Fuel Research in Great Britain

NEARLY five hundred guests visited the Fuel Research Station at East Greenwich on June 9. They were received by the Director of Fuel Research (Dr. F. S. Sinnatt). The plant and laboratories were open to inspection and the work in progress was explained by members of the staff.

The Lancashire boiler was seen in operation using a pulverised fuel burner and distributor designed at the Station. The boiler (25 ft. × 7 ft. 6 in.) is rated at 5,000 lb. of steam per hour, but was working smoothly and without difficulty at an overload of 100 per cent. Commercial users of these appliances have found that they enable greatly increased loads to be maintained steadily for long periods. The distributor, which enables a heterogeneous stream of material to be divided into two equal parts, was first shown last year, and has since been successfully applied in a number of industrial plants. A Scotch marine boiler has just been installed for examining bunker coals under conditions comparable with those prevailing at sea, and also for trying out alternative methods of firing.

The cleaning and grading of coal at the colliery before it is placed in the market is a practice that has extended greatly in recent years. A detailed study is being made at the Station of the effects of moisture in fine coal on treatments such as dedusting, screening and dry cleaning. The use of flocculating agents for promoting rapid settlement of suspended solids in washery circulating systems is now an accepted practice, but work is proceeding to try to elucidate the actual mechanics of the processes involved and to determine the best way of applying these flocculating agents. Special attention is being given to coal breaking. The coal industry is beginning to experience certain difficulties owing to the diminished demand for large coal and the increased demand for graded sizes. Tests carried out under the direction of Survey officers are proceeding in certain coal fields with the view of providing data regarding the breaking properties of seams and the relative value of various types of breakers. The Fuel Research Station is co-operating particularly in assessing the stability of breaker products when subjected to transport and handling.

The carbonising plant at the Station includes a setting of horizontal gas retorts of the type that are in use for carbonising between seven and eight million tons of coal a year in the gas works of Great Britain. In retorts of this type, steaming of the charges of coal has not normally been practised. Investigations carried out in the horizontal retorts at the Fuel Research Station have shown that by a special method of steaming during the later hours of the carbonisation period, the output of gas can be increased by about 10 therms per ton of coal or about 14 per cent above normal. During this investigation, one retort of the setting of eight has been isolated to allow of accurate determinations of the extent of steam decomposition when different rates of steam supply have been used. The fundamental aspects of the steaming process have received special attention during the work, which is now almost completed.

The greatest interest is being taken in the low temperature carbonisation plant which has been developed at the Fuel Research Station. The hydrogenation programme is of importance in relation to the economical utilisation of the tar. The work done in the plant on British coal seams has shown that a very wide range of coals can be successfully treated. This is of the greatest use in considering the developments that are taking place in low temperature carbonisation. At least one setting of this type of retort developed at the Station is being operated commercially.

The intermittent vertical chamber ovens at the Station are being used in an investigation of the effects, on the coke produced, of blending weakly caking coal with strongly caking coal. One of the main objects of this work is to explore the possibility of extending the life of the supply of strongly caking coals in Great Britain. Series of blends are being carbonised at high temperatures and the conditions of carbonisation with each blend are adjusted so that the final rate of gas evolution at the end of the carbonisation period is as nearly constant as possible with each blend.

A process for the manufacture of active or absorbent carbon from sized coal has been worked out. It has been observed that the nature of the coal is a critical factor in the process and, up to the present, three coals have been found suitable for the purpose. The information for the identification of these coals has been provided by the Fuel Research Coal Survey, reinforced by special experiments on a small scale. Large amounts of the coals suitable for the process are available in the country. When the conditions required for converting coal into active carbon had been established on a small scale, the work was transferred to the large-scale plant at the Station. The sized coal was carbonised continuously in the narrow brick retorts developed at the Fuel Research Station, at

a temperature of 480° C. The low-temperature product obtained was activated by treatment with superheated steam at a temperature of 950° C. This second stage of the treatment was carried out in the same type of retort. The yield of active carbon was 20–25 per cent of the coal originally carbonised. Some of the active carbon sized to a grade from $\frac{1}{4}$–$\frac{1}{8}$ in. is being used at the Station for the recovery of spirit and benzole from coal gas.

The low-temperature carbonisation of coal produces large amounts of tar for which new industrial outlets are continually being sought. Similarly, the whole of the high-temperature tar produced in Great Britain does not always find a ready market. Processes such as hydrogenation-cracking which employ tars and tar distillates as raw materials for the production of fuel oils are therefore worthy of examination.

Experimental work has been in progress to determine the conditions and plant necessary for the conversion of tars and tar oils into materials, such as motor spirit, for which the market is relatively large. The process is one of hydrogenation-cracking and is operated under high pressures of hydrogen (normally about 200 atmospheres) and at elevated temperatures (350°–550° C.). The most satisfactory conditions and catalysts are being determined by experiment, and continuously operated plants are in use in which the variables of the process are being studied. The catalyst favoured at present for the treatment of crude low-temperature tars is a sulphide of molybdenum supported on a porous gel, but for selected oil distillates more active catalysts are available.

It has been found that low-temperature tar with no pre-treatment, other than filtration to remove dust, can be hydrogenated satisfactorily. In one passage through the supported molybdenum catalyst there is obtained a product which is free from pitch and which contains motor spirit amounting to 45 per cent of the tar treated. By re-processing the high-boiling oils the total yield of spirit becomes 76 per cent by weight of the tar and 100 per cent by volume. Tar fractions can be treated with greater ease than crude tar. Creosote, for example, is much more readily treated than high-temperature tar. The crude spirit requires very little refining to make it a stable water-clear motor spirit having satisfactory properties. It has a good anti-knock value (octane number 70–75).

The scale of operation of the process has been increased in stages, the latest development being the design and construction of a plant capable of dealing with 1–2 tons of raw material per day. In erecting this plant, two main tasks were undertaken. The first of these consisted in working out a technique or method of operation which should be applicable to a large-scale plant; the second entailed the examination of the effect of variables (temperature, pressure, through-put, etc.) with the view of determining the best working conditions for the treatment of various raw materials. The first task has been accomplished, and work on the second is in progress.

The Fuel Research Station is also the headquarters of the Physical and Chemical Survey of the National Coal Resources, which is examining the coal seams of Great Britain. Much interest was taken in samples which were exhibited to show the great diversity in the appearance and properties of different types of coal, and in the methods and apparatus used in their examination.

The Kiss Precise

FOR pairs of lips to kiss maybe
Involves no trigonometry.
'Tis not so when four circles kiss
Each one the other three.
To bring this off the four must be
As three in one or one in three.
If one in three, beyond a doubt
Each gets three kisses from without.
If three in one, then is that one
Thrice kissed internally.

Four circles to the kissing come.
The smaller are the benter.
The bend is just the inverse of
The distance from the centre.
Though their intrigue left Euclid dumb
There's now no need for rule of thumb.
Since zero bend's a dead straight line
And concave bends have minus sign,
The sum of the squares of all four bends
Is half the square of their sum.

To spy out spherical affairs
An oscular surveyor
Might find the task laborious,
The sphere is much the gayer,
And now besides the pair of pairs
A fifth sphere in the kissing shares.
Yet, signs and zero as before,
For each to kiss the other four
The square of the sum of all five bends
Is thrice the sum of their squares.

F. SODDY.