

long the lives of the guns, the army 12-inch guns (U.S.A.) having been so injured after firing 60 rounds as to lose their accuracy entirely.

STEAM AND ELECTRICAL RAILROADS.

Judging from the events of the year the time is still far removed when the steam locomotive will have been crowded off the great system of railroads which it has brought into existence, and on which it has been so long supreme. For long distance service it still remains the most economical.

Just now the most noticeable steam railroad lines under construction are those of the Tehuantepec railroad, which must necessarily prove a formidable competitor to the Panama Canal, and the so-called Cape-to-Cairo railroad. The former line is about completed, and the latter has made such good progress that it has now been carried over two thousand miles north of Cape Town, and some fifteen hundred miles south of Cairo. Early in the year the road should reach Lake Tanganyika, after which it will be necessary to construct only about four hundred miles of road in order to afford a complete rail, river, and lake route from Cape Town to the Mediterranean Sea.

In this connection mention should be made of the recent attempt to interest the investing public in the proposed Zambesi-Johannesburg electrical power transmission line—a scheme which, in spite of the prominent names which have been recently associated with it in press despatches, seems to border on the *Wild Cat*. If it does not pay to transmit from Niagara Falls to New York, the question may pertinently be asked: how can the thing be profitably done over twice the distance through a barren and savage country?

AERONAUTICS.

In the field of aeronautics the most important event of the year was the publication of the first authoritative statement by the Wright Brothers regarding their successful power-driven aeroplane flights, made in the fall of 1905, and its acceptance by the Aero Club of America. It will be remembered that the *Scientific American* wrote to every one of the purported witnesses of these flights, and received the most convincing evidence that they actually took place. The most brilliant flight of the series was achieved on October 5th, when the Wrights covered a distance of 25 1/5 miles, at a speed of over 38 miles an hour, the flight terminating only with the exhaustion of the fuel supply. When the history of mechanical flight comes to be written, this achievement will give these two young machinists the same position that Stephenson holds with regard to the locomotive, Fulton to the steamboat, and Edison to the electric light. At the recent Aero Club show the Wright Brothers exhibited a 30 h.p. aeroplane motor, designed and built, of their new and larger machine, which, with one man aboard, they are confident of driving for a distance of 500 miles, at an average speed of not less than fifty miles an hour. With mechanical aeroplane flight an accomplished fact we may now look for a diversion of interest and effort from the dirigible balloon to the aeroplane proper. Its field of usefulness will be found chiefly in military service, where it will be invaluable for reconnoitring purposes, and for the conveyance of swift despatches. In all probability its chief development ultimately will be in the field of sport, where it should enjoy a popularity equal to that of the automobile.

The investigators who have confined their attention to the balloon and the dirigible balloon have also met with very encouraging success. The machines have grown in size, power, speed, and controllability. The most prominent of these are the dirigibles of Count Zeppelin, Lebaudy Brothers, and

Henry Deutsch, the giver of the well-known prize known by the name of the donor. At the same time European inventors have not neglected the aeroplane. Mention is made of Santos Dumont, who "recently managed to rise above the ground for a brief flight of a few hundred feet" on a machine built on the "lines of the Wright Brothers' machine." Reference is made to the Gordon-Bennett race, in which sixteen different balloons started from Paris, meeting with various fortune. Seven of these crossed the Channel, the greatest distance covered being by the American contestant, Lieutenant Lahm, who covered a distance of 402 miles, landing near Whitby, in Yorkshire. Shortly afterwards Bucknell beat that record with a flight of 472 miles, from London to Vevey, in Switzerland. The reference in this part of the article closes with the mention of the various prizes now offered for the flight between London and Manchester, the aggregate of which now mounts up to 70,000 dollars.

AUTOMOBILES AND MOTOR BOATS.

That the automobile industry has settled down to certain fixed types, and that improvement is looked for, from now on, more particularly in details, is proved by the fact that in any review of the year's work it becomes increasingly difficult to find any novelties of a radical and far-reaching character. This was evident at the seventh annual show of the Automobile Club of America, in which it was evident that the makers had approximated so closely one type and standard of excellence, that a visitor failed to observe those broad points of difference which formerly lent a stirring interest to the technical review of these annual shows.

The gasoline motor still reigns supreme. While the makers of steam and electrical machines are turning out a product of the highest excellence, these types give no signs of ever again becoming serious competitors of the automobiles driven by internal combustion engines. The electric motor promises to find its most successful field of work in the propulsion of heavy motor trucks and delivery waggons, of which some splendid specimens were shown at the late exhibition.

The public interest in speed competitions remains unabated. From particulars of the running at Ormonde-Daytona the following are of special interest: the Stanley steam racer covered the mile on the smooth sands of the beach in twenty eight and one-fifth seconds, a speed of 127.65 miles an hour; the 200 h.p. Darracq racer covered two miles (winning the two mile event) in fifty-eight and one-fifth seconds, at a speed of 122.46 miles an hour; the fastest speed ever made by a gasoline automobile. The 10 h.p. Napier racer secured the 100 mile record of 1 hour 15 minutes, 40 and 2/5 seconds, at a speed of 79.28 miles an hour.

At the fuel efficiency contest of the Automobile Club of America a four-cylinder air-cooled Franklin roundabout covered 87 miles at a fuel cost of 0.613 cent per ton-mile; a 24 h.p. air-cooled Frayer-Miller covered 47.9 miles at the phenomenally low cost for fuel of 0.517 cent per ton-mile.

At the Vanderbilt cup contest all the honours went to foreigners, the non-success of the American cars being due to the failure of their non-skid tyres; all having to carry tyres of that description on account of the greasy nature of the track. But their speed seemed to be unexceptionable.

It begins to look as if the application of the internal combustion motor to boat and ship propulsion will, in the future, find its most successful field, not in the flimsy high-speed racing craft, but on staunch, serviceable, sea-going launches and cruisers, and ultimately in the propulsion of various types of merchant

craft. The record for racing craft still remains at 30 3/4 miles an hour, at which it was placed by the French motorboat *Antoinette* in 1905. An interesting development of the racing craft is that of the hydroplane type. In this type an effort is made to lift the boat clear or partially clear of the water, and drive it along on a series of slightly inclined planes. A vessel of this type was recently tried on western waters, and two others in France, the latest type being that of Levavasseur, which consists of a front boat holding the motor to which is attached the light wooden frame, for carrying a long tail at the rear of which is the propeller.

The gasoline motor has been successfully applied to a torpedo boat by the Messrs. Yarrow, of London, who produced a little vessel, only weighing a ton, which has shown a maximum speed of 26 knots an hour, and has a radius of action, when carrying one ton of oil, of 300 miles. This vessel has been bought by the British Admiralty, and is likely to become the pioneer of a new and very useful type of torpedo craft.

The Thornycroft Company have recently constructed a vessel which is driven by a producer gas engine of 500 h.p.; while the Otto Gas Engine Company have already fitted their producer gas engines to a dozen or more vessels, the power ranging from 30 to 90 h.p. The latest success of this company was realised with a flat-bottomed barge of 240 tons, which is driven by a 4-cylinder 100-h.p. engine. The vessel has proved to be highly economical in operation, as may be seen by the fact that during a single year 5,200 tons of freight were carried, representing nearly 2,000,000 ton miles at a cost of a cent per ton.

MERCHANT MARINE.

The most significant event of the year in the merchant marine has been the steady advance in the performance and popularity of the steam turbine, as a drive for ships of all sizes, types and speeds. It is true that in proportion to the number of ships afloat, or even of those building, the number of turbine-driven vessels is as yet very small; but the uniformly excellent results obtained with the latest and most improved forms of marine turbines point, with increasing emphasis, to this as the ultimate type of engine for all vessels, unless we except the tramp steamers of large capacity and low speed.

The year has witnessed the launch of the two Cunarders, the weight of each vessel as she went down the ways being over 16,000 tons. These ships, 786 feet long, 88 feet beam, 60 feet deep, and of 45,000 tons displacement, are considerably the largest afloat. Their contract speed is 25 1/4 knots on trial: their contract horse-power 68,000. Outside these vessels, and a sister ship to the *Kaiser William II*, building for the North German Lloyd Company, all of the new transatlantic liners belong to the large, moderate speed, freight and passenger type, represented by the *Kaiserin Auguste Victoria* of the Hamburg-American Line, which made her maiden voyage during the year, and the new *Adriatic* of the White Star Line.

A vessel which attracted considerable attention at various ports in 1906 was the great auxiliary clipper *R. C. Rickmers*, which has the distinction of being the largest sailing ship afloat; her length being 441 feet, and her displacement 11,360 tons. She is equipped with an auxiliary steam engine of 750 indicated h.p. Under steam she can make from 6 to 8 knots an hour, and under sail she has made 16.

The tonnage of the Italian Mercantile Marine has recently been increasing at an abnormal rate, especially in the direction of large twin-screw steamers fitted for carrying emigrants, of whom an increasing number cross the Atlantic every year.