

otherwise the wing is complete. The wing is of the greatest interest, because any student of venation would certainly classify it as dipterous and nothing else, and yet *we do not know whether the insect to which it belonged had four wings or only two!* Also, it is the oldest known dipterous type of wing by many millions of years.

To facilitate discussion, it would be advisable to name the wing at once. At Mr. Barrett's request, I name it after my wife, as *Permotipula patricia* n.g. et sp. The wing must be classified in the superfamily Tipuloidea, in a new family Permotipulidæ characterised by the slight degree of petiolation, the short 2A and the elongate median cell (*mc*), and in a new genus *Permotipula* distinguished by the form of *Sc*, the positions of *rm* and *mcu*, the extreme narrowness and irregularity of *mc*, and the sessile origin of both median forks from that cell. A full analysis of the venational characters and a comparison with known archaic forms of Diptera will be published elsewhere. The figure itself is sufficient diagnosis of the species.

This discovery appears to indicate that the tendency towards lengthening and narrowing of the wings, which is marked enough to have been commemorated in the very name of the ancestral order, Mecoptera, ran to two successful specialisations. The first of these, the family Bittacidae, retained all four wings, and so remains classified to-day as a family within the Mecoptera. The second evolutionary effort, acting on much smaller and more insignificant types allied to the Nannochoristidæ, produced the true Tipuloid Diptera, or two-winged analogues of the Bittacidae. From such small and obscure forms as the one now discovered, the great order Diptera must have originated, with all its multitude of new types, just as the even greater order Lepidoptera must also have originated from small and obscure types resembling *Micropteryx* and its allies. For a correct understanding of the larval forms of these two great orders, maggot and caterpillar alike, we must go back to the ancient polypod larva of the true Scorpion-flies.

The Department of Scientific and Industrial Research.

A PERUSAL of the Report of the Department of Scientific and Industrial Research for the year 1927-28 (Cmd. 3258. London: H.M.S.O.), which includes a summary review of the work carried out under the various research organisations of the Department during the year, will provide the reader with abundant evidence of the wide range of the activities and responsibilities of the Department. The position of the research associations formed under the ægis of the Department is discussed elsewhere in this issue (p. 749). The National Physical Laboratory and the Geological Survey have been for some years under the general direction and control of the Department; and there are between forty and fifty research boards and committees, dealing with such diverse subjects as chemistry, fabrics, engineering, metallurgy, physics, radiology, building, architectural acoustics, heating and ventilation, food, forest products, fuel, atmospheric pollution, national coal resources, water pollution, adhesives, dental investigations, gas cylinders, illumination, lubrication, and X-rays. To attempt to give, in a reasonable allowance of space, a condensed compendium of what the report has to say on all, or even most, of these activities, is obviously impossible, and we must be content to select, more or less at random, some features of interest.

There are 36 pages devoted to a summary of the main features of the work of the nineteen research associations still in receipt of grant aid from the Department. The Wool Research Association has introduced this year a new woollen ring spinning frame which, it is claimed, is capable of producing two and a half times as much yarn per spindle as the standard frame, and of giving a superior yarn. It is the outcome of an exhaustive analysis by the latest scientific methods of the exact functions of every part of the existing 'Standard' machine; an analysis which showed clearly the directions in which simplicity could be effected without destroying practical efficiency. Reference is made to the new lead alloy introduced by the Non-Ferrous Metals Research Association as a result of investigations undertaken in co-operation with the Research Department, Woolwich. It has a strength, weight for weight, some 40 per cent greater than the ordinary commercial lead which is used for lead pipe, and, because of its freedom from the defect of a peculiar type of cracking, it is being used as a covering for electric cables. The remarkable, but not surprising, statement is made

that "the Association has hitherto failed, in spite of many efforts, to arouse any interest in it among manufacturers of lead pipe and sheet". This is but another instance of the many that could be given to illustrate the lag between the completion of a research and the application of its results to large-scale industrial practice.

The report directs attention to the surprising statement in the inaugural address of the president of the Institution of Locomotive Engineers, in September 1927, that locomotive engineers have "not at their disposal any facilities for trying out experimental scientific research", and that there is no existing organisation in Great Britain which is available generally for the accurate testing of the performance and thermal efficiency of a locomotive. The Advisory Council, as the result of recent conferences on this subject, foreshadows the establishment of a national organisation for locomotive research.

On the subject of low temperature carbonisation the report states that "several processes are now being operated on a scale large enough to provide reliable data by which the possible limits of commercial success can be judged". A subsidiary company of the Gas Light and Coke Company, for example, is erecting plant to try out on a commercial scale the experimental retorts developed at the Fuel Research Station. Other investigations, connected with fuel research, to which brief reference is made, are those on metallurgical coke, which are being carried out by the Federation of Iron and Steel Manufacturers in co-operation with the Department; on the use of pulverised fuel in the mercantile marine; and on the economical use of coal.

The Empire Marketing Board has provided a sum of £18,500 for the period up to Mar. 31, 1929, which has enabled the Director of Food Investigation to initiate a new programme of research on the preservation and transport of fish. Attention has been paid, in the first place, to those investigations likely to yield results capable of adoption by the existing fishing fleets, and, in particular, to an investigation into the possibility of landing in first-rate condition an increased proportion of the fish caught. "Preliminary investigations carried out during the summer of 1927 showed, rather unexpectedly, that the flesh of fish is not inherently of a highly perishable nature, but that, on the other hand, the natural rate of deterioration is profoundly affected by secondary environmental factors." Aberdeen has been selected

as the location of a research station for the fundamental researches needed.

In summarising the work done, and being done, on cement and concrete research, attention is directed to the fact that there are two main differences between concrete and steel, which are in themselves sufficient to account for the many anomalies observed by engineers when applying to concrete the standard methods of test to determine the strength of steel. The first of these differences is the normal expansion and contraction of the material as the moisture in the surrounding atmosphere varies, and the second is the gradual flow of concrete under load. Investigations on the measurement of adhesion stresses, and of stresses introduced in the steel of reinforced concrete by the shrinkage of cement, have been undertaken at the Building Research Station and "have already been productive of data of much importance".

Coming to the Department's activities that relate to what is usually called 'pure science', we may note that the grants for researches, research workers, and students for the year ended Mar. 31, 1928, amounted to £31,346 net. The grants made under this head during 1927-28 were in number 186, and the grants refused 118, as compared with 214 and 213 respectively for the previous year. The researches so assisted in the year under review include, among others, the work carried out by Sir William Bragg and his collaborators on the X-ray examination of materials; and investigations on magnetic phenomena by Dr. P. Kapitza and his collaborators.

Age-Hardening of some Aluminium Alloys.

SOME physical properties of five typical aluminium alloys containing copper, magnesium silicide, or both, have been examined by Dr. M. L. V. Gayler and G. D. Preston, and the results were presented at the March meeting of the Institute of Metals. From this experimental work the following conclusions regarding the causes of the age-hardening of such materials are reached.

On prolonged annealing it is known that the precipitation of CuAl_2 or Mg_2Si , or both, depending on the composition of the alloy, occurs. The changes of density which occur during ageing, together with the accompanying changes in the lattice parameter, suggest that a similar precipitation from the solid solution takes place during the earlier stages of this process. X-ray analysis shows that, in addition to the change of parameter, the crystals in the aged material are in a disturbed state which is gradually relieved as the heating is continued. This distortion of the space-lattice is accompanied by an increase of the electrical resistance and is believed to be caused by the formation of minute particles of the precipitated compounds. The precipitation of the dissolved substance from the supersaturated solution entails, first the rejection of the atoms of the dissolved metal from the lattice of the solid solution accompanied by the possible formation of molecules, a process which entails a profound disturbance of the lattice. In the second stage, which may follow closely upon the first and probably largely overlaps it, a 'coagulation' of these rejected atoms or molecules takes place, resulting in the formation of minute crystallites. This coagulation process, except perhaps in its earliest stages, by removing the dissolved metal from the matrix, will tend steadily to lessen the distortion of the lattice, and thereby to diminish the hardness and the electrical resistance.

It is interesting to note that if the age-hardening is due to the precipitation of a metal, and not a compound of that metal, the hardening effect is small; for example, the iron-copper alloys. This would be

expected on the basis of the theory outlined above, since it would cause less distortion of the lattice, no formation of molecules being required. If the formation of a compound involves the combination of atoms of the solute with those of the matrix, a greater distortion of the lattice will occur and the hardening be greater. When, however, the compound is formed by the combination of two or more different solute atoms, then still greater distortion is to be expected and marked increase of hardness results. Thus the ageing of an alloy with 4.5 per cent of copper due to the formation of CuAl_2 is relatively much less than that of one with 1.08 per cent of Mg_2Si .

Although up to the present the existence of lattice distortion has been inferred on general grounds, the new evidence from the X-ray spectra of aged alloys provides complete confirmation and shows, by the broadening of the lines, that this disturbance occurs to a marked extent which varies with the degree of hardness and electrical resistivity attained at the successive stages of the process. In the later stages of the ageing, when 'coagulation' has become appreciable and the precipitated substances have formed small distinct crystallites, the electrical resistance begins to fall again, the hardness diminishes, and the lines in the X-ray spectrum become less diffuse. F. C. T.

University and Educational Intelligence.

CAMBRIDGE.—Dr. A. B. Appleton has been re-appointed University lecturer in anatomy, and Mr. G. E. Briggs has been reappointed University lecturer in botany.

Grants have been made from the Gordon Wigan Fund to Prof. J. E. Marr, Prof. J. Stanley Gardiner, Mr. F. T. Brooks, and Prof. J. Barcroft.

Dr. H. R. Dean, professor of pathology in the University, has been elected Master of Trinity Hall.

A Syndicate was appointed in May 1928 to report on the position of mineralogy in the studies of the University. This Syndicate has now reported to the University, and has made the following recommendations:

- (1) Two new departments should be created in place of the existing Department of Mineralogy, namely, a Department of Crystallography and a Department of Mineralogy and Petrology;
- (2) the Department of Mineralogy and Petrology should be closely associated with the Department of Geology, but should also work in co-operation with the Department of Crystallography;
- (3) the head of each of the new departments should be a professor, and the minimum additional staff of each department should be one lecturer and one demonstrator;
- (4) a new building should be erected for the Department of Mineralogy and Petrology adjacent to the Sedgwick Museum;
- (5) the premises of the existing Department of Mineralogy should be assigned to the new Department of Crystallography;
- (6) crystallography should become a subject in Part I. of the Natural Sciences Tripos, but should carry a smaller maximum of marks than the existing subjects;
- (7) mineralogy and petrology should form part of the subject of geology in Part I. of the Natural Sciences Tripos, either as an alternative to palæontology or in addition at the candidates' option, and that in the latter case mineralogy and petrology together should carry the same additional maximum of marks as that allotted to crystallography;
- (8) that both crystallography and mineralogy and petrology should be included in Part II. of the Natural Sciences Tripos, but that their relation to the other subjects, or to possible subdivisions of them, should be determined by the appropriate University bodies;
- (9) subject to the adoption of the above recommendations, the existing subject of