an obvious criticism that the basis of calculation may be of changing value owing to changed conditions by stating that the percentage cost of materials in a cottage in 1914 and 1921 was found practically identical. From the diagrams the increased cost of a cottage due to variation in the market price of a material can be at once ascertained. We imagine that variations in human output are a good deal less amenable to graphic representation. Apart from this, however, a great deal of useful matter on relative costs and methods of calculation will remain truly recorded in this publication.

The notes which constitute the report on cob and *pisé* building form an interesting epitome of a subject which came into great prominence during and after the war, when bricks were prohibitive in price and the bricklayer was laying them at a minimum rate never contemplated. It is very unlikely that the methods of building described will ever become general, though in special local circumstances they will continue to have value.

The contributors to these notes write quite dispassionately, a fact which adds greatly to the value of the concise information given. Various methods used are explained in detail with dimensioned sketches of the simple shuttering and tools used in this construction, while photographs of cob and *pisé* cottages show how satisfactory a home it is possible to produce, even for two-storied buildings, direct from natural earths. Walls, which may be of lumps from a mould or formed *in situ*, are one or two feet in thickness and the houses are said to enjoy a very equable temperature and to remain dry, but a brick or concrete foundation about a foot high is necessary. The recent times of stress have produced a great many new types of building, but if we are to judge

from American experience it would seem that, taking capital and current cost over a decade, the ordinary brick still holds its own against later competitors.

Houses or cottages having been constructed, it is necessary to provide heating appliances, and range-makers and others will find much useful information in the third of these reports. The necessity for the conservation of fuel energy during the war provided the stimulus for this useful investigation. It is common knowledge that the kitchen range is, in most houses, the main and most wasteful coal consumer, and it is surprising that range-makers have not before now turned their attention to the production of more efficient designs. This may be due partly, as the author points out, to the incompatibility of running economy and initial low cost of apparatus, but if capital and current costs were simply tabulated the purchaser would soon realise the ultimate cheapness of a range designed to utilise more heat units.

The purposes of a range for boiling, baking, water heating, and perhaps warming, render, the report tells us, a really economical design impossible, and attention should therefore be directed to the consideration of any means for separating these functions which might be practicable at least in large establishments. These functions were tested independently both from a broad physical and also from a purely culinary standpoint. Considered as separate functions, only 2½ per cent. of the heat is transmitted to the oven, 12 per cent. to heating water, and 1.5 per cent. to the hot plate, as an average for commercial ranges. These figures were very largely increased in appliances designed during the tests. It has been stated that market conditions preclude the commercial success of many improved types of range.

Diseases of Plants in England in 1920-21.¹

By Dr. E. J. BUTLER, C.I.E.

MOST countries in the civilised world have been forced within the last twenty years to take steps to protect their crops from the menace of foreign parasites. During that period, with the growing recognition of the aid that science can give to agriculture by studying the cause and control of plant diseases and pests, has come a great increase in knowledge of the dangers of unrestricted traffic in plants. Many instances have occurred to prove how real is the risk of introducing plant parasites from other countries and how difficult to guard against. America has been the chief sufferer, but it is sufficient to mention gooseberry mildew and wart diseases of potato to show that England has not escaped. Distances, as measured in time and in the amenities of transport, are constantly contracting between the continents, and the interchange of living plants—with their parasites—goes on in ever-increasing volume. Quarantine restrictions, at first imposed in a few special cases, have extended until at present the exporting seedsman or nurseryman is faced with barriers to his trade which are often extremely hampering. It is easier for a human being to enter the United States to-day than for a potato, unless it is accompanied by a sheaf of health certificates; while total prohibition of certain categories of plants is not uncommon.

Correspondingly heavy responsibilities have fallen on the official plant pathologists of the various

countries. Produce for export has to be inspected and certified, and imports from each country have to be scrutinised for possible dangers. As an essential foundation for efficiency in what may be called the "Plant Protection Service," it is obviously necessary to know what diseases already exist in one's own country and what may be introduced from each of the countries from which imports are received. Plant disease surveys have been developed in nearly all the more advanced countries, that of the United States being the most complete, as is natural in view of the vast interests involved. So far as the fungous diseases are concerned, it is to Mr. A. D. Cotton, mycologist to the Ministry of Agriculture, that is due the organisation of the English survey. The present report is the third of the series for which he has been responsible, and will be the last in view of his appointment as keeper of the Herbarium, Royal Botanic Gardens, Kew. It is also by far the most complete that has yet appeared and is second to none in any European country.

The report covers the two years 1920 and 1921. These years offered an extreme contrast in their meteorological features, and not the least valuable of the results of the survey is the way in which the differences in the two seasons are reflected in the incidence of particular diseases. Potato blight, a lover of cool and damp conditions, was rampant in 1920, but could not withstand the hot, dry summer of 1921. The attack of crown rust on oats in Wales was unprecedented in the former year and singularly slight in 1921. The mildews, on the other hand, were unusually bad in 1921, and common scab of potatoes,

¹ Ministry of Agriculture and Fisheries. Report on the Occurrence of Fungus, Bacterial and Allied Diseases on Crops in England and Wales for the years 1920-21. (Miscellaneous Publications, No. 38.) Pp. 104. (London: H.M. Stationery Office, 1922.) 3s. net.

a disease that has recently been shown to prefer warm soils, established a record in virulence.

One may hope that the accumulation of such facts (of which the report contains many), and their correlation with the weather charts which are attached, will enable trustworthy forecasts of the intensity of particular diseases to be issued. It is unnecessary to emphasise the practical value of this to the grower.

Another point of the highest practical interest, and one that is best brought out by the methodical records of a survey, is that of varietal resistance to specific diseases. Such a year as 1920 is invaluable in establishing the behaviour of different varieties of potatoes to blight under optimum conditions for the latter. Kerr's Pink, for example, appears at or near the top of nearly all the lists of blight-resistant potatoes that are also immune to wart disease.

Equally valuable are the records of new crop parasites. No less than 136 names have been added to this report as compared with that for 1919, and several of these are diseases not previously known to occur in the country.

The report deserves a wide circulation at home and abroad, as it presents in a handy and convenient form a remarkably complete summary of the fungous and allied troubles with which the British grower has to contend.

Wave-power Transmission.

AN interesting paper has recently been presented to the North-East Coast Institution of Engineers and Shipbuilders, by W. Dinwiddie, on wave-power transmission. Wave-power machines are classified under three heads: (1) Continuous waves, where the generating plunger moves with simple harmonic motion. (2) Impulse waves, in which a single harmonic motion is transmitted in wave form at regular intervals, greater than the period of the motion itself. (3) Synchronous and asynchronous motors, monophasic or polyphasic, in which direction research is proceeding.

Liquids such as oils and water are at present the media used, while the transmission of impulse along a steel wire has been used. A reciprocating pump plunger of small stroke is oscillated at a high speed at one end of a closed pipe line. Waves of compression and expansion are propagated through the pipe line. If the pipe line is completely closed at the other end, very high pressures can be generated in the pipe line; but if a plunger similar to the pump plunger is placed there, this will move in synchronism with the pump plunger, and is therefore able to do work on some type of machine. To prevent excessive rise of pressure in the pipe line when the synchronising plunger is stopped, capacity analogous to a condenser in an electric circuit is put in the pipe line, and if all machines are cut off a stationary wave is formed and theoretically no energy is given to the system by the generator. It is desirable that connexions to machines along the pipe line shall be made at $\frac{1}{4}$ wave-length points. Machines tapped in at half wave-length points along the pipe will be self-starting and stable in running, while those at the quarter wave-length and three-quarter wave-length will not be self-starting. If, however, a machine is started at half wave-length along the pipe, then a machine at a quarter wave-length will start; and if a machine is started at a wave-length along the pipe, then machines at a quarter and three-quarter wave-length will start. That this is so can be seen by examining the changes of pressure that take place at these points, when there is a stationary wave, and when there is a progressive wave superimposed on the stationary wave.

The principle has been successfully applied to controls on aeroplanes, to the working of rock-drilling machines, and to riveters. A description of the special transmission pipes to resist the high pressures generated, and the mechanism for rotating the rock drill, is given in the paper.

University and Educational Intelligence.

ABERDEEN.—The University Court has agreed to refit the Botanical Museum in Old Aberdeen, prior to the occupation of the new botanical department which is at present being built there. It has also agreed to make provision for increased laboratory accommodation for the department of chemistry.

CAMBRIDGE.—Mr. T. M. Cherry, Trinity College, has been elected to an Isaac Newton studentship, and the tenure of the studentship of Mr. W. M. H. Greaves, St. John's College, has been renewed for one year.

Smith's prizes have been awarded to Mr. J. C. Burkill, Trinity College, for an essay on "Functions of intervals and the problem of area," and to Mr. A. E. Ingham, Trinity College, for an essay on "Mean value theorems in the theory of the Riemann Zeta-Function." Rayleigh prizes have been awarded to Mr. E. F. Collingwood, Trinity College, for an essay on "The formal factorisation of an integral function of finite integral order," to Mr. W. R. Dean, Trinity College, for an essay on "The elastic stability of a plane plate," to Mr. E. C. Francis, Peterhouse, for an essay on "The Denjoy-Stieltjes integral," to Mr. C. G. F. James, Trinity College, for an essay on "The analytical representation of systems of space curves," and to Mr. M. H. A. Newman, St. John's College, for an essay "On discontinuities of functions of a single real variable."

The subject proposed for the Adams prize for the period 1923-4 is "The physical state of matter at high temperatures." Investigation is suggested of the statistical equilibrium of an assemblage of atoms in various ionised and quantised states together with free electrons and radiation. The essay may deal, however, in any way with the simplifications or the complications which appear in the properties of matter at high temperatures.

The Special Board for Oriental Studies will proceed to the election of the Eric Yarrow student in Assyriology early next term.

The Board of Research Studies in publishing its third report announces that the number of research students has risen to 179. Of these about two-thirds are working on the scientific side; chemistry and physics have the largest number, followed by botany, agriculture, and biochemistry.

Grants from the Gordon Wigan fund have been made to Prof. Punnett for plant-breeding experiments, to the Museum of Zoology for cases, to Prof. Gardiner for a centrifuge and incubator, to Mr. Harker for sections of rocks, and to Prof. Seward for sections of fossil plants.

DURHAM.—The council of Armstrong College, Newcastle-upon-Tyne, invite applications for the chair of philosophy. The latest date for the receipt of applications and testimonials is May 1. They should be sent to the Registrar.

LONDON.—The following doctorates have been conferred:—*Ph.D. in Science*: Mr. M. V. Gopalaswami of University College for a thesis entitled "Economy in Motor Learning"; Mr. A. M. Mosharafa of King's College for a thesis entitled "The Quantum Theory of Spectral Series"; Mr. W. S. G. P.