

but mere conservatism that makes us hesitate to abandon all of it, and to admit that, even in respect of energy, a fixed electron can have the properties which classical dynamics attributes to a moving electron? Classical dynamics, it is clear, is only "statistical"; what are the principles of the elements of the statistical group is the main problem of the physics of the future.

NORMAN R. CAMPBELL.

November 16.

The Testing of Balloon Fabrics.

ON p. 130 of the Report of the National Physical Laboratory for 1919 reference is made to the testing and experimental work carried out in connection with the manufacture of balloon fabrics for war purposes, and in connection with this we wish to place on record this company's work in the manufacture of materials, especially hydrogen-proof fabric, for lighter-than-air craft.

The North British Rubber Co., Ltd., first took up the manufacture of this material in 1908, and, realising that the problems involved in manufacture necessitated scientific control, as a preliminary installed in its laboratory an apparatus for measuring the permeability of rubber to hydrogen, and thereafter initiated research into the factors responsible for the deterioration of rubber under the influence of light.

When the Admiralty installed its test station at Manchester we were requested by the officer in charge to furnish drawings of the special type of hydrogen diffusion apparatus which had been designed at Castle Mills, and one of its staff received a course of instruction in the company's laboratories on the procedure to be followed in testing balloon fabric. At a later period of the war this department was taken over by the newly formed War Office Aircraft Fabrics Department, which installed an extended testing plant, and another member of that staff also received his training in this work in our aeronautical laboratories.

The Aeronautical Inspection Department was also indebted to the laboratory of the North British Rubber Co., Ltd., for the training of some of its scientific staff, and its testing equipment was in many respects also based on the results of this experience.

During the course of the war our output was steadily increased, and at the armistice we were manufacturing more than 35,000 yards of balloon fabric per week, every piece of which was tested in our aeronautical laboratories for weight, strength, and hydrogen leakage.

The investigation of the research laboratory into the action of light on rubber resulted, moreover, amongst other things, in a discovery which, without any increase in weight, permitted the production of a fabric of vastly enhanced durability specially suitable for use in the tropical theatre of the war.

Our reason for asking for the publication of this communication is only for the purpose of stating that at least one manufacturer was sufficiently well equipped, not only in the manufacture, but also in their scientific staff and laboratories, to carry on without outside help, and it is not intended to detract in any way from the very useful and great assistance which the National Physical Laboratory gave to Government Departments and others starting out in what was probably new ground to them.

W. A. WILLIAMS,
Works Manager.

The North British Rubber Co., Ltd., Castle Mills, Edinburgh, November 12.

NO. 2665, VOL. 106]

Luminosity by Attrition.

WITH reference to Sir Ray Lankester's suggestion in NATURE of November 4 that chemists should endeavour to ascertain the cause of the "empyreumatic" odour which accompanies the flashes of light produced by rubbing two quartz pebbles together, may I suggest also that the inquiry might be extended to include other substances which possess this property of tribo-luminescence?

The property is not confined to *crystallised silica*; it is displayed also by the amorphous varieties (opal, etc.) and by flint and chert.

Feldspars possess the property in varying degrees; in general, it is more pronounced in the alkali feldspars than in the lime-soda species. Fused albite displays the property.

Certain types of igneous rocks, both crystalline and glassy, behave in the same way. The property is most marked in the acid types; in the basic types (e.g. picrites, etc.) it is feeble or wanting.

Among the sedimentaries, sandstones, arkose, etc., and among the metamorphics, gneiss and some crystalline schists, display the property. The empyreumatic odour is a general accompaniment in the cases referred to above.

Saccharin and certain varieties of sugar possess the property in a moderate degree, and Dr. Lawson (Newcastle) has observed it in uranium nitrate when crystals of the salt are shaken up in a bottle.

I have investigated a large number of other substances (artificial glasses, rocks, and minerals); in the main, the results are negative.

Luminescence occurs between any pair of the "active" rock or mineral substances mentioned, and it would seem that the property is not dependent on crystallinity or wholly on chemical composition, but its relation to silica content (in silicates, etc.) is as yet obscure.

As regards the crystalline substances, the idea prevalent on the Continent is that during the process of crystallisation some of the outer electrons of the atom-system become detached, as it were, from the rest, but can recombine, with accompanying luminescence, under the stimulus of violent vibration. On the other hand, it may be a piezo-electric phenomenon; strain and deformation may induce positive and negative electrical charges on neighbouring particles, discharge being accompanied by luminescence. As the investigation is incomplete, further discussion would be out of place.

A. BRAMMALL.

Imperial College of Science and Technology
(Royal School of Mines), South Kensington,
ton, S.W.7, November 13.

Spiranthes autumnalis.

IN NATURE of September 16, p. 79, I reported the occurrence of this orchis, new to Scotland, in Lower Strathspey. As I can find no record of the species growing on soil other than cretaceous, and as there is no lime in the soil where I found the plants, I suspect that I may have been deceived by the superficial resemblance between *Spiranthes* and *Goodyera repens*. The point, of course, might have been decided at once by lifting a root; but, being very unwilling to disturb rare plants, I refrained from doing so. I hope to return to the place next summer to verify the species; until then I must ask botanists to dismiss my note as *non avenue*. If it should prove that I have erred, I have done so in good company, for was not Sir Joseph Hooker deceived by the decussate, scale-like leaves of *Veronica cupressoides* into pronouncing that plant to be coniferous from specimens sent from New Zealand?

HERBERT MAXWELL.

Monreith.