

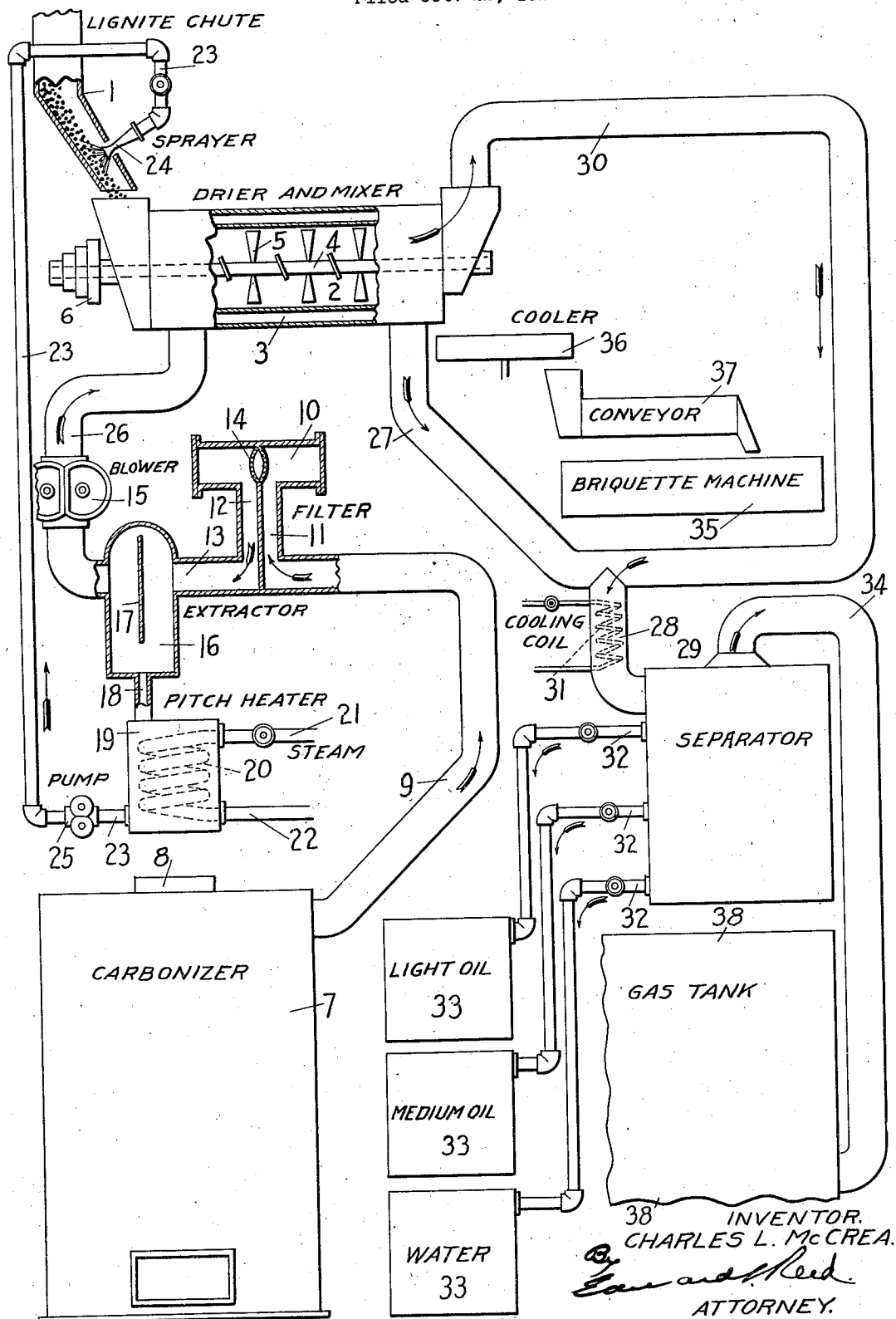
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METHOD FOR MANUFACTURING BRIQUETTES FROM LIGNITE

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METHOD FOR MANUFACTURING BRIQUETTES FROM LIGNITE.

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This invention relates to a method and apparatus for manufacturing briquettes from lignite.

It has been proposed heretofore to manufacture briquettes from lignite by crushing the lignite, extracting the moisture therefrom, mixing the dried lignite with a binder and then pressing the same into briquettes, but much difficulty has been experienced in securing a briquette of commercial quality and so far as I am informed no practical commercial lignite briquette has been produced up to this time. Briquettes of this character must have certain definite characteristics in order to be practical and of commercial value and the processes heretofore used have not, so far as I am informed, been such as to produce a briquette having these characteristics. The briquette must be of such hardness and strength that it will not be subject to undue breakage in the ordinary handling and shipping of the product and, further, the binder which is employed for uniting the particles of crushed lignite into a briquette must have substantially the same combustion characteristics as the lignite itself so that the whole briquette will be consumed with substantial uniformity. If the binder is consumed more rapidly than the lignite the briquette will quickly disintegrate on the furnace grate leaving there a mass of crushed fuel which will not readily burn.

One object of the invention is to provide a method whereby a briquette having these essential characteristics may be produced; and by means of which such a briquette may be produced in large quantities at a relatively low cost and by the use of a comparatively simple apparatus.

Other objects of the invention are to provide a method of producing briquettes in which the by-products may be saved and utilized.

A further object of the invention is to provide a suitable apparatus for carrying out the method.

Other objects of the invention will appear as it is described in detail.

The accompanying drawing is a diagrammatic illustration of one form of apparatus by means of which the method may be performed.

In carrying out my method the lignite is

first crushed and then mixed with pitch, which has been extracted from lignite other than that from which the briquettes are to be formed, and this mixture of pitch and crushed lignite is dried to extract therefrom the desired percentage of the moisture, and the dried mixture of binder and lignite is then cooled and delivered to the briquette forming machine where it is, pressed into briquettes. In extracting the pitch from the lignite, to provide the binder, various volatile elements of the lignite will be liberated in the form of gases, or vapors, and these gases, which are very hot, may be utilized for heating the drier. Regardless of whether or not these gases are utilized for heating the drier they are subsequently subjected to the action of a condenser and the oils and gases separated and preserved for use.

In order to form briquettes having the necessary hardness and strength it is important that a certain amount of the moisture be retained in the mixture of lignite and binder when the latter is delivered to the briquette machine. If the mixture is too dry the briquettes will not be properly formed and the material will obstruct the machine. If too large a percentage of moisture is retained in the mixture the briquettes will dry after they have been formed, which will result in the briquettes checking and cracking in such a manner as to cause them to readily break in ordinary handling and shipping. The percentage of moisture which is retained in the mixture will, of course, vary according to the moisture content of the lignite, which varies in different deposits, but with the ordinary lignite I have found that most satisfactory results may be secured by extracting approximately ninety per cent of the moisture and retaining the remaining ten per cent in the mixture when this is delivered to the briquette machine. However, the moisture retained in the mixture may be decreased or increased and satisfactory results still secured. Very good briquettes may be produced from a mixture containing fifteen or twenty per cent of moisture.

In the present drawing I have shown in diagram an apparatus by means of which the method may be carried out but it will be understood that this particular apparatus

is here shown for the purpose of illustration only and that the character and arrangement thereof may vary greatly from the illustration.

5 The lignite from which the briquettes are to be formed is first crushed into relatively fine granular form. This may be accomplished by any suitable crushing machine and I have not in the present drawings illustrated such a crusher. The crushed lignite is delivered from the crusher, by means of a suitable conveyor, to the drier and, in the present instance, this conveyor is shown in the form of a chute 1 of a wide flat character so that the crushed lignite will move through the same in a wide thin layer. This conveyor discharges the lignite into a drier 2 which may be of any suitable character and is here shown as an elongated cylinder surrounded by a jacket 3 adapted to receive a heating fluid. The drier is provided with suitable means for moving the lignite through the same and agitating the same as it moves from one end of the drier to the other and in practice the drier will be set at an inclination so that the movement of the lignite through the same will be assisted by gravity. The present drier has mounted therein a longitudinally extending shaft 4 to which are secured a series of propelling and agitating blades 5 which act upon the pulverized material to move the same lengthwise of the cylinder and to agitate the same. This shaft may be provided with any suitable driving means by which it may be rotated and this driving means is preferably of such a character that the speed of rotation of the shaft may be controlled so as to regulate the speed at which the material is moved through the drier, thus enabling the desired drying action to be secured. In the present instance, the driving means is shown as a stepped pulley 6, which may be belted in a well known manner to any suitable source of power.

As the crushed lignite is conveyed to the drier it is mixed with a suitable binder which, in the present form of the apparatus, is sprayed onto the thin bed or layer of lignite as it travels toward the drier. In order that this binder may have the same combustion characteristics as the lignite itself I have utilized as the binder, pitch extracted from lignite other than that which is to be formed into briquettes but of the same character and qualities. To this end a body of crushed lignite is treated in a carbonizer 7 of any suitable character which will cause the lignite to throw off the pitch and other volatile ingredients. The lignite is delivered to the carbonizer in a crushed form and may be secured from the same crushers which provide the lignite for the briquettes and this delivery may be by conveyor or in any other suitable manner. In

the present illustration I have not shown the conveyor for delivering the lignite to the carbonizer but have provided the carbonizer with a charging opening 8 at the upper end thereof through which the lignite is delivered thereto. The quantity of lignite treated in the carbonizer is so regulated as to provide the desired quantity of pitch for mixture with the lignite from which the briquettes are to be formed. While the amount of pitch thus delivered to the lignite from which the briquettes are to be formed may vary I prefer to add to this lignite a quantity of pitch equal to approximately one-half the quantity of the pitch contained in this lignite itself, thereby increasing the pitch content of the lignite approximately fifty per cent. Consequently I deliver to the carbonizer a quantity of lignite equal to approximately one-half the quantity delivered to the drier. The gases and vapors which are liberated from the lignite in the carbonizer escape therefrom through a conduit 9, the pitch being carried in suspension with the gases and other vapors. This conduit leads first to a filter by means of which the pitch is, to a large extent, separated from the gases and vapors. As here shown, this filter is in the form of an elongated cylindrical structure 10 having an inlet 11 connected with the conduit 9 and having an outlet 12 connected with a conduit 13 which, in effect, forms an extension of the conduit 9. Interposed between the inlet 11 and outlet 12 of the filter is a body of filtering material 14, such as mats of woven glass. The filtering material 14 will separate from the gases and vapors the pitch which is in suspension therein and this pitch will pass out of the filter through the discharge opening 12, along with the vapors and gases. The conduit 13 leads to a pitch extractor 16 and that portion of the pitch which has been separated from the gases and the vapors by the filter will flow into this extractor while the gases and vapors themselves will be discharged against a baffle plate 17 which will separate therefrom any pitch which may remain in suspension therein. The pitch which is thus delivered to the extractor is discharged therefrom through an outlet 18 to a heater 19 where the temperature of the pitch is increased to such an extent that it is highly liquid in form. The heater may take various forms but is here shown as a receptacle having therein a steam coil 20 connected by an inlet pipe 21 with any suitable source of steam supply and having an outlet or exhaust pipe 22. A discharge pipe 23 leads from the lower portion of the pitch heater 19 to a point adjacent to the conveyor 1 where it is provided with a discharge nozzle 24 of such a character as to spray the hot liquid pitch over the mass of crushed lignite as the latter travels toward

the drier. As here shown the nozzle is mounted in a suitable opening in the upper wall of the conveyor and is of such a character as to spray the pitch uniformly over the entire width of the layer of lignite thus causing the pitch to be mixed with the lignite uniformly. Preferably a pump 25 is interposed in the discharge pipe 23 to force the liquid pitch to the nozzle and through the same with sufficient force to secure the desired spraying action.

The heat for the drier 2 may be secured from any suitable source but, in the present instance, I have utilized the hot gases from the carbonizer for this purpose. To this end a conduit 26 connects the pitch extractor 16 with one end of the jacket 3 of the drier and the gases passing through this jacket are discharged near the end thereof through a conduit 27 which is connected with a conduit 28 leading to a separator 29. A suitable pump or blower 15 is interposed in the gas line to cause the gases and vapors to flow through the same and this pump is preferably located beyond the pitch extractor so that the pitch will not interfere with its operation. The action of the heat on the lignite and pitch in the drier releases certain gases and vapors therefrom and these gases are discharged from the drier through a conduit 30, which is also connected with the conduit 28 leading to the separator 29. Interposed in the conduit 28 is a condenser which, in the present instance, is shown as a cooling coil 31 mounted in the conduit 28 and connected with a suitable supply for cold water. As the gases and vapors pass through this condenser the vapors are condensed and delivered to the separator in liquid form. This liquid consists in the most part of water and oil and the water will settle to the bottom of the separator and the oils of different weights will rise above the same. The separator is provided with suitable discharge pipes 32, through which the liquids may be withdrawn and, in the present instance, I have provided three such pipes, one near the bottom for drawing off the water, one at a somewhat higher level for drawing off the medium oils, and one near the top for drawing off the light oils. These discharge pipes lead to storage receptacles 33. The gases which are not condensed escape from the separator through a conduit 34 which leads to a gas storage tank 38. This gas being of a combustible character may be employed for the purpose of securing the heat and power necessary for the operation of the apparatus.

The pulverized lignite, which has been coated with fair uniformity with the pitch, is passed through the drier 2 at such a speed that the heat to which the drier is subjected will drive off the desired quantity of moisture and this mixture of lignite and

pitch, containing a relatively small percentage of its original moisture, is delivered to a briquette machine 35. Preferably the mixture is cooled before delivering it to the briquette machine and, as here shown, a rotary cooling tray 36 receives the mixture from the drier and delivers it to a conveyor 37 which in turn delivers it to the briquette machine.

While I have described in detail my method of producing lignite briquettes and have illustrated and described one form of apparatus for carrying out this method, I do not wish to be limited to the details, either of the method or of the apparatus, as various modifications of both will readily occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. The method of producing lignite briquettes, consisting in crushing the lignite, mixing the same with pitch extracted from lignite other than that from which the briquettes are to be formed, treating the mixture to extract therefrom all but a relatively small part of the moisture and then forming the mixture into briquettes.

2. The method of producing lignite briquettes, consisting in crushing the lignite, mixing the same with pitch extracted from lignite other than that from which the briquettes are to be formed, treating the mixture to extract therefrom all but a relatively small part of the moisture, cooling the mixture and then forming the same into briquettes.

3. The method of manufacturing lignite briquettes, consisting in crushing the lignite, mixing the same with pitch extracted from lignite other than that from which the briquettes are to be formed, treating the mixture to extract therefrom approximately ninety per cent of its moisture, retaining the residue of the moisture in said mixture, and delivering the mixture to a briquette forming device.

4. The method of manufacturing lignite briquettes, consisting in crushing the lignite, mixing the same with a binder, delivering the crushed lignite and binder to a drier, so regulating the action of the drier as to drive off all but a relatively small part of the moisture contained in said lignite and said pitch, and forming the mixture delivered from the drier into briquettes.

5. The method of producing lignite briquettes, consisting in crushing the lignite, mixing therewith a quantity of pitch extracted from lignite other than that from which the briquettes are to be formed and equaling in quantity approximately fifty per cent of the quantity of pitch contained in the lignite from which the briquettes are to be formed, drying the mixture to extract

all but a small percentage of the moisture therefrom and forming the dried mixture into briquettes.

6. The method of producing lignite briquettes, consisting in crushing the lignite, spreading the crushed lignite in a relatively thin layer, spraying over said layer of crushed lignite a quantity of hot pitch extracted from lignite other than that from which the briquettes are to be formed, extracting all but a relatively small amount of the moisture from the mixture of lignite and pitch and then forming said mixture into briquettes.

7. The method of producing lignite briquettes, consisting in crushing the lignite from which the briquettes are to be formed, treating other lignite to extract the pitch therefrom, heating said pitch, mixing the heated pitch with the crushed lignite from which the briquettes are to be formed, extracting all but a relatively small percentage of the moisture from said mixture of lignite and pitch and then forming said mixture into briquettes.

8. The method of producing lignite briquettes, consisting in crushing the lignite from which the briquettes are to be formed, delivering the crushed lignite from the crusher in a relatively thin layer, treating lignite other than that from which the briquettes are to be formed to extract pitch therefrom, heating said pitch, spraying the heated pitch over said thin layer of crushed lignite, extracting from said crushed lignite and pitch all but a relatively small amount of moisture contained therein and then forming said mixture into briquettes.

9. The method of producing lignite briquettes, consisting in crushing the lignite from which the briquettes are to be formed, treating a quantity of lignite equal to approximately one-half of the quantity from which the briquettes are to be formed to extract the pitch therefrom, spraying said pitch in a heated condition over the crushed lignite from which the briquettes are to be formed, extracting all but a small amount of the moisture from said crushed lignite and pitch and then forming the mixture of lignite and pitch into briquettes.

10. The method of producing lignite briquettes, consisting in crushing the lignite from which the briquettes are to be formed, treating lignite other than that from which the briquettes are to be formed to extract

therefrom the pitch and volatile substances, separating the pitch from the vapors and gases driven off from said last mentioned lignite, mixing the pitch with the lignite from which the briquettes are to be formed, utilizing the heated gases and vapors from the last mentioned lignite to drive off all but a small amount of the moisture from the lignite and pitch from which the briquettes are to be formed and then forming said lignite and pitch into briquettes.

11. The method of producing lignite briquettes, consisting in crushing the lignite from which the briquettes are to be formed, treating lignite other than that from which the briquettes are to be formed to extract therefrom the pitch and volatile substances, separating the pitch from the vapors and gases driven off from said last mentioned lignite, mixing the pitch with the lignite from which the briquettes are to be formed, utilizing the heated gases and vapors from the last mentioned lignite to drive off all but a small amount of the moisture from the lignite and pitch from which the briquettes are to be formed, then forming said lignite and pitch into briquettes, and treating said gases and vapors to separate the oils and gases therefrom.

12. The method of producing lignite briquettes, consisting in crushing the lignite from which the briquettes are to be formed, treating other lignite to extract therefrom the pitch and volatile substances in the form of gases and vapors, separating the pitch from said gases and vapors, delivering the pitch in a heated condition to the lignite from which the briquettes are to be formed, extracting all but a relatively small amount of the moisture from said mixture of lignite and pitch, forming said mixture into briquettes, and treating said gases and vapors to separate the oils and combustible gases.

13. The method of producing lignite briquettes consisting in crushing the lignite, spreading the crushed lignite in a relatively thin layer, spraying a heated binder over said crushed lignite, extracting all but a relatively small amount of the moisture from the mixture of lignite and binder and then forming said mixture into briquettes.

In testimony whereof, I affix my signature hereto.

CHARLES L. McCREA.