THE SPERRY GYROSCOPIC STABILIZER.

In our issue of July 3rd of last year we gave a very brief description of the Sperry gyroscopic stabilizer. This week we supplement our previous article with a description of the gyro by Mr. Lawrence B. Sperry and an exposition of a demonstration before the Aero Club of America on December 8th last. For these and the accompanying illustrations we are indebted to the Editor of our New York contemporary, *Flying*.

"In the design of a machine for artificially accomplishing what Nature has already accomplished, we cannot do better than to adopt the principles which Nature has adopted as the result of infinite knowledge and infinite experience. In the design of a flying structure no human being can hope to equal the results obtained by Nature in her design of the bird. As an illustration of this point it is interesting to note that the flying machine was first made practicable by imitating the wing tips of a bird. Close study of the bird's wings and of its general characteristics as a flying structure shows that Nature has provided the bird with an automatic stabilizer in the form of the sense of equilibrium which serves to automatically maintain the bird's stability by operating its wing tips or other appendages, thus generating righting couples without movement of the bird itself. Thus the bird is built to fly through disturbed air conditions without any departure from its normal attitude. The only movements which are seen to be made are slight movements of its wing tips or appendages. In our mechanical birds or aeroplanes this instinct of the bird has been replaced by the aviator. In some rare instances aviators, such as Garros, Pégoud, and Roland, seem to have been endowed with a super-distinctness of equilibrium—as unfailing and unerring as that of the bird. Even in these cases, however, the aviators are subject to fatigue. The aviator of ordinary ability is not only subject to fatigue, but must for his safety depend upon certain base lines, such as the earth's horizontal, and these base lines may disappear—as in fog.

"A careful analysis of the problem shows that the first, foremost and all-important requirement is a base line which will hold the true horizontal plane regardless of any motions or forces created by the aeroplane in flight. If we can fulfil this requirement we will have replaced the aviator's imperfect sense of the horizontal with an instrument which will at all times indicate the angular position of the machine with relation to the horizontal, both laterally and longitudinally.

"It can be said without fear of contradiction that the gyroscope is the only means of obtaining such a result. The problem is not an easy one. A single gyroscope cannot be used, because, to prevent it from wandering, it must be made pendulous, and when made pendulous it is badly affected by acceleration and centrifugal forces. If two gyroscopes are coupled, they are capable of maintaining one axis only, and even then they are impracticable, as they will be disturbed when the aeroplane turns. For instance, suppose the gyro are used for maintaining a traverse axis so that they will indicate longitudinal departures for the correct flying position; when the aeroplane turns it must bank—when banked, the turning movement will have a component about the traverse axis of the aeroplane which will result in throwing the gyro pair out of operation.

"There are many other problems encountered in an application of the gyroscope to this purpose. A technical description of these problems, and of the method adopted by us for solving them, would be long and tedious. Let it suffice to say that the problem has been solved and that the result is:

"(1) Perfect maintenance of a true horizontal plane, regardless of any movements of the aeroplane;

"(2) Elimination of the effects of centrifugal force or acceleration pressures.

THE SPERRY GYROSCOPIC STABILIZER.—On the left, general front view of gyroscopic element. A. Lateral inclinometer. B. Longitudinal inclinometer. C. General termina l for all wires. D. Longitudinal impressor gear. E. Lateral impressor gear. F. Bow (the means for getting long, motion outside the element). On the right, the Gyroscopic Stabilizer mounted on the Curtiss aeroplane. The small lever between the control wheels, shown by the arrow, controls the longitudinal and lateral inclination of the aeroplane.

"The base-line so obtained would be of value as a clinometer for indicating to the aviator his departure from the horizontal, laterally or longitudinally. In the Sperry Stabilizer a much higher result is obtained by using this base-line to automatically operate through the aid of a servomotor the ailerons or wing-tips for lateral control, and the rudders or tail surfaces for longitudinal control. In both lateral and longitudinal controls there is interposed between the gyro base-line and the servomotor a floating lever to permit of setting the aeroplane for any inclination laterally or longitudinally, without disturbing or shifting the gyroscopic base-line. Longitudinal control from the gyro equipment is coupled by means of a floating lever to a hand-operated device, which permits the aviator to set the machine for any inclination of climb or descent, the gyros serving to maintain the machine at this angle.

"A further device in the form of an anemometer serves to indicate to the aviator the machine in case its speed drops below the critical speed. When this anemometer device operates, it automatically prevents the aviator from setting the automatic stabilizer for a climb until a proper speed has been obtained, after which the control is given back to the aviator. By means of a foot-pedal the pilot of the machine may at any time cut out the automatic stabilizer and resume hand-control.

"In comparing a machine fitted with this automatic stabilizer to