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NEW YORK, SATURDAY, NOVEMBER 16, 1901.

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.

PROPOSED INCREASE OF THE NAVY.

The recommendations of the Naval Construction Board, which have now been laid before Secretary Long, call for the addition of no less than forty warships to the United States navy. The most important element is, of course, the battleships and the cruisers, the Board recommending the construction of three of the former, each to be of 16,000 tons displacement, and two armored cruisers of 14,500 tons displacement. The design of battleship recommended is practically that adopted by the majority report of the Board on Construction. It follows the general lines of that most admirable design the "Maine" the chief points of difference being the substitution of the new 7-inch for the 6-inch gun in the broadside battery, and the increase of the number of guns from sixteen 6-inch up to twenty 7-inch. It will thus be seen that we have returned from the "Georgia" type, with its much-debated double turret, to the simpler and more conservative arrangement of the "Alabama" and "Maine" classes. The two armored cruisers will probably carry as their main armament four 10-inch breech-loading guns in place of the four 8-inch which form the main battery of the "California" class. These vessels will unquestionably be the heaviest armed and armored ships of their respective classes in the world.

The Board also recommends the construction of six gunboats of about 1,200 tons displacement, six of 600 tons and six of 200 tons. The provision of these boats was prompted by the necessities of the naval situation in our foreign possessions, more particularly in the Philippine Islands, where there is a great demand for a handy, light-draft vessel for blockade and police duties. Another provision which cannot be too highly commended is that for two huge colliers of no less than 15,000 tons displacement each; while those friends of the navy who believe that our bluejackets should be sailors in the full sense of the term will be pleased to know that the construction of six training ships of about 2,000 tons displacement is also recommended. There is a call for four picket-boats of about 650 tons and four tugboats. When this programme of construction is submitted to Congress it will have before it the latest section of a carefully-thought-out scheme for providing the United States with a navy made up of the proper number and proportion of various units to compose a thoroughly harmonious and well-balanced whole. The recommendations have the indorsement of what is known as the General or Dewey Board, as well as that of the Board on Construction. We sincerely hope that when Congress comes to pass upon them, the members of that body will be satisfied to be guided by the judgment of men, who are qualified by their professional knowledge and long experience to have the last say upon the question of the types of ships and general make-up of the United States navy. The question of appropriations rightly belongs to Congress itself.

THE TUNNEL BETWEEN SCOTLAND AND IRELAND.

The proposed railway tunnel between Scotland and Ireland, judged as one element of the general scheme or schemes which are now being mooted for shortening the distance of the ocean passage between Europe and America, is placed in somewhat the same category as the late Austin Corbin's dream for the creation of a great terminal port at Montauk, at the eastern end of Long Island; there being this difference, however, that when judged on that ultimate basis to which all such schemes must come—financial practicability—the Scotland and Ireland tunnel is even less feasible than Corbin's project. The cost of the tunnel is estimated by the contractors at $50,000,000, exclusive of interest, and, as matters now stand, there is not nearly sufficient traffic, either freight or passenger, to enable the scheme, if completed, to earn interest on the cost of construction. Nevertheless, in view of the rapid growth of commerce and the vast accumulation of capital seeking investment, it is conceivable that conditions may arrive in some future day that will guarantee the construction of a 34½-mile tunnel such as this.

The engineering features of the tunnel were discussed recently in a paper read by James Barton, M.I.C.E., before the International Engineering Congress at Glasgow. Of the three possible locations for the tunnel, the one selected lies between Wigtonshire, Scotland, and the Irish coast, at a point where the distance from shore to shore is within 23 miles. The maximum depth of water varies, according to the line selected, between 480 and 900 feet. The route forms a through line between Carlisle and Belfast, and has the advantage of providing the best route from Scotland to the whole of Ireland, and from the North of England to Ireland. The survey for the tunnel proper commences five miles from Stranraer railway station and finishes five and a half miles inside the shore line of the Irish coast, the total length of the tunnel being thirty-four and a half miles. Leaving the tunnel, the line extends for ten and a half miles to the city of Belfast. The total length from Stranraer to Belfast is fifty-one and a half miles, thirty-four and a half of which is tunnel, and twenty-five of it beneath the sea. The roof of the tunnel will lie one hundred and fifty feet below the sea bottom. The proposed heading is seven feet high by ten feet wide. It is expected that the portion of it which is driven through the Silurian will be cut as rapidly as the Simplon tunnel, while progress through the Keuper marls is expected to be more rapid. It is estimated that the whole of the heading would be completed in less than ten years and the tunnel finished in about twelve years. This estimate is based upon a comparison of the speed of driving four notable tunnels. The Mont Cenis was driven at the rate of 6 yards a day, and at a cost of $1,120 per yard. In the St. Gothard the maximum speed was 10 yards a day, at a cost of $710 per yard. In the Arlberg the maximum speed rose to 12 yards per day, while the cost was reduced to $535 per yard; and it is expected that on the Irish tunnel, judging from the quality of the material to be passed through and the improved methods now being used on the great Simplon tunnel, the speed will be increased and the cost per yard reduced still further. As to the question of water entering the tunnel, although the uncertainty on this point is admitted, the author of the paper does not consider that the difficulty will be a serious one. No water leakage in any great quantity occurred during the construction of the Severn or the Mersey tunnel, at least in those portions of these tunnels that were immediately beneath the sea; and it is believed that the sea bed below the Irish tunnel has probably closed all faults in the rock sufficiently to keep out sea-water in any but easily-handled quantities. The line will be operated electrically from power stations located near the main shafts at each end of the tunnel; and it is proposed to run trains at a speed of from 60 to 70 miles, thereby reducing the time in the tunnel to about half an hour.

THE PROBLEM OF THE LOCOMOTIVE BOILER.

In the controversy over the respective merits of British and American locomotives, there is no point of comparison on which the two types have been found to differ so widely as on the most essential one of boiler capacity. It will probably be within the truth to say that in a comparison of a hundred locomotives of each type it will be found that fully one-half of the American locomotives has over a hundred per cent more heating surface in its boilers, and that the other half has from thirty-five to forty per cent more heating surface than that of the British engines. From an early day in the development of the locomotive our builders have realized that all improvements looking to an increase of power and capacity must begin with the boiler; and it is to the fact that our locomotives are never over-cylindered, that is to say, that the boilers are able at all times to supply an abundance of dry steam, even under the most excessive demands, that we must attribute, more than to any other cause, the much greater hauling capacity of the American type. The average express locomotives to-day on first-class American roads will have 2,000 square feet of heating surface, and the latest expresses for hauling fast trains carry not less than 3,000 square feet, the most powerful of them all; the new Atlantic type on the New York Central Road, having a total of 3,505 square feet. Comparing this with the latest powerful express engines in Great Britain we find that the most powerful freight engine has only 2,500 square feet of heating surface, as against 3,805 square feet in the big freight engines used in the ore traffic from the Lakes to Pittsburg, while there is an even greater discrepancy between the new six-coupled express engines on the North-Eastern Railway, England, and the New York Central express engine above mentioned. The British type has cylinders 20 by 26 inches and 1,700 square feet of heating surface, whereas the New York Central engines have cylinders 21 by 26 inches, with, as we have said, 3,505 square feet of surface. In comparing the last two, the American builder wonders how in the world the North-Eastern boiler can provide steam enough for its cylinders. Of course, the coal is superior, and there may be some advantage in the copper firebox, though this cannot amount to very much.

Enormous as the boilers of American locomotives are, it is certain that the demand for increasing power will continue, and our builders must be prepared to make some radical changes if they are to meet this demand. The present type of boiler has grown to such a size that it cannot be increased much further within the limits prescribed by the size of the tunnels and clearance of platforms. What is required is a boiler with a larger steam-raising capacity for a given bulk, and the indications point to the adaptation of a water-tube boiler as the only kind that can fulfill these conditions. The excellent results which have been obtained in some recent locomotives both here and abroad, by the use of water-tubes, either in the grates, in the arch, or transversely in the upper portion of the firebox, suggest that the time is ripe for building an experimental locomotive with a water-tube boiler. Such a boiler would open the way for an increase in steam pressures to 250 or even 300 pounds to the square inch. With steam supplied at such pressures we should look for the universal adoption of compound cylinders, and, in time, for the introduction of triple, and even quadruple expansion. As a concomitant of these features we shall see superheating introduced; indeed, there are locomotives on the continent of Europe that are already equipped with superheating devices that are giving excellent results. With these changes successfully worked out, there is no reason why the power of our locomotives should not be increased from 35 to 40 per cent within the next decade. There will, of course, be the problem of providing sufficient adhesion for the great cylinder power thus rendered possible; and it is likely that in spite of the great popularity of the four-coupled Atlantic type, in the most powerful express engines of the next decade we shall see a return to the six-coupled type.

NEW LONDON TELEPHONE SYSTEM.

The British Post Office has decided to adopt the toll system in connection with their new London telephone service, which will be in operation in the course of a few weeks. For this purpose a special meter has been designed. The number of the subscriber is inscribed upon the meter, and the instrument will record 10,999 messages. The machine is automatic in its action, the operator simply having to press a button at the close of each service to effect its record. The Postal Telephone Exchange is established in the building in Queen Victoria Street, hitherto utilized for the transaction of the business of the Post Office Savings Bank. It will be one of the finest and best equipped exchanges in the world when the work is complete. The Western Electric Company are fitting the exchange at a total cost of $250,000. The total capacity will be 14,400 subscribers. The telephone wires are conveyed into the exchange in 110 ducts laid in a tunnel. Each duct carries 434 wires. The ducts are paper-insulated and sheathed in lead. When they reach the sub-basement that has been provided to the exchange, the tubes decrease in diameter, silk insulation being substituted for that of cotton. The smaller tubes are employed to facilitate convenient handling on the testing frames. The exchange room is in the shape of the letter L, with the superintendent's desk placed in the center. This official can tap any operator's circuit, without the exchange operator's knowledge, and can overhear any conversations between the operator and subscriber. The arrangement will be of particular value in the investigation of complaints. The superintendent can also instantly connect the operator's apparatus with his own for the purpose of ascertaining obstructive or irregular working. The glow lamp system has been adopted. The switchboard is divided into sections with 180 subscribers to each, presided over by one operator. There are two sets of accumulators for providing the necessary current. Each set consists of eleven lead tanks, weighing two tons when filled.

THE BERLIN-ZOSSEN HIGH SPEED ELECTRIC ROAD.

A series of most important and interesting experiments in electric traction is about to be conducted on the military road between the two German cities of Berlin and Zossen by the two foremost electrical companies in Germany. The car, which has been already constructed, has attracted world-wide attention by reason of the fact that the unprecedented speed of 124 miles per hour may be reached, although the attainment of such high speed is by no means the primary purpose of the experiments.

Of the relative efficiencies of steam and electric

roads, not a little, it is true, has been written. Nevertheless, it has never been definitely determined at what speeds the electric car is more efficient than the steam locomotive. It will therefore be the object of the engineers in charge of this novel enterprise to collect such accurate data as will enable the future constructor of railways to know what are the motor-efficiencies for various speeds and for various wind-resistances, what must be the power capacity of the central station, and what is the profitable speed limit of the electric car. In the current SUPPLEMENT will be found an exhaustive article by Mr. A. Lasche on the preparations which have been made for the speed trials, and an interesting description of the car to be used.

For American engineers this investigation, which will probably be carried out with characteristic German thoroughness, will be of peculiar importance. The directors of the London Underground Road, despite American protests, have declared themselves strongly in favor of the three-phase system of electrical traction. The Berlin-Zossen road will be operated on a three-phase system, which differs only in the use of transformers on the cars from the system advocated for London. For that reason the results will be looked for with no little interest. If the truth must be told, we know but little of high-tension, polyphase railway systems in the United States. For industrial purposes, it is true, the alternating current of great voltage is now widely employed; but for electric railways we still cling to the direct-current system. The Germans and Austrians have proved, to their own satisfaction at least, that for railways of standard size the three-phase system presents immense advantages over the direct-current method. The Valtellina road, built by an Austrian firm in Italy, certainly proves that in the main the polyphase current is better than the direct current. Whether the Berlin-Zossen trials will furnish convincing proof of the greater efficiency of the three-phase system of electric traction is a question that is of more weight than may at present be appreciated. For its answer may mean the complete abandonment of a system which was invented in America, and the substitution of a distinctly European method of transmitting electrical energy for railways.

PARIS EXHIBITION OF ALCOHOL-CONSUMING DEVICES.

The enormous production of alcohol in France has led M. Jean Dupuy, Minister of Agriculture, to offer a series of prizes for any kind of apparatus or machinery that will open a way for its greater consumption. An exhibition of inventions for the use of alcohol for illuminating or heating purposes or for motor power will be given in Paris in the grand palace of the exposition, Champs Elysées, from November 16 to 24. It is proposed to apply motor power to agricultural implements, under the direction of the Department of Agriculture. The prizes awarded will consist of a series of medals.

The exhibition and experiments will be divided into three classes:

First. Stationary motors; motors for navigation; locomobiles and motors for working pumps; automobiles under 25 horse power; insulated carburetors.

Second. Incandescent lighting, divided in two classes: (1) Apparatus using pure medicated alcohol; (2) apparatus using carbureted alcohol.

Third. Heating apartments; bath houses and hothouses for flowers; chafing dishes, dish warmers, flat-iron heaters, curling irons, lamps, etc.

The minister does not state whether the citizens of other countries will be permitted to compete for the prizes, but, in any case, the presence of Americans in Paris with their apparatus for the consumption of alcohol would furnish a good opportunity for introducing their goods into the French market.

A recent law has entirely removed from wine and beer the high tax formerly levied upon those drinks when they were brought into a city. One of the means adopted to make up for the deficit caused by the abolition of the gate tax was the imposition of a tax of 220 francs ($42.46) per hectoliter (26.417 gallons) of alcohol, in place of the old tax of 56 francs ($10.80) per hectoliter. There is also an additional tax in the cities, according to their population. In Lyons it is 100 francs ($19.30) per hectoliter, making 250 francs ($48.25), which goes to the State. Besides this, there is a gate tax in Lyons of 30 francs ($5.79) per hectoliter, which goes to the municipality, making a tax of 280 francs ($54) on every hectoliter of alcohol.

It is declared that this new tax on alcohol has caused a diminution of 50 per cent in the consumption of rum, and a smaller falling off in the consumption of other alcoholic liquors. But the output of alcohol augments, and it is contended that the increased volume is the work of fraudulent producers, what we would call "moonshiners," who declare but a small part of what they produce. They are here called "boilers of growths." They have a license from the government to produce alcohol, but their production invariably exceeds the quantity reported and upon which they pay the tax. The market is in some way or other flooded with medicated and other alcohol, for all of which it is desired to find a means of consumption.

A report on this subject, presented to the French Parliament and published in the Journal Officiel two years ago, gave a tabulated statement of the quantity of alcohol produced in France and Germany in 1897. The production in France was reported to be 2,022,000 hectoliters (53,415,174 gallons) of legal alcohol. It stated that the illegal product of the boilers of growths could not even be approximated. For the year 1899, the production for all of France was 2,241,382 hectoliters (59,210,580 gallons). When I applied to the office of the internal-revenue collector, he could only give me data for the two years here mentioned. He assured me that the excess of stock consisted largely of the unreported production of the boilers of growths. Of 250 distilleries, 50 produced nearly the entire quantity reported as given above.

The production of alcohol in Germany in the year 1897 was 3,616,319 hectoliters (95,532,300 gallons), two-thirds of which was derived from potatoes of domestic origin. It was produced in country distilleries, which number about 12,500, of which 5,226 produce only from 10 to 100 hectoliters (264 to 2,642 gallons).

The report submitted to the French Parliament says that France's best customer for sugar, the United States, will soon become an exporter on account of its relation to Cuba, and it therefore urges the enactment of a law that will encourage the manufacture of alcohol as a consumer of the supposed future surplus in the beet crop. The present annual sugar product of France is 850,000 tons, of which the United States buys more than any other country. Should American purchasers fall off, the beets now worked up into sugar would go to increase the output of alcohol, for which there is now no means of consumption in sight. In connection with the projected exhibition, it is observed that alcohol enters but very little into use for lighting, while in Germany it is the great illuminant for parks and public places.

I would suggest to Americans who may attend the coming exhibition that lighting, heating, and cooking apparatus are likely to receive favorable attention here, says United States Consul John C. Covert, of Lyons, where coal is dear and oil pays a high customs duty, as well as freight over 3,000 or 4,000 miles of land and sea. It is possible that a small handy cooking apparatus, heated by alcohol, would fill a want. All over France there are thousands of people who lead an isolated existence in one room, up four or six flights of stairs, who would prepare their first meal of coffee or chocolate and their evening soup on such a contrivance. The national custom, especially among the poor and middle class, is to take these two meals in a cheap restaurant; but customs change, and the effort to introduce new uses for alcohol may be a means of breaking up this habit—above all, if it is in harmony with ideas of strict economy.

END OF THE PAN-AMERICAN.

The Pan-American Exposition ended November 2 at midnight, when President John G. Milburn pressed an electric button and the lights in the electric tower grew dim for the last time. A corps of buglers standing in the tower sounded "taps," and one of the glories of the exposition, the electrical illumination, passed away, and the exposition was ended, says The New York Times.

The exposition has not been a financial success, but the benefits derived from it will be of great value to the commercial interests of the country. The primary object of the exposition was to advance the friendly relations and commercial intercourse between the United States and the other countries of the two Americas. In this respect it has been a decided success. The republics of Central and South America, Mexico, and the Dominion of Canada responded heartily to the suggestion of an all-American exposition, and sent to Buffalo a collection of exhibits seldom if ever before equaled.

The financial loss will be in the neighborhood of $3,000,000. The statement to be issued by the officers of the exposition setting forth the expenditures and receipts will be made public some time this month.

The loss will fall upon the holders of the common stock, the holders of second mortgage bonds, and the contractors who erected the buildings. Two hundred and ten thousand shares of common stock were sold at $10 a share. The stock was subscribed for by the citizens of Buffalo and the Niagara frontier in small lots of from one share to one hundred, so that this loss of $2,100,000 will not be seriously felt. The first mortgage bonds amounting to $2,500,000 will be paid in full. An issue of $500,000 second mortgage bonds is unprovided for, but the revenue from salvage on the buildings and from other sources will probably cover a part of this indebtedness. The balance due to contractors is not definitely known, but it is said that it represents their profits for the work done and no one will be seriously embarrassed by the loss.

The total number of admissions for the six months was close to 8,000,000. The great snowstorm of last April was a severe blow to the exposition, and the formal opening of the exposition was postponed until May 20. The death of the President was another blow to the Pan-American. The attendance had been increasing steadily up to the date of the assassination of President McKinley. The gates were closed for two days, and when they reopened there was a drop of 12 per cent in the attendance and no improvement followed.

The government exhibit will be at once shipped to Charleston.

PRIZES COVERING OVER $11,000 FOR A TRACTOR FOR MILITARY PURPOSES.

It is essential that tractors for military purposes should be capable of a much greater radius of action, without the replenishment of fuel or water, than is at present obtained by any engines constructed for either military or commercial purposes. The Secretary of State for War of the British government offers three prizes for the best tractor meeting the requirements. The first prize is 1,000 pounds sterling; the second, 750 pounds sterling; and the third prize, 500 pounds. To each prize will be added a bonus of 10 pounds for every complete mile beyond the minimum of 40 miles. The total amount of this bonus shall not exceed the sum of the particular prize to which it may be added. The trials will be conducted by the War Office Committee on Mechanical Transport, and will commence in the spring of 1903, and the exact nature of the trials will be determined upon by this committee. The general scheme will be drawn up and issued to all competitors. Forms of entry will be supplied on application to the Secretary of Mechanical Transport Committee, War Office, Horse Guards, Whitehall, London, England. Those who intend to enter the competition must send in these forms to the Secretary not later than January, 1903. A full set of drawings giving dimensions and a specification giving complete details, together with a statement of the prize, must be lodged with the Secretary before the commencement of the trials. Any of the competing tractors may be purchased at the price stated by the competitor, and all designs will be considered confidential, and even the tractors which are retained by the government will not prejudice the patent rights. Full details of the qualifications may be obtained of the Secretary.

SCIENCE NOTES.

The new English coin bearing the head of King Edward VII. will shortly be ready for circulation. The designs have been prepared by Mr. G. W. De Saulles of the Royal Mint, a special audience for the accomplishment of which was granted him by the King. There will be but slight alterations from the designs on the existing Victoria coins. The Latin inscription will be the same, the name King Edward the Seventh being substituted for that of Queen Victoria, and such additions carried out as are rendered necessary by the change in the royal title recently sanctioned by Parliament. With respect to the reverse side no alteration will be made on any of the coins, with the exception of the bronze money. In this instance the familiar figure of Britannia will be displayed, but without the ship and lighthouse.

The British Association has made the following grants for scientific purposes: Mathematics and physics: Electrical standards, £40; seismological observations, £30; investigation of the upper atmosphere by means of kites, £75; magnetic observations at Falmouth, £80. Chemistry: Relation between absorption spectra and constitution of organic substances, £20; wave length tables, £5; properties of metals and alloys affected by dissolved gases, £40. Geology: Photographs of geological interest, £5; life zones in British carboniferous rocks, £10; exploration of Irish caves, £45. Zoology: Table at the Zoological Station, Naples, £100; index generum et specierum animalium, £100; migration of birds, £15; structure of coral reefs of Indian region, £50; compound Ascidians of the Clyde area, £25. Geography: Terrestrial surface waves, £15. Economic Science and Statistics: Legislation regulating women's labor, £30. Mechanical science: Small screw-gage, £20; resistance of road vehicles to traction, £50. Anthropology: Silchester excavation, £5; ethnological survey of Canada, £15; age of stone circles, £30; anthropological teaching, £3; exploration in Crete, £100; anthropometric investigations of native Egyptian soldiers, £15; excavations on the Roman site at Gelligaer, £5. Physiology: Changes in hæmoglobin, £15; work of mammalian heart under influence of drugs, £20. Botany: Investigations of the cyanophycene, £10; the respiration of plants, £15. Educational Science: Reciprocal influence of universities and schools, £5; conditions of health essential to carrying on work in schools, £2. Corresponding societies: Preparation of report, £15. Total, without grant to corresponding societies, £1,000.