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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.

THE SHIP SUBSIDY BILL.

The day when the American merchant marine shall be restored to its former proud position in the deep-sea carrying trade of the world has been brought a step nearer by the passing of the Ship Subsidy Bill by the Senate. Although the measure, as amended, does not undertake to assist the merchant marine to the extent that its friends had hoped, it should prove of enormous assistance in lifting the shipbuilding industry from the slough of despond into which it has fallen. The fate of the bill is now in the hands of the House of Representatives, and if the generally-favorable attitude of the individual members be sustained, it should become a law by the close of the present session.

The history of the movement to resuscitate our shipbuilding and deep-sea carrying interests shows that there has been a gradual education of the public to the true meaning of the proposed subsidy, and to a realization of its absolute necessity, if we are to carry our own imports and exports in American bottoms—to say nothing of our sharing in the general deep-sea trade of the world. At the present time the United States is paying out between 200 and 300 million dollars annually to foreign shipping concerns, for carrying to and fro the foreign trade of this country. This immense revenue, logically and by right, should be earned by American ships. That it is diverted to foreign nations is due to the fact that because of the higher wages and the higher ideas of living and comfort that prevail in the United States, it is impossible either to build or to operate ocean-going ships as cheaply as they can be built and operated by foreign countries. Although the cost of ship construction is being gradually reduced, it still costs considerably more per ton to build a steamship in our own than it does in European shipyards; and the more generous wages paid to officers and crews, and the better class of fare provided, increase the cost of operation of ships, if manned by Americans, 30 per cent above the cost of operating the same ships with European crews, and under European conditions.

Now, as far as private capital is concerned, the question of the advisability of operating any proposed line of American steamships is judged purely upon the utilitarian basis of its dividend-earning probabilities. It is not a question of sentiment or patriotism, but of profits; and since it has been proved to a demonstration that, under existing conditions, it is impossible to compete with foreign built and owned ships, the decline and present stagnation of our present merchant marine is readily accounted for.

The Subsidy Bill is a proposal to have the government assist the merchant marine, by paying to the owners of vessels a sum sufficient to make good the difference in cost of construction and operation between American-built-and-operated ships and those of foreign nations. In return for this the merchant marine gives a *quid pro quo* to the government by building certain of its ships to meet government requirements with a view to rendering them available as transports; by assisting in the creation of a naval reserve both of officers and crews, and by holding their vessels at the disposal of the government, and liable to be taken up at short notice in the event of hostilities.

In our issue of January 27 we dwelt upon the urgent necessity for the resuscitation of our merchant marine, if only to provide the government with a system of transport service that would be available, and instantly available, in case of hostilities. We quoted certain figures taken from a report of the General Staff of the Army, showing how completely paralyzed, in the event of sudden war, this nation would be if it attempted to transport a small army of, say, 25,000 men across the seas. It was shown that for the transportation of such an army, either on the Pacific or on the Atlantic Ocean, there should be afloat in our merchant marine no less than 228 vessels of a gross tonnage of 1,368,000 tons, all of them ranging from 5,500 to 6,500 tons displacement; whereas, as a matter of fact, in 1904, the whole American merchant marine included only 57 sea-going vessels of 4,000 tons and upward, with a total of 400,000 gross tons. The argument for subsidizing, from the standpoint of the military necessities of the country, is simply unanswerable.

Judged from the commercial standpoint, the question of ship subsidies is purely one of expediency. None of us are particularly fond of the term subsidy, and some of us have tried to get away from it by a bit of psychological legerdemain which ends in calling it subvention. Be that as it may, however, subsidizing is but a matter of giving heroic treatment to a patient whose case is desperate. There can be little doubt that if the bill be passed and becomes a law, the next ten years will see a notable revival of an art for which this country has proved itself in the past to have splendid aptitude. When once our merchant marine has become big enough to carry the whole of our deep-sea trade, we shall not only have diverted vast annual revenues back to their legitimate channel; but we shall have developed a magnificent industry; given employment to a large army of skilled labor; and caused the American flag to fly once more in a score of seas and at a hundred ports where now it is conspicuous by its absence.

THE "DREADNOUGHT."

Largely because of the unusual circumstances attending its design and construction, the powerful battleship of 18,500 tons displacement, which has just been launched at Portsmouth, England, is attracting more than common interest. The "Dreadnought" is the first battleship to be built since the war; she is the largest and most powerful fighting ship ever constructed; and, as the result of the effort of the government to see just how quickly a battleship can be built in Great Britain, she has been launched in four months, and will be completed in eighteen months from the day on which her keel was laid.

The Scientific American has received information from the highest official sources in Great Britain that there were present on the ships of Admiral Togo's fleet several British officers, who had been detailed to secure technical information of the valuable kind that can only be gathered in an actual sea fight. The mass of information affecting the construction and management of warships, thus secured, was placed before a special committee, corresponding to our Board of Construction in this country, which called in for consultation, we understand, several expert private naval architects and builders, and proceeded to design a type battleship embodying the valuable experience gathered in the Russo-Japanese war. The result is the mighty ship which was launched on February 10, only four months from the day on which the keel plate was laid.

The "Dreadnought" embodies, naturally, a large number of novel features; but owing to the extreme secrecy which has attended the construction of the ship, and the care with which her plans have been guarded, only the leading characteristics of the design can be stated with certainty. In the first place, the displacement, as compared with previous battleships of the "Lord Nelson" type, has been increased by about 2,000 tons, the "Dreadnought" displacing 18,500 tons and costing, when complete, over $8,000,000. The most radical change, due to the experience gained in the war, is the elimination of the secondary battery and the reduction of the armament to two types of guns, the 12-inch and the 3-inch. It was proved that the 6-inch gun is too light to be effective at the greater ranges at which modern engagements are fought, and that it is not sufficiently rapid in its fire and is rather too heavy a gun to be used for defense against torpedo boats and destroyers, a work for which the 3-inch gun is well suited. The "Dreadnought's" battery consists of ten 12-inch guns, all mounted at about the same level on the upper deck; two forward in a turret, two in a similar turret aft, and three on each broadside, mounted within single turrets. For defense against torpedo attack the ship will carry eighteen 3-inch guns. The 12-inch gun will be of the wire-wound type and about 45 calibers in length. Each gun will throw an 850-pound shell with a muzzle energy of 49,568 foot-tons. Owing to the improved methods of handling the 12-inch guns, they will be theoretically capable of discharging four tons of metal a minute with sufficient energy to penetrate 16 inches of Krupp steel at a range of 5,000 yards.

The armor protection will be particularly heavy and complete, and structurally the ship will be built with a view to resist the severe racking effects, which played such havoc with the Russian ships in the battle of the Sea of Japan. On this point it is interesting to note that Admiral Rojestvensky, in an address before the Imperial Technical Society at St. Petersburg, stated that when the heavy high-explosive shells of the Japanese "exploded in the water near the Russian vessels, they cracked the plates and opened great leaks." Similar effects were noted at the bombardment of Russian ships at Port Arthur, as recently explained in the columns of this journal. At the longer ranges, the shots that fell short, but near the ships, would not explode until they had penetrated several feet below the surface, and were close to the under-water surface of the hull. The Japanese high-explosive shell-filler seems to have acted with the effect of a mine, bulging in the plating and causing serious leaks along the seams. If this be the case, it might well happen that the shots which struck a little short of the ship might be actually in the long run more destructive than those that landed between wind and water. We believe that this problem has been given special attention in the under-water design of the "Dreadnought." Above water the heavy armor has been carried right up to the upper deck, and is nowhere pierced by casemates.

Another important innovation in this new ship is the introduction of steam turbines. There will be four propellers on four shafts, and the estimated speed is 21 knots an hour. If this speed is secured, the "Dreadnought" should be practically invincible, and a fair match for any other two ships afloat, since she could choose her own distance and position, and fight a long-range action with her 12-inch guns. The great speed with which the new ship has been constructed is due to the desire of the Admiralty to subject her to a series of very thorough tests before building any other ships of her class. As she was designed to be launched in six months from the start of work, and was actually launched in four, it is probable that she will be completed within the estimated period of eighteen months from the laying of the keel. The significance of this rapid construction is seen in the potentiality of replacement it suggests if Great Britain were engaged in a lengthy war. There are a dozen yards (including those of the government) that could build one or two ships of this class in about the same time; and this would mean the creation of a new battleship fleet of a dozen vessels in the period covered by the Japanese war.

EVOLUTION OF HEAT FROM RADIUM.

Prof. Angström, of Upsala, Sweden, some time ago conducted certain experiments with a view to ascertaining accurately the amount of heat given off by radium. From these experiments the evolution of heat was shown to remain practically constant during the period of a year, being independent of the nature of the surrounding medium. Thus it may be inferred that the amount of energy given off in the shape of beta and gamma rays constitutes only a minimal fraction of the total energy.

According to recent experiments by Paschen on the same subject, the Gamma rays would, however, constitute more than half of the total energy evolved by radium. In view of this evident contradiction, Prof. Angström (see Physikalische Zeitschrift, No. 21) again took up his experiments with the utmost care and on a larger scale, the experimental conditions being likewise altered. Though Herr Paschen has in the meantime found his own results to be unreliable, an account of these most recent experiments would seem to be interesting owing to the importance of the subject. 86.5 milligrammes of pure radium bromide inclosed in a small metal cylinder were placed in the neighborhood of another cylinder, with dimensions as nearly identical with the first as possible, and which was protected against all heat effects. This cylinder contained a small manganine coil heated by an electrical current. The temperatures of the cylinders were measured with great accuracy by means of thermo-elements, while the amount of heat given off by the radium was found by varying the current traversing the manganine coil until the two thermo-elements showed the temperature of the two cylinders to be strictly identical. The amount of heat given off by the coil (as determined by the current intensity and resistance) was then equivalent to that evolved by the radium, and in order to eliminate any errors due to a lack of symmetry, the two apparatus were repeatedly substituted for one another. The heat evolution thus ascertained was found to be exactly the same whether lead, copper, or aluminium cylinders were used, being 1.136 small calories per minute for each gramme of radium bromide. The energy of both beta and gamma rays is accordingly quite immaterial, being at most a small per cent of the total amount given off by the substance.

The evolution of heat from the radium product investigated by Angström from September, 1903, to January, 1905, was found to undergo no alterations worth speaking of throughout this interval, the mean value according to earlier determinations for the period from September, 1903, to April, 1904, being 1.14 small calories per minute, or 68.5 small calories per hour, for each gramme of radium bromide. The heating effect of radium is thus shown to be due either to the internal collision of the alpha particles, the living force of which seems to be sufficient to bring about rather decided effects, or to some other agent, which is different from the three classes of rays.