by meter, and the quantity used is charged for on the basis of its calorific value, that is, by the therm. Gas is essentially the poor man's fuel, and the prepayment meter has made it easy for him to obtain it in small amounts as desired for cash. Larger consumers have their meters read quarterly and have that amount of credit.

Actually a far more satisfactory method of charge capable of leading to progressive development would be similar to that adopted for the telephone and by the electrical industry. In both these there is recognition of the service rendered by having the commodity on tap : a fixed annual charge covers the overhead charge of the service and enables the commodity charge to be low. This would mean that extra use of gas above a minimum becomes cheap and therefore attractive. As it is, most of the small users of gas are unremunerative to the industry. An attempt to alter this state of things in London met with considerable opposition probably because the ground was not sufficiently prepared for its wisdom to be understood. Dr. E. V. Evans, the acknowledged technical leader of the gas industry, outlined a little more than a year ago an ideal scheme for a unit community involving the co-operation of the two services gas and electricity, for the development of an ideal balanced fuel-supply. It incorporated a fixed charge for the ordinary dwelling house of 40*s*. per annum and a supply of gas at 6*d*. for the first 300 therms and 4*d*. a therm afterwards. The charge to the domestic consumer must include payment for the services given him ; whereas the charge to industry is for a convenient heating material in bulk and does not include services. It can be directly related to the cost of coal.

The Relationship of the Gas and Chemical Industries

A problem of interest for the future is the position of the gas industry as a source of raw materials for the chemical industry, in particular the new synthetic chemical industry from which so much is hoped in the days to come. In the past, much of the organic chemical industry has been built up on tar products—notably benzene, toluene and naphthalene ; but the demands of chemists have only taken a little of the tar made, so that other uses have had to be found for the bulk of it. This problem has been largely solved by the use of tar on the roads—not haphazard, but in the form of tar carpets scientifically designed.

The motorist has taken the surplus benzol at a price which includes the tax on imported petrol : this demand is resulting in all the benzol being scrubbed out of gas. This can only take place if the price paid for it represents the value of the benzol as therms in the gas and the cost of separating it. The chemical industry wants cheap benzol and is reluctant to pay the equivalent of the hydrocarbon duty on it.

Gas also contains ethylene, while its main constituent is methane. Are these worth more to chemical industry than to gas as therms ? Since Great Britain has only a very small oil-refining industry, it largely lacks the two carbon compounds from which most organic syntheses start. The problem is, Shall the gas industry concern itself only with its legitimate business, the making and distribution of gas, or shall it be in with the synthetic chemical industry and help to make basic raw materials for it ? Only the future can answer. Personally, I hold the view that a gas works should be the place in which all coal should be processed, some to make gas for the domestic consumer and for industry, some to make methane, benzol, and other raw materials for chemical industry, and some to make petroleum hydrocarbons. The balanced interlocking of the various processes would lead both to economies in the use of coal, almost Britain's only raw material with a thermal value, and bring about a cheapening of the various products enumerated. Vision for the future is required; but at a moment when an influential Government committee is inquiring into the future of the industry, its potentialities as a scientific coal-processing industry should be given full consideration.

SEED-BORNE FUNGI

ON October 28 the British Mycological Society met in Birmingham to discuss certain seed-borne fungal diseases. The programme was arranged by the Plant Pathology Committee of the Society.

The first two papers dealt with fungi parasitizing the seeds of British grasses, and Dr. Mary Noble, in an interesting account of the blind seed disease of ryegrass, directed attention to its effect in reducing the germination of seeds, especially those of the modern 'leafy' or 'indigenous' strains. Since these leafy strains normally seed much less profusely than the commercial types, this added loss is especially serious. The disease is known in New Zealand, where it has caused considerable damage in some recent seasons, and is now widespread in Britain.

The identity of the causal fungus has been the subject of much confusion. The imperfect stage was first erroneously ascribed to Pullularia, while the perfect stage was originally described as an inoperculate discomycete of the Helotiæ, but the close similarity of the blind seed fungus to the rye parasite *Phialea temulenta* of Prillieux and Delacroix was observed by Dr. Noble and her colleagues at Edinburgh. Subsequent investigation of the anatomy of the apothecium supported the view that the two fungi were identical, and this was finally proved by Dr. Neill in New Zealand, who examined some of the original material of Prillieux and Delacroix. In addition to rye and *Lolium* spp., *P. temulenta* has been found infecting *Festuca arundinacea*, *F. rubra* var. *fallax*, *Cynosurus cristatus* and other grasses ; but its commercial importance so far is confined to the ryegrasses. Infection occurs at flowering time, that is, in late June in Great Britain, at a point on the ovule just below the stigma. Large numbers of conidia are produced externally, but hyphæ penetrate more deeply and may completely destroy the embryonic structure. Blind seeds result from rather later infection after the embryonic tissues and the endosperm have been differentiated. Still later infection may result in the production of conidia, but the embryo escapes and the seeds remain viable. Blind seeds are sown with healthy ones, and, provided they are not more than 1½ inches under the soil, give rise to stalked apothecia just as the ryegrass is coming into flower. The production of apothecia continues for about three weeks, and thus both early and late strains of ryegrass are subject to infection. Cool wet weather favours infection, as under these conditions the dissemination of pollen is reduced while the glumes open repeatedly and entrance of the fungus is facilitated.

Since *Phialea temulenta* penetrates so deeply into the seed the disease cannot be controlled by fungicidal dusts, and the only practical way of cleaning large stocks of seed is to store them for two years, during which time the fungus dies out. In Scotland in 1944 a trial service was set up along the lines of one already functioning in New Zealand, under which growers were invited to send in samples of heads before harvest. These were examined for the disease and a reply sent to the grower within two days advising him as to whether his crop was worth saving for seed or not. This is a great help, as it saves the useless work of harvesting diseased seed, and the crop can be converted into hay.

Single-spore (ascospores or macroconidia) isolations of *P. temulenta* give cultures of two types: (*a*) mainly conidial with a smooth shiny type of growth, or (*b*) mycelial in which the surface of the colony is rough, due to the development of white aerial hyphae. It is just possible that this mycelial form may be the well-known *Lolium* endophyte, but so far no proof has been obtained that the blind seed fungus can infect its host systemically. The various endophytes of *Lolium* were discussed by Miss K. Sampson in her paper on "Some Endophytic Fungi of the Grasses". Darnel (*Lolium temulentum*) has long been known to carry an endophytic fungus situated just outside the aleurone cells of the seed, and *Lolium remotum* and *L. multiflorum* also have endophytes which appear to be of a similar nature. In *L. perenne* two types are distinguished. The first occurs in indigenous perennial ryegrass in Great Britain but not by any means in every plant. It was isolated and cultured at Aberystwyth in 1937, and Neill (1941) in New Zealand, by different methods, also cultured a fungus which appears to be identical. Neill observed sporodochia and microconidia very similar to those produced by the blind seed fungus. This again suggests the interesting possibility that this *Lolium* endophyte may be a non-fertile strain of *Phialea temulenta*, but there is still the difficulty that nobody has yet shown that the blind seed fungus can cause systemic infection in *Lolium*. The second *L. perenne* endophyte has only been studied at Aberystwyth, and is distinguishable from the first by its mycelial characters and by the comparative ease with which it can be cultured. Its microconidia seem more characteristic of Sclerotinia than of the Endoconidium type figured by Neill for the first *L. perenne* fungus. It seems that we still need to clear up many points in relation to the fungi parasitizing *Lolium* spp., but the information given by Dr. Noble and Miss Sampson at this meeting suggests that appreciable progress has been made in this direction. The choke disease of grasses caused by *Epichloe typhina* was also mentioned by Miss Sampson. We know that the disease is carried by the seed in certain species, notably *Festuca rubra* and *F. ovina*; but so far it has never been demonstrated in the seed of cocksfoot (*Dactylis glomerata*), one of the most seriously affected grasses in Great Britain.

Dr. Millard gave an interesting account of broccoli canker (caused by *Phoma lingam*) in the West Riding of Yorkshire, where many small growers save their own seed and therefore run into trouble since the disease is seed-borne. These local strains have become infected, but they are suited to the district, and growers are loth to import recognized varieties from other parts of the country which often do not acquit themselves so well in Yorkshire. In order to clean up these local strains, Dr. Millard for some years has accepted from growers seed stocks which are freed from *Phoma* by immersing them for twenty-five minutes in a hot water bath at 50° C. Germination may be depressed a little but in practice this has not proved serious unless the seed was old. Stocks have been cleaned and propagated at Askham Bryan and handed back to the growers in a perfectly clean condition. The value of this service to the market gardener needs no emphasis.

A case of seed-borne club root (*Plasmodiophora Brassicæ*) on swedes was described by Dr. L. G. G. Warne, of Manchester. Dr. Warne was able to infect a clean sample of seed with washings from an infected one, a thing which has not been done before. We do not know how widespread seed-borne club root is and it probably does not occur very often, but the fact that the possibility has been demonstrated is of great interest to plant pathologists and gardeners generally.

An account of seed examination at the Pathology Laboratory of the Ministry of Agriculture and Fisheries, Harpenden, was given by Dr. A. Smith, who explained that practically all the samples are from consignments intended for export to countries requiring a certificate of health based on an examination of the seeds.

More than four thousand samples were examined in the year covering 1939–40, the great majority being vegetable and flower seeds. The War has cut down this export considerably and few agricultural seeds are exported to countries requiring certificates. The main causes of rejection are *Ascochyta* in peas, *Septoria* in celery and parsley, and halo blight in dwarf beans, but occasional samples of other diseased seeds are encountered. The presence of *Ascochyta* in seed peas was responsible for the rejection of 23 per cent of all peas examined for export purposes between 1925 and 1943. Considerable rejections of peas for marsh spot have also occurred, but, since it has been realized that this is not a communicable disease, affected peas may be exported provided they are likely to give a sound plant. In the same period 23 per cent of all samples of celery seed have been refused certificates because of the presence of *Septoria* pycnidia on the seed. An even greater percentage of parsley has been so rejected, namely, 31 per cent. Comparative figures for halo blight (*Pseudomonas phaseolicola*) are not available, but in recent years the percentages rejected have varied from 5 per cent to, in one year, as much as 25 per cent of the samples submitted.

All seed-borne diseases are not recognizable from an examination of the seeds themselves nor can they all be detected on incubation. Some diseases, for example, certain bacterial and virus diseases, as well as certain downy mildews in the seed coat, must perforce escape detection. Freedom from these can only be assured by an inspection of the growing crops.

Among seeds examined for purposes other than export may be mentioned a sample of onion seed which showed the presence of *Botrytis Allii* as a seed-borne disease.

G. C. Ainsworth exhibited maps showing the world distribution of certain seed-borne fungi from the series of "Distribution Maps of Plant Diseases" now being issued by the Imperial Mycological Institute. He emphasized that seed-borne diseases are often a particularly suitable subject for legislation and this aspect was briefly discussed in connexion with fungi the range of which is, or is not yet, co-extensive with that of the host.

The importance of seed-borne diseases was stressed in an interesting discussion that followed the papers, and the meeting certainly proved successful in providing an opportunity for useful comment on this very topical problem. J. H. WESTERN.