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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.

### BUILDING AMERICAN LOCOMOTIVES IN BRITISH SHOPS.

A significant event that calls for more than passing notice is the securing by a British firm of a Canadian order for twenty high-class locomotives, to be built from American designs. Hitherto the competition has been between American-built and designed locomotives and locomotives which were English both in design and construction, and the result has generally proved that British locomotive builders were rarely able to promise delivery within several weeks of the date set by their American competitors, while their engines were from 20 to 30 per cent more costly. In explanation of these differences, it has been claimed by British builders that their engines are better constructed and contain more costly materials, and that although their first cost is greater, they are more economical in operation and considerably more durable in service. The order for the Canadian locomotives was secured in competition with American firms, and as the locomotives will be of American design, an opportunity will be presented to see whether the superior economy of operation and the greater durability of English-built locomotives are due to the design or to the workmanship. Of course, it is understood that the operative results will not absolutely settle this question, as there are liable to be various elements entering into the comparison that will prevent any conclusive deductions being made; but it is certain that after the locomotives have been delivered and been operated for a number of months, we shall know a great deal more about this vexed and very interesting question than we do just now.

### NAVAL WAR-GAME BETWEEN THE UNITED STATES AND GERMANY.

In view of the rather startling developments just now occurring in South American waters, particular interest attaches to a series of articles from the pen of Mr. Fred T. Jane, which is being published in the SCIENTIFIC AMERICAN SUPPLEMENT. The author of these papers, who is a naval writer of world-wide repute, is the originator of the Jane Naval War-Game, which is being played extensively by the officers of the navies of the world. The object of the game is to approximate, as closely as possible, the conditions which would obtain if an engagement were carried out between the ships of two contending navies. The sphere of operations in playing the game is a large board ruled into squares representing 2,000 yards on a side and smaller squares representing 100 yards, or half a cable, on a side. This magnified checkerboard is used for the actual engagements when two hostile fleets have drawn so close together that they can be contained within the board. Preparatory to the actual conflict, strategic moves are made by each side in six-hour runs, which are carefully plotted by the rival admirals on charts, the courses followed by the opponents being compared by the umpire, who is seated at a central table. When the hostile forces approach within sighting distance, the models of the ships are transferred to the large checkerboard, which is known as the "seaboard."

The ships used in the game are accurate models of the ships of the two contending nations that are in commission when war is declared, and each vessel is maneuvered by a different player who acts as her captain throughout the war. Until the engagement begins, the admirals are allowed to give any directions they please to their captains; but after fire is opened, they may transmit signals only through the umpire, and each captain has to think for himself, and carry out his orders to the best of his ability. Firing is allowed to commence at 8,000 yards, and targets representing the actual ship to be attacked at various ranges and positions, are used. Hits are determined by an instrument known as a "striker," and when armor is hit, penetration depends, as in actual war, on the nature of the projectile, the range, and the angle of impact. It is claimed by the naval officers

who play the game that the actual average of hits works out very closely to actual battle results.

An interesting feature of the war-game is that, in playing it, fleets may be made up, if so desired, each of which contains vessels of different navies and widely different types; or two opposing fleets may be arranged which contain opposite types of design; or, yet again, battleships may be pitted against armored cruisers. Indeed, any combination desired may be made, and valuable lessons learned as to the relative efficiency of different types and the degree to which they are likely to attain the results which were aimed at when they were designed.

Just now a very interesting "war" is being fought out by the Portsmouth (England) Naval War-Game Society between the navies of the United States and Germany. The account of the various battles of this war, illustrated with diagrams representing the positions of the ships in the various stages of the battle, referred to above, is being contributed by Mr. Jane to the SCIENTIFIC AMERICAN, with exclusive rights in this country and in Great Britain. The first of these most interesting papers was given in the last issue of the SUPPLEMENT, and they will appear in successive issues until the war is over.

Directly war broke out, both sides put all available ships in commission. As a rule, this affected the coast defense squadrons (both far removed from the scene of war) and the commerce-attack cruisers which were destined to have an early meeting. The United States Mediterranean squadron was cabled to proceed to the Far East. The South Atlantic squadron put to sea in an endeavor to bring on an action with the Germans in those waters; while the Home fleet cruised up and down the coast awaiting developments. On the German side the first Home squadron went to Gibraltar at full speed, which it reached seven days after the breaking out of war; but by this time the United States Mediterranean fleet was well down the Red Sea. Both sides adopted somewhat similar dispositions for their cruisers. That is to say, there was little inclination to speed them, their efforts being directed rather to hunting for hostile cruisers than to attempting action against commerce.

In the current issue of the SUPPLEMENT is described a great battle of the hostile fleets which took place in mid-Atlantic, the American fleet consisting of the flagship "Olympia," the commerce destroyers "Columbia" and "Minneapolis," and the cruisers "Raleigh," "Cincinnati," "Detroit," "Marblehead" and "Montgomery." The German fleet was made up of the flagship "Prinz Heinrich," the "Victoria Luise," "Geflon," "Amazone," "Thetis" and "Ariadne." The result as worked out in the game was the defeat of the American fleet, due mainly to the lack of under-water torpedo-tubes, the "Olympia" being torpedoed and captured; the "Columbia," "Cincinnati," "Marblehead" and "Montgomery" sunk by torpedoes; the "Detroit" rendered unmanageable and captured; while the "Minneapolis" and the "Raleigh" escaped. On the German side the damages were that the flagship "Prinz Heinrich" was sunk by torpedo fire; the "Victoria Luise" badly injured by torpedoes; the "Thetis" badly raked by gun fire and scuttled by the Germans; while the "Geflon," "Amazone" and "Ariadne" were cut up by gun fire, several of their guns being put out of action. In the following issue will be a description of an indecisive battle in the Far East, where the Germans had concentrated with designs on one of the outlying islands of the Philippine group.

### THE NEW RAILROAD AND TROLLEY TUNNELS ENTERING NEW YORK.

In spite of the strenuous effort made by a certain section of the Board of Aldermen to defeat the Pennsylvania Railroad tunnel grant, the clearly expressed will of the people and the undoubted advantages to be derived from the Pennsylvania Railroad's proposal have carried this important measure through. New York city can now rest assured that before many years have elapsed, it will be in possession of a terminal station that will be commensurate with its needs and in keeping with its importance as the metropolis of the western hemisphere. It is certainly a curious anomaly that for so many years a city of the size of New York should have contained within it only one terminal station. The explanation is to be found in the peculiar geographical features of the site upon which the city has grown up. Surrounded, as it is, on three sides by the broad waters of the Hudson and East Rivers, direct communication by railroad was only possible, at least in the earlier years of railroad construction, from the north; and it was inevitable that the first railroads to enter New York city should come in by way of the Harlem River. The East River, it is true, did not present the insuperable obstacle to a railroad bridge that seemed to exist in the Hudson River to the west; but in earlier years the comparative unimportance of the Long Island Railroad precluded any serious consideration of an East River railroad bridge, while the travel from the New Eng-

land States by way of the New Haven Railroad obtained entry to Manhattan Island over the tracks of the New York Central Road. With the exception of the systems that use the Forty-second Street terminal, however, New York city has been practically cut off, as far as direct railroad communication is concerned, from the majority of the great railroad systems of the United States; for in spite of the fact that an excellent ferry service had grown up across the Hudson River, it is a fact that the majority of the trunk railroads that serve New York city have their terminals in another city and another State.

Within a few years' time all this will have been changed. The most progressive railroad system in America will have erected in the heart of Manhattan Island the largest railroad station in the world; the problem of railroad bridges across the Hudson and East Rivers will have been solved by the construction of a series of main-line tunnels beneath Manhattan Island, giving a direct trunk line service between New York city and the whole of the United States, and a direct suburban service to the vast residential districts lying to the east and west of New York. The tracks will be carried in two separate 18-foot, tube tunnels extending below Thirty-first and Thirty-second Streets until they reach Seventh Avenue, where the easterly façade of the central station will be located. Here a third track, to extend below Thirty-third Street, will be added, and the three tracks will continue across Manhattan Island under the three streets named, converging below the East River to unite in a single tunnel as they enter Long Island. The great central station with its underground yard will cover more than four large city blocks, including all the space between Tenth and Eighth Avenues and Thirty-first and Thirty-second Streets and between Eighth and Seventh Avenues and Thirty-first and Thirty-third Streets. Altogether there will be in the station 25 parallel tracks, access to which will be gained by a broad causeway, which will be approached from street surface by easy grades at either end of it. The causeway will extend entirely across and above the tracks, with easy stairways leading to the platforms. What might be called the superstructure of the station will contain the waiting rooms, baggage rooms, and general offices of the company, and its architectural features and great size are such that it will constitute one of the most imposing buildings in the city. The construction of this great engineering work, which is to cost, all told, some \$50,000,000, will be one of the most interesting works of its kind ever carried on. It will give employment to a vast army of laborers; and in this and other respects will prove of undoubted benefit to the city, even before the general public begins to appreciate the great saving of time and trouble, which will be realized from the very day that the station is open for service.

Concurrently with the granting of the Pennsylvania Railroad franchise, the Board of Aldermen granted a second tunnel franchise, permitting the New York and Jersey Railroad Company to construct a large terminal passenger station on the New York side of the North River at the foot of Christopher Street. The New York and Jersey Railroad Company was organized under the laws of the State of New York to complete the tunnel begun some years ago by the Hudson Tunnel Railway Company. At the present time more than 4,000 feet of this tunnel have been constructed from the New Jersey side, and a gap of only about 1,400 feet remains between the completed end of the tunnel and the New York shore. Active work on the tunnel has been in progress for some months under the supervision of the chief engineer, Charles M. Jacobs, who is also chief engineer for the Pennsylvania Railroad tunnel. The New York terminal station will be in the block bounded by Christopher, Greenwich and West Tenth Streets. The completed section of the tunnel begins in the yards of the Delaware, Lackawanna & Western Railroad, and the Jersey terminus of the tunnel is close to the Erie Railroad's terminus. Probably these circumstances have given rise to the rumor—denied by the railroad companies themselves, but generally accepted by the press and the public—that the Erie and the Delaware, Lackawanna & Western Railroads have an understanding with the New York and Jersey Railroad Company, by which they will be enabled to run their cars through to the New York terminus. If this rumor proves to be true, the closing days of the year 1902 will have witnessed the inauguration of the most important scheme for the betterment of transportation to and from New York city in the history of the metropolis.

During August, Scotch shipbuilders launched 22 vessels, of about 46,882 tons gross, as compared with 19 vessels, of 32,022 tons gross, in July, and 23 vessels of 55,080 tons gross, in August last year. In the eight months Scotch builders have launched 198 vessels, of 338,708 tons gross, as compared with 185 vessels, of 354,826 tons gross, in the corresponding period of last year, and 321,360 tons gross in 1900.