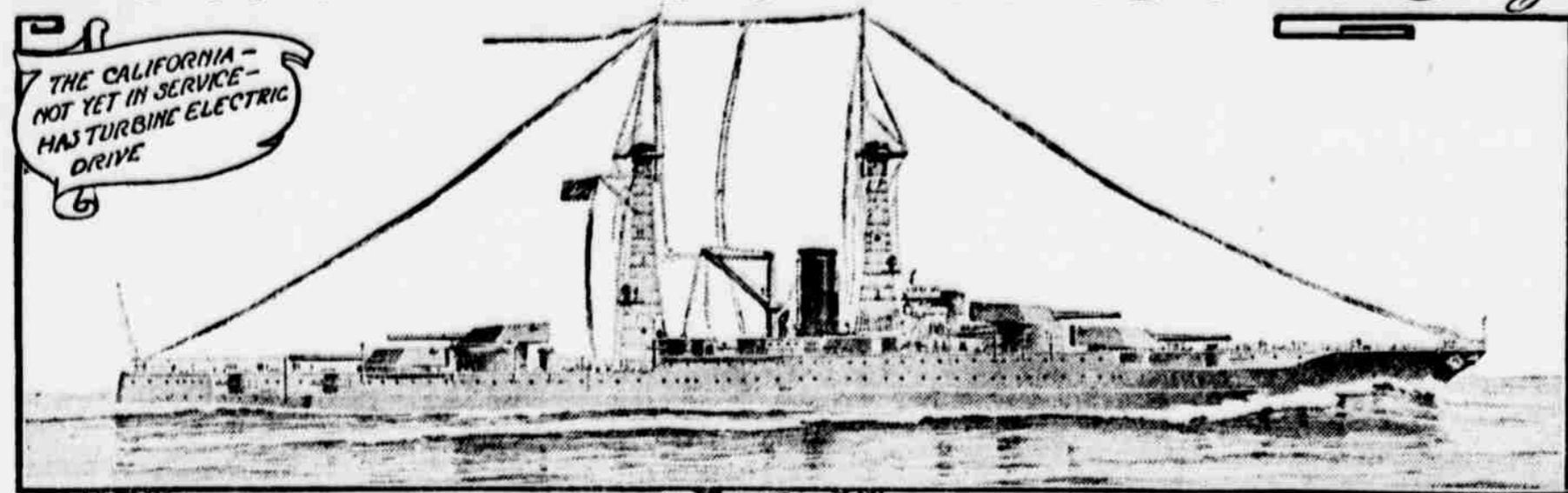
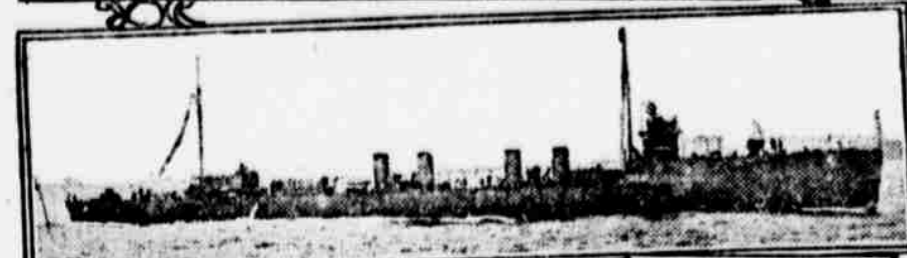


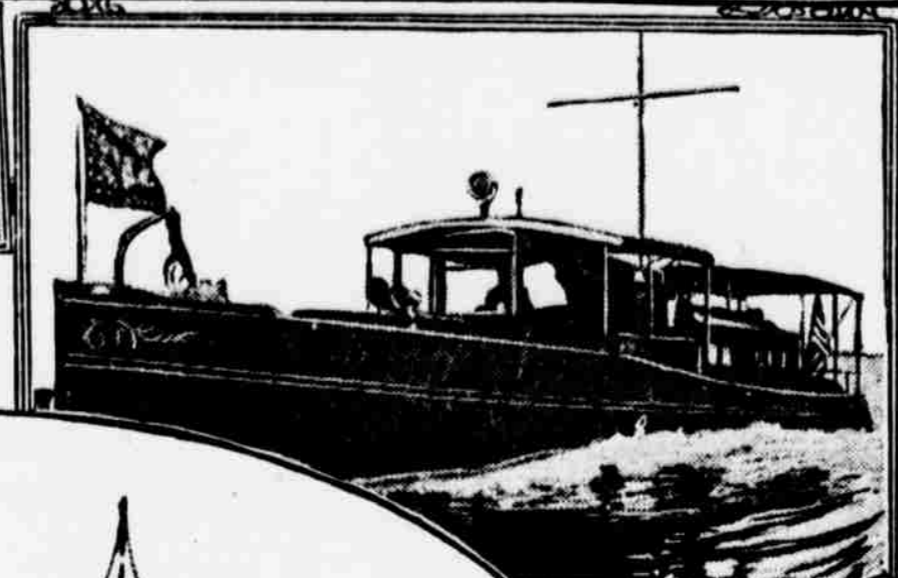
MIGHTY ENGINES FOR OUR NEWEST WARSHIPS



THE CALIFORNIA - NOT YET IN SERVICE - HAS TURBINE ELECTRIC DRIVE



THE PERKINS - OUR FASTEST DESTROYER



SWIFT MOTOR BOAT PATROLS OF OUR NAVAL RESERVE

TWO hundred thousand horse-power must be concentrated in one ship which attains a speed of 40 land miles an hour. Oil fuel and electric drive make feat possible

TO DESIGN bigger and more powerful marine engines than ever known, about eight times the power of those on the Pennsylvania or other late super-dreadnaughts, is the problem which the authorization of the new battle cruisers for the United States navy has thrown on Rear Admiral Robert S. Griffin, chief of the bureau of steam engineering, according to a writer in the New York Sun.

These engines, which will be of the electric-drive type, are expected to push the 900-foot ships through rough seas at a speed approaching 35 knots; that is, about four knots better than the latest United States destroyers and at the rate of a passenger train running on a carefully graded road.

When Admiral Griffin tells the story one gains from his manner the impression that about all he had to do was to speak to Captain Dyson about it and the design of these \$6,000,000 engines sprang into existence, but those who know the admiral have their own opinion about that; and it differs somewhat radically from the impression.

"Yes," said the chief, "at first it was rather appalling when we realized the magnitude of those engines. The largest in any of our battleships give 25,000 horse power; those of the Lusitania were 70,000; and it is said that those which drive the English Tiger at about 30 knots are from 80,000 to 120,000. So one can see that we had to make a leap, and at first it seemed like a leap in the dark, to provide approximately 200,000 horse power. But somehow, when we got the conditions right before us, everything seemed to unfold itself and fall into the right place and there really was little difficulty.

"We saw at the outset that it was impossible to control and apply the power without adopting oil fuel and the electric drive. In the great merchant ships like the Aquitania and the Vaterland we had examples of the 900-foot boats with a speed of 25 or 26 knots, but it is the last few knots which are so difficult to get. Very roughly speaking, the new cruisers steaming at 15 knots will consume the equivalent of 150 tons of coal a day, and to attain somewhere between 34 and 35 knots will burn up the same quantity in one hour; to put it another way, the coal required to drive one of these cruisers at full speed for a day will drive a battleship across the Atlantic and back. If full speed can be maintained steadily for three days and seven hours it will take one from New York to Liverpool; but as that would require 12,000 tons of coal it is certain that such a run will never be attempted on coal fuel.

"No one can tell what the chemist-engineer of the future will do; but until something is found battle cruisers will have to depend upon oil to convert water into steam; and without that substitute they cannot be driven many consecutive hours at full speed. It would not be possible to transmit so much power on one shaft or one screw. Therefore it is distributed to four shafts, each receiving about 50,000 horse power, or double the total power in a super-dreadnaught and greater than that of any but the largest of the modern merchantmen.

"If only a low or moderate rate of speed were required the old-style reciprocating engines would, because more economical, probably be selected, but to secure the high rates turbines will be adopted.

"The electric drive is not difficult to comprehend if one will think of the familiar trolley, subway or railway car driven by electricity. The power is created by the operation of steam-driven generators or dynamos. They produce the electric current, which is carried by wire to the many small motors in the cars scattered along the system. The motorman or engineer turns on the power and the motor is driven ahead; he moves his lever and the power is shut off; he shoves it further over and reverses his motor. For many small motors say several large ones and you have the plan of the ship's electric drive. The turbines operate the generators of the current for the motors, and the motors turn each of the four propeller shafts of the ship.

"This is the simple scheme of propulsion adopted for these new cruisers. It is known to be effective, but it is not as simple in the application as in the telling. To the troubles of the steam engine are now added the dangers of the electric current, and the engineer must have mastered electricity as well as steam. If the steam from 200,000-horse-power boilers could render the ship, the current it would generate, misapplied, would work untold harm to ship and crew.

"One of the disadvantages of a single engine or a single turbine is that it must be in one large compartment, and if this is breached from the outside the flow of water fills the entire space, puts all the machinery within it out of commission and places the ship in great danger. With the electric drive every motor, generator and turbine can be isolated, thus adding to the safety of the vessel. The electric drive is not an experiment. It has been operated on the naval collier Jupiter and on its trial trips the perfect success of this way of gearing down the power was proved beyond a reasonable doubt. This system is also being installed in the latest battleships, the New Mexico, Tennessee and California.

"There are several reasons why the cruisers must be so much longer than the dreadnaughts—approximately half as long again. The most important of these is to insure the fineness of line forward and the long smooth run indispensable to speed, with sufficient buoyancy to sustain the unavoidably great weights of hull, equipment and engines. Another reason is to provide space enough for the number of boilers which will supply steam to the turbines. The Oklahoma requires 14 water tube boilers to furnish her steam; and on that basis the new ships will require 84, although it probably will not work out in just that way. These boilers will contain many miles of tubing.

"A special problem for the engineer after the design of her hull has been fixed, is to determine the size of each of the propellers, their position and the pitch of the blades. A factor in solving this is the number of revolutions which the engines will give and the number which will give the best results. Although we have built no ships of this size and design and have no relative data to guide us, the solution presents no great difficulty, as Captain Dyson is a recognized expert in this line and will take care of this situation.

"The bureau of steam engineering will have to lay miles of wiring for electric lights and signals in a very limited space, at least as many as a town of 15,000 inhabitants would need. For this purpose we will supply separate generators; but by way of precaution provision will be made for coupling the lighting system with the generators which drive the propellers.

"It is needless to say that in working out the designs there will be constant co-operation between this bureau, the naval constructors, the ordnance department, the builders of the ships

and the manufacturer of the electric machinery. Everyone knows that Admiral Taylor can juggle with ship models and find the one he wants; and it may be taken for granted that the experiments made in the model tanks have produced a hull suitable for the speed required. The questions of armor and armament, of the gun placements, magazines and balanced turrets; the thousand details for the stores, plumbing, lighting, fuel tanks and engine space and the everlasting question of weights, have received the most careful consideration. Of course, engineers must know the shape of the hull before they can design the engines, but the constructors must know the weights and dimensions of the engines before they can give the last word in the designs.

"It seems hard that such enormous sums must be outlaid for ships which in 20 years will be scrap without rendering any very good service unless the nation should become involved in war; it is also unfortunate that a police force of any sort is necessary and that fire insurance premiums must be paid. The only compelling cause for the construction of these ships is that they are a type which other nations possess, and without which the United States will be at a grave disadvantage if opposed to a nation possessing them.

"As commerce destroyers it is plain that their speed and power will enable them to overtake and destroy anything afloat except battleships. The raids made by the German cruisers upon the English coast show how easily they can slip past a battleship fleet; and the Emden has proved what a swift cruiser can do against an enemy's commerce until a swifter and more powerful cruiser puts an end to its career. If it were not for the English cruisers, which would seek and cut them down one by one, the German battle cruisers, in spite of all the battleships of the English navy, would go to sea and make all kinds of trouble for the ships bearing to the allies munitions, food supplies and money paid for the manufactured articles which the allies in their ships are sending to the markets of the world because they have sea control.

"The battle of Jutland most certainly has not established anything not already known against the cruiser. No one ever had the slightest reason to suppose that one could engage a battleship at any range on equal terms. The naval engineers put all the expensive and powerful machinery in them; the designers of the hull gave them the fine lines to keep them at a long range from the backbone of the fleet; and when that speed was used to take them close to the battleships the inevitable happened.

"As a scouting force to locate the enemy these swift powerful ships break through a screen and accomplish what they were intended to do; and there is no doubt that as the swift wing of a fleet they will be invaluable in pursuit of an enemy and in certain other fleet maneuvers. That they cannot be successfully opposed to battleships no more proves that they are unfit for their strategic functions than the inability of English battleships to overtake the German cruiser does prove that they are unable to give and receive blows.

"So, because battle cruisers have their own important functions, both in and out of the fleet, the United States navy must have them, and the more of them and the sooner the better; for the navy is the one means of defense against a military nation."

Avoiding a Suggestion.
"Do you think your townspeople will give you any banquets?"
"Not if I can head 'em off," replied Senator Sorghum. "I don't want to get with a crowd and sit right down in front of a reminder of the high cost of living problem."
Giovanni Libretto, dead in New York, ordered \$10,000 spent on his funeral.

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BRINGS BOOM TO BOLIVIA

Finding of Rich Deposits of Tungsten Has Aroused Great Excitement.

Mining for tungsten or wolfram has brought prosperity to Bolivia. According to El Diario de La Paz, the boom at the mining center of Oruro can scarcely be exaggerated. Daily the miners and workmen flocked into the town from the outlying districts, carrying the fruit of their labors. The camps were full of nervous energy. Individuals pass through the streets of Oruro with faces burned by the wind and sun. They are the miners who have come to offer the exporting houses lots of wolfram, varying between 100 and 1,000 pounds. The amount of this sale, \$200 to \$2,000, is considerable in view of the modest condition of the miners, of whom the majority are Indians. The proceeds of the sale are deposited in the banks at sight, and the miner, happy and contented with the certificate of his capital, returns to the Cordillera to bring down new treasures.

In nearly all the mineral districts of the department of Oruro there are rich deposits of wolfram. Motor cars have been rapidly springing into popularity for use in visiting the mining regions, and many cars have recently been ordered from the United States.

Tungsten and tin ores are found at altitudes between 13,500 and 16,500 feet above sea level. Men, mules and llamas can climb up and down, but the slopes are too steep for working and handling of ore. Aerial ropeways are used to bring the ore down to a place where water for concentration is available.

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FIND VOLCANO IN MINDANAO

Recent Eruption Was Apparent, Lieutenant Donnelly Says of the Discovery.

Mindanao has a new volcano, according to the Mindanao Herald. Lieutenant Donnelly, while on a hike into the interior of Lanao province, discovered an active volcano in the Ptagayunan range of mountains, which heretofore was not known to exist. Lieutenant Donnelly says of his discovery in the following report:

"June 5, 1916, the undersigned, in command of a combined detachment of the First Cotabato company, and the First General Service company, on reconnaissance patrol from Kapad northwest through the Ptagayunan mountain range, came in sight of an active volcano which from all indications had recently erupted a discharge of volcanic ash and either smoke or flame.

"From the fact that foliage in the forest on the mountain sides three miles to the southeast had been scorched as though by flame, hot smoke or toxic gas, and that ground vegetation of scrub grass and weeds had been partially destroyed, leaving the stalks intact and the scorched leaves retaining their form, it was thought that the eruption had been recent. At all events, so recent that the wind had not blown away nor destroyed the fragile remnants of the burned foliage."

The Darker Side.

"Does the possession of a car help you to make friends?"
"Only to a limited extent," replied the motorist. "While I occasionally make a friend of a stranger by giving him a lift to town, I nearly always incur the enmity of numerous pedestrians by trying to show him how fast my car can go."

A new typewriter attachment automatically feeds envelopes or cards into a machine to save an operator's time.

By-Product Coke Oven.
The iron industry of this country has been adopting the by-product coking process at a marvelous rate. There are practically no by-product coke plants in the United States, which do not recover ammonia, tar and light oil (crude benzol).

In the vast majority of the plants also surplus gas is recovered and utilized either at the plant itself or by distribution to outside consumers. There are possibly two or three very small by-product coke plants at which tar and ammonia are not recovered for disposal to the outside markets, but these would certainly represent considerably less than 1 per cent of the total by-product coking capacity of the country that is not now equipped with benzol recovery plants, and the by-product coking plants now under construction have either contracted for benzol recovery equipment or indicated a strong probability that such provision will be made.—Metallurgical and Chemical Engineering.

Simply Beyond Them.
"The subjects of royalty are queer." "How so?" "They don't seem able to take it in when a king acts like an ordinary human being."

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