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Agglomeration of Fine Materials

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A paper by Prof. WALTER S. LANDIS, of Lehigh University, gave a concise review of the general subject of agglomeration of fine materials, including both the molding and the sintering processes. In the absence of the author it was presented by Dr. J. W. Richards.

Fine materials have heretofore been wasted to a greater or smaller extent. A list of such fine materials includes:

1. Fuels, fines being produced in the mining and preparation and in the storing of coal and lignites.
2. Concentrates from ore-dressing operations.
3. Fine ores.
4. Flue dust. Prof. Landis estimates the flue dust made by the iron blast furnaces of this country in 1910 as 3,500,000 tons, carrying at least 35 per cent of iron. At a low value of 4 cents per unit of iron, this dust costs almost $50,000,000 for its iron content alone, besides the $1,500,000 worth of coke in it.
5. Scrap metal, such as filings, chips.

The processes of agglomeration of fine materials are divided by Prof. Landis into two groups.

In the first group certain properties in the material are utilized for producing the desired coherence without addition of any foreign binder. Thus ores carrying soluble salts, clay, easily hydrated compounds, etc., may be moistened with water and molded into form and dried. But while coherence is thus produced, the product has the great disadvantage that on heating to a temperature sufficiently high to drive off the water, the briquets fall to pieces.

Pressure greatly assists in developing the cohering power of many materials. Sometimes the best results are obtained with dry materials, sometimes a certain amount of moisture is necessary. The pressure so far used in such processes runs up to 2000 atmospheres.

Heating to a high enough temperature also brings materials into a pasty or semi-fused state so that they sinter into a more or less firm mass. When carried out in a rotary kiln, the process is called nodularizing. This same property may be taken advantage of by molding the material into briquets, using only a slight pressure to insure filling the mold, then burning the briquet so formed at a temperature that will insure cohesion. (Gröndal.)

Finally a combination of pressure and sintering may be employed.

In the second group which includes the greatest development of the briquetting process, a foreign substance is used as a binder. Some of the binders which have been employed are clay, lime, ground slags, natural and Portland cements, waterglass, kieselguhr, carnallite, tar, pitch, asphalt, petrolemum, sulphite residues, napthaline, parafine, molasses, resin, starch, and other materials.

The operations of this second group are divided into three sub-classes: (a) Processes in which the binder is mixed with fines and molded under low pressures; (b) processes in which

higher pressures are used along with the binder; (c) processes in which a binder and pressure are used together, with a subsequent heat treatment.

Prof. Landis thinks not enough attention has always been paid to the selection of a binder for the particular case at hand. Too often is the intrinsic cost of the binder itself considered to be the main item in its selection, the subsequent cost it entails in passing through the smelting or refining furnace, being entirely overlooked. The waste-product possessing binding power may become very costly if it entails the production of an extra amount of slag to be smelted, or introduces in the furnace product a small amount of impurity which is difficult to remove afterwards.

Pressure increases the effectiveness of all binders, enabling one to obtain the desired results with the use of a minimum of extraneous material.

Finally the physical properties which a briquet should have are briefly summed up.