

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.

R. M. DEELEY.

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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:--

Let  $S$  be an element of the sustaining surface,  $\alpha$  its angle of attack,  $z$  its distance from the plane of symmetry. Then the lifting power of the surface is proportional to  $\sum S \sin \alpha \cos \alpha$ , while the tendency to bank up at the outer side in rounding curves is proportional to a coefficient which I call  $L_q$ , and is proportional to  $-\sum Sz^2 \sin \alpha \cos \alpha$ , being negative in the ordinary case where an aeroplane tends to rise excessively on the outer side when rounding corners. Now the principle of the "negative wing tip," as Dunne calls it, is represented symbolically by the fact that by making  $\alpha$  positive when  $z$  is small, and  $\alpha$  negative when  $z$  is large, you can make—

$$\begin{aligned} \sum S \sin \alpha \cos \alpha & \text{ positive,} \\ \sum Sz^2 \sin \alpha \cos \alpha & \text{ zero or negative,} \end{aligned}$$

thus giving lift and yet neutralising or reversing the banking action.

There is much to be said for Mr. Dunne's remark: "Finally I must remind you that all my work has been done by practical experiments. It is not the experimental facts which are in question, but the theory which I have evolved to cover these facts, which theory I submit to this learned Society for criticisms. But the facts are unquestioned. The aeroplane does do these things, and if the theory does not give warranty for the practice, then it is the theory which is wrong."

G. H. BRYAN.

#### THE ATLANTA MEETING OF THE AMERICAN ASSOCIATION.

THE sixty-fifth meeting of the American Association for the Advancement of Science was held at Atlanta, Georgia, during the week December 29, 1913, to January 3, 1914, under the presidency of Dr. E. B. Wilson, of Columbia University. It was the first meeting which the association has held in the Southern States since the New Orleans meeting of 1905, and was marked by an important series of papers relating indirectly to the industrial advance in the south, to health conditions existing among its people, and to its geological and other resources. The attendance was not large, only about 400 members and fellows registering.

Nine of the national societies affiliated with the American association met at the same time and place, as follows:—

Astronomical and Astrophysical Society of America, Botanical Society of America, American Association of Economic Entomologists, Entomological Society of America, American Microscopical Society, American Physical Society, American Phytopathological Association, School Garden Association of America, Southern Society for Philosophy and Psychology.

The address of the retiring president, Prof. E. C. Pickering, Director of the Harvard College Observatory, was on the subject "The Study of the Stars."

The addresses of the vice-presidents, or chairmen of sections, were as follows:—

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A, "The Influence of Fourier's Series upon the Development of Mathematics," E. B. Van Vleck, University of Wisconsin; B, "The Methods of Science: To What Do They Apply?" A. G. Webster, Clark University; C (on account of the absence of Vice-President Miller the address was omitted); D, "Safety and the Prevention of Waste in Mining and Metallurgical Operations," J. A. Holmes, Bureau of Mines; E, "Pleistocene History of Missouri River," J. E. Todd, University of Kansas; F, "The Story of Human Lineage," W. A. Lacy; G, "The Evolution of a Botanical Problem," D. S. Johnson, Johns Hopkins University; H (the address was omitted on account of the absence of Vice-President Fewkes); I, "The Development of our Foreign Trade," J. H. Hammond, New York; K, "The Physiological Instruction of Medical Students," J. J. R. Macleod, Western Reserve University (read by title); L, "Science, Education, and Democracy," J. McKen Cattell, Columbia University.

Two public lectures complimentary to the citizens of Atlanta were given—the first by Dr. C. W. Stiles, of the U.S. Public Health Service, on the subject "The Health of the Mother in the South." In this address, in which some very remarkable facts were told in a very plain way, the speaker urged in a most emphatic manner the segregation of the races in the south, an idea which has heretofore received little attention in the United States, although British sanitarians in the tropical British colonies have appreciated its importance for some years.

The second public lecture was by Prof. C. E. Munroe, of the George Washington University, on the subject "The Explosive Resources of the Confederacy during the War and Now: A Chapter in Chemical History." Prof. Munroe, one of the American authorities on explosives, and for a long time Professor of Chemistry at the United States Naval Academy at Annapolis, dwelt upon the extraordinary activity of the south, isolated as it was from other countries by the blockading vessels of the northern fleet, in developing such resources as they were known to possess, and in manufacturing from them the enormous quantity of explosives which were used by the large southern army during its four years' struggle for independence.

The papers read before Section E (geology and geography) were devoted practically entirely to the geology of the Southern States, and the council of the association has made a grant to secure the publication of these papers in a single volume.

An important symposium was held under the auspices of Sections D and I, on highway policies and engineering, and other joint meetings were held between the Section of Zoology and the American Entomological Society, and between the Section of Botany and the American Phytopathological Association. Under the Botanical Society of America was held a symposium on temperature effects.

Probably the most important symposium of the meeting was held under the auspices of Section K (physiology and experimental medicine), on the subject of Pellagra. The subject was opened by