showing definite promise for short-rotation arable lye, such as occurs in the South Island. Interesting work has been carried out by the Plant Chemistry Laboratory on plant growth-substances and their effect in promoting the rooting of cuttings, and particularly effective results have been obtained with β-indolylbutyric acid.

The report also refers to the work of the Leather and Shoe Research Association, the Wool Manufacturers Research Association, which has continued the study of the raw wool scouring process, to radio research, the activities of the Social Science Research Bureau and of the Dominion Laboratory and Geological Survey.

THE CRAB NEBULA: A PROBABLE SUPER-NOVA

THE Crab Nebula in Taurus, which has the distinction of being No. 1 in Messier's Catalogue, is of peculiar interest, as is shown by articles published respectively in *L'Astronomie* (August 1939) and in the *Telescope* (September 1939). These articles summarize the results of several technical papers published on this subject during the past few years. It seems likely that the Crab Nebula was first recorded by John Bevis, an English physician, in 1731. It was rediscovered in 1758 by the French astronomer, Charles Messier, and was later the subject of careful scrutiny by Sir William Herschel. It was observed with the great reflector at Parsonstown, Ireland, by Lord Rosse, whose drawing of the nebula, published in 1844, probably suggested its name. It remained, however, for astronomical photography to show, first in 1892 by Isaac Roberts and later by the American astronomers (Keeler, Curtis and Ritchey), its peculiar filamentary structure and afterwards to provide data for measuring its linear rate of expansion of about 0·18″ per annum.

Using this value and the present angular dimensions of the nebula and extrapolating backwards, an interval of about 800 years is obtained for the nebula to expand from a point of origin. A similar time interval (900 years) was obtained by Hubble. Spectra of the Crab Nebula, first obtained in 1913–15 at the Lowell Observatory, showed a bowing of the emission lines, when the slit of the spectrograph crossed the whole extent of the nebula (major axis 6′). Interpreting this feature as a differential Doppler effect due to the approaching nearer side of a shell of gas and the receding further side, Mayall in 1937 derived a velocity of expansion of about 1,300 km./sec. from Lick spectrograms. Assuming a constant rate of expansion, he concluded from the available data that the epoch of the outburst was about A.D. 1100. Meanwhile, Lundmark had pointed out that the Crab Nebula was near the position of the bright object recorded in Chinese and Japanese annals as having been seen for six months in A.D. 1054. In 1934, a translation by Y. Iba of the Japanese records gave the position of the object as near the star ζ Tauri and its brightness as equalling that of Jupiter. By combining the apparent linear expansion in seconds of arc per annum with the absolute expansion in km./sec., the order of distance was derived as 1,500 parsecs, equivalent to nearly 5,000 light years. Using this distance and the apparent magnitude of Jupiter (− 2·2 m.), the absolute magnitude of − 13·1 is obtained for the nova, which must have been at least one hundred times as bright as an ordinary nova.

In *Contributions* from the Mount Wilson Observatory No. 600, W. Baade assembles the evidence for the existence of two classes of novæ, common novæ and super-novæ, which differ in luminosity by a factor of about 10,000. Typical of the former class is the nova which appeared in the Andromeda nebula in 1885 and reached a maximum apparent visual magnitude of 7·2, equivalent to an absolute magnitude of − 15·0. To this recently recognized class of super-novæ, so the evidence suggests, the nova of 1054 may have belonged, and the expanding shell of gas originating with the cosmic explosion is still visible as the Crab Nebula.

TREATMENT FOR ROT-PROOFING SANDBAG REVETMENTS

SANDBAG revetments exposed to the weather tend to break up, due to rotting of the sandbags, and inquiries have been made about preservatives. Two types of preservative are suitable. They are respectively a creosote or tar distillate, used as a water emulsion, or a solution of an organic copper salt in creosote made up into an emulsion. The former is more widely available than the latter and is suitable for treatment of revetments in position which have already deteriorated by being exposed to the weather for some time. The latter is more potent but is also more expensive, and its use will not generally be justified unless the bags are in good condition and unless it is desirable to take down the whole revetment, treat all the bags and then re-pile them.

The application of the preservatives should conform with the following specification:

(1) A creosote or tar distillate of medium creosote type applied as a water emulsion in such a quantity as to give on the exposed portion of the bag a coating of creosote not less than one fifth of the normal dry weight of the fabric exposed. This is given approximately by a 25 per cent creosote emulsion when sprayed on the bags to give a thorough coating. completely satisfying the absorption of the fibres, The creosote should comply with British Standard Specification No. 144/1936, 'Creosote for preservation of timber'.

Any normal emulsifying agent may be used and the following is given as an example of the process of emulsification.

The following ingredients are used: 65 parts creosote and 35 parts water with 1·2 parts oleic acid, 0·8 parts casein and 0·36 parts sodium hydroxide as the emulsifying agent. The agent is dissolved in water and the two fluids are mixed in a jet similar to that of a cream-making machine. An emulsion prepared in this way should be stable and can be transported in drums or kegs. Before use it should be diluted with water to a suitable consistency for spraying so that the creosote content does not fall below 25 per cent.

(2) An organic copper salt is dissolved in creosote or tar distillate of the type indicated in (1) above, the solution then being made up into an emulsion with water, by the use of a special type of emulsifying agent. The copper salt should be one of an organic fatty acid of high molecular weight (such as, for example, copper oleate). The organic copper salt should be added in the proportion of 16 per cent of the weight of the creosote, and the whole should be emulsified with water. When sprayed on the bags it should be applied as 20 per cent emulsion. This will leave 0·5–1·0 per cent of metallic copper, estimated on the normal weight of the fabric when conditioned under ordinary atmospheric conditions.

Care should be taken to coat thoroughly any seams visible on the face of the pile and to work the emulsion well into the seams. The spraying should be done with a paint spray or horticultural spray, and the stirrup-pump recommended for A.R.P. fire protection may be used if no other spray is available. Care is needed to avoid fire risk during application as when handling creosote in the ordinary way. As creosote may cause permanent stains, suitable measures should be taken to protect the surface of buildings against which the bags are placed whilst spraying is in progress.

In order to obtain the best possible penetration into the revetment the preservatives should not be applied immediately after a heavy rain. They will be far more effective if the pile is given a reasonable time for drying after rain.

It will be desirable to repeat the treatment, and this should be done at intervals not exceeding three months.

UNIVERSITY EVENTS

Durham.—The honorary degree of D.C.L. has been conferred on Sir Charles Peers, chief inspector of ancient monuments and architect in charge of the Durham Castle restoration scheme since 1933. The honorary degree of M.Sc. has been conferred on Mr. C. A. Linge, clerk of works for the scheme.

London.—Owing to the war, and the absence of the University from London, the following honorary degrees among others have been conferred *in absentia*: D.Sc. on Prof. Niels Bohr and Sir Robert Robinson; D.Sc. (Economics) on Mr. R. G. Hawtrey and Mr. Simon Marks.

Oxford.—R. S. G. Rutherford, Wadham College, has been appointed a research officer in the Institute for Research in Agricultural Economics as from October 1.

Dr. S. N. Chakravarti, St. Catherine's Society, has been granted the degree of D.Sc. for his work in synthetic organic chemistry.

SCIENCE NEWS A CENTURY AGO

Fecundation and Development of Plants

At a meeting of the Ashmolean Society, at Oxford, on November 19, 1839, Prof. Daubeny explained the new views with respect to the fecundation and the development of plants, which had been brought forward by Brown, Mirbel, Schlieden and other botanists of the day. When Linnæus, he said, had established the doctrine of the sexuality of plants he left to his successors two branches of inquiry in a manner untouched, namely, first, in what precise method do the stamens operate upon the pistils when they cause fecundation to take place; and secondly, to what extent can we trace an analogy between the mode of fecundation and development in the case of flowering plants where sexes exist, and in that of cryptogamous ones, where they are not discoverable. The first of these points had been elucidated by the researches of Brown, A. Brongniart and Ehrenberg, while the analogy subsisting between flowering and cryptogamous plants had been investigated by Mirbel in France and Schlieden in Germany. The former observed new cells originating out of those already existing in the case of Marchantia; while the latter appears to have shown that a process the same in kind takes place within the pollen tubes emitted from flowering plants at the very time they reach the ovary and impregnate it, as well as the cells of the plant in the subsequent stages of its growth. From Schlieden's researches it would seem to follow that the embryo exists in the pollen, and not in the ovary; the office of the latter organ being merely that of furnishing to the young individual a receptacle and nourishment. This, however, was disputed by Mirbel.

Conception of the Steam Hammer

In his "Autobiography", James Nasmyth, when speaking of the iron ship *Great Britain*, which it was at first intended to drive by paddlewheels, said that Mr. Francis Humphries, finding great difficulty in obtaining tenders for the large wrought iron shaft, approached Nasmyth. "In this dilemma," said Nasmyth, "he wrote a letter to me. . . . This letter immediately set me a-thinking. How was it that the existing hammers were incapable of forging a wrought-iron shaft of thirty inches diameter? Simply because of their want of compass, of range and fall, as well as of their want of power of blow. A few moments' rapid thought satisfied me that it was by our rigidly adhering to the old traditional form of a smith's hand hammer—of which the forge and tilt hammer, although driven by water or steam power, were mere enlarged modifications. . . . The obvious remedy was to contrive some method by which a ponderous block of iron should be lifted to a sufficient height above the object on which it was desired to strike a blow and then to let the block fall down upon the forging, guiding it in its descent by such simple means as should give the required precision in the percussion action of the falling mass. . . . I then rapidly sketched out my Steam Hammer, having it all clearly before me in my mind's eye. In little more than half an hour after receiving Mr. Humphries's letter narrating his unlooked-for difficulty, I had the whole contrivance, in all its executant details, before me in a page of my Scheme Book. . . . The date of this first drawing was the 24th November, 1839."