Float of Voisin hydro-aeroplane.

The Third Aviation Salon at Paris

Interesting Aeroplanes and Their Constructional Details

By Stanley Yale Beach

Leaf-spring fork of Blériot monoplane.

THE third International Aviation Salon was held in Paris from December 16th to January 2nd. It was noteworthy that, as compared with the exhibitions of previous years, the collection of exhibits on view was more or less international in character. The exhibition was held in the Grand Palais, and was opened by President Fallières, who was conducted through the Salon by a committee headed by M. Robert Esnault-Pelterie. As heretofore, the exhibition was organized by the Chambre Syndicale des Industries Aeronautiques, under the auspices of the International Aeronautic Federation and the Aero Club of France.

Although the advance in the performance of aeroplanes has been very decided during 1911, the improvement in the machines themselves has kept pace with it. Besides great structural changes, improvements have been made looking to the comfort of pilots and passengers; and given the Deutsch "taxicab" to begin with, the coach builders will soon be called upon to make closed bodies for aeroplanes the same as they do for automobiles.

The influence of the monoplane upon the biplane appears in the adoption by many prominent biplane builders of the long covered fuselage, or body, of the monoplane, with the propeller in front, in place of the four spars that were formerly used to support the tail. The Farman brothers still use the latter arrangement, but the lower plane of the Maurice Farman biplane has been very much shortened (see photo.) until it is now no longer than the lower plane of the Breguet, which, by the way, was the first biplane to adopt the monoplane body and propeller placing, several years ago. In order to be in line with the new idea of inclosing the motor, Louis Breguet, two of whose biplanes carried off the honors in the recent military competition, exhibited the machine with covered four-cylinder, water-cooled motor shown in one illustration. The radiator can be seen beside the body. When the bonnet was raised slightly, it gave the front end of the machine the resemblance of a whale with open jaws, and created much amusement. Another Breguet novelty was a side door in the body and a ladder leading up thereto, as shown in one of the small illustrations.

The inclosing of the motor, when a revolving cylinder Gnome was used, was more or less complete in most cases. The complete inclosure of the engine in a very neat manner is shown on the Morane monoplane. The entire body of this machine, designed by Engineer Saulnier, is of pressed steel—a marked advance indeed in fuselage construction, comparable only with the pressed steel automobile frame. Led by Robert Esnault-Pelterie, whose R.E.P. monoplanes have triangular bodies of steel tubing (see SUPPLEMENT No. 1871), a goodly number of the French manufacturers are adopting metal construction. A monoplane with sheet metal wings was on exhibition. Thus the SCIENTIFIC AMERICAN all-steel monoplane racer, illustrated in these columns a year and a half ago, is gradually being approached by the builders. The narrow wings we showed on this machine were approximated by the Blériot racers in the International Cup race last July, and also by the Kaufmann monoplane in the recent Salon. The latter and the Paulhan-Tatin monoplane were the only machines exhibited with disk wheels, i. e., wheels with cloth-covered spokes to reduce air resistance. Emile Train, whose monoplane killed Minister of War Ber-

The "Tubavion" monoplane with underslung car and motor.

A single steel tube forms the backbone, the propeller being mounted on it behind the main plane

Farman biplane fitted with new form of stabilizing planes.

The two planes are mounted on a vertical shaft which is turned to swing them outward.

"Albatross" biplane (German) viewed from above.

A typical biplane with monoplane body flattened to form a tail the tip of which is flexible enough to steer aeroplane up and down. Note also the pointed flexible wing tips of the upper plane, the short lower plane, and the inclined struts connecting the two.

The Nieuport stand, showing three recent monoplanes.

The machine in the foreground is fitted with a 28 horse-power double-opposed-cylinder motor. It was with this motor that Nieuport had his first success and broke many speed records.

NOVELTIES AT THE PARIS AERO SHOW

teaux at the start of the Paris-Madrid race, is another builder employing all-metal construction, even of the wings. M. Train is a pioneer in this line, besides having the distinction of having flown an hour and twenty-five minutes at the Rheims meet, in August, 1910, with a motor of but 20 horse-power.

Although there was a distinct tendency toward the use of torpedo or fish-shaped bodies. Several monoplanes were shown without any body whatever except a short underslung car, with motor in front under a bonnet, the same as on an automobile. One such machine, the "Tubavion" of MM. Panché-Primard, is illustrated. A long tube forms the backbone and replaces the usual monoplane body. Converging, upwardly-curving skids attach to this tube at front and rear. The propeller is mounted on the tube behind the main plane, and is chain-driven from an extension of the engine shaft, which runs back beneath the pilot's seat. As no starting crank is provided, perhaps this machine is quite up-to-date and is accordingly provided with a self-starter. The tubular backbone and underslung seat for the pilot remind one of the Grade monoplane, a leading German make that has found much favor.

England and Germany were represented at the Salon, which accordingly for the first time had somewhat of an international flavor. A Bristol monoplane, one of which, piloted by the Englishman, Valentine, made a sensational flight over Paris recently, was the chief representative of Great Britain, while an "Aviatic" monoplane and "Albatross" biplane gave an idea of German construction. This latter machine has flexible extensions of the main planes at the rear, as can be seen from the photograph, in place of ailerons. Suitable wires warp these extensions in much the same manner as on the Wright biplane. The Paulhan-Tatin torpedo monoplane, illustrated in our last issue, has upcurved wings which give sufficient automatic transverse stability so that, in the hands of an experienced pilot, no warping is needed. All the "Albatross" machines are fitted with double control. More than twenty have been sold to the German government, and six more have recently been ordered. Russia is also a client of the Albatrosswerke. The "Albatross" biplane is typical of the latest biplanes in that it has a monoplane body which becomes flat at the rear and terminates in a horizontal rudder, while the vertical rudder, in the shape of a fin, is placed above the tail. Another point in which this machine is typical of the latest foreign biplanes is that the lower plane is very short. The struts connecting the two planes are, in this instance, arranged diagonally. This arrangement does away with the usual truss wires that were heretofore employed.

The use of a flattened fuselage at the rear, with rudder above the tail, and elevator at its extremity, was inaugurated last summer by Blériot with his racer. He is now using it on his military-type machines, and its use has been adopted by most of the leading manufacturers.

There were many machines on exhibition having novel stabilizing devices, some of them for the maintenance of the equilibrium automatically. The Bronislavski stabilizer, shown in one of our photographs on a Henry Farman biplane, consists of two small planes mounted on a vertical post. Normally these planes are in the position shown in the photograph, but when the machine tips, they are swung out until they are parallel with the main planes. These small planes at

each end are worked in conjunction by the aviator. This device is said not to produce any turning of the aeroplane, and hence use of the vertical rudder to correct the same is not required. It consequently does not infringe the Wright patent.

A monoplane having a somewhat similar arrangement of the wings to that just described was one of the features of the show. This machine, known as the de Marçay and Mooney, had wings arranged so that they could be swung by the pilot from the regular position to a position parallel with and above the body. Upon alighting, the pilot can swing his wings back and then run the machine along a road as an automobile.

There were a number of novelties and improved details about the various machines. Among those illustrated herewith is a small propeller which is revolved by the movement of the aeroplane through the air and is made to drive a pump for maintaining the air pressure in the fuel tank. There was also a biplane with electric headlights. This machine recalls the fact that aviator George M. Dyott made the first flight with an aeroplane fitted with electric headlights at Nassau Boulevard in America last October. Mr. Dyott used a dynamo for generating the electricity. Among the details to be noted are the hydroplane float of the Voisin "Canard" and the flat leaf springs used on the latest Blériot military monoplanes. The use of springs in connection with skids is also coming into vogue and is shown on a number of machines, notably the "Albatross." The new Blériot fork makes it impossible for the wheels to give sideways if the machine does not land on both wheels at the same time. A skillful pilot is needed in order to alight without breakage. In one Morane monoplane that was exhibited there were no shock absorbers of any kind, the under carriage resembling considerably that of Santos Dumont's "Demoiselle."

The exhibit of motors this year was very large. All told there were seventy motors on exhibition, varying in size from 25 to 200 horse-power. A number of these were of the rotary type, but the four-cylinder vertical water-cooled type was also in favor.

The Romance of Echoes

ECHOES form one of the most romantic chapters in the book of Nature.

Which are more severe tests of credulity—the echoes of fiction, or the echoes of fact? There is a tolerable repertory of the former, beginning with the antique fable of that lovely oread who pined away to "a voice and nothing more," and coming down to Paddy Blake, made famous by Samuel Lover:

"But civilly spake, 'How d'ye do, Paddy Blake?'"

The echo politely says, "Very well, thank you."

However, these are but puerile attempts to vie with authentic marvels.

Some recent observations in Germany and Switzerland upon the reflection of sound from atmospheric strata miles above the earth's surface—which have opened up a new and, in the best sense, romantic field of meteorological observation—make it timely to review the remarkable vagaries of echoes, as they have been recorded from time to time in all parts of the world.

Knowing that the sound-waves of the air are subject to reflections and other deviations analogous to those undergone by the light-waves of the ether, we might, on theoretical grounds alone, arrive at the conclusion that the echo is by no means a simple and uniform phenomenon. And so, in fact, we find that echoes are infinitely various.

Of the better-known remarkable echoes are two classes; (1) those which, owing to the great distance of the reflecting surface from the origin of the sound, send back the latter after a long interval, and are therefore able to repeat, for example, a large number of words or syllables after

the original sounds have ceased; and (2) those which, by successive reflections back and forth between two or more surfaces, repeat a single sound many times over. The most familiar instance of the first class is the echo in Woodstock Park, Oxfordshire, described by Sir John Herschel, which repeated seventeen syllables by day and twenty by night. This echo still holds its place in the school-books and guide-books, though it is, in fact, no longer heard, as some alterations in a bridge have completely silenced it. The tomb of Cæcilia Metella, in the Roman campagna, has a famous echo that repeats a whole hexameter verse. In illustration of the second class Herschel cites the echo of Shipley Church, in Sussex, which repeated a syllable twenty-one times; but this echo, also, has vanished. Echoes are frail creatures; a slight change in the architecture of a building or the configuration of a landscape often suffices to extinguish them. All the old books on sound describe the echo of Simonetta Palace, near Milan, which according to the travelers of long ago repeated a pistol-shot fifty or sixty times. Perhaps some of our Italian readers will tell us whether the story still holds good. These instances might be multiplied indefinitely.

In many buildings may be observed the focussing of sound by vaulted ceilings and other curved surfaces; and whispering galleries are a part of the stock-in-trade of guides the world over. That of the Capitol, at Washington, is too well known to need description here. In the Hall of the Caryatides, in the Louvre, which has a cylindrically vaulted ceiling, there are two ancient basins of Sicilian alabaster, one at each end of the room. The slightest whisper uttered at the edge of one of these vases is distinctly heard by a person standing near the other, from which it appears to proceed. A similar acoustic effect is observed in the cathedral of Girgenti, Sicily. If you stand on the steps of the high altar you can distinctly hear anything that is said, even in an undertone, at a spot near the threshold of the principal west entrance, 100 feet away. A story often told of this echo will bear repeating. It appears that one focus of the echo was unluckily chosen for the site of a confessional. The other focus was accidentally discovered by a gentleman, who for some time took great pleasure in overhearing the words intended solely for the confessor, and sometimes invited his friends to share in his amusement. One day, however, as the story runs, his own wife was in the confessional, and he and a friend thus became aware of secrets that were far from agreeable to the husband. Shortly afterward the confessional was moved. Whispering galleries are usually mere accidents of construction; but the famous "Ear of Dionysius," in the quarries of Syracuse, was said to have been designed for the purpose of enabling the tyrant to overhear the conversation of the prisoners in the dungeon adjoining his palace.

So far we have dealt only with echoes that slavishly imitate the sounds that come their way; but there are others possessing more originality. The proverbial Irish echo, which we have mentioned among the echoes of fiction, is not so fictitious as might be supposed by any one unfamiliar with "harmonic echoes." The harmonic echo does not repeat the identical sound that it receives. Lord Rayleigh, who furnished an explanation of these echoes some years ago, quotes descriptions of several from Brewer. For example:

"On the river Nahe, near Bergen, and not far from Coblenz, is an echo thus described by Barthius: It makes seventeen repetitions at unequal intervals. Sometimes the echo seems to approach the listener, sometimes to be retreating from him; sometimes it is very distinct, at others extremely feeble; at one time it is heard at the right, and the next at

(Concluded on page 76.)

Breguet biplane body with side door and ladder to mount.

Small propeller driving pump for maintaining pressure in fuel tank.

Torpedo shaped Morane monoplane body of pressed steel.

The Gnome motor is completely inclosed. An uncovered section of one wing is seen on the left, in which the construction of steel tubing can be plainly seen.

A Maurice Farman biplane and a Henry Farman monoplane.

Both machines are of the latest type, having ailerons set into the wings. The biplane has staggered planes, the lower being much shorter than the upper, and a single-surface tail. Front and rear elevators are fitted; also twin vertical rudders.

The latest Breguet biplane with inclosed motor and flexible 3-bladed propeller.

The resemblance of the body of this machine to some of the recent automobile bodies produced abroad is striking.

NOVELTIES AT THE PARIS AERO SHOW

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Ice is the solid form assumed by liquid terrestrial waters in the process of congelation or freezing. When what may for the moment be called liquid aerial water-rain, freezes, we get hail-stones. But the water held in suspense by the atmosphere surrounding our earth is held in the form of vapor. Saturation of the atmosphere with water-vapor is followed by condensation. This vapor in its condensed form, becomes too heavy to be supported by the atmosphere which forthwith lets it fall back to earth whence it was before, and will again be taken up through the incessant evaporation. Deposits of condensed atmospheric vapor occur in various forms and from various causes. When a warm vapor saturated area of our atmosphere is suddenly cooled by contact with colder air-currents, or other causes, it undergoes condensation and lets its liquid burden fall back to earth as rain, hail or snow. When a saturated section of the lower atmosphere comes in contact with a section of earth at a lower temperature, as during a summer night the surplus moisture in this air falls as dew; in winter as hoar frost; under conditions which are far rarer and seldom occur except locally, in high mountain districts in early winter, the deposit takes the form of frost-flowers. These frost-flowers are identical in form with those other flowers, called snow flakes, which are formed "in the clouds" or yet again the ice-flowers which, welded together by their natural expansion, cover pools of water with a sheet of ice in frosty weather—as already described. The white deposit of hoar-frost is also built of them. All invariably come into existence as six-sided stars. There is no other type, but this type apart, the forms are of an infinite variety: over 1,000 have been enumerated.

It is hardly possible to photograph those ice-stars, the birth of which precedes the change of liquid water into solid ice. To photograph snow-flakes is, again, not easy. The pictures accompanying this article are therefore all reproduced from photographs of ice-flowers or natural objects coated with hoar-frost.

The Romance of Echoes

(Concluded from page 69.)

the left; now in unison with the direct sound, and presently a third, fifth, or tenth of the fundamental. Occasionally it seems to combine two or more voices in harmony, but more frequently it resembles the voice of a single mimic."

Brewer also tells us that the celebrated echo of the Gap of Dunloe, in the lakes of Killarney, will render an excellent second to a simple air played on a bugle. This is merely an embroidered version of the true story, which is that if the bugler chooses the right station and plays in the right tempo, the reflected notes will be heard at the same instant with different notes of the direct air, and may harmonize with them in many cases. This does not appear to be a true case of harmonic echo. An unmistakable case was, however, reported by Rayleigh himself, viz., that of the echo at Bedgebury Park, the country residence of Mr. Beresford Hope. The sound of a woman's voice was returned from a plantation of firs, situated across a valley, with the pitch raised an octave. The original sound required to be loud and rather high, and a man's voice would not produce the effect.

Rayleigh explained these echoes on the principle of selective reflection. Just as small particles in the air will reflect light of short wave-lengths, but not that of long wave-lengths—a fact that explains the colors of the sky—so obstacles that are small in proportion to the length of the sound-waves will reflect only the smaller sound-waves; i. e., those of high pitch. Thus, in the case of a composite note, such as that proceeding from the human throat, a group of small obstacles will return high-pitched overtones, or harmonics, but not the fundamental.

Lastly, we come to aerial echoes; i. e., sounds reflected not by solid obstacles but by invisible acoustic clouds in the atmosphere. Once upon a time it was believed that ordinary clouds, visible aggregations of water-drops, were potent reflectors of sound; and that, similarly, a fog obstructed the passage of sound. These notions were effectually dispelled by Tyndall, as a result of his experiments

with fog signals, in 1873. Tyndall found on the other hand, that the sounds of syrens and signal-guns were reflected by the atmosphere even in the clearest weather. He explained this effect as due to a flocculent condition of the air arising from unequal heating or moisture.

The latest episode in the romance of echoes—and one of the most romantic—has to do with aerial reflections on a vast scale, and it is especially noteworthy for the reason that it has suggested to meteorologists a novel method of investigating regions of the upper air that are far beyond the reach of kites and balloons.

On November 15th, 1908, a magazine containing some 28 tons of dynamite exploded in a tunnel of the Jungfrau railway. The detonation was heard over a zone extending to the north and northeast for a distance of about 30 kilometers (the configuration of the mountain preventing the propagation of the sound in other directions). Beyond this zone no sound whatever was heard over a region some 100 kilometers wide, embracing the northern half of Switzerland. Yet, strange to say, over a wide region beginning near the northern border of the country and extending north into Germany the sound was heard. In other words, there was a zone of normal audibility, then a wide zone of silence, and then a zone of abnormal audibility, beginning about 140 kilometers from the place of the explosion and ending about 50 kilometers farther away. These facts were fully established by the Swiss Meteorological Institute, which took pains to collect reports from all parts of Switzerland and southern Germany, and published a map showing the places from which positive and negative information was received. Moreover, the same curious acoustic phenomenon had been observed in connection with certain explosions in Germany a few years before.

How is this effect explained? Making due allowance for the acoustic shadows of the mountains, and for the refraction of sound due to vertical variations of wind and temperature, we must still seek an adequate explanation of the fact that the sound of the explosion jumped completely over a region 100 kilometers in diameter, and, after pursuing a path through the air above the level of certain mountain observatories (from which negative reports were received) returned to earth again. This looks like a case of aerial reflection, and we must seek its cause.

In his recent studies on the stratification of the atmosphere¹ Dr. Alfred Wegener offers the following explanation: The atmosphere is rather abruptly divided at an altitude of about 70 kilometers by the boundary plane between a stratum consisting chiefly of nitrogen, and one consisting chiefly of hydrogen. The speed of sound is many times greater in the latter gas than in the former. Hence a sound-wave impinging on this boundary plane at a sufficiently great angle of incidence would undergo total reflection. If the plane of separation were sharply defined, and if no other causes conspired to deflect the path of the sound, it would, when propagated upward from the earth's surface, return to the ground at and beyond a distance of 40 kilometers from its place of origin. These conditions, however, are not fulfilled, for the path is in the first place deflected by the ordinary causes of acoustic refraction, and in the second place it does not encounter a sharp plane of demarcation between the two gases. Taking these facts into account, Wegener finds that the path of the sound is a gradual curve, the crest of which varies in altitude with the angle at which the sound leaves its origin. According to his calculation the nearest point at which the sound should return to the earth is 116 kilometers.

Why not, asks Wegener, reproduce the Jungfrau explosion experimentally? With a widespread corps of observers on the alert to note results at a prearranged moment, a much less powerful and less costly explosion would suffice to send a message forty-odd miles above the earth and back again. The suggestion is worthy of the attention of meteorologists, for no means should be neglected that may lead to precise knowledge concerning the, at present, decidedly problematical structure of the atmosphere above the level where it ceases to be air.—C. F. T.

¹ *Physikalische Zeitschrift*, March 1, 1911.

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