TECHNICAL NOTES.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

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THE OPTICAL WING ALIGNING DEVICE OF THE LANGLEY FIELD TUNNEL.

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Aerodynamical Laboratory, N. A. C. A.,
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In conducting tests on aerofoil models at the Langley Memorial Aeronautical Laboratory, the technical staff of the National Advisory Committee for Aeronautics have devised the following convenient and accurate method of aligning the wing chord with the air flow.

This device has been developed to permit rapid and accurate alignment of aerofoils and models with the air stream passing through the tunnel. It consists of three main parts: a projector, a reflector and a target, and these parts are arranged as shown in Figure 1. The projector is mounted at the same height as the axis of the tunnel and projects a beam through a vertical slit and lens against a narrow mirror clamped to the chord of the aerofoil, from which the beam is reflected back to a target, consisting of a white ground on which is ruled a vertical line, mounted directly below the projector. If the chord of a wing is correctly aligned with the air stream the projected band of light will be superimposed upon the black line of the target.

A movement of the mirror of one degree, deflects the reflected beam two degrees with a resulting displacement on the target of S tan 2i, S being the distance between mirror and target and i the angle of movement of the wing. The deflection may easily be read to as low as 1/50 of an inch and as 1° movement of the wing gives about 2 inch deflection on the target, it is obvious that the corresponding error in chord alignment need not be greater than 1/100 of a degree.

The actual construction of the individual parts is shown in Figures 2 and 3. The illuminator, a concentrated filament nitrogen filled bulb, is mounted in common with the slit, lens and target on a single cast iron base which slides on horizontal iron ways bolted to the wall of the experimental chamber. This permits the entire device to be moved fore and aft to accommodate various locations of the mirror inside the tunnel. Obviously the accuracy of the instrument does not depend on the alignment of these ways for, as long as they are straight, the projected beam will remain parallel to its initial position or perpendicular to the air stream. Adjustment of the zero position is made by changing the lateral position of the slit until the lift drag values obtained from the same aerofoil mounted in erect and inverted position on the balance show the same magnitudes at equal indicated angles of incidence. The mirror may be tilted in its clamp about a horizontal axis, allowing it to be used in various positions along the span of the aerofoil if so desired, and still reflect the beam against the target. This axis is set horizontal when the mirror is clamped to the wing, by the aid of a small spirit level built integral with the clamping device.

This arrangement has proven satisfactory in operation and is far more expeditions than the old method of sighting across a long batten, as the operator of the balance may see the target and directly judge of the accuracy of his alignment. Whereas the old method required two operators and several minutes' time to align to within 1/10 degree, this method enables one operator to align a wing to within 1/100 of a degree in a few seconds. This method also has the advantage of being able to measure the angle of the wing while the tunnel is running, thus showing the true angle of incidence.

Diagram of Aligning Device

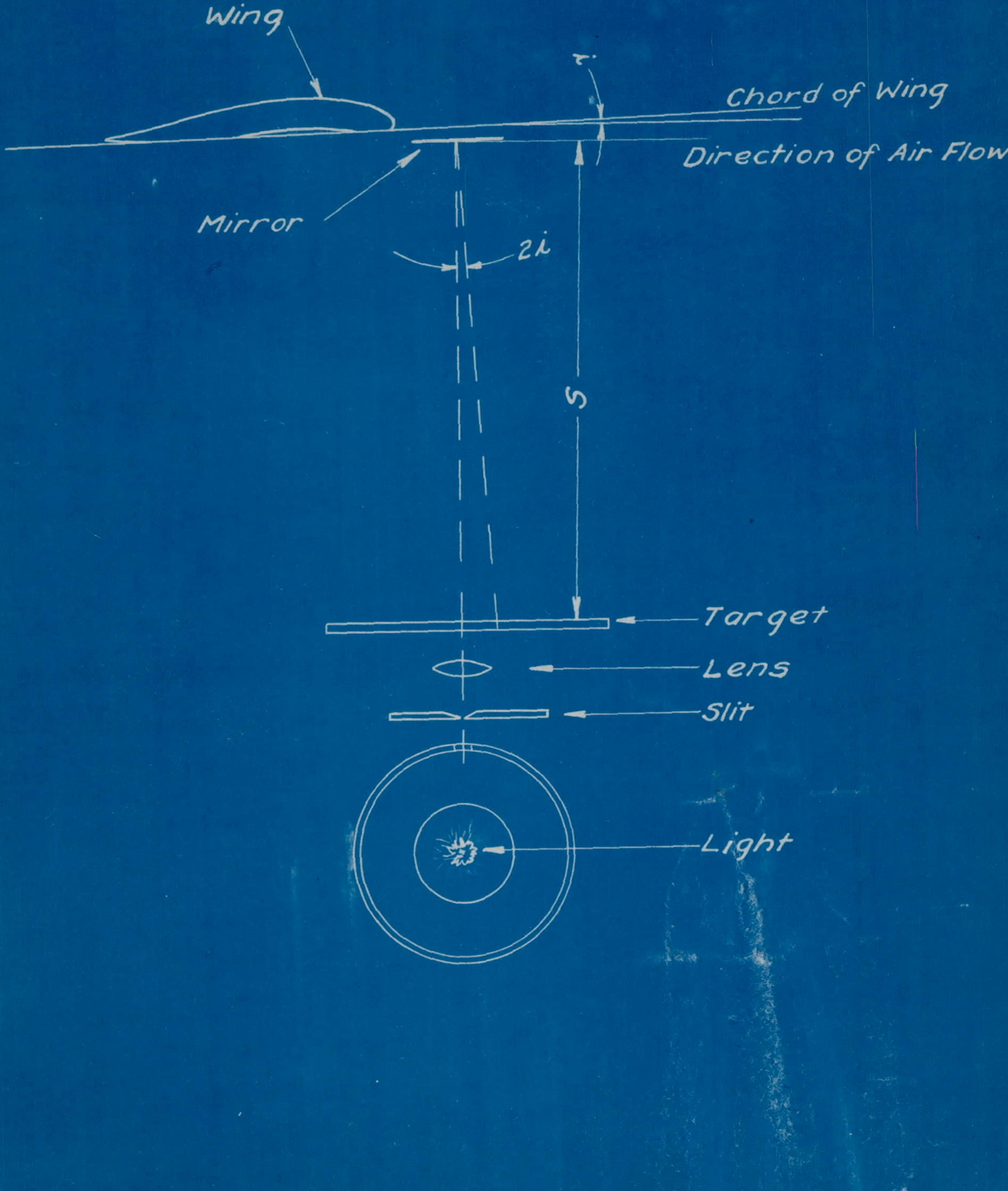

Fig. 1.

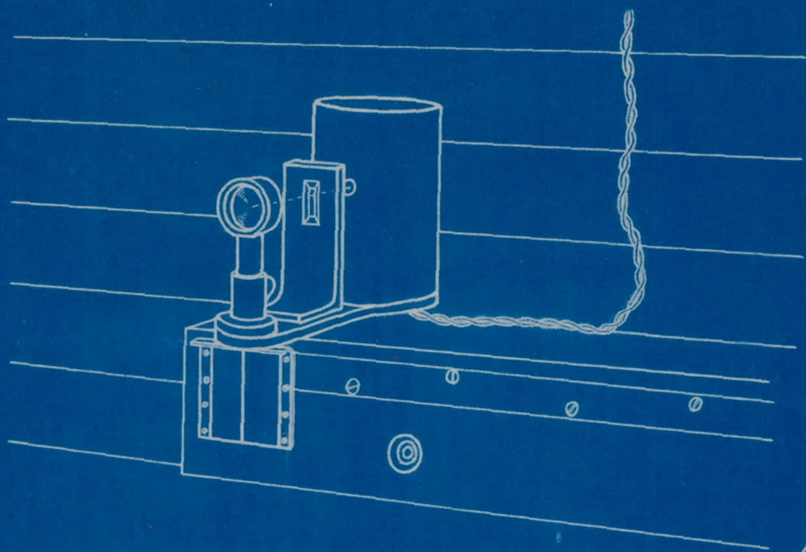

Fig. 2.

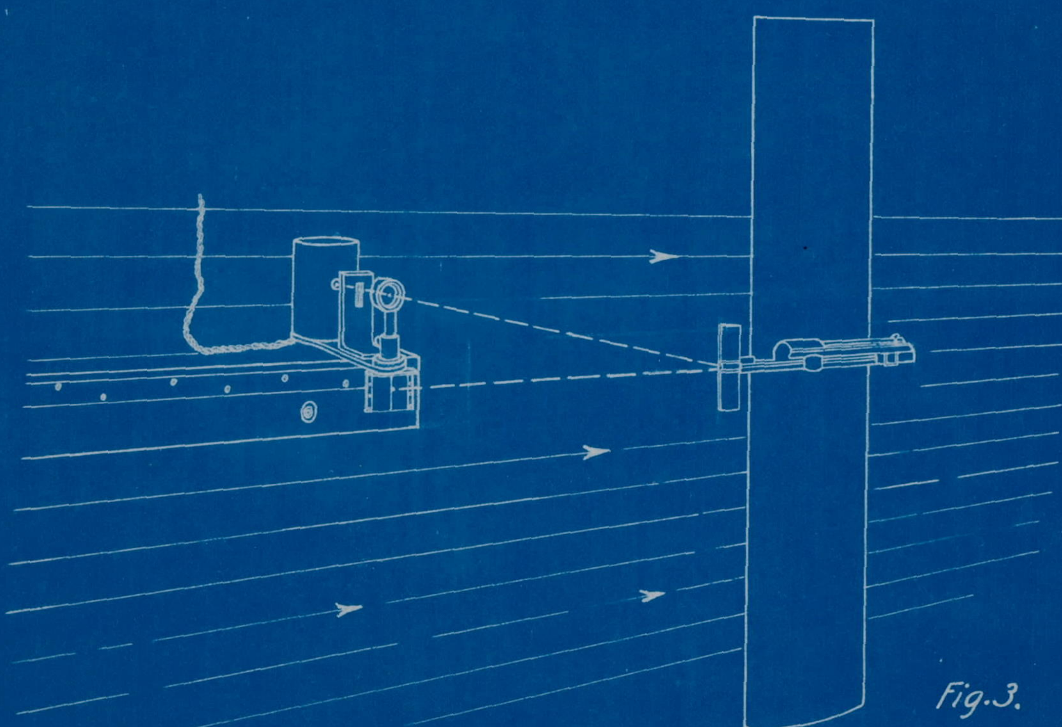

Fig. 3.