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Cuatro Vientos

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

TECHNICAL MEMORANDUM. 134

AERODYNAMIC LABORATORY AT CUATRO VIENTOS.

By Jubera.

September, 1932.

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The proximity of my office to the airdrome at Cuatro Vientos enables me to be informed, almost immediately, of any success or misfortune that occurs there and to be in a position to impart this information to the readers of "La Accion". Moreover, this proximity affords me an exceptional opportunity to associate, intimately, with many of the military aviators.

At the last international aeronautic congress, which the writer attended as a Spanish delegate, it was agreed that every nation should specialize in aerodynamic research. The Spanish government therefore assigned to Mr. Emilio Herrera, a scientist of world-wide reputation, the task of making aerodynamic tests with spheres, etc. in order to determine coefficients.

Herrera is, also an expert pilot and an advocate of establishing an air line between Spain and America.

Captain Olivié is second in charge of this work. This laboratory comprises two sections, one for mechanical and chemical tests of materials, and the other for aerodynamic tests.

When an airplane is received, it passes into the laboratory and is subjected to static tests, which consist in loading sand on its inverted wings in quantities seven times greater than its ordinary load. It is then taken apart, and all of its members are tested separately.

The propeller is subjected to a very severe test. The wood is first examined, and if found to contain a knot, crack, or other

* Abstract of an undated clipping from "La Accion."

[illegible] is promptly rejected.

In the equilibrium test the propeller is placed on an axis which acts on a balance, indicating zero in any position, where a state of equilibrium exists. If a lack of equilibrium appears the propeller is rejected, no connection being made as in other nations where lead is added or a portion is removed by planing to obtain equilibrium.

Strength and flexibility are also tested. In this test the Moore Artigas light and a special micrometer are used, the propeller being driven by a 750 HP engine. The degree of flexure is observed through the sight-hole of the micrometer which must indicate the same flexure, as that calculated, for a force equal to the power of the engine, otherwise, it is rejected. Then the power is increased by one-half, as a further strength test. Of every ten propellers, one is stressed to the breaking point. The efficiency test on the ground is then made, which consists in measuring the thrust and torque, by means of a helicoidal axis and two Herrera manometers.

Other parts of the airplane, such as turnbuckles, wires, etc., are tested, by subjecting them to seven times the required load, carrying one to the breaking point. In the testing of these parts one is selected at random, and if found satisfactory, the rest are given a mark of guaranty.

The tests of flight efficiency are truly interesting. Since they cannot be made in actual flight, on account of the inherent danger to the pilot, the idea was conceived of making the dynamic

tests in a wind tunnel, with stationary models, giving the air stream a velocity equal to the speed of the airplane in actual flight. In order to conduct these tests, Herrera and Olivié built the Cuatro Vientos Aerodynamic tunnel, which on the whole is considered one of the best in the world. The accompanying drawings give a fair idea of its size and design.

The diameter of its longest portion is 3 meters (nearly 10 feet) and its height is 14 meters (nearly 46 feet). It is equipped with a four-bladed fan, driven by a 750 HP engine, producing a wind velocity of 200 km (124 miles) per hour.

The principal tests made in this tunnel are flight tests for propellers and tests with models. The propeller to be tested is installed, with its engine, between the cones of the tunnel, and an air current is generated equal to that produced by the same engine and propeller in flight. Its thrust and torque are then measured by the same methods as employed in the ground tests. If the results are satisfactory, the propeller is accepted. These tests are very important, since, if a propeller breaks in flight - as has been known to happen - death is certain. After the tests have been completed, the propeller is again installed on the airplane, and made ready for flying.

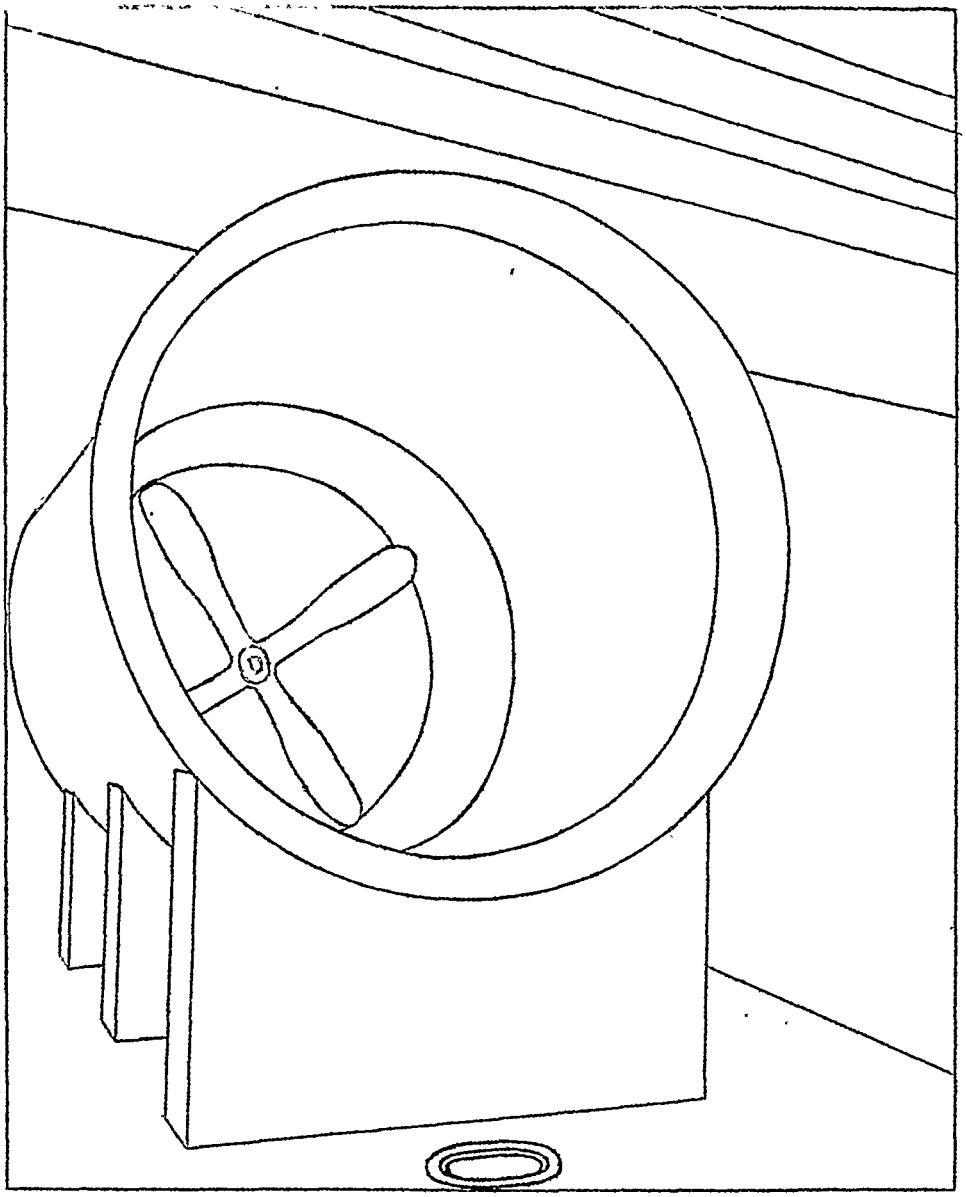
Herrera and Olivié, after much study and experimenting, constructed a new type of balance, which "registers automatically the characteristics of any model presented."

Models of a two-meter span are tested, and when received from the designer, are installed in the experimental chamber, between

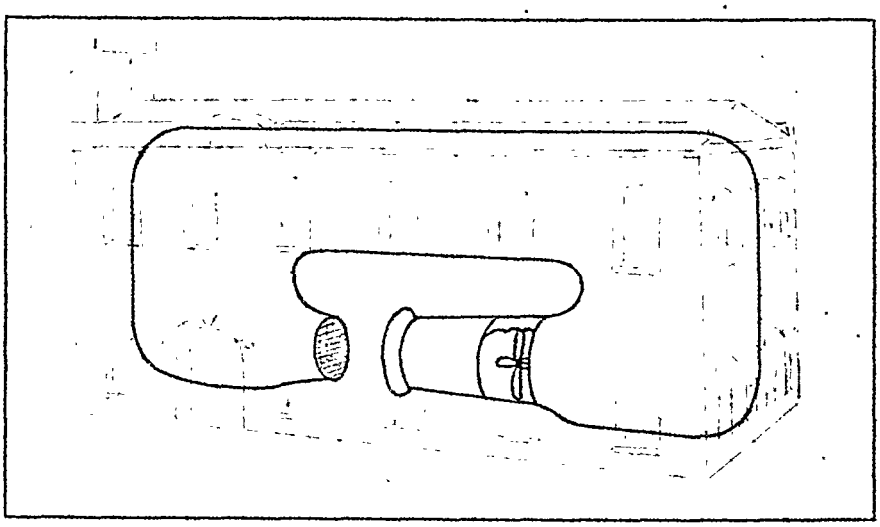
the cones. The tunnel is then made to function, and suitable tables, accompanied by photographs, determining their characteristics are prepared.

Connected with the laboratory, there are rooms for the chemical analysis of lubricants, varnishes, gasoline, etc., and for the testing of engines, and also a room for the examination of pilots, who are subjected to tests in rarefied air, as to sensitiveness of hearing, sight, touch, and functioning of the lungs and heart.

Translated by the National Advisory Committee for Aeronautics.



One of the cones of the giant tunnel.



Wind tunnel and building showing position and relative size.