NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

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COMPARISON OF NONRIGID AND SEMIRIGID AIRSHIPS.

By Lt. Stapfer.

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By Lt. Stapfer.

The discussion following the communication of Mr. Nobile on Italian semirigid airships leads me to offer a few considerations which are doubtless not new, but which seem to me to have never been presented from a purely objective point of view.

One of the main objects of airship science consists in establishing cooperation between two vertical forces, the buoyancy of the air and the attraction of gravity. The mechanism for establishing this cooperation must have the minimum weight and offer the minimum head resistance. Starting with this principle, let us consider what improvements can be made in the present type of nonrigid airships (derived from the "short car" type).

The principle of this type is, briefly, as follows: The total lift F is distributed throughout the length L of the envelope. The total weight $P = F$ is distributed along the shorter length l of the car. The necessity of making the shearing stresses and bending moments as small as possible in the car and in the envelope leads to a division of the weight and lift into n parts p_q and f_q, respectively equal, and to connecting them by n suspensions, as shown by accompanying figure.

The vertical component of the suspension q is equal to $p_q = f_q$ It follows, on the one hand, that the tension T of this suspension increases with its inclination α, since

$$T_q = p_q \times \frac{1}{\cos \alpha} .$$

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From this there follows, on the other hand, compression stresses $c_q = p_q \tan \alpha$, which become considerable for large inclinations α of the suspensions. These interior forces must be offset by the interior tension of the gas. The consequences of the obliquity of the suspensions are therefore:

A. The necessity of increasing the strength of the suspensions and, hence, their weight and drag.

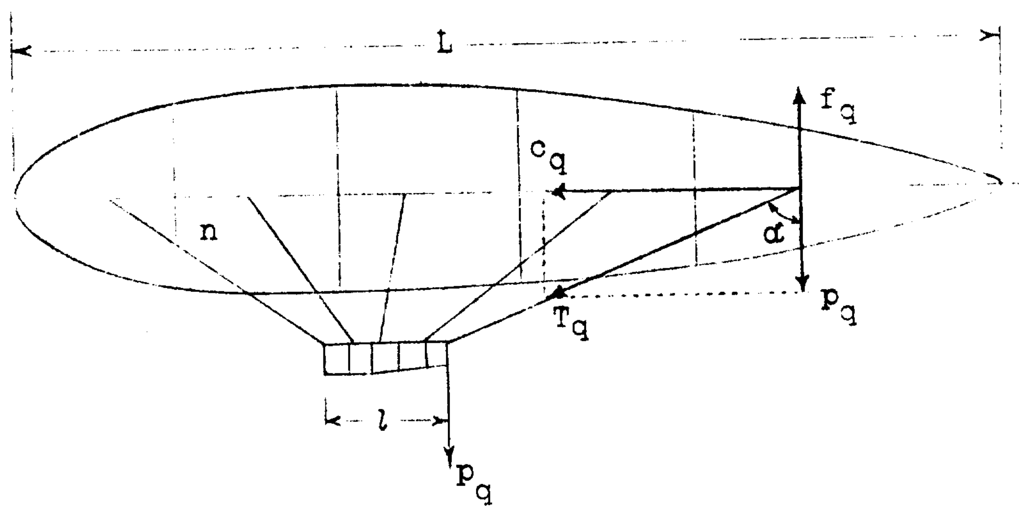
B. The necessity of increasing the inside tension and, hence, the strength of the envelope, its weight, volume and drag.

There are two ways to diminish the inclination of the suspensions:

The first consists in increasing the distance between the envelope and the car. This increases the drag and introduces prohibitive obstructions.

The second way is to place the weights on the vertical lines passing through the corresponding centers of lift. Thus we arrive at the semirigid type, which accordingly appears to be the result of improvements applied to the nonrigid type and which offers, moreover, along with other advantages, increased facility of maneuvering.

Translated by the National Advisory Committee for Aeronautics.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