AN INTERESTING GERMAN FLYING MACHINE.

BY DR. ALFRED GRADENWITZ.

The flying machine illustrated herewith is arousing much interest at the present moment in German engineering circles; it has been developed by Privy Councilor J. Hofmann, of Berlin, during more than twelve years' strenuous work, in spite of early lack of success and encouragement.

Hofmann began his experiments as early as 1895 with a trial similar to Lilienthal's fatal flying experiment, gliding with an aeroplane from the roof of a small factory building. In connection with a more extensive experiment, the flying machine was placed on a cart pushed by workmen, while two men on the cart held the device in position. As, however, one of these men, contrary to instructions, left the cart, the machine was caught up and broken by a sudden gale of wind. In consequence of this failure Hofmann lost the support which he needed for the work, and was himself obliged to install a small workshop in a dwelling room in which several flying machine models, on a scale of about 1 to 10, were constructed. All these had identical steam boilers and engines, but different propellers, wings, and legs. In spite of the successful flying experiments carried out with these miniature airships, the public remained skeptical in regard to Hofmann's work, it being thought unlikely that similar success would attend experiments on a large scale. Santos Dumont

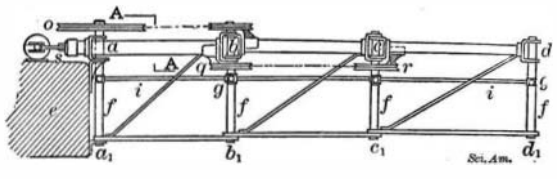


Fig. 3.—Side Elevation of the Extended Left Wing of the Machine.

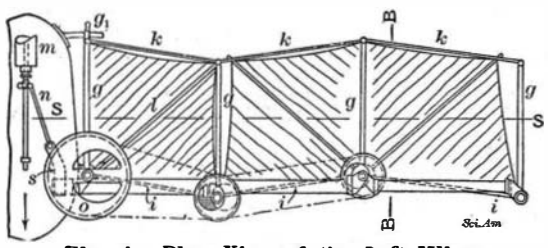


Fig. 4.—Plan View of the Left Wing.

it was who proved that the success of flying tests is independent of the size of the airship.

A committee of supporters having finally been formed, the inventor commenced the construction of a large-sized machine. In place of wings rigidly fixed to the body, Hofmann uses movable wings, which, like those of insects, are folded up against the body when the latter is at rest, and are stretched out to the right and left during the flight. In the case of a large-sized machine, however, it becomes necessary to subdivide the wings like those of birds and bats, as represented in Figs. 3, 4, and 5 of the illustrations herewith. Fig. 3 is an elevation of the left-hand wing extended, and Figs. 5 and 6 are plan views; *e* is the body of the machine flying in the direction of the arrow; to both sides of this framework the girders of the wings are applied. The vertical rods *f* carry at the rear the outriggers *g*, which in turn are connected together at the back. To the upper ribs *a*, *b*, *c*, *d*, or to the lower ribs a_1, b_1, c_1, d_1, or to both of them, or finally to special rods *i*, there may be fitted horizontal sails secured to the rods *g*, both at the front edge *i* and at the lateral edge, while the back edge and other lateral edge are usually left unattached. During the flight of the machine the air will throw the sails from underneath against the framework members *k* and *g*, while after the landing the framework girders are folded immediately by a single motion of the piston *m*.

In the machine constructed by Hofmann the part *a b*, corresponding to an upper arm, is 10.9 feet, the lower arm *b c*, 11.9 feet, and the hand *c d*, 12.9 feet in length. As the body itself is 5 feet in breadth, the total width of the flying machine is 76.5 feet, while the length in the direction of flying from the front edge of the propeller to the rear edge of the rudder is 26.5 feet. The machine, when traveling on land with folded wings, is 33 feet in length and over 13 feet in breadth. Another feature of the machine is the fact that the wings, when stretched out, can be moved both in a forward and a backward direction, thus replacing the rudder or correcting any mistake in the adjustment of the center of gravity.

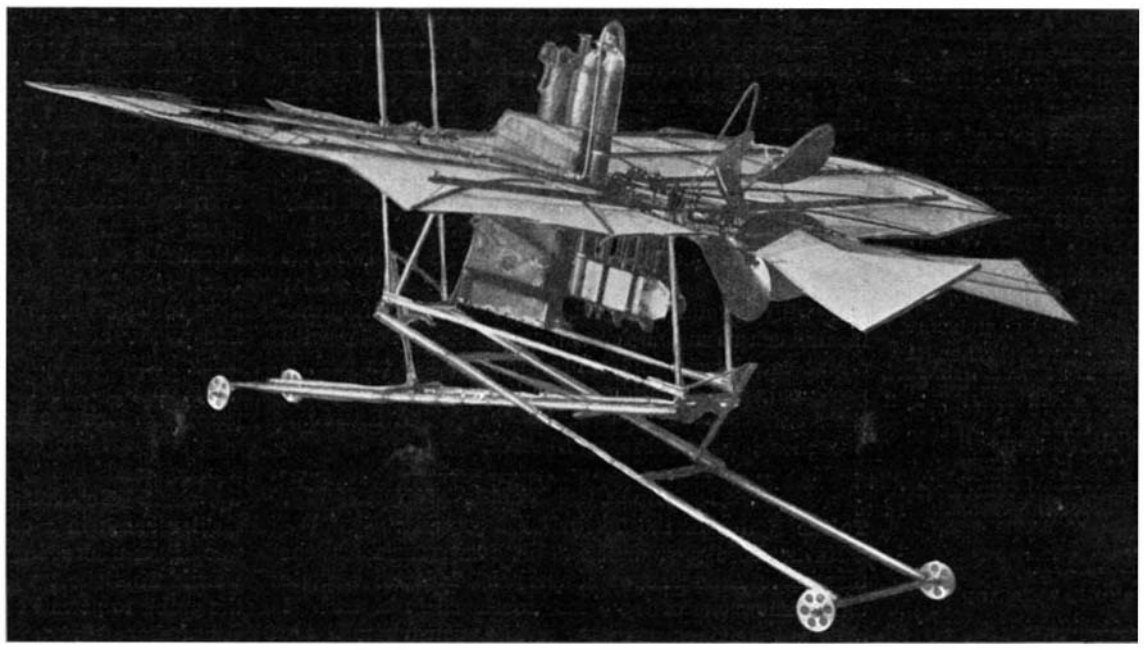


Fig. 1.—The Flying Machine as It Would Appear in Full Flight.

Much time and money were expended on trials intended to ascertain the most convenient shape of propeller screws. The design of the propeller at present adopted will be seen from Figs. 1 and 2, which were made from photographs of Hofmann's full-sized machine. It is, however, intended to reconstruct this machine, adapting it to combustion motors, and then a patented type of propeller will be made use of. These improved propeller screws are, like the above, mounted on arms connected with the shaft, while free to rotate in bearings in which they are turned around during operation by means of a handle. The forward and backward motion of the machine is thus controlled by this handle, dispensing with the use of any change gearing, as in the case of ship screws with adjustable blades.

The flying machine at present constructed, as seen from Figs. 1 and 2, comprises a quadruple screw propeller arranged in front with its shaft, behind which the steam engine is located. The axles of the four wheels are fitted to the ends of lengthy springs placed in guiding tubes, which are free to rotate around the center of the machine. Between the upper frame of the machine and the front and rear bogies corresponding to fore and rear legs there are two reinforced steam cylinders with projecting piston rods; this patented arrangement enables the body of the machine with the aeronaut, wings, and all to be raised about four and a half feet. While the body of an animal is provided with a backbone, breastbone, and ribs, inside of which the more sensitive organs are hidden, this winged flyer has a protective framework of steel tubes and rods inside of which the motive parts are arranged. The steam boiler and superheater are of zigzag form; the steam raised in the lower part of the water-tube boiler rises into the steam chamber, placed immediately in front of the aeronaut, where the water is separated out and returns to the boiler, through return pipes; the moist steam is conveyed to the superheater located on the top, running toward the fire as far as the lower boiler, and finally through the fireplace to the throttle valve near the driver's position and thence to the propelling mechanism. The driver's position, in addition to the devices usual in connection with locomotives, contains all apparatus for controlling the auxiliary machinery, thus allowing the flying machine to be lifted or lowered and the wings to be extended or folded up by means of a single manipulation in each case. It further contains the handwheel for steering the front wheels, the machine being used on land as an automobile, and two levers for the two horizontal flight rudders arranged behind the engine on either side of a stationary vertical keel. The flight

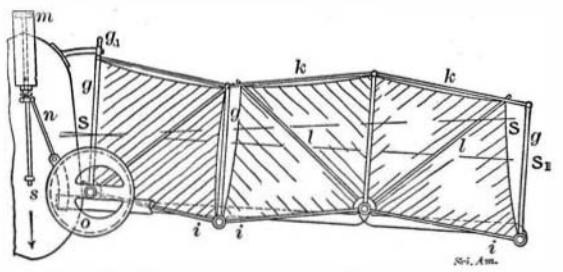


Fig. 5.—Plan View of the Extended Wing.

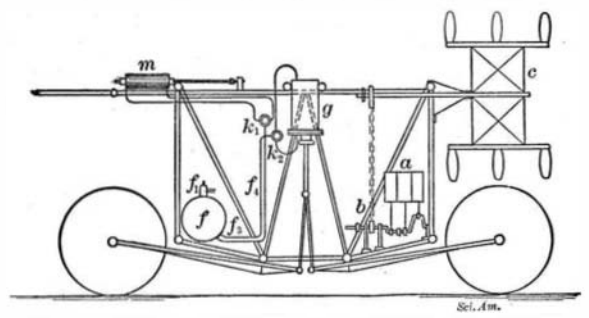


Fig. 6.—Auxiliary Motor for Actuating the Wings and Legs.

rudders as well as the sails of the wings have not yet been placed in position.

If the boiler be heated with charcoal, a superheat corresponding to the temperature of melting lead is obtained with a maximum pressure of 15 atmospheres. Now, as the boiler of a 30-horse-power engine contains 13 gallons only of water, while the copper tubes (0.2 inch in outside diameter and 0.17 inch in inside diameter) represent an aggregate length of 7,260 feet, it will be readily understood that the control of the fire is not an easy matter. The fluctuations in the consumption of steam, depending on the working of the auxiliary machinery, and the operation of the copper tube superheater, exclude any possibility of a single operator tending the boiler and engine, and steering the machine through the air. Now, as internal-combustion motors are at present constructed so light in weight, Mr. Hofmann, as above mentioned, intends substituting such a motor for his present engine.

After making this substitution, the construction will be as shown in Fig. 6. The motor *a*, while the propeller *c* is running at no load, fills

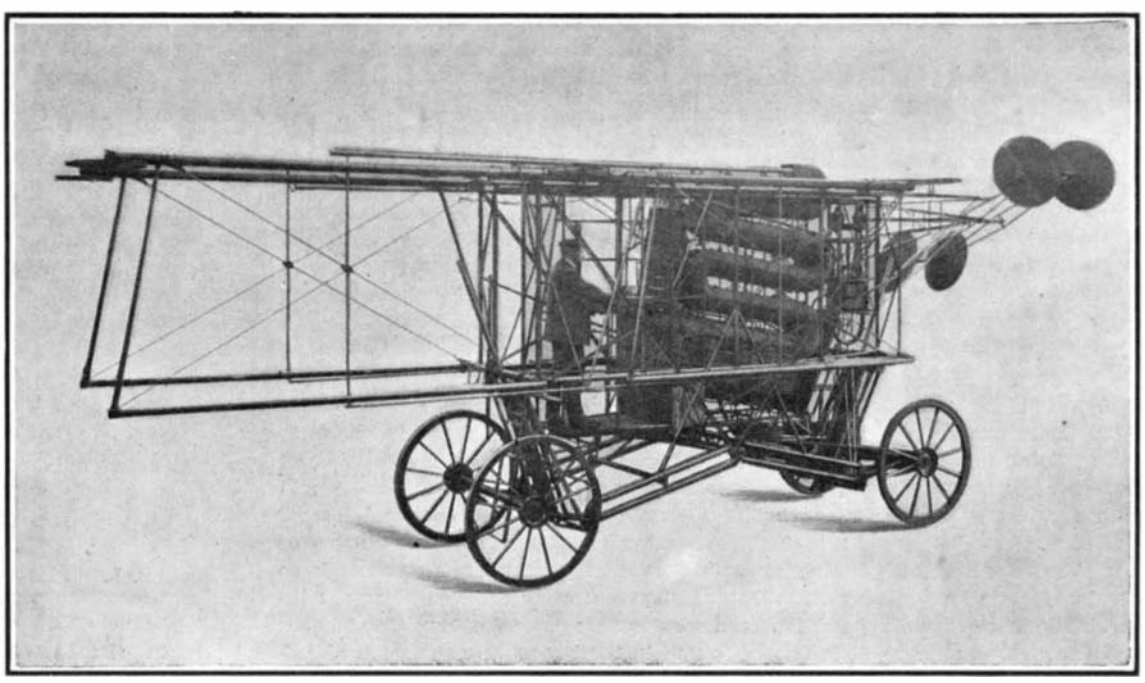


Fig. 2.—The Incomplete Hofmann Flying Machine During Construction.

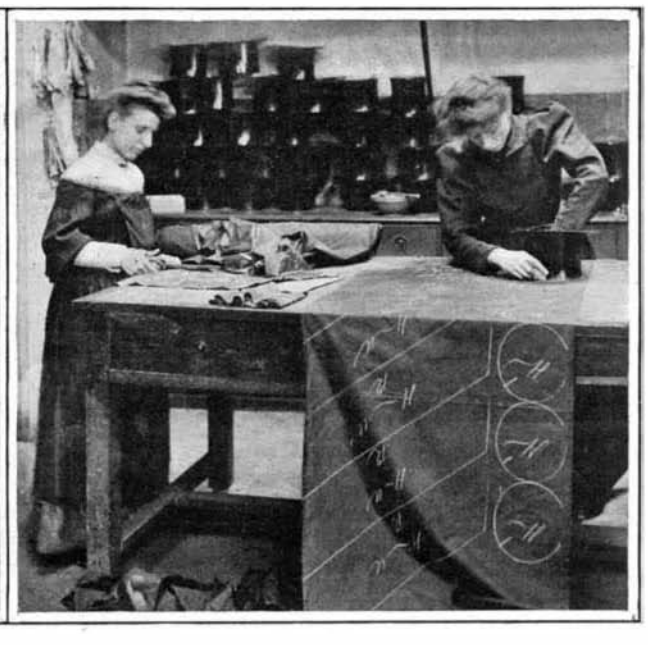
the reservoir, f, with compressed air until the latter is continually discharged through the safety valve f_1. The flying machine, whose supporting surfaces and rudder are arranged in the direction of the propeller axis, is then slowly lifted through 4½ feet by allowing air to enter through k_2 into the cylinder or cylinders g. The propeller is next adjusted for forward running, while compressed air is introduced through k_1 into the cylinders m, thus unfolding the wings suddenly. As the whole wing surface remains parallel to the ground, the flyer is drawn by the propeller at a speed of 10 to 12 yards a second. At this very moment the direction of the air in the lifting cylinder g is reversed by turning the cock k_2, thus causing the legs of the airship to be pulled upward, and allowing the machine to fall freely 4½ feet. It actually falls some distance while being launched forward, and even if this distance be only half a yard, an increase in speed of about 3 yards will be derived therefrom, thus giving an initial flight speed of 13 to 15 yards per second. If the center of gravity of the whole machine be so placed in regard to the wings that the former, while transmitting its load to the wings, is rotated, e. g., to a certain extent lifted in front and lowered backward, the flight is bound to continue, the rudder being actuated in the case of a permanent operation.

In landing, the speed of the propeller is reduced while adjusting the wings to a steeper inclination by lifting the two back rudders; then the whole airship slowly drops upon its rear legs, and in a half-flying and half-rolling motion falls on its fore legs. By reversing k_1, the compressed air in the cylinder m is immediately controlled in such a way as to draw the wings abruptly to the body, thus ending the flight.

As regards the performance of this kite flyer in bad weather and winds, a special point has been made of imitating the behavior of birds. It should be remembered that all birds in their tails possess approximately horizontal surfaces, by means of which all horizontal and vertical motions as required in flying can be obtained.

If now the bird unexpectedly is taken sideways by a sudden gale, it is struck behind its center of gravity by a far greater number of air particles than in front of the center of gravity. It thus quite automatically turns toward the wind, thereby eliminating any danger. For this reason the inventor has provided his machine with rear rudders and an intermediary stationary vertical keel, in the place of the front rudder used by Santos Dumont, which on the above theory would be rather dangerous.

Covering Hat Bodies with Silk Plush.



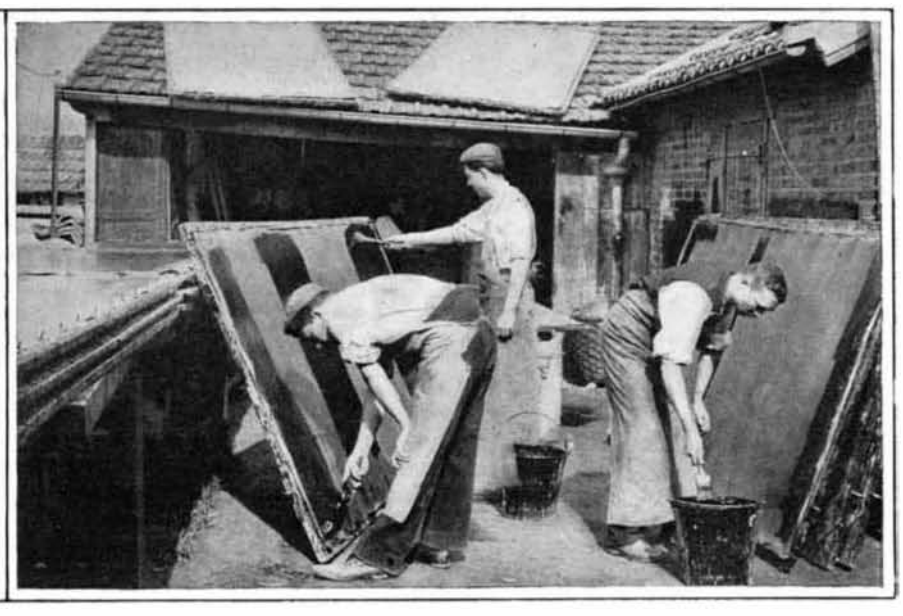
Cutting Out Plush Hat Covers.

THE STORY OF A SILK HAT.

BY JACQUES BOYER.

In the making of the silk hat, that indispensable accessory of fashionable masculine attire, comparatively little use is made of the marvels of modern machinery that play so important a part in most of the arts and manufactures. The construction of a silk hat includes five stages: making the foundation or body (called in French *galette*, that is, "pie crust"), covering, shaping, sewing the silk plush cover, and, finally, lining and trimming. The body is composed of several thicknesses of very fine muslin which are wrapped around wooden forms (blocks) representing the styles of the season. The muslin, before it is put on the blocks is stretched on frames brushed with a solution of shellac in alcohol containing a little ammonia, and dried in the open air or in well-ventilated rooms, according to the season and the weather. The foundation, or body, thus constructed is varnished. It is as hard as wood, very light and absolutely water-tight. If it is thrown on the floor it will rebound without becoming deformed. In order to make the foundation exactly fit the wooden block, which is smaller in the middle than at the ends, the first strip of muslin is cut bias. The innermost layer of the top of the hat consists of satin or watered silk. To this the prepared muslin is applied in one or more layers. The foundation of the brim is made of two or three layers of stouter muslin coated with shellac, which are pressed together and smoothed by a machine which consists essentially of

Shaping and Curling the Brim.



Coating Muslin with Shellac for Foundation.

Making Brims.

Shaping Hats After Covering.

THE STORY OF A SILK HAT.