COMPRESSED AIR HYGROMETER FOR MEASURING FROST POINT IN THE STRATOSPHERE

THE most satisfactory method of measuring the water vapour content of air in the stratosphere, where the frost point is −75° C. (−103° F.) or less, is to determine the frost point with the Dobson–Brewer frost-point hygrometer carried in an aircraft. In this apparatus the water vapour in the air is condensed as ice on the outside of a thimble cooled internally by cold petrol (cooled by a mixture of petrol and solid carbon dioxide) or by liquid air. The observer adjusts the rate of flow of the cooling liquid and notes the temperatures at which the ice deposit increases and decreases. The mean of these two temperatures is taken as the frost point; there may be an interval of 5–10 deg. C. between them. As the frost point is reduced, the ice deposit becomes thin and more difficult to see and, finally, at frost points below −85° C. (−121° F.) the ice becomes glassy and cannot be seen at all without special optical aid.

Dr. A. W. Brewer (Clarendon Laboratory, Oxford) suggested that the effective range of the instrument could be effectively increased by compressing the incoming air before it reached the hygrometer. Compression raises the frost point, as can be seen from the fact that the humidity mixing-ratio (grams water vapour per kilogram of dry air) is unchanged by the compression. The mixing ratio at the low vapour pressures concerned is proportional to e/p, where e is the vapour pressure and p the air pressure. The ratio e/p is constant in compression so that a ten-fold increase in pressure increases the vapour pressure in the same ratio. This produces an important increase in frost point. Thus, if air with a frost point of −85° C. at the pressure of 115 mb. prevailing at about 50,000 ft. is compressed to 1,014 mb., the mean air pressure at sea-level, its vapour pressure is increased from $23{\cdot}53 \times 10^{-5}$ mb. to $2{\cdot}0757 \times 10^{-3}$ mb. and its frost point correspondingly increased to −71·5° C. (−96·7° F.). A frost point of about −70° C. is much more easily measurable than one of −85° C.

Mr. P. Goldsmith (Meteorological Research Flight of the Meteorological Office) has proposed (*Quart J. Roy. Met. Soc.*, October 1955, p. 607) the use of the engine compressor of a jet aircraft as the source of compressed air. The system has been used on both Ashton and Canberra aircraft, and satisfactory agreement obtained with frost points measured by the normal method. The compressor provides air compressed to a pressure of six to eight times the external air pressure. Goldsmith's article describes in detail the working of the apparatus.

Using this instrument, thirty-five ascents were made from South Farnborough by the Meteorological Research Flight during 1954 to measure frost point in the stratosphere at heights up to 50,000 ft., and the results are given in a paper by R. J. Murgatroyd, P. Goldsmith and W. E. H. Hollings (*Quart. J. Roy. Met. Soc.*, October 1955, p. 533). The compressed air was used above 30,000 ft.; at lower altitudes there is a danger that the high pressure and temperature of the compressed air would damage the hygrometer. They found the frost point decreased steadily with height through the troposphere and that there was usually no change in the rate of fall at the tropopause. In the stratosphere the rate of decrease of frost point decreased with height, and sometimes there was a discontinuity of the rate of fall a few thousand feet above the tropopause. At heights of 10,000 ft. to 15,000 ft. above the tropopause the frost point became almost constant at a value of −82° C. (−115·6° F.) to −85° C. The value was the same in summer and winter. The air here is very dry, having a relative humidity with respect to an ice surface of only 1 per cent. The humidity of the stratosphere is important in the study of the flux of long-wave radiation and of the large-scale circulation of the atmosphere. It is believed that such low humidities are only explicable on the supposition that the air has come from the equatorial stratosphere, being warmed as it does so.

WELDING OF ALUMINIUM AND ITS ALLOYS

THE welding of many commercial aluminium alloys is rendered difficult as a result of their tendency to crack at temperatures above the solidus, or in other cases at much lower temperatures during the cooling of the weld. In 1944 the light-alloy industry initiated a comprehensive series of researches on this problem at the University of Birmingham, the investigations being started under the supervision of the late Prof. D. Hanson and continued under Prof. L. Aitchison. The Aluminium Development Association, in its Research Report No. 27*, has now published a summary of the work of this research team during 1944–50. This quite admirable publication, prepared by Dr. W. I. Pumphrey, a former leader of the team, summarizes the principal investigations and conclusions of the twenty-six papers which have been published.

It was first necessary to develop a hypothesis to explain the high-temperature cracking, and it was shown that on heating to the solidus temperature the ductility fell to zero and the strength dropped rapidly but did not disappear entirely until some higher temperature, still below the liquidus, had been attained. This latter fact was found to be of prime importance, and the temperature above the solidus at which the strength finally disappears emerged as a major factor in the elucidation of the problem.

The development of tests to reveal the susceptibility to both high- and low-temperature forms of cracking was essential to the continuation of this work, and such tests, applicable not only to welds but also to castings, have been developed and are described. The low-temperature form of the defect is connected with the ductility of the material and, in particular, with the nature and mode of occurrence of the brittle intermetallic compounds. Where the weld is under conditions of severe restraint, the presence of these compounds in an intercrystalline form is clearly a source of great weakness.

The other main objective of the work was the development of alloys with good welding and mechanical properties, and three series—the aluminium–copper–silicon alloys, those of aluminium with zinc and magnesium and those with zinc, magnesium and copper—are specifically considered. The tests devised permit the materials to be given at any rate a quasi-quantitative value, and, from this, cracking diagrams have been drawn up for a number of binary and

* Aluminium Development Association. Research Report No. 27: Research into the Welding of Aluminium and its Alloys: a Summary of the Work of the A.D.A. Welding Research Team at the University of Birmingham, 1944 to 1950. Prepared by Dr. W. I. Pumphrey. Pp. 60. (London: Aluminium Development Association, 1955.) 7s. 6d.

ternary alloys together with the quaternary aluminium–copper–magnesium–silicon and aluminium–magnesium–silicon–manganese alloys; in one case, aluminium – zinc – magnesium – copper – manganese, a start has been made on a quinary series.

The work has most clearly justified the time and money expended on it, and this publication provides a first-rate summary of the results which have been obtained. F. C. THOMPSON

A RARE *CRYPTOMERIA*

YAKU-SHIMA, an island about thirty-seven miles off Kyushu, Japan, and covering approximately 190 square miles, is famed for the forests that cover its steep mountain-sides and for its abundant wild-life, especially deer and monkeys. The really unique and outstanding feature of the island, however, is the *Cryptomeria japonica* or 'Yaku-sugi' trees that are found there. These can be compared with the world's most spectacular trees, both because of their size—they grow to 16½ ft. in diameter and 117 ft. high—and their age, which is calculated to be between 1,000 and 3,000 years old. Their classification in systematic botany is not clear, although they are believed to be the ancestors of the Japanese species of *Cryptomeria*, in spite of differing from them both morphologically and ecologically. At one time there seems to have been a mysterious gap in the species' ecology, due either to its requirements or the conditions it was subjected to, as no trees are to be found between four hundred and eight hundred years old; they are all either older or younger. The Yaku-Shima virgin forests are of great interest, for the Yaku-sugi trees grow there along with firs, hemlock and Yamagurumas (*Trochodendron aralioides*, Sieb. et Zuce), and fill the island's valleys with tall trees decorated with intertwining epiphytic and parasitic plants.

At present, negotiations are going on between the Forestry Agency of the Ministry of Agriculture and Forestry and the National Park Division of the Ministry of Welfare to see whether the area should be designated as a national park. It would be a tragedy if the island's beauty were not perpetuated for future generations, and the International Union for the Protection of Nature has offered all possible help to its member, the National Parks Association of Japan, which in its turn is supporting the National Park Division's project (*Bull. Inter. Union Protect. Nature*, **4**, Nos. 5 and 6; December 1955).

WEATHER AND THE LAND

DURING the early years of his period of office the late Sir Nelson Johnson, director of the meteorological Office during 1938–53, realized that much greater assistance could and should be given by the Office to the economic life of Great Britain. One of his major decisions in this respect was the establishment in 1947 of the Agricultural Meteorological Section of the Climatology Branch, the Section becoming in 1948 the Agricultural Branch of the Office under the assistant director for climatology. Since then the Branch has developed its activities very widely. Besides the Branch office at the headquarters of the Meteorological Office, there are now meteorological advisers at the offices in Bristol and Cambridge of the National Advisory Service for Agriculture, and a meteorologist has recently been posted to the Meteorological Office, Edinburgh, for similar duties in Scotland.

A pamphlet written by the staff of the Branch* explains to the farmer the 'why and how' of his meteorological problems, how meteorologists can help to solve the problems, and how best to use the forecasts prepared at the Central Forecast Office and broadcast by the B.B.C.

The first chapter describes the general climate of the British Isles with special reference to plant growth, and the second gives the local variations in climate associated with altitude, aspect, and the nature of the soil and its covering. The third chapter explains the meteorological aspects of methods available for using solar radiation more efficiently by means of glasshouses and cloches, and methods such as shelterbelts and irrigation, of mitigating unfavourable meteorological effects. After this is a chapter describing the structure of depressions and the use of cloud forms and other portents of weather in interpreting the broadcast forecasts and applying them to local conditions. Finally, the fifth chapter gives the times of and areas used in the broadcast forecasts, lists the local meteorological offices from which forecasts can be obtained by telephone and the various special forecast services such as spell warnings which are available, defines terms used in weather forecasts, and states how the farmer can obtain advice (from headquarters, or from the meteorological offices attached to the National Advisory Service or to the Edinburgh Meteorological Office) on making the best use of his land.

The pamphlet gives a general compendium of meteorological knowledge as applied to agriculture in all its aspects and is of very great value to all agriculturists, while the parts on the use of the broadcast forecasts would be of much value to those whose business or pleasure is affected by the weather. Chapter 4 could well be used in schools for teaching the use of weather forecasts.

* Bulletin No. 165 of the Ministry of Agriculture, Fisheries and Food: Weather and the Land. Pp. iv+35+4 plates. (London: H.M.S.O., 1955.) 3*s*. net.

EMPLOYMENT STATISTICS FOR RECENT BRITISH GRADUATES

A RECENT broadsheet on "Graduates' Jobs", issued by Political and Economic Planning (No. 387), summarizes the results of an inquiry into the careers of 3,961 men who graduated in Great Britain in 1950. Returns were received from some 30 per cent of these, and it is unlikely that there is any main source of bias in the sample; more than half graduated in arts, more than a quarter in science, and less than one-fifth in technology. Many were older than the normal run of graduates, and most had seen war service or had done national service before going to a university. More than half had married by October 1954, and 20 per cent had married in the year they graduated or earlier.

Much the largest entries were into industry and teaching (both 23·4 per cent), mathematics and science teaching claiming 6·7 per cent, while 33 per cent of arts graduates became teachers as compared with 19·9 per cent of science graduates. The Civil Service took 8·6 per cent, 5·5 per cent (or 15·7 per