ABSTRACTS.

Power Curve for the Aerial Propeller.

The author employs the method of least squares in order to determine the actual law governing the relation between the power of the airscrew and the ratio V/ND, or forward speed/revs. per min. x diameter. He uses model results from Eiffel, and corresponding full-scale figures from Captain Dorand. He shows that these results are more nearly represented by a formula in which P, the power, is made to vary as $N^{3.076}D^{5.15}$ for a constant V/ND, instead of varying as N^3D^5 as accepted theory requires. The practical utility of any such formula is open to doubt, especially as it appears to assume an accuracy in the experimental data which is probably unwarranted. ("Aerial Age Weekly," November 18, 1918.)

Stresses in Aeroplane Ribs.

In a paper presented at a meeting of the American Society for Testing Materials, Irving H. Cowdrey, gives a method of transverse testing under non-uniformly distributed load with special application to the wing ribs of aeroplanes.

At the outset it is pointed out that many of the members entering into the construction of the framework of the aeroplane are of such form or construction that it is very difficult, if not impossible, to calculate the stress distribution in and between the different parts of the members. This condition has led to some attempts to test certain of the completed portions of the craft, but the results of the tests have usually been of doubtful value, owing to the conditions of test differing very much from actual conditions.

In the method described in the paper, a wing rib is tested under any desired distribution of loading by applying the loading on the rib through elastic rubber bands of different widths. A wing rib with short lengths of front and rear spars attached is supported in the upside down position from two horizontal bolts, each of which passes through the centre of the spar section. The rubber bands, which were cut from a motor cycle tyre, are attached at their upper ends to a series of stirrups which rest on the rib at intervals along its length; the lower ends of the band are connected to a stiff horizontal beam of wood, to which is applied the weight constituting the total load on the rib. Each of the distributed loads acts on the upper side of the rib under test (which is the under side in flight). In the example given of an actual test, the total load was divided into 14 parts, which number, it is stated, could well be increased. The deflection of the rib was measured at various points along its length, and a diagram of deflections is given for various total loads. The load distribution, as calculated from the widths of the rubber bands and the points of application of the forces was checked from the observed extension of each band and its calibration. There was a slight difference due to distortion of the rib. ("Aviation," November 1, 1918.)

Properties of Aeroplane Fabrics.

In March, 1917, the U.S. Bureau of Standards issued instructions for the manufacture of cotton fabric for experimental purposes, and in August, 1917, this fabric was adopted, and is known as Grade A fabric. The properties required by doped and undoped fabrics are described, also the various tests of the apparatus to carry them out, such as an inclination balance for testing tensile properties of textile material, and an apparatus for testing the bursting strength of cloth under uniformly distributed pressure. The inclination of balance is described by means of a diagrammatic drawing, and there is an arrangement for taking an autograph record. Several examples of such diagrams are given which clearly show the yield point and the various characteristics of the fabric; these diagrams are discussed at some length. In the apparatus for testing the bursting strength, the fabric is placed in a frame over a sheet of indiarubber to make it airtight, and the air pressure is then applied. (E. D. Walen, " Journal of the American Society of Mechanical Engineers," November, 1918.)

Parachutes for Aeroplanes.

From various reports it appears that the fitting of parachutes in case of need is endorsed by experienced pilots who have actually tried parachute drops from aeroplanes. Experiments have been carried out since 1916, but it cannot be stated if any service planes have been fitted with emergency parachutes. Various reports point to the fact that parachutes now exist which, instead of being pulled out below the aeroplane by the pilot jumping out, can be launched upwards and so pull him out above the machine, which is left to fall to earth below him. Such a type known as the " soaring parachute " is necessary in the case of a machine in a flatspin with the controls carried away of a machine wtih the wings shot off, otherwise the machine might spin into the parachute in the one case, or even fall faster than the man in the other. Thus there are limitations to the type which depends upon gravity for releasing the apparatus. (" Air Service Journal," September 26, 1918.)

Use of Oxygen Tanks on Aeroplanes.

This is a short note on the advantages derived from the use of automatic oxygen apparatus in flights for any length of time at an altitude of above 10,000 or 12,000ft. The few who are able to continue for any length of time beyond 10,000 or 12,000ft. have a sense of lack of air and open their mouths in breathing and breathe more quickly and deeply. Although they may feel perfectly fit and well, they are not as efficient as when near the ground. Reaction becomes slower, resulting in longer time taken to judge distances, to aim, etc., so that the pilot without oxygen is at a great disadvantage as compared with the pilot who has a supply. The latter, when he returns to the ground after a prolonged flight, will be fresh and able to start out anew, while the man who did not use oxygen will be tired out and unable to do any more that day and possibly the next. It has been proved that the squadrons at the front which used oxygen were six times as efficient as those which did not, and the use of oxygen is strongly recommended by the flight surgeons. ("Air Service Journal," October 17, 1918.)

" Giant " Aeroplanes.

The article describes types of " Giant " aeroplanes, and points out that Italy has preferred different types to those accepted by Great Britain, France, and Germany. The author first deals with the Caproni biplane, with three motors, having a span of 22 m. surface of 90 m^2, 320 h.p. motors, and is capable of lifting 1,000 kg.; this machine has two separate bodies. A larger Caproni machine has a surface of 125 m^2, 600 h.p. motors, and will lift 1,500 k.g. The Voisin triplane, the second type of which was built in 1916, has two bodies in the vertical 'plane, a total span of 36 m., surface of 200 m^2, 800 h.p. motors, and a lifting capacity of 2,000 kg. The Caproni triplane has a total span of 30 m., a surface of 180 m^2, 600 h.p. motors, and a lifting capacity of 2,000 kg. The Gotha-Lizenz, a German biplane type, has a span of 41 m. surface 314 m^2, four motors with a total power of 1,200 h.p., and a lifting capacity of 13,000 kg. Finally, the author describes the new American Langley machine with 300 m^2, surface biplane type, with 1,600 h.p. motors. All the machines are illustrated by photographs and line drawings. (" La Nature," November 30, 1918.)

Centrifugal Tachometers on the Principle of the Conical Pendulum.

The article is in two parts and describes five main types of centrifugal tachometers. The general theory of each type is given, and the relation between n, the revs. per minute, and α, the angular displacement of the arms of the conical pendulum, is worked out. There is for each type a variable β, such that $n=f(\alpha, \beta)$, and a series of characteristic curves of n against α are drawn for a range of the values of β.

(A). Conical pendulum with flat spiral spring control. In this instrument the shaft, whose revolutions are to be measured, carries two arms in the form of a cross, each of which can turn about its centre, *i.e.*, about an axis at right angles to that of the shaft. Each arm also carries a ball at each end. The couple due to the centrifugal forces on the balls is balanced by that due to the pull in a flat, spiral spring, whose plane is parallel to the two arms. The variable parameter β in this case is the angle α_0, which is the value of α when n is zero. The characteristic curves show that positive values of α_0 up to about 30° give the best range of measurable speeds, and the most open scale. α_0 is positive when the zero position (spring unstretched) is such that the spring is extended when the arms begin to move outwards from the axis.

The angular movement of the arms is communicated by means of a pair of links to a sleeve which slides on the revolving shaft. The axial displacements of the sleeve are transmitted by means of a connecting rod and crank to the scale pointer. An excellent uniform scale over a fairly wide range of speeds can be secured in this manner; the best results are obtained if the joint of connecting rod and crank lies above the crank centre when the shaft is at rest, assuming the axis of the shaft to be vertical.

(B). Conical pendulum with gravity load. This is an instrument on the principle of the Watt Governor. It can only be used for limited ranges of speed. Characteristic curves are shown in which the variable parameter is the ratio between the distance of the hinges of the arms carrying the balls from the axis of rotation and the length of the arms.

(C). Conical pendulum with linear spiral spring control. This scheme is the basis of successful types of accurate tachograph. The pendulum masses are joined directly by the spring, and the arms are hinged about the ends of a bar which is at right angles to, and turns with, the shaft whose revolutions are to be measured. The angular movements of the pendulum arms are communicated by a link mechanism to a sleeve on the shaft, and the sleeves are directly transmitted to the pen, which traces a record on the revolving drum.

The characteristic curves are drawn with the unstretched length of the spring as the variable parameter. They show that the principle is only applicable to cases where the speeds to be recorded are merely comparatively small variations from a constant mean.

(D). Centrefugal tachometers with differential gear drive. In these instruments the principle of the foregoing centrefugal tachometers, viz., a conical or rotating pendulum controlled by means of springs, is utilised, but the method of registering the deflection of the arms is essentially different. In outline the method is as follows: The displacement of the rotating pendulum masses produces a relative motion between two concentric shafts, one of which is connected to one side of the differential gear, and the other (a hollow shaft) is driven directly through bevel gearing from the main shaft. This hollow shaft has a speed of rotation equel and opposite to that of a second hollow shaft, also driven from the main shaft by bevel gearing, and connected to the other side of the differential gear. The above mentioned relative displacement of the concentric shafts can therefore be seen as a displacement of the axis of the two middle wheels of the differential gear with respect to the axis of the shaft, and this latter displacement is registered

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by the indicator. The arms carrying the rotating pendulum masses have their hinges at opposite ends of the diameter of a rotating disc, mounted on the hollow shaft, and the axis of the hinges are also those of a pair of toothed wheels which gear with a pinion on the inner shaft. Any displacement of the arms gives rise to a turning of the toothed wheels, and therefore to a relative movement between the two concentric shafts.

If the centrefugal forces on the rotating masses are balanced by flat spiral springs, then the characteristic curves are similar in character to those of type A. There are no improvements in the characteristics as compared with type B when the two masses of the present kind of tachometer are joined by a linear spiral spring. An instrument can, however, be devised which gives an excellent linear relation between n and α and over a very wide range of speeds. The essential point of such an instrument is to choose suitably the position of the fixed end of a straight spiral spring, which is attached at its other end to one ball only. The axis of the spring should be roughly at right angles to the mean position of the arm carrying the ball.

(E). Centrifugal tachometers with combined spring and gravity loading. The example given of this type is a combination of types B and C, and its characteristic curves are certainly an approximate proportionality between n and α. both as regards range and approximate proportionality between n and α. ("Zietschift des Vereines deutscher Ingenieure," November 16 and 23, 1918.)

The Krell Manometer.

A modification of the ordinary U tube type of manometer is the Krell, in which one branch of the U is a glass tub, set at a small angle, and the other branch is a large tank. For various reasons the Krell manometer requires calibration. These are chiefly connected with the fact that glass tubing is generally not absolutely uniform in surface or bore along its length and may also not be exactly straight.

A. A. Merrill describes a manometer designed by himself, in which the reading is an observation of the movement of the sloping tube along its length required to bring it into the same position relative to the meniscus as for the zero, thus cutting out the errors due to the causes mentioned above. In order to avoid any change in level due to the movement of the tube connecting the sloping glass tube with the reservoir the former is made about two feet long. ("Aviation," November 1, 1918.)

Safeguarding the Health of Workpeople in Aeroplane Dope Shops.

The writer describes the composition of dopes and their solvents and outlines means to be adopted for securing the safety of operators using dope. The great danger arises from the vapours given off by the dope when applying it to the wings, etc., of aeroplanes. Three coats are generally applied with a brush, each coat being allowed to dry before applying the successive one.

The methods employed for trapping the vapours are very varied, but may be divided into three broad classes. In one, the wings or planes to be doped are arranged on the framework of large funnels, the opening of which is fitted with piping connected up with a small forge ventilator. The writer condemns this type. He remarks that, although the vapours are heavier than air, a single suction pipe is insufficient. The efficiency of the ventilator is also low. There is also great danger in allowing these vapours to circulate in the ventilator, owing to risk of fire. Further, it is uneconomical to allow products to escape into the air which are of commercial value.

In another type the ventilator sucks the vapours into the base of a metal

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column filled with coke which is constantly being played upon by an atomiser. This is more economical, but has the same defects as the first.

In the third type suitable draught hoods or one or two high-efficiency helical fans are installed. This arrangement does not tend to economy, but is very efficient in that the entire air of the dope-room is breathable.

In conclusion, the writer suggests as the true solution the complete trapping of the vapours at the points where they are formed, and their recuperation, where possible. They should be trapped under a funnel or hopper, having at least three suction heads, with high-efficiency and low-depression ventilators placed at the end of the recuperator tower, and not between the hopper and the tower. Instead of having a single column of coke, the towers should be led to slabs on which are placed earthenware rings, and at least two towers should be working at a time. ("Annales d'Hygiène Publique," August, 1918; "Bull. de la Soc. d'Encouragement pour l'Industrie Nationale," September-October, 1918.)

Development of Air Traffic.

The article is the author's reply to the discussion which followed his Paper:

1. The regidity of the long girders which support the gas cells is ensured by making them not less than 25 to 30 feet deep.

2. With regard to the two supporting wheels at either end of the girders, it is pointed out that these wheels are provided with springs and rest in frames similar to the wheels of aeroplanes. If, therefore, the weight of the airship increases, the springs will yield and give additional points of support to the girders. There is, however, no reason why a larger number of wheels and springs should not be fitted, should this be found desirable.

3. Girders 25 to 30 feet deep should be of ample strength to carry uniformly distributed motors of 200 to 300 h.p., as motors of this size have not given any trouble or produced undue local stresses in the framework of slender and lightly-built aeroplanes.

4. There should be no difficulty in elevating the airship by means of propellers, as these do not in any way support the weight of the ship. The bouyancy of the airship will, in fact, cause it to rise without any help from the propellers. (A. P. Kapteuyn, "De Ingenieur," November 2, 1918.)