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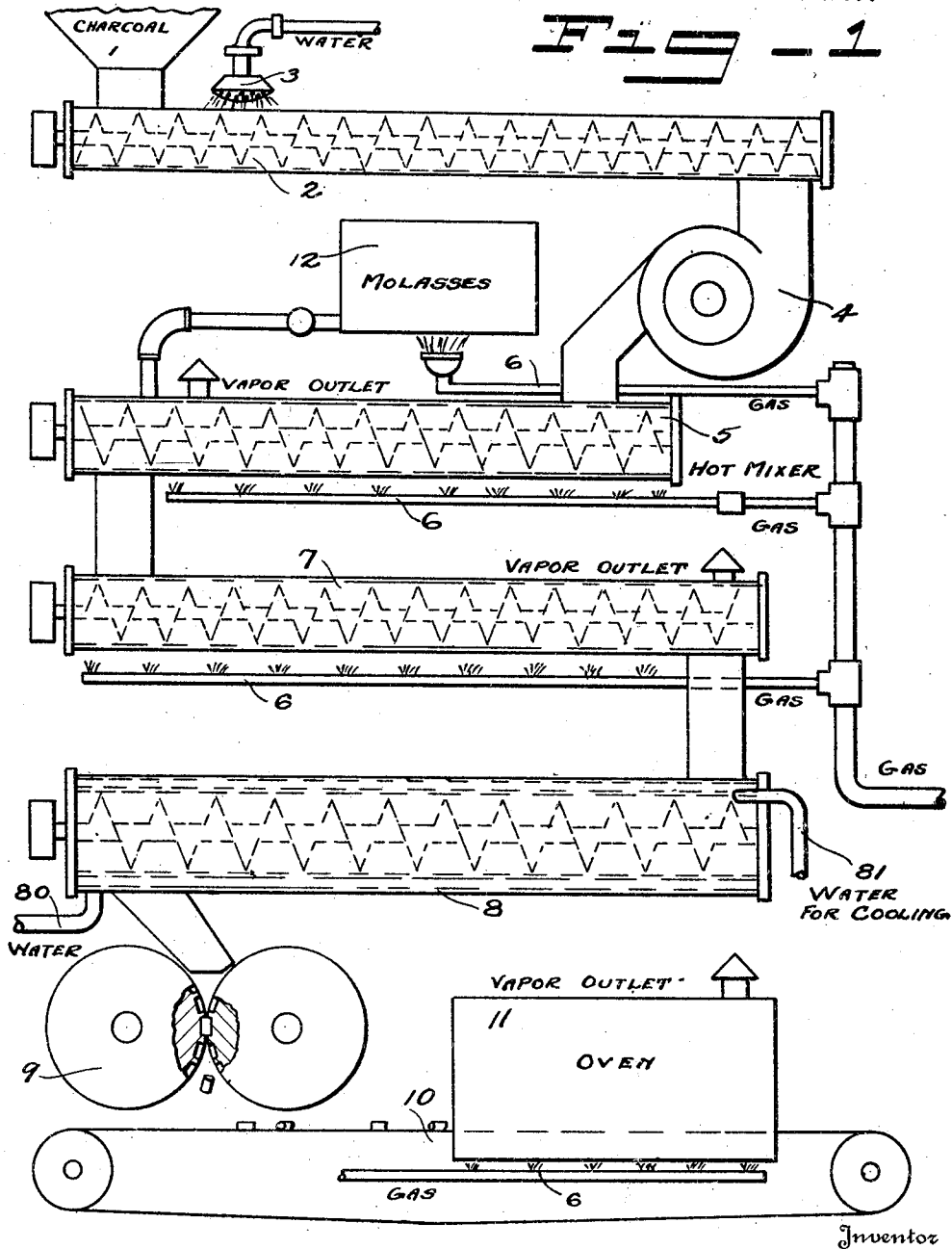
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P. C. MULLIGAN

ART OF BRIQUETTING

Filed Oct. 4, 1926

2 Sheets-Sheet 1



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By *H. L. + S. A. Reynolds*
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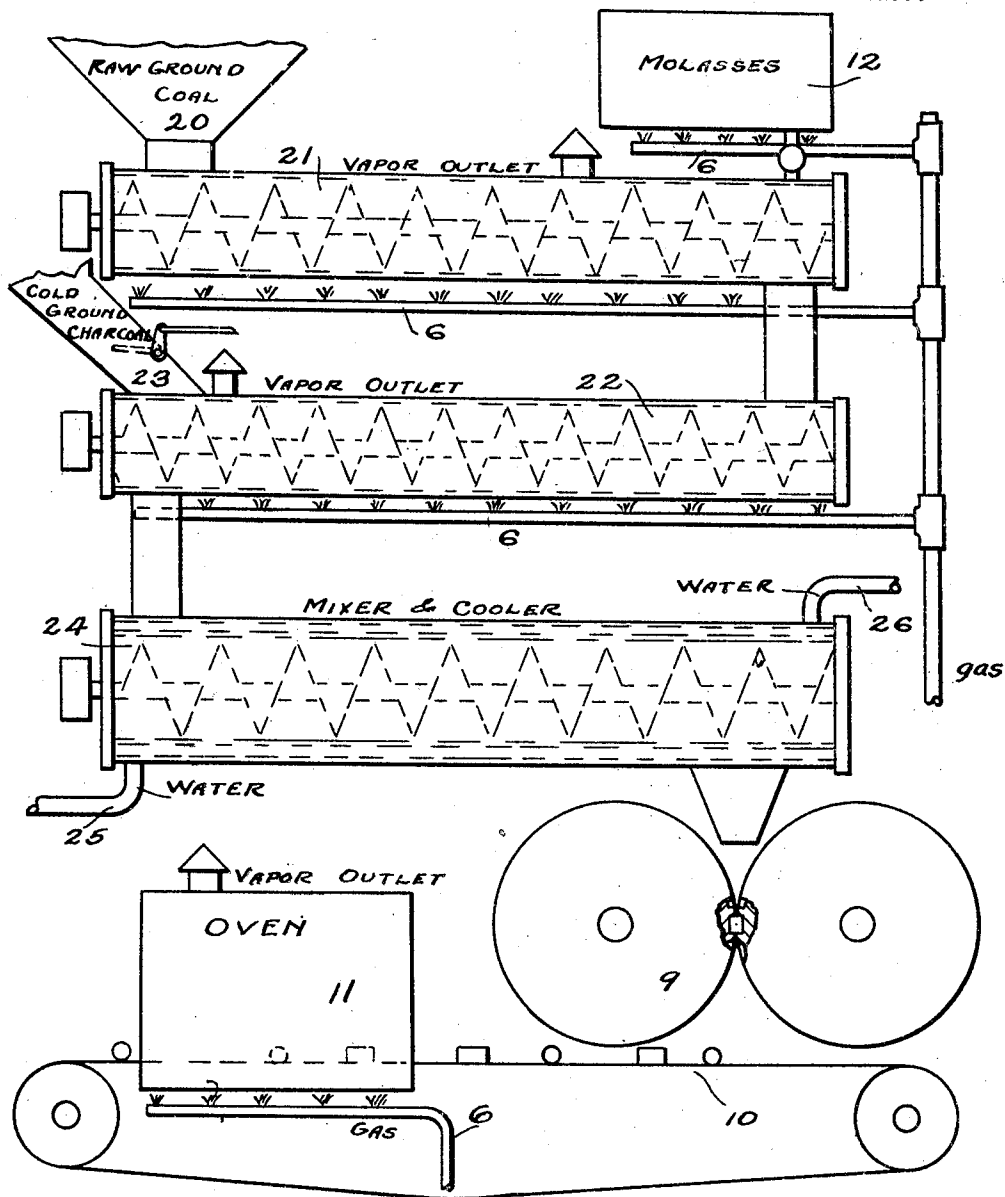


Fig. 2

Inventor

Paul C. Mulligan

By *H. L. & C. L. Reynolds*

Attorneys

UNITED STATES PATENT OFFICE.

PAUL C. MULLIGAN, OF SEATTLE, WASHINGTON, ASSIGNOR TO LUTHER J. HULL,
ISAAC M. FOSTER, AND HIMSELF.

ART OF BRIQUETTING.

Application filed October 4, 1926. Serial No. 139,381.

My invention relates to the art of briquetting, and especially to a briquetting process, or a process of preparing materials for briquetting, in which ordinary molasses is used alone as a binder. Where such molasses has been used heretofore, it has been considered necessary to use high temperatures to drive off the water which is contained in the molasses to enable the briquette to harden, or to employ a lengthy and time-consuming process at lower temperature, or to employ acids or other materials with the molasses binder.

Inasmuch as high temperatures are injurious to the base materials, especially when lignite or bituminous coal is employed, and as it is desirable to speed up the process as much as possible and to effect economy of heat, it is a primary object of the present invention to provide a process for the preparation of materials for briquetting whereby molasses may be used as a binder, in which only low temperatures are employed, at which temperatures the volatiles will not be driven from coal, if such is used as the base material, and yet a process in which the heat required is conserved and the time for completion of the process is reduced to a minimum.

It is also my object to provide a process which is adaptable to the employment of wood charcoal, or a mixture of wood charcoal with coal, and employing molasses as a binder, for ordinarily it has been found that molasses can not readily be added to charcoal without causing the mass to ball. Hence, it is a further object to provide a process as especially adapted to the employment of wood charcoal and molasses as a binder therefor, wherein the molasses may readily be mixed with the charcoal and yet one in which the entire process can be completed quickly and without waste of heat.

The advantages of the roll type press, such as economy of operation and first cost, rapidity of manufacture, and simplicity, as compared to a punch type press, are well known, and yet it has been found difficult to prepare briquetting material comprising or containing charcoal and employing a molasses binder for briquetting in a roll type press. The molasses bound mixture in a roll press will not hold together after pressing, due to the inherent characteristics of molasses, requiring special preparation of the materials for briquetting. It is an object of my invention, therefore, to provide a process whereby the

materials referred to above, and using the molasses binder alone, can be so prepared as to enable their briquetting in a roll type press and without the addition of special and expensive modifying agents to affect the molasses.

My invention comprises the novel process and the novel steps therein as will be hereinafter described in this specification and more particularly as defined by the claims terminating the same. The accompanying drawings illustrate several arrangements of apparatus for carrying out my process.

Figure 1 illustrates an arrangement adapted for using charcoal alone as the base material.

Figure 2 illustrates the apparatus arranged for employing coal alone or a mixture of coal and charcoal.

Referring first to the straight charcoal process, it should be understood that wood charcoal is a substance which is extremely difficult and, to a certain degree, dangerous to handle. It contains a large amount of fine dust and the particles are extremely friable and hence will fly readily into fine dust. It is therefore difficult to grind properly, and the dust, when present in a confined space, presents the danger of a dust explosion. It is therefore desirable that it be moistened to permit it to be ground, but inasmuch as it must be heated to complete and harden the briquette, the addition of moisture ordinarily presents the problem of later eliminating this moisture with the consequent consumption of heat.

I have found that the addition of moisture as is required for safe grinding and handling of the charcoal, may be turned to advantage in another way, in that the molasses, having an affinity for or being perhaps somewhat diluted by the water contained within the mass, will readily penetrate to all parts of the mass without causing it to ball. It forms practically a homogeneous free handling mixture in which the molasses is thoroughly incorporated. Thus, by the addition of water to the charcoal, it is prevented from dusting and may be ground readily, and the molasses can then be added in such a manner that it most readily penetrates the mass and mixes with and coats all particles thereof. The admixture of molasses can occur as the water is being driven from the mass by heat. Hence the molasses is in a sense substituted for the water, and the water in the molasses can be

eliminated by a continuation of the heating.

After elimination of the water which is inherent in the molasses, and of the water which had been added to the charcoal, it is necessary only to cool the mixture and to pass it through a press when the proper temperature has been reached. This temperature, when straight charcoal is used as the base, is the ordinary atmospheric temperature, or approximately 60° F. The mixture at this temperature is readily pressed and the briquettes formed thus in a roll type press will hold their shape. To complete them, however, it is necessary that they be baked to carbonize the molasses, but this may readily be done by passing them through a heating zone or oven, by reason of the fact that all excess water has been eliminated, which requires heating but for a short period and at a not excessive temperature to accomplish carbonization of the binder.

By reference to Figure 1, the entire process as relates to the employment of charcoal, will be understood at a glance. The charcoal is admitted from a hopper 1. When first admitted, it will usually be dry and varying in sizes from fine dust to chips. It is passed through a conveyor and mixer, indicated at 2, and upon its delivery to the conveyor a water spray 3 adds sufficient moisture to it to keep the dust from flying about. This mixing is continued long enough to thoroughly incorporate the water with the charcoal. I have found that water to the extent of eight per cent of the charcoal is sufficient to accomplish my purpose.

When this water is thoroughly incorporated into the mass of charcoal, the mixture is passed through a grinder, indicated at 4, where it is reduced to a fine powder. The addition of water prevents this powder from flying about in the grinder and the entire mass may be handled by gravity or by other means and delivered from the grinder 4 to a hot mixer 5. A gas burner 6, or other means, may be employed to heat the ground mass as it passes through the mixer 5. In this manner the water is eliminated to a considerable degree, but not entirely. Prior to entire elimination of the water, hot molasses from a tank 12 is admitted to the mixer 5 and this molasses, being hot, mixes readily with the still moist charcoal and is disseminated throughout the mix. The mixing is continued until enough molasses is added to produce, after final baking, a sufficiently hard briquette. I have found that approximately thirty-five per cent of molasses by weight of the finished briquette best accomplishes this result, though more or less will accomplish approximate results. A second hot mixer 7 is provided for the purpose of mixing in the molasses, this mixer being heated by a second gas jet 6. In this manner the remaining water, which was added from the

sprayer 3, is eliminated, and the moisture, which comprises approximately twenty per cent of the molasses, is also largely eliminated, but the mixture is not heated to the point where the molasses will begin to carbonize.

When the water is substantially eliminated from the mix, the mixture is delivered to a cooler 8, water for cooling being admitted at 80 and passing out at 81 from the jacket surrounding the mixer. The material is advanced through this mixer until it reaches ordinary room temperature, such as 60° F. It is then delivered to a roll type briquetting press, indicated by the complemental rolls 9. From these, the finished briquettes are dropped upon a conveyor or belt 10 and are passed through an oven 11. In this oven the briquettes are baked for a short time at a temperature sufficient to carbonize and harden the molasses and when removed from the oven and cooled, they will stand any ordinary handling and shipping and, further, will not break up when burned or if the fire is shaken or otherwise disturbed. This carbonization, or baking of the briquettes may be done in any known manner, the precise manner in which it is done forming no part of my invention.

The essential features of the process may be employed for mixtures of charcoal and coal, or, indeed, may be employed with raw coal alone. Reference to Figure 2 will illustrate an arrangement of apparatus for carrying out the process as applied to coal or mixtures of coal and charcoal.

According to this process the raw ground coal in any percentage desired is delivered from a hopper 20 to a hot mixer 21. A gas jet 6 is employed for heating the mixture, or any other suitable means may be used. In this mixer the coal is heated and any excess water is driven therefrom. It is not heated to a point to drive off the volatiles, however. Heated molasses from a tank 12 is then added. This molasses is best in the proportion of fifteen to thirty per cent of the total weight of the briquette.

The mixture of coal and molasses is then passed through a further hot mixer 22 where the water is largely eliminated from the molasses. At this point, if charcoal is to be mixed with the coal, the cold ground charcoal is added as from a hopper 23. If the coal and molasses are mixed first, it is very difficult to mix the charcoal into this mixture with molasses binder. The percentage of molasses and charcoal may be widely varied and will ordinarily be determined by the availability of these two materials.

Upon the addition of the charcoal the mixture is passed into a mixer 24 wherein the mixing is continued while the mass is cooling. Water pipes, 25 and 26, are provided as illustrating a means for cooling the mix-

ture. While the cooling is in progress and when the mass has reached a tacky consistency, it is passed into a press, comprising the complementary rolls 9, and is then delivered to a belt conveyor 10, by means of which it is passed through an oven 11, where the molasses is carbonized, as in the straight charcoal process.

It will be observed that the mixture must be heated before addition of the molasses. Hence the addition of water to retain the charcoal in condition for handling requires but little additional heat to eliminate it and the molasses could not be added unless the water were present in the straight charcoal process. Thereafter it becomes necessary to eliminate the water inherent in the molasses and the water previously added comprises but a small percentage of the water which is ultimately eliminated.

By eliminating a large portion of the water during the next heating of the mixture, the final baking requires but a short time and but low temperatures. The temperatures are generally sustained, except as the mixture must be cooled, to permit it to be pressed properly. At no time, however, do these temperatures rise to a point, nor are they sustained long enough, to drive off any considerable percentage of volatiles from the mass. Thus, there is preserved in the briquette the combustible volatiles such as are inherent in lignite and bituminous coals.

What I claim my invention is:

1. The process of briquetting fuel by the use of a molasses binder which consists in heating the base fuel material, adding thereto and mixing therewith the molasses, continuing heating of the mixture to drive off the water contained in the molasses, but maintaining the temperatures throughout below that required to drive off the volatiles, cool-

ing the mixture to a briquetting consistency, pressing the mixture, and finally baking the briquettes to carbonize the binder.

2. The process of preparing fuel for briquetting, with the use of a molasses binder, which consists in heating the fuel materials to a point less than sufficient to drive off all volatiles therefrom, adding thereto and mixing therewith the molasses, heating the mixture to drive off the water from the molasses, and finally cooling the mixture to a briquetting temperature.

3. The process of preparing volatile-bearing fuel materials for briquetting which consists in heating the fuel material to a point less than sufficient to drive off the volatiles, adding hot liquid molasses thereto and mixing the same therewith, further heating the mixture to expel moisture from the fuel and from the molasses, adding finely divided carbonaceous material to and incorporating it into the mixture, and finally reducing the temperature of the mass to one suitable for pressing.

4. The process of briquetting volatile-bearing fuel materials which consists in heating the fuel material to a point less than sufficient to drive off the volatiles, adding hot liquid molasses thereto and mixing the same therewith, further heating the mixture to expel moisture from the fuel and from the molasses, adding finely divided carbonaceous material to and incorporating it into the mixture, and finally reducing the temperature of the mass until the mass reaches a tacky consistency, pressing the individual briquettes, and heating them to carbonize the molasses.

Signed at Seattle, Washington, this 20th day of September, 1926.

PAUL C. MULLIGAN.