

# United States Patent

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[54] **COMPOSITE FUEL ARTICLE**

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[56] **References Cited**

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[57] **ABSTRACT**

A composite fuel article comprised of particulate consumable material, such as ground corn cobs and husk material; a petroleum derivative, such as paraffin slack wax; a lignosulfonate; and a corn starch. The lignosulfonate is heated and mixed with the corn starch, the wax is heated to melting and then all the constituents are mixed together, compressed under very moderate pressure in a mold, and cooled to form the solid fuel article in the shape of a log or briquette.

**2 Claims, No Drawings**

## COMPOSITE FUEL ARTICLE

## BACKGROUND OF THE INVENTION

Composite fuel articles in the form of logs or briquettes have been made from a variety of consumable particulate materials including coal fines, shredded wastepaper, chopped hay, vegetable matter such as ground corn cobs, bagasse, and ligno-cellulosic material such as sawdust, wood chips, wood shavings, and the like.

See U.S. Pat. to Davis No. 621,041 (1899); Patterson No. 665,973 (1901); Patterson No. 665,974 (1901); Davis No. 671,078 (1901); Sachse No. 748,312 (1903); Barnes No. 778,096 (1904); Bausher No. 848,150 (1907); Williams No. 2,475,766 (1949); Stevens No. 2,789,890 (1957); and Levelton No. 3,227,530 (1966).

These patents, particularly those to Davis, Barnes, and Bausher teach the use of crude petroleum and petroleum derivatives such as paraffin wax as an ingredient to bond the particulate material into a mass and increase the flammability of the resulting composite fuel article.

The use of the natural bonding agent of wood, namely, lignin, as a bonding material for composite fuel articles such as logs and briquettes is also known. See the above mentioned patents to Levelton and Stevens and Crown Zellerbach Corporation's publication CPD-9127-5M-163 entitled, "The Orzan Products."

## SUMMARY OF THE INVENTION

My invention resides in a new composite fire log which exhibits greatly improved stability characteristics, particularly during burning, which are similar to a wood fire log.

The article is referred to as a "log" because it is preferably cylindrical in shape, but it is recognized that the article may be formed in any suitable shape and size.

The consumable particulate material of my log is basically ground corn cobs which are normally plentiful and inexpensive. I have found that including husk material in the grinding process provides a log of increased strength since the somewhat elongated fibrous strands and cohesiveness to the log and tend to hold it together.

Further, I have discovered that the addition of a relatively small quantity of corn starch to the mixture of the log greatly changes the log's stability characteristic during burning. An elongated composite log, such as one of consumable particulate material, crude paraffin wax, and lignin will tend to droop or sag if not supported along its length during burning. Furthermore, such a log may accidentally be disintegrated into a burning heap of coals if jostled even slightly, particularly during the later stages of burning. This may not only present somewhat of a hazardous situation, but also prevents turning of the log which enhances its burning just as the periodic turning of a wood fire log improves the burning thereof. My fire log exhibits vastly improved cohesiveness and stability during burning which are characteristic of a burning wood log.

My log burns very evenly, substantially at the rate of a wood fire log, and with an aesthetic orange flame similar to a natural wood fire. The heating value may exceed that of most wood fire logs and leaves a minimum amount of ash.

The log is simple and inexpensive to manufacture, durable, easy to handle and store, and may be readily dispensed from a coin operated machine (such as shown in my U.S. Pat. No. 3,088,629) which might be advantageously placed in convenient locations such as parks, camping grounds, super markets, and gas stations.

Further objects, features and advantages will be apparent from the following description of the invention.

## DESCRIPTION OF A PREFERRED EMBODIMENT

The bulk of my preferred composite fire log is made up of ground corn cobs and husk material. While the use of ground corn cobs to make composite fire logs has been known for years, I have discovered that the use of ground husk material

together with the ground cobs results in a more durable log. The elongate fiber strands of the ground husk material intertwined in the log add significant strength and cohesiveness.

The cost of these basic ingredients, cobs and husks, is very low. While corn cobs were once thought of as a waste material and merely as a disposal problem, rather diverse agricultural and industrial uses for corn cobs, usually in crushed or ground condition have now been discovered through research. However, the supply of corn cobs still is far greater than the demand. No such widely accepted agricultural and industrial uses have yet been discovered for the husks which are still considered basically a waste and nuisance material. These factors assure a readily available, low-cost supply of cobs and husks.

The corn cobs and husk material should be air dried to a moisture content somewhere in the range of about three to about 12 per cent prior to grinding. The grinding operation may be performed in a typical hammer mill or the like. Hammer mills are essentially impact crushers, having rotor mounted hammers of various descriptions rotating at high speed to shatter the material by impact against breaker plates. The breaker plates and perforated screens form the enclosure within which the rotor turns. A perforated screen having about 1/2-inch or 5/8-inch openings is preferably employed to control the product size by retaining material within the mill case until it is small enough to pass through the screen perforations. It is understood that much of the husk material in the form of fibrous strands will be longer than one-half inch, but will be carried through the size control screen by the ground corn cob material. As mentioned herein before, the elongate strands of husk material tend to hold the log together for added strength.

While the particular size of the ground material is not considered critical, it has been found that material passing about a one-half inch screen produces a more desirable log than substantially larger particulate material.

In view of the prior art, it is recognized that other ground materials or combinations thereof, such as disclosed in patents previously mentioned could be used to produce a useable composite fire log, however, the ground corn cob and husk log is believed to have significant advantages over such other logs. It is believed that any cob variety may be used.

Because of my unique composition, I have found that I am able to use a lower grade petroleum derivative wax and, thus, less expensive wax than heretofore could satisfactorily be employed in the manufacture of composite fire logs. It is recognized that microcrystalline waxes and petroleum derivative paraffin-type waxes such as fully or partially refined waxes, and crude scale paraffin wax could be readily used if the cost thereof was not prohibitive for use in a fire log product.

I am able to advantageously utilize the lower grade and relatively inexpensive petroleum derivative, paraffin slack wax, in my log. Although various grades of paraffin slack wax may be used, I have found that a wax having generally the specifications shown in Table I, can be used to produce a most satisfactory log.

TABLE I

Flash point, COC, °F., Min. (ASTM D 92)	380
Flash point, PM, °F., Min. (ASTM D 93)	300
Soybolt universal viscosity at 210° F. (ASTM D 88)	35-50
Melting point, °F. (ASTM D 127)	115-145
Oil content, %, max. (ASTM D 721)	8

A lignosulfonate, or a combination of lignosulfonates, chosen from a group consisting essentially of ammonium lignosulfonate, sodium lignosulfonate, calcium lignosulfonate and magnesium lignosulfonate is used as a bonding material for my composite fire log. I prefer to use ammonium lignosulfonate which is readily available at a relatively low cost in liquid form from a variety of sources in the paper industry. I

have found that ammonium lignosulfonate, having specifications generally in accordance with Table II can be used with good results.

TABLE II

Solids, %	50-55
Sp. gravity at 75° F.	1.22-1.27
Viscosity at 100° F.	100-500
pH	2.0-3.5
Sugars (% on solids, Mannose)	18-25
Lignosulfonic acid (% on solids)	45-55
Carbon (% on solids)	48-54
Nitrogen (total % on solids)	2.7-2.8
Ash (% on solids)	0.7-0.9
Sulfated ash (% on solids)	0.7-1.0
Sulfates, as sulfur (% on solids)	0.6-0.7
Sulfur, total (% on solids)	5.4-5.6
CaO (% on solids)	under 0.3
MgO (% on solids)	under 0.1

I have discovered that the addition of a relatively small amount of corn starch such as, pearl starch or a degradation product of starch such as, white dextrine, yellow dextrine, British gum, or the like greatly improves the stability of the log, particularly during burning.

A process of making a preferred log will now be described. The corn cobs and husk material are ground in a hammer mill or similar grinder preferably with about a 1/2-inch or 3/8-inch mesh control screen. The lignosulfonate is heated to about 140°-150° F. and about 1 part to about 2 parts of powdered pearl starch by volume is thoroughly mixed with about 5 to about 15 parts by volume of the lignosulfonate. The paraffin slack was is heated to melting, about 115°-145° F. All the ingredients are then thoroughly mixed, preferably with a tumbling action, in about the following proportions by volume:

70 to 90 parts ground corn cob and husk material,  
 15 to 25 parts paraffin slack wax,  
 5 to 15 parts lignosulfonate, and  
 1 to 2 parts corn starch.

5 The mixture is placed in a hollow cylindrical mold and compressed against the bottom end of the mold with a ram under moderate hand pressure. It is then cooled to room temperature.

This method produces a simulated log having a rather rough exterior surface with fissures and cracks extending into the compressed mass. This roughness not only adds a natural appearance to the log, but the fissures and cracks in the log are filled with air which greatly enhances burning.

10 It is understood that my invention is not confined to the particular embodiments described herein as illustrative of the invention, as it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit and scope of the invention.

I claim:

20 1. The process of producing a composite fuel article comprising the steps of:

a. forming a first mixture of about 5 to 15 parts by volume liquid lignosulfonate selected from a group consisting essentially of ammonium lignosulfonate, sodium lignosulfonate, calcium lignosulfonate and magnesium lignosulfonate and about 1 to 2 parts by volume pearl starch or starch degradation product selected from a group consisting essentially of British gum, white dextrine and yellow dextrine,

30 b. mixing said first mixture with about 15 to 25 parts by volume melted paraffin slack wax and about 70 to 90 parts by volume of consumable particulate material selected from a group consisting essentially of ground corn cobs, sawdust, wood chips, and wood shavings, and

35 c. molding the resultant mixture into an article of desired shape and size.

2. A composite fuel article made by the process of claim 1.

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