

the waterline armor is reduced in thickness, tapering to 4 inches as a minimum. From the top of the main armor belt to the main deck protection is afforded by a belt of 5½-inch armor which turns in to meet the barrette, thus forming a completely inclosed citadel. Immediately inside the 5½-inch armor are worked cofferdams, 3 feet in width by 3 feet in height, which are packed with corn-pith cellulose. Above the 5½-inch belt is another continuous wall of 5½-inch armor which extends from the main deck to the spar deck. This wall also terminates in forward and after transverse bulkheads. Within the protected citadel thus formed is mounted on the main deck a broadside battery of eight 6-inch 40-caliber rapid-fire guns, and on the same deck forward toward the bow, two 6-inch guns are mounted in two sponsons protected by 6 inches of armor. It should be mentioned that 1½-inch splinter bulkheads are worked in between each pair of 6-inch guns in the central battery. On the spar deck above the broadside battery are four additional 6-inch guns, with an arc of fire from abeam to dead-ahead and dead-astern. These guns also have 6 inches of armor protection. The armor on the conning tower is 10 inches in thickness and the tube which connects the conning tower with the central station below the protective deck has walls 7 inches in thickness.

The main battery consists of four 13-inch guns, mounted in turrets, one forward and one aft, protected by 15 inches of armor, which is increased to 17 inches on the port plates. These port plates, by the way, are another innovation, being inclined sharply to the rear with a view to deflecting projectiles and presenting a greater horizontal thickness to penetration should the projectiles "bite." The barbettes are protected by 15 inches of armor. The turrets, like those on the "Kentucky," are oval, the oval form being adopted to reduce unnecessary space at the side of the guns and provide extra room behind them for handling and loading. Another good feature of these turrets is that the center of gravity of the rotating parts lies in the axis of rotation, and the turret, being thus exactly balanced, can be turned without difficulty, even when the ship is rolling or has a heavy list. The forward 13-inch guns have a fine command, their axis being 26½ feet above the normal load waterline. The after turret swings just above the main deck and has a command of 19 feet. Each turret has three sighting hoods. The one in the center is occupied by the officer whose duty it is to keep the guns pointed at the target, and who is simply concerned with the turning in a lateral direction. The hoods on either side are occupied by the gun pointers, who attend to the elevation and depression of the guns. The secondary battery is made up of sixteen 6-pounder, rapid-fire guns, six 1-pounder, four Colts, and two 3-inch rapid-fire field guns for the use of landing parties. The vessels are provided with four long Whitehead torpedoes, which are discharged from the berth deck, the torpedo tubes being located behind the protection of the 5½-inch side armor. Although the contract speed for these vessels was only 16 knots, they each did over a knot better, the trial speed of the "Alabama" being 17.1 knots, that of the "Wisconsin" 17.17 knots, while the "Illinois" made 17.45 knots. As may be seen from the accompanying photographic view of the "Wisconsin," these vessels present a fine, seaworthy appearance, and while somewhat behind the battleships of their date in speed, they are superior in armament and protection.

ENGINES OF THE BATTLESHIP "WISCONSIN."

Although the work of the Bureau of Steam Engineering of the navy does not figure so prominently in the illustrated journals of the country as that of the Bureau of Construction, which is responsible for the design of the hulls of our warships, it is no less important, and to its efficiency we owe much of our naval prestige. Witness the feat of the "Oregon" in steaming 14,000 miles to the theater of war, and almost on the day of her arrival giving successful chase to a 20-knot cruiser and bringing her to, with a shell from her forward gun. Well-designed and well-built motive power and efficient engine room service did far more to win the victories of the late war than they have ever received credit for.

The engines of the "Wisconsin," herewith illustrated, were designed by the Bureau and built by the Union Iron Works, San Francisco. There are two sets of engines, rights and lefts, placed in separate watertight compartments, separated by a longitudinal bulkhead. They are of the vertical, inverted-cylinder, direct-acting, triple-expansion type. The high-pressure cylinder is 33½ inches, the intermediate 51 inches, the low-pressure cylinder 78 inches in diameter, the common stroke of all pistons being 48 inches. The maximum indicated horse power of the two sets as developed on trial was 12,609.

The framing consists of special forged and bolted-up columns for the back, and forged steel, turned columns for the front side. The forged column con-

sists of two forged, scrap-iron, plate sides, with flanges for securing the column to the bed-plate, forged solid with the sides, as are also the flanges for securing the columns to the cylinder bottoms. Between these two sides is secured the casting that forms the main guides, which extends clear through from the front to the back of the columns and forms a rigid connection between the two sides. Below the guides the sides separate and form an inverted Y-frame, and here a plate is worked in between the two legs forming a strong intercostal. The construction provides a frame of great rigidity, which does not weigh any more than the cast steel frames, and provides a greater certainty of absolutely reliable material. It has given complete satisfaction in the engines of the "Olympia" and the "Oregon," and has been readily accepted by the Bureau of Steam Engineering in place of the type called for in the original specifications of these engines. The crank shaft is made in three sections, which are reversible and interchangeable. The crank pins are 14¾ inches in diameter and 17 inches long, and the crank webs are each 16¾ inches wide by 10 inches thick. A 7½-inch hole is bored axially through each shaft and crank pin. The thrust shafts are 14 inches in diameter with 9-inch axial holes. Each shaft has 11 thrust collars, 2 inches wide, placed 3½ inches apart, the outside diameter of the collars being 21½ inches. The propeller shafts are 14¾ inches in diameter, with a 9¾-inch axial hole bored throughout their length, the hole being tapered in the after section, where it passes through the propeller hub. All of the crank line and propeller shafting is of hollow, forged steel, of very high quality. The reversing gear is of the straight-push type, controlled by a hydraulic controlling cylinder and differential valve gear, and a hand pump is attached to the hydraulic end of the reversing engines for operating by hand. The air pumps, which are of the single-acting, vertical type, with inverted steam cylinders, are independent of the main engines. There are two air pumps for the set, which balance each other.

A special feature of the condensers for these engines is the fact that the shells are made of steel plate, the water ends being of bronze. This is a feature that may be considered as somewhat experimental, and the result of using steel for the shell will be watched by marine engineers with considerable interest. The main circulating pumps which supply the condensers with cooling water are of the centrifugal type. There are two of them, one being placed in each engine room. When they are used as emergency pumps on the bilge of the ship they will have a capacity of 12,000 gallons per minute each. Each engine room is also fitted with an auxiliary condenser with its air and circulating pumps, fire and bilge pumps, main and auxiliary feed pumps, and hydraulic steering pumps in duplicate.

The screw propellers are of manganese bronze and are three-bladed, the pitch being variable from 16 feet 6 inches to 18 feet 6 inches, the designed pitch being 17 feet 6 inches. The diameter of the propellers is 15 feet 6 inches. The starboard propeller is right, and the port propeller left-handed. Each blade is firmly bolted to the boss by tap bolts of rolled manganese or Tobin bronze, secured by lock plates. An interesting feature is that the hubs and plates for these propellers have been tinned, this being done for the purpose of maintaining a better surface on the propellers, and also with a view to mitigating, to a certain extent, any galvanic action which may arise between the propellers and the adjacent steel structural material. The ship carries eight single-ended steel boilers placed in four compartments, two boilers in each compartment. Each boiler has a mean outside diameter of 15 feet 6½ inches, and an outside length of 10 feet. They have a total grate surface of 685 square feet and a total heating surface of 21,200 square feet; the boiler pressure is 180 pounds to the square inch.

"MAINE" CLASS—FIRST-CLASS BATTLESHIP "MAINE."

The "Maine" class of battleships, which includes the "Maine," "Missouri" and "Ohio," was authorized May 4, 1898. The first plans drawn up for these vessels were almost identical to those of the preceding ("Alabama") class. The announcement of their contract speed, which was set down at 16 knots, aroused a storm of criticism, on the ground that this was at least 2 knots less than the average speed of foreign battleships at that time under construction, and the agitation resulted in a decision to enlarge the ships, and give them a speed of 18 knots an hour. The amended designs were a great improvement over those which they superseded. While the hulls are similar to the "Alabama" type, they are refined by the addition of 20 feet amidships, this lengthening being made to accommodate the increased motive power necessary to give the additional 2 knots speed. It also admitted of the addition of two more 6-inch guns to the broadside battery. The improvement of the "Maine" over the "Alabama" was not confined, however, to speed. The developments in armor manufacture, during the few years preceding the construction of the vessel, due to the introduction of

the Krupp process of face-hardening, had enabled our Naval Constructors to secure the same amount of protection with considerably less thickness of armor, the weight thus saved being distributed judiciously among the other offensive and defensive elements of the design. Moreover, the Bureau of Ordnance had succeeded in making a highly satisfactory form of all-nitrocellulose smokeless powder, and it had brought out an entirely new set of guns suitable to the new powder, of great length and high velocity, which, piece for piece, were vastly more powerful and effective than the earlier weapons. Water-tube boilers had also been developed to a point at which the Bureau of Engineering felt justified in adopting them exclusively in the "Maine" class. One advantage of the reduction of weights, due to the use of improved materials of construction, is seen in the increase of the maximum coal-bunker capacity from 1,355 tons in the "Alabama" to 2,000 tons in the "Maine."

The hull is constructed with the usual double-bottom, elaborately subdivided, and controlled by powerful pumps. The upper, or spar-deck, as in the "Alabama," extends aft to the after barrette, the freeboard forward being 19 feet and aft 11 feet. The vessels have the seaworthy qualities and handsome appearance of the "Alabama" class, but the effect is enhanced by the greater length and by the arrangement of the funnels on the longitudinal axis of the vessel instead of transversely, as in the preceding class. The waterline belt has a thickness amidships of 11 inches at the top and 7½ inches at the bottom. It extends from abaft of the after barrette forward to the stem, decreasing to 4 inches in thickness as a minimum at the bow. The protective deck is 2¾ inches on the flat above the engine and machinery spaces and slopes with a thickness of 3 inches to the bow, and aft, with a thickness of 4 inches, to the stern. Diagonal bulkheads of heavy armor will extend athwartship from the main armor belt at each barrette. Resting upon the main belt and its bulkheads is another wall of armor, 6 inches in thickness, which will be about 16 feet in height and will extend unbroken, from the main belt to the upper spar deck. This wall of armor will prevent the entrance of explosive shell beneath the central, 6-inch rapid-fire battery, and will form a complete wall in front and around this battery.

The turrets containing the four 12-inch guns will have a thickness of 11 inches and 12 inches on the port plates. Forward, in the bow, the two sponsons which carry, each, a 6-inch gun, will be protected by 6 inches of armor, and the same thickness will protect each pair of guns on the upper deck amidships. All of this armor will be face-hardened by the Krupp process and, ton for ton, its resisting power will be from 40 to 50 per cent greater than that of the untreated plates, with which our ships of twelve or fifteen years ago were protected.

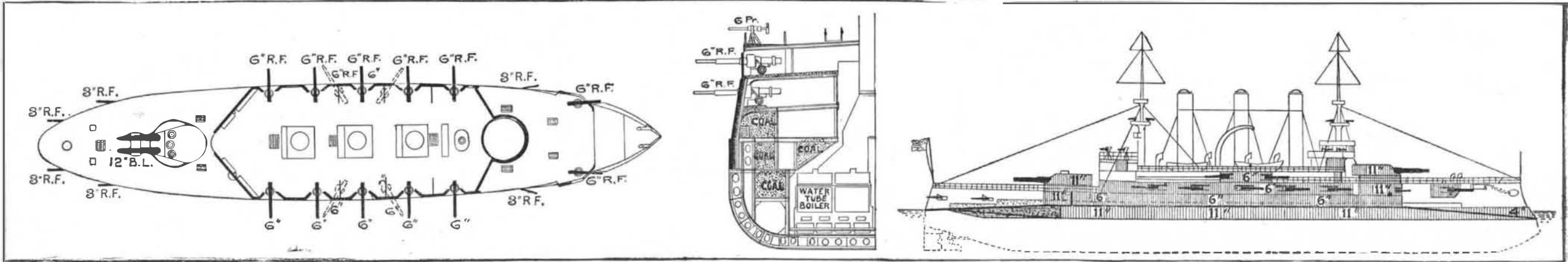
The main armament will consist of four of the new smokeless powder, 40-caliber, 12-inch guns, and sixteen 6-inch smokeless powder 50-caliber guns. This 12-inch gun has developed on trial a muzzle energy just under 48,000 foot tons, or nearly double the energy of the 12-inch guns of the "Iowa," when using brown powder during the war. The 6-inch gun has shown a velocity of over 3,000 feet per second and a muzzle energy of over 6,000 foot tons, or about double that of the 6-inch guns firing brown powder with which our vessels were equipped during the Spanish War.

Other novel features in the "Maine" class are the fitting of under-water torpedo tubes, the advantage of which over above-water torpedo tubes in respect of safety from explosion by the enemy's shell-fire is obvious. The lessons of the war, as shown in the destruction by conflagration of Cervera's fleet, are exemplified in the fact that wood is used very sparingly throughout the vessel. With the exceptions of the main deck outside the superstructure, the upper deck and the bridges, decks will be covered with linoleum, rubber tiling, wire mats or cement, and such wood as is used will be fully fireproofed. Wherever it is possible light metal will be used for gangways, bridges and all fixtures, except such as can be readily thrown overboard when going into battle. Another noteworthy feature in these vessels is that electricity will constitute the motive power of many of the auxiliary engines. It will be used to run the ventilating blowers, hoist the ammunition, to turn and control the turrets, besides furnishing light throughout the vessel and providing current for four searchlights and a double set of Ardois night signals.

"VIRGINIA" CLASS—FIRST CLASS BATTLESHIP "GEORGIA."

The five great battleships of the "Virginia" class form by far the largest and most important addition ever made to the United States navy. Never before have we built so many armored ships of one class, and never a vessel of the great displacement of 14,948 tons. The "Maine" of 12,300 tons is a big ship; but the "Georgia" will be larger by 2,648 tons. The story of the increase is shown in the accompanying table.

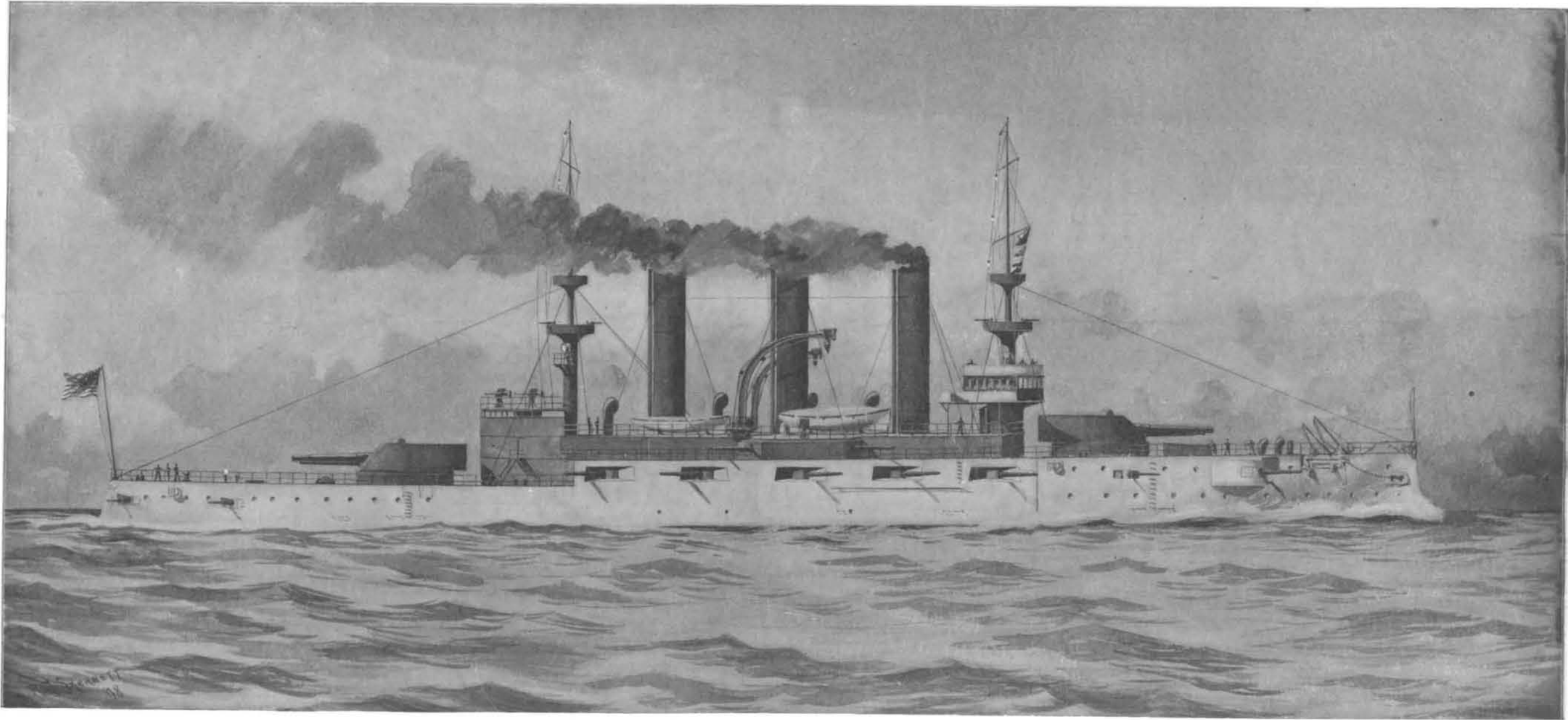
The vessels of the "Virginia" class will be known as the "Georgia," "Nebraska," "New Jersey," "Rhode Island" and "Virginia." The first three were author-



Plan of Main Deck.

Midship Section, Showing Protection of Boilers by Double Bottom, Side Armor and Coal Bunkers.

Gun and Armor Plan. "Maine" Class.



FIRST-CLASS BATTLESHIP "MAINE," ALSO "MISSOURI" AND "OHIO."

Displacement, 12,300 tons. Speed, 18 knots. Bunker Capacity, 2,000 tons. Armor (Krupp): Belt, 11 inches to 4 inches; turrets, 12 inches to 11 inches; barbettes, 12 inches; deck, flat, 2 3/4 inches, slopes, 3 inches to 4 inches. Armament: Four 12-inch 40-caliber, sixteen 6-inch 50-caliber R. F., six 3-inch R. F., eight 8-pounders, six 1-pounders, two Colts, two 3-inch field guns. Torpedo Tubes, 2 submerged. Complement, 551.

Battleship.	Authorized.	Length.	Displacement.
Texas.....	1886	301 feet.	6,315 tons.
Oregon.....	1890	348 "	10,288 "
Kentucky.....	1895	368 "	11,540 "
Maine.....	1898	388 "	12,800 "
Georgia.....	1901	435 "	14,948 "

ized on March 3, 1899; the last two on June 7, 1900. The accepted design, as shown in the accompanying illustration, was only arrived at after a long controversy in the Naval Board on Construction, which was prompted by the revival of the question of the superposed turret. As first designed, the "Georgia," "Nebraska" and "New Jersey" were to be of 14,650 tons displacement, and their main armament was to consist of four 12-inch and eight 8-inch breech-loading rifles, and twelve 6-inch rapid-fire guns, besides a dozen of the new 3-inch rapid-fire pieces, the 8-inch guns to be carried in four separate turrets as in the "Oregon." In the following year, when the battleships "Virginia" and "Rhode Island" were authorized, the acceptance and gunnery trials of the superposed turrets on the "Kearsarge" had made such a favorable impression that an agitation was started in favor of reviving this form of turret on the two new ships. The suggestion was opposed by the Board of Construction, the same arguments being used as in the discussion over the "Kentucky" and "Kearsarge." Ultimately, as a compromise, it was decided to build three ships with and two without the superposed turrets, and a few months later the board, for the sake of uniformity, declared in favor of building the whole five ships with superposed turrets.

Of course, the most striking novelty in these magnificent ships is their great size. As compared with the "Maine" class the length has gone up from 388 feet to 435 feet; the beam from 72 feet 2½ inches to 76 feet 2½ inches; while the normal draft is 3 inches greater, or 23 feet 9 inches, as against 23 feet 6 inches. Great size has distinct advantages in the way of seaworthiness, a stable gun platform, and a wider margin of flotation when the waterline is being pierced in a close action. The greater displacement of the "Georgia" has been judiciously distributed among guns, armor, and motive power. She is the fastest, best protected and most powerfully armed ship in the United States navy, and the most powerful in any navy. A great improvement over the "Maine" class will be seen

in the uniform freeboard of 20 feet from bow to stern. Apart from the military advantage gained in the added command of the guns of the main battery aft, there will be a net gain in accommodations, which will contribute greatly to the comfort and healthfulness of both officers and crew. None of them will be shut up behind blank walls of heavy armor, and lighted only by artificial means, the living spaces all having air ports and direct access to sunlight. The added freeboard aft, too, will make the ships more weatherly in a following sea.

The hull will be protected by an 8-foot belt reaching from stem to stern, which will extend 5 feet below

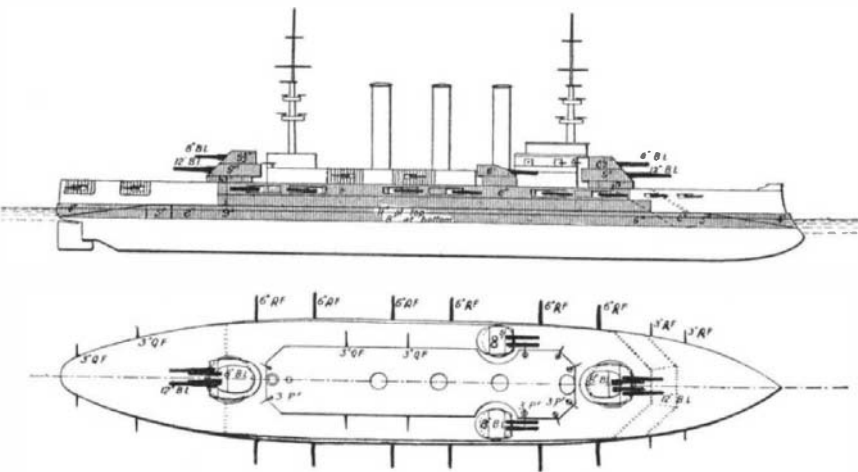
curved protective deck from bow to stern, which will be 1½ inches thick on the flat and 3 inches thick on the slopes. A cellulose belt 3 feet in thickness will be worked continuously from bow to stern along the sides above the protective deck. The obturating material will be the well-known corn-pith cellulose. Wood will be used very sparingly, and, where indispensable and not exposed either to the weather or under water, will be fire-proofed. Light metal bulkheads will supplant the usual wooden partitions in the living spaces; some of the furniture will be of pressed metal; the chart-house will be of bronze; and all of the decks under cover will be laid with linoleum. To guard against the overheating of the magazines, there will be a 4-inch air space around them in addition to a coating of some non-conducting material, while certain of the magazines are to be arranged so that they may be chilled by compressed air from the refrigerating plant.

The fighting powers of the vessels will be centered in the main battery of four 12-inch and eight 8-inch breech-loading rifles, the main rapid-fire battery of twelve 6-inch breech-loading rifles, the secondary rapid-fire battery of twelve 14-pounders and a dozen 3-pounders, and the auxiliary battery of eight 1-pounders, two field pieces, two machine guns, and a half dozen 0.3 automatic guns. All the heavy guns will be of the new smokeless-powder, long-caliber type.

The four 12-inch rifles will be mounted in two elliptical, balanced turrets 10 inches thick except for the slanting port plates, which will be an inch heavier.

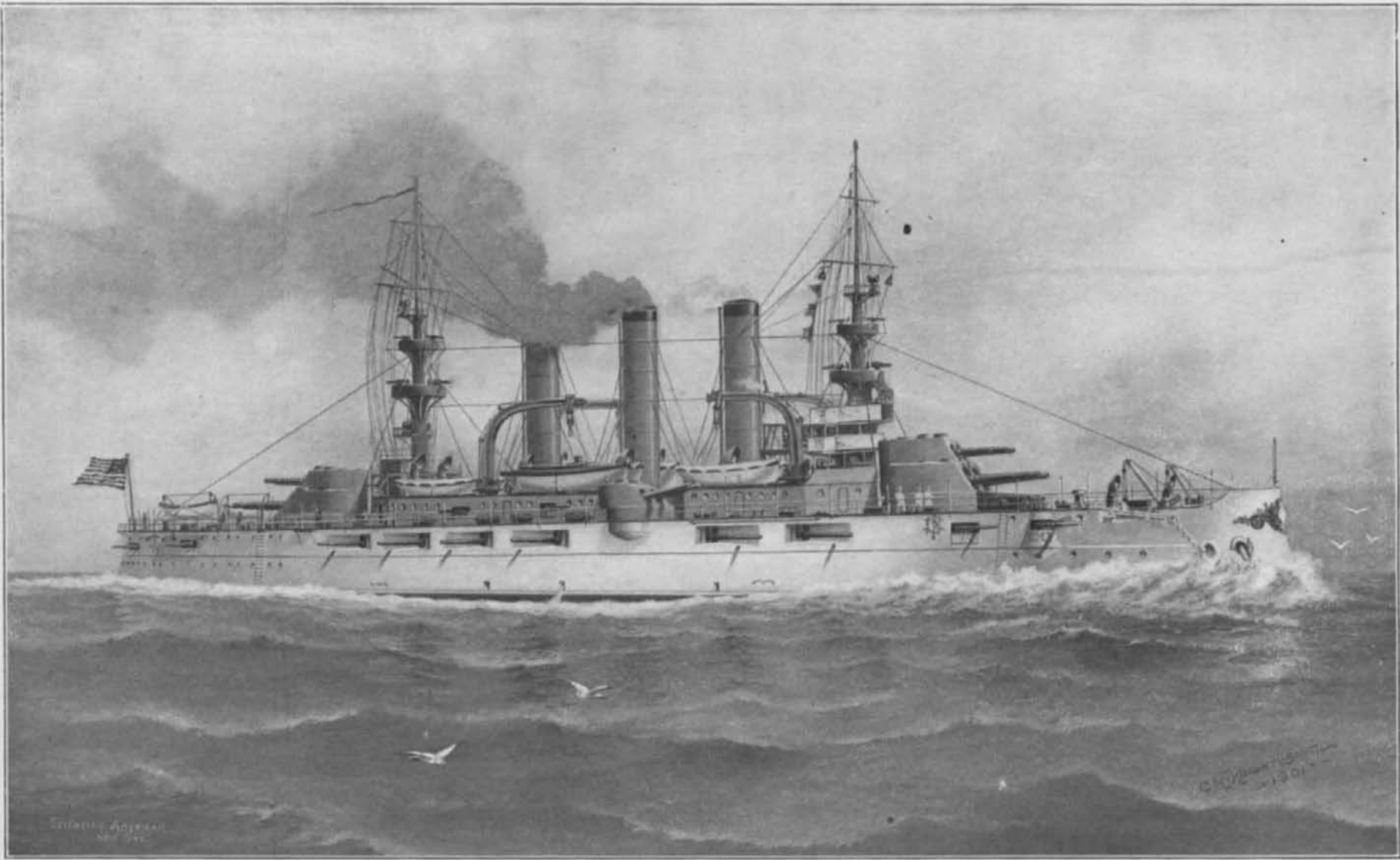
These guns will fire through arcs of 270 degrees. Four of the 8-inch guns will be superposed upon these turrets, fixed to move in unison, and they will be sheltered by walls of 6-inch armor increased half an inch on the slanting face plates. The four remaining 8-inch guns will be mounted amidships, two on each side, on the main deck, and will be housed in independent turrets similar to those placed above the 12-inch guns. These 8-inch rifles will have arcs of fire of 180 degrees, ranging from dead ahead to dead astern. This arrangement of the 12 and 8-inch guns gives a bow and a stern fire of six 8's and two 12's, and a broadside of six 8's and four 12's.

The 6-inch guns are arranged in broadside. Each gun, of which there are six on each broadside, has an arc of fire of 110 degrees, and the ports are so arranged that the guns can be turned inboard within the side line, the two forward pairs swinging forward, and the other eight guns swinging aft, the recesses being



Gun and Armor Plan; "Georgia" Class. "Georgia," Nebraska," "New Jersey," "Rhode Island," "Virginia."

and 3 feet above the waterline at normal draught. From the top to the waterline the belt will be 11 inches through, and thence to the lower edge it will taper to 8 inches. These dimensions will be maintained throughout the engine and boiler room spaces for a distance of 192 feet. Forward and abaft of this the belt will taper in thickness to a minimum of 4 inches at bow and stern. Above the main belt, for a distance of 245 feet amidships, i. e., throughout the position of the main broadside rapid-fire battery of 6-inch guns, the sides will be reinforced by armor of a uniform thickness of 6 inches. This armor will reach all the way up to the main deck, and it will be joined to the barbettes of the 12-inch turrets by athwartship armor of 6 inches in thickness aft, and by inclined armor of like thickness forward, yielding, in this latter case, the added protection of glacis against the head-on raking fire of an enemy. The after athwartship armor is vertical. There will be a



Displacement, 14,948 tons. Speed, 19 knots. Bunker Capacity, 1,900 tons. Armor: Belt, 11 inches to 4 inches; turrets, 11 to 10 inches and 6¼ to 6 inches; barbettes, 10 inches and 6 inches; deck, flat, 1½ inch, slope, 3 inches. Armament: Four 12-inch 40-caliber B. L.; eight 8-inch 45-caliber B. L.; twelve 6-inch 60-caliber R. F.; twelve 3-inch R. F.; twelve 3-pounders; eight 1-pounders; two 3-inch field guns; six automatic guns; two machine guns. Torpedo Tubes, 2 submerged. Complement, 705.

FIRST-CLASS BATTLESHIP "GEORGIA."

long enough to bring the muzzle of the gun almost flush with the side of the ship. This arrangement does away with the inconvenience of dismounting the guns to avoid obstructions or to guard them against the stress of heavy weather. Each of these guns is sheltered behind a heavy port shield, and there is a splinter bulkhead of 2½-inch nickel steel between each gun and its neighbor on either side. The twelve 14-pounders, sheltered by local armor of 2-inch steel and by shields, are to be mounted eight on the gun deck well forward and aft, and four up in the superstructure on the main deck, aft of the amidship 8-inch turrets. The twelve 3-pounders are to be mounted on the bridges and on the superstructure deck, while the 1-pounders, automatic and otherwise, and the Gatlings, are to be placed in the tops and in the boats. The submerged torpedo-tubes, of which there are two, are to be placed one on each side, well forward, and the operator is to control his tube from an armored station on the deck above, sufficiently sheltered to be proof against 6-pounder fire.

The main engines will be of the four-cylinder triple-expansion type, driving twin screws, capable of developing 19,000 indicated horse power, and designed to drive the ship at 19 knots. The steam pressure will be 250 pounds, and the cylinders will be: H. P. 35 inches, I. P. 57 inches, and two L. P. each of 66 inches dia. by 4 feet stroke. Number of revolutions a minute, 120. There will be twenty-four boilers of the straight water-tube type, placed in six water-tight compartments. They will have quite 1,280 square feet of grate and 55,000 square feet of heating surface. The air pressure in the ash-pits will not exceed one inch of water. Each ship will be fitted as a flagship and accommodations will be provided for 37 officers and 668 seamen and marines; a total complement of 705 persons.

Monitors.

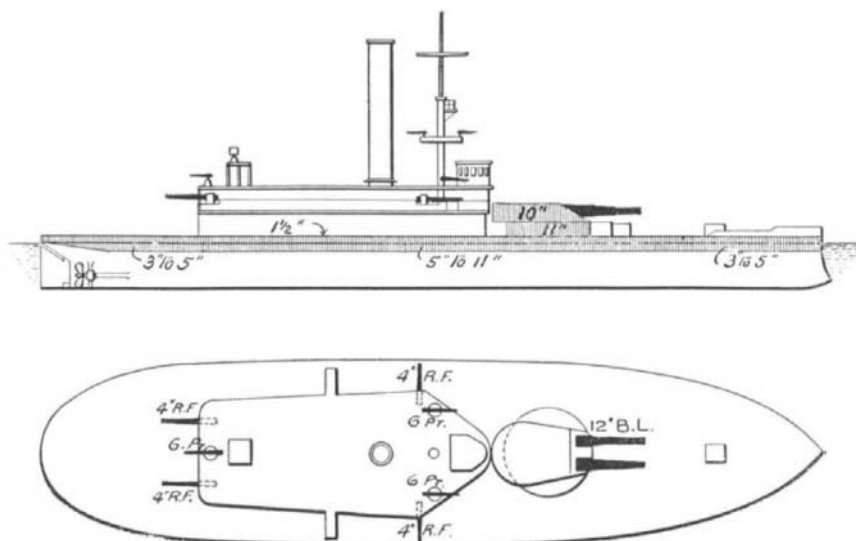
"ARKANSAS" CLASS—THE MONITOR "ARKANSAS."

It is safe to say that the four monitors "Arkansas," "Wyoming," "Connecticut" and "Florida," which are now under construction for the United States navy, are the last monitors that will be built for our own or any other navy. In the light of modern developments the type is discredited. Indeed, these four will owe their existence to panic legislation during the late war, due to the fear of bombardment entertained by some of the leading Atlantic cities. The monitor is purely a harbor-defense vessel, and would be practically useless, if not, as Sampson's operations off the northern coasts of Cuba and Porto Rico proved, a positive incumbrance in naval operations on the high seas.

The monitor lacks those prime qualities of a fighting ship—seaworthiness, steadiness as a gun platform, habitability, and mobility. As regards this last, one

The stem is carried well forward below the water and formed into a powerful ram. The maximum beam is 50 feet; and the draught upon the normal displacement of 3,235 tons is 12½ feet. Upon this displacement the ship carries, closely stowed in the bunkers, 400 tons of coal.

The hull is of steel, unsheathed, with an inner bottom reaching up to the armor shelf and ranging fore and aft throughout nearly the whole length of the ship. This intramural space is extensively subdivided into water-tight compartments, and, like the large, main compartments of the ship proper, it is under the control of a pumping plant of large capacity.



Gun and Armor Plan; "Arkansas" Class. "Arkansas," "Wyoming," "Connecticut," and "Florida."

The hull is protected by a continuous band of armor, extending from the main deck line down to a depth of 30 inches below the waterline amidships. This armor has a maximum thickness of 11 inches at the deck line throughout the region occupied by the engines, the boilers, and the magazines, tapering thence to the armor shelf well below water. Forward and abaft the "vital" space the armor is graduated by easy steps till it terminates at the bow and the stern in thicknesses of five inches. The protective deck, or more properly speaking the main deck, is composed of two thicknesses of ¾-inch plating, of which the upper course is of nickel steel. This is sufficient defense against the acute angle at which most plunging shots would have to strike.

A five-sided superstructure occupies the central portion of the main deck. In the lower half are quartered some of the officers, and there, too, is the galley, the armory, some wash rooms, and spare space for the housing of part of the crew if so desired. On the next deck above, i. e., the superstructure deck, is placed the major part of the rapid-fire portion of the battery. The hammock berthing is also in the superstructure on that deck, lending a very mild protection to the

right upon the fundamental plating. Wherever possible, woodwork is omitted and supplanted by light metal bulwarks, etc., but where wood is found needful for the sake of health and the saving of weight, it is carefully fireproofed.

The ship is propelled by twin screws driven by two triple-expansion engines, placed in one watertight compartment. These engines are of the vertical, inverted-cylinder, direct-acting type, each with a high-pressure cylinder of 17 inches, an intermediate-pressure cylinder of 26¼ inches, and a low-pressure cylinder of 40 inches, the stroke of all pistons being 2 feet. The collective indicated horse power of the propelling and the circulating pump engines will be 2,400 when the main engines are making in the neighborhood of 200 revolutions per minute. Steam is supplied at a working pressure of 250 pounds, by four water-tube boilers, having a total grate surface of quite 200 square feet, and a total heating surface of 8,800 square feet, and capable of supplying all the steam on shipboard when running at full power.

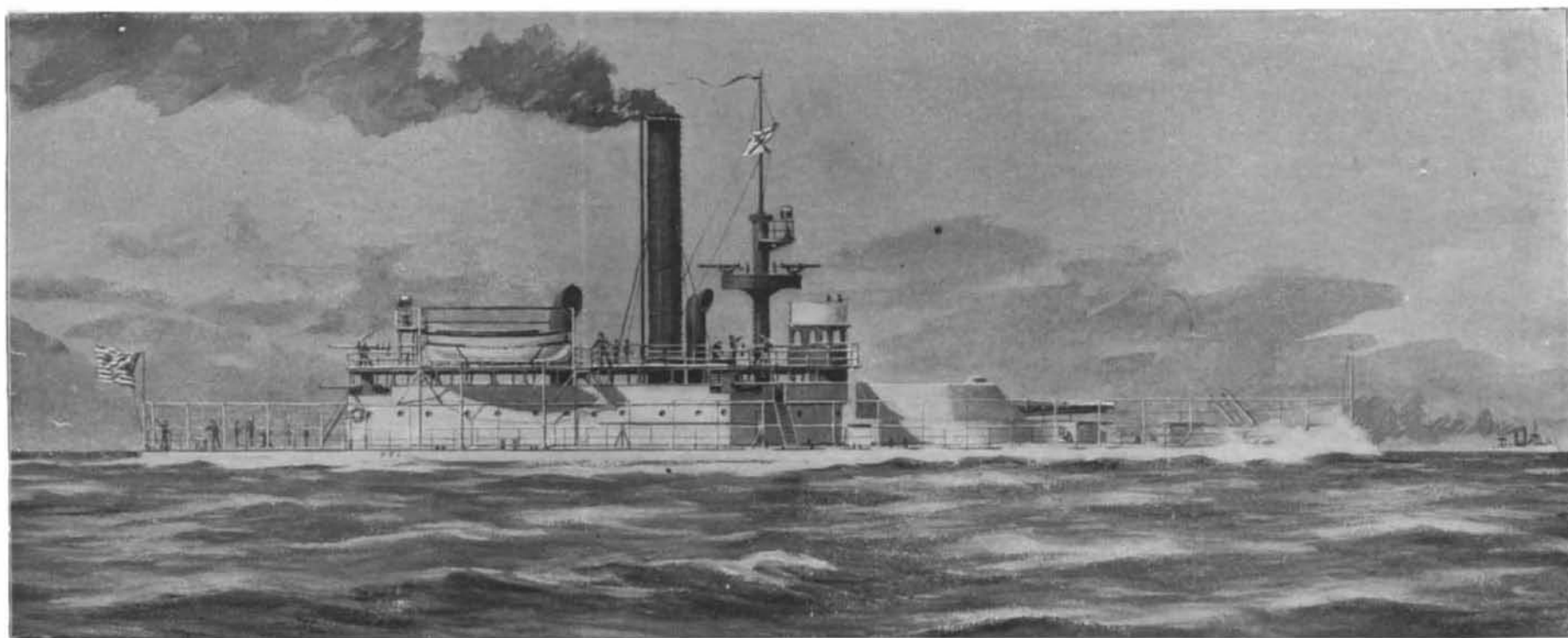
The vessel is lighted by electricity, while the turret mechanisms and all the ammunition hoists will be actuated by the same power. By the adoption of electricity so generally, the presence of long passages of heating steam pipes is obviated, and in this way alone a very considerable reduction of temperature will be effected under service conditions.

The main battery consists of two of the new 40-caliber 12-inch breech-loading rifles, and the secondary battery of four 4-inch rifles, while the auxiliary battery includes three 6-pounders and four auto-

matic 1-pounders.

The 12-inch guns are mounted in a single barbette turret of the balanced type, having an inclined face with a pitch of 42 degrees. The armor for the turret and the barbette is 10 and 11 inches thick and treated by the Krupp process. The four 4-inch guns are mounted on the four principal corners of the superstructure deck, where they will command a wide field of fire. These guns are protected by shields. Three 6-pounders are mounted on the bridge deck, while the 1-pounders are placed on the hammock berthing, amidships, and up in the single top of the military mast. The 12-inch and the 4-inch guns are designed for smokeless powder, the first having a muzzle velocity of 2,800 feet per second and the latter of 2,900 feet per second, the respective muzzle energies being 46,246 and 1,870 foot-tons.

The ship will carry two searchlights, one forward on the mast and the other upon a stand at the after end of the bridge deck. Every modern facility will add to the equipment and finish of the vessel, and ample quarters and bathing facilities will make life reasonably comfortable for the complement of a captain, six other officers, and 130 enlisted men.



Displacement, 3,235 tons. **Speed,** 11.5 knots. **Bunker Capacity,** 400 tons. **Armor:** Belt, 11 inches; turrets, 10 inches; barbettes, 11 inches; deck, 1½ inch. **Armament:** Two 12-inch 40-caliber B. L.; four 4-inch R. F.; three 6-pounders; six 1-pounders two Colts. **Complement,** 137.

HARBOR-DEFENSE MONITOR "ARKANSAS."

battleship, capable of going anywhere and casting loose her guns under any conditions, is worth a fleet of monitors, huddled within a mined and fort-defended harbor, into which an enemy's fleet will in all probability never be so rash as to force an entrance.

The "Arkansas" has a waterline length of 252 feet.

gun crews of some of the smaller pieces. On the bridge or uppermost deck are carried the chart-house, the boats, and all of the 6-pounder rifles. This and the deck just below, like the main deck, being exposed to the weather, are not fireproofed; but the berth deck, being under cover, is covered with linoleum placed

These four vessels will be used to a large extent to meet the growing need of proper schools of instruction for the increasing ranks of the naval militia; and it is easy to see how successfully they meet the demand, by covering every practical branch of naval warfare, with the single exception of torpedo duty.