weight of the car fully equipped, including the propellers, gasoline for the motor and water supply, was about 852 pounds. The airship had two guide ropes, whose position will be observed. The heavier of these was attached forward the front of the balloon, while the lighter rope was suspended from the framework.

Most of the Parisian experts agree that this aeronautical tragedy was due to De Bradsky himself. One expert claimed that the ascensional screw was at fault, the perturbing influence of which would have sufficed to paralyze both the propelling screw and the rudder, even if the motor had been strong enough to resist the light breeze from the southwest. The ascensional screw turned vertically under the car at the rate previously mentioned, and caused the airship to swing around at the rate of one turn per minute. Under these circumstances the propelling screw and rudder were powerless. From the Place de l'Opéra it was plainly visible that under the influence of this horizontal screw the axis of the balloon, obliged to turn by the resistance of the air, ceased to be parallel with the axis of the car, and in consequence the steel wires which fastened the car to the balloon were subjected to a torsional strain which they could not withstand. When the balloon was completely inflated, and the network of the steel wires completely stretched, little danger was to be anticipated. But when the balloon lost gas and its silk envelope became flabby, the steel wires from which the car was suspended were subjected to unequal strains and were easily enough twisted and broken one after another at the point at which they were fastened near the gas bag. Lachambre, the constructor of the airship, states that he had no confidence in the mechanical construction of the airship. Nevertheless, he says that the balloon had points of merit and marked a real progress in airship design. The defects were that the car was too light and that the motor and guiding screw were too weak, in Lachambre's opinion.

The army rifle competition held at Fort Sheridan, shows that the scores made this year have never been exceeded except during 1892 and 1893.

NEW YORK-BOSTON AUTOMOBILE RELIABILITY TEST.

BY THE SCIENTIFIC AMERICAN'S OFFICIAL OBSERVER.

After six days of dusty traveling, sixty-eight out of seventy-five automobiles that left New York on October 9 arrived again at the starting point at 4 P. M. on Wednesday, the 15th, some twenty without having made any stops other than those on the schedule, and the rest with but one or two stops and very few breakdowns. Although the roads and weather conditions were much better than those encountered last year in the New York-Rochester test, this alone does not explain the much better showing recently made by the automobiles. In the former test, but 50 per cent of the vehicles that started finished; in the present one less than 10 per cent failed to do so. This large increase of successful contestants is the direct result of improvements in American machines.

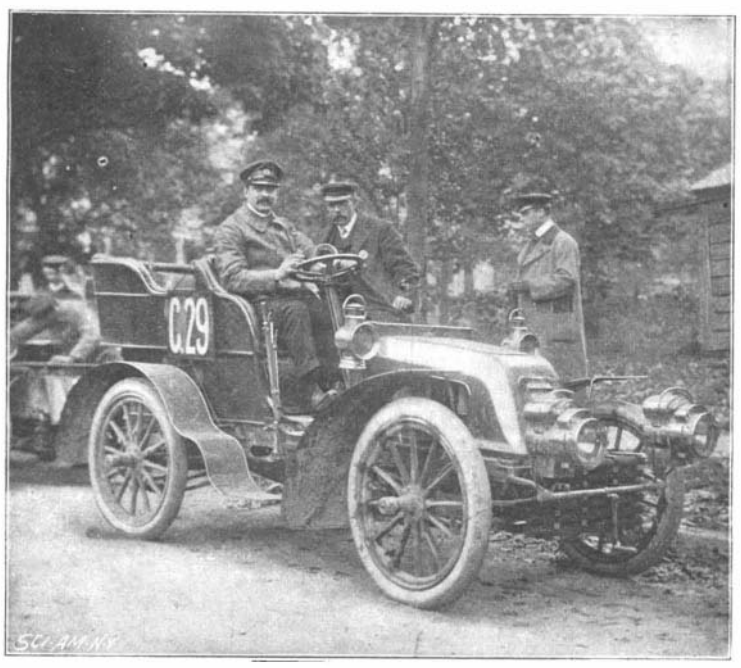
The breakdown that occurred on the Knox machine at the beginning of the second day's run, as noted in our last issue, was repaired by the operator and observer with the aid of one local assistant, and, after six hours' delay, a second start was made from New Haven shortly after 6 P. M. Hartford, 42 miles distant, was reached in three hours, which was the schedule time; and Springfield, the terminus of the day's journey, was entered at the end of a two and one-quarter hours' run, just after midnight. The next morning at 9 o'clock this machine started with the others, and had no further stops or mishaps throughout the rest of the tour. The other two Knox cars, which were new, had no trouble whatever. The test has therefore demonstrated once more that the single-cylinder air-cooled motor of as much as 8 horse power is a success; and that larger waterless gasoline motors can be built by simply increasing the number of cylinders, is a natural deduction. Another car driven by an air-cooled motor was the Franklin, which weighs 1,125 pounds, and was equipped with a quadruple-cylinder, 8 horse power motor of the ordinary flange type. This motor also made a very creditable performance, and brought the vehicle through with but one penalized stop. It was the only other representative of the air-cooled class of motors in the test.

Among the new gasoline cars that had but little trouble on the journey was Mr. A. L. Riker's tonneau machine, which we illustrate. Its only accident was the breaking of four bolts in the differential gear, just after entering the Hartford control on the homeward trip. This necessitated a delay of four hours to obtain some new ones, after which the machine proceeded to New Haven without any other delays. The car behaved remarkably well for a new one. It has several novel features which we hope to illustrate later. The percentage of steam carriages that participated in the trial was quite small; but most of the machines of this type made a very creditable performance. There were five White carriages entered, four of which are believed to have made no penalized stops. These are shown in one of our illustrations. The condenser fitted on the front of each carriage gives it a radius of 150 miles with one filling of water. The advantages of the steam carriages for mounting hills were clearly shown, and their running on the level was smooth and even. The Stearns stanhope we also depict is another steam car that is said to have made a perfect score. It was about the only machine equipped with tubular steel wheels, most of the others having wheels of wire or wood.

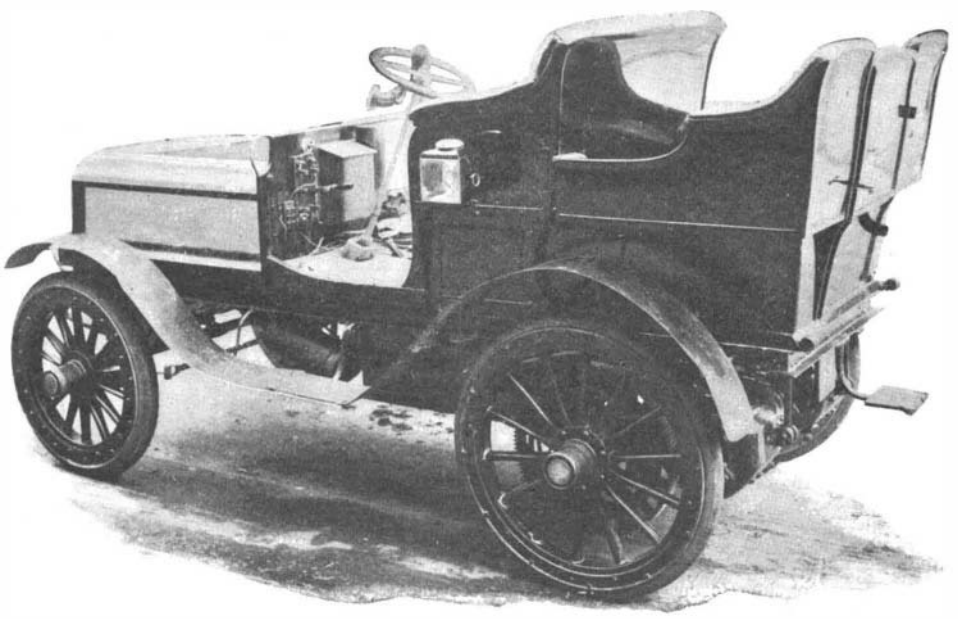
A touring car of decided novelty is seen in the lower right-hand illustration. It is a combination gasoline-electric machine, the invention of Mr. Knight Neftel. It has a set of sixty-four storage battery cells of 75 ampere-hour capacity. This is sufficient capacity to propel the car about fifteen miles. An 8 horse-power gasoline motor coupled to a dynamo and placed in the front end of the car generates sufficient current to run the car on a level road and charge the batteries at the same time. When a hill is mounted, the battery discharges and furnishes the extra power. By employing this arrangement, a mechanical transmission is dispensed with, and an electrical car with portable charging plant is obtained. The motor is started by throwing a couple of switches, which cause the dynamo, then acting as a motor, to turn it over. The control of the car is entirely electrical, and, although the machine weighs 3,500 pounds, it can be handled with the

Stearns Steam Stanhope with Tubular Wheels.

White Steam Stanhopes and Delivery Wagon, Showing Condensers Arranged in Front.



The Riker Gasoline Touring Car.



The Neftel Gasoline-Electric Automobile.

THE NEW YORK-BOSTON AUTOMOBILE RELIABILITY TEST.

greatest ease. Unfortunately it was ditched at Westport, Conn., when turning out for a wagon; and the water-cooling coils becoming damaged, together with trouble with the pump, caused the owner to drop out of the test after he reached New Haven.

The absence of electric vehicles was distinctly noticeable. None of the manufacturers tried to demonstrate the feasibility of these machines for long-distance travel, although in view of the recent statements of some of them concerning runs of 75 or 80 miles on a charge, one would expect to see some attempts made at covering this distance daily for a week, especially since an hour and a half was allowed each noon for recharging.

The tour was a most delightful one, in every way, and it showed as never before the ease with which 100 miles a day can be traveled in a modern automobile. With almost any of the present machines the chance of serious accident appears to be slight, since but few cars had a breakdown occur which could not be repaired in a short time with what local aid could be obtained.

KING CHARLES I. BRIDGE ACROSS THE DANUBE.

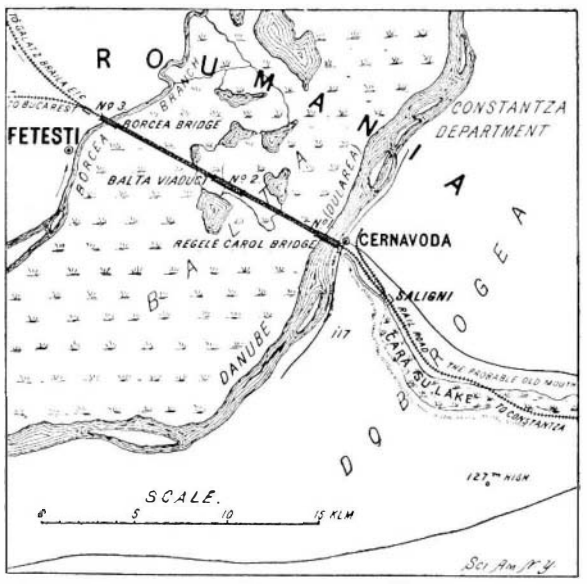
BY NICOLAE IONESCU, LIEUTENANT ROUMANIAN ROYAL NAVY.

After the great Russian-Roumanian-Turkish war of 1877-78, Roumania regained a territory which in former days she had lost, Dobrogea, lying between the Black Sea, the Danube and Bulgaria. For military and commercial reasons it was necessary to place this province in communication with the metropolis. A few years after the war Dobrogea had grown to be an important part of Roumania; its towns were greatly improved, especially Constantza, the most important town of the new province, which was destined to become a great Black Sea port. Besides its political and strategical importance, Constantza early presented itself to the Roumanian government as an excellent seaport for maritime commerce, especially during the hard winter, when the Danube was frozen and the large river ports like Galatz and Braila are inaccessible because of the dangers to which ships are exposed from the ice. It was, therefore, determined to build a railroad connecting Roumania with Constantza, a work which involved a difficult and costly crossing of the River Danube. At the inception of the work the Roumanian government instituted an international competition to secure plans for the bridge. The result was unsatisfactory and no contract was given out to any private firm, the Roumanian government deciding to have the designs executed by its own engineers. The matter was put into the hands of Mr. A. Saligny, Chief Engineer, who with the assistance of Mr. T. Baiulescu was responsible for the whole work.

The Danube at this point, as will be seen from the map, separates into two branches, the Danube and the Borcea. Between them lies a submerged island 13 kilometers in width. The main branch is only 620 meters wide and 7 meters deep, but at high water the river rises 7 meters above the ordinary level and covers the island as far as the Borcea with 2 meters of water. The current runs 2 meters a second, and the fall of water is about 18,000 cubic meters for the principal branch and 26,000 cubic meters in all. On this account the crossing involved the construction of a main bridge across the Danube, another over the Borcea, and the building of a viaduct across the island and the submerged country lying between the two branches.

In detail the crossing consisted first of the main bridge over the Danube, 748.28 meters in length, followed by 912.75 meters of viaduct, which carries the crossing to the island. Then follow 4,126 meters of embankment, 1,455 feet of viaduct, 6,086 meters of embankment and 400 meters of viaduct, which brings the crossing to the Borcea bridge. The latter has a total length of 420 meters, and from the bridge to the mainland is another short viaduct, 150 meters in length. The main crossing, the King Charles I. bridge over the Danube, as will be seen from our engraving, is an exceedingly handsome structure. It is carried on four stone piers and consists of two main cantilevers 240 meters in length and three trussed bowstring girders 90 meters in length. The depth of the girders is proportionate to the moments of the bridge, and its greatest depth, which is, of course, over the piers, is 32 meters. The webs of the girders are built up of inclined members, and the bridge is of the through type, that is, the floor is supported on the lower chords. The plane of the trusses is inclined, 1 to 10 from the vertical, after the manner followed in the construction of the great cantilever bridge over the Firth of Forth, Scotland. The width, center to center, of the trusses is 9 meters at the lower chords and 2.63 meters center to center over the piers. The most interesting feature of the bridge, next to its great length, is the foundations for the King Charles I. bridge, which on account of the great depth at which rock was found, namely 31 meters below mean water level, involved some very difficult foundation work. The foundation caissons were sunk by the compressed air method. The caissons were of steel with double walls and, in spite of the abnormally high pressure under which work had to be carried on, no serious accident occurred on any of the piers, notwithstanding that there was a rise of the water level at times of 10 meters above low water mark. It will be noticed that, as in all Continental bridges, particular attention has been paid to the architectural features, and as usual with very good effect. The Cernavoda pier is the great monumental portal of the bridge. It is built of Italian granite on a massive and dignified design, and is flanked by two colossal bronze figures representing two Roumanian soldiers "Dorobanti" in commemoration of the army corps which was the first to see active service in a war which resulted in the recovery of Dobrogea by the Roumanian people. The stretch of viaduct 912.75 meters long between the Charles I. bridge and the island consists of fifteen deck trusses 60.85 meters in length, carried on stone piers. Then follow 4,126 meters of stone embankment and 1,455 feet of viaduct over the ground at Balta. These viaducts are through structures 42.80 meters in length. The next stretch of crossing consists of 6,086 meters of embankment followed by 400 meters of viaduct, the latter made up of eight deck trusses, 50 meters in length. The Borcea crossing consists of a single cantilever having a center span of 140 meters and two connecting bowstring girders 90 meters in length, the cantilever arms being each 50 feet in length, thus making three clear spans of 140 meters. The approach on the Fetesti side consists of three 50-meter spans.

In a work of this size the total quantities necessarily reached a very large figure. There are 110,207 cubic meters of masonry, while the total weight of the steel superstructure and caissons was 16,823 tons. The total cubical contents of the earth-work in the whole crossing is 2,950,000 cubic meters. The cost of the work completed was $7,000,000. The subsequent



Map Showing in Full Black Line Location of the Bridge Across the Danube and the Borcea.

results since the opening of the bridge have fully justified the confidence which led to the undertaking by the Roumanian people of this great engineering work; for Roumanian commerce has been directed to the Black Sea port of Constantza, and several new and important lines of steamships have been inaugurated with excellent results.

World's Production of Coal in 1901.

The forthcoming volume of the Mineral Resources of the United States for the calendar year 1901, United States Geological Survey, estimates the world's production of coal in 1901 at 866,165,540 short tons. The three great coal-producing countries of the world are the United States, Great Britain and Germany. The output of these three countries combined makes up 81.61 per cent of the world's total. Austria-Hungary comes fourth, France is fifth, Belgium sixth, and Russia seventh. The last country, notwithstanding its vast area, produces only about 6 per cent as much coal as the United States. The three countries which lead in the production of coal are the three countries that lead in industrial development. Prior to 1899, Great Britain led among the world's coal producers, but during 1899, 1900 and 1901 the United States has made such remarkable increases in coal production, due principally to the unprecedented activity in the iron and steel and in other metal trades, that we now stand far in the lead of all competitors, with a production in 1901 exceeding that of Great Britain by 47,965,938 short tons, or 19 per cent. Up to the close of 1900 the coal production of Great Britain and her colonies, if taken together, still exceeded that of the United States, the excess in 1900 being 3,368,825 short tons; but the enormous output of the coal mines of this country last year exceeded by about 26,000,000 short tons the entire output of Great Britain and her dependencies, including India and the Transvaal.

Of the output of coal in 1901, the United States produced 33.86 per cent, Great Britain and her dependencies 30.86 per cent, and Germany 19.42 per cent, or, combined, 84.14 per cent of the total production.

Electrical Notes.

The failure of the electric vehicle trials of the Automobile Club of Great Britain to take place, owing to lack of competitors, would seem to indicate that in the United Kingdom at least the electric automobile has retrograded during the last two years. At that time a successful test of electric vehicles was held under very adverse conditions. This year, after a committee had spent considerable time perfecting rules and classifying vehicles under the heads of town and country machines, the tests for the former of which were extremely easy, but one firm was willing to enter the contest, and so it had to be abandoned. This result is pretty much in line with what occurs in this country when a chance is given electric vehicle manufacturers to demonstrate what their vehicles can do in a well-conducted, impartial test, such as the recent reliability trials, for example. It ought to be an easy matter for a machine equipped with a battery capable of propelling it 118 miles on smooth asphalt streets, as it is claimed that one of the National Electric Vehicle Company's runabouts did recently, to cover fifty miles of country roads per charge, and keep this up twice daily for a week, yet neither this nor any other company saw fit to enter one of its carriages in the test.

The last of the main generators and engines intended to be installed in the power plant of the Mersey Tunnel Railway are about to be shipped from the Westinghouse Works at East Pittsburg. These generators are of the railway type (1,200 kilowatts, 650 volts, 90 revolutions per minute) and are to be direct-connected to vertical cross-compound Westinghouse-Corliss engines of 1,500 horse power each. The power house lighting and the electric light of all stations, sidings, etc., will be supplied from a separate generating plant comprising two compound-wound generators, each having a capacity of 200 kilowatts at 650 volts, direct-connected to Westinghouse compound engines and running at a speed of 250 revolutions per minute. The power-generating plant will have an aggregate output of about 6,600 horse power—6,000 horse power for the railway proper, and 600 horse power for lighting. The Westinghouse electro-pneumatic system of train control is to be used, and the cars will be equipped with Westinghouse high-speed air-brakes. The rolling stock will consist of sixty cars, each about 60 feet in length. The trains will be formed of five cars each, the first and last cars of a train being motor-cars equipped with four 100 horse power motors each.

In demonstrating the ionic charges of the atmosphere, H. Ebert describes some simple and instructive experiments. A plate of tinned iron two square meters in area is supported four meters above the earth's surface on insulating pillars planted on the top of a slope seventy meters high overlooking the River Isar. In clear weather the plate was first connected to earth acquiring a negative charge, then being disconnected and left to itself for some time so as to acquire the potential of the surrounding air. It was then earthed through a galvanometer, and showed a current proceeding from the plate to the earth. The charges acquired vary within wide limits by the weather, being largest in fine and smallest in foggy or damp weather. This shows that the connection of negative ions from the atmosphere of the earth varies in accordance with their mobility in the atmosphere. A rough estimate of the quantity of electricity thus conveyed on a fine day gives about 300,000 electrostatic units per square kilometer per minute.—Physikalische Zeitschrift.

Wireless Telegraphy for Yachtsmen.

The Marconi Wireless Telegraph Company of America has secured a site for a station at Eaton's Neck, Long Island, where a station will be installed, the first of a series along the Sound, and the territory adjacent to it, which will be operated for the convenience of yachtsmen. While the service will not begin until next season, several of the best known yachtsmen in America, who are identified with vast business interests, have already made arrangements to have their craft equipped with Marconi apparatus. The Sound service and the stations on the ocean side at Cape Cod, Sagaponack and Babylon will make it possible for yacht owners cruising in these waters to keep in communication with New York whenever necessary.

Reconstruction of the "Philadelphia."

The "Philadelphia," one of the original "White Squadron," is being remodeled at the Puget Sound navy yard. The vessel is to be completely re-equipped in every respect. When she is launched again she will be a vessel of which the navy may be justly proud. At least a year and a half, or perhaps two years, will be required to remodel her completely.