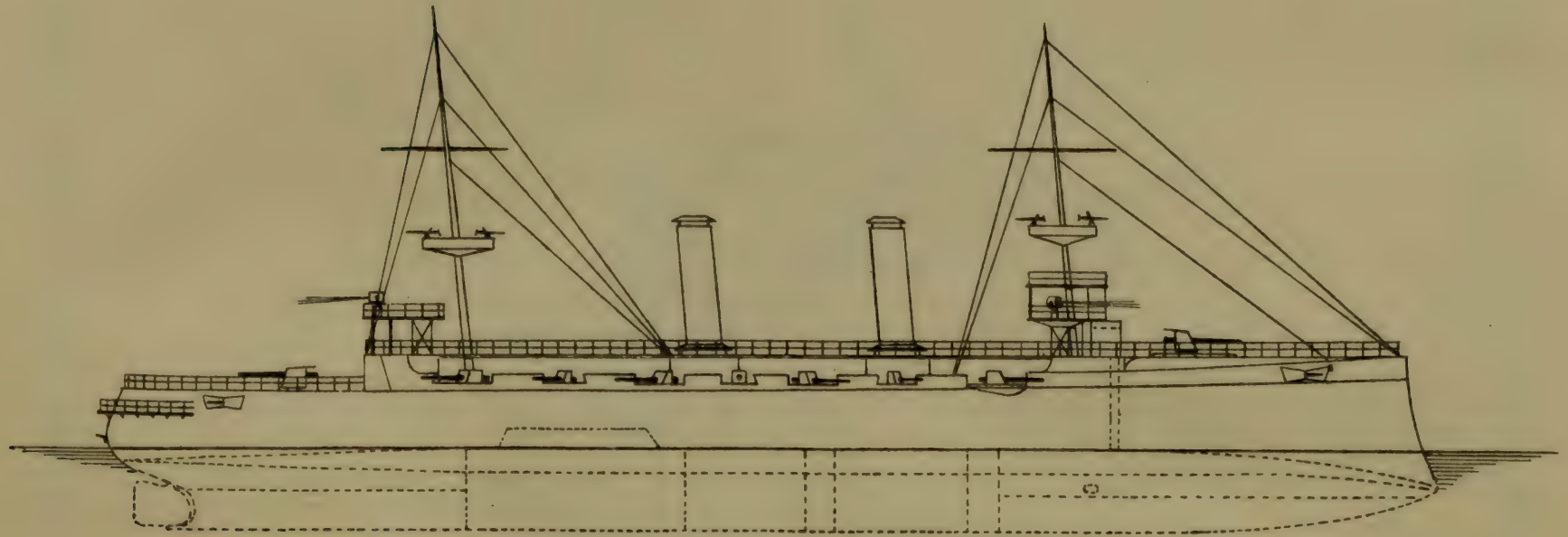
Of these vessels, the *Minerva* is a sister ship to the *Talbot*, while the remainder differ only in having a beam 6 inches greater than that of the *Talbot*, and a consequent increase in weight of hull of 20 tons, and in having six more rapid-firing guns. The *Minerva* was launched at the Chatham Navy-Yard September 23, 1895, having been laid down December 4, 1893. The *Venus* was launched at Glasgow by the Fairfield Shipbuilding Company, having been laid down June 28, 1894, and the *Diana* was launched at Glasgow by the same company December 5, 1895, the keel having been laid August 13, 1894. The *Juno* was launched at Barrow by the Naval Construction and Armaments Company November 16, 1895, the keel having been laid June 22, 1894, and the *Doris* was launched by the same company March 3, 1896, having been laid down August 29, 1894. The *Isis* was launched on June 27, 1896, at Glasgow, by the London and Glasgow Engineering and Shipbuilding Company, the keel having been laid January 30, 1895, and the *Dido* was launched by the London and Glasgow Engineering and Shipbuilding Company on March 20, 1896, her keel having been laid August 30, 1894. Some injury was done to the hull in launching the *Dido*, necessitating six weeks' repairs in dry dock.

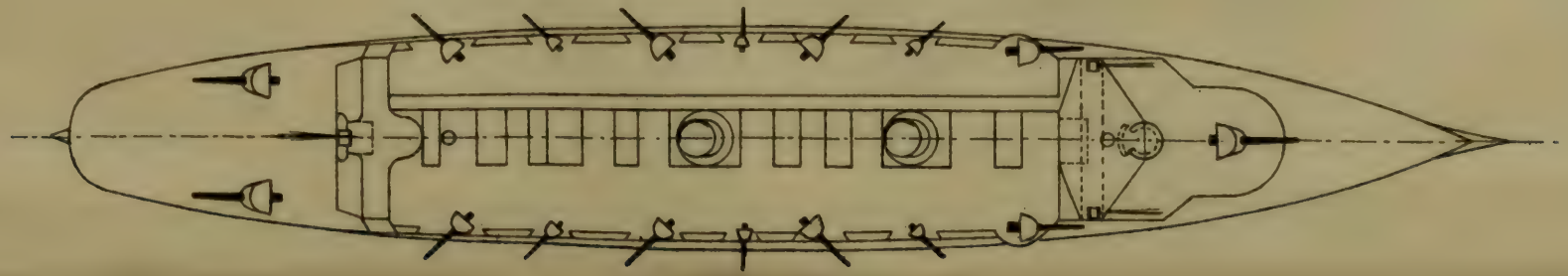
ARROGANT.

(Page 35, No. XIV.)

This vessel was launched at the Devonport Navy-Yard May 26, 1896, her keel having been laid June 10, 1895. In order to launch the *Arrogant* at the time stated it was necessary to delay work on her sister ship *Furious*, laid down at the same yard on the same date.

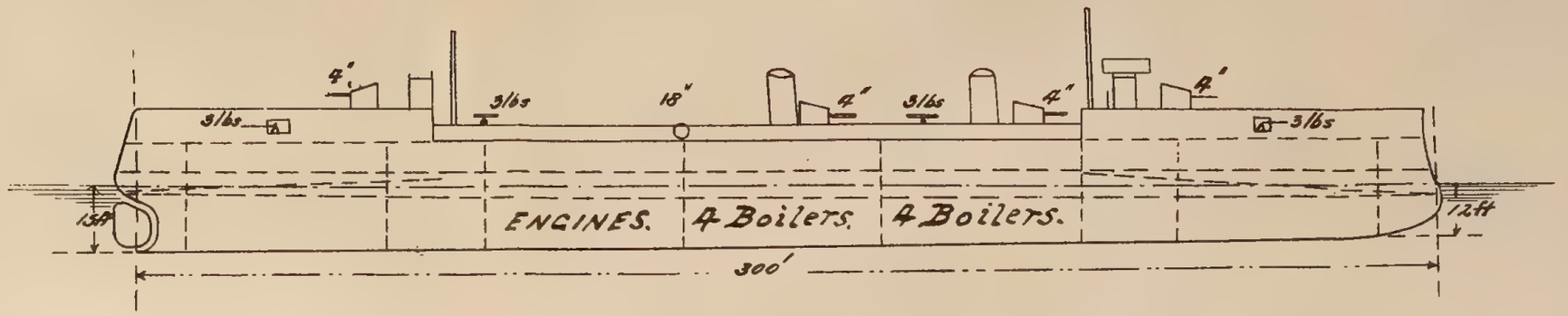
MINERVA.

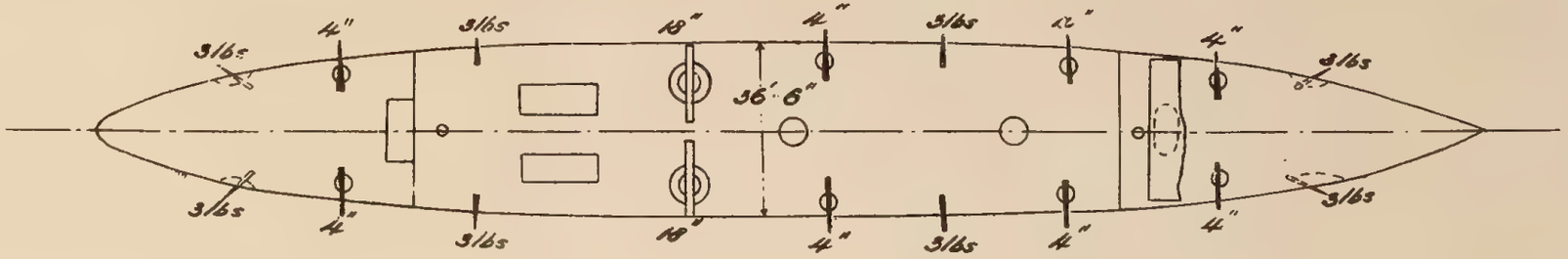


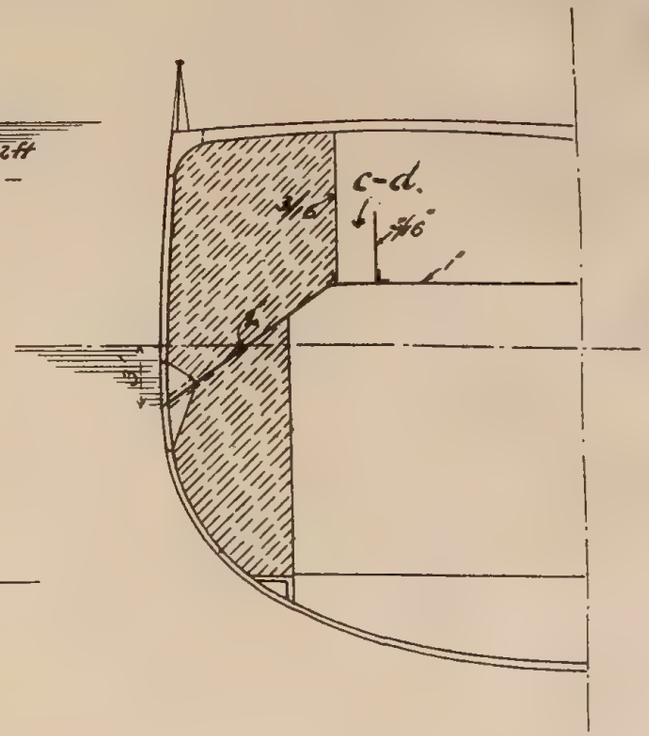












PELORUS AND CLASS.

PELORUS.

(Page 36, No. XIV.)

This vessel, laid down at the Sheerness Navy-Yard May 21, 1895, was launched February 15, 1896. A more complete description follows:

Armament.—Eight 4-inch Armstrong R. F. G. on pedestal mounts, two on the forecastle, two on the poop, and four in broadside; eight 3-pounder R. F. G. will be similarly distributed; two 0.45-inch Maxim guns, and there will be two 14-inch torpedo launching carriages.

Protection.—Protective deck of Siemens-Martin steel varying in thickness from 2 inches on slopes and 1 inch on top in wake of machinery and boilers, to 1 inch on slope and 0.5 inch on top at the extremities. Conning tower 3 inches thick. The machinery and boilers are likewise protected by coal in twenty-eight separate compartments disposed both above and below the protective deck.

Motive power.—Two sets of 3-cylinder inverted triple-expansion engines designed to develop 7,000 I. H. P. at forced-draft and 5,000 I. H. P. at natural-draft, and to give corresponding speeds of 20 and 18.5 knots. There are eight Normand water-tube boilers. The coal capacity is 250 tons, which will give a radius of 7,000 miles at 10 knots.

Dimensions, etc.—Length, 300 feet; beam, 36.5 feet; draught forward, 12 feet; aft, 15.2 feet; displacement, 2,135. The complement will be 225 officers and men.

STEAM TRIALS.

The Admiralty has decided that all vessels in the fleet reserve shall undergo a machinery trial once every three years.

MAGNIFICENT AND MAJESTIC.

(Page 9, No. XI; 146, No. XII; 14, No. XIII; 36, No. XIV.)

These battleships underwent steam trials in September, 1895, with the following results, viz:

Magnificent.—In an eight hour's continuous run under natural-draft, the induced-draft being equal to 1.4 inches of water, the mean revolutions were 95.99, the mean I. H. P. 10,301, which was 301 H. P. in excess of contract, the mean vacuum 26.5 inches, the mean boiler pressure 150.5 pounds, and the mean speed was 16.5 knots.

The four hours' full-power trial under induced-draft measured by 2.1 inches of water furnished by eight air fans 8.5 feet in diameter fitted in the uptakes, gave 100.4 mean revolutions, 12,157 mean I. H. P., an excess of 157 H. P., a mean vacuum of 26.3 inches, boiler pressure 154 pounds, and a mean speed of 17.6 knots. The temperature in the fire rooms was never high.

The thirty hours' coal-consumption trial resulted in a consumption of 1.67 pounds per I. H. P. per hour at 6,086 I. H. P., the revolutions being 82, the steam pressure 133 pounds, and the speed 14.65 knots. The use of the induced-draft showed a saving of 9 per cent of coal over the *Majestic.*

While undergoing a trial of her machinery in the basin at the Chatham Navy-Yard in September, 1895, the contractor's engineers being in charge of the engines at the time, the Admiralty ordered that the engines be run at a speed not exceeding a corresponding speed of 5 knots for the ship. The contractor's representatives in the engine room, without authority, increased the speed to one corresponding to 8 knots and the resulting disturbance of the water caused some floating staging to break adrift. The signal to stop given from the bridge by the officer of the deck was disobeyed, and the staging fouled the propellers, injuring them so as to necessitate the ship being docked, which was done at the contractor's expense. The Admiralty has directed that in future implicit obedience to signals from deck must be given by contractors' engineers who may be handling machinery on board of ships undergoing machinery trials.

Majestic.—This ship, when about to begin her eight hours' trial, ran aground near Spithead, but was floated off on the rising tide without injury, and the trials were postponed.

The eight hours' run under natural-draft was held off Portsmouth September 12, 1895. The draught forward was 24.9 feet and aft 25 feet. The mean revolutions were 100.5 and the I. H. P. developed was 10,418, which was 418 H. P. above contract; the mean vacuum was 26.5 inches and the speed was 16.9 knots by patent log. The coal consumption per I. H. P. per hour was 2.07 pounds.

On the 18th of the same month the four hours' full-power trial was held. The air pressure in the closed fire rooms was 0.9 inch of water, and the I. H. P. developed was 12,497, being 497 H. P. above the contract requirements. The mean revolutions were 106 and the speed 17.9 knots.

The thirty hours' coal-consumption trial was delayed by leaky condensers believed to have been caused by the grounding of the ship near Spithead. It finally took place in October with a mean I. H. P. of 6,075, a steam pressure of 135 pounds in the boilers, a vacuum of 27.5 inches, 85 revolutions, and a coal consumption of 1.84 pounds per I. H. P. per hour.

The gun trials of the *Majestic* in September were entirely satisfactory. The guns were fired under all possible conditions of service and worked well. In firing the 12-inch wire-wound B. L. R. against time the interval between shots, counting from the first discharge, was 1 minute 19 seconds, the guns being loaded from the fixed position, and 1 minute and 21 seconds when loaded separately from the all-round loading position. The *Royal Sovereign* class, whose guns load only from a fixed position, have a record of 2 minutes. The time firing from the 6-inch wire-wound R. F. G. resulted in a string of three shots in 27 seconds and a second string of three in 23 seconds. Two strings of six shots each were fired from the 12-pounder R. F. G., resulting in 23 seconds for the first string and 24 seconds for the second.

The arms of the masthead semaphores fitted on these ships are 13 feet long, necessitating the lengthening of the topmasts by 20 feet.

For rapid construction the *Magnificent* and *Majestic* hold the record, the former having been completed in 1 year 4 months and 20 days and the latter in 1 year and 10 months.

RENOWN.

(Page 9, No. XI; 149, No. XII; 38, No. XIV.)

The results of the trials of this ship are of unusual interest for the reason that the British navy is to be increased by five ships of this type improved. The trials were held in the English Channel toward the end of March, 1896.

The eight hours' natural-draft trial gave the following results: Average steam pressure in boilers, 146 pounds; vacuum, 26.97 pounds; average air pressure, 0.27 inch; average revolutions, 97.8; I. H. P., 10,708; and speed, 17.9 knots.

The four hours' full-power trial gave results as follows: Average steam pressure in engine rooms, 145 pounds; vacuum, 27.3 inches; air pressure, 0.7 inch; average revolutions, 104.1; I. H. P., 12,901, being 901 in excess of contract, and the speed by cross bearings and patent logs was 18.75 knots.

The thirty hours' coal-consumption trial gave: Steam pressure, 137 pounds; vacuum, 27.3 inches; no pressure in fire rooms; revolutions, 86.8; I. H. P., 6,187; speed, 15.3 knots; and coal consumption, 1.88 pounds per I. H. P. per hour. The ship's draught during this trial was 26.7 feet, which will be her draught when fully equipped for sea.

A set of official trials in March and April, 1896, gave the following results:

Trials.	Steam pressure.	Vacuum.		Revolutions.		Air pressure.	I. H. P.		Total I. H. P.	Speed.
		Starboard.	Port.	Starboard.	Port.		Starboard.	Port.		
	Lbs.	*Ins.*	*Ins.*			*Ins.*				*Knots.*
Forced-draft, four hours...	145	27.5	27	101.6	106.5	0.8	6,340	6,561	12,901	18.75
Natural-draft, eight hours.	143	26.9	26.9	97.5	98.2	.....	5,233	5,475	10,708	17.9

The firing trials of the *Renown* developed the complete efficiency of the battery. The 10-inch barbette guns were fired to within 30 degrees forward or abaft the beam according to their location. The pairs of guns in each barbette were fired simultaneously, with full charges, at 35 degrees elevation, trained directly forward and aft, without any trace of injury to the ship or the mounts. Torpedoes were successfully fired from the submerged tubes while steaming at speeds varying from 7 to 18 knots. The *Renown* is to have another dynamo, three being insufficient.

HERMIONE.

(Page 14, No. X; 16, No. XIII.)

The draught of this vessel has been increased by certain changes in her construction, among which are the addition of four sponsons for the 6-inch R. F. G., and the conversion of the wing-passage storerooms into coal bunkers. Her trials were held in August, 1895.

A four hours' natural-draft trial off Plymouth gave the following results: Steam pressure in boilers 140 pounds, at engines 134 pounds; vacuum, 25.3 inches; air pressure, 0.42 inch; revolutions, 126.4; I. H. P., 7,207; and speed by patent log, 18.3 knots.

The mean results of two hours' trial under forced-draft were: Steam pressure in boilers 152 pounds, at engines 147 pounds; vacuum, 24.8 inches; air pressure, 1.1 inches; revolutions, 134.2; I. H. P., 9,044; and speed by patent log, 18.95 knots. The engines had to be eased during a portion of the trial, owing to heating of the bearings of a connecting rod.

A series of progressive trials were held in Stokes Bay to inspect the working of the engines at various speeds. Two runs were made at a speed of 4 knots, two at 7 knots, four at 10 knots, four at 13 knots, four at 16 knots, and four at full speed, natural-draft. The speed on the last runs was 18.25 knots.

TALBOT.

(Page 149, No. XIII; 41, No. XIV.)

The trials of this vessel in May, 1896, gave the results tabulated below:

Trial.	Steam pressure.	Vacuum.		Revolutions.		Air pressure.	I. H. P.		Total I. H. P.	Coal per I. H. P. per hour.	Speed.
		Starboard.	Port.	Starboard.	Port.		Starboard.	Port.			
Forced-draft, four hours	*Lbs.* 144	*Ins.* 25	*Ins.* 25	144.2	138.9	*Ins.* 1.06	4,957	4,819	9,776	*Lbs.*	*Knots.* 20
Natural-draft, eight hours	142	25.6	25	133	131.1	.....	4,256	4,206	8,462	.....	19.2
Coal consumption, thirty hours	.....	26	26.1	114.9	113.5	.....	2,451	2,462	4,913	1.84	16.68

ECLIPSE.

(Page 149, No. XIII; 41, No. XIV.)

The trials of this sister ship to the *Talbot* were held in June, 1896.

Trial.	Steam pressure.	Vacuum.		Revolutions.		Air pressure.	I. H. P.		Total I. H. P.	Coal per I. H. P. per hour.	Speed.
		Starboard.	Port.	Starboard.	Port.		Starboard.	Port.			
Forced-draft, four hours	*Lbs.* 155	*Ins.* 25.7	*Ins.* 26.6	141.2	142.4	*Ins.* 0.94	4,820	5,033	9,853	*Lbs.*	*Knots.* 20.1
Natural-draft, eight hours	152.7	25.7	26.5	135.7	135.7	.39	.....	.....	8,220	2.27	19.2
Coal consumption, thirty hours	135.6	26.5	26.5	115.7	116.3	.....	2,418	2,420	4,838	1.83	16.8

PALLAS.

(Page 24, No. X.)

A natural-draft trial of this cruiser September 27, 1895, gave results as follows: Steam pressure in boilers, 140 pounds; vacuum, 26.7 inches; revolutions, 141.2; I. H. P., 4,855; and speed by patent log, 17.8 knots.

PHŒNIX AND ALGERINE.

(Page 16, No. XIII; 41, No. XIV.)

The trials of these vessels under forced and natural-draft took place in January and in February, with results as follows:

	Steam.		Vacuum.		Air.		Revolutions.		I. H. P.		Speed, knots.	
	F. D.	N. D.	F. D.	N. D.	F. D.	N. D.	F. D.	N. D.	F. D.	N. D.	F. D.	N. D.
	Lbs.	*Lbs.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*						
Phœnix	149	147	25.5	25.9	1.14	0.6	200	186	1,491	1,181	13.4	13.4
Algerine	150	150	27.4	27.6	.8	.38	203	192.2	1,490	1,206	13.1	12.7

FOX.

(Page 41, No. XIV.)

The commissioning trial of the *Fox* in April, 1896, gave a speed of 17.75 knots and 7,170 I. H. P. under natural-draft. When this is compared with her official steam trials in September, 1894, we find she then made 19 knots on 7,034 I. H. P. natural-draft; and in October, 1894, 19.9 knots on 9,063 I. H. P. The result is that the vessel is rated at 1.25 knots greater speed than she is capable of making at a seagoing draught, a fallacy due to the practice of holding steam trials when the vessels are at light draught.

TORCH.

(Page 150, No. XII; 41, No. XIV.)

The eight hours' natural-draft trial of this vessel gave the following results in the summer of 1895: Steam pressure, 150.4 pounds; revolutions, 186.6; I. H. P., 1,163; and speed, 13 knots.

The induced-draft trial of four hours' duration gave: Steam pressure, 153 pounds; vacuum, 27.4 inches; air pressure, 1.2 inches; revolutions, 203.4; I. H. P., 1,457; and speed, 13.4 knots. At the coal-consumption trial 1.94 pounds were consumed per I. H. P. per hour as compared with 1.75 pounds in the case of her sister ship, the *Alert*.

SHARPSHOOTER.

(Page 303, No. VII; 336, No. VIII; 22, No. IX; 27, No. X; 36, No. XIII.)

Exhaustive trials for the purpose of testing Belleville boilers were held with this vessel in the summer and fall of 1895, and the results as reported by her commanding officer follow.

H. M. S. Sharpshooter special sea trials.

No. of trial.	Date.	Distance run.	Duration of trial.	Nature of trial.	I. H. P.	Speed by log.	Boilers in use (total, 8).	Grate surface in use.	Total heating surface in use.	Coal.			Engines eased during trials.	
										Total during trial.	Per square foot of grate per hour.	Per I. H. P. per hour.	From—	
													Date.	Time.
	1895.	*Miles.*	*Hrs.*					*S.ft.*	*Sq.ft.*	*Tons.*	*Lbs.*	*Lbs.*		
1	June 20 to 22.	693	48½	Sea	1,553	14.3	6	202	5,770	63	14.4	1.87	June 21 ....do ... June 22 ....do ... .do ...	9.20 p.m. 11.15 p.m. 2.40 a.m. 3.50 a.m. 5.45 p.m.
2	June 25 to 28.	1,000	69	Sea	1,549	14.4	6	202	5,770	91.4	14.6	1.91	Engines not eased...	
3	July 3 to 6.	1,000	66½	Sea	1,569	15	6	202	5,770	96.5	16	2.07	.....do.....	
4	July 11 to 14.	1,000	68	Sea	1,554	14.7	6	202	5,770	91.8	14.9	1.94	July 11	11.30 p.m. 11.45 p.m.
5	July 19 *b* July 23 *b* July 28 to 31.	1,000	66¾	Sea	1,804	14.9	6	202	5,770	103.4	17.2	1.92	Engines not eased...	
6	Aug. 7 to 11.	1,000	69½	Sea	1,820	14.4	6	202	5,770	104.2	16.6	1.84	Aug. 9	8.15 a.m.
7	Sept. 18 to 21.	1,000	65	Sea	2,016	15.3	6	202	5,770	105.1	17.9	1.8	Engines not eased...	
8	Sept. 28 to Oct. 1.	1,000	63½	Sea	2,037	15.7	6	202	5,770	103.2	18	1.79	.....do.....	
9	Oct. 8 to 13.	1,000	62	Sea	2,194	16.1	6	202	5,770	105.4	18.8	1.73	Oct. 8	8.50 *d*

a July 12, banked fires all day till 1.50 a. m. of the 13th.
b Trial abandoned on account of bad weather.

H. M. S. Sharpshooter special sea trials.

Engines eased during trials.			Feeding of boilers; was it regular and constant?	Did boilers prime?	Was there any flaming at the smoke-pipes?	Repairs.		
To—								
Time.	Date.	Cause.				Main engines.	Auxiliary engines.	Boilers.
10 p.m. 1.50 p.m. 3 a.m. 8.25 a.m. Discontinued trial at end of 693 miles.	June 21 June 22 do do do	Thick fog. do do do do	Yes	No	No	Nil	Nil	Nil.
.....	.....	.....	Yes	No	No	Nil	Nil	Four coned sleeves fitted to feed nipples.
.....	.....	.....	Yes	No	No	S. I. P. piston rings broken.	Nil	Two coned sleeves fitted to feed nipples.
12 (night) stopped.	July 11*a*	Heavy squalls.	Yes	No	No	Crack in web of S. H. P. cylinder.	Nil	Nil.
.....	.....	.....	Yes	No	No	Crack in brazing of P. I. P. receiver pipe.	Nil	Nil.
9.30 a.m.	Aug. 9*c*	Squalls and thick fog.	Yes. Crack discovered in plunger of 1 feed pump; but feed maintained by starting another pump.	No	No	After propeller shaft bearings worn; condenser leaked.	Feed pump plunger cracked.	Nil.
.....	.....	.....	Yes. Feeding of 1 boiler was by hand for part of the time, as a small piece of wire got under the valve of the automatic feed.	No	No	Nil	An obstruction removed from the valve box of 1 feed pump.	Piece of wire removed from 1 automatic feed valve. Spindle of 1 blow-off valve broken.
.....	.....	.....	Yes	No	No	Stud of reversing gear broken.	Nil	Nil.
.....	.....	Gale of wind, causing engines to race excessively.	Yes	No	No	Bracket of reversing gear broken.	Furnace air engine damaged by a spanner.	One bolt for securing element to feed nipple. Brick work of furnace.

c 9.30 a. m., banked fires and distilling till 2 p. m. of the 10th.
d 11, drew fires in 5 boilers, banked fire in 1 boiler. Continued trial at 11.5 October 10.

H. M. S. Sharpshooter special sea trials—Continued.

		I. H. P.	Speed by log.	Boilers in use.
Dec. 2, 1895.	Torpedo practice	1,450	Abont 13.5	4
Dec. 10, 1895.	Target practice	1,450	do	4
Dec. 11, 1895.	Torpedo practice	1,450	do	4

In all cases the ship was manœuvred as she might be in battle, the vessel cleared for action, and the men at their stations for general quarters. Full power for four boilers was used, giving a speed of 13½ knots, 190 revolutions, and 1,450 I. H. P.

The following manœuvres were practiced: Stopping frequently from full speed and starting again, without warning, after intervals of five minutes to one and a half hours, getting away at full speed from banked fires.

All that was found necessary in the fire rooms was to close the draft plates of the furnaces, and open wide the tube-box doors, and in the engine rooms to make a moderate use of the blow-off valves to the condensers when suddenly stopping. There was no priming at the engines. Fires were banked on December 9, at 7 p. m., steam maintained all night at 150 to 200 pounds till 8 a. m. on the 10th, when the ship was gotten under way and started immediately at full speed, and manœuvred, as already mentioned, for six hours. On this trial, as a precautionary measure, a petty officer was stationed at the separator to insure that its blowing-out apparatus did not fail, but the apparatus acted most satisfactorily, and the services of the petty officer were not once required. During the above trials the firemen employed were the men forming the first training class, who had been in the ship about a fortnight.

SPANKER.

(Page 27, No. X.)

This vessel of the *Sharpshooter* class has been fitted with Du Temple boilers and a series of trials was begun in February, 1896, to test their efficiency as compared with the Belleville boilers of the *Sharpshooter*.

	Steam.	Air.	Vacuum.	Revolutions.	I. H. P.	Speed.
	Pounds.	*Pounds.*	*Inches.*			*Knots.*
Forced-draft	149	1.48	28	248.7	2,759	18.3
Natural-draft	149	3.59	27	276.7	3,920	20

VESSELS RE-ARMING, REFITTING, ETC.

The Homacoustic voice pipes installed on board the *Fox* were thoroughly tried during last year's manœuvres, and although not a complete success the new invention gave greater satisfaction than the ordinary voice pipes. The apparatus has been so improved since as to completely insulate the sound, and it has been successfully tried in the torpedo boats, and will be given an exhaustive trial on board of the *Eclipse* before it is regularly adopted.

The following vessels have had their armaments changed: *Aurora*, 6-inch B. L. R. replaced by 6-inch R. F. G. *Australia*, same. *Galatea*, same. *Immortalité*, same. *Imperieuse*, to have new mounts for her

R. F. G. *Narcissus*, 6-inch B. L. R. to be changed for 6-inch R. F. G. *Sanspareil*, same. *Severn*, same. *Warspite*, same and ventilation of the magazines to be improved. *Achilles* receives 6-inch R. F. G. converted. *Mercury*, machine guns now comprise four 5-barreled and one 2-barreled Gardners. The *Beagle* and *Nymphe* are to carry four machine guns, two 5-barreled and two 2-barreled Gardners.

In the following vessels the motive power has been modified: *Barham* and *Bellona*, new Thornycroft water-tube boilers and a new electric plant; *Dreadnought*, thirteen new boilers, new condensers, a new electric plant, and the masts lengthened; *Salamander* and *Sheldrake*, locomotive boilers to be replaced by water-tube; *Seagull*, six Niclausse water-tube boilers installed; *Melampas*, the stays in the boilers gave way during a water-pressure test, as did also one of the furnaces, and extensive repairs will be necessary; *Hecate*, to have new boilers.

The following-named vessels have been refitted for other service: *Amphion*, to be employed hereafter in the trooping service, to replace the *Tyne*, which will in turn become a storeship; the 6-inch B. L. R. are replaced by 6-inch R. F. G., and the sponsons removed. *Inconstant*, to have engines and boilers removed, and to be converted into a training ship; *Raleigh*, same; *Black Prince*, guns removed, to become a training ship; *Hecla*, converted into a repair ship.

Vessels that have undergone a general refit are as follows:

Blake.—The engine rooms are made more accessible, the ventilation improved, a new electric plant provided, alterations made in the combustion chambers of the furnaces, the boilers retubed and fitted with ferrules, and the 6-inch B. L. R. replaced by 6-inch R. F. G. A subsequent trial of four hours' duration gave a steam pressure of 147 pounds, air pressure 2.3 inches, I. H. P. 19,579, and a speed of 21.5 knots.

Benbow.—The masts have been lengthened for signal purposes, the 6-inch B. L. R. replaced by 6-inch R. F. G., and auxiliary hand gear installed in the turrets.

Carysfort and Conquest.—To have an extensive refit, the M. L. guns to be replaced by 6-inch R. F. G.

Comus.—Underwent a general refit. The magazines were removed from amidships to forward and aft, and ten 6-inch B. L. R. installed. A trial after refit gave a steam pressure of 56.8 pounds; revolutions, 89.3; I. H. P., 1,922, and speed 12 knots.

Cordelia.—Fitted a new light deck and moved the magazines as in the case of the *Comus;* also installed ten 6-inch B. L. R. The trial gave a steam pressure of 55 pounds; vacuum, 25 inches; I. H. P., 1,628, and a speed of 12.75 knots.

Phaeton.—After an extensive refit, in which the 6-inch B. L. R. were replaced by 6-inch R. F.G., a trial gave the following results: Steam pressure, 83 pounds; vacuum, 26.9 inches; revolutions, 93.2; I. H. P., 4,755, and a speed of 17 knots.

The following changes in batteries are to be effected: *Swiftsure*, eight 4-inch B. L. R.; *Invincible*, six 4-inch B. L. R.; *Triumph*, four

5-inch B. L. R; *Iron Duke*, four 5-inch B. L. R. All to be replaced by R. F. G. of the same caliber. Military masts are also to be fitted in these four vessels.

Masthead semaphores are to be fitted in all vessels over 2,000 tons displacement.

VESSELS LOST, SOLD, OR STRUCK FROM THE LIST.

Bacchante to be sold. *Assistance* to be sold. *Vixen* to be sold. *Canada* and *Caroline* to be sold. *Himalaya* struck from the list. *Hector* unfit for service.

TORPEDO BOATS.

FIRST-CLASS TORPEDO BOATS.

Of the so-called "destroyer" type Great Britain will have 90, when those authorized in this year's budget are completed. Forty-two of these are rated at 27 knots, 46 at 30 knots, and 2 are to be built for a speed of 32 knots, one by Messrs. Thornycroft & Co., using their own boilers, and the other by Messrs. J. & G. Thomson, using Normand boilers.

The ten smaller first-class boats authorized in 1895 have not yet been laid down.

Hereafter the engine and fire rooms of the "destroyer" class will be lighted by electricity, and automatic feed apparatus for boilers has been installed on board a number of them. The cost of the earlier boats has varied from $165,200 to $190,000 in round numbers. The last batch of boats will have a displacement of about 300 tons, which is generally acknowledged to be the extreme limit for torpedo boats, beyond which they become torpedo vessels. A complete list is given below. A number of these torpedo boats have been detailed for the instruction of firemen in handling water-tube boilers.

Name.	Builder.	Length.	Beam.	Draught.	Displacement.	I. H. P.	Mean trial speed.
		Feet.	*Feet.*	*Feet.*	*Tons.*		*Knots.*
Daring	Thornycroft	185	19	6	220	4,735	28.66
Boxer	do	200	19	7.6	250	4,800	29.17
Decoy	do	185	19	6	220	3,900	27.64
Ardent	do	200	19	7.6	250	4,350	27.84
Bruiser	do	200	19	7.6	250	4,156	28.14
Desperate	do	210	20	5.3	.....	5,600	30.46
Fame	do	.....	.....	.....	.....	.....	.....
Foam	do	.....	.....	.....	.....	.....	.....
Mallard	do	.....	.....	.....	.....	.....	.....
Angler	do	210	20	5.3	.....	.....	.....
Ariel	do	210	20	5.3	.....	.....	.....
Albatross	do	.....	.....	.....	.....	.....	.....
Coquette	do	.....	.....	.....	.....	.....	.....
Cygnet	do	.....	.....	.....	.....	.....	.....
Cynthia	do	.....	.....	.....	.....	.....	.....
Havock	Yarrow	180	18.5	5.3	220	3,500	26.78

Name.	Builder.	Length.	Beam.	Draught.	Displacement.	I. H. P.	Mean trial speed.
		Feet.	*Feet.*	*Feet.*	*Tons.*		*Knots.*
Hornet	Yarrow	180	18.5	5.3	220	4,400	28.03
Hasty	do	190	18.5	5.3	220	3,250	26.08
Charger	do	190	18.5	5.3	220	3,500	26.08
Dasher	do	190	18.5	5.3	220	3,182	26.21
Ferret	Laird	194	19.3	5	220	4,507	27.61
Lynx	do	194	19.3	5	220	4,000	27.01
Banshee	do	210	19.5		265	4,400	27.60
Contest	do	210	19.5		265	4,400	27.40
Dragon	do	210	19.5		265	4,500	27.14
Quail	do	210	21.7	5.3	300		
Sparrowhawk	do	210	21.7	5.3	300		
Thrasher	do	210	21.7	5.3	300		
Virago	do	210	21.7	5.3	300		
Earnest	do	210	21.7	5.3	300		
Griffon	do	210	20	5.3			
Locust	do	210	21.7	5.3	300		
Panther	do	210	21.7	5.3	300		
Seal	do	210	21.7	5.3	300		
Wolf	do	210	21.7	5.3	300		
Express	do						
Fervent	Hanna	200	19	7.8	250		
Zephyr	do	200	19	5.3	300		
Conflict	White	205.6	20		230		
Teazer	do	200	19.5	5.6	250		
Wizard	do	200	19.5	5.2	250		
Janus	Palmer	200	19.7	6.5	277		
Porcupine	do	200	19.7	6.5	277	3,650	27.91
Lightning	do	200	19.7	6.5	277	4,000	27.94
Bat	do	210	20	5.3			
Chamois	do	210	20	5.3			
Whiting	do	210	20	5.3			
Crane	do	210	20	5.3			
Star	do	210	20	5.3			
Flying Fish	do	210	20	5.3			
Flirt	do						
Fawn	do						
Hardy	Doxford	196	19	5	245	4,184	26.8
Haughty	do	196	19	5	245		
Sylvia	do						
Violet	do						
Spitfire	Armstrong	200	19	5.3	264		
Swordfish	do	200	19	5.3	264		
Sturgeon	N. C. & A. Co	195	20.5		240	4,010	27.16
Starfish	do	195	20.5		240	4,000	27.97
Skate	do	195	20.5		240	4,100	27.10
Avon	do	210	20	5.3			
Bittern	do	210	20	5.3			
Otter	do						
Leopard	do						
Salmon	Earle	200	19.5	5.4	264	3,580	27.60
Snapper	do	200	19.5	5.4	264	4,500	27.90
Bullfinch	do						
Dove	do						
Sunfish	Hawthorn	200	19	5.2	264	4,174	28.03

Name.	Builder.	Length.	Beam.	Draught.	Dis-placement.	I. H. P.	Mean trial speed.
		Feet.	*Feet.*	*Feet.*	*Tons.*		*Knots.*
Ranger	Hawthorn	200	19	5.2	264	3,900	27.13
Opossum	do	200	19	5.2	264	4,174	28.20
Cheerful	do						
Mermaid	do						
Handy	Fairfield	200	19	7.8	250	3,800	27.04
Hart	do	185	19	6.3	220	4,010	27.07
Hunter	do					4,245	27.25
Fairy	do						
Gipsy	do						
Osprey	do						
Zebra	Thames I. W	200	20	6	280	4,500	
Brazen	Thomson	210	20	5.3			
Electra	do	210	20	5.3			
Recruit	do	210	20	5.3			
Vulture	do	210	20	5.3			
Arab	do						
Kestrel	do						
Rocket	do	205.6	19.5	5.25	250	4,200	28.25
Shark	do	205.6	19.5	5.25	250	4,250	27.50
Surly	do	205.6	19.5	5.25	250	4,400	28.05

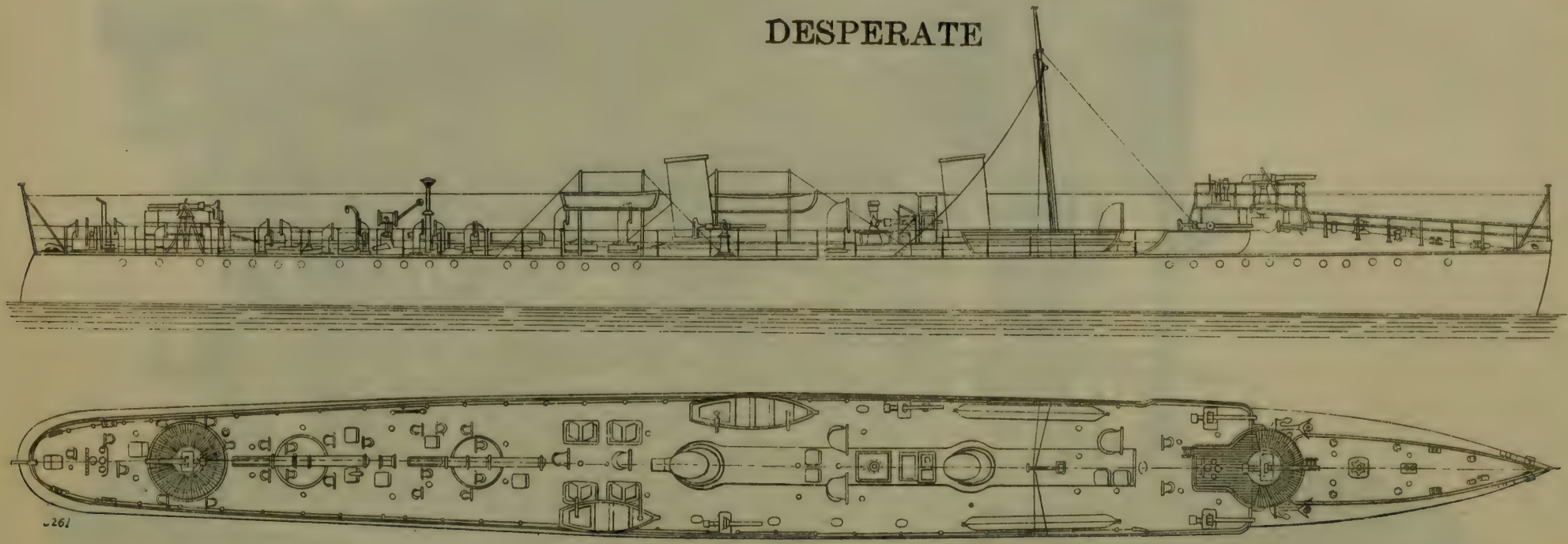
The torpedo boats of the "destroyer" type are so lightly constructed and their machinery is of such a delicate character that breakdowns are of very frequent occurrence. Some of these accidents are of the following character: *Charger*, the crown of the fire box of one of the boilers cracked while steaming. *Dasher*, bows smashed in collision with a dredger. *Dragon*, reversing gear untrustworthy. *Handy*, defective water gauge showed water in boiler when there was none, and the tubes consequently burned out. *Haughty*, a fire broke out in coal bunkers, due to the great heat from adjacent boilers, and the fan engine broke down. *Lynx*, a boiler broke down. *Opossum*, leaky condenser. *Rocket*, broke down five times from various serious defects. *Skate*, many defects developed in engines and boilers. *Sturgeon*, seams in side opened, due to excessive vibrations set up at full speed, and boiler tubes gave out. Scarcely a single one has escaped so far from a defect of some sort.

The *Lightning*, while undergoing her twelve hours' consumption trial near Sheerness, after nightfall and in a thick mist, going at a speed of 12 knots, collided with a steam barge. Her bows were smashed in and the stem bent around to starboard, as shown in the plates, but in spite of this the boat was able to proceed on her way and safely reach port, although she grounded once on Maplin Sands before reaching the Chatham Navy-Yard. The lines of the bow are very fine, the stem being a light forging. The frames are stiffened by reverse frames, and the side plating is treble riveted at the keel and sheer strake and double riveted elsewhere. The bow is stiffened by a side stringer, worked inside on the frames and running midway between decks, and is further

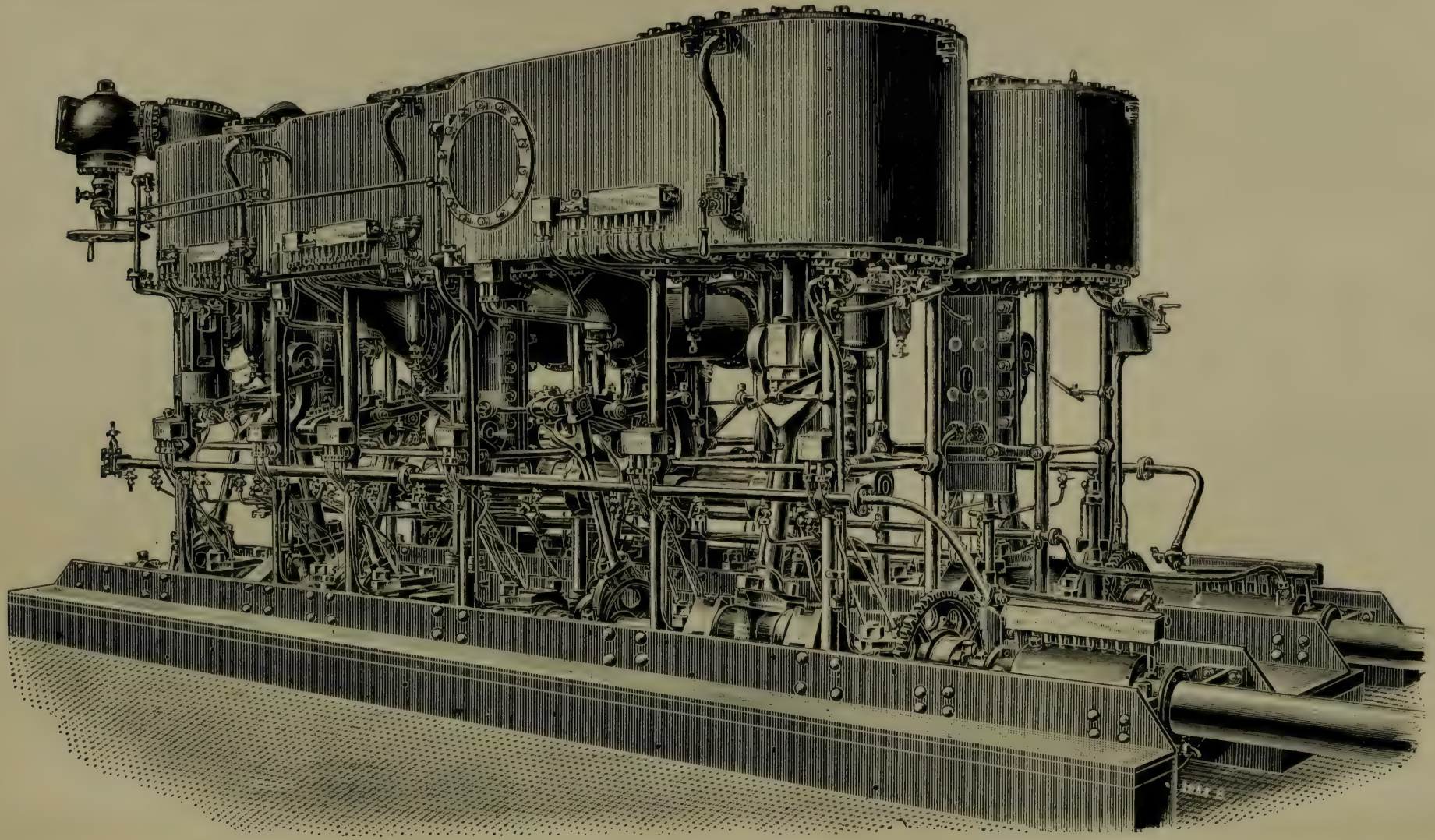


SURLY.

DESPERATE

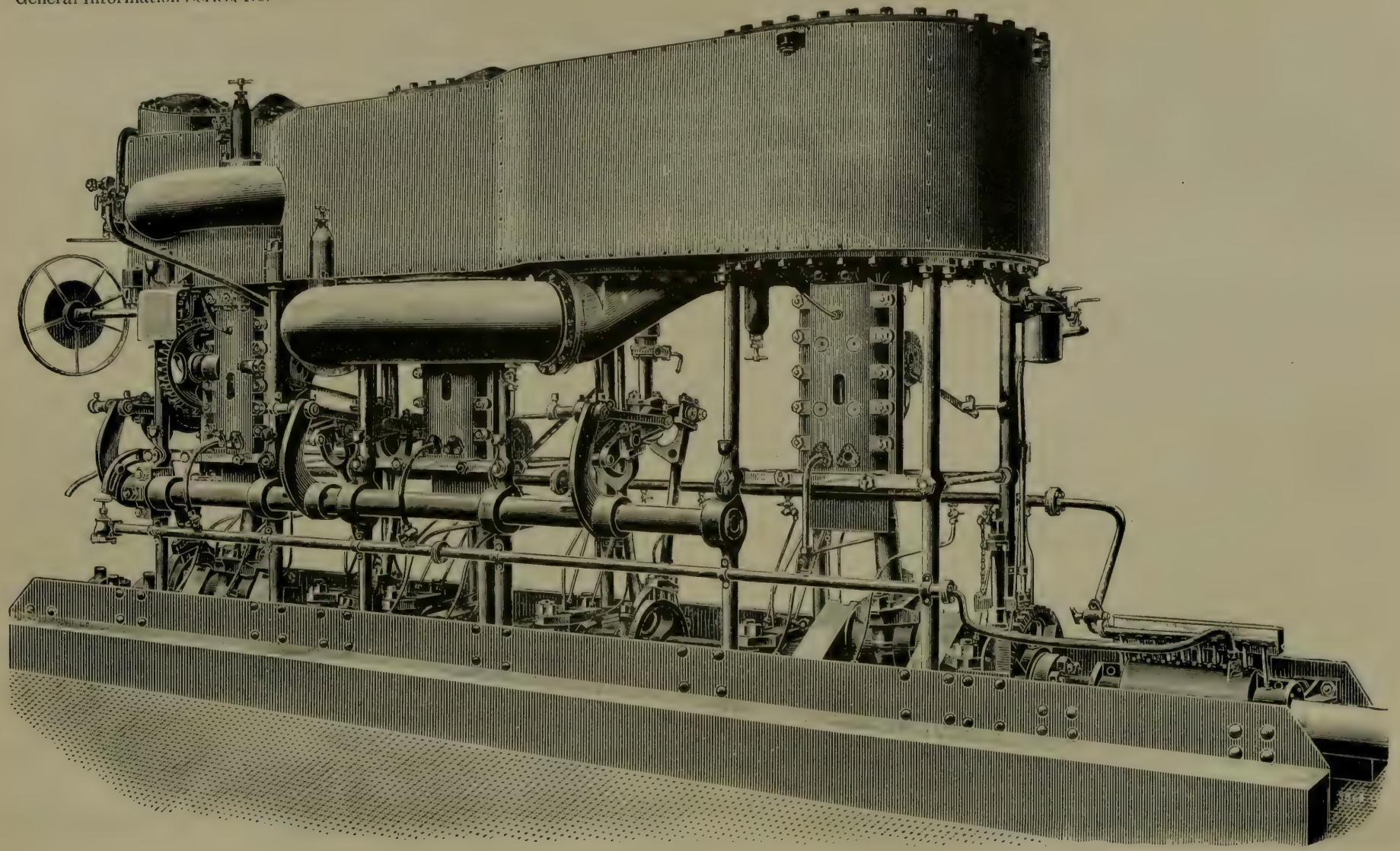


Engineering.



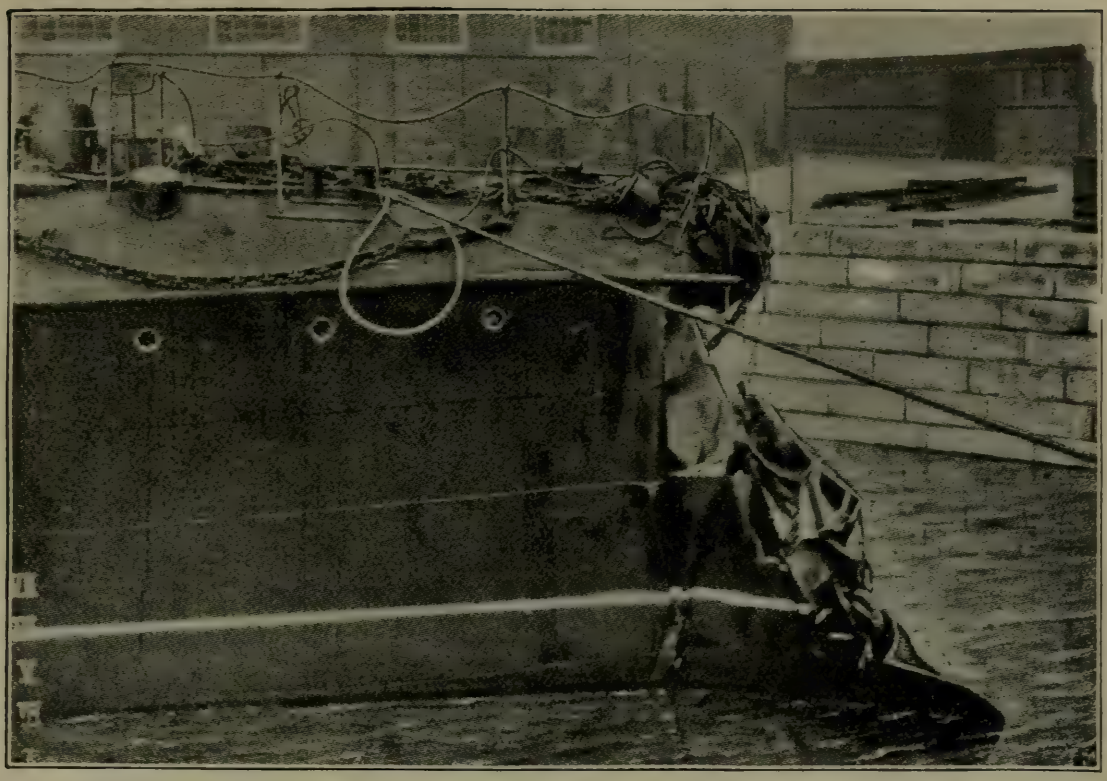
HART AND HANDY ENGINES.

Engineering.



HART AND HANDY ENGINES.

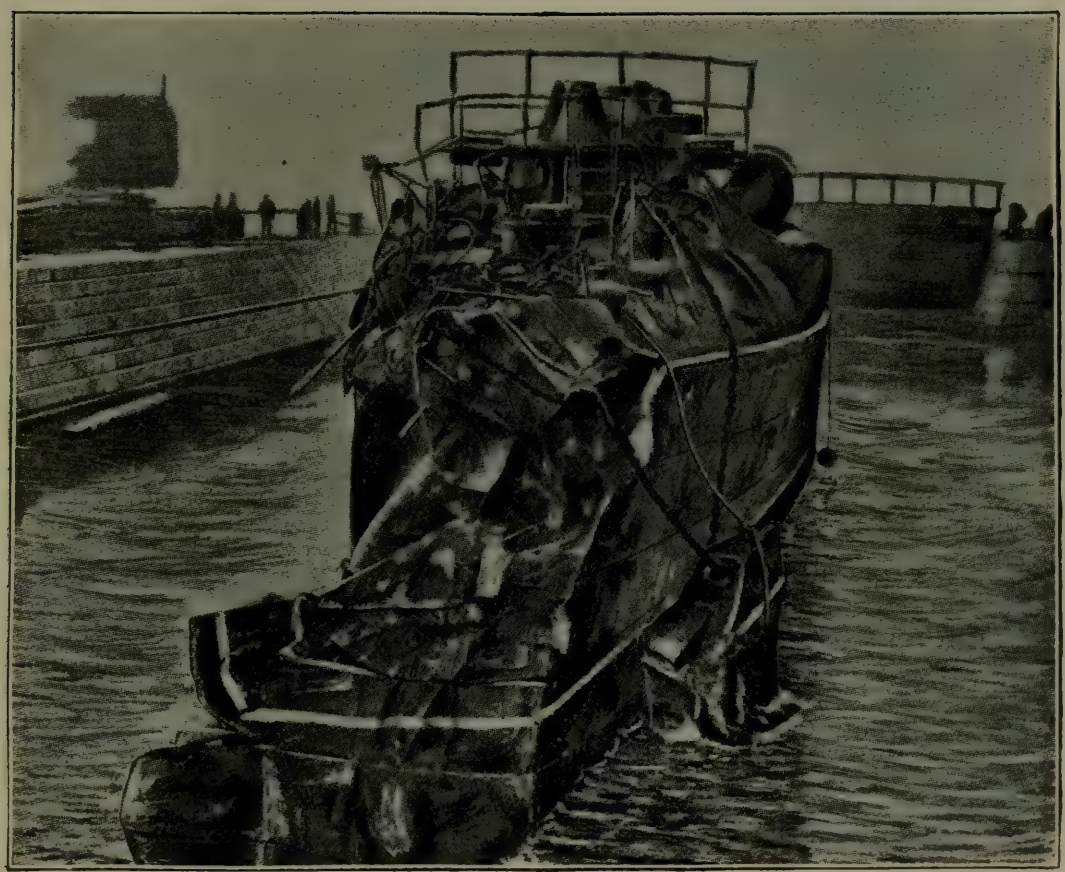
Engineering.



COLLISION—LIGHTNING.



COLLISION—LIGHTNING.



COLLISION—LIGHTNING.



SARDEGNA. (Page 46, No. XIV.)

strengthened by a breast hook and stringer plates in wake of the lower deck. The upper part of the bow sustained the most damage; the collision bulkhead, 6 feet abaft the stem, was completely smashed and torn in two, but the next bulkhead remained intact, confining the water to the two forward compartments.

Torpedo boat *No. 80* is to be fitted with new Thornycroft boilers.

ITALY.

The budget for 1896–97 carries a sum of $18,785,972.75, of which $4,342,500 is devoted to construction. Besides carrying on work on the *Ammiraglio di Saint-Bon*, *Emanuele Filiberto*, *Puglia*, *Carlo Alberto*, *Vettor Pisani*, *Giuseppe Garibaldi*, and *Varese*, the budget provides for the construction of one armored cruiser, two torpedo vessels, several torpedo boats of large size and some smaller ones, as well as vessels for harbor use.

Owing to the heavy expenses incurred in the African campaign the construction of the *Giuseppe Garibaldi* and the two cruisers of the *Etruria* type, named *Principe di Napoli* and *Regina Margherita*, will be temporarily suspended. The admirals of the Italian Navy having been called upon for an expression of opinion as to the proper building policy to pursue, gave a consensus of opinion in favor of powerfully armed, high speed armored cruisers, as the best vessels for the Italian navy. The *Varese* has been sold to Argentina by the contractors and named the *San Martin*, and another will be built for Italy in her place.

VESSELS PROPOSED, AUTHORIZED, AND BUILDING.

ARMORED CRUISER.

This vessel has not yet been laid down, as the new minister of marine has not decided upon the details of construction. The length will be 419 feet; beam, 65.5 feet; draught, 25.3 feet; displacement, 10,500 tons; I. H. P. 13,000, and speed 23 knots.

AGORDAT AND COATIT.

(Page 61, No. XIII.)

These two torpedo vessels of the *Partenope* type (p. 343, No. VIII) have been laid down at Castellamare, and their characteristics will differ but little from the type vessel. Their speed will be greater and their dimensions will be: Length, 287.4 feet; beam, 30.5 feet; draught, 10.4 feet; displacement, 1,313 tons. A protective deck and cofferdams will furnish protection to the motive power.

TWO TORPEDO VESSELS.

These vessels, authorized this year, will probably have a displacement of 1,100 tons; length, 275.5 feet; beam, 26 feet; I. H. P., 7,000, and speed 22 knots.

VESSELS LAUNCHED.

CARLO ALBERTO AND VETTOR PISANI.

(Page 158, No. XII.)

The former was launched at Spezia, March 14, 1896, and the latter at Castellamare, August 14, 1895. The principal characteristics of these vessels are as follows:

Armament.—Twelve 5.98-inch R. F. G., eight in battery and four at the corners of the armored casemate; six 4.7-inch R. F. G. on the superstructure; ten 6-pounder R. F. G.; eight 1-pounder R. F. G., and five torpedo tubes.

Protection.—A complete belt of steel 6 inches thick, above which for two-thirds of the length is worked casemate armor of like thickness. The upper battery is protected by 2 inches of steel with splinter screens and the protective deck is 1.4 inches thick. There are double bottoms, numerous water-tight compartments and cofferdams.

Motive power.—Two sets of triple-expansion engines develop 13,000 I. H. P. and give a speed of 20 knots. Eight single-ended boilers are distributed among four compartments. The maximum coal supply will be 1,000 tons, in addition to liquid fuel.

Dimensions, etc.—Length, 325 feet; beam, 59 feet; draught, 22.9 feet; displacement, 6,500 tons. Total complement, 460 officers and men.

STEAM TRIALS.

SICILIA.

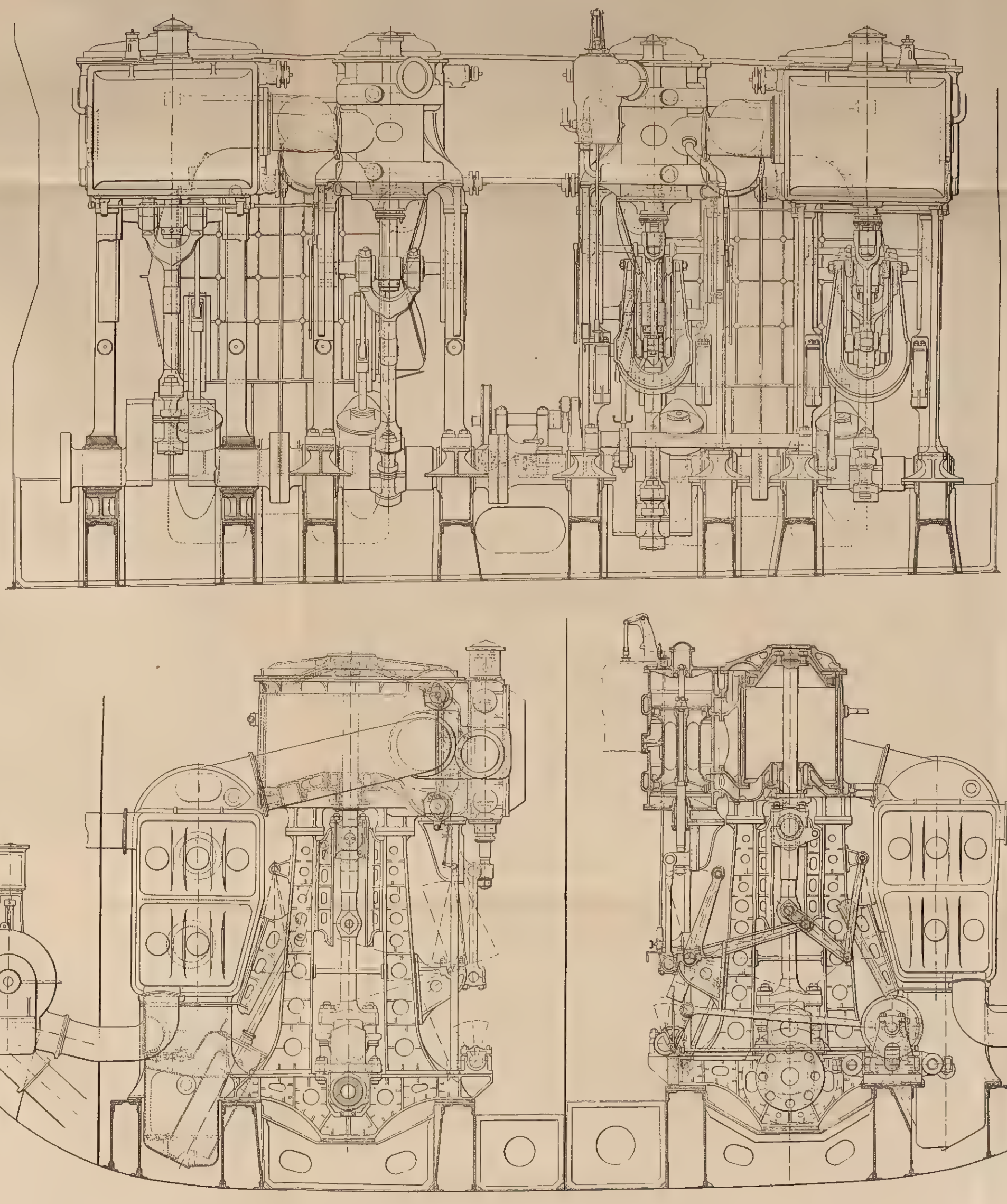
(Page 42, No. X; 42, No. XI.)

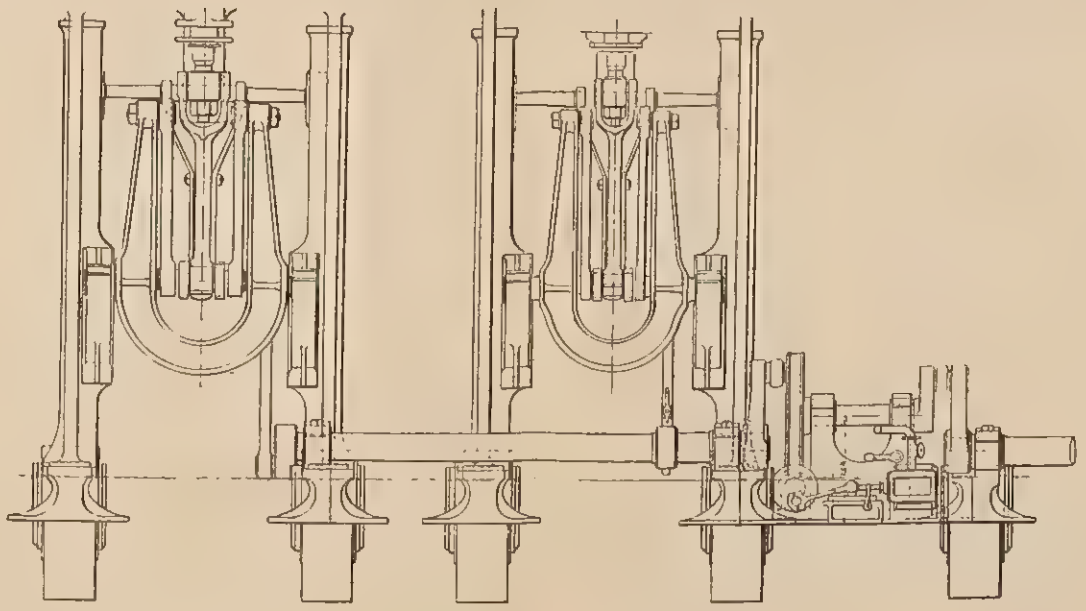
The natural-draft trials of this vessel took place in September and October, 1895, and a mean speed of 19.3 knots was maintained. The following data of the trial have been published:

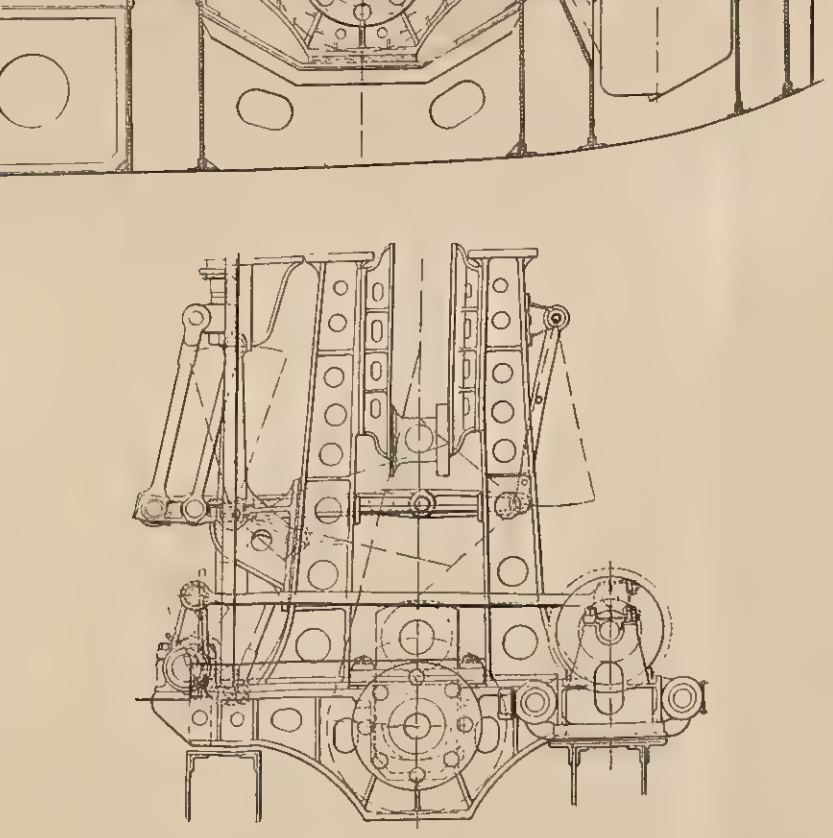
Results of natural-draft trials of the battleship Sicilia.

Hour.	Pressure in boilers.	Starboard engines.					Port engines.					Collective I. H. P.
		Pressure in reservoirs.		Vacuum.	Revolutions.	I. H. P.	Pressure in reservoirs.		Vacuum.	Revolutions.	I. H. P.	
		High.	Low.				High.	Low.				
	Lbs.	*Lbs.*	*Lbs.*	*Ins.*			*Lbs.*	*Lbs.*	*Ins.*			
9.30	92.3	92	18.0	27	83.5	7,355.4	88.5	14.5	27.3	86.0	7,380.0	14,735.4
10	100.3	100	19.0	27	87.0	8,487.3	97.0	18.5	27.5	88.1	8,090.2	16,577.5
10.30	96.0	94	17.0	27	86.0	7,995.6	93.0	15.0	27.3	86.6	7,667.2	15,662.8
11	92.6	91	16.5	27	85.6	7,846.9	91.0	14.5	27.3	86.2	7,373.4	15,220.3
11.30	98.5	97	17.5	27	86.2	8,354.2	95.5	16.0	27.3	87.2	7,926.8	16,281.0
12	92.0	90	17.0	27	81.8	7,629.2	88.0	14.5	27.5	86.1	7,365.1	14,994.7
12.30	94.8	97	17.0	27	87.8	8,875.6	88.5	17.0	27.5	88.2	8,141.9	17,017.5
1.	92.6	93	16.5	27	85.5	8,111.6	91.5	15.0	27.5	86.7	7,784.5	15,896.1
1.30	96.0	95	16.0	27	86.0	8,060.7	92.5	15.5	27.5	87.0	7,791.3	15,852.0
2.	97.1	95	15.5	27	86.3	8,223.1	94.5	15.5	27.5	87.3	7,746.6	15,969.7
2.30	95.6	94	15.5	27	85.2	7,928.4	94.0	15.5	27.5	86.8	7,673.7	15,602.1
3.	92.3	90	15.0	27	84.7	7,643.7	89.5	14.5	27.0	86.2	7,365.6	15,009.3

ENGINES OF THE "SICILIA."







UMBRIA, LOMBARDIA, LIGURIA, ETRURIA, AND ELBA.

The results of the progressive trials of this class of cruisers are given below:

UMBRIA.

(Page 343, No. VIII; 43, No. X.)

	First.	Second.	Third.	Fourth.	Fifth.
Number of boilers used	4	4	4	4	4
Mean boiler pressure.....pounds	130	135	135	138	148
Draft	(a)	(a)	(a)	(a)	(b)
Cut-off in high-pressure cylinder	.65	.65	.65	.52	.65
Revolutions	70	90	110	127	140
Speed	10.3	13	15.5	17.7	19
I. H. P	630	1,820	3,000	4,910	7,400

a Natural. *b* Forced.

LOMBARDIA.

(Page 343, No. VIII.)

	First.	Second.	Third.	Fourth.
Number of boilers used	2	2	4	4
Boiler pressure.....pounds	125	125	140	140
Draft	(a)	(a)	(a)	(b)
Cut-off in high-pressure cylinder	.5	.6	.7	.8
Revolutions	40	79	116	149
Speed	5.3	10.6	15	18.4
I. H. P	175	817	2,610	6,010

a Natural. *b* Forced.

LIGURIA.

(Page 343, No. VIII; 158, No. XII.)

	First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.
Number of boilers used	2	2	2	2	4	4	4	4	4	4
Boiler pressure.....pounds	150	150	146	145	150	140	142	138	143	142
Draft	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(b)
Cut-off in high-pressure cylinder	.2	.2	.2	.2	.2	.2	.2	.2	.3	.4
Revolutions	39	49.5	60	69.5	93.4	89	105	119	127	145.4
Speed	5.1	6.3	7.6	9.1	9.5	11.3	13.3	14.9	15.9	18.1
I. H. P	146	223	423	579	663	1,143	1,935	2,946	3,444	5,536

a Natural. *b* Forced.

ETRURIA.

(Page 343, No. VIII; 43, No. X.)

	First	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	Eleventh.
Number of boilers used	2	2	2	2	2	2	4	4	4	4	4
Boiler pressure ....lbs	145	140	130	140	150	150	115	120	119	143	152
Draft	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(b)
Cut-off in high-pressure cylinder	.43	.43	.43	.43	.43	.43	.65	.65	.65	.65	.65
Revolutions	39.5	48	59	69.4	78.6	89	100.5	105.5	113.5	126	142
Speed	5.6	6.9	8.5	10	11.5	12.8	14	14.9	15.7	16.9	18.8
I. H. P	205	305	520	725	1,022	1,463	2,016	2,630	3,189	4,602	7,019

a Natural. *b* Forced

ELBA.

(Page 42, No. X.)

The trials of this vessel took place in May and June, 1895.

	Steam.	Vacuum.	Revolutions.	I. H. P.	Speed.
	Pounds.	*Inches.*			*Knots.*
Natural-draft	128	26	135	4,928	15.9
Forced-draft	145	26	151	7,471	17.9

An air pressure equivalent to 2 inches of water was maintained during the forced-draft trial.

CAPRERA.

(Page 158, No. XII; 61, No. XIII.)

The trials of this torpedo vessel took place in the summer of 1895. Under natural-draft 2,200 I. H. P. was developed, giving a speed of 17 knots. Under forced-draft, with an air pressure of 1.2 inches of water and a steam pressure of 180 pounds, the I. H. P. developed was 4,190 and the speed attained was 17.75 knots.

MINERVA.

(Page 42, No. XI.)

The forced-draft trial of this vessel, at a displacement of 828 tons and a draught of 10 feet, gave results as follows: I. H. P., 3,884; revolutions, 285; mean speed, 19 knots. The following are the principal characteristics of this vessel of the *Partenope* class:

Armament and protection.—Are like the type ship.

Motive power.—Two sets of 3-cylinder vertical triple-expansion engines and four locomotive boilers.

Dimensions.—Length, 229.3 feet; beam, 26.9 feet; draught, 10.1 feet; displacement, 846 tons.



ETRURIA.



YOSHINO. (Page 65, No. XIII.)

MARCO POLO.

(Page 41, No. XI; 158, No. XII.)

This vessel underwent her steam trial January 20, 1896, at a displacement of 4,584 tons and a mean draught of 19.1 feet. The trial lasted three hours, and four boilers were used with results as follows: Steam pressure, 143.5 pounds; air pressure, 2 inches; vacuum, 27.1 inches; mean revolutions, 140; I. H. P., 10,663; coal consumption per I. H. P. per hour, 2.11 pounds; mean speed, 17.84 knots.

TORPEDO BOATS.

The work of fitting Italian torpedo boats for the use of liquid fuel is progressing. A 28-knot torpedo boat, to be fitted with water-tube boilers, and to use liquid fuel, has been ordered at the Odero Works, Sestri Ponente.

The *Sparviero* in a forced-draft trial at Spezzia developed 1,800 I. H. P. with 280 revolutions and gave a speed of 22.3 knots.

On board the *Aquila* during a steam trial in July, 1895, the crown sheet of a boiler ruptured, filling the boiler and engine rooms with steam. Four of the crew were killed and a number wounded.

Torpedo boat *No. 19* was lost with eleven persons on board.

The navy department has turned over to the treasury department, for use in connection with the custom-houses, Thornycroft torpedo boats *Nos. 3*, *7*, *8*, *9*, *10*, *13*, *15*, *16*, *20*, and *21*, and White torpedo boats *Nos. 5*, *7*, and *14*.

A 135-ton torpedo boat has been ordered at the Odero Works, Sestri Ponente. She will have a length of 154.3 feet, beam 17 feet, and draught 4 feet. Her speed will be 25 knots on 2,500 I. H. P.

JAPAN.

The scheme for increasing the Japanese navy is one of vast proportions and is divided into two programs. The appropriations in this year's budget provide for the first program, which is to be completed in seven years, and which includes 54 vessels with a total displacement of 45,890 tons. The second program is to be completed by April, 1906, and includes 63 vessels with a total displacement of 69,895 tons. The total increase in the navy will thus be 117 vessels, with a total displacement of 115,785 tons. The battleships *Fuji* and *Yashima*, building in England, and those vessels now building in Japan, are not included in the above program. The table on page 70 gives the types of vessels to be built.

	First program.	Second program.	Total.
Battleships	1	3	4
First-class cruisers	2	2	4
Second-class cruisers	3	.....	3
Third-class cruisers	.....	2	2
Torpedo vessels	1	2	3
Torpedo supply vessels	.....	1	1
First-class torpedo boats (large)	8	3	11
First-class torpedo boats	5	18	23
Second-class torpedo boats	28	3	31
Third-class torpedo boats	6	29	35
Total	54	63	117

These vessels will be constructed both at home and abroad as follows:

	Japan.	Abroad.
Battleships	1	3
First-class cruisers	2	2
Second-class cruisers	2	1
Third-class cruisers	2	.....
Torpedo vessels	2	1
Torpedo supply vessels	.....	1
First-class torpedo boats (large)	7	4
First-class torpedo boats	19	4
Second-class torpedo boats (*a*)	.....	.....
Third-class torpedo boats	35	.....

a Not yet determined.

The outlay for 1896 will be (12,749,647 yen) $6,782,812.20. It is also the intention to increase the personnel to a strength about equal to that of Great Britain.

VESSELS PROPOSED, AUTHORIZED, OR BUILDING.

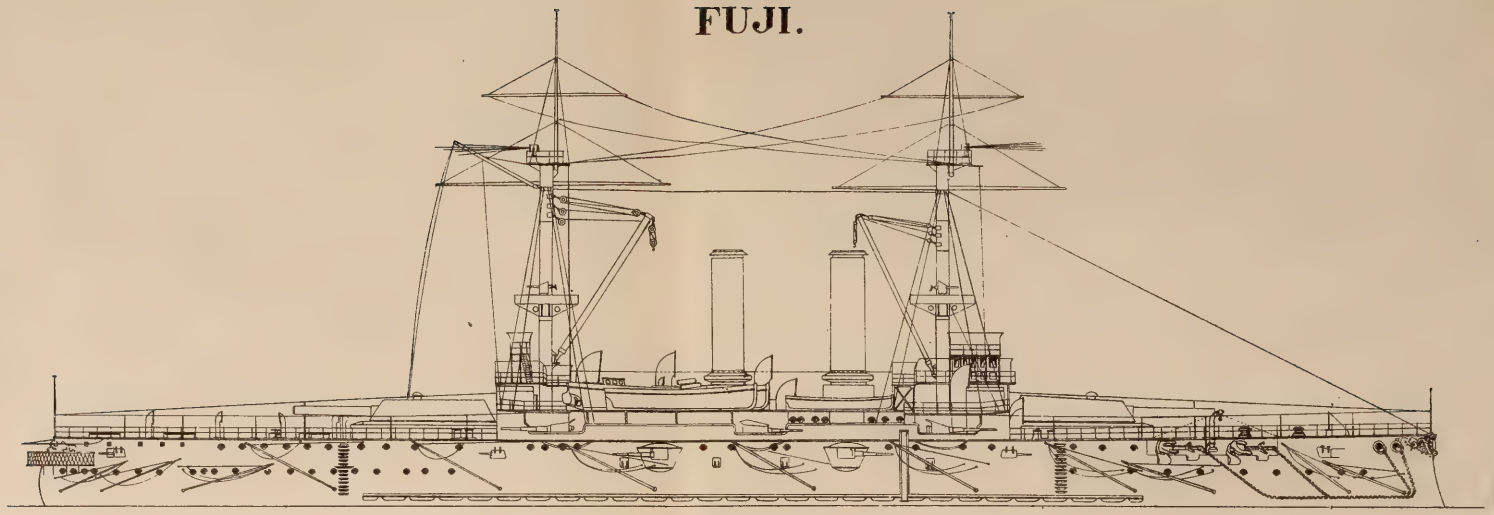
As far as known the vessels of the new program will be of the following types:

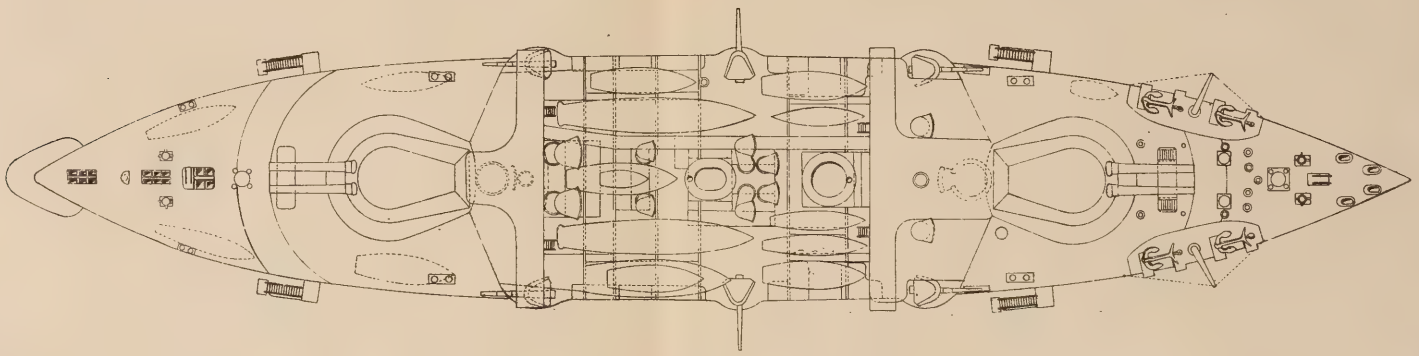
	Tons.
Battleships of the *Majestic* type	15,140
First-class cruisers of the *Edgar* type	7,500
Second-class cruisers of the *Yoshino* type	4,850
Third-class cruisers	3,200
Torpedo vessels	1,200
Torpedo supply vessels of the *Vulcan* type	6,450
First-class torpedo boats of the *Hornet* type	255
First-class torpedo boats	120
Second-class torpedo boats	80
Third-class torpedo boats	54
Vedette boats for battleships	11

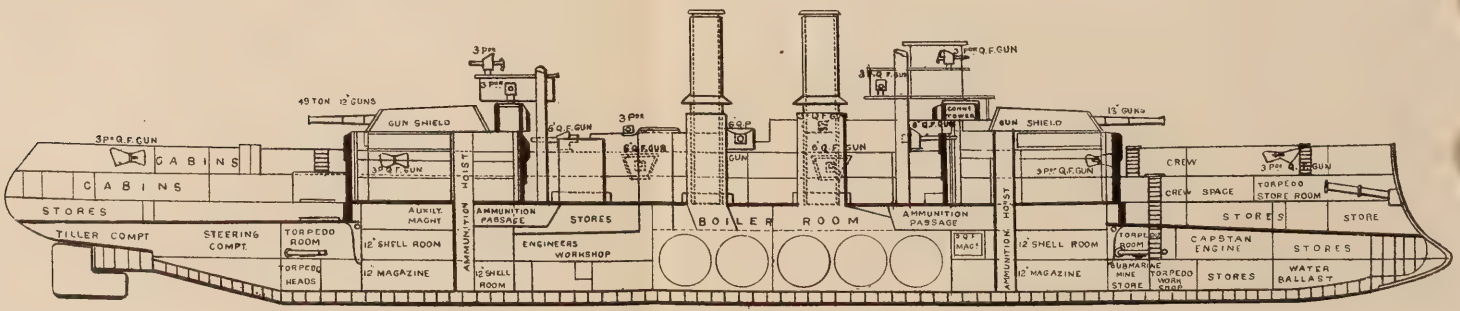
The latest reports state that four battleships, four first-class cruisers, and two second-class cruisers have been ordered in Scotland, and that two cruisers will be ordered in the United States.



FUJI.






3Pdr Q.F.GUN
CABINS
CABINS
STORES
TILLER COMPT
STEERING COMPT.
TORPEDO ROOM
TORPEDO HEADS
49 TON 12" GUNS
GUN SHIELD
3Pdr
6" Q.F.GUN
AUXILY MAGHT
12" SHELL ROOM
12" MAGAZINE
AMMUNITION HOIST
AMMUNITION PASSAGE
STORES
ENGINEERS WORKSHOP
12" SHELL ROOM
BOILER ROOM
9.2" MAG.
AMMUNITION HOIST
AMMUNITION PASSAGE
12" SHELL ROOM
12" MAGAZINE
GUN SHIELD
12" GUNS
CREW
CREW SPACE
TORPEDO STORE ROOM
STORES
STORE
CAPSTAN ENGINE
STORES
TORPEDO ROOM
SUBMARINE MINE STORE
TORPEDO WORK SHOP
STORES
WATER BALLAST

VESSELS LAUNCHED.

FUJI AND YASHIMA.

These battleships are practically sister ships. The *Fuji* was launched at the Thames Iron Works, Blackwall, March 31, 1896, and the *Yashima* by Sir W. G. Armstrong, Mitchell & Co., at Elswick, March 25, 1896. The principal characteristics of these vessels follow:

Armament.—Four 12-inch 49-ton B. L. R., two in each barbette turret forward and aft; six 6-inch R. F. G. in broadside, six of these on the upper deck with shields and four on the main deck in partial sponsons; twenty 3-pounder R. F. G., eight on the bridges, four on the bulwarks, and eight on the main deck; four 2.5-pounder R. F. G. in the tops; and five torpedo tubes, one in bow and two broadside submerged.

Protection.—An armor belt 226 feet long and 8 feet wide extends at normal draught 3 feet below and 5 feet above the water line. It will have a maximum thickness of 18 inches tapering to 14 inches. Above this belt 4 inches of armor extends up to the main deck. The barbettes have 14-inch armor extending down to the main deck; below this, to the protective deck, 9 inches. The pear-shaped turrets have 6 inches of armor in front tapering to less at the rear. From each of the barbettes there are 4-inch screens between the main and protective decks; these are not directly athwartships, but incline at an angle. The 6-inch guns on the main deck have 6-inch armor on the front of their casemates and 2-inch armor on the rear part. The conning tower has 14 inches of armor and the directing tower 3 inches. Over the machinery is a flat protective deck 2.5 inches thick across the top of the belt; forward and abaft this the deck is lower and slopes forward and aft in the usual way. There is an extensive coal protection.

Motive power.—Two sets of triple-expansion engines to develop 13,500 I. H. P. under forced and 10,000 I. H. P. under natural-draft, and give speeds of 18.25 and 16.75 knots, respectively. There are ten single-ended cylindrical boilers with four furnaces each. The total coal supply is 1,200 tons and the normal supply 700 tons.

Dimensions, etc.—Length, 372 feet between perpendiculars; beam, 73.5 feet; depth, 43.6 feet; mean draught, 26.3 feet; displacement, 12,320 tons. The boats consist of two 56-foot torpedo vedette boats, one 42-foot launch for countermining, one 30-foot steam launch, and a number of smaller ones. There are 181 water-tight compartments.

VESSELS RE-ARMING, REFITTING, ETC.

The battleship *Chin Yen* has undergone a very extensive refit, having suffered from neglect while in the Chinese service.

Extensive preparations have been made for raising the Chinese vessels sunk at Weihaiwei, namely, the *Lai Yuen*, *Ching Yuen*, *Wei Yuen*, and *Ting Yuen*, and several of them have already been floated. They will all be repaired and added to the Japanese navy.

The *Hei Yen*, coast defense vessel, captured at Weihaiwei, has been extensively repaired.

The *Kohei*, captured at Weihaiwei, was lost off the Pescadores Islands December 21, 1895, with almost the entire complement of officers and men.

The 5.9-inch Krupp B. L. R. of the *Naniwa* are to be replaced by Armstrong 6-inch R. F. G.

TORPEDO BOATS.

In July, 1895, there were 29 torpedo boats in the Japanese navy, including those captured from China. This force will be increased by the number set forth in the budget. The Yokosuka Navy-Yard has had some experience in torpedo boat construction, and a number of the new boats will be constructed there. The *Fukurin*, after undergoing repairs at Yokosuka, developed a speed of 19 knots.

MOROCCO.

BASCIR.

This vessel has been completed at the yard of Messrs. Orlando Brothers, Leghorn, for Morocco. She is a brig-rigged steamer with a topgallant forecastle and poop, and a sumptuously fitted cabin.

Armament.—One 5-inch R. F. G. on the forecastle; five 4-inch R. F. G., two in sponsons on each broadside and one on poop; four 1-pounder R. F. G., and one bow torpedo tube.

Protection.—A strake of plating 1.4 inches thick, half above and half below water, extends the length of the machinery space. The plating over the magazines is one-half inch thick. Coal is distributed along the side in wake of engines and boilers, and cofferdams in wake of the magazines are filled with cork conglomerate. There are twelve water-tight compartments below the berth deck.

Motive power.—Two sets of 3-cylinder triple-expansion engines develop 2,400 I. H. P. under forced and 1,500 I. H. P. under natural-draft, giving speeds of 15.75 and 13.75 knots, respectively. There are two double-ended and one single-ended cylindrical boilers, and the coal capacity is 240 tons, which at 10 knots speed will give a radius of 6,000 miles.

Dimensions.—Length, 207.4 feet; beam, 30 feet; depth, 17.8 feet; displacement, 1,100 tons.

NETHERLANDS.

The budget for 1896 carries $6,334,726.45, of which $2,613,046.73 is for ship construction and repairs. The minister of marine reports that with the exceptions of the *Reinier Claeszen*, *Evertsen*, *Kortenær*, *Piet Hein*, *Koningin Wilhelmina*, *Sumatra*, and several torpedo boats, the ships of the navy are out of date, their hulls have deteriorated and



KORTENAER.

their engines and boilers are worn out; consequently instead of going to the expense of repairing the old vessels it is recommended that a new building program be commenced with the ultimate view of replacing each old vessel by a new one. The *Holland*, *Zeeland*, and *Friesland* will replace the *Van Galen*, *Koning der Nederlanden*, and the *Johan Willem Friso;* the *Evertsen*, *Kortenær*, and *Piet Hein* will replace the *Buffel*, *Guinea*, and *Tijger*, while three coast-defense vessels yet to be laid down will fill the places of the *Schorpioen*, *Stier*, and *Panter*. The scheme is to be accomplished gradually. There are to be three cruisers, to be completed in 1900, and six coast-defense vessels, to be completed one-half in 1902 and the remainder in 1905.

STEAM TRIALS.

EVERTSEN, KORTENÆR, AND PIET HEIN.

(Page 59, No. XIII; 51, No. XIV.)

These vessels had their steam trials as follows, viz:

EVERTSEN.

Date, 1895	Nov. 12.	Nov. 12.	Nov. 14.
Trial	Coal consumption, one boiler.	Coal consumption, two boilers.	Forced-draft.
Duration ..... hours..	4	4	4
Boiler pressure ..... pounds..	160–120	142–186	175–190
Speed ..... knots..	9.21	12.43	15.85
I. H. P.	785	1,886	4,735
Coal consumption per I. H. P. per hour ..... pounds..	1.9	2.1	2.6

KORTENÆR.

Date, 1895	Oct. 1.	Oct. 1.	Oct. 3.	Oct. 8.	Oct. 9.	Oct. 9.	Oct. 10.	Oct. 24.
Trial	One-half power speed trial.	One-half power speed trial.	Natural-draft full power coal trial.	Forced-draft power trial.	One boiler coal trial.	Two boilers coal trial.	Two boilers coal trial.	Forced-draft power trial.
Duration ..... hours..	1	1.5	4	4	4	6	4	4
Boiler pressure ..... pounds..	180	180	150–175	180–150	175–155	150–175	160–180	180–186
Speed ..... knots..	10.78	8.76	14.44	15.3	8	10.1	12.88	15.78
I. H. P.	1,017	1,187	3,435	4,095	479	964	2,161.5	4,436
Coal consumption per I. H. P. per hour ..... pounds..	.....	.....	1.7	1.8	2.0	1.8	1.3	1.7

PIET HEIN.

Date, 1895	Oct. 11.	Oct. 11.	Oct. 12.	Oct. 12.	Oct. 17.	Oct. 18.	Oct. 18.	Oct. 19.	Oct. 24.
Trial	Speed trial.	Speed trial.	Natural-draft speed trial.	Forced-draft speed trial.	Forced-draft power trial.	One boiler coal trial.	One boiler coal trial.	Two boilers coal trial.	Forced-draft power trial.
Duration...hours..	1	1	2	1	4	6	4	4	4
Boiler pressure, pounds	175	165	182–168	176–148	180–155	140–170	175–160	175	180–170
Speed.....knots..	10.2	13.78	13.7	15.14	15.67	10.44	8.36	13.64	16.12
I. H. P	1,010	2,787	2,675	3,995	4,416	995	542	2,452	4,736
Coal consumption per I. H. P. per hour....pounds..	2.0	1.8	2.0	2.0	2.0	1.9	.....	1.9	2.0

NIAS.

(Page 58, No. XIII.)

This gun vessel, for duty in the East Indies, had her trials in 1895, as follows:

Date	Nov. 5.	Nov. 5.	Nov. 9.	Nov. 15.
Trial	One boiler coal trial.	Speed trial.	Full power forced-draft.	Full power natural-draft.
Duration.....hours..	4	1	4	4
Boiler pressure.....pounds..	170–144	170	193–154	180
Speed.....knots..	8.75	12.58	13.05	12.29
I. H. P	253	939	1,227	910
Coal consumption per I. H. P. per hour.....pounds..	2.7	.....	1.7	1.6

She was constructed at Amsterdam by Huygens & Van Gelder and has the following characteristics:

Armament.—Three 4.7-inch R. F. G. and two 1.4-inch R. F. G.

Motive power.—Two sets of vertical triple-expansion engines and two cylindrical boilers. I. H. P. 1,100 and speed 14 knots.

Dimensions.—Length, 164.3 feet; beam, 30.6 feet; maximum draught, 11 feet; displacement, 810 tons.

VESSELS STRUCK FROM THE LIST.

The coast-defense vessels *Buffel* and *Guinea* have been struck from the list.

NORWAY.

A naval commission appointed to consider the question of the ship-building policy of Norway recommended the construction of two coast-defense vessels of the Swedish *Svea* type and three torpedo boats. The budget for 1895–96 provides for these new vessels, and for thoroughly refitting the four old coast-defense vessels *Mjölner*, *Skorpionen*, *Thor*, and *Thrudvang*. For the two new coast-defense vessels $2,144,000 is appropriated, and for refitting the old ones $114,168.

VESSELS PROPOSED, AUTHORIZED, OR BUILDING.

TWO COAST-DEFENSE VESSELS.

These vessels will resemble the *Svea* (p. 77, No. XIII). The contract for their construction has been awarded to Sir W. Armstrong, Mitchell & Co., at whose yard they were laid down in May, 1896. They will have the following characteristics:

Armament.—Two 9.8-inch B. L. R. in hooded barbettes, one forward, one aft; four 4.7-inch R. F. G., six 9-pounder R. F. G., ten 1-pounder R. F. G.

Protection.—The thickness of armor on the citadel is 9.6 inches and elsewhere it ranges from 2 inches to 10.7 inches.

Motive power.—Two sets of engines will develop 3,700 I. H. P. under natural-draft and give a speed of 15 knots.

Dimensions.—Length, 274.5 feet; beam, 48 feet; draught, 17 feet; displacement, 3,400 tons.

FRITHJOF.

The principal characteristics of this torpedo vessel are as follows:

Armament.—Two 4.7-inch Armstrong (45-caliber) R. F. G., four 12-pounder (41-caliber) R. F. G., four 1-pounder (45-caliber) R. F. G., two 2.95-inch field guns, and two 18-inch torpedo tubes.

Protection.—The protective deck is of two thicknesses of plating, in all 1.4 inches. Glacis plates 5 inches thick protect the machinery. There is also coal protection and a cellulose belt. The conning tower is 3.3 inches thick.

Motive power.—Two sets of 3-cylinder vertical triple-expansion engines developing 3,000 I. H. P., and six cylindrical boilers carrying a steam pressure of 160 pounds.

Dimensions.—Length, 217.2 feet; beam, 32.8 feet; draught, 13 feet; displacement, 1,371 tons.

VESSELS LAUNCHED.

VALKYRIEN.

(Page 52, No. XIV.)

This torpedo vessel, built by subscription, was launched March 26, 1896.

VESSELS RE-ARMING, REFITTING, ETC.

The *Mjölner*, *Skorpionen*, *Thor*, and *Thrudvang* will have two 4.7-inch R. F. G. and two 9-pounder R. F. G. Six of the old second-class gunboats will receive 1-pounder R. F. G., and two of them will be fitted for handling submarine mines. One of the third-class gunboats rebuilding will have one 9-pounder R. F. G.

TORPEDO BOATS.

Under the budget for 1895–96 $226,728 is appropriated for three torpedo boats. These three boats will be built at the Schichau Works,

Elbing, and will have a displacement of 95 tons and a speed of 23 knots. It is rumored that one of the three may be larger than the others.

PORTUGAL.

It is reported that the Portuguese Government has ordered from the Thames Iron Works and Shipbuilding Company, Blackwall, one fast cruiser, two gunboats, and a seagoing tug.

VESSELS LAUNCHED.

SALVADOR CORREIA.

This vessel is a transport built by Messrs. Laird Brothers, Birkenhead, for Portugal, at a cost of $56,208.

Armament.—The battery was installed at Lisbon and consists of one 12-pounder R. F. G. and two 1-pounder R. F. G.

Motive power.—The engines are compound, developing 48 I. H. P., and the boilers are cylindrical. Speed, 11 knots.

Dimensions.—Length, 140 feet; beam, 21 feet; draught, 8.5 feet; displacement, 300 tons.

DOM LUIZ.

This gun vessel, of the type of the *Diu* (p. 51, No. IX), was launched June 22, 1895. The following are the principal features:

Armament.—Four 4-inch Krupp R. F. G., two forward, two aft; one 9-pounder R. F. G., and one machine gun.

Motive power.—One horizontal 2-cylinder compound engine and two cylindrical boilers. Speed, 10 knots; coal capacity, 105 tons.

Dimensions.—Length, 150.5 feet; beam, 27.5 feet; draught, 13.6 feet; displacement, 721 tons.

HONORIO BARRETO.

A light-draught gunboat, launched by Messrs. H. Parry & Son, Ginjal, for service in Guinea.

Armament.—Two 3-pounder R. F. G., one forward and one aft, and one Nordenfelt machine gun, each gun being protected by steel screens so as to form a sort of turret.

Dimensions.—Length, 99 feet; beam, 16.5 feet; draught, 33 inches; displacement, 93 tons.

ADAMASTOR.

(Page 53, No. XIV.)

This vessel will be launched July 12, 1896.

VESSELS REFITTED.

VASCO DA GAMA.

This battleship had new steering gear installed at Southampton, England, in the summer of 1895.



XII APOSTLES. (Page 71, No. XIII.)

RUSSIA.

The Czar has approved estimates including a shipbuilding program covering a period of seven years; the total expenditure to be $321,579,320. For 1896 the sum of $44,772,000 is provided, which will increase by a yearly increment of $389,320, until in 1902 it amounts to $47,107,320. For new construction in 1896 the sum of $14,015,320 is appropriated. Work is to be continued on the *General Admiral Apraxine*, *Russia*, *Verni*, *Khrabry*, and *Rostislav*. The new ones provided for are the *Svetlana*, *Pérésviet*, *Osliabia*, 2 protected cruisers of 6,500 tons, 1 torpedo vessel, 20 torpedo boats, including the 5 authorized last year, and 1 gunboat. It is also the intention to build a 14,000-ton armored vessel at the Baltic Works. The *Sisoi Velikii No. 3* (p. 54, No. XIV) is apparently not provided for this year and the *Rurik No. 3* of last year's budget has given way to one of the 6,500-ton cruisers.

VESSELS PROPOSED, AUTHORIZED, AND BUILDING.

A BATTLESHIP.

A battleship of 14,000 tons displacement will be laid down at the Baltic Works.

ROSTISLAV.

(Page 66, No. XIII.)

The keel of this battleship was laid at the navy-yard, Nikolaiev, in the summer of 1895. She is to be a modification of the *Sisoi Velikii*.

Armament.—Four 12-inch B. L. R. in two turrets with arc of 270 degrees; six 6-inch R. F. G. in central battery with arc of 100 degrees, four of these may be placed in small turrets; sixteen 3-pounder and 1-pounder R. F. G., and six torpedo tubes, one forward, one aft, and two in each broadside.

Protection.—For four-fifths of the length a water-line belt 7 feet wide tapers from 16 to 12 inches in thickness. The central redoubt above the belt is protected by 5 inches of armor and the turrets are 12 inches thick in front and 10 inches in rear. The armored deck varies in thickness from 3 to 2 inches.

Motive power.—Two sets of vertical triple-expansion engines develop 8,500 I. H. P. and give a speed of 16 knots. There will be sixteen boilers in four compartments, with furnaces fitted to burn liquid fuel.

Dimensions.—Length, 344.5 feet; beam, 66.5 feet; draught, 23.5 feet; displacement, 8,880 tons.

PÉRÉSVIET AND OSLIABIA.

Of these armored cruisers or second-class battleships the former was laid down at the Baltic Works November 21, 1895, and the latter at the New Admiralty Yard on the same date. Few of the particulars are yet published, but both vessels will be sheathed.

Armament.—Four 10-inch (45-caliber) B. L. R., two in each turret; eleven 6-inch R. F. G. in casemates; sixteen 2.95-inch R. F. G.; six 3-pounder and twenty 1-pounder R. F. G.; and three above-water and two submerged torpedo tubes.

Protection.—Armor belt for three-quarters of the length 9 inches thick, tapering to 7 inches at the ends, and 7.7 feet wide. The transverse bulkheads and the ends of the belt are 8 to 7 inches thick. The armored deck varies in thickness from 2.5 to 3.5 inches. The turret armor is 10 inches thick and on the casemates 5 inches. The conning towers are 12 inches thick.

Motive power.—Three sets of triple-expansion engines to develop 14,500 I. H. P. and give a speed of 18 knots. Thirty Belleville boilers. Coal supply, 2,050 tons. Radius of action at 10 knots' speed, 5,980 miles.

Dimensions.—Length, 434.5 feet; beam, 71.8 feet; draught, 26 feet; displacement, 12,674 tons.

DIANA AND PALLADA.

These protected cruisers will be constructed at the Galernia Yard.

Armament.—Six 6-inch (45-caliber) R. F. G., six 4.7-inch (45-caliber) R. F. G., eighteen 3-pounder R. F. G., fourteen 1-pounder R. F. G., two 2.5-inch field pieces, and four torpedo tubes.

Protection.—A curved protective deck extends the full length of the ship with a thickness of 3 inches on slopes and 2 inches on flat. There is extensive coal protection.

Motive power.—Three sets of engines drive triple screws. They are of the 3-cylinder vertical triple-expansion type, to develop 11,600 I. H. P., and give a speed of 20 knots. Belleville boilers. Normal coal supply, 972 tons.

Dimensions.—Length, 414 feet; beam, 55 feet; draught, 21 feet; displacement, 6,630 tons.

SVETLANA.

(Page 55, No. XIV.)

This cruiser was laid down at Graville, near Havre, in the summer of 1895. A more detailed description than that in No. XIV follows:

Armament.—Six 5.9-inch (45-caliber) R. F. G., one each on forecastle and poop, and four in sponsons on gun deck; ten 3-pounder R. F. G., and six above-water torpedo tubes, one in bow, one in stern, and four in broadside.

Protection.—The protective deck has a thickness of 1.96 inches on the slopes and 0.98 inch on the flat, with cofferdams worked along the water line for 266 feet. Glacis plates a foot high and 4.7 inches thick protect the openings in the protective deck, and a débris deck 0.6 inch thick is worked under the protective deck and over the machinery and boilers. The double bottom extends under the machinery and boiler spaces. The conning tower will have a thickness of 3.9 inches, and

the ammunition hoists are protected by trunks. The magazines and living spaces will be covered by linoleum and canvas.

Motive power.—Two sets of 3-cylinder vertical triple-expansion engines to develop 8,500 I. H. P. and give a speed of 20 knots. There will be eighteen Belleville boilers in six fire rooms.

Dimensions, etc.—Length, 331.4 feet; beam, 42.7 feet; depth, 35 feet; draught, 18.8 feet; displacement, 3,828 tons. She will have two pole masts and three smoke-pipes and will be sheathed with teak and copper.

GILIAK.

A gun vessel to be used as a *stationnaire* in the Chinese rivers will be built on the Neva.

Armament.—One 4.7-inch R. F. G.; five 2.95-inch R. F. G.; four 3-pounder R. F. G.; six 1-pounder R. F. G.

Protection.—Coal carried in side bunkers protects the water line.

Motive power.—Two sets of 3-cylinder vertical triple-expansion engines to develop 1,000 I. H. P. and give a speed of 12 knots. Six Belleville boilers. Coal capacity, 80 tons.

Dimensions.—Length, 207 feet; beam, 37 feet; draught, 8.5 feet; displacement, 963 tons.

TWO TORPEDO VESSELS.

These vessels are building at the works of Messrs. Crichton & Co., Abo. They are of the *Gaidamak* class, but larger, having a displacement of 550 tons.

MINE VESSEL.

A mine vessel of 800 tons displacement, building at the Nevsky Works, St. Petersburg.

VESSELS LAUNCHED.

GENERAL ADMIRAL APRAXINE.

(Pages 67, 68, No. XIII; 67, No. XIV.)

This coast-defense vessel of the class of the *Admiral Senyavin* and *Admiral Ushakov* was launched on the Neva in presence of the Czar May 12, 1896.

Armament.—Four 9.2-inch B. L. R., coupled in turrets forward and aft; four 5.9-inch Canet R. F. G. in the redoubt; six 3-pounder R. F. G. and eight 1-pounder R. F. G. on the upper deck; four smaller guns in the tops, and four torpedo tubes, one in bow, one in stern, and two in broadside.

Protection.—A belt extends for 177 feet of the length and is 10 inches thick amidships, tapering to 8.8 inches forward and 7.8 inches aft. The ends of this belt are joined by transverse bulkheads 7.8 inches thick

forward and 5.9 inches aft. The turrets are 7.8 inches thick and the armored deck 3 inches, tapering to 2.5 inches.

Motive power.—Two sets of triple-expansion engines will give a speed of 14 knots under natural-draft and 16 knots under forced-draft. There are eight boilers. The normal coal supply will be 215 tons and the maximum 390 tons. The steaming radius at 10 knots will be 1,600 miles.

Dimensions.—Length, 278 feet; beam, 52 feet; draught, 17 feet; displacement, 4,126 tons.

RUSSIA.

(Page 54, No. XIV.)

This vessel was also launched in presence of the Czar on May 12, 1896. Some changes are to be made in her battery and she will carry a greater number of guns, but they will be of smaller caliber than first designed.

The armament now comprises four 8-inch B. L. R. in sponsons, sixteen 6-inch R. F. G. in battery, twelve 2.95-inch (50-caliber) R. F. G., eighteen 3-pounder R. F. G., eighteen 1-pounder R. F. G., and two 2.5-inch field and boat guns. The revised dimensions are: Length, 480.5 feet; beam, 68.5 feet; draught, 26 feet, and displacement, 12,195 tons. The coal capacity is 2,500 tons.

VERNI.

(Page 56, No. XIV.)

This school-ship for naval cadets was launched at the Baltic Works, St. Petersburg, on November 21, 1895. She is a composite vessel and carries 13,000 square feet of sail, but her engines develop 500 I. H. P. and give a speed of 10 knots. Belleville boilers are installed. The dimensions are: Length, 223 feet; beam, 36 feet; draught, 13.5 feet, and displacement, 1,290 tons. She will carry four 4.7-inch R. F. G. and a secondary battery.

KHRABRY.

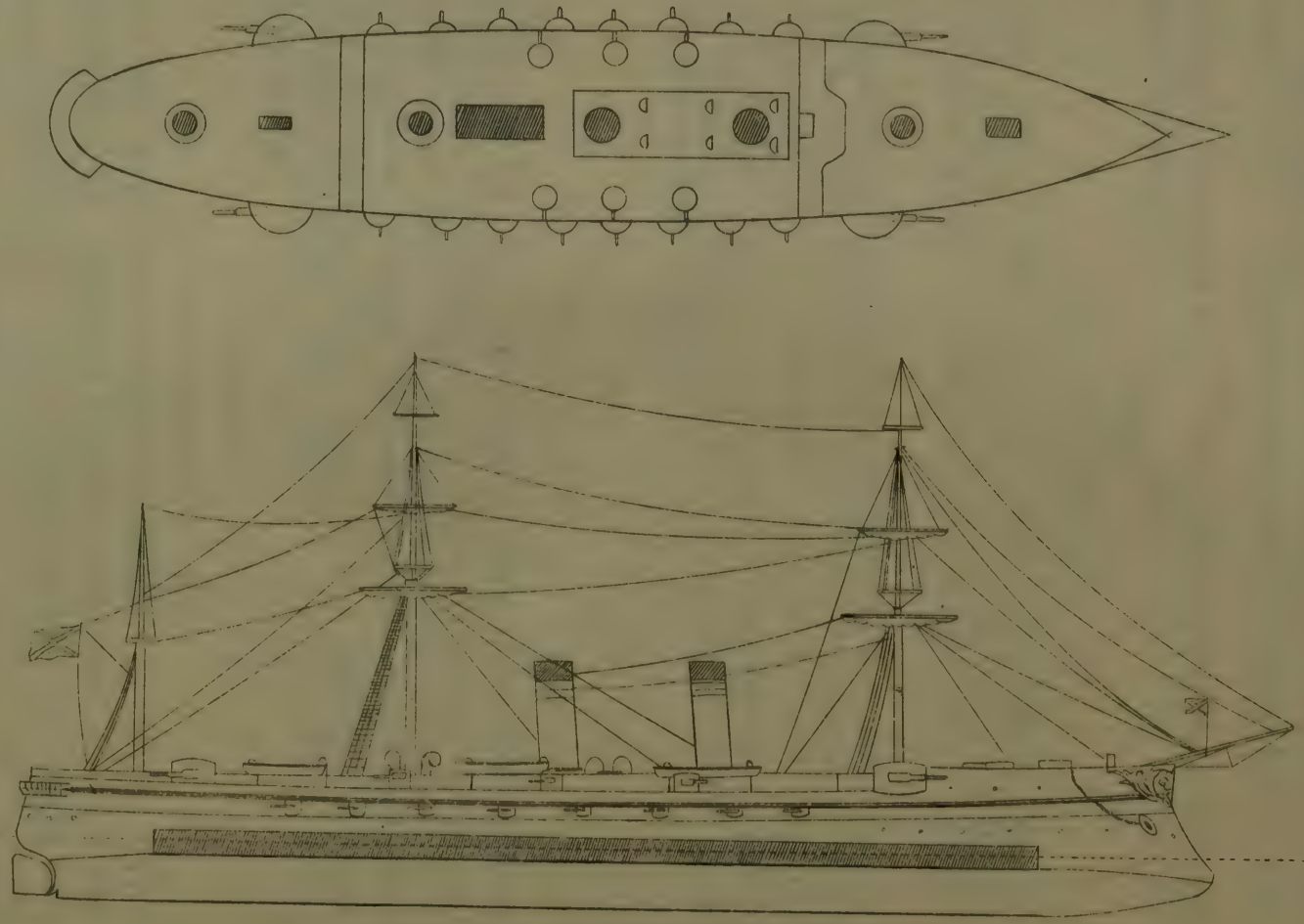
(Page 55, No. XIV.)

Armored gun vessel, sister ship of the *Otvajnii* (p. 72, No. XIII), launched at the New Admiralty Yard, St. Petersburg, on November 21, 1895. She is fitted with eight Niclausse boilers, and differs from her prototype by having a topgallant forecastle and the following armament: Two 8-inch (45-caliber) B. L. R., one 6-inch (45-caliber) R. F. G., seven 3-pounder R. F. G., five 1-pounder R. F. G., and two 2.5-inch boat guns.

ABREK.

(Page 68, No. XIII.)

This vessel, of the *Gaidamak* class, was launched at the works of Messrs. Crichton & Co., Abo, in June, 1896.



DECK PLAN AND PROFILE OF "RURIK."

Journal R.U.S. Institution.



RURIK.

STEAM TRIALS.

GEORGII POBYEDONOSETZ.

(Page 45, No. XI.)

The steam trials of this battleship were held off Sevastopol May 21, 1896. The trial was one for horsepower with an air pressure of 0.25 inch in the fire rooms and the hourly results were as tabulated below:

	Steam pressure.	Vacuum.		Revolutions.		I. H. P.		Total. I. P. H.
		Starboard.	Port.	Starboard.	Port.	Starboard.	Port.	
First hour	135	28	28	89	88	6,478.8	6,235.2	12,714
Second hour	138	28.3	28.3	89	87.5	6,379.3	6,301.3	12,680.6
Third hour	150	28.3	28.3	92	90	7,067.4	6,833.1	13,890.5
Fourth hour	140	28.3	28.3	90	90	6,811.6	6,819	13,630.6
Fifth hour	145	28.5	28	92	91	6,821.3	7,169.8	13,991.1
Sixth hour	140	28.5	28	91	91	6,782.6	7,117.8	13,900.4
Mean total I. H. P.								13,468

ADMIRAL USHAKOV.

(Page 160, No. XII; 68, No. XIII.)

The twelve hours' natural-draft trial on October 3, 1895, gave a speed of 15 knots on 5,764 I. H. P.

RURIK.

(Page 38, No. IX; 161, No. XII; 58, No. XIV.)

A four hours' trial of this vessel on September 5, 1895, gave an average speed of 18.84 knots with 82 revolutions and a boiler pressure of 120 to 130 pounds. On September 7, 1895, a trial for full power gave 13,711 I. H. P. A complete description of this vessel follows:

Armament.—Four 7.87-inch B. L. R. in sponsons on the main deck, sixteen 5.9-inch R. F. G. in broadside on the gun deck, six 4.7-inch R. F. G., in broadside on the main deck, eighteen 3-pounder and 1-pounder R. F. G., two boat howitzers, and four torpedo tubes. The ammunition is hoisted electrically and run out to the guns on overhead trolleys. All the guns in the main battery are fitted with electrical firing apparatus, and concentration of fire may be controlled from the conning tower. Electric night sights are fitted. The range, charge, and projectile to be used are signaled from the conning tower to the guns, and indicated upon dials about a foot in diameter fitted between the guns. The faces of the dials are painted with phosphorescent paint so as to be readable at night. Five search lights are carried.

Protection.—The side for about three-quarters of the length is protected by a water-line belt 9.8 inches thick and 7 feet wide. The protective deck is 1.6 inches thick, and instead of gratings over its openings it has solid doors.

Motive power.—There are four sets of 3-cylinder vertical triple-expansion engines, two on each shaft, of which the forward engine in each

pair may be disconnected. The boiler power consists of eight double-ended cylindrical boilers below and two single-ended ones above the protective deck. Closed fire room forced-draft is used. The radius of action with 2,000 tons of coal is estimated at 20,000 miles.

Electric plant.—There are three sets of two Sautter-Harlé dynamos each. Those below the protective deck are for use in action. The output of each dynamo is 320 ampères at 100 volts. Three large storage batteries are carried, in which sufficient power is stored to run the motors and incandescent lights for eight hours.

Dimensions, boats, etc.—Length, 426.5 feet; beam, 66 feet; draught, 25.6 feet; displacement, 11,270 tons. Two 14-knot vedette boats are carried, each of which carries a bow tube and a search light.

SAMOÏED.

(Page 56, No. XIV.)

The trial of this transport August 20, 1895, gave a speed of 12.5 knots, the I. H. P. developed being 1,495; the revolutions, 142; the steam pressure, 160 pounds, and the vacuum 28 inches.

VLADIMIR.

(Page 56, No. XIV.)

The trial of this vessel resulted in a speed of 13.5 knots for forty-eight hours with an I. H. P. of 3,500.

VESSELS RE-ARMING, REFITTING, ETC.

DMITRI DONSKOÏ.

This armored cruiser has undergone extensive repairs at Cronstadt. The masts have been reduced in size and fitted with lighter yards. The old battery has been replaced by four 5.9-inch R. F. G. and ten 4.7-inch R. F. G., both being 45 calibers long, and six 1-pounder R. F. G. have been mounted in the fore-top and four in the mizzen-top. New boilers have been supplied.

MININ.

To have new engines, new boilers, and a new armament.

GERTZOG EDINBURGSKII.

This armored cruiser is to have new engines, new boilers, and a new armament.

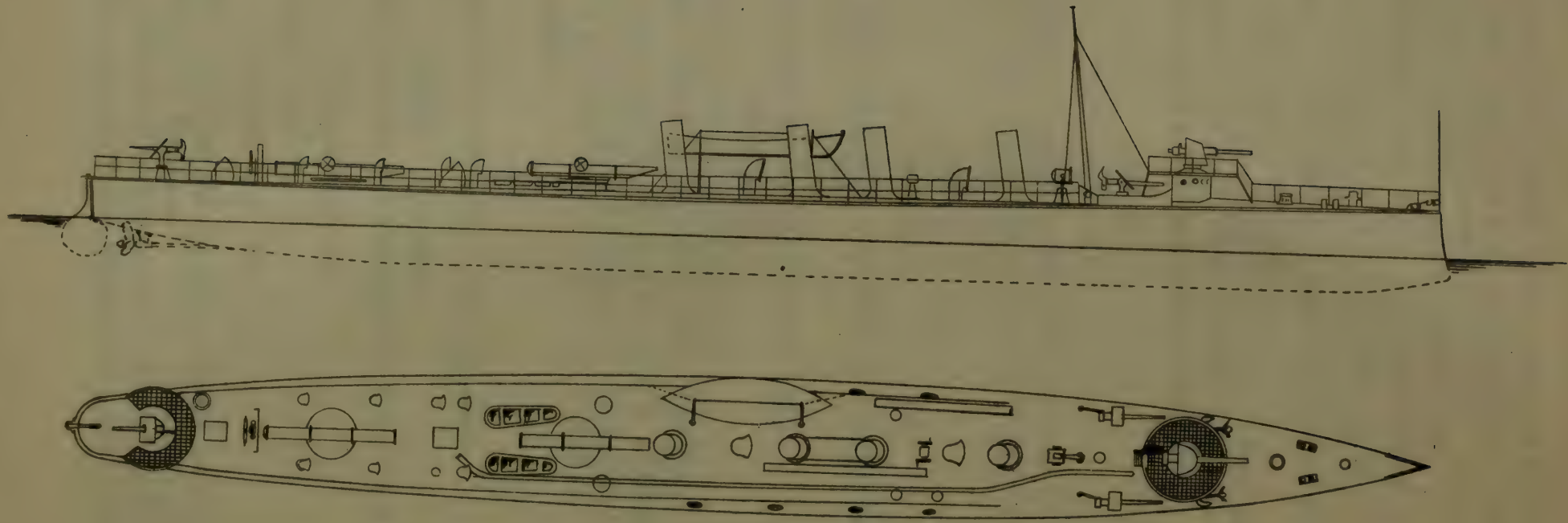
VLADIMIR MONOMACH.

To have a new battery of R. F. G.

TORPEDO BOATS.

Hereafter with a few exceptions the Russian torpedo boats will be known by numbers instead of by names. The boats in the Baltic will have numbers from 101 upward and those in the Black Sea from 251 upward. The exceptions seem to be the *Vzriev*, *Sokol*, *Revel*, *Sveaborg*,

SOKOL.





SOKOL.

and *Borgó*. The small boats are numbered from 1 to 100, and as a rule but about sixty of them are of value. A total of twenty-two torpedo boats will be built this year, eighteen of them being of the *Anakria* and *Pernov* types, the former to cost $61,471 each and the latter $110,546 each. Several boats of the *Pernov* type have already been launched. A boat of the *Sokol* type has been ordered of Messrs. Crichton & Co., at Abo, to cost $204,900, and three others of this type are proposed. Thus since 1894 twenty four boats of the *Pernov* type have been completed or are now under construction. Torpedo boat *No. 269* has been sunk in a collision.

New classification of torpedo boats.

BALTIC.

Former name.	Present number.	Former name.	Present number.
Kotlin	101	Tosna	115
Viborg	102	Domesnes	116
Pernov	103	Ekeness	117
Sestroretsk	104	Dago	118
Lakta	105	Polangen	119
Louga	106	Pakerort	120
Narva	107	Nargen	121
Abo	108	Gogland	122
Vindava	109	Kronstchlot	123
Libava	110	[illegible]eskar	124
Biorke	111	[illegible]pe	[illegible]25
Rochensalm	112	Transund	1[illegible]6
Gapsal	113	New boats	131
Moonsund	114		132

BLACK SEA.

Former name.	Present number.	Former name.	Present number.
Batoum	251	Kilya	262
Anapa	252	Novorossisk	263
Aitodor	253	Rene	264
Gagri	254	Chardak	2[illegible]5
Gelenjik	255	Yalta	2[illegible]6
Kotka	256	Ismaila	2[illegible]7
Sookoom	257	New boats	268
Poti	258		269
Adler	259		270
Anakria	260		271
Kodor	261		

SOKOL.

(Page 59, No. XIV.)

The trial of this torpedo boat on September 6, 1895, in England, consisted in three runs over the measured mile at Maplin, a straightaway run to seaward and back lasting two hours and a quarter, and three

final runs over the mile. The mean speed was calculated from the revolutions as noted on the measured mile. The results were as follows:

First set of mile runs.

	Mean pressure in steam pipe.	Air pressure.	Mean revolutions.	Observed time.	Speed.	Mean of two runs.	Mean speed.
	Pounds.	*Inches.*		*M. S.*	*Knots.*	*Knots.*	*Knots.*
First mile	153	1.13	394.12	2 11	27.481	29.392	29.445
Second mile	154	1.32	403.3	1 55	31.304		
Third mile	152	1.25	394.8	2 10	27.692	29.498	

Then followed the run of two hours and a quarter, during which the revolutions averaged 405 per minute.

Second set of mile runs.

	Mean pressure in steam pipe.	Air pressure.	Mean revolutions.	Observed time.	Speed.	Mean of two runs.	Mean speed.
	Pounds.	*Inches.*		*M. S.*	*Knots.*	*Knots.*	*Knots.*
First mile	156	1.63	411	1 53.5	31.718	30.032	30.102
Second mile	159	1.37	412.2	2 7	28.346		
Third mile	162	1.37	410.1	1 52.5	32.000	30.173	

From the mean of these runs the speed was calculated to be 29.762 knots, and the coal consumption for the three hours was 10.35 tons. The I. H. P. was under 4,000.

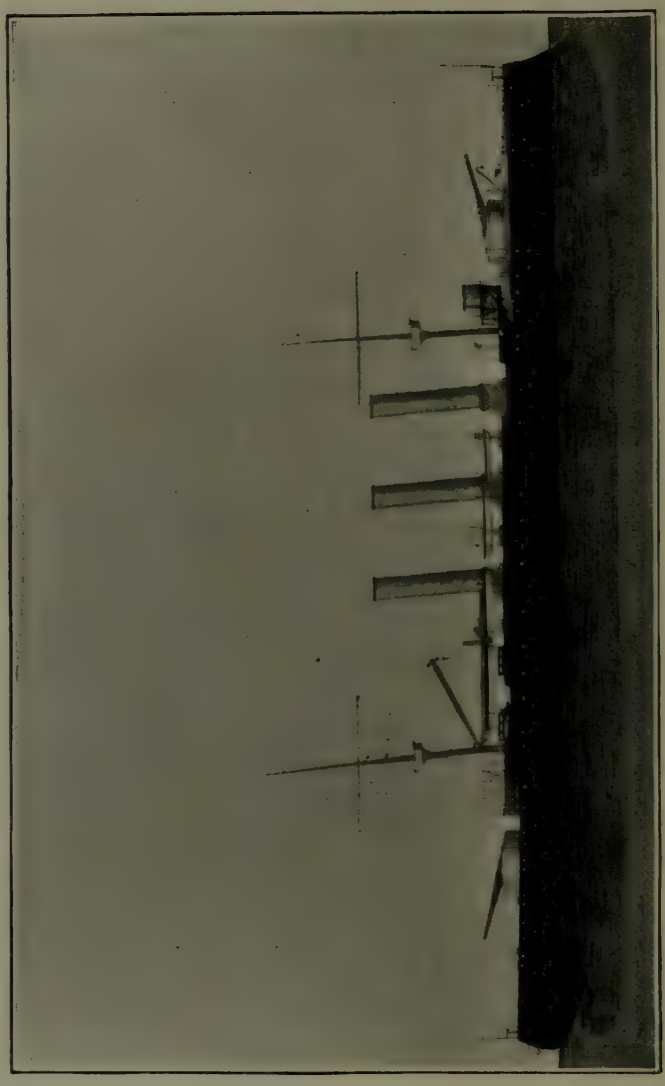
VIBORG.

This torpedo boat, now known as *No. 102*, has been fitted to burn liquid fuel.

SPAIN.

The naval estimates for 1896 carry a total of $4,439,000. The following items are appropriated for: The new *Reina Regente*, $386,000; for a battleship of 11,000 tons, $579,000, the total cost of which is estimated at $4,246,000; for two 6,800-ton cruisers, $965,000, the total cost to be $2,895,000; for two torpedo vessels, $829,900; for three 400-ton tugs, $289,500; to change the 4.72-inch B. L. R. to 5.5-inch R. F. G., in the *Pelayo*, $173,700; to refit the *Numancia*, $965,000; to fit new boilers in the *Destructor*, $104,220.

Great activity has been manifested in the navy-yards in fitting out ships for service in Cuban waters. Officers were sent into Scotland to inspect merchant vessels suitable for conversion into cruisers for such service, but none seem to have been secured, and six steamers of the Compañia Transatlantica have been supplied with their regular armaments, as vessels of the naval reserve, and taken into service at a monthly rental of $115,800.

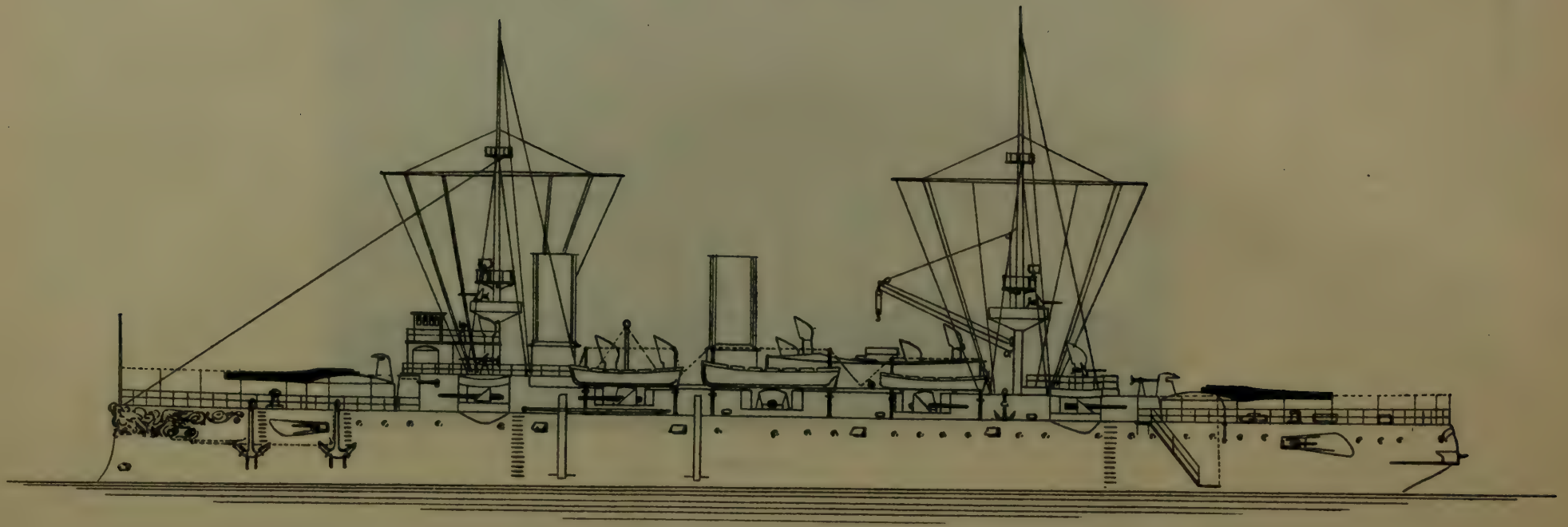


CARLOS V.



PRINCESA DE ASTURIAS

AND CLASS.





INFANTA MARIA TERESA.

The vessels of the Spanish navy have been reclassified by a recent order and divided into protected and unprotected as follows: Protected: First class, armored vessels of over 9,000 tons; second class, armored vessels from 6,000 to 9,000 tons and all protected cruisers. Unprotected: First class, cruisers from 2,000 to 6,000 tons; second class, cruisers from 800 to 2,000 tons. Gun vessels: First class, from 300 to 500 tons; second class, from 100 to 300 tons; third class, from 20 to 100 tons. Torpedo boats: First class, from 100 to 500 tons; second class, less than 100 tons.

The Spanish people in all parts of the world have taken an interest in their navy and in some cases have contributed money toward its enlargement. An organization of Spanish subjects in Mexico is reported to have contributed $225,000 toward a torpedo vessel of the *Temerario* type, and other colonies in Caracas and Lima have been equally patriotic. A syndicate in Madrid offers to build a gunboat for service in Cuba, and the Centro de Dependientes de Comercio of Havana will likewise purchase a small gunboat, for like service. A commission was sent to Italy in May, 1896, to inspect two armored cruisers of the type of the *Giuseppe Garibaldi*, which Messrs. Ansaldo Brothers offer to sell for about $3,400,000 each.

Shipbuilding in the navy-yards of Spain progresses very slowly. It took from ten to twelve years to build the cruisers of the *Reina Mercedes* class, and the *Princesa de Asturias*, whose keel was laid in October, 1889, is still on the ways progressing at the rate of 0.88 ton per day. The cost of building in the navy-yards is from three to four times as great as the cost in private yards. Of the three protected cruisers of the same class, the *Isla de Cuba*, *Isla de Luzon*, and *Marques de la Enseñada*, the first two, built in England, cost $223,590 each, while the last, built in Spain, cost $1,439,973, which, even allowing 25 per cent for exchange, still makes the *Enseñada* cost five times as much as her sister ships.

VESSELS PROPOSED, AUTHORIZED, OR BUILDING.

PRINCESA DE ASTURIAS, CARDENAL CISNEROS, AND CATALUÑA.

(Page 50, No. X.)

These armored cruisers, building at the navy-yards at La Carraca, Ferrol, and Cartagena, respectively, have not yet been launched, though commenced in 1889–1891. Their principal characteristics are to be as follows:

Armament.—Two 9.45-inch B. L. R. in covered barbettes; ten 5.5-inch R. F. G. in battery; eight 6-pounder R. F. G.; eight 3-pounder R. F. G.; two 0.43-inch Nordenfelts; two 2.8-inch R. F. boat guns; six above-water torpedo tubes, one in bow, one in stern, and two in each broadside.

Protection.—Belt at the water line like the *Infanta Maria Teresa*, but 13.8 inches higher and 11.8 inches thick along the middle body, tapering to 7.9 and 5.9 inches at the ends. It extends from within 30 feet of

the stem to 50 feet of the stern and is 5.5 feet thick. Transverse bulkheads 9.8 inches thick join the extremities. The armored deck extends across the upper edge of the belt, but forward of the belt it extends from the belt's lower edge in a curve to the ram, while abaft the belt there is no such step, but the deck curves sharply downward to the stern. Cofferdams are worked behind the belt, and the vitals are protected by from 6 to 9 feet of coal. The barbette armor is 11.8 inches thick.

Motive power.—Two sets of horizontal triple-expansion engines to develop 15,000 I. H. P. under forced-draft and 10,000 I. H. P. under natural-draft, and give a maximum speed of 20.3 knots. There are to be four double-ended and two single-ended cylindrical boilers. The coal capacity is 1,200 tons, which gives a radius of action of 12,000 miles at 10 knots.

Dimensions.—Length, 349.9 feet; beam, 60.9 feet; draught, 21.6 feet; displacement, 7,000 tons.

REINA REGENTE.

This protected cruiser is to replace the one lost. She was laid down at the Ferrol Navy-Yard in December, 1895, and will have a displacement of 5,000 tons. The main battery will probably consist of four 7.87-inch B. L. R. and six 4.7-inch R. F. G. The boilers will be of the Belleville type and the I. H. P. is to be 12,000 and the speed 22 knots.

DOÑA MARIA DE MOLINA, MARQUES DE LA VICTORIA, AND DON ALVARO DE BAZÁN.

(Page 74, No. XIII.)

Work on these torpedo vessels was not begun until May, 1894. The main features of the design are:

Armament.—Two 4.7-inch R. F. G. on poop and forecastle, four 1.65-inch and two 0.43-inch Nordenfelts, four above-water torpedo tubes, two in bow and two in broadside.

Protection.—Engines and boilers protected by coal.

Motive power.—Two sets of vertical triple-expansion engines to develop 3,600 I. H. P. under forced-draft and 2,600 I. H. P. under natural-draft, and give speeds of 19 and 17 knots, respectively. They will have four locomotive boilers. The total coal capacity of 185 tons will give a radius of action of 2,500 miles at 10 knots.

Dimensions.—Length, 232.9 feet; beam, 27 feet; draught, forward 6.6 feet, aft 10.9 feet; displacement, 823 tons.

FUROR AND TERROR.

Messrs. J. & G. Thomson, Glasgow, are building these torpedo vessels for Spain. The keels were laid in November, 1895, and they are to be completed in August, 1896, a double force of workmen being employed. They are of the so-called "destroyer" type, but with larger scantlings.



HERNAN CORTEZ.

Armament.—Four 2.24-inch Maxim-Nordenfelt R. F. G.

Dimensions, etc.—Length, 220 feet; beam, 22 feet; draught, 13 feet; displacement, 380 tons. The I. H. P. under forced-draft will be 6,200 and the speed 28 knots.

TWO TORPEDO VESSELS.

It is reported that the ministry has ordered from Messrs. J. & G. Thomson two more vessels of the *Furor* type, to make a speed of 30 knots and to be completed one in five and a half and the other in six months. Their displacement will be 400 tons and they will cost $463,200 each.

VILLALOBOS.

A sister ship of the *Quiros* (p. 61, No. XIV), was ordered to be built at Hongkong in August, 1895.

ALMONTE, CORCUERA, AND MINDANAO.

Three galvanized steel launches, built at Hongkong for service in Mindanao. They have a displacement of 90 tons, draw 4 feet of water, and have a speed of 10 knots. The armament consists of one 1.65-inch Nordenfelt R. F. G., one 0.9-inch Nordenfelt machine gun, and two 0.43-inch Nordenfelt machine guns. They are capable of carrying 65 men.

VESSELS LAUNCHED.

HERNÁN CORTEZ, PIZARRO, AND VASCO NUÑEZ DE BALBOA.

Three single-screw steel gun vessels, built for the Spanish navy by Messrs. J. & G. Thomson, Glasgow, were laid down July 22, 1895, and all launched within six weeks. They are for service in Cuba.

Armament.—It is intended that they shall ultimately carry two 2.95-inch Nordenfelt R. F. G., but only the *Pizarro* has both guns; the *Balboa* has but one, and the *Cortez* one 5.12-inch Parrot.

Dimensions, etc.—Length, 154.9 feet; beam, 21.5 feet; draught, 6.3 feet; displacement, 300 tons. Complement, 3 officers and 50 men. Coal capacity, 67 tons. Radius of action at economical speed, 2,900 miles. I. H. P. 352 and speed from 12.2 to 13.5 knots.

DIEGO VELÁSQUEZ AND PONCE DE LEON.

Two single-screw steel gunboats for service in Cuba, built by Messrs. J. & G. Thomson, Glasgow, and launched in September, 1895.

Armament.—Two 2.24-inch Nordenfelt R. F. G., one 1-pounder R. C.

Dimensions, etc.—Length, 135.9 feet; beam, 19 feet; draught, 5.1 feet; displacement, 200 tons. Complement, 3 officers and 35 men. Coal capacity, 35 tons. I. H. P. 228 and speed 12.5 knots.

ALVARADO AND SANDOVAL.

Two single-screw steel gunboats for service in Cuba, also built by Messrs. J. & G. Thomson, and launched in September, 1895.

Armament.—One 2.24-inch Nordenfelt R. F. G., one 1-pounder R. C.

Dimensions, etc.—Length, 109.9 feet; beam, 15.5 feet; draught, 5 feet; displacement, 100 tons. Complement, 2 officers and 31 men. Coal capacity, 11 tons. I. H. P. 137 and speed 19 knots.

ALERTA, ARDILLA, COMETA, FRADERA, GAVIOTA, GOLONDRINA, ESTRELLA, FLECHA, LIGERA, LINCE, SATELITE, VIGIA, ALMENDARES, BARACOA, CAUTO, GUANTÁNAMO, MAYARIT, AND YUMURI.

Of these eighteen single-screw steel gunboats for service in Cuba, the first twelve were built in England, six by White and six by Forrest, and the remaining six were built at Cadiz.

Armament.—One 6-pounder Maxim-Nordenfelt R. F. G., one 1-pounder Maxim automatic gun.

Dimensions, etc.—Those built in England: Length, 69.8 feet; beam, 8.5 feet; draught, 4.3 feet. Those built in Spain: Length, 65.6 feet; beam, 12.3 feet; draught, 3.9 feet. General displacement, 40 tons. Complement, 23 men. Radius of action, 800 miles. I. H. P., 200, and speed, 10 knots.

LANAO AND GENERAL BLANCO.

Two small gun launches launched in 1895.

VESSELS PURCHASED.

DELGADA PAREJO, CENTINELA, GUARDIÁN, RELÁMPAGO, DARDO, ESPERANZA, INTREPIDA, MENSAGÉRA, AND VALENTE.

These vessels were purchased in the United States and converted into gunboats. Most of them were small yachts, their American names being *Sparkle*, *John E. Thropp*, *Navisink*, *Shrewsbury*, *Leon Abbett*, *Petrel*, *Aztec*, *Dart*, and *Edith*.

Armament.—In most cases they carry one 0.98-inch Nordenfelt machine gun. Two of them, however, mount one 1-pounder R. F. G. and one 2.24-inch Nordenfelt R. F. G.

Dimensions, etc.—Lengths, from 56 to 98 feet; beams, from 9 to 17 feet; draughts, from 3 to 6 feet; displacements, from 22 to 85 tons; speed, about 10 knots, and complement, 15 men.

CLARA.

A vessel bought in England to replace the receiving ship *Ferrolana*.

CITY OF RICHMOND.

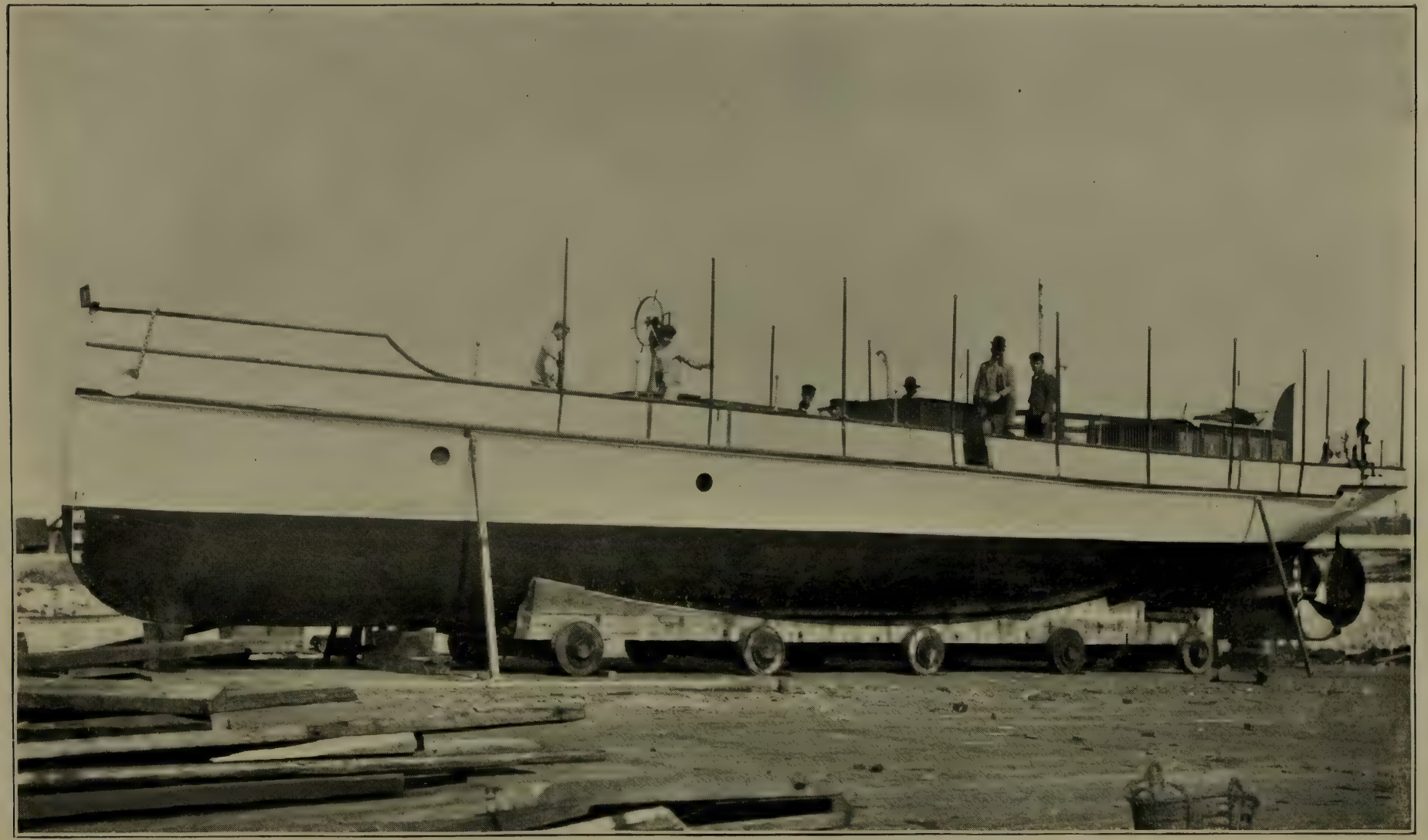
This vessel, once belonging to the Inman Line, has been purchased for use as a transport.

STEAM TRIALS.

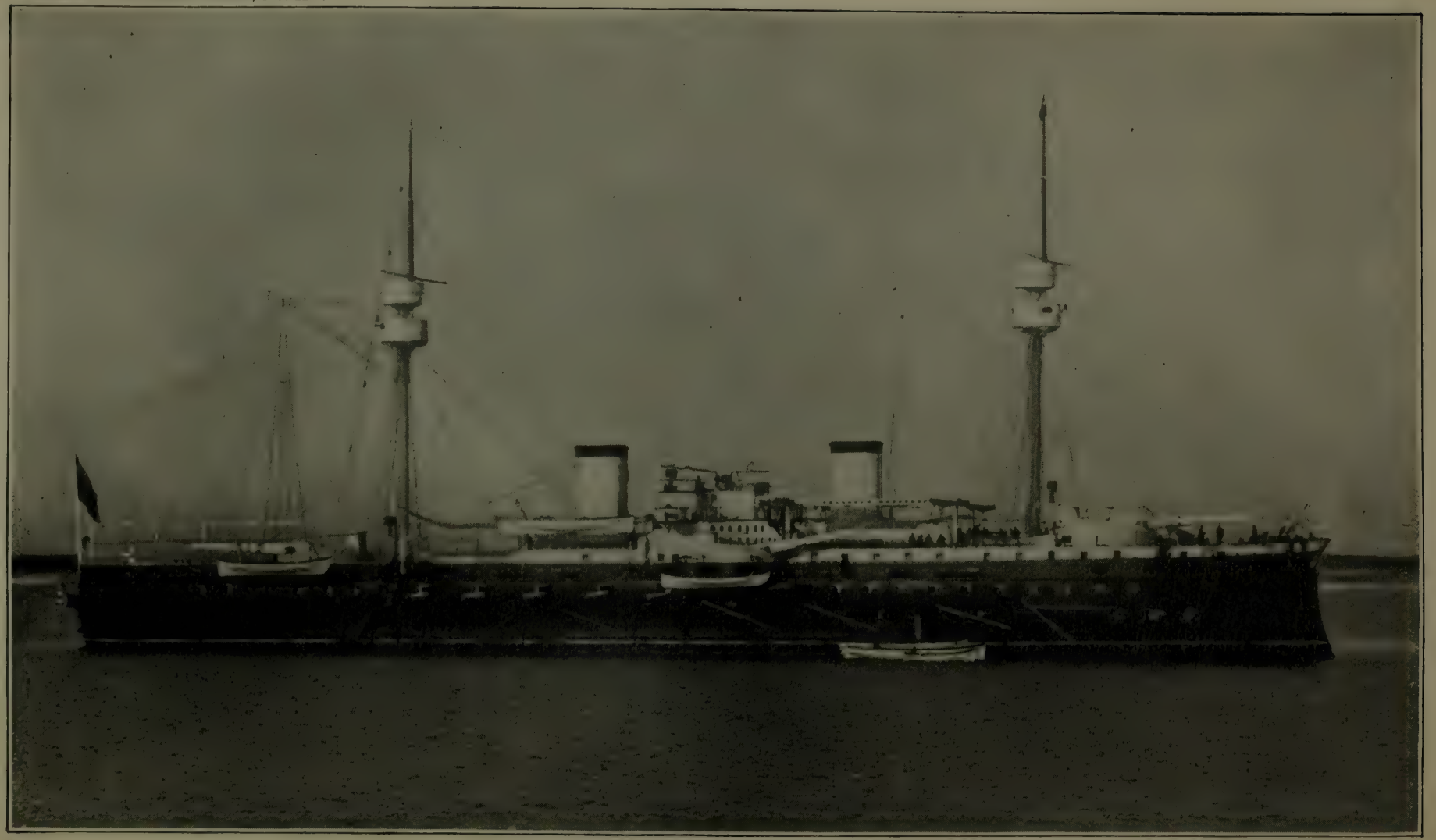
OQUENDO.

(Page 50, No. XI.)

The trials of this vessel were held off Bilbao August 26, 1895. Four runs were made over the measured mile, followed by a run of six hours at sea and four more runs over the mile course. The trial was under



MAYARIT.



PELAYO.

natural-draft with 105 revolutions; I. H. P., 9,000, and speed, 18.49 knots. A short run under forced-draft gave 117 revolutions; I. H. P., 13,000, and speed, 20.25 knots. A single-screw trial for half an hour gave 85 revolutions and a speed of 12.25 knots.

ALFONZO XIII.

(Page 51, No. XI.)

The preliminary natural-draft trials of this vessel in April, 1896, gave 60 revolutions and a speed of 14 knots.

VESSELS RE-ARMING, REFITTING, ETC.

PELAYO.

(Page 207, No. V; 271, No. VI; 356, No. VIII.)

This battleship has had her boilers generally repaired and retubed at the Ferrol Navy-Yard, and is ready for service. The condition of the vessel is excellent, the only defects being due to faulty design in certain particulars, viz, insufficient protection for the 4.72-inch guns, lack of subdivision of the space over the armored deck, and the small coal supply, only 600 tons.

NUMANCIA.

This ship, of the old type of broadside coast-defense vessels, launched in 1863, is to be converted into an armored cruiser. The present side plating, of 4.7 inches of wrought iron, is to be replaced by a water-line belt of steel, and an armored deck will be fitted. Two turrets will be installed, one forward and one aft, each housing 11-inch guns, while 9.45-inch guns will be carried in side redoubts. The central battery will consist of 5.5-inch R. F. G. Triple-expansion engines will be supplied to give a speed of from 18 to 20 knots, and two military masts, with armed military tops, will be fitted.

ISLA DE CUBA.

(Page 272, No. VI; 321, No. VII.)

This vessel had her boilers retubed during the winter of 1895–96, and in a subsequent steam trial satisfactory results were obtained.

ISLA DE LUZON.

Sister ship to the *Isla de Cuba*. Boilers retubed.

DESTRUCTOR.

(Page 208, No. V; 272, No. VI.)

The boilers of this torpedo vessel are worn out and new ones are to be ordered from England. The present ones are of the locomotive type, but water-tube boilers will be substituted.

FILIPINAS.

(Page 162, No. XII.)

The *Filipinas* started for Cuba, but her boiler tubes gave out, and she put in at the Canary Islands, where they were retubed. A second start was made and Cayenne reached, from which port she was towed to Havana by the *Legazpi*. The principal characteristics of the *Filipinas* are:

Armament.—Two 4.72 Hontoria R. F. G.; four 1.65-inch Nordenfelt R. F. G.; two 0.43-inch Nordenfelt machine guns; four torpedo tubes, of which two are fixed in bow and two training aft.

Protection.—Coal is carried at the sides in wake of the engines and boilers, to a thickness varying from 27.6 to 17.7 inches; it is also distributed forward of and above the boilers and between the boiler and engine rooms.

Motive power.—Two sets of 3-cylinder triple-expansion engines, which on trial developed 4,200 I. H. P. and gave a speed of 20 knots. There are four locomotive boilers, each in a separate compartment. Coal capacity, 125 tons.

Dimensions.—Length, 240.9 feet; beam, 27 feet; draught, 9.5 feet; displacement, 750 tons.

VESSELS LOST OR INJURED.

The cruisers *Cristobal Colon* and *Sanchez Barcaistegui* and the gunboats *Caridad* and *Iajo* were lost.

INFANTA MARIA TERESA.

(Page 74, No. XIII.)

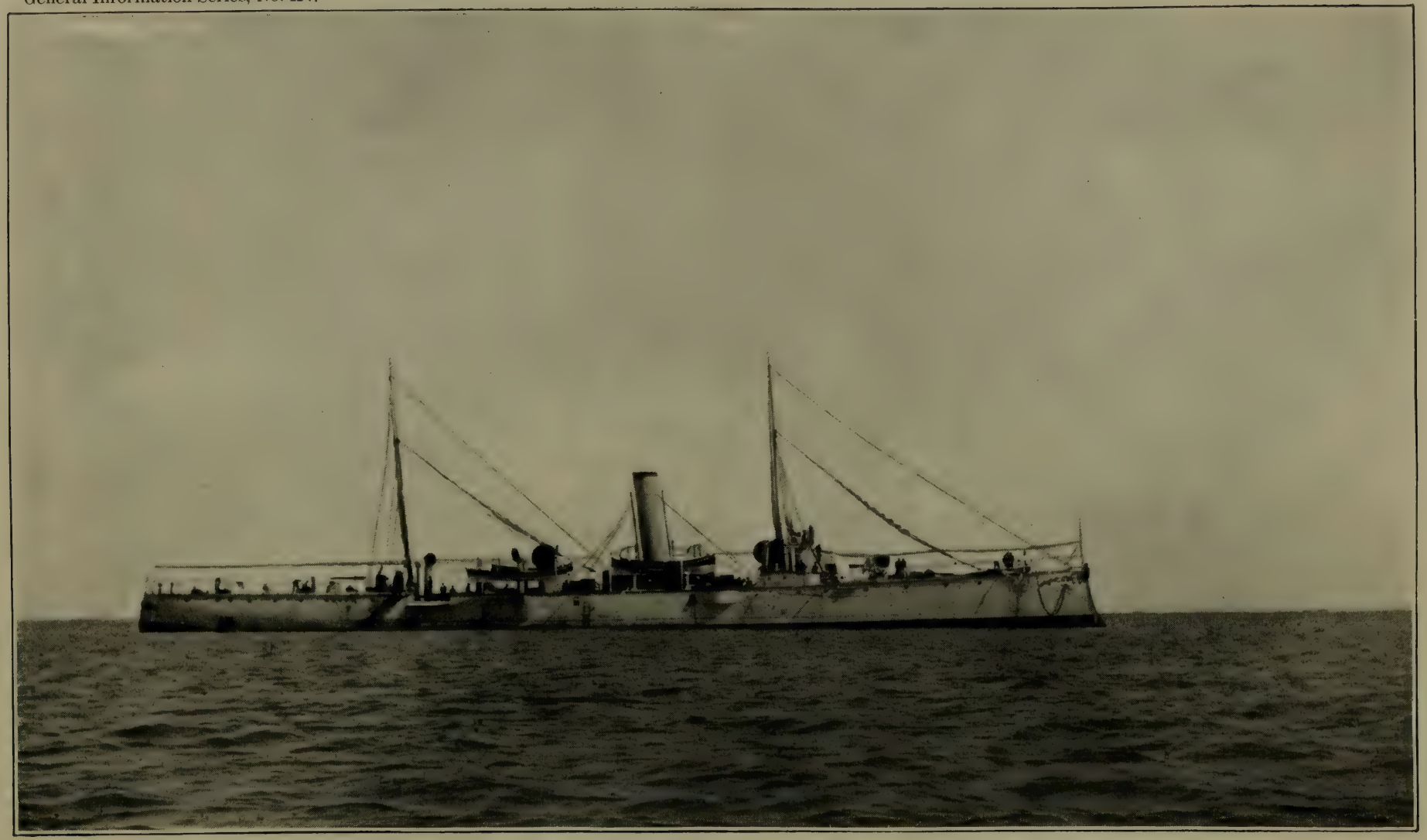
The bottom of this vessel was somewhat injured by running on a rock outside of Ferrol Harbor. During the gun trials in March, 1896, a premature explosion of a cartridge in one of the 2.75-inch Sarmiento converted R. F. G. resulted in wounding nine persons. In April three men were wounded by firing a 5.5-inch R. F. G. with a defective gas check.

ALVARADO.

This gunboat collided with a schooner near Waterford, Ireland, in October, 1895, and had her bulwarks smashed and davits and boats carried away. The fore compartment was flooded and the gunboat was docked for repairs.

TORPEDO BOATS.

The list of Spanish torpedo boats now numbers 13, most of which are undergoing repairs. The *Ariete* and *Rayo* were fitted with new Normand boilers, while the *Halcon*, *Azor*, *Acevedo*, *Ordoñez*, *Orion*, *Barceló*, and *Retamosa* are having their old boilers repaired.



FILIPINAS.

SANTO DOMINGO.

RESTAURACION.

Messrs. Napier, Shanks & Bell, of Glasgow, are building a small unprotected cruiser for Santo Domingo. The vessel was launched May 15, 1896.

Armament.—Nine Hotchkiss R. F. G.

Dimensions, etc.—Length, 200 feet; beam, 30 feet; depth, 15 feet; displacement, 1,000 tons; speed, 15 knots.

SIAM.

The navy of Siam is reported to be the best managed and maintained branch of the Government. A list of the vessels is given on page 92.

List of the Siamese navy.

Name.	Type.	Hull.	Where built.	Displacement.	Length.	Beam.	Draft.	Number of screws.	Rig.	Armament.	Speed.	I. H. P.	Date of launch.
				Tons.	*Feet.*	*Feet.*	*Feet.*				*Knots.*		
Maha Chakrkri	Cruiser	Steel	England	3,000	300	40	14	2	Schooner	4 4.72-inch R. F. G.; 8 6-pounder R. F. G.; 6 machine guns.	15	3,000	1892
Makut Racha Kumar.	do	do	Hongkong	650	175	22	11	2	do	2 40-pounder B. L. R.; 5 20-pounder B. L. R.; 5 machine guns.	14	6,000	1887
Muratha	Gun vessel	Teak	Bangkok	580	150	25	11	1	do	1 70-pounder M. L. R.; 2 12-pounder B. L. R.; 1 6-pounder B. L. R.; 2 machine guns.	10	150	1867
Yong Yot	do	Composite	do	450	145	21.3	11	1	Three-masted schooner.	1 40-pounder M. L. R.; 6 18-pounder M. L. R.; 2 machine guns.	10	340	1875
Maida	do	Iron	England	370	137	19.3	10	1	Schooner	1 40-pounder M. L. R.	11	300	1873
Nirben	Gunboat	Teak	Bangkok	290	133	17.3	9.5	1	do	1 30-pounder M. L. R.; 6 4-pounder M. L. R.	9	180	1877
Han Hak Sakrn	do	Composite	do	260	88	25.8	6.5	2	do	1 10-inch M. L. R.; 1 20-pounder B. L. R.	7	140	1875
Siam Mongkut	Gunnery ship	Teak	do	950	208	25.8	12.5	1	Bark	8 32-pounder M. L. R.; 2 12-pounder M. L. R.	.....	.....	1870
Regent	do	Iron	England	660	162	26.3	10.5	2	Three-masted schooner.	8 guns	.....	.....	1868
Thoon Kramom	Training ship	Teak	Bangkok	800	157	28.2	13	.....	Bark	8 S. B. G.	.....	.....	1864
Akarat	Torpedo depot ship.	Composite	do	545	213	20	8.5	(1)	Schooner	.....	11	400	1866
Moradoph	Spar torpedo boat.	Teak	do	45	72	9.3	5	1	.....	.....	10	35	1888
Chamroen	Transport	Iron	England	600	174	27.8	8	2	Sloop	.....	10	350	1889

Fylla	do	Teak	Hongkong	245	106	18	9	1	Schooner		8	99	1890
No. 1	River transport	do	Bangkok	95	120	16	3	(1)	do		7	90	1888
Gladys	Dispatch vessel	Iron	England	700	162	26	12	1	do		9	145	1880
Ubon	do	do	do	700	162	26	12	1	do		11	400	1879
Uthai	Dispatch boat	Teak	Hongkong	134	84	14	8	1	do		8	99	1890
Koh Si Chang	do	do	do	100	76	13.5	7	1	do		8	80	1890
Apollo	Yacht	do	Bangkok	650	188	24.6	10.3	(1)	do		10	480	1879
Akaret	do	do	do	450	178	22.3	8	(1)	do		10	400	1875
Rising Sun	do	do	do	300	164	18.9	7	(1)	do		8	190	1870

[1] Paddle.

NOTE.—In addition to the above there are 42 steamers and launches of less than 100 tons used for river and coast service.

SWEDEN.

The Swedish estimates for 1896–97 contemplated the building of two armored vessels, four torpedo vessels, and six torpedo boats. For this purpose, the Upper House voted $3,157,040, but the Lower House reduced it to $1,340,000.

VESSELS LAUNCHED.

ODEN.

(Page 62, No. XIV.)

This coast-defense vessel was launched at Stockholm March 9, 1896. The two proposed armored vessels will probably be of this type.

TORPEDO BOATS.

In April, 1896, a galvanized steel torpedo boat was launched at the Schichau Works for Sweden.

TURKEY.

Nothing has been done toward increasing the navy this year.

VESSELS LAUNCHED.

PELENG-I-DERIA, AND NIMET.

(Page 62, No. XIV.)

One of these torpedo vessels while on her trial trip off Kiel in the summer of 1895 met with a serious accident. The vessel was on the third mile of her run, making 234 revolutions, when the starboard forward boiler burst, penetrating the deck above, hurling the smokepipe overboard, and tearing the bridge, creating general havoc. Seven persons were reported killed and many wounded, some being blown overboard from the deck. The cause of the accident is reported to be "no water in the boiler."

URUGUAY.

Uruguay proposes to build two light cruisers and will probably order them from Messrs. Orlando Bros., Leghorn, Italy.

VENEZUELA.

MARISCAL AYACUCHE.

On March 15, 1896, fire broke out on board of this vessel at Caracas; the magazine blew up and eight men were killed and a number wounded. The force of the explosion was entirely upward, carrying away decks and masts and destroying the machinery. The underwater body was uninjured.



BOILER EXPLOSION. TURKISH VESSEL.

II.

NOTES ON ORDNANCE AND ARMOR.

By Lieut. PHILIP V. LANSDALE[1] and Ensign LAY H. EVERHART, United States Navy.
Staff Intelligence Officers.

GUNS AND MOUNTS.

Progress continues to be made in the adaptation of guns of larger caliber to the rapid-fire system, and the tendency to increase the rapid-fire armament at the expense of guns of larger caliber is marked, some of the largest ships being now armed exclusively with rapid-fire guns. The French cruisers *Chateau-Renault* and *Guichen*, of 8,145 tons displacement, have rapid-fire guns to the exclusion of guns of larger caliber. A striking example of the value of the rapid-fire system is seen in the case of the two new Russian ships *Rurik* and *Russia*, of 10,964 tons and 12,195 tons displacement, respectively; the latter being practically an improved *Rurik*. Although of nearly the same size the difference between the fire of these two ships is enormous, and mainly due to the development of rapid fire in the *Russia*, which has 6-inch R. F. guns where the *Rurik* has 6-inch B. L. R. guns. The total energy of fire per minute of the *Russia* is about 470,000 foot-tons, while that of the *Rurik* is only about 180,000 foot-tons. As noted in No. XIV, page 65, the recent war in the Orient has fully demonstrated the advantages to be gained by shell attack with rapid-fire guns, and it might seem that the value of large guns and belt attack was now being made secondary to rapid-fire guns and shell attack.

The development of wire-wound guns is chiefly confined to the British, who are putting as high as 12-inch guns of this type on their new battleships, and for which they claim the highest efficiency. It is said that the latest 12-inch wire-wound guns of 46 tons have a greater penetration than the 16-inch B. L. R. guns of 110 tons, which, if true, may be partly due to improved projectiles for the former.

[1] Lieutenant Lansdale compiled the information on guns for Austria and Sweden, and on armor.

In controlling gun turrets, the hydraulic system is still used to a great extent, especially for the larger guns. The French, however, are having excellent results with electric control, and they are now adopting this system for the largest turrets. The two most important advantages claimed for the electric system are:

(1) The ease and rapidity of replacing the mechanical by hand power.

(2) The facility of maintaining and repairing the leads. It is also claimed that there is a saving in cost.

A good deal of attention continues to be directed to the improvement of mounts for rapid-fire guns.

AUSTRIA.

A sight designed for R. F. guns made by Mr. E. Skoda is shown in figs. 1, 2, 3, and 4. The first two are from photographs kindly furnished by the manufacturer.

For facility in changing the elevation and to provide a larger space for inscribing the graduation up to 2,200 meters (2,400 yards), an eccentric disk or cam takes the place of the sight bar. This has an annular groove which serves as the notch of the rear sight. Alongside of this is a disk on the periphery of which the ranges up to 2,200 meters are engraved. For greater distances an ordinary sight bar is provided.

The device for illuminating the sights at night is shown in figs. 3 and 4. The annular notch in the eccentric disk of the rear sight is pierced with numerous small holes through which the light from an incandescent lamp appears. The front sight is illuminated by means of another small lamp contained within its upper half. Through an aperture in its point a small spot of light may be seen from the rear.

FRANCE.

The French navy estimates for 1895 include the following items under ordnance: Manufacture and repair of ordnance, 7,750,000 francs ($1,495,759); ammunition, 12,900,000 francs ($2,489,700); maintenance of arms, etc., 500,000 francs ($96,500); torpedoes, etc., 250,000 francs ($48,250).

The appropriations for 1896 include the following: Manufacture and repair of ordnance, 6,999,333 francs ($1,349,700); extraordinary for new ships, 6,999,333 francs ($1,349,700); ammunition, 12,228,225 francs ($2,360,000); maintenance of ordnance and running expenses, 495,422 francs ($95,618); torpedo material, 1,883,837 francs ($363,580); miscellaneous, 1,400,000 francs ($270,000).

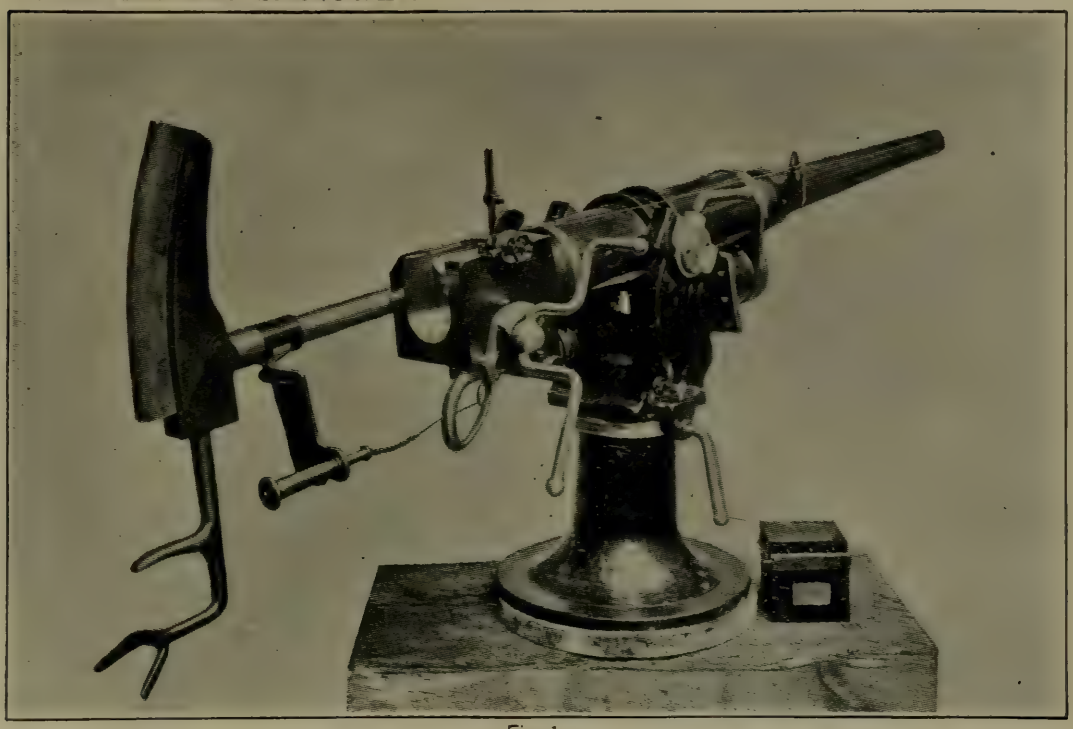


Fig. 1.

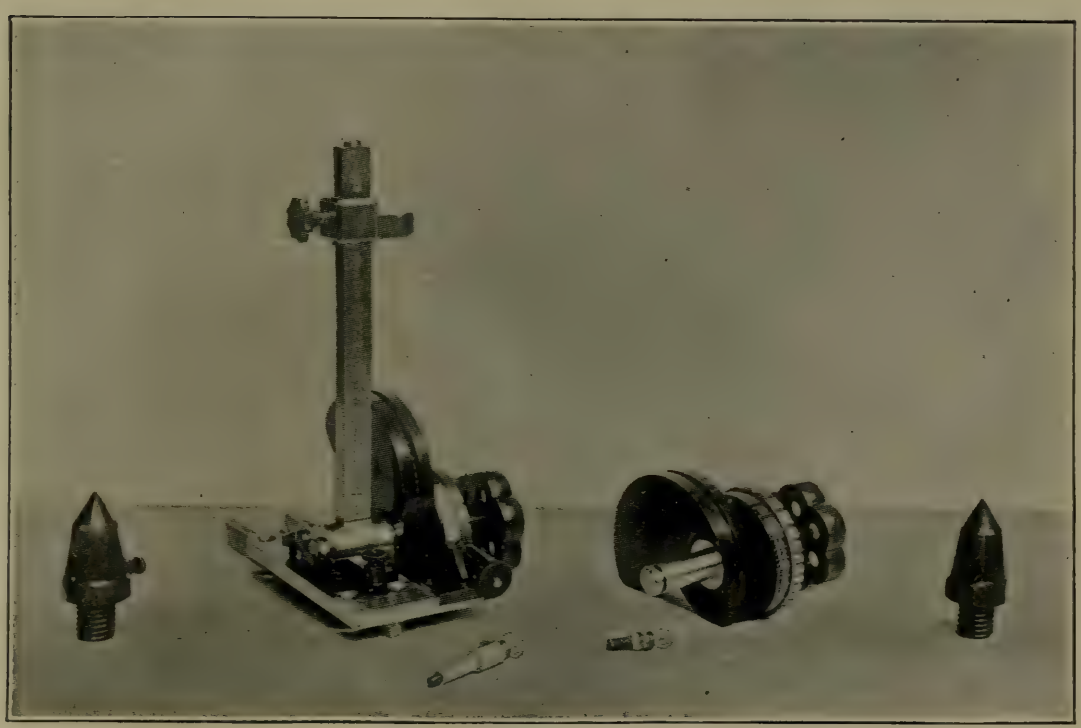


Fig. 2.

SIGHTS FOR SKODA R. F. GUNS.

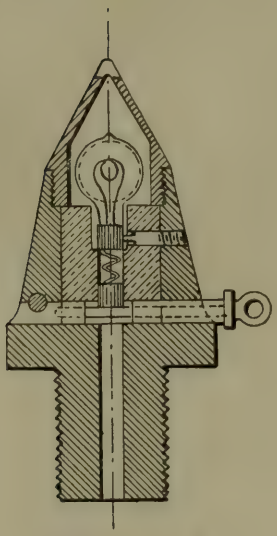


FIG. 4.

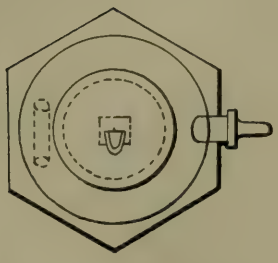
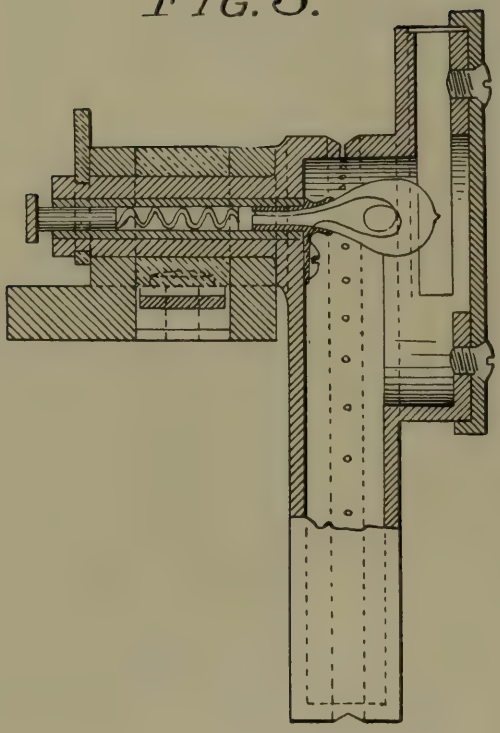


FIG. 5.

FIG. 3.



SIGHTS FOR SKODA R. F. GUNS.

DATA REGARDING FRENCH NAVAL ORDNANCE, 1896.

[Translation by Lieutenant Lansdale, United States Navy.]

Weight of igniting charges for different calibers.

Caliber.		Length of bore.	Weight of charge. (Powder B smokeless.)	How divided.	Weight of igniting charge, C² (8×8mm).	Weight of exercise charge.	Weight of igniting charge (exercise).	Saluting charges of black powder (MC30).
Mm.	*Inches.*		*Lbs. oz.*		*Lbs. oz.*	*Lbs. oz.*	*Lbs. oz.*	*Lbs.*
420	16.54	L/19.3	242 5	(2)	1 8.7	161 6	1 8.7	.....
370	14.57	L/28.5	229 3	(2)	1 8.7	99 4	1 5.2	.....
340	13.39	L/42	242 5	(2)	1 10.1	88 2	1 1.6	33.06
320	12.60	L/25	96 1	(2)	1 5.2	38 1	12.7	.....
305	12	L/45	200	(2)	.....	.....	.....	.....
274.4	10.80	L/19.7	48 1	(1)	1 1.6	.....	.....	.....
194	7.64	L/20.2	44 7	(2)	10.6	15 9	7.1	.....
164.7	6.49	L/45	25 6	(1)	.....	10 1	.....	5.51
138.6	5.45	L/45	21 7	(1)	.....	.....	.....	4.4
100	3.94	L/26	2 3	(1)	2.1	1 6	2.1	2.2
240	9.45	L/28.5	52 2	(2)	12.7	13 2	12.7	.....

NOTE.—When the service charge is made up in two cartridges the exercise charge is made in the same manner. In case of the 340 mm. gun, and probably with all calibers for which the cartridge is divided into two parts, the base of each cartridge contains a pastille of igniting powder of the weight given in the sixth column.

DATA REGARDING THE 340mm L/42 13.38-INCH GUN OF THE JEMMAPES, VALMY, HOCHE, NEPTUNE, ETC.

The gun consists of a tube extending throughout its whole length. Over the rear half is shrunk a jacket upon which are hoops. Forward of the jacket hoops are shrunk all the way to the muzzle. A hoop screwed on opposite the center of gravity of the gun takes the place of trunnions.

The breech plug weighs 3,086 pounds; it is of the Farcot type. The firing device and other attachments are the same in the models of 1881 and 1887. Reckoning the weight as 132,277 pounds, the gun cost from $7.72 to $8.36 per pound. This gives the total cost of $49,210.

The service charge is 242.5 pounds of B34 (smokeless) powder, put of up in two serge cartridge bags, each containing 141.25 pounds of the above, and each in addition being provided in its base with a pastille (lozenge) of C2 black powder, each weighing 1.63 pounds. It is 9.5 inches in diameter. The exercise charge is 88.18 pounds of BTR65 powder, also put up in two bags. Each contains in its base a pastille of C2 powder 7.9 inches in diameter and weighing 1.10 pounds. Four black powder saluting charges (MC30) are provided, weighing each 33.06 pounds. This number is furnished for each gun and may be used for removing projectiles which are stuck fast in the gun. The grains of C2 powder are 0.31 by 0.31 inch.

Proportion of full charge used to make the exercise charge.

Caliber.		Full charge.	Length of bore.	Proportion of the full charge velocity obtained.	Pressure exercise.
Mm.	*Inches.*	*Per cent.*		*Per cent.*	*Tons.*
420	16.54	66	L/19.4	.....	.....
370	14.57	43	L/28.5	.....	8.46
340	13.39	36	L/42	64	.....
320	12.60	41	L/25	.....	.....
305	12.00	.....	.....	.....	.....
274.4	10.80	.....	.....	.....	.....
240	9.45	25	L/28.5	.....	.....
194	7.64	36	L/20.2	.....	.....
164.7	6.49	40	L/45	.....	6.9
138.6	5.45	.....	L 45	.....	.....
100	3.94	.....	L/26	.....	.....

Details of projectiles for the 340 mm. L/42 13.38-inch gun.

Kind of projectile.	No. per gun.	Bursting charge.	Total weight.	Price per pound.	Total cost of a projectile.
			Pounds.		
Armor piercing.....	60	16.37 pounds of fine sporting powder.	926	$35.01–$39.39	$340.80
Common shell.....	5	81.57 pounds of MC30 powder.	926	4.377	4.053
Cast shell with large bursting charge.	15	84.87 pounds of mélinite.	926	.....	.....
Exercise shell.....	4	.....	926	.....	.....
Total number..	[1] 84	.....	.....	.....	.....

[1] That is, 77,784 pounds of projectiles per gun.

The cost of one discharge, A. P. shell and full charge, is $500; that of an exercise round, $98.40. In this no allowance is made for the wear and tear of the gun.

The life of the gun with powder B has not been determined, but it is considerably longer than with the PB powder formerly used. It may be taken as 800 service charges. This would give the cost by deterioration of the gun per discharge $61.50. It may be taken as a fact that five practice charges do not fatigue the gun more than one service round. This, then, would give the cost of one practice round in deteriorating effect on the gun as $12.40.

The total cost of firing this gun would then be as follows: Service charge with A. P. shell, $561; exercise charge with common shell, $111.

Penetration at muzzle, 47.62 inches iron; at 1,100 yards, 40.20 inches.

The greatest elevation possible is 10 degrees, depression 4 degrees. The range at the former elevation is 12,000 yards.

The maximum recoil possible is 42.6 inches; that for which the carriage is adjusted is 31.2 inches.

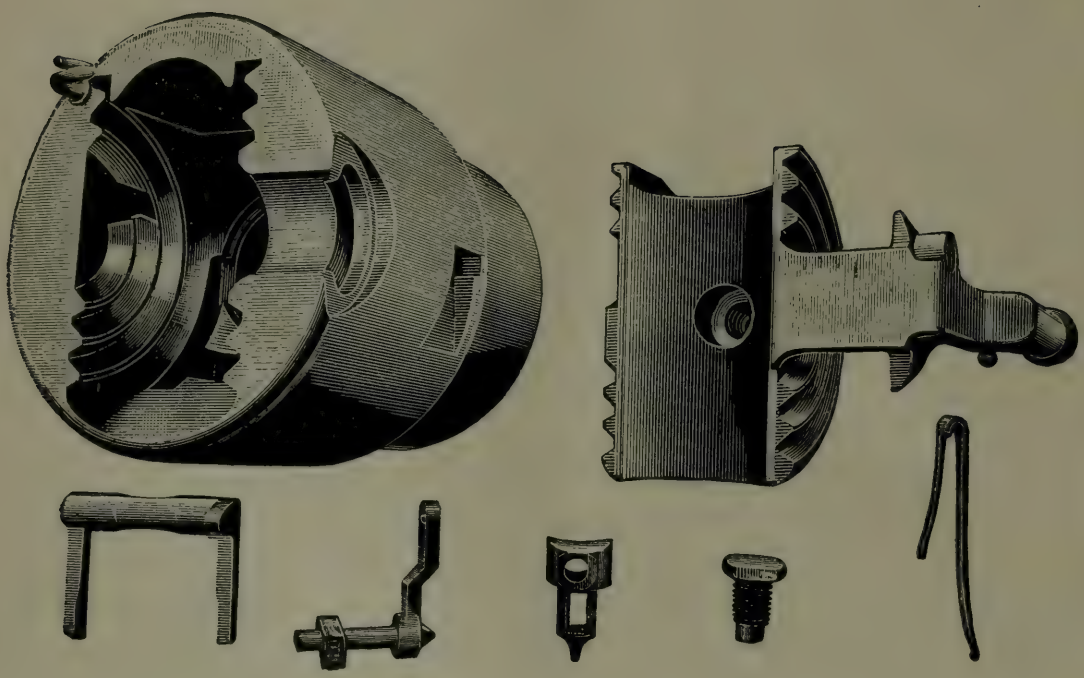


Fig. 8.—CANET'S AUTOMATIC BREECH MECHANISM FOR R. F. GUNS.

Engineering.

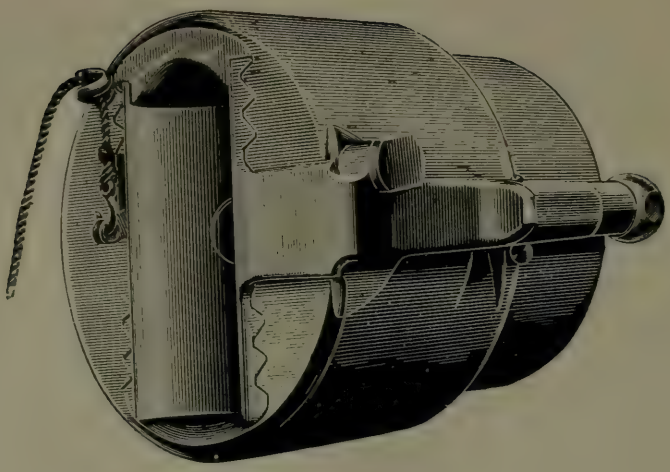


Fig. 6.

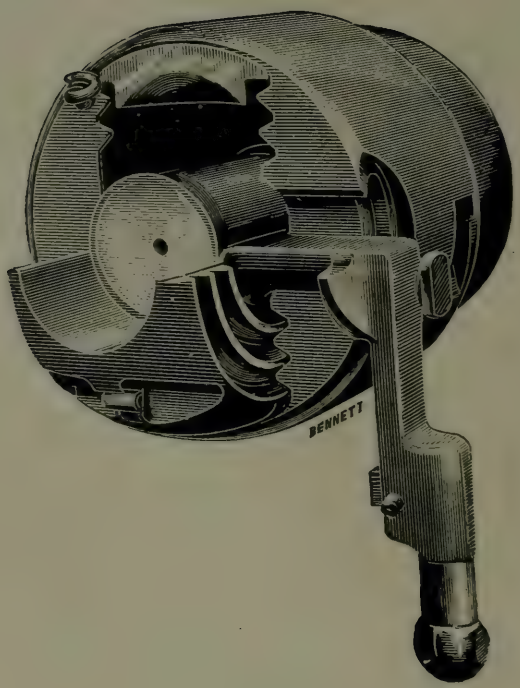


Fig. 7.

CANET'S AUTOMATIC BREECH MECHANISM FOR R. F. GUNS.

Engineering.

The sight is a vertical bar operated with a rack and crank. It has three faces, on each of which is a graduation as follows: For the armor-piercing shell up to 10,500 yards, for the common shell up to 13,800 yards, and for the exercise shell up to 7,200 yards.

The Brennus has Charpentier sights; the Trehouart, the tire optique of de Fraysseix.

CANET'S NEW R. F. BREECH MECHANISM.

"This breech mechanism consists chiefly of a block formed, as regards the front portion, by a spherical surface, on the sides by two planes, and at the rear by a concave semicylindrical surface. The plane faces are grooved with a series of concentric threads that may have either a triangular or a square section. In the breech of the gun a corresponding seating is cut parallel to the axis of the bore, to receive the block and its two lateral faces; it has, therefore, a series of concentric grooves similar to the threads on the block. When the breech is closed the block fits exactly to the seating in the gun, and offers ample resistance to the powder pressures. A bent lever is either bolted to or forged on the block. The longer arm of this lever is straight, and moves in a vertical plane on the right-hand side of the gun; the short arm is of a semicylindrical shape, and moves to and fro in a recess formed in the rear face of the gun. The axis of the semicylinder passes through the centers of the two series of threads and concentric grooves; it is, therefore, around this axis that the oscillating motion of the block, in opening and closing the breech, is produced. These two movements are limited, the first by a stop set in the upper part of the seating in the gun, and the latter by a special screw, the nut of which projects from the long arm of the lever. The length of this screw is greater than the depth of the nut, so that when screwed to the bottom of this latter it projects slightly beyond the inner face of the lever. The end of the screw that thus projects enters a circular groove cut on the right side of the gun. The length of this groove sets a limit on the range of travel of the lever, and at the end it corresponds to the extreme open position of the breech. On the end of the longer arm of the lever slides a handle provided with a lateral tooth which fits a corresponding recess cut in the side of the gun. Within the handle is a coiled spring which, when the breech is closed, presses the tooth into the recess and thus prevents the breech from moving until after the gun has been fired. The charge can be exploded either by percussion or by an electric primer, or by both combined. In the first method, which is shown in the illustrations, a "repeating" device is used; that is to say, a device by which the same primer can be acted on several times without changing the position of the breech. It consists of a striker controlled by a V-shaped spring and actuated by a detent with two branches, one of which carries a ring to which is attached the firing cord. These various parts, except one arm of the detent that is visible in the illustration, are mounted in a recess formed in the block. So long as the breech is not

completely closed the detent is fixed and premature firing can not take place. The cartridge cases are removed from the gun by means of a four-armed extractor, which is placed in a recess in the gun. It is operated by the breech plug itself, which bears against the two short arms of the extractor levers at the end of the opening movement and depresses them by its weight. To open the breech it is sufficient to press the handle on the lever and disengage the safety tooth already mentioned. The lever is then released, and as the center of gravity of the block is located in front of its center of oscillation, the breech opens automatically by reason of its weight alone. This movement is very rapid, because the block has only to make an angular movement of 90 degrees to open the bore of the gun completely. In this movement the rear semicylindrical portion takes a horizontal position, and at the end of the motion it forms an extension of the powder chamber and thus acts as a carrying table for the cartridges, which is a very considerable convenience when serving the gun rapidly. The arrangement is also convenient for the ejection of the cartridge cases. To close the breech, a reverse motion is given to the lever, and as soon as it is thrown over the safety catch enters the recess and the breech is closed. The breech plug and its accessories consist of five parts in all; these can be taken apart and reassembled by hand with facility and with but little loss of time. The operation of dismounting is as follows: The nut that works in the circular groove is run back, and the lever, thus set free, is turned through 180 degrees; the block is then entirely independent of the gun, and can be removed for cleaning or inspection, or to replace an extractor or the firing mechanism. In its present form this very ingenious arrangement has been tested at the gun factory of the Forges et Chantiers Company at Havre, and has been found to give very satisfactory results. The advantages that are claimed for it, judging from the experiment made, are as follows: The mechanism is extremely simple and rapid in its operation, and is manœuvred by a single motion of the lever. The opening of the breech is entirely automatic. The mounting, dismounting, and examination are of a very simple character; there is absolute safety in working. There are no projecting parts in the way of the men serving the gun. All the parts of the breech are well protected by the gun itself, and there is nothing projecting at the time the gun is being loaded. It is claimed that the number of parts is smaller than in any other arrangement of breech-closing mechanism, being reduced to four when an electric primer is employed, and to five in case of percussion firing."

Figs. 6, 7, and 8 show the arrangement in detail

ELECTRIC TURRETS.

There is a marked increase in the employment of electricity for control of turrets and guns, and it is in France that the development of this system has been chiefly effected. Turrets of this description have been built, or are building, in France, for Denmark, Russia, and Spain.



Fig. 9.

Scientific American.

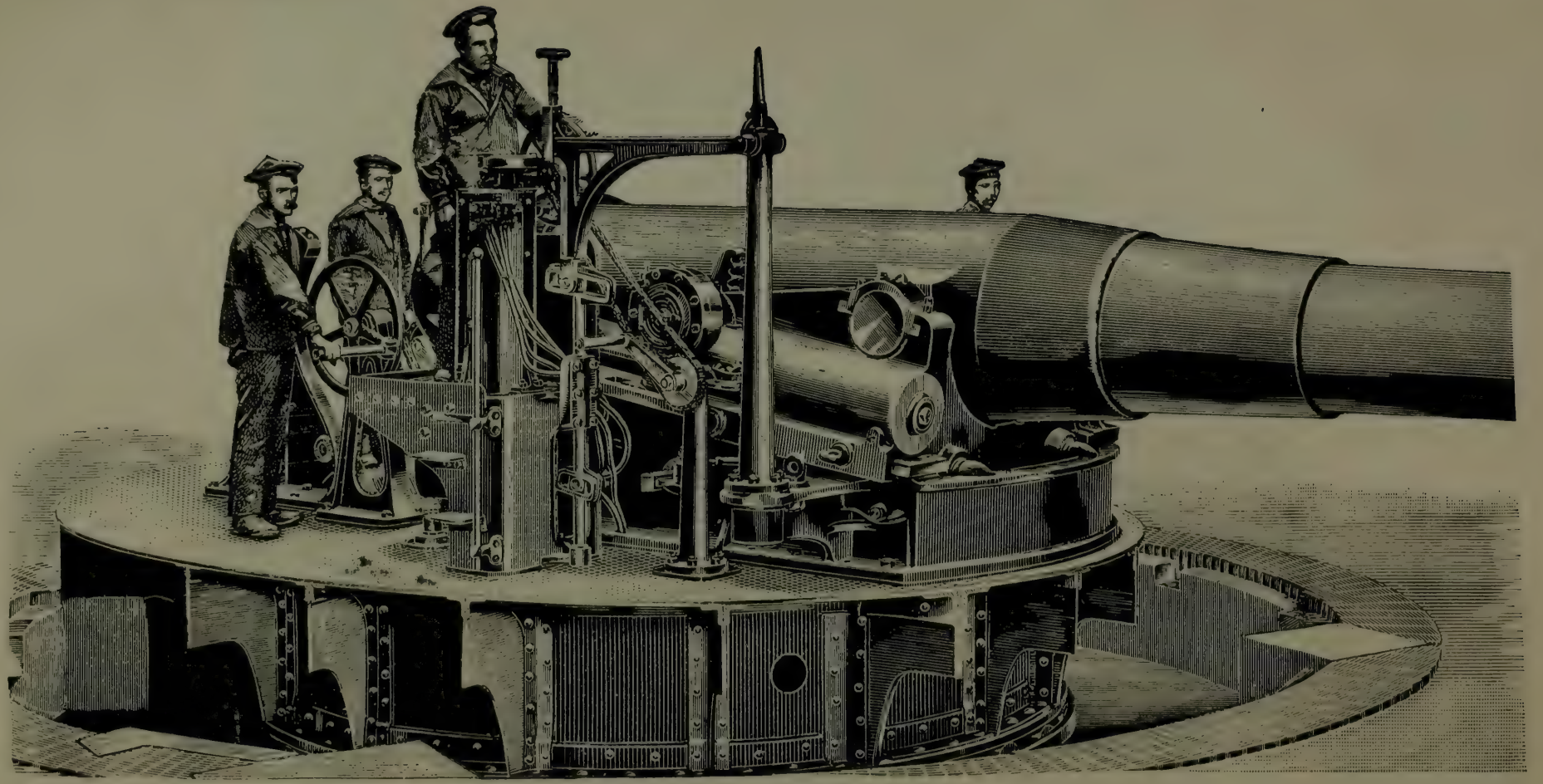


Fig. 10.

Scientific American.

Electric control is displacing hydraulic control in France especially, and in other countries to a great extent. In the electric control there is much gain in weight and lack of cumbersomeness, and the electric leads are more easily protected than the many water pipes under pressure in the hydraulic system; in fact, the electric system is simpler and more durable, and the change to hand gear is more readily made.

To the Société des Forges et Chantiers de la Méditerrannée is due to a great measure the credit of developing electric control. After the success of the Chilean ship *Captain Prat* (built by this firm), the French Government adopted electric control for the cruiser *Latouche-Tréville* and for the *Jauréguiberry*. The electric systems used have met with excellent success and their application is to be made general on the *Pothuau* (building at Havre), the *d'Entrecasteaux* (building at Seyne), and the *Saint-Louis* (building at Lorient).

The *Jauréguiberry* and the *d'Entrecasteaux* are fitted with the system supplied by the firm Saulter-Harlé. On the *Latouche-Tréville* the *cartouche-électrique* system is used, and also on the *Pothuau*.

The Forges et Chantiers de la Méditerrannée have recently constructed the gun carriages for the turrets of the Danish ship *Skïold* (*see* figs. 9 and 10), carrying 24-centimeter (9.45 inches) and 12-centimeter (4.72-inches) Krupp guns. In the case of the larger gun elevating is done by hand and training by electricity, and the ammunition is hoisted by electricity or hand. The system used for both of these guns is the same as that employed on the *Latouche-Tréville*. The two 24-centimeter guns have gravity-return mounts.

The 12-centimeter guns are trained by electricity and elevated by hand, and the ammunition is supplied by hand.

In both mounts hand gear may be immediately substituted for electric control.

The turrets of the *Skïold* are balanced, thus reducing to a minimum the power required to rotate them. For revolving the 24-centimeter gun turrets the capacity of the machinery is about 15 horsepower, and for the smaller guns about 3 horsepower.

EFFECTS OF ATTACK ON FORTIFICATIONS BY SHIPS.

Toward the end of January last the French ships *Amiral Duperré* and *Sfax* carried out some experimental firing against a specially erected fortification on the "Ile de Levant," in accordance with an agreement arrived at between the navy and war departments.

"The *Amiral Duperré* and the *Sfax* had each been directed to carry out several series of firing, during which the course, the speed, the end to be attempted, and the nature of the firing were changed, each series occupying about three-quarters of an hour. During the experiments, which lasted altogether six hours, more than 1,000 shots were fired from guns of 34 centimeters, 16 centimeters, 14 centimeters, and 10 centimeters (13.3 inches, 6.2 inches, 5.5 inches, and 3.9 inches), which

works out at a little over two shots a minute per ship, a certain number of shell being filled with mélinite. As it was necessary to examine the effects of the fire after each series, the experiments had to be spread over a period of three days.

"The fortifications consisted of two batteries constructed by the engineers after the most approved fashion, and in which were represented very accurately, by models and dummies, the guns with their gun detachments and accessories. In each battery was simulated an armament of eight guns, four of heavy and four of medium caliber. One of the batteries on the slope of the island had an altitude of 65 feet, the second, crowning the crest of the island, had a command of about 328 feet. More than half the dummies of the gun detachments were hit, and about one-quarter of the guns were dismounted or more or less damaged. The harm done to the forts themselves was insignificant, both from the shells filled with mélinite and those filled with black powder. The mélinite shells, which burst into very small pieces, would have been particularly deadly to the personnel. Some fragments were found at more than 1,000 yards from the batteries, proving the enormous initial velocity produced by the explosion.

"Attention might be called to the advantages that forts possess in being able to draw on a practically unlimited supply both of men and ammunition, and also that the defense would continue as long as the work is tenable and a gun remains fit to fire. To dismount a few guns and put out of action a fair number of their gunners (who could have been replaced from others held in reserve), it is estimated that the *Sfax* and the *Amiral Duperré* found it necessary to fire 39 tons weight of projectiles. During the last Continental war it was calculated that for every man killed his weight in metal had to be fired, but in the experiments under consideration not less than nine or ten times his weight in metal was required to remove one man of the defense. Such are the disadvantageous conditions under which ships are placed when contending against well-constructed fortifications. If, on the other hand, we suppose that the sixteen guns which served as a target had replied to the fire of the *Amiral Duperré* and the *Sfax*, we may presume that the two vessels would have been several times hit and have received some serious damage. A single shell of 240 millimeters (9.5 inches) fired from the commanding position of the battery on the crest would have been most dangerous to the armored decks, and in any case would have produced destructive results."

Experiments of just the opposite nature, viz, attack of land batteries on ships, were made, toward the middle of June, at Fort Chavagnac in Cherbourg, a 19-centimeter (7.48 inches) gun being used with mélinite shell. For a target the old ship *La Galissonnière* was used, to which steel plates had been fixed specially for the occasion.

Four shells were fired from the fort and pierced the hull of the vessel, the water-tight bulkheads being completely traversed by the projectiles.

In the interior the gun deck was strewn with débris of all kinds. Of the two sheep which had been placed on board the warship, one was killed, its back having been carried away by the bursting of one of the shells; the other was safe and sound. It was thought that they would both have been killed by the shock caused to the vessel by these experiments. From this it is concluded that a man would also be able to resist the shock. On the other hand, fragments of shells caused great damage and penetrated to almost every part of the vessel.

These experiments are finished for a time, but probably will be continued later upon another part of the vessel.

EXPLOSION IN THE POWDER MAGAZINE OF THE AMIRAL DUPERRÉ.

An alarming explosion occurred on board the *Amiral Duperré* on the 13th of May last. A loud report was heard and the after part of the vessel was soon filled with thick smoke, which was found to be issuing from the central powder magazine on the lower deck. The fire alarm was immediately given throughout the ship by means of bugle and drum, and in a very short time the crew were at their posts and directing streams of water upon the magazine. In three minutes the smoke had almost ceased. Admiral de Cuverville then went below and found that the door of the magazine had been hurled a distance of 30 feet. Closer investigation showed that a cartridge about 13 inches long had exploded, but that none of the other cartridges among which it was packed was discharged. The magazine contained 3,000 kilogrammes of gunpowder and mélinite shells, none of which was disturbed in any way. The explosion is attributed to the overheating of the magazine by condensing pipes from the boilers.

SCHNEIDER & CO.'S BREECH MECHANISM.

Schneider & Co.'s system of breech mechanism for R. F. guns of large caliber, model 1895, illustrated by figs. 11 to 26, is the interrupted screw plug turning in a collar and swinging from the gun by means of a bent hinge.

By the simple and continued rotation of a crank the plug is disengaged from the breech and swung round clear for loading. The mechanism, composed of but a few pieces easily assembled by hand and without the use of tools, is exposed only from the rear.

The gun is fired by a percussion lock which is automatically cocked when the breech is being closed. If desired, the gun can be fired by electricity by replacing the firing pin with an electric contact.

DESCRIPTION.

The mechanism consists of:

Breech plug A; carrier ring or collar B; plug-lever crank C and axis D; stop bolt E and spring; firing pin F, sleeve N and striker O; sear G and spring P; trigger H; extractor I; axis J, and the collar ramp K.

The breech plug.—The breech plug is supported by a carrier ring or collar to which it is connected by a screw thread of the same pitch as that in the breech. The screw threads of the plug and those of the breech are cut out on four-eighths of the circumference, so an eighth of a revolution of the plug completely disengages its screw threads from those of the breech. The forms and dimensions of the threaded portions and blanks are such that it is not necessary to draw the plug directly to the rear in order to open the breech. As soon as the threads of the plug are disengaged from those of the breech the plug is swung out on an arc of a circle by the hinge B. On the rear of the plug A is a short geared arc, the teeth of which engage a number of collars, *a*, on the axis D of the handle.

Carrier ring or collar.—The hinged carrier ring or collar B holds the plug, the axis of the plug, the lever crank D, the stop bolt E, and the trigger H.

The plug lever crank and axis.—The crank C and axis D are in one piece; the latter has a number of collars, *a*, which form a kind of rack and engage teeth on the rear of the geared arc of the screw plug A, and a screw thread, a_1, which engages in the collar B, as in a nut. Turning the crank C in one direction or the other raises or lowers the axis D in the collar B, and this rotates the plug A, making it engage or disengage the screw threads in the breech. Stop chocks limit this motion both ways. During the swinging to of the plug the axis D is held by the stop bolt E until the front end of the latter takes against a projection on the rear of the gun, when it is released. (Fig. 13.)

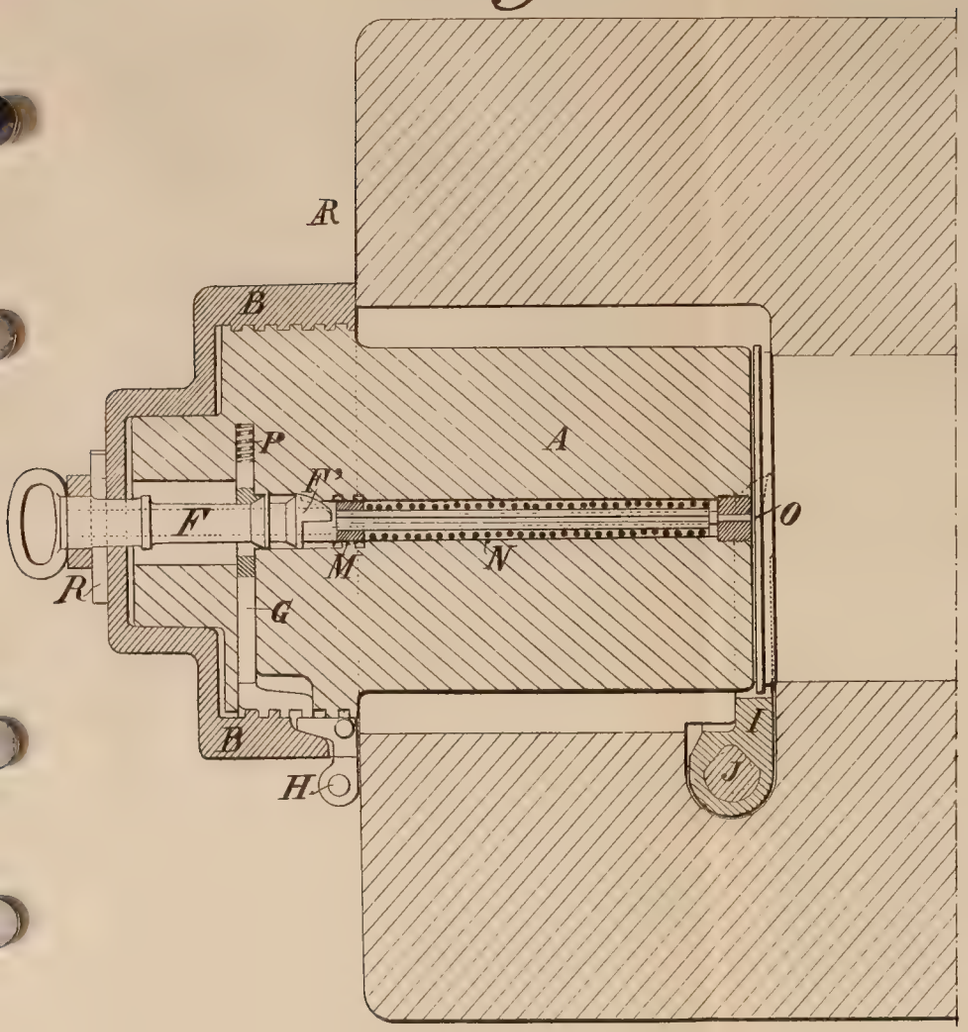
The stop bolt.—As stated above, the stop bolt E holds the axis D at the proper time by means of a spur, *e*, which the stop bolt spring causes to engage in a mortise, e^1 in the axis D. (Figs. 18 and 21.)

The extractor.—The forked extractor I has two bearing points which take under the rim of the cartridge case at opposite ends of a diameter. The brisk movement of the fork dislodges and ejects the empty cartridge case. To obtain this effect the extractor is mounted on an axis J, which has a stud, *i*, on which the ramp *f* of collar K (figs. 12 and 26) takes at the proper moment. The latter is rigidly secured to the hinge bolt by means of a screw.

The firing apparatus.—Two symmetrical helicoidal ramps (figs. 11, 15, 22, and 23) F′ of the firing pin F, in the center of the plug, rest, at the moment of opening, on two similar ramps. (Figs. 24 and 25.) The spring N is situated between the striker O and the sleeve M, and must follow the motions of the firing pin. A pin R passes through the firing pin F and collar B, preventing the former from turning; but a slot in the firing pin permits it to have a motion in the direction of its axis, and this motion is given it by the action of the helicoidal ramps in turning the plug for opening the breech. The spring N is thus compressed by the drawing to the rear of the firing pin. The sear G, working freely in a slot in the plug, has a hole in it (figs. 11, 15, 16, and 17), through

SCHNEIDER & CO.'S BREECH MECHANISM FOR LARGE R. F. GUNS.

Fig. 11.



SCHNEIDER & CO.'S BREECH MECHANISM FOR LARGE R. F. GUNS.

Fig. 12.

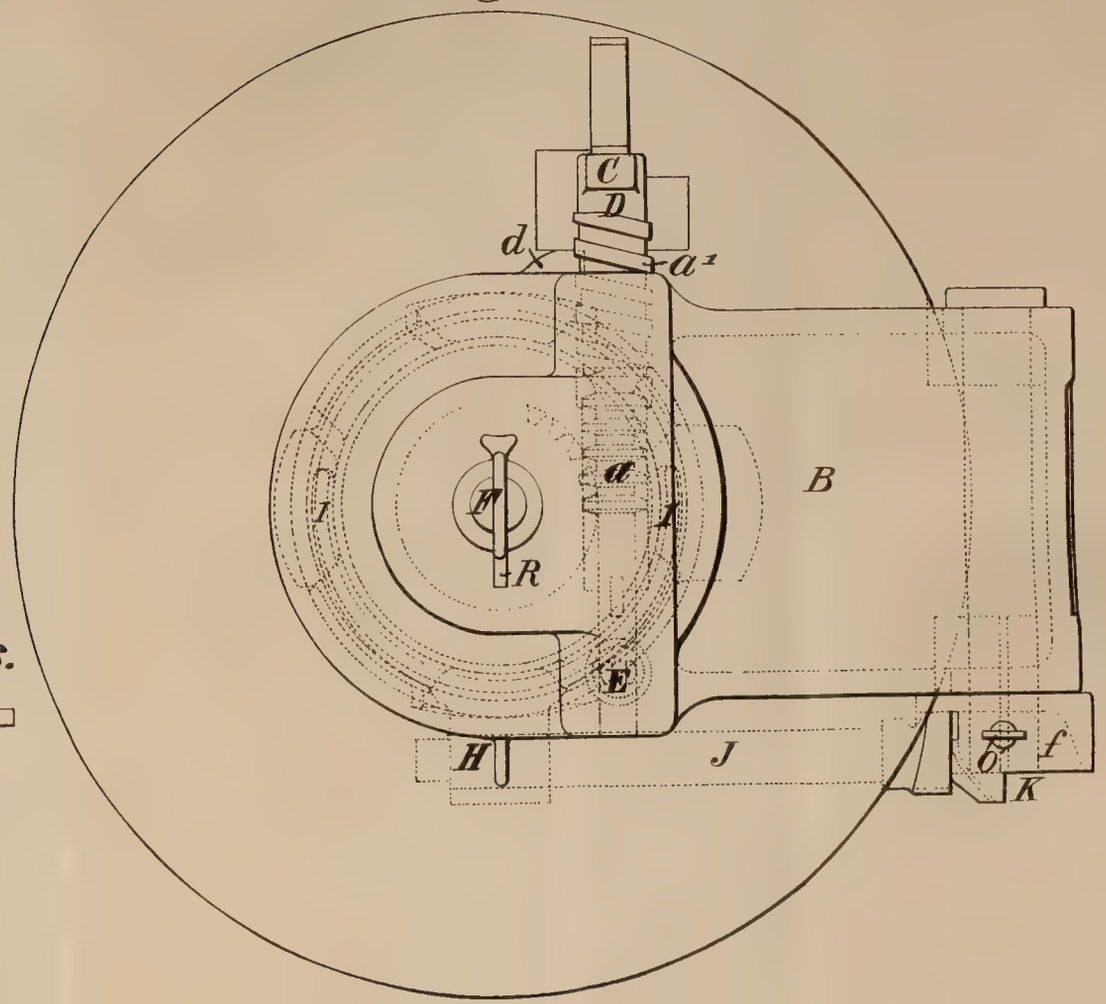
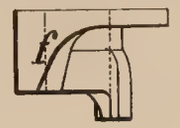


Fig. 26.



SCHNEIDER & CO.'S BREECH MECHANISM FOR LARGE R. F. GUNS.

Fig. 13.

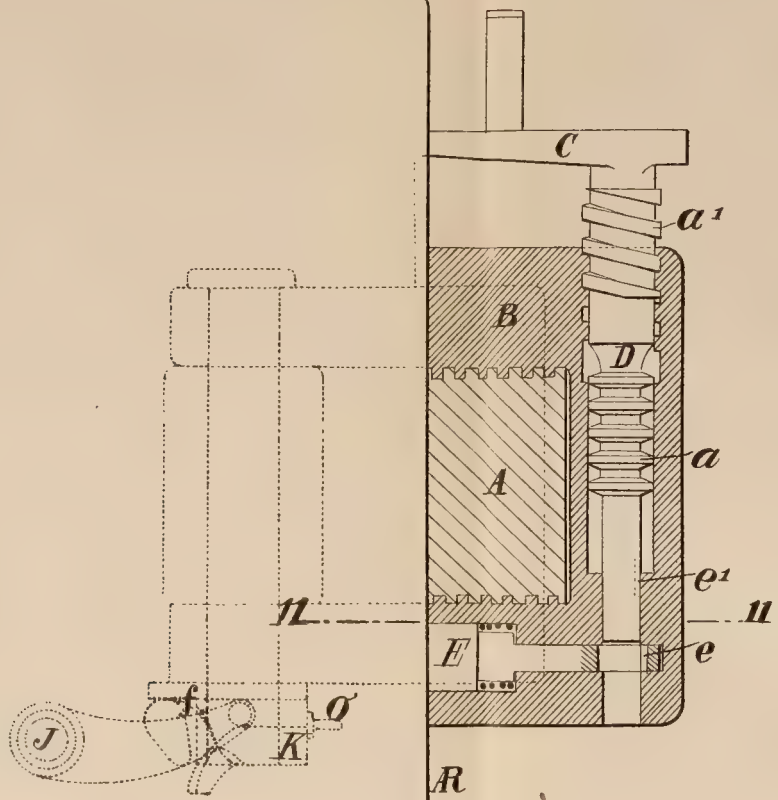


Fig. 15.

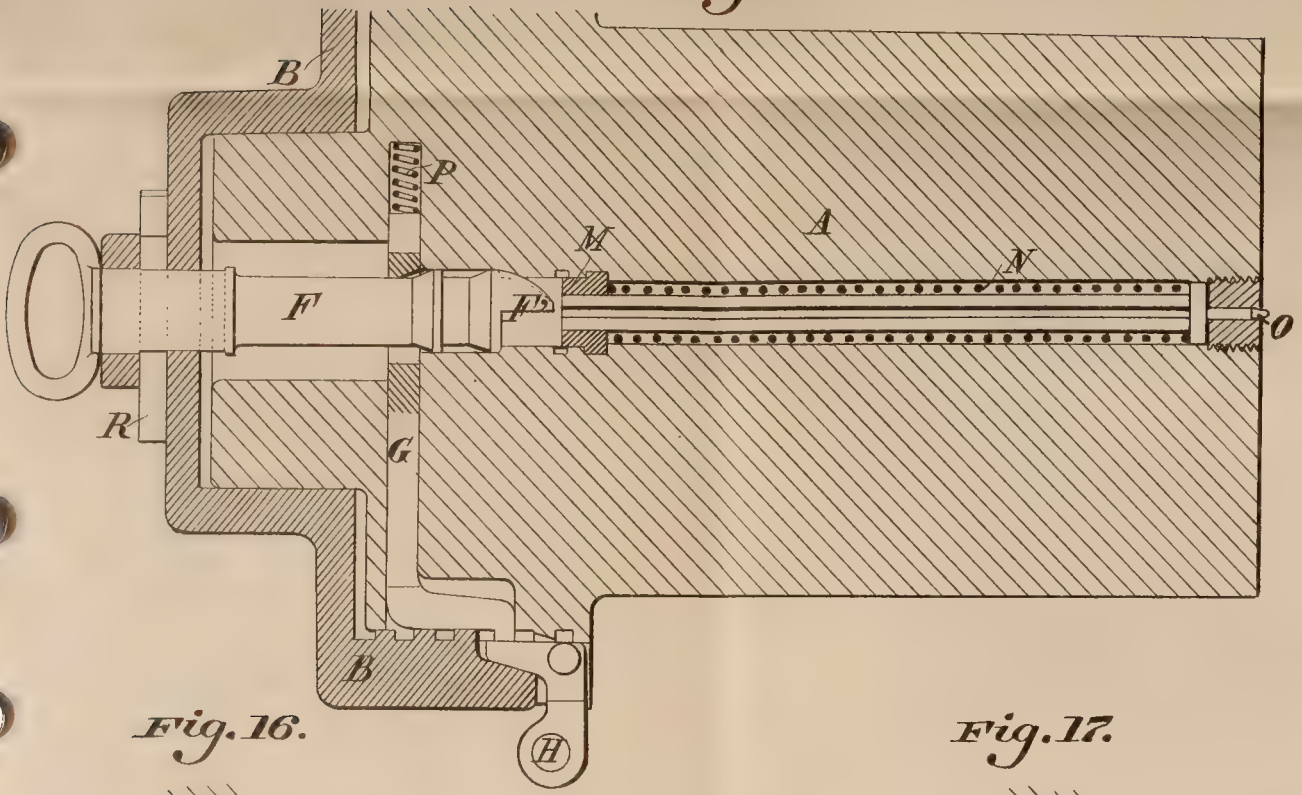


Fig. 16.

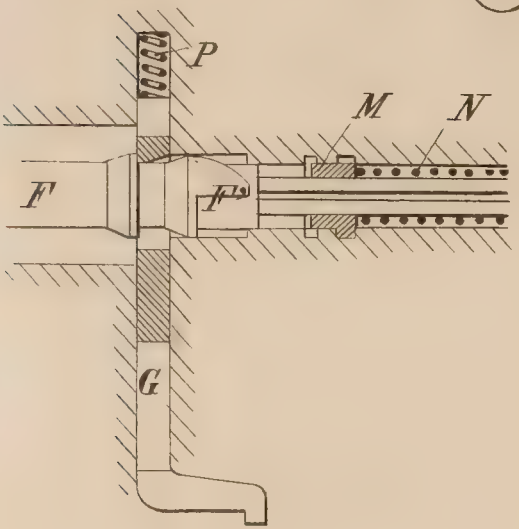
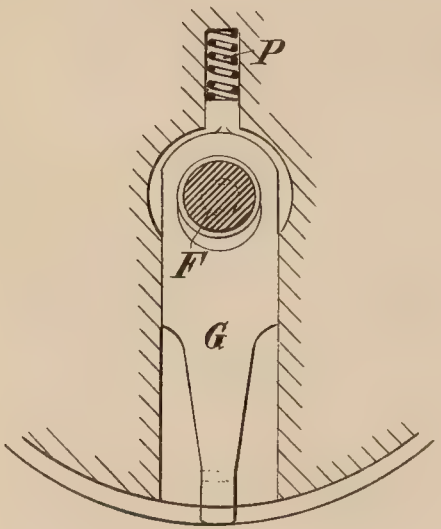


Fig. 17.





SCHNEIDER & CO.'S BREECH MECHANISM FOR LARGE R. F. GUNS.

Fig. 14.

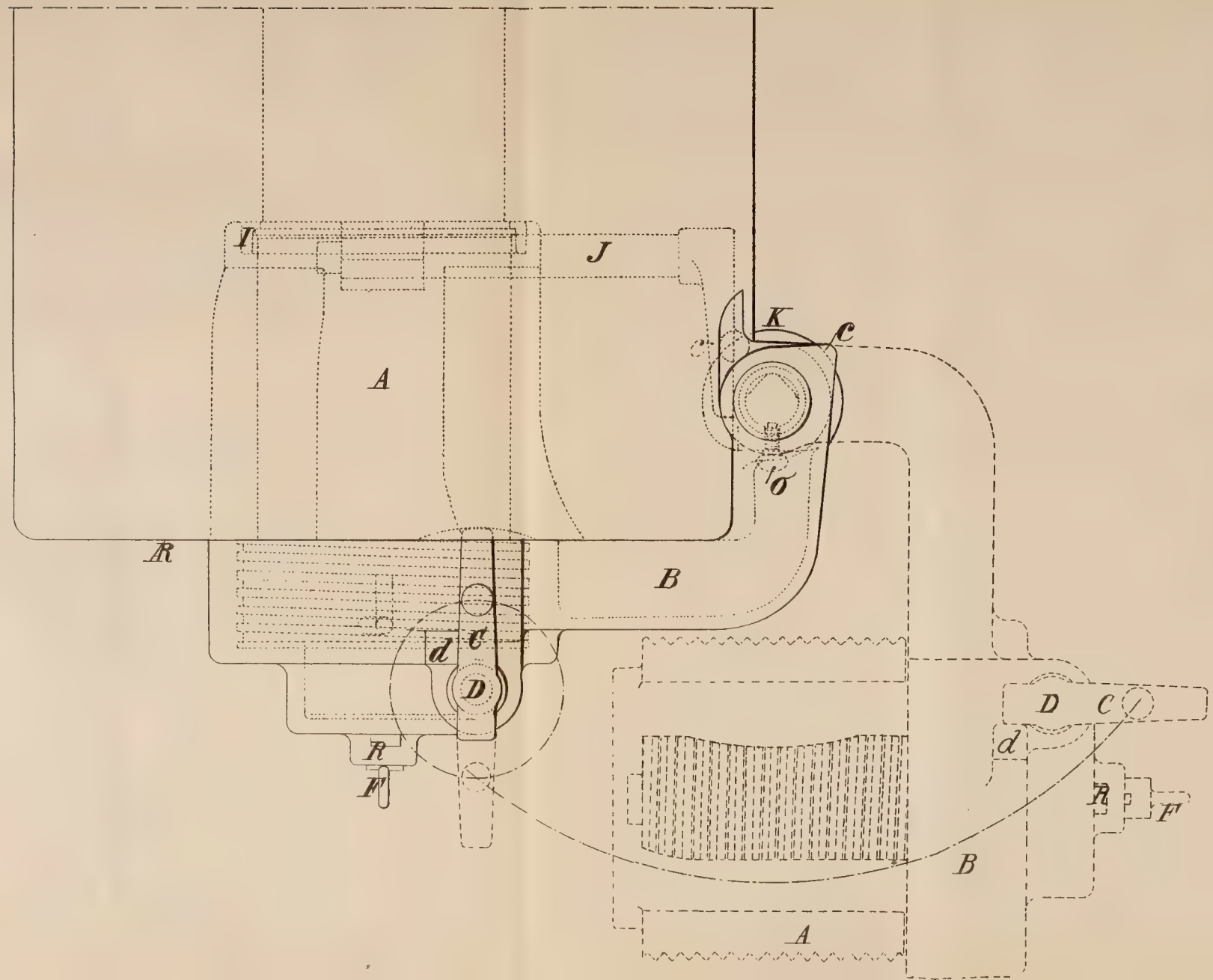


Fig. 21.

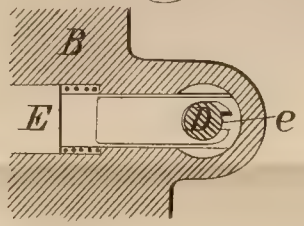


Fig. 19.

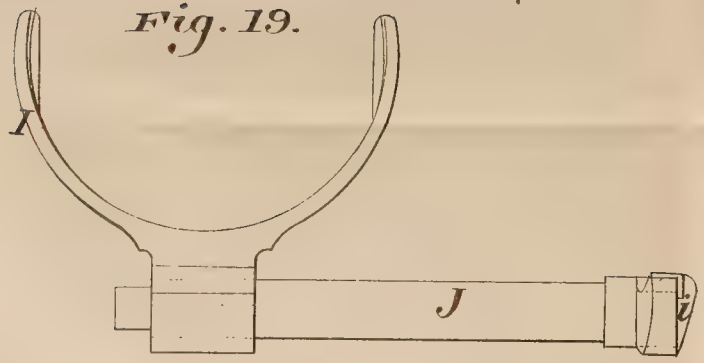


Fig. 18

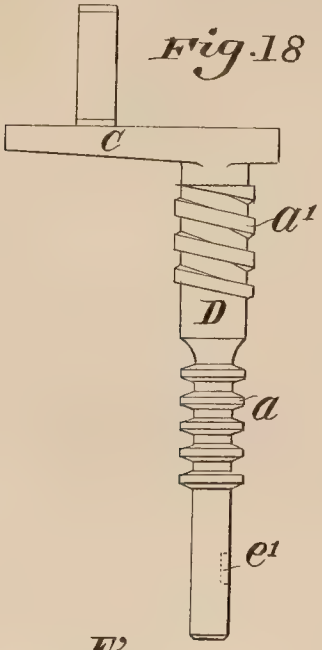


Fig. 20.

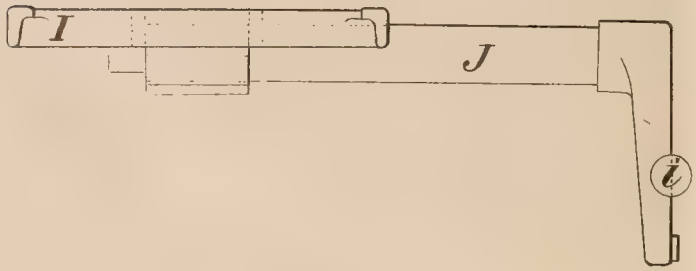


Fig. 23.



Fig. 22.

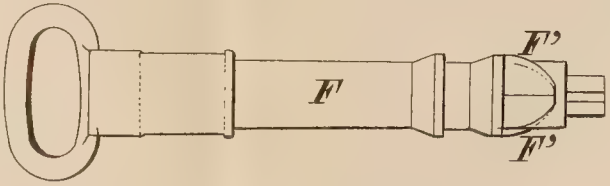


Fig. 24.

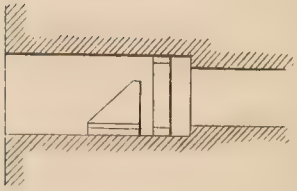
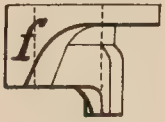


Fig. 25.



Fig. 26.





SCHNEIDER & CO.'S BREECH MECHANISM FOR SMALL R. F. GUNS.

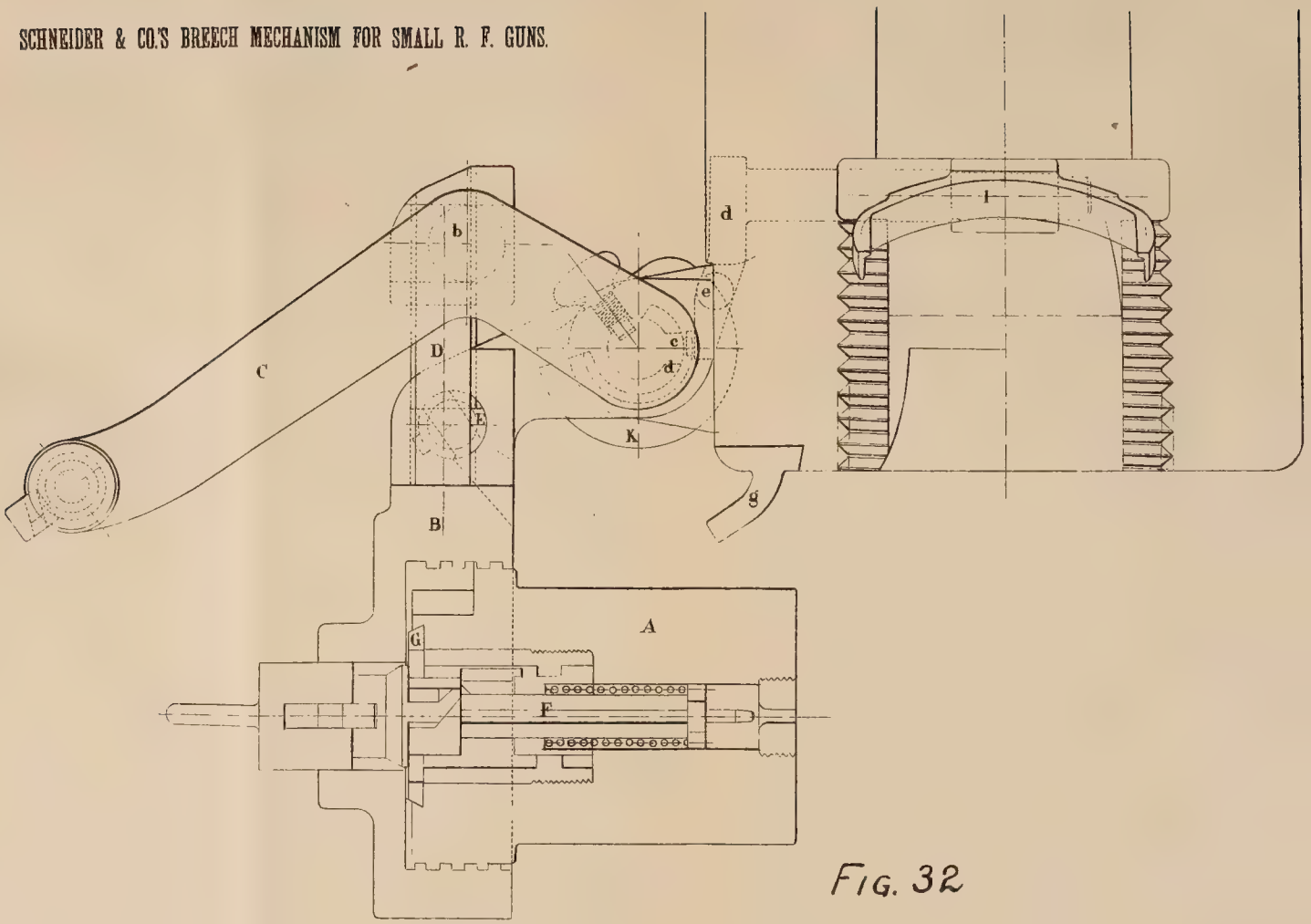


FIG. 32



SCHNEIDER & CO.'S BREECH MECHANISM FOR SMALL R. F. GUNS.

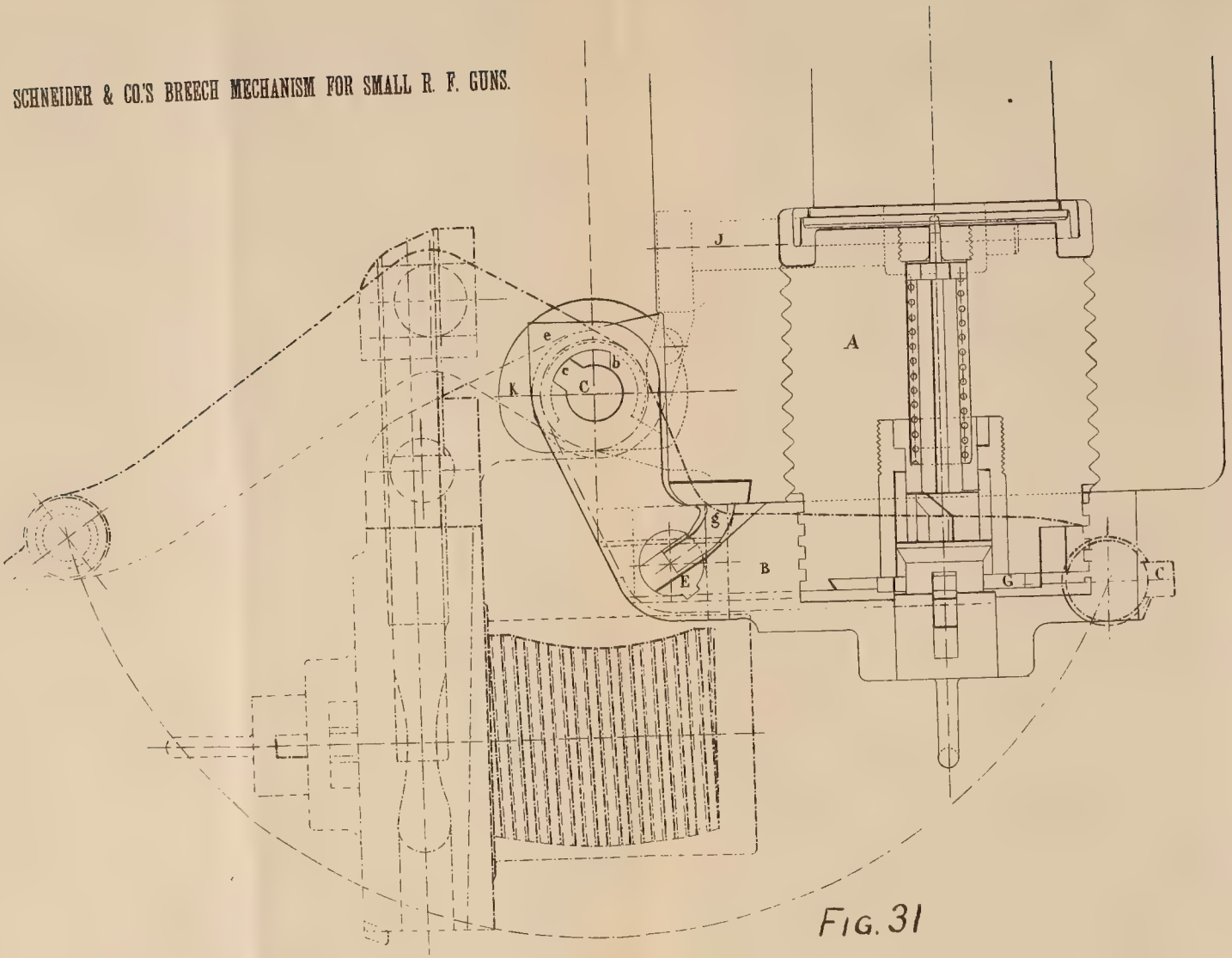


FIG. 31

SCHNEIDER & CO.'S BREECH MECHANISM FOR SMALL R. F. GUNS.

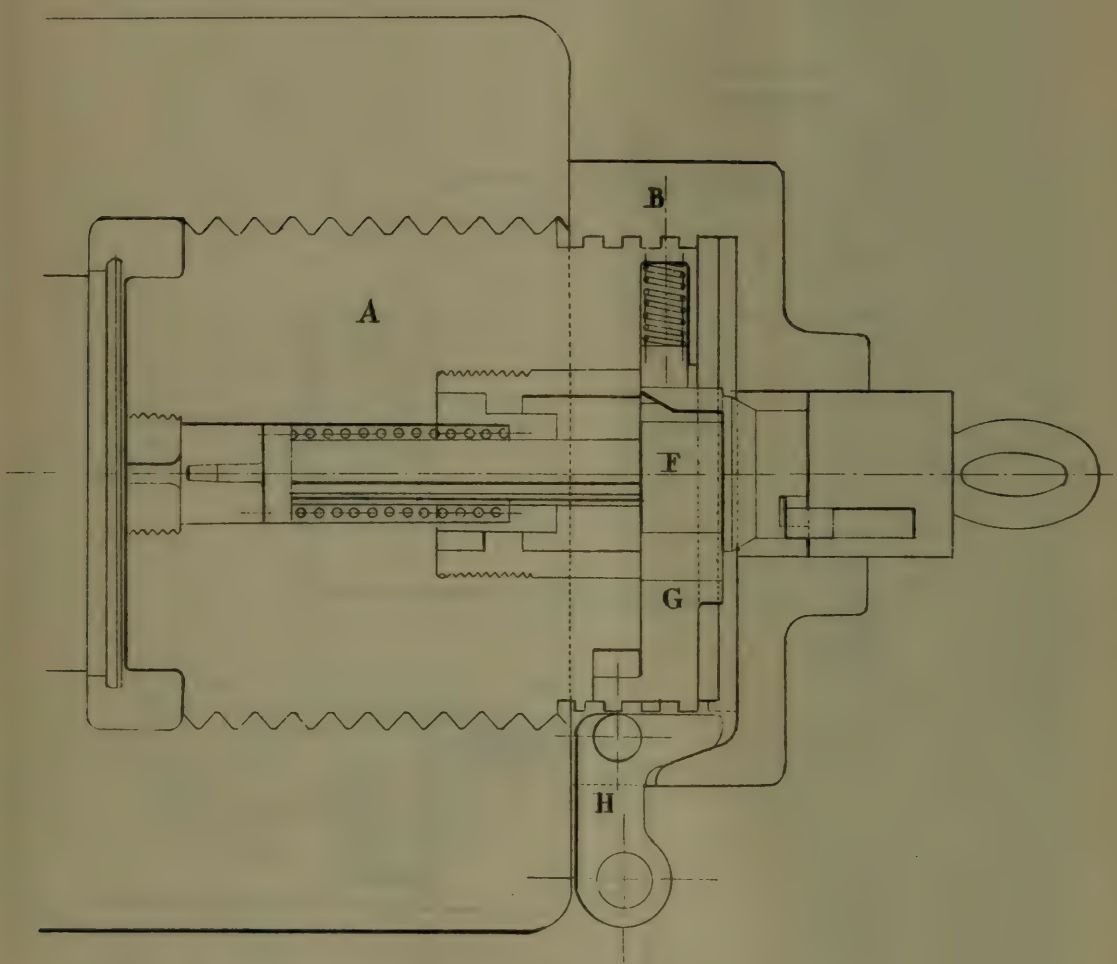


FIG. 29.

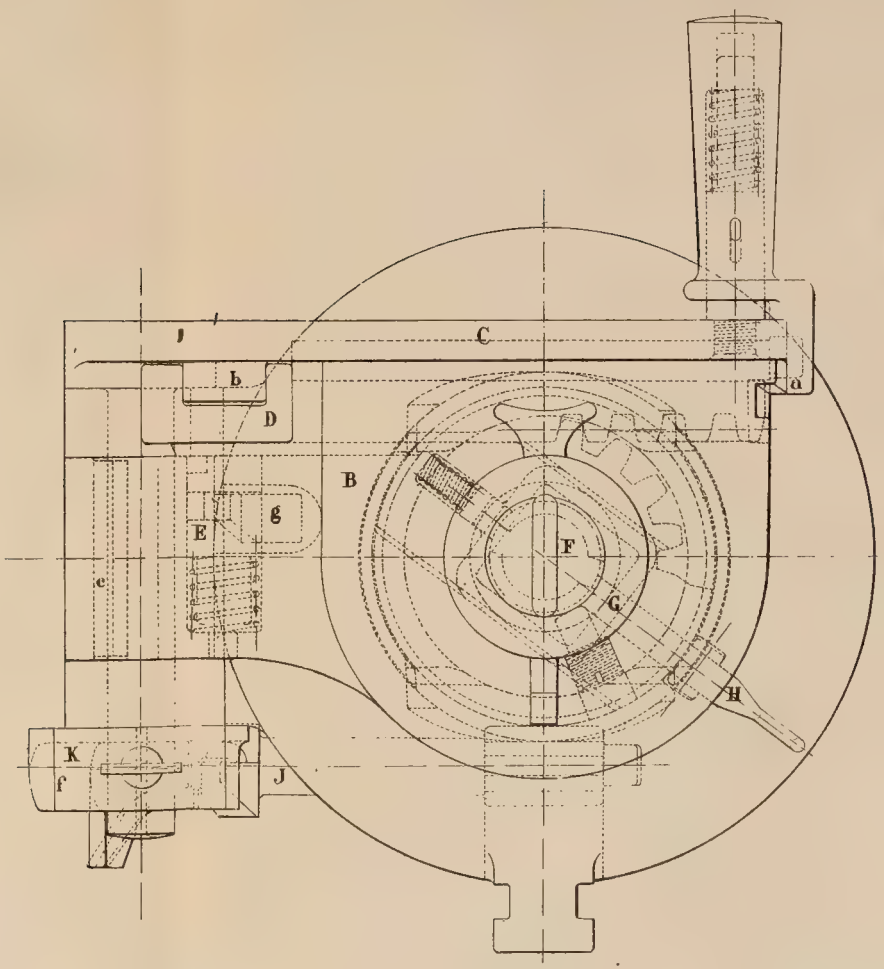
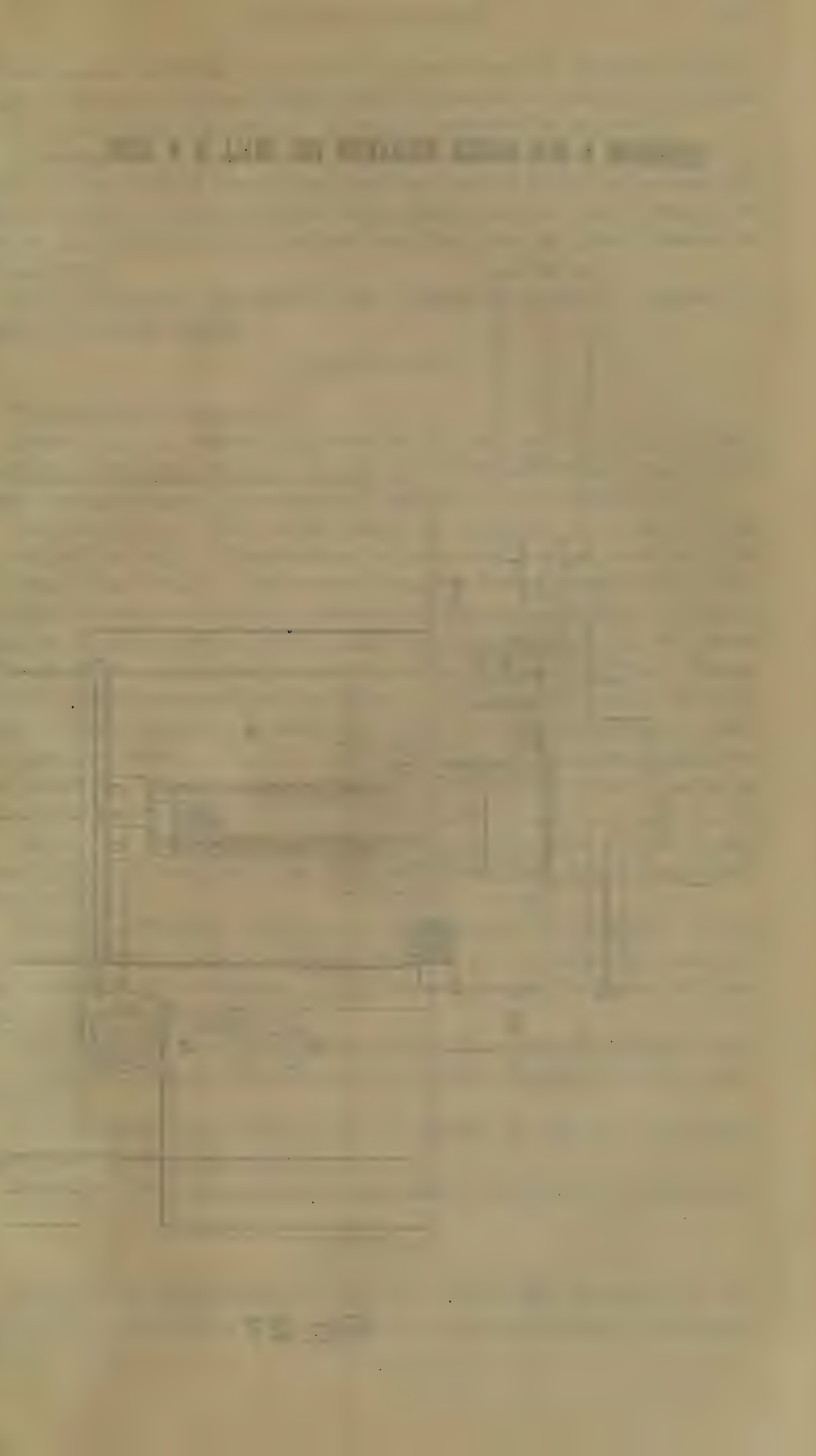


FIG. 28



SCHNEIDER & CO.'S BREECH MECHANISM FOR SMALL R. F. GUNS.

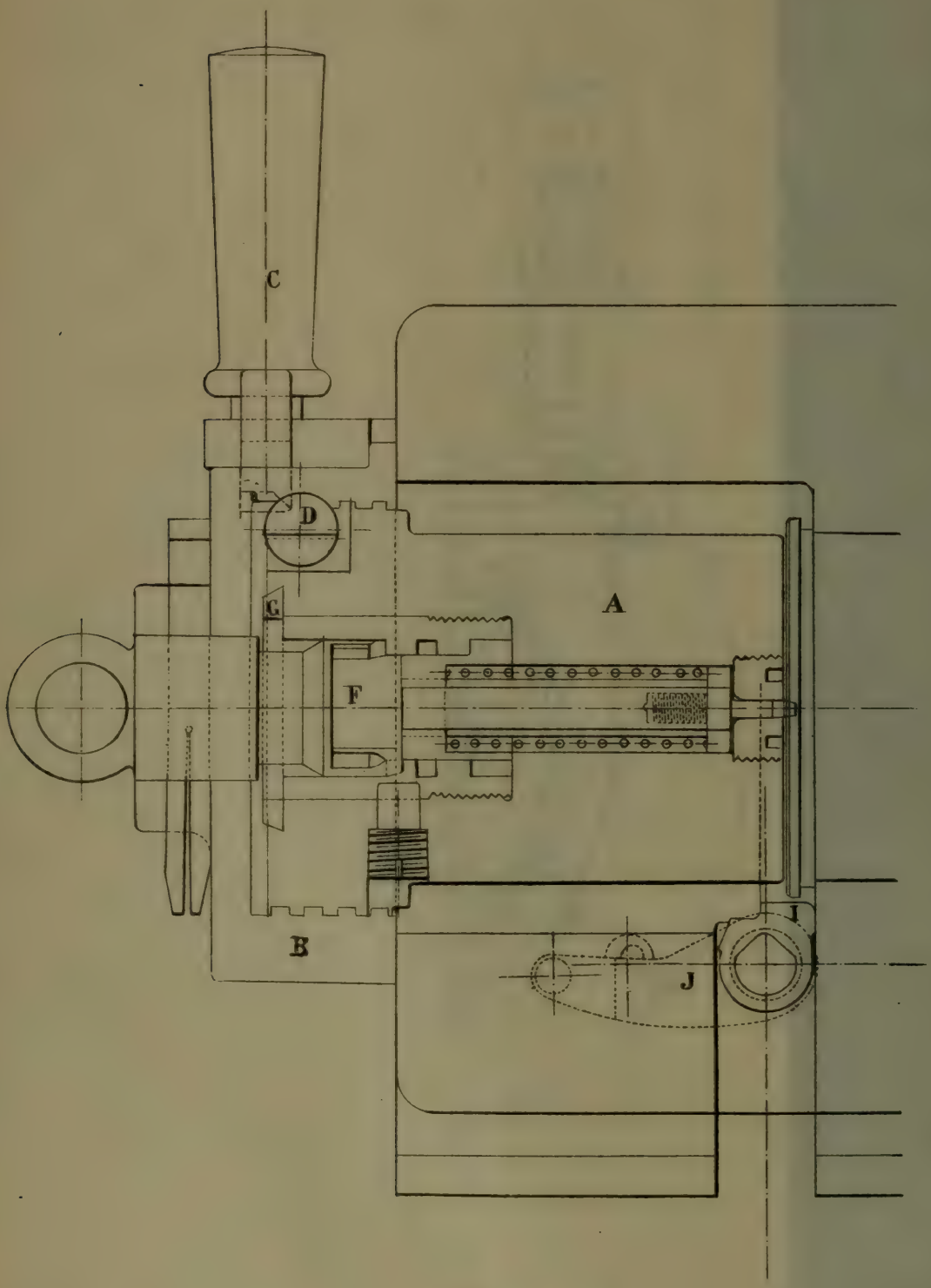


FIG. 27

which passes the firing pin, and it is pressed out by the sear spring P against the firing pin, and rests under a shoulder on it when it is drawn back, thus keeping it cocked. The sear rests on the trigger H.

Schneider & Co.'s system of breech mechanism for R. F. guns of small caliber, model 1895, illustrated by figs. 26 to 32, is the same as the preceding, in that it follows the general design of an interrupted screw plug turning in a collar and swinging from the gun by means of a bent hinge.

This mechanism can, with a few modifications, also be applied to guns of medium caliber.

DESCRIPTION.

The mechanism consists of:

Breech plug A; carrier ring or collar B; cam lever C; rack D; stop bolt E and spring; firing pin F, sleeve, spring, and striker; sear G and sear spring; trigger H; extractor I and axis J and collar ramp K.

The breech plug.—The breech plug A is supported by a carrier ring or collar B, to which it is connected by a screw thread of the same pitch as that in the breech. The screw threads of the plug and those of the breech are cut out on two quarters of the circumference, so that a quarter of a revolution of the plug completely disengages the screw threads of the plug from those of the breech. The forms and dimensions of the thread portions and blanks of the plug and breech are such that it is not necessary to draw the plug directly to the rear in order to open the breech. (Fig. 31.) As soon as the plug is disengaged from the screw threads of the breech it is swung directly out and around on the collar B.

The carrier ring or collar.—The carrier ring or collar B is of bronze and is fitted to hold the plug, the rack D and its stop bolt, and the trigger H.

The lever.—The lever and axis of the collar are in one piece. In the lever is the pin *b*, which operates the rack D. In the lever handle is an automatic catch, which engages in the collar when the breech is closed and thus prevents accident.

The rack.—The rack D works in a slot in the collar and gears in teeth on the plug. (Fig. 28.) In the end of the rack is the slot in which enters the pin *b*.

The extractor I and trigger H are similar to the ones previously described for the larger guns.

From the above the manner of operating the mechanism is apparent.

GERMANY.

The German navy budget for 1896–97 includes the allowance for ordnance and fortifications of $1,178,300, but a slight increase over estimate for last year.

GREAT BRITAIN.

Under the head of naval armaments, the estimate for 1896–97 is £2,543,200 ($12,376,483), an increase over last year of £850,000 ($4,136,530).

In the statement explanatory of the estimates for 1896–97 the first lord of the Admiralty says:

> During the year various experimental armor plates have been submitted for purpose of trial. None of these, however, have as yet shown qualities equal to those possessed by the Harveyized steel armor at present used. Consequently armor of that description is still being contracted for.

EASTWICK & TIMMIS AUTOMATIC WORKING OF BIG GUNS, AND PROTECTION OF SCREW THREADS OF BREECH.

The following is a description of the gearing for the automatic working of big guns, designed by Messrs. Eastwick & Timmis, and is shown in figs. 33 to 39.

Objects.—When the gun is fired at any angle of elevation, it (after the recoil)—

(1) Automatically rises at the breech end to a level (or slight muzzle depression) position. This movement enables a heavy gun to be run out again by comparatively light springs.

(2) Breech unlocks and opens automatically.

(3) The gun completes its run out and is held there. It then either remains at that elevation or automatically falls to any other required elevation for loading.

(4) The gun is loaded in any way that may be desired.

(5) The breech is then automatically closed by a second set of springs.

(6) The gun returns automatically to any firing elevation that is desired.

The firing and loading elevations are regulated by the officer in charge. The gun automatically conforms thereto.

Fig. 33 is a side elevation of the gun and gearing. The cylinders M, L, I, K, and M are fixtures and do not rise and fall with the gun, but the rams in L and I, and which are attached to the gun slide C, move up and down in L and I as described below.

The gun A is carried by the carrier B and the whole rest on and slide in the gun slide C, which swivels on the trunnion T.

Fig. 34 is a rear-end elevation.

Fig. 35 is a half cross section on lines V and VI in fig. 1.

Fig. 36 is a half cross section on lines VII and VIII in fig. 1.

Fig. 37 is a half plan on lines IX and X in fig. 4.

Fig. 38 is a half plan on lines I and II in fig. 3.

Fig. 39 is a half plan on lines III and IV in fig. 3.

The letters are the same in each figure.

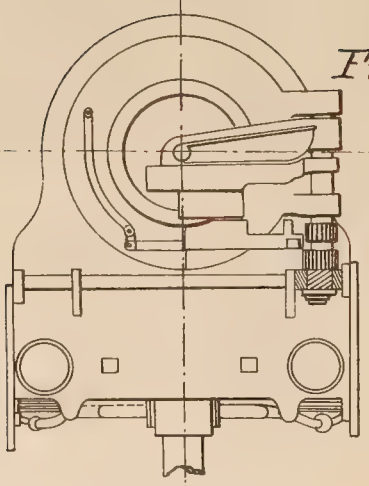


Fig. 34.

END ELEVATION

Fig. 35

HALF SECTION ON
V–VI

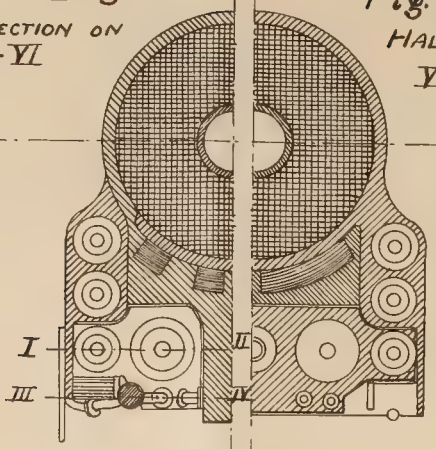


Fig. 36.

HALF SECTION ON
VII–VIII

(Reference letters omitted to avoid confusion.)

Fig. 37

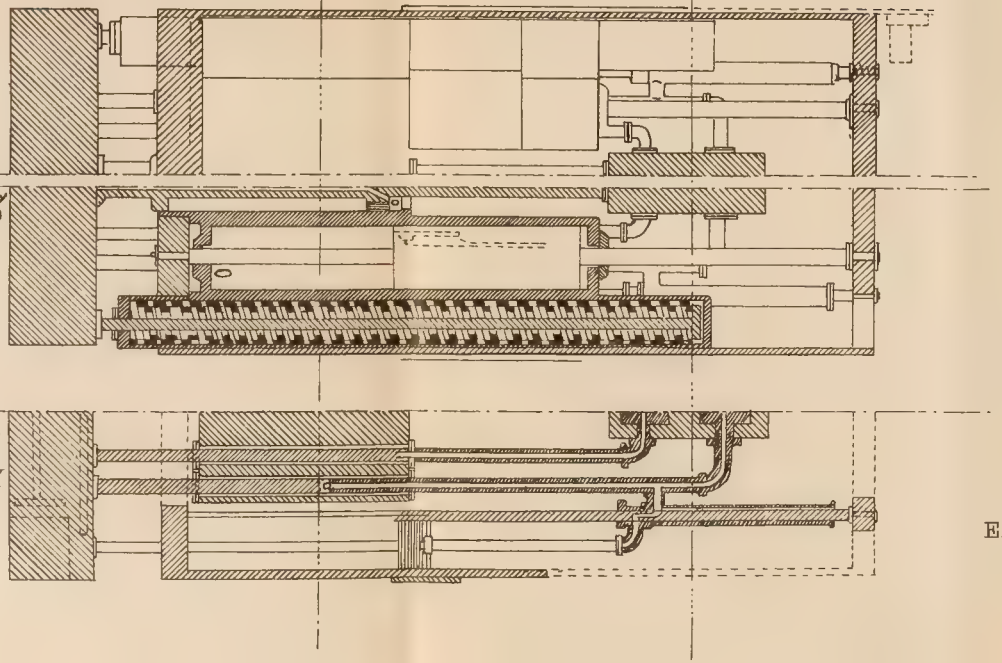
HALF PLAN OF WORKING PARTS

Fig. 38

HALF SECTION ON LINE I–II

Fig. 39

HALF SECTION ON LINE III IV



EASTWICK & TIMMIS'

GUN MOUNT.



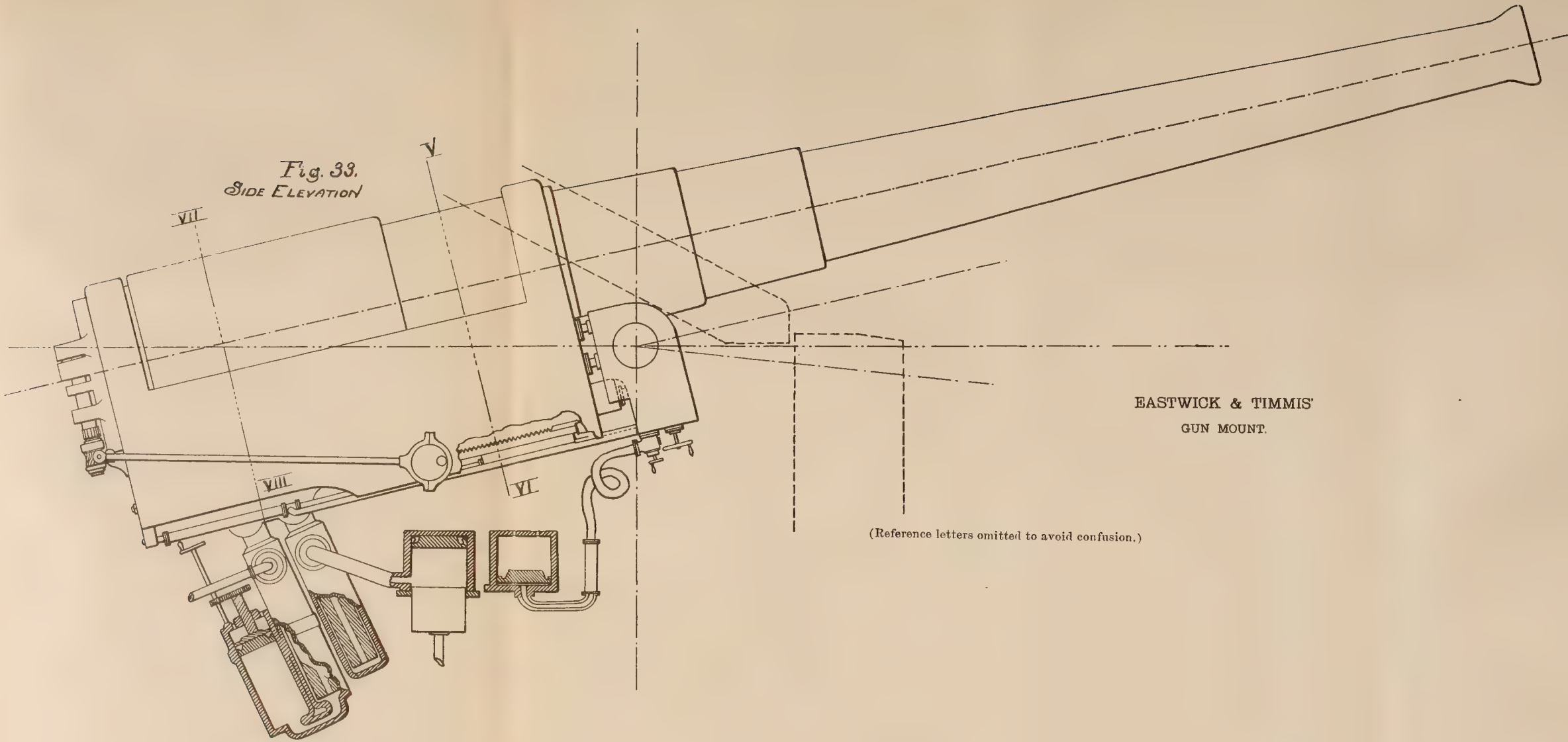


Fig. 33.
Side Elevation

EASTWICK & TIMMIS'
GUN MOUNT.

(Reference letters omitted to avoid confusion.)



A is the gun.

B the carrier which holds the gun.

C is the slide turning on the trunnion T and in which the gun and its carrier slide during recoil.

D D are the four sets of main or gun springs.

E E are the two sets of auxiliary springs.

F F are the coils of wire in the bobbins of the electro magnets, the common armature being represented by the carrier B.

G is the hydraulic brake of the ordinary pattern.

H H are the hydraulic cylinders, one on either side.

I is the firing elevator.

K its compensating chamber with a floating diaphragm *k*, and its plunger C which regulates the firing elevation of the gun.

L is the loading elevator.

M its compensating chamber with its floating diaphragm.

N is its second compensating chamber with its floating diaphragm *n*. The contents of M are regulated by the screw shown on top.

P P are the racks, one on either side, which work and actuate the pinions Q Q shown in figs. 34 and 39.

S S are the frames for carrying H H, E E, and G.

The working is as follows: The gun being ready for firing, as shown, is fired either automatically when it arrives at that position or by hand, and recoils. The recoil being taken up by the hydraulic piston in G (this piston is fixed to the gun slide C) and if desired also by the electric brakes. A and B recoil for 3 feet with S S and G. The springs D D are compressed by carrier B, and E E are compressed by frames S S, and the cylinders H H attached to S S are also carried back. The frames S S, cylinders H H, and springs E E are then held by the hydraulic brake G, but electrically controlled through valve.

The gun A and its carrier B and the pistons in cylinder H H are now run forward again by the springs D D for a short distance, say 12 inches, and during that time the pistons of H H force the liquid in H H through the port No. 5 (*see* fig. 38) into the sliding jacket 7, through the main 8, through the hollow joint 9, and the main 10, and the cylinder L, thus forcing the ram in that cylinder upward and raising the gun and carrier and slide to a practically level position, regulated beforehand by the officer in charge. As an amount of fluid is forced through the port 5 in cylinder H, a corresponding amount of fluid enters the other end of the cylinder at the back of the piston through port 6, shown in dotted lines. This fluid comes in from the cylinder I, being replaced in I from K, the loaded diaphragm *k* driving it out. It flows through the main 11, through 13, 14, and 15. The springs are now still powerful enough to drive the gun forward at a level position, or slight muzzle depression by preference. Ports 5 and 6 are closed in H H, and the liquid flows through port 16 (fig. 38) and then through the return port 16*a*, which is opened.

Meanwhile the racks P P (one on either side) have been held fast with S S and E E, but the pinions Q Q (*see* figs. 35 and 39), and which are behind the cam Z in fig. 1, and the cams have been carried forward by B. QQ are operated by P P in moving over them and so operate the cams, which in their turn revolve cranks Y Y (one shown in fig. 33) which operate the breech, unlocking and opening gear by revolving an upright shaft with a worm wheel in the usual way.

Thus the gun recoils and is again run out with a light set of springs, and the breech is unlocked and opened, and all done automatically.

The gun is now held at the firing point by the electric brake, as the hydraulic brake is in use holding S S, E E, and C. Of course two hydraulic brakes could be used. The slide valve 3 (fig. 39) is now opened and L and M cylinders are now in communication through 9 and 10 and junction 4 (*see* figs. 37, 38, and 39) with the main 17, valve 18, through armored hose 19 to cylinder N.

If high level loading is required M keeps the gun at its high breech level, valve 18 being closed, and also port 5.

If low level loading is required valve 18 is open and fluid enters N and lifts *n*, its weight being less than the balance weight of the gun, and as 5 is also open and the liquid in it is released, the gun sinks automatically to the prearranged level for loading as fixed by the screw in top of the cylinder M.

The gun is now loaded.

The brake G is released and the springs E E send forward the frames S S and cylinders H H and P P.

During the first part of movement the liquid at rear end of H H is sent through 16*a* to the other end at 16, and at the same time P P actuate the pinions Q Q and close and lock the breech.

Then the liquid in H H passes through 6 into M L and N, and as 5 is opened the liquid in I and K which is not required returns into the front end of H H, and the gun returns automatically to its firing elevation, as prearranged by the officer controlling the ram O.

MESSRS. EASTWICK AND TIMMIS' SCHEME FOR PROTECTING SCREWS OF BREECH WHILE LOADING.

(Figs. 40 to 43.)

A number of solid teeth or screw threads which correspond to and fit into any desired number of the grooves between the screw threads in the breech of the gun, are joined by metal plates which lie over and protect the screw threads in the breech. These teeth and plates do not extend into the blanks of the breech.

When the breech plug is forced into the breech, the teeth and metal plates which are joined by one or more rings do not hinder the breech plug from being pushed home.

The breech plug is then rotated, say, one-sixth of a turn, in the ordinary way, to lock it, and as it rotates its threads engage in the grooves

FIG. 40.

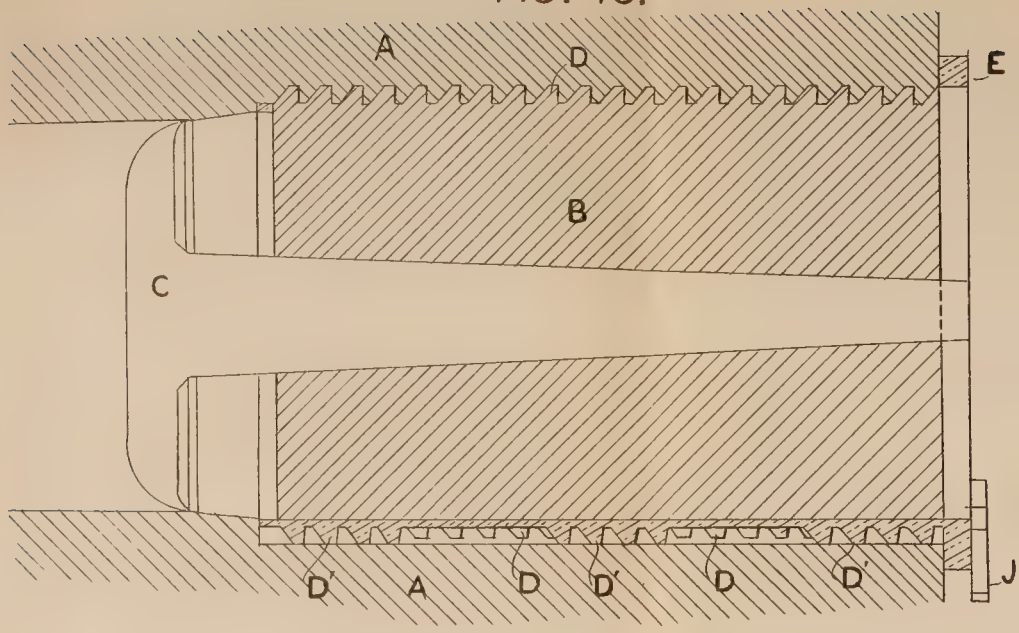


FIG. 41.

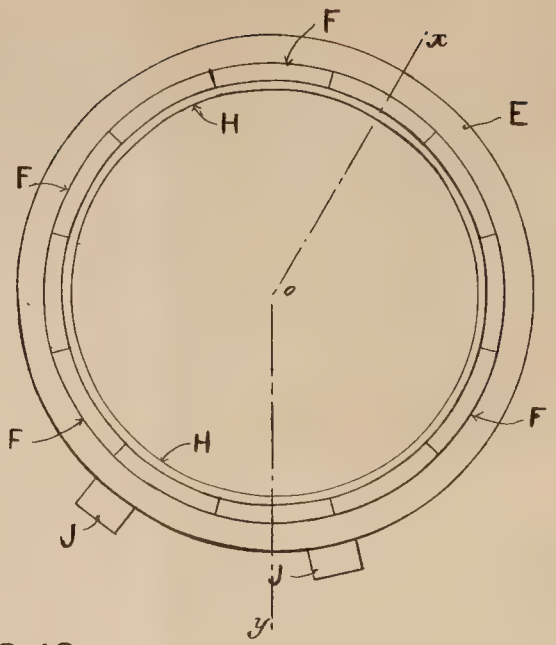


FIG. 42.

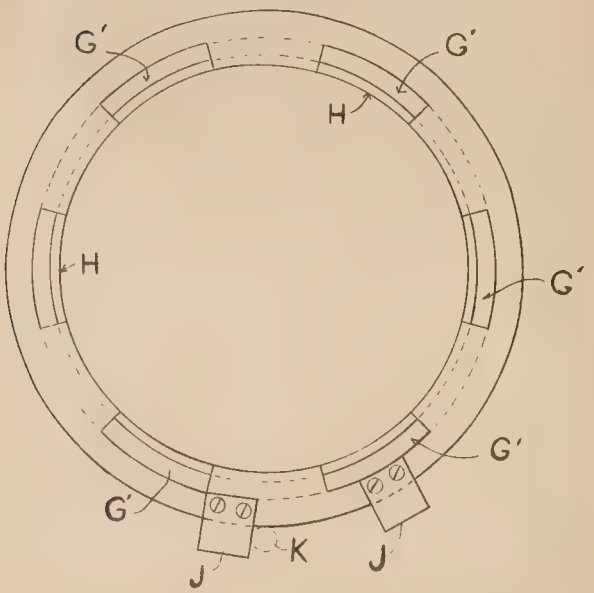
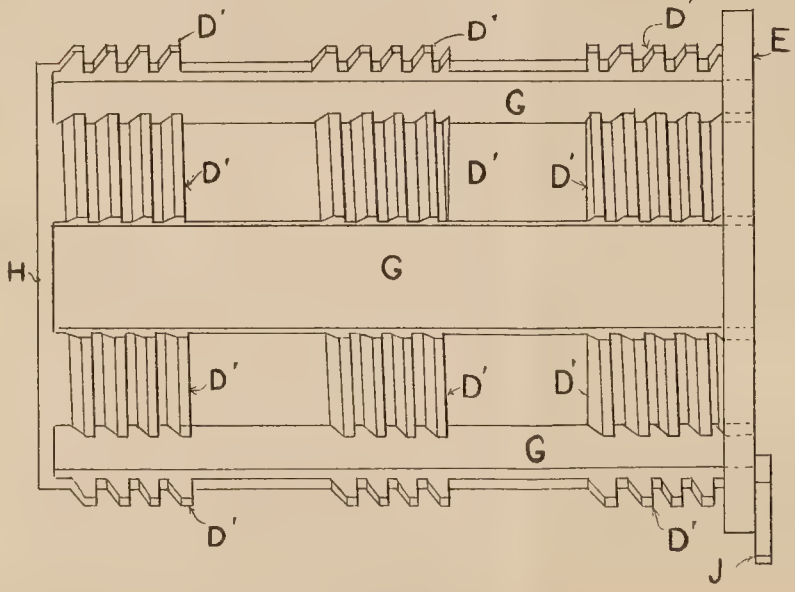


FIG. 43.



EASTWICK & TIMMIS' SHIELD FOR PROTECTING SCREW THREADS OF BREECH.

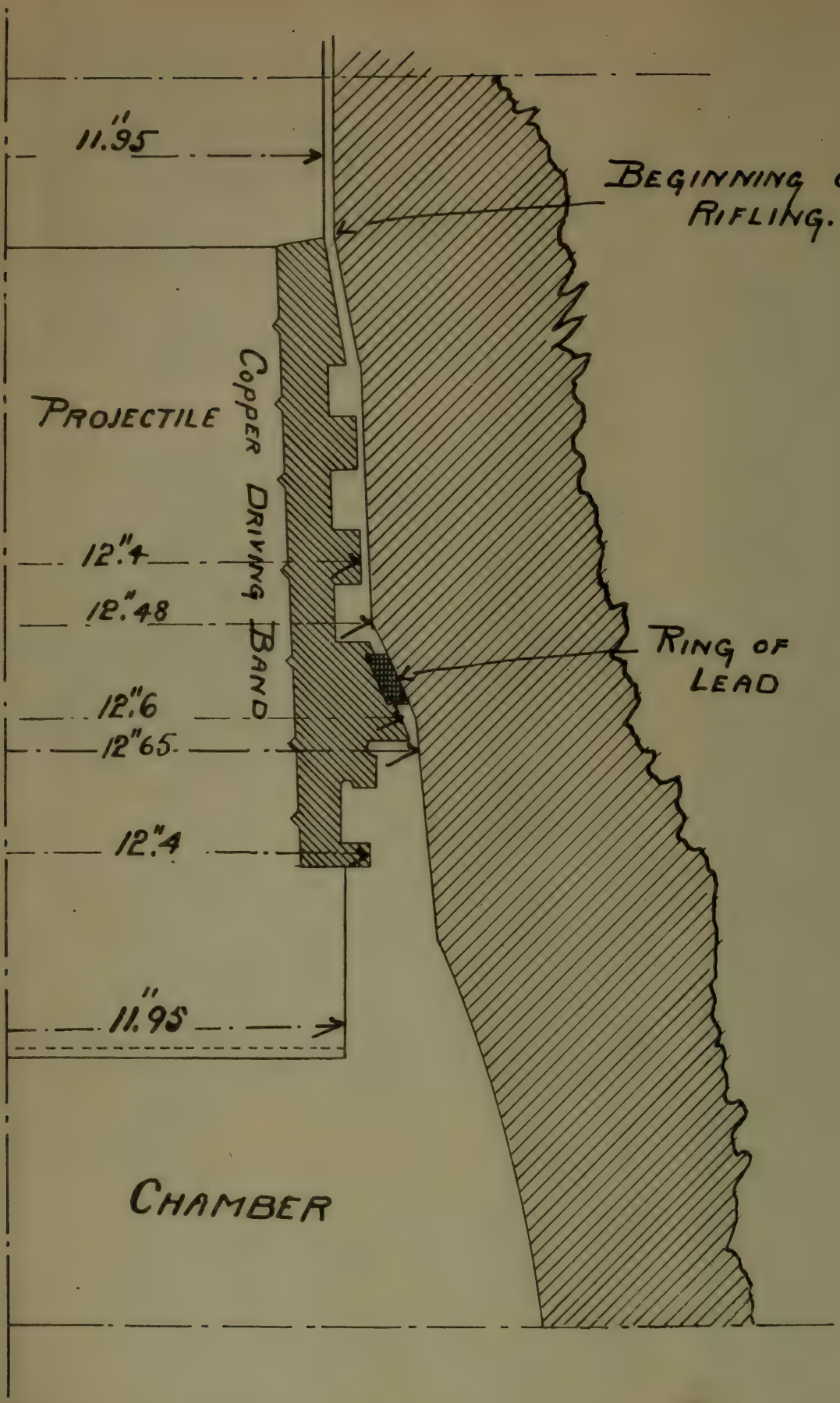


FIG. 45.

ROTATING BAND FOR PROJECTILES.

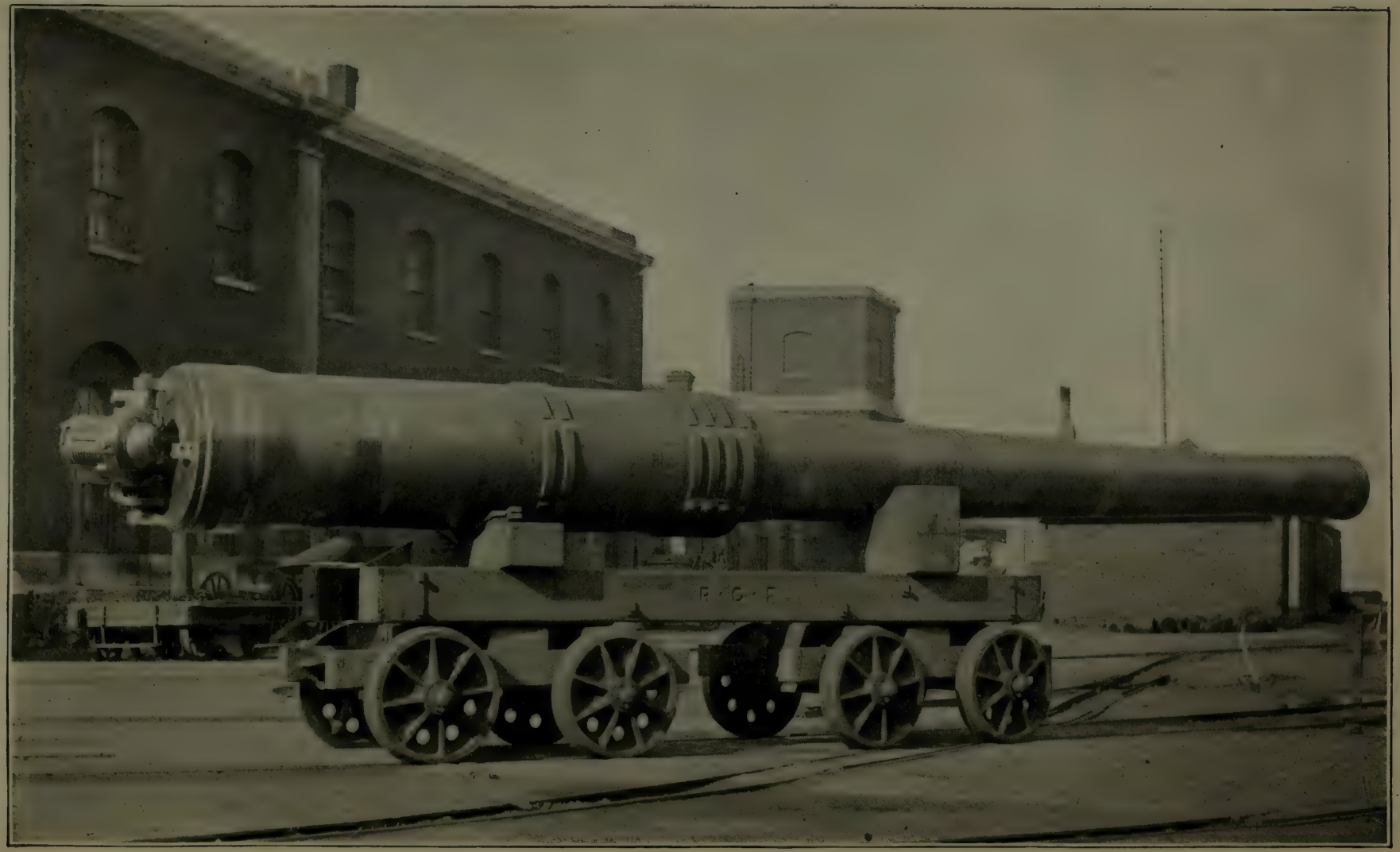


Fig. 44.—12-INCH B. L. WIRE-WOUND GUN, 46 TONS.

between the screw threads in the breech and so force out the teeth and projecting plates from their loading position into the blanks of the screw box.

On the other hand, when the breech plug is unlocked and rotated back again its screw threads force the teeth and projecting plates into their former position ready for the next loading operation.

This system is illustrated by the figures as follows:

Fig. 33 is a longitudinal section through the breech and breech plug on line *k o y* of fig. 34.

Fig. 34 is a view of that end of the shield which is nearest to the chamber.

Fig. 35 is a view of the outer end of the shield.

Fig. 36 is an external view of the shield removed from the breech.

In these figures A is the gun; B, the breech plug; C, the obturator; D, the screw threads of the breech plug; D′, the screw threads or teeth of the threaded portions of the parts F F F of the shield (figs. 33 and 36); E is an external ring which connects the partially threaded portions F F F of the shield. G G G are the open portions of the shield in which the threaded portions of the breech plug B lodge themselves when the breech plug has been rotated to disengage from the breech; G′ G′ G′ are recesses cut inside ring E, corresponding to and as wide as open parts G, in order to allow the breech plug to be removed. H is a ring which connects the inner ends of the threaded portions D′; J J are two stops attached to the external ring E, and limiting its partial rotation as they strike against pin K. The shield is shown partially threaded, but it may be threaded throughout its whole length.

Thus it is seen that when the breech is open the shields lie over and protect the screw-threaded portions of the breech, and that the partial rotation of the breech plug in closing the breech causes the shields to partly rotate and occupy the blanks.

WIRE-WOUND GUNS.

The British are making wire-wound guns of all calibers up to and including 12-inch guns, and with apparent success.

The process of manufacture of these guns is clearly described in General Information Series No. XIII, page 81.

Fig. 44 shows the completed 12-inch wire-wound gun, such as is furnished for the *Majestic* class; the breech is open and the breech plug is shown.

The rotating band originally intended for the projectile of this gun has been abandoned. This band was of copper, with a lead ring around it to insure the checking of the gas. A copper ring is now used.

Fig. 45 shows the old band and also the base of the projectile. The weight of the projectile is 850 pounds; cordite charge, 167.5 pounds; initial velocity, 2,381 foot-seconds.

The following are particulars of the 9.2-inch wire-wound gun supplied to the *Powerful* and *Terrible:*

Length of gun, 32 feet; weight of projectile, 380 pounds; muzzle velocity, 2,347 foot-seconds; perforation through wrought iron at muzzle, 28 inches.

MOUNTS FOR THE 12-INCH WIRE-WOUND GUNS OF THE MAJESTIC CLASS.

Fig. 46 shows the fixed and all round loading position, the ready stowage of projectiles, the hydraulic and hand gear, the loading trays, and the ammunition hoists.

The ammunition hoist in section shows the projectile above and charge below, the gate open, the former coming out first on to the loading tray followed by the charge below. On the other side in section the gate is drawn closed and projectile and charge not showing.

The all round loading position is shown above the fixed loading position (see dotted line 1 degree) the powder hoist being between the guns.

The ready lockers as shown in sketch contain eleven projectiles each below and seven each above, making thirty-six in all.

(1) Middle line left gun; (2) middle line right gun; (3) section through A B; (4) seven projectiles horizontal; (5) seven projectiles horizontal; (6) ammunition hoist; (7) eleven projectiles for each gun; (8) seven projectiles for each gun; (9) ammunition hoist; (10) loading position 13 degrees; (11) loading position 1 degree.

"The method of securing the guns to their cradles is quite new. Instead of the broad bands passing over and strapping the gun on their cradles—as in the *Royal Sovereign* class and previous ships—thrust rings are provided to the 12-inch guns which fit into corresponding grooves in the cradles, and thus transmit the longitudinal thrust of recoil. Slots in the rings and keys keep the guns down in their places. The arrangements actually in use for securing the guns to their cradles are thus all below the axis of the guns and are well protected. There is another new feature about this method of attachment. It will easily be understood that, for convenience, the breech plugs of guns in a turret or gun house have to work to opposite hands, the breech plug of the right-hand gun hinging on the right-hand side of the gun and the breech plug of the left-hand gun on the left-hand side. At first sight it appears that to effect this the guns themselves would have to be right and left handed. But the Elswick plans get over this by arranging that the guns shall be reversible. If it is required to place the right-hand gun in a left-hand position, it is only necessary to turn it upside down. The thrust rings encircle the gun and, therefore, always coincide with the grooves in the cradle, and slots are provided in the rings to meet the requirements of either position. Each gun with its complete mounting is made to balance (when the gun is out in the firing position) upon a pair of trunnions. These trunnions are fitted to the slides and are strong enough to transmit the shock of recoil to the

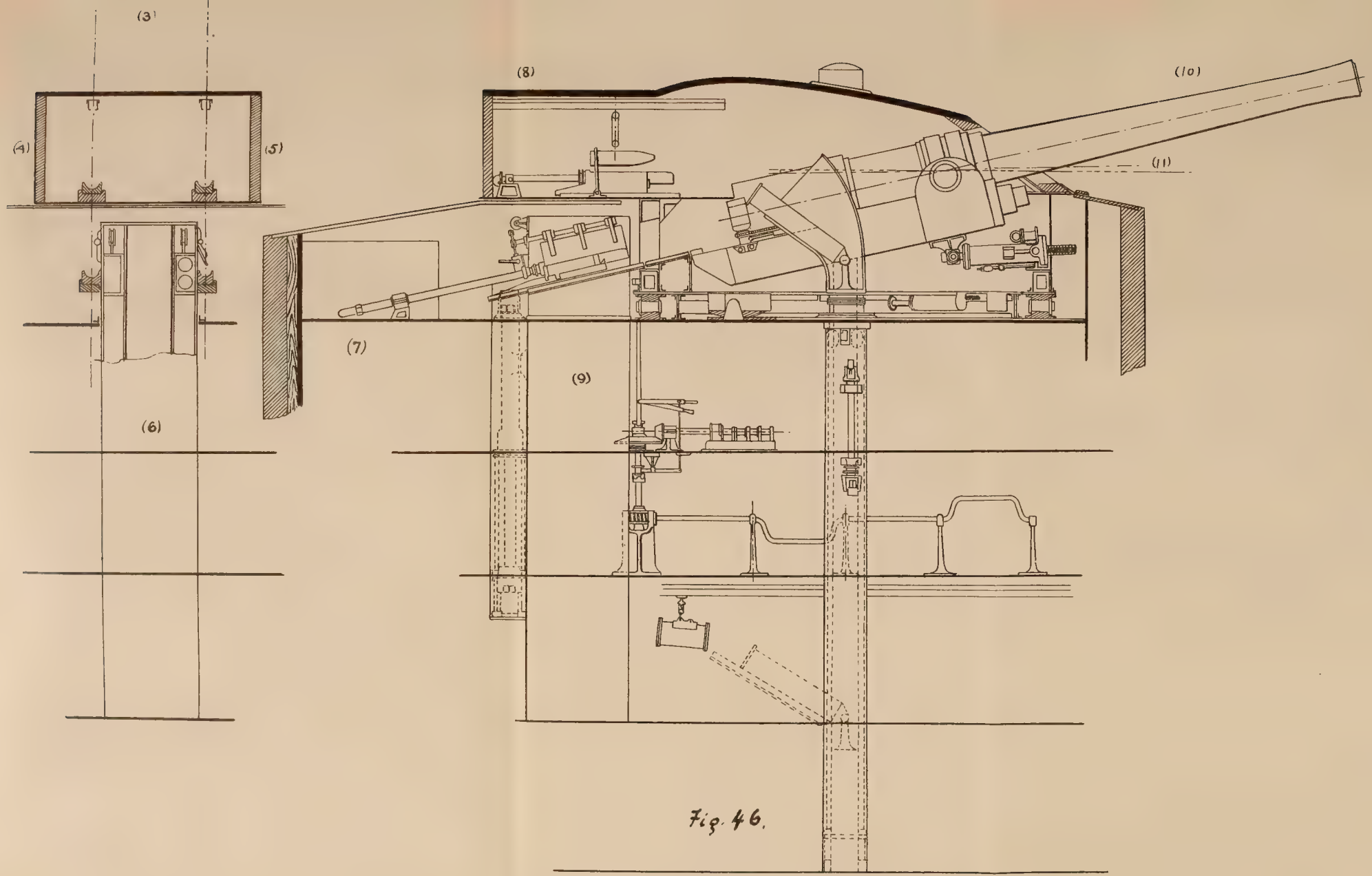


Fig. 46.

HYDRAULIC MOUNT 12" WIRE WOUND GUN. (SKETCH.)



structure of the turn-table, as well as to take the whole weight of the gun and mount. The object of the balancing is to make it possible to give elevation or depression to the gun by hand and still retain recoil in the line of fire.

"The guns may be run in or out by hydraulic pressure. In firing it is only the motion of running out that is necessary, for the recoil will always bring the guns in; but for cleaning purposes and drill it is convenient at any time to have the power of running them in. Hitherto guns in the navy worked by hydraulic power have been loaded in the 'run in' position, but the *Majestic* guns are loaded when run out. Much more room is thus obtained in rear of the guns for the loading operations. In the *Royal Sovereign* class there is but the one fixed loading position—that is to say, after each round the turntable has to be brought to a certain fixed position and locked there until the operation is over. If one gun only has been fired the other has to be practically put out of action for about two minutes until the first has been reloaded. In the *Majestic*, however, in addition to the fixed ammunition hoist, which has been retained with the idea that to load both guns simultaneously it is the quickest system, there is a central or all round loading hoist for the supply of the powder, and a considerable stock of projectiles stowed in the gun house provides the other essential. Thus either gun, or both guns, can be loaded in any position, and the loading of one gun does not in any way interfere with the working or firing of the other. To sum up, every operation can be performed by hand, should the hydraulic gear—which is, however, almost completely duplicated—break down. The guns can be loaded simultaneously at a fixed position, or separately at an all round position, and the time necessary for working the guns has been much reduced.

"These mounts were fully tested in the firing trials of the *Majestic*. Three rounds were fired from each of the two guns in the fore barbette. In the first round a reduced charge was used to make sure that everything was all clear, the guns being horizontal and trained over the starboard beam. A full charge with a full-weight projectile was used for the second round, the guns being trained, the one 10 degrees before and the other 10 degrees abaft of the starboard beam. The fixed loading position and the automatic breech gear were used for one gun, while for the other the all round loading position and the hand breech gear were used, so that both systems had a thorough testing. In the third round the two guns were fired simultaneously. A still more severe test was applied with the guns in the after barbette. Two reduced charges were first fired and then two full charges, the guns being trained over the port beam. The firing was against time, the fixed loading position being used for one gun and the all round loading position for the other, and the time was taken from the firing of the first round, the assumption being that there would be ample time to load for the first round before the ship entered an action. In the case of loading from the fixed

position the interval of firing rounds was one minute nineteen seconds, and in the case of loading from the all round position it was one minute twenty-one seconds."

The gun protection is a compromise between the barbette and turret systems. The sloping sides and roof offer no surface to a direct hit from a projectile. The plating in front is 10 inches thick.

THE MANUFACTURE OF CORDITE, WITH A BRIEF DESCRIPTION OF THE DEVELOPMENT OF SMOKELESS POWDERS.

[Derived from Treatise on Service Explosives, 1895.]

Soon after the discovery of gun cotton attempts were made to suit it for military purposes as a smokeless powder, but the extreme difficulty of controlling with certainty its rate of combustion was a great obstacle in the way. It is noteworthy that the French were the first to adopt a smokeless powder in the Vieille powder for the Lebel rifle, which was simply a mixture of soluble and insoluble nitrocotton somewhat hardened by digestion with ether and alcohol.

Since, a number of explosives, giving little or no smoke, have been proposed to take the place of black powder, and they consisted essentially of gun cotton or other varieties of nitrocellulose, or of mixtures of them with other substances, specially treated to render them slower burning. The general nature of treatment consists in dissolving or gelatinizing the gun cotton or soluble nitrocotton by the use of liquid solvents, such as acetic ether and acetone for the former, and mixtures of ether and alcohol for the latter, by which process the fibrous character of the original substance is more or less destroyed and a horny material produced, the rate of combustion of which is slower than when in the fibrous state, the reduction in rate of combustion being due to the physical condition of the resulting product.

Heating compressed blocks or granules of these substances with camphor, instead of treating them with liquid solvents, also has the effect of hardening their surfaces and of reducing the rate of combustion, and has been applied with some little success to the production of semismokeless powders.

The solvents above mentioned (except camphor) do not enter into the composition of the finished material; the gelatinous mass obtained is in this condition rolled out into sheets or pressed through suitable dies into wires, rods, or tubes, which remain, on complete evaporation of the solvent, in a homogeneous horn-like state, and are cut up into suitable lengths for charges.

Later, the combination of nitroglycerin with nitrocellulose has been found to produce a smokeless explosive. Soluble nitrocellulose when kneaded with nitroglycerin under the influence of heat absorbs the latter and at the same time loses its fibrous character, forming *blasting gelatin*, or, if the proportion of nitrocellulose used be higher and the materials be incorporated by rolling between hot rollers, products of a somewhat plastic nature or of a horn-like character. Camphor

employed as a further agent for promoting the union of the two explosives reduces the rapidity of the explosion and forms the explosive *ballistite.*

The camphor, however, does not remain a constant ingredient, and its evaporation, even at ordinary temperatures, leads to alterations in ballastic properties of the explosive, a grave defect for service explosives. To overcome this defect and employ gun cotton instead of soluble nitrocotton, an explosive was developed consisting essentially of nitroglycerin and gun cotton incorporated and gelatinized by the aid of a solvent. This material is incorporated without the aid of heat, which is essential for the production of ballistite. A small proportion of a mineral hydrocarbon is incorporated with this preparation, and appears to operate beneficially in regulating the explosiveness of the product and in improving its uniform stability under varied climatic conditions. It serves also as a lubricant during manufacture. This smokeless explosive, which is now definitely adopted by the British Government, is known by the name of *cordite*, owing to the cord-like form it finally assumes in manufacture.

The composition of cordite for small arms and for all natures of ordnance is the same, the required rate of combustion being obtained by varying the diameter of the die through which it is pressed in manufacture. Its density is constant (sp. gr. 1.56), and it contains practically no moisture, nor is it affected by dampness, as it is nonabsorbent. It is poisonous.

This is the composition of cordite:

	Per cent.
Nitroglycerin	58
Gun cotton	37
Mineral jelly or vaseline	5
Total	100

Mineral jelly or vaseline is a material obtained by the fractional distillation of crude petroleum oil at a temperature of over 392° F. It is a hydrocarbon having the formula $C_{16}H_{34}$. The variety used for cordite must have a flashing point not below 400° F., a specific gravity not below 0.87 at 100° F., and a melting point not below 86° F. It also must be free from acidity and foreign mineral matter.

Acetone, which is used in considerable quantities in the process of manufacture as the solvent, is one of the products of the destructive distillation of wood; it may also be obtained by distilling certain mineral acetates, such as those of lime, barium, and strontium. Its chemical formula is C_3H_5O. Acetone is a colorless aromatic liquid, is inflammable, and burns with a luminous flame. As used for the manufacture of cordite, it must have a specific gravity of not more than 0.802, must leave no residue on evaporation at 212° F., nor must it contain more than 0.005 per cent of acidity; further, when mixed with a 0.1 per cent potassium permanganate solution, the mixture should retain its pink color for not less than two minutes.

MANUFACTURE OF CORDITE IN THE BRITISH GOVERNMENT FACTORY AT WALTHAM ABBEY.

The various processes in the manufacture of cordite are:

(1) Drying the gun cotton.
(2) Weighing out and mixing the gun cotton and nitroglycerin.
(3) Incorporating.
(4) Pressing, and reeling or cutting.
(5) Drying.
(6) Blending and packing.

(1) DRYING THE GUN COTTON.

The gun cotton, as it comes from the wet gun cotton store, molded in cylinders 2 inches long and 3 inches in diameter, contains from 40 to 45 per cent of moisture. In this form it is laid out on trays with copper wire gauze bottoms, arranged on racks in stoves. The drying is effected by means of warm air blown into the stoves by a circular fan run at a fairly high speed, the air being warmed by passing it through a series of pipes surrounded by steam and contained in a cylindrical chamber or heater, the whole arrangement resembling a small horizontal multitubular boiler. The warm air enters the stove on three sides through branches which project into it a few inches above the floor level, these branches being set at right angles to and at intervals along the main air pipe, which is outside the stove. The openings in the branches are so arranged that the air impinges directly on the floor of the stove. A clear space is left all around between the walls of the stove and the racks for the trays. The only outlets for the air are two small windows covered with fine wire gauze, one at either end of the stove. Until the amount of moisture has been reduced to about 10 per cent the temperature of the air blast, as it enters the stove, is not allowed to exceed 140° F.; after this point is reached, and until the gun cotton is dry, the maximum temperature of the blast is reduced to 120° F.; the actual temperature in the stove, however, is never allowed to exceed 100° F., so that, to insure this, the above temperature may have to be reduced at times. The gun cotton is dried to about 1 per cent of moisture, which ordinarily takes from ninety to one hundred hours. The stove is then allowed to cool down, and, when cool, the gun cotton is taken off the trays and placed loosely in wooden boxes, in which it is conveyed to the weighing room.

(2) WEIGHING OUT AND MIXING THE GUN COTTON AND NITROGLYCERIN.

In the gun cotton weighing room the gun cotton is weighed out into brass-lined wooden boxes, 27¾ pounds to each box, and sent to the nitroglycerin weighing and preliminary mixing house. Each charge of nitroglycerin as soon as it comes to this house from the nitroglycerin factory is weighed off into gutta-percha jugs. The quantity of nitroglycerin for a 27¾-pound charge of gun cotton is 43½ pounds, and this

amount is poured on the gun cotton in the brass-lined boxes. As soon as the glycerin has been weighed out and transferred to the boxes the contents of each box is mixed or rubbed up by hand so as to break up the gun cotton and make it absorb the nitroglycerin. It takes about a half hour to rub up the contents of each box, and, in this condition, the mixture of gun cotton and nitroglycerin is not nearly so sensitive or dangerous to handle and transport as either the dry gun cotton or liquid nitroglycerin alone. This rough mixture of gun cotton and nitroglycerin is known as "cordite paste."

(3) INCORPORATING.

The cordite paste is taken to the incorporating house. The incorporating machine is in an iron box, on suitable supports, open at the top, and with a bottom shaped to form two semicircular troughs in each of which a spindle, with screw-shaped blades, revolves. The spindles turn in opposite directions, one moving at twice the rate of the other. They are driven by cogwheels on a third spindle running underneath the machine. This driving spindle has two pulleys on it, either of which can be put into gear by means of a friction cone; both pulleys are driven from an overhead shaft, and as one has an open and the other a cross belt, the spindles can be made to revolve in either direction. The temperature is kept down during incorporation by means of an iron jacket through which cold water is circulated—104° F. is the maximum temperature allowed. The blades revolving close to the bottom of the machine, the paste is squeezed between the blades and the bottom and between the blades themselves.

There are two sizes of incorporating machines—one of 75 pounds and one of 150 pounds capacity.

The details of the process with the smaller machine are as follows: Half of the charge of acetone—15 pounds 10 ounces—having been poured into the machine, the blades are started to revolve toward one another, and the cordite paste ladled in with a wooden scoop, the remainder of the acetone being poured in as the paste is added. The operation of charging only takes a few minutes, and as soon as it is completed the top of the machine is closed with a wooden cover, to prevent the loss of acetone by evaporation, and the machine is allowed to run for three and one-half hours. At the end of this time the quantity of mineral jelly—$3\frac{3}{4}$ pounds—is added, and the machine run for three and one-half hours more. For the last fifteen minutes of the run the motion of the blades is reversed so as to break up the "cordite dough," as it is now termed, that it may be more easily filled into the press cylinders. At the end of the seven hours the gelatinization of the gun cotton and its admixture with the nitroglycerin by the aid of the common solvent, acetone, is complete, and the mineral jelly is also uniformly distributed through the mass. The machine is now stopped and the cordite dough removed and placed in brass-lined boxes for conveyance to the press house.

(4) PRESSING, AND REELING OR CUTTING.

There are three kinds of presses for pressing or "squirting" cordite, viz: screw, screw and hydraulic combined, and hydraulic. The screw presses are used for the manufacture of small arm cordite, and are combined with an automatic reeling arrangement for winding the cordite on reels as it issues from the die. The screw and hydraulic combined and the hydraulic presses are for producing large sizes of cordite, and they are provided with cutting gear for cutting the cordite to the required lengths as it is pressed.

The essential features of the screw press are a plunger or piston worked by a screw, and a cylinder. The latter is filled with cordite dough by means of an hydraulic ramming machine, which consolidates the material, and placed in the press under the plunger. The cylinder is closed at the bottom by a screw plug, in the center of which is the die. Resting on this plug is a perforated steel plate supporting a fine wire gauze disk, which acts as a sieve to prevent foreign substances from getting into and blocking up the die. Each cylinder contains a little over a pound of cordite dough, which is pressed out into a length of about 2,000 feet and wound on the reel. The empty cylinder is removed from the press and a full one inserted. The reel, the body of which is a perforated zinc cylinder with skeleton brass ends, is mounted near the press on a horizontal spindle which is connected to the worm shaft which supplies the power for the plunger in such a way that the speed of the reel may be adjusted to suit the rate at which the cordite is issuing from the die. The cordite is traversed automatically from side to side on the reel as it is wound on it. A fresh reel is used for each cylinder, the full reels being taken to the drying stove.

The screw and hydraulic press is practically on the same principle as the screw press. The cylinder, however, is an integral part of the machine, and not removable for filling, the filling being done from a hopper attached to the cylinder, which latter is deep enough to contain the whole charge in an uncompressed condition. When the cylinder is charged the valve leading to the hydraulic gear is opened and the pressure acting on the ram and plunger forces it down and compresses the material into the actual press cylinder, performing in this way the same function as the hydraulic ramming machine in the case of the cylinders for the small press. The screw gear is then started and the cordite dough pressed through the die. The number of dies, that is, the number of cords, that can be pressed at one time depends on the diameter of the cylinder and the size of the cordite.

The smaller sizes of cordite, sizes 5, 7.5, and 10 (these figures are diameters of die in hundredths of an inch), are reeled by hand on reels of the same material as those used for small arm cordite, as they issue from the die. As soon as a pressing is completed the reels are taken to a cutting machine consisting of two horizontal steel blades mounted on

a stand opposite each other and in the same plane. The reel is supported in the stand so that the cordite lies at right angles to and between the two blades (or, more clearly, the axis of the reel in the plane of the two blades), which are then brought together until they touch the reel, cutting the cordite and dividing it into a number of nearly equal lengths. The cordite is then laid out flat on shallow wooden trays, the bottoms of which are formed of narrow battens with open spaces between them.

The larger sizes of cordite—15 and above—are led, as they issue from the die, on to an endless leather band traveling at the same rate as the issuing cordite. This band has steel blades on its surface at right angles to the direction of its motion. The band passes under a roller, which is adjusted so as to press the cordite against the knives, and in this way the cordite is cut, the length being regulated by the distance apart of the blades. As they are cut the lengths of cordite are picked off the belt by hand and arranged on trays as for the smaller sizes.

In the hydraulic press the plunger is fixed and the cylinder is supported on a table which is secured to the ram. As the ram ascends, the cordite is pressed out and reeled. or cut on the endless band as above described.

(5) DRYING.

All cordite, after pressing, is dried in stoves to remove the acetone and moisture that remain. The temperature is not allowed to exceed 100° F. The trays are arranged on open racks, the steam pipes being fixed to the walls of the stove. Small-arm cordite takes about three days, medium sizes about six days, and the largest sizes about three weeks to dry.

(6) BLENDING AND PACKING.

After drying, small-arm cordite is blended as follows: Ten single-strand reels are mounted on a frame and wound off together on a large reel; then six of these large reels are wound off on a drum, making altogether sixty strands of cordite. When the reeling has been completed the ends are all secured by a band of stout tape wound around the drum, and the drum is packed in a box ready for issue.

Larger sizes of cordite, which have been cut into lengths, are blended as follows: as the trays come from the stove their contents are packed into boxes, each containing about 100 pounds of cordite, until a sufficient number of boxes to form a lot have been filled. This number is subdivided into batches, the number of boxes in a batch varying according to the size of the cordite, and the cordite in each batch of boxes is blended by taking a few sticks from each box of the batch and packing them in another set of boxes, filling one box at a time, until the whole of the original boxes have been emptied. A box of blended material is then taken from each batch and the contents of these boxes

again blended as before so as to form, when completed, a uniform lot of 101 cases. Cordite is packed in wooden boxes which are not metal-lined.

EXAMINATION AND PROOF OF CORDITE.

The tests to which finished cordite are subjected may be divided into chemical, mechanical, and ballistic.

The chemical tests are:

(1) Analysis: to ascertain that the percentage composition is correct.

(2) Moisture test: to ascertain that it does not contain more than a certain percentage of volatile matter.

(3) Heat test: to determine its freedom from uncombined acid.

The mechanical test consists of an inspection to see that the cordite is dry, homogeneous and free from air holes, and in measuring the sticks for diameter and length.

The ballistic test is for pressure and velocity, the cordite being heated to 80° F. when fired.

The sizes of cordite are expressed by a fraction, the numerator of which gives the nominal diameter (i. e., the diameter of the die) in hundredths of an inch and the denominator the length of the sticks in inches.

Table showing the conditions of acceptance of British service cordite.

Size of cordite. *a*	Dimensions.						Volatile matter, maximum.
	Length.			Diameter.			
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Per cent.*
$\frac{50}{16}$	16	16.6	16.3	0.484	0.495	0.490	0.6
40	----------	----------	----------	.343	.353	.348	.6
$\frac{30}{14}$	13.2	13.8	13.5	.258	.268	.263	.5
$\frac{20}{14}$	13.2	13.8	13.5	.175	.184	.1795	.5
$\frac{15}{14}$	13.2	13.8	13.5	.131	.140	.1355	.5
$\frac{7\frac{1}{2}}{11}$	10.6	11.4	11	.059	.067	.063	.4
$\frac{5}{11}$	10.7	11.3	11	.042	.046	.044	.4
5	On drums.						

a The numerator gives, in hundredths of an inch, the diameter of the die through which the cordite is pressed; the denominator, the length of the sticks in inches.

Table showing the conditions of acceptance of British service cordite—Continued.

Size of cordite. *a*	Gun.	Firing proof. Weight of charge.	Gravimetric density.	Weight of projectile.	Number of rounds.	Muzzle velocity. Minimum.	Muzzle velocity. Maximum.	Factor of regularity.	Pressure. Maximum, one round.	Pressure. Mean.
		Lbs. oz.		*Lbs. oz.*		*f. s.*	*f. s.*	*f. s.*	*Tons.*	*Tons.*
50/16	12″ B. L., VIII	167 8	.....	850 0	3	2,350	2,400	(*b*)	17	16.5
40	9″.2 B. L., VI	63 0	.....	380 0	3	.....	.....	(*b*)	.....	.....
30/14	6″ R. F	13 4	.....	100 0	5	2,175	2.225	(*b*)	16	15.5
20/14	4.7″ R. F	5 7	.....	45 0	5	2,160	2,210	(*b*)	15.5	15
15/14	4″ R. F	3 9	.....	25 0	5	2,300	2,340	(*b*)	15	14.5
	12-pdr. R. F., 12 cwt.	1 15	.....	12 8	5	2,210	2,260	(*b*)	15	14
7½/11	5″ B. L., III, IV, V	4 7½	113.18 / 0.244	50 0	5	1,745	1,795	(*b*)	15.5	15
5/11	12-pdr. B. L., I	1 0	114.5 / 0.242	12 8	10	1,660	1,700	(*b*)	14.5	14
5	6-in. B. L. howitzer	1 13	126.4 / 0.219	118 8	3	770	790	5	11	.....

a The numerator gives, in hundredths of an inch, the diameter of the die through which the cordite is pressed; the denominator, the length of the sticks in inches.

b The means of the deviations of the muzzle velocities of the several rounds, from the mean velocity of all the rounds, not to exceed 10 foot-seconds.

Table showing the guns for which the various sizes of cordite are intended.

Guns.	Size and weight of charge. 50	40	30	20	15	10	7½	5
B. L. guns.	*Lbs. oz.*	*Lbs. oz.*	*Lbs. oz.*	*Lbs. oz.*	*Lbs. oz.*	*Lbs. oz.*	*Lbs. oz.*	*Lbs. oz.*
12-inch, I and III to VII	.....	.....	*a* 88 8	.....	.....	.....	.....	.....
12-inch, VIII, wire wound	167 8	.....	.....	.....	.....	.....	.....	.....
10-inch, I to IV	.....	.....	*a* 76 0	.....	.....	.....	.....	.....
9.2-inch, I to VII	.....	.....	*a* 50 8	.....	.....	.....	.....	.....
9.2-inch, wire wound	.....	*a* 63 0	.....	.....	.....	.....	.....	.....
8-inch, III	.....	.....	.....	*a* 28 12	.....	.....	.....	.....
8-inch, IV, VI	.....	.....	.....	*a* 32 10	.....	.....	.....	.....
6-inch, III to VI	.....	.....	.....	14 12	.....	.....	.....	.....
5-inch, II to V	.....	.....	.....	.....	.....	.....	4 7½	.....
4-inch, II to V, and VII	.....	.....	.....	.....	.....	.....	.....	3 1
30-pounder, I	.....	.....	.....	.....	.....	2 6	.....	.....
12-pounder, 7 cwt., I	.....	.....	.....	.....	.....	.....	.....	15¾
15-pounder, 7 cwt., I	.....	.....	.....	.....	.....	.....	.....	15¾
12-pounder, 6 cwt., I	.....	.....	.....	.....	.....	.....	.....	12 7/16
R. F. guns.								
6-inch, I to III	.....	.....	13 4	.....	.....	.....	.....	.....
4.7-inch, I to IV	.....	.....	.....	5 7	.....	.....	.....	.....
4-inch, I	.....	.....	.....	.....	3 9	.....	.....	.....
12-pounder, 12 cwt., I	.....	.....	.....	.....	1 15	*a* 1 9½	.....	.....
12 pounder, 8 cwt., I	.....	.....	.....	.....	.....	*a* 13½	.....	.....
6-pounder, N. and H	.....	.....	.....	.....	.....	.....	.....	7¾
3-pounder, N and H	.....	.....	.....	.....	.....	.....	.....	6 6/16

a Provisional.

ACTION OF CORDITE IN SERVICE.

Experience has shown that the manufacture of cordite is dangerous. Free nitroglycerin has proved itself even more treacherous than was expected. On the other hand, the finished product, as issued for service, has borne severe tests satisfactorily and has established its character for reliability as well as for high ballistic qualities. The British Admiralty, after testing it in the hottest magazines for long periods, decided more than a year ago to issue it for all types of R. F. guns, and provisional charges have now been decided upon for the larger guns, including the 12-inch.

Dangerous as nitroglycerin is in the free state, it appears capable of being completely combined with gun cotton, and in cordite, though taken up mechanically, it is claimed that the nitroglycerin is not liable to be exuded. Danger and difficulty in manufacture are limited to a part of the process which is, more or less, subject to control, and do not exist in service.

In a rifle on a dry day there is no smoke visible, but in a very damp atmosphere the condensation of water formed by the combustion of the hydrogen gives rise to a faint appearance of smoke. For the heavy guns, however, there is always a certain amount of reddish smoke visible, but it rapidly clears away. It is believed the red color of the smoke is due to finely divided particles of copper ground off the rifling band of the projectile in its passage through the gun.

After the Yalu fight the guns of the *Yoshino* were found to be lined on the inside with copper, the copper bands on the shells sometimes being partly fused by the cordite, and it took fourteen days to scrape it off, special steel scrapers on a wooden head being made for the purpose. The inside of the gun looked as if it had been enameled with copper, and the Japanese officers thought that there was chemical action.

ITALY.

The Italian navy estimates for the year 1896–97, under the head of guns, torpedoes, and small arms, amount to $1,732,470, a decrease of $66,190 under last year.

RUSSIA.

The Russian navy estimates for the year 1896, under the head of guns and torpedoes, amount to $3,514,564, an increase of about $287,000 over last year.

SWEDEN.

The Swedish Government ordered a number of 24-centimeter (9.45-inch) guns from an English firm, which were fitted with a new form of screw breech plug, the invention of a Swedish engineer. It is characterized by several novel features. At the proof firing which took place last year twenty-four rounds were fired from one gun and four from

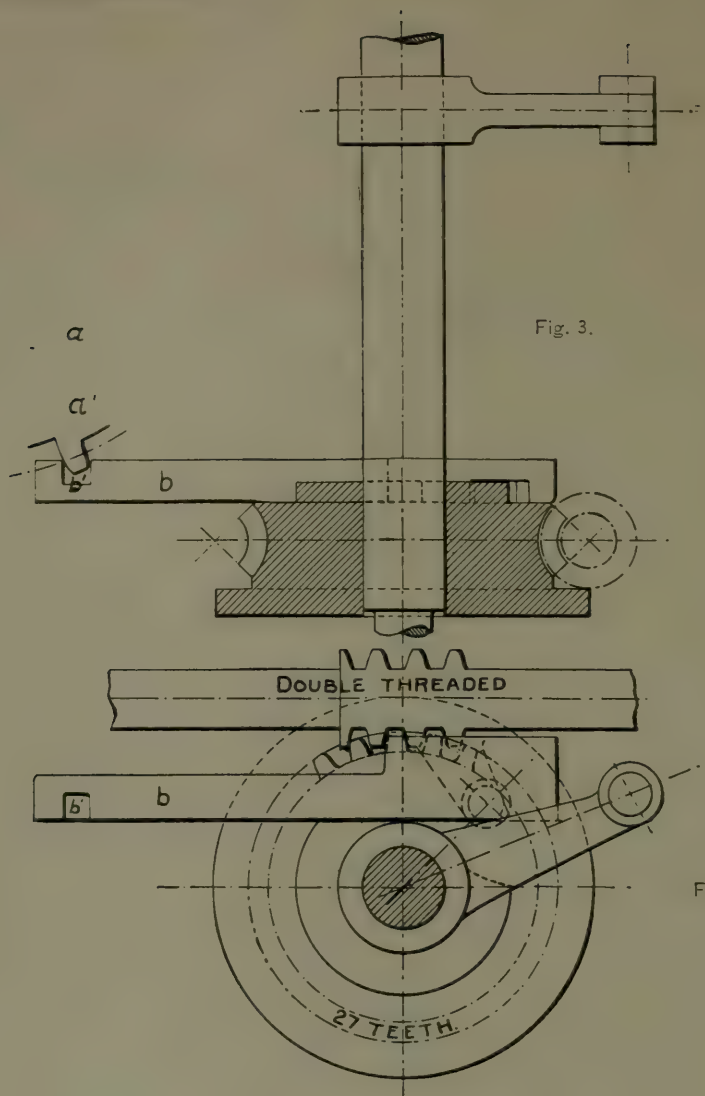


Fig. 3.

Fig. 4

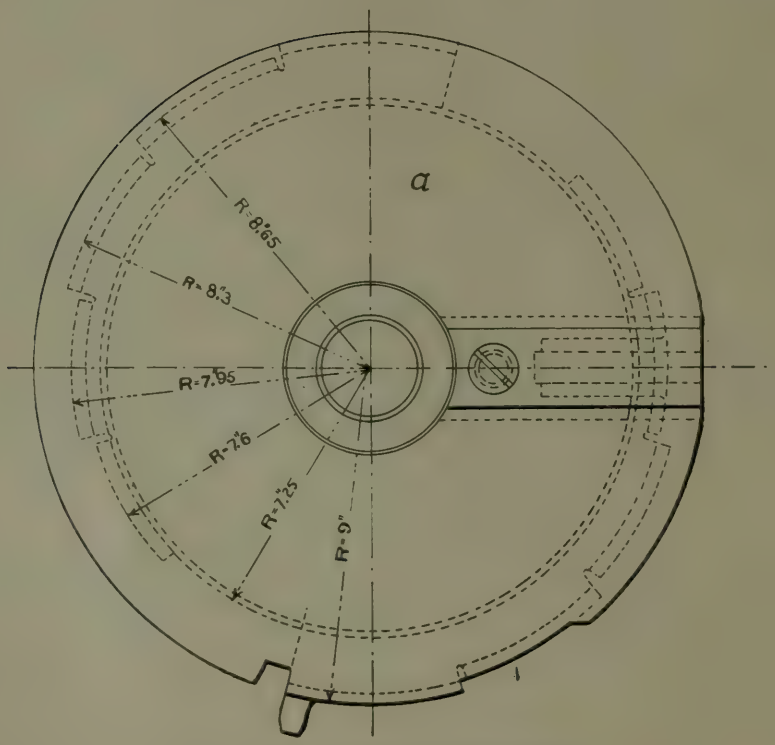


Fig. 48.—WELING BREECH MECHANISM.

Engineering.

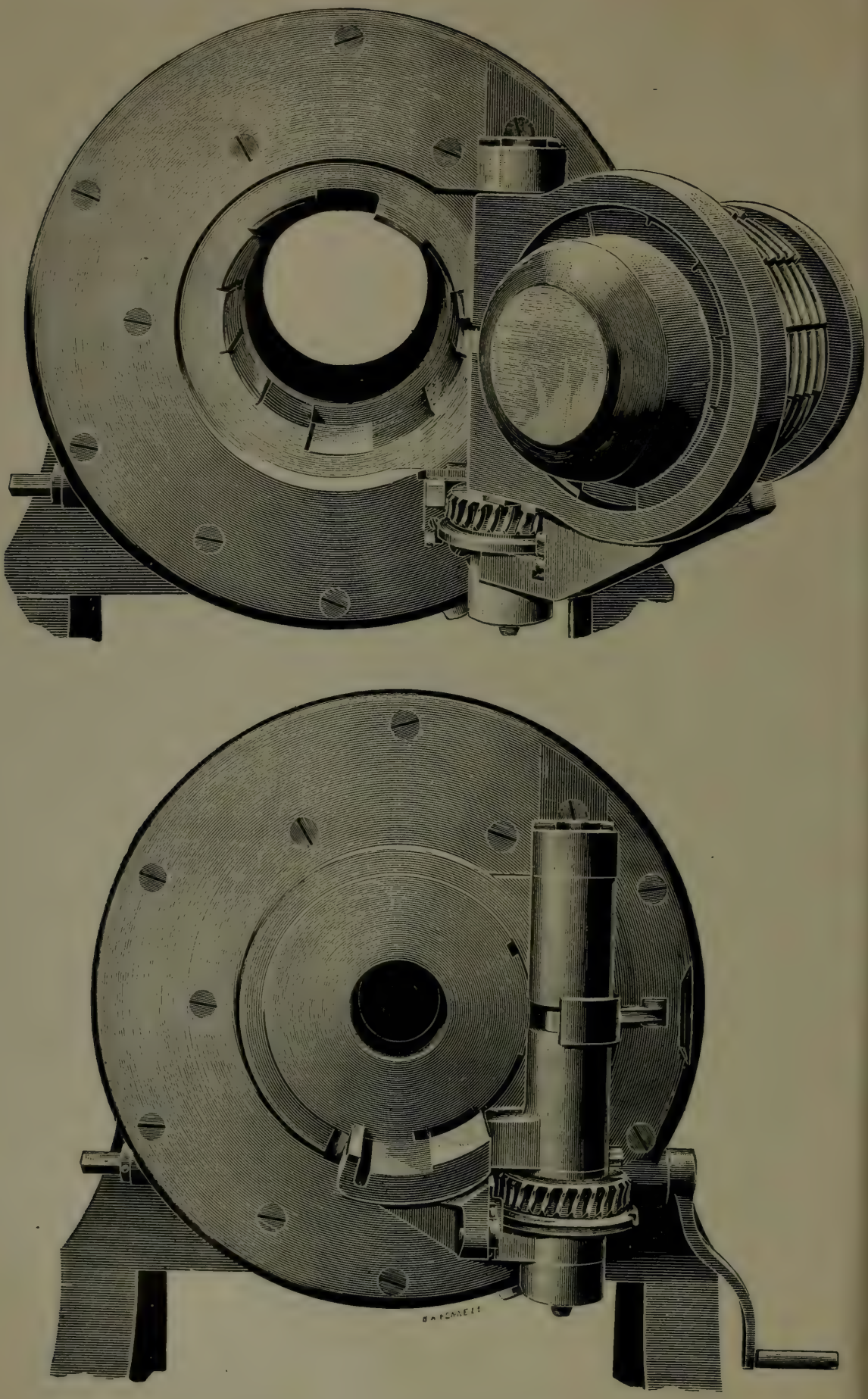


Fig. 49.—WELING BREECH MECHANISM.

Engineering.

each of the others, the chamber pressures in some instances exceeding 19 tons.

Excessive weight is an unavoidable characteristic of the ordinary interrupted or French screw, when applied to heavy calibers, and with this comes difficulty in manipulation, on account of the considerable length which must be given, in order to compensate for the loss in resisting power caused by the necessary cutting away of the threads over half of the circumference.

The inventor of this mechanism has succeeded by a simple and ingenious device in reducing this inconvenience by arranging the threaded segments in steps, giving to each successive segment a radius larger than that of the preceding one, by the height of the thread. By this arrangement a plug, divided, say, into eight segments, of which, according to the ordinary construction, four would be blank and four threaded, would have six threaded segments, only the remaining two being blank, and by this means he secures 50 per cent more resisting capacity per linear measurement of plug.

Figs. 48 and 49 show a breech mechanism constructed for a 10-inch gun. The plug is divided into twelve segments, ten being threaded and two blank. Here the bearing and resisting surface is increased nearly 60 per cent over the ordinary type of interrupted thread, a slight percentage being wasted for clearing grooves, and the saving in weight on this particular block is very considerable.

It is claimed that a breech mechanism of this construction for a 16-inch gun would weigh about half a ton less than an ordinary interrupted screw mechanism.

Besides this the seat of the obturator is brought nearer the breech end of the gun, and it can, therefore, be more readily examined; the effective length of the gun is consequently increased.

It may be objected that the cutting of the stepped threads on the block would involve an excessive amount of labor and expense, but experience has shown that this is not the case, and that the saving in material compensates for the increased cost of manufacture.

It will be noticed that the inventor has endeavored to overcome the objection so frequently urged against other existing continuous motion mechanisms of large calibers, that there is not sufficient leverage at the beginning of the opening and the end of the closing movement.

Figs. 3 and 4 are an elevation and plan (partly in section) of some of the parts to a larger scale, showing the positions when the breech is closed.

The breechblock a is unscrewed by the tangential slide b, which has a notch b^1, engaging with a single tooth a^1, on the block, and the leverage employed for traversing the slide diminishes when the block has been started. For this purpose the slide is slotted at b^2 to receive a roller c^1, pivoted on the worm wheel c, which is actuated by the worm on the axis of the handle.

It will be observed that when the breech is closed the slot b^2 is almost tangential to the path of the roller c^1, and therefore in opening the breech the slide b is at first moved very slowly and with great leverage, but as the breech plug is turned the leverage decreases and the speed augments until at last the slot b^2 is almost radial to the path of the rollers c^1. The leverage, the shortness of the plug, and the lightness of the mechanism all tend toward rapidity of manipulation. The relatively small space occupied by the mechanism when thrown open is an additional advantage, especially valuable in cramped places, such as turrets on board men-of-war, etc. There are no springs (except in the firing lock), and the mechanism can be taken to pieces in a few minutes by anyone acquainted with its construction.

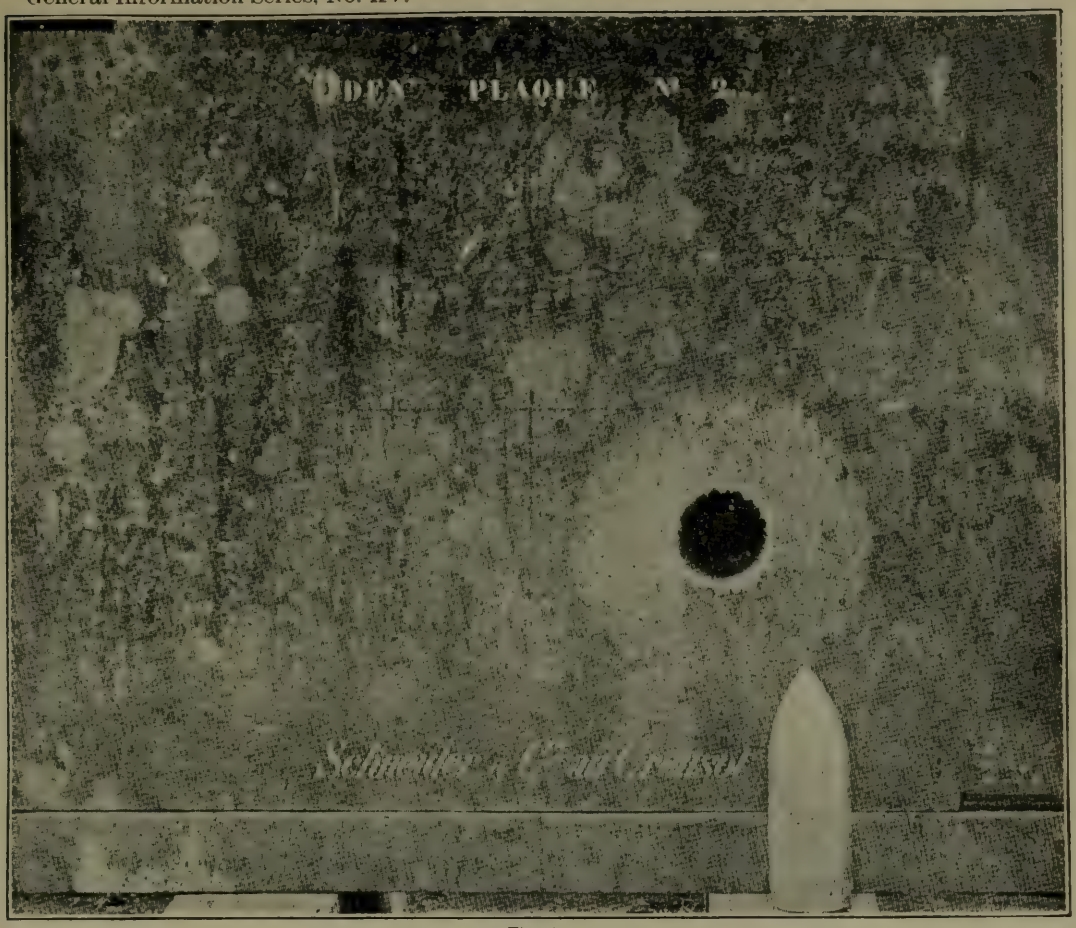


Fig. 1.

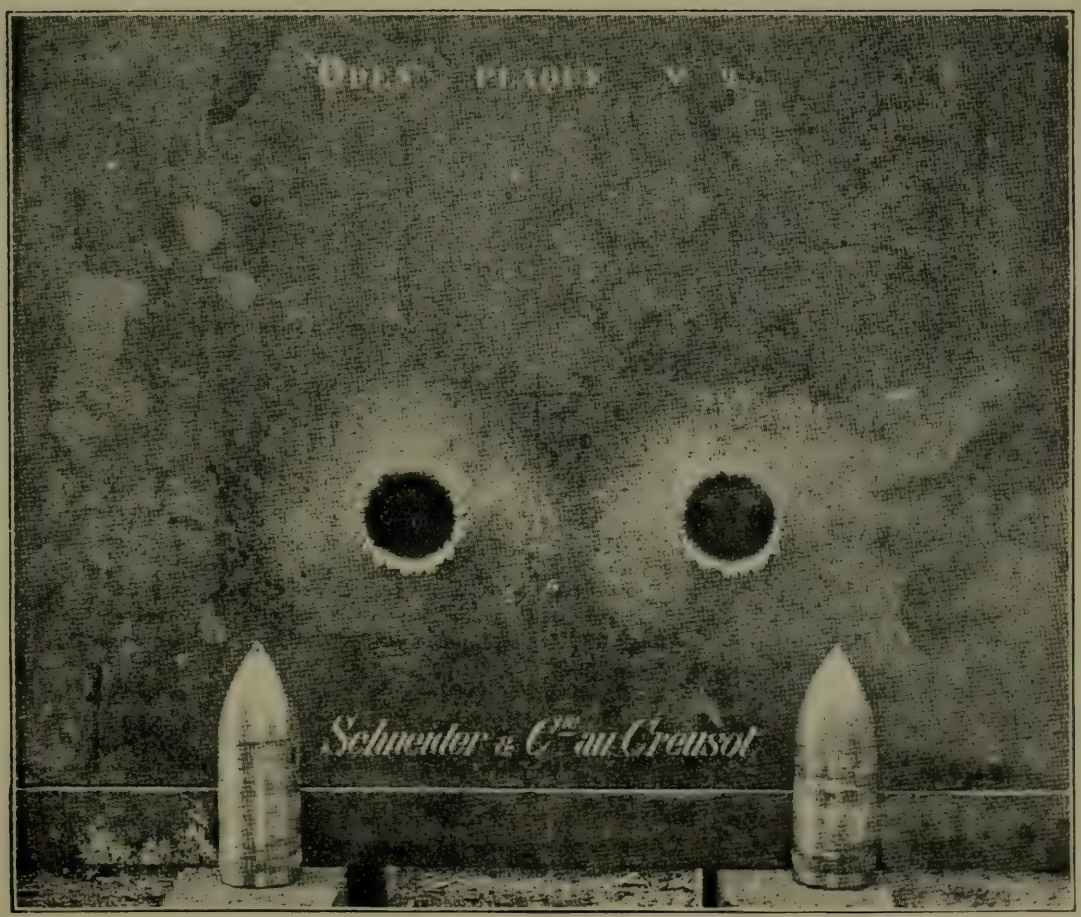


Fig. 2.

CREUSOT PLATE OF "HOMOGENEOUS" STEEL.

Dimensions, 79 by 59 by 9.8 inches.

Le Yacht.

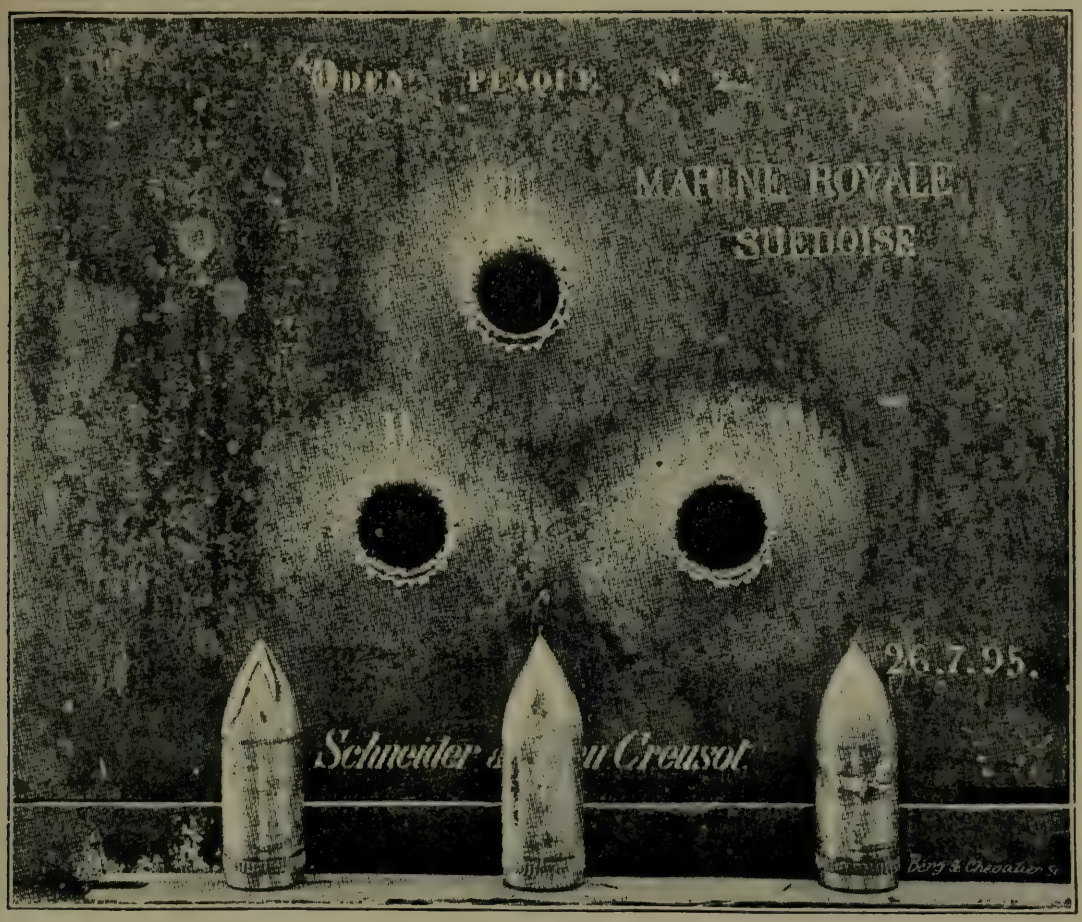


Fig. 3.

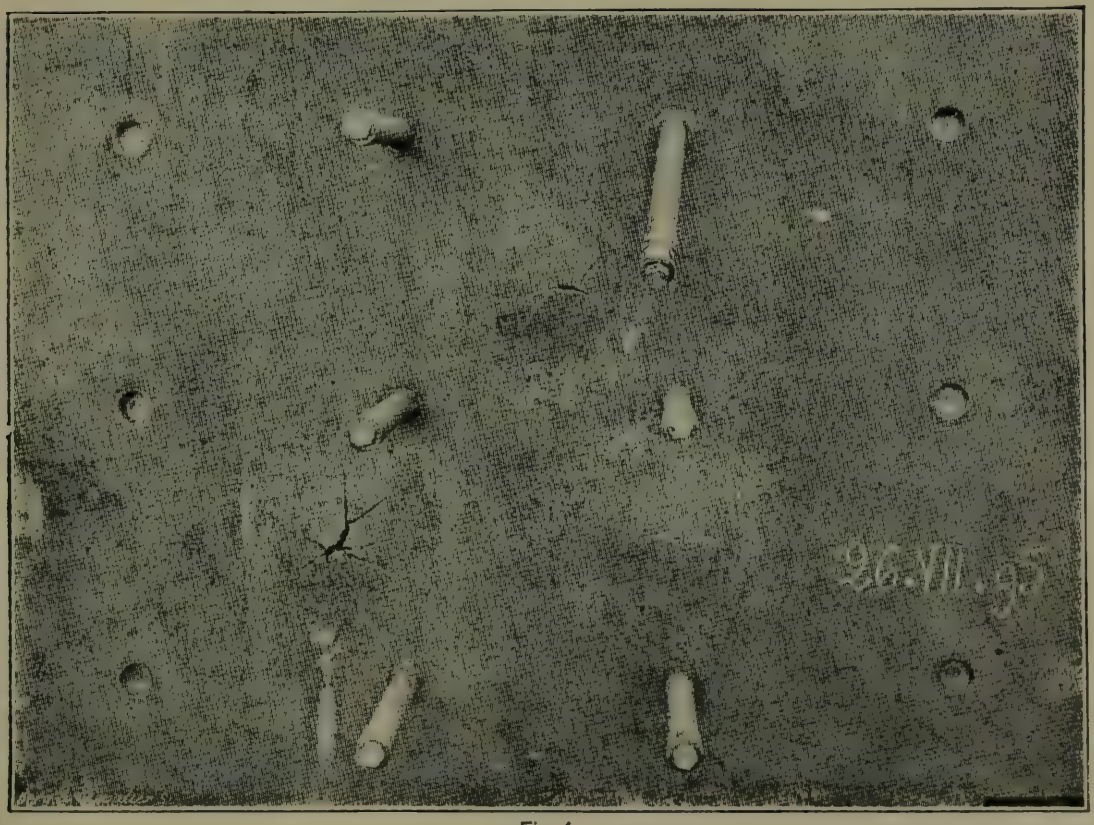


Fig. 4.

CREUSOT PLATE OF "HOMOGENEOUS" STEEL.

Dimensions, 79 by 59 by 9.8 inches.

Le Yacht.

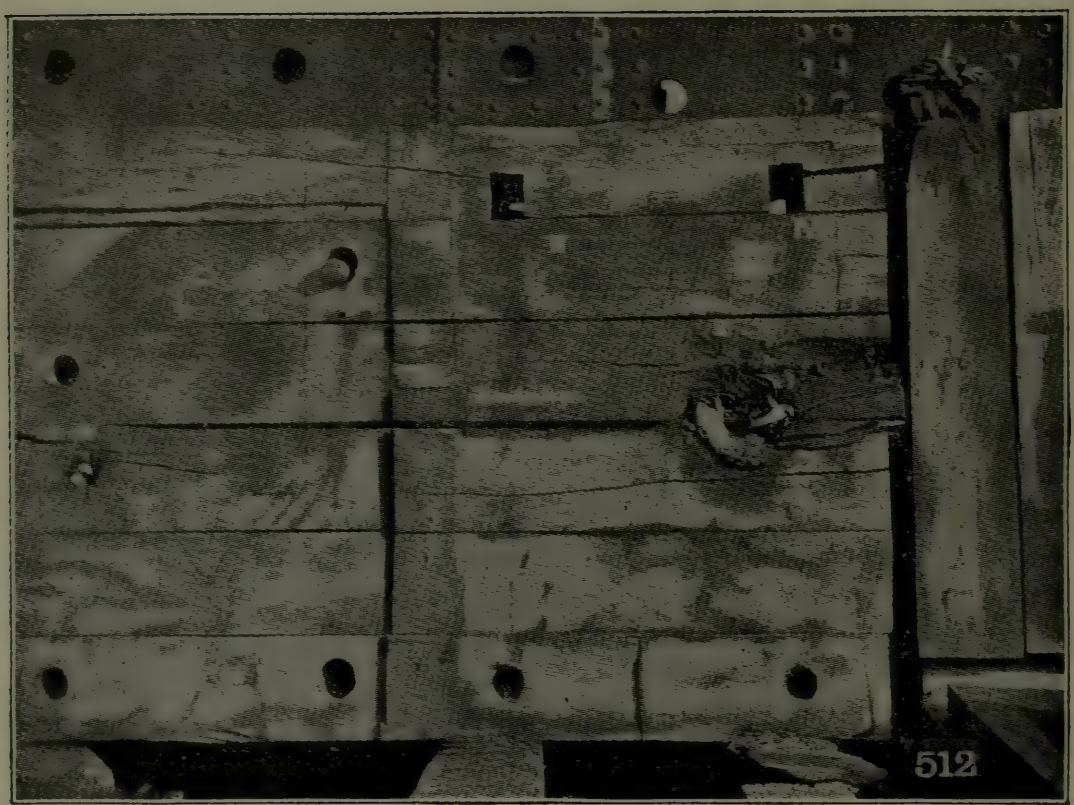


Fig. 5.

KRUPP F. H. NICKEL-STEEL PLATES.

Marine Rundschau.



Fig. 3.

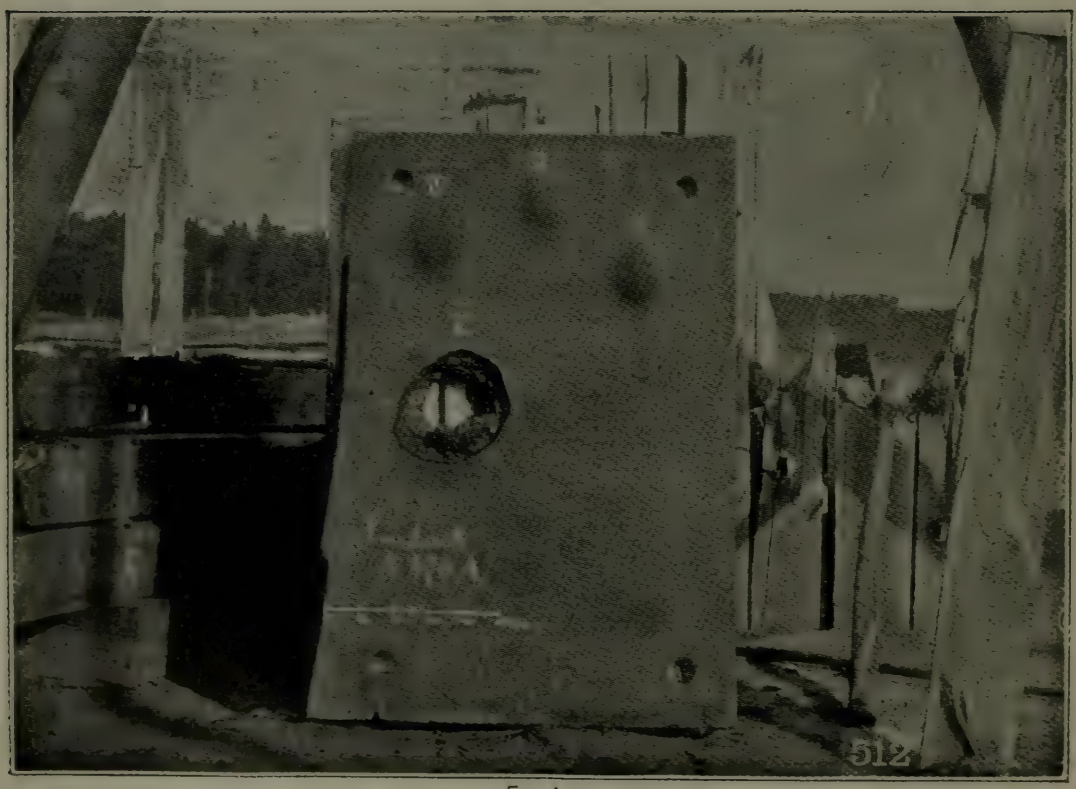


Fig. 4.

KRUPP F. H. NICKEL-STEEL PLATES.

Marine Rundschau.



Fig. 1.

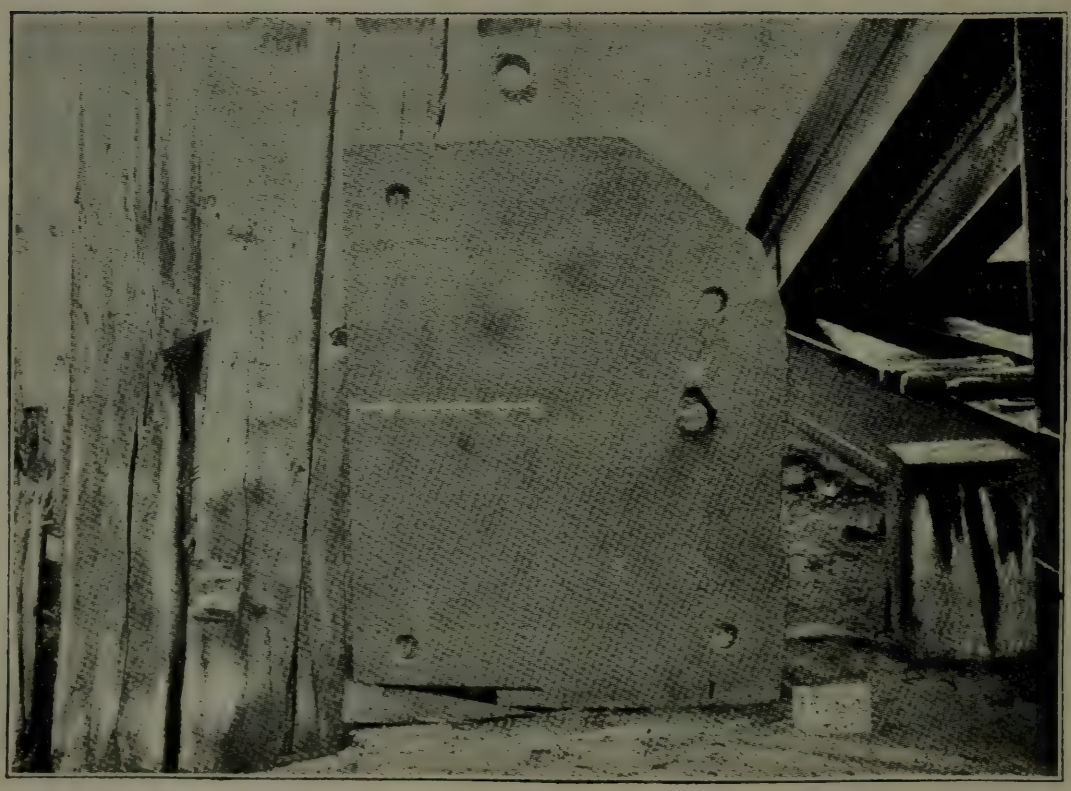


Fig. 2.

KRUPP F. H. NICKEL-STEEL PLATES.

Marine Rundschau.

ARMOR.

FRANCE.

The firm of Schneider & Co. manufactured for the Swedish Government certain armor plates, to be of the "best homogeneous steel," for the coast-defense vessel *Oden*. The trial took place at the proving ground of the company July 27, and consisted in firing against the test plate three projectiles from a 15-centimeter (5.9-inch) gun. The terms of the contract required that the test plate should withstand the impact of three 99-pound Finspong forged chrome-steel projectiles with a striking velocity of 1,850 feet; the projectiles to be furnished by the Swedish navy department. None of the projectiles nor fragments of the plate must enter the backing. The first shot must not crack the plate, nor either of the remaining two break off pieces of the plate.

The points of impact were to be at the angles of an equilateral triangle formed of sides 3½ calibers long drawn in the middle of the plate, the base being horizontal. It was secured to its backing by 12 bolts.

First shot.—Striking velocity, 1,860. The projectile penetrated to a depth of 10.4 inches; rebounded 41 feet, and its diameter was increased 0.2 inch. There were no cracks on face of plate. (*See* figs. 1 and 4.)

Second shot.—Same as first, and with a like result. (*See* figs. 2 and 4.)

Third shot.—Same result except that the projectile rebounded 108 feet. (*See* figs. 3 and 4.)

The rear face of the plate contained three bulges 1.5 inches in height, in which were small cracks. (*See* fig. 4.)

The commission before whom the trial was conducted expressed satisfaction with the results obtained.

GERMANY.

Three f.h. nickel-steel plates were tried at Meppen in October last, as follows:

Plate No. 476B was 3.75 by 5 feet by 3.15 inches. It was secured to 11.8 inches of oak backing and a 1.6-inch wrought-iron plate by means of four nickel-steel 2.2-inch bolts. In all cases the projectiles struck at an angle of 3 degrees from normal.

Shots Nos. 1, 2, and 3.—The gun used was an 8.8-centimeter (3.46-inch) L/26 R. F. G.; projectile, 15.4 pounds. The striking velocities were 1,483, 1,919, and 1,998 feet, respectively, and energies of 236, 394, and 427 foot-tons. The first shot did not penetrate; the second penetrated 0.4 inch, and the third 0.7 inch, with a slight bulging of the rear face. (*See* figs. 1 and 2.)

Shot No. 4.—The gun used was a 10.5-centimeter (4.13-inch) L/31 B, L. R.; projectile, 35.3 pounds. The striking velocity was 1,378 feet. corresponding to an energy of 46.4 foot-tons.

The head of the projectile perforated the plate, penetrating the backing 4 inches; the greater part was picked up in front. (*See* figs. 1 and 2.)

Plate 476A was of the same dimensions, and was secured in the same manner.

Shots Nos. 1 and 2.—The gun used was an 8.8-centimeter (3.46-inch) L/26 R. F. G.; projectile, 15.4 pounds. The striking velocities were 1,489 and 1,991 feet, respectively, the corresponding energies being 237 and 424 foot-tons. In each case the projectile struck at an angle of 3 degrees from the normal and were smashed. The rear bulge made by the second shot was 0.5-inch high. (*See* figs. 3, 4, and 4.)

Shots Nos. 3 and 4.—The gun used was a 10.5-centimeter (4.13-inch) L/31 B. L. R.; projectile, 35.3 pounds. The striking velocities were 1,414 and 1,522 feet, respectively, with energies of 488 and 567 foot-tons. Each projectile struck at an angle of 3 degrees and was smashed. Shot No. 3 made a depression in the plate 1.6 inches deep by 4.7 inches in diameter, with a rear bulge 1.2 inches high with a distinct radial crack 3.9 inches long. The head of shot No. 4 stuck in the plate, afterwards dropping out, and showing a penetration of 1.4 inches. The height of the rear bulge was 0.87 inch. (*See* figs. 3, 4, and 5.)

Shot No. 5.—The gun used was a 15-centimeter (5.9-inch) L/28 B. L. R.; projectile, 88 pounds, which had a striking velocity of 1,498 feet and 1,088 foot-tons of energy. The plate was perforated; fragments of the projectile penetrated the backing. (*See* figs. 3, 4, and 5.) The plate was now removed from its backing and placed on its side.

Shot No. 6.—The gun used was a 10.5-centimeter (4.13-inch) L/31 B. L. R.; projectile, 35.3 pounds, having a striking velocity of 1,692 feet and an energy of 702 foot-tons. The projectile struck at an angle of 42 degrees and was smashed. It made a depression in the surface of the plate 0.4 inch deep and 3.9 inches in diameter. (*See* figs. 6 and 7.)

Shot No. 7.[1]—Plate unbacked. Projectile struck the lower edge, knocking a piece out. (*See* figs. 6 and 7.)

Shot No. 8.—Plate unbacked. Gun and projectile as in shot No. 6. The striking velocity was 1,860 feet and the angle of impact 42 degrees from normal. Energy, 843 foot-tons. The projectile perforated the plate, but was smashed into fragments in so doing. A disk-shaped piece of the plate was punched out weighing 24 pounds and measuring 7.9 by 5.9 inches. (*See* figs. 6 and 7.)

Shot No. 9.—Same gun and projectile. Striking velocity, 1,775 feet; energy, 772. Angle of impact, 42 degrees. The fragments of the shell glanced off, making a bulge 3.9 inches high. A through crack extended around one-third of its circumference. (*See* figs. 6 and 7.)

Plate No. 475 was 8.2 by 4.9 feet by 3.94 inches. In all cases the angle of impact was 3 degrees.

Shot No. 1.—The gun used, 8.8-centimeter (3.46-inch) L/26 R. F. G.; projectile, 35.3 pounds. The striking velocity was 1,732 feet and energy

[1] Caliber of gun and other particulars not given.

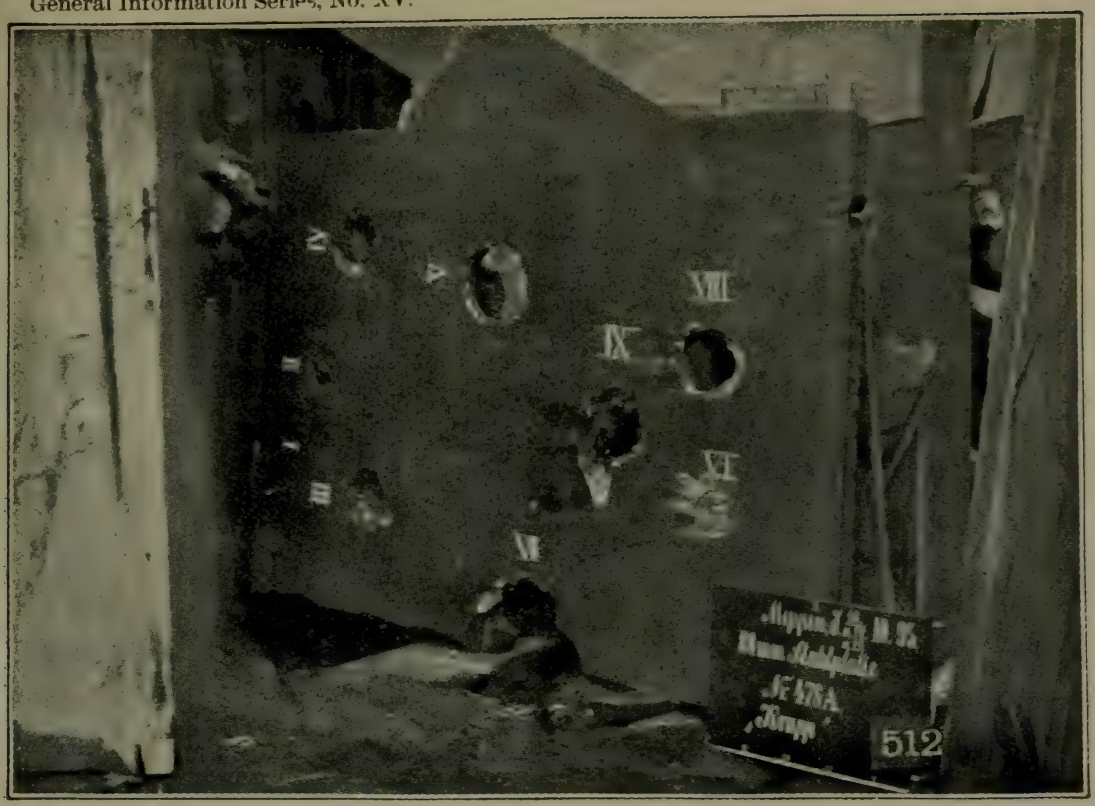


Fig. 6.

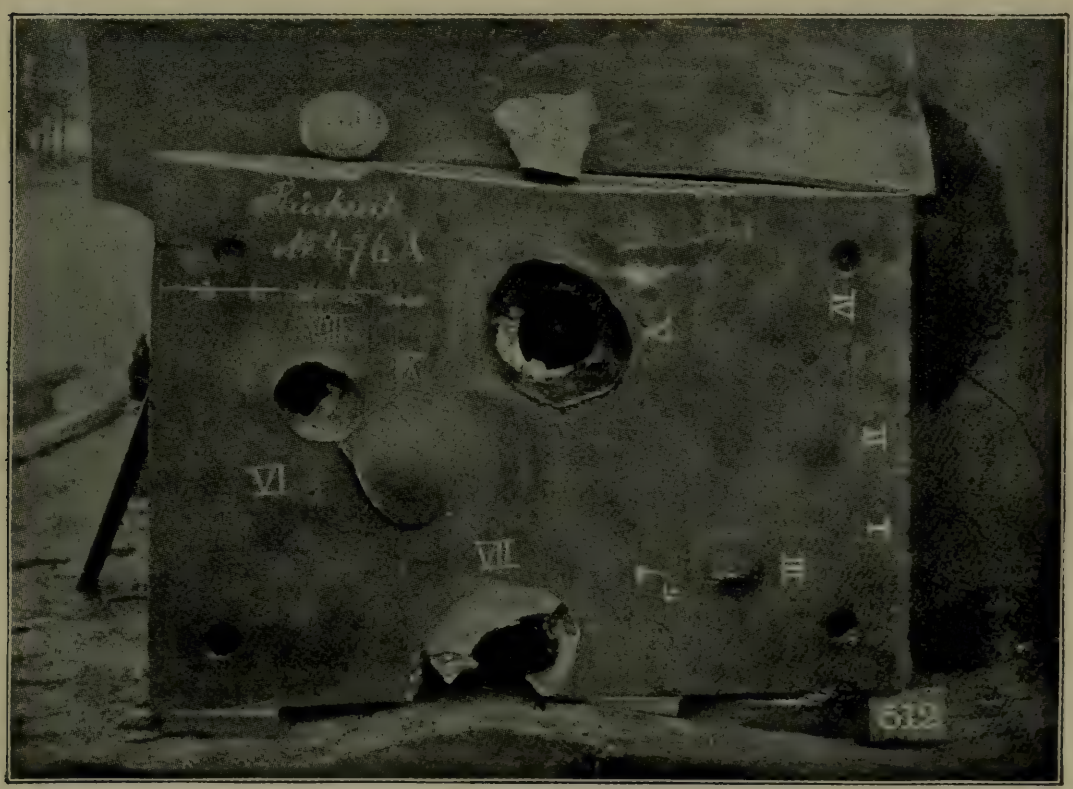


Fig. 7.

KRUPP F. H. NICKEL-STEEL PLATES.

Marine Rundschau.

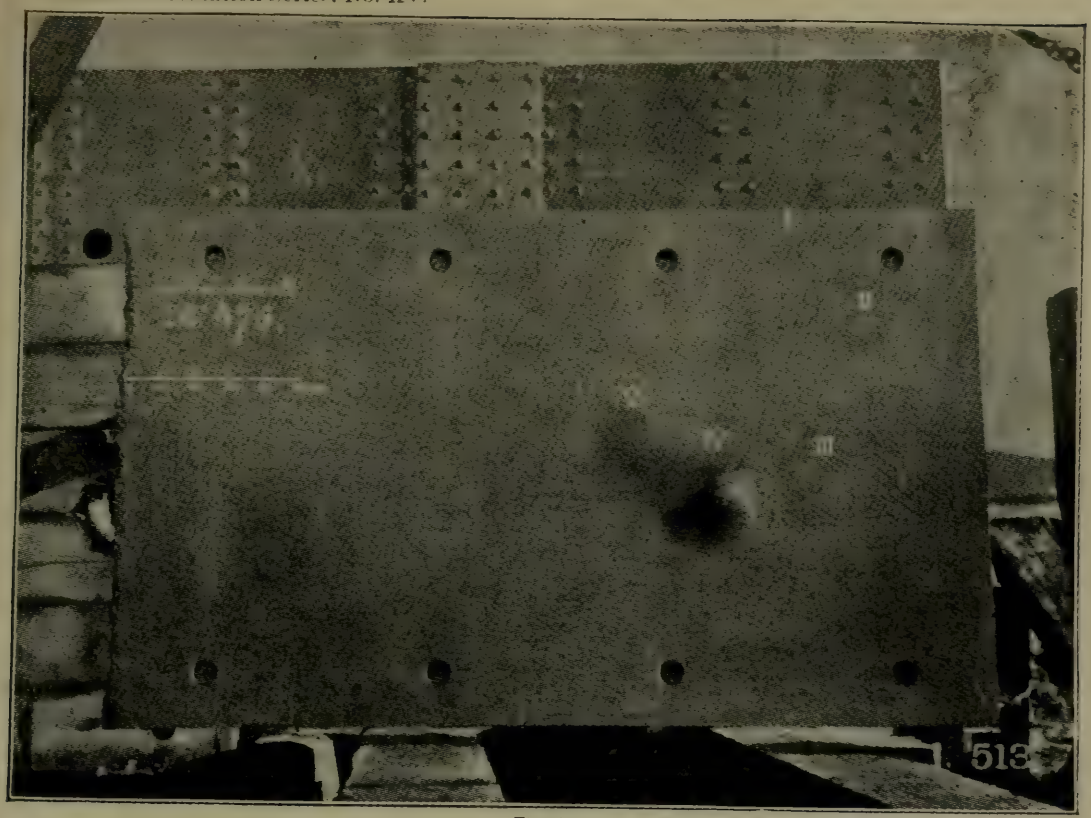


Fig. 8.

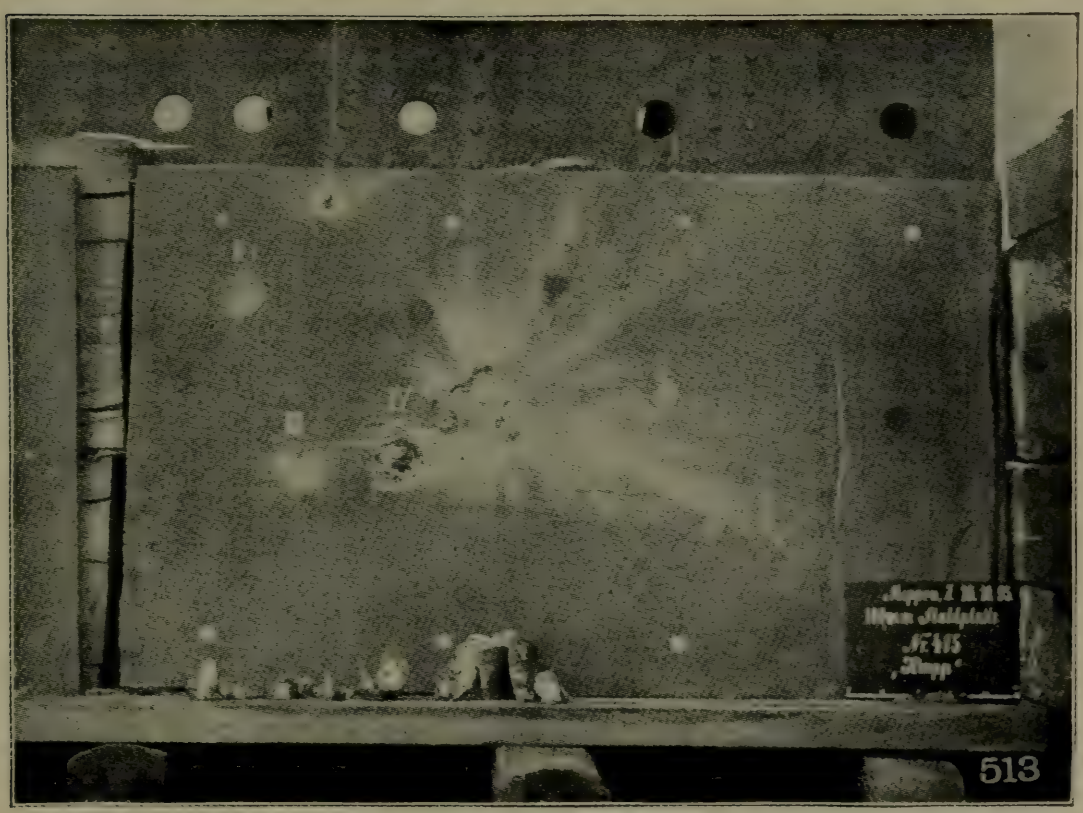


Fig. 9.

KRUPP F. H. NICKEL-STEEL PLATES.

Marine Rundschau.



Fig. 10.

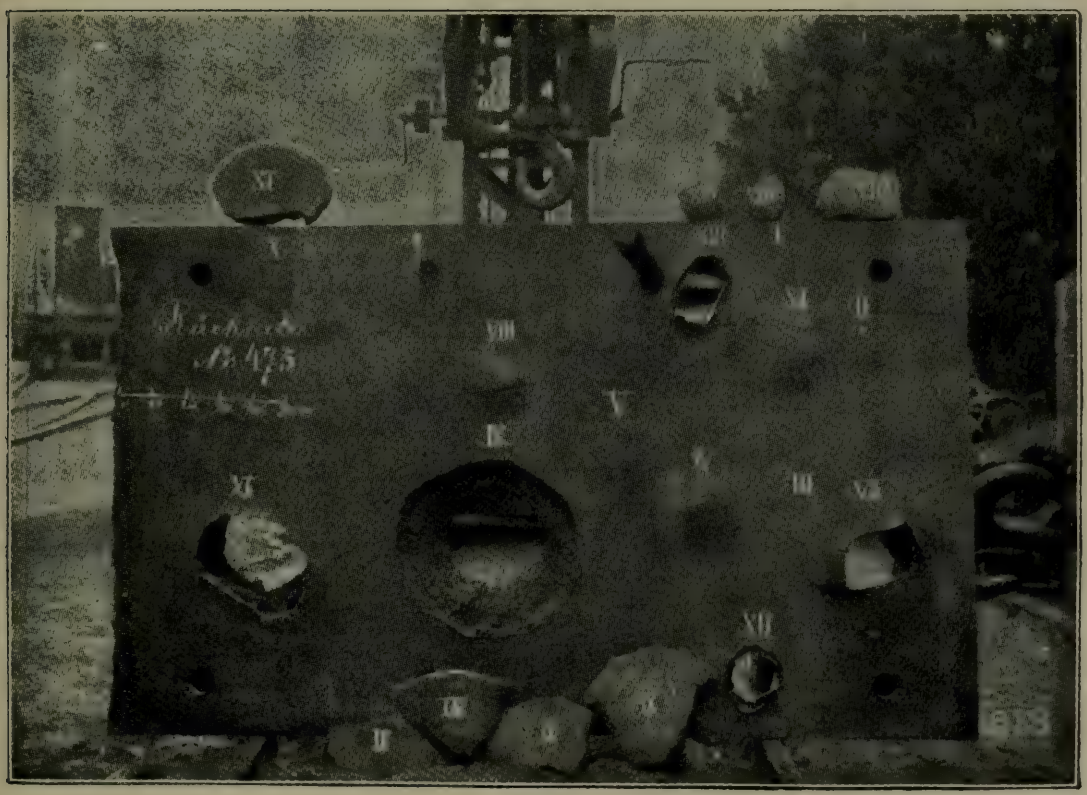


Fig. 11.

KRUPP F. H. NICKEL-STEEL PLATES.

Marine Rundschau.

of 322 foot-tons. The projectile was smashed, making an indentation 3.1 inches in diameter and 0.3 inch deep. (*See* figs. 8 and 9.)

Shot No. 2.—The gun used was a 10.5-centimeter (4.13-inch) L/31 B. L. R.; projectile, 35.3 pounds, with a velocity of 1,286. Striking energy, 407. The projectile was smashed, making an indentation 3.9 inches in diameter and 0.2 inch deep. (*See* figs. 8 and 9.)

Shot No. 3.—Same gun and projectile. The velocity was increased to 1,590 feet, with an energy of 620 foot-tons. The projectile was smashed, making an indentation 4.1 inches in diameter and 0.35 inch deep, with fine concentric cracks. (*See* figs. 8 and 9.)

Shot No. 4.—Same gun and projectile. The velocity was increased to 2,035 feet, with an energy of 1,007 foot-tons. The projectile was smashed, penetrating the plate to a depth of 3.2 inches, and bulging it in rear to a height of 1.8 inches and diameter of 11.8 inches. (*See* figs. 8 and 9.)

Shot No. 5.—The gun used was a 15-centimeter (5.9-inch) L/28 B. L. R., and projectile of 88.2 pounds. The striking velocity was 1,330 feet and energy 1,088 foot-tons. The indentation was 5.9 inches in diameter and 0.8 inch deep, and the bulge was 7.9 inches in diameter and 0.7 inch high, without cracks. The projectile was broken and the head was upset. (*See* figs. 8 and 9.)

Shot No. 6.—The gun used was a 12-centimeter (4.72-inch) L/35 B. L. R., with a projectile weighing 57.3 pounds, having a striking velocity of 1,640 feet. The striking energy was 1,072 foot-tons. The projectile was smashed, flaking off the surface of the plate over an area 7.1 inches in diameter. The bulge was 11.8 inches in diameter and 1.4 inches high, and contained a small vertical crack. (*See* figs. 10 and 11.)

Shot No. 7.—The gun used was a 15-centimeter (5.9-inch) L/34 B. L. R., with a projectile of 112.4 pounds. The striking velocity was 1,340 feet and the energy 1,404 foot-tons. The projectile was smashed, knocking a fragment out of the plate weighing 42 pounds and driving it 6 inches into the backing. (*See* figs. 10 and 11.)

Shot No. 8.—Plate unbacked. The gun used was a 10.5-centimeter (4.13-inch) L/31 B. L. R., with a projectile of 35.3 pounds. The striking velocity was 2,000 feet and energy 975 foot-tons. The projectile was broken up, making an indentation in the plate 5.9 inches in diameter and from 0.3 inch to 2.9 inches in depth. (*See* figs. 10 and 11.)

Shot No. 9.—Plate unbacked. The gun used was a 15-centimeter (5.9-inch) L/37 B. L. R. The projectile weighed 100 pounds. The striking velocity was 2,100 feet and energy 3,089 foot-tons. The projectile was broken up, knocking a hole in the plate 11 to 11.8 inches in diameter, the fragments from which weighed 234 pounds. The diameter of the hole on rear face of plate was 21 inches. (*See* figs. 10 and 11.)

Shot No. 10.—Plate unbacked. Same gun and projectile as in No. 9, but with a velocity of 1,715 feet and energy of 2,053 foot-tons. The projectile struck 10 inches from the upper edge of plate and was

smashed. A mark was made in the plate 0.7 inch deep, from which radial surface cracks extended from 1.4 to 1.6 inches in depth. The bulge in rear was 0.6 inch high and 12 inches in diameter.

Shot No. 11.—Plate unbacked. Same gun and projectile. Striking velocity, 1,884 feet; energy, 2,411 foot-tons. An elliptical fragment was knocked out of the plate weighing 97 pounds, measuring 10.2 by 9 inches on front face and 13.8 by 9.8 inches in rear. (*See* figs. 10 and 11.)

Shot No. 12.—Plate unbacked. Gun used, 10.5-centimeter (4.13-inch) L/31 B. L. R., with a projectile of 35.3 pounds. The velocity was 2,198 feet; energy, 1,181 foot-tons. The projectile was smashed, perforating the plate, a piece weighing 11 pounds being knocked out. (*See* figs. 10 and 11.)

Shot No. 13.—Plate unbacked. Gun same as in preceding round. Velocity, 2,067 feet; energy, 1,045 foot-tons. The projectile was smashed, knocking a fragment out of the plate weighing 15.4 pounds. (*See* figs. 10 and 11.)

III.

NOTES ON SMALL ARMS.

By Lieut. LINCOLN KARMANY, United States Marine Corps,
Staff Intelligence Officer.

Reports on operations in India and Africa give instances of a want of stopping effect of the 0.303-inch Lee-Metford bullet when used against savages. This was not unexpected, for such men are almost insensible to shock and will sustain very severe wounds without being placed hors de combat. With regard to the effect on bone there appears no cause for want of confidence in the modern arm, and when its immense superiority in the matter of rapidity of fire and flatness of trajectory is considered, it is not surprising that the weight of opinion remains in favor of the small caliber. Armed with the new Lee rifle, eighteen or twenty men can for several minutes maintain a fire equal in intensity to that of a Maxim automatic machine gun, and if properly directed there can be little doubt of the effectiveness of such a fire. It appears, however, that in order to obtain at short range the so-called explosive effect frequently observed as the result of a hit by a small-caliber bullet the velocity of impact should not be much below 2,000 foot-seconds, while in recent operations in India it is probable that the muzzle velocity of the Lee-Metford bullet did not exceed 1,900 foot-seconds. The introduction of the small-caliber rifle is being continued by those powers having adopted it.

In the use of this arm for killing large game, bullets are made to mushroom on impact by exposing the lead core at the point, and it has been proposed to use such ammunition altogether in service, or to provide a small quantity to each man for use at short range. It has already been used to some extent in range practice, as the bullet, stripped of its steel coating at the point, does not glance on oblique impact as does the other; practice is safer, and existing ranges may be used. The penetrative powers are, however, much impaired by the use of such ammunition.

The efforts of inventors have been directed for years toward perfecting a magazine pistol to replace the low-powered revolver now in general use, and in which smokeless powder can not be used with proper

effect. Several automatic arms of this class have been placed in the hands of troops of European countries for practical tests. The main features of two such pistols are here described and illustrated, one having a forward and the other a rear moving barrel. It seems probable that when proved sufficiently simple and certain of action such an arm will be regularly introduced into service. It may be made light and sighted to an effective range of 500 or 600 yards.

MANNLICHER REPEATING SEMI-AUTOMATIC PISTOL.

This pistol has been made of several calibers, 0.296-inch and 0.256-inch. Probably smaller calibers have also been made. It is of the double-acting, self-cocking type; its magazine carries nine cartridges, staggered, and is filled from clips (Mauser system) by stripping the cartridges off. The clips contain five cartridges, and the upper or tenth charge is entered in the chamber by the backward movement of the barrel after charging magazine. In general terms the action of the piece is as follows:

The barrel has a forward and backward movement in a sleeve upon the frame, this movement being somewhat greater than the length of the cartridge. Upon firing, the barrel is carried forward by the bullet and the cartridge case is held fast until the barrel nearly reaches its full throw, when the extractor ejects the case and a new cartridge is fed up to the receiver. The action of a spring (within the sleeve) then drives the barrel to the rear, the cartridge enters the chamber, the hammer is brought to half-cock, and the breech is closed. A pull upon the trigger is required to full cock the piece and to fire. Five rounds can be readily charged and fired in five seconds. The pistol has strong ballistic qualities. For caliber 0.296-inch the initial velocity is 725 foot-seconds. Its precision is good and its perforating power thirty sheet plates 0.008-inch thick, spaced at intervals of 0.4-inch. The safety devices are excellent. The hammer is automatically half-cocked whenever the piece is loaded or the breech closed.

Fig. 1 shows the position of the various parts when at rest; fig. 2 the same immediately after the firing of a shot, the section in this case being taken through the magazine; fig. 3 is a general view of the pistol, and fig. 4 shows the cartridge packet. The barrel *a* is capable of longitudinal motion, the two extremes of its course being shown in figs. 1 and 2. The forward movement of the barrel is resisted by the spiral spring *b*, which serves to return it into position. Taking the pistol as shown in fig. 1 and assuming a cartridge in the chamber and others in the magazine, the working of the arm is as follows: On pulling the trigger and so actuating the hammer *c* the charge is exploded and the bullet carries the barrel forward. This movement, which in a simple manner actuates a shell ejector, is brought to a finish by a stop, but not before the end *d* of the lever *e* has been pressed by the action of the spring *f* into the notch *g* on the barrel, as shown in fig. 2. The

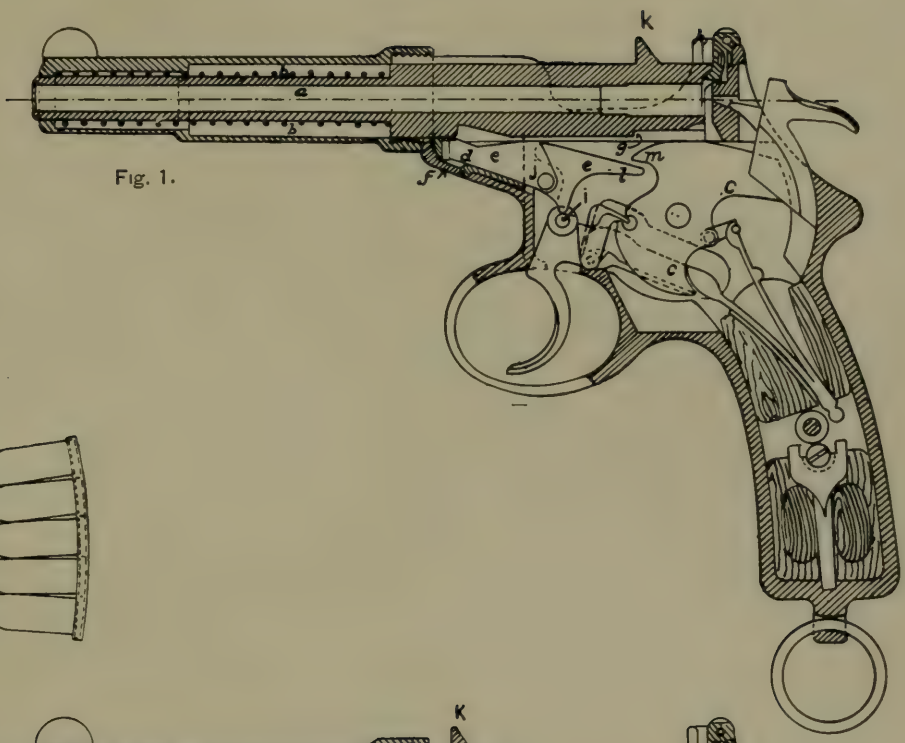


Fig. 1.

Fig. 4.

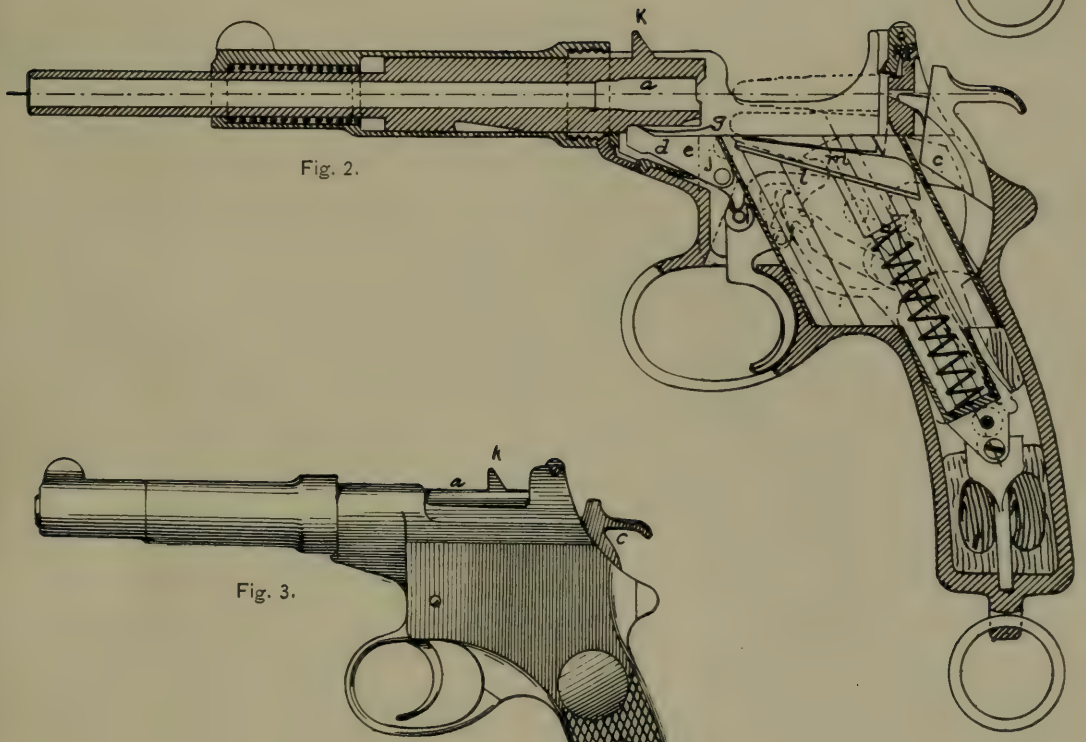


Fig. 2.

Fig. 3.

MANNLICHER REPEATING SEMIAUTOMATIC PISTOL.

effect of this is to retain the barrel for the moment in the forward position, and while here the cartridges in the magazine are pressed up in the usual manner and the upper one placed as shown in fig. 2, its upward movement being arrested by the spring stop *h*. The barrel is held forward while the pressure is kept on the trigger after firing, the lever *e* being automatically disengaged from the catch *g* when the trigger is released. This is brought about by a projection *i* on the trigger plate, which is pressed, under the influence of the trigger spring, against an extension *j* on the lever. The effect of this pressure is to depress the end *d* of the lever *e* until the barrel is released and returned to the rear position by the spiral spring *b*, and receives the upper cartridge into its chamber. The lock action does not differ from that usual in double-acting revolvers; it may be cocked and fired by a long pull on the trigger, or the hammer cocked by hand and then released by a short pull on the trigger. The magazine is charged either by single cartridges or by stripping them from a clip, while the barrel is in its forward position. The projection *k* at the top of the barrel serves to push it forward by hand for the purpose of loading. The hammer is locked against accidental discharge by the relative positions of the nose *l* on the lever *e* and the nib *m* of the trigger plate *c*.

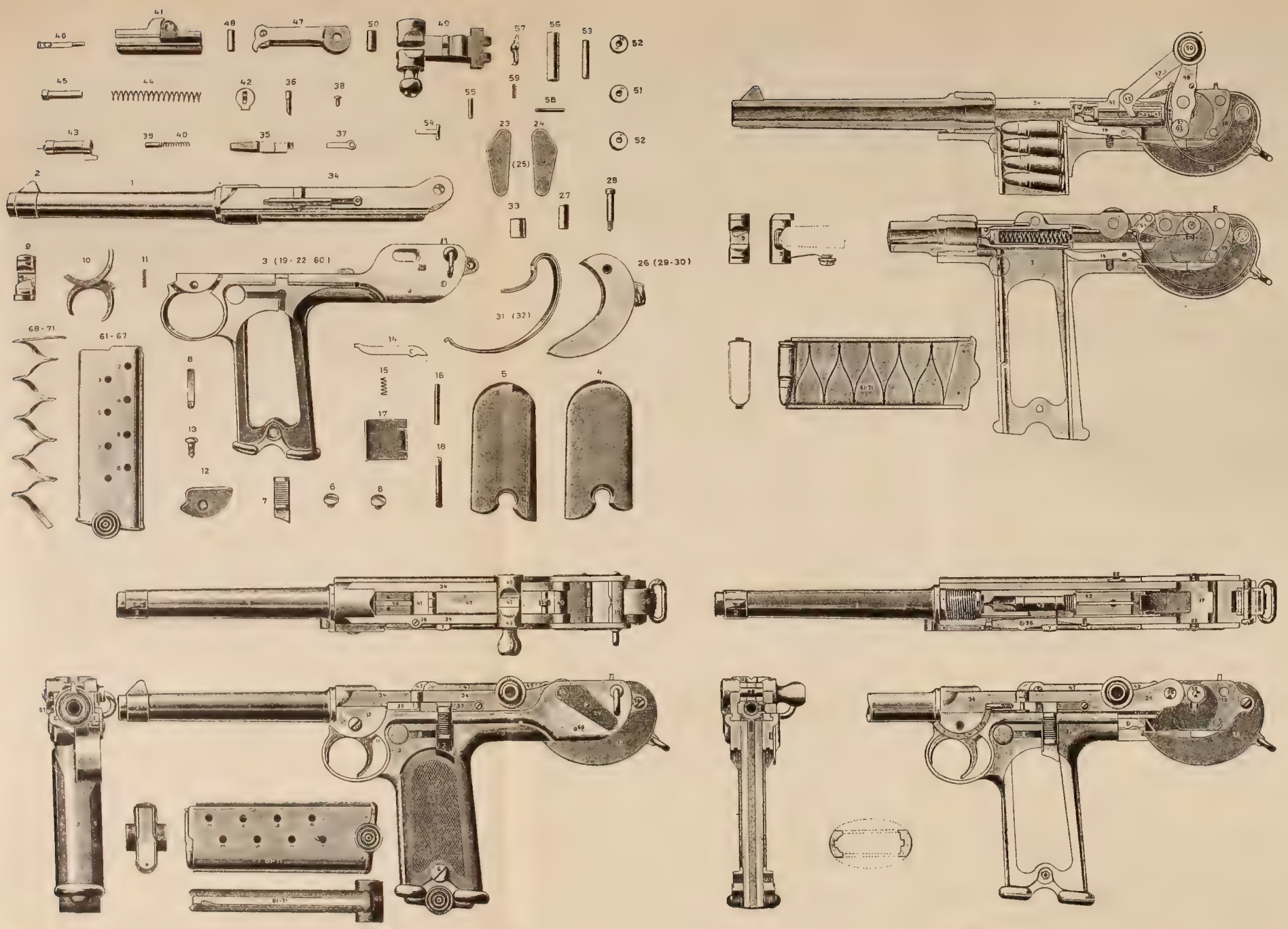
BORCHARDT REPEATING AUTOMATIC PISTOL.

In this system the opening of the breech, ejecting of the empty shell, the reloading, breech closing, and cocking, are all performed automatically. The magazine is entered from the bottom of the pistol grip and holds eight cartridges. By means of the spring 68–70 (*see* plate) these are brought successively in front of the breechblock 41 when the latter, after opening the breech, has reached its rearmost point. The closing of the mechanism carries them into the chamber, when they are fired by pulling the trigger. The recoil drives the barrel and breech mechanism to the rear, the forked-shaped receiver 34 of the mechanism being guided in grooves and slots in the lock case 3, which forms the upper part of the grip. The total recoil is 0.373-inch; that of the receiver and barrel 0.118-inch. Through the rear end of the forked receiver passes the connecting pin 56, which joins the rear link 49 of the toggle joint (composed of 47 and 49) to the receiver. The ends of this connecting pin project through an elongated slot in each side of the lock case, thus limiting the recoil of the barrel. The plates 23 and 24 cover the slots and secure the connecting pin. The rear end of the link 49 is made wide enough to fill completely the space between the sides of the lock case; it carries with it in its motion three friction rollers, 51 and 52. The front end of the link 49 is secured by a pin to the after end of link 47, and forms the center joint of the toggle; it straddles the receiver: on the left it is formed into a small knob by which to open the mechanism by hand, on the right it carries the catch lever 57, which snaps over a corresponding catch on the grip when the parts are closed. The front

end of the link 47 is joined to the breechblock 41; it has a projection on the left side, which draws back the firing pin on the opening of the breech. The breechblock is guided by means of two ribs, working in slots in the receiver. The left rib of the breechblock is itself slotted to make room for the nose of the sear 35, which, while the breech is being closed, engages a lug on the firing pin and cocks it. The firing pin 43 is a hollow cylinder with lug as described; it is propelled forward by the spiral spring 44, resting against a screw plug 42, which closes the rear end of the breechblock. The front end of the breechblock is countersunk to receive the head of the cartridge (rimless); it is fitted on top with a spring extractor 46, and has a groove on its bottom to allow the ejector 14 to rise when the motion to the rear is nearly completed. The lock case of the grip is closed at its rear end by a curved butt piece to which is fastened the closing spring 31 and the cover for the spring, 26. The short arm of the spring rests against the under side of the lock case while the other arm passes in a long curve to hook to the stirrup 54 which is joined to the rear link 49 of the toggle. A recoil spring 17 is placed in the rear at the bottom of the lock case, and is held in place by the pin 18.

On firing, the barrel and breech mechanism are driven to the rear by the shock of recoil, through a distance of 0.118-inch. The three friction rollers, all on the same axis, strike against the curved butt piece and are forced downward; at the same time the middle point of the toggle is raised and the breechblock is drawn back to the rear position, taking with it, by means of the extractor, the empty shell. When the breechblock has reached the end of its travel the ejector throws out the shell. The recoil imparts more than sufficient momentum to the moving parts to overcome the tension of the firing pin spring and closing spring, the surplus being stored up by the recoil spring 17, upon which the friction rollers impinge at the end of the recoil. As soon as the force of the recoil is neutralized, the locking spring, supported at first by the recoil spring, draws the link 49 of the toggle joint forward and downward; the breechblock shoves the top cartridge forward into the barrel, which has also been moved forward through 0.118-inch, and the firing pin is arrested and cocked by the sear. The sear is on the left side of the receiver, and the movement of the parts is so rapid that the finger has scarcely time to release the trigger before the parts are again in position to fire.

In order that the sear may reach its foremost position and not strike against the curved horn of the trigger, the front end of the sear is made yielding; a hole is bored into its forward end, and a pin 39, resting upon a spring 40, is fitted to it. The pin recedes when it strikes against the trigger, and, when the trigger is released, snaps forward, so that the firing can be repeated. The sear is operated by coming in contact, at the forward end, with the beveled surface of the horn on the trigger. The magazine is held in place by the holder 9; 7 is a



BORCHARDT REPEATING AUTOMATIC PISTOL.



safety device for locking the sear; it also prevents any rearward movement of the barrel.

Following are some measurements and ballistic data: Weight, 2.75 pounds; total length, 1 foot; length of cartridge, complete, 1.4 inches; caliber, 0.301-inch; initial velocity, with charge of 7 grains smokeless powder and 77-grain bullet, 1,300 foot-seconds.

Maximum ordinates, for ranges up to 550 yards, approximately:

For 110 yards	inches	3
For 220 yards	feet	1.5
For 330 yards	do	3.5
For 440 yards	do	8
For 550 yards	do	15

Penetration, at a distance of 11 yards from the muzzle, in 0.75-inch pine boards spaced 0.5-inch apart, from 8 to 10.5 inches.

The magazine of eight cartridges can be emptied as rapidly as the firer can release and renew the pressure on the trigger. A detachable skeleton butt-stock may be fitted to the pistol and the whole slung by a strap over the shoulder, stock up, so that with one hand it can be brought to the shoulder for firing.

ARGENTINA.

The full order, 150,000 0.301-inch Mausers, is probably completed.

AUSTRIA.

The statement that a caliber of 0.197-inch has been decided on is premature. Trials have been continued with a view to determine the smallest effective caliber. Press reports state that the 0.315-inch rifle now being turned out at Steyr to complete re-arming the reserves is a modification of the old model in the following respects: Weight only 8.4 pounds; barrel shortened and made thinner; other parts likewise lightened; breech closure changed for a symmetrical system at forward end of the bolt; barrel in contact with the forestock only at front and rear ends. Sight bases no longer set in the barrel but held to it by metal clasps. The cartridge used is M/90.

BRAZIL.

Reports of the adoption of the Spanish Mauser rifle, caliber 0.276-inch, are confirmed. It is believed that 120,000 were ordered, most of which have already been delivered.

CHILE.

An order for 0.276-inch Mauser rifles (60,000, it is believed) is being filled at the Loewe Works, Berlin. This arm is practically the Spanish model, though designated M/95. It is not fitted with the indicator of an empty magazine which is a feature of the Spanish model and Turkish M/93, and which is described in the notes under Spain.

CHINA.

A considerable number of "two-men breech-loading jingals" have been made during and since the close of the late war, the number being reported at several hundred thousand. This weapon is a little over 9 feet in length and has a bore somewhat less than an inch in diameter. The demand for this arm is believed to be due to the poor results obtained with the condemned arms and ammunition furnished the army during the war.

The arsenal near Shanghai has recently been engaged in the manufacture of a new rifle termed the Whanglee, the invention of the superintendent of the gun factory, a foreigner, and modified by the Chinese. The caliber is 0.303 inch; breech closure, straight pull bolt locking at its rear end by a heavy pawl-like lug. Magazine central, under receiver, charged by clips containing five cartridges, the clip entering Mannlicher fashion and dropping out below when empty. There is no cut-off. A safety catch on the left rear of the bolt-casing locks both firing pin and bolt, there being no half cock. The bolt stop lies on the left side of the breech casing. The packet of cartridges may be ejected by pressing a catch in front of the trigger. The piece is manufactured of domestic steel, each part being made by hand, and it is very doubtful if many of the parts are interchangeable. The rifling is uniform. Sights of the usual sliding-leaf pattern, graduated to 2,100 yards. A wooden hand guard is fitted to the rear end of the barrel. Nickel-enveloped bullets and smokeless powder of domestic manufacture are used.

FRANCE.

All vessels are now provided with the Lebel rifle, M/86–93, caliber 0.315-inch. The 1893 modifications are substantially as given on page 166, General Information Series No. XIII. The forestock is provided with a section of cleaning rod about one-eighth of an inch in diameter and 10 inches long, the sections belonging to several arms being screwed together to form the complete rod.

The men belonging to field pieces, whether of the navy or of the field artillery, are armed with 0.315-inch mousquetons. These are short Lebel rifles with magazine under the receiver. The ammunition is that used in the infantry arm; the bayonet, a flat knife blade about 10 inches long. Following are some weights and dimensions of mousqueton, M/92: Length without bayonet, 3 feet 1 inch; weight, uncharged, without bayonet, 6 pounds 13 ounces; weight, charged, without bayonet, 7 pounds 0.5 ounce; weight of bayonet without scabbard, 15 ounces; weight of bayonet with scabbard, 1 pound 6.5 ounces.

The charger holds three cartridges.

GREAT BRITAIN.

It is believed that the ships of the Channel and Mediterranean squadrons have been given the Lee-Metford rifle, and arrangements made for supplying the others.

Rapid wear of the Metford rifling in firing with cordite charges has led to a return to the old Enfield rifling in a modified form, and this system will hereafter be used in all 0.303-inch barrels. There are five grooves; the Metford had seven. The lands are broader and the edges are sharp; depth of grooves increased from 0.003-inch to 0.005-inch. A Martini-Enfield has been fired 13,000 rounds and still gave good results. Fitted with this barrel the Lee rifle is termed the Lee-Enfield.

In re-arming the permanent battalions and militia of Canada it was decided to have none but the magazine arm, and early in the present year 40,000 Lee-Enfield rifles and 2,300 carbines of the same system were ordered through the British war office.

The re-arming of the regulars and militia of the Empire is said to be assured, and the volunteers are also to have the magazine arm.

ITALY.

Service papers state that the manufacture of the Mannlicher-Carcano rifle, caliber 0.256 inch, adopted in 1891, will be pushed so that the troops of the first line shall be armed with it by July 1, 1897.

JAPAN.

Work is being pushed on the 0.315-inch Murata magazine rifle in the home arsenals, with the intention of arming both army and navy as soon as practicable. This arm is similar in breech closure and magazine mechanism to the Kropatschek, turn-down bolt, tubular magazine (with cut-off) under the barrel, holding eight cartridges, entered singly through the receiver.

MEXICO.

In 1895 8,000 Spanish Mauser rifles, caliber 0.276-inch, were delivered to this Government from the Loewe Works, Berlin. A rifle of 0.197-inch caliber is to be subjected to service tests by regular troops.

NORWAY.

The report that this country has ordered 20,000 0.256-inch Krag-Jorgensen rifles is confirmed. The pieces are to be made at Steyr, Austria.

ROUMANIA.

Re-arming with the 0.256-inch Mannlicher has been continued, the arms being manufactured at the Steyr works.

RUSSIA.

After trials extending over several years a revolver has been adopted in which smokeless powder is used to advantage; a gas-tight joint is made between cylinder and barrel on firing, the escape of gas and consequent erosion prevented, and the bullet given a much higher velocity.

The cylinder has seven chambers and has not only a movement of rotation, but also one longitudinally. The cartridge case is prolonged over and somewhat beyond the point of the bullet, and when in the cylinder projects somewhat in front of the cylinder face. In the forward movement of the cylinder caused by the pressure of the finger on the trigger the projecting end of the cartridge case enters the barrel by the extent of this projection, and the piece can be fired only when the cylinder and barrel are in contact; thus premature fires are prevented and the case forms a gas-tight joint. After firing the cylinder returns to the rear. Following are weights, dimensions, and ballistic data as published in service papers:

Caliber, 0.30-inch; weight, 1 pound 11.5 ounces; total length, about 9 inches; length of barrel, 4.75 inches; charge, smokeless, 12.4 grains; weight of bullet, flat-headed and with envelope of maillechort, 108 grains; weight of cartridge, 193 grains; initial velocity, 900 foot-seconds.

Tested for penetration in 1 inch dry pine boards, spaced several inches apart, at a distance of 27 yards all bullets passed through three boards, 68 per cent through four, and 25 per cent through five boards; at 200 paces at least one board was penetrated. Following are the radii of the circles containing half of the shots:

	With a rest.	Without rest.
	Inches.	*Inches.*
At 15 paces	.8	1.4
At 25 paces	1.1	1.8
At 35 paces	1.4	2.5
At 50 paces	2	3.7
At 70 paces	2.7	.....

SERVIA.

It has been decided to carry out small-arm trials in this country, and after deciding on a caliber and system to order 120,000 rifles.

SPAIN.

Press reports state that urgent orders for additional 0.276-inch Mausers have recently been placed with the Loewe Works, and that large quantities of ammunition have been contracted for in France. Machinery has also been installed in the arsenal at Oviedo for the manufacture of this arm. The principal features of the mechanism are

described on page 172, No. XIII, and some ballistic data given on page 156 of the same volume. A simple device, common to this arm and the Turkish Mauser, M/93, indicates an empty magazine and prevents the continued working of the bolt after the contents of the magazine are exhausted; when the bolt is withdrawn and the magazine empty a longitudinal rib on the feed plate rises before the bolt head and prevents its being shoved forward to close the breech; the action of charging the magazine removes this obstruction. The arm has been supplied to nearly all new vessels.

Difficulty has been experienced in endeavoring to adapt the Remington breech mechanism to the small caliber ammunition and probably the attempt will be abandoned.

Service papers note the creation of a permanent small-arms commission.

SWEDEN.

The order for 8,000 0.256-inch Mauser carbines, noted in No. XIV, has probably been filled.

TURKEY.

It is believed that the 0.301-inch Mauser is being issued to the troops. M/93 is fitted with the device for indicating an empty magazine, described in notes under Spain.

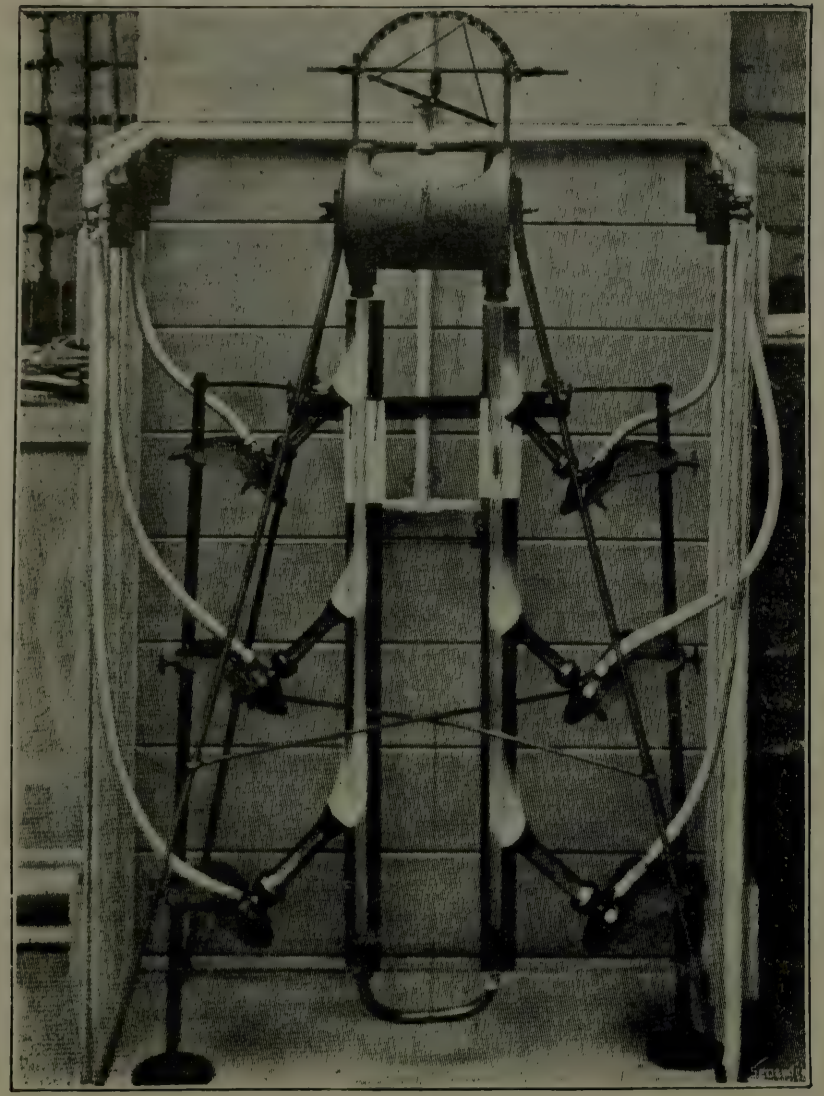


Fig. 3.

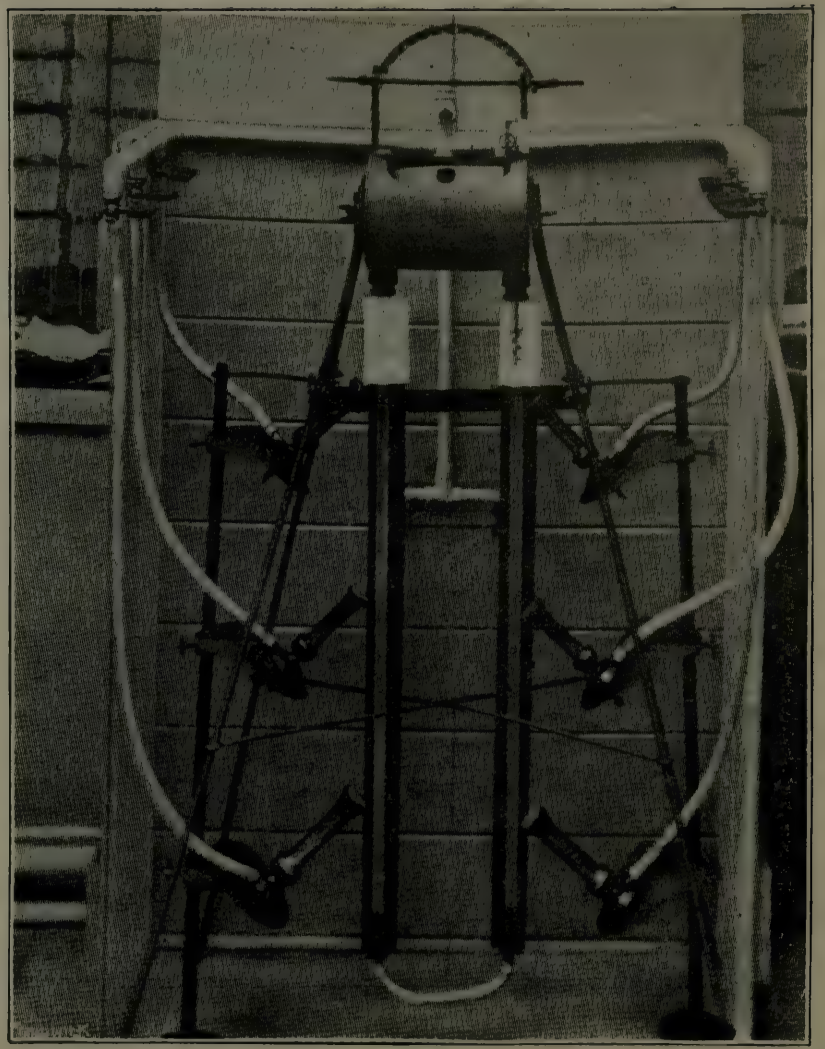


Fig. 4.

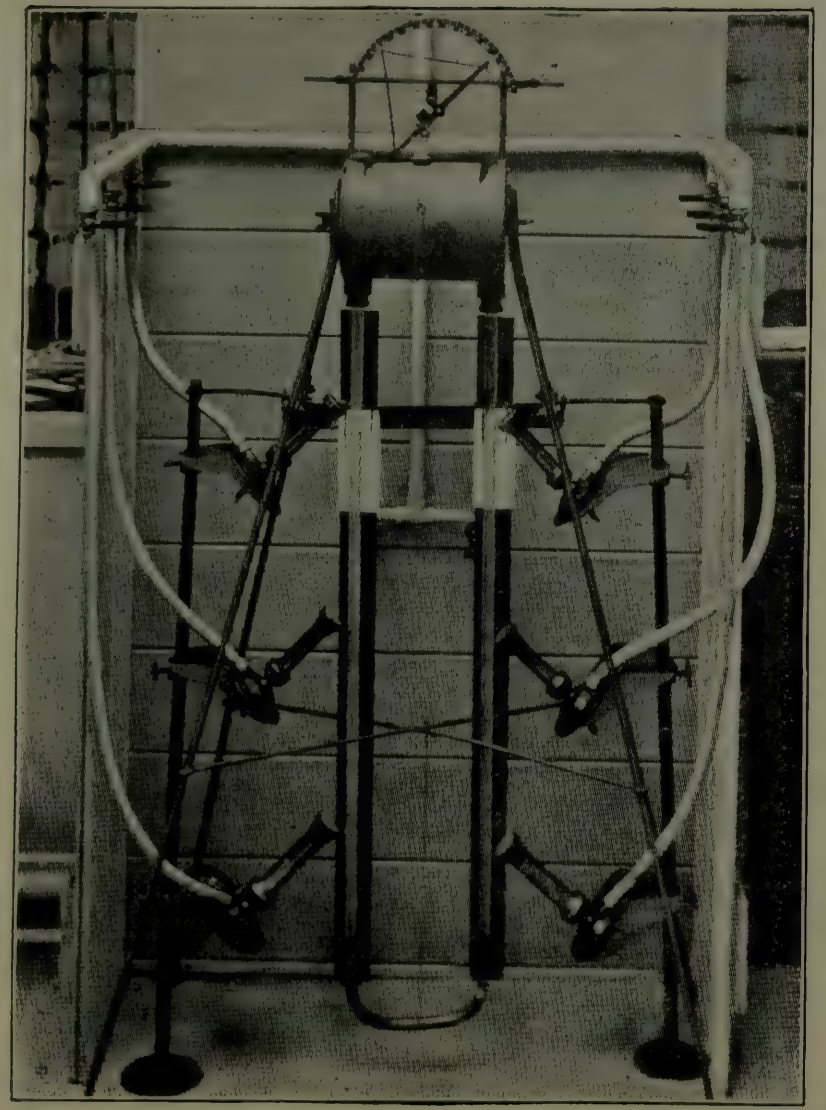


Fig. 1.

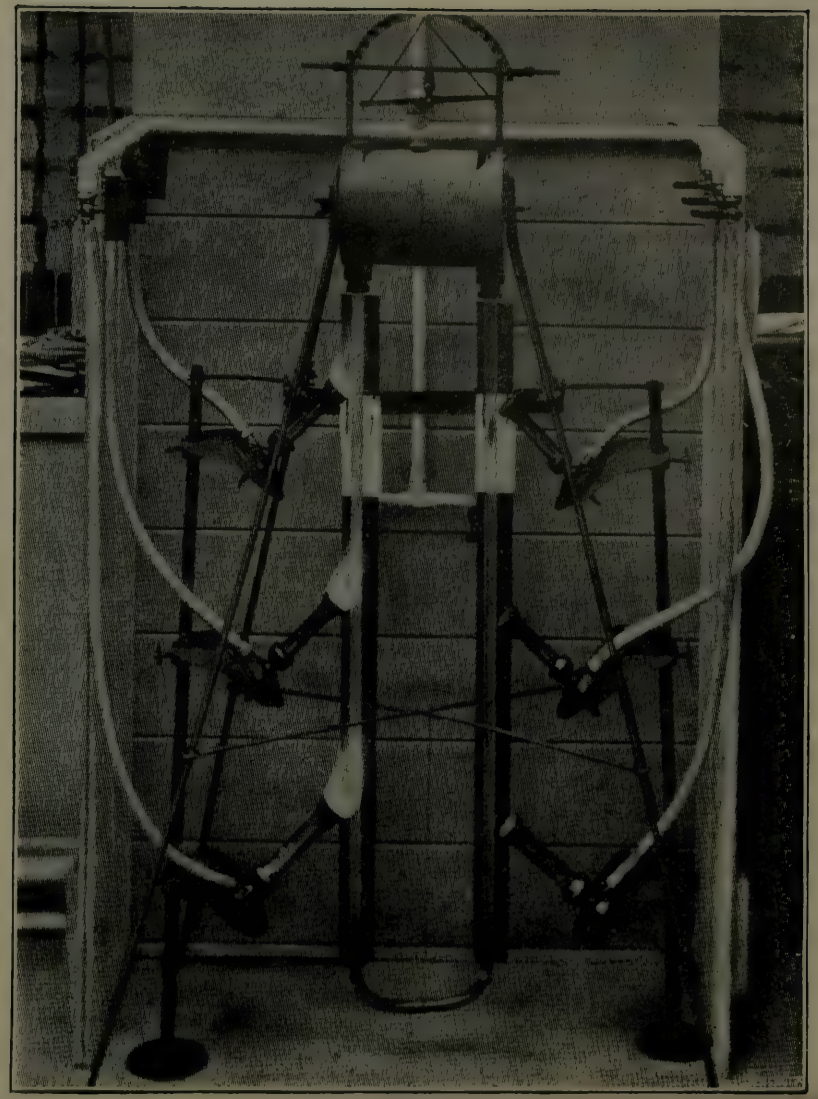


Fig. 2.

IV.

NOTES ON BOILERS.

By Ensign SUMNER E. W. KITTELLE, United States Navy,
Staff Intelligence Officer.

The past year has been productive of much valuable information with regard to water-tube boilers. Extensive researches have been made by eminent authorities on marine engineering, and the results of their experiments and experience have greatly widened the field of general knowledge, and led to very profitable discussions. Exhaustive circulation experiments were made by Messrs. Yarrow & Co., in January, 1896, and witnessed by many persons interested in the subject.

An apparatus (figs. 1, 2, and 3), consisting of two glass tubes joined at their lower extremities by a copper bend and entering a drum above, was set up, as shown in the plates, and three Bunsen burners arranged to heat each tube. Above the drum was placed an arc scale, and a triangle was pivoted in the center of its base so that the apex acted as a pointer. A cord, having a plunger attached to its lower end, was made fast to one angle of the triangle and the plunger, the surface of which was grooved, was allowed to descend within the tube carrying the down current of water. With no current running, the water in the tubes being cold, the pointer marked -45, as in fig. 1. One burner was then lighted on the up tube, which set up a slight intermittent current; a second burner strengthened the current, and the pointer marked -12. A third burner being turned on the up tube the pointer marked -5, as in fig. 2. The three burners on the down tube were then lighted one by one, and the successive readings on the scale were $+10$, $+15$, and $+20$, fig. 3 showing all six burners alight.

This experiment demonstrated the fact that heat applied to the down tube increased the circulation, previous trials having shown that within limits the rapidity of the current depends upon the total amount of heat applied, irrespective of its relative application to down or up tubes. The above experiment was at atmospheric pressure, and the measures were purely relative and not quantitative.

Fig. 4 shows a similar apparatus, with an attachment for measuring the speed of the current. In the down tube a screw of known pitch was placed, its spindle having a worm at the upper end, actuating a worm wheel and counter. With two burners under the up tube, the current showed a speed of 28 feet per minute, while with three burners going, the speed, was 36 feet.

The next experiment was with tubes inclined at a small angle to the horizontal, as in fig. 5, the Bunsen burners under the up tube being larger than those under the down tube. As in the previous trials, the circulation in the tubes was increased when the heat was applied to the down tubes. No comparative results between these tubes and the more upright ones were obtained, but the circulation in this case was sufficiently rapid for efficiency. It was shown in all the trials that the steam bubbles formed in the down tube, but disappeared again at the bend of the U, a fact ascribed to the increased pressure below, while the same cause tended to increase the convection in the up tube.

A fourth experiment was made with a model more nearly approximating to the design of the Yarrow boiler. Three tubes, half glass, half copper, lead into a common drum above (fig. 6), while their lower ends are also in communication with one another and are inclosed in an asbestos-lined metal case. Bunsen burners were so arranged that the flame played on the first tube while the hot gases encircled the remaining tubes and thence passed to the chimney. When the burners were lighted only the first tube carried an upward current, the other two were down tubes, but after becoming thoroughly heated the second also became an up tube, leaving the last to accommodate the down current. Nine pounds of water per square foot of heating surface were evaporated in this model. Fig. 7, of similar construction, except that the third tube was at the back, gave the same results.

The acceleration of circulation was also shown by the use of air. Fig. 8 shows two glass tubes joined at the bottom and leading into a tank above, the tank and tubes being filled with water. Near the lower end of each tube, a rubber tube and cock connected it with an air pump. When the air pressure was turned on one tube, it became the up tube and the current circulated as in other experiments, while the admission of air pressure to the down tube increased the circulation. The air pressure was then turned off the up tube, but the current continued to flow in the same direction under the impetus of the air pressure entering the down tube.

The next experiment was with a closed apparatus shown in fig. 9. The usual set of two tubes was used, this time leading into an air-tight steam drum above. Circulation was started by lighting three small burners on the left side, that tube becoming the up tube. The five large burners on the down tube were then lighted one by one until all were alight, when the circulation became very vigorous in the same direction as before and the steam pressure rose to 150 pounds at the

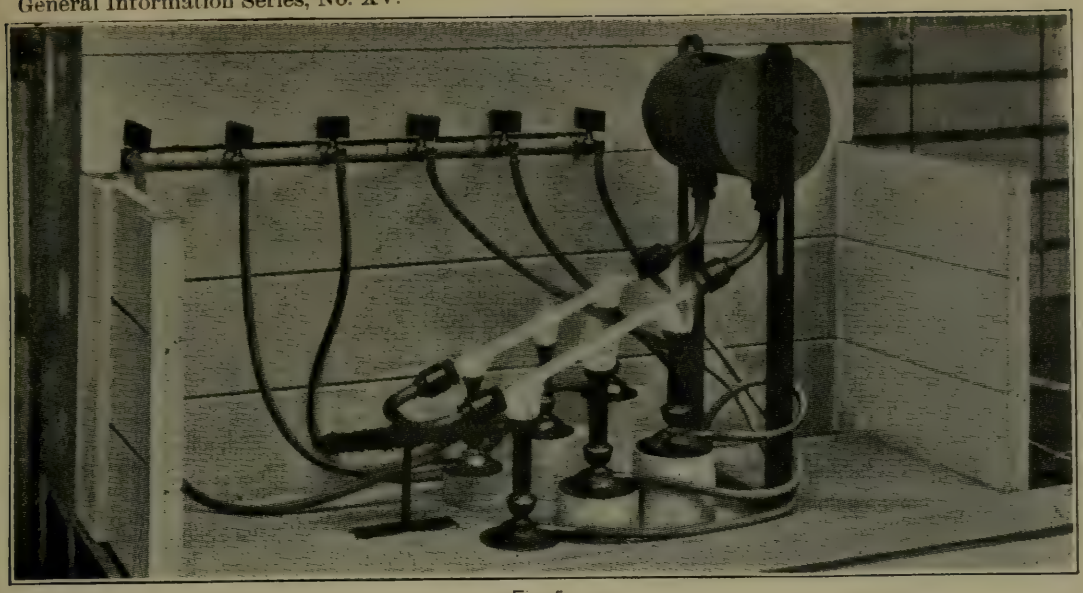


Fig. 5.

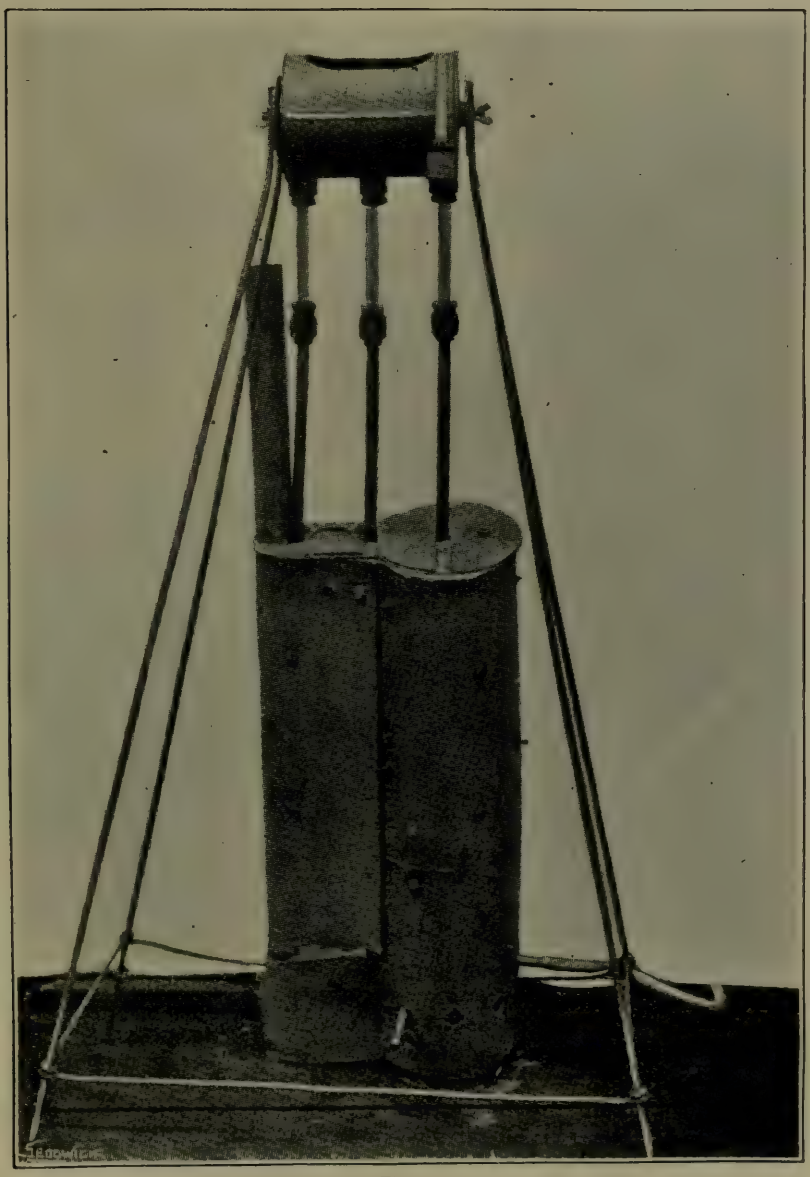
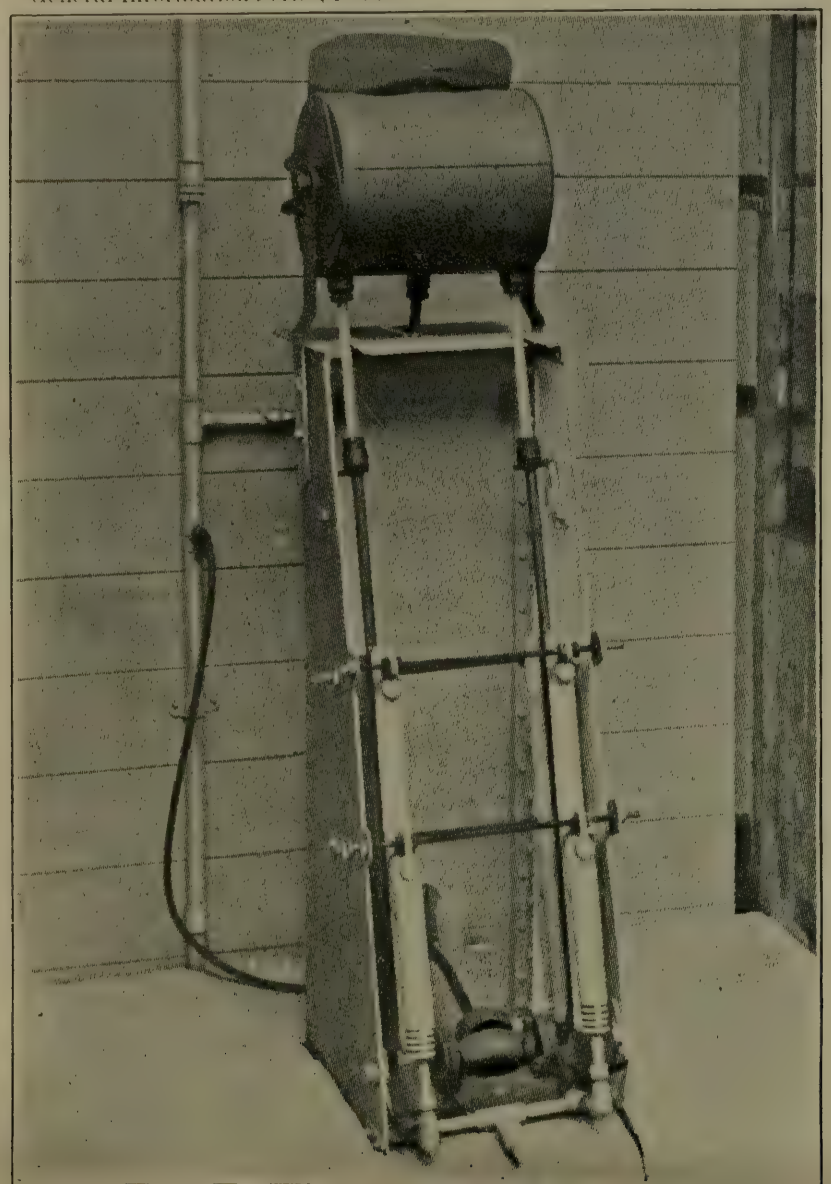
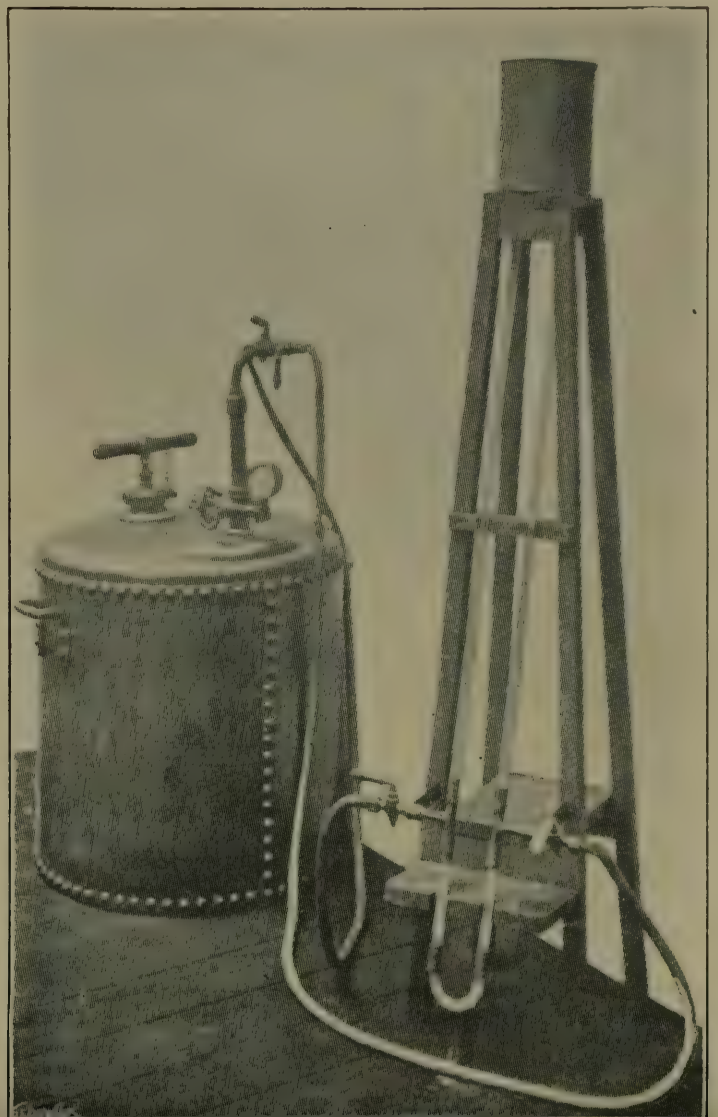


Fig. 6.





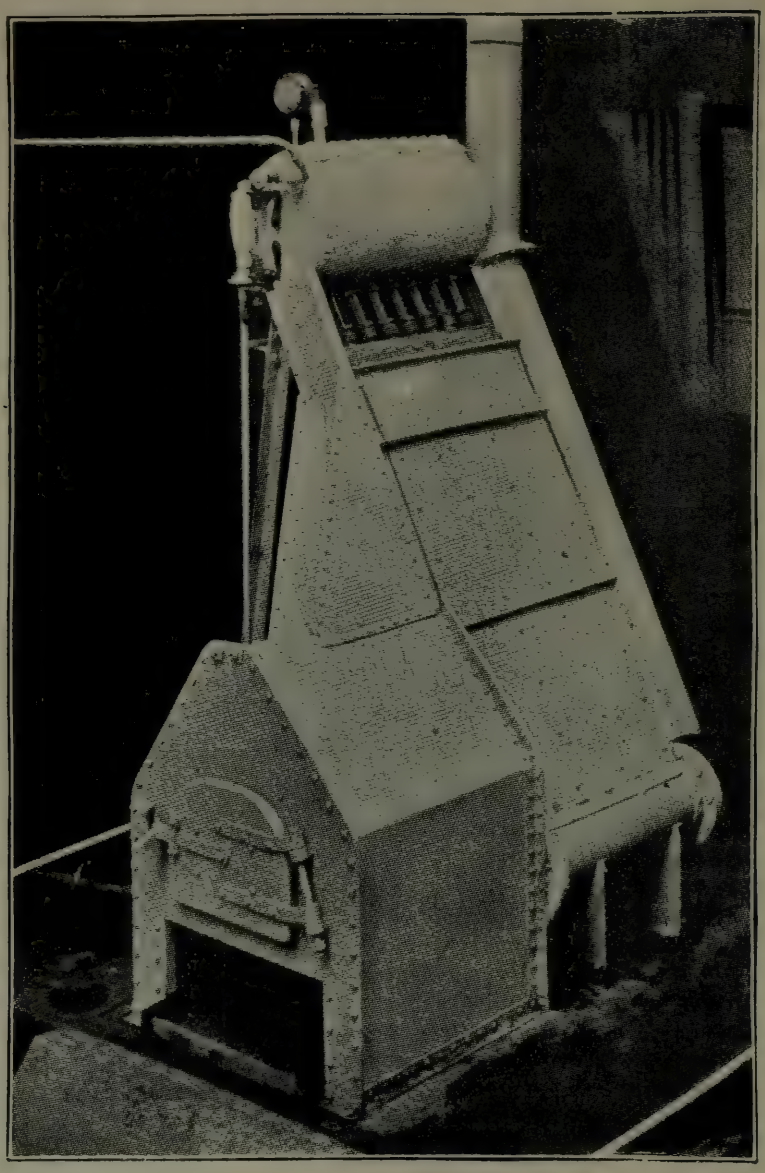


Fig. 12.

Fig. 11.

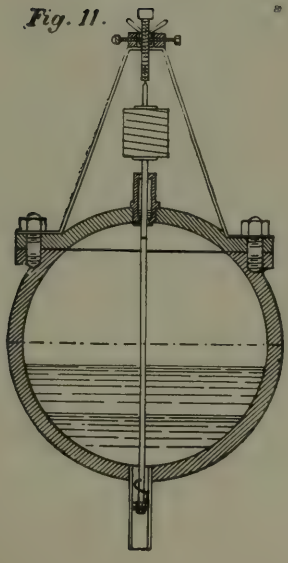
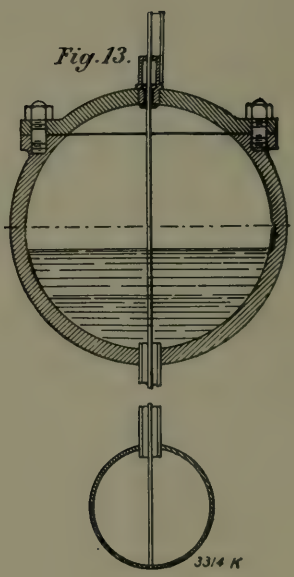
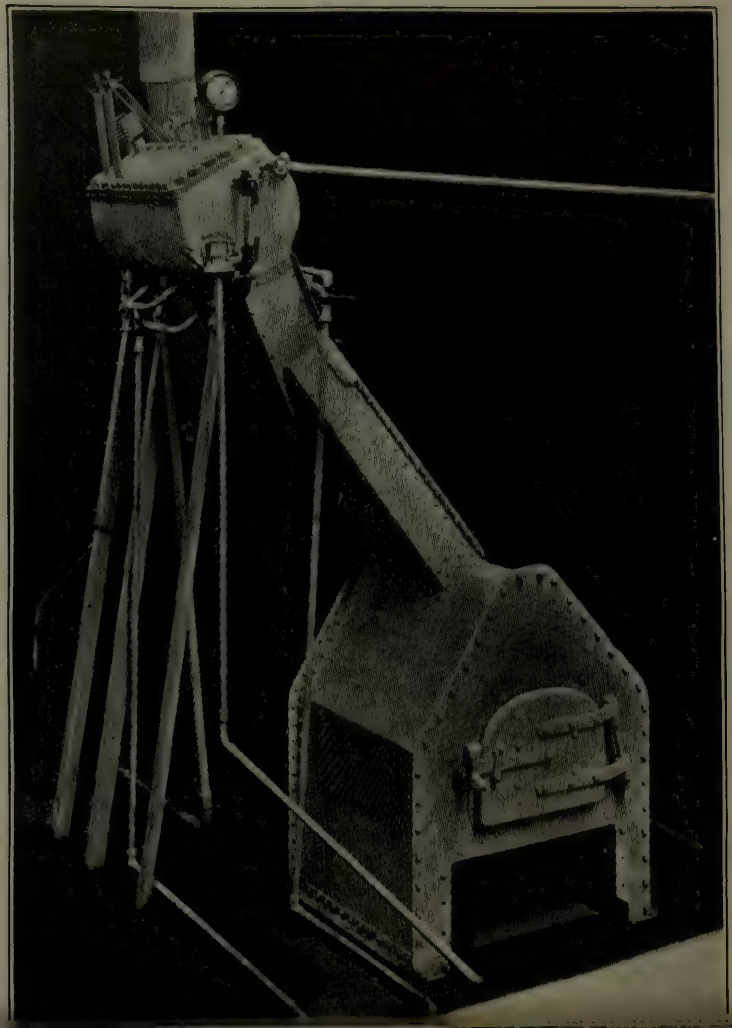


Fig. 13.







gauge. The three burners on the up tube where then extinguished, but despite the fact that all the heat was now applied to the down tube the direction of the current remained unchanged.

A model to record the speed of the current under pressure is shown in fig. 10, which is a full-sized section of a Yarrow boiler. The heat is supplied by a small coal furnace with steam-jet forced-draft, and the products of combustion pass out of the chimney after acting on the tubes. The drum is steam tight, and the last and third from last tubes are fitted with screws of known pitch whose spindles have wooden cylinders at their upper ends, fitted as shown in fig. 11. With this apparatus never less than two tubes carry the down current.

Another full-sized model (fig. 12) was rigged with glass tops to the tubes to observe the action of the water in the tubes while raising steam, the tubes coming into action successively and the last three finally acting as down tubes. To prove that with good circulation straight tubes in water-tube boilers are not objectionable from a standpoint of irregular expansion and contraction, Mr. Yarrow fitted a device (fig. 13) in one of the models like fig. 10. This device consists of a long rod, extending to the bottom of the water chamber where it is attached, and projecting upward through a gland in the top of the steam chest. The upper end of the rod has a pointer which comes exactly in line with a fixed pointer on the top of the chest. The rod will have the temperature of the circulating water and steam, and as experiments showed that there was no movement of the pointer whether the fires were forced or withdrawn, the tubes must also have the temperature of the circulating water and steam, as the device was sufficiently delicate to show any difference in expansion.

Great differences of opinion are still held by authorities on the relative merits of Scotch and water-tube boilers and on the efficiency of the various types of the latter. Mr. Durston, engineer-in-chief of the British navy, says:

> The general question of the use of higher steam pressures, which necessarily involve, in my opinion, the use of water-tube boilers, will be of interest, * * * and if it be shown by experience that increased pressures can be obtained with water-tube boilers with safety and efficiency, and that a considerable gain in economy results from the use of such high pressures, no doubt the mercantile marine will be forced by competition to their adoption, assuming, of course, that any practical difficulties are shown by experience to be overcome when proper appliances are fitted. One very important reason for the adoption of very high pressures exists in the navy, however, to a much larger extent than in the mercantile marine, and follows from the fact that with naval machinery, although possessing the capability of exerting great power, the usual power exerted on service of the naval ship is but a small proportion of the full power. It is well known that such small powers can not be developed in a large engine with economy, and one advantage of the provision of very high pressures for the maximum power lies in the reduced size of engine which results, and which will have a beneficial effect in making the engine more economical at those low cruising powers which the vessel exerts during most of her life.
>
> Besides this special advantage which accrues in the navy, there is, of course, the general advantage of lightness. There are certain types of war vessels where

the development of the highest possible power for short spurts is of paramount importance, and this highest possible power is required on the lowest possible weight of machinery.

A series of experiments has been carried on at Devonport to determine the distribution of temperature over the tubes and tube plates of boilers, and the results showed that tubes remained tight up to a temperature of 750° F., but above this leakage must be expected; that the loss of efficiency due even to a slight deposit of grease in the boiler was about 11 per cent, and that brass and copper tubes were more liable to leakage than steel and iron tubes. In consequence the brass and copper tubes, where used, are being replaced by steel tubes in the British service. Referring to leaky tubes Mr. Durston states:

An occurrence in one of the new torpedo boat destroyers may also be mentioned as confirming the view that when the temperature is raised beyond 750°, i. e., about the temperature of melting zinc, leakage of tubes will occur. The vessel in question is fitted with four boilers, arranged in two stokeholes, two boilers in each, one main feed pump and one auxiliary feed pump being provided for each pair of boilers. During a full speed run a defective tube burst in the forward boiler, but this fact was not immediately recognized by those in the stokehole; the water disappeared from the gauge glass, and in the endeavors to maintain the usual water level in this damaged boiler the water became so low in the other boiler that the tubes were seriously overheated. Some idea of the temperature reached can be obtained from the fact that the solder securing the ends of the wire on the main steam pipes and a zinc slab in the steam collector of the boiler were melted; so that the temperature of steam had been above 750°. When the accident was realized, the defective boiler was shut off and water pumped into the overheated boiler; the tubes of this latter leaked considerably at the steam collector joints, and required subsequent rerolling throughout, but no other repair. This incident took place in a water-tube boiler, where the generating tubes enter the top collecting chamber below the normal water line; but a still more recent case of shortness of water and consequent overheating has occurred in a boiler where the generating tubes all enter above the water line, and in this case also tube leakage resulted, so that in every case the same result may be expected to occur if the critical temperature is reached.

It is satisfactory to note that in the case of the tube bursting, the safety appliances, viz, automatic ash-pit doors and automatic stop valves on the boiler where the tube burst acted efficiently, and no injury of any kind occurred; indeed those in the stokehole first ascertained what had taken place from inquiries made by those on deck.

Speaking of the proportions of boilers for powers to be developed the same authority says:

For the ordinary tank boiler, the size of boiler fitted is such that 1-horsepower is developed from each 2.5 square feet of heating surface on an eight-hours' trial, termed the natural-draft trial. For a shorter trial of four hours' duration, called the forced-draft trial, the power is increased by 20 to 25 per cent, so that for this short period the heating surface is at least 2 square feet per indicated horsepower. On actual service, the minimum which it is insisted must be developed by the engines and boilers continuously for as long as the coal will last in the vessel, is 60 per cent of the natural-draft power, so that at this minimum power it will be seen that the heating surface is about 4 square feet per indicated horsepower. This continuous power is clearly that which corresponds to the seagoing powers of the mercantile marine. Although the Admiralty lay down this minimum power, there is no limitation of the amount obtained up to the full natural-draft power, and on trials made

expressly to ascertain the amount of power which can be continuously maintained, the minimum of 60 per cent is generally considerably exceeded. The table exhibited shows the results of a series of fourteen trials, and by inspecting the column No. 7, showing the heating surface for power actually developed, it will be seen that the royal navy and mercantile marine practice on this question is much the same.

1	2	3	4	5	6	7	8	9
Ship.	Type.	Load on safety valve.	Duration of trial.	I. H. P.	Heating surface.	Heating surface per I. H. P.	Coal per I. H. P. per hour.	Full natural-draft power.
		Lbs. per sq. in.	*Hours.*		*Sq. ft.*	*Sq. ft.*	*Pounds.*	
Royal Sovereign.	Vertical triple	155	72	8,180	20,034	2.44	1.84	9,000
Royal Arthur	do	155	72	8,821	24.828	2.81	1.85	10,000
Sans Pareil	do	135	50	7,051	19,980	2.83	2.23	7,500
Sirius	do	155	64	4,555	15,918	3.19	2.03	7,000
Pallas	do	155	73	3,620	11,109	3.06	.....	4,500
Resolution	do	155	48	8,085	21,178	2.61	2.1	9,000
Cossack	Horizontal compound.	130	48	1,435	6,836	4.76	2.51	2,200
Mohawk	do	130	48	1,998	6,836	3.42	2.7	2,200
Fearless	do	120	48	1,888	6,439	3.41	2.46	2,100
Spartan	Vertical triple	155	72	6,777	15,918	2.34	1.96	7,000
Bonaventure	do	155	72	7,083	15,600	2.2	1.76	7,000
Partridge	Horizontal triple	145	48	719	2,087	2.9	2.1	700
Vulcan	Vertical triple	155	48	7,236	15,868	2.19	1.86	7,200
Buzzard	Horizontal triple	140	48	1,232	3,892	3.1	2.4	1,400

On the subject of induced-draft, which has been successful in the case of the battleship *Magnificent*, the engineer-in-chief says:

Induced-draft was first tried in the navy afloat on H. M. S. *Vesuvius* in 1875; in her case a 6-foot fan running 570 revolutions was used in connection with a boiler having 42 square feet of grate surface, producing about the same draft as an ordinary chimney; in this ship was also tried the effect of discharging the gases through a horizontal chimney with an outlet astern. Mr. Martin, who deserves credit for his persistent advocacy, and has largely associated himself with this method of increasing the rate of combustion, made some further experiments with the system, and showed that a considerable draft could be obtained with it.

In 1889 it was decided by the Admiralty to make a comparative set of experiments with a boiler fitted with this system of draft, and subsequently with navy forced-draft (closed fire room), and a locomotive boiler at Portsmouth was selected for the purpose. The results of these trials showed:

(*a*) That with fans used to produce the induced-draft there was no difficulty in obtaining high rates of combustion.

(*b*) That, as compared with forced-draft (closed fire room), there was an appreciable gain in evaporative efficiency.

(*c*) Moreover, the open stokehole, if properly ventilated, has advantages in comparison with the closed stokehole.

It was, therefore, decided to proceed further with the system, and try it on board a ship, and for this purpose H. M. S. *Gossamer* was selected, one of her boiler rooms being fitted with induced-draft, and the other retaining the forced-draft (closed fire room) system. An extensive series of trials was carried out in that ship, the net results of which was to show that while on other grounds there was little to choose between the two systems, the great convenience and comfort due to the conditions involved in working with an open stokehole, in lieu of a closed stokehole, were

very valuable. In view of these results further practical adaptations of the system have been made. H. M. S. *Torch*, a gunboat, has been fitted on this plan, and still later H. M. S. *Magnificent*, a first-class battleship, and both these vessels have passed satisfactorily through their trials, and extended experience of the actual working of the arrangements at sea will soon now be obtained.

The adoption of the Belleville water-tube boiler for certain of the larger vessels of the British navy has met with disapproval on the part of many engineers, who consider that this boiler has not yet proved its superiority to the Scotch boiler as a steam generator for large vessels. The trials of the *Sharpshooter*, the results of which are given under "NOTES ON SHIPS AND TORPEDO BOATS," are quoted as showing the wastefulness of the Belleville boiler, and serve as an argument against their use. The two vital objections urged against water-tube boilers, and which the Admiralty is said to have overlooked, are: (1) The greater coal consumption per I. H. P. per hour as compared with cylindrical boilers; (2) the greater number of firemen and coal passers required for a given power. Belleville boilers were fitted in the new steamer *Ohio*, plying between Hull and New York. There were four of these boilers of 2,000 I. H. P., 6,000 square feet of heating surface, and 192 square feet of grate area. The first voyage occupied twenty-one days at a speed under 7 knots, the coal consumption being 19 tons per day, and succeeding voyages were almost equally slow, and at low powers. The tubes gave great trouble from leakage, and the lack of economy has caused the company to order cylindrical boilers for a new steamer now under construction. The advantages claimed for the Belleville boilers by the British Admiralty were grouped under five heads, and these are discussed at length by Mr. James Howden, who takes the opposite view. This gentleman reviews the advantages and disadvantages in Engineering, and extracts from his criticisms are given below:

The first claim was "the advantage of raising steam from cold water quickly," the official statement being "that steam can be raised from cold water to 250 pounds pressure in one hour in tubulous boilers, while with cylindrical boilers it takes from six to twelve hours," and of this supposed advantage it was said, "The importance of that could not be overestimated. That alone was sufficient to justify the Admiralty." It will be interesting to examine this feature for which such a preponderating importance is claimed.

As the fourth Admiralty claim is somewhat analogous to the first, I give it here to save unnecessary repetition of arguments. It is, "With water-tube boilers the fires could be instantly withdrawn, the grates cleaned, the tubes swept, and the ship ready to start again with clean boilers in three hours, which was impossible with cylindrical boilers."

The respective times for raising steam in the two types of boilers are here greatly overstated in favor of the water-tube boiler. The bias of the water-tube advocate is apparent, the small water-tube boilers being brought into comparison with the largest class of cylindrical boilers for seagoing steamers. Quick steam raising, likewise, in water-tube boilers is generally exhibited as a feat by having fires specially prepared for quick ignition and kindling, while such a thing is never thought of for cylindrical boilers, because steam raising an hour or two more or less quickly in a seagoing ship is of no importance whatever, either in a mercantile or war ship, as will be afterwards shown. If the same precautions were taken to get up steam as

quickly in cylindrical boilers, the time usually taken would be greatly reduced. Still, it would always be much longer than in tubulous boilers. If 1.5 hours be allowed for a Belleville boiler for a seagoing steamer of a certain character, it would not be unfair to allow 4.5 hours for cylindrical boilers for the same class of ship using the same means.

It is a fact, however, that should not be lost sight of, that in proportion to the quantity of water contained, cylindrical boilers raise steam from cold water much more quickly than water-tube boilers, simply because almost the entire heat of combustion is imparted to the water in cylindrical boilers in raising steam, while in water-tube boilers a great proportion of this heat passes up the chimney to the outside casings. If the raising of steam quickly in a boiler could be attained without sacrificing features of more importance, or thereby creating defects, it would be a certain advantage, though of very minor importance. Quick steam raising in water-tube or other boilers, however, can only be obtained by sacrificing features of vital importance, and by creating several serious defects. I have already explained elsewhere that the rapidity with which steam can be raised in a boiler is simply a measure of the quantity of water in that boiler, and of the risk and difficulty of working it, likewise of its durability; the less the water the quicker the steam is raised, but also the greater is the risk and difficulty in working, and the shorter the life of the boiler. All these are facts which no one experienced in water-tube boilers can deny.

But supposing these serious disadvantages arising from the small quantity of water in tubulous boilers (stated in the official defense as from one-fifteenth to one-thirtieth that in cylindrical boilers), to which alone the quick steam raising is due, did not follow, a brief consideration of a few facts which all can understand will show that even then how small and unimportant the advantages of raising steam quickly in a war ship really are.

Suppose in time of war (the only time in which quick steam raising can be of serious importance) a war ship, say of the smallest and most easily handled class, is laid up, that is, without men or consumable stores on board, but otherwise equipped, and is suddenly ordered to perform some work of attack or defense in the shortest possible time. As the steam machinery must always be kept in order, the artificer in attendance could fill boilers of any kind, raise steam, and turn the engines before the crew could get berthed and their duties apportioned, stores put on board, and everything ready for movement. Not one moment would be lost as far as raising steam was concerned. In large war ships where not hours, but days, may be required for preparations, still less would the time of raising steam require to be considered. Quick or slow steam raising would not enter the case.

Should, however, the supposed war ship be fully manned and equipped with coal, stores, and ammunition, if she had cylindrical boilers she would never lie in these conditions with steam down, if liable to be attacked or wanted to be ready for immediate service, as it is always easy to maintain steam with banked fires, or what is still better, with incandescent fires, having air almost entirely shut off, as will be further explained. With water-tube boilers, the difficulty of maintaining steam for a period with the engines at rest is so great, owing to the small quantity of water they contain, their large grate surface and their small steam room, that it becomes necessary to remove fires, let down steam, and have the fire bars recoaled and ready for lighting. It follows, therefore, that the ships with water-tube boilers lying at anchor would always be found in a state of unpreparedness, while those with cylindrical boilers would be found ready to move within a few minutes' notice.

Then, for war ships at sea, cruising or blockading, this claim of advantage in quick steam raising is distinctly based on the idea that cylindrical boilers require to let down steam frequently, and have the coals removed from the furnaces in order to get the tubes swept as in water-tube boilers. After once raising steam in a cylindrical boiler, it can be kept working at full power continuously for months, as is being every day experienced, as all the operations of cleaning fires and sweeping tubes are

done while the boiler is at work, and no stoppage whatever is required. To such boilers the time occupied in raising steam at starting is of no consequence whatever.

With these boilers the largest cruisers with evaporators on board for fresh-water supply could keep at sea for years without stopping. Each boiler could in succession be blown down and examined internally and cleaned and refilled with fresh water after, say, seven or eight weeks constant work, and so kept in perfect working order. The highest power would, therefore, be always at command with cylindrical boilers. Further, cylindrical boilers can use without injury a considerable quantity of salt water. They would always be at the density of sea water when about to be examined internally, so as to lose no fresh water in blowing off.

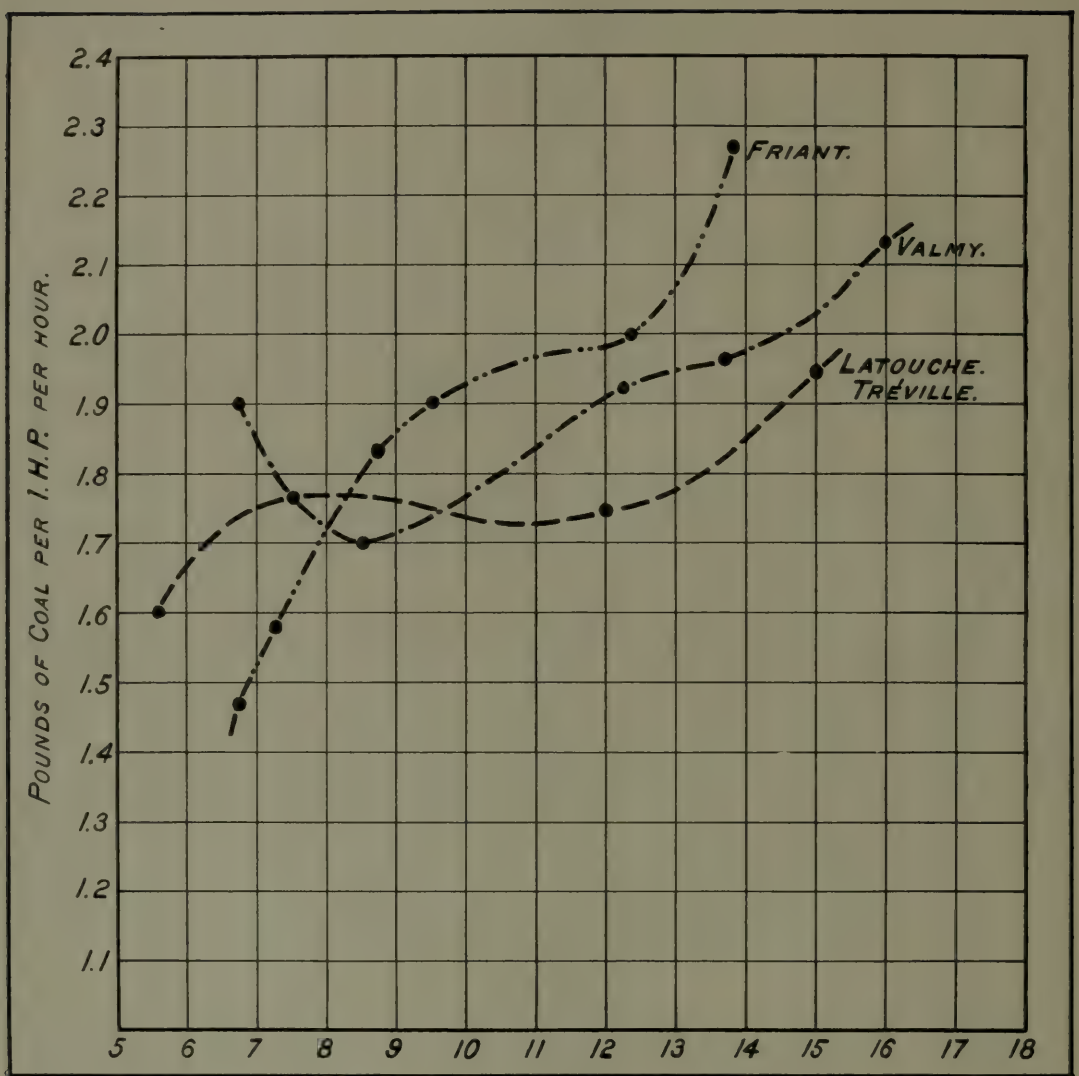
Water-tube boilers, on the other hand, can not run at sea continuously on account of their structural arrangement, on which the quick steam-raising depends, and on the fact that the fire gases act on the outside of the tubes. Such boilers with small water tubes can only run at a high speed from three to four hours without stopping to clean. The larger tubes of seagoing boilers run longer before cleaning, in proportion to the rate of combustion per unit of heating surface and width of spaces between the tubes. Again, the frequent blowing off for examination and cleaning of water-tube boilers necessitates a much greater supply of fresh water for these boilers than for cylindrical boilers, and, beyond this, the daily waste of fresh water from cocks, stop valves, and safety valves, is in proportion to the number of these fittings. As from five to ten water-tube boilers are required for every cylindrical boiler the proportion of fresh water wasted must be from five to ten times more with water-tube boilers than with cylindrical boilers for equal power, not to mention the frequent blowing off of the boilers for cleaning as already mentioned. Including the special waste in water-tube boilers arising also from frequent repairs, it is probably not overstating the case to say that water-tube boilers would require at least ten times more fresh water to keep them cruising than cylindrical boilers of equal power. This is a serious matter and has evidently never been taken into account in the misplaced enthusiasm which has led to the adoption of these boilers for our war ships and cruisers.

The second claim of superiority made by the Admiralty for the water-tube boiler is: "The engines could be stopped suddenly at full speed with Belleville boilers without the pressure rising or injuring the boiler, as the control of the steam pressure was greater than in the boilers of the cylindrical type."

It is easily understood that with their limited quantity of water, small steam spaces and large grates, it is impossible to keep fires in water-tube boilers with the engines stopped without raising the steam pressure quickly and blowing off. Consequently the "control of steam pressure" instead of being "greater" is much less in water-tube boilers than in cylindrical boilers. The only way steam can be controlled in water-tube boilers, under the conditions mentioned in this claim, is to pull the fires out of the furnaces. The steam is then "controlled" by falling rapidly.

The third official claim is: "That if a boiler was damaged in action, the danger to the stokers and ship was less with water-tube boilers, because the water capacity of the boiler was only one-fifteenth to one-twentieth of the cylindrical boilers."

If possible to send a heavy shot under water through the ship's side and protecting coal bunkers, which will also be able to penetrate the thick steel plates of a cylindrical boiler shell, this shot would be greatly more than sufficient to smash every tube in a water-tube boiler. The result would be equally fatal in both cases; the only difference would be that in the one boiler the steam would issue from one hole, while in the other it would issue from fifty or more. Boilers in war ships are, however, supposed to be completely protected from shot entering by the sides by being under water and by the coal in the side bunkers. What is more likely to happen is damage from shell splinters getting in through the funnel and ventilating spaces from above. Such pieces as would be harmless against a cylindrical boiler


POUNDS OF COAL PER I.H.P. PER HOUR.
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
5
6
7
8
9
10
11
12
13
14
15
16
17
18
FRIANT.
VALMY.
LATOUCHE.
TRÉVILLE.

shell might easily destroy water-tube boilers. But the latter are exposed to a much greater risk than cylindrical boilers from their great multiplicity of tube connections, steam pipes and branches on the upper part of the boilers. The safety of a boiler from external damage is inversely in proportion to the number of separated or detached parts. In Belleville boilers the tubes from every element connect to the steam receivers and form steam branches. The forty-eight Belleville boilers each of the *Powerful* and *Terrible* have many hundreds of these steam branch connections, not one of which is in cylindrical boilers. They have, in addition, complete sets of steam pipes and connections for each boiler. As nine double-ended cylindrical boilers would give as much if not more steam than the forty-eight Belleville boilers of these ships, the relative danger arising from these steam pipes alone is as 48 to 9 against the Belleville boilers.

The fifth and last claim of the Admiralty for the water-tube boiler is that "they could be removed without wrecking the ship, as was necessary with cylindrical boilers."

Should cylindrical boilers require to be removed, this can be done without the least damage to the ship. As boilers must have funnels and air hatches and spaces round the funnels, there is always sufficient room in any properly designed war ship to remove any cylindrical boiler through these spaces. This, however, should, as a rule, never be required. Furnaces or other interior parts can and should be renewed if ever necessary on board ship.

These views are given as representing the cylindrical boiler side of the controversy. Time and experience will develop the practical value of the water-tube boiler for large war vessels. Their value in torpedo vessels, where great powers and speeds are required for short periods, is now generally conceded. France has used the water-tube boiler in her larger vessels for some years and does not discard them for inefficiency, and other powers are extending their use of them.

Messrs. Maudslay Sons & Field, in defense of the Belleville boiler, have discussed at considerable length in Engineering of December 13 and 20, 1895, the article on "TUBULOUS BOILERS IN THE FRENCH NAVY," which appeared in General Information Series No. XIV. They claim that the automatic feed works perfectly and that there is no excessive wear shown in the tubes due to either slow circulation or impure water. That the Belleville boilers prime excessively is also denied, and instead of 10 per cent of water passing over with the steam it is claimed that the steam is generally somewhat superheated; it is, however, admitted that in starting suddenly some water passes into the separator, but not an undue amount. The question of economy is taken up and the evaporative efficiency declared to be at least equal to that of double-ended cylindrical boilers, and the special feed pump used is claimed to require no more steam than do other feed pumps. The relative evaporative efficiency of the three types of French water-tube boilers is given by the curves as plotted by these gentlemen.

Latouche-Tréville	Belleville boilers.
Valmy	Lagrafel-D'Allest boilers.
Friant	Niclausse boilers.

The adoption of Belleville boilers by the British Admiralty was severely criticised in Parliament in June, when it was charged that

they were adopted without sufficient trial, and that if they proved a failure twenty-three vessels of the navy would have to be supplied with new boilers. The Admiralty, however, held that the strategic value of the boiler, in getting up steam rapidly, outweighs all disadvantages.

Col. N. Soliani, director of naval construction of the Italian navy, in dealing with the subject of water-tube as against cylindrical boilers, puts forth the claims of compound boilers in the following words:

The steady advance of water-tube boilers in the field of steam navigation has aroused a natural reaction in favor of ordinary marine cylindrical boilers, which, according to many, although inferior in certain respects, possess features of great value for marine purposes not yet fully secured in the new boilers. This view refers, however, to boilers for ships other than torpedo craft, which have requirements that only water-tube boilers can now fulfill. Within these limits the contention in favor of cylindrical boilers does not appear groundless.

In fact, the marine cylindrical boiler is not a new production of the inventive genius of man, but is the result of experience of two generations at sea. It is the last stage reached of development and improvement, under existing practical conditions, of an organ in the evolution of the entire organism, the steamship, to which it belongs. And, in such a long adaptation to surrounding conditions, the marine boiler, from the early types to the present one, has in effect developed features of real fitness for ocean navigation, and reached a state of perfection not easy to attain immediately with any new boiler.

The prominent features of the modern marine cylindrical boilers are well known, viz, efficiency, simplicity of parts, fewness of bolted joints, durability, easiness of inside inspection, fitness to available space on board ships, small liability to derangement, possible concentration of large power in few boilers, so reducing number and complication of pipes and fittings, steadiness of action, by which water feed and steam pressure are under easy control, facility of repair of the heating tubes under steam, adaptability for temporary use of sea water for supplementary feed, etc.

Although some of the foregoing characteristics may be claimed also for water-tube boilers of various types, others of them are certainly special to the cylindrical boiler, and it is to these important features that cylindrical boilers owe their success in the domain of ocean navigation and the present campaign in their favor.

In this respect it is worth notice that, if we except France, where water-tube boilers of the Belleville and a few other types are in general use both for merchant and war ships, in England and other countries the mercantile marine has not yet shown any marked propensity to abandon its familiar and faithful servant; while the navies, although now in full swing for the new boilers, began really to feel the want of a change only when the cylindrical boilers appeared unsuitable to forced draft. I use on purpose the word "appeared," because I think it is not yet proved whether the proclaimed unsuitableness is unavoidably due to organic constitution of the boilers, or to the magnitude of the extra strain and suddenness with which it was applied before the boilers were given time to adapt themselves to the new demands made upon them.

In support of this view, the very good results obtained with the Serve tubes and with the Howden and Brown systems of combustion, by which the steaming power of marine cylindrical boilers, per unit area of wetted heating surface, has been brought up to the limits which were lately deemed dangerous, might be mentioned; but, apart from these arrangements, which, if efficient in increasing the specific power of the boilers, have certainly not improved them in respect to lightness and suitableness to rapid steaming—which are prominent features of the water-tube boilers—it may be asked: Have cylindrical boilers reached their last stage of development? Can not such boilers compete much longer, or must they soon give way to the newcomers?

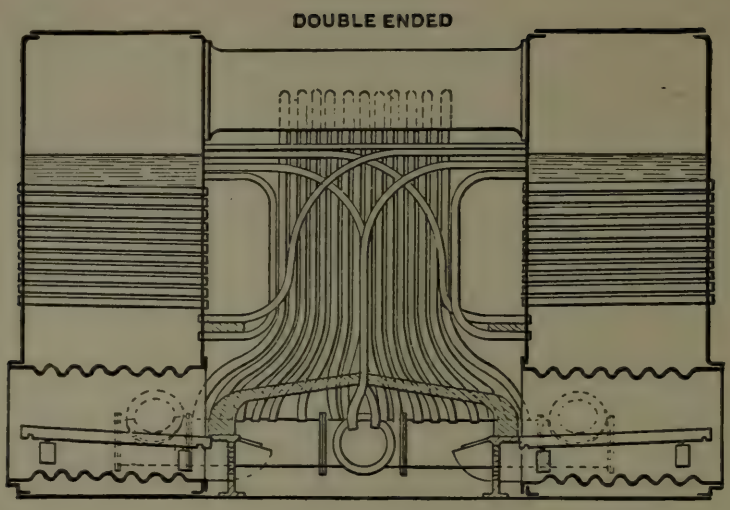


Fig. 5.—Longitudinal vertical section.

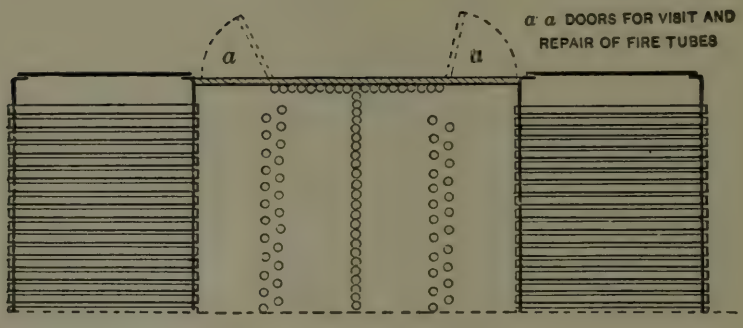


Fig. 6.—Horizontal section, fig. 5.

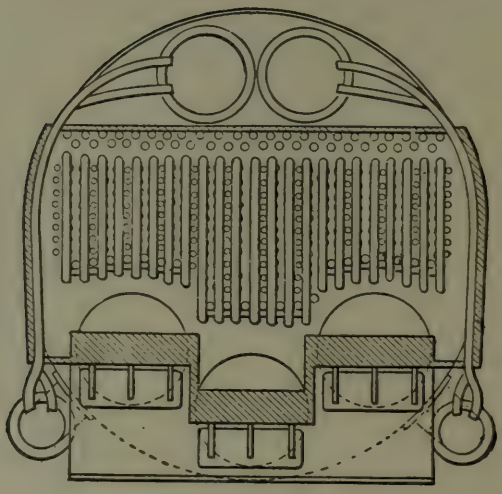


Fig. 7.—Transverse vertical section, fig. 5.

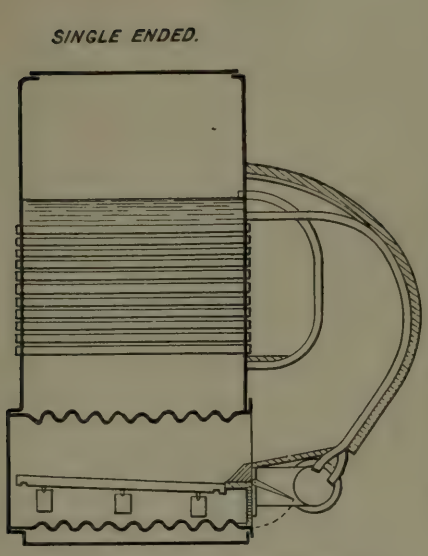


Fig. 1.—Longitudinal vertical section.

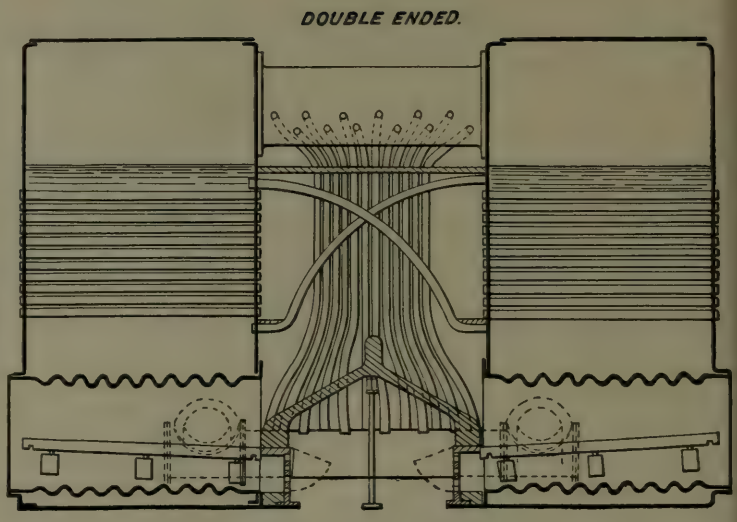


Fig. 3.—Longitudinal vertical section.

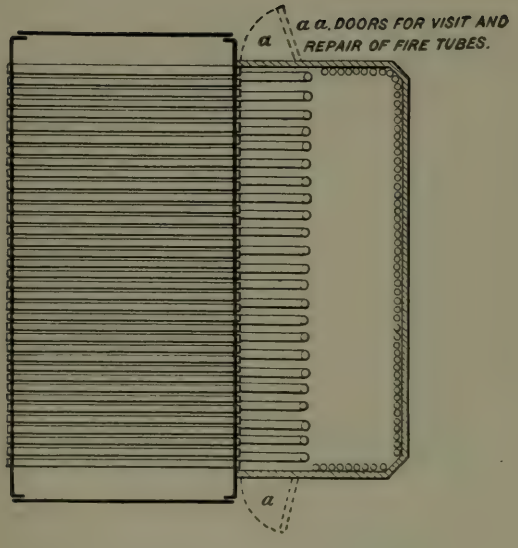


Fig. 2.—Horizontal section, fig. 1.

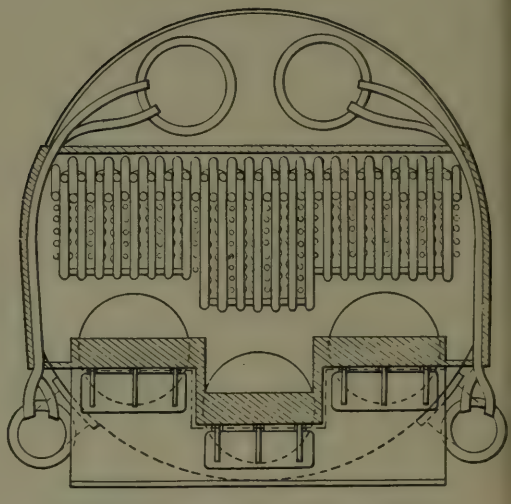


Fig. 4.—Transverse vertical section, fig. 3.

Well, while it is pretty certain that, owing to certain important advantages which water-tube boilers offer, principally for navy purposes, the difficulties which still beset their general adoption will be vigorously attacked and finally overcome, I think, from what has been said above, that cylindrical boilers not only have, as yet, a great power of endurance in the mercantile competition, but that there is still room on their side for further improvement, by which their vitality may be increased and the struggle prolonged, even for navy purposes, with advantage to the great interests involved.

This new vitality may, I think, be conferred on cylindrical boilers by "compounding" them with water tubes in such a way as to make them partake, to a certain extent, of the good features of the water-tube boilers, without detracting much from their own valuable characteristics.

There are already in the market various compound boilers, viz, boilers having the heating surface made up both of water and fire tubes.

Such are the Roger's boiler, the Barthlet's boiler, the Anderson & Lyall's boiler, etc., but none of them, as far as I know, may be styled "a real compound marine cylindrical boiler." Even the Anderson & Lyall boiler, although more akin to it, is altogether a different thing; it is a special boiler of itself, having features which belong to various types, resembling a locomotive boiler in its furnace, a marine boiler in its combustion chamber, and a stationary boiler in its barrel.

In saying so I do not wish to disparage these boilers, which, on the contrary, appear very good and efficient, but simply to show that they are not the kind of boiler I mean, viz, a marine cylindrical boiler compounded with water tubes to the extent that is necessary to give protection to the tubes and tube plates, and improve the boiler also in other respects (such as economy of weight, fitness to rapid changes of temperature, etc.), but without altering its main characters.

Such a result may, in my opinion, be achieved simply by doing away altogether with the water spaces around the ordinary combustion chambers, and substituting for them water tubes, some of which would be properly arranged as a protecting screen in front of the tubes and tube plates.

My meaning will perhaps be clearer by reference to figs. 1 to 4, in which the proposed alteration is sketched as applied both to single and double ended cylindrical boilers. Such boilers, if successful, would be lighter, simpler, less sensitive to difference of temperature and to rapid changes of fire; while the screen of water tubes in front of the tube plates would in them, as in the Anderson & Lyall boiler, protect to a great extent plates and tubes from damage under forced-draft. In other words, these boilers would fulfill most of the requirements of modern steaming at sea, and exert, if adopted, a useful function in the present period of transition, which, by them, would become longer and smoother. The benefit would be mainly felt by the mercantile marine, on account of the larger interests involved, and because of its requirements, to which the ordinary marine boilers appear on the whole so well suited.

Another advantage of the arrangement I propose would be the facility of admitting air under the back end of the fire grate, in a proper measure, to improve the efficiency of combustion, through a regulating door fitted under the bridge and underneath the casing of water tubes forming the combustion chambers.

In marine engineering I am only a dilettante, therefore, in what I have had the honor to say my aim has been simply to raise a question which seems important and to elicit discussion by the experienced members of the institution. My suggestions may be briefly summarized as follows, with a view to meet discussion:

(1) For swift vessels of small dimensions, designed for the use of torpedoes or special services, water-tube boilers are a necessity.

(2) For certain classes of war ships of large size water-tube boilers are distinctly advantageous.

(3) For mercantile purposes and many classes of war ships the water-tube boilers are not yet perfectly suitable, and the cylindrical type of marine boiler is still to be preferred, and its continued employment is probable for some considerable time.

(4) There is a possibility of retaining the most valuable characteristics of the cylindrical type, while securing increased efficiency and fitness to meet the exigencies of modern steaming, by means of arrangements of water tubes somewhat of the character illustrated by figs. 1 to 7.

As stated elsewhere, the largest vessels in the British navy having water-tube boilers are the armored cruisers *Powerful* and *Terrible*. A complete description of these boilers as fitted in large vessels, taken from Engineering, is given here as being of special interest at this time when the controversy is at its height:

Each boiler consists of a series of sets of tubes, placed side by side over the furnace, and inclosed in nonconducting casings. Each set of tubes, called an element, is constructed in the form of a flattened spiral, and consists of a number of straight tubes, connected at the ends by means of a casting, termed a junction box. The junction boxes of each element are built vertically over each other, and tubes enter and leave these on the same level. The boxes at the back end of the boiler are close-ended, but those toward the stoking platform have holes in them to permit of the inspection of the inside of the tubes, these holes being closed by specially constructed doors, kept tight by the boiler pressure. The tubes are all slightly inclined to the horizontal, and the lowest box of each element is connected, by means of a special form of conical joint, secured by bolts, to a horizontal cross tube of square section, forming a feed collector. Each element is also connected at its upper end, by a similar bolted joint, to the lower side of a horizontal cross drum, which performs the duties of a steam collector, and on the upper side of which is placed the main stop valve. Two external circulating pipes connect the bottom of the steam collector with two depositing chambers or mud boxes, placed at each end, and to be described later, and whose upper ends are in turn connected with the end of the horizontal feed collector. The boiler feed water is delivered by either the main or auxiliary feed system to the adjustable feed-regulating valve, placed in a convenient position for adjustment from the stoking platform. From thence it passes through the valve of the automatic feed regulator up to the feed check valve placed on the steam collector, midway between its ends and slightly below its horizontal center. These special features we shall describe later.

Circulation takes place by each element receiving a supply of water from the horizontal feed collector into its lowest tube; this water is partly evaporated here, and passes, part as steam and part as water, through the back junction box, into the tube above it, where a further portion of the water is evaporated. Each tube, therefore, has to convey all the steam made in those tubes of the same element which are below it as well as that formed within itself. A mixture of steam and water is thus continuously discharged from each element into the collector. The water so circulated mixes with the fresh feed water, and both pass along the bottom of the collector, and by means of the external circulating pipes, placed at either end, into their respective mud boxes, and thence into the feed collector, again to be circulated through the elements.

The function of the mud boxes, which are illustrated by figs. 18 and 19, is important. Deposits on the heating surfaces of marine boilers, arising from the presence of small quantities of sea water and grease in the boiler feed, have always been a source of trouble, and frequently of accident. It is with the view to obviating the deposits on these surfaces that the depositing chambers or mud boxes have been arranged. Two tanks containing limewater are provided (fig. 23). In the lime tank an inlet pipe is attached to the top, and the outlet is regulated by a cock situated on the side of the tank near the bottom. Lime is put into the tank by a manhole, and the portion of the feed water diverted through the tank becomes impregnated to the desired degree by means of the regulating valves provided. The diluted feed, as it passes along the bottom of the steam collector, together with the water

which issues from the various elements, is raised to the temperature of evaporation before reaching the external circulating pipes. Here it is found that the lime salts contained in the feed water, together with those added from the tanks to the feed, separate out in a solid noncrystalline form, but in a state of very high subdivision; and in being precipitated they carry down with them the small globules of oil which may have gained admission to the feed. This precipitate gathers in the lower part of the depositing or mud chambers in the form of a greasy mud, and can be removed through the blow-off valves fitted at the bottom, while the purified feed water flows off the top into the cross feed collectors. There is a vertical pipe screwed into the top of each mud box, and it conveys the return water together with the boiler feed water from the steam collector, and a horizontal branch on the side communicates with the feed collector. A vertical web extending from the top of the mud box intervenes between these inlet and outlet orifices, and is carried to a sufficient depth in order to prevent the direct passage of water from the one to the other. The down-coming water, together with the suspended greasy mud, descends along the side of the mud box, and as its movement is relatively slow, the precipitated mud and lime salts continue to descend by virtue of their greater density, and are deposited at the bottom of the vessel, while the purified water flows off at the top into the feed collector by the exit branch. The blow-off valve for removing this deposit is shown on the bottom of the mud box, and the valve fitted on the side is for draining the boilers into the reserve fresh-water tanks, in accordance with the usual Admiralty requirements. A couple of handholes with doors, similar to those of the junction boxes, are also provided.

The Belleville automatic feed regulator, illustrated in detail by figs. 20 and 21, consists of a cast-steel vessel in direct communication with the boiler by two connections, one pipe entering its lower end and connecting it with the feed collector, the other pipe being attached to the top of the apparatus and connecting it with the seventh junction box of the generating element nearest to it. The lower part of the vessel contains a float, guided at its lower end by a rod, which enters a hole in the bridge piece carried by the bottom cover. The float is suspended by another rod from a lever which rests on knife edges, and which carries a roller at its other extremity. This roller lifts a rod, which is connected to an external lever, from one of whose extremities is suspended a counterweight consisting of a spring, bearing against a lug on the top cover, and of lead disks, of which some are placed on the upper end of the rod of the counterweight, in order that their number may be more readily varied. The weight of the float is thus placed *in equilibrio*, partly on account of its displacement from the water of the vessel, and partly by the action of the counterweights. In this condition, the regulating feed valve uncovers its opening to a certain extent, and the inlet feed water, entering through the outer check valve, flows through the regulating valve, and up to the feed check valve on the side of the steam collector. If the water level sinks, the float sinks also, to preserve its equilibrium, and the internal lever lifts the rod attached to the external lever, which presses down the regulating feed valve, and so enlarges the passage for the feed water. If the water level rises, the float rises also, in order to preserve its equilibrium, and the roller on the end of the internal lever descends. The counterweight causes the rod which presses on this roller to follow its motion, so that the external lever in sinking on the side of the counterweight, rises on the other side, lifting the regulating feed valve, which diminishes the section of the passage for feed water. Thus the float acts continuously for maintaining the water level at the same height in the apparatus.

This level will be higher or lower according as the counterweight is loaded with a greater or less number of lead disks. Thus the level is raised by adding some disks and is lowered by removing some. It should be remarked that the pressure exerted by the steam on the lower side of the feed regulating valve always tends to close it, while, on the other hand, the pressure of the steam in the apparatus, which acts upon the rod in connection with the external lever, tends, on the contrary, to

open the feed valve. The diameters of the feed regulating valve and of this rod, together with the proportions of their respective levers, are so regulated that these two pressures are *in equilibrio*, and that, therefore, they have no influence upon the action of the automatic apparatus.

One of the most important features in the working of the Belleville boilers is the regulation of the feed for a determined degree of dryness of the steam. When the boiler is at rest the water level is at the same height in the feed apparatus and in the boiler; but when steam is being raised the resistance which the steam mixed with the water experiences in circulating through the tubes produces a reaction which causes the water level to rise in the feed apparatus in proportion as the evaporation is more active. On the other hand, as the quantity of water carried by the steam tends to increase with the rate of evaporation, it is necessary, in order that the steam should arrive in the steam collector always at the same degree of dryness, that the quantity of water contained in the boiler should vary in an inverse ratio to the activity of the fire. This result is obtained by the automatic feed apparatus illustrated by fig. 21. The height of the water level in the feed regulator being regulated once for all, the supply is cut off automatically when this level is attained. From this it results that if the combustion becomes more active the evaporation increases, and the water level rises in the regulator. The balance arrangement reduces the passage of the feed, and the quantity of water contained in the boiler diminishes progressively, according as the rate of combustion increases. On the other hand, if the rate of combustion diminishes, the evaporation becomes less active, and the level sinks in the apparatus, which causes the opening of the feed regulating valve to be increased, and the quantity of water contained in the boiler increases progressively according as the rate of combustion decreases. In the one as in the other case the quantity of water contained in the boiler is always in an inverse proportion to the rate of combustion, and the degree of dryness of the steam always remains practically the same whatever may be the activity of the fires.

There are in all forty-eight boilers for the *Terrible*, located in eight boiler rooms, and arranged symmetrically on each side of the central longitudinal water-tight bulkhead. The four after spaces on each side of the vessel contain eight boilers, respectively arranged in three groups, the forward and after groups each consisting of two boilers placed side by side, and the center group of two pairs of boilers placed back to back and fired from athwartship stokeholes (figs. 14 to 17). The remaining sixteen boilers are placed in four forward boiler rooms, situated likewise in pairs on each side of the central bulkhead, and fired from longitudinal stokeholes. This difference in arrangement is necessitated by the fineness of form of the vessel at this part. The funnels are four in number, of oval section, one to each transverse division. They are of different cross dimensions, to suit the number of boilers leading to each, but the longitudinal dimensions have been kept the same in all four, in order to accord with the general symmetry of the ship. The height of each funnel from grate is 80 feet. To supply the air required for suitable deflection of the furnace flames and for admixture with the gases for insuring complete combustion, eight air-compressing engines are supplied and fitted in the boiler rooms, there being one double-cylinder compressor for each of the four large compartments, and a single-cylinder compressor for each of the four smaller forward spaces. The air is injected into the furnace from a nozzle box placed on the front of the boiler immediately above the furnace doors, and extending the whole width of the fire grate. This air is discharged over the fire through small nozzles, which divide it into thin streams. The total grate surface is 2,200 square feet and the total heating surface 67,800 square feet, which should give an ample margin of boiler power even when compared with merchant service proportions.

In the case of the *Terrible's* boilers the junction boxes are malleable cast iron and the tubes are mild steel lap-welded, 4½ inches outside diameter, and varying in thickness from three-eighths inch for those of the lower to three-sixteenths inch for the

uppermost rows. The tubes are screwed into the back boxes, the pitch of the screw on the tube being very slightly different from that of the box, so as to form a metallic joint between them. A jam nut is added for greater security. A similar device is employed for the front ends, with this exception, that, instead of both tubes entering the box, one is connected by means of a screwed coupling nut to a projecting nipple. This arrangement is adopted to facilitate the removal of the tubes which form the elements. The casings which inclose these elements are particularly deserving of notice, from the careful manner in which they have been designed so as to secure the requisite stability, together with a minimum of weight. The radiating surfaces of these casings, as well as of the steam collectors, have been covered with a layer of asbestos 3 inches thick, which is in turn protected by thin plates securely and neatly fastened.

The feed arrangements for supplying the forty-eight boilers have been most carefully worked out, and every precaution has been taken to insure the efficiency of the system against any contingency. The arrangement comprises a main and auxiliary system of pumps and pipes which are separate and independent of each other. Four sets of evaporators and two distilling condensers have been provided in the after auxiliary machinery space, together with the necessary pumps, etc., and these have been arranged so as to admit of triple and compound distillation, which greatly increases their efficiency over the ordinary method. The evaporators are capable of producing an aggregate of 26,880 gallons of fresh water per day from sea water, part of which is condensed in the condensers in the form of pure aerated fresh water for ship's drinking purposes, and the remainder is condensed in the auxiliary condensers situated in the engine rooms. From thence it is conveyed to the main feed tanks, so as to make good any loss of water incurred by the machinery through escape of steam and other causes. The main feed system consists of six double-acting pumps of Messrs. G. and J. Weir's well-known special type, three being placed in each engine room. These draw by independent pipes from the feed tanks, and each delivers by a separate pipe to a compartment of eight boilers, whence the water is distributed by branch pipes to the feed regulators attached to the boilers. The eight pumps of the auxiliary feed system, likewise of Messrs. Weir's manufacture, are placed one in each boiler room; those in the four aft (?) rooms are the same size as the main feed pumps, while all are capable of supplying their own boiler room at full power. These auxiliary pumps are also connected to the main feed tanks by independent pipes, and in addition have separate connection to the reserve fresh-water tanks and the sea, and each discharges to the feed regulators in connection with the boilers.

The main steam supply is conveyed by six lines of steel steam pipes, three lines being arranged on each side of the central bulkhead, and these, being each entirely independent of the other, as are also the connecting pipes from the boilers to each of these lines. Any boiler may, therefore, be cut out from the system without interfering with the performance of the others in its compartment, as may also any compartment from which one of these main steam pipes lead, without affecting the efficiency of the other compartments. Any group of boilers may supply steam to any of the engines.

The reduction of the pressure of steam from 260 to 210 pounds is secured by valves placed in the engine room. It is effected by means of wiredrawing. A cylindrical bell-shaped "gridiron" valve is employed, illustrated by figs. 24 and 25, on page —. This valve has its ports cut in planes at right angles to the axis, and extending about two-thirds of the circumference. Similar ports are cut in the circular valve face, which is secured into the valve chest in a manner similar to the liner of a piston valve into the cylinder casting. The inlet steam is led round the back of the valve face, and thence flowing through the narrow circumferential openings between it and the valve, enters the center of the hollow valve and escapes without further obstruction by the mouth of the bell to the outlet branch. The valve chest is carried up over the dome of this valve, and through a special form of stuffing box at

the top, projects a spindle which is in connection with this dome. This spindle is jointed at its upper or exterior end to a lever, whose fulcrum is at its other extremity. At its center is poised, on steel knife edges, a cross beam, from each of whose ends hangs a frame of springs. The lower ends of these frames are likewise attached to a similar cross beam, and an adjusting hand screw, yoked through a stiff projection from the bottom cover of the valve chest, is attached to the center of this beam.

As the space between the dome of the valve and the exterior valve chest is, practically, not under steam pressure, it follows that the upward pressure of the steam, which has passed through the valve openings on the interior of the dome of the valve, is resisted by the extension of the springs. By adjusting this extension, either by means of adding more springs to the frame, or by removing some, as well as by means of the hand screw for finer variations, the openings of the circumferential ports may be regulated to any desired degree, and in consequence a corresponding reduction of pressure may be effected. The details of these valves have been most carefully elaborated, and are the results of many years' experience on the part of Messrs. Delaunay, Belleville & Co. A small safety valve, loaded so as to blow off at about the "reduced pressure," is placed on the outer branch.

Before concluding, it may be remarked that two large pumping engines of Messrs. J. & G. Thomson's duplex pattern are also fitted in each engine room to serve as fire engines and for pumping out the engine and boiler room and tunnel bilges, in addition to the other compartments of the vessel. These pumps are capable of discharging a total of 90,000 gallons per hour, with reduced steam pressure of 150 pounds per square inch at about 80 double strokes per minute. The drains from the main and auxiliary steam pipes, stop and safety valves, and all auxiliary engines throughout the ship, are led by a special service of piping to a special collecting tank, from which the water is pumped by the duplex drain pump to the feed tanks. This special drainage system, which was initiated by the Admiralty some years ago, is a most important factor in reducing the loss of fresh water for the boilers, the significance of which loss is naturally becoming more and more apparent as the power of the engines is increased.

In the use of petroleum, now constantly increasing in favor as a fuel for marine boilers, France takes the lead, using it in mixed combustion with coal. All the new vessels of the French navy will be fitted for burning this auxiliary fuel, and the vessels in commission will also have their boilers converted for this purpose. The petroleum used is refuse oil, of the consistency of thin molasses, of a yellowish color, and comparatively odorless. The liquid fuel is admitted to the furnaces in the form of spray, greatly increasing the intensity of the heat, and in proportion to the amount of petroleum so admitted. The use of forced draft is thereby avoided with the consequent discomfort of the closed fire room; and means are provided of quickly increasing the speed without increasing the labor. The wear and tear on the boilers is less than that produced by forcing the draft. The only waste is that of the fresh water expended in pulverizing the petroleum, for which live steam is required. The various types of pulverizers are shown in an article on liquid fuel by Col. N. Soliani in the "Transactions of the World's Columbian Exposition Engineering Congress," which also gives some results of the use of liquid fuel in Italy. Mr. Jules d'Allest has published another valuable addition to the literature on this important subject.

In the French service the ratio of petroleum to coal burned varies

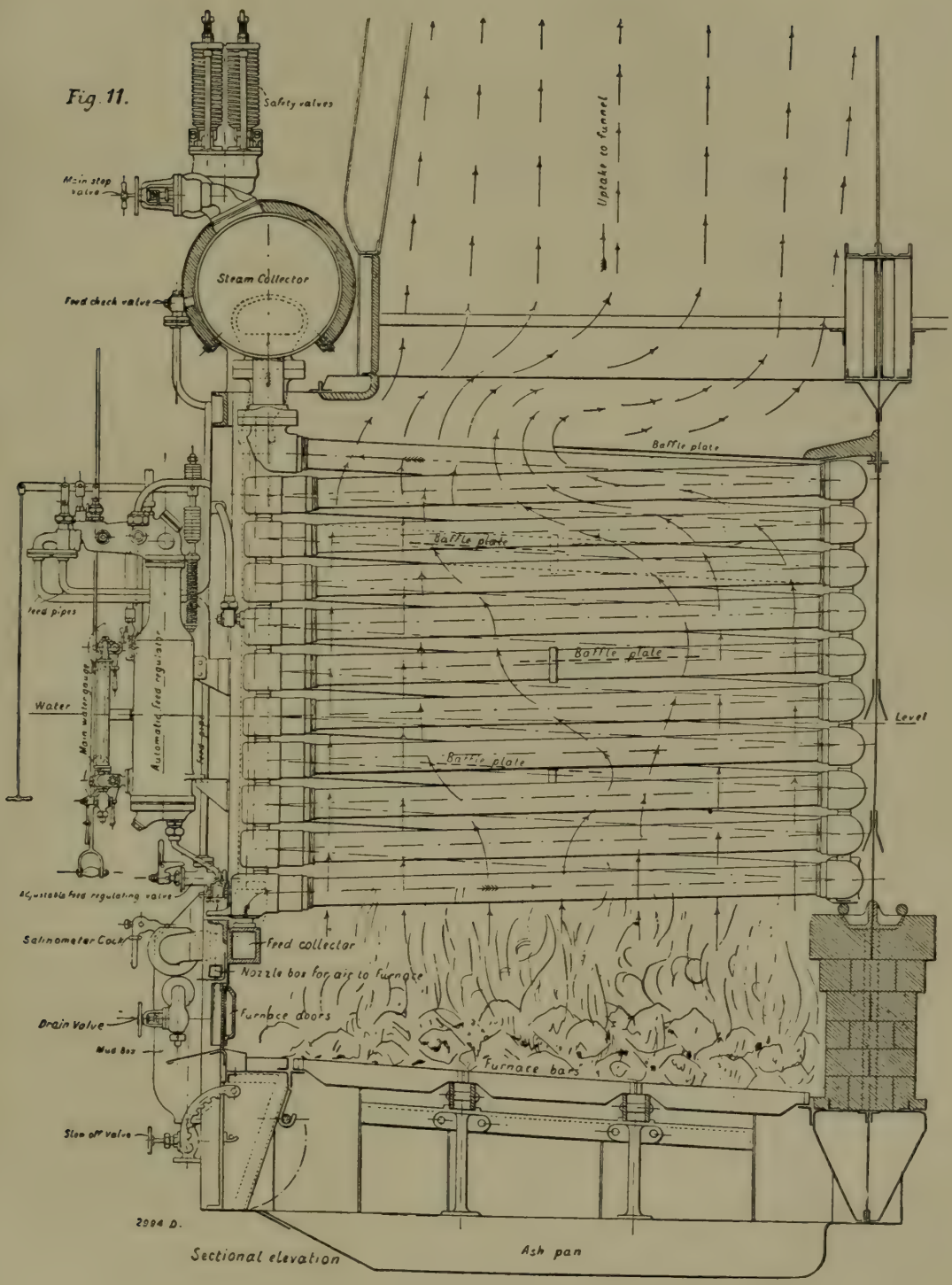

Safety valves
Main stop valve
Steam Collector
Fwd check valve
Uptake to funnel
Baffle plate
Baffle plate
Baffle plate
Baffle plate
Level
feed pipes
Water
Main water gauge
Automatic feed regulator
feed pipe
Adjustable feed regulating valve
Salinometer Cock
feed collector
Nozzle box for air to furnace
Drain Valve
Furnace doors
Mud Box
Furnace bars
Slow off valve
2994 D.
Sectional elevation
Ash pan

Fig. 11.

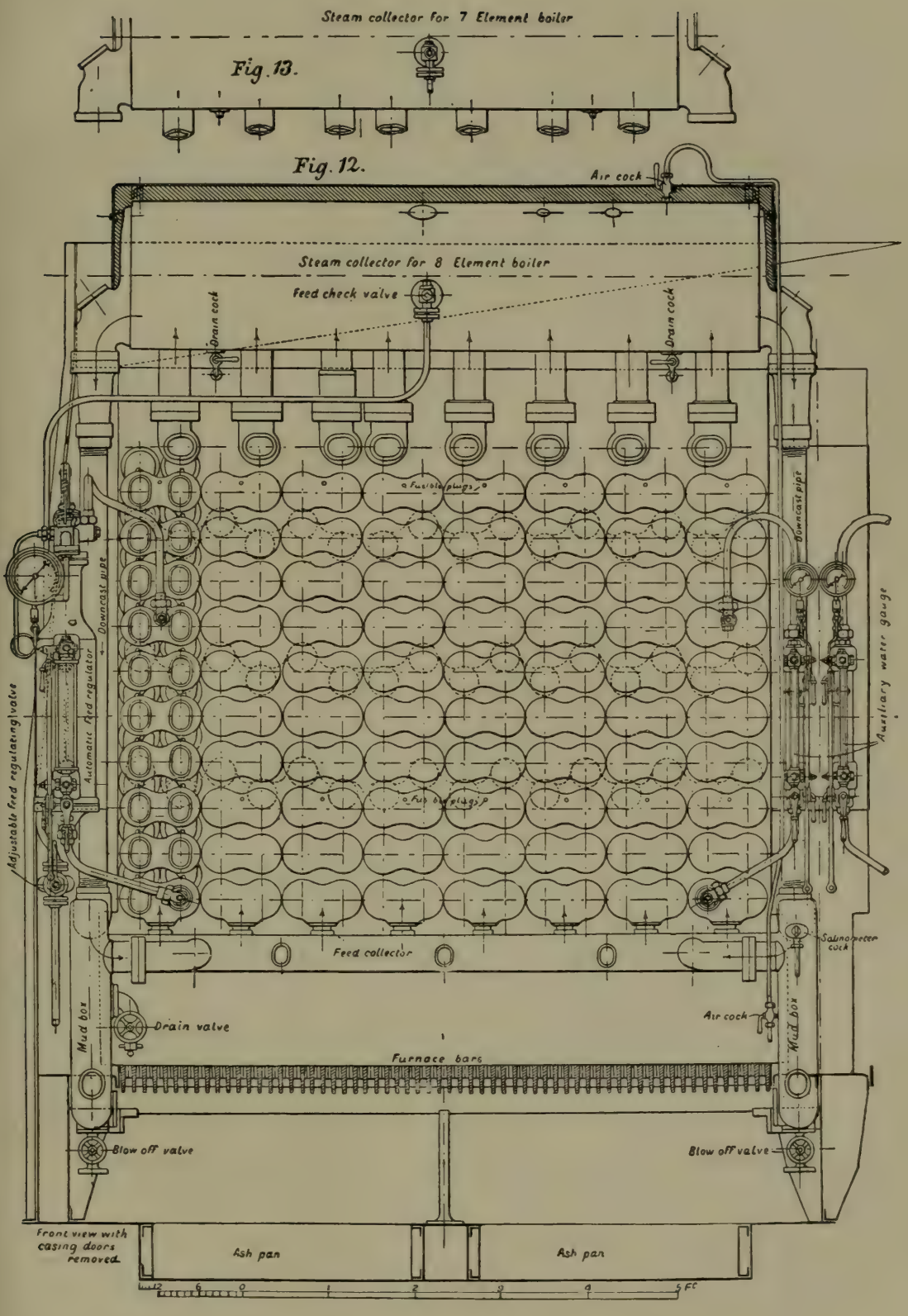

Steam collector for 7 Element boiler
Fig. 13.
Fig. 12.
Air cock
Steam collector for 8 Element boiler
Feed check valve
Drain cock
Drain cock
Fusible plugs
Fusible plugs
Downcast pipe
Downcast pipe
Automatic feed regulator
Adjustable feed regulating valve
Auxiliary water gauge
Feed collector
Salinometer cock
Mud box
Drain valve
Air cock
Mud box
Furnace bars
Blow off valve
Blow off valve
Front view with casing doors removed
Ash pan
Ash pan
0 1 2 3 4 5 Ft

Fig. 14. Sectional Side Elevation Girder to carry Casing Top.

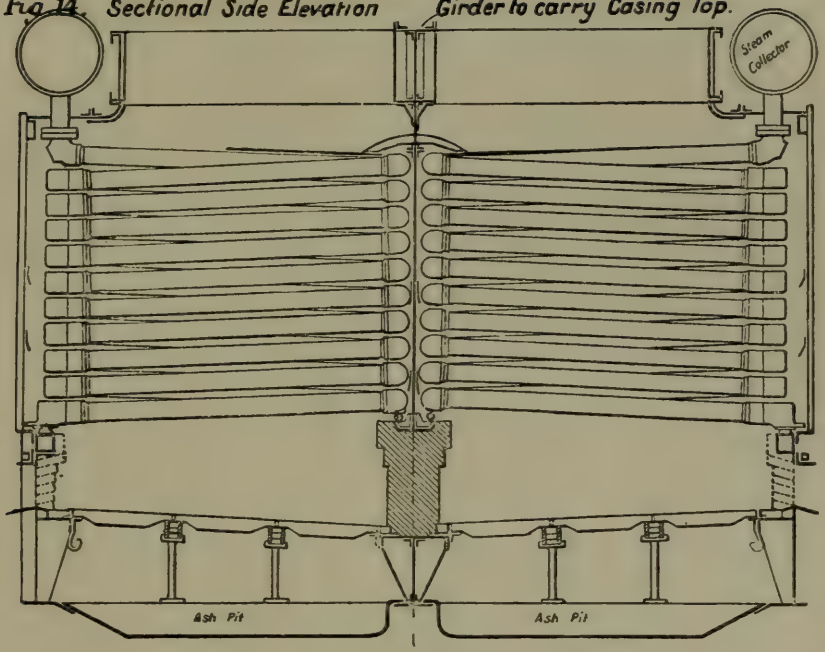
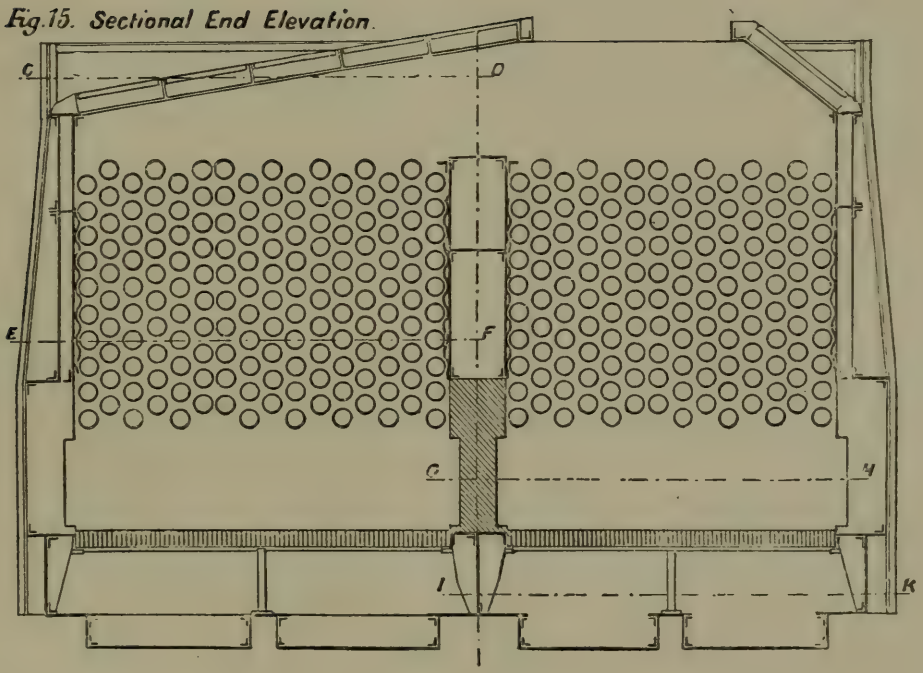
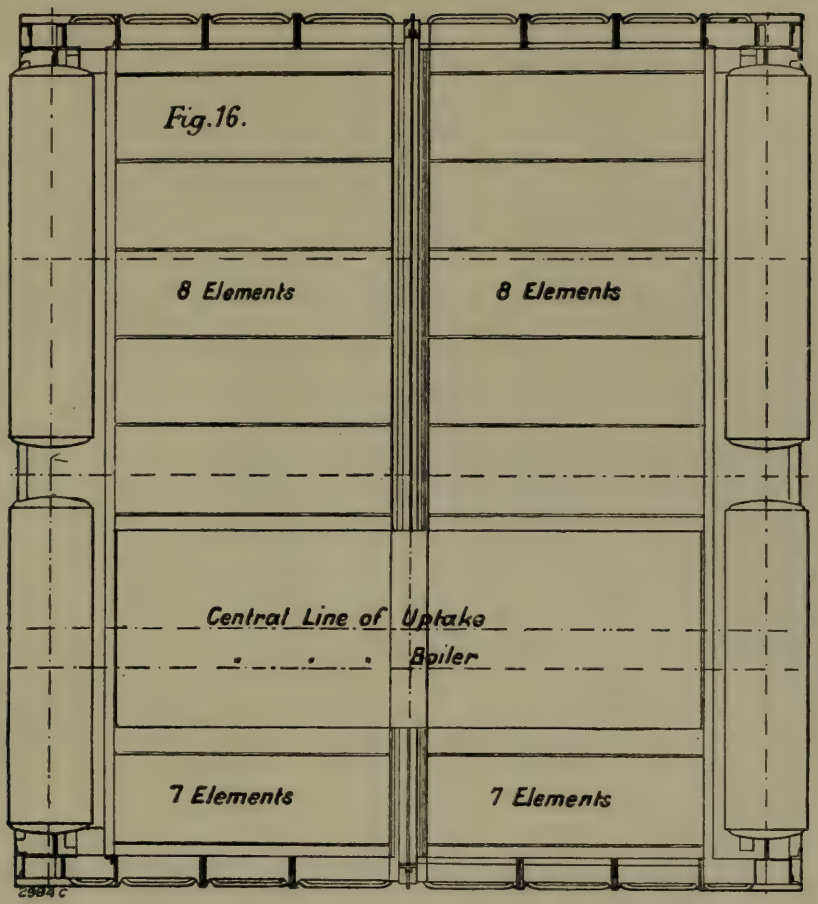
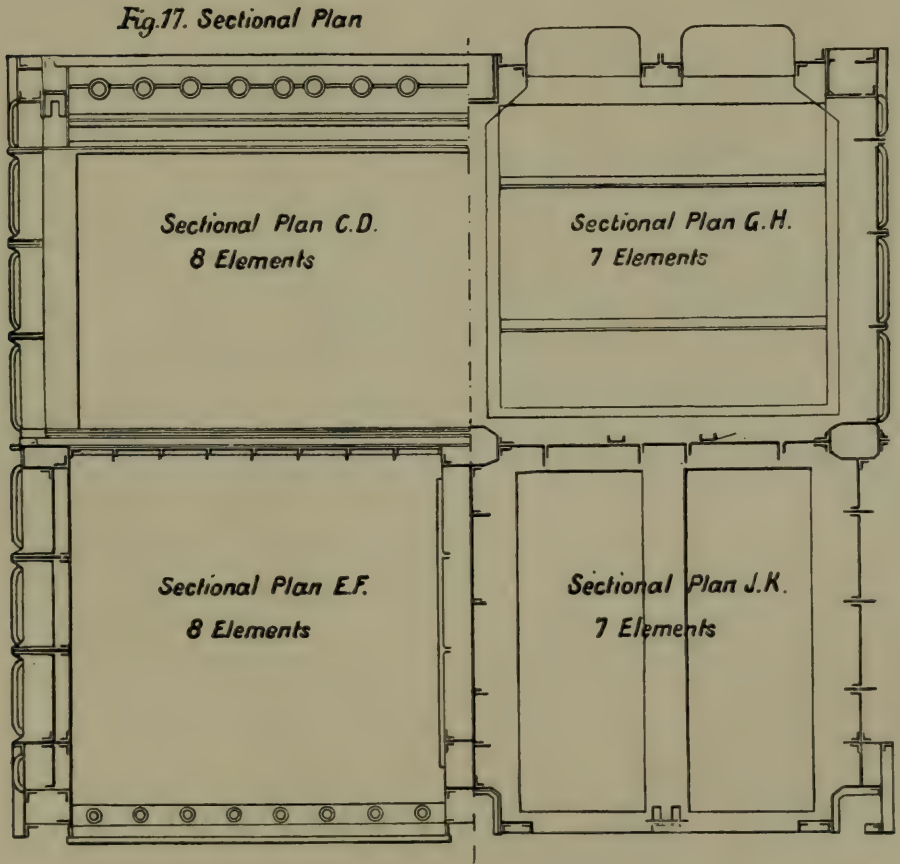


Fig. 15. Sectional End Elevation.




Fig.16.
8 Elements
8 Elements
Central Line of Uptake
Boiler
7 Elements
7 Elements


Fig.17. Sectional Plan
Sectional Plan C.D.
8 Elements
Sectional Plan G.H.
7 Elements
Sectional Plan E.F.
8 Elements
Sectional Plan J.K.
7 Elements

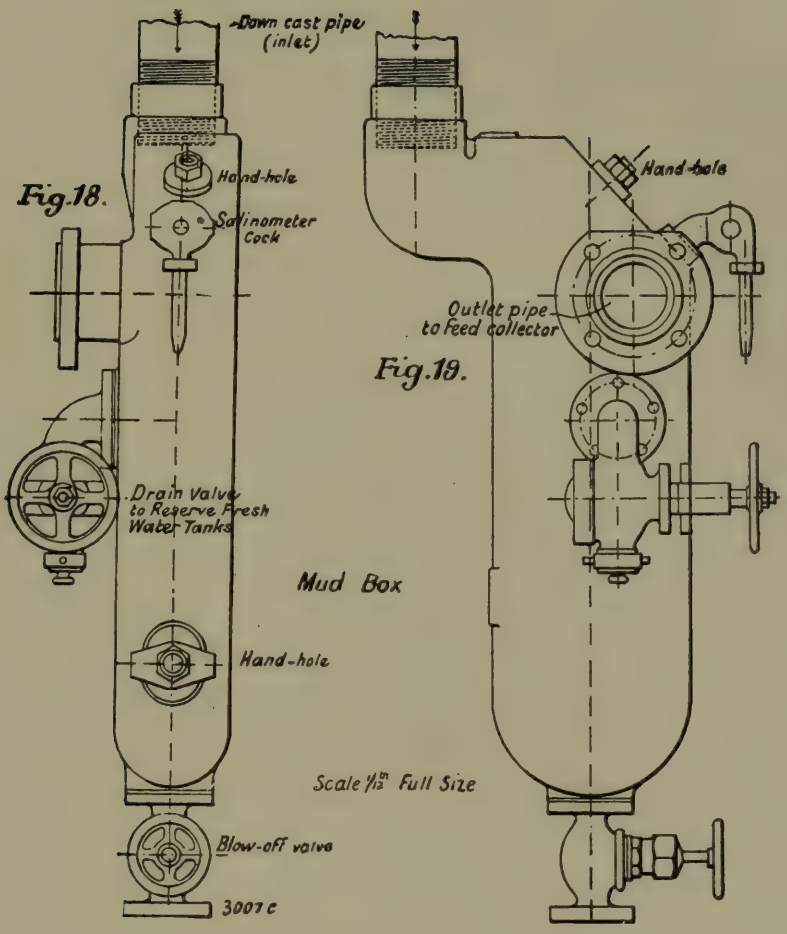
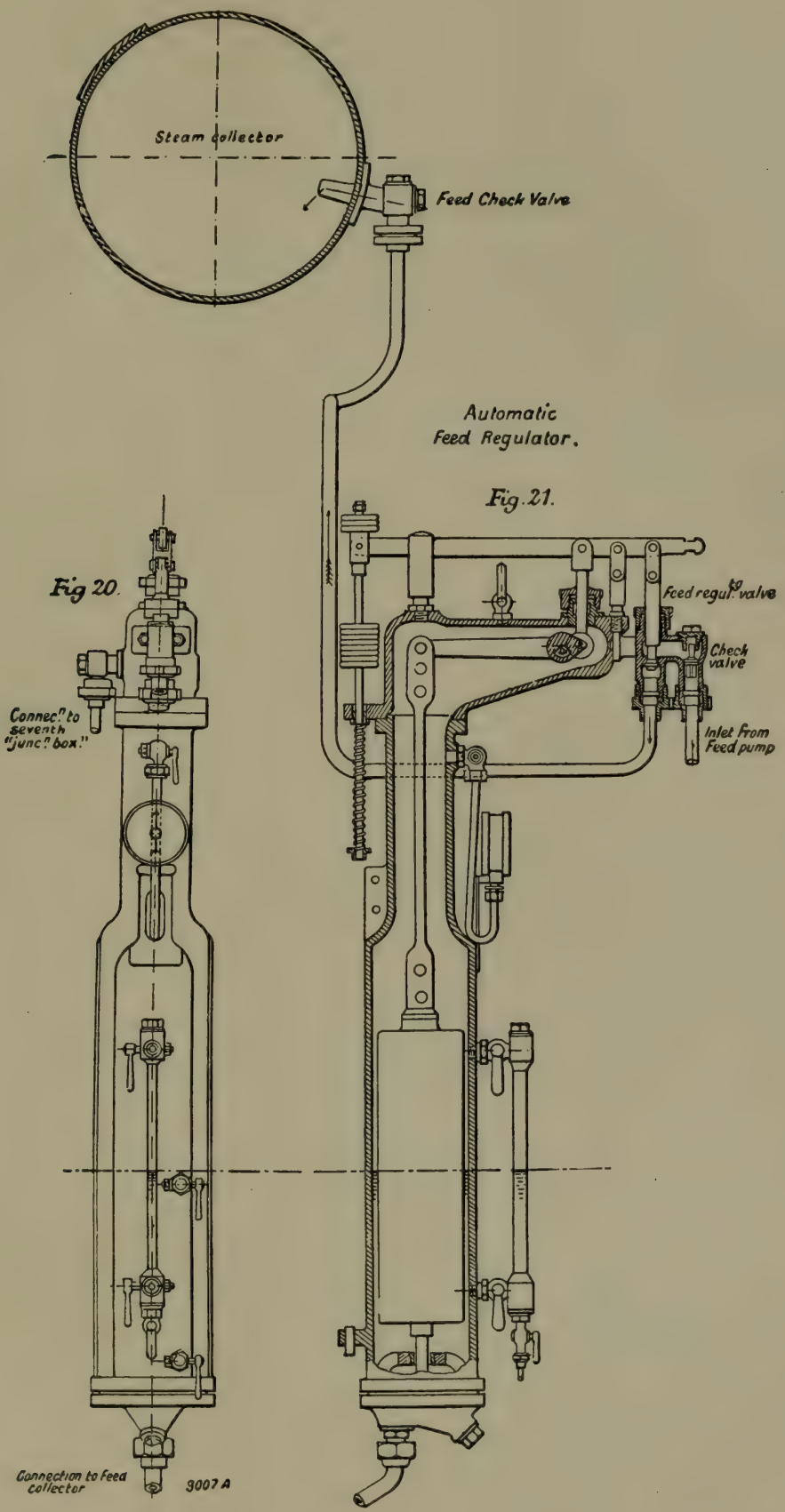
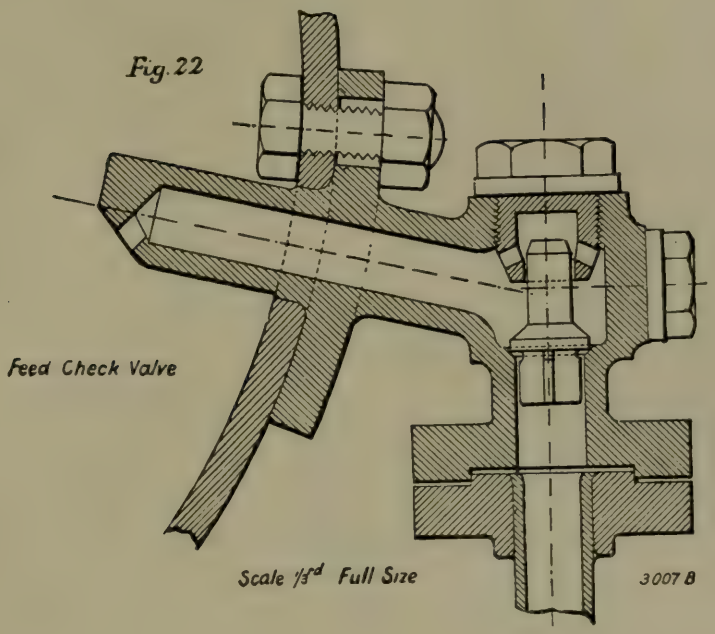
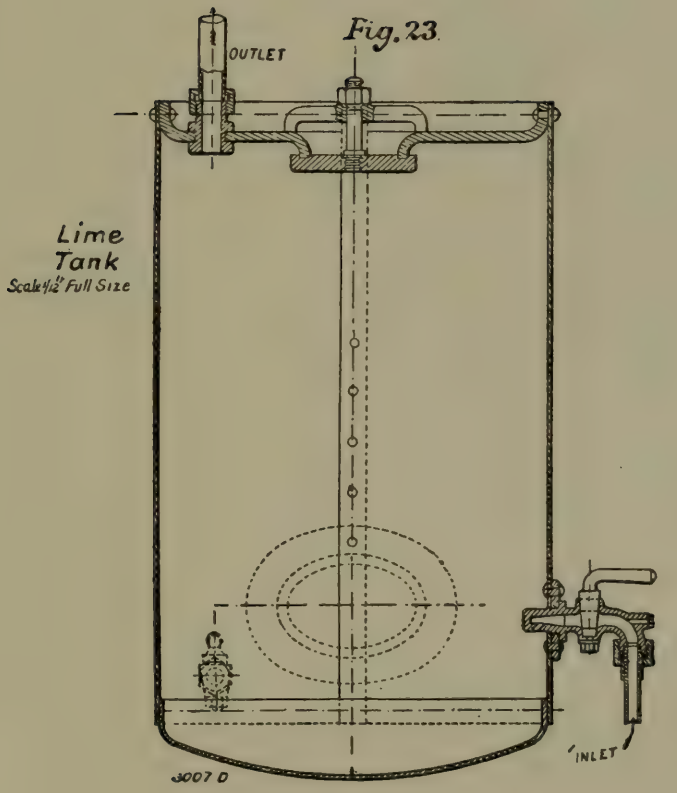

Down cast pipe (inlet)
Hand-hole
Salinometer Cock
Drain Valve to Reserve Fresh Water Tanks
Mud Box
Hand-hole
Blow-off valve
3007 c
Hand-hole
Outlet pipe to feed collector
Scale 1/12 in Full Size

Fig. 18.

Fig. 19.


Steam collector
Feed Check Valve
Automatic
Feed Regulator.
Fig. 21.
Fig 20.
Feed regul.g valve
Check valve
Inlet From Feed pump
Connec.n to seventh "junc.n box."
Connection to Feed collector
3007 A


Fig. 22
Feed Check Valve
Scale 1/3rd Full Size
3007 B


Fig. 23
OUTLET
Lime
Tank
Scale 1/12" Full Size
INLET
3007 D

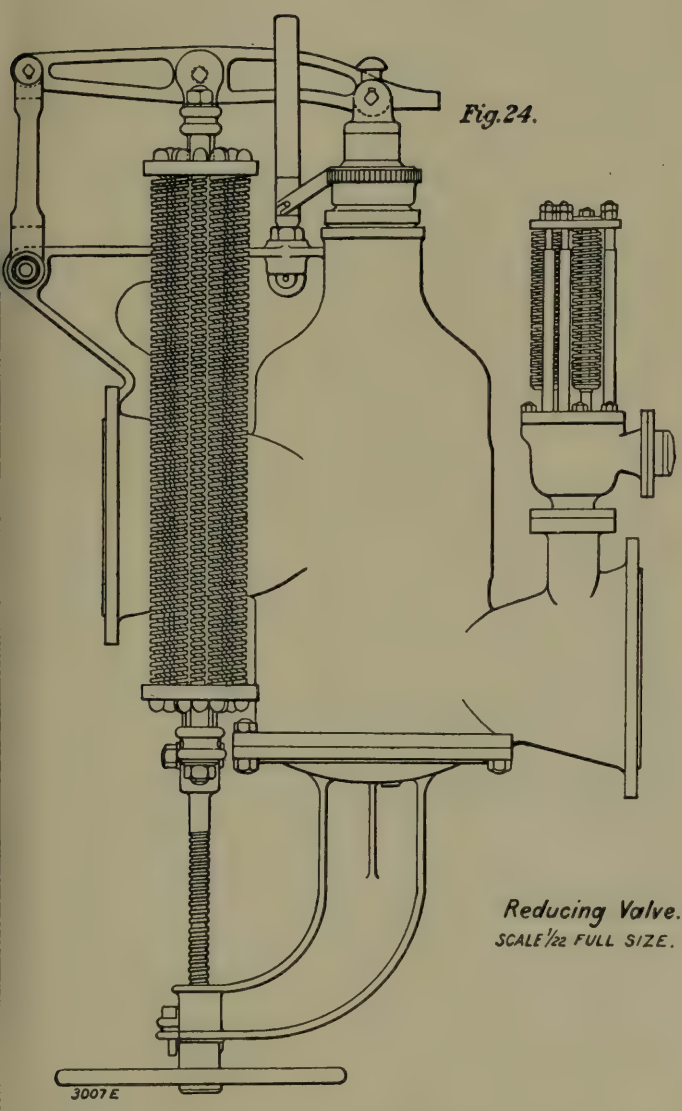


Fig.24.

Reducing Valve.
SCALE 1/22 FULL SIZE.

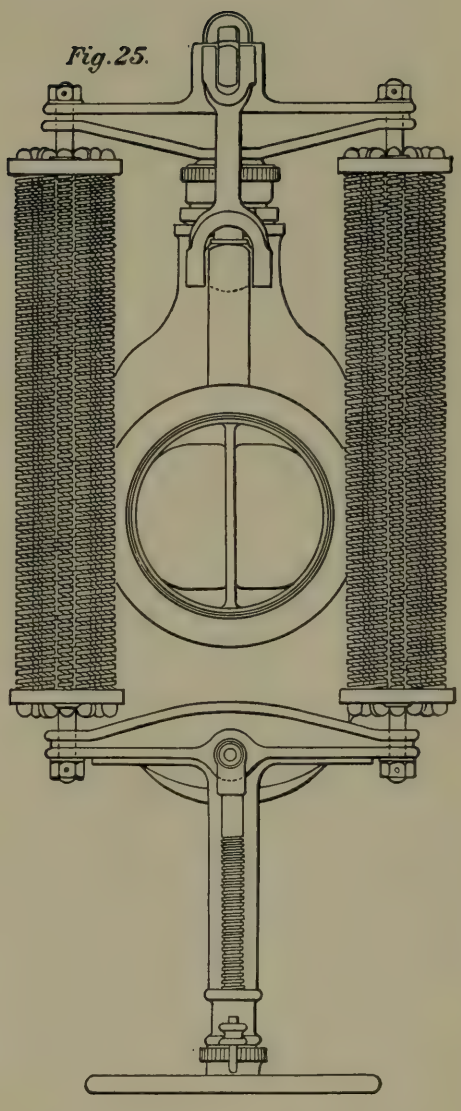


Fig.25.

BELLEVILLE STEAM REDUCING VALVE.

from 0.17 to 0.65, depending on the vessel, type of boiler, thickness of the fire, and degree of forcing required. The heating efficiency of petroleum compared to that of coal is as 10 or 12 to 8. The increased expense of the petroleum prevents its sole use as a fuel, the Russian article delivered in France costing at least twice the price of coal, not taking into account the duties imposed.

A liquid fuel installation consists of: (1) A storage tank holding about 6 tons, placed high in the bunkers to aid the flow of the oil; (2) a pump on the floor of the fire room, which pumps the oil from the tank to a reservoir; (3) a reservoir, consisting of a metal cylinder holding 35 gallons, where the oil is under a slight pressure; (4) a burner for each furnace, with piping from reservoir; (5) piping to conduct live steam to the burners to pulverize the petroleum. The force and fineness of the spray is controlled by valves in the burner, and a shower of pulverized oil is distributed over the surface of the fires.

It has been shown that by using the petroleum, the speed may be increased from 8 to 13 knots in from seven to fifteen minutes, without increasing the expenditure of coal. The larger vessels will carry from 60 to 80 tons of the liquid fuel. It is urged by some that torpedo boats use liquid fuel only, on the ground that for these small vessels it may be made as cheap as coal, after carefully developing the system of combustion to the highest possible state of efficiency. A type of boiler for the sole use of petroleum has been designed by Mr. Seigle, and is under consideration by the French navy department. Great results are claimed for this boiler, whose principal characteristics are: (1) Complete and direct utilization of the heat produced and rapid circulation of the water; (2) division of the single furnace into a number of tubular telescopic furnaces so as to increase the heating surface and consume the fuel regularly; (3) perfect combustion, the gases issuing from the smoke pipe being without trace of carbon monoxide.

Germany is beginning to use liquid fuel more extensively and Italy is installing it in all torpedo boats. The other powers are still in the experimental stage.

V.

NOTES ON VOICE TUBES IN SHIPS.

By Ensign SUMNER E. W. KITTELLE, United States Navy,
Staff Intelligence Officer.

The important question of internal communication on board of vessels of war has heretofore baffled investigators who have sought to overcome all the defects in existing means and obtain a perfect apparatus. The shortcomings of the ordinary system of voice tubes and of the telephone as generally adopted for ships are well known to the seagoing officer. The most important objections to the tubes consist in mouthpieces that admit extraneous noises and confuse the sound, angles and curves in the lead of the pipes that reduce the volume of and set up disturbing vibrations in the sound, porous metal that allows outside noises to enter, vibrations from bulkheads through or along which the pipes pass, and defective signaling to call attention by whistles or bells; while the telephones, though transmitting the sound with greater clearness than the pipes and being less bulky in the leading parts, are more readily disabled. For the transmission of absolute messages, such as ranges to the battery, helm angles to the helmsman, and variations in the movement and speed of the engines to the engineer, the visual indicators are the most accurate, but for more detailed orders some system of speaking must be resorted to.

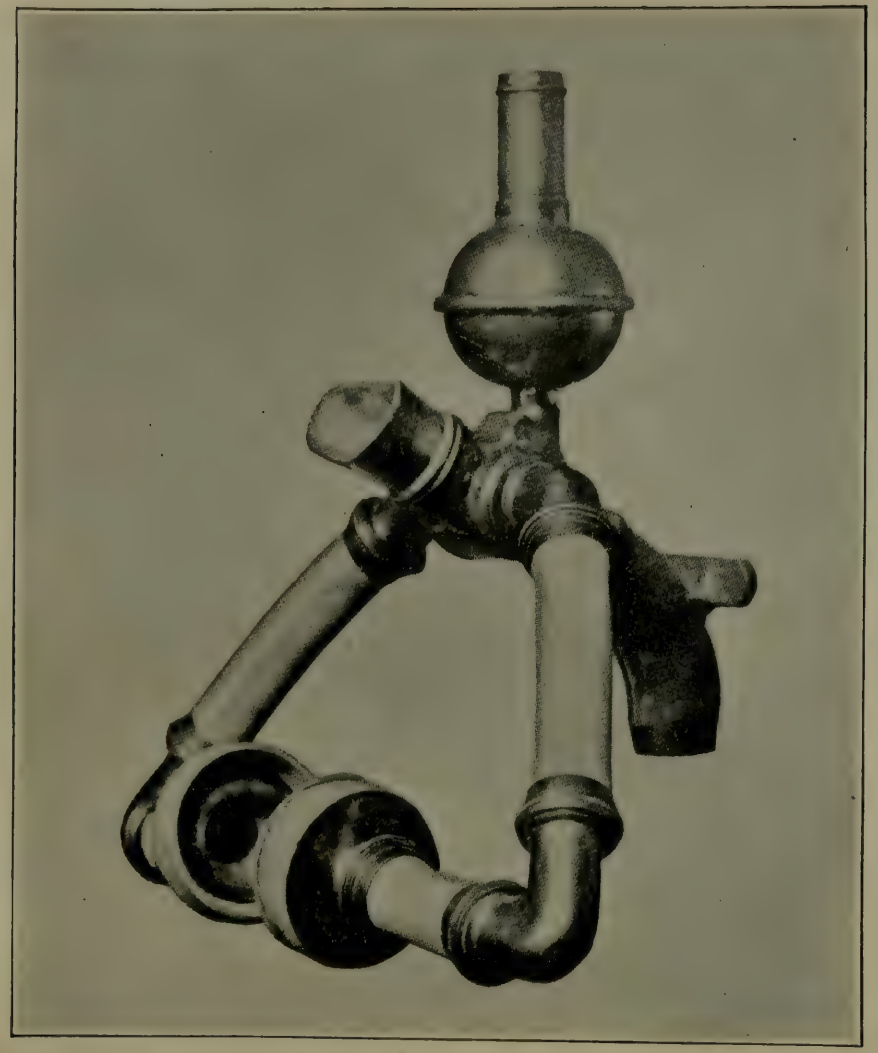
By the British Admiralty the question has been considered for some years, and a commission appointed to develop an ideal voice tube failed to find one. Many improvements were made by Captain Rose, R. N., and others, and experiments were carried out on board of the *Rodney*, *Royal Sovereign*, *Sappho*, *Hawke*, *Blenheim*, *Repulse*, *Hercules*, and *Sybille*, but until recently the results have not been wholly satisfactory.

An Australian, Mr. H. A. Cutmore, has invented what is known as the Homacoustic system of voice pipes, which has been tried on board of the *Fox* with considerable success, and will probably be adopted by the British Admiralty for use in the navy. This system possesses the following advantages, viz: (1) The transmitting and receiving instruments close mechanically; (2) the method of signaling for attention is by an effective pneumatic device; (3) a multiplicity of mouthpieces is avoided by the use of a switch plate, on the principle of the cylinder of a revolver; (4) extraneous noises are completely shut out while speaking and listening simultaneously; (5) a mechanical indicator works perfectly in any sea way; (6) the pipes are made of nonresonant metal;

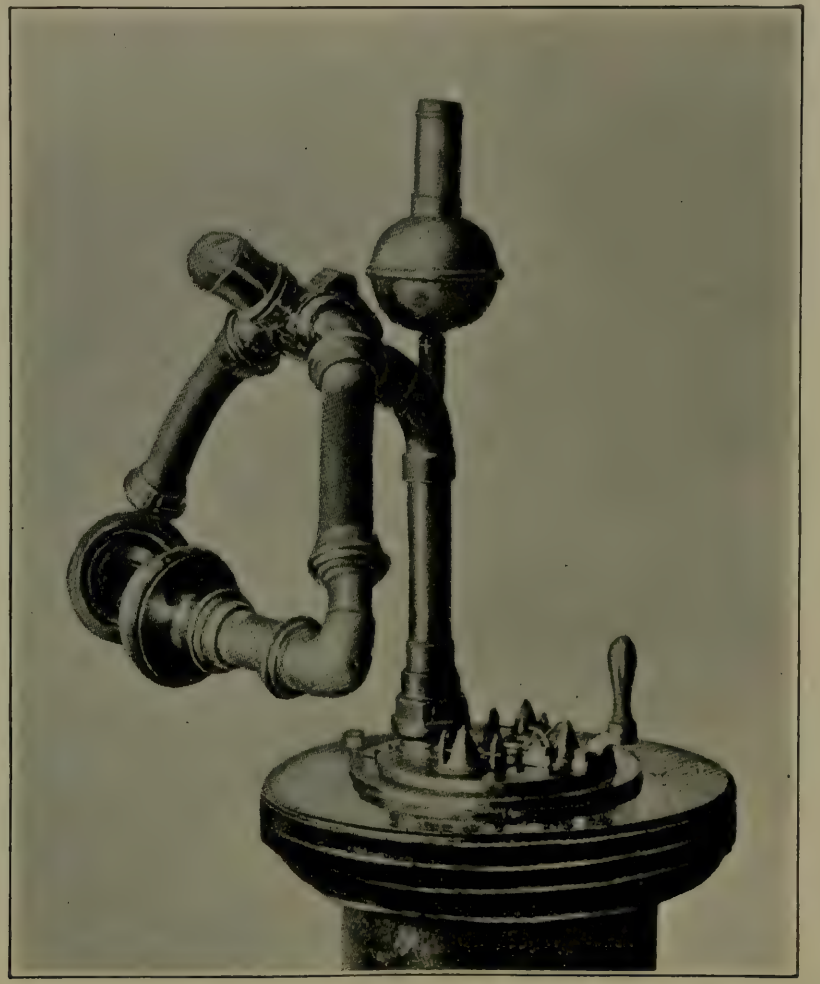
(7) the whole system is insulated from all other hard substances, and the passage through bulkheads is water-tight; (8) at all angles and curves in the pipes the volume of sound is preserved intact by the use of metal reflecting tongues.

The accompanying plates show the switch plate or commutator with the receiving and transmitting instrument attached and the manner of using it. The signaling device, shown by a ball surmounted by a cylinder on top of the instrument, consists of an elastic ball A (see section), preferably of rubber, fitted within a metal or vulcanite sphere E, the bottom of which opens into the voice tube through a small orifice D. The upper portion of the rubber ball ends in tubing, protected by the cylindrical casing B, in the top of which is fitted the whistle C. To sound the call, place the finger over the orifice of the whistle and press the cylinder down smartly, releasing it at once. To open the receiver for conversation, the arms bearing the ear pieces must be raised to a position horizontal with the mouthpiece. The commutator enables one mouthpiece to control two or more tube circuits, and consists of a fixed circular plate F, called the base plate, which is rigidly fixed to the stand and in which the ends of the tube circuits G G G G G G are housed. Over this base plate a flat disk, called the switch plate H, revolves on a central pivot I. The switch plate carries the receiving and transmitting instrument J, the five whistles K K K K K, the handle L for turning the switch plate, and the cup M. The switch plate H is fitted with a number of recesses N N N N N, into which a locking ball O and spring fits, to lock the switch plate in exact coincidence with the various tube terminals. Each of the whistles K has a small cap, which, when the whistle is sounded, flies over against the cup M and indicates which circuit has called. As these small caps are apt to be uncertain of action in a sea way, an improved device is used, consisting of a conical cap P, fitting over the whistles, hinged upon a wire Q, the ends of which wire slide in the grooves in the plates R. The puff of air blows the conical cap either over on its pivot wire, or else up over the highest point in the groove and down on the other side, either of which indicates satisfactorily from which tube the signal comes, and the conical cap is replaced by hand. The sound in the tubes is deflected and intensified by the use of german-silver tongues S, generally of the shape shown, the metal being thin, so as readily to take up the vibrations, and the tongue suspended at one point only. These tongues, when placed in curves and angles of the tubes, preserve the volume of the sound and deflect it in the proper direction. Where the tubes pass through decks or bulkheads, the water-tightness is maintained by stuffing boxes, and the tubes themselves are fitted with rubber sleeves to take up all jar.

This Homacoustic system of voice tubes has been adopted on board of the Argentine torpedo vessel *Patria*, where it is said to work well, and if the continued experiments in the British navy prove successful the ideal tube may be in sight.



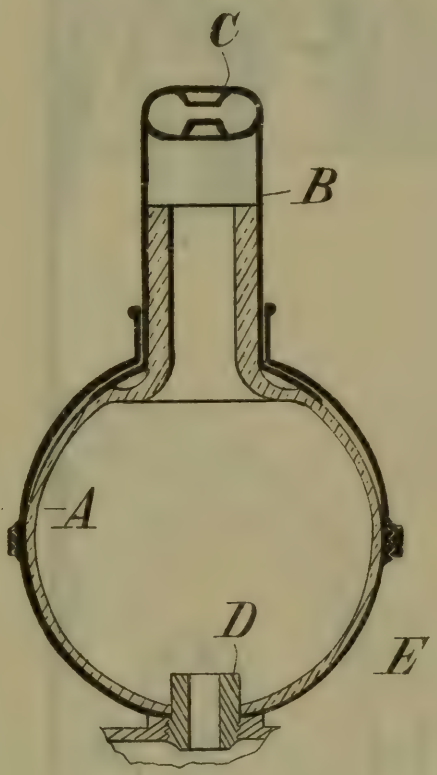
Admiralty pattern.



Navy commutator.



INSTRUMENT IN USE.



SIGNALLING DEVICE.



Fig 1.

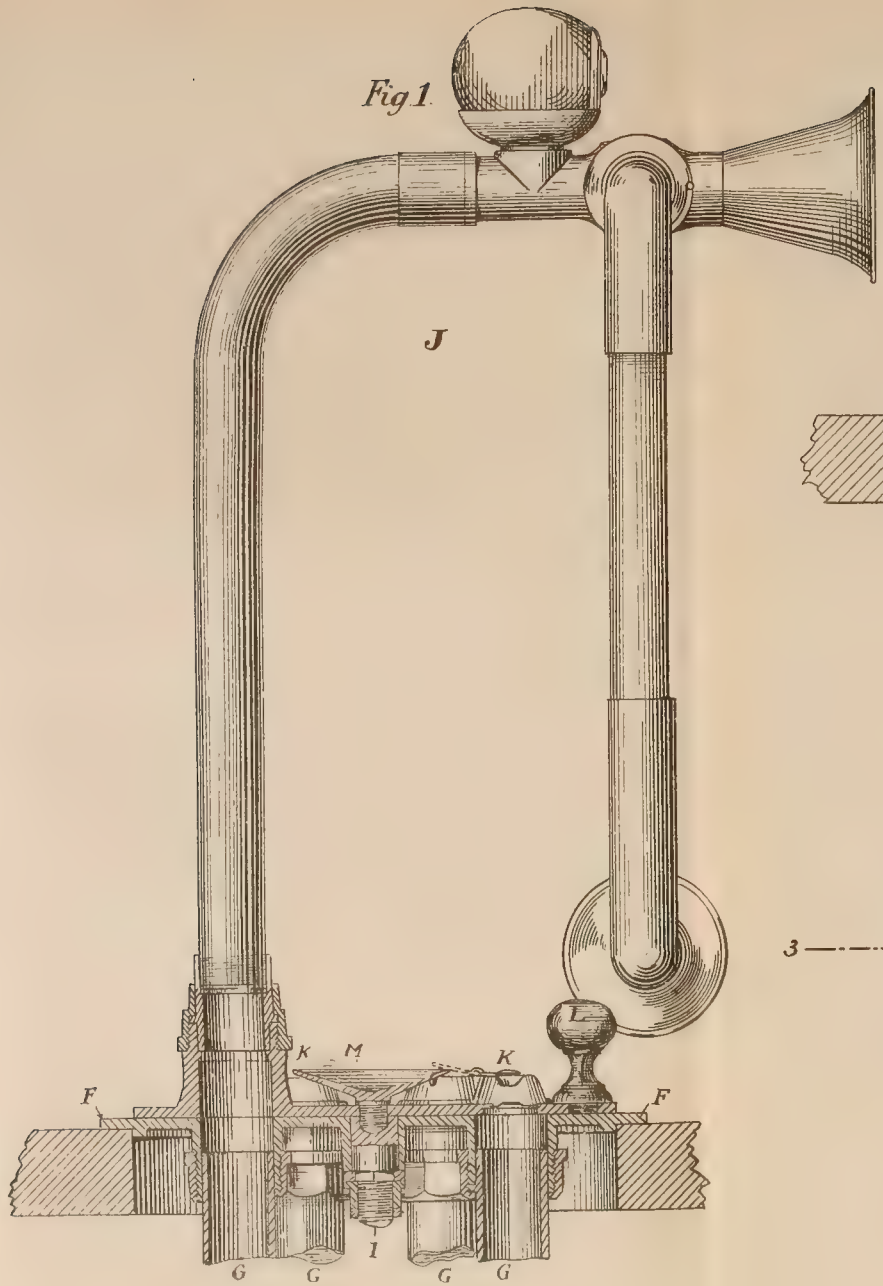


Fig. 3.

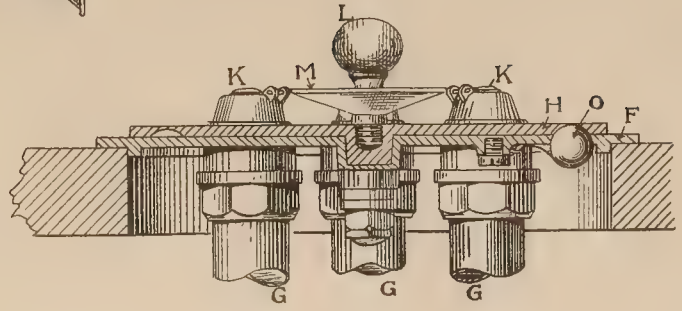


Fig. 2.

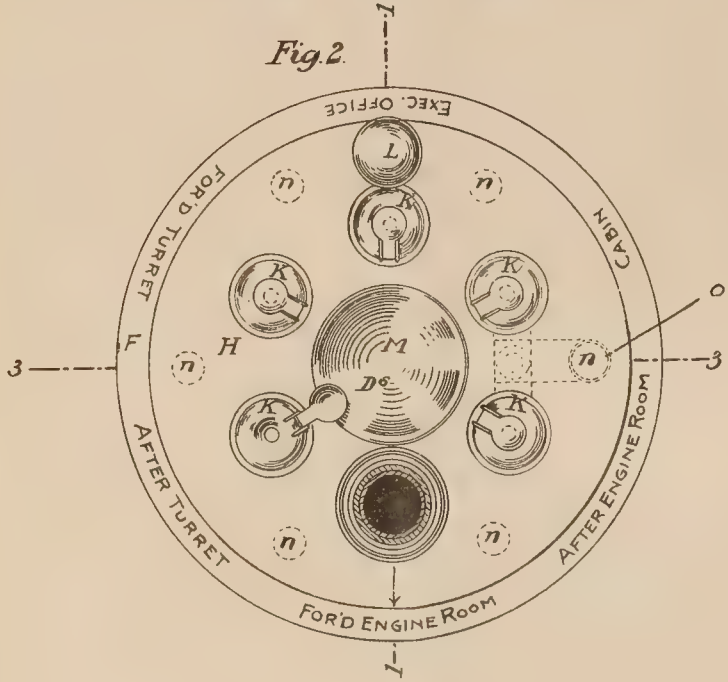




FIG. 1.

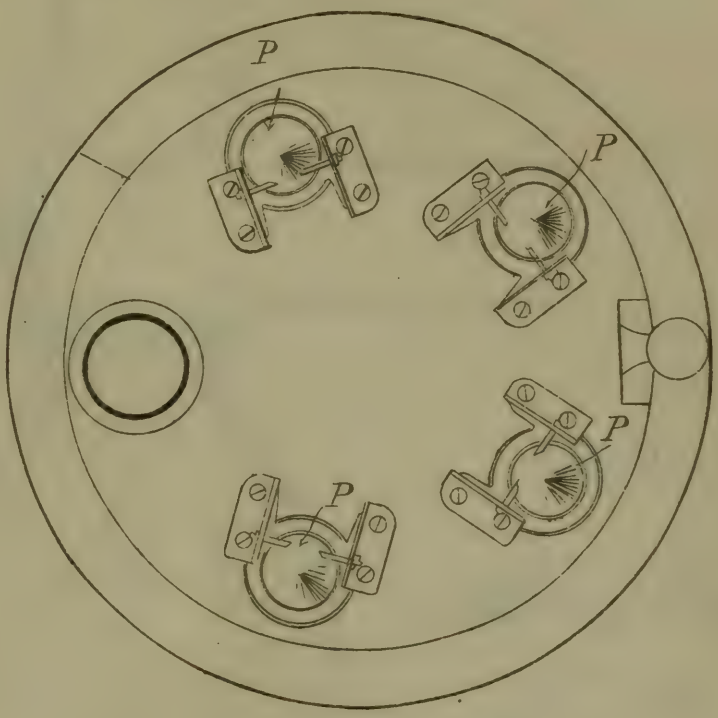


FIG. 2.

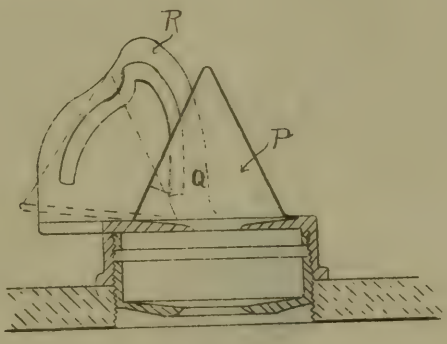
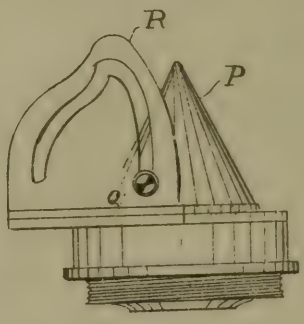


FIG. 3.



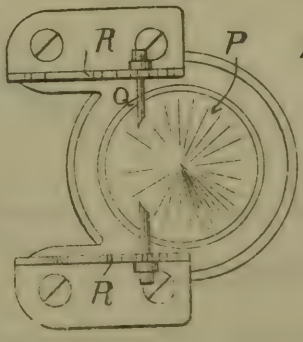


FIG. 4.

FIG. 1.

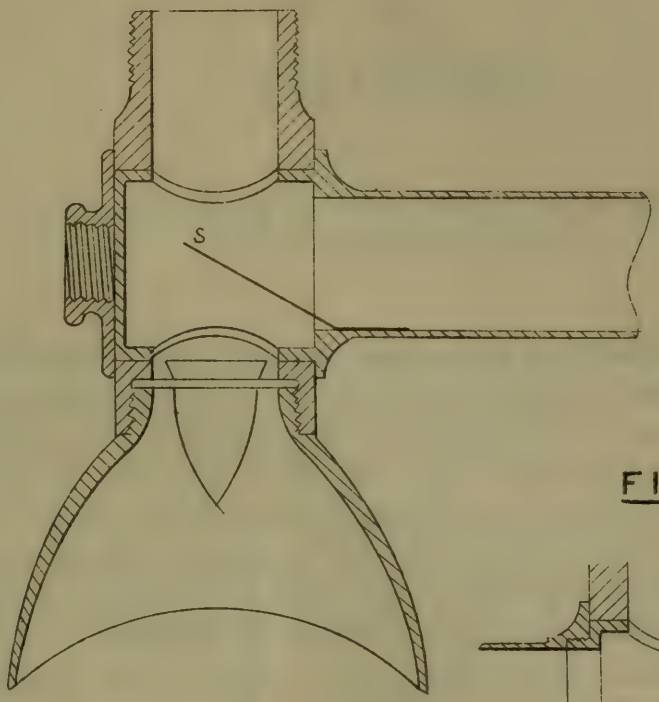


FIG. 3.

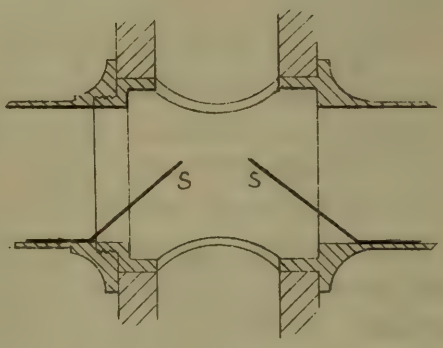


FIG. 2.

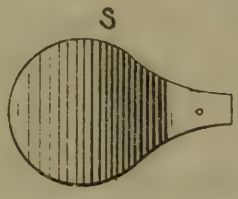
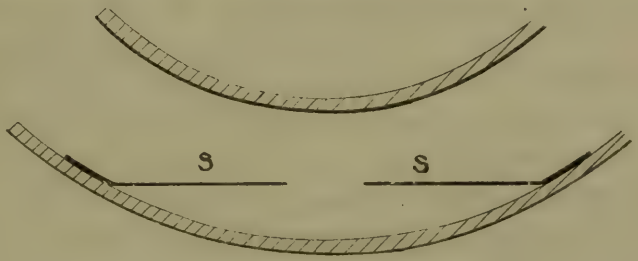
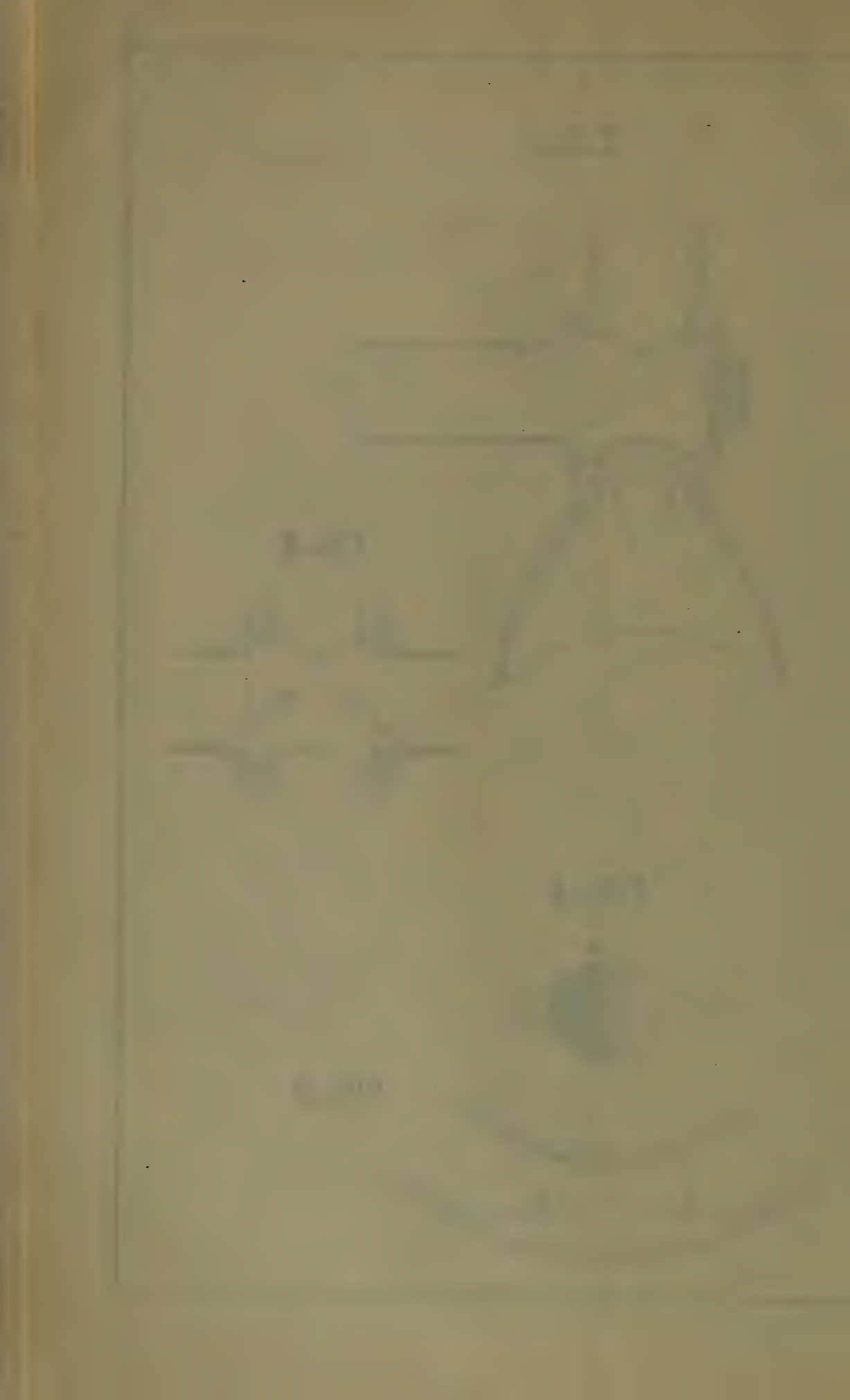


FIG. 4.





VI.

CELLULOSE.

By Ensign SUMNER E. W. KITTELLE, United States Navy,
Staff Intelligence Officer.

Of the many water-excluding materials that have come into temporary or permanent use in filling the cofferdams of men-of-war, the only ones that have received serious consideration in this country are cocoa cellulose and corn-pith cellulose. The former, which was the first adopted for use in the United States Navy, was produced by the Franco-American Cellulose Company from the husks of the cocoanut imported from Ceylon, the cellulose being separated from the fiber by machinery and treated chemically to insure its keeping qualities and render it incombustible, after which it was mixed with a small percentage of the fiber and packed in the cofferdams. Before the introduction of the corn-pith the cocoa cellulose was believed to be the best extant. The corn-pith cellulose, discovered by Mr. M. W. Marsden, was brought to the notice of the Navy Department in the spring of 1895, and soon after it was subjected to a competitive test with the cocoa cellulose, resulting greatly in favor of the American product, as will be shown hereafter.

Early in 1896 a plant for the manufacture of the corn-pith cellulose was erected at Owensboro, in the corn belt of Kentucky, the machinery being specially adapted by Mr. Marsden. The process of manufacture is of considerable interest. The large, untrimmed cornstalks, after being thoroughly dried, are fed into a cutting machine, and there cut into pieces of about an inch in length, after which they fall into the receiver of a pneumatic conveyor, which consists of a system of galvanized piping of the size of ordinary stove piping, through which a strong current of air is forced by centrifugal fans. The air blast in the pneumatic conveyor separates the leaves and lighter parts and blows them up through one branch pipe to one loft, while the heavier pieces of stalks pass through another pipe to a second loft and are blown through a grating to remove any remaining leaves. The cut stalks are then fed into another branch of the conveyor and are carried to a large hopper, whence they pass into an attrition mill, which cracks the shell and releases the pith and its fiber. This whole disintegrated mass then passes into a large rectangular box with conical ends at top and bottom,

into which ends lead pipes of another pneumatic conveyor. This box is called the cyclone, the strong currents of air within being so directed as to blow the pith and its fiber upward, and the pieces of the shell of the stalk downward, where the latter are ground and reground with the leaves as feed for cattle. The pith and fiber, blown upward, pass into a double concentric cylindrical screen which revolving slowly in an air-tight compartment sifts out all the dust. Then there remains only the coarse cellulose and its fiber, and the fine cellulose which is like flour, and these are again separated by air blast and fall in different compartments. The coarse cellulose and fiber is now ready for chemical treatment, to render it fireproof, after which it is ready for the press.

The field of usefulness of the fine cellulose is claimed to be very extensive and constantly increasing; its applicability to naval purposes has not yet been demonstrated, but it is thought favorably of as the principal ingredient in a fireproof insulating cement or paint for bulkheads and in a fireproof lining for living spaces, the latter to be molded into decorative panels of any design for cabins and wardrooms. It will enter into the manufacture of paper and linoleum and may supplant wood pulp in the manufactures.

In May, 1895, a board, presided over by Naval Constructor J. H. Linnard, United States Navy, was appointed by the Navy Department to conduct the competitive tests between the cocoa cellulose and the corn-pith cellulose. Two cofferdams of the character and dimensions shown in the accompanying plates were provided. In one cofferdam was placed 832.5 pounds of cocoa cellulose packed to density of 7.7 pounds per cubic foot and in the other 702 pounds of corn-pith cellulose at a density of 6.5 pounds per cubic foot. The results of the various tests were reported as follows:

In the first experiment with the cocoa cellulose, a 6-inch shell loaded with sand was fired at the cofferdam from a distance of 314 feet, with a firing velocity of about 1,000 feet per second. The weight of the shell was 100 pounds. The hole at the point of entry was of the diameter of the shot; that at the point of exit at the rear of the cofferdam was a somewhat irregular oval, 7.5 by 8.5 inches. The center of the hole was 5 feet below the top of the cofferdam. The passage of the shot caused a large handful of the cellulose to be projected to the front through the hole made, and a quantity, estimated at about 1 quart, thrown out to the rear. The appearance of the cofferdam at the rear is shown in the plate. The manholes having been secured, the pump was started, the water reaching the level of the hole at 12.27 p. m. and reaching the top of the cofferdam at 12.28.10 p. m. By means of the hose the water was kept at a level which was not allowed to descend below a point 6 inches from the top of the cofferdam, being refilled from time to time as found necessary. At 12.37.15 p. m. the first drop of water appeared at the rear of the cofferdam through the hole. The flow gradually increased and in a few minutes had become comparatively steady. The water coming out of the hole was measured in a box of 12 gallons capacity. The first box was filled at 1.05.15 p. m., or twenty-eight and one-fourth minutes after the water had reached the level of the hole in front. The box was filled a second time twenty-four minutes later, and a third time in twenty-eight minutes, showing that the flow had become approximately constant, and somewhat less than one-half gallon per minute, when this test was suspended.

In the meantime the cofferdam containing corn-pith cellulose was fired at with a

6-inch projectile weighing 100 pounds from a distance of 314 feet. The velocity of the projectile, the quantity of material projected from front and rear, and other conditions were the same in all respects as in the case of the cocoa cellulose. The holes in the front and rear were about the same size as those of the previous shot. The center of the hole was about 4.6 feet below the top of the cofferdam. A second plate shows the effect of this shot on the cofferdam. The water being turned on as before, reached the level of the hole at 12.53.30 p. m., and was at the top of the cofferdam at 12.54.50 p. m. Similar precautions were taken to keep the level of the water within 6 inches of the top. This head of water was maintained until 2.24.30 p. m., when it was drawn off for further experiments, the hole having remained about one hour and a half under water. During this time no water appeared at the hole in the rear of the cofferdam, nor at the end of the time had the corn-pith cellulose in the vicinity of the hole in the rear become damp.

The cofferdam containing cocoa cellulose was then fired at with an 8-inch shell loaded with sand and weighing 250 pounds. The striking velocity was about 1,000 feet per second. The distance from the cofferdam was 314 feet. The hole in front was the size of the shell, and in the rear a rough lozenge shape, of which the diameters were about 12 inches and 9 inches, respectively. A third plate shows the appearance of this hole. The center of the hole was 4.9 feet below the top of the cofferdam. About a pint of cellulose was projected from the front hole, and about 2 quarts from the hole in the rear. The water having been turned on as before, reached the level of the hole at 2.36 p. m., and the top of the cofferdam at 2.37.45 p. m. At 2.36.25 p. m., twenty-five seconds after the water had reached the level of the hole, a few drops appeared at the hole in the rear. The flow gradually increased, and a similar box being used to catch the water, one box full had dripped out at 3.06.15 p. m., about thirty minutes from the time the water had reached the level of the hole in front. A second box was filled in eighteen minutes, and a third box in twenty-two minutes, showing that the flow had settled down to a practically steady rate of about one-half gallon per minute. The previous 6-inch hole during this period continued to allow water to pass at about the same rate as it had before At the end of this time the water was drawn off for further experiments.

Under the same conditions an 8-inch projectile, weighing 250 pounds, was fired from a distance of 314 feet, with a striking velocity of 1,000 feet per second, at the cofferdam containing corn-pith cellulose; the holes produced being entirely similar to those produced in the cofferdam containing cocoa cellulose, and the amount of material projected being about the same. The center of the hole was about 4.6 feet below the top of the cofferdam. A fourth plate showing this hole is annexed. The water having been turned on as before, reached the level of the hole at 3.19.40 p. m., and the top of the cofferdam at 3.20.40 p. m. The water was drawn off at 4.04.40 p. m., forty-five minutes after it had reached the level of the hole, without any of it appearing at the hole in the rear of the cofferdam, nor was the corn-pith cellulose at that point damp. No water appeared in the rear at the 6-inch hole which had been previously made, nor was it damp at the completion of the experiments. A plate showing the arrangement of the front of the cofferdams during the penetration tests is also annexed.

In order to determine the relative resistances of the materials to the washing out effect of waves on the exterior of a vessel, a 1.3-inch nozzle was placed on the hose connected with the steam fire pump, which was started up at such a speed as to give a moderate force to the stream issuing from it. The nozzle was held at 12 feet from the 6-inch holes in the front of the cofferdams and directed full in these holes successively. The effect of this stream, in the opinion of the board, was much greater than any likely to be produced by wave action or the rolling of the ship. The stream was held in these holes for thirty seconds, and at the end of this period it was found that the material had been washed out in an elongated cone to a depth of 18 inches from the surface in the case of the cocoa cellulose, and to a depth of 14 inches in the case of the corn-pith cellulose. The pump connected with the hose

was then started up to full pressure, such as would be given in an ordinary fire main, and the stream directed successively against the 8-inch holes in the two cofferdams. Under this powerful washing action a clean cylindrical hole was cut through from one side of the cofferdams to the other through the shot holes, the time occupied being nine seconds in the case of the cocoa cellulose, and eighteen seconds in the case of the corn-pith cellulose.

In the opinion of the board, these tests with the hose, of which it is difficult to give an adequate idea, lead us to believe that there is no danger whatever of the cellulose material being washed out through the action of the sea and thus failing to produce the obturating effects with either of these materials. Certainly no such effect would be produced within the limit of an action at sea, after which there would be time and opportunity to plug the holes in the exterior of a vessel.

The corn-pith cellulose was then dug out of the 6-inch hole in the rear of the cofferdam until it was found damp, showing the extent to which the water had penetrated during the total period of two hours and a quarter during which the 6 inch hole had been under water. It was found that damp cellulose was reached at 8 inches in from the hole at the rear. The 8-inch hole having been washed through by the experiment with the hose, it was not determined how far the water had penetrated in this case, but on examination and digging out from the rear it was found that slightly above the level of the hole the cellulose was dry up to a point 12 inches in from the rear. In the case of the 6-inch hole, slightly above the level of the hole, the material was dry 12 inches in from the rear.

During the progress of the above tests other tests were made to determine the noncombustibility of the materials. A portion of the cellulose having been placed loose in an iron envelope a 3-pounder shell containing one-tenth of a pound of powder was exploded in its midst. This experiment was twice repeated for each kind. Similarly a 1-pound bag of powder was exploded in the midst of the material in the iron envelope. In each case the cocoa cellulose ignited, but the corn-pith cellulose did not, but was merely charred. The cocoa cellulose in each case smoldered awhile, and then, under the influence of the slight breeze blowing, burst into flame.

The iron envelope used was a 13-inch shell of which the rear end had been broken off. The chamber of this shell was filled with the loose material and the mouth covered with an 8-inch shell stuck into the opening.

At the conclusion of the experiments outlined above, the manholes at the tops of the cofferdams were removed and the cofferdams unpacked to ascertain how far into the material the water had penetrated. Lieut. N. E. Mason, United States Navy, reports the results as follows:

On removing the material from the dams, from the top, the wetted portions were found to be in the form of truncated cones, whose bases were toward the front face or water space of the dams, and whose dimensions are shown in the plate appended. No examination was made of the under side of these cones.

The sketch shows in each case that the amount of wet material is notably greater in the case of the cocoa than in that of the corn-pith cellulose.

To test the keeping qualities boxes of about a cubic foot capacity each were taken to a room in the basement of the Navy Department. These boxes were filled, two with corn-pith and two with cocoa cellulose. The materials were loosely packed. Into one of the corn-pith and one of the cocoa cellulose boxes were poured about 2 gallons of fresh water. The temperature of the room was about 84° and of the water 64°. The boxes were examined weekly, and the following are the results of the examinations:

First week.—The dry corn-pith and the cocoa were unchanged. The wet cocoa smelt musty, the corn-pith cellulose the same, and showed slight mold.

Second week.—The dry corn and cocoa were unchanged. The wet cocoa smelt musty, the portion in contact with the unpainted iron had turned black and corroded the

iron. The painted iron was untouched, the paint softening and skinning off. The wet corn-pith slightly increasing in musty smell, the iron not corroded and corn not decayed.

Third week.—The dry corn-pith and the cocoa unchanged. The wet corn-pith and cocoa slightly more musty than before; the wet cocoa corroding the iron and the corn-pith not affecting it.

Fourth week.—The dry corn-pith and cocoa unchanged. The wet corn-pith showed slightly increased moldiness, with slight ammoniacal smell, but no fermentation; the iron corroding above the level of the corn-pith, but not below the surface to any marked extent.

The cocoa not increased in fermentation or smell, but the iron much corroded by acid action, and the cocoa itself turned black and rotting where in contact with the rusting iron.

Fifth week.—The box containing damp cocoa cellulose, when emptied, showed that the portions covered with red lead paint had been preserved from corrosion, but the red lead paint had softened all over. The portion of the cellulose in immediate contact with the iron had turned black. The portions in contact with the unpainted iron were strongly discolored and were adherent to the iron. The iron showed evidence of superficial corrosion.

The box containing the wet corn-pith cellulose, when emptied, showed that the painted portions were not attacked, and the paint itself was much firmer and more adherent to the metal. That in contact with the unpainted iron surface was only slightly blackened, slightly adherent in some parts, and the iron very slightly corroded; hardly more than would have been due to moisture alone, showing that the corn has practically no corrosive effect. The strong smell of ammonia was again observed, probably due to the fireproofing material, the nature of which has not been disclosed.

The box containing the dry cocoa cellulose, when examined, showed that the painted surfaces were unchanged and the paint dry, firm, and adherent. There was a slight adherence of the cellulose to the unpainted iron, but practically no action had taken place.

The condition of the box containing dry corn-pith cellulose was exactly the same as that containing the dry cocoa cellulose.

When both are packed at the same density the corn-pith cellulose costs but two-thirds as much as the cocoa.

Abroad, trials of cellulose of the earlier varieties have been made in France, Italy, Austria, Germany, Russia, Netherlands, and Denmark, but in none of these countries has it been permanently adopted. Its failure on the Continent was probably due in a measure to the inferior quality of the material there used and to its lack of proper treatment for preservation and noncombustion. The faults developed on trial seem to have been inflammability from shell explosion, and decomposition and loss of obturating qualities when exposed to moisture, the odor from the decaying material being also objectionable.

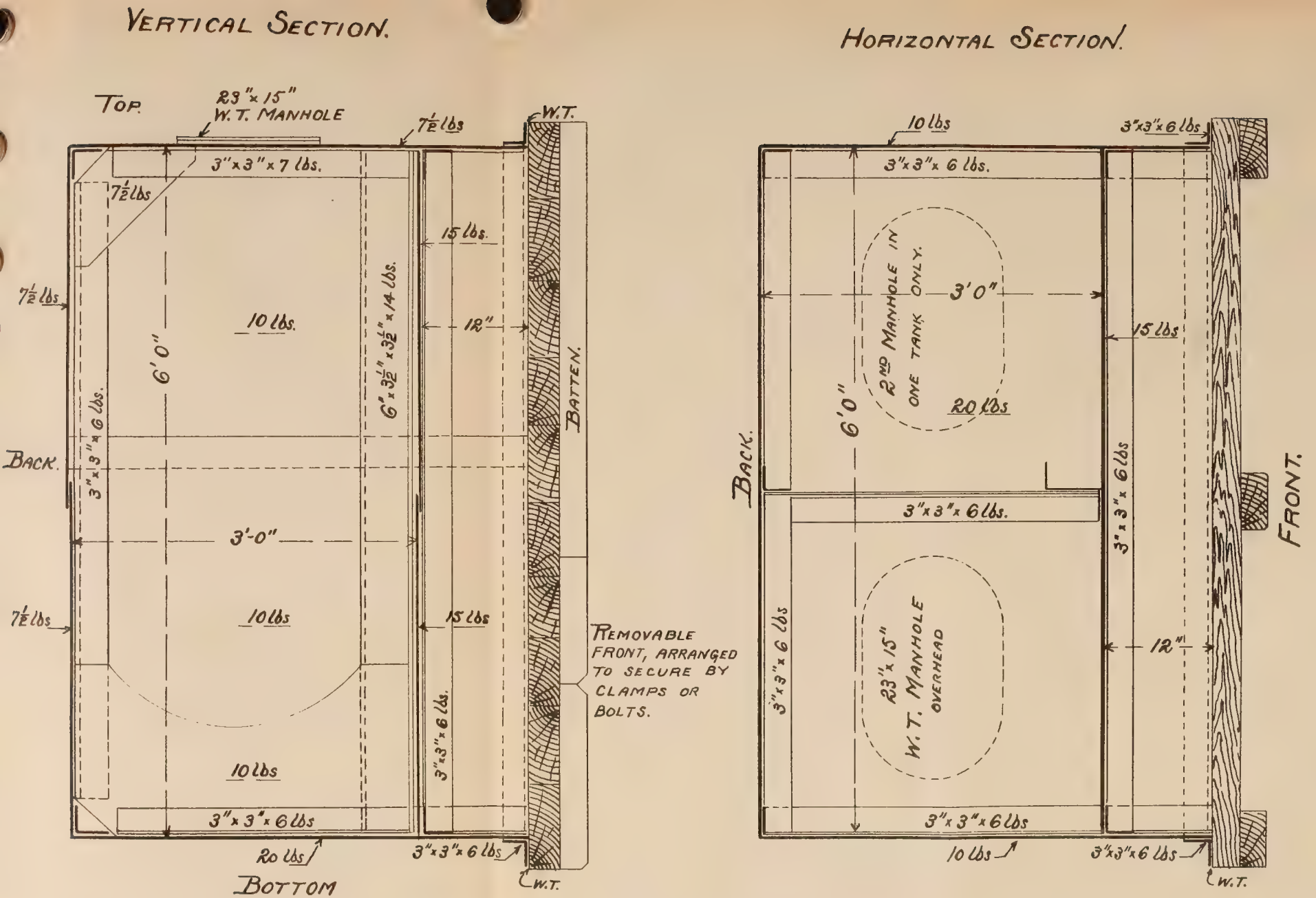
In the Italian navy a material called *typha latifolia* (cat-tail) was tried for awhile but discarded because of its high cost and bad-keeping qualities. The *typha latifolia* as used in cofferdams consisted of the furry heads of the common cat-tail plant packed in canvas bags and covered with some noncombustible coating. In place of it Italy has adopted cork conglomerate, a mixture of cork shavings with tar, pressed into cakes.

France also tried the *typha latifolia* and other materials less well

known, but finally settled on *zostère*, a seaweed common to the French coast as well as our own. The seaweed is dried, treated chemically, packed in canvas bags, and smeared with a waterproof coating. For stowage in cofferdams the *zostère* is pressed into bricks, and being a marine growth it is safe from deterioration in salt water.

In Germany the favored obturating material is cork cut into smooth slabs about an inch thick, and closely stowed in the cofferdams with marine glue to fill all the interstices.

Other powers seem to have adopted no substitute for cellulose, and may return to it in its improved form.



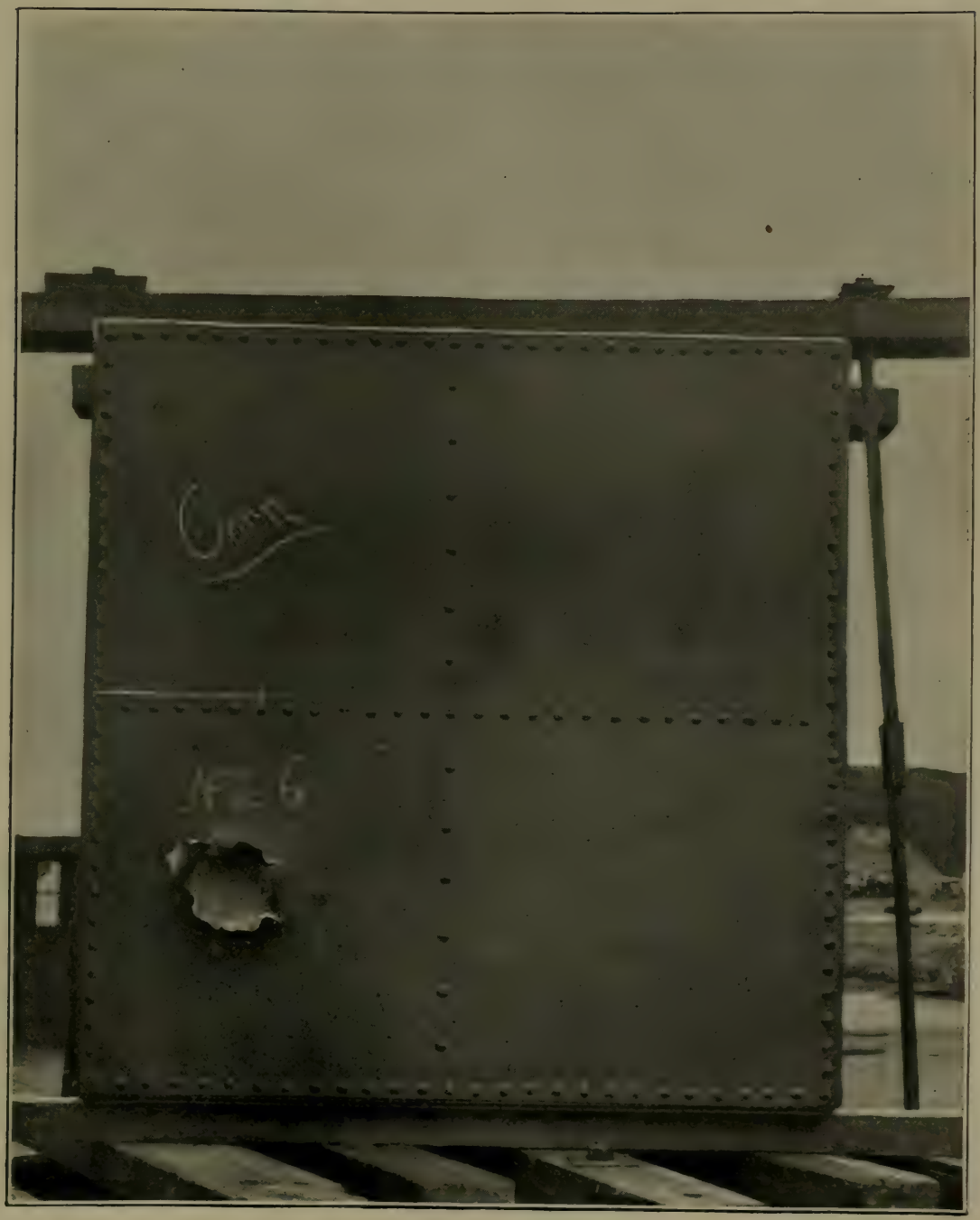
WATERTIGHT COFFERDAM TO TEST CELLULOSE.

SCALE, 1" = 1 FT

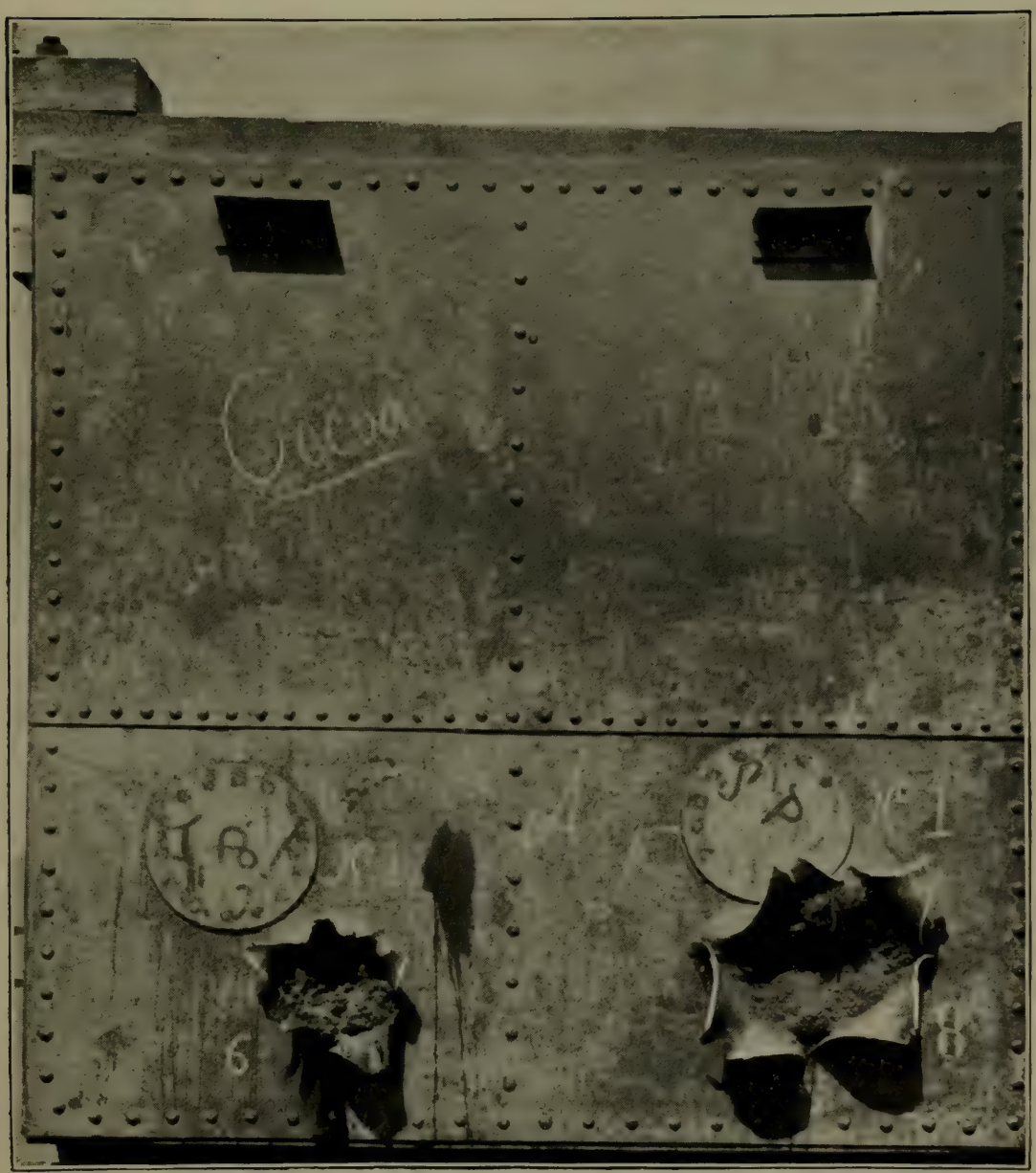




COCOA, 6 INCH—REAR.



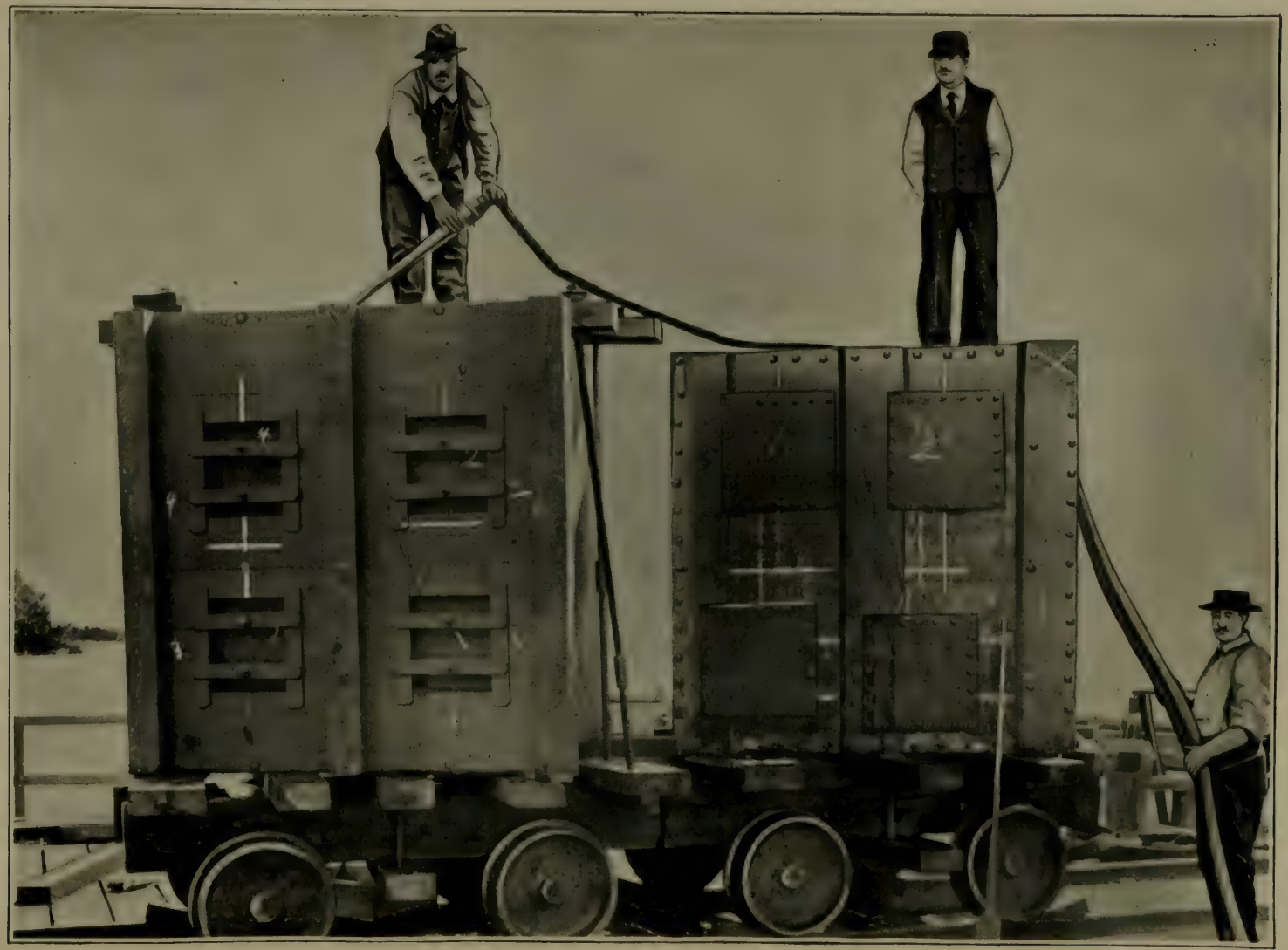
CORN, 6 INCH—REAR.



COCOA, 6 AND 8 INCH—REAR.



CORN, 6 AND 8 INCH—REAR.

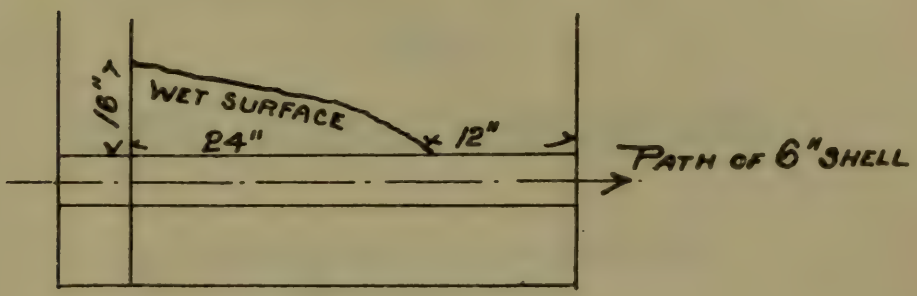


WATER TEST.

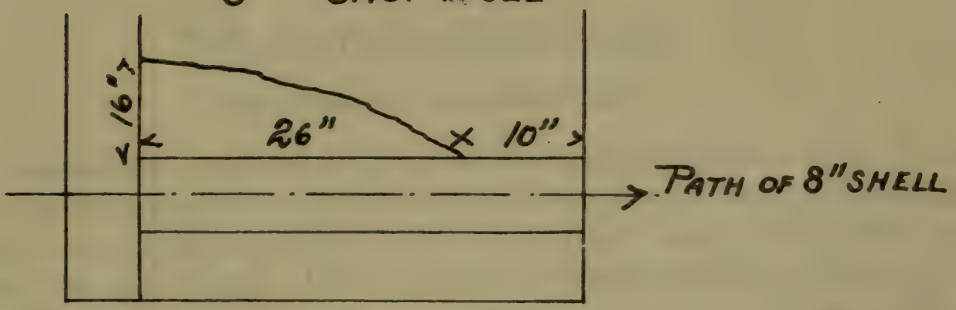
SKETCHES SHOWING AMOUNT OF WETTED SURFACE IN COFFERDAMS FILLED WITH CORN-PITH AND COCOA FIBRE.

CORN-PITH DAM.

6 INCH SHOT HOLE.

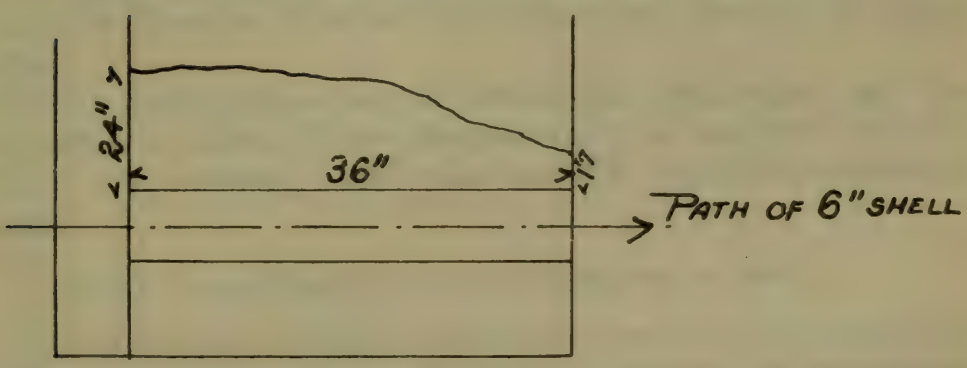


8 INCH SHOT HOLE

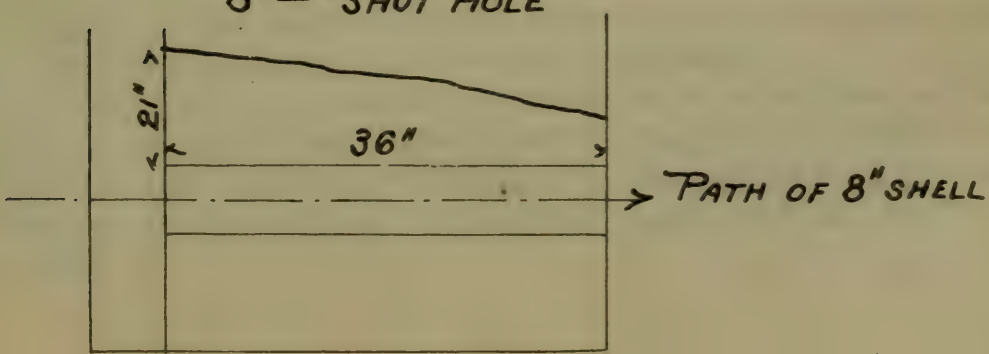


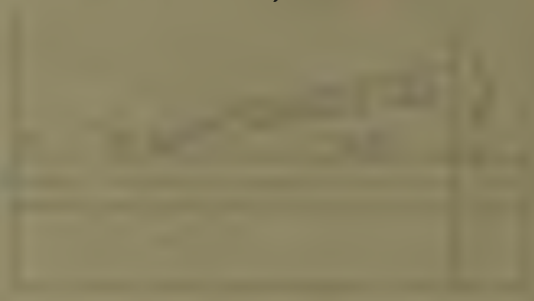
COCOA FIBRE DAM.

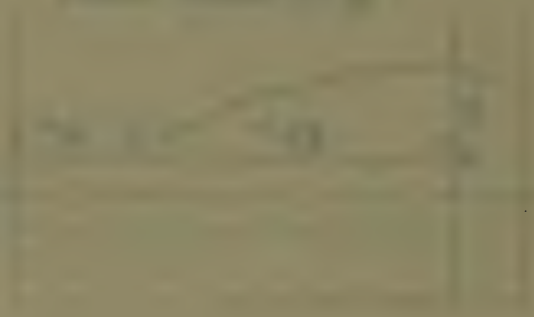
6 INCH SHOT HOLE.



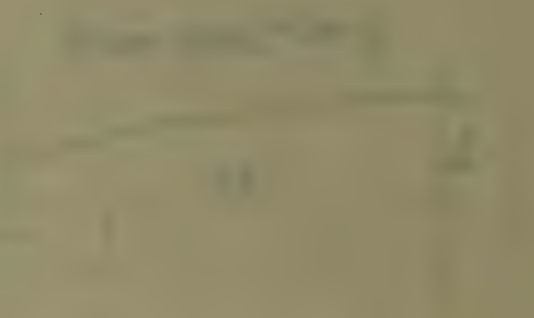
8 INCH SHOT HOLE











VII.

NAVAL MANŒUVRES OF 1895.

By Lieut. E. B. Barry, United States Navy,
Staff Intelligence Officer.

THE BRITISH MANŒUVRES.

PRELIMINARIES TO MOBILIZATION.

The commander in chief at Devonport received orders May 12 to prepare for commissioning for the naval manœuvres in July, 4 first-class cruisers, 3 second-class cruisers, 2 special service vessels, 6 torpedo vessels and 7 torpedo boats. He was also instructed that the crews of the 7 guardships in the Devonport command would be filled to the seagoing complements when ordered.

June 11 the Admiralty requested the naval officers and civil officials forming the mobilizing committee of the Western District to meet as early as convenient in order that preliminary arrangements might be made for mobilizing a portion of the fleet under the Devonport command, and the Director of Naval Intelligence was directed to attend the meeting.

June 20 the naval authorities at Portsmouth, Devonport, and the Nore were officially informed that the fleet was to be mobilized July 17, and June 24 the following notice was posted in the custom-house at Portsmouth:

Royal Naval Reserve—Naval Manœuvres of 1895.

Men of the first class and second class and firemen (new class) may volunteer for service in Her Majesty's ships during the summer manœuvres. The conditions of service and date of embarkation will be announced later.

By June 27 a large number of steam colliers had been engaged to fill up at Cardiff for the supply of the manœuvring ships.

Early in July it was found that the mobilization of the fleet on the 17th, the date originally fixed, would deprive a number of naval electors of the privilege of exercising the franchise at the approaching general election, and, in consequence, the Admiralty postponed the mobilization to July 24.

The following orders and arrangements were issued by the Admiralty:

TACTICAL EXERCISES, 1895.

GENERAL ORDERS AND INSTRUCTIONS.

The Lord Commissioners of the Admiralty have decided to take advantage of the partial mobilization of the fleet to carry out this year's exercises of a tactical character.

These will consist of a series of exercises to be performed by two independent fleets and of certain exercises and manœuvres to be undertaken by a torpedo squadron in the St. George's Channel.

The ships and vessels assigned to the Channel Fleet will assemble at Portland. Those assigned to the Reserve Fleet will assemble at Torbay.

The ships, torpedo-boat destroyers, and torpedo boats forming the torpedo squadron will first assemble at Plymouth.

When in all respects ready, the Channel and Reserve fleets will proceed to sea for a period of exercise, which may be extended to the evening of Saturday, the 3d of August.

The exercises during the cruise should include:

(1) Fleet evolutions.

(2) Exercises in cruising formations at night.

(3) Exercises in battle formations during the day.

(4) Anchoring and weighing the fleet.

(5) Scouting and distant signaling.

At the expiration of this first cruise the Channel Fleet will proceed to Berehaven and the Reserve Fleet at (sic) Lough Swilly to complete with coal and prepare for the second cruise.

Both fleets are to leave their respective ports on Thursday afternoon, the 8th of August, weather permitting, and each will proceed to a rendezvous to be hereafter communicated to the admirals in command, from which position they will take the necessary measures by means of their scouts and cruisers for finding each other and effecting a junction.

The two fleets will then be organized as one, and under the command of the vice-admiral will continue the evolutionary cruise until [the] morning of the 14th of August, when the fleets will separate, and, after being dispersed, will proceed to carry out target practice during the following day, returning to their ports of assembly either singly or together as may be arranged by the admirals commanding.

Only one-half of one quarter's allowance of ammunition is to be expended from the heavy, light, machine, and quick-firing guns of the mobilized ships, and this proportion is to be fired only on the day appointed for target practice, when the gun crews have become accustomed to their work and can benefit most by the practice.

Target practice from all natures of guns, in the case of mobilized ships, is to be carried out separately and not in squadron, ships when separated for this purpose, being allowed ample time for the careful performance of their practices.

On return to their ports of assembly all ships that have been mobilized are to be inspected, and are to be back at their ports of commissioning by Tuesday, the 20th of August.

ADMIRALTY, *July, 1895.*

The ships to be commissioned for the manœuvres were overhauled and their stores, except provisions and ammunition, were put on board.

July 22 the men for the ships to be commissioned at Devonport were mustered at the Royal Naval Barracks at Keyham. Next day the engine-room force was embarked in order to allow the men time to

become somewhat familiar with the engines before having to work them.

At Portsmouth arrangements were made to supply crews for ships to be mobilized there. For the Midway Reserve vessels to be mobilized, the crews were drafted from the Sheerness Royal Naval Barracks, and from the depot ship for the Midway Fleet Reserve.

Of the Royal Naval Reserve, 26 lieutenants, 8 sublieutenants, 3 midshipmen, 250 first-class, 250 second-class men, and 100 firemen; 37 officers and 600 men were appointed for service. The first-class men to rate as able seamen, the second-class men as ordinary seamen, and the firemen as "noncontinuous first-class stokers."

Under authority of the Admiralty the manœuvre fleets were composed as follows:

COMPOSITION OF THE FLEETS.

Channel Fleet.

Vice-Admiral Lord WALTER I. KERR; second in command, Rear-Admiral ARTHUR H. ALINGTON.

First place of assembly, Portland; second place of assembly, Berehaven.

Ship.	Class.	Date of completion.	Displacement.	Guns, main battery.	Maximum speed.	Complement.	Mobilized from.[1]
			Tons.		*Knots.*		
Royal Sovereign (flag)	Battleship	1892	14,150	14	18	730	C.
Empress of India (flag)	do	1893	14,150	14	18	725	C.
Resolution	do	1893	14,150	14	17.9	725	C.
Repulse	do	1894	14,150	14	17.5	730	C.
Blenheim	Armored cruiser	1893	9,000	12	21.6	563	C.
Endymion	Protected cruiser, first class.	1894	7,350	12	20	544	C.
Grafton	do	1893	7,350	12	20	544	C.
Theseus	do	1894	7,350	12	20	544	C.
Charybdis	do	1894	4,310	10	20	325	T.
Forte	do	1895	4,360	10	20	325	T.
Latona	Protected cruiser, second class.	1891	3,400	8	20	273	P.
Indefatigable	do	1892	3,600	8	19.7	273	P.
Iphigenia	do	1892	3,600	8	19.7	273	P.
Andromache	do	1891	3,400	8	20	273	T.
Apollo	do	1892	3,600	8	20	273	T.
Pearl	do	1892	2,575	8	19	227	D.
Bellona	do	1894	1,830	6	17	160	C.
Speedy	Torpedo vessel	1894	810	2	20.2	91	C.
Halcyon	do	1894	1,070	2	18.5	115	C.
Jason	do	1894	810	2	19.2	91	G.
Niger	do	1894	810	2	19.3	91	G.
Sheldrake	do	1890	735	2	20	91	G.
Alarm	do	1894	810	2	19.6	93	T.

[1] C. In commission, full crew, Channel Fleet. G. In commission, reduced crew, Coast or Port Guard duty. D. Commissioned for manœuvres at Devonport. T. Commissioned for manœuvres at Chatham. P. Commissioned for manœuvres at Portsmouth.

Reserve Fleet.

Rear-Admiral EDWARD H. SEYMOUR, C. B.; second in command, Rear-Admiral HUGO L. PEARSON.

First place of assembly, Torbay; second place of assembly, Lough Swilly.

Ship.	Class.	Date of completion.	Displacement.	Guns, main battery.	Maximum speed.	Complement.	Mobilized from.
			Tons.		*Knots.*		
ALEXANDRA (flag)	Battleship	1877	9,490	18	14.3	674	G.
BENBOW	do	1888	10,630	12	16.7	503	G.
DREADNOUGHT	do	1875	10,820	10	13.6	440	G.
EDINBURGH	do	1886	9,420	9	14.2	396	G.
COLOSSUS	do	1886	9,420	9	14.2	396	G.
WARSPITE (flag)	Armored cruiser	1888	8,400	14	16.7	535	G.
GALATEA	do	1888	5,600	12	18.1	497	G.
FLORA	Protected cruiser, first class.	1894	4,360	10	20	318	D.
ASTRÆA	do	1894	4,360	10	19.7	318	D.
THAMES	do	1888	4,050	12	17.3	325	D.
MERSEY	do	1887	4,050	12	17.3	327	G.
MELAMPUS	Protected cruiser, second class.	1892	3,400	8	20	273	G.
NAIAD	do	1891	3,400	8	20	273	P.
TRIBUNE	do	1892	3,400	8	20	325	T.
THETIS	do	1892	3,400	8	20	325	T.
IRIS	Cruiser, second class	1879	3,730	13	17	257	P.
LEDA	Torpedo vessel	1894	810	2	19.2	91	G.
ONYX	do	1894	810	2	19.2	91	G.
RENARD	do	1894	810	2	19.2	91	G.
SALAMANDER	do	1891	735	2	19	91	G.
HAZARD	do	1894	1,070	2	19	115	D.
ANTELOPE	do	1894	810	2	19.2	91	D.

Torpedo Squadron.

Rear-Admiral ARTHUR KNYVET WILSON, K. C. B.

First place of assembly, Plymouth; second place of assembly, Milford Haven.

Ship.	Class.	Date of completion.	Displacement.	Guns, main battery.	Maximum speed.	Complement.	Mobilized from.
			Tons.		*Knots.*		
Hermione (flag)	Protected cruiser, first class.	1894	4,360	10	20	312	D.
Fox	do	1894	4,360	10	20	312	P.
Seahorse	Special	1880	670	1	12.6	53	G.
Curlew	Partly protected gun vessel.	1885	950	4	14.5	103	G.
Traveller	Special	1883	700	4	12.1	175	G.
Landrail	Partly protected gun vessel.	1886	950	4	14.5	103	G.
Daring	Torpedo boat, first class	1894	240	6	28.6	50	G.
Havock	do	1893	215	1	26.7	43	C.
Decoy	do	1894	240	6	27.6	45	C.

Torpedo Squadron—Continued.

Ship.	Class.	Date of completion.	Displacement.	Guns, main battery.	Maximum speed.	Complement.	Mobilized from.
			Tons.		*Knots.*		
Boxer	Torpedo boat, first class	1894	280	6	29.1	45	C.
Bruiser	do	1895	280	6	27.9	45	C.
Dasher [1]	do	1895	220	6	27	45	P.
Ferret	do	1893	220	1	27.6	50	G.
Dragon	do	1895	265	6	27.1	50	T.
Rocket	do	1895	260	6	27.4	50	D.
Shark	do	1895	260	6	27.6	50	D.
Surly	do	1894	260	6	28	50	D.
Banshee	do	1895	265	6	27.9	50	D.
TORPEDO BOATS.				Tubes.			
No. 79	First-class	1886	75	1	22–24	15	C.
No. 83 (divisional)	do	1889	85	3	23	19	C.
No. 84	do	1889	85	3	23	19	C.
No. 94 (divisional)	do	1894	130	3	23.5	18	P.
No. 95 (divisional)	do	1894	130	3	23.5	18	P.
No. 80	do	1887	105	5	23	21	D.
No. 85	do	1889	85	3	23	19	D.
No. 86	do	1889	85	3	23	19	D.
No. 87	do	1889	85	3	17	15	D.
No. 72	do	1886	75	5	19–20	15	T.
No. 73	do	1886	75	5	19–20	15	T.
No. 74	do	1886	75	5	19–20	15	T.
Contest [1]	do	1894	265	1	27.4	50	D.

[1] Replaced by *Contest*.

The *Grafton*, *Charybdis*, *Forte*, *Halcyon*, FLORA, HAZARD, *Hermione*, *Fox*, *Daring*, *Decoy*, *Boxer*, *Bruiser*, *Dasher*, *Ferret*, *Dragon*, *Rocket*, *Shark*, *Surly*, and *Banshee*, and torpedo boats *Nos. 94, 95*, and *86*, are new vessels, taking part for the first time in naval manœuvres.

MOBILIZATION.

The partial mobilization of the fleet took place at 9 a. m. July 24.

At Portsmouth 6 cruisers, 1 torpedo vessel, and two torpedo boats were put in commission. As soon as pennants were hoisted the work of getting aboard ammunition and provisions began.

By 3 p. m. the *Latona* had completed this part of the work and left the harbor, and by sunset all six of the cruisers were anchored at Spithead. Owing to boisterous weather the torpedo flotilla vessels were kept in Portsmouth for the night.

July 25 all these vessels adjusted compasses, made the one-hour steam trials required of the specially commissioned ships, and left for their respective rendezvous.

At Chatham 6 cruisers and 5 small craft were commissioned, and within fifty-two hours of hoisting the pennants all the vessels had left the Midway.

Of the thirty vessels at the Nore held in readiness for sea only 9 were mobilized. This is the smallest number yet furnished.

They adjusted compasses in Sheerness Harbor and then left for their respective rendezvous, making their one-hour commissioning steam trials en route. The whole work of mobilization was carried out without any mishap or delay. The first vessels to get away were the *Andromache*, the *Tribune*, and a torpedo vessel.

At Devonport 5 cruisers and 7 small craft were commissioned, 1,670 men received from Keyham Barracks were drafted into the various vessels in the morning, and later in the day 200 coast guardsmen and 120 naval reserve men, who arrived by train about 1 p. m., were mustered and distributed among the mobilized ships.

The arrangements for transporting the men to their ships were carefully made by the drafting staff and no difficulty was encountered in carrying out the arrangements.

July 24 the crews were busily engaged in getting provisions and ammunition on board and next morning the vessels hauled out into the sound for compass adjustment, the *Astræa* leading out at 7.10 a. m., followed at short intervals by the other cruisers.

The *Dasher*, torpedo boat, collided with a mud dredge just after coming out of dock and stove in her bow plates so badly that she was withdrawn from the manœuvre fleet and the *Contest*, topedo vessel, was substituted.

After adjusting compasses and making their commissioning steam trials all the vessels left for their first places of assembly.

The *Latona*, *Iphigenia*, and *Indefatigable* were the first of the specially commissioned ships to join the Channel Fleet at Portland, which they did July 25. On the 28th this fleet was complete, except the *Theseus* and *Grafton*, which ships joined from Gibraltar after the fleet had put to sea.

The ALEXANDRA, SALAMANDER, and LEDA were the first of the specially commissioned ships to join the Reserve Fleet at Torbay, which they did at 9 p. m. July 25.

July 29 all the ships of this fleet had arrived, except the RENARD, and were moored in four lines according to the third organization, so arranged that a small squadron of scouts or lookout ships could be detached from either flank line without disturbing the main body of the fleet.

Inshore, the first line was composed of the torpedo vessels HAZARD, ANTELOPE, ONYX, LEDA, RENARD (when present), SALAMANDER; the second line, ALEXANDRA, GALATEA, EDINBURGH, DREADNOUGHT, FLORA; the third line, WARSPITE, COLOSSUS, MERSEY, BENBOW, ASTRÆA, THAMES; fourth line, TRIBUNE, THETIS, IRIS, NAIAD.

As each ship took up her moorings a collier was hauled alongside and the bunkers filled.

The Torpedo Squadron assembled in Plymouth Sound July 27 and at daybreak next day got under way in columns for Milford Haven, the second place of assembly, at 7 knots speed. After passing Rams Head the speed was increased to 10 knots and some evolutionary

tactics were practiced, after which the speed was gradually increased to 13 knots. After passing Lands End the wind freshened and the torpedo vessels began to dip their bows into the sea. It was noticed that vessels carrying bow tubes dipped their noses well into it, while the others made much better weather.

July 28, at 7.30 p. m., the squadron entered Milford Haven and anchored in single column opposite New Milford.

PRELIMINARY EXERCISES.

Channel Fleet.

From July 29 to August 3, inclusive, the *Channel Fleet* exercised at steam tactics, fleet anchoring and weighing, and also in signaling, to which last much attention was paid, and three different systems employed. In steam tactics both rectangular and oblique movements were practiced. The evolutions of the cruisers were to a great extent independent of those of the battleships, the general idea being that the former should, in scouting, act as lookouts by day and an encompassing guard against torpedo attack by night.

July 29 the fleet left Portland at 9.45 a. m., and exercised in fleet tactics during the day, the formation on weighing being column of divisions, inverted order, the *Royal Sovereign* leading one column, the *Empress of India* the other. When abreast the Lizard the cruisers were detached and sent in to reconnoitre Mounts Bay, where the fleet arrived July 30. July 31 the fleet left Mounts Bay about 10 a. m. in single column and continued fleet tactical exercises, the individual ships exercising, meantime, at the usual gun and small-arm drills.

August 1, at 9 a. m. the cruisers were sent forward to Bantry Bay with orders to coal, and on the 3d the whole fleet had assembled there and moored in columns at $1\frac{3}{4}$ cables.

From the 3d to the morning of August 9 the fleet was engaged in coaling, cleaning ship, and in carrying out routine duties at anchor. Much attention was paid to fitting out armed boats, to abandon ship, and to sweeping for mines. Sweepers consist of two countermines, each charged with $18\frac{1}{2}$ pounds of gun cotton, each suspended from two boats, their depth of flotation being regulated from the boats. Should a submerged mine be caught the charges are exploded by electricity. Creepers for cutting cables and connections resemble grapnels, and carry a small charge of gun cotton.

Reserve Fleet.

July 29, at 8.30 a. m. scouts and lookout ships were sent out in pairs from Torbay, and at 9.30 the battle fleet, consisting of the five battleships and five of the larger cruisers, steamed out in column of divisions, natural order, led by the *Alexandra* and *Warspite*, and proceeded down channel. Three pairs of scouts kept a lookout ahead and on the bows while a linking ship between the scouts and the battle fleet was

thrown out on either flank. During the day fleet tactics were practiced, using visual and fog signals, while all ships' crews were exercised at clearing ship for action and general quarters. At sunset, while still at sea, the scouts rejoined the fleet at a prearranged rendezvous. Night quarters took place shortly before midnight.

The next day, July 30, the scouts were again sent out and the linking ships were practiced at distant signaling, while in the battle fleet fleet tactics and target practice with Morris tubes were carried out. July 31 the whole fleet was exercised in fleet evolutions in the morning, and later in the day scouts and linking ships were thrown out. At 5 p. m. the fleet anchored in Bantry Bay. In the evening drilled at repulsing torpedo attacks.

August 1 left Bantry Bay at 9.30 a. m. As the sea was rough a good opportunity was afforded to observe the behavior of the different types of vessels. The GALATEA was the steadiest; the BENBOW and DREADNOUGHT behaved well; the ALEXANDRA rolled from 16 to 20 degrees, while the EDINBURGH and COLOSSUS rolled deeply, the latter rolling the muzzles of her guns under several times when the turret was trained abeam.

Landing parties were organized and the new landing equipment tested. The individual outfit comprised twelve articles kept in a canvas bag convenient for issue and storage.

August 3 the MELAMPUS joined and at 3 p. m. the fleet anchored in Lough Swilly in three lines; the first, or inshore line, comprised the ALEXANDRA, GALATEA, MELAMPUS, EDINBURGH, DREADNOUGHT, and FLORA; the second, the LEDA, WARSPITE, COLOSSUS, MERSEY, BENBOW, ASTRÆA, and THAMES; the third, the SALAMANDER, TRIBUNE, THETIS, IRIS, NAIAD, HAZARD, and ANTELOPE.

Coaling and general preparations were begun at once.

Exercises similar to those of the *Channel Fleet* occupied the time until August 8.

MANŒUVRES.

Channel Fleet.

August 9 the fleet got under way at 8 a. m. and steamed out of Berehaven. The position to be reached, named "L," was signaled as the fleet started; latitude, 53° 30′ north; longitude, 17° 30′ west, about 300 miles distant.

An attempt was made to go to sea on the 8th, but bad weather prevented, and Vice-Admiral Kerr succeeding in informing Rear-Admiral Seymour in time to prevent the RESERVE FLEET from going out.

The Admiralty order was: "Both fleets are to leave their respective ports August 8, weather permitting, and each will proceed to a rendezvous to be hereafter communicated to the admirals in command, from which position they will take the necessary measures by means of their scouts and cruisers for finding each other and effecting a junction."

Neither fleet knew the position to be reached by the other fleet.

The speed of the *Channel Fleet* was 10 knots, in order to bring the fleet to the rendezvous the following evening, where it arrived at 6 p. m.

At night all running lights were masked, the guide light abaft the after bridge for the vessel next astern alone being visible.

It was reasonable to suppose the RESERVE FLEET would not be placed in the Irish Channel, but that its most probable position would be north of the *Channel Fleet* and at a distance from Lough Swilly of not less than 250 miles, also within the area defined by the Butt of Lewis on the north, the Blaskets off Dingle Bay on the south, and by the *Channel Fleet* rendezvous, some 300 miles west of Slyne Head. Accordingly the vice-admiral determined to sweep the greater part of this area with cruisers. Twelve detailed for the search started on courses one point apart, speed 14 to 15 knots. They left the rendezvous at 6 p. m.

The following are the names of the vessels and the courses and distances assigned them:

Charybdis, north, 210 miles; *Apollo*, north by east, 230 miles; *Latona*, north-northeast, 240 miles; *Forte*, northeast by north, 250 miles; *Iphigenia*, northeast, 260 miles; *Indefatigable*, northeast by east, 270 miles; *Speedy*, east-northeast, 275 miles; *Jason*, east by north, off northwest angle of County Clare (Eagle Island); *Niger*, east, to Slyne Head; *Bellona*, to offing off the Shannon; *Pearl*, to offing off the Blaskets, and *Andromache*, to offing off the Fastnet.

Each ship when she reached the limit of her original direction was to shape a course without altering speed for the rendezvous "M," situated 20 miles west of Blackrock light-house, latitude, 53° 30′ north; longitude, 15° 20′ west.

The admiral steered direct for rendezvous "M" with the battle squadron and the *Halcyon*, *Sheldrake*, and *Alarm*, speed 7 knots, which speed was of course known to the cruisers in order to estimate the admiral's whereabouts should they desire to communicate with him.

Should any cruiser fall in with any vessel of the RESERVE FLEET her orders were to inform the stranger of the movements of the *Channel Fleet*. Having ascertained the position of the RESERVE FLEET, to communicate as quickly as possible to the RESERVE'S admiral where the *Channel Fleet* was to be found and then to rejoin her own flag at full speed. It will be seen that the area covered would be thoroughly searched, rendering it almost impossible to miss so large a fleet as the one searched for. Had all cruisers returned to rendezvous "M" unsuccessful, the conclusion could have been reached that the RESERVE FLEET was not within the area examined.

Shortly after midnight the *Iphigenia* sighted the main body of the RESERVE FLEET, and a little later the *Jason* sighted a cruiser. About 1.30 a. m. the cruisers TRIBUNE, THETIS, and FLORA, of the RESERVE FLEET, signaled the *Royal Sovereign* that the RESERVE FLEET was about 25 miles distant in a southeasterly direction. As the *Iphigenia's*

course was northeast, the RESERVE FLEET evidently had crossed in front of the *Channel Fleet* and at no great distance. A slight alteration of speed would have brought them into contact where their courses intersected.

The fleets sighted each other at 10 a. m. August 11.

Junction was effected about 1 p. m. The RESERVE FLEET was complete except the HAZARD, but most of the cruisers of the *Channel Fleet* were still absent.

RESERVE FLEET.

August 8, at 1.30 p. m. the cruisers weighed in obedience to signal and proceeded to the mouth of Lough Swilly to await the admiral. The fleet had unmoored when the telegram from Vice-Admiral Kerr, stating that the *Channel Fleet* was detained by bad weather, caused sailing orders to be countermanded. August 9, however, at 10 a. m., the fleet weighed, the cruisers and light vessels leaving the Lough first and awaiting the battleships outside.

The fleet formed two divisions: First division, ALEXANDRA, GALATEA, EDINBURGH, and DREADNOUGHT; second division, WARSPITE, COLOSSUS, BENBOW, and ASTRÆA. The rest of the vessels, 13 in all, formed the scout and lookout division, organized as follows: First scout division, FLORA and THETIS; second scout division, NAIAD and SALAMANDER (changed places with LEDA); first lookouts, MELAMPUS, THAMES, and TRIBUNE; second lookouts, MERSEY and IRIS; first linking ships, ANTELOPE and LEDA (changed places with SALAMANDER); second linking ships, ONYX and RENARD. The torpedo vessel HAZARD was absent.

The position to be reached, named "S," was not made known until the fleet was well clear of the Lough, latitude, 54° 30′ north; longitude, 15° 30′ west, about 280 miles from Lough Swilly and 210 miles west of Donegal Bay. Speed was fixed at 10 knots, which should have brought the ships to position "S" at 4 p. m. August 10, but the unsuccessful search for two men, washed overboard from the EDINBURGH about 3.30 a. m., delayed the fleet four and one-half hours, and although speed was increased after daylight when the weather cleared, the rendezvous was not reached until 7 p. m.

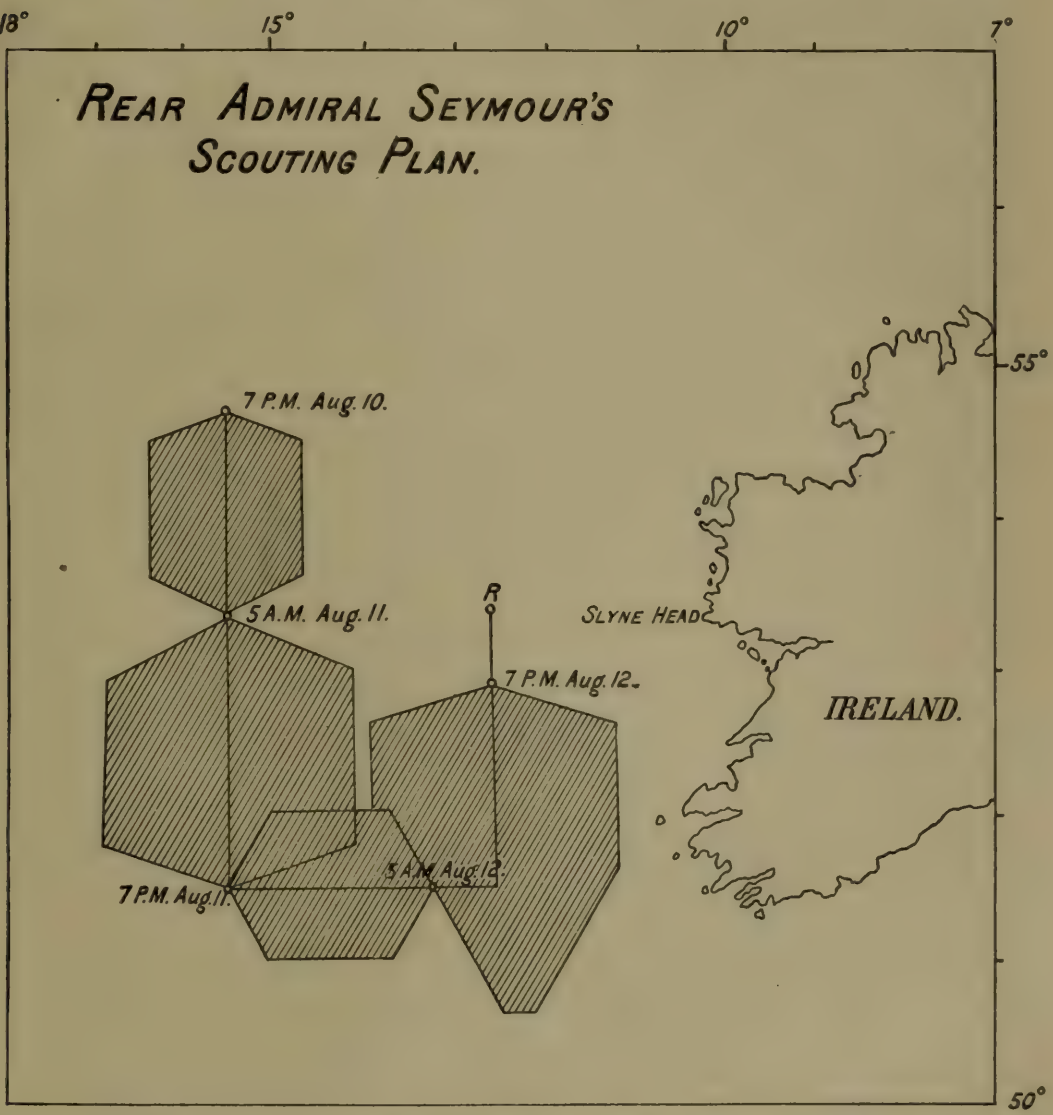
The course was altered to south-southwest. Speed for the battle fleet was fixed at 8 knots, a rendezvous appointed for 5 a. m., and the rest of the fleet was dispatched in the following manner:

Of the 13 available vessels not in the line of battle, 4 were detached as distant scouts while the remaining 9 were spread over a wide area ahead of the fleet. Imagine a chessboard with one of its diagonals in the prolongation of the flagship's course; the corners of the squares are always easily located if the length of the side of the board is known, and also the number of squares within it. To each corner of the squares was assigned a letter, where evidently a cruiser could be placed by

signal. With the cruisers spread over this area a screen was interposed through which no enemy's ship could penetrate without being seen.

To protect the flanks and also to enlarge the area under observation the four scouts were employed as follows:

A pair of scouts leaving either flank steered a course diverging 6 points (68° 30′) outward from the fleet at 14 knots speed for 26 miles, they then steered parallel to the fleet at 10 knots for 60 miles, and finally, diagonally inward again at 14 knots to meet the fleet at the



prearranged rendezvous 80 miles at 5 a. m. The scouts in each pair kept 5 miles apart. The other 9 vessels of the lookout divisions were placed ahead of the fleet in fan-shaped formation, 4 miles apart during the day and 2 miles apart during the night.

During the day the outward runs were to be 49 miles at 15 knots, the parallel runs, 70 miles at 10 knots, and the inward runs, 49 miles again. The main column at 8 knots is met at 7 p. m. after covering 112 miles. By this means an area could be watched 110 miles broad by day and

60 miles broad by night. The scouts were in pairs that one might communicate with each fleet. In war, one would report a hostile fleet while the other remained to keep touch.

A vessel meeting the CHANNEL FLEET or one of its vessels at night was to throw a beam from her search-light into the sky and then in the direction of the vessel met, interval between flashes to be five seconds; the number of ships to be indicated by the number of vertical flashes.

These measures met with prompt success. The flashing of search-lights began soon after midnight, and communication was established with the *Iphigenia* and *Jason*. About 1.30 a. m. August 11 the THETIS, FLORA, and TRIBUNE signaled to the *Royal Sovereign* the whereabouts of the RESERVE FLEET.

It will be seen that the time occupied in searching for the *Channel Fleet* was only six hours. The RESERVE FLEET changed course and steamed toward Blacksod Bay at 5 knots speed, sending the SALAMANDER to inform Vice-Admiral Kerr of the location of the rendezvous.

During the morning the scouts rejoined. The *Halcyon*, *Niger*, and *Sheldrake*, torpedo vessels, sighted the fleet, and then steamed off to join their consorts.

Junction was effected about 150 miles southwest of Achill Head. The RESERVE FLEET took position in column to starboard of the *Channel Fleet*, and course was shaped for Bantry Bay. The IRIS was sent to the rendezvous "M," off Blacksod Bay, to instruct the cruisers to rejoin with all dispatch. By the morning of August 13 they had all rejoined.

COMBINED FLEETS.

While the fleets were together Vice-Admiral Kerr took command of the 16 battleships, while the cruiser divisions remained under the immediate control of their respective flag officers.

The battleships exercised at fleet evolutions and the cruisers at scouting. The first day Rear-Admiral Seymour sent one section 4 miles ahead, another 4 miles astern, and a third 6 miles on the starboard beam, with links 3 miles distant.

The second day the *Channel Fleet* cruisers also took part in the scouting exercises.

August 14, at 6 a. m. the fleets separated for target and torpedo practice; that of the *Channel Fleet* taking place off Lands End; that of the RESERVE FLEET, off the Scilly Islands. The former anchored off Portland, the latter in Torbay, August 16. After inspection all ships specially commissioned for the manœuvres were put out of commission at their home ports.

TORPEDO-BOAT FLOTILLA, MILFORD HAVEN.

The object of the torpedo-flotilla exercises was: First, ordinary exercising at various speeds, with tactics, to accustom officers and men to handle their vessels, and to ascertain how to utilize the vessels' special

armaments to the best advantage; second, deploying for lookout purposes and re-forming; third, target practice at special targets towed at high speeds; fourth, torpedo practice; fifth, to ascertain how nearly the best torpedo boats can prevent modern ships of war from using a channel, such as the English Channel, at night in time of war, with the opposite coast in the enemy's hands; also, to what extent torpedo vessels accompanying ships at sea can protect the ships from torpedo-boat attacks; sixth, to what extent, if at all, it is desirable to use torpedo vessels for seagoing purposes.

For cruising and tactical purposes the *Torpedo-Boat Flotilla* was organized into two divisions, each subdivided into groups of three.

The following was the organization:

First Division.

First subdivision, *Hermione*, protected cruiser, second class.
Torpedo boats, first class, *Daring*, *Bruiser*, *Decoy*.
Nos. 95, 73, 84.
Second subdivision, *Havock*, *Boxer*, *Contest*.
Nos. 94, 72, 85.

Second Division.

Third subdivision, *Fox*, protected cruiser, second class.
Torpedo boats, first class, *Ferret*, *Rocket*, *Surly*.
Nos. 83, 74, 86.
Fourth subdivision, *Shark*, *Dragon*, *Banshee*.
Nos. 80, 79, 87.

The large torpedo boats had numbers painted on their bows for purposes of identification; those of the first division were marked 11, 12, 13, and so on, beginning with the *Daring;* those of the second division 01, 02, 03, and so on, beginning with the *Ferret*.

There was one torpedo boat of each type in each subdivision.

The first division exercised at target practice at high speed, the *Hermione* and *Fox* towing targets. In one case the torpedo boats overtaking the target and in another dropping astern. Owing to vibration and other motion not much damage was done the targets, the test being regarded as somewhat severe.

The torpedo boats of the second division at the same time engaged in torpedo practice. Firing took place while at speeds varying from 20 to 23 knots, with good results.

August 1, after steam tactics at high speed, a chase into port took place. The smaller torpedo boats were given about twelve minutes start, when the larger torpedo boats attempted their capture. In a run of about 40 miles only two torpedo boats were captured. The notice given was rather short, which is said to account for the comparatively

slow speed developed. *Nos. 86* and *95*, the leading torpedo boats, are said to have averaged 18½ and 19½ knots. They made 23 knots on trial.

The large torpedo boats made 22½ knots, but the distance was not great enough in which to overhaul the boats. The *Banshee* arrived first and the *Bruiser* second.

August 5, at night a blockading exercise took place. The substance of a memorandum issued for the guidance of the officers taking part is as follows:

One of the auxiliary ships will take up a position 10 miles from the mouth of the harbor to represent the ships of a blockading squadron. The shore being enemies' country, the large torpedo boats are not to go within half a mile of it, nor within the red section of St. Anns light. A subdivision of small torpedo boats will at some time during the night attempt to pass the large torpedo boats and attack the blockading vessel. No torpedoes will be fired, but a Holmes light attached to a piece of wood will be thrown overboard instead when torpedo boats get within firing distance. The blockading ship and torpedo boats when within range are to use blank rifle ammunition, and the time is to be taken from the firing of the first rifle by the auxiliary vessel to the burning of the Holmes light, so as to gauge the time under fire and thus the effect of fire on the boat, the primary object of the exercise being to find out the value and uses of the large torpedo boats. The auxiliary vessel can not put a torpedo boat out of action; this can be done only by an equal number of large torpedo boats passing an equal number of small torpedo boats. Torpedo boats must maintain a straight course, and no doubling or dodging will be allowed to prevent the larger boats from getting ahead of them. Torpedo boats to attack together, if possible, though they may scatter for safety. No men to be landed to obtain information when the torpedo boats leave the harbor. All vessels are to return by 4 a. m., or when all torpedo boats have been put out of action.

Under the above instructions the CURLEW anchored about 10 miles from Milford Haven, while the first subdivision of torpedo boats blockaded the harbor mouth.

The second subdivision of torpedo boats anchored in White Dole Bay, where their small torpedo-boat subdivision tried to pass them, making for St. Govans Head. The larger vessel gave chase, trying to pass the torpedo boats before reaching St. Govans Head.

It is to be regretted that the results of these exercises are not given, as they would be undoubtedly interesting and instructive.

August 9 the gun vessels *Curlew* and *Sandrail*, with 10 torpedo boats, took up their position along the coast of Ireland. *Nos. 73, 74, 79*, and *84* at Howth; *Nos. 80, 85, 83, 86, 87*, and *94* at Wicklow and Rosslane. They steamed in company to Kingstown Harbor and then separated. Owing to an accident *No. 72* had to be docked and *No. 95* also was absent, having run aground, leaving but 10 of the torpedo boats to take part in the exercise.

August 11 the FOX and HERMIONE, accompanied by the large torpedo boats, left Milford Haven and took station as follows: Base, Milford and Carlingford, DARING, BRUISER, DECOY, ROCKET, SHARK, and CONTEST, to blockade Wicklow; HAVOCK, BOXER, DRAGON, and BANSHEE, to blockade Howth; FERRET and SURLY, Rosslane. Hostilities began at 10 p. m.

The object of these manœuvres was to find out whether and to what extent the large torpedo boats could prevent torpedo boats from attacking a fleet at sea, to be done by blockading them in their own ports and intercepting them when out.

The FOX and HERMIONE represented the fleet to be protected, and it was held they could put out of action any or all of the opposing flotilla, including the *Curlew* and *Landrail*; they could not be put out of action themselves unless torpedoed, and then only for the moment, as they were to continue to represent a fleet.

The *Curlew* and *Landrail* could not be put out of action by the large torpedo boats, but under certain conditions could put out of action any or all of them. Three small torpedo boats could put one large torpedo boat out of action, but the large torpedo boats had to be in the proportion of 2 to 3 to effect a like result; so that, while guarded by the *Curlew* or *Landrail*, no small torpedo boat could be put out of action by any number of large torpedo boats.

The HERMIONE and FOX were soon engaged, and kept up a supposed communication between their bases. The night was dark and favorable for torpedo-boat attacks. No difficulty was experienced by *Nos. 73*, *83*, *86*, and *94* in getting out of Howth, nor by those at Wicklow. All joining the *Curlew* entered Wicklow about 4 a. m., secure against the attacks of the larger vessels through the presence of the *Curlew*. There they remained until nightfall.

During the night the HERMIONE chased the *Landrail*, which vessel took refuge behind a sand bank. The DARING, in sounding a channel for the HERMIONE, was put out of action by the *Landrail*, but the latter in a few minutes was claimed by the HERMIONE. Both claims were allowed.

August 12 the FOX, FERRET and SURLY joined the HERMIONE off Arklow. They proceeded to Dublin Bay, where a council of war was held. As a result, the FERRET, SURLY, BOXER, and BANSHEE proceeded to Carlingford Lough, but not finding any of the enemy there returned, the FERRET and SURLY to help blockade Kingston Harbor, the BANSHEE and BOXER to Howth. This placed 6 torpedo boats blockading Dublin Bay and 5 Wicklow.

The night was again fine, though dark, and nearly all the torpedo boats got away safely, notwithstanding the many claims as to putting them out of action.

No. 94, Lieut. P. W. Dumas commanding, performed a clever ruse by which she made her escape. This boat has two smoke pipes, but by the

aid of her torpedo shoots her crew succeeded in rigging what looked like two more pipes. In the darkness she so nearly resembled one of the larger torpedo boats that she passed unmolested through the center of the blockading force.

No. 74 was seen by the DECOY and put out of action. *Nos. 83, 87, 85,* and *84,* also were claimed by the blockading force. The HERMIONE was torpedoed.

August 13, at 4 a. m. hostilities ceased and the flotilla returned to harbor, where later they coaled and watered. The flotilla left Milford Haven for Devonport and Portsmouth August 16, where they were to be put out of commission.

FORMATIONS AND EVOLUTIONS.

The cruisers of the *Channel Fleet* were organized into three divisions and marked on the smoke pipes as follows: First division, *Charybdis,* one black band on forward smoke pipe; *Apollo,* one on each; *Latona,* on after smoke pipe. Second division, *Forte,* double band forward smoke pipe; *Indefatigable,* on each; *Iphigenia,* on after smoke pipe. Third division, three bands similarly arranged on the *Andromache, Pearl,* and *Bellona.*

The normal cruising formation was the battle squadron in the center surrounded by cruisers distant about 1 mile; beyond these, successive scouting divisions were sent out, keeping within signal distance of one another and by means of a widely extended line, with the flagship. The cruisers were recalled toward nightfall and the battle squadron took up a more extended formation for the night.

The principal evolutions were changing from line to column, and the reverse, echelon, columns of divisions, and other fleet tactics. Particular attention was given to mooring and unmooring, getting under way, and anchoring. The fleet anchored in Berehaven in columns of divisions, ships at less than 2 cables distance.

It is stated that helm and speed signals were dispensed with after the first practice, in order to strengthen judgment by the eye.

The RESERVE FLEET was organized with the battle squadron in two divisions and four subdivisions, two divisions of scouts, one of lookouts, and one of linking ships. Leaving Torbay, 6 cruisers in pairs left at 8 a. m., while the rest of the fleet did not receive the signal to weigh until 9.30 a. m. They steamed out in columns of divisions, natural order, the ALEXANDRA and WARSPITE leading, columns at 6 cables, ships at 2 cables. The first night was foggy, but the admiral changed course 16 points during the night. As last year, fog buoys were used.

The formation the following day was as before, but interval between columns was increased to 12 cables.

Evolutions were change of course, echelon, forming columns, and extending or narrowing front, by division and subdivision.

BRITISH NAVAL MANŒUVRES
OF 1895

S

L

EAGLE I.
BLACK ROCK
BLACKSOD B.
ACHILL HD.
SLYNE HD.
R. SHANNON
BLASKETS
DINGLE BAY
BANTRY BAY
FASTNET
DONEGAL BAY
LOUGH SWILLY
CARLINGFORD B.
DUBLIN
HOWTH
BAY
WICKLOW
ROSSLARE
MILFORD HAVEN
ST GOVANS HD.
LANDS END
MOUNTS BAY
LIZARD HD
SCILLY IDS
TORBAY
PORTLAND

56
55
54
53
52
51
50
49

18 16 14 12 10 8 6 4 2

The first lookout division, THETIS and RENARD, kept in touch by the linking ship ANTELOPE; on the starboard bow the second lookout division, NAIAD and SALAMANDER, with the ONYX as linking ship. Sent on some given course or to some given rendezvous would be the first scout division, TRIBUNE and LEDA; in another direction the second scout division, IRIS and HAZARD.

The fleet anchored August 3 in Lough Swilly in three lines, every ship in her station.

Battle formation was taken after leaving Lough Swilly. The weather line of the battle fleet comprised the ALEXANDRA, GALATEA, EDINBURGH, and DREADNOUGHT, and the lee line the WARSPITE, COLOSSUS, BENBOW, and ASTRÆA. The scouts and cruisers took position ahead and on either beam.

By signal the cruisers were stationed in various prearranged formations in accordance with orders and diagrams prepared earlier in the cruise. First. In diamond-shaped formation off the bows of the flagships and 4 miles distant from one another. Second. Spread out in fan-shaped formation with the base 8 miles from the battle fleet and a linking ship between. In this formation the most distant ships were 20 miles from the admiral. Third. Central protection, the cruisers radiating from the battle fleet, but covering only a small area. Intended as a protection against torpedo attack.[1]

The second scouts, 4 cables ahead of the ALEXANDRA; to starboard of them and distant 4 cables were the first lookouts, first scouts, and first linking ships in column of vessels 2 cables between divisions. To port of the WARSPITE and distant 4 cables were the second lookouts and second linking ships in similar order.

The formations when the fleets were searching for each other already have been described.

When the fleets combined the formation was columns of divisions, inverted order, with the RESERVE FLEET cruisers ahead and on the starboard bow.

The advantages of this compact formation are particularly noticeable in the handling of large fleets, not only as to the area covered, but also as to the facility and rapidity with which signals can be transmitted.

COALING.

Three commanders on the retired list were appointed as "additional officers for coaling duties" aboard the *Royal Sovereign*, ALEXANDRA, and HERMIONE. The Temperlay transporters were subjected to further trials.

Many complaints were made concerning the neglected condition of the gear supplied from the dockyards to the hired colliers.

[1] There is a discrepancy between the "fan-shaped" formation here described and that given under the Reserve Fleet, page 172.

Coal was brought to the places of assembly in colliers. The supply seems to have been adequate.

The following are some of the coaling times:

Channel Fleet.

Name.	Time.	Tons.	Average tons per hour.
	Hours.		
Royal Sovereign	5	280	56
Empress of India	4½	310	71.5
Resolution	6½	388	59.6
Repulse	7⅔	301	39.2
Blenheim	5½	250	45.4
Endymion	5⅓	240	45
Theseus	17	407	23.9

RESERVE FLEET.

Name.	Time.	Tons.	Average tons per hour.
	Hours.		
ALEXANDRA	7¼	185	26
BENBOW	5	230	45
DREADNOUGHT	7¾	260	35
EDINBURGH	14	267	19
COLOSSUS	5	166	33
WARSPITE	16	286	18
GALATEA	13¾	172	13
FLORA	5½	150	28
ASTRÆA	9⅓	148	16
MELAMPUS	.....	.....	14
THETIS	.....	.....	27
THAMES	.....	.....	20
MERSEY	.....	.....	20
IRIS	.....	.....	30

The coaling average of the RESERVE FLEET was slower than that of the *Channel Fleet;* this can be attributed partially to the bad weather. Rapidity in coaling is governed also to a great degree by the construction and arrangement of coal bunkers; where careful stowing in minutely subdivided coal bunkers is required the last few tons always take the longest time to stow.

It has been reported that the *Trafalgar* of the Mediterranean Fleet, on January 24, coaling at Alexandretta, took in 405 tons of coal in 2 hours and 52 minutes, an average of 141 tons an hour. The average for 1 hour is given as 150 tons. The account of this coaling does not state whether her bunkers were empty when coaling began, or whether they were filled during the operation; nevertheless it can be regarded as a remarkable performance.

The amount of coal expended by the four battleships of the *Royal*

Sovereign class during the week's steaming of the preliminary exercises was as follows: *Royal Sovereign*, 186 tons 14 hundredweight; *Empress of India*, 91 tons; *Resolution*, 214 tons 16 hundredweight; *Repulse*, 192 tons 8 hundredweight.

SIGNALS.

The *Blenheim* and NAIAD were fitted with the Fane collapsible drum for distant signal experiments to the ALEXANDRA, similarly equipped. In addition to the Fane apparatus fitted at the fore, the *Blenheim* carried the Wilson semaphore at the main; this semaphore was carried also by the *Royal Sovereign*.

Admiral Fane's apparatus consists of a collapsible drum affixed to the foremast head and worked by levers from the deck. The Morse code is used. For night work twenty-six 50-candlepower lights are placed in a circle within the drum. When closed the lights are invisible, but when the drum is enlarged to 6 inches they can be seen. Thus, by operating the lever, the Morse code can be used. By day the drum is operated by two ropes, one to open, the other to close it. Each rope is manned by two men, but the system is a slow one. Multiple fiber lanterns were fitted to the cruisers *Fox* and IRIS.

Admiral Wilson's masthead semaphore is the usual apparatus, fitted to the masthead and worked from the deck by sprocket wheels, chains, and levers.

Under favorable conditions, with a smooth sea and not much wind, the Fane drum worked well. It could be more plainly seen and distinguished farther than either flags or semaphore, but the signals could not be read so easily nor so rapidly as those made by the semaphore within a distance of 11 miles; beyond that distance, when it would work, the drum had the advantage. Signals can be read 13 miles with ease and 15 miles with some difficulty.

At night the drum signals under favorable conditions can be read much more clearly than the flashes from the ordinary masthead lamps.

The practical difficulties have not yet been overcome. With a strong breeze and when the vessel signaling is rolling deeply the motions of the drum drag and hang, rendering it very difficult to distinguish between a dot and a dash. This is particularly the case at night.

Although the Fane drum was read about 16 miles the consensus of opinion seems to be in favor of the masthead semaphore for day and the multiple fiber masthead lamp for night. Both are much more certain in their action under service conditions and much more rapid in the transmission of messages.

Rear-Admiral Seymour devised a flag-signal system in which four large flags, slung rainbow fashion, were used. Signals were read by this means at a distance of 10 miles.

For fleet drills the ordinary service signals were used.

The signal force aboard the cruisers and scouts was too small for the work thrown upon it. Many long semaphore messages had to be repeated.

TARGET PRACTICE.

Nothing especial was developed. The Barr & Stroud range finder gave great satisfaction, and resisted the effect of heavy gun fire without injury.

A little prism station-keeper used aboard the *Blenheim* also gave excellent results.

The torpedo vessels ran torpedoes at targets while steaming past at 15 knots. The practice was very good.

The two cruisers *Hermione* and *Fox* steamed abreast at 12 knots speed; distance apart, 3 cables. The torpedo boats steaming ahead at 18 knots turned by signal and passed between the cruisers at half cable from one, firing at a target towed 2 cables astern of the other, time allowed for firing being from abreast the cruisers to abreast the target.

The ships specially commissioned fired one torpedo from each tube, more for the purpose of testing the tubes and discharger than for target practice, as the torpedoes had their screws locked.

It is the policy of the Admiralty to have target practice after the termination of the manœuvres in order to obtain the best results derived from the drills and exercises. It will be observed that the general orders and instructions directed the target practice of mobilized ships to be carried out separately and not in squadron, and that ample time be allowed for the purpose, two important considerations for ships newly commissioned.

During target practice aboard the *Royal Sovereign* the cartridge case was ruptured in a 6-inch R. F. gun. A jet of flame escaped at the breech carrying fused particles of the case. Several of the gun's crew were severely but not seriously scorched and punctured with minute particles of the fused metal.

CASUALTIES.

BATTLESHIPS.

Edinburgh: When anchoring in Lough Swilly August 3 parted the starboard bower cable.

Dreadnought: Her picket boat collided with a torpedo spar August 6 and had to be hoisted inboard.

Warspite: Main condensers were reported by signal July 31 to be leaking, but the ship kept her station during the day's exercises.

ARMORED CRUISER.

GALATEA: After anchoring in Lough Swilly, August 3, reported port engine disabled; she left with the fleet August 9, defects made good.

PROTECTED CRUISERS, SECOND CLASS.

Hermione: During steam trial, July 27, developed a few leaky joints. Repaired by force on board. August 11, accident to capstan gear.

Indefatigable: Boat capsized August 3; crew rescued.

MELAMPUS: So seriously damaged port windlass as to necessitate sending her to Plymouth. She rejoined August 3.

NAIAD: Sea-water inlet choked during exercise August 10. Cleared by force on board.

THETIS: Leaky boilers, July 27.

TRIBUNE: Parted port cable anchoring in Torbay, July 27. Recovered by aid of divers.

TORPEDO VESSELS AND TORPEDO BOATS.

ANTELOPE (torpedo vessel): Sea-water inlet choked during exercise, August 10. Cleared by force on board.

BRUISER: Frame forming guide of starboard starting engine piston rod broke August 1 and rod bent. Repaired at Pembroke.

CONTEST: The tubes in forward boiler were found to be leaking July 29, when getting her ready to replace the DASHER. Continuous work by Plymouth mechanics got her ready for a steam trial August 1.

DASHER: Bent her propeller blades July 23 coming out of dock. While steaming out of Portsmouth Harbor, July 24, collided with a dredger, receiving such serious damage as to prevent her from taking part in the manœuvres.

DRAGON: Arrived at Plymouth July 27 with safety valves leaking badly. Repaired at the yard. Afterwards developed leaky condensers.

FERRET: Automatic feed gear broke down. Given a trial after repairs July 26, when feed gear again gave out and it was necessary to fit new valves.

HAZARD (torpedo vessel): Both low-pressure piston rods were found to be out of line August 6. A spare piston rod was fitted to the port engine and she steamed from Lough Swilly to Plymouth at about 7 knots speed. Upon examination the starboard keep ring was found broken and also the exhaust ports. The fittings and repairs that enabled the vessel to reach Plymouth are regarded as very creditable to the engineer's force.

LYNX: July 23 burst her forward boiler and could not be commissioned. August 7, after repairs at Plymouth, a satisfactory trial took place off Plymouth, but an inspection showed her boilers to be defective again. It had been the intention of the Admiralty to commission her to relieve the *Surly*.

RENARD (torpedo vessel): Water was discovered in one of the magazines August 14. It had been found there before after the rough passage up the Irish Channel. The water entered through the ship's sides. Some of the powder was damaged, which would indicate the powder was not properly protected.

ROCKET: July 25, at Devonport, the tube ends of her two after boilers were found to be leaking badly. Repairs were pushed night and day until completed.

SALAMANDER (torpedo vessel): Accident to main feed valve August 10 caused her speed to be much reduced during the rest of the cruise and prevented her use as a scout.

Surly: Broke her fan engine August 1. Several minor defects, principally leaky condensers, developed in other torpedo vessels. Main sea-water inlets were choked with weeds and had to be cleared by divers.

TORPEDO BOATS.

No. 72: Run into off Wicklow, August 10, by *No. 80;* stern seriously damaged and boat nearly foundered. Large bulge on starboard quarter; port quarter slightly injured; deck lifted a foot in places; propeller blades and shafting thrown out of line. Was towed to Pembroke by the HERMIONE and docked.

No. 73: Steering gear broke down August 10, outside Wicklow. She was towed into harbor by *No. 94.*

No. 80: Defect in crosshead July 25; repaired at Devonport. August 1, piston and feed pumps gave trouble.

No. 83: Ran aground July 27 at Devonport, and damaged her propeller; was repaired and left for Milford Haven July 29.

No. 85: Injury to fan engine August 5; bulkhead plates found to be cracked August 8; leaking badly and had to be docked.

No. 95: Grounded on boat slip while attempting to leave New Milford Pier August 8. An attempt to get her off was made without waiting for the rising tide to float her. As a consequence, the propeller blades were so bent as to foul the rudder; the shafting was bent and the supporting frame cracked. Work was much delayed owing to want of dock accommodation at Pembroke. *No. 95* was floated three times to let *No. 85* in and out and also for *No. 72* to enter. *No. 95* took no further part in the exercises.

Four lives were lost during the manœuvres. A fireman aboard the *Theseus* was killed while at work, by starting the engine; a Royal Naval Reserve man was found dead in his hammock aboard the DREADNOUGHT, and two men were washed overboard from the EDINBURGH while trying to replace a bunker plate.

COMMENTS.

Taking part in the manœuvres this year were only the following: 9 battleships, 3 armored cruisers, 11 protected cruisers, first class, 9 second class, 1 cruiser, and 12 torpedo vessels, making a total of 45 vessels. Although a torpedo-boat flotilla comprising 30 vessels in addition was mobilized, its operations were separate. Dissatisfaction was expressed not only at the small number of ships specially commissioned, but also at the lengthy notice given the dockyard officials. Indeed, mobilization ceases remotely even to resemble what would be required in the event of hostilities.

The experience gained in the past, however, has not been thrown away, and it is thought dockyard mobilization is now sufficiently systematized to meet any call made upon it. No effort was made to coal ships at sea. In fact, the problem of coaling seems to have been neglected, probably because the manœuvres this year were not of a "hostile" character. Coaling ship is not, however, a settled matter, and the importance of certain and rapid coaling can not be overestimated. A press correspondent goes so far as to recommend that a small fleet of very fast and roomy steam colliers be added to the navy, one or more of them to be at each coaling station. Undoubtedly these vessels, fitted with every modern appliance rapidly to load and discharge cargo, would in time of war be of great value.

The program as laid down for the fleets did away with any manœuvres of a hostile or strategic character. After the conclusion of the usual preliminary cruise the final work was intended as an exercise in scouting. Owing to the proximity of the fleets the scouting problem set was not a difficult one. Starting from known positions the time occupied in reaching the unknown ones was so short that each admiral could be almost certain of the fact that the relative latitudes of the fleets remained the same. Hence the northern fleet expected to find the southern fleet to starboard and vice versa.

In spite of their initial proximity the battle squadrons passed each other, but the area covered by the cruisers was so large that six hours only were necessary to establish touch between the fleets. The time was too short for these tactical exercises to be of much utility.

The methods of scouting and the disposition of the scouts made by the two admirals possess admirable features, but it would seem that the method followed by the RESERVE FLEET is the more efficient, not only as to the thoroughness with which the area under observation is patrolled, but also, and this is of the greatest importance, that all the scouts were under the control of the commander in chief and were in frequent communication with him. Under the method pursued by the *Channel Fleet* many of the cruisers did not rejoin until twenty and even thirty hours after the junction of the fleets.

So little publicity was given the torpedo flotilla exercises that but little can be said about them. The superiority of the larger torpedo boats in speed and seaworthiness is established, yet the smaller boats successfully evaded a strong blockade. It is fair to assume that the protection afforded a fleet against torpedo boat attack in narrow waters by the larger boats is not perfect. If torpedo boats are in sufficient numbers and make a sudden dash, a few are almost certain to get within striking distance.

The boilers show great sensitiveness to impurity in the water, the slightest indications of foreign matter producing priming and reduction of speed. The boats themselves show lightness of construction;

in working anchors in a seaway several times holes were knocked in their bottoms. Too much has been sacrificed to lightness and speed.

As a result of the flotilla exercises it is intended to keep a number of the larger boats in commission in addition to those on stations as tenders and exercise vessels; four each have been commissioned at Portsmouth, Chatham, and Devonport. This undoubtedly will add to the efficiency of the boats and of the engineers' force serving aboard them.

Opinions differ concerning the systems of signaling. In action, flag signals can not be used with any certainty; the Fane drum offers a good target, and once struck is sure to be disabled; besides, its action under unfavorable conditions is uncertain. The Wilson semaphore appears at present to be the most efficient, but is open to the same objection as the Fane drum, though in a lesser degree, of being disabled by shot.

With the destruction of its signal apparatus a fleet dependent upon it and upon the signal book will degenerate rapidly into a mob of ships; whereas, under a special set of battle signals, easily made and easily understood, well-drilled and well-prepared fleets can maintain their cohesion. The power, volume of fire, and accuracy of the R. F. gun make the problem of efficient signaling in action a very serious one. Under all circumstances, rapidity and accuracy in sending and receiving messages, only to be attained by an efficient signal corps, are of paramount importance.

Concerning the personnel but little need be said. As always has been the case the preliminary cruise was of the greatest benefit to the newly trained ships. Trained officers and men readily shake down into new but similar conditions.

The naval reserve is not spoken well of, except the men of the engineer's force. There is nothing surprising in this, for it accentuates the wide separation between the merchant sailor and the modern man-of-war's man. Nothing can be more strongly impressed upon the mind in connection with this important subject than these two facts. The training in merchant steamers prepares the man for duty in the fire room of the man-of-war. On the other hand, to be efficient, the seamen class must be men-of-war's men "first, last, and all the time."

THE FRENCH NAVAL MANŒUVRES.

The naval manœuvres took place in the Atlantic, and at the same time in the Mediterranean. Apart from the usual tactical exercises, the principal study was to discover and keep touch with the enemy.

CHANNEL AND ATLANTIC.

The operations began July 1. They were divided into two parts: (1) Squadron exercises and landing in force at Quiberon; (2) forcing blockade and attack of Rochefort and Cherbourg.

The following-named vessels took part in the manœuvres:

NORTHERN SQUADRON.

Ship.	Class.	Date of launch.	Displacement.	Guns, main battery.	Maximum speed.	Complement.
			Tons.		*Knots.*	
Suffren (flag)	Battleship	1870	7,782	14	14.3	675
Hoche (flag)	do	1886	11,300	22	16.2	660
Réquin	Coast-defense vessel	1885	7,200	2	15	332
Jemmapes	do	1892	6,590	2	17.5	334
Valmy	do	1892	6,590	2	17	295
Dupuy de Lôme	Armored cruiser	1890	6,300	8	20.5	515
Latouche-Tréville	do	1892	4,750	8	18.5	375
Chasseloup Laubat	Protected cruiser, second class	1893	3,740	10	19.3	358
Friant	do	1893	3,722	10	19.7	358
Coëtlogon	Protected cruiser, third class	1888	1,848	4	19.5	190
Surcouf	do	1889	1,848	4	19.5	190
Epervier	do	1886	1,240	5	17.3	134
				Tubes.		
Lance	Torpedo vessel	1886	395	2	18	63
Salve	do	1886	395	2	18	63
Archer	Torpedo boat, first class	1893	120	2	20.5	26
Dauphin	do	1894	115	2	25.2	24
Tourbillon	do	1892	104	2	20.5	26

DÉFENSE MOBILE.

Port.	Vessel.
Cherbourg	Torpedo boats *Nos. 107, 112, 153, 154, 161, 162.*
Brest	Torpedo boats *Nos. 18, 21, 23, 61, 75, 83* (usually commissioned), *73, 81, 136, 137, 138, 139, 145* (mobilized).
Lorient	Torpedo boats, *6.*
Rochefort	Torpedo boats, *10.*

RESERVE SHIP, BREST.

Ship.	Class.	Date of launch.	Displacement.	Guns, main battery.	Maximum speed.	Complement.
			Tons.		*Knots.*	
Tourville	Protected cruiser, first class	1876	5,743	21	16.9	550

PART I.

The period of the fleet and tactical exercises began July 1. The *réservistes* were called out and joined rapidly; 140 embarked aboard the *Tourville*, commissioned for the training of these men, others aboard the torpedo boats or were assigned to the signal stations; 120 were sent to the *Hoche* and *Surcouf* when the ships arrived at Cherbourg. The first division got under way July 2, but the sea was so rough that torpedo vessels and torpedo boats returned to the Brest anchorage; in fact, heavy

weather kept the division at anchor July 1. The second division, under command of Rear-Admiral Ménard, did not return from the Kiel celebration until July. It joined the first division at Quiberon about July 5. The first division, under command of Vice-Admiral Alquier, steamed out July 2, the flagship *Suffren* leading, followed by the *Réquin*, *Latouche-Tréville*, *Friant*, and *Coëtlogon* in the order named. The rest of the first division got away from Brest July 4 and joined at Quiberon. A force of 300 marines (fusiliers marins) were sent to Quiberon peninsula for the purpose of opposing a landing. The attack, supported by the cruisers, took place July 9 and the defenses were carried.

Of the rest of the exercises nothing especial need be noted. The torpedo boats were particularly active preparing for the second part of the manœuvres.

Part II—Forcing Blockade.

The theme of the second part of the manœuvres was as follows:

A division, *A*, is blockaded at Brest by a division, B. It is to force the blockade, and, if successful, is to bombard Cherbourg and Rochefort. The speed of *A* is greatly superior to that of B, but, on the other hand, *A* is compelled to simulate recoaling either at Brest or Quiberon between the attacks on Cherbourg and Rochefort.

Division A, under command of Captain Huguet, was composed of the armored cruisers *Dupuy de Lôme* and *Latouche-Tréville*. They were aided by torpedo boats *Nos. 73*, *81*, *136*, *137*, *138*, *139* (mobilized), *18*, *21*, *23*, *61*, *75*, *83* (usually in commission), composing the Brest flotilla. The speed allowed the cruisers was 13 knots.

Division B, under the command of Rear-Admiral Ménard, was composed of the battleships Hoche, Jemmapes, and Réquin; cruisers Friant, Chasseloup-Laubat, Coëtlogon, and Epervier; torpedo vessels Lance and Salve, and torpedo boats Dauphin and Tourbillon. Speed for the battleships was limited to 10 knots; none of the other vessels could exceed three-quarters of their maximum trial speed.

Although in reality neither armed nor manned for the manœuvres, the defenses of Brest were supposed to be in such a state of military efficiency as to prevent B from passing a line joining Point St. Mattheu and Tas-de-Pois.

Vice-Admiral Alquier acted as umpire, and the flagship *Suffren* took no active part in the manœuvres.

Division A had the use of the semaphore stations, and was protected by the Brest forts, supposed fully equipped for the purposes of the manœuvres.

Division B left the anchorage July 16 and the blockade began. Some vessels turned south toward the Raz-de-Sein and the Point de Penmarche. B was divided into two groups. The first comprised the battleships and the Epervier, that cruised off the Iroise and at the


ENGLISH CHANNEL
C. DE LA HAGUE
CHERBOURG
USHANT
BREST
FRANCE
QUIBERON
BELLE ILE
ILE d'YEU
ROCHEFORT
FRENCH NAVAL MANŒUVRES
OF 1895.
BAY OF BISCAY
NORTHERN COAST.

entrance of the Four; the second comprised the cruisers and lighter vessels, and blocked the entrance of the Raz-de-Sein. At night the torpedo vessels and the DAUPHIN covered the Four and the Iroise as closely as possible; the cruiser watched the available exits, while the battleships took station farther at sea.

The numerous entrances to the harbor of Brest permitted *A* to attempt escape during daylight almost at will, but in full sight of B, rendering it almost impossible to escape. At night prudence dictated the use of two channels only, the Iroise or the Four. This explains the disposition of DIVISION B. The torpedo-boat flotilla, however, rendered it possible for *A* to create a diversion under cover of which the blockade might be forced. *No. 145* was sent along the coast under cover of darkness to ascertain the position of the enemy; three other torpedo boats followed her a short time afterwards. The *Dupuy de Lôme* and the *Latouche-Tréville* got under way, but anchored in Camaret Bay to wait for dawn. In the meantime *No. 145* made several attacks upon the B ships, some of which were considered successful.

The cruisers of *Division A* passing Iroise escaped to the southward by the Raz-de-Sein; thence passing Ushant steered for Rochefort. They were followed, however, by the light B ships, but managed finally to get out of sight. The B division followed on to Rochefort, taking the chances that *A* would first attack that port. As a consequence, at the expiration of two hours, B appeared and *A* was compelled to seek refuge at Quiberon. The rules required six hours without being attacked by the pursuing fleet for the bombardment to be successful. Had the *A* division, after losing sight of its pursuers, attacked Cherbourg, it would not have been molested. Heavy weather came on and B was compelled to seek shelter at Belleisle. The boilers of the SALVE required attention; the EPERVIER and LANCE needed supplies. All three refitted at Rochefort and the DAUPHIN was storm-bound at the Isle-d'Yeu; these casualties materially reduced the strength of the division. July 20 the *A* cruisers attempted to run the blockade, but were compelled to anchor by a sudden and heavy fog. July 21, at 7 a. m., however, they succeeded in getting out and headed for Cherbourg at 13 knots speed. There was a southwest gale and a heavy sea running which made them roll deeply. It was considered that they would have found it impossible to fight their guns. Cherbourg was reached at 10.30 a. m. July 22, and the six hours' bombardment was finished when B hove in sight off Cape La Hague. *Division A* immediately put to sea at full speed and headed for Brest, pursued by the CHASSELOUP-LAUBAT, FRIANT, and COËTLOGON, the heavier vessels following. *A*, however, escaped. At 8 a. m., July 23, *A* was off the Four Light; course was shaped through Fromveur passage and around the Pierre Noire Light for Brest, which was reached before noon, and the vessels anchored without having been molested.

The following coefficients had been assigned the vessels: *Depuy de Lôme*, 80; *Latouche-Tréville*, 70; total, 150. HOCHE, 100; JEMMAPES, 60; RÉQUIN, 50; FRIANT, 25; CHESSELOUP-LAUBAT, 25; COËTLOGON, 15; EPERVIER, 10; SALVE and LANCE, 5; total 290. B could not defeat *A* without more than half its total force present. The superior speed of *A* was also an important factor, yet the light division of B was very successful in pursuing and getting touch. During the heavy sea the HOCHE alone would have been able to fight her guns. For continuous service but little dependence can be placed even on the larger types of torpedo boats; they were unable to keep the sea during the storm.

That there were so few casualties is worthy of note. An insignificant injury to the engine of the EPERVIER July 16, repaired in less than five hours, and an injury to the boilers of the SALVE, quickly repaired. *No. 145* had a tube give way which was replaced in a few hours. It speaks well for the efficiency of the Northern Squadron that during a period of eight days, under the most unfavorable conditions, but three casualties should have occurred.

With the return of the battleships to Brest, July 23, at 3 p. m., and of the *Suffren* at 4 p. m., the manœuvres terminated.

THE MEDITERRANEAN.

Taking part in the manœuvres were the *Active Squadron*, the *Reserve Squadron*, and the DEFENSE MOBILE, of Toulon, Corsica, Tunis and Algeria. The following-named vessels took part:

MEDITERRANEAN FLEET.

Vice-Admiral DE LA JAILLE, commander in chief.

ACTIVE SQUADRON.

FIRST DIVISION.

Ship.	Class.	Date of launch.	Displacement.	Guns, main battery.	Maximum speed.	Complement.
			Tons.		*Knots.*	
Formidable (flag)	Battleship	1885	11,441	12	16.2	640
Marceau	do	1887	10,581	21	16.5	660
Amiral Baudin	do	1883	11,380	15	15.2	630
Tage[1]	Protected cruiser, first class	1886	7,345	18	19.1	400
Vautour	Protected cruiser, third class	1889	1,280	5	17	134
Wattignies	do	1891	1,310	5	18.6	180
d'Iberville	Torpedo vessel	1893	925	1	21.6	118
				Tubes.		
Argônaute	Torpedo boat, first class	1893	120	2	25.1	34
Éclair	do	1891	106	2	21.5	27
				Guns.		
Cosmao	Protected cruiser, third class	1889	1,877	4	19.5	190

[1] Replaced by the *Cosmao*.


NEIGHBORHOOD OF BREST
5°
5°30'
48°30'
48°
FOUR LIGHT
ILE D'OUESSANT (USHANT)
PASSAGE DU FROMVEUR
CHENAL DU FOUR
LES PLATEAUSSE
CHENAL DE LA HELLE
Pte de CORSEN
BREST
Pte St MATHIEU
GOULET DE BREST
PIERRES NOIRES LIGHT
CHAUSSÉE DES PIERRES NOIRES
CHENAL DU FOUR
CAMARET
PASSE DU CORBEAU
LES TAS DE POIS
DINANT
IROISE
BAIE DE DOUARNENEZ
ILE SEIN
"THE SAINTS"
CHAUSSÉE DE SEIN
RAZ DE SEIN
Pte du RAZ

Mediterranean Fleet—Continued.

ACTIVE SQUADRON—Continued.

SECOND DIVISION.

Rear-Admiral MAIGRET, commanding.

Ship.	Class.	Date of launch.	Displacement.	Guns, main battery.	Maximum speed.	Complement.
			Tons.		*Knots.*	
Dévastation (flag)	Battleship	1879	9,639	14	15.1	685
Courbet	do	1881	9,652	14	15.4	669
Redoubtable	do	1894	8,857	14	14.8	700
Davout	Protected cruiser, second class	1889	3,027	10	20.7	336
Troude	Protected cruiser, third class	1888	1,877	4	20.9	190
Leger	Torpedo vessel	1891	450	1	18.8	69
				Tubes.		
Filibustier	Torpedo boat, first class	1895	120	2	25	34
Sarrazin	do	1892	104	2	20.5	27

THIRD DIVISION.

Rear-Admiral M. G. DE SLANE, commanding.

Ship.	Class.	Date of launch.	Displacement.	Guns, main battery.	Maximum speed.	Complement.
			Tons.		*Knots.*	
Magenta (flag)	Battleship	1890	10,600	21	17.5	660
Neptune	do	1887	10,630	21	16.5	660
Suchet	Protected cruiser, second class	1893	3,427	10	20.4	246
Faucon	Protected cruiser, third class	1887	1,240	5	17	134
Lévrier	Torpedo vessel	1891	450	1	18.5	69
				Tubes.		
Kabyle	Torpedo boat, first class	1891	106	2	21.5	27

RESERVE SQUADRON.

Vice-Admiral GERVAIS, commander in chief; Rear-Admiral TOURQUET DE BEAUREGARD.

Ship.	Class.	Date of launch.	Displacement.	Guns, main battery.	Maximum speed.	Complement.
			Tons.		*Knots.*	
Richelieu (flag)	Battleship	1873	8,767	19	13.2	720
Terrible (flag)	Coast defense	1881	7,713	6	14.5	332
Indomptable	do	1883	7,168	6	14.8	332
Amiral Duperré	Battleship	1879	10,487	10	14.3	664
Caïman	Coast defense	1885	7,200	6	15	332
Cécille	Protected cruiser, first class	1888	5,766	22	19.2	486
Sfax	do	1884	4,502	20	16.7	473
Forbin	Protected cruiser, third class	1888	1,848	4	20.6	190
Milan	Cruiser, third class	1884	1,550	5	18	186
Bombe	Torpedo vessel	1885	395	4	18.5	63
Flèche	do	1886	395	4	18	63

Mediterranean Fleet—Continued.

DEFENSE MOBILE.

TOULON.

Ship.	Class.	Date of launch.	Displacement.	Tubes.	Maximum speed.	Complement.
			Tons.		*Knots.*	
No. 38	Torpedo boat, third class	1877/1882	34	2	19	10
No. 65	Torpedo boat, second class	1878/1885	50	2	20	16
No. 98	do	1885/1890	54	2	20	16
No. 123	do	1885/1890	54	2	20	16
No. 124	do	1885/1890	54	2	20	16
No. 143	do	1890/1891	54	2	20	16
No. 167	Torpedo boat, first class	1893	79	2	21	22
No. 178	do	1893	79	2	21-24	22
No. 185	do	1894	80	2	24	22
No. 190	do	1894	80	2	24	22
AUDACIEUX	do	1889	103	2	20.3	27
ORAGE	do	1891	106	2	20.5	27

CORSICA.

No. 62	Torpedo boat, second class	1878/1885	50	2	20	16
No. 97	do	1885/1890	54	2	20	16
No. 134	do	1890/1891	54	2	20	16
No. 140	do	1890/1891	54	2	20	16
No. 172	Torpedo boat, first class	1893	79	2	21	22
No. 173	do	1893	79	2	21	22
No. 176	do	1893	79	2	21	22
No. 177	do	1893	79	2	21-24	22

ALGERIA.

No. 63	Torpedo boat, second class	1878/1885	50	2	20	16
No. 85	do	1885/1890	54	2	20	16
No. 93	do	1885/1890	54	2	20	16
No. 121	do	1885/1890	54	2	20	16
No. 133	do	1890/1891	54	2	20	16
No. 142	do	1890/1891	54	2	20	16
No. 144	do	1890/1891	54	2	20	16
No. 174	Torpedo boat, first class	1893	79	2	21	22
No. 175	do	1893	79	2	21	22
No. 179	do	1893	79	2	21-24	22
No. 181	do	1893	80	2	21	22
BALNY	do	1886	66	2	20	21
CAPITAINE MEHL	do	1886	66	2	20	21
DOUDARTE DE LAGRÉE	do	1886	66	2	20	21
COULEUVRINE	Torpedo vessel	1885	395	4	18.9	63

The manœuvres were divided into three parts: (1) Separate squadron tactics, target practice, and other exercises by the Active and Reserve squadrons during a period of six days. (2) Combined fleet drill, anchoring, getting under way, etc.; division into three squadrons, which proceed: A to Toulon, B to Algiers, C to Ajaccio, each squadron making a night attack upon its port before anchoring, embracing the second week of July. (3) During the third week A and B endeavor to effect junction, being opposed by C. July 22 to 25 blockade of C in Ajaccio by A and B united.

Part I.

The *réservistes* detailed to take part in the manœuvres began to arrive June 30. Toulon was considered to be in a state of siege until July 6. July 1, during the forenoon, the fleet was busily engaged landing material and impediments considered useless in time of war; in other words, exercising at a real drill of "clear ship for action." Among other things landed were all boats not used as armed boats or for landing parties. It is not stated whether the boats retained had sufficient capacity to carry the ships' crews in case of abandon ship.

The *réservistes* of the fifth district were distributed among the vessels of the Reserve Squadron and torpedo defense, those belonging to Corsica taking part exclusively in the defense of that island. The reserve signal force was distributed among the semaphore stations from Port Vendres to Villefranche.

With the exception of the battleship *Amiral Baudin*, the Active Squadron left Toulon July 2, at 8.30 a. m., and the Reserve Squadron shortly afterwards.

The *Milan* remained in Toulon Harbor until July 4 to receive the last of the *réservistes*. She joined the Reserve Squadron at St. Raphael.

The battleship *Amiral Duperré* had been docked for repairs May 18. She was floated out July 6, and left Toulon July 11 to take part in the manœuvres.

The first night the Active Squadron anchored at Salins-d'Hyères, where it was attacked by the Toulon torpedo-boat flotilla. This operation resulted in the complete defeat of the torpedo boats; they were few in number, too large and easily made out owing to their color. On the other hand, the ships were well prepared and their crews on the alert. The working of the search-lights was all that could be desired.

Squadron evolutions, target practice, both with great guns and practice tubes, and torpedo practice at moving targets took place. All exercises and results were considered highly satisfactory, especially in the *Wattignies*, *d'Iberville*, *Tage*, and *Marceau*. July 5 the Active Squadron, in fleet formation, in spite of bad weather, picked up the mooring buoys at Toulon. July 6 all material previously landed was taken aboard. July 5 the Reserve Squadron remained at anchor at Villefranche, exercising boats during the afternoon. At 7 p. m. got under

way and exercised at squadron tactics all night, anchoring the morning of July 6 in Salins-d'Hyères.

The *Bombe*, *Flèche*, and *Orage* remained at Villefranche for two hours after the rest of the squadron and attacked it later. Lights in the squadron were masked, but the *Richelieu* was compelled to show hers to avoid collison with a sailing vessel and it was claimed that she was torpedoed by the *Orage*.

Part II.

July 8 the two squadrons weighed and united off Toulon. The day was spent in tactical and scouting exercises. At 7 p. m. the fleet moored in five lines at St. Tropez in the following order from north to south:

First line, *Troude*, *Tage*, *Redoutable*, *Amiral Baudin*, *Cécille*, and *Sfax*

Second line, *Suchet*, *Neptune*, *Courbet*, *Marceau*, *Terrible*, and *Indomptable*.

Third line, *Davout*, *Magenta*, *Dévastation*, *Formidable*, *Richelieu*, and *Caïman*.

Fourth line, *d'Iberville*, *Vautour*, *Faucon*, *Wattignies*, *Milan*, and *Flèche*.

Fifth line, *Lérrier*, *Léger*, and *Bombe*.

The 9th and 10th were spent in similar exercises. July 10 the fleet divided into three squadrons, *A*, *B*, and *C*, as follows:

Squadron A.

Rear-Admiral de Maigret, commanding. Battleships, *Dévastation* and *Courbet;* coast defense, *Caïman* and *Terrible;* cruisers, *Tage*, *Sfax*, and *Wattignies;* torpedo vessels, *Lévrier* and *Flèche;* torpedo boats, *Sarrazin*, *Argonaute*, and *Éclair*.

The *Tage* broke down during drill and was replaced in *Squadron A*, by the *Cosmao*.

Squadron B.

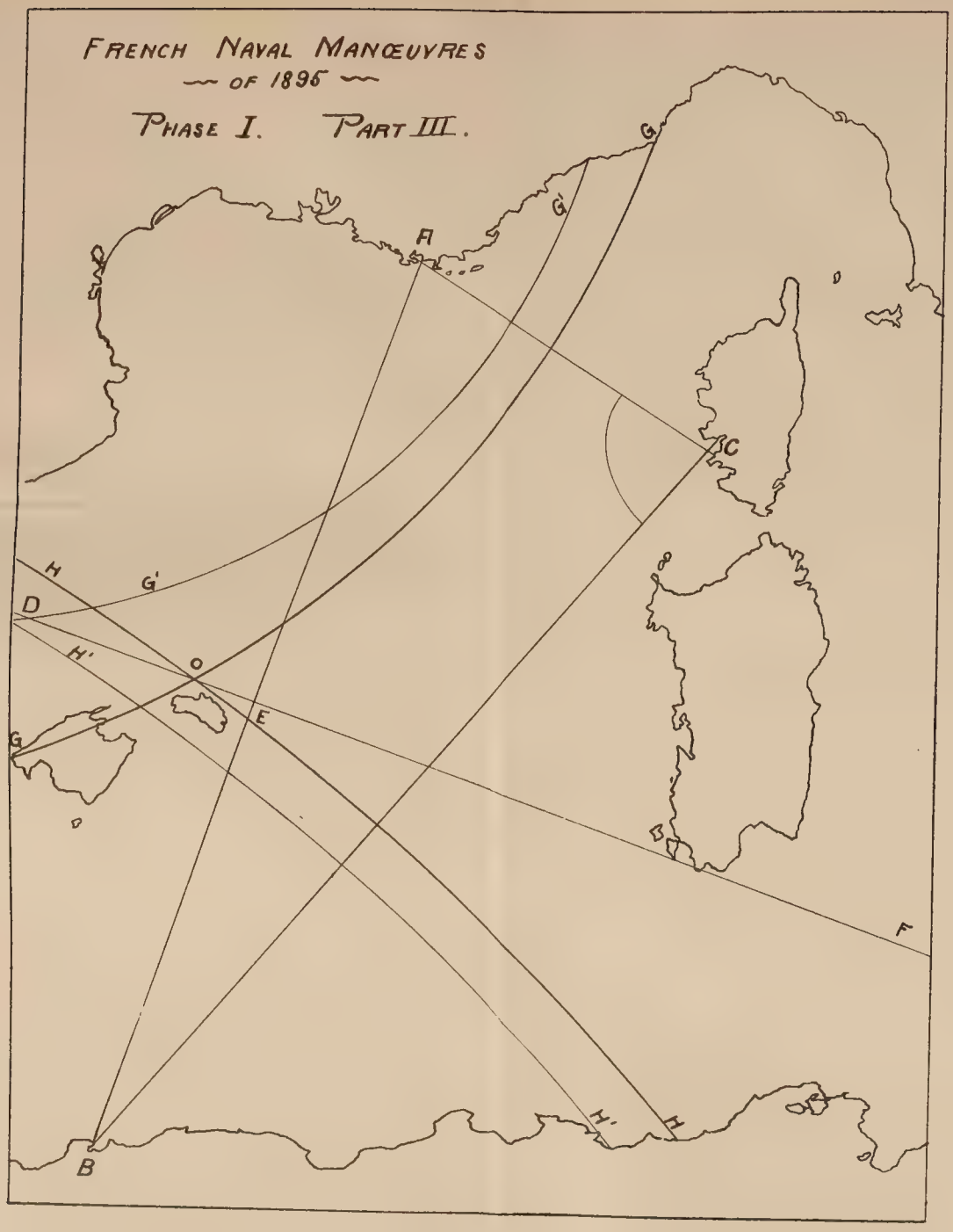
Rear-Admiral McGuckin de Slane, commanding. Battleships, *Magenta*, *Neptune*, and *Redoutable;* cruisers, *Davout*, *Troude*, and *Faucon;* torpedo vessel, *Léger*.

Squadron C.

Rear-Admiral Turquet de Beauregard, commanding. Battleships, Amiral Duperré, Marceau, and Amiral Baudin; coast defense, Indomptable; cruisers, Cécille, Suchet, Vautour, Milan, d'Iberville, and Forbin; torpedo vessel, Bombe; torpedo boats, Flibustier, Kabyle, Audacieux, and Orage.

Umpire ships, *Formidable* and *Richelieu*, neutral during the rest of the manœuvres.

The squadrons formed with intervals of 1,200 meters (1,312 yards)


FRENCH NAVAL MANŒUVRES
— OF 1895 —
PHASE I. PART III.
A
G
G'
C
H
G'
D
H'
O
E
G
F
H'
H
B

between them. Vice-Admiral Jervais, with the *Richelieu*, retained command of C until the junction of Rear-Admiral de Beauregard in the AMIRAL DUPERRÉ at Ajaccio.

The organization was completed in less than half an hour. Passing in review near the *Formidable* each squadron shaped course for its destination.

The *Formidable* moored to a buoy in Toulon at 4 p. m. July 11.

The Toulon torpedo-boat flotilla, except **Nos. 185** and **190**, left the harbor during the evening of July 11 and took post along the coast; they were commanded by Commander Le Clerc, aboard **No. 167**. He sent out five to find the enemy, retaining three in the immediate vicinity of the port.

Squadron A was discovered at 3 a. m., with all lights masked, and the torpedo boats were discovered about the same time. Attacks lasted until 4 a. m., but all were repulsed. The ships moored in the harbor shortly after 5 a. m.

Squadron B approached Algiers July 11. The REDOUTABLE was attacked 35 miles from port, but the torpedo boat was repulsed. About 4 a. m. the whole squadron was attacked. The morning, however, was clear with moonlight, rendering the torpedo boats plainly visible so far away as to enable the vessels to put them out of action before they got within their radius of attack. One torpedo was thought to have been successful. The squadron moored in the harbor at 8 a. m.

SQUADRON C approached Ajaccio the night of July 11 with a smooth sea and bright moonlight. About 3 a. m., near Cape Muro, the torpedo-boat flotilla, except **Nos. 97** and **172**, attacked the squadron. Owing to the clearness of the night and the good use of the search-lights but one attack was successful. **No. 173** torpedoed a cruiser. At 4 a. m. the attack ceased and the torpedo boats returned to harbor. The squadron moored at 4.30 a. m. July 12 off Ajaccio. At 7 a. m. the AMIRAL DUPERRÉ, bearing the flag of Rear-Admiral de Beauregard with the cruiser VAUTOUR in company, joined the squadron. The *Richelieu* became neutral.

PART III.

THEME.

First phase, July 15 to 20: Two squadrons, *A* and *B*, *A* at Toulon, *B* at Algiers, endeavor to effect junction in the Mediterranean between the meridians of Cape Corsica and Palma, Majorca. A squadron C, stronger than either, but weaker than their combined force, starting from Ajaccio, endeavors to prevent their junction. If C meets either *A* or *B* alone C is victorious; but if *A* and *B* unite, C must take refuge in Ajaccio. Speed allowed C 12 knots, speed allowed *A* and *B* 10 knots. C weighs at noon, *A* and *B* at 4 p. m. C's cruisers, however, can not leave the main squadron until 4 p. m.

If *A* and *B* succeed in effecting junction they may chase at 12 knots.

Second phase, July 22 to 25: From the evening of July 22 *A* and *B* concentrate; the blockade of Ajaccio is established at 4 p. m. July 23. C aided by the *défense mobile* forces the blockade and takes refuge in Salins-d'Hyères, supported by the *défense mobile* of Toulon. The three squadrons anchor July 26 at Toulon.

Squadrons A and B.

In each squadron two light divisions were formed. *Squadron A*, first division, *Cosmao*, *Wattignies*, and *Lévrier;* second division, *Sfax* and *Flèche*. *Squadron B*, first division, *Davout*, *Faucon*, and *Léger;* second division, *Troude*.

Each first division was to do distant scouting; each second division kept generally in contact with the battleships.

PLAN.

The main force of *A*, accompanied by the second light division, was to hug the coast as far as Cape Martin and then to manœuvre in squares 35, 36, 59, and 60 during the 16th. If not discovered by the enemy to be in square 90 not later than 8 p. m. From this point, if he thinks the course clear, the rear-admiral will send a cruiser to hug the coasts of Corsica and Sardinia to meet *B* and to inform the rear-admiral commanding that *A* is advancing according to prearrangement. The main force of *B*, with the *Troude*, was to steer so as to be in square 1193 about 10 a. m. July 16, and at 8 p. m. in square 956, thence along the coast of Sardinia; if the enemy was not encountered the squadrons would meet either in square 381 or 435 about 9 a. m. July 17. If, upon arrival, *A* has not arrived and *B* has no news of *A's* movements *B* will remain, if the enemy does not interfere, until noon, and then manœuvre as explained in the modification.

MOVEMENTS OF THE LIGHT DIVISIONS.

The first division of *Squadron A*, with the *Éclair* and *Sarrazin* in company, was to steer about S. 15° E. to make contact if possible with C, to attack the battleship with the torpedo boats if occasion offers, and to destroy any cruisers caught by themselves. Full speed to be used and afterwards to effect junction in square 530 about 10 a. m. July 16 with the first division of *Squadron B*.

The first division of *Squadron B*, upon leaving Algiers, was to steer for the passage between Majorca and Minorca where, at 15 knots speed, it should reach square 528 about 5 a. m. July 16. It was thought the C scouts could not reach this point before 5.30 a. m. They were to be captured or chased, if possible, or else evaded so as to effect junction in square 530 with the *A* division about 10 a. m. When the division united they were to be under the commanding officer of the *Davout*. He was to establish a cruising line as soon as possible upon the mean direction

joining squares 480 and 210. He was to cover as much space as possible, at the same time keeping the vessels able rapidly to concentrate. Should he discover the main force of C he was to send information to *A* and *B*. Every effort was to be made to mislead the enemy as to the probable positions of the two squadrons. If he concluded that nothing interfered with their junction, he was to retire his force gradually toward the selected point so as to reach it about the same time as the allies. Should he receive information of the destruction of either squadron he was to join the other at once for orders.

MODIFICATION.

In case the commander of *A* thinks the enemy's cruisers have discovered his squadron during the 16th, and that it is no longer possible to carry out the plan as above given, he will return as he came out, passing from square 14 behind the Hyères Islands and thence to square 135. The new rendezvous will be either square 312 or 363. In case this change takes place *A* must inform *B*, either through a cruiser or through the light divisions, and also when he left the cruising ground of July 16.

Squadron B, when informed of the change, or in any case at noon July 17, will make for the second rendezvous, crossing square 734 and passing between Majorca and Minorca. Since, under this hypothesis the squadrons will make about equal runs, supposing *B* to leave square 435 at noon July 17, the squadrons should join between 8 p. m. and midnight, July 18.

It is understood that the commander of *B* is to proceed to the second rendezvous should he find it impossible to execute the first plan, endeavoring to inform *A* of the change.

SQUADRON C.

SQUADRON C was organized as follows: Main force, first division, AMIRAL DUPERRÉ and MARCEAU; second division, AMIRAL BAUDIN and INDOMPTABLE; torpedo boats, AUDACIEUX attached to AMIRAL DUPERRÉ and CÉCILLE; FILIBUSTIER attached to MARCEAU and SUCHET; KABYLE attached to AMIRAL BAUDIN and FORBIN; ORAGE attached to INDOMPTABLE and VAUTOUR.

Light squadron, first division, CÉCILLE and MILAN; second division, SUCHET and D'IBERVILLE; third division, FORBIN and BOMBE; fourth division, VAUTOUR (repeating ship).

The commanding officer of the CÉCILLE was to command the light squadron. The vessels were classed for speed as follows: D'IBERVILLE, SUCHET, CÉCILLE, MILAN, BOMBE, FORBIN, and VAUTOUR. And for military power in the following order: CÉCILLE, SUCHET, FORBIN, VAUTOUR, MILAN, D'IBERVILLE, and BOMBE.

PLAN.

The squadron was to weigh at 11.35 a. m. so as to be moving at noon. Course shaped for Toulon. Precisely at 4 p. m. the light squadron will carry out previous orders as follows:

The cruisers immediately will seek for *Squadron A* and explore all the section included between the coast and the curve envelope of the positions of *A* supposing that force leaves Toulon at 4 p. m. July 15, making 10 knots. This curve will be followed pretty closely by the D'IBERVILLE.

The following courses to be taken:

Hours.	Courses and distances.			
	D'IBERVILLE.	SUCHET.	CÉCILLE.	MILAN.
4 to 8 p. m....	N. 70° W. at 18 kts..	N. 55° W. at 18 kts..	N. 59° W. at 17 kts..	N. 86° W. at 16 kts.
8 to 10 p. m ..	S. 40° W. at 17 kts...	(1)	N. 80° W. at 12.5 kts.	N. 73° W. at 14 kts.
10 to midnight	S. 75° W. at 16 kts...	N. 81° W. at 14.5 kts.	N. 86° W. at 14.6 kts.	W. at 14.7 kts.
Midnight to 2 a. m.	N. 85° W. at 16.8 kts.	N. 87° W. at 13.5 kts.	S. 86° W. at 13.5 kts.	S. 86° W. at 14 kts.
2 to 4 a. m....	N. 71° W. at 16 kts..	N. 74° W. at 14.7 kts.	N. 74° W. at 14.8 kts.	N. 74° W. at 14.9 kts.
4 to 5 a. m.[2] ..	N. 30° W. at 17 kts..	N. 58° W. at 17 kts..	N. 60° W. at 18 kts..	N. 60° W. at 15 kts.
5 to 6 a. m....	N. 12° W. at 18 kts .	S. 4° E. at 17 kts	S. 53° W. at 18 kts...	S. 18° E. at 15 kts.
6 to rendezvous.	S. 44° E. at 18 kts...		S. 37° E. at 18 kts ...	

	FORBIN.	AUDACIEUX.	VAUTOUR.	BOMBE.
4 to 8 p. m....	N. 72° W. at 15 kts..	N. 74° W. at 14.8 kts.	N. 77° W. at 14.8 kts.	N. 84° W. at 15 kts.
8 to 10 p. m...	N. 73° W. at 14.8 kts.	N. 74° W. at 14.8 kts.	N. 77° W. at 14.8 kts.	N. 84° W. at 15 kts.
10 to midnight	S. 85° W. at 14.8 kts.	S. 81° W. at 15.2 kts.	S. 76° W. at 14 kts ..	S. 75° W. at 15.5 kts.
Midnight to 2 a. m.	N. 85° W. at 15 kts..	N. 87° W. at 15 kts..	N. 86° W. at 15 kts..	N. 85° W. at 15.2 kts.
2 to 4 a. m....	N. 74° W. at 14.5 kts.	N. 73° W. at 15 kts..	N. 74° W. at 14.5 kts.	N. 72° W. at 15.5 kts.
4 to 5 a. m....	N. 60° W. at 15 kts..	N. 53° W. at 15 kts..	N. 53° W. at 15 kts..	N. 41° W. at 15.5 kts.
5 to rendezvous.	S. 26° E. at 15 kts....	S. 32° E. at 15 kts...	S. 37° E. at 13 kts ...	S. 50° E. at 14 kts.

[1] Examine Hyères Islands so as to be on line of other cruisers at 10 p. m.

[2] Instead of 5 a. m. read 4.30 for the SUCHET and 4.45 for the CÉCILLE.

At 4 p. m. the FILIBUSTIER will steer for Bormes Roads at 20 knots speed, where she should arrive about 8 p. m. Following the coast she will examine particularly the anchorages of Hyères and Brégançon, reconnoitre Toulon, entering the roadstead to be certain of the departure of *A*, then thoroughly search the coast, the anchorages of Ciotat, Marseilles, Gulf of Fos, Aigues-Mortes, arriving at the last port about 3 a. m., and thence will steer for the rendezvous, where she should arrive before 7 a. m.

The KABYLE and the ORAGE will steer direct for Cape Sicié at 16 and 16.5 knots; they will examine the Brusc anchorage and then follow the route marked on the plan so as to be near Aigues-Mortes about

3.30 a. m.; then making a leg to the westward will steer for the rendezvous, where they are to arrive about 7 a. m. The main force to steer first toward Toulon and then at the admiral's discretion.

If at 8 a. m. the enemy still remains undiscovered, attention was to be directed to find *B*, in which case course would be made for the Straits of Bonifacio at 12 knots. A light division, composed of the SÉCILLE, SUCHET, and D'IBERVILLE, would be sent out in line following the counter departure curve, supposing *B* to have started from Algiers at 4 p. m. July 15 at 10 knots. The curve to be made for 17 knots.

Measures also were taken to maintain touch with the enemy, either by day or by night. Finally courses to be steered were given if *B* was met before or after effecting junction with *A*.

Squadron A.

July 15, at 4 p. m., *Squadron A* got under way from Toulon, sending out the light division to the southeast. The rest of the squadron, at 10 knots, stood to the eastward, passing behind the Hyères Islands and hugging the coast. The night was dark, but all lights were hidden. At dawn the squadron was off Cape Martin and the course was changed gradually toward Corsica. At 8 a. m. speed was reduced to 7 knots and the coast of Corsica followed to the southward; the second light division was sent back during the afternoon to the Hyères Islands and at 7 p. m. speed was increased to 10 knots. At 2 a. m. July 17 the squadron was off the Sanguinaires. At 3 a. m. signals were seen to the westward, found to be made by cruisers of SQUADRON C reporting their discovery. At daybreak *A* made out the cruisers FORBIN, D'IBERVILLE, and SUCHET and immediately afterwards the battle squadron, which at once gave chase.

At 7 a. m. the torpedo vessel *Léger* joined, in spite of the SUCHET and D'IBERVILLE, who tried to intercept her. C was gaining rapidly when *B* was made out ahead at 7.20 a. m., two hours ahead of time.

Squadron B.

Squadron B got under way July 15, at 4 p. m., and followed the courses as laid down in the original plan, with which the enemy did not interfere. At 2 a. m. the squadron exercised at night quarters, during which the *Neptune* lost a man overboard. Two hours were spent in an ineffectual search, when the squadron proceeded on its course. Preparations were made to repel torpedo boats, expecting an attack from Corsica. July 17, at daylight, made out the coast of Sardinia, and at 6 a. m. smoke on the horizon; went to general quarters. Within a short time *A* was made out, chased by C. *B* increased speed, and junction with *A* was effected near Asinara Island, about 5 miles off the coast of Sardinia.

Cruisers A and B.

The cruisers followed out the plan as originally laid down. About 8 p. m. July 15 the *A* cruisers surprised the MILAN, that, through some inexplicable error, allowed them to approach within about 100 yards. She was regarded as destroyed and went to Ajaccio.

The light divisions joined, and after cruising together for a day and a night without seeing anything or doing anything proceeded to the rendezvous only to find the manœuvre terminated.

SQUADRON C.

Following the program as laid down by the rear-admiral commanding, C weighed from Ajaccio at noon July 15, and sent out the cruisers at 4 p. m. to find *A*. At 8 p. m. the main force was in the neighborhood of the spot where it was hoped *A* would be met.

About 9 p. m. the torpedo boat FILIBUSTIER discovered the main force of *A* off Cape Bénat. After following the squadron for some time without being discovered to obtain exact information as to course and speed, she steered westward at full speed to communicate, making signal that the enemy was steering east. The signals were soon perceived and repeated from ship to ship to the admiral, in spite of the break caused by the absence of the CÉCILLE that, owing to an accident to one engine, remained motionless for seven hours. This vessel can make 16 knots using one screw. The MILAN was supposed destroyed, and had gone to Ajaccio, where the CÉCILLE arrived at 5 p. m. July 16, under orders from the admiral.

The squadron steered at once to the eastward to find the enemy, expecting to be guided by the FILIBUSTIER. Unfortunately, although following at first the proper course, the umpire ship *Richelieu* was met and the torpedo boat was stopped to obtain information. The vessel remained near the *Richelieu* by an error of judgment, and the squadron was unable to find either the FILIBUSTIER or the enemy.

The CÉCILLE not knowing what had happened, when temporary repairs had been made, went as far as Cape Creux; the SUCHET went off to the northeast to join and got lost, but accidentally found her friends the following night; the VAUTOUR injured her feed pump and could not continue scouting; the BOMBE found the squadron only the following morning; the FORBIN also got lost, and the admiral was left with but one cruiser, the D' IBERVILLE, to obtain information.

The admiral was thus compelled to await information and also to abandon the alternative effort against *B;* he finally decided to return to the neighborhood of Ajaccio. Thus heavily handicapped it was by accident that *A* was discovered and chase given; but it was then too late, the time lost enabling *A* and *B* to effect junction. The advantage was now with the combined squadrons. C at once changed course for Ajaccio and *A* and *B* gave chase in two columns, *A* to starboard, *B*

to port, interval between columns 2,200 yards, trying to surround C, but the latter escaped owing to superior speed. At 9 a. m. the enemy's torpedo boats were signaled, but they made no attempt to attack. The pursuit was abandoned at 1.30 p. m., and the squadrons shaped course for Salins-d'Hyères, where they anchored July 18. C anchored at Ajaccio. This terminated the first phase of this part of the manœuvres. Victory was with *A* and *B*.

A and *B* returned to Toulon, where they coaled and took in stores. C did the same at Ajaccio.

THE BLOCKADE OF AJACCIO.

The blockade of Ajaccio to be established at 4 p. m. July 23. C, aided by the *défense mobile* of Corsica, to force the blockade, then to take refuge on the coast of Provence supported by the Toulon force. The vessels of *A* and *B* not to approach within 4 miles during the day or 3 miles during the night of a line joining Revellata Point, Capes Gargolo and Rosso, Sanguinaire Light-house, Cape Muro, and Senetose Point. C can force the blockade anywhere between Revellata Point and Senetose Point. The zone of action for the *défense mobile* is limited to 30 miles from the coast between the last points named. The Toulon force is limited to 30 miles from the coast between Planier and Cape Ferrat. Speed for the main force of *A* and *B* not to exceed 11 knots; C, not to exceed 10 knots; speed of all cruisers as before.

If C breaks the blockade the squadron must reach an anchorage on the coast of Provence before being overtaken either by *A* or *B*, in which case C will be considered safe and the manœuvres finished.

The semaphores on the west coast of Corsica and from Marseilles to Villefranche on the coast of France are at the service of C.

The blockade was established July 23, at 4.30 p. m., by *A* and *B*, with the following arrangement of force: The cruisers and torpedo vessels were to follow the movements of the C cruisers, keeping at the proper distance from the shore. The main force of C was to be the objective of the main force of *A* and *B*. Fearing, however, that a false attack by the cruisers might lead to the escape of C, it was decided that the cruisers and light vessels should go one way, while the main force followed an inverse direction.

The C cruisers and torpedo vessels, supported by the *défense mobile*, came about 2 miles offshore cruising everywhere, obliging the enemy's cruisers to follow them. The main force of C had not left the anchorage. The night was dark. After nightfall the C cruisers were very active, made much use of their search-lights, and finally, when to the northward, fixed their beams as if to make a luminous screen, under cover of which the main force could escape. Deceived by this, the main force of *A* and *B* concentrated to the northward, leaving but one cruiser, the *Davout*, to guard the southern exit. C slipped out, and was signaled

by the *Davout*, but the latter did not follow, nor were any further signals made by her. Hence the main force of C reached the French coast unmolested, while the C cruisers kept up the use of their searchlights all night, completely deceiving the blockading force. The C cruisers maintained the same tactics during July 24. The cruisers, thanks to their speed, escaped during the night and joined the main force of C at Salins-d'Hyères. The *défense mobile* was very active, and contributed materially to the escape of both divisions.

Rear-Admiral Margret, commanding the *A* squadron, endeavored to obtain information, both from the C light division and from the signal stations, but without success. The C light division was seen escaping by a cruiser and the fact signaled to the fleet, but it was not chased, as the main force was thought to be still inside. It was not known that C had broken the blockade until the morning of July 25.

Four torpedo boats were captured July 23 by the *Wattignies*, and two others attacking at night were considered destroyed. The torpedo boat *Sarrazin* was captured July 23 by the AMIRAL DUPERRÉ; she anchored at 6 p. m. at Ajaccio.

July 26 the squadrons united and entered Toulon together. The *réservistes* were detached and sent home and the manœuvres were considered terminated.

TARGET PRACTICE.

Target practice, particularly in the Active Squadron, was considered to be very satisfactory; hits were made at 4,400 yards. At tube practice each ship anchored four targets in a square, each side of which was about 2,200 yards, so that both broadsides could be used at the same time. Speed during this exercise was about 8 knots.

Torpedo practice at moving targets was held as well.

COALING.

Coaling was done in port July 18. At Toulon the following amounts of coal were taken:

Magenta, 200 tons; *Caïman*, 100 tons; *Terrible*, 130 tons; *Cosmao*, 100 tons; *Wattignies*, 60 tons; *Faucon*, 50 tons; *Léger*, 55 tons; *Lèvrier*, 50 tons; *Flèche*, 15 tons; *Sarrazin*, 8 tons; *Éclair*, 12 tons. No coal was taken by the *Dévastation*, *Courbet*, *Redoutable*, *Neptune*, *Sfax*, or *Troude*. Nearly all the vessels coaled more than once. There were no attempts made to coal at sea.

CASUALTIES.

BATTLESHIPS.

Amiral Baudin: Man seriously injured July 1 while landing material.

Amiral Duperré: Man slightly injured same day.

Courbet: Two men slightly injured same day by the breaking of forward bolt of steam launch when boat was being hoisted.

FRENCH NAVAL MANŒUVRES
— OF · 1895 —

— THE MEDITERRANEAN —

VILLEFRANCHE
CAPE MARTIN
BORDIGHERA
ST. RAPHAEL
ST. TROPEZ
HYERES ILES
TOULON
BRUSC
BORMES
CIOTAT
MARSEILLE
G. DE FOZ
CETTE
G. D'AIGUES MORTES
PORT VENDRES
C. CREUX
C. CORSO
REVELLATA Pt.
C. GARGOLO
G. ROSSO
CORSICA.
AJACCIO
SANGUINARES LIGHT
G. MURO
SENETOSE Pt.
BONIFACIO STRAITS
ASINARA I.
C. FALCONE
C. CACCIA
SARDINIA.
S. PIETRO I.
S. ANTIOCO I.
MAJORCA
PALMA
MINORCA
C. BERRUT
C. CARBON
BOUGIE
ALGIERS
BONA
C. SERRAT
BENZERTA
TUNIS
3° LONG. EAST OF PARIS
6° LONG. EAST OF GREENWICH

35 36 59 60 90 135 210 312 363 385 435 480 528 734 956 1193

44° 43° 42° 41° 40° 39° 38° 37°

0 1° 2° 3° 4° 5° 6° 7° 8°

Indomptable: Fire aboard July 17. Damage done slight, mainly through the energy and courage of Chief Engineer Valo, who was complimented publicly by the commander in chief.

Neptune: Lost a man overboard July 16 while going to night quarters.

CRUISERS.

Cécille: Injury to one shaft, night of July 15. Temporary repairs made by force on board. She was sent to Ajaccio July 16 to repair and coal. She went to sea next day.

Sfax: Injury to boiler tubes.

Tage: Injury to feed pump July 11; was obliged to return to Toulon. She took no further part in the manœuvres, and her place was taken by the *Cosmao*, just returned from the Levant.

Vautour: Detained in Toulon for repairs until July 9, when she joined C at Ajaccio. She broke down July 15 through an accident to the feed pump, which was repaired by the force on board about 25 miles outside Ajaccio. She broke down again, however, a few hours later, and the admiral sent her to Toulon. It is said her accident was due to trial of liquid fuel.

TORPEDO VESSEL.

Flèche: Cylinder damaged.

TORPEDO BOATS.

Argonaute: Was unable to leave Toulon July 8 with the Active Squadron. She took no further part in the manœuvres, but was ready for service July 27.

Sarrazin: Broken piston.

No. 172: Injury to machinery July 22; towed to Ajaccio for repairs.

No. 143: Slight injury to machinery July 11; towed to Toulon by **No. 178**.

PIGEONS.

July 4 at sunrise a number of homing pigeons were released about 186 miles (300 kilometers) at sea, off St. Nazaire. The first Brest bird returned at 4.15 p. m. in spite of a high wind and much fog. The armored gun vessel *Achéron* was used during the manœuvres in the Mediterranean and conducted several pigeon flights. Exact information is wanting.

COMMENTS.

Many of the *réserristes* were tardy, not reaching Toulon for several days after the time set. This would be the cause of serious, perhaps fatal, delay in time of war. Measures are to be taken to remedy this defect. In other respects the attendance and work done were very satisfactory.

The work of the Northern Squadron developed nothing of special interest, except to demonstrate the difficulty, if not the impossibility of

maintaining a blockade under modern conditions. To close a harbor like that of Brest effectually will require a force at least twice as powerful as the fleet within.

The *défense mobile* of Brest always is well drilled and enterprising. There is no school superior to an active torpedo-boat flotilla to prepare young officers for command.

The permanent torpedo-boat flotilla forms a seasoned nucleus of trained officers and men with vessels not liable to break down just when most needed, around which the hastily mobilized force can gather and can be brought to an efficient condition more rapidly than in any other way.

In the Mediterranean the defense of Toulon was in strong contrast to that of Brest. When *Squadron A* attacked Toulon not a torpedo boat was seen until nearly daybreak, although the squadron was within the sector of attack. Speaking generally, the torpedo-boat flotillas in the Mediterranean were not successful in their operations; exception must, however, be made in favor of the *défense mobile* of Ajaccio, which contributed materially to the escape of C during the last stage of the manœuvres.

The principal interest centers about the first phase of Part III. With increase of mobility the offensive power of fleets is increased greatly, facility of concentration and combined movements rendered more certain, while discovery is rendered much more difficult. Scouting becomes more and more important. To discover the best methods of finding and keeping touch with a hostile fleet, communicating necessary information quickly to the friendly fighting force and guiding that force by the shortest line to the enemy, are divisions of the scouting problem capable of solution during peace under conditions more closely resembling those of war than any other phase of peace manœuvres.

To obtain a correct idea of the many phases, the problem should be solved as far as possible by the graphic or geometrical method.

A and *B* leaving Toulon and Algiers, respectively, at the same time and at the same speed, manifestly would meet at the point E, equidistant from each; were they to steer a direct course, A B, they would meet somewhere on the perpendicular D F to this point, were each to steer directly for a prearranged rendezvous. Taking the speeds allowed, *A* and C would meet somewhere on the circle G G, called in France "circle of meeting" (circle de rencontre).[1] Similarly, *B* and C would meet on the circle H H′. *A* and *B* plainly would reach places inside these circumferences before C; consequently they could meet where common interior areas exist without C being able to reach these areas until too late. This position, as shown on the sketch, begins near

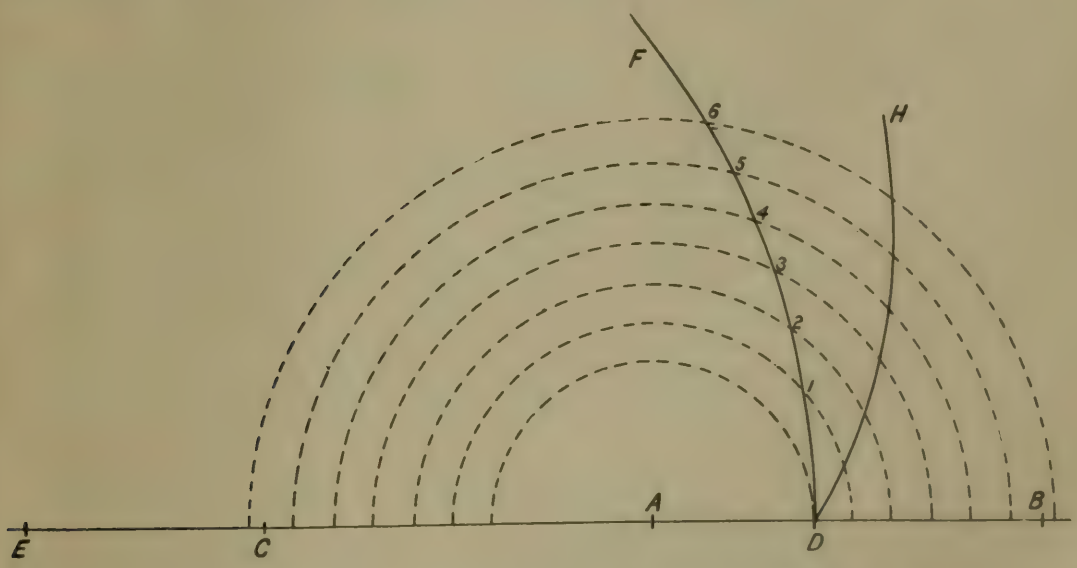
[1]The circle of meeting is struck with a radius equal to half the distance to the point where two ships or fleets would meet on the opposite side of the starting point of the slower, if moving at the given speeds, and on the same course. Thus, in the figure let A represent a ship or ships moving at 12 knots, and B a ship or ships moving at 16 knots. Suppose the figure drawn to scale, and that A and B are 100 miles

Minorca, and just north of it. *A* and *B* then could effect concentration without interference from C, supposing the squadrons leave port at the same time. As originally prepared by the general staff this was to have been the case, so that the task set C was impossible. This error was discovered very quickly by the admirals of the fleet, hence C was given a start of four hours.

Under the new arrangement the circles of meeting, G′ G′ and H′ H′, are not intersected by the perpendicular within the limits assigned for the manœuvres. The margin allowed, however, was too narrow, for should C be retarded by any cause, such as a strong westerly wind, *B* would meet *A* before C could interpose. Allowing for the probable state of the sea is necessary correctly to estimate on speed and time where the margin is small. So, also, other causes likely to retard speed must be allowed for, such as fog, accidents, or man overboard.

It may be asked if it will be possible in time of war to search on a hostile coast for an enemy's squadron aware of pursuit. Cruisers and scouts, especially at night, will run great danger from hostile torpedo flotillas, if searching near the coast, and they must approach it if they are to obtain any information.

Plate 00 is a theoretic plan and solution of the problem given by La Marine Française. C steams toward Toulon until 4 p. m. and then deploys his scouts so that they shall reach at 8.15 p. m. on the circle of meeting corresponding to a speed of 15 knots the positions I, II, III, IV, V, and VI. The torpedo vessels to beat up the coast, while the cruisers in column follow the counter departure curve, which differs but little from the circle of meeting II′. Should the enemy not be discovered the scouts will have searched the gulf and the light vessels



apart, the radius will be D E, equal to B C, and equal to 200 miles; the circle of meeting is D F, struck from D, where meeting would take place on courses opposite and approaching. The curved line D H is called the line of counter departure; the points on the curve are the intersection of the relative hourly speeds; A, from A as a center; B (after four hours), from D.

can rejoin the main force at the rendezvous, which division steams for S, the point of meeting at 4 a. m. with the main force of *A*, at which time the C cruisers are at E_1, E_2, E_3, E_4, E_5, and E_6. The search still unsuccessful, the cruisers follow the curved courses while the main force steers south until 8 a. m., at S_8, when all steer for the Strait of Bonifacio.

If C deems it impossible to search at night and waits for day, at 4 a. m. *A* will be on M M′ and *B* on K K′. C must cover M M′ to sight *A*, and this circumference measures over 420 miles, besides which, the cruisers must be able to inform C in sufficient time to enable the main force to cut off *A*. The possibility of success rests entirely upon transmission of information. If C can be informed by signal, let us say, in an hour, the main force can take post in the center at R. If, however, the information must be carried by a vedette, at least six hours will elapse, supposing the enemy is sighted at T, 120 miles from R, before C starts in pursuit and *A* escapes. The offensive sector diminishes rapidly with the method of conveying information, and the area properly covered in which an action may be forced, will be regulated by the time required for information to reach the flag. Hence the great importance of speed and rapid and distant signaling.

C can attack *B*, whose 4 a. m. sector is much smaller than that of *A*, but the C cruisers at this time will be 40 miles from K K′, while the main force will be more than 90 miles distant. Nevertheless, if the cruisers and light vessels are deployed on the curve of shortest distance, V V′ of *B* and the C cruisers, while the main force, to guard against *A*, steers for Minorca, the chances are the most favorable to meet *B*. On the other hand, if *B* hugs the coast of Algeria to the eastward to the intersection of V V′, it will be almost impossible for C to meet *B*.

These considerations point to the elaborately prepared plan of Rear-Admiral Beauregard, in which everything was allowed for except what happened. An important point, and which may have deprived C of the victory, was the separation of the scouts. It will be remembered that in the English scouting manœuvres Rear-Admiral Seymour sent his scouts out in pairs; had the FILIBUSTIER been in company with a friendly scout the destruction of the *A* force would have been almost certain. However, the problems set were not the same, so it is difficult to compare one system with the other, but it would seem that scouts and lookout vessels should be in pairs, always within reasonable distance of each other.

Apart from the enemy's point of departure usually supposed known there are three principal factors in every scouting problem: (1) The enemy's route, (2) the hour of departure, (3) speed of the ships. The difficulty of solution varies with the known factors.

Much credit is due the cruisers of *A* and *B* for the faithful execution of their orders. The capture of the MILAN contributed to the success of the combined squadrons.

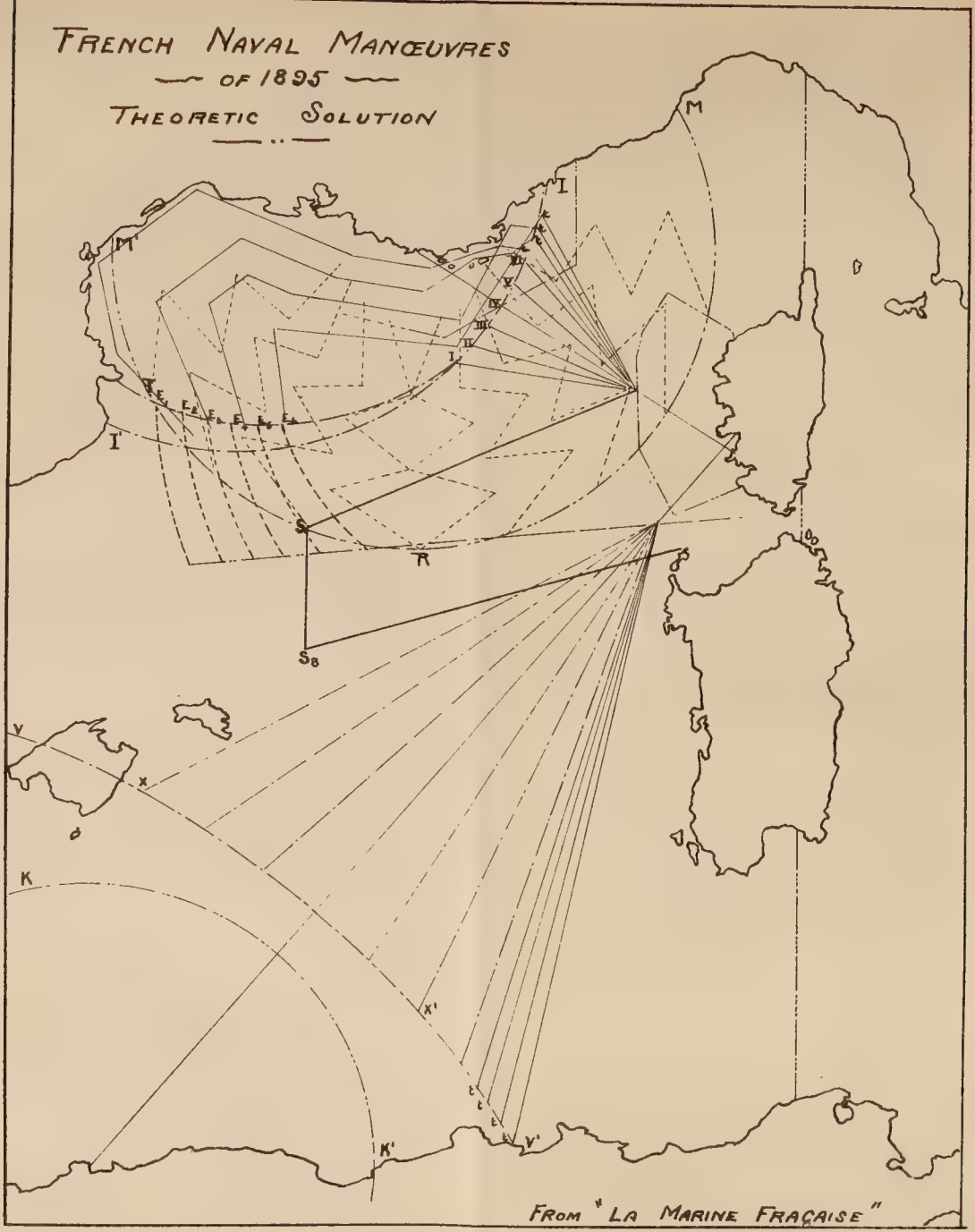

FRENCH NAVAL MANŒUVRES
OF 1895
THEORETIC SOLUTION
M
I
M'
I'
S
R
S8
V
X
K
X'
K'
V'
FROM "LA MARINE FRAÇAISE"

PLATE 00.

The general plan of *A* and *B*, however, is open to doubt. From the nature of the problem, as already shown, the better plan was for *A* and *B* to attempt junction by the western line; the squadrons would approach each other more rapidly than by any other route; the left flank of *A* and the right flank of *B* could have been covered by their cruisers, with a force sufficiently strong to compel the C cruisers to concentrate in order to obtain information, thus reducing their area of observation and delaying the movements of the main force. *A* and *B* would approach at 20 knots while C could make but 12. C could intercept *A* only by a straight course at full speed to O, the point of intersection. By waiting at any station for information the time lost could not be regained. As previously mentioned, the margin allowed C was too narrow.

It may be asked if the rôle assigned the *A* and *B* cruisers was the proper one. There was no definite plan by which *A* or *B* was to receive information obtained by the cruisers. Their rôle was passive and not that of scouts and no efforts were made to locate the main force of C. In fact, when they reached the rendezvous the other parts of the manœuvres had been completed.

The failure of C to prevent the junction of *A* and *B* was due to no defects in the plan as prepared by Rear Admiral Beauregard, but to causes over which he had no control and accidents against which it was impossible to provide.

Even at the very last minute, had it not been for the interference of the umpire ship *Richelieu*, the FILIBUSTIER would have regained touch with *A* and have guided C to victory.

The numerous accidents to the cruisers would indicate either an undue tenderness or something wanting in the care and manipulation of the machinery. As far as can be ascertained no vessel was forced unduly.

Many objections are made, and justly, against the umpire rôles given the commanders in chief. It is certain that no such duty in time of war will devolve upon a flag officer and nothing is gained by having umpire ships. Under any circumstances the rôle is too subordinate to be taken by the officers that ought to direct the operations.

The results obtained both at Brest and at Ajaccio seem to indicate that blockade, as formerly understood, is impossible. If the enemy can be kept at a certain distance from a harbor entrance he cannot prevent a fleet from putting to sea.

When it is desired to get the fleet to sea without action an efficient and aggressive coast-defense force can divert the attention of the enemy, especially at night, keeping the main force and possibly the inner lines sufficiently far away from the harbor mouth to enable the blockaded fleet to slip out unobserved.

The semaphore service, particularly in Corsica, did not show good results. This important adjunct to any properly organized system of coast defense should be maintained in the highest state of efficiency.

SCOUTING EXERCISES.

ACTIVE SQUADRON.

February 5 and 6 a scouting exercise by the Active Squadron took place in the Mediterranean. In the general order of Vice-Admiral de La Jaille on the subject, the outline of the theme is as follows:

A battle squadron is signaled off Cape Corso heading for the French coast. The light division is to reconnoitre and to inform the commander in chief of its composition and movements.

The battle squadron to weigh at 5 p. m., February 5, and to proceed directly to the designated point.

The light division to be ready at 7.30 a. m. February 6, to weigh by signal, at which time the hour of the supposed passing of Giraglia by the battle squadron will be communicated.

Area of exercise limited by the line from Cape Ferrat to Giraglia, the parallel of Ajaccio and the meridian of Toulon. The battle squadron must pass within 15 miles of the Corsican coast.

Being purely a scouting exercise, the light vessels must not approach the armored ships within 5,000 meters (5,468 yards) by day, nor 2,000 meters (2,187 yards) by night.

As soon as the battle squadron is recognized a light vessel will be sent to the admiral to inform him of the character of the information obtained. The exercise will be ended when all the light division (less one) is assembled at the required distance from the battle squadron, which squadron will be informed by signal when this is accomplished. In any case, the manœuvre will end not later that 10 p. m. February 10.

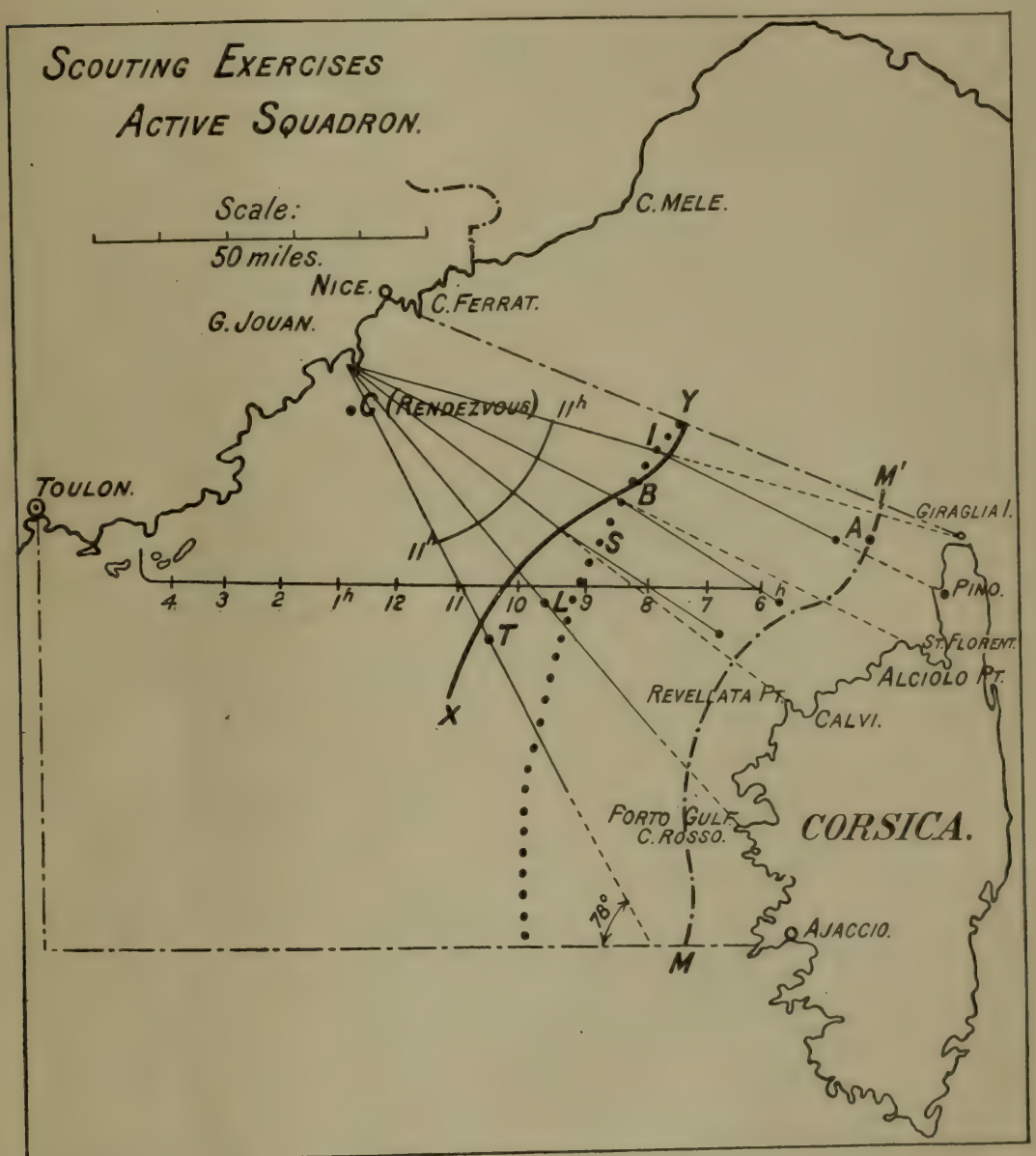
Speed for battle squadron 9 to 10 knots (that obtained by the *Formidable* with 45 revolutions), the light division to make 13 knots.

The battle squadron was composed of the battleships MAGENTA and NEPTUNE, under command of Rear-Admiral de Slane; the light division of the *Tage*, protected cruiser, first class; *Suchet*, protected cruiser, second class; *Bombe*, *d'Iberville*, and *Léger*, torpedo vessels, under command of Captain Melchior, of the *Tage*.

PLAN.

The search was organized as follows: A line, Y X, was traced, showing where the squadrons would meet on the shortest lines at 10 and 13 knots, respectively, the battleships coming from any point of the limit line M′ M, and the light division from the Gulf of Jouan. The light division to make 52 miles on the following courses: The *d'Iberville* toward the semaphore on Cape Corso, the *Bombe* toward the St. Florent Light, the *Suchet* toward Calvi semaphore, the *Léger* toward Cape Rosso, and the *Tage* S. 22° E. Having made 52 miles the *d'Iberviell* was to change course, to run parallel with the northern boundary and 7 miles distant from it until within 23 miles of the Corsican coast, the *Suchet* to head for latitude 42° 50′ N., longitude 6° E. (from Paris), and,

upon arrival, to await information, steaming in a circle about 5 miles in diameter, until informed by either the *d'Iberville* or the *Bombe* of the discovery or absence of the enemy, the *Bombe* to steer for Alciolo Point until 20 miles from the coast, when she was to communicate with the *d'Iberville*, then to inform the *Suchet* of meeting the enemy, if successful, and then the *Léger*, who was to notify the *Tage*, the *Suchet* in



the meantime joining the *d'Iberville*. Should the enemy not be discovered in the eastern section the *Bombe* and *d'Iberville*, joining the *Suchet*, to close on the *Tage*. The *Léger* was to hold her course until within 23 miles of Corsica, to remain at this distance and to serve as linking ship between the *Suchet* and *Tage*. The light division, in column, at from 10 to 12 miles distance, was to try to cross the track of the enemy.

EXECUTION.

The enemy was signaled as being 15 miles north of Revalatta Point at 6 a. m., or about 15 miles southwest of the expected point A, but the instructions to the scouts were not changed. The light division weighed at 7.30 a. m. At 11.05 a. m. the enemy was seen 10 miles to the southward by the *Tage* and the *Léger*. The former followed at once. Without waiting for orders the *Léger* went in search of the *Suchet*, but at reduced speed. At 1.10 p. m., thinking the weather bad, the *Léger* headed for the Gulf of Jouan, where she arrived at 5.45 p. m., having done nothing. The *Tage* maintained touch until the enemy anchored at Bregançon at 6 p. m.

The wind and sea rose during the day; nevertheless the other scouts endeavored to carry out their orders. The *Suchet* reached her station at 2.10 p. m., but not seeing either the *Bombe* or the *d'Iberville* headed for Hyères. At 2.40 p. m. sighted the *Bombe* astern, but only found the *d'Iberville* at the Hyères Islands. The battle squadron steered directly from the point of departure to Hyères Islands at 8 knots speed.

A second scouting exercise took place in April. The conditions were nearly similar, though the area allowed was somewhat larger. The battle squadron was composed of the battleships DÉVASTATION, COURBET, and NEPTUNE, the protected cruiser, third class, FAUCON, and the torpedo vessels D'IBERVILLE and LÉGER. The light squadron was composed of the protected cruiser, first class, *Tage*, the protected cruiser, second class, *Suchet*, the third-class cruisers *Lalande*, *Condor*, and *Wattignies*, and the torpedo vessel *Lévrier*.

The plans, in spite of the failure during the first exercise, were similar, and a similar disastrous result followed, the enemy breaking through an interval made by a disabled cruiser.

The system followed in both searches was faulty. Diverging lines of cruisers cannot maintain speed and position beyond a certain time. Once separated beyond communicating distance from the curve of advance they will become lost and worthless to one another until found in the neighborhood of the rendezvous, usually far removed from where they are needed at the critical moment. Scouts cannot advance abreast with any chance of success unless they are near enough to communicate with one another. Besides, to be effective, a large number of scouts is required.

The curve envelope Y V should have been reached and then followed by the cruisers in column. The column possesses many advantages over the line; the course is always known and distance easily preserved, and an injury to one or more vessels does not destroy entirely and disorganize the plan.

It is curious to note in each of these preliminary exercises the disastrous effects produced by the failure of one scout; surely any plan must be faulty that is ruined by so comparatively trivial a cause.

SQUADRON MANŒUVRES.

Later in the year two torpedo exercises took place in the Reserve Squadron.

The first exercise was a day attack, for which purpose the squadron was divided into two divisions. The torpedo flotilla of the Toulon defense was attached to one division.

The two divisions approached each other in line, until within 3,000 meters (3,280 yards), when one division stopped while the other filed to the right and left, unmasking the torpedo-boat flotilla that immediately attacked the stationary division.

In his criticism Vice-Admiral Gervais says: The results [correct aiming and hits] are not satisfactory. The errors committed were large, much exceeding those reasonably to be attributed to errors in estimating speed and direction of target. Failure must be attributed to officer's want of training and strangeness of the conditions governing the exercise. The boats attacked with insufficient speed.

The second exercise was torpedo attacks against the two divisions at anchor; one division at Lavandou, the other at Bregançon. Weather clear, with bright moonlight. Vice-Admiral Gervais says the *Richelieu* and the *Terrible*, anchored at Lavandou, were attacked by the *Audacieux*, *Bombe*, and *Orage* separately. The Bullivant nets stopped the torpedoes. The *Orage* was so much interfered with by the search-lights that she signaled at one time her position was not known and the lights were shut off.

In the attack at Bregançon by the Toulon flotilla out of five torpedoes launched but one hit the anchored vessels. These bad results are due to failure to judge distance correctly and to the use of the electric lights. As in the other exercise, the effect of the novel situation on the officers in command is shown.

In summing up, he says:

The mechanical results are splendid, but that the errors and failures are due to want of practice.

For night attacks, if one notices that in war torpedo boats, besides the artillery and search-lights of ships, also, must contend against those of the torpedo vessels and other boats on guard, one can not help thinking that without great familiarity with this method of attack they will have but a poor chance of success, unless in cases of surprise.

It seems, therefore, of the greatest importance never to give command of a torpedo boat for this kind of attack to any but an officer of the coolest sort, one who has taken part in numerous exercises resembling as closely as possible the reality, and I do not hesitate to demand, owing to the slight expense, that our torpedo drills with exercise head, should take place at least once a quarter.

Evidently Vice-Admiral Gervais believes that practice makes perfect.

The vice admiral was transferred to the command of the Active Squadron and went to sea for the first time October 12.

The fleet anchored that evening at La Ciotat to receive a torpedo boat attack, the object being to obtain fire discipline and a methodical

regulation of search-lights. There was no exterior protection and the orders were for the torpedo boats to renew their attacks as frequently as possible. Sea calm, no moon, and dark, starlight night. The attacks began at 8.20 and continued until 9.30, when the admiral stopped the exercise.

The lights were not well handled, the second line frequently illuminated the first line, rendering the vessel plainly visible. No attempt was made to discover if friends were interfered with or aided in firing. At times the entire horizon would be hidden from several ships by the search-light screen interposed by another ship.

No rule, apparently, governed the firing, but an interesting fact was developed. The first attacks were stopped (under the rules) at from 800 to 1,000 meters (874 to 1,093 yards); as the attacks progressed they approached nearer and nearer to the ships; two were stopped finally about 500 meters (546 yards). It is asked if this may not be attributed to the tension caused either by the exercise, even if executed under conditions favorable for the defense, or by fatigue of the ships' crews after even such a short time as an hour and a half.

October 14 and the forenoon of the 15th were devoted to coast scouting, with reports to the commander in chief of the results; target practice by day and by night. During the afternoon of the 15th ramming exercises took place. The *Magenta*, at 7 knots, towed a target representing the forward part of a ship.

In column, and beginning from a distance of about 250 meters (820 feet) from the *Magenta*, the squadron, in succession, attempted to ram the target.

It is impossible to speak too highly of exercises of this character. Vice-Admiral Gervais is thoroughly practical and under him the Mediterranean Active Squadron has become an ideal school for the French navy.

It cannot be reiterated too often that only by constant practice can efficiency be attained.

GERMAN MANŒUVRES.

The official program of the ceremonies marking the opening of the Kaiser William Canal were closed by a sham naval battle. The following-named vessels composed the squadrons:

DEFENDING SQUADRON.

Ship.	Class.	Date of launch.	Displacement.	Guns, main battery.	Maximum speed.	Complement.
			Tons.		*Knots.*	
FIRST DIVISION.						
Kurfürst Friedrich Wilhelm	Battleship, first class	1891	10,033	12	15	556
Brandenburg	do	1891	10,033	12	16.5	556
Weissenburg	do	1891	10,033	12	17.2	556
Wörth	do	1892	10,033	12	17.2	556
SECOND DIVISION.						
Baden	Battleship, second class	(1880) (1896)	7,400	6	14	377
Bayern	do	(1878) (1896)	7,400	6	14	377
Sachsen	do	(1877) (1896)	7,400	6	14	377
Württemberg	do	(1878) (1896)	7,400	6	14	377

ATTACKING SQUADRON.

GNEISENAU	Training ship	1879	2,856	14	13	461
MOLTKE	do	1879	2,856	14	13	461
STEIN	do	1879	2,856	14	13	446
STOSCH	do	1877	2,856	14	13	446

June 22, at daybreak, the ATTACKING SQUADRON put to sea, turning about 10 a. m. to meet the *Defending Squadron* steaming out from Kiel in column with a division of torpedo boats on either flank. The torpedo boats took no part in the sham engagement but executed a series of independent manœuvres.

Referring to the plan, the ATTACKING SQUADRON, BLUE, is supposed to be sighted by the *Defending Squadron, Red*, from the position D, *Red* at the time heading southeast by east and BLUE southwest by south, both in column. *Red* changed course in succession 8 points to port, bringing BLUE on the starboard bow. When the leaders were within half a mile they opened fire. The engagement ended when the rear vessels had passed each other. The BLUE ships using port helm countermarched and fell in astern of the *Red*, second division. The united squadrons now countermarched, using port helm and stood into the harbor.

The *Red* vessels kept their stations to perfection, though the distance between ships was but 1 cable. This admirable result can be attributed to the homogeneity of the squadron and to the constant practice of the

officers. The BLUE SQUADRON did not show such excellence, as the ships had been together only a few days for the first time within a year.

Speed signals were made with a black-ball hoist. Stop, is signaled with the ball on the rail; full speed, with the ball at the yard arm; ahead slow, half speed, and fast, by intermediate positions. Backing is indicated by three short blasts of the whistle. The signals are made as soon as the speed order is confirmed from the engine room.

Helm signals were made with a red cone on the port side and a green cone on the starboard side. With the helm amidships, the cones, with their bases in the same horizontal plane, are half way between the rail and the top of the hoist. As the helm is put over the cones separate until, at hard aport, for example, the red cone is at the rail and the green one at the upper end of its hoist.

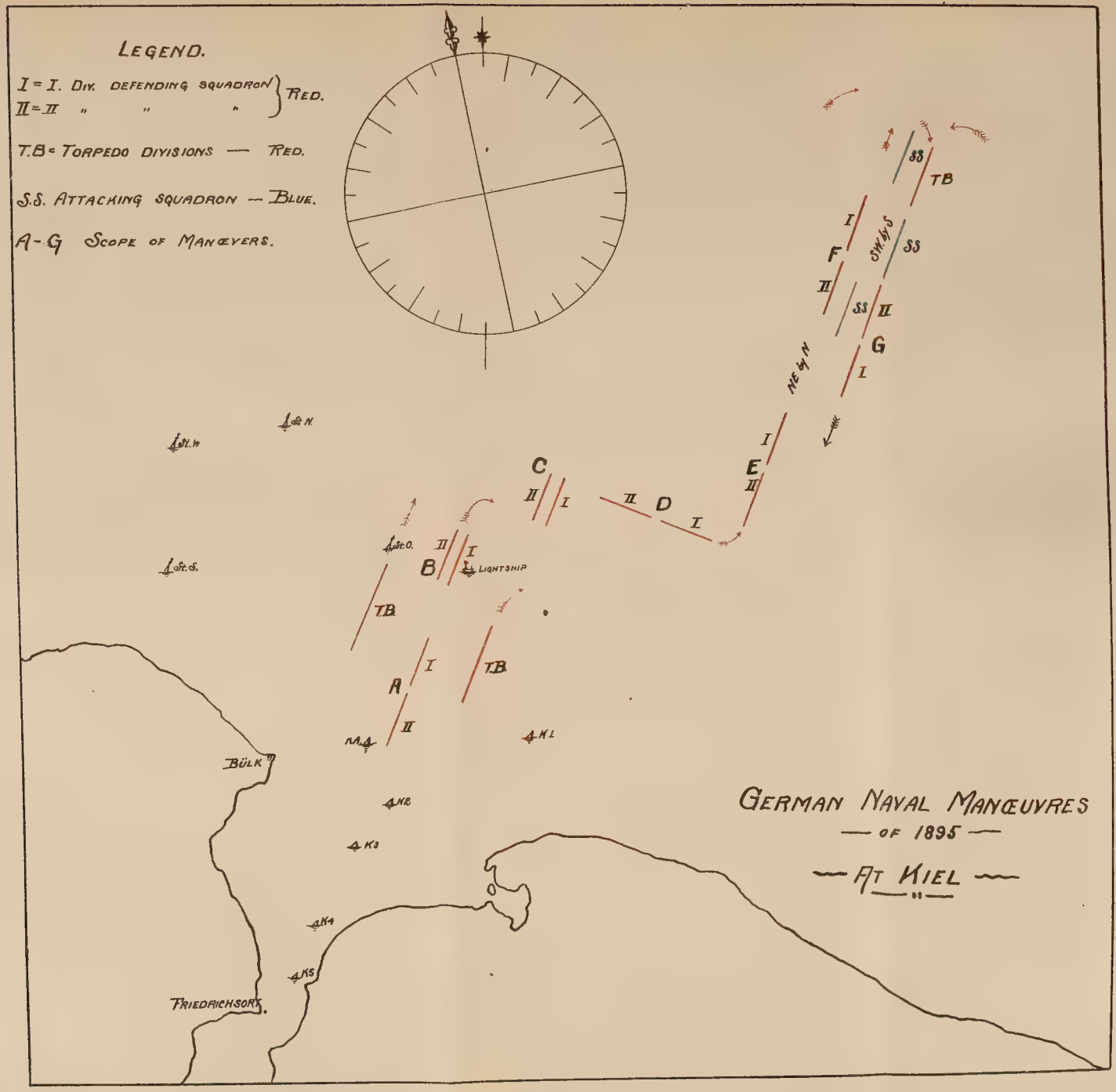
FORMATIONS AND EVOLUTIONS.

Red left the harbor in column with the flagship leading and the second in command in the rear. Double column was formed, and column again formed when course was changed 8 points to starboard by the usual method. To form column of vessels from double column, when the second in command is leading the second column, the first column slows or stops, the rear ship of the second column comes in astern with port helm, while the others, with starboard helm, wheel through 32 points, coming into column, inverting their former order and bringing the second in command into the rear. It is questionable whether time can be gained by this method.

The torpedo-boat formations were very simple. Evolutions were performed from a wedge formation in each division, with the divisional boat at the apex. The boats are so close that distances are about 5 yards and broadside-on the boats overlap. Changes of course were ordered by passing the word, and the signal of execution was a wave of the arm. Helms were put over together, and the speed was regulated by the eye, the commanding officer of each boat being expected to watch his own boat and his next ahead. Stations were kept accurately; speed about 15 knots.

Naturally in such close order collisions occur, but unless the subsequent investigation shows gross negligence, no further notice is taken of the accident. Officers thus are encouraged to take reasonable risks, whereby they gain that skill and confidence so vital to success in real warfare.

Apart from the high order of excellence displayed, these manœuvres present no special features.


LEGEND.
I = I. Div. defending squadron } Red.
II = II " " "
T.B = Torpedo Divisions — Red.
S.S. Attacking squadron — Blue.
A-G Scope of Manœvers.
SS
TB
I
F
SW. by S
SS
II
SS
II
G
NE by N
I
E
II
C
II
I
II
D
I
B
II
I
Lightship
TB
A
I
TB
II
BÜLK
FRIEDRICHSORT
German Naval Manœuvres
— of 1895 —
— At Kiel —

VIII.

SOME STANDARD BOOKS ON PROFESSIONAL SUBJECTS.

Officers and others are requested to inform the Office of Naval Intelligence of any standard works on professional subjects, of recent date, which are not mentioned in the following list, or in the inventory of library books issued by the Bureau of Equipment.

Foreign books, newspapers, and periodicals may be obtained from B. F. Stevens, 4 Trafalgar Square, Charing Cross, London. B. F. Stevens' advertising circular states: "New books are charged at trade prices, which are usually 25 per cent off the price of publication. Book postage to America is only one-half penny for every 2 ounces up to 4 pounds weight. The discount off publication price is about equivalent to the cost of freight or postage, and commission; hence, in making purchases of new books it is safe to estimate that the books would be received at a cost of 25 cents to the shilling (publication price), exclusive of duty, if any."

Remittances to B. F. Stevens, 4 Trafalgar Square, Charing Cross, London, may be made in sterling by banker's drafts, or post-office orders on London, or in American currency at $5 to the pound sterling, this being 25 cents to the shilling. For odd amounts send postage stamps. New York agents, Tice & Lynch, 45 William street.

Catalogues of new books of interest to the service are as a rule issued by the publishing houses mentioned in this list, and can be had free upon application.

GENERAL WORKS.

ADMIRALTY, BRITISH:

FLAGS IN USE AT THE PRESENT TIME BY VARIOUS NATIONS, DRAWINGS OF. 1890. Admiralty. Price, 50s. To be obtained from J. D. Potter, 31 Poultry; Eyre & Spottiswoode, East Harding street, Fleet street, London, or Hodges, Figgis & Co., 104 Grafton street, Dublin.

BARRÈRE, A.:

A DICTIONARY OF FRENCH AND ENGLISH MILITARY TERMS. In two parts. Libraire Hachette. London: 18 King William street, Charing Cross.

BERGER-LEVRAULT:

CARNET DE L'OFFICER DE MARINE. Annual. 1896. Sixteenth year. Vol. in-8, relié, 3 francs 50 centimes. Berger-Levrault et Cie, 5 rue des Beaux-Arts, Paris.

CLOWES:

THE NAVAL POCKET BOOK. By W. Laird Clowes. The object of the Naval Pocket Book is to provide in handy form a more full and exhaustive collection of facts and figures relating to modern navies of all nations than has ever yet appeared in any country. A statistical annual with plans. 1896. London: Tower Publishing Company, Limited, 95 Minories, E., or Edward Stanford, naval and military publisher and bookseller, 26 and 27 Cockspur street, Charing Cross, S. W.

DABOVICH:

NAUTISCH-TECHNISCHES WÖRTERBUCH DER MARINE. Deutsch, Italienisch, Französisch und Englisch. 1883. By P. E. Dabovich, K. K. Marine-Bibliotheksadjunct. Pola: Redaction der Mittheilungen aus dem Gebiete des Seewesens. It can be purchased, London, Dulau & Co., W., 37 Soho Square; Paris, Challamel aîné, 5 rue Jacob; Wien, Gerold & Co.; Triest, Julin Dase; Torino, Ermanno Loescher. Erster Band: Deutsch, Italienisch, Französisch und Englisch. Italienisch, Deutsch, Französisch und Englisch. But one volume published whose argument is either Italian or German.

DELBOS:

TERMES DE MARINE ANGLAIS-FRANÇAIS. 1890. Par Léon Delbos, professeur à l'École navale anglaise. Prix, 4 francs. Paris: Publié par L. Baudoin et Cie, 30 rue Dauphine. Deuxième édition. 1 vol. in-12°, relié. Notes et tableaux à l'usage des officiers de la flotte et des élèves des écoles navales.

FITZ GERALD:

THE YEAR BOOK OF THE IMPERIAL INSTITUTE OF THE UNITED KINGDOM, THE COLONIES, AND INDIA. 1896. A statistical record of the resources and trade of the Colonial and Indian Possessions of the British Empire. Compiled chiefly from official sources. Published at the offices of the Imperial Institute, South Kensington, S. W.

GEROLD:

ALMANACH FÜR DIE K. U. K. KRIEGS-MARINE. 1896. Herausgegeben von der Redaction der Mittheilungen aus dem Gebiete des Seewesens. Wien, Gerold & Co., in Comm. Geb., 4 marks. An annual.

GIBBS:

THE ILLUSTRATED GUIDE TO THE ROYAL NAVY AND FOREIGN NAVIES: ALSO MERCANTILE MARINE STEAMERS (BRITISH) AVAILABLE AS ARMED CRUISERS AND TRANSPORTS. By F. T. M. Gibbs. 1896. London: Waterlow Brothers & Layton, Limited, 36 Parliament street, Westminster, S. W.

JONES:

SHIPPING WORLD YEAR BOOK: A DESK MANUAL IN TRADE, COMMERCE, AND NAVIGATION. 1896. Edited by Evan Rowland Jones, United States Consul. Price, 3s. 6d. London: Printed and published annually at the Shipping World Office, Gresham Press Buildings, Pilgrim street.

MULHAL:

DICTIONARY OF STATISTICS. Routledge & Sons, 9 Lafayette place, New York. 1895.

MÜLLER-SAGAN:

DISLOKATIONSKARTE DER HEERE EUROPAS. In four parts. 1895.

PORNAIN:

TERMES NAUTIQUES, ANGLAIS-FRANÇAIS. Augustin Challamel, 5 rue Jacob, Paris.

VIVANT:

DICTIONNAIRE TECHNIQUE, ANGLAIS-FRANÇAIS. 1884. Par E. Vivant, mécanicien en chef de la marine. Prix, 12 francs. Paris: Publié avec l'autorisation du ministre de la marine. 1 fort vol. in-8.

WHITAKER:

ALMANACK, 1896. Containing an account of the astronomical and other phenomena, a large amount of information respecting the government, finances, population, commerce, and general statistics of the British Empire throughout the world, with some notice of other countries.

NAVAL AND MILITARY ARTS.

ABBOT:

PROFESSIONAL PAPERS OF THE CORPS OF ENGINEERS, UNITED STATES ARMY, No. 23. Report upon experiments and investigations to develop a system of submarine mines for defending the harbors of the United States. 1881. Submitted to the Board of Engineers by Lieut. Col. Henry L. Abbot, Corps of Engineers, brevet brigadier-general United States Army, member of the Board. Washington: Government Printing Office.

ANSON:

DETAIL BOOK FOR USE OF OFFICERS OF H. M. SHIPS. By W. V. Anson, Commander, R. N. 1896. Portsmouth: J. Griffin & Co., No. 2 The Hard.

BARBER:

HIGH EXPLOSIVES IN WARFARE. 1891. By Commander F. M. Barber, United States Navy. Published in the Journal of the Franklin Institute, Vol. CXXXI, No. 782, February, 1891, No. 2, pages 117 *et seq.*, Philadelphia. Dr. William H. Wahl, secretary.

BETHELL:

REMARKS ON THE MANŒUVRES OF TWO VESSELS IN ACTION. 1881. By Lieut. G. R. Bethell, R. N. Price, 2s. Portsmouth: Griffin & Co., No. 2 The Hard. London agents: Simpkin, Marshall & Co.

BOADO Y CASTRO:

LOS FUSILES MAUSER ADOPTADOS EN EUROPA Y EN AMERICA. By D. José Boado y Castro, capitan de artillería de la fabrica nacional de armas de Oviedo. 1894. Pardo, Gusano y Compañía, San José, 6. 1 peseta. 7.65 mm. Mauser, 1890–91 models. Full description of each part.

BOURGOIS:

LES TORPILLEURS, LA GUERRE NAVALE ET LA DÉFENSE DES CÔTES. 1888. Par le Vice-Amiral Bourgois. Paris, Librairie de la Nouvelle Revue, 18 Boulevard Montmartre. Deuxième édition.

BOUTAKOF:

NOUVELLES BASES DE TACTIQUE NAVALE. Par l'Amiral Grégoire Boutakof. Traduit du russe par H. de la Planche, lieutenant de vaisseau. Paris: Arthus Bertrand, éditeur, Librairie Maritime et Scientifique, rue Hautefeuille, 21. Ouvrage couronné par l'Académie des Sciences de St.-Pétersbourg, publié par ordre de S. Exc. le Marquis de Chasseloup-Laubat, Ministre de la Marine et des Colonies. Accompagné de 26 planches gravées, dont 15 en couleur, et de nombreuses figures intercalées dans le texte.

BUCHARD:

TORPILLES ET TORPILLEURS DES NATIONS ÉTRANGÈRES, SUIVI D'UN ATLAS DE FLOTTES CUIRASSÉES ÉTRANGÈRES. 1889. Par H. Buchard, lieutenant de vaisseau. Prix, 6 francs. Paris, Berger-Levrault et Cie, 5 rue des Beaux-Arts. Vol. in-8, avec 114 planches, broché.

CAMPBELL:

ESSAY ON TACTICS IN AN ACTION ON THE OPEN SEA WITH EXISTING WEAPONS. By Lieutenant Campbell, R. N. Price, 2s. London: Harrison & Sons, 59 Pall Mall, S. W. 8vo. Sewn.

CHALON:

TRAITÉ THÉORIQUE ET PRATIQUE DES EXPLOSIFS MODERNES ET DICTIONNAIRE DES POUDRES ET EXPLOSIFS. 1889. By Paul F. Chalon, ingénieur des arts et manufactures. Price, 25 francs. Publishers, E. Bernard et C^ie^, 71 rue La Condamine; 53 Quai des Grands-Augustins. 1 vol. in-8 de 506 pp., avec 162 fig. dans le texte. Seconde édition.

CHARMES:

LES TORPILLEURS AUTONOMES ET L'AVENIR DE LA MARINE. 1885. Par Gabriel Charmes. Prix, 3 francs. Paris: Berger-Levrault et C^ie^, 5 rue des Beaux-Arts. Vol. in-12, broché.

CHEVALIER:

LES INSTITUTIONS DE LA MARINE.

CLERGEAU:

GUIDE PRATIQUE DU CHAUFFEUR ET DU MÉCANICIEN SUR LES BATEAUX—TORPILLEURS. Rédigé en conformité de la dépêche ministérielle du 15 janvier 1887, par M. E. Clergeau, mécanicien en chef de la marine. Dessins du 2^e^ maitre-mécanicien C. Deguy, Paris, 1888. Un beau vol., in-8, relié. Price, 5 francs 50 centimes.

CLOWES:

THE NEWEST FACTOR IN NAVAL WARFARE. 1891. By W. Laird Clowes. Price, 1s. Published in the United Service Magazine for February, 1891. To be obtained from the International News Company, New York.

COURNÈS:

APERÇUS SUR LA TACTIQUE DE DEMAIN MIS EN RAPPORT AVEC LA PUISSANCE DU NOUVEL ARMEMENT ET L'EMPLOI DE LA POUDRE SANS FUMÉE. Commandant Cournès. Paris: Baudoin.

CRAIG:

AZIMUTH, A TREATISE ON. 1887. By Joseph Edgar Craig, Lieutenant-Commander, United States Navy. New York: John Wiley & Sons, 51 Astor Place. A study of the astronomical triangle and the effect of errors in the data. Illustrated by loci of maximum and minimum errors.

CRONEAU:

CONSTRUCTION DU NAVIRE. Par A. Croneau, ingénieur des constructions navales. Paris: Gauthier-Villars et fils, Quai des Grands-Augustins, 55.

CANONS, TORPILLES ET CUIRASSES. Par A. Croneau, ingénieur des constructions navales. Leur installation à bord des bâtiments de combat. Paris, Gauthier-Villars et fils, Quai des Grands-Augustins, 55.

ARCHITECTURE NAVALE: Construction pratique des navires de guerre, 1894. 2 vols. and atlas.

CUNDILL:

A DICTIONARY OF EXPLOSIVES. 1889. By Maj. J. P. Cundill, Royal Artillery. Printed by W. & J. Mackay & Co., Chatham. Published by the Royal Engineers' Institute, Chatham. Agents, W. & J. Mackay & Co., Chatham, Kent. Also sold by Hamilton, Adams & Co., London.

DIDELOT:

LA DÉFENSE DES CÔTES D'EUROPE. Étude descriptive au double point de vue militaire et marine, 1894. Avec un atlas de 204 cartes. Par Carl Didelot, lieutenant de vaisseau. Berger-Levrault et C^ie^, 5 rue des Beaux-Arts.

DREDGE:

MODERN FRENCH ARTILLERY: (The St. Chamond, De Bange, Canet, and Hotchkiss Systems.) 1892. By James Dredge. Price, £2 10s. London: Offices of Engineering, 35 and 36 Bedford street, Strand, W. C. New York: John Wiley & Sons, 53 East Tenth street. Imperial quarto, handsomely bound in half

DREDGE—Continued.

morocco, 500 pages of text, tables, and plates, and over 700 illustrations. The work is provided with a carefully prepared and copious index, and also contains many illustrations of French war ships.

DU VERDIER:

L'AMIRAUTÉ FRANÇAISE; SON HISTOIRE; SES TRANSFORMATIONS; ÉTAT ACTUEL. By Marcel R. Du Verdier. Paris: Berger-Levrault et Cie, 5 Rue des Beaux-Arts.

EARDLEY-WILMOT:

THE DEVELOPMENT OF NAVIES. 1892.

ELLIOT:

THE RAM. THE PROMINENT FEATURE OF FUTURE NAVAL VICTORIES. 1884. By George Elliot. Price, 5s. London: Published by the Journal of the Royal United Service Institution.

COAST DEFENSE BY GUNBOATS. 1887. By George Elliot. Price, 7s. 21 pp., 8vo, with 1 plate and 7 figures. Published by the Journal of the Royal United Service Institution.

FARRET:

ÉTUDES COMPARATIVES DE TACTIQUE NAVALE. 1883. Par M. Étienne Farret, lieutenant de vaisseau. Prix, 3 francs. Paris: Berger-Levrault et Cie, 5 rue des Beaux-Arts.

FOURNIER:

LA FLOTTE NÉCESSAIRE, SES AVANTAGES STRATÉGIQUES, TACTIQUES, ET ÉCONOMIQUES. Par le Contre-Amiral F.-E. Fournier. 1896. Price, 3 francs. Paris: Berger-Levrault et Cie, 5 Rue des Beaux-Arts.

GAVOTTI:

MANUALE DEL TIMONIERE. Compilato per ordine del Ministro della Marina da Francesco Gavotti, capitano di corvetta. 1889. Roma: Forzani, Tipografia del Senato.

GOUGEARD:

LA MARINE DE LA GUERRE. SON PASSÉ ET SON AVENIR. CUIRASSES ET TORPILLEURS. 1885. Par M. Gougeard, ancien ministre de la marine. Prix, 3 francs. Paris: Berger-Levrault et Cie, 5 rue des Beaux-Arts. Grand in-8, avec 1 planche, broché.

GUYON:

DESCRIPTION ET USAGE DES INSTRUMENTS NAUTIQUES. Ministère de la Marine. 1889. Par M. E. Guyon, capitaine de frégate, chef du service des instruments nautiques au service hydrographique de la marine. Paris: Imprimerie Nationale.

GWYNNE:

HINTS ON ANCHORING AND MOORING WITH THE FLEET. By Staff Commander B. Gwynne. Price, 1s.

HEBLER:

DAS KLEINSTE KALIBER. By Professor Hebler. Zürich: A. Müller.

HEWETT:

ORDER BOOK FOR EXECUTIVE OFFICERS OF THE ROYAL NAVY. By Commander W. W. Hewett, R. N. 1894. Portsmouth: J. Griffin & Co., No. 2 The Hard.

HOVGAARD:

SUBMARINE BOATS. 1887. By G. W. Hovgaard, lieutenant in the Danish navy. E. & F. N. Spon, 125 Strand, London, and 35 Murray street, New York.

LANESSAU:

LA MARINE FRANÇAISE AU PRINTEMPS DE 1890.

LEDIEU ET CADIAT:

LE NOUVEAU MATÉRIEL NAVAL. 1890. Par A. Ledieu, correspondant de l'Institut de France, prix extraordinaire de l'Académie des sciences; officier de la Légion d'honneur et de l'instruction publique; commandeur, officier et chevalier de divers ordres étrangers; auteur de nombreuses publications sur les machines marines, la navigation, etc., et Ernest Cadiat, ingénieur des arts et manufactures. Price, Vol. I, 40 francs; Vol. II, 30 francs. Paris, Vve. Ch. Dunod, éditeur, Librairie des corps nationaux des ponts et chaussées des mines et des télégraphes, Quai des Augustins, 49. Tome premier: Balistique, agents explosifs, canons et mitrailleuses, hydraulique de manœuvre pour l'artillerie, fusils, électricité en marine, piles, accumulateurs, dynamos et magnétos, lumière et éclairage électriques, torpilles. 1890. L'ouvrage complet contient 300 figures intercalées dans le texte, et est accompagné d'un atlas de 51 planches et 6 grands tableaux. Tome second et dernier: Torpilles (suite et fin); torpilleurs et bateaux sous-marins; complément sur les armes à feu: appareils de sillage, de sondage et de signaux; utilisation industrielle du soleil et production mécanique de chaud et de froid; balons captifs et libres, aéronefs et avires, pigeons voyageurs; étude technique des guerres maritimes modernes et constitution des flotes actuelles; formes et utilisation des principaux types de navires présentement en usage.

LEGAL:

LA MARCHE ET LA CONDUITE DES CHRONOMÈTRES, APRÈS LES TRAVAUX DE MM. CASPARI LIEUSSOU, DE MAGNÆ, ETC. 1882. Par Fulgence Legal, lieutenant de vaisseau. Price, 1 franc 50 centimes. Paris: Berger-Levrault et C^ie^, 5 rue des Beaux-Arts.

MACKROW:

THE NAVAL ARCHITECT'S, SHIPBUILDER'S, AND MARINE ENGINEER'S POCKET BOOK. 1892.

MARTIN:

A TREATISE ON NAVIGATION AND NAUTICAL ASTRONOMY. 1888. Compiled by Staff Commander W. R. Martin, R. N., instructor in nautical surveying, navigation, and compass adjustment, lecturer on meteorology at the Royal Naval College, Greenwich, and formerly Naval Assistant to the Hydrographer. London: Longmans, Green & Co., and New York: 15 East Sixteenth street. Sanctioned for use in the Royal Navy by the Lords Commissioners of the Admiralty.

MARTINENQ:

AIDE MÉMOIRE DU CONSTRUCTEUR DE NAVIRES, DE MACHINES ET CHAUDIÈRES MARINES, DU MÉCANICIEN, DU NAVIGATEUR ET DE L'ARMATEUR.

MINISTRE DE LA GUERRE:

MÉMORIAL DES POUDRES ET SALPÊTRES, publié par les soins de service de poudres et salpêtres avec l'autorisation du ministre de la guerre. Prix pour un an (4 fascicules): Paris et départements, 12 francs; Union postale, 13 francs. Published by Gauthier-Villars et fils, 55 Quai des Grands-Augustins, Paris. Grand in-8, trimestriel.

Le Mémorial paraît depuis 1890 sous forme de recueil périodique, en quatre fascicules trimestriels, et forme, chaque année, un beau volume de 24 feuilles environ, avec figures et planches.

Le Tome I (1882) et le Tome II (1889), parus avant la transformation du Mémorial en recueil périodique, se vendent séparément. Price, 12 francs. L'abonnement est annuel et part de janvier.

MINISTRE DE LA MARINE:

MANUEL DU MÉCANICIEN-TORPILLEUR. 1890. Publié par ordre du ministre de la marine. Prix, 4 francs 50 centimes. Paris: L. Baudoin et C^ie^, 30 rue Dauphine. 1 vol. in-8, avec planches, relié. 2^e^ et 3^e^ parties.

MINISTRE DE LA MARINE—Continued.

MANUEL DU MARIN FUSILIER. 1895.

MANUEL DU MARIN CANONIER. 1894.

MOCH:

VUE GÉNÉRALE SUR L'ARTILLERIE ACTUELLE. Par Gaston Moch. 1895. Price, 5 francs. Paris: Berger-Levrault et Cie, 5 rue des Beaux-Arts.

MOLARD:

PUISSANCE MILITAIRE DES ÉTATS DE L'EUROPE. 1893. Par J. Molard. Considérations militaires—Organisations défensives—Chemins de fer—Armées et marines. Paris, Plon Nourrit et Cie.

MONBRISON:

LES ARMES DE PETIT CALIBRE, ÉTUDE COMPARATIVE, and LES ARMES DE PETIT CALIBRE. Fusils en essai et en construction. Par Capt. J. de Monbrison. 1894. Paris: L. Baudoin, 30 rue Dauphine.

OFFICIER SUPÉRIEUR:

LES ARMES À FEU PORTATIVES DES ARMÉES ACTUELLES ET LEURS MUNITIONS. 1894. Par un officier supérieur. 131 illustrations. Paris: L. Baudoin, 30 rue Dauphine.

PAQUIÉ:

DE LA RASANCE DES FUSILS DE PETIT CALIBRE ET DE SES CONSÉQUENCES TACTIQUES. 1892. Par E. Paquié, colonel du 11e régiment d'infanterie. Paris: L. Baudoin, 30 rue Dauphine.

PELLEWS:

FLEET MANŒUVRING. By Pellews. Price, 12s. 6d. Portsmouth, England: Griffin & Co., No. 2 The Hard.

PENHOOT:

ÉLÉMENTS DE TACTIQUE NAVALE. 1879. Par M. le Vice-Amiral Penhoot. Paris: Berger-Levrault et Cie, 5 rue des Beaux-Arts. 1 vol. grand in-8, avec 29 figures.

PHILLIMORE:

NAVAL TACTICS. Translated from the French by Capt. Augustus Phillimore. Price, 10s. London: Harrison & Sons, 59 Pall Mall, S. W. Contains general instructions, principles of chasing, naval tactics under steam and sail. 8vo, cloth.

PLACH:

DIE GEPRESSTE SCHIESSWOLLE, eine Abhandlung über die Beurtheilung, Verwendung und Behandlung dieses Explosiv-Präparates für Torpedo- und Seeminen-Lehrcurse. 1891. By Franz Plach, k. u. k. Marine-Artillerie-Ingenieur. Price, 2.40 florins. Pola, E. Scharff.

POLLARD ET DUDEBOUT:

ARCHITECTURE NAVALE. Théorie du navire. 1890–1891. By J. Pollard et A. Dudebout, ingénieurs de la marine, professeurs à l'École du génie maritime. Paris, Gauthier-Villars et fils, imprimeurs-librairies du bureau des longitudes de l'École polytechnique, Quai des Grands-Augustins, 55. This is the most complete work on the subject of naval architecture that has ever been written, and probably the most authentic. Four volumes (sold separately).

Volume I. Calcul des éléments géométriques des carènes droites et inclinées. Géométrie du navire. 1890. Price, 13 francs.

Volume II. Statique du navire. Dynamique du navire dans le mouvement de roulis en mer calme. 1891.

Volume III. Dynamique du navire dans le mouvement de roulis sur houle. Dynamique du navire dans le mouvement rectiligne horizontal. Résistance des carènes.

Volume IV. Dynamique du navire dans le mouvement curviligne horizontal. Propulsion. Vibrations des coques des navires à hélice.

RAPER:

THE PRACTICE OF NAVIGATION AND NAUTICAL ASTRONOMY. By Henry Raper, Lieutenant, R. N., F. R. A. S., F. R. G. S. Price, 16s. London: Published by J. D. Potter, 31 Poultry and 11 King streets, Tower Hill. Griffin & Co., 2 The Hard, Portsmouth, England.

RANDOLPH:

PROBLEMS IN NAVAL TACTICS. 1879. By Vice-Admiral Randolph. Price, 2s. Portsmouth: Griffin & Co., 2 The Hard. London agents: Simpkin, Marshall & Co.

REED:

A TREATISE ON THE STABILITY OF SHIPS. 1885. By Sir Edward J. Reed, K. C. B., F. R. S., M. P., etc. London: Charles Griffin & Co., Exeter street, Strand. Numerous diagrams and tables.

SCHABODE-ARNAULT:

ESSAI HISTORIQUE SUR LA STRATÉGIE ET LA TACTIQUE DE FLOTTES MODERNES. 1879. Par Schabode-Arnault, lieutenant de vaisseau. Prix, 1 franc 25 centimes. Paris: Berger-Levrault, 5 rue des Beaux-Arts. Grand in-8, broché.

SCHMIDT:

LES NOUVELLES ARMES À FEU PORTATIVES ADOPTÉES COMME ARMES DE GUERRE DANS LES ÉTATS MODERNES. 1889. Par Rodolphe Schmidt, colonel d'infanterie, directeur de la fabrique fédérale d'armes à Berne. Bâle-Genève-Lyon, H. Georg, libraire-éditeur. Description détaillée, précédée d'une étude générale des armes d'infanterie et accompagnée d'un atlas contenant 100 figures chromolithographiques. Addition to the above by the same author published in 1891, containing drawings and descriptions of latest rifles.

SCHNEIDNAGEL:

MINAS HYDRÁULICAS DEFENSIVAS. 1886. Por el Coronel de Ingenieros D. Leopoldo Schneidnagel. Madrid: Librería de Francisco Iravedra, calle del Arenal, num. 6. Segunda edición.

SHORTLAND:

NAUTICAL SURVEYING. 1890. By the late Vice-Admiral Shortland, LL. D., late fellow of Pembroke College, Cambridge. London and New York: Macmillan & Co. Published by the author's widow and children.

STORY:

ELEMENTS OF ELASTIC STRENGTH IN GUNS. A text-book for the use of student officers at the United States Artillery School. By Capt. John P. Story, Fourth Artillery, United States Army. Artillery School Press, Fort Monroe, Va.

VIGLEZZI:

ARMA DA RIPETIZIONE. 1890. By Ippolito Viglezzi, lieutenant-colonel of artillery. Published by Voghera Carlo, Rome. May be obtained through B. F. Stevens, No. 4 Trafalgar Square, London. Vol. I, text; Vol. II, plates.

WAR, SECRETARY OF STATE FOR:

A TREATISE ON SERVICE ORDNANCE. 1893.

TREATISE ON AMMUNITION. Printed by order of the Secretary of State for War. Price, 6s. To be purchased, either directly or through any bookseller, from Eyre & Spottiswoode, East Harding Street, Fleet street, E. C., London; or Adam & Charles Black, North Bridge, Edinburgh; or Hodges, Figgis & Co., 104 Grafton street, Dublin. Fifth edition, corrected to March 31, 1892.

INFANTRY SWORD EXERCISE. 1895.

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THE COMMAND OF THE SEA. 1894. By Spenser Wilkinson. London: A. Constable & Co.

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USEFUL ARTS.

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PRACTICAL ELECTRICITY. 1889. By W. E. Ayrton, F. R. S., associate member of the Institution of Civil Engineers; Professor of Applied Physics at the City and Guilds of London Central Institution. Price, $2.50. Cassel & Company, Limited, London, Paris, New York, and Melbourne. Also by W. J. Johnston Company, Times Building, New York. A laboratory and lecture course for first-year students of electrical engineering, based on the practical definitions of the electrical units. With numerous illustrations. Fourth edition.

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BOILER TESTS. By Geo. H. Barrus. Price, $5. Boston: Cowing & Co., 70 Kilby street. The following is the table of contents:

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A universal steam calorimeter.

BANKSON:

A FRENCH METHOD FOR DETERMINING SLIDE VALVE DIAGRAMS. By Assistant Naval Constructor Lloyd Bankson, United States Navy. Van Nostrand Science Series, No. 108. New York: Van Nostrand, 23 Murray street and 27 Warren street.

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MARINE PROPELLERS. 1891. By Sidney W. Barnaby, M. I. N. A., and Assoc. M. Inst. C. E., gold medalist of the Institution of Civil Engineers. Price, 10s. 6d. E. & F. N. Spon, 125 Strand, London. New York: 35 Murray street. Third edition entirely rewritten and greatly enlarged. In demy 8vo, cloth, with illustrations.

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A TREATISE OF HYGIENE AND PUBLIC HEALTH. 1879. Edited by Albert H. Buck, M. D., Instructor in Otology in the College of Physicians and Surgeons, New York, etc. New York: William Wood & Co. Two volumes.

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THE MARINE STEAM ENGINE, ITS CONSTRUCTION, ACTION, AND MANAGEMENT. By Carl Busley, Professor at Imperial German Naval Academy. 1892. Two editions, German and English. Lipsius & Fischer, Kiel and Leipzig.

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THE STEAM ENGINE. 1891. By Daniel Kinnear Clark, M. Inst. C. E., M. J. M. E., honorary member of the American Society of Mechanical Engineers; author of Railway Machinery: A Manual of Rules, Tables, and Data for Mechanical Engineers; The Exhibited Machinery of 1862; Tramways, their Construction and Working; etc. Price, per vol., 12s. 6d. London, Glasgow, Edinburgh, and New York: Blake & Son, Limited. A treatise on steam engines and boilers, comprising the principles and practice of the combustion of fuel, the economical generation of steam, the construction of steam boilers, and the principles, construction, and performance of steam engines, stationary, portable, locomotive, and marine, exemplified in engines and boilers of recent date. Illustrated by above 1,300 figures in the text and a series of folding plates, drawn to scale. Four volumes, 1,556 pages.

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THE ART OF ELECTROLYTIC SEPARATION OF METALS, ETC. (Theoretical and Practical.) 1890. By G. Gore, F. R. S., author of the Art of Electro-Metallurgy; The Theory and Practice of Electro-Deposition; Electro-Chemistry; The Art of Scientific Discovery; The Scientific Basis of National Progress. London: "The Electrician" Printing and Publishing Company, Limited, Salisbury Court, Fleet street, E. C. New York: The D. Van Nostrand Company, 23 Murray street and 27 Warren street.

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L'ÉLECTRICITÉ APPLIQUÉE À L'ART MILITAIRE. 1889. Par le Colonel Gun. Price, 3 francs 50 centimes. Paris, librairie J.-B. Baillière et fils, rue Hautefeuille, 19, près du boulevard Saint-Germain. Avec 140 figures dans le texte.

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THE METALLURGY OF STEEL. 1892. By Henry Marian Howe, A. M. (Harvard), S. B. Vol. I. Published by the Scientific Publishing Company, 27 Park Place, New York. Third edition. This book was first published in the Engineering and Mining Journal, commencing 1887. References are given in the book of the authorities used; it would profit most readers to examine them; contains many tables of data. The titles of the eighteen chapters are as follows:

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Iron and silicon.
Iron and manganese.
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A TREATISE ON ELECTRICITY AND MAGNETISM. 1883. By Mascart and Jubert. Translated by E. Atkinson, Ph. D., F. C. S. Price, $14.90. London publishers, Thomas de la Rue & Co., 110 Bunhill Row. Text-book, Johns Hopkins University. 2 vols., sold separately. Vol. I, General phenomena and theory. Cloth. 654 pages. 127 illustrations. Price, $7.40. Vol. II, Methods of measurement and application. Cloth. 792 pages. 136 illustrations. Price, $7.50.

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INSTRUCTIONS FOR OBSERVING CLOUDS ON LAND AND SEA. 1888. By Hon. Ralph Abercromby, F. R. Met. Soc., author of Principles of Forecasting Weather, Seas and Skies, etc. Price, 18d. London: Edward Stanford, Charing Cross, S. W. With photographs and engravings.

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OUTLINES OF INTERNATIONAL LAW. 1887. By George B. Davis, United States Army, assistant professor of law of the United States Military Academy. New York: Harper & Brothers, Franklin Square. With an account of its origin and sources of its historical development.

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