crystals are produced round those first formed. Some of the original crystals, which have been distorted by rolling, are completely broken up into the new smaller crystals before recrystallisation begins in other laminæ. The new crystals are soft, and the unaltered laminæ remain hard. Incompletely annealed metal thus consists of alternate strips of hard and soft material.

Prof. C. J. Patten: (1) Model illustrating the topography of the Tuskar Rock and Lighthouse relative to some features in the diurnal migration of certain birds. (2) Studies in the migratory movements of birds at the Tuskar Light-station, illustrated by a series of photographs.

The John Innes Horticultural Institution: Phenomena of plant-breeding. (1) "Maternal" hybrids and actual hybrids in Primula and Nicotiana. (2) Inheritance of double flowers and sex in Tropœolum. (3) Inheritance in *Campanula persicifolia*. (4) Double flowers of various types in Begonia.

Dr. G. D. H. Carpenter: A synepigonic series of *Papilio dardanus* from the parent form *planemoides*. This exhibit represented the first proof by breeding that the form *planemoides* is definitely of the species *Papilio dardanus*.

Dr. H. F. Standing: Photographs of the skeletons of extinct giant lemurs from Madagascar, also casts of skulls of the same. This exhibit showed casts of the skulls and photographs of the mounted skeletons of two species of giant lemur recently exhumed in a subfossil condition at Ampàsambazimba, in the centre of the Island of Madagascar. The smaller animal (*Palaeopropithecus maximus*) shows curious specialisation for an amphibious mode of life. It probably burrowed in the banks of lakes and streams; the peculiar roughened upward extension of the nasal bones no doubt carried some kind of epidermal excrescence, presumably used in burrowing. The larger animal (*Megaladapis grandidieri*) was arboreal in its habits, and its mode of life probably resembled that of the chimpanzee.

Prof. W. M. Flinders Petrie: Egyptian jewellery, 3400 B.C. The pectoral exhibited is of soldered gold inlaid with cut turquoise, lazuli, and carnelian, like the celebrated pectorals of Dahshur, and probably by the same artist. Found with it was a piece of inlaid open work of Senusert II., and a gold shell with soldered wire work of Senusert III. None of this fabric has reached England before. These were found at Gerzeh, forty miles south of Cairo, in a grave in which a plunderer had been killed by a fall of the roof.

REMARKABLE DROUGHT IN THE PHILIPPINES.

THE drought experienced during the eight months, October, 1911–May, 1912, probably the most severe ever observed in the archipelago, has been discussed by the assistant director of the Weather Bureau. At Manila the total rainfall recorded during the period was only 3·73 in., or a monthly average of less than half-an-inch; the driest month was April, with only 0·03 in. The following rainless periods are especially noteworthy: October 24–November 16 (24 days); November 20–December 11 (22 days); March 19–April 12 (25 days); April 14–May 7 (24 days). Deducting the insignificant amount of 0·004 in. (0·1 mm.) on May 8, there would result a rainless period from April 14–May 20 (37 days).

Sr. Coronas shows that, so far as Manila is concerned, the drought was the worst experienced since the establishment of the observatory in 1865. From a cursory inspection of his tables it is seen that for the months October–December, 1911, the rainfall was 14·05 in. below the normal; for the months January–May, 1912, 5·10 in. below, and that the total rainfall for the eight months was 5·56 in. below the absolute minimum recorded for those months during the entire period. In other regions of the archipelago the results cannot be so convincing as those for Manila, as the statistics for the secondary stations cover only a relatively short period. A table of the rainfall at twenty-six selected stations shows that it was without exception less than the normal at every station. The longest dry periods occurred in western Luzon, and the shortest on the eastern coasts of Samar and Mindanao; this was to be expected, as in the former case the dry season is most pronounced, especially from December to March, and in the latter case during the same months the most persistent rains of the whole year occur. An extraordinary period of 165 days without rain occurred at Vigan (western Luzon) between December and May.

Some very high temperatures were recorded in April and May. At Manila a maximum of 100·9° (38·3° C.) occurred on May 19; so high a temperature had not been recorded since May, 1889. It may not be without interest to recall the fact that the drought of the summer of 1911 in this country was followed by a remarkable period of excessive rainfall during the winter six months of 1911–12. This period has been specially discussed by Dr. Mill, and referred to in our columns.

WORK OF THE ROTHAMSTED EXPERIMENTAL STATION.

THE annual report for 1912 of the Rothamsted Experimental Station, which has lately been issued, includes an introduction, the annual report proper, and a supplement giving the year's yields of the various series of plots. The report deals first with the season 1912, its peculiarities, and their effect on the crops, and proceeds to give short abstracts of the work of the various members of the staff.

The central idea of the work of the Rothamsted Experimental Station is the investigation of the relation between plants and the soil in which they grow. Dr. Russell, who has during the year succeeded Mr. Hall as director, is engaged, in conjunction with Messrs. Hutchinson, Golding, Petherbridge, and Goodey, in investigating the effects of partial sterilisation of the soil. His results have now got beyond the theoretical stage. Partial sterilisation is now practised largely in the glasshouses of the Lea valley with good results, and has so impressed the tomato and cucumber growers of that district that they are endeavouring to get established an institute for the investigation of the problems of glasshouse culture—a most encouraging instance of the readiness of practical men to adopt any really sound innovation put before them in a feasible form.

Dr. Miller continues his investigations of the nitrogen content of rainfall and drainage. Dr. Brenchley is studying the possible stimulating effects of poisons on plant growth, and has extended her survey of the weeds of arable land to the eastern counties. Mr. Davis has published the results of a careful series of comparative determinations of potassium by the perchlorate method, which he recommends as accurate and trustworthy. The method is well worth the attention of analysts in these days of dear platinum.

The report on the whole is of great interest as showing the varied methods of attack which are being applied with success to the central problem of the relation of plants to the soil in which they grow. References are given to the original publications, which are for the most part contained in *The Journal of Agricultural Science*.

The report is accompanied by a circular of the society for extending the Rothamsted experiments, which gives details of the financial position of the trust. Subscriptions are invited for the rebuilding of the old laboratory, which must shortly be undertaken, and for the maintenance of the permanent plots, which entails very considerable annual expenditure.

DESIGN AND USE OF SCIENTIFIC INSTRUMENTS IN AERONAUTICS.[1]

AFTER expressing his admiration for the character of Wilbur Wright, his brilliant engineering work, and the scientific method by which he obtained his results, the lecturer considered the resemblance and differences of the manufactured aëroplane and the living bird. The resemblance may be simply the result of copying the bird, or it may be that similar designs have been arrived at independently by birds and men. The wings of both are roughly the same shape: of wide span, and narrow in the direction in which the bird flies; both have concave wings with thick leading edges. In many aëroplanes hollow spars are used like bones and like the quills of the feathers of birds. We copy plants also in this respect, for they too have learnt the economy of material in the use of hollow spars.

These resemblances are remarkable, but there are great differences. The Wright brothers found no biplane bird to copy and did not flap their wings. No flying animal uses a continuously rotating propeller to drive him forward on soaring wings, and it is perhaps scarcely too much to say that if birds only knew how, they would now copy the Wright brothers. Muscular action and the circulation of the blood, however, put supreme difficulties in the way of the development of the continuous rotation of a part of an animal.

Instruments Used in Aëroplanes.

It is important to realise beforehand the difficulties of using instruments on aëroplanes during flight and the errors that may be introduced in the readings. The aëroplane shakes, it does not remain level, and is subject to acceleration in all directions. The instrument should be so designed as not to be affected by any of these disturbances. A vertical acceleration has the same effect as a change in the amount of the downward pull due to gravity; the tilting of the aëroplane changes the direction of the downward pull with regard to the instrument. A lateral or longitudinal acceleration has the effect of altering both the direction and the amount of gravity. But vibration is a greater difficulty still. The hand of an instrument may move so much and so rapidly that it is difficult to estimate the mean reading on the scale, and sometimes it is quite impossible to do so. And this may happen when the quantity which is indicated by the position of the hand only varies slowly and by small amounts. The moving part of an instrument should be well balanced. This reduces the vibration from the shaking of the aëroplane as well as the error caused by its tilting or want of level.

In a compass as ordinarily made, the condition of balance cannot be fulfilled. The magnet rests on a steel point and is horizontal, and its centre of gravity is below the steel point. The force on the north pole acts in a downward direction towards the north, and the force on the south pole in an upward direction towards the south, and the magnet is made to rest in a horizontal position by arranging that the centre of gravity of the magnet is between its south end and its centre. It is below and to one side of the point about which rotation takes place. Hence a sideways movement must start it swinging. The magnet and card in aëroplane and ship compasses are usually surrounded by a liquid, so that any vibration which may be caused by its want of balance is rapidly reduced.

Instruments on aëroplanes should be damped, using the word to damp in the sense of "to dull" or "to abate the motion of." This damping is specially important if it should happen that the rate of vibration of the whole instrument should agree with the natural rate of vibration of the moving part. When this happens with an undamped instrument, the vibration is excessive. Damping is also required in cases where the fluctuations in the quantity to be measured are rapid; it may then be difficult to read the instrument, and the excursions of the hand may indicate a much greater amount of variation of the quantity than really takes place. If the mean reading is required the instrument must be damped, and the damping should be of a particular kind.

The essential features of satisfactory damping are that no force should be applied to the moving part whilst it is at rest, but that as soon as it moves a force should act opposing the movement. Friction at the joint does damp the instrument, but does not fulfil these conditions, and is bad. The force should be small when the movement is slow, and it should increase when the movement becomes more rapid. The most usual method is to immerse the moving part, or a paddle fixed to it, in a liquid more or less viscous, or the paddle can be replaced by a fan in the air. Another method is to damp by the movement of a copper plate between the poles of a magnet. If a Pitot tube is used, the flow of air through the connecting tubes damps the instrument.

Mr. A. Mallock has pointed out that in order to obtain a true mean reading with an instrument the damping force should be proportional to the velocity of movement of its index. When the damping force varies as the square of the velocity there may be no error or there may be a considerable error. Suppose that the quantity to be measured remains at 80 for 2/10 second, and then suddenly increases to 140 and remains at that amount for 1/10 second, and then it goes back to 80 and remains at that amount for 2/10 second, and that this rapid oscillation goes on indefinitely. Suppose also that the instrument is damped by a force which varies as the square of the velocity of the index, and that it is so much damped that the hand appears to remain at rest. The reading of the instrument will be 92 and the true mean in reality is 100, so that we have an error amounting to 8 per cent., by no means a small error. The diagram (Fig. 1) gives the supposed variations of the quantity as it would be recorded on a moving sheet of paper, and gives the true mean and the instrument reading.

In the magnetic method of damping, the force varies as the velocity and the true mean is obtained. With liquid and air damping the force varies as the square of the velocity, unless the movement is extremely slow, when it varies nearly as the velocity.

Speed of Aëroplanes.

The speed of the aëroplane through the air is often measured by a Pitot tube and a manometer.

The principle of the Pitot tube is very simple. If the open end of a tube faces the wind, the air wants to pass down the tube; if the tube is closed at

[1] From the first Wilbur Wright memorial lecture delivered before the Aëronautical Society of Great Britain on May 21, by Mr. Horace Darwin, F.R.S.