SOME NEW TYPES OF LIFEBOATS.

An interesting development of the gasoline motor for marine purposes has taken place in England, where it has been applied to a lifeboat for the Royal National Lifeboat Institution. For many years past the authorities have been following the progress of the utilization of this type of engine, with a view to its employment in lifeboats, as a mechanical means of assistance to the men, thereby relieving them somewhat of the heavy work entailed in approaching a wreck against heavy seas and head winds.

Deeming the present a ripe and suitable time for such an experiment, the Institution, acting upon the advice of their consulting naval architect, Mr. G. L. Watson, resolved to select an old lifeboat, install therein a gasoline motor, carry out a series of exacting experiments therewith in all sorts and conditions of weather, and to act upon the experience thus derived in the construction of a special vessel for the purpose. In this manner valuable constructional data would be obtained, which would be impossible in any other manner. The general scheme on which the motor should be installed in this lifeboat, together with all the necessary details, were intrusted to Capt. E. du Boulay, the marine motor engineer of the firm of Thellusson & Co., ot Cowes, in the Isle of Wight.

The successful adaptation of the gasoline motor to a lifeboat involves the surmounting of several inherent difficulties, such as do not present themselves in other boats, owing to the peculiar nature of the work the lifeboat has to fulfill, and the adverse conditions under which it has to operate. In the first place, it is imperative that the motor should be adequately protected from the violence of the waves that are incessantly shipped. To attain this end necessitates the inclosure of the engine within a perfectly water-tight case. Yet there must be an adequate air supply, to obtain the complete combustion of the gases. This requisition was fulfilled by a pipe leading into the case inclosing the engine, so arranged as to prevent the influx of water when waves broke over the craft, and to dry and heat the air before it reached the engine.

Then again the motor had to be as completely automatic as possible, since when once started the engineer would not be able to devote any minute or careful attention to it, especially on a cold, dark night with a heavy sea running, owing to the more important work he would have in hand. Under these circumstances a completely reliable system of lubrication had to be incorporated, the orthodox sight feed oilers being entirely useless.

Further, all those parts which from time to time require a certain amount of manipulation had to be lengthened and extended, so that they could be handled by the engineer from without the case, and moreover the handles to same had to be of different shapes, so that they could be readily and easily distinguished in the dark. The vaporizer had to be of special design, so as to readily and instantly accommodate itself to all possible positions, and not starve the engine or fail to work when the boat is standing more or less on end, or when heavily listed over by a sea or the pressure of the sails. But what was far more important was that the lifeboat should not lose its self-righting qualities owing to the weight and position of the machinery, and also that the motor should automatically stop in the event of capsizing, since when it righted itself again it would race away uncontrolled, leaving the crew in the water, and the latter might further be imperiled by the revolving propeller. Then again the engine must not interfere with the ordinary rowing or sailing capacities of the boat, while the engine itself had to be of the simplest construction in working, since it has to be manipulated by persons who invariably are not skilled mechanics, and must always be ready to start instantly at any required moment, either in summer or winter, even after long periods of enforced idleness.

The craft selected for these exacting experiments was an old one withdrawn from the Folkestone station on the south coast. It measured 38 feet in length by 8 feet beam, was pulled by twelve oars double-banked, and was of the usual self-righting type rigged with jib, fore-lug, and mizzen. At the shipyard some of the air cases under the deck amidships were withdrawn, and a strong mahogany case measuring 4 feet long by 3 feet wide, and as high as the gunwales, lined with sheet copper so as to be watertight, with a closely-fitting lid easily removable if necessary, was fitted in their place. In this case was placed a two-cylinder Fay & Bowen motor of 10 horse-power supplied by the Mitcham Motor Company of Cowes, together with all the necessary pumps, vaporizers, electric equipment, etc. The motor drives a three-bladed propeller through a long shaft with a disconnecting clutch between, so that for starting or stopping the engine temporarily, the screw can be disconnected from the engine by raising the clutch.

The gasoline is carried in a metal tank stored away inside the forward end box, where it is safe from any possibility of accidental damage. Sufficient oil fuel is carried in this reservoir for a ten hours' run. The motor is started by a handle in the usual way. The position and size of the motor case is such that only two oars are interfered with, but this does not necessarily mean that the services of two men are rendered nugatory, since they can double-bank some of the other oars if desired.

The vessel was completed last April, and was submitted to several preliminary tests in the varying weather of that month. It was found that the boat could be driven fairly well against a sea by the aid of the engine alone. But it was while working in conjunction with the sails that the true efficacy of the motor as an auxiliary power was realized, and the boat could be worked to windward in a manner that was hitherto impossible. It was also observed that neither the heeling effect of the sails, nor the pitching and rolling in a seaway, interfered in any way with the proper working or starting of the motor, and it ran evenly and regularly throughout, thereby showing that the vaporizer successfully accommodated itself to the varying positions of the boat.

A series of severe tests and trials were then carried out by Commander St. Vincent Nepean, R.N., the Chief Inspector of Lifeboats, together with Mr. Barnett, who represented Mr. G. L. Watson, who was unfortunately absent through illness. The trials were as follows:

1. Running on the measured mile, with full crew and all stores on board, the boat developed a speed of just over 6 knots. The mean draft in these conditions was practically the same as when the craft was an ordinary lifeboat, with her crew and gear in her, and her water ballast tanks filled.

2. With the equivalent weight of 13 men lashed on the thwarts, and with all the equipment on board, she was capsized by a crane four times, but never failed to self-right, even with sails set and sheets made fast.

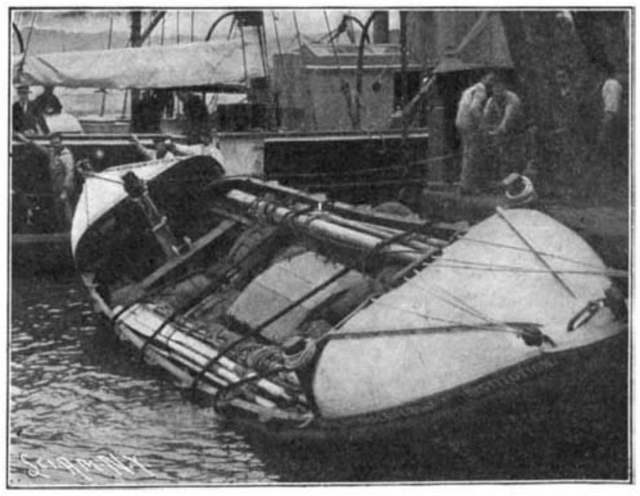
3. During the capsizing, the motor, which had been previously started, was automatically stopped directly the boat reached a position just beyond that of "on her beam ends."

4. After the capsizing, the motor started again at the second turn of the starting handle, and worked well.

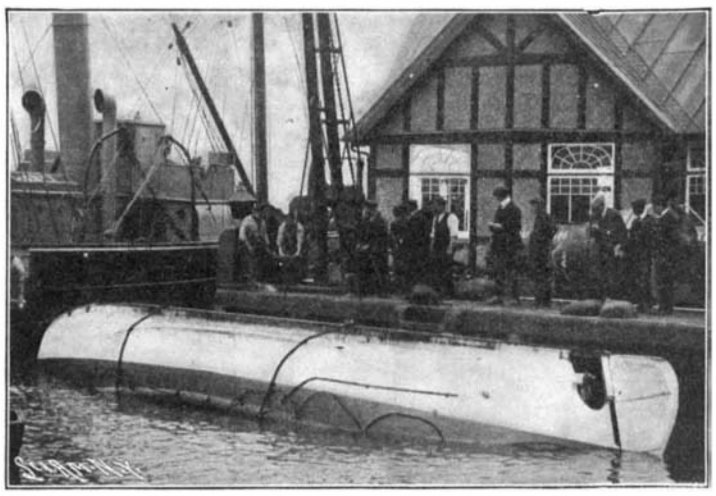
From the foregoing it will be realized that the gasoline motor can be satisfactorily adapted to the requirements of lifeboat work. It gives in combination with the oars and sails an assistance for reaching a wreck, especially should the casualty have occurred dead to windward.

Encouraged by the success of these trials, the Institution has resolved to further test the lifeboat by placing it in regular service at Newhaven during this winter. By following the behavior of the craft under actual life-saving conditions much valuable data will be obtainable, which will be of inestimable service in the future construction of motor-propelled lifeboats.

One of the most interesting features of the Life-Saving and Hygiene Exposition which is now being held in Paris is a new lifeboat invented by M. Albert Henry, who is connected with the Government Arsenal at Rochefort. The novel points lie in the combination of a movable keel, a set of water-tight compartments, and a screw operated by a gasoline motor. The new lifeboat possesses two valuable qualities, namely, that it is steady in all seas and is also insubmersible. This has been shown in actual tests, which are referred to below. The boat is an evolution of the old lifeboat which uses an iron keel fixed to the bottom of the boat about 20 inches below the water line and weighing 650 pounds. These figures seem to be about the limits which can be used in practice with this system. The weight of the keel cannot be increased too much, as the boat must be light and easily handled. On the other hand,

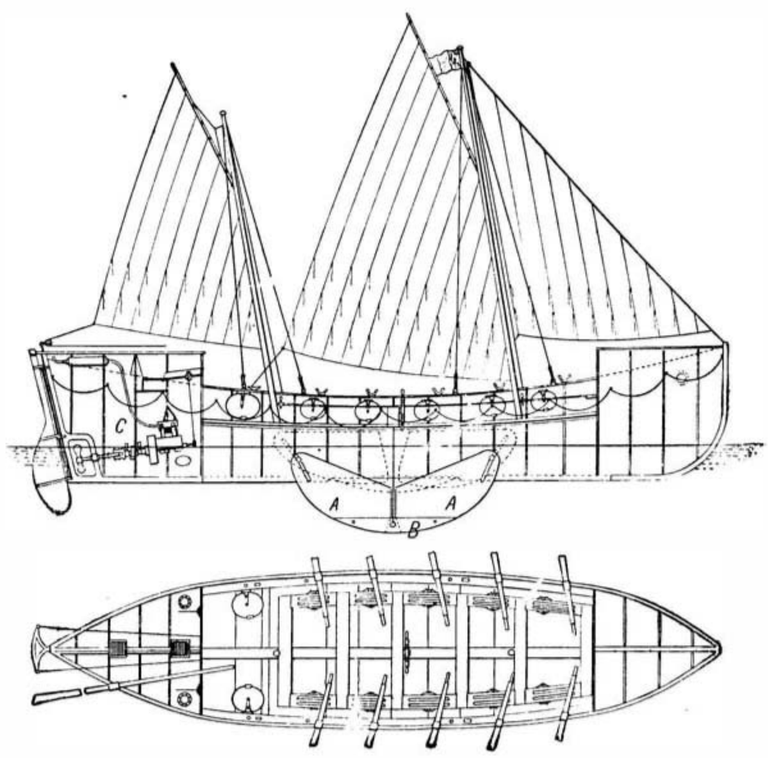


LIFEBOAT FITTED WITH 2-CYLINDER 10 H. P. GASOLINE MOTOR, INCLOSED IN A WATERTIGHT CASE TO PROTECT IT FROM FOUL WEATHER

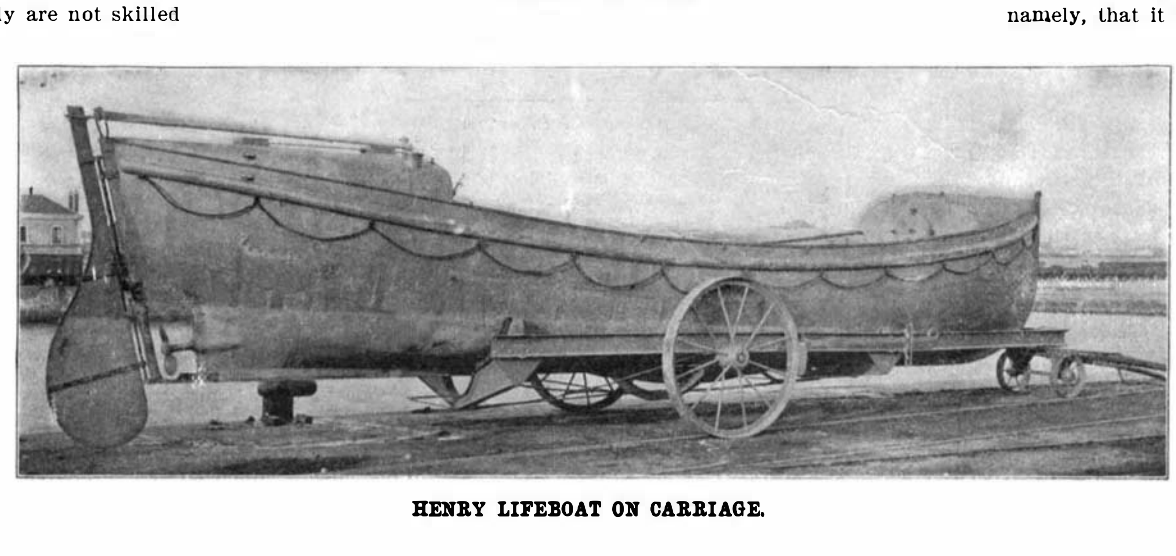


THE MOTOR BOAT CAPSIZED.

As the boat turns, the motor automatically stops running; but it can be easily started up when the boat rights itself.



HENRY'S LIFEBOAT.



HENRY LIFEBOAT ON CARRIAGE.

the keel cannot project too far down, as otherwise the boat will not run in shallow water.

In the new boat designed by M. Henry, stability is assured by a system composed of sheet-iron pieces which project from the bottom of the boat. To the lower part of these pieces is fixed a torpedo-shaped cast-iron weight of about 650 pounds which serves the same purpose as the weighted keel of the lifeboat mentioned above. By the present arrangement, the weight is made to descend much lower than in the former type, and it now has a leverage of over three feet, which greatly increases its efficacy in keeping the boat steady. As the sheet-iron plates have a surface of over three square yards, they offer a considerable resistance to the lateral movement of the boat. This arrangement of sheet iron support and weight has been employed for some time upon various forms of pleasure craft. But in these latter boats the device was fixed, and while it no doubt served sufficiently well in these cases, it could not be adopted for lifeboats, as the disadvantages of such a system are apparent in cases of landing the boat or putting it to sea. Some means therefore had to be found for making it movable and allowing it to be drawn up into the boat when not in use.

M. Henry has now succeeded in accomplishing this by a very simple device which presents no difficulty in operating and does not take up too much space. The weight, with its sheet-iron carrying pieces, is movable up and down, and enters a chamber in the bottom of the boat. This occurs either automatically, as when the keel strikes an obstacle or comes ashore, or on the other hand, it can be drawn up by hand from the inside of the boat by a windlass, and does not come above the flooring. The new form of keel, which is somewhat crescent-shaped, will be noticed in the diagram at the middle of the boat. It has a comparatively short length and is formed of two sheet-iron wings, *A A*. At the top the wings carry a slot (which is placed so as not to reduce the side resistance) allowing them to slide upon two specially-designed bolts. At the lower part the wings carry a cast-iron weight *B*, which is made in two longitudinal parts bolted together, thus forming a slot in the middle which receives the wings. The latter are thus pivoted to the weight by bolts. To the middle of the weight is attached a steel cable of 0.15 square inch section which passes up in the middle of the boat and works upon a hand drum. Working the drum causes the keel to rise and take any desired height. When fully drawn up, the wings take the position inside the chamber which is shown in dotted lines, while the weight lies against the bottom of the boat. This chamber is made of an appropriate form to receive the keel and lies below the flooring of the boat. By this means the stability of the boat is assured in an efficient manner, for when the keel is lowered, the boat draws nearly five feet of water instead of less than two feet as before. With the keel up the draft is about two feet.

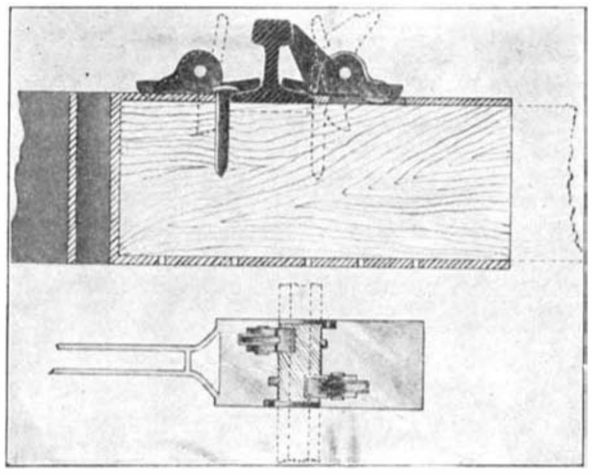
Another valuable point about the new boat is that it secures the complete evacuation of the water which is shipped. This is carried out by means of an orifice which runs along the whole length of the keel-chamber. The resistance of this chamber to the movement of the boat is stated to be ten times less than with the usual evacuation tubes. It has a surface of 45 square feet, being 18 feet long and 2.5 inches wide. This allows the instantaneous evacuation of the water. A system of valves is used to prevent the projection of water from below through the chamber. The use of the specially-formed keel combined with the evacuation of the water prevents the boat from overturning, and it is also made insubmersible. To this end it is provided with a system of air-compartments which are separated by partitions. The compartments have oval-shaped doors and can be used for keeping different kinds of stores.

As regards the propulsion of the boat, it is equipped with the usual sails and oars, besides a small petrol motor. The difficulty of placing a mechanical propelling device in a lifeboat has been overcome in the present case. M. Henry uses a small gasoline motor which is intended as an auxiliary in connection with the ordinary means of propelling the boat. Its principal use is to facilitate the maneuver of entering or leaving the port, and to enable it to carry out all the necessary movements so that it can approach and aid a ship in distress with great rapidity and ease. This it does by helping out the sails and oars, which are often difficult to handle when near the ship and offer great risks both for the crew and the passengers. In the present case the motor is placed as shown in the diagram in the stern chamber, *C*. As this chamber is of small size it makes the motor somewhat difficult to place, and its weight and power must be limited to give a speed of 6 knots. This speed can be increased to 8 knots by using the sails at the same time. The form of the boat, which can carry 40 to 50 persons, is designed so as to give the greatest possible stability with the maximum load. High speed is a secondary point with this kind of craft, and is sacrificed to the general security.

The lifeboat has been recognized in France as one of the best craft of its kind. It was classed in the first place in the concourse which was held at Brest in 1903, for the best projects for lifeboats provided with auxiliary motors. M. Decout-Lacour, the constructor, shared the honors with M. Henry. The concourse was held under the patronage of the Brittany Life Saving Society, and the present lifeboat was recognized as possessing all the improvements and qualities necessary for this special form of service, and answered in all points to the requirements of the Commission. A series of actual tests upon a boat made according to the above project was made not long ago in the port of La Rochelle, in the presence of over 10,000 persons, among whom were delegates of different life-saving societies and other marine interests. The tests included putting the boat to sea by means of a special carriage, trials of its solidity by dropping it into the water from a crane at a height of 18 feet, tests of steadiness and evacuation of water (in one case a cask containing 120 cubic feet of water was emptied into the boat from a height of 15 feet); also tests of towing other boats, and maneuvers of life-saving and landing. In all the trials the boat made a brilliant showing and was highly applauded. The first Henry lifeboat is now stationed at the port of Brest, and others have since been built.

METAL CROSS TIE FOR RAILROADS.

A railroad tie has recently been invented which combines the cushioning effect of the ordinary wooden tie with the strength and durability of a metal tie. The rail rests on wooden blocks, which are securely held in metal boxes. The metal boxes form opposite ends of cross ties, being connected by pairs of metal plates, as indicated in our plan view. A recess is cut in the top plate of each box, to admit the base of the rail. A pair of ears are formed at diagonally opposite sides of this recess, to receive the pivot pins of a pair of clamping devices. The clamp on the inner side of the rail consists of a short arm formed with a widened



METAL CROSS TIE FOR RAILROADS.

end, which fits over the base flange of the rail. The opposite end of the arm is formed with a cam swell, adapted to pass through a slot in the top plate of the box, and rest on the wooden block. The outer clamping device is similarly formed, but is in addition provided with a limb, which projects diagonally upward and serves as a brace for the ball of the rail. When laying the track, the rail is placed in position, and the clamping device is adjusted before the wooden block is driven into place. When the block is driven in, it engages the cam swells of the clamps, pressing them securely in place. The block is then secured in place by a pair of spikes driven therein through slots in the top plate of the box. These slots are indicated in our plan view of the tie. The heads of the spikes overlap the base flange of the rail, and serve as additional securing devices. While this tie is applicable for general track use, it is designed more especially for a safety curve and bridge tie. When the wooden blocks wear out, they can be discarded and replaced with new ones. Only a short block of wood is used instead of a full-length cross tie, thereby effecting a great saving of wood. The inventor of this cross tie is Mr. Allen Newell, of Guadalajara, Mexico.

The Current Supplement.

The current SUPPLEMENT, No. 1501, contains an unusual variety of interesting articles. The Italian first-class battleship "Regina Margherita" is fully described and illustrated, together with her engines. Of domestic interest is a brief but instructive article on non-poisonous textile and egg dyes for household use. The subject of plastic cements employed to secure joints in vessels and connections (generally for temporary purposes) has been rather neglected in chemical literature. For this reason Mr. Samuel S. Sadtler's contribution on "Lutes" should receive no little attention, containing as it does a great number of useful formulæ. Mercadier's system of attuned telegraphy is fully described and illustrated. Mercadier makes use of alternating currents which, by the application of tuning fork interrupters, are taken from direct-current sources for the transmission of telegraphic signals in his multiplex system. Mr. W. Watson describes an excellent quartz thread vertical force magnetograph. Prime Minister Henry A. Balfour's scholarly address on "The Work of a Great Ethnologist" is concluded. The St. Louis correspondent of the SCIENTIFIC AMERICAN describes the Chinese Pavilion and Exhibit at the Fair. Excellent pictures accompany his contribution. Mr. Walter Wood gives much curious information on Atlantic cattle carrying. A striking picture of the leg and foot of a spider is presented, striking for the reason that the picture in question was taken by means of a camera alone. One of the most valuable articles which has ever appeared in the SUPPLEMENT is that by Prof. W. F. M. Goss on the modern steam locomotive. Dr. S. Tolver Preston contributes an excellent article on the mechanics of the gyroscope.

MODEL OF THE PENNSYLVANIA RAILROAD HUDSON RIVER TUNNEL STATION AT NEW YORK.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Our front-page illustration, from a photograph taken at the St. Louis Fair of a large model of the Pennsylvania tunnel station that is to be built at New York, gives an excellent idea of the internal arrangements and vast proportions of this great structure. The ground on which the station is to be built measures 500 feet by 1,000 feet. The building itself measures 400 feet by 800 feet. The model is made on a scale of ⅜ of an inch to one foot, and as it is 22 feet in length, it is large enough to permit the architectural and constructional features to be made perfectly clear. The station will stand partly below and partly above the street level. It will be 45 feet from the street to the tracks, and there will be practically three floors—first the track level, with 21 parallel tracks running side by side the entire length of the station, then a second floor 20 feet above the tracks, and a third floor at street level. Our illustration shows the interior of the main rotunda, a magnificent hall 85 feet in width, 300 feet in length, and 150 feet in clear height. This will be the most magnificent hall of its kind and purpose in the world. At night time it will be lighted by the huge electric globes shown in our view, each of which will be 10 feet in diameter. There will be ladies' and gentlemen's waiting rooms on the right, and on the left of the rotunda will be a dining room and a combined waiting room for men and women. The broad concourse at the right of the rotunda will be roofed with glass; it will be 120 feet wide by 300 feet in length and 100 feet in clear height to the roof, and its floor will be on the same level as that of the main rotunda. At each end of the station, at the level of the second floor, will be the tracks of the proposed Seventh and Eighth Avenue Rapid Transit subways, with convenient connections by broad entrances and exits from the subways to the Pennsylvania tunnel station. No one will be permitted to cross the tracks, gradual ascents and descents being made by stairways, although it is probable that by the time the station is built, moving stairways or elevators will be substituted. The superstructure of the building, above ground, will be three and four stories in height, and the noble façades will be treated in a severely classical style, consistent with the long perspectives and massive dignity of the building.

Adjacent to the model of the station, stands another fine specimen of the model maker's art, showing a section along the center line of the Pennsylvania Railroad tunnel from Hoboken to Long Island. The scale is 1-1,000 full size, and the section is carried down from the surface of the ground to a level considerably below the bottom of the tunnel. The model in plan takes in a considerable stretch of Hoboken, Manhattan, and Long Island, and the buildings and streets are reproduced to exact scale with remarkable fidelity. At intervals, seven subsidiary cross sections are introduced, showing the nature of the construction at the points where the cross sections are taken. These represent the tunnel construction at such points as Bergen Hill; at the center of the North River, where the tunnel consists of two tubes carried on cast-iron piles; at the point where the two tracks merge in a common tunnel; at another point under Manhattan and nearer the station, where the tracks diverge into a three-track tunnel; and a section showing the four-track tunnel portion between Eighth and Ninth Avenues. The two models together afford very complete information as to the leading engineering features of this, the greatest piece of tunnel and station construction ever undertaken by a railroad company.

Vesuvius's Latest Eruption.

Vesuvius is in eruption again. A piece of rock weighing about two tons shot out of the crater a week or so ago, and lava was flowing out of the crater so hot that it has melted the steel rails of the road that runs up the volcano.