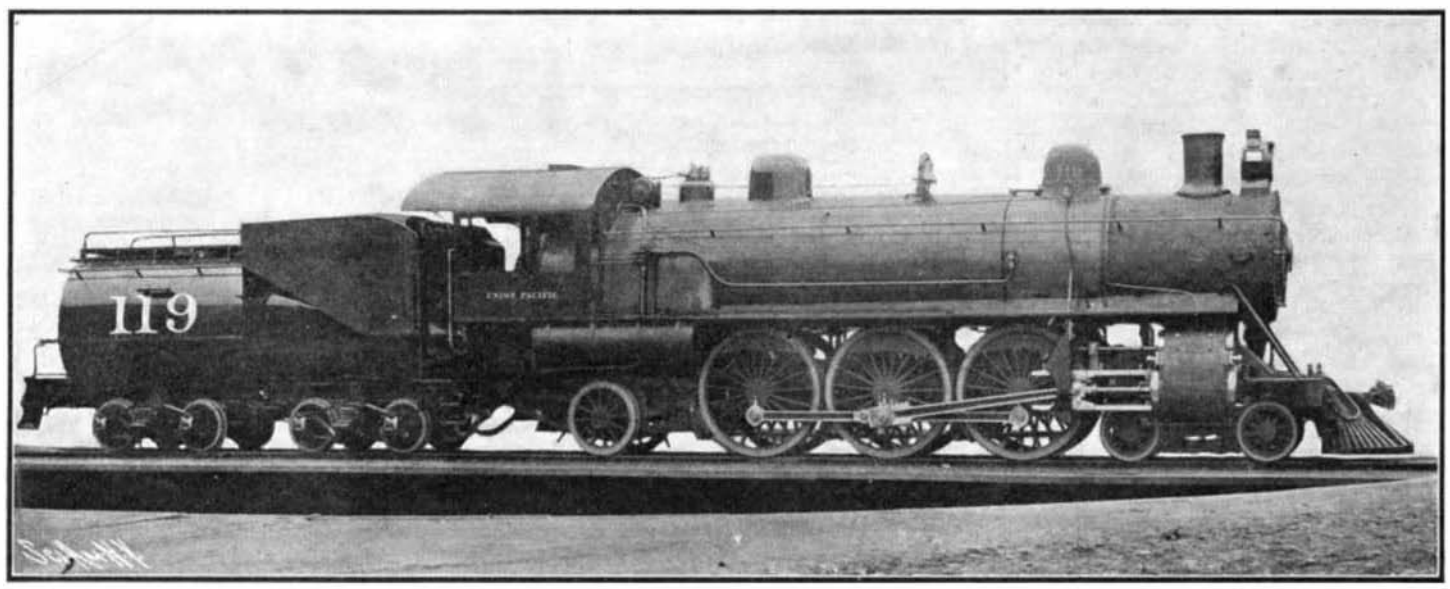
PASSENGER LOCOMOTIVE WITH VANDERBILT TENDER.

One of the novel features that arrested immediate attention in the Transportation Building at the World's Fair, was the new type of locomotive tender, designed by Cornelius Vanderbilt, which was shown on several fine locomotives of modern design. The one herewith selected for illustration was built by the Baldwin Locomotive Company for the Union Pacific Railroad Company, and is known as the Pacific type. The locomotive has cylinders 22 inches in diameter by 28 inches stroke, connected to the middle pair of the six-coupled driving wheels, 77 inches in diameter. The total weight of the engine is 222,520 pounds. It is carried as follows: 141,290 pounds on the driving wheels, 37,330 pounds on the front truck, and 43,900 pounds on the trailers. The boiler is of the straight type, with a diameter of 70 inches and a working pressure of 200 pounds to the square inch. The total heating surface is 3,053 square feet, and the grate area 49.5 square feet.



For the same capacity there is a saving of 7⅛ tons on a Standard 73-ton tender.

PASSENGER LOCOMOTIVE WITH THE VANDERBILT CYLINDRICAL TENDER.

It will be seen from this description that the engine is of a standard type. The tender, however, departs very broadly from the old lines with which we are familiar. The water tank, instead of being of the rectangular pattern, is cylindrical. It is built of ¼-inch steel, and measures 8 feet in diameter by 23 feet in length. It is carried on a narrow frame, which for reasons given below is much lighter than that of the ordinary type of tender. The length over bumpers is 26 feet 3¾ inches. At about the mid-length of the tank there is a plate-steel saddle, which serves to support the rear end of the coal hopper. The latter occupies the space above the forward half of the tender, and it is of a general rectangular form, with a sloping bottom arranged at the proper pitch to give a free delivery of the coal to the foot-plate. The trucks are of the arch-bar, simplex bolster type, with cast-iron, steel-tired wheels, 33½ inches in diameter, the journals measuring 5½ inches by 10 inches. In a light condition the tender weighs 46,740 pounds. Fully loaded with coal and water, its weight is 136,450 pounds, or 68 tons, which, by the way, was the weight of a good-sized locomotive not so very many years ago. The water capacity is 7,000 gallons, and the coal capacity 14 tons.

The advantages of the Vanderbilt tender are many. For its capacity and weight the cylindrical form is the strongest that can be used. Its transverse strength is so great that, in spite of its length of over 26 feet, the tank is quite capable of carrying its load of 29 tons of water without any center support, and, consequently, the underframe can be made very much lighter than would be necessary in a tender of the same capacity but of the rectangular shape. The frame need only be made strong enough to withstand the pulling and pushing stresses of the engine, and, as compared with the standard type of frame, it is remarkably narrow and light. In a comparison of two tenders, one rectangular and the other cylindrical, and each carrying 7,000 gallons of water and 14 tons of coal, there is a saving of about 7½ tons of weight in favor of the Vanderbilt type. A further advantage is that the fuel is located at the forward end of the tank, immediately at the back of the foot-plate, and, therefore, in the most convenient position for the firemen.

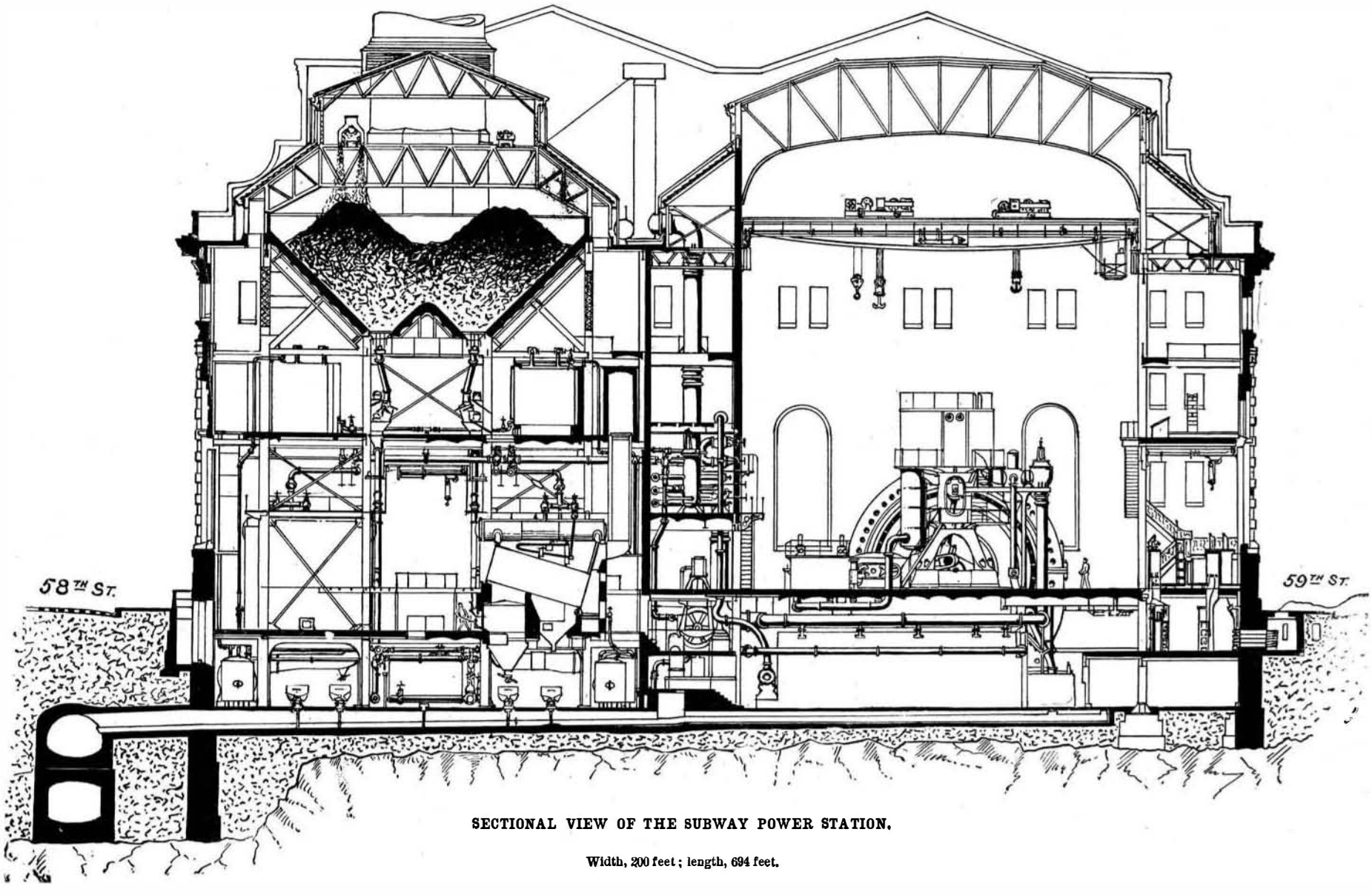
The British consul at Bahia states that ropes made from the fiber of the caroá plant will soon rival the best manila.

OPENING OF THE NEW YORK RAPID TRANSIT SUBWAY.

On October 27 the Rapid Transit Subway of this city was formally opened with simple but dignified ceremonies that took place in the City Hall. Mr. Alexander E. Orr, representing the Rapid Transit Commission, formally handed over the road to the Mayor, and after a party of invited guests had made a trip over the system, the sale of tickets commenced at seven o'clock in the evening, and the citizens of New York were thus placed in possession of this splendid addition to its traveling facilities. In our issue of September 10 we gave an illustrated description, dealing with the general features of the road, its route, construction, equipment, and method of operation, and to that article reference is now made for the fuller details which it is not necessary to elaborate here.

In no city of the world is there an underground railroad that can compare in size, capacity, and speed with this. The total length of the line is 24.7 miles, of which 19 miles is underground and 5.7 miles is carried on an elevated structure. It includes 6.7 miles of four-track, 7.4 miles of three-track, and 10.6 miles of two-track road. If we include 5 miles of switches and sidings, there is a total track mileage of 70 miles. The contract was let four years ago for $35,000,000, this being the amount necessary for the construction of the road. The equipment, power station, etc., cost $12,000,000 more, making the total cost $47,000,000.

There are two classes of service, express and local; the former using the two inside tracks, and the latter the two outside tracks of the four-track road. Express trains, which will run at a speed of about 25 miles an hour including stops, are made up of eight cars, of which five are motor cars. The local trains, which will have a speed of about 16 miles an hour, including stops, are made up of six cars, four of which



SECTIONAL VIEW OF THE SUBWAY POWER STATION.

Width, 200 feet; length, 694 feet.

are motor cars. The motor cars carry two 200-horse-power motors each, or 400 to the car, or 2,000 for the express trains. On tangents the expresses will attain a maximum speed of about 50 miles an hour. Special precaution has been taken to safeguard the passengers. The wooden cars have steel underbodies, and these will gradually be replaced by all-steel cars, built with a view to rendering them both fireproof and collision proof, the cars being of a modified vestibuled type, with special construction at the ends to prevent telescoping. A block signal system, which includes the latest refinements in the way of automatic stops at the signals, absolutely preventing a train running into a block when the signals are against it, has been installed, and it is likely that the enviable record of the elevated roads in respect of the small number of accidents, will be surpassed on the Subway system.

The present article is devoted more particularly to the great power station, which has been built at Fifty-ninth Street and the North River, the spot being chosen for its central location with regard to the distribution of the current, and because of the facilities afforded for water transportation, and transportation by rail on the New York Central Railroad tracks, which run past the power house. The building occupies an entire block, and measures 200 feet in width by 694 feet in length. It is divided longitudinally by a central wall into two portions. The northern half, 117 feet in width, is known as the operating room, while the southerly half, 83 feet in width, is the boiler house. As will be seen from our accompanying sectional drawing, the operating room or engine house is built with galleries extending the whole length on each side, those on the northerly side containing the electrical apparatus, those on the southerly side being occupied chiefly by the steam-pipe equipment. When the plant is entirely completed, it will contain six sections. Each section, with the exception of the turbine section, consists of twelve boilers, two engines, each connected to a 5,000-kilowatt alternator, together with the necessary condensing and boiler feed equipment, and a chimney, there being six chimneys in all. A novelty in respect of the last named is that they are carried on the steel structure of the building, upon a platform at an elevation of 76 feet above the basement floor. The supporting columns for carrying the chimneys form part of the regular system of columns of the boiler house. The top of each chimney is 225 feet above the gratebars, or 162 feet above the top of the supporting platform, and each weighs 1,200 tons. The obvious advantage of this arrangement is that the brick portion of the chimney extends only from about the level of the roof upward, the interior of the boiler house being thus entirely free from brickwork, and the space thus saved is available for boilers. This enables the line of boilers to extend continuously through the whole length of the house, and preserves the general symmetry of the installation. Above the boiler house, extending the full length thereof, is a coal bunker capable of holding 18,000 tons of coal. Immediately below the bunkers, and all on the same floor, are the boiler economizers, and below these again are the boilers, which are arranged in two long lines confronting each other, with a central platform between them, from which they are fired. The ashes are dumped by gravity into hoppers, which deliver them to small ash dump cars running on tracks in the basement. The cars are drawn out by a small electric locomotive to the water front, where they are dumped into a 1,000-ton bin, to be subsequently disposed of by barge or otherwise.

The coal is brought in barges or vessels to a pier on the water front, where it is unloaded by coal-unloading towers, crushed, weighed, and carried by belt-conveyors to a system of 30-inch elevating belt-conveyors, by which it is elevated to the top of the boiler house and delivered to a system of 20-inch, horizontal belt-conveyors, for even distribution throughout the bunkers.

The boiler room will ultimately contain seventy-two Babcock & Wilcox boilers, with an aggregate heating surface of 432,576 square feet. They will operate at a working steam pressure of 225 pounds to the square inch. It is ultimately intended to apply superheaters to the whole boiler plant, but before doing so a trial is being made of two well-known makes of superheaters built in this country. Special attention has been paid to the design of the steam piping, and all fittings are made somewhat heavier than is customary in ordinary practice, and they are all of special design. The line and bent pipe is of wrought iron, with loose flanges made of wrought steel rolled at the Krupp works. The engine equipment when all is completed will consist of eleven 7,500-horse-power Allis-Chalmers engines of the same general type as those installed in the 76th Street power station of the elevated road of this city, which have already been described in this journal. As these are capable of working at overload up to 11,000 or 12,000 horse-power, the total horse-power of the plant for traction purposes alone will aggregate say 121,000 horse-power. To this must be added four steam turbines used for electric lighting and two exciter engines, which would bring up the total horse-power for this station to a maximum capacity, when pushed to the utmost, of 132,000.

The main engines are each made up of two component compound engines, driving a common shaft, upon which is carried the 5,000-kilowatt generator. The high-pressure cylinders are placed horizontally and the low pressure vertically, each pair connecting to a common crankpin. The high-pressure cylinders are 42 inches in diameter, the low-pressure 86 inches in diameter, and the common stroke is 60 inches. This is for each cylinder, as compared with the Manhattan engines, a reduction in diameter of 2 inches, the stroke being the same and the revolutions per minute, 75, being also similar. The steam pressure of the Rapid Transit Subway engines is 175 pounds, as against 150 pounds for the earlier engines. The low-pressure and the high-pressure piston rods are both 10 inches in diameter, and the crankpin is 20 inches in diameter, an increase of 2 inches over the dimensions of the Manhattan engines. The low-pressure valves are single-ported Corliss, and the high-pressure valves are of the poppet type. At the journals the shaft is 34 inches in diameter, and the length of the journals is 60 inches.

The guarantees of the engines specify that they must be capable of operating continuously, when indicating 11,000 horse-power, without producing abnormal wear, jar, noise, or other objectionable results. They are to be so proportioned that if desired they can be operated with a steam pressure at the throttle of 200 pounds above atmospheric pressure. They must also operate successfully under 175 pounds pressure, should the temperature of the steam be maintained at the throttle at from 450 to 500 degrees. Finally, the engine must not require more than 12¼ pounds of dry steam per indicated horse-power per hour when indicating 7,500 horse-power at 75 revolutions per minute, with a vacuum of 26 inches at the low-pressure cylinders, with a steam pressure at the throttle of 175 pounds, and with saturated steam at the normal temperature due to its pressure.

The turbo-generators for electric lighting consist of four Westinghouse-Parsons multiple-expansion, parallel-flow turbines, each consisting of two turbines arranged in tandem-compound. The alternators will run at a speed of 1,200 revolutions per minute, and produce current at a pressure of 11,000 volts. Each unit will have a normal output of 1,700 horse-power, and it is guaranteed to operate under 450 degrees of superheat. The guarantee under a full load of 1,250 kilowatts is 13.8 pounds per electrical horse-power hour, which, it will be seen, is considerably lower than the guarantee for the reciprocating engines. There are also two exciter engines of the compound type, direct-connected to 250 kilowatt generators.

In view of the fact that the efficiency of the engines depends so largely on the vacuum, particular care was given to the design of the condensing plant. Each engine is supplied with two Alberger barometric condensing chambers, each attached as closely as possible to its respective low-pressure cylinder. The circulating pumps are vertical, cross-compound, Corliss engines. Their foundations are on the basement floor; but their steam cylinders are above the engine floor and are, therefore, under the eye of the engineer. The normal capacity of each pump is 10,000,000 gallons per day; therefore, the total pumping capacity of the station is 120,000,000 gallons per day.

The 5,000-kilowatt alternators, like the engines, closely resemble those of the Manhattan Railway Company. They deliver 25-cycle alternating three-phase current at a pressure of 11,000 volts. The revolving part is 32 feet in diameter, and it weighs 332,000 pounds. The machines stand 42 feet in height, and the total weight of each is 889,000 pounds. The revolving parts have been constructed with a view to securing ample ability to resist the centrifugal forces which would be set up should the engines, through some accident, run away. The hub of the revolving field is of cast steel, and the rim is connected to the hub by two huge disks of rolled steel. The alternators have forty field poles, and they operate at 75 revolutions per minute. Field magnets form the periphery of the revolving field, the poles and rim of which are built up of steel plates, dovetailed to the driving spider. The armature is carried outside of the field and is stationary.

Current is delivered at 11,000 volts to eight substations, where it is transformed and converted to direct current at a potential of 625 volts, at which it is delivered to the third or contact rails. As explained in our article of September 10, the third rail is protected by a lateral and overhead shield, which should prove fully effective in safeguarding the workmen or passengers from injury.

We take this opportunity to express our indebtedness to Mr. George S. Rice, the Chief Assistant Engineer of the Rapid Transit Commission, for his invariable courtesy and assistance in the preparation of the many articles that we have published during the construction of the Subway.

Automobile Notes.

One of the automobile novelties at the St. Louis fair is a self-moving lunch wagon. Besides the usual cooking paraphernalia of a lunch wagon, this one is fitted with a 25-horse-power gasoline motor and transmission, and is mounted on rubber-tired artillery wheels, on which it rolls about at from four to ten miles an hour. The wagon is illuminated at night by thirty electric lights.

An interesting motor-boat race is scheduled to take place on Saturday, October 29, on the Hudson River, when Mr. Frank Croker's new boat, which was built by the Herreshoffs and has been fitted with a 90-horse-power Mercedes engine, will race the "Challenger"—the boat which went to England to race for the Harmsworth cup. The race is to be run from New York to Poughkeepsie and back, a total distance of 140 miles. As it is the first long-distance event of this character to be held in America, it will no doubt be watched with great interest by many.

Two handbooks that will be found very useful to the intending purchaser of an automobile and the confirmed user respectively are the "Handbook of Gasoline Automobiles" and the "Automobile Laws of All the States." In the former book no less than seventy-six of the latest types of leading American and foreign gasoline motors are illustrated, and their main specifications given, thus making it possible to readily compare them and determine which one suits a person the best. The pamphlet of State laws regulating automobiles has been compiled by the Automobile Club of America. It contains the laws of all those States which have passed legislation on this subject, and it will consequently be found very useful to tourists, as it will aid them in determining in advance whether it is necessary to procure a license and number before traveling through a given State. The necessity of having a separate number for each State (which is the law in several of our principal States) has become such a nuisance to tourists that the National Association of Automobile Manufacturers is about to take steps to stop it and to make one number with the initial letter of the home State serve for all States through which a car may pass. It is to be hoped that the Association will succeed in bringing about such a result.

The New York Juvenile Asylum, which now is located in the Borough of Manhattan, will soon move to a site on the Hudson River near Dobb's Ferry, when a change will be made in the manner of housing the children in its care. They will be placed in "homes" where a group of about twenty children will constitute a "family," and as the inmates of the asylum are very numerous, there will necessarily be several of these houses. The cooking will be done in one kitchen, and it has been decided by the management that in order that the delivery of food to the different homes shall be done with as little delay and as economically as possible, an automobile shall be made use of. Before coming to a final conclusion in this matter the opinions of a number of builders of automobiles were sought, and all regarded the scheme as not only feasible but desirable for the purpose. A vehicle will be built for the special work and will be heated in some manner so that the food will be delivered hot. While the general plan has been decided upon the details remain to be worked out, and several designers and builders of automobiles have promised to consider the matter and submit plans for this novel vehicle.

Automobile affairs are not far behindhand in India, if we are to judge by the 833-mile reliability run which is to be held between Delhi and Bombay. It is organized by the Motor Union of Western India. The trip is to be made in eight days, comprising stages between the large towns varying from 147 to 71 miles. The run begins on the 26th of December, starting from Delhi, and ends at Bombay on January 2. This is the first contest of the kind which has been held in India. It should be remarked that that country offers a wide field for the automobile industry, both for transportation of freight and voyagers, as well as for postal service and agricultural work. The present test is not a speed trial, as the minimum is fixed at 12 miles an hour and the maximum at 30 miles, which is not to be exceeded. The object is to determine the best type of car, the one which will be in the best condition after the run and which has the least number of stops and accidents. The prize consists of a cup of high artistic value, which is offered by the Kaikwar of Baroda. Different Indian princes have offered prizes for other tests which are to be held at the same time. These will bear upon the type of car which is best adapted for road use in agricultural districts that have no railroad facilities; for carrying passengers, freight, and mail matter, besides motor bicycles and quadricycles. For the Delhi-Bombay contest the cars must be presented by amateurs. Entries are received up to the 15th of December, and information can be obtained from the secretary of the Motor Union of Western India, Bombay.