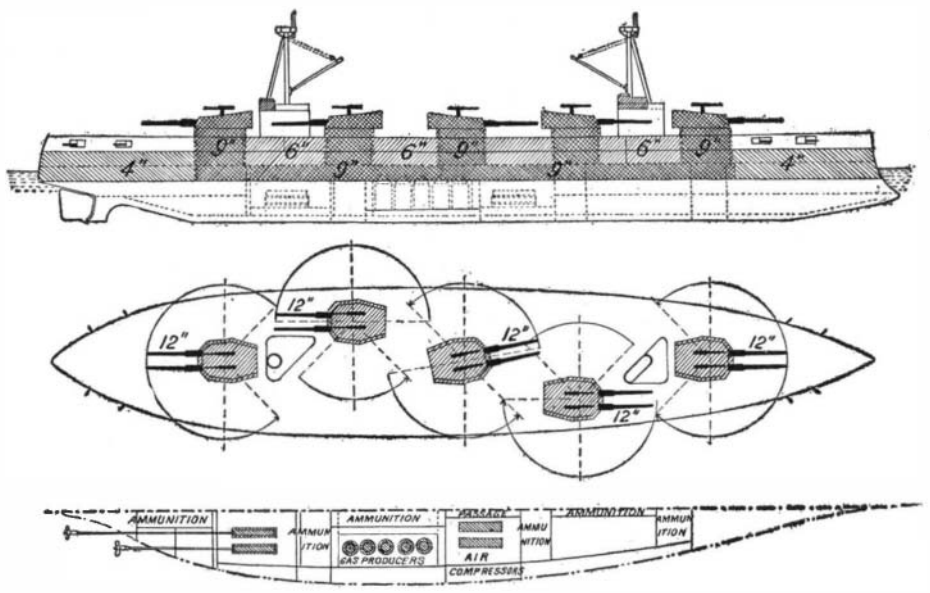
GAS-DRIVEN BATTLESHIPS AND CRUISERS.

A dispatch cabled from England, to the effect that the British government is about to lay down a large "Dreadnought" cruiser which will be driven by producer-gas engines, and will be without the customary funnels, has caused no little interest, and has brought several inquiries to this office regarding the truth of the statement. We may as well state at the outset that, in our opinion, it is very improbable that the British government is about to do any such thing; and this, in spite of the fact that successful experiments have been carried out with producer-gas engines installed on an old gunboat of the British navy.

The ever-recurring rumors of the construction of a gas-driven battleship or cruiser are, no doubt, ultimately traceable to a paper read a few years ago before the British Institution of Naval Architects by James McKechnie, Chief Engineer for Vickers, Sons & Maxim, in which he made a comparison between the 16,350-ton steam-driven battleship "Dominion," of the British navy, and a design of his own for a battleship of the same displacement driven by producer-gas engines. At that time no such ship existed, and no such ship exists to-day except on paper. The comparison, however, coming from such an eminent authority, is reliable; and, in view of the possibilities of the future, is of great value and interest. We reproduce three views of the ship. The many advantages of her design will be at once apparent. In the first place, although she is between 3,000 and 4,000 tons smaller than our own "North Dakota," she carries the same number of 12-inch guns, and these guns are mounted all on the upper deck, which is unincumbered either by smokestacks or superstructures. The comparison of weights, etc., of steam, gas, and oil machinery for a 16,000-horse-power battleship, which is given in the accompanying table, speaks for itself. The data for the steam engines are those of the exact weights, etc., of the engine, boilers, etc., of the "King Edward" class of battleships of the British navy.



Armament: Ten 12-inch; eighteen 4-inch guns.

Outboard profile, deck plan, and hold of design for a 16,350-ton gas-driven battleship

COMPARISON OF WEIGHTS, ETC., OF STEAM, GAS, AND OIL MACHINERY FOR 16,000-HORSE-POWER BATTLESHIP.

	Steam Engine.	Producer Gas Engine.	Oil Engine.
I.H.P. available for propelling the ship	16,000	16,000	16,000
Weight of machinery including usual auxiliaries, but not deck machinery	1,585 tons *	1,105 tons †	750 tons ‡
I.H.P. per ton of machinery	10.1	14.48	21.33
Area occupied by machinery, engines and boilers or producers	7,250 sq. ft.	5,850 sq. ft.	4,110 sq. ft.
Area per I.H.P.	453 sq. ft.	366 sq. ft.	257 sq. ft.
Fuel consumption in pounds per I.H.P per hour:			
At full power	1.6 lbs.	1.10 lbs.	0.6 lb.
At about ¼ full power	1.66 lbs.	1.15 lbs.	0.75 lb.

* Includes water in boilers.

† Includes water in jackets and piping, but not coal in producers.

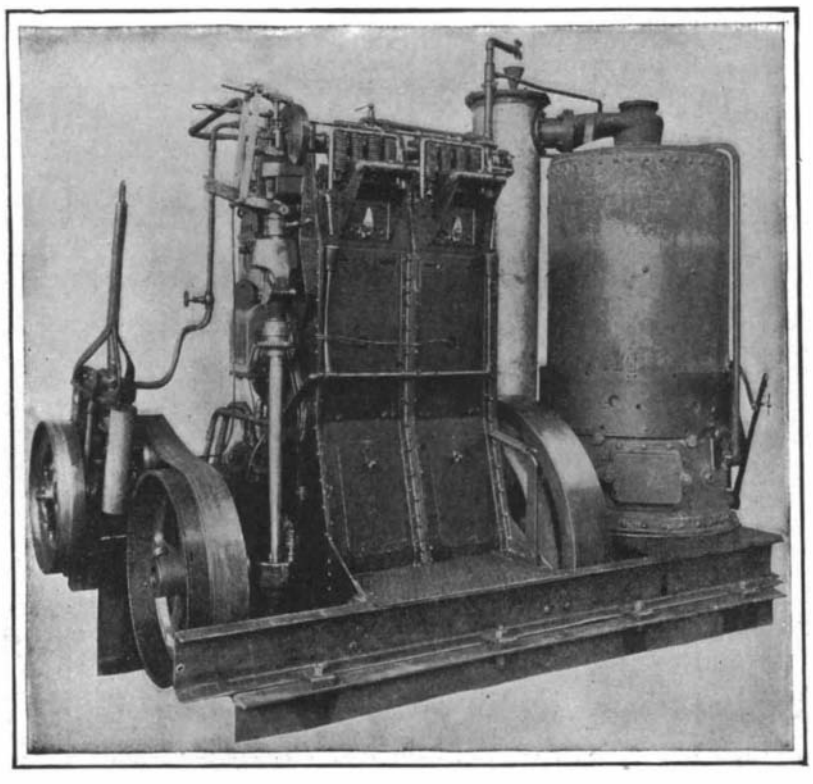
‡ Includes water in jackets and piping.

The plan shown provides a two-cycle gas engine, which may be worked either by producer gas or heavy oil. The compressed-air plant may be located in any part of the ship, and coal may be stored in the bunkers and oil in the double bottom. The gas machinery is divided into three groups, accommodated in six compartments. The ship is driven by four 10-cylinder vertical gas engines, coupled to four propeller shafts. The gas producers occupy the two center compartments, and in the forward compartments there are four sets of air compressors driven by gas engines.

The advantages of the gas system in solving the always difficult problem of placing the magazines to the best advantage, is shown by a study of the half plan of the ship; for it will be seen that each of the main magazines is located immediately below the pair of guns which it is intended to serve, and that there is communication between the various ammunition and shell rooms. This enables the ammunition to be readily distributed throughout the ship on one level. Hence, if any turret were put out of action, its ammunition could be transported below the armored deck for the service of other turrets.

The abolition of boiler uptakes and funnels enables the turrets to be so disposed, *without increasing the length of the ship*, as to admit of all the ten guns being fired on either broadside, and of six guns being concentrated ahead or astern. The advantages of the use of gas engines may be summed up as follows: It makes possible the carrying of a much heavier armament, and the use of far wider arcs of fire. The machinery is lower in the ship, and is, therefore, better protected. As the power per unit of weight of fuel consumed is greater, the radius of action is proportionately increased. When Mr. McKechnie comes to speak of the future (the paper was written some few years ago) he is properly conservative, reminding us that "it must be borne in mind that the largest marine gas engines as yet installed are of insufficient size, and much experimental work must be done before any application to a costly battleship will be warranted."

In comparison with the task of driving a 16,000 or 20,000-ton battleship by gas power, the applications which have already been made to marine work, and particularly naval work, are very modest indeed. Probably the best-known system of producer-gas engine for marine purposes is that known as the Capitaine, an illustration of which is herewith presented. The plant, which is of 30 horse-power, was illustrated and fully described in our issue of March 4, 1905, about which time it had accomplished successful demonstrations. It consists of a generator, cooling and scrubbing apparatus, and the engine, all mounted upon a single foundation. The floor space occupied by this installation is 7 feet 6 inches in length by 3 feet 6 inches in width, and its weight is about 2¾ tons. The cylinders are 27 inches in diameter by 11.02 inches stroke, and the normal speed of the engine is 200 revolutions per minute. To determine the suitability of the Capitaine system for small powers, the Thornycroft firm of Chiswick, London, fitted a canal barge with a 2-cylinder, 35-horse-power engine, which was sent on an extended trip over the English canals. She left Brentford, fully loaded, and towing two ordinary canal barges, which she took to Birmingham. After giving various demonstrations there, she went on to Manchester, where further trials were had, then worked her way back to the Thames, Oxford, and returned to Chiswick after being away for about sixty days. The total fuel consumed on the round trip, and the various demonstration runs made at different places, was 5.05 tons, the engine having been under way for forty days during the two months. Producer-gas engines of small power have also been fitted on canal boats or other small vessels both in France and Germany, and in every case, as far as can be learned, the plant has shown all those advantages of light weight in proportion to power, and high fuel economy, which characterize producer-gas engines.



Floor space, 3½ by 7½ feet. **Weight,** 2¾ tons. **Horse-power,** 30.

The marine producer-gas engine as used experimentally on a canal boat.

Of the success of marine gasoline engines, it is scarcely necessary to speak, so familiar are they to the reading public. It is the ideal motor for launches, high-speed racing craft, and the type of low-powered cruising cabin boats which has become so enormously popular during the past few years. Also, it has found an increasing field of usefulness as an auxiliary for sailing craft, large and small. The present practical limit of size for gas engines seems for marine purposes to be from 500 to 550 horse-power; for above that size the difficulties of cooling become very serious. For naval purposes, the work with the gas engines has been confined to ship's launches, although Yarrow has turned out some successful gasoline torpedo boats of small power, and last year two river gunboats of 250 horse-power were built by the same firm for work on the Danube. Of the excellent service of the gasoline motor as a drive for submarines, it is not necessary to speak in detail.

The most important work that has been done in developing a producer-gas engine for naval purposes is that of the Beardmore Company on the Clyde. The experiments resulted in the construction of two units, one of 500 and the other of 1,000 horse-power. The first of these was applied to the old British gunboat "Rattler," of 715 tons displacement. The old reciprocating engines and boilers were removed, and a 500-horse-power Capitaine producer-gas engine and auxiliary plant substituted. The 500-horse-power unit was the largest size in which the piston could be used without water-jacketing. The engine is of the vertical, 5-cylinder type, working on the Otto cycle, and the gas producer uses bituminous coal. The displaced steam machinery weighed 150 tons, whereas the gas plant substituted weighed only 94 tons, a saving of about 66 per cent. The trials of the ship lasted for eight days, during which several short runs of 45 knots or less total length were made. The fuel consumption averaged 6.46 cents per knot at an average speed of 10.5 knots per hour. The absence of noise and vibration in the engine room was noticeable; and the fuel consumption, as compared with that for the steam engines of the same power, was about 50 per cent less. A similar plant of 1,000 horse-power has been constructed, and is now undergoing tests.

Outside of the saving of weight, as shown in the comparison by Mr. McKechnie, and in the recent tests of the gunboat "Rattler," there is a saving of fuel consumption which, in the best producer-gas engine, is fully 50 per cent as compared with a good average steam plant, and of from 25 to 30 per cent as compared with the most economical steam plant. But it will be seen that a great advance has to be made in the size of the producer-gas engine before it can be successfully applied to a modern first-class battleship or cruiser. The power developed in the engine room of such ships will aggregate from 25,000 to 45,000 horse-power. Before 45,000 horse-power can be developed, even on four shafts, it is evident that much experimental work must be done to increase the size of the individual marine gas engine above the 500 horse-power at which it now stands. But as the size of the unit increases, the piston and piston rod increase to a point at which it becomes necessary to provide some system of water cooling; and this problem must be effectually solved before the risk is taken of applying the new form of motor to a ship calling for from 25,000 to 45,000 horse-power in the engine room.

Preserving Vinegar.—5 parts 80 per cent vinegar essence, 8 parts purified wood vinegar, 3¼ parts common salt, 1/10 part nitrate of potash; 1/3 part sulphate of potash; 50 parts good, young wine, 1½ part starch sugar or honey, 40 parts water.