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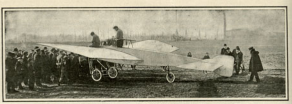
NEW EUROPEAN AEROPLANES AND AIRSHIPS.

BY OUR PARIS CORRESPONDENT.

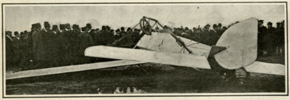
Aeronautical experimentation abroad still continues actively, and every day, almost, sees the production of some new airship or aeroplane, or new trials of those already constructed.

The latest of these aeroplanes is that of two Parisian aeronauts, Messrs. Gastambide and Mangin. This machine, which is shown in one of our illustrations, was constructed in three weeks' time. As can be seen from the picture, it is of the monoplane type, consisting of two wings attached to a central longitudinal body, the wings being set at a dihedral angle. The total spread of the wings is 10 meters (32.8 feet), while the length of the body is 5 meters (16.4 feet). The wings can be readily detached from the body part of the machine. They are attached to aluminium girders, which are sufficiently strong to sustain without injury the weight of a man standing upon them. They are braced by means of steel ribbons instead of steel wires, as the former do not offer so much resistance to the air. The aeroplane is mounted upon three pneumatic-tired wheels, the two forward wheels being pivoted so that they can be turned in order to steer the machine when it is running along on the ground.



The Bleriot No. 6 Aeroplane As It Looked Before Its Accident.

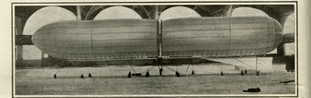
This aeroplane is a modified Langley-type machine the rear planes of which have been shortened and made to form a horizontal rudder. Spread of wings, 36 feet; supporting surface, 269 square feet; weight, 935 pounds.



The Bleriot Aeroplane After Its Accident in Which the Wings Broke While the Machine Was in Flight.

The photograph shows the machine upside down viewed from the rear and gives a good idea of the length of the rear planes as compared with those in front.

All the wheels are carried in spring-supported forks, which reduce the shock when the machine alights. The 50 horse-power, 8-cylinder, V motor is placed at the forward end of the body, and carries a two-bladed propeller upon its crankshaft. This propeller is 2 meters ($6\frac{1}{2}$ feet) in diameter and has a pitch of 1.3 meters ($4\frac{1}{4}$ feet). The aeronaut's seat is placed back of the motor in the central part of the body. The machine has a vertical rudder at the rear, but no horizontal rudder is provided, as the inventors found from their experiments with a model that the setting of the planes at a suitable angle upon the body was sufficient. They expect to control the height of the aeroplane when in flight by varying the speed of the motor. The total supporting surface of this new machine is 24 square meters (258 1-3 square feet), and the weight, including the operator, is given as 400 kilogrammes (880 pounds). In tests which were made with the motor and propeller, a thrust of 140 kilogrammes (308 pounds) was developed by the latter. The inventors expect to attain a speed of about 33 miles an hour with their machine.

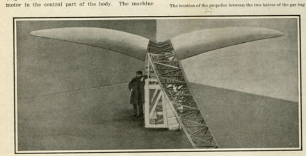


The De Marcay Airship—A New Type of Dirigible Balloon.

The location of the propeller between the two halves of the gas bag is intended to stop the pitching of the latter and also to propel it more easily.

Two other of our photographs show the appearance of the latest Bleriot (No. 6) aeroplane before and after its mishap due to the breaking of the wings while in flight as a result of the failure of one or more of the guy wires. As can be readily seen from the photograph, M. Bleriot has modified the Langley type machine which he first used successfully last summer, until it is now practically a monoplane, since the rear pair of planes have deteriorated into a horizontal rudder formed of two planes—one on each side of the body—which can be separately set at different angles to allow of making a turn. There is also a vertical rudder placed between these two planes. The new machine is considerably larger and more powerful than its predecessor. It consists of a tapered body rectangular in cross section, and brought to a blunt point at the forward end. This body is carried upon three wheels, the two at the front end being pivoted for the purpose of steering when the machine is running along on the ground.

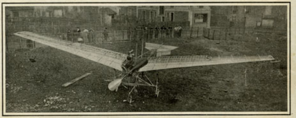
The third wheel is on a vertical fork beneath the body, a little more than half way back. Attached to the body on its lower side and near the forward end are a pair of wings having a total spread of about 36 feet, and a width from front to rear of about $7\frac{1}{2}$ feet. The total supporting surface thus obtained is 25 square meters (269 square feet). As the total weight of the machine with operator is 425 kilogrammes (935 pounds), the surfaces are loaded to about $3\frac{1}{2}$ pounds per square foot, which is a high figure. This new aeroplane has double the horse-power of Bleriot's previous one, the engine in this case being a 50 horse-power, 8-cylinder, V motor of the well-known Antoinette make. The engine is located in the forward part of the body over the front edge of the wings, and it carries a four-bladed propeller on the forward end of its crankshaft. This propeller has a diameter of 2.1 meters (6.88 feet) and a pitch of 1.1 meters (3.6 feet).



The New Antoinette Aeroplane, Showing Its Large Size in Comparison With a Man.

This aeroplane, which was built after Capt. Ferber's design, is the largest flying machine thus far constructed in France. It will have a 100-horse-power engine and the total weight of the machine and operator will be over 1,000 pounds.

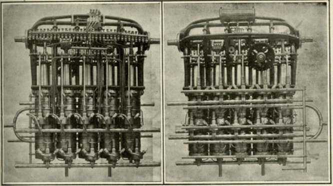
On November 16th, during its first test, the new aeroplane made a short flight at a speed estimated to be about 90 kilometers (56 miles) an hour. On November 29th, it made another flight of 150 meters (492 feet) at 2 or 3 feet above the ground, during which it showed excellent stability. On December 1st it made flights of from 80 to 150 meters (262 to 492 feet) at about 30 feet height. On December 4th it made flights of about 150 to 200 meters (492 to 656 feet) and also attempted to make a turn. On December 6th, in a



The Gastambide-Mangin Aeroplane—The Latest French Flying Machine of the Monoplane Type.

Spread of wings, 32.8 feet; diameter and pitch of propeller, $6\frac{1}{4}$ x $4\frac{1}{4}$ feet; engine, 8-cylinder V motor of 50 horse-power.

THE LATEST FRENCH AEROPLANES AND AIRSHIP.



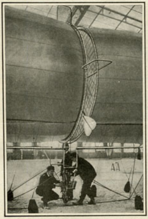
The Dufaux 120-Horse-Power, 10-Cylinder, Double-Acting, Gasoline Motor for Aeronautical Work. Total Weight as Shown, 187 Pounds.

The motor, which is of the 4-cycle type, has ten double-acting cylinders arranged in pairs and connected to five separate cranks. As it is a double-acting engine there are in reality twenty working cylinders which give ten impulses per revolution of the crankshaft. There are forty spark plugs and forty valves, twenty of the latter being mechanically operated. The weight per horse-power of this engine is only 1½ pounds.

splendid flight of 400 to 500 meters (1,312 to 1,640 feet), it made a complete circle. It was on the 18th of December that the accident happened while the machine was in flight. One of our photographs shows its appearance after the accident. The machine struck the ground head first and turned completely over, and that M. Bleriot was not killed or seriously injured, seems quite marvelous. This accident has shown that constructors of aeroplanes should pay more attention to the strengthening of the parts.

Another of our photographs shows the new Antoinette aeroplane which has recently been constructed after the design of Capt. Ferber. As can be seen from the illustration, this aeroplane consists of two large concave wings attached to a central body which gradually tapers down to form a tail. The 100 horse-power, 16-cylinder, V motor is to be placed in the framework between the wings, and the aeronaut will sit just back of it. In the SCIENTIFIC AMERICAN of October 26, 1907, we illustrated this machine in course of construction, as well as the model in flight.

The photograph of the dirigible balloon which we reproduce herewith, shows the latest development in this line, which consists in dividing the envelope into two halves and attaching the propeller blades to the ends of a long shaft placed transversely of the envelope in the space between its two halves. The two halves of the envelope are fitted with rings of steel tubing at the ends where the division is made, for the purpose of strengthening them and holding them in shape, and also as a support for the short propeller shaft, which is concentric with the axis of the airship. A 6-horse-power motor placed below the gas bag is connected by a belt with the pulley on the propeller shaft. The blades of the propeller are about a foot in length. They exert a thrust upon the air in the immediate vicinity of the gas bag and at all points around it, and in this way it is proposed to do away with pitching. The gas bag has a total capacity of 4,838 cubic feet. The two halves are connected by four small U-shaped tubes, which tie together the two circular frames at the center, and also serve to put in communication the gas in the two halves and thus keep it under the same pressure. This new type of airship acted very well in the first tests which were made of it in the Galerie des Machines, at Paris. It moved along at a good pace upon an even keel, and did not require any rudder or flat planes to keep it going in a straight line.



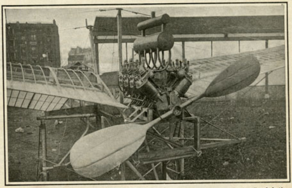
Near View of the Space Between the Two Halves of the Envelope, Showing the Propeller Which Drives It.

The engine shown in two of our illustrations is the latest and lightest aeronautical motor which has been constructed in Europe. It was designed and built by the Dufaux brothers of Geneva, Switzerland, and it is built on the same principle as a small two-cylinder, air-cooled motor which they constructed over a year ago for a helicopter. The present engine is water-cooled, the cylinders being surrounded by corrugated copper water jackets, through which a liberal supply of water is forced by a suitable pump. As can be readily seen, the cylinders are arranged in superposed pairs, there being a stuffing box at the ends and in the common head of each pair of cylinders for the piston rod to pass through. The rod is connected to a cross-head that moves within a tubular guide and that is joined to the crankshaft by a connecting rod. The piston and piston rods are made hollow and very light, and they are thoroughly cooled by a current of air which is forced through them. The water is circulated by means of a centrifugal pump. There are three intake pipes for the water, running across the three sets of valve chambers, and two outlet pipes passing over the center of the water jackets and connected together by a curved pipe at one end. These pipes, as well as two of the inlet pipes for the gas, are shown in the right-hand picture, in which is also visible the distributer, the oil reservoir, and one of the cam-shafts for operating the valves. The gas-inlet pipes for the other two cylinders can be seen in the left-hand picture. The inlet valves are of the automatic type, and the exhaust valves are mechanically operated, although the push-rods for the lower set of cylinders are not shown in the photographs. The oiling of the motor is very complete. There are a large number of sight feeds, and these are supplied by three special oil pumps, which draw the oil from the oil reservoir and pump it at a certain pressure to the proper sight feeds, whence it is carried by a small oil pipe to the motor. The cylinders and crankshaft are mounted upon a framework of brazed steel tubes, which is very strong and light. This motor is said to give 120 horse-power at 1,500 R.P.M., and its total weight is given as 85 kilogrammes, or 187.3 pounds, which corresponds to 1.56 pounds per horse-power.

A Record in Shipbuilding.

A 400-foot vessel has just been built and launched on the Tyne, England, in the record time of sixty-nine working days. The vessel in question is the steamer "Blackwell." She was specially constructed to the order of the Tyzack & Bancroft Steamship Company, Limited, and is designed for their "Well Line," trading between Middlesbrough and London and Calcutta. The principal dimensions of the steamer are: Length over all, 417 feet; breadth, extreme, 50 feet 9 inches; depth, molded, 29 feet 9 inches. The "Blackwell" has been constructed under Lloyd's special survey for their highest class on the spar deck rules and deep frame system, and has a poop 27 feet long, bridge 112 feet long, and forecastle 43 feet long. The officers', engineers', and passengers' accommodation is on the bridge, the saloon being tastefully fitted up in polished hardwoods, and the whole of this accommodation is heated by steam radiators. There is a most elaborate arrangement of deck machinery and derricks for the rapid handling of all kinds of cargo, and provision is made for dealing with lifts up to 25 tons weight. A complete electric light installation is now being fitted. This includes clusters of lamps to provide illumination when loading or unloading at night and a searchlight for use in the Suez Canal. The vessel was built at the North Sands Shipbuilding Yard, Sunderland.

Manganese, according to the American Machinist, is the best deoxidizing agent for nickel and its alloys, and is now extensively used. Not only does it remove the oxygen, but the sulphur as well.



The 50-Horse-Power Antoinette Motor, Showing the Propeller Mounted on the Engine Crankshaft.

The wings of the aeroplane are built up on wooden and aluminium girders. The duplex water tank is seen above the motor.

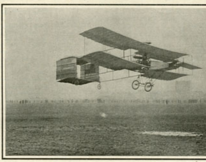
POWERFUL AERONAUTICAL MOTORS AND DETAIL VIEW OF DIVIDED AIRSHIP.

THE PRIZE-WINNING CIRCULAR FLIGHT OF THE FARMAN AEROPLANE.

After but three months of active experimentation, Henry Farman, an Englishman residing in Paris, succeeded in winning, on January 13 last, the Deutsch-Archdeacon prize of $10,000 for a circular flight of one kilometer (0.621 mile) by an aeroplane or other heavier-than-air type of flying machine. Twice before, two days previously, he had accomplished this feat without touching the ground, but this was not done under the observation of the donors of the prize and the proper officials of the Aero Club of France.

The photographs reproduced herewith give an excellent idea of the appearance of the machine when making the prize flight. As can be seen from these pictures, it consists of two main planes, 12 meters (39.37 feet) long by 2 meters (6.56 feet) wide, and placed one above the other at a distance apart of 2 meters. At a distance of 4½ meters (14¾ feet) behind these planes are placed two other superposed planes, some 10 feet in length by 2 meters (6.56 feet) in width, i. e., in the fore-and-aft direction. These two latter planes serve as a balancing tail, and carry but little weight. They are connected together at each end by a pivoted vertical rudder, the two rudders being made to work in unison. The 8-cylinder, 50 horse-power gasoline motor is located at the rear part of the lower forward plane, half way between its ends, and it carries upon the rear end of its crankshaft a two-bladed propeller, 2.1 meters (6.88 feet) in diameter by 1.1 meters (3.6 feet) in pitch. A seat for the operator is provided just in front of the motor, while a single-surface horizontal rudder is mounted upon the front end of a quadrangular, tapered body, which extends out in front of the lower plane at a distance of 5 or 6 feet. The rudder which was first employed was a double one, but this was modified and changed to a single surface, placed a little higher than before, which was found to operate better. The rudder is in two halves, each half being on the outside of two stout, upwardly curved wooden supports. It is pivoted about 1/3 the distance back from its forward edge, and is operated by means of two lever arms set at right angles to its frame at the pivot point and connected by rods to the steering column in such a way that by rocking the latter in a vertical plane, this rudder is operated.

The forward pair of planes are mounted on a tubular framework carried on two pneumatic-tired wheels; while the rear pair of planes are supported on two very small wheels of a similar type. Both the forward and the rear pairs of planes are connected by wooden posts, while the two sets of planes are connected by four horizontal rods of wood, strengthened by four vertical posts. The forward pair of planes are slightly lower at their center points than at their ends, so that they form a slight dihedral angle which, in combination with the low center of gravity obtained by placing motor and operator on the lower plane, is used to assure the transverse stability of the aeroplane. The total surface is about 650 square feet, of which 516.67 are furnished by the main planes. The weight is 530 kilogrammes (1,166 pounds). As the forward planes support practically all the weight these surfaces are loaded to over 2 pounds per square foot.



Three-Quarter Front View of the Aeroplane in Flight.

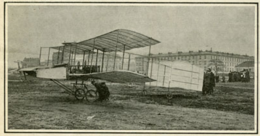
Note the notches cut in rear edges of the upper and lower planes at their centers for the purpose of allowing the propeller on the rear end of the motor crankshaft to turn.

As has already been pointed out in our columns, Farman's aeroplane is by no means as efficient as that of the Wright brothers. He has accomplished by mere power what they accomplished, after many experiments in gliding flight, by skill and by the construction and proper utilization of correct-shaped surfaces. Farman's machine, as he has modified it from time to time, has come to resemble that of the Wrights more and more, until at the present time its chief difference lies in the use of small following planes for the purpose of steadying the main planes. As the center of pressure of these planes appears to be back of a point halfway between the front and rear edges when the machine is in flight, the aeroplane would dive to the ground were it not for the downward pressure upon the top of the rear surfaces and the upward pressure upon the horizontal rudder.

In thus keeping the machine on a fairly level keel in the fore-and-aft direction, the tail and rudder absorb a very considerable amount of power, while the angle of attack of the main surfaces is probably not the most efficient one, and the surfaces themselves doubtless have not the very best shape, although Farman, like the Wright brothers, claims to have constructed them after making numerous experiments with models.

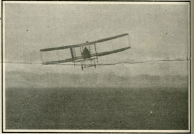
A description of the manner in which Farman built, tested, and improved his aeroplane until he finally achieved the result of flight in a closed circle is interesting. After first experimenting with models, he had the Voisin brothers construct a full-sized machine fitted with a 50-horse-power motor and weighing complete about 1,100 pounds. He expected to fly at once, but he soon found that the machine did not have sufficient power to leave the ground. After effecting modifications in the tail, he at length managed to make a few short leaps, of 50 yards or so. After a month or more of experimenting, changing the position of the steadying planes, trying new propellers, etc., he finally succeeded in making a true soaring flight of several hundred yards. From this time on, having once acquired the knack of getting up in the air, he made many flights of varying lengths and heights, but all in a straight line. He next began to attempt circular flight, and he found that it was necessary to ride the aeroplane in much the same manner as a bicyclist rides a bicycle. In making a turn, one has to incline the body and the machine toward the inside of the circle. He points out that the aviator not only has to steer to the right and to the left, but that he also has to maintain the fore-and-aft equilibrium of the machine and counteract its tendency to dive downward at any angle while at the same time tipping to one side. Besides all this, he is obliged to control the powerful 8-cylinder motor. The accomplishment of

(*Continued on page 94.*)



The Aeroplane Just Before Its Flight, Showing the Remodeled Rear Part.

The horizontal rudder, the gasoline and water tanks, the steering wheel, and the engine are all plainly to be seen in this illustration.



View of Aeroplane Making the Turn.

The considerable angle with the horizontal made by the machine in turning is apparent in this picture, as is also the slight dihedral angle of the planes.

The End of the Flight. The Aeroplane Is Descending On a Perfectly Even Keel Just Before Crossing the Line.

FLIGHT OF THE FARMAN AEROPLANE FOR THE $10,000 DEUTSCH-ARCHDEACON PRIZE.

there is an elaborate system of reading telescopes and scales, forming what is termed by the physicist a cathetometer. The director is looking through the telescope in order to fix the lower surface of the mercury, and the adjustment of the cross hairs at this point is made with great accuracy by a system of reflectors. A modification of this instrument is used to measure the pressure of the hydrogen gas in the air thermometer, which is the standard now adopted not only in connection with the standards, but in all exact temperature measurements. Here at the Bureau the relation of the gas thermometer to the mercurial, platinum resistance, and other thermometers has been most carefully studied, so that now temperature measurements can be made with the greatest accuracy.

In the same room with the standard barometer are the balances of precision used in comparing the standards of mass, or kilogramme and other weights. As shown in the illustration, the observer is at a distance of about 15 feet from the balance, and looking through a telescope notes the deflection of its beam as indicated by a mirror and scale. By means of a system of rods and cranks, he is able completely to control the mechanism without approaching the apparatus. The balance shown in the illustration is of the Ruprecht type, used in comparing the standard kilogramme. In this, after the two standard weights are placed in the scale pans, the beam can be set in motion or brought to rest, and the weights interchanged in the two scale pans by the mechanism referred to without the case being approached or opened by the observer. The Bunge balance, also illustrated, combines all the essentials just mentioned, but in addition permits the weighing to be done in a vacuum. The cabinet behind the observer, it will be noticed, contains various standards, and one of the original kilogrammes of platinum-iridium is to be seen on the table in front of the balance. The sensitiveness of these balances is something marvelous, a difference of a milligramme showing a movement of from 25 to 50 divisions on the scale.

In connection with the study of standards, many important physical determinations and researches must be made, and for these the Bureau has appropriate laboratories with special instruments and equipment for chemical, optical, and electrical work and for the general study of the properties of various materials.

NEW TERMINAL STATION AND APPROACHES OF THE BROOKLYN BRIDGE.

At last, after a quarter of a century of service, the Brooklyn Bridge is to be provided with a terminal station and approaches worthy of the importance and dignity of that structure. The present station is in every way inadequate, both in its appearance and in its accommodation, to form a fitting entrance to this, the most famous bridge in the world. The overcrowding at the Manhattan terminal has long been the most serious of the many cases of congestion of traffic in Manhattan Island. Fully a decade ago, the conditions were described in the columns of this journal as "intolerable." What they are to-day passes description; and that the accidents are not more frequent, is due to the wonderful self-repression and patience, in the face of enormous inconveniences, of the many millions that pass to and fro through the station.

The decidedly ugly building which now disfigures the bridge entrance is to be entirely removed, and in its place is to be erected a much larger and more dignified structure, whose architectural features, as shown in our front-page engraving, have been so judiciously treated, that the station with its approaches will form a decided addition to the architectural features of City Hall Park; while the whole scheme has been laid out on such a spacious scale, that the days of excessive overcrowding must soon become a thing of the past. In addition to serving its purpose as a station, the new terminal building will form an appropriate annex to the municipal office building, twenty stories high, which the city will ultimately erect above the new Subway station adjoining the bridge entrance to the north. The design of the new bridge station, which will be about the height of the present terminal, has been treated in the Grecian style. The façade, whose front will be flush with the building line of the World building, will be formed of six massive columns with glass between, and at each corner of the coping line, above the masses of masonry which flank the central glass-lighted portion of the building, will be symbolic groups of statuary. The approach to the station from City Hall Park will be by way of an esplanade 40 feet in width and of richly ornamented design, which will extend across Park Row and Center Street into City Hall Park, where access to the esplanade will be had by means of four broad stairways; one to the north, another to the south, and two with an escalator between them to the east of the structure. The escalator will be inclosed, as shown in the engraving. All four stairways lead up to an impressive peristyle, which marks the termination of the esplanade. At each end will be massive figures of the Sphinx, and the treatment of the electric light standards, the balustrades, and other features of the design admitting of decorative work, has been done with a simple dignity that harmonizes well with the general treatment of the whole work.

The massive steel bridge which has recently been thrown across Park Row, and the rearrangement of traffic at the present terminal, must not be confused with the permanent improvements referred to above. The recently-completed structure is of a temporary character only, and is designed to offer immediate relief until the new bridge and approaches are completed. The temporary extension of the bridge terminal was made to provide additional platform space and increase the switching facilities. With its opening a couple of weeks ago, cable-car service during the rush hours was discontinued, and through elevated trains are now operated from distant points on the Brooklyn Rapid Transit system during all hours of the day and night. Although the inauguration of this improvement was attended with much confusion, it is confidently expected that ultimately the capacity of the bridge will be increased, and the congestion not a little relieved, particularly in view of the fact that the recent opening of the Subway to Brooklyn has diverted a large amount of travel from the bridge.

The new station will be considerably larger than the old. In the first place, it will be widened to occupy the whole of the available space from building line to building line; and it will be lengthened, by extending it eastwardly over the present viaduct, which is being widened to accommodate it. There will be three floors, as in the present station. The ground floor, or surface, now occupied by the surface car loops, will be cleared of these, leaving an absolutely free passage for pedestrians. The eight loops will be transferred to the second, or mezzanine floor, as it will be called. The third floor will be given over entirely to the elevated service. By this arrangement there will be a complete separation of the three classes of traffic—foot passenger, surface car, and elevated. The passengers who wish to use the surface cars will pass through on the ground floor below the station, and ascend by the particular stairway which serves the line on which they wish to travel. Each loop will have its own stairway from the ground floor, and each stairway will carry a sign designating the lines which may be reached on the floor above. In this way the crossing and recrossing of the tracks, which is such a source of confusion and danger, will be entirely eliminated, and, as the mezzanine platforms will be very spacious, the present congestion will be entirely relieved.

As soon as the extension of the tracks and platforms of the new station has been completed, the temporary extension across Park Row will be taken down, and the new approaches built in its place. Passengers desiring to take the elevated trains will pass along a platform on the mezzanine floor, which will be raised above the platform of the trolley loops, and from this platform another set of stairways and escalators will lead to the elevated lines on the floor above. These escalators will also carry signs, which will enable the passengers to go direct to the platforms from which their particular trains are starting.

At the present time the work of widening the roadways of the bridge is nearing completion. This widening is done to enable the Subway cars which will cross the bridge to descend into a tunnel, which will connect the bridge with the Subway terminal station and the Subway loop. When the roadways have been widened, the trolley tracks will be moved out to permit the laying of another track on each side of the bridge to connect with the Subway. The advantages of the scheme of tracks and connections as outlined above are that if the Brooklyn Rapid Transit Company does not wish to operate the Subway loop connecting the bridges, it still can operate its elevated trains to the Park Row terminal. Moreover, in that case the company which operates the Subway loop will be independent of the Brooklyn Rapid Transit Company. The passengers who use the Subway loop will not be required to use the bridge terminal station, but can take their cars from the big Subway terminal station below the Staats Zeitung building site.

The Subway terminal station will extend for a distance of three blocks, and it will contain three loading and two unloading platforms, each 450 feet in length. The trains from the bridge will cross under William Street and Park Row, where they will enter the station. Access to the station will be amply provided for. There will be five stairways where Park Row and Center Street form a triangle; three for the loading platforms, and two from the unloading platforms, the flow of incoming and outgoing passengers being maintained in opposite directions. At the mid-length of the station there will be another series of entrances leading from Duane, Center, and Reade Streets, and at the extreme northerly end of the terminal there will be another series of exits and entrances. The center loading platform will be 40 feet wide. On either side of this will be two unloading platforms; while on each extreme side of the station there will be another loading platform.

A four-track system will extend from this station, through Center Street and the Bowery, to Delancey Street. There will be stations at Leonard and Franklin Streets, at Howard and Grand Streets, and a large station, built on the general lines of the Park Row station, at the Bowery and Delancey Street. This station, which will be at the entrance of the approach to the Williamsburg Bridge, will cover nearly three city blocks, and the same system of separate loading and unloading platforms and complete separation of incoming and outgoing traffic, that has been planned for the Park Row Subway station, will also be used here.

Important improvements, designed to remove the present surface car congestion at the entrance to the bridge, are being carried out on the Brooklyn side, the main feature of which is the erection of an incline from Washington Street to the bridge yards, a short distance this side of Concord Street, and beyond the elevated spur which connects the Brooklyn elevated system on Adams Street with the bridge. By means of this elevated construction it is confidently expected that the long waits of surface cars at the Brooklyn end of the bridge will be eliminated.

The public has but little idea of the magnitude of the improvements of which the new bridge terminal forms an integral part; for the total cost of all this work will be about $40,000,000. The Manhattan Bridge with the cost of the land and approaches will call for an expenditure of $25,000,000. The Subway loop will cost $10,000,000; the remodeling of the Manhattan terminal, that is to say, all that work shown in our engraving, will cost $3,000,000; the Subway station in Delancey Street in connection with the Williamsburg Bridge will cost $1,500,000; and other items will bring the total up to the $40,000,000 named above.

THE PRIZE-WINNING CIRCULAR FLIGHT OF THE FARMAN AEROPLANE.

(*Continued from page 92.*)

a circular flight in an aeroplane is, therefore, quite difficult, and can only be attained after considerable training.

As to the type of aeroplane to be used in the immediate future, Farman believes this will be a combination of the double and single surface, following plane machines, such as used by himself and Bleriot. Accordingly, his new aeroplane will have three pairs of superposed wings in front and two following pairs at the rear. The spread of the forward wings will be 7 meters (22.96 feet), while that of the rear wings will be somewhat less. The total supporting surface will be 45 square meters (484.36 square feet). The wings will be attached to a quadrangular body 14 meters (45.93 feet) long and mounted on three wheels. The 50-horse-power motor at the front end of this body will carry a 2½ meter (8.2 foot) propeller directly on its crankshaft. One pair of the forward planes will be hinged and used as a horizontal rudder.

On January 13, the day on which Farman made his flight for the prize, the weather was fair and the air was calm. At 9:30 A. M., Farman and the Voisin brothers, after a minute final examination of the aeroplane, ran it out of its shed and tried the motor, which was found to operate perfectly. The aeroplane was then taken to the starting point at one end of the Parade Ground at Issy-les-Moulineaux. Two poles bearing flags of the Aero Club of France were located at a distance of 50 meters apart, while the turning post was located on the perpendicular to the line connecting these posts, at a distance of 500 meters away. Various officials were located at the starting and turning points, while other members of the Aero Club followed the aeroplane in an automobile. At about 10:15 the motor was started, and the aeroplane was released. After a run of several hundred feet, it rose in the air, and crossed the starting line at a height of about 12 feet. It flew straight for the turning post at a speed of fully 30 miles an hour, rising meanwhile to a height of 20 to 25 feet; and, turning about the post at right angles some 300 feet away, it flew a considerable distance—fully 1,000 feet—parallel to the starting line, after which, another right-angled turn was made, and a long straight flight continued back to the goal. The total distance actually covered is estimated to have been between 1,300 and 1,500 meters (4,265 and 4,921 feet), which would bring the average speed up to as high as 28½ miles an hour. The flight lasted 1 minute and 28 seconds. In finishing, the machine crossed the line at about the same height as before, and landed about 100 feet beyond. Farman was given a great ovation, and was heartily cheered by the onlookers. Not content with having so easily won the prize, he made another circular flight before housing the machine in its shed and going back by automobile to Paris. At a banquet of the Aero Club a few days later, he received the prize, in addition to a number of other commemorative medals.

on Saturdays, until retreat, which immediately precedes supper.

Reveille, 6 A. M.

Police call, 6:20 A. M. Rooms must be swept, bedding folded, and everything in perfect order.

Breakfast, 6:30 A. M. Thirty-five minutes allowed for breakfast, including going and returning.

Sick call, immediately after return from breakfast, 7:05.

Guard mounting, 7:15 A. M.

Call to quarters, 8 A. M. Academic period for study and recitation begins. Cadets confined to quarters when not attending recitations. Recitations and periods of study alternate until 1 o'clock.

Dinner, 1 P. M. Three-quarters of an hour allowed for this meal.

Call to quarters, 2 P. M. Second period for study and recitation extends until 4 P. M.

During both academic periods, from 8 A. M. to 4 P. M., there are also hours of attendance for riding and gymnastics.

Drill, 4 P. M. Squads form for various drills. Some attend light battery; others, standing gun, siege battery, seacoast battery, signal drill, target practice, pickets and advance guards, etc. Details for these drills change from day to day, and the drills themselves with the seasons.

Recall from drill, 5:20 P. M.

Parade, 5:30 P. M. to 6 P. M., depending on the season.

Supper, immediately after parade.

Call to quarters, 30 minutes after return of battalion from supper. Evening period of study extends from this time until tattoo.

Tattoo, 9:30 P. M. Preparation for bed.

Taps, 10 P. M. Lights out; inspection.

This schedule is an outline of the occupation of the cadets from September 1 until June 1, modified as to drills by the season. In the first week in June the "graduating exercises" take place, after which the battalion goes into camp. During this camp, which lasts almost three months, there are no academic studies, the work being purely military, and an entirely different schedule goes into effect. Reveille is at 5 A. M., and the day is spent in drills, practice marches, practical work in military engineering, target practice, scouting, sharpshooting, building and digging intrenchments an rifle pits, riding, and lessons in tactics in the open.

It will be noticed that during nine months of the year the cadet has no leisure except a short time after each meal; but during the summer he has two or three hours a day for amusement. However, at no time during his cadetship is he free from accountability for every moment of his time, sleeping or waking, and for every word and action. Every detail of his work and time is hedged about with orders and regulations from which there is no escape. He is taught to obey absolutely, unquestionably, in order that when he has been graduated he may know how to command. His bed and his clothes must be folded according to rule and placed just in their right places. His hair must be kept short. (Whistler, the famous artist, lost his cadetship because he would not have his hair cut, among other reasons.) His person and his clothes must be immaculate at all times; every going and coming must be registered; his quarters are subject to frequent and critical inspection; every penny he spends must be accounted for.

All of this Spartan strictness is imposed upon the cadets because the Military Academy undertakes to turn over to the American army as officers men whose morals, minds, and bodies it can guarantee, as well as men whose ability to perform their duties it has insured. The consequence is that when, at the end of his four years of hard work and unrelenting discipline, the proud cadet receives his commission and becomes an officer in the American army, all his energies are at a maximum of efficiency and his character is tempered like a Toledo blade.

Some New Flying Machine Prizes.

According to a cable dispatch, M. Michelin, the automobile-tire maker, has given a $20,000 trophy for an annual international aeroplane race. Besides the trophy, a cash prize of $3,000 goes to the winning aviator. The length of the first race is not given, but it is the idea of the donor to double the distance each year. M. Michelin, according to the dispatch, has also offered a cash prize of $20,000 to the first aviator to travel between Paris and Puy de Dome, some 250 miles distant, in an aeroplane before the year 1918. This prize is similar to that offered by the London Daily Mail, which is $50,000 for a flight of 180 miles from London to Manchester, England.

Among other recent prizes offered abroad is one of $2,500 for a flight of 10 minutes' duration this summer at the Munich exposition. It is also expected to hold an aeroplane race at Vichy, France, for cash prizes to the amount of $4,000.

A recent number of the Bulletin of the Bureau of Standards contains a long paper by Messrs. E. B. Rosa and N. E. Dorsey describing a new determination of the ratio of the electro-magnetic to the electrostatic unit of electricity. The value found by the authors, as a result of researches continued without interruption since November, 1904, is $v = 2.9963 \times 10^{10}$, taking the dielectric constant of air as unity. Referred to a vacuum, this becomes 2.9971×10^{10}. The authors believe this is correct to within 1 part in 10,000.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

DIAPER-HOLDER.—F. JONATA, New York, N. Y. The holder or container can be quickly opened, a diaper introduced or taken out, and as quickly and conveniently closed, adapting the diaper perfectly to the body of the child. The device is sanitary, can be worn with comfort, and no sharp objects are necessary in closing the garment or holding it closed.

HAT-HOLDER.—MINNIE E. CROUSE, Lawrence, Mass. The purpose of the invention is to provide a device especially adapted to hold a hat, bonnet, or other article of head-wear in position to be trimmed or lined, and to so construct the device that it can be quickly and conveniently attached for sustaining engagement with any size hat-crown, interiorly or exteriorly, and universally adjusted to bring the hat to any position required by the operator.

SHOE-LACE FASTENER.—G. H. NICHOLLS, Galveston, Tex. The object in this case is to provide a shoe-lace fastener for boots or shoes which shall be adapted to prevent displacement of the free end of the tongue as well as for securing the lace proper against the tendency to become unfastened when in wear.

Electrical Devices.

SUPPORT FOR ELECTRIC SERVICE WIRES AND CABLES.—E. H. GREENLEAF and T. A. DISSEL, Newburgh, N. Y. The object here is to provide a support, arranged to permit of quickly and securely fastening the supports in place on a span wire or the like, to allow of conveniently laying the service wires or twisted pairs in position, and to permit of running any one of the service wires or twisted pairs to a house from any point along the line.

WIRE-SUSPENDING DEVICE.—H. E. STEVENS, Macdonaldton, Pa. The object of the inventor is to provide a device easily applied, and more especially designed for use in mines and other places, for suspending and securely retaining in position the feeder or trolley wire of an electric haulage device or the like. It relates to devices such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Stevens and Mr. Gellatly.

INSULATOR FOR HIGH-TENSION CONDUCTORS.—S. H. SUMMERSCALES, Winnipeg, Manitoba, Canada. More specifically, the purpose of the invention is to provide an arrangement for virtually increasing the length of the path of leakage from the conductor to the arm, and, further, to provide an arrangement for preventing, as far as possible, the leakage which is enhanced by the presence of moisture around the insulator in rainy weather.

INSULATOR FOR HIGH-TENSION CURRENTS.—L. STEINBERGER, New York, N. Y. This latest invention of Mr. Steinberger relates to insulators and admits of general use, but is of peculiar service upon transmission lines carrying currents of high potential, and is especially adapted to prevent arcing from the wire to the support under conditions where arcing would otherwise take place.

Of Interest to Farmers.

BALER.—R. E. ZIMMERMAN, Troy, The invention relates to that class of presses in connection with which wire reels are employed and mechanism for twisting the wire and binding the bale, and in the applicant's mechanism the essential operations of the parts are caused by the movement of the press follower acting on a movable door, the movements of the latter serving to properly shift the needles used in the binding mechanisms for the insertion of the wires in the twisting devices, after which a further movement of the door operates the twisting devices.

SPARK-ARRESTER.—D. MCIVOR, Humboldt, Minn. The design of the invention is to provide a spark arrester for use about a barn or pound yard. The arrester may be conveniently thrown back out of the way in kindling a fire, so that the draft may not be impeded and be afterward turned down again into operative position to restrain the sparks when the engine is at work.

PNEUMATIC GIN-FEEDER.—R. L. HOLLINGSWORTH, Decatur, Ga. The improvement refers to cotton cleaners and vacuum boxes and belt distributers, such as are used for removing dirt and sand from the cotton before the cotton is passed to a ginning machine. The object is to produce a machine having improved means for feeding cotton into the machine and for removing the dirt and sand.

CORN-HARVESTER.—J. HETTRICH, Grand Island, Neb. The point of novelty in this instance consists in providing the teeth or spokes of the wheels with hinged or pivoted terminals which are automatically operated as the wheel assumes a bent position while taking up corn from the ground and straightening out the same as soon as the load is ready to be deposited on the table or platform from which it is to be conveyed to the husking mechanism, for example.

BEET-PULLER.—L. PRUE and W. CHARLTON, Wabeno, Wis. In the general operation of this machine, as it is drawn forward the digging wheel lifts the beets from the ground and carries them upward toward the rear platform where they are released from the blades of the wheel and thrown upon the said platform.

WEED-CUTTER.—C. A. DESPAIN, G. A. KITT, and E. R. GORDON, Harrington, Wash. The invention refers to agricultural implements, and especially to weed cutters. The object is to produce an implement of this class of simple construction, which will operate efficiently to cut away or remove weeds, roots, and similar obstructions near the ground level.

CANE-CUTTER.—E. M. HIBBLER, Lyon, Miss. The construction in this case is simple and enables the ready adjustment of the parts and also permits the removal of the handle or the blade and the substitution of new ones, and also provides, apart from the connecting bolts, a device made in four parts, any one of which may be replaced whenever necessary because of breakage or otherwise.

Of General Interest.

COIN-RECEPTACLE.—E. W. ROBERTS, New York, N. Y. The object here is to provide a receptacle formed from a single blank by folding it into box form and locking it by interlocking flaps, to form a slit for the introduction of the coins, and to prevent removal of coins deposited in the box. It is designed for use of children as a savings bank, or for mite societies, Sunday-schools, etc.

PYROGRAPHIC TOOL.—J. P. MÜLLER, New Rochelle, N. Y. This thermocauter is provided with a handle fitted on the tool to insure the insulation thereof against the heat of the tool and thus protect the operator's hand, at the same time allowing the operating point to project the desired distance beyond the forward end of the handle, for convenient manipulation of the tool.

INKING-PAD.—D. T. O'SULLIVAN, West Orange, N. J. The inventor's purpose is to produce a pad which is adapted to be used with a small stamp, such as a dating stamp, but which can be also used for larger stamps; the general purpose being to protect the pad from dust or dirt and prevent evaporation of the ink, and further to construct the pad so that it will operate as a holder for the stamp.

MANUFACTURE OF CELLULAR BOARDS.—S. M. LANGSTON, Camden, N. J. The invention relates to certain improvements in the manufacture of cellular board or double-faced corrugated paper, and relates more particularly to the method and apparatus for the applying of the second facing sheet to single-faced corrugated paper and pasting parts together under a resilient but uniform pressure and while heat is being applied thereto.

SAFETY-RAZOR AND STROPPING DEVICE.—S. B. BATTEY, New York, N. Y. The object of the invention is to produce a device which can be readily manipulated to strop the blade of a safety razor without injuring the edge thereof. It is substantially automatic in operation in respect to the mechanism which holds the blade and reverses its position on the strop with each reciprocation of the blade.

COLLAPSIBLE LADDER.—W. J. BLUNDELL, New York, N. Y. The invention refers to certain improvements in means whereby the ladder may be folded to occupy the minimum space to facilitate storage or transportation, all of the parts remaining connected while in their folded position. One object is to provide a ladder and platform connected thereto and adapted to be automatically folded with the ladder.

MOLD.—W. J. MILLER, Coffeyville, Kan. The invention is an improvement in molds for glass and other articles, being especially designed for use on glass molds. In operation, when the mold is closed the yoke is moved to or nearly to or past the dead center of the mold, thus locking the mold sections securely together.

NEEDLE.—F. B. FOSTER, Santa Barbara, Cal. The inventor accomplishes the object of this improvement by forming the head of the needle with an aperture which enters the blunt end substantially centrally, and emerges a short distance therefrom at one side. At the point of emergence of the aperture an intersecting groove is provided, which is of sufficient depth to contain the strand or ligature with which the needle is threaded.

BOTTLE.—W. HARRISON, Day Dawn, Murchison, Western Australia, Australia. Mr. Harrison provides a bottle which cannot be refilled after being opened and emptied, without the refilling thereof being clearly apparent. This is accomplished through the releasing of a device detachably connected to the stopper, said device dropping to the bottom of the bottle as the stopper is removed.

KNOCKDOWN PLANT-BOX.—N. HIGHT, Wolfboro, N. H. The body portion of the box is in sections separable from each other and from the bottom, means being provided for holding the parts closely assembled while the plants are growing in the box, which locking means can be cast off to provide for separation of parts and exposure of earth in which the roots are contained, enabling the plants to be removed and transplanted with their mother earth intact.

AIR-SHIP.—E. F. LEEDS, Mount Carmel, Ill. The ship is constructed with a screw or auger which is driven by suitable means, as an electric motor or turbine engine, and operates preferably as the sole means for lifting and driving the ship in its flight. A car is suspended from one end of the screw, from which the relative direction and inclination of the screw may be controlled by a rudder having a universal connection at the rear end of the ship.

PIPE.—F. P. NOURSE, Lewiston, Idaho. The invention provides for the collection of saliva and nicotin as it passes to and from the bowl, and the easy removal of the same in cleansing the pipe when desired; it also provides for the cutting of the charred tobacco and other collected matter from the bottom of the bowl, whereby it will fall out with the ashes, etc.

PHONOGRAPH-HORN.—V. H. RAPKE, New York, N. Y. One purpose here is to provide a collapsible phonograph horn or megaphone, wherein the sections can be completely separated one from the other, and compactly nested, and to provide simple means for drawing the sections together, which means can be quickly and conveniently applied or removed.

EGG-TESTER.—C. F. SWANSON, St. Paul, Minn. The purpose in this case is to provide novel details of construction for a tester, which are simple and very effective in service, affording convenient means for giving mirrors employed any inclination from a vertical position, to reflect rays of light impinging thereon at a proper angle for illuminating eggs held in the tester for inspection.

EGG-LIFTER.—C. F. SWANSON, St. Paul, Minn. The invention relates to lifters employed for lifting eggs in quantity from a crate or the like, disposing the eggs while in the lifter for inspection in a tester device, and after they are tested returning the eggs in proper order within the crate. The object is to simplify and improve the lifter device for which a patent was formerly issued to Mr. Swanson.

FISHING-TOOL.—W. H. BUTTON and E. DYER, Bandon, Ore. This tool is intended for use in fishing out drills and other like devices from oil wells, artesian wells, and other borings. The object of the inventors is to provide a tool of this nature, which will operate to effectively grip tools which have been lost in borings, whether they may be in an upright position or have fallen over to one side.

WINDOW.—S. U. BARR, New York, N. Y. The aim of the present invention is to provide a window which is completely dust proof and air tight, and provided with multiple sashes having interlocking stiles, to give the window the appearance of a stationary muntin sash, but the sashes are capable of being opened and closed although no mullions are used. It relates to such as described in the Letters Patent of the U. S., formerly granted to Mr. Barr.

MATCH-CASE.—W. L. CHAMBERS, Brookville, Ind. The improvement refers to match safes or match cases such as are carried in one's pocket. The object is to produce a case which is simply constructed and which can

THE FIRST SUCCESSFUL TRIAL OF A NEW AMERICAN AEROPLANE.

The Aerial Experiment Association, which was formed last summer by Dr. Alexander Graham Bell, has been actively engaged during the past three months in constructing an aeroplane. The machine, which is along the general lines of those now being built for the government by Mr. A. M. Herring and the Wright brothers, is shown in the accompanying illustrations. It consists of two superposed surfaces having a spread of 43 feet from tip to tip and a width of 6½ feet from front to back at the center, which width gradually diminishes to 4 feet at the ends proper of the planes. The front edge of the upper plane extends out 4 feet beyond the last vertical connecting posts at each end, and the silk surface tapers back from this edge to the rear edge of the plane, and has several light ribs attached to it to give it stiffness. Thus the planes proper are 4 x 35 feet in size, which corresponds to a supporting surface of 280 square feet, while the flexible rear edges, etc., bring this up to a total of 385 square feet, which is also the weight of the machine fully equipped. Of this, 185 pounds represents the weight of the machine alone, and 200 that of the engine and propeller, filled fuel and oil tanks, etc. Mr. F. W. Baldwin, M. E., who operated the aeroplane in its initial test, weighed 185 pounds, so that the total weight was 570 pounds, or 1.48 pounds for each square foot of supporting surface—a loading that was sufficiently light to make it possible for the aeroplane to rise at a speed of about 25 miles an hour and lift over 20 pounds per horse-power.

In constructing this machine for the purpose of experiment, every effort was made to reduce the head resistance as much as possible, and it was with this idea in view that the planes were curved and brought nearer together at their ends (the spacing apart is 6½ feet at the center and but 4 feet at the ends), so that the connecting posts could be shortened. These posts are somewhat oval in cross-section, their greatest width being from one-fourth to one-third of the distance back from the front edge. The large center posts are 4 inches from front to back and 1 inch thick; the next posts on either side are slightly smaller; and so on to the end ones, which are 1½ inches from front to back and have a maximum thickness of ½ inch.

The surfaces themselves are made of silk and contain pockets, in which are placed the curved, laminated wood strips extending from the front to the rear edge and giving the surfaces their curved form. Above each pair of posts a T-shaped wood strip extends from front to back, and helps to strengthen the structure. The spacing of the vertical posts also decreases from the center outward. The two center posts at the front and rear edges are about 22 inches apart. The first post on either side of these two is 6½ feet away, while the spacing between this and the next post is 5½ feet, and from here to the outer post about 5. The planes are connected together with diagonal guys of the finest piano wire procurable. They are trussed in both a vertical and horizontal direction.

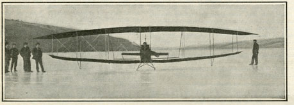
The horizontal rudder, which is 8 feet long by 2 feet wide, is located at the front end of a suitable framework, which projects out 5 feet from the forward center posts. This framework is covered with silk in order to lessen the head resistance. The rudder is steadied at each end by rods, which run back to the planes. It is pivoted on a horizontal axis, and is operated by a vertical lever extending an equal distance above and below it and located at its center. A wire runs from one end of this lever around a pulley in the body framework, and back to the other end of the lever. Attached to the pulley is a small operating lever for turning the same and thus maneuvering the horizontal rudder. This rudder is worked by the left hand of the aviator, while the vertical rudder is operated in a similar manner by a lever convenient to the aviator's right hand. The tail of the aeroplane consisted of but a single horizontal surface located 12 feet back of the rear edges of the planes. The dimensions of this tail were 14 feet 10 inches long by 3 feet wide, i. e., in a fore-and-aft direction. It was carried upon two long bamboo poles, which ran back horizontally from the lower plane, and which were well braced by other bamboo poles extending to the upper planes, and connected to the lower poles by spruce posts. This horizontal tail was also trussed on its under side to a vertical post, upon which was placed the vertical rudder. Despite this trussing, the pressure upward against the tail was so great as to cause it to buckle on one side while the aeroplane was in the air, the result being that the machine veered sharply to the same side and landed, sliding sidewise on the ice and breaking one of the outer runners and its supporting post. The motor employed was an 8-cylinder Curtiss air-cooled engine of 40 horse-power. This engine was mounted on horizontal wood beams connecting the front and rear large center posts. It carried a light bicycle wheel on its front end as a flywheel, while the 6-foot propeller was mounted directly on the rear end of the crankshaft. The pitch of this propeller was 4 feet, and the number of revolutions per minute that it made while the aeroplane was in flight was probably in the neighborhood of 1,200. With the aeroplane held stationary and the motor running, a thrust of 130 pounds was obtained at about 1,000 R.P.M. The lower plane was notched at its rear edge in the center, to allow of the propeller revolving.

The 40-horse-power motor used had a bore and stroke of 3⅝ and 3¼ inches respectively. This engine develops its full power at about 1,800 R.P.M., while at the speed at which it ran during the flight (viz., 1,200 R.P.M.) it developed only about 25 horse-power. The weight of this engine complete, without accessories, is but 145 pounds, while with a separate carbureter of 14 ounces weight upon each cylinder, and with the combined gasoline and oil tank shown as well as including the propeller, the total weight was but 200 pounds. The engine had been thoroughly tested, driving a propeller and running the motor ice-boat illustrated in our last issue.

The idea of mounting the aeroplane upon runners and testing it upon the ice seems to be an excellent one, and to offer several advantages. Besides the two main runners of substantial construction, the next to the last vertical post at the rear of the surfaces was prolonged downward and fitted with a runner also, for the purpose of steadying the machine and keeping it on a level keel. A runner was also fitted to the vertical rudder post, but was subsequently removed.

Owing to the warm weather and the melting of the ice on Lake Keuka, near Hammondsport, N. Y., where the test was held, it was feared that it would be impossible to try the machine. Fortunately, however, a slight cold snap gave the experimenters a chance to make the trial; and on the 12th instant, upon its first test, the aeroplane flew a distance of 318 feet 11 inches, and apparently showed good stability. After running 200 feet, the machine rose to a height of 15 feet, and the trial could have been continued and made much longer had the horizontal tail not been damaged. The chief point to be noted is that no difficulty was experienced in getting up in the air with this machine, and in all probability in the near future it will be possible to make much more extended flights.

The Aerial Experiment Association, and especially those members who have been active in the construction of this new aeroplane, deserve great credit for designing and building a heavier-than-air machine that was able to fly at the first attempt, and we feel sure that in due time some valuable results will be obtained from the systematic experiments being carried on by this association. In the current issue of the Supplement we have published a description of the experiments made by the association with Dr. Bell's tetrahedral kite last fall. While the results were encouraging, it was not deemed wise to attempt to fit a motor to the tetrahedral cell aeroplane, so the latter was discarded for the time being, and experiments were begun with the usual two-surface type of aeroplane, the result being as detailed above.



Front View of the New Aeroplane, with One of its Designers in the Aviator's Seat, Showing the Propeller, Horizontal Rudder, and Horizontal Tail.

Three-Quarter Front View of Aeroplane, Showing Engine, Propeller, and Both Rudders.

Spread of planes, 43 feet. Supporting surface, 385 square feet. Weight, 385 pounds. Propeller, 6 feet by 4 feet pitch. Engine, 40 H. P., 8-cylinder air cooled.

Side View of Aeroplane, Showing General Arrangement of Engine and Rudders.

The aviator sits at extreme front edge of lower plane and controls the rudders with two small levers within the truncated body.

A NEW AMERICAN AEROPLANE WHICH FLEW AT ITS FIRST TRIAL.

HOW TO CONSTRUCT A BALLOON.—THE MAKING, INFLATING AND SAILING OF GAS BALLOONS.

BY R. COURTRIGHT, AERONAUT; MEMBER AERO SOCIETY OF GREAT BRITAIN.

This article is, as its caption indicates, a practical treatise on the construction, inflation, and sailing of balloons, and it has been prepared for those whose knowledge of aeronautics and balloon making is limited, and with the main object of elucidating, in plain English, the elementary principles of aeronautics, which to many have been enveloped in a haze of mystery. During the past few years many novices have entered the field of aeronautics; and with the founding of societies and aero clubs, the present seems a most opportune time for such an article to make its appearance. Compared with other sciences, aeronautics has been retarded by a lack of information on the subject. Since the discovery of the balloon in 1783, a number of books on aeronautics have appeared, but none, to the writer's knowledge, giving full and complete instructions on the construction and operation of practical aeronautical machinery, excepting, possibly, John Wise's book (which is very old), and Moedebeck's "Pocket-Book of Aeronautics," which book is more for the use of the experienced aeronaut than for the amateur.

It is a well-known fact that when a body is immersed in any fluid, if its weight be less than an equal bulk of the fluid, it will rise to the surface; but if heavier, it will sink; and if equal, it will remain in the place where it is left. For this reason smoke ascends in the atmosphere, and heated air in that which is colder. Upon this simple principle depends the whole theory of the balloon.

By heating a quantity of air to about 500 deg. F., we double its bulk when the thermometer stands at 54 deg. in the open air, and in the same proportion we diminish its weight; and if such a quantity of this heated air be inclosed in a bag, and an equal bulk of common air weighs more than the bag with the air contained in it, both the air and the bag will rise in the atmosphere, and continue to do so, until they arrive at a place where the external air is naturally so rarefied that the weight becomes equal, and here it will float.

But it is not necessary to confine ourselves to heated air for raising balloons. There are many gases which weigh less than air. Hydrogen is the lightest of all, with pure coal gas next in order. Pure hydrogen weighs but 0.005 pound per cubic foot, and coal gas about twice as much; so if a cubic foot of hydrogen weighs 0.005 pound and a cubic foot of air weighs 0.075 pound, a cubic foot of hydrogen will lift 0.07 pound, and 1,000 cubic feet will lift 70 pounds; 1,000 cubic feet of coal gas, about 35 pounds.

It is necessary that balloons should be made to weigh as little as possible. On this account the form becomes an object of some consideration. A spherical form has been mathematically demonstrated to be the best, having a greater capacity under a smaller surface than any other, and this holds good whether the balloon be large or small. The cubical contents of a sphere, or any other form of which balloons and airships are made, increase much faster than their surfaces. Suppose we increase the capacity of a balloon eight times; the tendency to rise will be eight times greater, but this may be done without making the machine eight times heavier than before, in fact we increase the surface only four times, and therefore save fifty per cent in its construction.

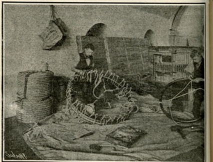
Diameters.	Surfaces.	Capacities.	Ascensive Powers.	
			Hydrogen.	Coal Gas.
24	1810	7238	452	253
25	1963	8181	511	286
26	2124	9203	575	322
27	2290	10306	644	360
28	2463	11494	718	402
29	2642	12770	798	447
30	2827	14137	884	495
31	3019	15598	975	540
32	3217	17157	1072	600
33	3421	18817	1176	658
34	3630	20580	1286	720
35	3848	22449	1403	789
36	4070	24430	1527	854
37	4301	26522	1658	928
38	4536	28731	1796	1000
39	4778	31060	1942	1087
40	5026	33510	2094	1175
45	6362	47713	2982	1569
48	7200	58000	3975	2030
50	7854	65450	4091	2290
55	9503	87114	5445	3049
60	11310	113098	7069	3955
65	13273	143794	8987	5043
70	15394	179595	11225	6286

The table herewith gives the diameters, surfaces, capacities, and ascensive power in feet of balloons inflated with hydrogen or coal gas.

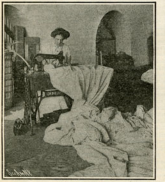
The next consideration is the material of which balloons are made. Silk is the lightest and strongest, but cotton has largely taken its place for reasons of economy and for the fact that its surface is less easily charged with static electricity. A cotton balloon, say from 36 to 40 feet diameter, with its car, net, etc., would weigh about 400 pounds, while a silk one of the same size would weigh about one-half as much. Although other kinds of silk will do, pongee is the best. It is very strong and light and takes varnish well. However, the writer has always preferred to use fine half-bleached muslin or cambric. It is cheap and is sold in any lengths, and varies from one to three yards in width. Other material than silk or muslin is unfit for ordinary gas balloons.

Before any of the material is cut to form the gores it must be varnished three or four times with a special varnish invented by John Wise, the great American aeronaut, made in the following way: Take an iron or copper kettle of 15 or 16 gallons capacity, and half fill it with pure linseed oil. The boiled oil that one buys from paint dealers is not fit for the purpose. Place the oil over a fire, and let it heat slowly to a degree at which it will char a piece of wood when immersed in it. At this point it will foam and emit vapor, and if not well secured from the air will burst into flame. This can be prevented by placing a tight cover with a small airhole in it on the kettle. This will keep the air from it, and the boiling can be kept up for an hour or more without any danger of its catching fire. When sufficiently done it will be very thick and stringy and of a dark red. Upon cooling it will get almost as hard as rubber, but it must be thinned with turpentine as soon as it has cooled enough to stand it. When cooled it is very elastic, more so than India rubber. It improves by keeping, and if

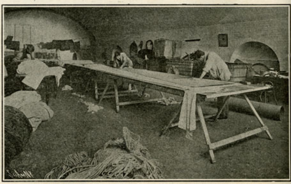
A London Factory. Examining the Gas Bag Before Shipment.



Roping the Concentrating Hoops.



Sewing Together Segments of Cloth Into Balloon Cases.



In an English Balloon Factory. Cutting the Cloth Into Properly Shaped Segments.

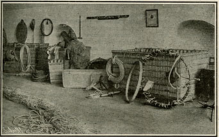
HOW TO CONSTRUCT A BALLOON.

placed in a glass vessel so that the light can get to it, it will settle, separate the pure part from the black carbonaceous matter. It will dry in the sun in five or six hours, and requires no driers. It will take about 25 or 30 gallons of it diluted with turpentine to varnish a balloon of 30 feet diameter, according to the number of coats applied.

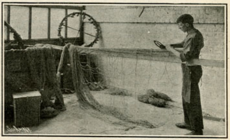
The writer made a small cotton balloon in August, 1904, coated with this varnish. It was used but three times and then stored away in a large box, where it has remained for over three years without showing the slightest symptoms of spontaneous combustion and very little adhesiveness. In Europe many aeronauts still use the old preparation (Arnoul's)—mixing litharge, umber, or birdlime, etc., with the linseed oil, which causes stickiness at high temperatures, demands constant inspection when in storage, and is liable to spontaneous combustion.

Of late years balloon cloth has been varnished by machinery. The machine is very simple, and can be made by the aeronaut himself. Fig. 1 shows one form of a machine. The cloth unwinds from a roller, and is drawn through the varnish in the tub under another roller. It then passes over and under a series of blades or scrapers which remove the surplus varnish. After passing the scrapers it winds on a third roller, and is then unwound and hung up to dry. When dry it is run through the machine again. This is done three or four times, and it will be seen that the cloth, after the first coat, receives two coats at a time, one on each side. Therefore, if the cloth is run through three times it receives five very thin coats. This saves much labor, makes a very light and gas-tight bag, and is far superior to a hand-varnished balloon. To varnish the material by hand, it is hung up by one edge or stretched on a frame and the varnish is applied with a brush. The coatings should be put on very thin and should be well brushed or spread, so as to close the pores of the cloth. It is well to keep in mind that the cloth holds the varnish and the varnish holds the gas, therefore great care should be taken in its application. If applied in thick and uneven layers it gets porous, and does not produce a very impervious or light-weight envelope. The same amount of varnish applied in three or four coats makes a far tighter envelope than if applied in one or two, for the pores left in the first coat are not all covered by the second, and the pores in the second are not all covered by the third, and so on. Having varnished the material, it must be cut out into properly shaped segments or gores to form the bag. This is done in the following manner: The piece intended for a pattern gore is divided into four equal parts by having a line drawn through its middle in length and one across the middle in width. Take any one of these quarters, and divide it into thirty equal parts as shown in Fig. 2. This makes twenty-nine cross lines to the quarter. If the balloon is to be a small one (say less than 29 feet diameter) divide the quarter into eighteen equal parts, making seventeen cross lines as in Fig. 3. At each cross line in both figures there is affixed a natural sine. Now, whatever the width (EF or MN) of the half gore may be, it must be multiplied by each one of these natural sines, which will give the length of the line of each division where the curve is to cut it. For example, line OP is equal to 0.86603 times EF, and line AB is equal to 0.81915 times MN. But a much quicker and better method to find the points where the curve is to cut the cross lines is as follows: Take a piece of wood, like a common ruler, which in length is equal to EF or MN. Divide this into ten equal parts and each part into tenths, which will make tenths and hundredths. Now the length of the first line above EF will be well over ninety-nine hundredths; the next line will be still over ninety-nine hundredths. The last line will be five-hundredths and a little over. The same rule applies to Fig. 3. After finding the point on the lines, draw the curve. By folding the pattern you can easily cut the other quarters of the gore into the same shape. A certain number of these gores (according to the diameter of the balloon) sewed together will make a sphere. Most aeronauts, especially the French, prefer the shape shown in Fig. 4. The neck, or tail as it is sometimes called, which is large enough for a person to pass in and out, as it is sometimes necessary to go inside the balloon, is made apart from the balloon and afterward sewed on.

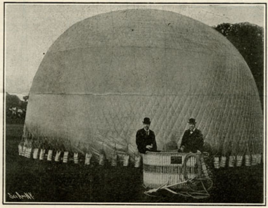
The gores having been varnished and cut out are now ready for sewing together on the machine. Hand sewing will do, but the machine does the work better and quicker. The edges should overlap each other at least an inch and be sewed with a double stitch, and care must be taken not to pucker the seams. After the seams are sewed they must be varnished on both sides to stop up the needle holes. The easiest way to varnish the seams is to sew the gores into sections. Suppose there are forty-two gores; sew the gores into three sections, making fourteen gores to the section. Varnish the seams and sew the sections together, and then varhish the three seams thus made. The cloth should be double for about six square yards at the top of the bag where the valve is to be and where the strain will be the greatest.



Cars and Accessories in an English Factory.



Knitting the Net Which Covers the Balloon.



Inflating a Balloon, Showing the Anchor and the Arrangement of Ballast Bags.

Ascent of a Military Balloon.

Looking Down at a Bed of Clouds from the Car of a Balloon.

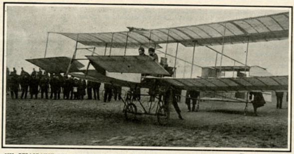
Ascent of a Military Balloon.

HOW TO CONSTRUCT A BALLOON.

THE FIRST TWO-PASSENGER AEROPLANE.

In view of the requirements of our War Department, whereby it is stipulated that the new aeroplanes which have been contracted for must carry two men, and also of the same requirement in the conditions governing the 220-mile, $20,000 prize flight to be made within the next decade in France, the photograph which we reproduce herewith will be found interesting, since it shows the manner in which those two noted aeronauts, MM. Farman and Delagrange, were mounted in the latter's aeroplane when, on March 21, they succeeded in making a short flight of 75 or 80 feet. This is the first time, so far as we know, that an aeroplane has flown and carried two people. The flight was made after both the aeronauts had spent the entire morning in making flights with their two quite similar machines. Shortly after 10 A. M., M. Farman made a successful attempt at breaking his best previous record. His flight upon this occasion was conducted similarly to the one he made when he captured the Deutsch-Archdeacon prize on January 13 last, there being two posts located at a distance apart of 500 meters, around which it was necessary to travel. In making the test, the aeroplane left the ground readily after a short run, and flew at an elevation of about 20 feet, making two complete circles and a half circle, and remaining in the air 3 minutes and 29 seconds. Officially, Farman covered 2½ kilometers in this time; but if the speed of his machine is used as a basis for calculating the distance actually traversed, this will be found to be more than 3 kilometers (1.86 miles) or three times the distance covered by him when he won the prize about two months before. Had the water-cooled motor not become overheated, it is probable that Farman could have flown much farther. The machine showed better stability than ever before, and even in making the turns it tipped but little. Late in the afternoon, Farman again took out his aeroplane and described two circles, each about a kilometer in length, in a continuous flight lasting 2 minutes and 45 seconds. He was again obliged to descend on account of the motor overheating. The day before, after refitting his aeroplane with the 8-cylinder, water-cooled, Antoinette motor in place of the similar-type, air-cooled, Renault motor with which he experimented with slight success a week previously, Farman made two flights estimated at 2.3 and 3 kilometers in 2 minutes 50 seconds and 2 minutes and 55 seconds respectively. With the air-cooled motor, Farman only succeeded in flying about 900 feet, though he expects that after his engine has been thoroughly overhauled and tested, he will be able to do even better with it than with the water-cooled engine. On March 27 Farman met with an accident while making a sharp turn. One end of the aeroplane struck the ground, and the aviator was thrown 35 feet. He was badly cut about his face, but not seriously injured.

M. Delagrange's No. 2 aeroplane is practically a duplicate of Farman's machine. On March 21 M. Delagrange succeeded in making several extended flights around the borders of the parade ground. In the longest of these he remained in the air 2 minutes and 5 seconds, and made a complete circle for the first time. On March 17 Delagrange competed for the 200 francs prize for a flight of 200 meters in a straight line. He covered a distance of 269½ meters (884.18 feet) in 21 1-5 seconds, which corresponds to a speed of 28.44 miles an hour. These performances of the sculptor show that the type of machine which he originated, and which was copied and modified by Farman, is capable of being flown by anyone of ordinary intelligence who will sufficiently practise the art. A duplicate of this machine can be had in America for $9,000. A Russian general has ordered one for his government.



MM. DELAGRANGE AND FARMAN ON THE FORMER'S No. 2 AEROPLANE, WHICH IS THE FIRST MACHINE TO RISE IN THE AIR WHEN CARRYING TWO AVIATORS.

List of Aviation Prizes Offered Abroad.

$100 given by A. C. Triaca, of the Correspondence School of Aeronautics, for the longest flight in 1908.

$100 prize of Aero Club of France for the best indicating level.

$200 offered by M. Pepin for the first machine that flies across the Garonne River in France.

$1,000 offered by the Aero Club of France for a flight of 5,000 meters (3 miles).

$2,000 offered by M. Armengaud, Jr., for the first machine that remains in the air 15 minutes.

$2,500 offered by Dr. Gans for a competition at the Munich Exposition this summer for the first machine which remains in the air 10 minutes.

$2,500 offered by Ruinart Fils for the first 18-mile flight across the English Channel.

$2,500 offered by Lord Montague, editor and proprietor of "The Car," to the aeroplane making the longest flight in England in any year. (Also $25 a mile up to 25 miles for said flight.)

$3,000 offered annually for ten years by MM. Michelin for the longest flight in a closed circuit in any country having an aero club in the International Federation. A $2,000 trophy goes with this.

$4,000 in cash prizes for aeroplane races at Vichy, France, next September. Conditions to be announced later.

$5,000 offered by the Daily Graphic for a flight of 1 mile at the Brooklands Automobile Race Track in England.

$12,500 offered by the Brooklands Automobile Racing Association for a 3-mile flight above the Brooklands Race Track.

$14,000 in cash prizes for aeroplane races held July 29 and August 2 and 9 at Spa, Belgium. 1st prize, $10,000; 2d, $2,000; 3d, $100.

$20,000 offered by MM. Michelin for a 220-mile flight from Paris to Puy-de-Dome, France, to be made in six hours (about 36 miles an hour) before January 1, 1919, by an aeroplane carrying two people.

$50,000 prize offered by the London Daily Mail for a flight of 160 miles from London to Manchester. Also $10,000 offered by the Adams Manufacturing Company if the entire machine is constructed in Great Britain, and $2,500 by the Autocar if the motor is of English fabrication.

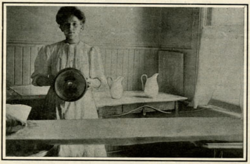
Exclusive of the last-mentioned special prizes, the cash prizes available for flights are $119,925, while including them the figure reached is $132,425.

A PHYSICIAN'S NOVEL USE OF AN AUTOMOBILE ACETYLENE LIGHT.

It has always been recognized that the automobile was invaluable to the physician as offering a means of covering more ground in less time, but it remained for a doctor in Rome, N. Y., to discover a new use for his little Ford runabout. The doctor in question received a hurry call from fifteen miles out in the country to come prepared to operate for appendicitis. Arriving at 6 P. M., after a half-hour ride, it was found that the condition of the patient was very serious and an operation urgent. In the farm house, as is usual, kerosene oil lamps were the sole source of illumination, the light furnished being quite insufficient for the conducting of a delicate surgical operation. More light was essential, and the manner in which it was obtained is shown in the photograph.

A piece of rubber tubing used for drainage was run from the automobile through the window into the room in which the patient lay. One of the gas lamps was taken off the auto and was pressed into service in the improvised operating room, the supply of gas being drawn from the acetylene generator on the auto, which was backed up beside the house near the window as shown. As soon as the gas was turned on and the lamp lighted, the resulting brilliant illumination permitted the successful carrying out of the operation.

The condition of the patient was such as to demand quick work. Had any other means of conveyance been relied upon, the doctor reports it might have been too late even to operate. It was necessary to operate immediately, and to do so, a clear and powerful source of light was needed. Had the physician's car been furnished with electric headlights fed from the ignition battery, or even had he had as part of his equipment a low-voltage, high-candle-power lamp (tungsten or tantalum) of high efficiency, by removing the battery from the car and taking it in the house, he could have had an excellent odorless source of light which would have compared favorably with that in a well-fitted operating room.



The Acetylene Gas Headlight of the Automobile Furnished Excellent Light for the Performance of the Surgical Operation.

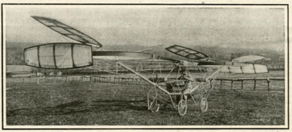
The Gas Generator on the Automobile Was Connected With the Lamp by a Piece of Rubber Drainage Tubing.

A DOCTOR'S NOVEL USE OF THE ACETYLENE LIGHT OUTFIT OF HIS AUTOMOBILE.

SUCCESSFUL TEST OF THE CORNU HELICOPTER.

A little over a year ago we described a test of a model helicopter constructed by M. Paul Cornu. This model weighed about 30½ pounds, and was fitted with a 2 horse-power gasoline motor. In the tests which were made of it, it rose vertically in the air and also, when the aeroplanes were set so as to receive the blast of air from the lifting propellers, it traveled along in a horizontal direction.

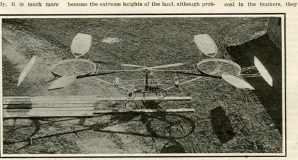
M. Cornu has recently completed a full-sized machine constructed along the same lines as the model. This machine is shown very well in the accompanying photographs. As can be seen, it consists of two horizontal 2-bladed propellers mounted upon horizontal wheels or pulleys. The pulleys are carried upon a suitable framework, the main member of which consists of large-diameter steel tubing arranged in the form of a wide U, in the bend of which is mounted an 8-cylinder Antoinette motor of about 24 horse-power, and also the aviator's seat. The backbone and superstructure of the machine are carried upon a 4-wheeled chassis, so that it can be run along on the ground. Such motion, however, is not necessary for the machine to rise in the air, as it is supposed to lift vertically, and afterward, when it is in the air and the aeroplanes seen at each end are set at the proper angle, to be driven along horizontally by the reaction of the air from the propellers. The pulley wheels carrying the propellers are driven by a long belt, that is crossed and passes over a pulley on the end of the motor crankshaft.



The Cornu Helicopter as Seen from One End.

The 8-cylinder motor, shown in the center of the machine, drives the two large pulleys by means of a belt. The aeroplanes seen at each end can be set at different angles in order to cause the machine to move forward from the air reaction of the propeller blades upon them.

The first test of his new machine was made near Lisieux, France, the first week in April. It was successful in as far as the lifting power of the machine was concerned, although the inventor could not make it travel in a horizontal direction. In the test he rose off the ground a distance of a foot or two. His machine is the first real helicopter to rise off the ground with its own power and carry a man, that has been brought out in France. A much larger machine of similar type—the Breguet-Richet gyroplane—succeeded in rising vertically into the air for a short distance some months ago, but in both cases the inventors have found that this is only half the problem. While it is comparatively easy to rise vertically, it is much more difficult to construct a machine that can be made to travel in a horizontal direction when once it is in the air. The helicopter is one of the most alluring types of flying machine, but from present indications it is one that will not be developed for some years to come, or not until after the aeroplane has reached a comparatively high degree of perfection. There has been considerable experimenting with machines of this type, but very few of them have shown any indications of success.



Plan View of Helicopter, Showing Arrangement of Motor, Driving Belt, and Aeroplanes at Ends.

The propellers are 6 meters (19.68 feet.) in diameter and make 90 R. P. M. The total weight lifted was 260 kilogrammes, or 853 pounds, so that the weight lifted per horse-power was about 35 pounds—the best that has yet been done.

A NEW FRENCH HELICOPTER.

Electric Telephotography.

A Swiss inventor, Eugen Frikart, has taken out a German patent on a method of electric telephotography, which should attract considerable attention. Of course, every one has heard of the wonderful achievements of Prof. Korn, of Munich, in this line. By means of a metallic conductor he transmitted to a distance of about six hundred miles, photographs and handwriting. But, according to the Berner Bund, Frikart has gone still further, as he can transmit with his apparatus pictures and writing over still greater distances without any metallic connection between the sending and the receiving station, the transmission taking place on the same principle as wireless telegraphy. It is possible, for instance, to transmit from Bern to Berlin, in five minutes, a facsimile of a piece of manuscript, without using any conductor. The transmission can take place at any time of the day, no optical apparatus being necessary. Further, only the instrument for which the picture is intended can receive it. Such an invention should have great value for communications between vessels and the land. (A German paper naturally adds "especially for the police.") To vessels that are several days from land, photographs can be sent; airships can transmit to any desired distance, or in any direction desired, photographs of fortifications over which they sail. The receiving apparatus makes the picture directly, it is said, without any chemical process, on the paper, and produces either one or more copies at once.

In sending, the picture is divided by the apparatus into several points of equal size, grouped together more or less thickly, according as the place in question is dark or light. Each of these points is transmitted by a roller, such as one finds in a phonograph, by means of a spark discharge, to the receiving apparatus, and there, by means of a tracing point, it is visibly and permanently fixed on a similar cylinder. Naturally, the cylinders of the sending and the receiving apparatus must have exactly the same rotation speed; this is also regulated electrically without the use of metallic conductors. There are still many difficulties which the new invention has to combat, but it is hoped that it will soon reach the same state of perfection as the wireless telegraph.

The Cubic Contents of Ocean Areas.

The mean height of all the land now above the sea is referred to by Lyell as being 1,000 feet. The mean depth of the ocean is at least 12,000 feet, that is, it exceeds the height of the land twelve times. This is because the extreme heights of the land, although probably no less than the extreme depths of the sea, yet are exceptional heights, while the ocean maintains its depth over enormous areas. Owing to the fact that the surface of the ocean to that of the land is as two and a half to one, the ocean would accommodate the whole of the land thirty times over, were it all pitched into the ocean areas.—Knowledge and Scientific News.

Only flaming arc and high-efficiency incandescent lamps are used in the business portions of Berlin, and 90 per cent of the outdoor lighting is now done with flaming arc lamps. Both tantalum and tungsten lamps are used, but the former are seen usually in old fixtures where the lamp cannot be placed vertically.

THE UNITED STATES BATTLESHIPS "DELAWARE" AND "NORTH DAKOTA."

When Great Britain, which sets the fashion in warship construction, had brought out the "Dreadnought," each of the other leading naval powers set about designing a "Dreadnought" of its own. France laid down the "Danton," an 18,400-ton ship, carrying four 12 and twelve 9.4-inch guns. Germany produced the 17,710-ton "Ersatz-Sachsen," which is generally credited with carrying sixteen 11-inch guns. Japan laid down the "Satsuma," an 18,800-ton ship mounting four 12's and twelve 10's. The answer of the United States was the "Delaware," of 20,000 tons displacement, carrying ten 12-inch guns as its main armament.

Although we have spoken of the "Delaware" and "North Dakota" as being the first of our "Dreadnoughts," it is quite a question whether the "South Carolina" and "Michigan" are not entitled to be called the first of this class. They fall below it chiefly in their displacement, which is only 16,000 tons; but they carry a main armament of eight 12-inch guns and therefore are entitled to rank in the all-big-gun class. These ships, moreover, have a main armor belt which is 16 feet wide and varies from 8 to 11 inches in thickness. The speed is 18½ knots, and the maximum coal capacity 2,200 tons. Taken altogether, then, they would seem to be well qualified to "lie in the line" against any of the modern "Dreadnoughts" which may oppose them.

The "Delaware" and "North Dakota" represent a great advance, on practically every point of comparison, over any existing ships of the United States navy. The most notable increase has been in the displacement, which on the normal draft will be 20,000 tons, or 4,000 tons greater than that of the next largest of our battleships. They will be 510 feet in length between perpendiculars and 518 feet 9 inches in length over all. They are 85 feet 2½ inches in breadth on the load water line, and at their normal displacement of 20,000 tons, when they will be carrying two-thirds of their full supply of ammunition and stores and about 1,000 tons of coal, they will draw 26 feet 11 inches of water. At full load displacement with full supply of ammunition and stores and 2,500 tons of coal in the bunkers, they will displace 22,060 tons.

The "Delaware" is being built by the Newport News Shipbuilding Company, and the "North Dakota" by the Fore River Shipbuilding Company. Work on these two ships was commenced last October and is proceeding favorably, particularly on the "North Dakota," which on March 31 last was 25.7 per cent completed. The progress on the two ships is shown month by month in the accompanying table:

Month	Delaware	North Dakota
October 31, 1907	2.33	4.23
November 30, 1907...	5.08	7.84
December 31, 1907....	7.05	12.70
January 31, 1908....	9.20	17.50
February 29, 1908....	12.77	21.40

If this rate of construction be kept up on the "North Dakota" she will be completed considerably within her contract time.

The great length of the "North Dakota" and the fineness of her model, as rendered necessary by the high speed of 21 knots, which she is expected to attain, necessitated an increase in the height of the freeboard forward to enable her to steam comfortably into head seas. Consequently, a forecastle deck has been provided, extending from the stem to abreast of the forward smokestack. This deck has a freeboard at the stem of 25 feet 9 inches and abreast the forward turrets of 25 feet 1 inch. From the forward smokestack the main deck runs flush to the stern, with an average freeboard of about 18 feet. The freeboard amidships, as designed, is 17 feet 10 inches on a draft of 26 feet 11 inches. The decks of the ship have been kept as free as possible of all incumbrances with

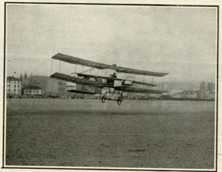
THE RECORD FLIGHT OF THE DELAGRANGE AEROPLANE.

The photograph which we reproduce herewith shows the Delagrange aeroplane in its record flight of April 11, when it remained in the air 9¼ minutes and covered a distance of about 4 miles. Before making this flight, the water tank had been augmented by a supplementary 5-liter reservoir, so that the total quantity of cooling water carried was 20 liters (5¼ gallons). With this amount of water the engine can be run stationary for 18 minutes without overheating. Thus, it was possible from this point of view for Delagrange to remain in the air 15 minutes, and win the $2,000 prize offered for this performance.

On the 10th of April, M. Delagrange again commenced his experiments. He had not been in the machine for several weeks, yet notwithstanding this he showed his complete mastery of it at the start. Under the supervision of the Aviation Commission of the Aero Club of France, he made a practice flight around a polygon marked out by posts, and flew about 2½ kilometers (1½ miles). He would thus have beaten Farman's record of March 21 (2,004.8 meters, or 6,577.41 feet) if he had not touched the ground once for perhaps three seconds. The witnesses of this flight noted particularly the ease with which the aeroplane flew, its apparent manageability, and the precision with which the aviator was able to take the turns. If one takes into consideration the short time and the relatively few experiments required by M. Delagrange in learning to fly, it would seem that the operation of an aeroplane of this type is easier to learn than the riding of a bicycle. Of course, however, the former requires somewhat more *sang froid*.

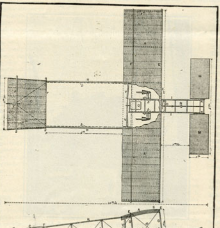
The next morning, April 11, at 11 o'clock, further experiments were made before the Aviation Commission. The course was a quadrangular one, there being four posts located 400, 200, 300, and 300 meters apart respectively. There was a rather strong, irregular, puffy wind, and no flights of any great length were accomplished. The trials were interrupted at noon, and they were not begun again until 5:30 P. M., when the wind was less lively, although there were puffs of considerable strength now and then. This time the course laid out was triangular, having sides 350, 200, and 275 meters in length respectively, or a total perimeter of 825 meters (2,706.68 feet). In the trial made at this time, the machine rose in the air after running along on the ground about 150 feet. During the first two rounds, Delagrange kept close to the ground, and touched the earth twice just after making a turn. The machine always drops slightly just after it makes a turn, and the aviator did not at first allow sufficient space for this drop. He afterward rose to a height of about 10 feet, and then succeeded in making nearly five rounds without touching. The distance covered in this latter part of the flight was officially measured as 3,925 meters (12,877.27 feet) in 6½ minutes; while the total distance covered is given as 5,575 meters (18,290.64 feet) in 9¼ minutes. This would correspond to an average speed of only about 22 miles an hour. As, however, the machine has shown itself capable of a speed of 28.44 miles an hour in straight-line flight, and as undoubtedly the distance covered was considerably greater than that measured between posts, it is safe to say that the machine flew between 3 and 4 miles at an average speed of between 25 and 28 miles an hour. M. Delagrange's new record beats that of Henry Farman, mentioned above, by 1,920.2 meters (6,299.84 feet). Farman remained in the air 3 minutes and 31 seconds without touching the ground, while Delagrange was in the air 6 minutes and 30 seconds, or nearly twice as long. It is interesting to note that the latter's flight was terminated by the failure of the fuel supply. M. Delagrange also is said to have stated that the strain upon his muscles caused by pushing and pulling on the steering wheel, in order to operate the horizontal rudder, was very great, and that he was thoroughly fatigued at the end of his flight. Nevertheless, had the fuel held out, he probably would have flown a greater distance. Several of the 1905 flights of the Wright brothers were terminated for the same reason, and these gentlemen were widely criticised for allowing their performances to be shortened by such a simple cause. It would seem as though Delagrange would profit from the Wrights' experience, and see to it that his fuel tank was filled before he attempted to make a record flight.

For the benefit of those of our readers who are interested in the new science and sport of aviation, we reproduce herewith drawings of the Farman and Delagrange machines. These drawings are fairly accurate, and will give a general idea of the shape and dimensions of the machines which, thus far, have given the greatest public proof of their ability to navigate the air successfully.



M. Leon Delagrange Making His Record Flight of About 4 Miles at Issy-les-Moulineaux on April 11.

The aeroplane made nearly seven rounds of a triangiar course in 9¼ minutes. It touched ground twice in the first two rounds, but afterward flew for 6¼ minutes without touching. Its speed was between 25 and 28 miles an hour.



Plan and Elevation of the Farman and Delagrange Aeroplanes.

THE RECORD FLIGHT OF THE DELAGRANGE AEROPLANE.

The International Committee on atomic weights has recently announced the changes in the list of elements for 1908. These are, with one exception, practically the same as those announced for 1907. The only notable change is the addition to the list of a new element, dysprosium, whose atomic weight is given as 162.5.

Apparent Overdevelopment of the Motor Industry in Europe.

Consul Albert Halstead, of Birmingham, states that a report has reached that English city that preliminary steps are being made looking to the combination of several of the larger manufacturers connected with the German motor industry. The consul's report continues:

This is said to be the result of unfavorable sales, due to foreign competition and difficulties in the matter of capital. In connection with this report it is interesting to note that people concerned in the motor industry in the United Kingdom are beginning to believe that the productive power of the industry here has finally equaled and will soon—if it has not already done so—exceed the demand. Purchasers do not now have to wait for their motor cars; as a rule manufacturers are able to deliver to purchasers almost immediately after an order has been received.

There has been a change in the methods of purchasers of motor cars. The idea that one who can afford to do so must have a new motor car every year is disappearing and purchasers are contenting themselves with motors that have satisfactorily met their requirements, instead of feeling that they must have every new device. This is regarded as a natural development partly due to the perfection which motor manufacture has attained. British builders appear to be devoting more attention to the manufacture of cars that will come within the means of people of comparatively moderate income. There is some apprehension that the great productive capacity of the industry in the United Kingdom may result in embarrassment for some motor manufacturers.

The British motor industry has had what is deemed a good year, though the unfavorable summer weather affected it somewhat unfavorably, as it did most decidedly the bicycle industry.

Reports from France indicate that the productive capacity of the French motor industry has considerably exceeded the market for French machines. In the natural course of events the immense development of motor manufacturing in the United Kingdom, Germany, France, and Italy would result in a decided effort to sell more machines in the United States, but the success of the industry in the United States and the fact that there appear to be more American cars sold abroad, together with the duty of 45 per cent on motor cars entering the United States, and the present American financial depression, naturally offset the tendency of foreign manufacturers to cultivate the American market to a greater extent.

The situation of the motor industry in the United Kingdom, as well as on the Continent, is such as to make the future most uncertain and to later bring about business difficulties such as affected the cycle trade some years ago, but perhaps to not as great a degree. It is not unlikely that greater attention will now be paid in the United Kingdom to the manufacture of motor cars for commercial purposes, which has not been a neglected side of the industry in the United Kingdom, and this should tend to make the industry more permanently stable.

Trial Flight of the Wright Brothers' New Aeroplane.

According to a newspaper report which has not been authenticated up to the time of our going to press, the Wrights made a preliminary test of their new aeroplane in the presence of some army officers on April 30 at Nag Head, N. C. A two-mile flight is said to have been accomplished, and their machine, it is claimed, could have flown much longer had the aviators so desired.

To Repair Rubber Shoes.—A piece of caoutchouc (India rubber), not too thick, is beveled off at the edges with the aid of a wet knife. The damaged place and the patch are then moistened with oil of turpentine; the parts moistened are brought into contact and subjected, for 24 hours, to a moderately heavy pressure.

provided that no building or part of a building should be carried above the limit mentioned within a distance of the street façade equal to the distance of the curb from the building line. Thirdly: He would allow of the purchase and sale between adjoining owners of the right to build high within the limit stated. And lastly: He would require that all sides of any structure carried above the limit of height should be treated architecturally, and that no wood whatever should be used in the construction of the entire building or its equipment.

PROGRESS OF THE WRIGHT AEROPLANE EXPERIMENTS.

Soon after the first reports were received from Manteo, on Roanoke Island, regarding the flights being made by the Wright brothers in testing their aeroplane, a considerable number of newspaper correspondents visited the scene of the trials, which is among the high and pointed sand dunes of the North Carolina coast on a long strip of land that extends from Cape Henry, near Norfolk, Va., southward some 80 miles.

The brothers refused to make any flights, however, when the reporters were near at hand, and so the gentlemen of the press were obliged to keep in hiding nearly a mile away from the scene of operations, and to merely watch the machine from afar through spyglasses when it was flying. Although no close view could be had of it, the spectators saw the aeroplane numerous times in flight, and were able to form a good idea of its general appearance and construction. The machine used in the experiments is said to be the old one which was taken apart in 1905, while the motor is claimed to be practically a more powerful French-made duplicate of the one with which the flights were made in that year.

Although it is presumably supplied with a suitable radiator for cooling the water, yet it seems to have given trouble from overheating. Doubtless this defect will be readily remedied, however.

On Monday, the 11th instant, the machine is said to have made two flights of about 2 7/16 and 2 1/16 miles respectively. The first of these flights was made at about 9:15 A. M. The machine started from the foot of Kill Devil Hill, and flew in a northerly direction almost parallel with the beach for 1¾ miles, after which it turned to the westward for 5/16 of a mile, and then returned to the starting point in a southeast direction, covering a distance of about ¾ of a mile more. The distances were computed from the telegraph poles ranged along the beach. The time of this flight is given as 3 minutes and 7 seconds, which corresponds to an average speed of 46.91 miles an hour. Another flight over practically the same course was made, the distance covered in this instance being only 2 1/16 miles, and the time being 3 minutes and 50 seconds. Instead of making the second turn, as in the first flight, the machine kept straight on until it was close to the water, when a landing was made. The aeroplane was started from a rail as heretofore. It was placed upon a small carriage, which supported it until sufficient speed was attained for it to rise in the air. It therefore still has the disadvantage of having to be carried back to this rail in order to start. It was transported back by a pair of wheels, which were placed beneath it, after which the engine was started, and the propellers were made to push it along on the wheels over the sand.

After these successful demonstrations on Monday, the inventors busied themselves working at their machine on Tuesday, and the following day they were out again early in the morning. This time both of the brothers could be seen seated in their aeroplane, and they could not have been any more elated at their successful flight than were the onlookers who viewed them from a distance, and who realized that these two young Americans were, in reality, the first men to ever fly together for any distance in a heavier-than-air machine. The first flight was made about 8:30 A. M. The machine is said to have covered about ¾ of a mile in 1¼ minutes, and to have come to earth in an attempt to clear a tree that stood in the midst of the sandy waste. So sudden and violent was the descent, that much sand was sent flying as the machine landed. The second flight made on this day was considerably better. The start of this flight occurred just before noon. During this flight the machine is said to have dropped from an elevation of about 30 feet to a distance of some 10 feet above the ground, and then to have followed up the side of Nag Head Hill (which is about 40 feet high), over the top of this hill, and down on the other side, thus showing its ability to rise and fall with ease and follow the contour of the land over which it is flying. The distance covered in this flight is said to have been about three miles, and three excellent turns were made. According to the reports, there was a stiff breeze of from 15 to 20 miles an hour blowing at the time these flights were made. Two other flights up the coast and back, each of which is estimated to have been 4 miles or more in length, were made. The machine traveled so far, that it was almost out of range of the spyglasses of the watchers. The strong wind which was blowing apparently had no effect upon the machine.

On Thursday three excellent flights were made without mishap. In one of these, Mr. Orville Wright operated the aeroplane, and took as passenger his assistant, Mr. Furness. A perfect circle was made around one of the sand hills, a distance of nearly 2 miles being covered in 2 minutes and 38 seconds. The machine was brought down within a few yards of the starting point, and was managed with great skill. The final flight was made with Mr. Wilbur Wright alone in the machine. Starting from a point near the shed, the aeroplane traveled some 3 miles up the coast and back again, completing a circuit of nearly 6 miles. It had almost reached the starting point when, instead of rising and passing over a sand dune which was in the way, it plunged down from a height of some 30 feet and was demolished. The operator escaped with a few scratches. From all that could be learned, the accident resulted from a change in the operation of the steering device, which caused the aviator to make a wrong move at a critical time. The Wright brothers expressed themselves as satisfied with the operation of the machine, however, and they have shipped what remains of it back to their home in Dayton, O., where they expect to incorporate the knowledge they have gained in the machine which they have contracted to deliver to the government in the next three months, or by August 28.

In view of these semi-public demonstrations, there can be no further doubt of the claims made by the brothers as to their ability to fly; and in all probability they will succeed in fulfilling the strenuous conditions which the War Department has prescribed. In view of the requirement that the machine should carry two men, which has already been fulfilled by the Wrights, it is interesting to note that on the 9th instant Henry Farman is reported to have flown some 700 feet with his father as a passenger, and with 8 gallons of water for cooling the motor and 2.6 gallons of alcohol for fuel.

POSTAL RAILWAY IN BERLIN.

A dispatch from Berlin to the London Times states that the German post office department has put forward a scheme to connect the general post office in that city with the various branch offices by the construction of an underground railway, by means of which the more rapid distribution of the mail bags to and from the main trains will be effected at a speed of about 25 miles an hour. The railway will be worked without a guard or driver, and the tunnel, which will be placed close beneath the road surface, is to be only 29 inches in height by 71 inches in width. Each truck or car is intended for the conveyance of a large-sized mail bag. The train will be composed of a dwarf electric locomotive and not more than four trucks. The locomotive will have a pair of axles, each furnished with a motor. The line will be double-tracked throughout and will have a 16.13-inch gage. Over each track will be conductor rails. A trench will be provided between the two lines of rails, so that a man will be able to pass through the tunnel. The railway is to be operated by electricity. The construction of these tunnels for distribution of mails, the dispatch says, is regarded as a matter of certainty, as the negotiations between the postal authorities and city of Berlin have already been concluded.

EXPERIMENTS WITH A POSTAL AUTOMOBILE IN FRANCE.

The French post office department has lately conducted some experiments with a postal automobile, which gave excellent results.

The test was made at Lorris in the department of Loiret, with a closed touring car furnished by the De Dion-Bouton Company, and it extended over a period of two weeks from the 15th to the 30th of January last.

The post office at Lorris has eleven postmen, who are obliged to deliver mail in the city and in the surrounding suburbs of Moutereau, Cour-Marigny, Chailly, Coudray, Chatanay, Noyers, Vieilles-Maisons, and Grignon. Despite the fact that the postmen are supplied with bicycles, it is nevertheless difficult to give good service on account of the large amount of mail. As a consequence, most of the suburbs have only one delivery a day.

The experiment was carried out in the following manner: Five of the postmen were located permanently in the suburbs of Moutereau, Cour-Marigny, Chailly, Coudray, and Chatanay. Each morning the automobile started at seven o'clock and made the rounds of these suburbs, delivering to the various postmen their mail pouches. Upon receipt of the pouches, the postmen immediately began delivering the mail. The automobile also collected from the postmen the pouches filled with outgoing mail, and was able to deliver these at Lorris at 9:15 A. M., in time for the mail leaving at that hour for Montargis, a place some thirteen miles distant, to which the mail is conveyed by a horse-drawn omnibus.

The experiment proved that by using an automobile in this manner, the services of several postmen could be dispensed with, and that two deliveries and collections per day could be readily made, the first delivery being a half hour earlier than before. This method of delivering mail makes it necessary for the postman to be on hand when the automobile arrives, and thus puts a check upon him. During the fifteen days of the test, although the train was always late in arriving at Lorris, the automobile finished every trip on time.

PROTECTION FOR PATENTS AND TRADE MARKS OF GOODS TO BE EXHIBITED.

Ambassador Thomas J. O'Brien, of Tokyo, transmits an extract from a Yokohama newspaper containing a reply from Viscount Kaneko, director of the exhibition executive, to a communication from the Yokohama Foreign Board of Trade relative to the protection of inventions, trade-marks, etc., of articles to be exhibited at the world's fair in Japan in 1912. The director writes:

"According to the provisions of the present patent law, models of utility law, designs law, and trade-marks law, when notice is given to the patent office before installing such articles in the exhibition, if application for patent or registration has been made within six months from the day of receipt of said articles at the exhibition, such application shall have the same validity as if it had been filed on the same day as the original notice. From this it will be seen that there will be no danger for any invention installed in the exhibition to be regarded as 'publicly known,' which on that account will properly secure the rights of the inventor, while with regard to designs, models of utility, and trade-marks, after one has given notice concerning them to the patent office, as aforesaid, he shall enjoy a prior right to them. So that by enforcement of these laws we feel a proper protection for foreign exhibits is already assured. But in order to render the rights of foreign exhibitors more secure, and also to make it easier for them to send articles for exhibition, the Imperial Government has already decided to introduce in the present session of the Diet a bill for that purpose, etc."

THE CURRENT SUPPLEMENT.

The Boscoreale relics are discussed in the opening article of the current SUPPLEMENT, No. 1690. Nilsson's and Burbank's methods in plant breeding are discussed by Prof. Herbert Maule Richards. The well-known French authority on bees, Gaston Bonnier, writes most exhaustively and instructively on organized anarchy among bees. A recently-issued British naval report contains a memorandum on the subject of caisson disease, an abstract of which memorandum is published. K. H. Floering writes on a rotary field model, the advantage of which is to present graphically the well-known wave diagrams employed to illustrate the theories of electromotive forces and currents. The Hon. C. A. Parsons and Alan A. Campbell Swinton contribute a paper on the conversion of the diamond into coke in vacuum by cathode rays. R. G. Skerrett shows how far the Italians have progressed in the matter of submarine navigation. From his account it would seem that their submarines are far in advance of other foreign submarines. The weathering of coal is discussed by S. W. Parr and N. D. Hamilton. The subject of malleable iron castings is treated by C. H. Gale. How the metropolitan tunnel in Paris was constructed with the aid of the Pifre erector is well described. Dr. Koller shows how gold and silver residues may be recovered.

SENDING WIRELESS MESSAGES TO A BALLOON.

On May 13 several officers of the Signal Corps, with Lieut. Frank P. Lahm as pilot, made an ascent in one of the army balloons from Washington at 1 P.M. and landed at Patuxent, a small place near Baltimore, at 4:10. During the course of the flight, messages were received on board the balloon from the government's wireless station at Annapolis. A special antenna was suspended from the basket, and the latter was also enveloped in a wire netting. So successful was the experiment, that Major Russell believes that balloons will soon be equipped with wireless apparatus, which will enable them not only to receive messages, but also to send them. With this improvement, the use of the balloons will be greatly increased in time of war.

The number of bicycles imported into Switzerland in 1906 was 20,229, a decrease of 721 on the imports of 1905; of these Germany supplied 17,000; France, 2,284. The number of British-made machines imported was only 391, an increase of 91 as compared with 1905. The trade in American bicycles decreased from 120 in 1905 to 53 in 1906.

SCIENTIFIC AMERICAN

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Vol. XCVIII.—No. 22. Established 1845. ★ NEW YORK, MAY 30, 1908. ★ [10 CENTS A COPY $3.00 A YEAR.

This Aeroplane is the First Dynamic Flying Machine to Traverse a Considerable Distance and Carry Two Men at a Speed of 45 Miles an Hour. A Similar Aeroplane to be Built for the United States Government by the Last of August Must Remain in the Air for an Hour and Cover 40 Miles in That Time.

THE WRIGHT 30-HORSE-POWER AEROPLANE IN FLIGHT ABOVE THE NORTH CAROLINA COAST.—DRAWING PREPARED FROM DESCRIPTIONS BY OBSERVERS OF THE EXPERIMENTS.—[See page 393.]

FIRST FLIGHTS OF THE AERIAL EXPERIMENT ASSOCIATION'S SECOND AEROPLANE

Although in its first test the second aeroplane to be con.tructed by the Aerial Experiment Association covered a distance of but 279 feet at a height of but about 10 feet, on May 18, this flight is considered by Dr. Alexander Graham Bell, and by Lieut. T. E. Selfridge, U.S.A., and the other members of the Association, to have been the first really successful flight of the second heavier-than-air flying machine of this particular pattern. A number of other aeronauts who are at Hammondsport, N. Y., where the tests are being conducted, and who are building other types of flying machines, gave praise to the new machine.

The Association's first aeroplane, the "Red Wing," which flew 318 feet above Lake Keuka on March 12 last, was illustrated in the Scientific American of March 21. This machine had a horizontal single-surface tail, which buckled in the first flight. The tail was changed to a double-surface box shape, like that used on the Farman aeroplane, and in a subsequent flight in the rain a few days later, the aeroplane tipped to one side and, crashing to the ice, was demolished.

The new aeroplane—the "White Wing"—is practically the same as the former one, save that it is mounted upon pneumatic-tired bicycle wheels instead of runners. A rectangular box tail has been fitted. For experimental purposes, so that the machine could obtain a start before ascending, a half-mile track was built. By running along on this track, proficiency in handling the steering gear and other mechanism was attained. In a trial on the ground the day previous to the successful ascent, a slight defect in the steering gear was detected and remedied. The experimenters had thought that the aeroplane could be guided by the rudder alone when running on the ground, but they found it was also necessary to turn the wheels. Besides the horizontal rudder in front for controlling the elevation of the aeroplane and maintaining its fore and aft equilibrium, there is the usual vertical rudder for side steering in the middle of the box tail, while in addition to this the wing tips are pivoted horizontally about their forward edges and made to move up and down slightly in turning a corner by means of a cord which runs through pulleys at the rear corners of the upper plane and which is attached to the aviator's body. The instinctive leaning to one side of the aviator in making a turn is thus used to set the wing tips properly.

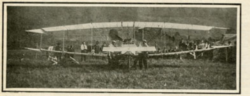
The new aeroplane has double superposed surfaces. There are two distinctive features in the design. The first is the general principle and arrangement of the truss which supports the two surfaces, and the second is the shape of the surfaces themselves.

In this machine the truss differs radically from ordinary designs, being a double bowstring truss, which was found to have structural advantages over the flat bridge design commonly used. The other features which distinguish the machine from the usual type of double-deck machines lie in the shape of the supporting surfaces, which are very much like a bird's wing in plan, tapering toward the tips, and at the same time decreasing in curvature.

A wooden propeller is used, with an eight-cylinder 40 horse-power Curtiss air-cooled motor. The propeller's diameter is 6 feet 2 inches. The pitch is about equal to the diameter. At about 1,200 R. P. M., with the motor developing 25 horse-power, the propeller develops some 245 pounds thrust. The aeroplane is 42 feet 6 inches long from tip to tip and 4 feet deep at the outside panel. It has a total supporting surface of 408 square feet, while its weight is 431 pounds.

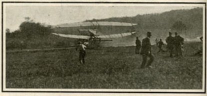
The flight on the 18th was an excellent one. The machine left the ground readily after a run of about 200 feet, and alighted at the end of the flight without serious shock. A good idea of its appearance in flight can be had from the photograph reproduced above, from which it can be seen that the transverse stability was apparently excellent. The propeller was slightly damaged during this flight, but repai s were soon made, and the following day two more short flights were executed. The first of these could hardly be called a test, as the machine remained in the air but two seconds and traveled about a hundred feet. When it descended on its wheels it ran 201 feet on the ground before stopping. In this run a guy wire broke, which impeded slightly the action of the propeller. In a few minutes the damage was repaired and the second ascent was made in a quite heavy rain. In a few seconds sufficient velocity was attained and a rapid rise was made to a height of 30 feet. The aeroplane then dipped slightly to the right, slowly dropped about 12 feet, and then came to earth. The front rudder wheel was broken considerably, and several hours were required to repair the damage. Notwithstanding this, Dr. Bell was pleased with the trial. Lieut. Selfridge acted as aviator on this day, while F. W. Baldwin piloted it on the first trial.

On May 22 Mr. G. H. Curtiss, after som changes had been effected in th new aeroplane, made an excellent flight which, although his first, is reported to have extended over a total distance of 1,017 feet, and to have been accomplished in 19 seconds, or at a speed rate of about 36½ miles an hour. During this flight the machine touched ground once after covering 615 feet, but it immediately rose again and continued in the air until the aviator caused it to land near the edge of a plowed field. Mr. Curtiss appeared to have excellent control of the aeroplane, which rose and fell during the flight, varying in height from 5 to 25 feet.



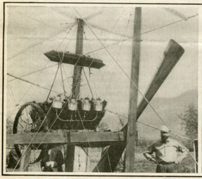
Front View of the Aerial Experiment Association's New Aeroplane.

The pointed wing tips have been made flexible so they can be twisted to aid in steering. The propeller and the frame of the box tail can be seen at the back, and the horizontal rudder in front.



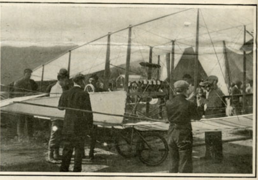
The Aeroplane in Flight.

The "White Wing" making its first flight of 279 feet at a speed of about 30 miles an hour.



The Motor and Propeller at the Rear of the Main Planes.

One corner of the rectangular box tail is visible at the end of one of the long bamboo poles which attach it to the aeroplane proper.



Three-quarter Front View of Aeroplane.

This view shows the horizontal rudder, the steering wheel, and the running wheels.

THE SECOND AEROPLANE OF THE AERIAL EXPERIMENT ASSOCIATION.

Finding the Specific Gravity.

The usual way of finding the specific gravity of an insoluble body is, as laid down in the text books and carried out in practice, to weigh the body first in air and then in water, find the difference in the two weights, and then divide the weight in air by that difference. Thus, a body weighing 10.32 pounds in air and only 1.25 pounds when fully immersed in water will lose $10.32 - 1.25 = 8.07$ pounds in weight when buoyed up by the water; its specific gravity will therefore be $10.32 \div 8.07 = 1.278$.

A better way is to weigh the object in air, then after immersing it in water and leaving the original weight untouched, to put in or on weights enough on the same side of the scale, with the object of bri ging back the even balances. The weight in the second pan, or in the second case—which weight will naturally represent the loss of weight in water—divided into the original sum, to obtain the specific gravity.

Where possible, it is still more simple to weigh out in the first case a given even quantity of the material to be tested—as of potatoes or beets in beet-sugar or potato-alcohol manufacture; there being used for this purpose two baskets, one above the other, of which the lower one is completely immersed in water. The material being weighed in the upper basket while the lower one hangs free in the water, is then transferred to the lower basket, and the weight added on that side of the balance to restore equilibrium is divided into the original sum, to obtain the specific gravity.

As an example: 100 pounds of beets are weighed out in the upper basket and then transferred to the under one; then 87.5 pounds are added on the same side with the beets to bring back the equilibrium; then the specific gravity is $100 \div 87.5 = 1.14$.

In handling such materials as beets and potatoes, any that swim should be thrown out before weighing, as they are hollow and contain air, and are useless for industrial purposes.

THE WRIGHT AEROPLANE TEST IN NORTH CAROLINA.

Upon the return of the newspaper correspondents and photographers from North Carolina, considerable more information was obtainable regarding the recent flights made by the Wright brothers in testing their aeroplane than has hitherto been available. Unfortunately, not one of these men is a qualified technical observer, for which reason we are little better off for details than we were before.

In addition to the frontispiece showing the aeroplane as it appears in flight, we are enabled, owing to the courtesy of P. F. Collier & Son, to show our readers two photographs taken at long range of the aeroplane in flight around Kill Devil Hill. These photographs, while quite minute, nevertheless when magnified give some idea of the actual appearance of the machine in flight; but their greatest value lies in dispelling all doubt as to the ability of the Wright machine to fly and to make good its designers' claims. All those who witnessed the flights agree that the performance of the machine was marvelous, and that the speed attained with the small motor of 30 horse-power was remarkable. As already noted in our last issue, the speed in question appears to have been from 45 to 48 miles an hour, although the last flight was timed in 7 minutes and 40 seconds, during which the life savers claim that the machine traveled slightly over 8 miles. The distances are said to be fairly accurate, since they were gaged by the known space between telegraph poles and the number of poles in the course. The probability is, however, that the speed of the machine did not at any time exceed 48 miles an hour. In fact, the Wrights do not claim a speed of much over 40 miles. Still, according to report, they state that before the flights witnessed by outsiders, they made three flights of 18, 24, and 32 miles respectively. In their final flight they had intended to remain in the air an hour and twenty minutes, or a third longer than is required in the government test; but a false movement of one of the operating levers caused them to plunge downward. Not more than $50 worth of damage was done to the machine, and save for a few scratches the aviator was uninjured.

A close study of the photographs which we reproduce shows that the horizontal rudder in front of the machine is of the double- or triple-surface type. The vertical rudder also can be seen well out at the rear, as well as the two propellers, half of each of which is in sunlight, and the other half in shadow. The aviator is seen sitting in the middle of the lower plane, while there are several radiating tubes for the cooling water of the motor running vertically upward to the upper plane from the motor, which is located in a fore-and-aft direction in the center of the lower plane, and which drives each of the two propellers through chains. A second lever in front of the aviator operates the vertical rudder, and a third one twists the planes to aid in steering.

In the tests recently made, the Wright brothers were trying out their new form of steering and control by means of levers and with the operator in a sitting position. In their former flights in 1905, the operator lay prone, and the change to a sitting position necessitated a different method of control. The brothers are quite satisfied with the results they have obtained, and there is little doubt that more will be heard from them in the near future. Upon hearing of their flights, Henry Farman sent a challenge for them to come to France and fly in competition with him. The Wrights paid no attention to this challenge. Their confidence in their machine is such that they do not believe it necessary to make a public trial either here or abroad in order to interest the other governments, which may yet purchase machines from them. Since their trial flights in North Carolina have been witnessed by newspaper men, and photographs of these flights have been secured, there is no longer any doubt of the pre-eminence of America in aviation. We hope that before the end of the year we shall be able to arrange for a public contest near New York, in which all the prominent foreign and American aviators will compete, and endeavor to win for the first time the SCIENTIFIC AMERICAN trophy.

The imagination of the artist who drew this picture eighty years ago was prophetic and daring. He graphically foretold the modern department store, the elevator, the military airship, the pleasure and military automobile, and the heavier-than-air flying machine (drawn by birds). He did not hesitate to build a bridge between Calais and Dover or to draw vehicles along the ground with the aid of kites.

"THE MARCH OF INTELLECT." FROM A PRINT MADE IN 1828, PREDICTING MANY MODERN MECHANICAL ACHIEVEMENTS.

Casein cement consists of casein and tannate of lime. A solution of tannin is first prepared, either by dissolving tannin in water or boiling Chinese gall-nuts in water and straining the fluid. Clear lime is gradually added to this solution till precipitation ceases and red litmus paper, dipped in the fluid above, is colored blue. The fluid is then decanted and the precipitate dried. The dried product, designated chemically tannate of lime, is then mixed with casein and the mixture ground and sifted. The proportion in which the ingredients are mixed depends upon the purpose to which the mixture is to be applied; as a rule, 90 parts of casein and 10 of tannate of lime are taken. When required for use, a sufficient quantity of water is added to the cement. A tenacious binding material of the requisite consistency is thus obtained. When completely dry, the cement is very hard and tough, and absolutely insoluble in water, petroleum, or oil; hence it is admirably adapted for a large variety of purposes.

 Photographs by J. H. Hare.

End view of aeroplane which is traveling to the left. The horizontal rudder can be seen in front and the vertical rudder behind. The inclined lines in front of latter are the propellers.

Three-quarter front view of aeroplane. The horizontal rudder is seen in front. The black spot in the center is the aviator and motor, and the dark line connecting the two surfaces, the radiator.

The Aeroplane Encircling Kill Devil Hill—the Gigantic Sand Dune at the Wrights' Experimental Grounds on the Coast of North Carolina.

FIRST PHOTOGRAPHS OF THE WRIGHT BROTHERS' AEROPLANE IN FLIGHT.

as protection against the smaller caliber shells, and that additional protection be given to the steering gear.

Except for flagships, on which an after bridge and an emergency cabin are essential, Admiral Evans considers that all flying bridges and after bridges are unnecessary and are a menace in action. He believes that the present forward bridge, with portable extensions on each end extending out at the side, is the most desirable type, the conning tower being used as the habitual steering position, with a wheel on the top and a rail around the conning tower, thereby affording a suitable position from which to pilot the ship.

Much stress is laid upon the proper design of the conning tower, and it is considered that this very important battle station should be large enough to permit of its habitual use for steering the ship at all times; that it should be elliptical in shape, extending athwartship far enough to permit a clear view directly astern. It should be directly over the central station, and connected to it by a thick armored tube large enough to permit a man to pass through. Furthermore, it should be large enough to accommodate the flag officer, for whom, at present, no armored position is provided. The report recommends the adoption of a cagework mast, specially constructed to resist being cut away, with a small armored tube extending from the spotter's station on the fire-control platform down to a point below the ship's armor. On the question of turrets the Admiral recommends the electric turret-turning gear of the type mounted aboard the "Maine" as being the best yet installed; and unless the compressed-air system of loading the guns proves to be successful, he considers the two-stage hoist to be the best, both as regards safety and rapidity, which now offers. It is considered advisable to place the turrets under air pressure, with a view to expelling the gases when the breach is opened. Attention is invited to the importance of fitting adequate means for hoisting turret ammunition by hand.

With regard to propelling machinery, the Admiral believes that the adoption of turbine machinery must soon take place, but he agrees with Naval Constructor Robinson that, in its adoption, care must be taken not to sacrifice those tactical and maneuvering qualities that are essential to the proper handling of ships, not only as single vessels but as units in a fleet. On the question of ammunition supply, although Admiral Evans believes that in one or two instances ordnance officers have requested a supply in excess of the actual demand, he states that the ships now in commission can only in special cases supply ammunition to the various guns as rapidly as it can be fired. This condition is largely due to the increase of the rapidity of fire since the ammunition supply systems were designed. He would favor providing an ammunition supply system which, on a short test, would supply ammunition at a rate equal to the average shots per minute on the record practice.

OUR AEROPLANE TESTS AT KITTY HAWK.

BY ORVILLE AND WILBUR WRIGHT.

The spring of 1908 found us with contracts on hand, the conditions of which required performance not entirely met by our flights in 1905. The best flight of that year, on October 5, covered a distance of a little over 24 miles, at a speed of 38 miles an hour, with only one person on board. The contracts call for a machine with a speed of 40 miles an hour, and capable of carrying two men and fuel supplies sufficient for a flight of 125 miles. Our recent experiments were undertaken with a view of testing our flyer in these particulars, and to enable us to become familiar with the use of the controlling levers as arranged in our latest machines.

After tedious delays in repairing our old camp at Kill Devil Hills, near Kitty Hawk, N. C., we were ready for experiments early in May. We used the same machine with which we made flights near Dayton, Ohio, in 1905; but several modifications were instituted to allow the operator to assume a sitting position, and to provide a seat for a passenger. These changes necessitated an entirely new arrangement of the controlling levers. Two of them were given motions so different from those used in 1905 that their operation had to be completely relearned.

We preferred to make the first flights, with the new arrangement of controlling levers, in calm air; but our few weeks' stay had convinced us that in the spring time we could not expect any practice at that place in winds of less than 8 to 10 miles an hour, and that the greater part of our experiments must be made in winds of 15 to 20 miles.

The engine used in 1905 was replaced by a motor of a later model, one of which was exhibited at the New York Aero Club show in 1906. The cylinders are four in number, water cooled, of 4¼-inch bore and 4-inch stroke. An erroneous statement, that the motor was of French manufacture, has appeared in some papers. This is, no doubt, due to the fact that we are having duplicates of this motor built by a well-known Paris firm, for use in European countries.

The longer flights this year were measured by a Richard anemometer attached to the machine in the same manner as in 1905. Except in the first few flights, made over regular courses, it was found impracticable to secure accurate measurements in any other way. These records show the distances traveled through the air. The measurements of the velocity of the wind were made at a height of six feet from the ground at the starting point, and were usually taken during the time the machine was in flight.

The first flight was made on the 6th of May, in a wind varying from 8 to 12 miles an hour. After covering a distance of 1,008 feet measured over the ground, the operator brought the machine down to avoid passing over a patch of ground covered with ragged stumps of trees.

In the morning of May 8 several short flights were made in winds of 9 to 18 miles an hour. In the afternoon the machine flew 956 feet in 31 seconds, against a wind of a little over 20 miles an hour; and later, a distance of 2,186 feet in 59½ seconds, against a wind of 16 miles. These distances were measured over the ground.

On May 11 the Richard anemometer was attached to the machine. From this time on the flights were not over definite courses, and the distances traveled were measured by this instrument. Three flights were made on this day in winds varying from 6 to 9 miles. The distances were: 0.78 mile, 1.80 miles, and 1.55 miles.

On May 13 four flights were made. The anemometer on the machine registered a distance of 0.60 mile in the first; 1.85 miles in the second; no distance measurement in the third—time, 2 minutes and 40 seconds; and 2.40 miles in the fourth. The velocity of the wind was 16 to 18 miles an hour.

On May 14 Mr. C. W. Furnas, of Dayton, Ohio, who was assisting in the experiments, was taken as a passenger. In the first trial, a turn was not commenced soon enough, and to avoid a sand hill, toward which the start was made, the power was shut off. The second flight, with passenger on board, was in a wind of 18 to 19 miles an hour. The anemometer recorded a distance traveled through the air of a little over 4 kilometers (2.50 miles) in 3 minutes and 40 seconds.

The last flight was made with operator only on board. After a flight of 7 minutes and 29 seconds, while busied in making a turn, the operator inadvertently moved the fore-and-aft controlling lever. The machine plunged into the ground, while traveling with the wind, at a speed of approximately 55 miles an hour. The anemometer showed a distance of a little over 8 kilometers (5 miles).

The frame supporting the front rudder was broken; the central section of the upper main bearing surface was broken and torn; but beyond this, the main surfaces and rudders received but slight damage. The motor, radiators, and machinery came through uninjured. Repairs could have been made in a week's time, but the time allowed for these experiments having elapsed, we were compelled to close experiments for the present.

These flights were witnessed by the men of the Kill Devil life-saving station, to whom we were indebted for much assistance, by a number of newspaper men, and by some other persons who were hunting and fishing in the vicinity.

The machine showed a speed of nearly 41 miles an hour with two men on board, and a little over 44 miles with one man. The control was very satisfactory in winds of 15 to 20 miles an hour, and there was no distinguishable difference in control when traveling with, against, or across the wind.

DEATH OF FRANCIS B. STEVENS.

Mr. Francis B. Stevens, one of the pioneer inventors in the field of transportation, died May 23, 1908, at the age of ninety-three. The first steam screw ship constructed by his family was built shortly before his birth, and he grew up in an atmosphere of ships, docks, engines, and railways, which make the name of Stevens a part of the history of transportation as we know it to-day. As a youthful engineer he ran a complete line of levels over the right of way of the Camden and Amboy Railway, producing one of the earliest known railway profiles. During his many years' service as an engineer in charge of the marine shop of that railway, he lived to see its evolution into the Pennsylvania system of to-day. In this shop he built some of the earliest steam-propelled vessels, and in their design made free use of multiple screws, the advantages of which were very apparent. He also designed and built steeple compound engines, in which the low-pressure cylinder was placed above the high-pressure cylinder, with special arrangements for making all parts of the machinery accessible, designing for these engines a single piston valve. After seventy years of service he designed and constructed the last of the side-wheelers built for the North River ferry service. He invented the cut-off that remains the usual valve motion for the marine beam engine. He was very active in the government tests of steam boilers, and he established the value of formulas used for determining their proportions. As far back as 1884 he advocated a salt-water pumping plant and a system of distributing mains for the protection of lower New York, and this same system will shortly be put into operation. He died within sight of the Stevens Institute of Technology, established by his uncle, and which had conferred upon him the degree of doctor of engineering. He is survived by his widow, a daughter, and two sons.

DEATH OF MISS TYLER.

The death of Miss Amelia Tyler, which occurred on the 23d of May, 1908, at her home in Washington, D. C., has caused widespread regret and sincere mourning among her friends and associates.

Miss Tyler was the grand-daughter of Chief Justice Royall Tyler, of Brattleboro, Vt., and was born in Connecticut in 1832. Her father was the Rev. Edward Tyler, a Congregational minister of fine attainments. One of her uncles was Judge Royall Tyler of the Probate Court, and her nephew, a graduate of the Naval Academy, is the present Assistant Commissioner of Patents.

She was the last survivor of her immediate family and is buried at Brattleboro, Vt., among her own people in Prospect Hill Cemetery.

Her first years in office were spent in the General Post Office, and in 1881 she came into the United States Patent Office, which was the final scene of her life work. In competitive examinations she won the position of an Assistant Examiner, being one of the first three women thus appointed, and one of her fellow examiners says:

"She entered Division One on the 10th of October, 1881, and remained an efficient and faithful assistant until the day previous to her death. She handled a large class—Trees, Plants, and Flowers' under the general division of Tillage—and was a skilled botanist."

FUTURE FOREIGN POSTAGE REDUCTION WITH GREAT BRITAIN AND COLONIES.

The gratifying announcement is made from Washington that Postmaster-General Meyer, with the approval of President Roosevelt, has concluded arrangements with the postal authorities in Great Britain, whereby the ocean foreign postage on first-class mail matter, which covers letters, is to be reduced from five cents an ounce to two cents an ounce on and after October 1, 1908. This is the present domestic rate in the United States and its foreign possessions. It is to be hoped the next improvement will be the decrease in rates on parcels sent *via* parcel post.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1693, contains a number of articles of unusual interest. The first-page engravings relate to the sinking of a concrete mine shaft on an entirely new system. This concrete mine shaft is a striking illustration of the complexity of modern anthracite mining as compared with the simple methods of former days. "Why Are Eggs Colored?" is a fully-illustrated article dealing with the curious phenomena of shell pigmentation. "Nerve as a Master of Muscle" is by Prof. Sherrington, F.R.S. "The Story of the Tobacco Pipe" gives the evolution of the pipe from primitive days. In every clime and country the fumes of tobacco are inhaled through some kind of pipe, and a collection of the world's pipes will contain more types of peculiarity than there are nations or tribes upon the face of the earth.

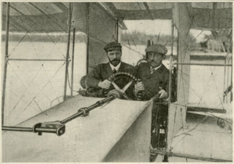
SCIENCE NOTES.

William A. Anthony, professor emeritus of physics, electrical and mechanical engineering at Cooper Union, died in New York May 30 at the age of seventy-three years. He was born in Coventry, R. I., and was graduated from Yale. For eighteen years he taught physics in the Iowa Agricultural College and in Cornell. At the end of that period he established himself in business as consulting engineer, and in 1895 he became a teacher in Cooper Union.

It was announced at a session of the International Polar Cogress held at Brussels, that an American intended to start on an expedition to the south pole under plans worked out by Commander Peary, although the latter would not be a member of the exploring party. Peary's old ship, the "Roosevelt," is to be used on this expedition. The party plans to start in the fall, to spend the winter on the north shore of Grant Land, and from there to make a dash for the pole in 1909. To shorten the distance a hundred miles and to escape the effects of the eastern currents a route along the coast of Grant Land will be followed. Commander Peary suggests a visit to Crocker Land, on the return trip, a section of the unknown world, the exploration of which he thinks may revolutionize the present ideas regarding the untraversed polar regions. The name of the American who is to make the voyage was not given.

FARMAN'S AEROPLANE FLIGHTS IN BELGIUM.

On May 27 M. Farman began his experiments in Belgium. In the afternoon of that day he flew from 328 to 984 feet at a height of 10 feet above the rather rough ground of the shipyard at Ghent. He could not do much on this occasion because of a rather strong wind. The next day he made two short flights of 80 and 450 meters (262 and 1,476 feet), the second of which was executed at a height of 10 or 12 feet. After making a modification in his aeroplane in the shape of two vertical partitions connecting the main surfaces on each side of the engine and aviator, Farman tried again on May 30. As the weather was very fine and calm, he wished to make a flight with two persons on board. Accordingly he took M. Archdeacon in his aeroplane. Rising rapidly from the ground to a height of 22 feet, he covered a distance of 1,241 meters (4,072 feet) and stopped only on account of the limits of the space. Judges furnished by the Aero Club of Flanders had been spaced along the course to observe the flight, and others followed the flight in automobiles. The speed of the aeroplane was quite high on this occasion. M. Farman thus established a new record for a flight with two persons on board. Besides he won the wager of $2,400 which was made with M. Charron. On the 9th of March last, a number of aeronauts were assembled, and Santos Dumont, Farman, and Archdeacon advanced the idea that an aeroplane would soon be able to cover a kilometer when mounted by two persons. M. Charron held the contrary opinion, and laid a wager of $2,400 against $1,200 with the three aeronauts that an aeroplane with two persons on board, one of whom weighed at least 132 pounds, would not cover the kilometer distance before the 10th of March, 1909. It is only three months since that time, and this performance has now been easily accomplished. Subsequent to this flight, Farnam flew a short distance with Mlle. P. Van Pottelsberghe de la Potterie, a young Belgian woman, as passenger. This young lady is therefore the first woman to fly in a motor-driven aeroplane.



MM. Henri Farman and Earnest Archdeacon in the Former's Aeroplane.

This photograph shows how the noted aviator and his passenger were seated in the machine. The two vertical partitions between the upper and lower planes are recent additions to the machine for the purpose of keeping it from gliding down end on when it inclines sharply inward in making a turn. Besides the connection from the steering wheel to the horizontal rudder, the gasoline pressure gage and the spark advance lever are seen at Farman's elbow.

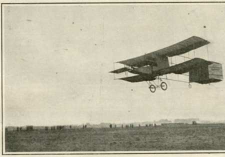
NEW FRENCH AVIATION PRIZES.

M. Armengaud has offered a new prize of $4,000 for the first aeroplane to make a half-hour flight.

M. René Quinton has offered a prize of $2,000 for the first aeroplane that, with its motor stopped, soars 5 minutes at a height of at least 50 meters (164 feet). In this connection it is interesting to note that Lilienthal, with his crude, bird-like glider, used to remain in the air longer than this, while Daniel Maloney, after dropping from a mile-high balloon with the Montgomery aeroplane in California, would soar for 20 minutes and land on any designated spot. Both aviators were killed from falls.

MILE FLIGHT OF THE PELTERIE AEROPLANE.

According to a cable report from Paris, on June 8 M. Robert Esnault-Pelterie made a flight of over a mile above his private aerodrome. Mr. Wilbur Wright is reported to have witnessed this flight. M. Esnault-Pelterie is a wealthy and energetic French engineer who has invented a novel 7-cylinder air-cooled aeronautic motor and an interesting monoplane, both of which we have already illustrated.



Farman's Aeroplane Making a Flight of Nearly a Mile with Two Men at Ghent, Belgium, on May 30.

Note the latest modification of this machine, which consists of two vertical partitions between the forward planes and a similar third one in the middle of the tail. One of the propeller blades can be seen beside the right front wheel.

The big rhinoceros Mogul at the Bronx Zoo has just had an operation performed for cataract. It required the services of fifteen veterinarians, 1¾ pounds of chloroform, and ½ pound of ether to reduce the animal to a proper state for the operation. The operation consumed half an hour, and it is hoped that it will prove successful. It will be a month, however, before this point can be determined.

The Beachy and Knabenshue Airship Experiments.

During the first week in June Lincoln Beachy conducted some airship experiments on Long Island. The chief of these was an attempt to control the stability of his balloon in a fore-and-aft direction by means of a bag of ballast, which could be shifted along a rope or wire of considerable length and attached to the body framework at each end. This same scheme was tried by Malecot in France last year without success, and Beachy's experiment resulted similarly. The airship pitched very badly and was well nigh uncontrollable. On June 6, however, this aeronaut made an excellent flight. He rose to a height of 1,500 feet, and remained at this altitude half an hour, describing all the while circles of a mile or more in circumference. Roy Knabenshue, at Toledo, made a successful short flight on June 10, and demonstrated that his airship, which is controlled by small aeroplanes, could be maintained in a level position or directed up or down at will. He expects shortly to make a long-distance flight from Toledo to Cleveland, O.

Automatic Cab Signaling on Locomotives.

The subject of signaling on railways is one which has engaged the attention of railroad officials for many years. The problem of giving directions to the engineer in the cab is one which appears easy to the layman, but which the practical engineer finds beset with real difficulties. Signalmen are to a certain extent checked by their fellow workers; and even if they do commit a vital mistake disastrous consequences may be avoided by the alertness and promptitude of the driver. But there is no check on the driver, who is the pivot of railroad signaling, if through any misapprehension or temporary aberration he misinterprets or ignores the signals set for him. Many devices have been tried, particularly in Europe, for obviating this weakness, but until recently none of them has proved satisfactory under test.

Delagrange's Aeroplane Flights in Italy.

M. Delagrange, the French aviator, made a sensational performance with his aeroplane at Rome on the 30th of May. He made a continuous flight of 15 minutes and 25 seconds duration, and in this time he covered a distance of 12.75 kilometers (7.92 miles). This is the longest flight which has yet been made in Europe. M. Delagrange had been in Rome for some time, but on account of the high wind which prevailed during some of his attempts, he did not succeed in flying as he expected. This brilliant performance more than makes up for the unpleasant experience of his first flights at Rome, when he was nearly mobbed by a crowd of 50,000 persons composed largely of the lower and most ignorant classes, who had, however, paid an admission fee to the grounds in order to see him fly. The successful flight was made above the Place d'Armes at 5:40 A. M. A light wind was blowing at the time. After a short run upon the ground of 300 feet or more, the aeroplane rose in the air and with great ease it made the round of the Place, keeping up the flight in a very regular manner for no less than ten complete rounds. M. Delagrange kept the aeroplane at a height of 12 to 22 feet above ground. He landed very easily at the end of the ten rounds. It is of course understood that he did not touch ground during the whole time. This performance was officially controlled by members of the Italian Aeronautic Club, including a number of officers; also by a delegation from the International Aeronautic Federation which included Mr. Cortlandt Field Bishop, president of the Aero Club of America; Prince Doria, Duke Gallese, and others. The committee had erected four poles on the Place, and the distance for one round was measured beforehand by means of a 300-foot cord. After the performance the committee signed a report addressed to the Paris Club. On the following day M. Delagrange made a number of evolutions in the presence of the French Ambassador, M. Barrière, but as there was a high wind blowing, the flights were not very long on this occasion. At 7 P. M. he made another series of three flights in the presence of 10,000 spectators. These lasted 6, 3, and 7 minutes respectively, the longest distance covered being nearly 4 miles. The enthusiasm of the public was great, and the aviator was borne in triumph from the field. On June 1, while flying again before the Queen, Queen Mother, and Crown Prince of Greece and a large number of sportsmen, the aeroplane, after making three-fourths of a circuit suddenly plunged to the ground from a height of 12 feet and was somewhat damaged, although its daring pilot escaped uninjured. In attempting to avoid striking some piles of wood, M. Delagrange suddenly made a wrong move. After repairs had been made, the aeroplane was shipped to Milan, where, on June 10, M. Delagrange made several short but successful flights above the Place d'Armes in the presence of the Queen. The following day, just after the aeroplane had started and was rolling along on the ground, the crankshaft of the motor is reported to have broken. Further flights cannot be made until a new crankshaft is received from Paris.

In a recent communication to the Royal Society, upon an investigation as to the atomic weight of radium, Prof. Thorpe states that from his experiments on radium chloride obtained from residues of the uranium workings of the mines at Joachimsthal, in Bohemia, he finds that this is 227. This figure is in very close agreement with that determined by Madame Curie, and has a special interest, owing to the fact that it throws light on the place of radium in the system of the elements and on its origin.