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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

GENESIS OF THE FIRST SUCCESSFUL AEROPLANE.

In all the history of invention there is probably no parallel to the unostentatious manner in which the Wright brothers, of Dayton, Ohio, ushered into the world their epoch-making invention of the first successful aeroplane flying machine. At a time when the various experimentalists in the field of aeronautics were dumfounded by the failure of the deservedly-renowned Langley to make a practical flight with his government-backed $50,000 machine, it was suddenly announced that two young machinists had produced an aeroplane which had made a continuous flight, with one of the inventors on board, of over twenty miles at a high speed and under perfect control.

Their success marked such an enormous stride forward in the art, was so completely unheralded, and was so brilliant that doubt as to the truth of the story was freely entertained; especially as the inventors refused either to give access to the machine or to make any statement as to its broad details.

The SCIENTIFIC AMERICAN, however, wrote to the seventeen eye witnesses who were mentioned as having seen the various flights and received letters from these reputable local residents, and published extracts therefrom, which completely set at rest all doubt as to what had been accomplished. Unfortunately, the foreign aeronautical world failed to appreciate the significance of the facts as thus made known; and when Santos Dumont made his recent short flight of a few hundred feet, with a machine built on the lines of the Wright brothers' aeroplane, he secured in Europe the credit for having made the first successful flight.

One of the editors of the SCIENTIFIC AMERICAN was recently accorded the first interview given to any technical journal, in which the Messrs. Wright gave some hints as to what they had actually accomplished, and outlined the investigation which led up to their final success.

After becoming interested in the problem of aerial navigation some ten years ago, the brothers experimented during several summers with a double-surface glider, with which they became so proficient that they could make long glides from the summits of the sand dunes and describe a letter S at the bottom. They improved their machine by the addition of a vertical and a horizontal rudder and a method of twisting the planes to preserve lateral equilibrium. After reaching sufficient proficiency in controlling the machine in gliding, the brothers undertook to transform it into a power-driven machine. As no light-weight gasoline motors were to be had at that time, they were obliged to build their own motor. They decided upon a four-cylinder, water-cooled, horizontal engine, which, when completed, weighed 250 pounds and developed about 16 horse-power, although it would show 24 horse-power for the first 15 seconds.

As they were unable to find any authorities giving definite rules for designing air propellers, they were obliged to work out a theory of their own on this important subject. They designed propellers for their machine, and calculated the speed at which it should travel with the horse-power at their disposal. In the first trial with a motor (in December, 1903) the machine flew at practically the speed the brothers figured it should attain; which speaks well for the truth of their theory of the action of screw propellers. In this first flight the machine went in a straight line a distance of 852 feet against a 25-mile wind. Having proved that the glider would fly with a motor, the brothers returned home, and during the spring of the following year resumed their experiments in a meadow some eight miles from Dayton, where they built a shed to house their machine. The greater part of the spring, summer, and autumn of 1904 and 1905 was spent in experimental work with the new aeroplane. A number of obscure difficulties were encountered, and it was found that the machine acted quite differently from what it did when merely gliding without a motor. In fact, with the motor installed, the operator had to make some moves for control of equilibrium exactly opposite to those which were necessary when the machine was simply gliding. For starting the machine, a light steel rail some 75 feet long was laid on the ground. A small carriage having two double-flanged wheels was placed on this rail and supported the aeroplane. The machine was steadied by one man standing at one side and holding it. It was hitched to a post and held while the motor and propellers were started. Then it was suddenly released and allowed to shoot forward, whereupon it would rise in the air before the end of the rail was reached. As the field was a comparatively small one, approximately rectangular in shape, it was necessary to make sharp turns to keep within its boundaries. In making these turns trouble was often experienced, and there were a number of narrow escapes from serious injury. It was not till October of last year that the brothers found out the cause of this instability, which was not due to instability of the machine so much as to the method of operating it. Soon after this discovery, they were able to make their flight of 24 miles in 38 minutes, or at the rate of nearly 40 miles an hour.

By their method of starting on a special rail the Wrights were able to get in the air with the expenditure of much less power than would have been needed if they had mounted their machine on pneumatic-tired wire wheels running on ball bearings and had run it along on a smooth, hard road. The pull of a machine mounted and run in the latter manner, as is well known, is several times greater than that of one mounted in the former way. This would account for the excessive power required by Santos Dumont to get his aeroplane in the air, as he ran his machine on pneumatic-tired wheels *on turf*, where the resistance was greater still. It does not explain his comparatively low speed when once he was in the air, however, and this can only be explained by the great resistance of his machine and the inefficiency of the propeller.

One of the chief points wherein the Wrights claim to have made a marked improvement lies in the design of their propellers. Instead of propellers giving 40 to 50 per cent efficiency, they estimate that the new screws which they have designed give fully 70 per cent efficiency.

There is one important point wherein the brothers do not agree with Langley, viz., regarding a plane traveling at a very high rate of speed carrying a greater load with the expenditure of less power than when traveling at a lower rate of speed. That it will carry a greater load they admit, but that less horse-power will be required to drive it is contrary to the law of atmospheric resistance, which is that the resistance increases as the square of the velocity. As a result of this, they find that the weight carried per horse-power expended varies inversely as the speed. At 38 miles an hour, they were able to sustain 62 pounds per horse-power. Consequently, at 20 miles an hour, they could sustain about 125, or at 75, only about 30.

Elsewhere in this issue will be found a photograph and description of the Wright brothers' new motor, with which they are confident of driving their new and large aeroplane, with one man aboard, for a continuous distance of 500 miles at an average speed of not less than 50 miles an hour. Their past successes would seem to give promise that they will accomplish the feat, if not at the first trial, at least in the near future.

THE SEVENTH ANNUAL SHOW OF THE AUTOMOBILE CLUB OF AMERICA.

Among the many evidences of the rapid development of the automobile industry in this country, is the fact that the task of writing a critical review of the great annual exhibitions becomes increasingly difficult with each succeeding year. This is due to the fact that, in design and workmanship, the various makers have approximated so closely the one general type and standard of excellence, that one no longer perceives, at the first view, those striking points of difference, which formerly lent piquancy and broad interest to a properly-written review of these annually recurring events. In the earlier exhibitions, even of as late as three or four years ago, the problem of description resolved itself into one of judicious selection of subjects from the bewildering number of designs that were on exhibition. The great motor contest between steam, electricity and internal combustion was at its height, as was the question of the type and proper location of the motors and of the best form of transmission and drive. A little later there was the keen contest between spark coil and magneto ignition, and between automatically and mechanically operated valves. To-day, however, these broad questions have been definitely settled, and with comparatively few exceptions, the cars shown in the Seventh Annual Exhibition of the Automobile Club of America conform, in everything but minor details, to one distinct, easily-recognized type.

To the majority of spectators the first impression produced is doubtless one of admiration for the general shapeliness of outline and beauty of finish of the cars. This is true even of the smaller and cheaper makes which, by the adoption of certain inexpensive features, affecting the proportions and general contour of the machine, present that stylish appearance which, for some years, has been the distinctive mark of the high-priced, imported automobile. Moreover, the good looks of the moderate-priced cars have been secured without any material sacrifice of good workmanship and materials; and it is to-day possible to secure a powerful, reliable, and handsome American-made car, with sufficient power and durability to stand all the hard service of long-distance touring, at a first cost of from $2,000 to $3,000. It is probable that the majority of the cars, which are being sold to-day, range between these limits of price; while at the extremes we have on the one hand the high-powered car of 40 or 50 horse-power, with its limousine top, luxuriously upholstered, and provided with a dozen conveniences in the way of telephones, annunciators, heaters, refrigerators, and electric light, and costing from $10,000 to $14,000; and on the other hand we have the trim little runabouts, which are said to have given during the past year very good service, for the moderate sum of $500.

The present *résumé* of the show will be supplemented in our forthcoming automobile number by illustrations of the more important machines and novelties exhibited. The type car carries a four-cylinder gasoline engine under a bonnet at the front end. This engine is generally of from 24 to 30 horse-power, and has the characteristics of water-cooled cylinders, mechanically-operated valves (the latter being placed generally at the side of the cylinders) and either high or low-tension magneto ignition. The drive is by propeller shaft and bevel gear through a three-speed progressive or four-speed selective type transmission. Such touring cars are capable of carrying five persons comfortably, and they are ordinarily provided with the increasingly-popular folding top. While there are many variations from this type, they form a comparatively small minority. The most striking development of the year is undoubtedly the great popularity of the high-powered runabout, provided with a rumble for the use of an additional passenger or for the mechanician, or even (as was recently seen on Broadway) for a full-fledged "tiger" in silk hat and cockade. These runabouts are a development of the small-powered runabout of previous years. They are of much greater power than their prototypes, some of them running as high as 40 or 60 horse-power. As far as smartness of appearance goes, they are decidedly the handsomest and most graceful-looking machines of the year, and they are doubtless destined to great popularity. We have already spoken of the limousine top, which, for winter use, bids fair to become in the larger cars almost the prevailing type. The addition of this top adds greatly to the appearance of size and weight of the cars, some of the largest of the limousine cars, and notably the foreign importations, being really imposing specimens of the coach builder's art.

Although some of the makers are showing six-cylinder cars, the present exhibition does not indicate that this is to become the prevailing type. In spite of its unquestioned advantages, due to the more even torque secured, there is the disadvantage of more complication due to a greater number of parts. There is a tendency to a steady increase in the cylinder capacity, which is due, no doubt, to the national temperament, which makes the driver prefer, if possible, to run continuously on the high speed, even where sharp hills have to be negotiated. On the other hand, we are inclined to think that equally good results could be secured if drivers would learn to make a more judicious use of the change-speed gears; for after a little experience, it will be found that as good average speed results would be obtained if the gears were properly manipulated with moderate-powered cars as are now sought by the more exclusive use of the high speed in connection with larger cylinders. The foreign makers, indeed, are already turning from their stock cars of 50 and 60 horse-power to the more moderate 40-horse-power cars of an earlier day.

The air-cooled type of engine seems to maintain its popularity; and judging from the results obtained during the year in the various endurance trials, this type is capable of showing as high and even higher economy, at least in the more moderate powered cars, as the water-cooled engines. The type was tested severely in the recent Vanderbilt cup and elimination races, where one make, using a positive feed of air through casings inclosing the cylinders, entered three cars each of 110 horse-power. The failure of these cars was due entirely to structural defects back of the engines, which, we understand, gave excellent running results, both in the elimination trials and in the race itself. While the steam car does not seem to gain in popularity, one or two first-class makes appear to be holding their own, and one of them, at least, has introduced an improvement in the way of a feed-water heater which is claimed to be giving excel-