The second of these equations implies that x_2 will not remain zero; later, when x_2 has grown, the term $k_{12}.x_2$ will cause x_1 to grow also. So unilateral disarmament is not permanent, as Germany has shown us

A race in armaments, such as was in progress in 1912, occurs when the defence-terms predominate in the second members of the equations. We have then approximately

$$\frac{dx_1}{dt} = k_{12}.x_2, \qquad \frac{dx_2}{dt} = k_{21}.x_1,$$

and both x_1 and x_2 tend towards infinity.

I submit that the equations do describe, at least crudely, the way in which things have been done in the past. As to the future, while indicating the desirability of disarmament-and-satisfaction, they suggest that such a condition might easily become unstable, and that there is a need for controlling terms of a quite novel type. More strength to the statesmen who are trying to provide such!

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Some Uses of the Air-Driven Spinning Top

SINCE no measurements have so far been published, from any country, on colloidal systems using the air-driven spinning top of Henriot and Huguenard[1], it is evident that the great importance of this remarkable tool has escaped the attention of most laboratories. This is especially surprising in view of the fact that any good mechanic can make the necessary simple equipment (a stator and a hollow rotor) for a cost of about two or three pounds, and that for most purposes no special precautions need be taken as to constancy of temperature or control of pressure. With much less than the pressure of air available in an ordinary garage, the top may spin at several thousand revolutions per second, producing centrifugal forces of the order of 10^5–10^6 times gravity.

We therefore mention a few of the purposes which since 1931 we have found to be served by the use of this intriguing invention in one of the forms perfected by the originators[1]. This is quite apart from the elaborate studies which have proved necessary in the attempt to develop the top as a convectionless transparent ultra-centrifuge, paralleling those of Svedberg. These will be reported on elsewhere[2]. We only remark here that in one case last year an accidental disturbance created a sharp boundary in a sedimenting solution of mercuric chloride, affording a unique opportunity of observing a sedimentation constant S, as measured upon the photographs, equal to $8{\cdot}90 \times 10^{-13}$ as compared with theory $8{\cdot}91 \times 10^{-13}$.

Convection does not occur in an immobilised system. Sedimentation may be observed by eye, by callipers, by a scraping pipette, or by pouring off supernatant liquid and weighing. Evaporation is minimised by a solid cover or by a thin piece of cellophane which can be perforated by a hot wire without disturbing the spinning top. We find that the best method of preventing interaction between steel tops and their contents is to bake on several thin coats of bakelite lacquer. One may take advantage of these factors in the following ways:

(*a*) Measurement of rate of sedimentation of jellies and curds. Examples studied: agar, silicic acid, and sodium palmitate in water; soap jellies in non-aqueous solvents.

(*b*) Purification of gelating colloids. Examples studied: agar, where half of the agar does not sediment with the rest of the agar jelly.

(*c*) Measurement of swelling pressure of jellies. When the jelly refuses to sediment further, it is in equilibrium with its swelling pressure.

(*d*) Replacement of ultra-filtration. Supernatant liquid or mother liquor may be removed from a sedimenting system, avoiding all effects of pore-size or adsorption.

(*e*) Measurement of bound or combined water in colloidal or biological systems using a reference substance separated as in (*d*) for analysis.

(*f*) Bound water, by increasing the density through addition of indifferent substances until sedimentation just ceases to occur. Then the reciprocal of the density of the system is identical with the partial specific volume of the non-sedimenting structure. The composition corresponding to this partial specific volume may be read from a table or graph of densities against composition. The simplest graph to read is that for the jelly itself, as for example agar in pure water.

(*g*) Determination of sorption. Example: methylene blue, which is strongly adsorbed by most materials, using method (*d*).

(*h*) There are many other possibilities, such as the observation of sedimentation equilibrium within any immobilised system.

We are of the opinion that all chemical, biological, metallographic and applied science laboratories might well employ one or more of these simple devices. Physical laboratories have long recognised the usefulness of solid tops as originally developed[1] for the measurement of the velocity of light, either with a path of only one metre or with the refinements and precision of the last work of Michelson.

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[1] E. Henriot and E. Huguenard, *J. Phys. et le Radium*, **8**, 433; 1927. *C.R.*, **180**, 1389; 1925.

[2] A private communication from Prof. J. W. Beams describes another beautifully simple and elegant means of eliminating the most serious difficulties of ultra-centrifuge design; this will appear shortly in *Science*.

A New Test of the Magneto-Ionic Theory

ACCORDING to the magneto-ionic theory of Appleton[1], we should expect a wireless wave incident on the ionosphere to be returned to the earth as two differently polarised components (the ordinary and the extraordinary) with a slight difference in the time of travel. For wave-lengths shorter than 214 metres (the critical wave-length of the theory, given by the expression $\lambda = \frac{2\pi mc^2}{He}$), the theory has been experimentally confirmed[2,3] and the following points are well established:

(*a*) The two magneto-ionic components are circularly polarised.

(*b*) The left-handed (ordinary) component penetrates the F region and the E region more easily than the right-handed (extraordinary).

(*c*) The intensity of the extraordinary wave decreases markedly as the magneto-ionic critical wave-length is approached. The theory predicts different results for waves of length greater than 214 metres, but so far as we know, experiments have not been made to test it for these wave-lengths.