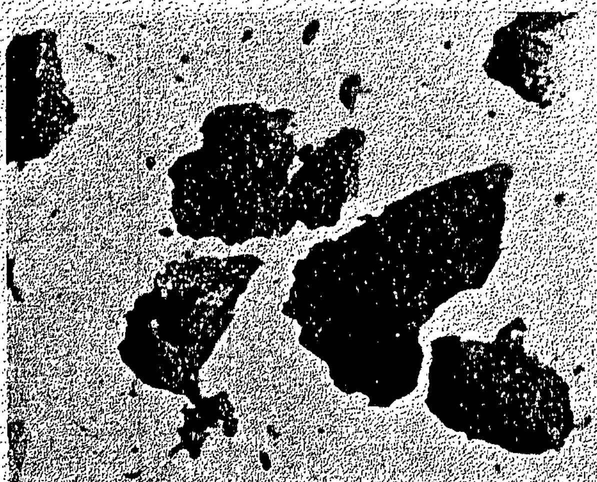
the more rapidly the combustion takes place, the higher will be the maximum pressure of the reaction. Considering these remarks, we may regard the maximum pressure produced by the explosion as a measure of the inflammability of a given dust under experimental conditions. Only in favourable circumstances will explosion result in the formation of a detonation wave.

The expansion pressure that is produced is due either to the rapid formation of gaseous reaction products, or to the expansion of the air by the heat of reaction. It was



Particles of emery × 79

originally supposed that dust concentrations only explode when combustible gases were present in the gaseous medium of suspension and that they propagated the explosion through the volatile matter resulting from the burning particles. It has now been proved that at the correct concentration a spontaneous reaction takes place between the finely divided dust and the oxygen molecules of the air. This occurs so rapidly that the pressure therefrom is capable of igniting the remaining unburnt dust particles.

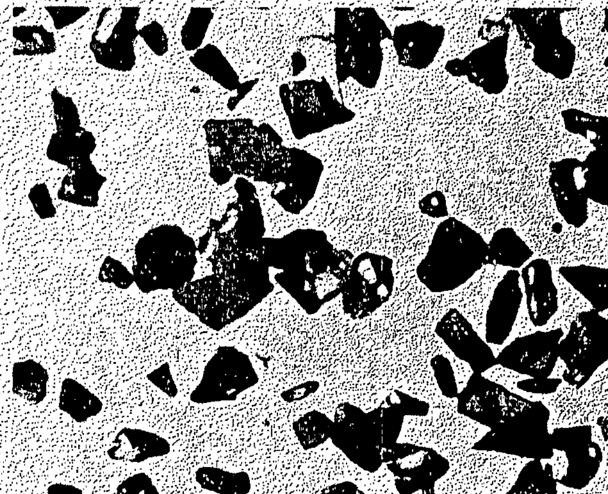
The pressure that is produced by an explosion of starch dust is mainly due to the rapid formation of relatively large volumes of gases. Sulphur, on account of its low ignition temperature, explodes more readily than starch, but, since it produces only half the volume of gas that an equal weight of starch produces, it explodes with correspondingly less violence.

With certain dusts, *e.g.*, aluminium, that do not produce gas, but on the contrary, use up oxygen from the air, the explosion pressure is due entirely to the thermal expansion of the air. The heat of reaction of aluminium dust is of such a high order that the explosion pressure is in the same range as that of starch.

In the majority of cases of factory explosions the damage is due to the expansion pressure that is produced, and a measurement of expansion pressures produced by different materials under standard conditions provides a satisfactory empirical basis for comparing the explosion hazard of each dust. It also is a method for the comparison of the inflammability of different concentrations of the same dust.

It has been found that the pressure developed by the explosion of a given dust is fundamentally modified by the following factors: the concentration of the dust; the chemical composition of the dust; the physical composition of the dust; the composition of the atmosphere; and the temperature, extent and duration of the ignition.

The particles of a dust cloud, although many thousand times larger in size than the molecules of a gas, are still exceedingly small, with the result that the finely-divided



Particles of carborundum × 79

material is in intimate contact with the gaseous medium in which it is suspended. It seems logical to expect, therefore, that dust dispersoids will burn with maximum velocity when the concentration of the actual combustible is chemically equivalent to the concentration of oxygen in the gas, for, when this is the case, the number of molecules of combustible material that are in direct contact with molecules of oxygen is at a maximum.

This is found to be quite true when put to experimental test. The explosion pressure is at a maximum at this concentration and diminishes rapidly as the concentration departs from this value in either direction.

(*To be continued*)

MANUFACTURERS' PUBLICATIONS

Chemical Plant.—The Gallenkamp catalogue No. 109 (1939 edition) deals with semi-scale chemical plant, the items being grouped together as far as possible under the various unit operations of chemical engineering. It is a 52-page catalogue fully illustrated.—*A. Gallenkamp & Co. Ltd.*

Fans.—The Sturtevant publication No. 1036 is a 12-page brochure giving particulars, diagrams and photographs of propeller fans and small electric ventilating sets.—*Sturtevant Engineering Co. Ltd.*

Lighting.—"A New System of Harmony Lighting" is the title of a recent Benjamin Electric publication (No. 1639/739) which has been circulated to the trade. It provides numerous details and pictures of the Anolier system of indirect lighting and its applications.—*Benjamin Electric Limited.*

Research Instruments.—A folder has been issued (Kip. 3) giving details of all the catalogues available describing the Kipp and Zonen research instruments, together with brief descriptions of the apparatus. Any of the catalogues therein listed is available on request from *W. Edwards & Company.*

Resins.—Complete ranges of Crestanol-Modified phenol-formaldehyde resins, Crestanol-Maleic anhydride resins, and Crestin-Pure phenolic resins are described in the second edition of a booklet issued recently by the manufacturers. Particular attention is drawn to Crestanol S.B. 226, described as a very hard, pale, high viscosity modified phenolic resin which can be dissolved in the cold in solvents or cooked direct into stand oil at a low temperature. Its colour retention is stated to be altogether unusual for a modified phenolic resin. Crestanol S.B. 248 can, it is stated, be used to produce very quick drying lacquers of great durability.—*Scott Bader & Co. Ltd.*