THE FIRST BRITISH MILITARY AIRSHIP. BY HAROLD J. SHEPSTONE.

Following the example of France and Germany, Great Britain has equipped her army with an airship. It is the first that the British government has constructed, and its recent successful flight will no doubt be the means of inducing the British War Office to build other aerial ships, and also to carry out experiments in that fascinating field—mechanical flight.

Naturally, the construction of the airship was kept a secret, and it was only a few days before this new dirigible was drawn out of its shed on Farnborough Common, near Aldershot, for its first flight, that the general public learned through the press that the British War Office had not only taken up the question of dirigible balloons, but had actually built one. It has been named the "Nulli Secundus," and compared to the airships of France and Germany, there is certainly some appropriateness in the title. Although the public was not aware that within a few miles of the military town of Aldershot an airship was nearing completion, the "Nulli Secundus" has been some six years on the stocks. No doubt, too, she would not have been completed to-day had it not been for the efforts and energy of the American, Col. S. F. Cody, well known as the inventor of man-lifting kites. Some months ago Col. Cody interested the British War Office in his kites, and he has been exclusively engaged by them ever since.

When he took up his quarters at Aldershot, he was shown the partially completed airship and the plans, and was asked to assist in its completion. When the writer inquired of this inventor what portion of the completed ship represented his handiwork, he replied: "I have certainly done some work upon it, particularly in connection with the framework, though I did not actually design it. I bought the engine for the government. I designed the engine-bed, the supports, and the devices for transmitting the power from the engine to the fore-shafts. In fact, I might add, the entire power-producing section of the airship is of my design, and a great deal of it was made at the forge, lathe, and bench with my own hands. I designed all the aeroplanes or wings by which the ship is steered." Although no official details of the airship have been given out, many interesting particulars have already been gleaned, while the photographs secured at the initial flight depict the leading characteristics of this, the first of Great Britain's aerial warships. The main gas-vessel resembles an enormous sausage, for it is cylindrical throughout, with the exception of the blunt semi-spherical ends. Over all it measures some 100 feet in length, while its diameter is about 30 feet, and its capacity for the hydrogen gas with which it is filled about 60,000 cubic feet. It is made of gold-beater's skin, and in addition to the netting, which at present covers the entire gas-vessel, there are at equal intervals four broad silk bands which pass round it. By means of these silk bands and netting, a secure fixing is obtained to an upper framing, that serves to support the rudder as well as the parts that lie below.

Suspended below the envelope there are in all three distinct horizontal frameworks; for at some little distance below that already referred to, is an intermediate elliptical grid made of tubing, which is held in place by a comparatively few diagonal and straight stays, of a much more substantial character than those which connect the envelope with the upper framing, while the car proper is hung some few feet still lower. By this means a very rigid structure is provided, which occupies some thirty feet between the envelope and the car. The rudder, which is of large size, projects out behind this framework, and the space between the upper and the intermediate framings is utilized for fixing a pair of superimposed canvas aeroplanes both fore and aft. A strong metal framework with a steel keel forms the car, this having been given the shape and general appearance of a canoe by the canvas covering with which it is incased. Some 30 feet long by 2

feet 6 inches deep, it hangs centrally beneath the huge envelope, while forming part of its framework is a long girder of tubular construction above the gunwale, placed transversely to project on either side. It is this transverse girder which supports the two propellers by which the ship is propelled, and these propellers are driven from the motor by long belts running over

END VIEW OF THE AIRSHIP, SHOWING THE PROPELLERS, RUDDER AND VANES.

wire-spoked pulley wheels. As will be gathered from our illustrations, the motor is fixed high above the forward portion of the "canoe," with a regular automobile radiator immediately in front of it, and with its wire-spoked flywheel on the rear end of the crankshaft. The flywheel, therefore, lies practically across the center of the car, leaving the entire aft half of the "canoe" available for the three occupants. The

THE FIRST BRITISH MILITARY AIRSHIP "NULLI SECUNDUS."

Length, 100 feet; diameter, 30 feet; hydrogen capacity, 60,000 cubic feet.

propellers are no less than 10 feet in diameter, and that is why the transverse framing which supports them is of as great a length as it is seen to be in one of the accompanying views. Each propeller has two blades, and is of very light construction. The engine is of the eight-cylinder V type, capable of developing over 50 horse-power, and its fuel tanks, which are tor-

pedo shaped, are secured above on the intermediate framework already referred to. The two main exhaust pipes project downwardly and rearwardly, one on each side, looking, with the silencers in which they terminate, like huge antennae.

From the envelope, the large filler tube is brought down to the stern of the car, and special arrangements—including certain automatic devices—are made both for regulating the pressure in the envelope to suit requirements, and also for automatically preventing it from rising unduly at any time. Auxiliary wings and aeroplanes are, moreover, features of great importance to the control of the ship, for not only have two large wings been fitted, one on either side—presumably to act to some extent as horizontal rudders—but other aeroplanes are, as already mentioned, arranged between the two upper frames. These side wings are hinged, so that they can be let down into a horizontal position when aloft, but can be swung up into the position shown in our illustrations when the ship is near the ground. As a matter of fact, these wings were removed during the second flight of the ship, but were carried and tested on the ship's first ascent.

On its initial flights—for the airship made two distinct ascents on the day it was first taken from its shed—it carried three passengers. On the first journey it took aloft Col. Capper, who took the wheel; Col. Cody, who looked after the machinery; and Capt. W. A. King. The great dirigible balloon rose slowly until it reached a height of 150 feet, when the vessel was stopped by the ropes which held it. Seeing that everything was all right, Col. Capper shouted through the megaphone "Let go!" and the ship sailed away, for the first time in its life free from all connection with Mother Earth. Rising to a height of some 400 feet, it made a straight course of about half a mile and then made a complete sweep, all the while maneuvering about apparently under perfect control. After having been aloft for some twelve minutes, the driving belt of the fan broke, and although a small matter, which could have been rectified on the spot, it was considered desirable to descend. The airship descended safely, and was taken back to its shed. A few hours later it was again brought out in the sunshine, and the second flight was accomplished, the passengers being Col. Capper,

Col. Cody, and Mr. McWade. This ascent quickly came to an end, however. The ship had hardly reached a height of 200 feet when an attempt was made to turn her suddenly. Almost instantly the ship turned its nose downward, and with great swiftness shot obliquely toward the earth. The spectators, fearful of the consequences, were greatly alarmed, but the ship, though hitting the ground hard, rebounded, which lessened the blow. The only damage done was the bending of some of the framework. This brought the trials to an end, and, all things considered, the ascents were most satisfactory.

Seen after the last ascent Col. Cody declared that the "Nulli Secundus" showed her capability of traveling from 12 to 15 miles an hour in a dead calm. "When some improvements are made," he declared, "we shall be able to do 25 miles and perhaps 30 miles an hour. Of course, if the ship is navigated against the wind, the velocity of the wind must be deducted, and if the ship goes with the wind the speed is still further increased. For instance, if the ship went 25 miles an hour, she would actually travel 40 miles, if she followed in a 15-mile an hour wind."

Undoubtedly the British airship compares very favorably with those possessed by the French and German armies, each of which possesses two military dirigibles at the present time. France

has the "Lebaudy," built in 1905, and "La Patrie," built in 1906. The latter, in July last, accomplished a remarkable and sensational flight directly over Paris. It answered the helm easily, and traveled at a speed of 18 miles an hour against the wind. This airship is driven by means of two lateral propellers actuated by a 75-horse-power Panhard motor. The car is so made

as to facilitate packing and transport by rail. This airship cost \$60,000 to build.

Germany also has had successful results with the Parseval and Gross airships, and the Germans are now about to build another huge airship of the Zeppelin type.

SEA-GOING TORPEDO BOATS.

The accompanying illustration of the torpedo-boat destroyer "Eden" should attract attention because it represents the latest evidence of a decided trend in the development of torpedo boats toward a vessel of considerable displacement and freeboard with ability to keep the seas in all weathers. The "Eden" is one of thirty-four sister vessels launched for the British government between 1903 and 1905. As a class, they are from 220 to 225 feet in length, 23½ feet beam, and draw 10 feet of water. There are slight variations among the thirty-four vessels as to dimensions and general particulars, the "Eden" being 220 feet long, 23 feet beam, and 8¾ feet draft. She is driven by Parsons turbines, operating six propellers, and with 7,000 horse-power her mean speed is 25½ knots an hour. She carries one 12-pounder gun forward and five 6-pounders aft and in broadside. She has two torpedo tubes, a coal capacity of 130 tons, and a complement of seventy officers and men.

Now in the "Eden" class of boats, the high speed of the preceding class of seventy 30-knot boats, built between 1896 and 1902 for the British navy, has been

this problem is of a rather complicated nature, there being three factors to be taken into account, namely, the hall itself, the auditors, and the speaker.

As regards the influence of the hall, Dr. Marage, of Paris, by the aid of his talking siren described in these columns,* has ascertained that this will be satisfactory if there is no echo, and if the sound of resonance is of a duration sufficient to reinforce the original sound without interfering with the one following.

As to the auditors, the sense of hearing obviously is not developed with the same sharpness in all of them, while their actual physiological condition is likewise of some importance.

As regards finally the orator himself, it is a known fact that certain voices are more far-reaching than others. The significance of this fact has not so far been known, and has been first elucidated by Dr. Marage, who, by the aid of his siren, has determined the energy required in order to be heard, by an orator, according as the latter has a bass, baritone, or tenor voice.

As the energy of the sound is given by the product VH of the volume V of air escaping from the lungs of the orator by the pressure H to which the latter is subjected, these two quantities have to be determined. Now, as in an ordinary orator an accurate measurement is impracticable, Dr. Marage replaces the speaker by an artificial orator, his talking siren.

By extensive experiments on acoustic sensitiveness,

voice, according to the hall, has sometimes to spend an energy nine times greater.

The energy to be evolved by the orator obviously depends on the situation of the auditors, the amount of energy to be spent by a bass in order to be perceptible to the worst located auditors at the Trocadero being, for instance, 0.004, while an energy of 0.0003, that is to say thirteen times less, will be sufficient for the first rows. However, these difficulties are partly compensated for by the fact that those auditors whose sense of hearing is inferior to the normal generally prefer the first rows.

As a practical rule, it may be said that in order to be heard in an unknown hall, the energy of the voice should be gradually augmented, till the orator himself begins to perceive the sound of resonance; if the energy be then reduced to some extent, the best possible results will be obtained.

Dr. Marage has later been able to experiment on two human subjects, one of whom had undergone a larynx amputation, his trachea communicating through a flexible tube with a caoutchouc membrane fixed in the mouth to an artificial glottis. This tube was branched in such a way as to allow the pressure to be determined by means of a metallic manometer. The output of air and the number and duration of inspirations were measured in the ordinary manner.

The other subject had normal vocal chords and a tracheal canula. The latter being made to communicate with a manometer, would give constantly the

A MODERN TYPE OF TORPEDO CRAFT, THE BRITISH SEA-GOING DESTROYER "EDEN."

sacrificed in favor of seaworthiness, comfort, and coal capacity. The 30-knot boats were about 10 feet shorter, of from 2 to 3 feet less beam, and about 4 feet less draft, and their displacement was 300 tons as compared with the 550 tons displacement of the "Eden" class. From our illustration it will be seen that the "Eden" carries a high forecastle deck, which extends aft to the conning tower, and it is upon this deck that the 12-pounder gun is mounted. She has a rather lofty bridge, a single signal mast, and two low funnels of large diameter. The other vessels of the class are generally similar in design, the main difference being that fifteen of the boats are provided with four funnels instead of two.

In the later ships, authorized from 1905 to 1906, the tendency to increase the displacement is even more marked, but at the same time there is a return to the high speed of the boats of the 1896 to 1902 period. Under this programme there are now being built five ocean-going turbine-driven torpedo boats of 600 tons displacement and 33 knots speed, and one turbine-driven ocean-going torpedo boat of 800 tons displacement, 30,000 horse-power, and 36 knots speed.

The Amount of Energy Consumed in Speaking.

BY DR. ALFRED GRADENWITZ.

An orator, when speaking in a hall, the acoustic qualities of which are unknown to him, is often uncertain as to the energy to be evolved in order to make himself heard by all his auditors. In fact,

Dr. Marage has shown that the synthetical vowels OU, O, and A (or their English equivalents OO, O, and A, as in father) when given out on the same note, F, for instance, which is shared by bass, baritone, and tenor voices, will produce the same impression on the ear of an auditor as a bass, baritone, or tenor voice respectively; it will thus be sufficient successively to produce these three vowels, ascertaining the minimum amount of energy required for making one of these sounds perceptible to an auditor placed at the different points of a hall.

The results found by Marage are recorded in the following table, the average of six experiments being given for each of four halls, and the energy of the sound being the amount of kilogramme-meters per second:

Halls.	Bass.	Baritone.	Tenor.
Trocadero	0.0014	0.00012	0.000088
Sorbonne Church	0.00089	0.00012	0.000088
Academy of Medicine.....	0.00026	0.00009	0.000030
Richelieu Amphitheater ..	0.00015	0.000051	0.000021

As inferred from this table, a bass voice is under a decided disadvantage, having to spend an amount of energy seven to sixteen times greater than a tenor. Baritone voices, while being intermediary between the bass and the tenor, are found to approach nearer the latter. As regards the various halls, a tenor has to give out four times more energy in the Trocadero than in the Richelieu Amphitheater, while a bass

pressure H of the air evolved during the talking process.

Some of the main results obtained by Dr. Marage are recorded in the following:

The air pressure, both in a natural and artificial larynx, will vary between 100 and 200 millimeters; in enunciating the simple phrase, "bonjour, monsieur," the manometer will oscillate between 120 and 160.

As the vocal chords are of different lengths in men (20 to 24 millimeters) and women (16 to 18 millimeters) respectively, experiments were made in which the length of the vibrating portion of the membrane was gradually altered.

In the case of a length of 24 millimeters, the minimum energy required for causing these artificial vocal chords to vibrate was found to be 57 kilogramme-meters per hour, while in that of short membranes (18 millimeters) 14.4 kilogramme-meters was found to be sufficient.

This accounts for the fact that women generally are tired far less by talking than men, and that children are able to talk the whole day without the least apparent fatigue.

The North German Lloyd Steamship Company contradict the report that they intend building a boat several knots faster than the "Lusitania." Such a speed is impracticable in steamships, and moreover, the company has sufficient boats for present requirements.

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