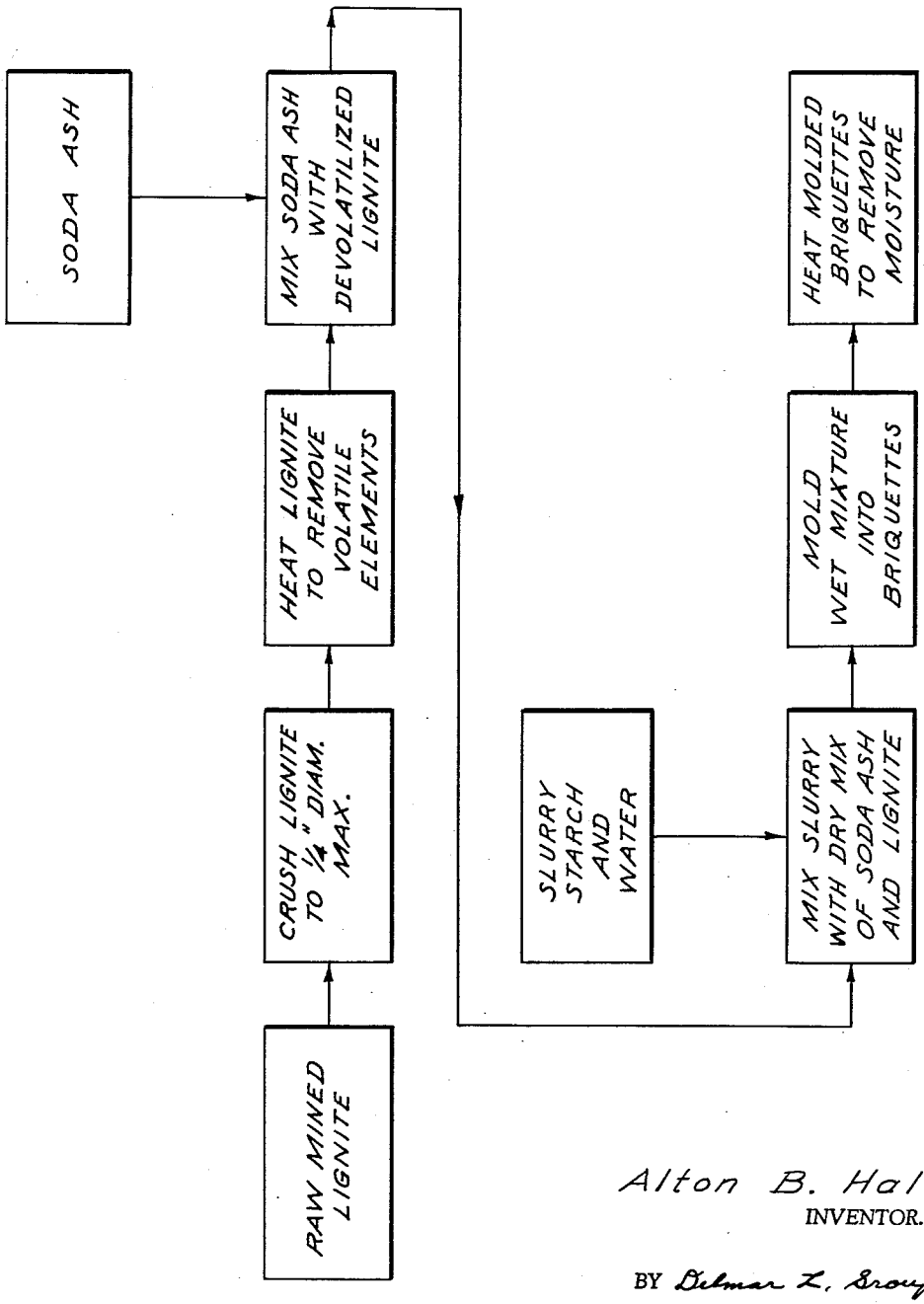
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PREPARATION OF FUEL BRIQUETTES

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PREPARATION OF FUEL BRIQUETTES

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This invention relates to fuel briquettes and their manufacture, and more particularly to a process for making briquettes from lignite. This application is a continuation-in-part of my co-pending application Serial No. 553,655, filed December 16, 1955, which was abandoned after the filing of this application.

In general, lignite is a fuel substance between peat and bituminous coal in quality and has a rather high voltaile content along with a large quantity of impurities. All of these characteristics tend to make lignite undesirable as a fuel. Numerous processes have been evolved which have attempted to overcome these undesirable qualities to produce a suitable fuel. However, no one to date has produced a briquette made of lignite which is suitable for use in the cooking of food over an open fire.

In view of the foregoing it is one object of this invention to produce a briquette from lignite which is clean burning and suitable for use in cooking food over an open fire.

It is a further object to produce a relatively slower burning briquette having a longer heat life than generally achieved by wood-based charcoal briquettes.

It is a still further object to produce a briquette which is low in cost and yet of the very high quality necessary for cooking purposes.

It is still another object to provide a process for producing the briquette described in the above objects.

It is yet another object to produce a briquette which is relatively clean to handle.

These and other objects will be apparent from the following detailed description and accompanying drawing, wherein the single FIGURE is a flow diagram showing the general process as practiced to produce the lignite briquette.

There are many problems involved in using lignite, especially a low quality lignite, as the basic ingredient for the production of high quality briquettes suitable for use as a means of cooking food over an open fire. In solving these problems there has been developed a novel process and composition which makes it possible to produce high quality fuel using lignite as the basic component.

In producing the lignite briquette of this invention as indicated by the flow diagram, the raw, mined lignite of any form is sized by screening or crushing to a suitable range of particle sizes. This range is not at all critical; however, a range of coarse particle sizes, for instance, sizes distributed between 1/16" and 5/16" in diameter, is presently preferred.

These crushed lignite particles are next introduced into some type of heating chamber where the objectionable volatile elements which would contaminate food in open fire cooking are substantially removed from the lignite. This operation may be performed in any well-known type of rotary kiln of the continuous loading and unloading type. The temperatures used in heating the lignite in the kiln range above 650° F. at which temperature the lignite will generally start to ignite. The upper usable heating

range is generally limited only by furnace design limitations; however, the presently preferred range for devolatilization is between 1150° F. and 1450° F. The amount of crushed lignite to be placed inside the rotary kiln and the amount retained therein during its operation will vary with the design of the kiln. It will usually be between 10 percent and 40 percent of the total inside volume. The volume of lignite in the kiln should be varied so that the retention time for lignite during processing will be adjusted in accordance with the temperature used and the characteristics of the lignite to produce lignite which will be substantially devolatilized by the time it has traversed the length of the tube. By substantially devolatilized it is meant that the major portion of the total combustible volatile content of the lignite is removed and by such removal all of the food contaminants and odor producing impurities which preclude the use of ordinary lignite for cooking food over an open fire are effectively removed. This means that the visible flame producing components of the lignite are also removed from the lignite so that a flameless, clean burning fuel is produced. The devolatilization of the lignite particles results in a shrinkage of such proportions that a 1/4" diameter particle will normally be reduced to approximately a 3/16" diameter particle.

Returning to the embodiment of my invention illustrated in the flow diagram, after the devolatilized lignite particles are removed from the kiln, dry soda ash is mixed therewith. However, the devolatilized lignite need not be immediately used in continuing the process, it may be stored and used whenever convenient as there is no need for it to be mixed with the soda ash while still warm from the rotary kiln. The amount of soda ash used may range between 1 and 5 percent by weight of the lignite but a generally preferred range for most purposes is between about 1½ and 3½ percent.

A starch binder in the form of a slurry is prepared by thoroughly mixing a quantity of starch or water in proportions between about 5/8 and about 7/8 lb. of starch per gallon of water. This starch slurry is cooked by heating above 195° F. or to the boiling point of the slurry and maintaining this temperature until the starch is gelatinized. This usually requires about five to seven minutes.

Next I inject the cooked slurry into the dry mix of soda ash and devolatilized lignite particles in the proportion of 3 to 5 percent dry starch in the total mix taken also on a dry basis. Depending upon the water content of the slurry the amount required may vary from about 5 to 8 gallons per 100 pounds of dry mix. The slurry and dry mix should be thoroughly intermingled so that the slurry completely coats every lignite particle. This is important for two reasons: first of all, it insures that the binder will be evenly distributed so as to form a solid briquette upon molding, since all of the particles will readily adhere to each other; and second, because the covering of the lignite particles makes a clean briquette since the carbon and other messy elements are covered, thus making for clean handling. The order of mixing is not important to the practice of my invention and any suitable means may be used to mix the soda ash with the devolatilized lignite and also to combine this dry mix with the starch slurry. For example, the soda ash may conveniently be mixed and cooked with the starch slurry provided the soda ash

used does not materially exceed 3½ percent since higher percentages adversely affect the adhesive properties of the starch slurry.

After this, the wet mixture is fed into any conventional type of molding apparatus for forming the briquettes. For example, this may be accomplished in a continuous type press having cooperating rolls with registering indentations.

Next the briquettes are removed from the press and placed in a drying chamber where the heat may range between 200° F. and 600° F.; preferably, however, this temperature should be generally below 350° F. since at higher temperatures the time of heating becomes critical because of spontaneous ignition of the briquettes after moisture is driven off. The briquettes are dried until the remaining moisture does not exceed 15 percent by weight.

The moisture removing operation is the final step in the process and upon the completion of same the product is ready for use.

In a specific application of my process, a rotary kiln which is fired internally with natural gas with the air mixture adjusted so as to supply ample oxygen to burn the natural gas but not to burn the lignite has proved satisfactory for substantial devolatilization of lignite. Using this kiln at devolatilization temperatures of 1150° F. to 1450° F. a retention time of 45–48 minutes for lignite particles of ¼" maximum size has been found to be adequate for the degree of devolatilization required for my briquettes. A water quench is provided at the discharge of the kiln to prevent combustion of the lignite since it discharges at red heat.

The soda ash is used in this process to reduce the ignition temperature and to control the rate of burning of the briquette. This effect of soda ash in my composition is presently believed to be primarily a catalytic effect in which the soda ash promotes the combustion reaction and lowers the ignition temperature of the briquette. Exactly how these effects are produced is not fully understood at this time; however, from observations of the burning of various compositions containing this ingredient, it is presently believed that either the soda ash or one or more of its decomposition products acts as a catalyst.

The devolatilized lignite used in this composition is very hard to ignite and burn because the volatiles which ignite at low temperatures have been removed. The principal function of soda ash in the practice of this invention is therefore primarily that of improving the ease of igniting the briquette whereby it makes possible relatively low temperature ignition of substantially devolatilized lignite. However, a second highly important effect is its effect upon the rate of burning.

Within the ranges specified above, a relatively higher percentage of soda ash is generally preferable to manufacture briquettes for domestic users in order to provide for such users a product that is easy to ignite. A suitable domestic product may be formulated with about 3 percent soda ash or more and the briquettes will ignite and burn with comparative ease and at approximately the rate of combustion of hardwood charcoal briquettes. Above 5 percent soda ash, the rate of burning becomes undesirably fast and the soda ash tends to adversely affect the adhesive properties of the binder.

On the other hand, the lower range of soda ash percentage is generally preferred by commercial users of briquettes for cooking since they are not as concerned with ease of ignition and such users generally prefer a longer heat life to conserve fuel consumption.

The following will serve as suitable examples of briquette compositions which have been found satisfactory in the practice of my invention:

I

	Pounds
Devolatilized lignite	100
Starch	5
Soda ash	5

II

	Pounds
Devolatilized lignite	100
Starch	3
Soda ash	1½

III

Devolatilized lignite	100
Starch	4
Soda ash	3½

IV

Devolatilized lignite	100
Starch	4
Soda ash	1

The starch used in the above compositions is added as a cooked starch slurry. It may be prepared from any suitable variety of starch such as, for example, corn, wheat, rice, potato, tapioca or arrow root, using a suitable quantity of water as explained heretofore. It will be understood, as explained above, that the devolatilized lignite and soda ash may conveniently be mixed with the cooked starch slurry in any order desired. For example, the lignite and soda ash may be mixed as a dry mix to be added to the cooked starch slurry or the soda ash and starch may be cooked together with a suitable quantity of water and these two components added together to the devolatilized lignite. Both methods of mixing have been used; however, the second method is presently preferred in order to readily obtain uniform distribution of soda ash throughout the composition with relatively short mixing time.

In the continuous production of briquettes, the water used in making successive batches of the starch slurry may be varied as desired to obtain any preferred consistency of the wet product for molding into briquettes. Usually the starch slurry will require between ⅝ pound and ⅞ pound of starch per gallon of water.

After all the components have been mixed as described above, the wet composition is generally of a paste-like consistency which may be readily formed into briquettes of any suitable size or shape with the use of very slight pressures.

The briquette of this invention produces an even fire and, as set forth above, such briquette may be formulated, as desired, to produce longer burning fire than the charcoal type briquette commonly used for cooking over an open fire. In addition, this briquette is relatively clean to handle, since all of the lignite particles are completely covered by the binder.

While I have described examples of my invention and have outlined advantages thereof, it will be understood that the exact materials or proportions shown may be varied or substitutions may be made without departing from the true teachings of my invention or the scope of the appended claims.

Having thus described my invention, what I claim as novel and desire to secure by Letters Patent of the United States is:

1. The process of preparing from lignite, briquettes suitable for cooking food over an open fire, said process comprising crushing the raw, mined lignite into particles approximately 1/16" to 5/16" in diameter, heating the crushed lignite at from 650° F. to 1450° F. until a major portion of its volatile elements are removed, mixing the devolatilized lignite with a quantity of soda ash equivalent to from one to five percent by weight of the lignite and a slurry composed of starch and water and agitating until thoroughly mixed, molding the mixture to form briquettes, and drying the molded briquettes, the starch slurry completely coating each lignite particle to insure the production of briquettes which are clean to handle.

2. The process of preparing from lignite, briquettes which are relatively clean to handle and suitable for cooking food over an open fire, said process comprising

crushing the raw, mined lignite into particles approximately 1/16" to 5/16" in diameter, heating the crushed lignite at from 650° F. to 1450° F. for a period of time, as determined by the particle sizes and temperature used, to cause at least a major portion of its volatile elements to be removed, mixing said devolatilized lignite with a quantity of soda ash equivalent to from one to five percent by weight of the lignite and a slurry of starch and water in the proportions of approximately 5/8 to 7/8 pound of starch per gallon of water, 5 to 8 gallons of the slurry being added per hundred pounds of dry ingredients, agitating the mixture until the slurry and dry ingredients are thoroughly mixed so that each particle of lignite is covered with starch, molding the mixture to form briquettes, and drying the molded briquettes.

References Cited in the file of this patent

UNITED STATES PATENTS

744,584 Mellinger ---------- Nov. 17, 1903

FOREIGN PATENTS

11,239 Great Britain ---------- of 1890
9,932 Great Britain ---------- of 1900
14,771 Great Britain ---------- of 1915
21,755 Great Britain ---------- of 1904
28,692 Great Britain ---------- of 1907
51,405 France ---------- June 24, 1942
(Addition to No. 861,930)