UNITED STATES GEOLOGICAL SURVEY. BULLETIN 343 BINDER FOR COAL BRIQUETS

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JAMES E. MILLS

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BULLETIN 343

BINDERS FOR COAL BRIQUETS

INVESTIGATIONS MADE AT THE FUEL-TESTING PLANT ST. LOUIS, MO.

BY

JAMES E. MILLS

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INVESTIGATIONS MADE AT THE FUEL-TESTING PLANT, ST. LOUIS, MO.[a]

By JAMES E. MILLS.

INTRODUCTION.

THE COMMERCIAL PROBLEM.

Coal, in the process of mining, transportation, and handling and on exposure to the weather, is subject to more or less disintegration. This disintegrated coal is usually called "slack" and amounts often to a considerable percentage of the lump coal produced in the mines. If this slack coal is wasted the loss so occasioned ranges from 5 to 50 per cent, or even more, of the total coal mined. It is therefore clear that the utilization of this waste slack coal becomes a serious economic consideration.

When the coal is suitable for the production of coke, the utilization of the slack presents no difficulty, as it is in demand for that purpose. If the coal does not produce good coke, but cakes rather readily, the slack can be used for boiler purposes, as it fuses together more or less quickly, and burns on the furnace grate without great loss. Coal that cakes less readily can be burned on grates of special construction. When so used it is more troublesome to handle, and the waste is greater than when lump coal is used. Consequently the price of much of the slack coal for fuel purposes ranges considerably lower than that of the lump coal from the same mine.

The full value of this slack coal as fuel can be realized by first forming the coal into a coherent mass or briquet, such briquets, when of good quality, being equal to or of greater value than the original

[a] The writer undertook the work herein reported, in 1905, at the fuel-testing plant of the United States Geological Survey, under the direction of Dr. Joseph Hyde Pratt, of the University of North Carolina, to whom he is greatly indebted for advice and suggestions, given not alone at the beginning but throughout the progress of the work. Acknowledgment is also due for suggestions given by Mr. A. A. Steel, of the University of Arkansas, and for the assistance of many individuals and corporations who have answered inquiries and furnished samples as desired. In compiling this report and in laboratory work free use has been made of all available information thus acquired.

lump coal from which the slack was derived. The object of the investigations herein reported was to determine as far as possible to what extent the manufacture of briquets from slack coal may succeed commercially under the conditions existing in the United States.

The problem of briquetting is not always that of how to make the best possible briquet, for the slack at hand may be of inferior quality and the best possible binding material may be too expensive for the conditions prevailing in that particular locality. The problem is always to produce at a profit a briquet of satisfactory grade for the use intended. This problem will be made clearer by a brief summary of the available binders, followed by a preliminary discussion of the characteristics of a good briquet.

THE KIND OF BINDER.

Definite answer to the question "What is the best binder to use in making briquets?" depends, as repeatedly emphasized in this paper, on the locality, on the character of the coal, and on the purpose for which the briquets are intended. For purposes of a brief comparison consideration is given to the binders available for a coal which is fairly easy to briquet and which cakes rather readily. A few coals will briquet with somewhat less and others require greater percentages of binder, but an endeavor has been made in the following summary to strike a reasonable average.

The experiments herein reported show that, in general, for plants situated where it can be obtained, the cheapest binder will prove to be the heavy residuum from petroleum, often known to the trade as asphalt. Four per cent of this binder being sufficient, its cost ranges from 45 to 60 cents per ton of briquets produced. This binder is particularly available in California, Texas, and adjacent territory.

Second in order of importance comes water-gas tar pitch. Five to six per cent usually proving sufficient, the cost of this binder ranges from 50 to 60 cents per ton of briquets produced. As water-gas pitch is also derived from petroleum, it will be available more particularly in oil-producing regions.

Third in order of importance is coal-tar pitch. Being derived from coal, this binder is very widely available. From 6.5 to 8 per cent will usually be required, and the cost ranges from 65 to 90 cents per ton of briquets produced.

Of local importance, where the price permits, are natural asphalts and tars derived from wood distillation. The price of each of these binders varies greatly with the locality, but there are doubtless places where they could compete with the binders above mentioned. Wax tailings could be used with an easily caking coal.

Pitch made from producer-gas tar is not yet on the market, but it will produce excellent briquets, with a lower percentage of binder

than other coal-tar pitches. It will doubtless be available in the future.

Briquets excellent in all respects except that they are not waterproof can be made by using 1 per cent of starch as a binder, the cost of which is 20 cents per ton of briquets produced. Extra care is necessary in drying and handling these briquets, and this adds to their cost.

The waste sulphite liquor from paper mills also produces excellent briquets except that they are not waterproof. At present it is a troublesome waste product dissolved in much water. Its utilization for this purpose will bear further investigation.

Of inorganic binders, magnesia might be utilized, as its probable cost would not exceed 22 to 30 cents per ton of briquets produced. Other inorganic binders, while available as regards price, would not make first-class briquets.

The briquetting of lignite coal offers a peculiarly difficult problem. If the lignite cakes in the fire, asphaltic residues from petroleum or water-gas tar pitch may be used as binder, larger percentages being required than for ordinary coals. The most promising binders for lignites that do not cake are starch, sulphite liquor, and magnesia. Lignites may be briquetted without binder if they are to be burned on grates specially constructed to overcome the tendency to fall to pieces in the fire.

Attention is called to the suggested method of deciding as to the value of coal-tar pitch for briquetting purposes. The method is likewise applicable to asphalts and petroleum residues generally: (1) The pitch or tar is distilled and all oils coming off below 270° C. are rejected as being of no value; (2) the flowing point of the portion to be used in briquetting is determined (this should generally not be less than 70° C.); (3) the pitch is extracted with carbon disulphide. The smaller the amount of residual carbon the more satisfactory is the pitch. The less readily the coal cakes the higher must be the flowing point of the pitch. If a pitch cracker is used, the pitch to work successfully on a hot summer's day must have a flowing point above 120° C. In the winter pitch with a flowing point of 100° C. may be used. All softer pitches and asphalts have to be melted and mixed in liquid form with the coal.

A pitch with a very high softening point, above 150° C., should be either thinned or superheated in the mixer. The efficient use of a binder depends very largely on the proper regulation of the conditions in the mixer. The presence of low-volatile compounds in the pitch to be used as a binder increases the smoke in burning; and also increases the tendency of the briquet to soften and crack open in advance of combustion, owing to the volatilization and escape of these compounds.