New Underground Electric Railroads for London. BY OUR LONDON CORRESPONDENT.

The congested traffic of the streets of London has become so acute, and the provision of more rapid transit from one point of the metropolis to another so imperative, that the matter has received the earnest attention of both Parliament and the London County Council, the latter of which is responsible for the wellbeing of the city. The success of the Central London and South London subterranean tube railways, which were purely tentative efforts to supply more expeditious traveling throughout the metropolis, has become so well established that similar means of communication are being projected in all directions. At the present moment there are over. \$250,000,000 at stake in connection with various enterprises of this description. Indeed, the schemes were so numerous that the government appointed a special Joint Committee of the two Houses of Parliament to investigate the respective plans. This committee has now issued its report upon the ten projects that it has considered; the best routes they should follow, and the main principles upon which they should be worked. The new tubes thus sanctioned cover 50 miles, and in view of the immense amount of money that is involved in their construction, it is essential that they should be closely studied from a public point of view, so that they may serve the interests of the community at large to the fullest extent, and also to avoid mistakes which would be irreparable in the future. The peculiar conditions of London traffic and the many difficulties that have either to be surmounted or circumvented, render this an abstruse problem to solve.

The committee, although mainly approving of the proposed lines in general, has stipulated several recommendations, which will have to be embodied. It has prevented the intrusion of one route upon another, although at the same time preventing any line from profiting by its practical monopoly at the expense of the public.

Probably the most important of these railways is that which will run parallel with the

Central London Railway. It will start from Kensington, and extend to Piccadilly Circus, thence along the Strand and Fleet Street to the City. This line will tap the busiest thoroughfares and greatest commercial centers in the metropolis, and it should prove of inestimable benefit to the streets under which it will pass. The committee approves of the proposed Charing Cross-Hampstead line which Mr-Yerkes is controlling, with a branch to Highgate, and another from Euston to Gospel Oak, provided there are no confluent junctions; also the Islington-Euston tube, connecting the former with the Islington branch of the City and South London Electric Railway, and the West and South London line, which will join Paddington to Victoria and thence

run to Kensington, crossing the Thames at Vauxhall. In the case of the King's Road tube it suggests that it be extended from Eel Brook Common to Putney Bridge. This line will run from the former station to Victoria, via King's Road, Chelsea. Interchange stations with the present trunk railways at Victoria are advocated. The North-East London tube, as proposed, begins at Cannon Street, and runs via Gracechurch and Bishopsgate Streets out to Tottenham, a thickly populated and at present badly served suburb, with a branch at Stoke Newington to Walthamstow. The City and North-East Suburban Railway has a proposed route from Bishopsgate Street to Waltham Abbey. This line would run through four miles of tube and ten miles of open country. At the city end of this tube the committee advises that it should run through Leadenhall Street and thus tap populous Whitechapel. If the Waltham Abbey Line be carried out, there will be no need for the North-East London branch to Walthamstow. The North-East London main line to Tottenham should be extended to where

Scientific American

the most economical system is to be adopted. The companies themselves will probably take care to observe this fact upon their own initiative, since the question of fares is controlled by legislation, which in this respect is favorable to the community. Once a railroad in England has established its maximum fare, it cannot raise it, even if it proves unprofitable, without the consent of the government; and if the latter considers that the existing tariff of any particular railroad is too high, then steps are immediately taken to compel that railroad to reduce its rates. The railways should be run for the benefit of the community is the axiom of Parliament. The Joint Committee, in dealing with the fares, recommends that this should be dealt with by the Board of Trade, which department supervises this question, but at the same time it advises that the Board of Trade should every five years report on the reasonableness of the fares and on the relations of the companies toward one another. Care is also to be observed that the companies are not over-capitalized. The lines must be constructed beneath the streets, since, the latter being public property, no heavy compensation will have to be paid, which would otherwise be the case if the privileges of burrowing beneath private property were sought. It also recommends that they should be either partially, or entirely, municipalized, as by this means the construction of railways in thickly populated or the development of unopened districts will be encouraged.

Tubes may be worked at the termini on the shuttle system (i. e., by trains shunting from the down line onto the up line) or by means of terminal loops, which would avoid shunting. Confluent junctions (i. e., trains running from one set of lines onto another at points) are to be avoided inside tubes.

The development of underground railroads has hitherto been severely handicapped by legislation. But the government has now awakened to the fact that this method of transit offers the only practical solution to the relief of the congested character of the streets. It is therefore suggested by the Joint Com-



BOARD ON CONSTRUCTION MAJORITY DESIGN FOR NEW 15,560-TON BATTLESHIPS.

Main Battery : Four 12-inch, twenty 7-inch. Secondary Battery : 'Twenty 3-inch.

mittee that a special supervising body should be constituted to control the construction of the present schemes, their working, and the regulation of projected tubes that will arise from time to time. By this means, the indiscriminate construction of tubes in all directions, and inconvenient overlapping, will be avoided. Such a public supervisory board would also insure that the convenience of the community was fulfilled to the fullest extent. It is contended that every new line should be part of a well-considered system, the essential point of Which must be to make travel easy from one point of Greater London to any other.

If the task is threshed out now it will be easy enough; if it is neglected, vested interests and the competition of lines covering the same districts will make it very difficult in the future. The matter is important enough to justify the appointment of a special Board of Control for underground lines, with representation of Central London and of the various localities interested.

The majority of these tubes will be laid at a depth

connection with its trame, and it remains to be seen whether the most beneficial advantages will be taken in connection with its fulfillment.

OUR LATEST DESIGN FOR BATTLESHIPS.

On the adjoining page is an illustration of the most powerful battleship ever designed in the history of naval warfare. The term powerful is used in its broadest sense as applying both to offensive and defensive qualities, and those other subsidiary but scarcely less valuable elements of speed, radius of action and habitability. There is probably no branch of engineering construction in which there is less of what we might call exclusive national individuality than in the matter of warship design; and just as in the yacht races held last summer off Sandy Hook it was seen that the two national types had approximated so closely that it required an expert to distinguish the British from the American yacht, and the speed was so close that in two out of three races sailed, the event was won by seconds only, so in warship design, the various nations keep in such close touch with each others' developments that the modern warship, no matter what flag it flies, approximates closely to a common type.

The Naval Board on Construction, by whom the new battleship herewith illustrated was designed, is composed of five Chiefs of Bureaus, the Bureaus being those of Construction, Ordnance, Engineering, Supplies and Intelligence. It is evident that of these five gentlemen the first three, being what might be called the technical members of the Board, would be naturally considered the most qualified to speak on the question of warship construction, since the Construction Department is responsible for the hulls, the Steam Engineering Department for the motive power, and the Ordnance Bureau for the guns, and this is said without any reflection upon the other two members of the Board, whose long experience on sea duty is, of course, of unquestionable value. As bearing upon what we have just said, it is significant that the three

members of the Board representing the technical bureaus are strongly unanimous in recommending that our new battleships be constructed upon the plans herewith presented, the Chiefs of the Bureaus of Supplies and Intelligence voting in favor of a ship which differs mainly from the one shown by carrying its guns in double-decked turrets, and retaining the 8-inch guns as part of the armament.

The type adopted by the Board abolishes the 8-inch gun, abolishes the doubledecked turrets, abolishes the 6-inch gun and reduces the number of types of weapons to three—the 12-inch, the 7-inch and the 3-inch; the first-named being carried in turrets and the 7-inch and 3inch in broadside armored casemates. The proposed ships are to be 450 feet in

length, 76 feet in beam and on a mean draft of 24 feet 6 inches are to have a displacement of 15,560 tons, while at extreme draft they will displace 16,900 tons. Engines of 20,000 horse power are to be provided, consisting (if the Chief of the Bureau of Steam Engineering has his way) of three sets of triple-expansion engines driving three propellers. The armament will be made up of four 12-inch, twenty 7-inch, and twenty 3-inch guns. The 12-inch rifles will be carried in two turrets, one forward and one aft, protected by 10 inches of Krupp armor. On the gun deck there will be sixteen of the new type 7-inch rapid-fire guns, protected by a continuous wall of 7-inch armor, this 7-inch armor extending down to the top of the main armor belt, which latter reaches continuously from stem to stern at the water line. On the main deck within at the four corners of the superstructure will be four other 7-inch guns, each of which will be contained in a closed casemate protected by 7 inches of armor in front and $2\frac{1}{2}$ inches of armor at the rear. Of the sixteen. 7-inch guns on the gun deck, the two forward and two after pairs will be each emplaced within a casemate protected with 7-inch armor, while the other twelve guns on this deck will be carried within a central citadel similarly protected, which will be divided transversely by two walls of 2½-inch armor extending across the gun deck between each pair of guns. These transverse walls will serve to limit the destructive effect of a shell which might penetrate and burst within the casemate. In addition to this numerous and extremely powerful battery there will be twenty of the very effective 50-caliber 3-inch guns, a type which has recently been perfected by the Bureau of Ordnance. Of these, six will be carried on the main deck, two forward in the bow and four astern, each gun being protected by 2 inches of Krupp steel. On the main deck there will be fourteen more of these weapons, six of them being carried in broadside between the 7-inch guns and the other eight being carried at the ends of the superstructure and having a range of fire from abeam to

the London County Council are erecting workmen's dwellings.

The Charing Cross, Hammersmith, and District tube would run as proposed from Hammersmith through Kensington to Hyde Park Corner, whence it would cross the Green Park to Charing Cross. Here it is proposed to connect with the Piccadilly-City tube, running from Piccadilly Circus to Cannon Street, where it joins the North-East London system.

The great Eastern Trunk Railroad to the Eastern Counties, which also serves several of the most thickly populated eastern suburbs, also proposes to construct a tube from its city terminus at Liverpool to Ilford, as an effective means of relieving its trunk lines of the greater part of its present congested local traffic. This railroad carries over 1,000,000 passengers between the city and these particular suburbs every night and morning, so that the paramount importance of the scheme will be adequately realized.

Electric traction is to be used on all these tubes, and

of 60 feet below the streets. The London County Council favors, in certain cases, the construction of shallow tunnels similar to the rapid transit tunnel of New York. This will serve a dual purpose. Elevators from the street level to the buried tubes will be obviated, since if a tunnel were laid immediately below the surface of the thoroughfare, steps only would be necessary. Another important factor in connection with shallow tunnels is that all telephone and telegraph wires, water pipes, sewers, cables, etc., would be laid in adjacent tunnels, so that to repair or to overhaul them it would be unnecessary to break the surface of the ground, which procedure severely interrupts pedestrian and vehicular traffic. There is no doubt that this principle of intercommunication, so far as the actual city itself is concerned, will be adopted, as several of the members of the London County Council have visited this city, studied the rapid transit tunnel scheme and reported favorably thereon. London is undergoing a radical revolution in



Displacement, 15,560 tons. Speed, 19 knots. Maximum Coal Supply, 2,000 tons. Armor : Belt, 10-inch ; Barbettes and Turrets, 10-inch ; Casemates, 7-inch. Armament: Four 40-caliber, 12-inch ; twenty 50-caliber, 7-inch ; twenty 50-caliber 3-inch

dead-ahead and dead-astern. The concentration of fire ahead from this arrangement of battery will be two 12-inch, four 7-inch and six 3-inch, while astern it will be possible to concentrate two 12-inch, four 7-inch and eight 3-inch guns. On each broadside there will be a concentration of four 12-inch, ten 7-inch and ten 3-inch guns.

The design marks a return to the "Alabama" and "Maine" type, than which we are inclined to think none better was ever thought out for our own or any other navy. It has the advantage of simplicity, of reduction of the number of different types of guns and of an excellent distribution of their emplacements. Having the 12-inch gun for the penetration of turrets, barbettes and belt armor, the 7-inch heavy enough to penetrate 6 and 7-inch casemate armor, which is something more than the 6-inch gun is capable of doing, and the 3-inch gun, which with its high velocity and great speed of fire will be used for smothering the gun ports and unprotected gun positions of the enemy with a storm of shells, and riddling smokestacks, superstructures and unprotected shell plating, the attacking power of the vessel will be both enormously powerful and well distributed. With the exception of the 12-inch guns, each piece has its own separate traversing and elevating gear, and although the protection is not, perhaps, quite so absolute as that afforded by turrets, this is more than offset by the fact that the gun crew can see where they are and

what they are doing, a most important consideration as affecting the morale of the men in battle. There is, in a comparison with 8-inch guns carried in turrets, the inestimable advantage that each 7-inch gun, being separately mounted, is not disturbed by the discharge of adjoining pieces-this last defect being one of the chief objections to the mounting-as in the superposed turret—of four guns upon a single turntable.

The advocates of the minority design favor the double turret, we understand, more for the sake of the larger piece (8-inch) which it carries than for any particular regard for the turret itself. Might it not be possible to compromise on the two plans by adopting the disposition of guns shown in the majority report, and substituting, say, sixteen 8inch for the twenty 7-inch rifles? To secure the allaround protection afforded by the turret it would only be necessary to place transverse screens of armor between every gun on the gun deck and work continuous longitudinal screens from forward to after bulkhead, thus placing each 8-inch gun in a separate, completely boxed-

in, casemate. In any case, whether the 7-inch or the 8-inch battery be used, it seems to us that in view of recent developments in high-explosive shells it would be wise to isolate entirely each gun by the addition of the transverse and longitudinal armor screens above suggested. We understand that the Board is likely to compromise on some such plan.

This fine battleship was not reserved for our special number on the "Development of the U. S. Navy Since the Spanish War," Dec. 14, 1901, for the rea-

Scientific American

world's record, and was closely followed by Foxhall P. Keene, A. C. Bostwick and A. L. Riker. The course was a specially prepared dirt strip of the old Coney Island Boulevard, having a slight down grade. The contestants went over the course singly, their times being taken at the start and at the finish by members of the Second Signal Corps, U. S. A. Over a mile was allowed to the chauffeurs to get under way, and about a quarter of a mile to slow up after passing the finish line. The race was a contest by some of the best chauffeurs in the world for the one-mile record.

At his first attempt Fournier, in his 40 horse power Mors racer, sped over the mile in the remarkable time of 52 seconds. Not content with this performance, he returned to the start for another trial, and succeeded in reducing the record made but a few minutes before by one-fifth of a second. Foxhall P. Keene, in a Mors carriage exactly similar to that of Fournier, covered the mile in 54 seconds. Americanbuilt vehicles were not much behindhand. A. C. Bostwick, in a 40 horse power Winton gasoline carriage, made the mile in 56 2-5 seconds at the first trial, and in 1 minute 3-5 seconds at the second trial.

Good as the road undoubtedly was, it was not altogether free from slight, almost unnoticeable depressions and projections. At a speed of twenty miles or even thirty miles an hour an automobile will ride over a slight elevation with no appreciable effect. But at the enormous velocity of nearly seventy miles an hour the same time it is but just to the other vehicles to state that while they were all capable of long-distance touring, the electric machine was capable of maintaining its maximum effort apparently for only a single dash over the mile course. It was towed to the course, towed back to the starting point after its trial, and charged its batteries immediately before its trial run from an adjoining electric car. By a special rheostat with which he has fitted his racing machine, Mr. Riker is enabled to divert part of the current from the field coils to the armature, after speeding up, so that the rotary speed of the armature-shaft is considerably increased. Since the racing machines of Fournier and Keene have already been illustrated in these columns, we have pictured only the carriage used by Mr. Riker.

The arrangements for timing the contestants seem to have been somewhat unusual. The timers at the finish were informed by the click of a telegraph instrument that a machine had started. An instant later an "O. K." signal was given to confirm the start. The timers consequently started their watches with the first click and caught the machines as they whirled past the finish line. If no "O. K." signal were given the watches were turned back for the next signal. As a result of this arrangement some machines ran over the course without being timed, no additional signal having been given. Foxhall P. Keene was one of those who suffered. His first trial was credited with a speed

> of 1 minute and 21 2-5 seconds, which was clearly an error. S. T. Davis, who made the mile in 1 minute and 15 seconds in a steam carriage and thus broke the previous steam carriage record of 1 minute and 39 seconds, was also mistimed in one of his attempts.

These are the most remarkable contests ever run on a public highway. They have shown that only a specially built locomotive engine running on steel rails can beat a modern racing automobile.

It is authoritatively stated that a concession has been granted by the government of Mexico to an American syndicate, to build a railroad from Monterey to Matamoros, which is situated in the State of Tamaulipas, near the mouth of the Rio Grande. The concession carries a governmental subvention of \$8,000 a kilometer (0.62137 mile), and there is a strong probability that the State of Tamaulipas will add \$2,000 a kilometer to this amount. The rich resources of northern Tamaulipas have remained undeveloped up to the present, on account of inadequate transportation facilities. Almost anything

RIKER ELECTRIC RACING AUTOMOBILE WHICH MADE THE PHENOMENAL RECORD OF ONE MILE IN 63 SECONDS ON SATURDAY, NOVEMBER 16TH.

> the carriages could not yield to the slight, scarcelyperceptible hollows, and at times every wheel would be clear of the road. And yet, despite this peculiar effect, they kept their course with remarkable precision and with no evident oscillation.

The vehicles driven by Fournier and Keene were both 40 horse power French gasoline carriages made by Mors. That a gasoline carriage would make the best record was inevitable. But no one foresaw that an electric car would also lower the previous world's record of 1 minute 62-5 seconds made by Winton. The carriage in question was designed and driven by Mr. A. L. Riker, and was a distinctly American type of machine. It was a racing machine pure and simple. an electromobile reduced to its lowest terms, a wheeled frame and a battery, with seats for two men arranged in tandem. Current is derived from 60 cells of the lead-zinc type, giving a maximum voltage of 130 and a discharge of 100 amperes. The battery weighs 900 pounds, and the entire carriage 1,850 pounds. With a start of only one-quarter of a mile, Mr. Riker covered the mile in 1 minute and 3 seconds, the armatures of his motors making about 3,300 revolutions per minute. The exact power of the vehicle has not been determined; but Mr. Riker informs us that the horse power is between 15 and 20. When it is considered that the French carriages of Fournier and Keene were equipped with motors rated at 40 horse power, Mr. Riker's performance is all the more remarkable. At suited to a subtropical climate will grow i. his section, especially corn, cotton, fruits, vegetables, sugar cane, etc., and it has recently been demonstrated that rice can be successfully cultivated near the Rio Grande. The extent of land lying along the rivers and through which the proposed railroad will pass, which is susceptible of successful irrigation, is unlimited. Mexico, and especially the State of Tamaulipas, offers inducements to prospective investors and canitalists and the policy of both the national and



son that the issue will contain only the ships that have been either commissioned, commenced or authorized since the war. Although Congress has authorized the drawing up of the plans for these battleships, no money has yet been voted for their construction, and hence they must necessarily be shut out of any tabulation of our navy that is drawn up on the basis we have chosen. Rather than omit mention of these fine ships altogether we present the above description.

NEW AUTOMOBILE SPEED RECORDS

Twenty-five thousand persons lined Ocean Parkway, Brooklyn, for a distance of two and a half miles on Saturday, Nov. 16th, and saw the most sensational automobile one mile speed tests ever made on either side of the Atlantic. A mile a minute on the highway is no longer an automobile dream; for no less than three of the contestants finished within that time. Fournier, the winner of the Paris-Berlin race, twice broke the State governments is to judiciously protect whatever industries may be established.



The Current Supplement.

The current SUPPLEMENT, No. 1352, has a number of articles of more than usual interest. The front page and two succeeding pages are given up to "Wire Grass—A New Industry," in which all the steps in the process of wire grass cutting and utilization are outlined. This is a comparatively new material and is proving of great value. The fourth installment of the important series of "Enameling" is published in this issue. "A Comparison of the Merchant Fleets of the World" shows graphically the relative size of the merchant marine of the twelve leading nations. "Comparison of Recent Battleship Designs" occupies considerable space. "The Geographical Conquests of the Nineteenth Century," by Gilbert H. Grosvenor, is accompanied by maps of various continents.