

NATIONAL ADVISORY COMMITTEE
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TECHNICAL NOTES

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TO: Mr. Luskatt

No. 156

THE N. A. C. A. RECORDING TACHOMETER
AND ANGLE OF ATTACK RECORDER

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THE N.A.C.A. RECORDING TACHOMETER
AND ANGLE OF ATTACK RECORDER.

By H. J. E. Reid.

This note contains photographs and descriptions of airplane flight apparatus for use in conjunction with a recording galvanometer employed for obtaining continuous records of angle of attack and engine speeds. In measuring the angle of attack a variable resistance is used, being controlled by a vane in the air stream. Thus it is only necessary to measure the change of resistance.

In the case of the tachometer, a rotary switch mounted on the engine connects a pair of condensers alternately to a battery and to the recording galvanometer, which is arranged so that its deflection is a measure of the rate of discharges through the latter.

Controller for Angle of Attack Recorder.

Inasmuch as a recording galvanometer* was already in use, it was desirable to make use of apparatus electrically operated. The principle involves a controller consisting of a movable vane fastened to a variable resistance connected through convenient cables to a Wheatstone bridge in the recorder. The change of resistance in the controller thus causes a change in galvanometer deflection

* N.A.C.A. Technical Note No. 150 - The N.A.C.A. Control Force Recorder.

which is recorded photographically.

Fig. 1 shows the angle of attack vane and controlling mechanism, while Fig. 2 shows the wiring diagram. The controller consists of a vane D connected to a rolling contact C on the resistance A. The latter forms with the two resistances K_1 and K_2 , two arms of the Wheatstone bridge so that any movement of the vane changes the ratio of these arms and causes a corresponding movement of the galvanometer mirror. The resistances are so proportioned that the galvanometer deflection varies as the angular movement of the vane and thus as the angle of attack of the airplane. The controller, which may be mounted in various positions on the airplane by means of proper attachments, is connected electrically to the recorder by a cable which may be plugged into a special three contact bayonet socket E. In order to change the sensitivity of the apparatus, variable resistances are provided within the recorder and the range may be adjusted by means of the collar F on the vane. In practice the apparatus is calibrated in place with the aid of a level-protractor, the angular position of the vane with reference to some known line on the airplane being a measure of the displacement on the record. Thus, if all displacements on the film are referred to a base line, future records may be scaled off and plotted directly.

Recording Tachometer-Controller.

In this mechanism a somewhat different principle is employed but the same recording galvanometer is used. Fig. 3 shows the

commutator, and Fig. 4 its cross-section and the wiring diagram. The operation of the apparatus is quite simple. There are two condensers alternately charged and discharged by means of a rotary switch* or commutator which connects each, first to the battery and then to the galvanometer whose deflection is proportional to the rate of the discharges. Since the period of the galvanometer is such that for a commutator R.P.M. of 100 or more, the record is a smooth line and not affected by the individual discharges, it is clear that the greater the number of discharges per second the greater the deflection. In practice, the controller is screwed to the tachometer connection on the engine and cables run from the bayonet sockets to the condensers and recorder. As ordinarily used the commutator is driven at one-half the engine speed so it is only necessary to obtain a laboratory calibration, which serves to plot the true speeds as taken from the records in flight.

At present, both controllers are used with two of the galvanometers of the control force recorder. There is being built, however, an instrument driven by an electric impulse motor* and housing the two galvanometers for these controllers. When the recorder is complete, the whole apparatus will be light and convenient to install, and will add considerably to the information obtainable by means of recording instruments.

* N.A.C.A. Technical Note No. 157 - An Impulse Motor for Driving Recording Instruments.

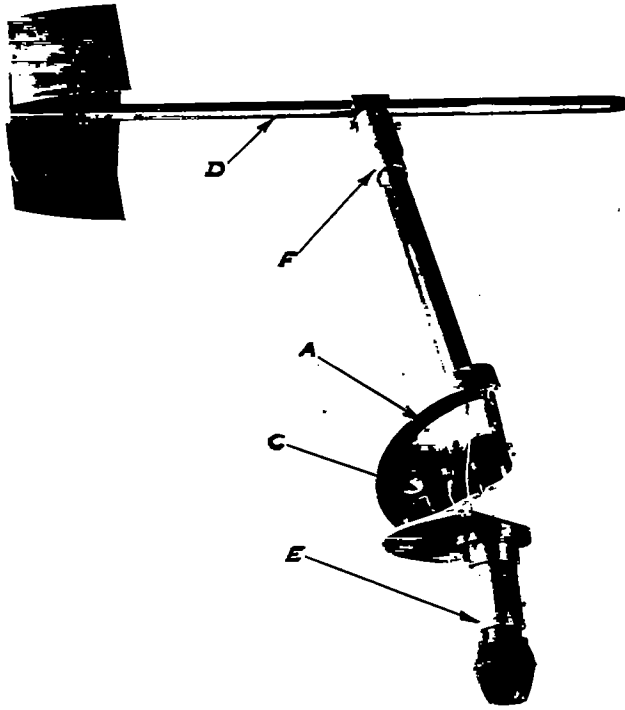


Fig. 1
Angle of attack vane
and controlling
mechanism.

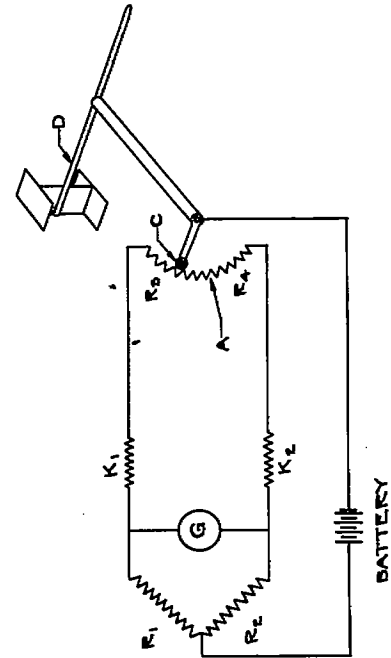


Fig. 2
Wiring diagram

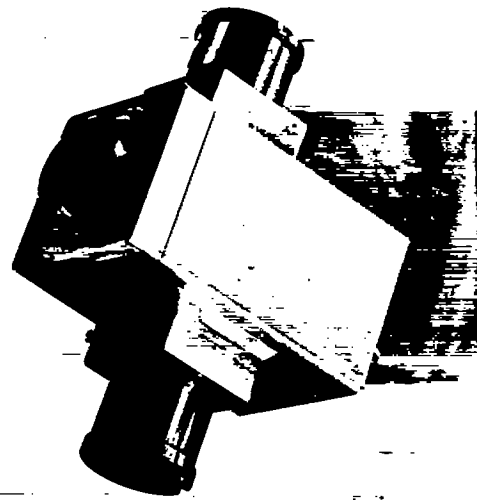


Fig. 3
Commutator

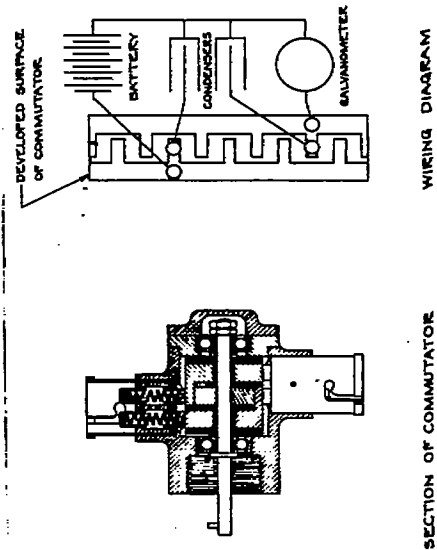


Fig. 4
Cross-section
of commutator
and wiring
diagram.