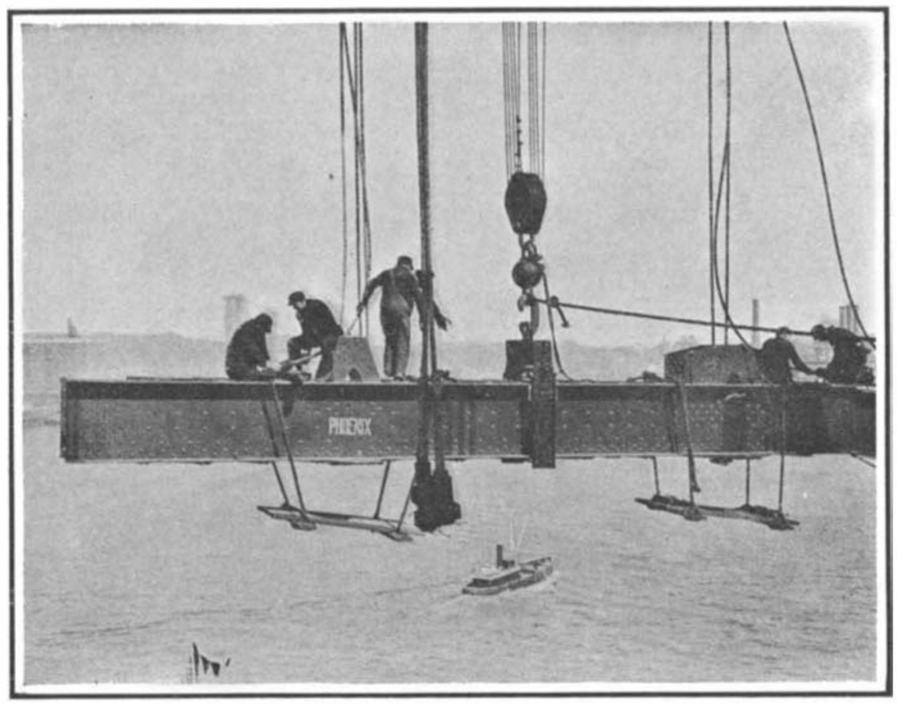
THE QUEENSBORO AND MANHATTAN BRIDGES ACROSS THE EAST RIVER.

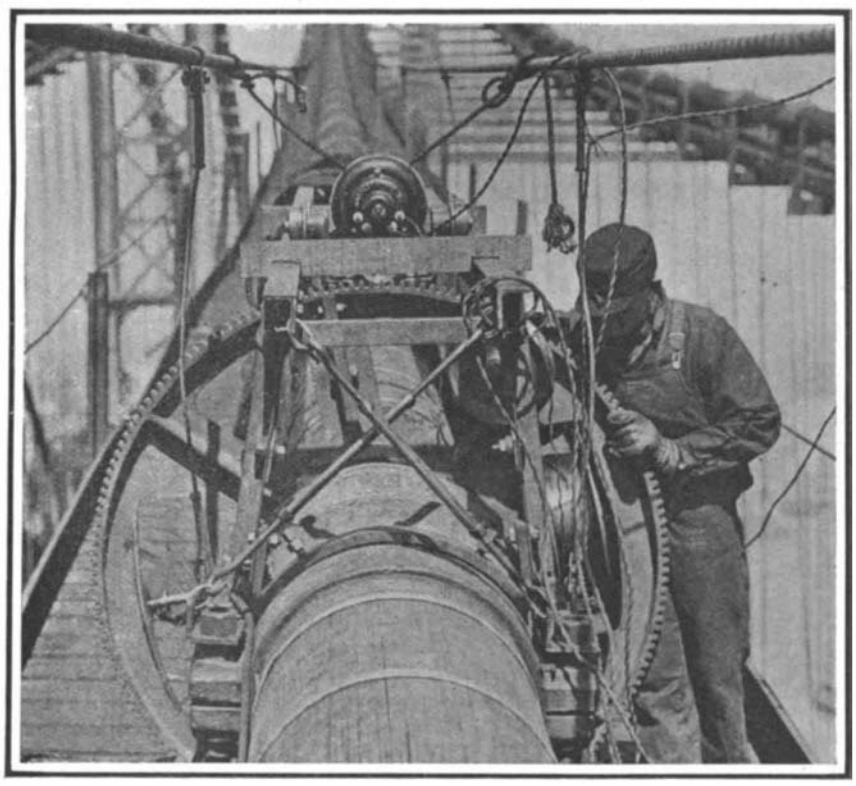
At half-past two on Tuesday, the 30th of March, 1909, the great cantilever bridge across the East River at 59th Street, New York, was formally opened for public use, when Mayor McClellan accompanied by the Commissioner and Chief Engineer of the Bridge Department, and followed by members of the Queensboro Bridge celebration committee, rode across the structure from the Manhattan terminus and back in automobiles.

We have so recently described the Queensboro Bridge (see Engineering Number, December 5th, 1908), that it will be sufficient to recapitulate the principal features of this great engineering work. In the first place, it is notable as being the heaviest steel bridge ever erected, surpassing, in this respect, the great cantilever bridge across the Firth of Forth, Scotland. The Firth of Forth spans are longer, it is true, each being 1,710 feet in the clear; but the greater weight of the Queensboro Bridge is explained by the great width of the floor system; the two decks with which it is provided; and the unusually heavy loading for which it is designed. Thus, the 630-foot span across Blackwell's Island in the center of the river alone weighs 10,400 tons, or 16½ tons to the lineal foot. Commencing from the Manhattan shore, the bridge is made up of the following parts: An anchor span, 469 feet long; a channel span of 1,182 feet; the island span, across Blaokwell's Island, 632 feet long; a 984-foot span over the east channel of the river, and a 459-foot anchor span on the Long Island shore. The total length of the bridge, including approaches, is 8,600

Pair of cables with suspenders in place.



Adjusting length of chord section to suspenders.

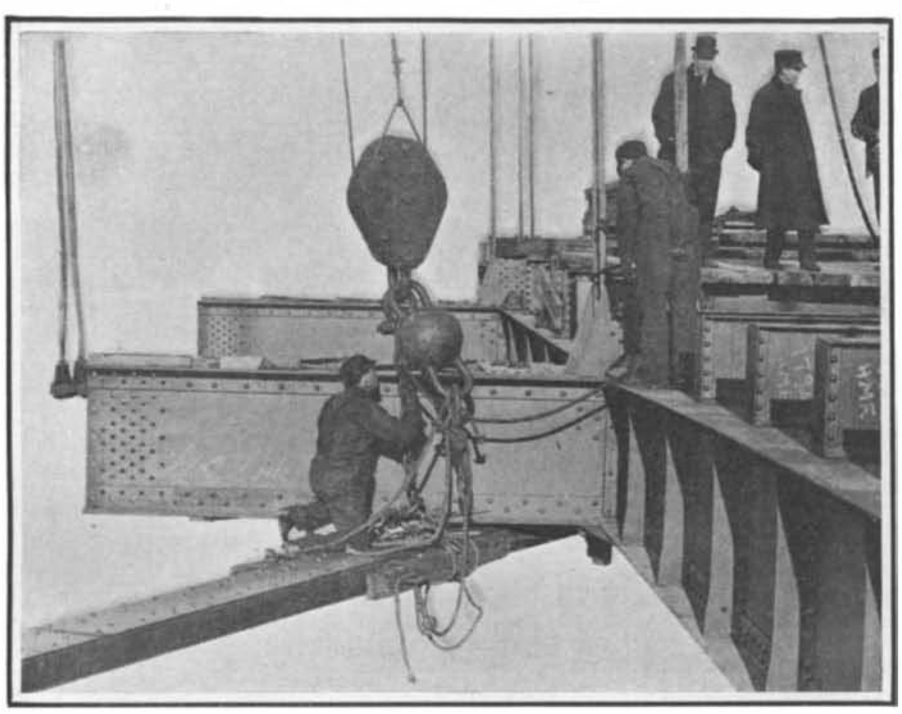


Motor on top of frame drives the spur wheel, which carries a spool of wire. This wire is wrapped upon the cable under the tension of an adjustable brake.

Wire-wrapping the 21¼-inch cables.

Note on cable to left the saddles which carry the suspender cables. Below is seen the completed portion of the roadway.

Manhattan bridge from the Brooklyn tower,



Floor system; showing bottom chords and floorbeams.

In bo'sun's chair painting suspenders.

BUILDING THE MANHATTAN BRIDGE OVER THE EAST RIVER.

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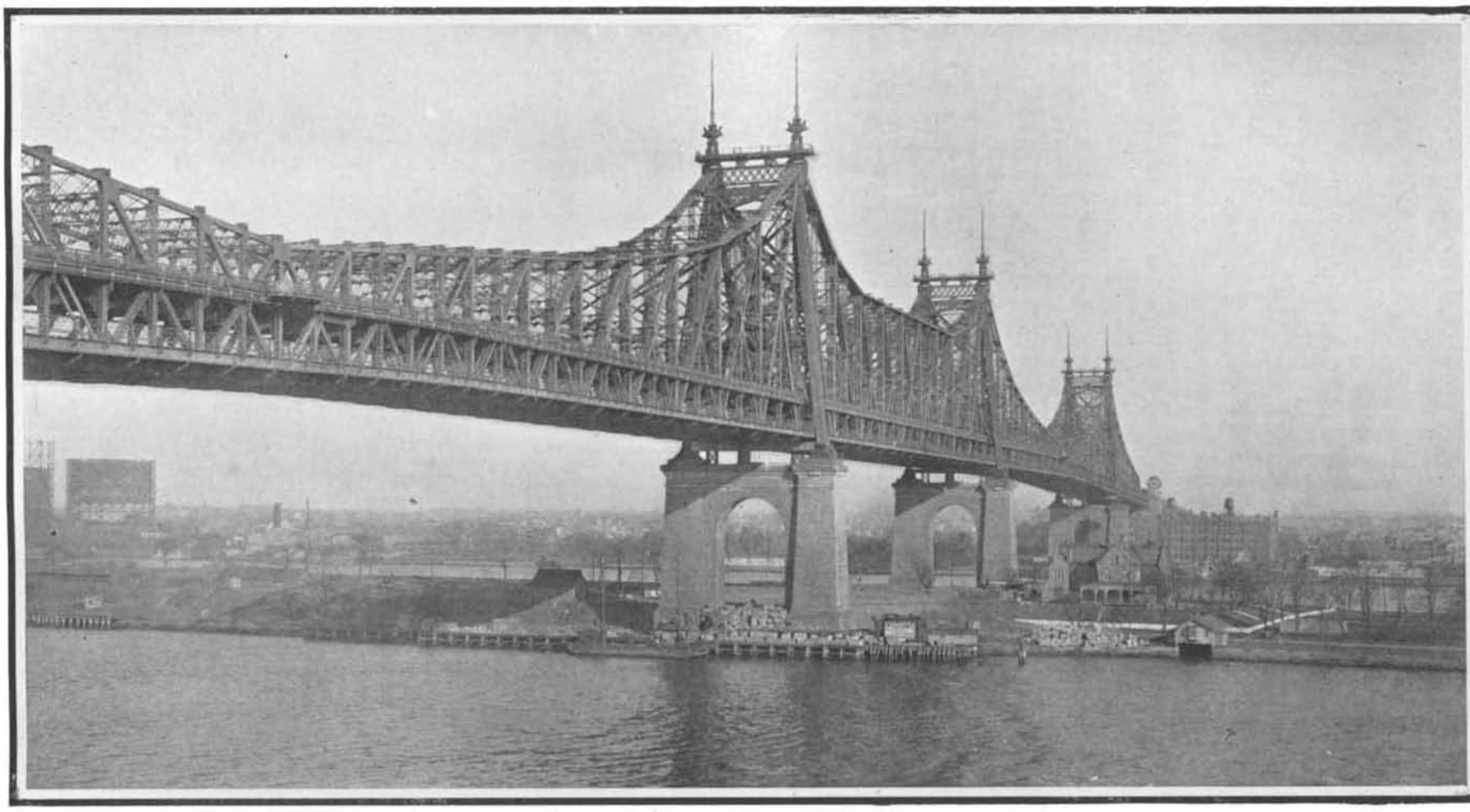

Total length, 8,600 feet. Total weight of cantilevers, 52,000 tons. Contains two main spans of 1,182 and 984 feet. Cost, $20,000,000.

The Queensboro cantilever bridge, opened for service March 30th, 1909.

The upward curve of the completed roadway is due to the partial loading of the cables, which are depressed near the towers and raised at the center. When the floor is completed it will lie in a true curve.

Building the suspended roadway of the Manhattan bridge.

THE QUEENSBORO AND MANHATTAN BRIDGES ACROSS THE EAST RIVER.—[See page 281.]

feet. The maximum depth of the trusses at the towers is 185 feet; and the bridge is 88 feet wide over all. Originally planned to carry a maximum congested live loading of 12,600 pounds to the foot, it was subsequently decided to add two additional elevated railroad tracks on the upper deck, and the congested loading was raised to 16,000 pounds to the foot. Anxiety regarding the structure, due to the fall of the Quebec Bridge, led to an investigation of its design, which showed that if it were completed on the amended plans, some of the members would be overstressed by from 25 to over 47 per cent. To bring the stresses down to a safe limit, the two additional tracks of the upper deck have been removed, and other heavy material has been taken out of the bridge. Furthermore, the traffic will be run under strict police supervision, to prevent the accumulation of congested live load. The compression members and floor system of the bridge are built of ordinary commercial structural steel and the eye bars and tension members of nickel steel. The bridge was built by the overhang system, and in the whole cantilever structure, from abutment to abutment, there has been worked in a total of 52,000 tons of steel. There is provision for four trolley tracks and one 34-foot roadway on the lower deck, and two rapid transit tracks and two 14-foot footwalks on the upper deck. The total cost was $20,000,000 and it has taken about seven years to build.

CONSTRUCTING THE MANHATTAN BRIDGE.

The work of completing the Manhattan suspension bridge, which is located about a quarter of a mile to the east of the Brooklyn Bridge, is progressing so rapidly that it will probably be completed by the close of the present year. In respect of its weight, strength, and carrying capacity, this is considerably the most important of the long-span suspension bridges. The length of the main span is 1,470 feet; the side spans are each 725 feet in length; and the total length of the bridge, including the approaches, is 6,855 feet. The width of the roadway over all is 120 feet. The towers extend 322 feet above mean tide water. Traffic will be carried upon two decks, and the bridge will accommodate four rapid transit tracks, four surface tracks, one 35-foot roadway, and two 11-foot footwalks. Construction work was commenced in 1901, and, as we have said, it will be completed toward the close of 1909.

One feature of the Manhattan Bridge which has attracted much attention and called for considerable comment is the apparently light construction, and the certainly light appearance of the towers. This is noticeable if they are compared with the massive masonry towers of the adjoining Brooklyn Bridge, or the bulky and very inartistic towers of the Williamsburg Bridge farther up the river. As a matter of fact, the Manhattan Bridge towers are of particularly strong and stiff construction. The weight is carried on four closed, plate-steel, box columns, which rise uninterruptedly from base to top. They are built of heavy plating, upon the cellular system, heavy transverse diaphragms running throughout the full height of each tower, and assisting to give the required amount of cross sectional area of steel and the necessary stiffness, to prevent distortion by buckling under the heavy loads imposed. To preserve the four legs in the true vertical position and resist all tendency to displacement by wind pressure, the whole of which on the full length of the bridge will be communicated to and must be resisted by the towers, each pair of legs is heavily braced together by transverse trussing. In addition to this, each pair of legs, as thus braced, is strongly tied together at the top, at the mid-height, and at the level of the floor system by massive trussing and knee bracing.

The great weight and capacity of the bridge is shown by the large size of the cables, which are 21¼ inches in diameter, as against 18¾ inches in the Williamsburg Bridge and 15¾ inches in the Brooklyn Bridge. The cross sectional area of each cable is 353 inches for the Manhattan cable; 275 inches for the Williamsburg cable, and 196 square inches for the Brooklyn cable; so that the four Manhattan cables, in view of the superior quality of steel of which the wires are made, have over double the carrying capacity of those of the Brooklyn Bridge.

The accompanying photographs showing the erection of the floor of the bridge speak for themselves. The floor beams, stringers, and chord sections are brought by barge to the masonry piers on which the towers stand; hoisted up to the floor level; and run out on trolleys to the end of the finished work, where they are picked up by erecting derricks, swung out into place, and bolted to the suspenders. The suspenders are hung in sets of four from cast steel saddles which are clamped to the cables overhead. At the end of each cable is a hollow threaded length of bolt, with a large nut for adjusting and carrying the floor system. The bridge is stiffened by four longitudinal trusses, 45 feet in depth, which extend continuously from anchorage to anchorage. These trusses lie in the same vertical planes as the main cables, and at each panel point they are hung from the cables by means of the four suspended cables above mentioned, the latter passing down below the bottom chord, and the proper adjustment of level being obtained by means of the threaded bolts and nuts. One of the illustrations shows a section of the bottom chord of the trusses being swung out and adjusted in place. Another view shows the intersection of the transverse floor beams with the longitudinal chord sections, and also the stringers which run longitudinally between the floor beams. The whole of this work is unusually heavy and strong.

Attention is drawn to the fact that in the photograph on the front page showing the whole of the bridge, the floor already built in place is curved in the opposite direction to that which it will assume when the span is completed. This is due to the fact that the cable, being flexible, is pulled down below the catenary curve in that portion of it on which the load is hung, and straightened out and pulled above the curve in the unloaded portion in the center of the span. When the whole of the floor is built in place it will assume the graceful curve of equilibrium for which it was designed.

A LIFE PRESERVER FOR BALLOONISTS.

BY DR. ALFRED GRADENWITZ.

Because of the remarkably rapid advance made of recent years in the conquest of the air, the adoption of proper safeguards against drowning has become imperative. In recent balloon races aeronauts were

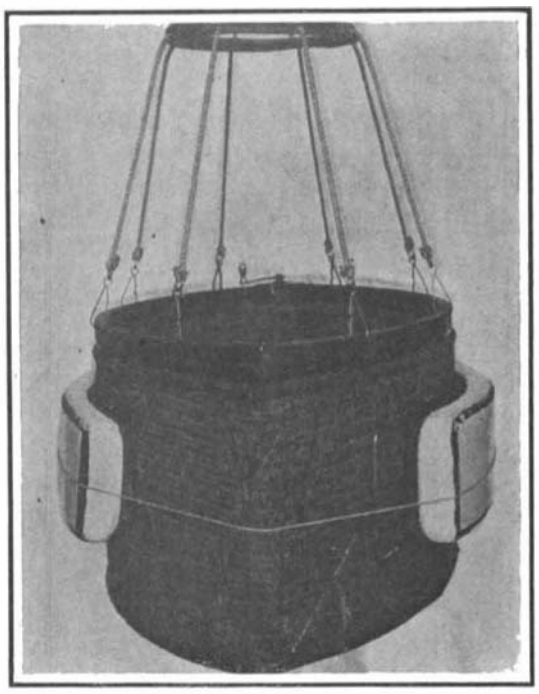

Fig. 1.—Car attached to balloon and floats held to its side wall.

deceived by fog and alighted on water. Only extraordinary skill and good luck saved them. Hence a competition for floating balloon baskets was instituted recently by the vice-president of the French Aero Club. As a makeshift German aeronauts have coated their baskets with cork. If a car so protected were to drop into the sea, the aeronaut would be compelled to stand in the water up to his hips, his safety being assured only as long as the lifting power of the gas sufficed to hold the car above water.

A really practical floating balloon-basket would be of oblong shape, the ratio of its length to the width being 2 to 1. It should consist of two substantial strata of wickerwork fastened together and having between them an intermediary layer of impervious material. A basket thus constructed would not leak.

This design has been adopted by Mr. G. Kretschmer of Berlin for the balloon car illustrated in Figs. 1 and 2. The car is made up of two light wickerwork baskets separated by an intermediary layer of

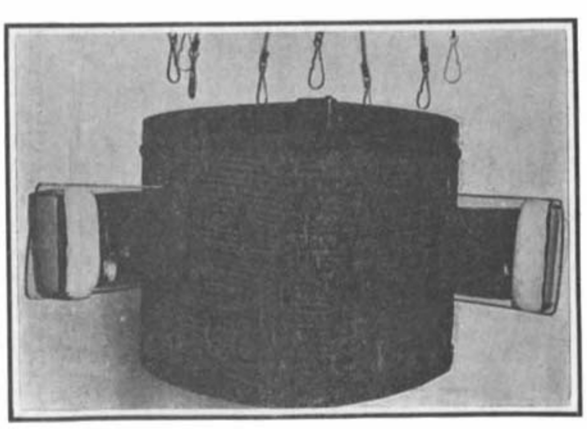

Fig. 2.—Car disconnected from balloon and floats thrown out.

A LIFE PRESERVER FOR BALLOONISTS.

some impervious material. The upper metallic rim of the car is provided with fastening devices to which the ropes running up to the gas bag are attached. The car can be cast loose from the balloon by rotating the metallic rim and releasing the fastening devices at the very moment the car touches the water.

Around the outside of the car are placed two semicircular floats of wood and waterproof cloth. Normally these floats are tied to the basket, as shown in Fig. 1. They are, however, provided with suitable extensible brackets and springs, so that, as soon as the rope is cut, they are instantly extended, as shown in Fig. 2. There is also a special device for automatically inflating the cloth half of each semicircular float and for hermetically sealing the flexible air tubes extending from these to the basket. The safety of this new type of basket is primarily due to the release of the suspension ropes at one time. If they were cut off successively as usual, the unequal strain on the car might capsize it.

AERONAUTICAL NOTES.

A short time ago a proposition was made by the proprietor of a Paris hostelry to have an alighting place for aeroplanes upon the roof of his hotel. The proprietor of the Hotel Astor, New York, is considering doing the same thing with the roof of his hotel. About 60,000 square feet of surface are available for this purpose.

Austria and Italy have lately taken up the construction of dirigible balloons for military purposes. The former country will have two sizes, one having a capacity of 1,500 cubic meters (52,972 cubic feet), and the other of 2,500 (88,287 cubic feet). Both are of the semi-rigid type constructed upon the designs of Dr. Raymond Nimfuhr, who is at present constructing models. Italy has ordered the construction of nearly a dozen airships similar to the successful dirigible built last year by Messrs. Croco and Ricaldoni. Russia has purchased the large Clement-Bayard dirigible and will probably order more airships of this type in the near future.

The latest prize for aeroplanes to be offered in America is $100 for the machine which covers a distance of 500 meters in the shortest time at the Morris Park race track of the Aeronautic Society, during the present year. The donor of this prize is Mr. Albert C. Triaca. In Germany the Opel firm has recently given $5,000 as a prize to be won by the first German aviator who flies from Frankfort to Russelsheim and back (about 25 miles) at any time during the Frankfort Aeronautical Exhibition which is to be held at Frankfort from June until October. Count Zeppelin is at the present time constructing a second new airship which is to be stationed at Frankfort during the exhibition, and is to be used for carrying passengers on sightseeing flights to different parts of Germany.

The first use this season of the Aeronautic Society's grounds at Morris Park will probably be made by the promoters of the automobile carnival, which is to be held in New York city the last week in April. It is proposed to hold an automobile gymkhana at the park on either the 24th or the 29th instant, and if possible to have an aeronautical demonstration of some kind also at the same time. The Aeronautic Society expects to have its first 1909 exhibition and mechanical flight demonstration as soon thereafter as possible—probably about the middle of May. At this time Glenn H. Curtiss—the first winner of the Scientific American Trophy—will make flights with the new aeroplane he is building for the society. In order to have as complete an exhibit as possible of aeronautic development in America, the Society will be glad to hear from anyone who has a flying machine developed far enough to make demonstrations, or who has anything novel or interesting to exhibit. Communications should be addressed to the secretary, Aeronautic Society, Morris Park, Westchester, New York.

A Novel Automobile Transmission.

The novel friction-cone transmission described in the article on the buggy-type automobile in our March 20th issue was wrongly ascribed to the Simplo car. We take this opportunity of correcting the error and of stating that the transmission in question is patented by A. B. Cole and is used on the cars of the A. B. C. Motor Vehicle Manufacturing Company, of St. Louis, Mo., exclusively.

Every driver should learn to start and stop a car slowly and deliberately, and to negotiate curves and corners with care. The desire to develop top speed immediately after starting the motor, the lack of foresight which necessitates the urgent application of the emergency brakes, and the wish to cover ground rapidly irrespective of the kind of road, do more damage in racking the car and destroying tires than all the other abuses to which the average car is subjected.