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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A 21½-KNOT BATTLESHIP.

A battleship which is capable of carrying a battery of ten 45-caliber, 12-inch guns across the high seas at a sustained sea speed of 21½ knots an hour and a maximum speed, for a limited distance, of 22¼ knots, is a proposition which may well be commended to the serious consideration of that diminishing school of naval architects which believes that speed is a greatly overrated quantity in modern warship design. According to press dispatches, the British battleship "Dreadnought," which has been undergoing her official trials, steamed for eight hours over a course 172 miles in length, at an average speed of 21½ knots, during which she reached a speed at times of 22¼ knots. The turbine engines, which were designed for 23,000 horse-power, during the trial drove the ship at a maximum speed for which the corresponding horse-power would be 28,000. These results give to this remarkable ship the distinction of combining in herself, in the highest degree, the characteristics of the battleship and the cruiser; for she has the offensive and defensive qualities of the one and the speed of the other.

In view of the high speed of the "Dreadnought," we think that our naval constructors should depart from the rather conservative policy which they have followed, and allot a larger share of the displacement of our future battleships to motive power. It is true that the "Dreadnought" and the three sister ships which are being constructed are, of all foreign warships, the least likely to be arrayed against our own; but we must remember that since the mark set by this vessel will be the standard of attainment for all foreign governments, we must look for a speed of 20 knots and over in the typical battleships of the future.

Simultaneously with the announcement of the trials of the "Dreadnought," it was stated by a London daily, whose naval information is generally correct, that the designs of the three new British cruisers, "Invincible," "Inflexible," and "Indomitable," which were authorized last year, are based upon the "Dreadnought," and that like her they are to carry a main armament composed exclusively of 12-inch, 45-caliber guns, of which each vessel will carry eight. The three ships are to be of practically the same displacement as the battleship; and by placing the two broadside turrets *en echelon*, or diagonally, at the center of the ship, and the other two turrets on the center line, forward and aft, these cruisers will be able to deliver the same broadside and end-on fire as the "Dreadnought," namely, six 12-inch guns ahead and astern, and eight 12-inch on either broadside. Their contract speed is to be 25 knots an hour; they will be driven by turbine engines; and their armor is to be something between that of the cruiser and the battleship. To all intents and purposes, then, these vessels will be battleships of the first class, carrying armor superior to that of many existing battleships, and having a speed from 6 to 8 knots greater than that of 90 per cent of the ships of this class afloat at the present time. In contemplating these 21½ and 25-knot warships it is disconcerting to remember that we are spending $10,000,000 on two battleships, the "Idaho" and "Mississippi," which are to steam only 17 knots an hour.

In the presence of such facts as these, it is not too much to say that a speed of 17 or even 18 knots is, for all future battleships, obsolete. Hereafter no design should be laid down which contemplates a speed of less than 20 knots an hour.

COMPLETION OF THE PENNSYLVANIA DOUBLE TUNNELS.

At just a quarter past four on the afternoon of October 9, the two shields in the south tunnel of the Pennsylvania Railroad met beneath the Hudson River, and the chief engineer, Mr. Charles M. Jacobs, had the satisfaction of formally declaring that the boring was completed. The driving of the north tunnel was completed over a month earlier, the two shields on that occasion, as on this, meeting with great exactness.

Air pressure was first turned on at the Manhattan end of the north tunnel in June, 1905, and at the New Jersey end of the south tunnel, in the following month. During the intervening period, in which the air pressure has varied according to the depth of the tunnel from 20 to 37 pounds to the square inch, not a single life, according to the statement of the chief engineer, has been lost. During that time the enormous total of 66,000 tons of metal, consisting of the cast-iron lining, has been put in place, and the speed of driving has been such that all previous records on main line subaqueous tunnel work have been broken. Now that the tubes are in place, the important work of sinking the massive tubular piles through the bottom of the cylinders to the rock, which lies far below the silt and sand through which the tubes have been built, will be undertaken. These piles will be driven 15 feet apart along the axis of the tubes, and they are provided with a deep thread which, as the tubes are rotated, will carry them down to rock bottom. Where they pass through the cast-iron shell of the tube they will be rigidly connected to the same, and the weight of the tunnels and the trains that run through them will then be borne directly by the solid underlying rock and hardpan, assisted, of course, by the material through which the tubes have been driven. The strength and security of the tubes will be further insured by lining the interior with a coating of two feet of concrete. Each tube is 23 feet in diameter and over 6,000 feet in length from shaft to shaft. The present estimate of the time necessary to put the tunnels in condition for the operation of trains is about one year and a half.

PANAMA CANAL TO BE BUILT BY CONTRACT.

Next to the purchase of the Panama Canal, the most important step taken by the government affecting this great enterprise is its decision, recently announced, to have the construction of the canal done by contract. In no other way can it be built within a reasonable time. Proof of this has been abundant during the past few months, in which the great paucity of official information regarding the canal has raised a natural fear that matters were proceeding with halting steps, and that the government was encountering difficulties most serious and probably unforeseen. This silence has been in marked contrast to the stream of volubility which flowed from the Bureau of Publicity, or whatever it may have been called, which was instituted when the government first entered seriously upon the work of organization and construction. It is certain that perplexing problems have confronted the advocates of government construction. The Canal Commission appears to have been quite unable to solve the labor problem which, as the weeks have slipped by, has loomed large and perplexing, dwarfing, by comparison, the bugaboos of malaria, yellow jack, or even the turbulent Chagres River itself. For it has proved almost impossible to procure labor of the most simple and unskilled type, white or black, and this in spite of the fact that many experiments have been made with laborers from widely-separated localities, who were supposed to be peculiarly fitted to work under the conditions which prevail at Panama. Moreover, the many efforts made by the Commission to take to the Isthmus and retain there the more intelligent class of men capable of directing the common laborers and of performing other general duties of a more or less authoritative kind, have met with equal failure. It is more than probable that the discouraging results attending the efforts of the government to secure bids for the supply of Chinese labor, have proved to be the last weight in the scales to turn them in favor of doing the work by contract.

Many months ago, when this journal was strongly urging the government to take the step which it has now decided upon, we were taken to task by a technical journal devoted to the engineering and contracting interests of the country, for proposing something which we were assured was, in the very nature of things, an impossibility. It was urged that there were only one or two firms which could command the capital necessary for the undertaking of such a huge task, and that, therefore, competition was out of the question, and the government would be, in the matter of price and time, at the mercy of the contractor. We are willing to admit that if bids were called for upon this work according to the methods commonly followed, there would be much truth in the criticism. But in the plan which the government is about to adopt, the interests both of the country and the contractor are so secured, that we feel satisfied the canal will be built under conditions which will guarantee the interests of both parties to the contract. For although the construction will be let by contract, the government of the United States will not, in the least degree, relinquish its authority over the work. In fact, it will retain under its hand everything save the work of actual construction. The contractor will excavate and build, and the engineers of the government will supervise. The government will make the contract with a single individual or concern, which will be composed of several reputable concerns, each of which will be expert in some particular branch of the work to be done at Panama. The companies presenting bids under the single contracting concern must have an aggregate capitalization, outside of debts and encumbrances, of $5,000,000, and the successful bidder must furnish a bond of $3,000,000.

The bids will be awarded upon what is known as the percentage plan, each bidder setting forth for how small a percentage of profit on the total cost of the work he will undertake to do it. The contract will be awarded to the firm which offers to do the work for the smallest percentage, provided, of course, that the government is satisfied as to its ability to live up to the terms of its bid. The total cost upon which the compensation of the contractor will be based will be estimated by a board of engineers, two of whom will be appointed by the successful bidder, and three by the government. The chief engineer of the Commission will be one of the government's appointees and will act as chairman of the committee.

Before finally adopting the form of contract which is now announced, Chairman Shonts of the Canal Commission consulted with a large number of leading engineers and contractors, and the government is satisfied that several bids will be submitted to the Canal Commission for the work of construction. The competition is not limited to American bidders; and should any foreign firms submit bids to the Commission, they will be considered upon the same basis as those handed in by American firms. In a letter transmitting to Secretary of War Taft the form of contract which the Commission has drawn up, Chairman Shonts states that if the elements of time and cost did not enter so vitally into the undertaking, the Commission would have created its own organization and done the work by day labor. This was rendered impossible by the "unprecedented and greatly-extended industrial activity of the times and the consequent violent competition for all classes of superintendents, foremen, sub-contractors, skilled mechanics, and even ordinary laborers." The great contractors of the United States have organized forces which stand prepared and fully equipped to do such work as awaits them at Panama. The only new conditions which may threaten their efficiency are those due to the climate, with its attendant tropical fevers and general debilitating influences. The government claims, however, to have the problem of sanitation well in hand; and if General Gorgas and his staff of sanitary engineers are given a free hand there should be no cause for apprehension of such epidemics as have been wont to sweep through the Isthmus under the administration of earlier canal builders.

Conspicuous among the advantages of contract construction is the fact that thereby the work will be forever rid of the curse of political patronage. Furthermore, if the contractors are wise they will make it an indisputable condition in the bids that they shall be free to purchase supplies and plants in the cheapest markets, American or foreign.

THE STATUS OF THE LIQUID BARRETTER.

Of the many types of detectors devised for manifesting the presence of impinging electric waves on the aerial of a wireless telegraph receptor, none are more interesting in their various aspects than the liquid barretter of Fessenden.

Different from the coherer, the action of which was discovered by Branly, improved upon by Lodge, and perfected by Marconi, the liquid barretter, or, as it is perhaps better known, the electrolytic detector, is the result of the effort and ingenuity of one man, and to him alone is due the credit for evolving the idea, developing it experimentally, and finally applying it to the commercial reception of wireless telegraph messages.

The first detector Fessenden called a barretter—a euphonious name derived from "barretor," an old French word meaning "exchange," since it possessed the property of exchanging the energy of the oscillations surging through it for a continuous current—was based on the fact that a loop of wire having an exceedingly small diameter requires an infinitesimal amount of current to heat it. To obtain this heating effect by means of electric oscillations set up in the antennæ, the loop was made of a silver wire 0.002 inch in diameter and having a platinum core 0.00006 inch in diameter, the tip of which was immersed in nitric acid and the silver dissolved away, leaving a minute area of the platinum exposed. The ends of the loop were fastened to leading-in wires, which were sealed in a small glass bulb, the completed arrangement appearing very like a miniature incandescent lamp.

The action of this barretter is based upon the following theoretical considerations, namely, that if a wire