

several days in advance. However, any further expenditure of public money should not be granted, unless the information thereby obtained be published in such a detailed form and at such a price that it would be available for the study of all who take an interest in meteorological science.

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Liquid Air as a Fixative.

LAST year when Mr. Atkins and I were searching for a method of extracting sap unchanged from various vegetable tissues, treatment with liquid air suggested itself and proved a valuable means for attaining this object. The rapidity of its action in suspending vital processes and chemical changes and in rendering protoplasm permeable, suggested its further application as a fixative. Since then most promising results have been obtained in various cells and tissues by Miss E. S. Marshall, working in this laboratory, showing various nuclear and cytoplasmic structures with great clearness and with a complete absence of plasmolysis.

HENRY H. DIXON.

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Atomic Models and X-Ray Spectra.

It seems scarcely possible that Prof. Nicholson (*NATURE*, vol. xcii., p. 583) requires his two rings of electrons, rotating under the inverse square law, to have one and the same angular velocity; because, if so, the impossibility of two different radii is self-evident; but his letter does not guard against this elementary misapprehension.

OLIVER LODGE.

Mariemont, Edgbaston, January 24.

AUTOMATIC AÉROPLANE CONTROLS.

MUCH interest has been excited in the announcement contained in the daily Press that Mr. Orville Wright has succeeded in fitting aéroplanes with a device which, according to his statements, renders them as nearly "fool-proof" as anything can be.

This device, as illustrated in the *Daily Mail*, is an absolutely simple one, and works by compressed air. Lateral control is effected by a pendulum which operates an air valve, by which the compressed air is admitted to a cylinder containing a piston connected with the warping device. For longitudinal control, Mr. Wright uses a flat vane, which rises or falls when the air impinges on its under or upper surface; and this is similarly made to operate the elevator.

The compressed air is generated by a small windmill, which will continue to work when the engines are stopped.

I have pointed out in *NATURE*, vol. xci., p. 556, that a pendulum, operating on the controlling devices of an aéroplane, instead of increasing the stability and damping out the oscillations, may produce the reverse effect. It is thus evident that there must be *definite conditions* under which such a device as this may be able to accomplish its object, and that there are equally definite conditions under which it may lead to disastrous accidents. The inference is that Mr. Wright has by experimental tests arrived at a result which satisfies the con-

ditions favourable for automatic control as opposed to those favourable for automatic wreckage.

Apart from the use of a vane for longitudinal control, and a windmill as a generator of compressed air, the invention seems to differ very little from a patent previously claimed by Mr. H. G. Seager, of Colwyn Bay, which I have rather carefully examined, because I am interested in it, and he lives near. Seager uses a pendulum and air pressure, but instead of one he has eight valves, and the same number of cylinders or pneumatics, with the result that he can place his warping devices or elevators in eight different positions, according to the strength and sense of the disturbance requiring to be counteracted. It thus represents a more elaborate control.

There is a good deal of confusion at the present time as to what is meant by stability in aviation, and for this reason "automatic control" would probably be a safer name than "automatic stability" for self-righting devices involving moveable parts. The confusion arises largely from the want of an adequate theoretical basis of comparison in the early days of aviation. Had theory preceded practice, the first experiments would have soon disposed of the divergences between them, which appear to be leading to endless controversies, misunderstandings, and mis-statements at the present time.

Thus in a discussion on stability in *The Aeronautical Journal* for October, recently issued, Mr. J. H. Ledebor, near the end, says: "So far, everyone who has contributed to this discussion appears to have made the cardinal mistake of confusing stability with controllability, which are essentially different qualities, and are, in fact, often contradictory." And in Mr. Berriman's recent book, while introducing the term "weathercock stability" to designate something which may or may not be synonymous with dynamical stability, he advances the opinion that an absolutely stable aéroplane would never vary its inclination to the horizon, and further that its centre of pressure would always coincide with its centre of gravity. So far from being absolutely stable, the last-named condition might theoretically be described as giving neutral equilibrium, but unstable would be a more correct description.

The success of the Wright device is described both by Wright himself and by his fellow-passenger, Griffith Brewer. The statement that Wright flew several miles without touching the handles is undoubtedly genuine.

While these things are happening in America, considerable interest is still being shown in this country in the Dunne machine, as is evidenced by the recent discussions before the Aeronautical Society. In this case an important feature is that the tendency to excessive banking up in turning curves is counteracted by making the angle of attack negative at the tips of the wings, so that these are really pressed downwards instead of lifted. The principle involved may be stated symbolically as follows, provided that we make the assumptions necessary to simplify the formulæ:—