

THE NEW BATTLESHIPS.

The SCIENTIFIC AMERICAN published, in its issue of June 9 last, an illustration and description of the three battleships then designated "Georgia," "Pennsylvania," and "New Jersey." Some time later, after the report of a special board, the Navy Department assigned those names to the three ships that are to carry superposed turrets, which we now show, while the two vessels appropriated for by the last session of Congress, bearing the names of "Virginia" and "Rhode Island," will be as described and pictured in our issue of last June.

Without going into the merits of the case, the majority decision of the special board in favor of arming three of the five new battleships with superposed turrets followed directly upon the final acceptance trials of the "Kearsarge." The object of the board's being was the determining of the better type of ship, all five, of course, to be alike, and the decision or recommendation showed the board to be hesitating in judgment. The result is to miss the prime opportunity of fashioning five ships of absolute similarity, a feature of fighting efficiency in combined operations hardly to be overvalued.

In general dimensions, these ships will be like those

Apart from the military advantage gained in the added height of the guns of the main battery aft, there will be a net gain in accommodations of infinite comfort and healthfulness to both officers and crew. None of them will be shut up behind the blank walls of heavy armor, as heretofore, lighted only by artificial means, but the living spaces will all have air ports and direct access to sunlight. This added freeboard aft, too, will make the ships more weatherly in a following sea.

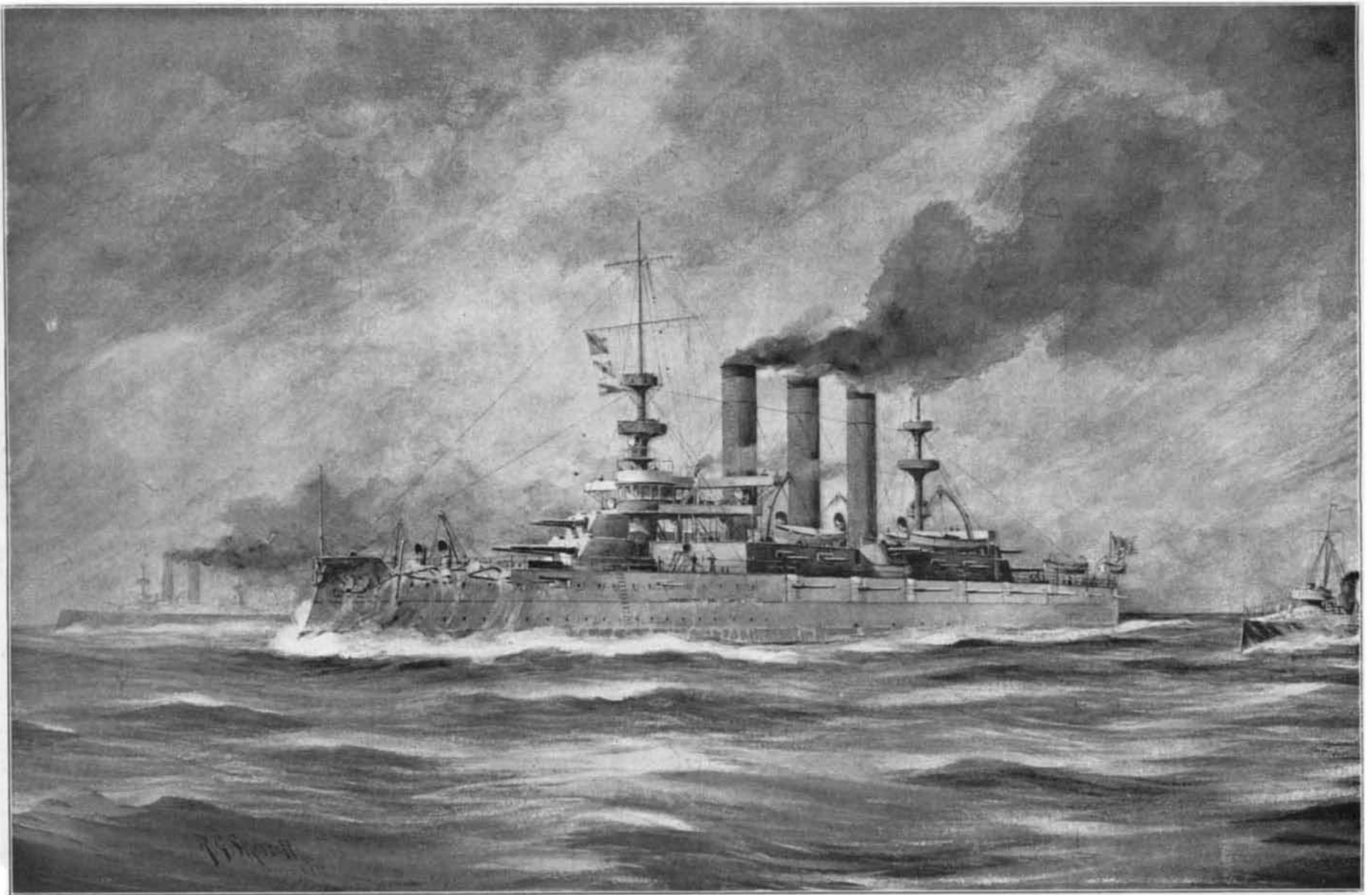
The armor protection to the hull will consist primarily of an 8-foot water-line belt, 5 feet of which will be below water at load draught. The maximum thickness of this belt is maintained amidships for a distance of 192 feet abreast the engines and boilers. From the top downward 5 feet, this armor will be 11 inches through, and thence to the armor shelf it will taper to 8 inches. The belt is continuous from bow to stern in varying thicknesses. For a distance of 60 feet forward and 32 feet abaft the central portion, the plates are to have a maximum thickness of 9 inches and a minimum of 6, the maximum 9 inches ranging downward 5 feet. For a distance of 16½ feet forward and aft, the next course of armor will have a greatest thickness of 6 inches and a least thickness of 4½, the limits of dimen-

pensable and not exposed either to the weather or under water, will be fire-proofed. Light metal bulkheads will supplant the usual wooden partitions in the living spaces, some of the furniture will be of pressed metal, the chart-house will be of bronze, and all of the decks under cover will be laid with linoleum. To guard against the overheating of the magazines, there will be a 4-inch air space around them in addition to a coating of some non-conducting material, while certain of the magazines are to be arranged so that they may be chilled by compressed air from the refrigerating plant.

Each ship will be fitted as a flag-ship, and accommodations will be provided for 1 flag officer, 1 commanding officer, 1 chief of staff, 20 ward-room officers, 12 junior officers, 10 warrant officers, and 658 seamen and marines; a total complement of 703 persons.

The refrigerating plant on each ship will have a cooling equivalent of two tons of ice daily; and a steam laundry capable of handling the clothes of seventy-five persons per diem will do most of the washing and ironing for officers and enlisted men.

The fighting powers of the vessels will be centered in the main battery of four 12-inch and eight 8-inch breech-loading rifles, the main rapid-fire battery of



THE NEW BATTLESHIP "GEORGIA"—ALSO "PENNSYLVANIA" AND "NEW JERSEY."

Dimensions: Length, 435 feet; beam, 76 feet 10 inches; mean draught, 24 feet. **Displacement,** 15,000 tons. **Speed,** 19 knots. **Maximum Coal Supply,** 1,900 tons. **Armor:** Belt (continuous), 11 to 4 inches; gun positions, 10 to 12 inches; deck, 1½ to 3 inches. **Armament:** Four 12-inch, eight 8-inch breech-loading rifles, twelve 6-inch rapid-fire, twelve 14-pounders, eight 1-pounders, two 3-inch field guns, eight machine guns and automatics. **Torpedo Tubes,** two (submerged). **Complement,** 650.

described previously. They will have a load-water-line length of 435 feet; an extreme beam of 76 feet 10 inches; a trial displacement of 15,000 tons; a mean draught at trial displacement of 24 feet; a greatest draught, full load, of 26 feet; a total coal bunker capacity of 1,900 tons; and a trial speed of 19 knots.

The most important difference in hull between these ships and the two of later appropriation is in the wood-sheathing and coppering which these ships will receive. Throughout the bottom and bilges and up to a height of three or four feet above the waterline there will be a thick covering of fine pine carefully tapped to the underlying metallic skin and rendered water-tight and non-galvanic. Over this will be laid the copper. The advantages of this system are too well known to need explanation here; and, in consequence, the ships will prove far more economical in their consumption of coal, readier at all times for high power service, and able to maintain their speed even after months in the fouling waters of the tropics. Such of our sheathed and coppered craft as have done service in the Far East have proved valuable practical examples of the advantages of this system of bottom protection.

In hull form there will be a novelty, common to all five of the new battleships, in the way the uniform freeboard of 20 feet is maintained from bow to stern.

sions, as in all following cases, being similar to those in the portions already described. Seventeen feet forward and aft, next, the armor will have a maximum thickness of 5 inches and a minimum of 4, while the remaining armor, running forward to the bow and aft to the stern, will have a uniform thickness of 4 inches. This armor will be treated by the Krupp process.

Above the main belt, for a distance of 245 feet amidships, i. e., throughout the position of the main broadside rapid-fire battery of 6-inch guns, the sides will be reinforced by armor of a uniform thickness of 6 inches. This armor will reach all the way up to the main deck, and it will be joined to the barbettes of the 12-inch turrets by athwartship armor of 6 inches in thickness aft, and by inclined armor of like thickness forward, yielding, in this latter case, the added protection of glacis against the head-on raking fire of an enemy. The after athwartship armor is vertical.

There will be a curved protective deck, reaching from bow to stern, being 1½ inches thick on the flat and 3 inches thick on the slopes. A cellulose belt 3 feet in thickness will be worked continuously from bow to stern along the sides above the protective deck. The obturating material will be the well-known corn-pith cellulose.

Wood will be used very sparingly, and, where indis-

twelve 6 inch breech-loading rifles, the secondary rapid-fire battery of twelve 14-pounders and a dozen 3-pounders, and the auxiliary battery of eight 1-pounders, two field pieces, two machine guns, and a half dozen 0.3 automatic guns.

The four 12-inch rifles will be mounted in two elliptical, balanced turrets 10 inches thick except for the slanting port plates an inch heavier. These guns will fire through arcs of 270 degrees. Four of the 8-inch guns will be superposed upon these turrets, fixed to move in unison, and they will be sheltered by walls of 6-inch armor increased half an inch on the slanting face plates. The four remaining 8-inch guns will be mounted amidships, two on each side, on the main deck, and will be housed in independent turrets similar to those placed above the 12-inch guns. These 8-inch rifles will have arcs of fire of 180 degrees, ranging from dead ahead to dead astern. This arrangement of the 12 and 8-inch guns gives a bow and a stern fire of six 8's and two 12's, and a broadside of six 8's and four 12's.

The 6-inch guns are arranged in broadside similarly to the ships previously shown last June. Each 6-inch gun, of which there are six on each broadside, has an arc of fire of 110 degrees, and the ports are so arranged that the guns can be turned inboard within the side

line, the guns swinging toward one another in pairs; beginning forward, the first gun turns aft while the next one swings its muzzle forward, etc., to the after pair. This arrangement does away with the inconvenience of dismounting the guns to avoid obstructions or to guard them against the stress of heavy weather. Each of these guns is sheltered behind a heavy port shield, and there is a splinter bulkhead of 2½ inch nickel steel between each gun and its neighbor on either side. The 14 pounders, sheltered by local armor of 2-inch steel and shields, are to be mounted on the gun deck well forward and aft, and up in the superstructure on the main deck, forward and aft of the amidship 8-inch turrets. The twelve 3 pounders are to be mounted on the bridges and on the superstructure deck, while the 1-pounders, automatic and otherwise, and the Gatlings, are to be placed in the tops and in the boats.

The submerged torpedo-tubes, of which there are two, are to be placed, one on each side, well forward, and the operator is to control his tube from an armored station on the deck above, sufficiently sheltered to be proof against 6-pounder fire.

The rates of fire given previously for the two other battleships apply in the case of these vessels and will be as follows: With ammunition supplied as fast as the electrical hoists can bring it to the guns, the 12-inch guns will fire once in every 1½ minutes; the 8-inch guns once in every 50 seconds; and the 6-inch guns three times a minute.

The motive engines will be of the four-cylinder triple-expansion type, actuating twin screws, and capable of developing 19,000 indicated horse power. The steam pressure will be 250 pounds, the stroke four feet, and the cylinders will be, H. P. 35 inches, I. P. 57 inches, and two L. P. each of 66 inches. Number of revolutions a minute, 120.

There will be twenty-four boilers of the straight water-tube type, placed in six water-tight compartments. They will have quite 1,280 square feet of grate and 55,000 square feet of heating surface. The air pressure in the ash-pits will not exceed one inch of water. On trial, the ships will carry only 900 tons of coal, and a reserve of 66 tons of fresh water will be carried either in tanks or in the double bottom during that time.

An originally contemplated, one 50-foot steam-cutter or picket-boat was to have been carried by each ship, but since the report of captains of the attacking fleet during the recent maneuvers at Newport, it is highly probable that each ship will be given two for vidette service against torpedo-boats or submarine craft.

Each ship will carry quite 570 tons of offensive ammunition, not counting torpedo outfit.

Thirty-six months is the maximum time allowed for the building of each ship, and the limit of cost is \$3,600,000, exclusive of armor and armament.

These ships were authorized by the Act of Congress approved March 3, 1899.

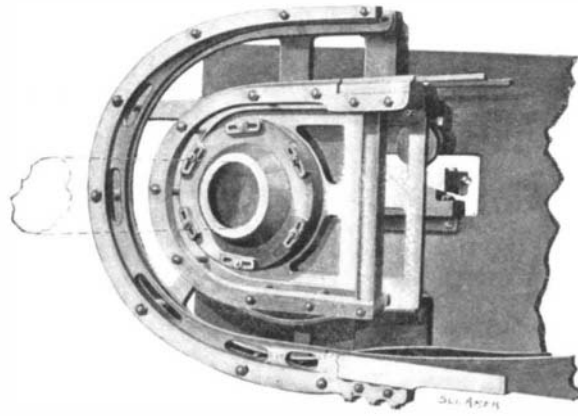
Long Range Firing with Heavy Guns.

Some interesting experiments at long range firing with heavy guns have been carried out by the Mediterranean squadron of the British navy. As a rule, target practice with the heavier guns never exceeds 2,000 yards, but in these experiments the range was increased to 4,000 and 7,400 yards. A target, 30 feet long by 15 feet high, covered with red canvas to make it conspicuous, was towed at a range of 5,000 yards from the battleship "Cæsar," which, at the time, was steaming at 10 knots per hour. The "Cæsar" fired in all forty rounds, sixteen of which were decided by the umpires to be excellent. On another occasion the battleship "Renown" fired at the target at a range of 7,400 yards, and scored the high total of 79 points. Only those shots were counted which would have hit a target of the same size as the first-class battleship "Cæsar." Six of the shots fired from the "Renown" would have hit the hull; one would have struck the superstructure; four would have hit the funnels and rigging; while nine overshoot the target by more than 100 feet. Long range gunnery fire will in future

constitute an important part of the gunnery practice of the British navy.

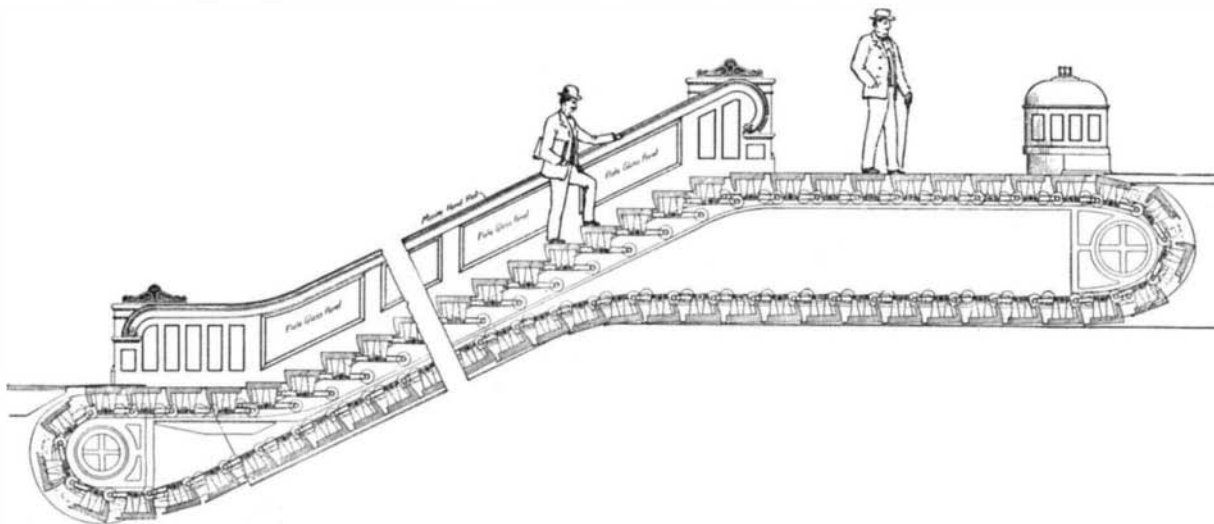
TRAVELING STAIRWAYS FOR THE ELEVATED RAILWAYS, NEW YORK.

The accompanying illustrations show the details of a moving stairway which is now being erected at the

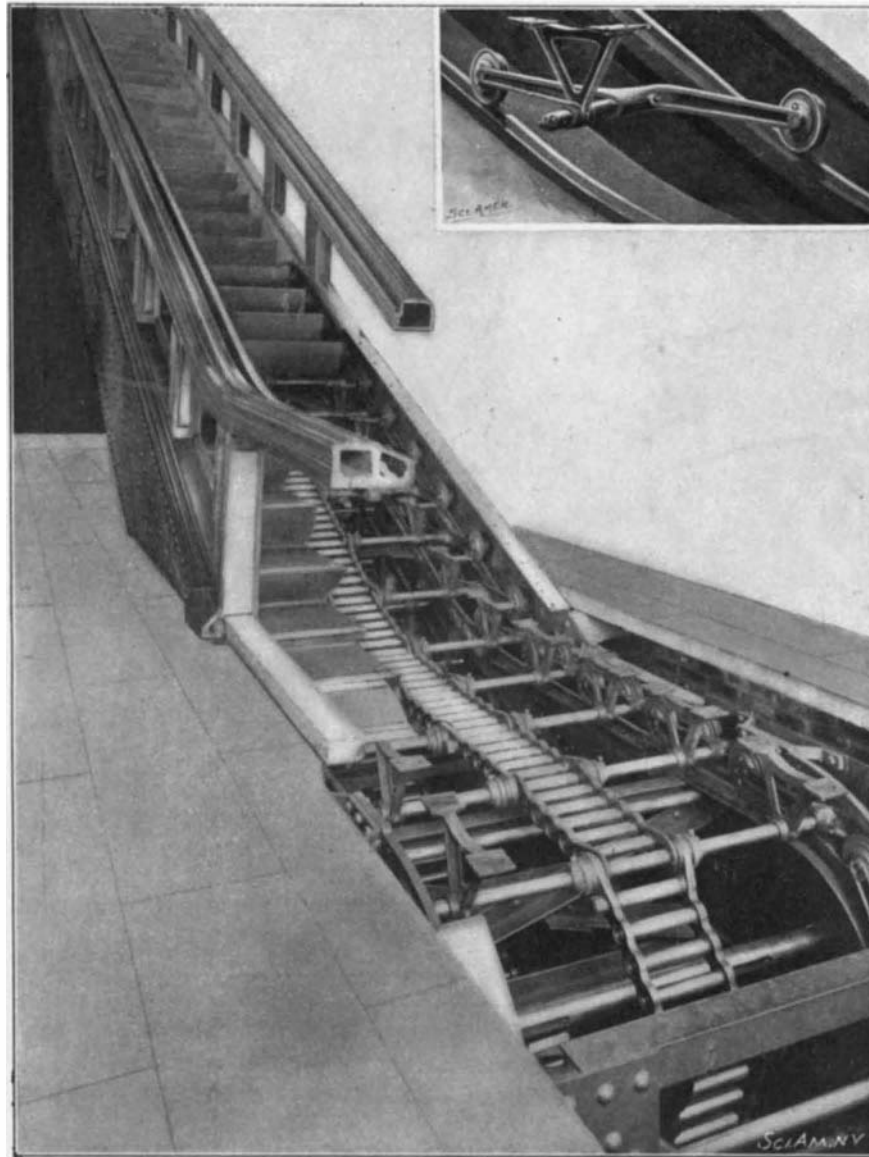


ONE SIDE OF THE DRIVING GEAR AT THE TURN.

Twenty-third Street station of the Sixth Avenue branch of the Manhattan Elevated system. At the Fifty-ninth Street station of the Third Avenue line of the same railway company there is in operation what is known as the Reno Inclined Elevator. The latter device was the first attempt to produce an inclined moving platform for carrying passengers from one elevation to another. It



LONGITUDINAL SECTION THROUGH THE STAIRWAY SHOWN AT PARIS EXPOSITION.



MOVING STAIRWAY AT THE TWENTY-THIRD STREET AND SIXTH AVENUE ELEVATED STATION, NEW YORK.

consists of an endless chain of rubber-covered slats attached to a series of transverse axles, upon the ends of which are small bearing wheels which serve to engage the lateral rails upon which the belt and its load of passengers are carried. At the top and the bottom of the incline, the axles engage large sprocket wheels, the whole system returning below the sprockets and moving over them in the form of an endless chain or belt. Power to drive the device is furnished by an electric motor.

The moving stairway at Twenty-third Street and Sixth Avenue is being built by the Otis Elevator Company and is known as the Otis Escalator. It differs from the Reno system chiefly in the fact that instead of a number of narrow transverse rubber-covered slats or bars, each element consists of the riser and tread of an ordinary stairway. As in the case of the Reno elevator, the elements are made up into an endless chain belt, which is supported during its ascent by means of small bearing wheels upon a system of side tracks, motion being imparted by means of end sprockets driven by an electric motor. Instead of a single track, however, there are two tracks on each side of the stairway, and instead of the axle of each member of the stairway having only a single carrying wheel at each end, it terminates in a Z-shaped arm, each end of the arm carrying a bearing wheel. These arms, and a pair of inverted A-brackets, which supports the steps, are rigidly attached to the axles.

As will be seen from the accompanying longitudinal section through a stairway of this kind, which is now in operation in one of the large department stores of this city, at each end of the inclined portion the stairway is carried for a considerable distance in a horizontal position. In this horizontal portion and around the end sprockets the two tracks on each side travel in the same horizontal plane, but in the inclined portion of the stairway the tracks separate and lie in different planes. The effect of this is that in the horizontal portions the treads of the steps are in the same horizontal plane, but as they strike the inclined portion of the stairway, the effect of the two tracks on each side lying in separate planes is to raise the steps, one above the other, as shown in the engraving. This ingenious arrangement throws the

steps at the embarking and disembarking points into the same plane as the surrounding surface and renders it easy to enter and leave the structure. As in the Reno elevator, a hand-rail at the side travels at the same rate as the steps. To make the ascent it is merely sufficient for the passenger to stand upon any particular step and remain there, although the ascent may, of course, be made more quickly by walking from step to step as the elevator ascends. If the Twenty-third Street plant proves to be a practical success, it is likely that the new device will be substituted for the present fixed stairways at all the elevated stations. It should be mentioned that the particular moving stairway of which we present a section was shown at the Paris Exposition this year, and was awarded the Grand Prix.

News of the Peary Expedition.

The whaling vessel "Eclipse" arrived at Dundee, Scotland, November 8, from Davis Strait, with Dr. Kann, an Austrian, Messrs. Stein and Warubath staying behind. The explorers passed the summer at Bedford, on Pym Island, the scene of the disaster of the Greely expedition, and from this point they saw the Peary exploring expedition pass, at the beginning of August, in three divisions. The first was led by Mat Hansen and the third by Lieutenant Peary. He was badly frost-bitten, and walked with difficulty. The party had sledges and some dogs, and Lieutenant Peary was determined to make a bold dash for the Pole. Many of the 200 dogs had died, however, and he was short of provisions. It is thought that Peary will winter at Conger.

Two thousand tons of American steel rails are being sent to Italy for use on the railways.