paying and easily sold inventions. When once thought of, their models are easy to construct and test.

In invention, as elsewhere, it is the little things that count, the little devices that pay, the little novelties that roll up fat royalties, the little improvements that are the real money-makers. The trouble is not in the little things, but in the workers who ignore them.

It is, indeed, axiomatic that, in invention, the simple things pay best of all. No costly machinery was needed to model the first return ball, to make the first metallic shoe-tip, or to construct the little sliding ring that holds the ribs of an umbrella, the removable cake-pan bottom, or the thousand and one well-known and profitable inventions. No great amount of training or inventive ability was displayed in any of these. They were simple, they were easy to make, they were useful, or they appealed to the public's appetite for novelty. Things sometimes sell for no other reason than that they are different or strange. Mechanically, they may not be one whit better than the devices that they temporarily supplant. But being new, they sell well, and satisfy for a time.

Yes, this "everyday" life is the field, here the harvest, here the numerous opportunities ready to hand for the occasional inventor.

The farm boy starts out, when inventing, by giving his attention to the time-honored churn. If the old family churn, unfortunately, has no wheel, he considerately supplies one; if it has but one, he haply adds two. Very well; the churn is not a bad thing to begin on, although it is a tremendously poor thing to end on. The boy is nearer success when he begins with a tool of whose use he has had experience, than the mechanic who begins with airships or with monocycles. And the boy's experience gains in significance from the bitterness of it, when he is compelled to churn though the streams are singing, and the woods are calling, calling to him. For many are the inventions which are rooted in human inconvenience or misfortune.

Practicability is the keystone that supports the arch of the inventor's success. The end to be attained must ever be in view, and no richness of ability or means sacrificed where simplicity will do.

The patient, long-suffering hen receives as much encouragement to add her small quota to the world's stock of breakfast food, from the ancient door-knob that jabs her breastbone and illusively slips around her goodly trotters, as she could from a fifty-dollar cut-glass nest egg, engraved with a legendary pedigree of a prize-winning breed of Leghorns. It is possible to overwork ideas like the churn and the nest egg. In fact, simplicity, practicability, utility, are the "tee-y-ties"—the trinity of the inventor's creed.

To recapitulate: let shop-worn ideas alone; stick to what you know. Trespass not in those old fields that have been passed over from the loving care of the originators to the first modifiers; from the first modifiers to the improvers of detail; from the improvers of detail (who were the last well-equipped toilers to conscientiously study them) to the heavy-eyed oxen and Don Quixotic donkeys. But work in those fields in which education of whatever degree, or kind, is available to prompt one to use one's self—those fields organic, pregnant with suggestion; those fields that, because of the personal relation, are to each individual always new and always tillable.

And now comes the final example, which sums in its suggestiveness all the truths to which this display of word, phrase, sentence, and paragraph has been tending; a leading example of how each man has endless opportunities to invent always beside him as he goes about his daily employment.

The steel drag scraper was not invented by an academical student. It might have been, of course. Some philosopher, or scholarly man of books, might have been ruminating on likely ways to benefit himself, or to confer blessings on toiling humanity, and incontinently let his intent gaze fall for a moment on the old-time scraper, and might immediately have seen the invention complete, pictured to the eye of his imagination. The great theories and epoch-making discoveries are mostly to the credit of scholars. Not so the practical, bread-and-butter inventions, such as are more apt to put money into empty pockets. Not so the steel scraper, which was invented by a practical contractor who had used wooden, iron-edged scrapers, and had found them to be deficient both in ease of handling and in wearing qualities. He made an all-steel scraper, and would have made as well his share of the snug fortune that eventually came of it, if he had not, so he always averred and so his fellow-townsmen generally believed, been unceremoniously, if not unscrupulously, squeezed out of the patent, and ejected from the business, by his partner.

Then along came another practical mechanic, who lived in the same town, and saw this first factory grow. Himself was likewise innocent of college training, and all the pomp and pageantry of marshaled lore. He added wheels to the steel "drag" scraper, and, literally as well as figuratively, was thus enabled to ride from poverty to a comfortable financial independence.

This is not written with the intention of discrediting college education—far be from me such an obsession; but in mechanics, men must be level-headed, and thousands of men educated superiorly to these scraper-men—scholars who, unlike them, are too cultivated to condescend to murder the king's English without the slightest provocation whatever—are yet incompetent for any original assembling of mechanical motions.

Cases innumerable could be cited that parallel these. Every town has its own kinglets, who once walked but now ride, because of certain fortunate inventions that led to the organization of prosperous factories.

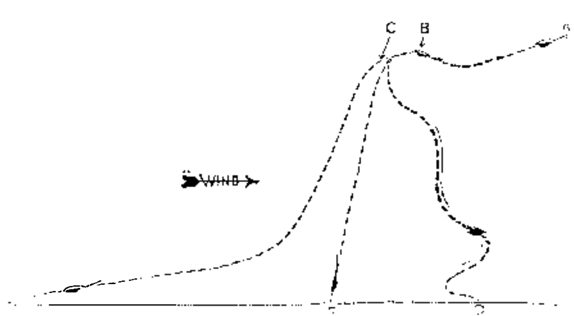
Correspondence.

The Flight of Birds.

To the Editor of the Scientific American:

Special interest should be shown by aerial investigators in the recent article by Mr. M. Field, which appeared in this magazine. He has touched on a problem which is attractive, and which will stand a little more thorough treatment than he chose to give it.

In speaking of the resemblance between birds' wings and sails, he states correctly that they are both curved surfaces, but neglects the far more important fact that one is kept permanently arched, while the other is free to assume any shape the wind bids. That is the difference between a wing and a sail. Keep a sail at an angle to the wind which will fill it out and preserve its shape, and it will do business, but sail (or soar) too close into the wind with it, and its effectiveness ceases. With a gliding machine this is a very serious matter, for it will result in the machine's becoming utterly unmanageable and darting vertically to the ground. Of its own accord a machine of this model will never recover its equilibrium after such a disturbance. But we can expect better things of a glider with permanently arched carrying surfaces. In an emergency the first machine does one thing always, takes a sudden and precipitous short cut for the



A, Starting point; B, machine meeting puff of wind; C, machine meeting region of calm; D, course of broken machine; E, course of machine with sail-like surfaces; F, course of machine with wing surfaces.

FLIGHTS OF GLIDING MACHINES.

ground, but the better type of machine takes its choice of two. It may turn clear over and dart backward, or it may recover and glide on forward. A machine of the second model is bound to get on an even keel if it is able to stand the strains of the drop it needs to acquire velocity. The sail type of surface will do for motor-driven fliers, which will fly with the wings at a sufficient angle with the wind; but for the powerful mile-a-minute man, hawks, and the motorless soarers of the future, the permanently arched surface will be necessary. Laurence Jerome.

Oak Park, Ill.

Jet Propulsion for Fast Steamships.

To the Editor of the Scientific American:

In your issue of October 13, 1906, you have an interesting article on forecast and fulfillment on the rapid increase in size and speed of transatlantic steamships. In the article you speak of the steam turbine as a factor in the development of speed, and desirability of other factors, and ending with the statement "that perhaps after all the solution lies with the propeller; for if we could prevent the present loss back of the thrust block a 30-knot boat could easily become an accomplished fact."

I think the latter diagnosis of the steamship question is the nearest to the solution of the problem, and that if a propeller were adopted where the loss back of the thrust block could be obviated it would realize a 30-knot boat. Such a propeller is to be found in the jet or hydraulic method of propulsion, and it will be a success when once it is understood by those competent to experiment on a large scale. The jet thrust is direct, and every bit of water is doing effective work. The possibilities of the hydraulic propeller are great, and yet the steamship interests have been spending millions in less likely fields to obtain even slighter results. J. W. H.

Boston, Mass., November 1, 1906.

PROGRESS OF AERONAUTICS IN FRANCE.

SANTOS DUMONT'S FLIGHT WITH HIS AEROPLANE, AND THE NEW DIRIGIBLE, THE "VILLE DE PARIS."

As already noted in our issue of November 3, Santos Dumont made a brilliant performance at Paris on the 23d of October with his new aeroplane. He succeeded in making a flight of some 200 feet, keeping at a distance of 10 feet above the ground all the while, and thus winning the $600 Archdeacon cup, which was offered for the first free flight by an aeroplane for a distance of 25 meters (82 feet). Such a flight with a motor-driven aeroplane has never before been publicly made. Our illustration on the following page shows the machine during its flight.

After the first flight of September 13, the aeroplane had to be repaired, and Santos Dumont decided at the same time to give it some slight modifications, which consisted mainly in the suppression of the third or rear wheel upon which it was mounted and the varnishing of the canvas surfaces. Otherwise, the main points of the apparatus remain about as we have already described. At present the weight, exclusive of the aeronaut, is 245 kilogrammes (540 pounds), and the supporting surface 60 square meters (645 square feet). Santos's weight is 110 pounds, which makes a total of 650. The eight-cylinder Antoinette motor weighs but 170 pounds and gives 50 horse-power. The propeller, which is direct-connected to the motor crank-shaft and makes the same number of revolutions per minute (1,500), is 2 meters (6.56 feet) in diameter with a 1-meter (3.28 foot) pitch. At 1,500 revolutions per minute it gives 150 kilogrammes (330.69 pounds) thrust when the machine is stationary.

The completed apparatus was brought to the Polo Grounds of the Bois de Boulogne at 9:15 A. M. and first made a trial run, being pushed along the ground on its two wheels by the propeller, and apparently being very well balanced. In a second trial, Santos Dumont made a run of some 500 feet, and thought he was in condition to begin the flight, when unfortunately a broken bolt obliged him to stop. But by 4:30 in the afternoon he was again ready to begin. Messrs. Archdeacon and Capt. Ferber were on the ground representing the Aero Club in order to have an official control of the tests. At 4:40 Santos Dumont climbed into the basket and the aeroplane started, rolling along the ground. Accelerating the speed, it began to mount in the air with an easy and gradual movement and rose to the height of 10 feet or so, after which it kept moving along in a straight line above the heads of the spectators. Naturally this performance awakened great enthusiasm. Santos continued to fly for some distance, keeping a good balance. Then the aeroplane had a tendency to turn to the left, and, not wishing to go too far out of the way, he brought it to a stop by cutting off the ignition current. The aeroplane alighted rather suddenly, and the shock was enough to break the wheels, but this was of small importance. The flight of 200 feet was accomplished at a speed of about 25 miles an hour. Santos thus won the Archdeacon cup and made the first public flight with a motor-driven aeroplane. The varnishing of the cloth is said to have had a good effect upon the carrying qualities of the flyer.

Santos Dumont expects to go on with his experiments, and he hopes to make a flight of 100 meters (328 feet), in which case he will be entitled to the $300 prize for this distance. After that he will make an attempt to win the Grand Prix offered by Messrs. Deutsch and Archdeacon of $10,000 for the first heavier-than-air machine to make one kilometer (0.62 mile) in a closed circuit. The Aero Club Commission, in a subsequent meeting, confirmed the above performance, so that Santos Dumont is officially the winner of the Archdeacon cup.

If we take the motor of Santos's aeroplane at its full rating, he succeeded in lifting only 13 pounds to the horse-power. If we suppose, however, that it only developed 40 horse-power, the lift would then be 16 pounds to the horse-power, while at two-thirds of its rated horse-power (which was about what the Wright brothers' motor developed) the lift would be 20 pounds per horse-power. Consequently the later flyer showed less than half the efficiency of the Wright machine.

As the Wright machine lifted from 38 to 61 pounds per horse-power, according to whether the motor was taken at its full power or at two-thirds of its rating, we see that the new aeroplane showed only from one-third to one-half the efficiency as far as lift per horse-power is concerned, and not taking account of the difference in speed.

The apparent inefficiency of Santos Dumont's machine, which we commented upon in our November 3 issue, may be partly explained by the statement of a well-known American experimenter to the effect that in towing experiments with a full-sized aeroplane loaded with sandbags he found a variation in lift of from 55 to 185 pounds per horse-power due to the difference in balancing, etc., of the machine. This would indicate that the inefficiency of the Dumont aeroplane may not be due entirely to its form, but that improper balancing, too great an angle, etc., are the chief causes.

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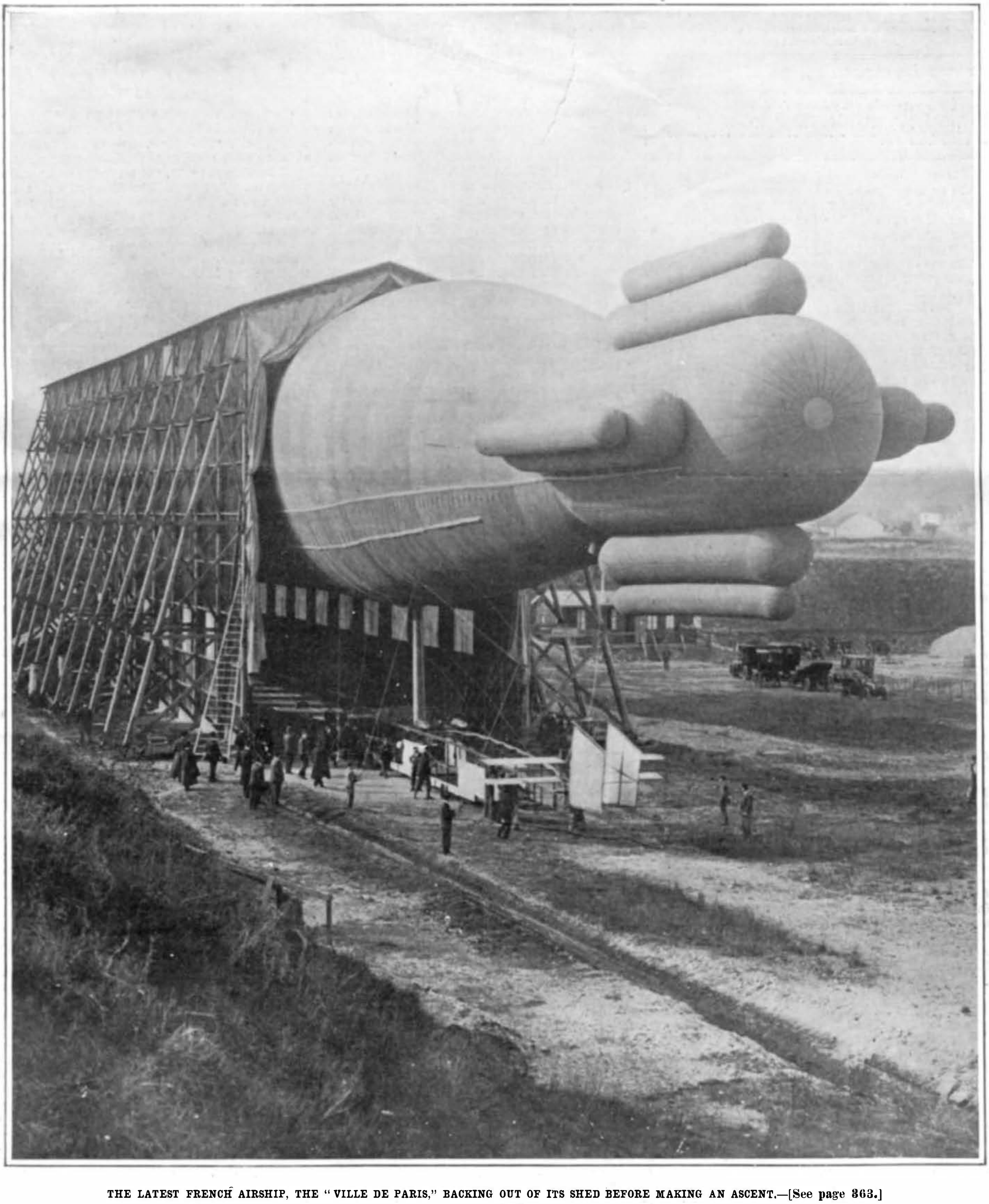


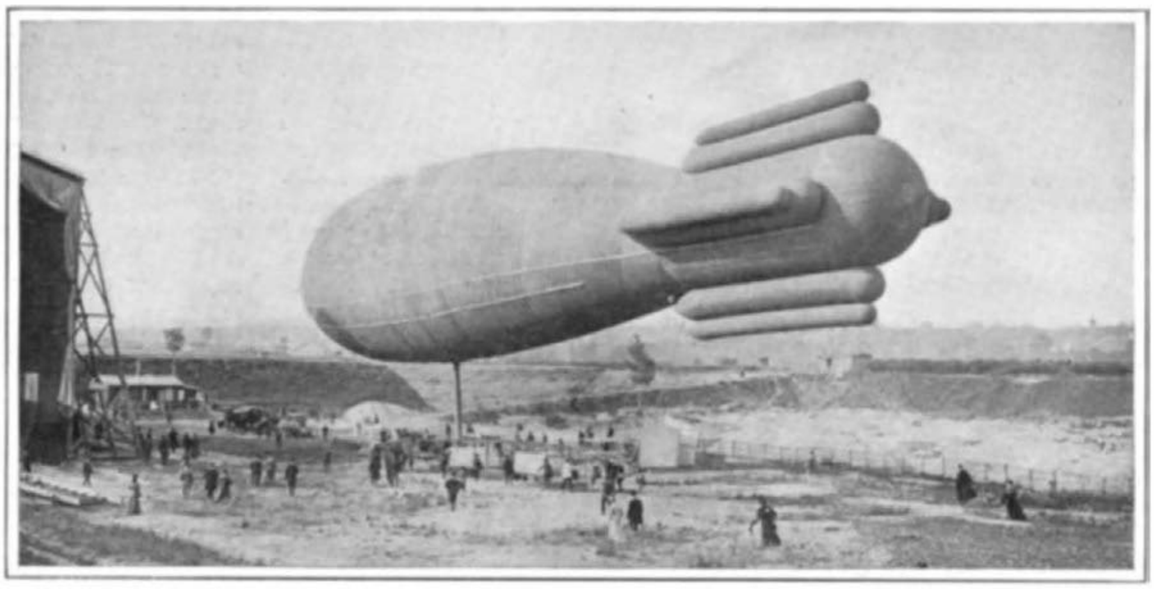
THE LATEST FRENCH AIRSHIP, THE "VILLE DE PARIS," BACKING OUT OF ITS SHED BEFORE MAKING AN ASCENT.—[See page 363.]

The balloon is 203.42 feet long and 34.45 feet in diameter. It has a capacity of 113,005 cubic feet and requires a 70-horse-power gasoline motor connected to a 19.68-foot propeller to drive it through the air.

Another aeroplane with which experiments are being conducted in France is that of M. Louis Bleriot, which was illustrated in the SCIENTIFIC AMERICAN of August 18, 1906. Experiments with this machine are being conducted on the Lake of Enghein. The aeroplane has two propellers which are turned in the opposite direction, and each of which is direct-connected to a 24-horse-power eight-cylinder motor of the same make as that used by Santos Dumont. The apparatus is mounted upon cylindrical floats of canvas which are pointed at their ends. When it attains a sufficient speed these floats leave the water and the apparatus soars in the air. It is controlled by a double horizontal rudder in front, and also by suitable vertical rudders at the rear.

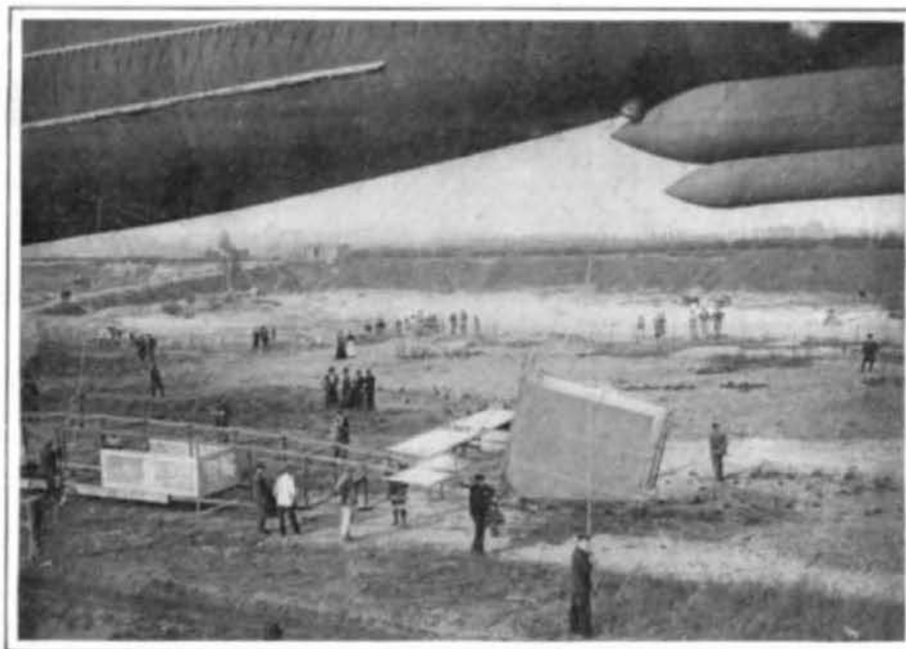
In opposition to the aeroplane or heavier-than-air type of flying machine, the French are particularly active just now in constructing large dirigible balloons. The latest of these is M. Henry Deutsch's airship, the "Ville de Paris," which is a trifle larger than the new Lebaudy airship that has recently been constructed for the French government. This latter airship has a length of 60 meters (196.85 feet) and a diameter of 10.8 meters (35.43 feet), while its capacity is 3,000 cubic meters (105,943 cubic feet). Its propellers are placed on either side of the body framework or "nacelle," and at about the center of the latter, which is boat-shaped. The weight which can be carried, outside of the equipment and the fuel sufficient for a ten hours' run, is about 1,100 pounds. A 70-horse-power Panhard motor is used, and as the power of the motor is considerably greater than that of the motors used heretofore, a much higher speed will be possible, and the radius of action of this new government dirigible will be considerably increased. It is expected that the first trials of the new Lebaudy airship will be held this month. This is the second dirigible balloon which the French war department has had constructed. We publish below and on the front page a number of photographs of the new airship "Ville de Paris." This dirigible is 62 meters (203.42 feet) in length and has a diameter of 10½ meters (34.45 feet). Its capacity is 3,200 cubic meters (113,005 cubic feet). It is built of double rubber-coated tissue, lined with an interior protecting coating. The balloon is constructed according to the late Col. Renard's theories, and is cigar-shaped, terminating at the rear in a cylindrical portion. The envelope is so designed and put together that there are no longitudinal seams. What seams there are are so arranged as to be relieved of heavy strains. The peculiar arrangement of cylinders placed at the rear end of the balloon is one of its original features. These cylinders are made up of canvas tubes filled with hydrogen and attached to the main body of the balloon. The cylinders are intended to form a kind of balancing tail. The framework below the balloon also carries a double vertical rudder for steering and a double horizontal rudder for directing the airship upward or downward. This framework is 105 feet long and carries a four-cylinder Argus gasoline motor of 70 horse-power at 900 revolutions per minute. The engine is geared to the propeller shaft with a reduction of 5 to 1. The propeller is placed at the front end of the framework, and is of a new design, having two blades which can be readily turned in the hub and which are automatically set at the proper pitch according to the thrust and speed of the propeller. The balloon is fitted with a large compensating ballonette into which air is forced from a blower seen in one of the illustrations, allowing for the expansion or contraction of the gas, and keeping it always at the same pressure. The blower is connected to a gasoline motor. The purpose of the ballonette is to compensate for the expansion or contraction of the gas in the balloon (which is due to the difference in temperature of the atmosphere) by allowing air to escape and by blowing it into the ballonette. This new airship is one of the largest and most improved craft. It is expected that a speed of 20 miles an hour will be attained.

On the 11th ultimo Count Zeppelin maneuvered his new dirigible above Lake Geneva, ascending to a height of 2,500 feet and steering the huge cigar-shaped aerostat very nicely. This airship is mounted on floats, so that it works equally well on the water.



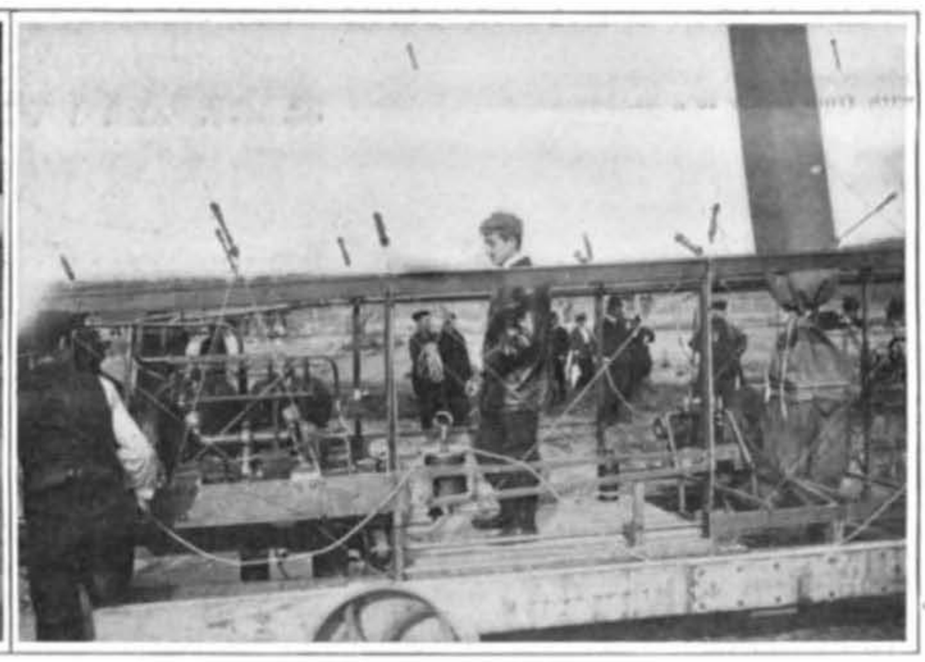
The New Deutsch Airship "Ville de Paris," the Latest and Largest Dirigible Balloon.

The peculiar arrangement of twin, hydrogen-filled cylinders forms a sort of balancing tail.



Under Side of the Balloon Toward the Rear.

In this view the "nacelle," or body framework, is shown. Note the double horizontal and vertical rudders at the rear.

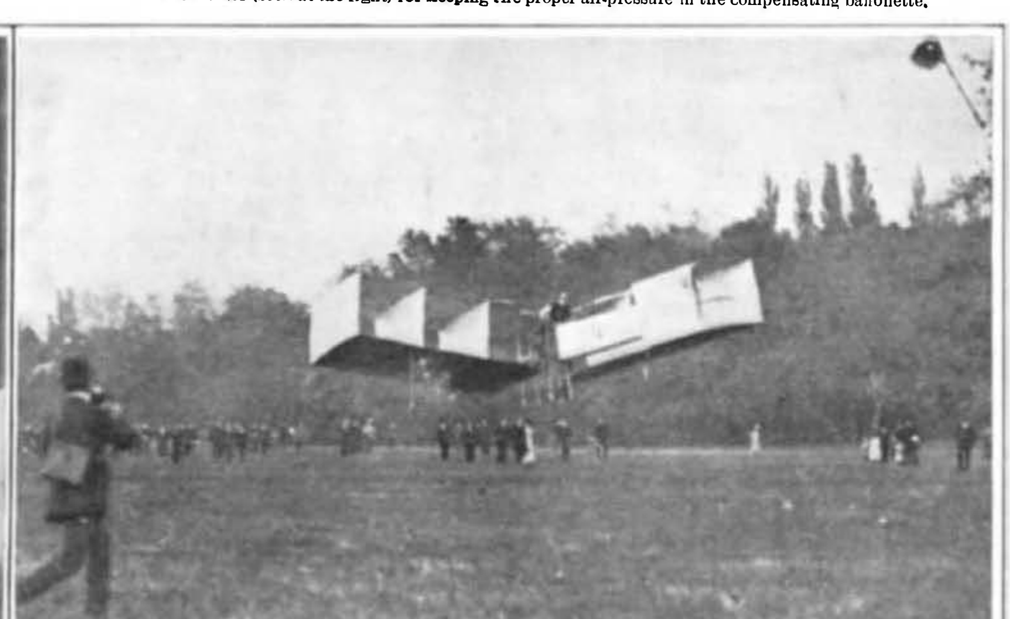


The Power Plant, a 70-Horse-power, 4-Cylinder, Water-Cooled Argus Motor.

The motor drives the 19.68-foot propeller through gears at 180 revolutions per minute. A smaller motor runs the blower (seen at the right) for keeping the proper air-pressure in the compensating ballonette.

Santos Dumont in the Basket of His Aeroplane "14-bis."

Note the control lever and wheel for the box rudder in front. The 50-horse-power motor is just back of the basket.



The Aeroplane Making Its First Successful Free Flight With Its Owner in Control.

The machine flew about 200 feet at an elevation of 10 feet from the ground.

PROGRESS OF AERONAUTICS IN FRANCE.