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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-

lent results in fuel economy. Electric cars are holding their own for the particular class of work to which they are specially suited, although the reiterated promise that a new battery of large capacity and high economy will be placed on the market, does not yet appear to have been fulfilled.

Tires carrying some form of non-skid reinforcement bid fair to become the prevailing type of the future. Judging from the disastrous results in the last Vanderbilt cup race, American makers have not yet discovered a thoroughly reliable method of attaching the steel-riveted leather strips to the tires; and, indeed, it was due to the stripping of this reinforcement, that the excellent cars entered by the American contestants failed to make a better showing in that race. The best makes of American tires are showing first-class qualities in every respect, and as soon as we have mastered the non-skid problem, our best cars will be in every respect equal to the best of those turned out in Europe. In the matter of wheels there is a tendency to increase the size, 32 and 34-inch wheels taking the place of the 30 and 32-inch wheels of last season; while the diameters have increased to 3½ inches for the front and 4 inches for the rear wheels.

The prevailing type of transmission from the engine to the rear wheels includes the leather clutch, change-speed sliding gears, and either the shaft or the chain drive, with a preference in the majority of cars for the former. There is room for improvement in the design of the clutch; as is proved by some creditable efforts which are being made in this direction, and which were on exhibition at the Show Two or three cars show double clutches, of which the smaller (generally metallic) takes hold first and gives the preliminary impulse to the car, while the larger and leather-faced clutch takes hold a moment later, as the car is accelerated to the higher speed. A modification which deserves special mention is that shown on a new racing car, which was built for the Vanderbilt cup race, but was completed too late to enter, in which the bevel gears are carried on a jack shaft, from which the drive is transmitted to the differential by means of spur gears. The object of this arrangement is to avoid any side thrust on the differential. In this particular car, moreover, was afforded an excellent opportunity to study the great refinement of materials and designs which is necessary in producing a modern racing car. The material throughout the car is chrome nickel steel, and the change-speed gears with their shaft, besides several minor parts, such as brackets, have been machined entirely out of the solid ingot.

The friction drive is still making a commendable struggle for recognition, and two or three cars which use this type, including a heavy motor truck, are on exhibition. In one of these there are two friction disk wheels, leather covered, carried on the main drive shaft, while between them is a transverse split shaft carrying two friction drive wheels. By means of a lever, placed at the right-hand side of the driver, the two friction disks can be thrown into the forward or reverse position, while the change of speed is effected by moving the same disks out or in to the center of the flywheel disks—this change of position being effected by a hand wheel located on the steering shaft below the steering wheel.

There are those who believe that the real future of the industry lies in the field of the motor truck. Certainly the displacement of the horse-drawn vehicle by the motor-driven truck is making steady progress. That the latter is destined ultimately to obtain almost exclusive control of the field, is assured by the fact that careful tests of the relative economy of the horse and the motor have shown that there is an average saving in favor of the latter of at least 20 per cent in cost; while over and above this are the many conveniences of storage, cleanliness, compactness, and more easy flow of traffic in congested districts, which may be urged in favor of the motor car. While most of the machines shown were driven by gasoline engines, some very powerful and excellently-designed electric-driven trucks were also on exhibition. One of the handsomest and most formidable of these was a five-ton truck, in which the motors were carried directly on the wheels. The axles and much of the gear of this truck were formed of manganese bronze, the parts being largely of a powerful I-section, and the whole truck showing evidence of a very careful and scientific design. A novelty among the gasoline trucks was one propelled by a two-cylinder two-cycle gasoline engine, which embodied all the best features upon up-to-date touring cars.

Space forbids any lengthy mention of the elaborate exhibition of sundries, which occupied an unusually large space in the Grand Central Palace. One of the most useful and commendable novelties was the provision of a tool and spare parts case, which was built into and formed the back of the tonneau. The whole of the back was covered by a board filled with recesses for the various tools arranged in convenient order. In the center of this board was a compact set of drawers containing spark plugs, waste, oil cans, and a hundred-and-one small items liable to be needed in an emergency. There was also space for two spare shoes, while at the sides were pockets to contain a couple of spare inner tubes. The whole arrangement was closed in by a couple of hinged doors molded to the curve of the tonneau back.

To automobilists a few comments on the show which opened in Paris on December 7 may not be without interest. From cabled accounts it would seem that this year's show has very little that is new to offer. So far as outward appearances go, the Grand Palais looks very much as it did in 1905. Even last year's stands are used, because new designs would have involved a heavy expenditure. The cars too offer little, if any, novelty. The only striking feature of the show is the lavish use of 6-cylinder motors. Apparently about 75 per cent of the French designers have pledged themselves to six cylinders. The tendency evinced last year of using metal instead of leather clutches is more pronounced than ever. Almost without exception the more powerful models are equipped with metal clutches. Many cars too have been equipped with the live axle or Cardan system of transmission, the live axle being for the most part independent of the transverse shaft. It may be safely said that the live-axle machines outnumber those driven with chains.

THE PATENT OFFICE IN 1906.

The report of the Commissioner of Patents on the business of the Patent Office for the fiscal year ended June 30, 1906, shows that there were received during that year 55,619 applications for mechanical patents, 821 applications for design patents, 172 applications for reissue, 1,938 caveats, 10,888 applications for trade-marks, 943 applications for labels, and 438 applications for prints. The number of patents granted, including reissues and designs, was 31,837, and there were registered during the year 10,408 trade-marks, 741 labels, and 354 prints. The number of patents which expired was 20,682, and 5,193 applications which had been allowed were forfeited by operation of law for non-payment of the final fee.

The total receipts of the office from all sources amounted to $1,811,297.84; and the total expenditures were $1,538,149.40, leaving a surplus of receipts over expenditures of $273,148.44, which surplus was turned into the Treasury.

While the act of February 20, 1905 (33 Stat. L., 724), amending the trade-mark law so as to authorize, among other things, the registration of trade-marks used in interstate commerce, became effective under its terms on April 1, 1905, no registrations were made under said act until after the beginning of the present fiscal year. This was owing to the fact that the law requires publication of the trade-marks in the Official Gazette of the Patent Office prior to registration. During the last three months of the fiscal year 1905, 9,710 applications for registration were received, and during the present fiscal year the number received was 10,888. This represents an enormous increase in the work of this character to be performed by the office force; and the number of trade-marks registered during the past year, 10,408, also shows an increase amounting to 500 per cent over the registrations for 1903 and 1904, which were approximately 2,200 for each year. These increases are due entirely to the liberality of the new trade-mark law, which not only makes a wide extension of the class of marks susceptible of registration, but reduces the cost of the proceedings therefor.

From a comparative table of the general operations of the office embodied in the report it appears that during the last seven years there has been an average increase of more than 59 per cent in the various classes of work performed in the office. Yet the increase in the number of employees from 1899 to the close of the past fiscal year was only 11.9 per cent. By the legislative, executive, and judicial appropriation act of June 22, 1906, Congress provided for an increase of 29 examiners of all grades, and of 21 in the clerical force. This increase of course did not become available until after the close of the fiscal year; but it is confidently expected that a gratifying condition of the work of the office will be shown at the end of the next fiscal year. Indeed, it is stated that an improvement in the conditions can already be observed. In this connection the commissioner suggests that, inasmuch as experience has shown that the work of the office has a regular substantial growth in times of prosperity, this condition might well be met by a moderate, regular annual increase in the force of examiners and clerks. The applications of all classes awaiting action at the close of the year were 21,958, as against 16,077 at the close of the preceding year.

Substantial progress has been made in the reproduction of exhausted copies of patents, and practically all printed copies are reprinted without delay upon request. The correspondence, drafting, furnishing of copies of patents and of records have been transacted with a fair degree of promptness, and some improvements in methods in the clerical divisions have been made.

Attention is invited to the fact that, instead of obtaining the illustrations for the Official Gazette from private contractors, in connection with which system the dummy card process has hitherto been used, the entire work upon the Gazette is now executed at the government printing office, and, in the illustrations, zinc etchings have been substituted for the photolithographic reproductions which were made from dummy cards. The change has been found to work satisfactorily. The legislative, executive, and judicial appropriation act of June 22, 1906, made a reduction in the appropriation for producing the Gazette of $70,000, and it is estimated that at least this amount will have been saved by the change described by the end of the next fiscal year.

The act of June 22, 1906, making appropriations for the legislative, executive, and judicial expenses of the government for the fiscal year ending June 30, 1907, contains the following provision:

"For rent for storage for patent office model exhibit, ten thousand dollars, or so much thereof as may be necessary; and the Secretary of the Interior shall dispose of a part or all of the models of said exhibits, either by sale, gift, or otherwise."

Immediately after the passage of this act, the commissioner of patents was instructed to ascertain what models could be disposed of as required by the act without injury to the interests of the service. From the report of the commissioner, it appears that a very large proportion of the models in the so-called model exhibit of the patent office form a valuable part of the records of the office, and that the disposal of the same would work a grave injury to the service, since reference thereto by the office, by patent attorneys, and at the instance of courts, is frequently necessary. A question also arose as to the effect of the foregoing provision upon section 484 of the Revised Statutes, which reads as follows:

"Sec. 484. The Commissioner of Patents shall cause to be classified and arranged in suitable cases, in the rooms and galleries provided for that purpose, the models, specimens of composition, fabrics, manufactures, works of art, and designs, which have been or shall be deposited in the patent office; and the rooms and galleries shall be kept open during suitable hours for public inspection."

The question was accordingly submitted to the assistant attorney-general of the department as to the effect upon section 484 of the Revised Statutes of the clause in the act of June 22, 1906, above quoted; and the opinion of that officer was to the effect that section 484 was not repealed by the enactment in question.

Thereafter a contract was entered into for the renting of the second, third, and fourth floors of the Union Building in Washington, the building in which these models have heretofore been exhibited, during the present fiscal year at a rental of $10,000, the amount appropriated by the act. Subsequently, correspondence was begun with the secretary of the Smithsonian Institution to ascertain whether any portion of the models not a part of the records could be placed in the National Museum for exhibition purposes, and if so, which models were desired and could be accommodated in the buildings of the institution. The officers of the institution have indicated their willingness to receive and provide for a portion of the patent office models, and the selection of the models to be transferred to the custody of the institution is now under consideration.

THE CURRENT SUPPLEMENT.

In the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1615, an article is published by Frank C. Perkins on electrically-operated pneumatic hammers in which German, American, and English types are described and illustrated. Dr. Hans Kuzel has invented a process by which the most refractory and obstinate metals can be made into lamp filaments. This process is described by J. Swinburne. It is not an easy task that confronts the amateur constructor of a large induction coil when he reaches a point in his work where he must choose the type of interrupter that he intends to use. Mr. A. Frederick Collins tells in a very clear way just how an independent interrupter can be constructed. His article is accompanied by complete drawings. Full details of construction are given. Some very interesting experiments have been made in Vienna for the purpose of studying the phenomena of fires originating on the stage of a theater, and determining the best methods of safeguarding the audience. The results obtained in this experimental theater are given. Other articles of interest are those entitled "Treatment of Rivers with Shifting Channels," "The Collecting and Testing of Carbonic Acid for the Purpose of Carbonization," "Greenhouse and Conservatory Heating," "The Accessibility of the Pajarito Ruins," "Mars as a Place to Inhabit," and "Gas as a Source of Power." Mr. Craig S. Thoms's article on "How Seeds are Carried" is concluded. Those interested in the gas turbine will find the article on the "Gas Turbine and the Turbine Compressor" of value.