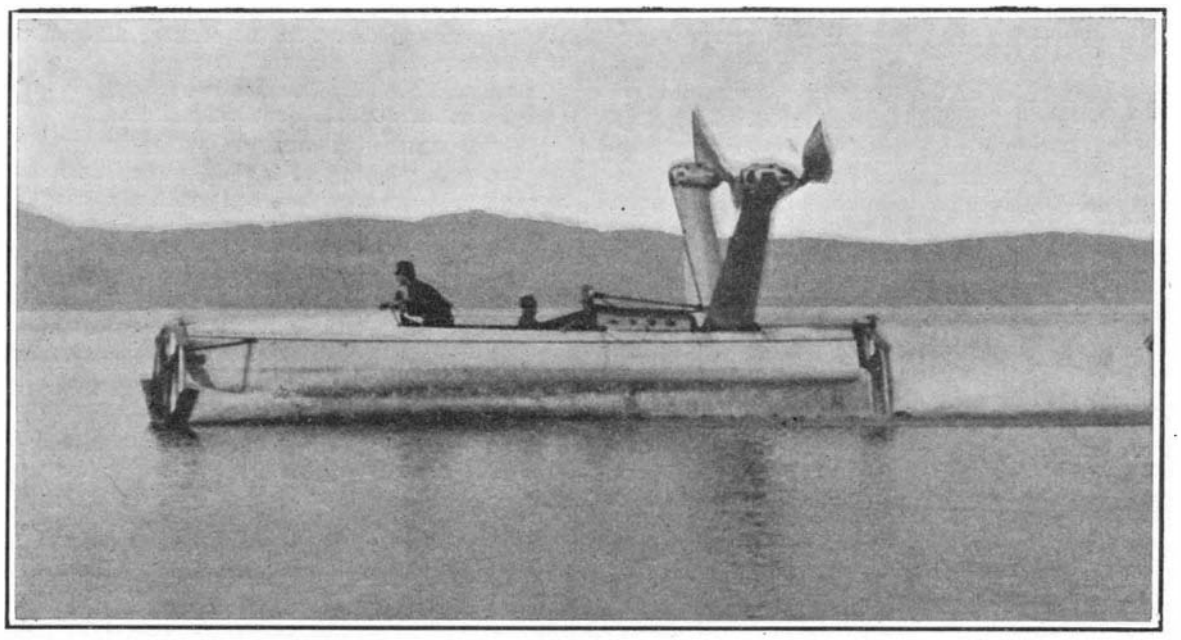
A NEW HYDROPLANE BOAT.

Our illustration shows a remarkable photograph of a new hydroplane boat, which was first experimented with successfully on Lake Bracciano, near Rome, Italy, on the 22d of last month. This boat was designed and built by Messrs. Crocco and Ricaldoni, of the Brigata Specialisti, Rome. It is fitted with two V-shaped fins at the bow and stern, respectively, in accordance with a patent issued to an Englishman named Thompson, and modified somewhat by the present experimenters. The boat is fitted with an 80 to 100 horse-power gasoline motor, which drives two air propellers that propelled the boat first through and then above the surface of the water, as can be seen from the photograph. The weight of the boat complete with two men on board is 1,500 kilogrammes (3,300 pounds), and it is to attain a speed of about 40 miles an hour, although the inventors do not state the speed actually attained thus far.



An 80 H. P. Hydroplane Boat Driven by Air Propellers.

THE MOST POWERFUL EXPRESS LOCOMOTIVE EVER BUILT.

The truly enormous express locomotive shown in the accompanying illustration represents the latest effort of one of our leading railroads to keep pace with the ever-growing demands of its express passenger service. This company has just received the new locomotive from the shops, and placed it in trial service, in the hope that it will prove equal to the task of handling in one train passenger trains which otherwise must be run in two sections several minutes apart, or else handled by "double-heading," that is, coupling up two locomotives at the head of a train.

The most powerful Pennsylvania standard express engines at present in service are themselves heavy and powerful machines, with cylinders 22 inches diameter by 26 inches stroke, which, on divisions having heavy grades, are capable of successfully handling trains made up of eight Pullman cars. But the passenger traffic has increased so rapidly that ten or twelve car trains are not unusual. The capacity of the Atlantic type, with four-coupled drivers, could not be increased sufficiently to meet the demands without adding considerably to the weight on the drivers. To gain the required capacity, therefore, it was found necessary to add another pair of drivers, and adopt what is known as the Pacific type of locomotive, in which the total necessary adhesive weight was realized without exceeding a load of 60,000 pounds on any one pair of drivers.

The dimensions of the new locomotive greatly exceed anything hitherto built, or that would have been considered possible a few years ago. We all remember the great interest which engine No. 999, built especially for hauling the Empire State express of the New York Central Railroad, excited when she was exhibited at the Chicago World's Fair. Yet, to-day it would take two of such engines coupled together to do the work that can be performed by the new Pennsylvania engine; for the latter locomotive, with water in its boiler and in running condition, weighs 134.6 tons; its tender when loaded with 11 tons of coal and 7 tons of water, weighs 70 tons, making a total for the engine and tender of 204.6 American tons, or 409,200 pounds.

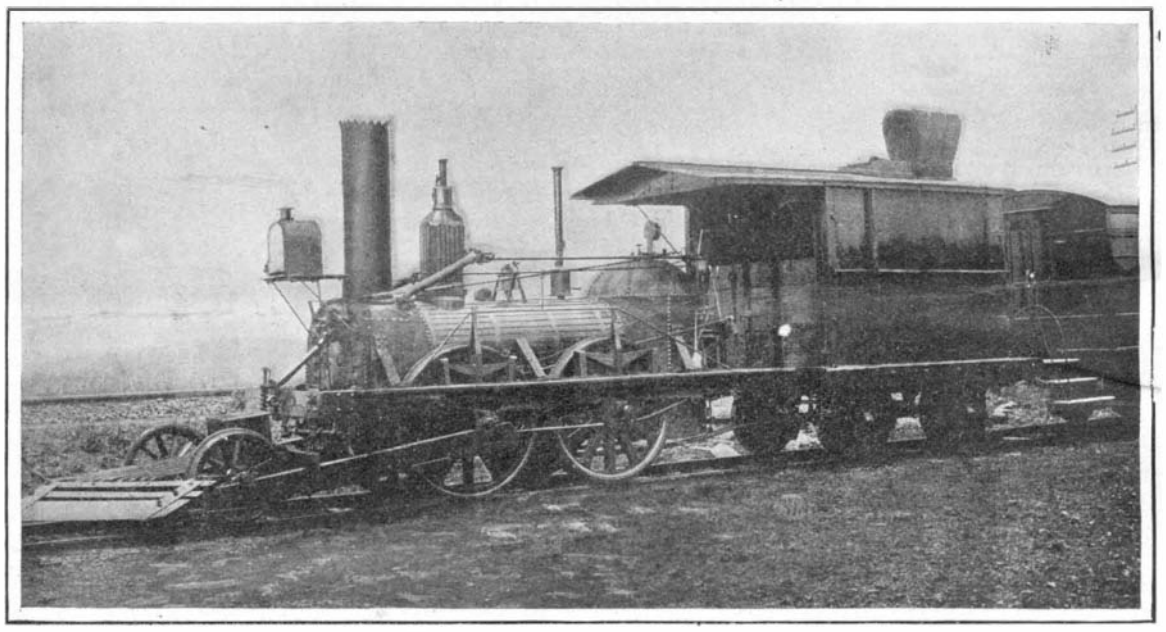
COMPARISON OF THE FIRST AND LATEST LOCOMOTIVE OF THE PENNSYLVANIA RAILROAD.

	John Bull.	Pacific Type.
Date	1831.	1907.
Weight	10 tons.	134.6 tons.
Boiler diameter	3 ft. 6 ins.	6 ft. 7¾ ins.
Total heating surface	249 sq. ft.	4,322 sq. ft.
Diameter of cylinders	9 ins.	24 ins.
Stroke of cylinders	20 ins.	26 ins.
Volume of cylinders	1,273 cu. ins.	11,378 cu. ins.

In order that the great power of the locomotive might be available at fairly high speeds, the drivers were made 80 inches in diameter, which is the same as that of the Atlantic type. The cylinders are 24 inches in diameter by 26 inches stroke, and the piston valves, which are operated by the Walschaert gear, are themselves 16 inches in diameter. The valve gear, which has been carefully designed with a view to bringing its working parts into one plane, is provided with a special supporting frame outside of the link. This frame will be observed in the accompanying view of the engine.

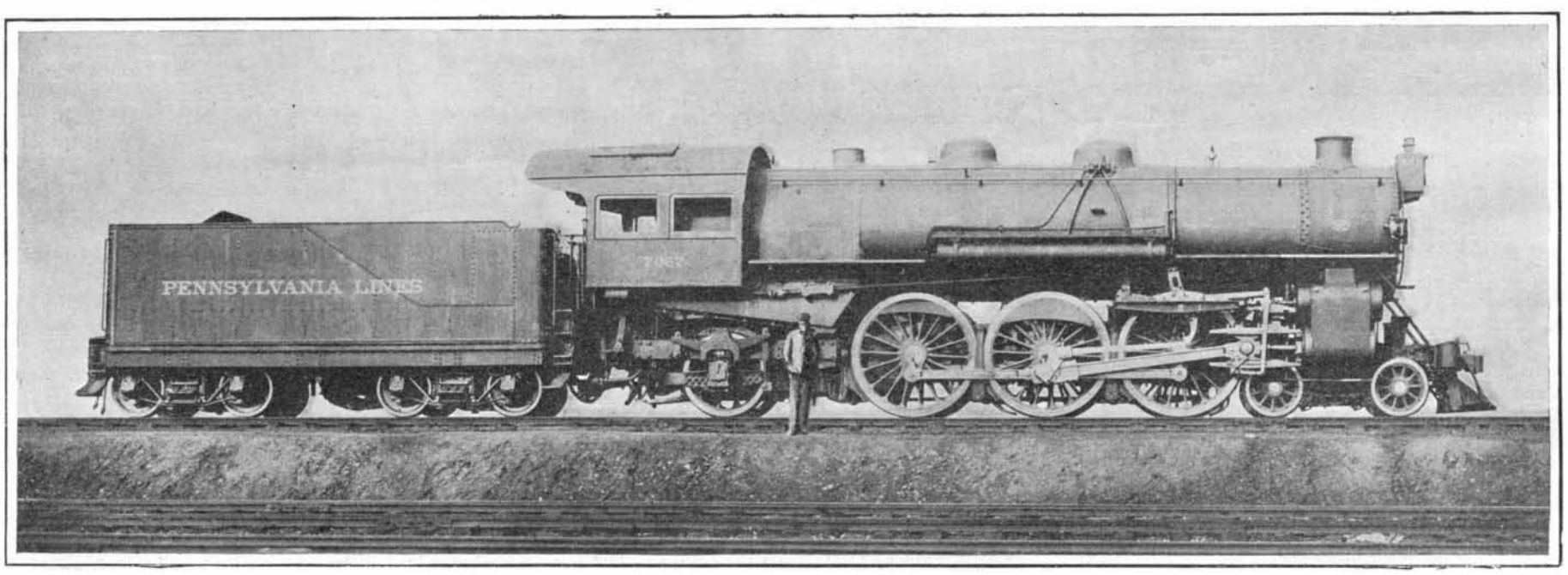
It will readily be understood that to supply sufficient steam for cylinders of this great capacity, an unusually large boiler was necessary. To begin with, the tubes, which are 2¼ inches in diameter, are 6 feet longer than those of the Atlantic type, or 21 feet over all; and of these there are 343 whose combined heating surface is 4,117 square feet. As there are 205 square feet in the firebox, the total heating surface reaches the enormous area of 4,322 square feet. The coal is burned on a grate whose area is 61.8 square feet. The maximum diameter of the barrel of the boiler is 79¾ inches, so that a man six feet tall could walk through the boiler shell, and yet clear the top of it by over half a foot. The maximum tractive power is 31,000 pounds or 15½ tons.

(*Continued on page* 530.)



Cylinders, 9 inches diameter by 20 inches stroke. Total heating surface, 249 square feet. Weight, 10 tons.

The "John Bull"; Built in 1831.



Cylinders, 24 inches diameter by 26 inches stroke. Total heating surface, 4,322 square feet. Weight, engine alone, 134.6 tons.

New Locomotive for Heavy Express Service.

THE FIRST AND LATEST LOCOMOTIVES OF THE PENNSYLVANIA RAILROAD.

ever had the honor to own, classified these abnormal sound aberrations as follows:

1. The audibility of a sound at a distance, and its inaudibility nearer the source of sound.

2. The inaudibility of a sound at a given distance in one direction, while a lesser sound is heard at the same distance in another direction.

3. The audibility at one time at a distance of several miles, while at another the sound can not be heard more than a fifth of the same distance.

4. While the sound is generally heard farther with the wind than against it, in some instances the reverse is the case.

5. The sudden loss of sound in passing from one locality to another in the same vicinity, the distance of the source of sound being the same.

Now, then, the problem can be stated as follows:

To invent or discover a sound-producing apparatus, no more complicated or expensive, or but slightly more so, than those in use, which will be heard uniformly at uniform distances, exception being made in favor of sounds swept away by a heavy wind; or to invent or discover a means of improving present fog signals, as a resonator or reflector, which will so amplify, direct, reflect, or otherwise project the sound that it will not be subject to the aberrations above described, saving that caused by a heavy wind. There is a wide market ready for the invention which solves this problem. In October, 1906, there were four hundred and fifty fog signals in the United States, operated by machinery, not including two hundred and thirty-four whistling and bell buoys. Then there are some thousands of vessels, all with fog signals, not belonging to the United States, and sixty lightships, the fog signals of which are supposed to be as reliable as can be made.

But the problem has another side. It is not enough to warn the mariner of a danger, or point out the course, by a sound; it is necessary to provide him with a means of finding the direction of the sound. Can you locate a cricket?

In a fog the sound seems to come from all directions, unless it is right on top of the vessel, and then the inevitable collision results. The very fact that in spite of warning apparatus of the greatest power collisions frequently occur, shows that some method is needed to definitely locate a sound.

Some vessels now carry a sound-receiving apparatus, consisting of a telephone and microphone immersed in wells in the ship connecting with the water outside, and designed to hear under-water vibrations. There is now an under-water bell on lightships, put overboard in a fog, designed to warn ships so equipped. It is hoped that in time apparatus will be designed by which the sound's direction can be recognized by turning the telephone receiver this way and that until the direction is ascertained by the loudness of the sound. A similar idea is in the invention of Prof. Mayer's "topophone," in which the sound wave is defined by means of resonators. But the apparatus requires the resonators to be attuned to the source of sound and an undistorted sound wave, and is not yet practicable.

The accompanying illustrations show some of the sound signal apparatus now in use. The Daboll trumpets are blown by compressed air, the power being furnished by an oil engine. One of the illustrations shows the interior of a typical first-order siren station. Although an ear-splitting sound may be produced from this steel throat, capable of carrying thirty miles under favorable conditions, the sound may be inaudible just when it is most needed, due to the causes suggested in the first part of this paper.

THE MOST POWERFUL EXPRESS LOCOMOTIVE EVER BUILT.

(*Continued from page* 528.)

By the courtesy of the Pennsylvania Railroad Company, we present, for comparison with their latest locomotive, a photograph of a diminutive engine, which has the distinction of having been the first to haul a train over the lines now owned by this company. The smaller engraving represents the celebrated "John Bull," which is now in the National Museum at Washington. It was the first engine used on the Camden & Amboy Railroad, which is now a part of the Pennsylvania system; and it was built in England in 1830 by Stephenson & Co., of Newcastle-on-Tyne, to the order of Robert L. Stevens, president of the railroad. It reached Bordentown, N. J., in August, 1831. The engine was originally named "Stevens," but on its arrival in this country the railroad company renamed it "John Bull." It was put in service November 12, 1831, at Bordentown, N. J., at the place where the Railroad Monument now stands.

The leading dimensions are as follows: Weight about 10 tons; boiler, 3 feet 6 inches diameter; cylinders, 9 inches diameter by 20 inches stroke. Four coupled wheels 4 feet 6 inches diameter, with cast-iron hubs and locust wood spokes and felloes. Tires of wrought iron ¾ inch thick; sixty-two tubes, 7 feet 6 inches long by 2 inches diameter. Furnace 3 feet 7 inches long by 3 feet 2 inches high (for burning wood). Heating surface of tubes, 213 square feet; of firebox, 36 square feet. Total heating surface, 249 square feet. The firebox was of the dome or Bury pattern. The reversing gear was complicated, the two eccentrics being secured to a sleeve or barrel, which fitted loosely on the crank shaft.

Soon after the engine arrived, the Camden & Amboy mechanics made the following changes and additions: As the railroad curves were very sharp, the coupling rods and cranks were removed and a lateral play of 1½ inches given to the leading axle, to which a cow-catcher was connected. The wooden wheels were replaced by cast-iron wheels. The dome was moved forward to the former manhole and the boiler lagged with wood. A bell was placed on the boiler and a headlight on the smokebox. A new tender was subsequently built, having a small cab on the rear for the accommodation of a brakeman, who, if anything went wrong with the cars, could signal the engine driver to stop. A cab and a large wood-burning chimney were subsequently added, but both these were removed some time before the engine was placed in the United States National Museum.

According to Mr. Herbert T. Walker, a well-known authority on locomotive history, this was the first engine equipped with a bell, headlight, and cowcatcher, although bells were used on English locomotives as far back as 1827.

This remarkable locomotive was exhibited at the Philadelphia Exposition of 1876, and again at the Chicago Exposition of Railway Appliances in 1883, and lastly, at the Columbian Exposition of 1893. Leaving New York city under steam April 17, 1893, it hauled "the John Bull train" of two cars 912 miles, without assistance, to Chicago, arriving April 22, and meeting with a continued ovation over the entire route. It formed part of the Pennsylvania Railroad's Company's exhibit, and was one of the great attractions of the World's Fair, carrying over fifty thousand passengers over the exhibition tracks in the terminal station yard. The engine left Chicago again under steam December 5, 1893, coming east over the Pennsylvania lines *via* the Southwest system to Pittsburg, and through Altoona, Harrisburg, and Baltimore to Washington, arriving there December 13, 1893. This was a very good performance for a locomotive sixty-two years of age. It was then returned to the museum at Washington, where it will remain permanently.

THE MAGNITUDE OF VICTORIA FALLS.

Oozing out of a black, boggy depression in the heart of Southern Africa is a sluggish, muddy stream which wends its way southward, very leisurely at first, but it soon grows rapidly in size and strength until it pours into the Indian Ocean, 1,650 miles away, fourth in rank among the mighty rivers of Africa. About 700 miles from its source, and just beyond the cataracts of Mololo, the Zambesi, joined by the waters of the Kwando River, spreads out into what might be termed a lake about six miles long and over a mile in width. This lake is studded with islands and the surface is very smooth, the vegetation along the banks being perfectly mirrored in the placid water. Strange to say, the lower end of this lake is marked not by a shore line nor by the slightest narrowing of its surface, but by an abrupt fall beside which our much-vaunted Niagara is a mere pygmy. It is an entire lake that takes the plunge, and not merely a river.

A comparison of Niagara and Victoria Falls is pictured in the front-page illustration, which shows at a glance how vastly greater is the African falls. At Niagara the river takes a plunge of 168 feet, but the Zambesi falls sheer 400 feet. The crest of Victoria Falls is over a mile long—5,808 feet, to be exact—whereas the American Fall at Niagara measures but 1,060 feet, and the Horseshoe Fall is only 1,230 feet across, or 3,010 feet as measured along the curve. To illustrate the magnitude of the African waterfall, we have depicted against it the skyline of New York from Battery Park to Worth Street. Not a building projects above the crest of the falls excepting only the tower of the Singer Building, which is now in process of erection. To be sure, in comparing Niagara with Victoria, it must be said in favor of the former that the Horseshoe Fall presents an unbroken crest, while the edge of the Victoria is divided by numerous islands into stretches which nowhere exceed 600 feet. At the center is Livingstone Island, and to the left, as you look up stream, is the main fall, while at the right of the island is the Rainbow Fall. Buka Island separates the main fall from the Cascade or Devil's Creek.

Fully as remarkable as the falls themselves is the peculiar formation of the chasm into which the waters pour. Facing the falls, and separated from it by a space of less than 300 feet in width, is a vertical wall of rock presenting a barrier to the flow of water which is unbroken except for a gorge near the center a little over 300 feet wide. It seems as if this wall, which at one time undoubtedly formed the lower terminal of the lake, had been moved bodily back by some giant hand, leaving a deep, narrow fissure into which the waters of the lake fall. Since there is but one outlet from this fissure, and that only 300 feet wide, the depth of water in the gorge must be exceedingly great. The peculiar geological formation may be said to cause the lake or river to flow first on end over the falls, and then on edge through the gorge.

The water pours into the fissure amid clouds of spray, with a deafening roar which may be heard for miles. This has given rise to its native name, Mosi-oa-Tounya, or the Thunder Sounding Smoke. For the same reason Niagara was called by the aborigines the Abode of the Spirit of Thunder. Bearing out the belief of the red man, his pale-faced brother has succeeded in drawing the lightning from this Thunder Spirit. Similarly, the white man expects soon to draw the fire from the Thunder Sounding Smoke, and use it to operate the machinery of the Rand gold fields. In keeping with the size of this giant waterfall, as outlined in the Scientific American of December 22, 1906, the Victoria power station, when completed, will have an output of 250,000 horse-power at the enormous pressure of 150,000 volts, and will transmit its power 600 miles, or nearly three times as far as any system now in operation.

The Sealed Bonnet Contest of the Automobile Club of America.

What proved to be one of the most interesting as well as successful automobile competitions ever held in the vicinity of New York city was that conducted by the Automobile Club of America during the last four days of last week, and which was known as a "Sealed Bonnet Contest."

In this contest the bonnets, radiators, gear boxes, tools, etc., were sealed and were not allowed to be touched throughout the total distance of 600 miles, which was covered in daily runs out and back of 150 miles each. The first and last day's runs were to Patchogue, L. I., and those on the second and third days were to Danbury and West Haven, Conn., respectively. Almost the total distance was over macadamized roads, but as the contestants were favored with fair weather, this made no particular difference.

No less than 47 cars started in the test on Wednesday, June 19, and 42 of these finished with a perfect score on the afternoon of Saturday, June 22. A Stoddard-Dayton runabout, entered by a private owner, dropped out the first day, owing to the replacing of the nut which holds on the steering wheel. The second day's run was completed with the loss of but one more contestant—the Columbia gasoline-electric touring car—which was obliged to open its bonnet in order to replace a broken valve spring. Three contestants were arrested for speeding at Mt. Kisko by a constable with a rope which he stretched across the road. In view of the fact that the club stationed men with flags at the entrance and exit of each village, thus cautioning the contestants to obey the speed limit under penalty of disqualification if they did not, this attempt to mulct the autoists by the Mt. Kisko authorities should not be passed over lightly. No competition of this character more devoid of racing has ever been held, and the Club will doubtless not allow the constable and justice of the village in question to put upon the contestants the stigma of speeding because of some very slight technical violation.

The cars were divided into three classes according to price. The price limits of these classes were: Class A, $3,000 and over; class B, $1,500 to $3,000; class C, $1,500 and under. Runabouts in class A were required to cover 175 miles a day instead of 150. The average speeds required of the three classes were 17, 15, and 13 miles an hour respectively.

All stops were recorded, and the length of each stop was added to the running time. Tire repairs were the only repairs permissible, and the time taken in making these had to be added to the running time of the cars. A notable feature of the various runs was the fact that there was little or no tire trouble; only two or three cars each day were delayed on this account. The fact that the runs were made over first-class macadamized roads doubtless accounts for the lack of tire trouble. Nevertheless, it is quite remarkable that out of nearly half a hundred cars of all sizes and weights, there should be such a small percentage delayed on account of tires in a series of runs aggregating 600 miles in length.

Altogether there were thirty-seven touring cars and ten runabouts engaged in the competition. Among these were an Aerocar, two American Mors, two Berliets, three Corbins, one Continental, one Columbia, two Darracqs, one Deere, one DeLuxe, an Elmore, a Glide, a Haynes, a Jackson, two Knoxes, four Locomobiles, two Loziers, two Mathesons, two Maxwells, three Moras, an Oldsmobile, a Pierce-Arrow, a Pope-Hartford, a Pope-Toledo, a Royal Tourist, a Rolls-Royce, three Stoddard-Daytons, one Studebaker, a Welch, and two Whites.

It is certainly remarkable that so many standard machines of both domestic and foreign manufacture were able to go through so severe a test with a perfect score; and their performance in this test should do much to influence intending purchasers, who have had