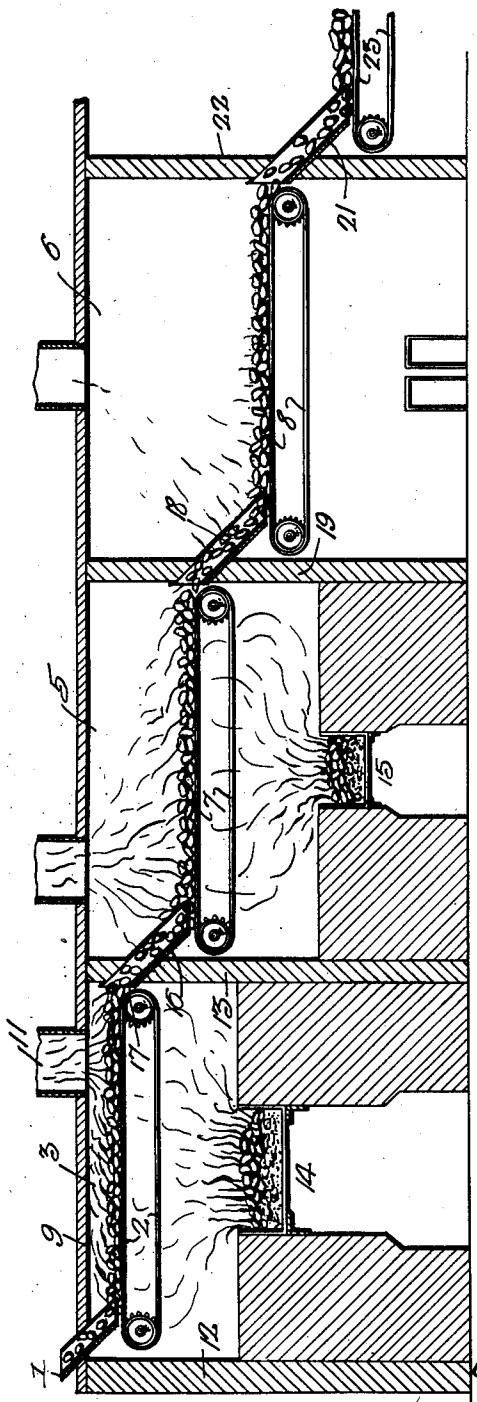
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APPARATUS FOR THE CARBONIZING OF BRIQUETTES

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APPARATUS FOR THE CARBONIZING OF BRIQUETTES

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My invention relates to furnaces, and it has particular relation to such furnaces as are particularly adapted to the manufacture of briquettes.

The coal mining industry, from the beginning, has been continuously presented with the problem of eliminating losses caused by the unavoidable production of unsalable, undersized particles of coal during the drilling, fracturing and crushing operations necessary to prepare the coal for market. Such small, undersized particles of coal are known in the trade as culm, silt, fines, or slack.

Technically trained fuel experts have spent years in study and research in an effort to discover satisfactory methods of utilizing such waste material, but so far such efforts have been unsuccessful, though involving the expenditure of large sums of money. Without referring to the various methods that have been experimented with, one method, in particular, appears to offer the most practical solution of the problem, namely, that of making the fines or culm into nuggets or briquettes. The disadvantages of the briquettes of the prior art are the smoke, soot, odor and obnoxious gases which result from burning the same. Moreover, many of the briquettes produced are not water proof, they do not stand weathering and they readily disintegrate in the fire. An object of my invention, therefore, is to provide a briquette that shall avoid the above-noted objections.

After a considerable period of experimental work and study, I have found that smokeless, odorless and non-softening briquettes may be made with a tar binder either as a sole binding agent or in combination with other substances of vegetable or organic or inorganic nature, by an open flame, semi-carbonizing process, wherein the briquettes are subjected to such a temperature as to cause the same to ignite almost instantly upon their introduction into a specially designed furnace. The burning briquettes are then successively conveyed through one or more heated chambers of the furnace and subsequently discharged onto a conveyor operating in a cooling chamber.

Another object of my invention is to provide a furnace especially designed for the production of smokeless, odorless non-softening briquettes, said furnace being equally adapted to the treatment of anthracite coal, bituminous coal or other carbonaceous materials.

Other objects and applications of my invention, as well as details of construction and operation, whereby my invention may be practiced, will appear more fully hereinafter, when taken in connection with the accompanying drawing, wherein

The single figure of the drawing is a sectional view of a furnace embodying my invention.

To facilitate the description and understanding of my invention, I shall now describe the various steps in the manufacture of a smokeless, odorless, non-softening briquette from Lehigh anthracite coal. The binder employed for this type of coal is coal tar and silicate of soda or dextrine emulsion. The tar preferably has a melting point of 90 degrees F. and the sodium silicate a density of Baumé 40 or 42, under which temperature and density the tar and sodium silicate combine readily. However, the melting point of the tar may be as high as 170 degrees F. but when higher than 90 degrees F. special heat must be provided to keep the same in a fluid condition. The total binder used may be 10% of the weight of the coal, but it is preferably 8%. This variation depends upon the fineness of the granulated coal, when sized through a screen of one-sixteenth inch round mesh and taking all passing the screen as is,—but the coal preferably consists of practically 20% through 100 mesh; 25% through 50 mesh; 20% through 30 mesh; and 15% through 20 mesh.

The binder and the coal are fed into a rotary paddle mixer and kneaded until the coal particles are coated with binder, whereupon the mixture is passed through a rotary press (not shown). The resulting briquettes are then discharged through a chute 1 onto a conveyor 2 which is positioned in one section 3 of a furnace 4. The furnace 4 is also provided with additional sections or open combustion chambers 5 and 6 and conveyors 7

and 8, respectively. The conveyor 2 is disposed in the upper portion of the chamber 3 immediately adjacent to an upper side 9 thereof, the latter being provided with an exhaust stack 11. The remaining chambers 5 and 6 are provided with similar exhaust stacks. The conveyor 2 extends between outer and inner walls 12 and 13, respectively, of the chamber 3. A fire box 14 of conventional design is positioned in the base portion of the open combustion chamber 3, and it serves to heat said chamber 3 to such temperature as to cause the briquettes to ignite into a flame almost immediately upon entering the same. In other words, the briquettes quickly heat up to such point that the gases emitted therefrom ignite. There is thus a burning of the briquettes in open flame, resulting in a semi-carbonization of the material of the briquettes but no ashing of the surface thereof since the flame does not come in actual contact with the briquette surface. For the particular type of coal under consideration, this temperature is substantially between 900 and 950 degrees F.

As a result of the presence of sodium silicate or other organic substance in the briquette, it almost immediately hardens when introduced into the furnace. The burning briquettes are thus conveyed across the heated combustion chamber 3 at a predetermined rate, say 3 feet per min., and the briquette is thus partially carbonized. Experience has shown that when the briquettes on the conveyor 2 have become ignited into a flame, i. e., the gases from the briquettes have become ignited, the primary source of heat 14 may be dispensed with inasmuch as the necessary heat for the treatment of the briquettes is produced by the open flame combustion of the gases produced from said briquettes. Thus the heat treatment of the briquettes in the chamber 3 becomes an automatic one.

Should the heavy soot element of the briquettes be not removed after passing through the heated chamber 3 and then require a further heat treatment, a fire box 15 may be caused to heat the open combustion chamber 5 to the desired temperature. A chute 16 extending through the wall 13 of the chamber 5 serves to convey the burning briquettes from the conveyor 2 to the conveyor 7. An upper edge 17 of the chute 16 is positioned immediately adjacent to the conveyor 2 in order to prevent such briquettes as may adhere thereto from being carried around to the underside of the conveyor. The advantages of a sectional conveyor system of the type shown in the drawing are apparent. For example, it tends to prevent the briquettes from sticking to the conveyors by periodically dropping the briquettes from one conveyor to another, as well as simplifying the construction of the conveyor.

The hardening of the briquettes due to the presence of sodium silicate or dextrine prevents the breaking of the same upon the passage from the conveyor 2 to the conveyor 7. A chute 18 is mounted in a second wall 19 of the chamber 5, and it serves to convey the briquettes to the conveyor 8 in the chamber 6. This chamber serves to cool the briquettes below the flaming point, say to approximately 800 degrees F., whereupon the briquettes may be discharged through a chute 21 which is positioned in a remaining wall 22 of the cooling chamber 6. The chute 21 is operatively associated with a conveyor 23 which leads to further cooling means (not shown), whereupon the briquettes may be cooled and stored. A briquette resulting from the foregoing process has been found to be smokeless, odorless, semi-carbonized and to have a relatively high volatile content.

My invention also contemplates the manufacture of briquettes from non-coking bituminous, strong-coking bituminous coal and gaseous bituminous coal. When the non-coking bituminous coal is used, the binder comprises approximately 25% tar and 75% sodium silicate. The percentage of the binder to the coal is 10% or less according to the sizing of the coal. The treatment in the furnace 4 is substantially the same as that just described for the anthracite coal, the time in the chamber 3 being approximately fifteen minutes. As will be apparent, the tar constitutes the coking medium for the non-coking coal and the silicate of soda adds sufficient strength to the raw coal briquette to hold the same together until the desired carbonization is completed. The sodium silicate also serves to lower the fusing point of the coal and to prevent the disintegration of the briquettes in the fire before they are completely burned to ash.

The binder for the strong-coking bituminous coal may comprise a half and half solution of sodium silicate and water. The percentage of binder to coal is 10% or less according to the sizing of the coal. The natural tar content of the coal in the present material is the coking element and the solution of sodium silicate constitutes the preliminary binder.

The gaseous bituminous coal has a high tar content, so that it tends to soften and run under moderate heat. In accordance with my invention, such coal is mixed with such other coals as non-coking bituminous or anthracite coal, or it is mixed with such inorganic substance as clay. When coal is used as a mixture as, for example, anthracite fines, a half and half proportion has been found satisfactory. When clay or other inorganic substances are used, the proportions are approximately 10 to 15% inorganic substance and the balance gaseous bituminous coal. The clay or inorganic substance should be dried, pulverized and preferably sized to

pass one-sixteenth inch round mesh screen. The binder used with either of the clay and coal mixtures or a mixture of different coals is silicate of soda, the percentage of binder to coal varying from 4 to 8%. As above noted, the foregoing examples are given for purposes of explanation and illustration and are susceptible to various changes necessitated by the various varieties of coal and the different grades in each variety.

While I have described certain embodiments of my invention in detail, and while I have pointed out certain of the most obvious principles and purposes thereof, I do not intend that the language employed in the following claims shall be limited to the precise features described, but I intend that the claims shall be construed to cover all combinations which are fairly included in the language thereof, when read in connection with the prior art, regardless of the details and functions mentioned in the description or illustrated in the drawing.

I claim:

1. Apparatus for the carbonizing of briquettes, comprising a furnace having a plurality of independent chambers, a horizontally disposed flat conveyer in each chamber for supporting and progressively transporting briquettes through the said chambers respectively, the receiving end of one chamber lying immediately adjacent the delivery end of the preceding chamber, the conveyers in the successive chambers being respectively disposed in relatively lower planes than the conveyer in the preceding chamber, chutes adjacent the delivery end of each conveyer adapted to remove the briquettes from the respective conveyers and direct them to the next succeeding conveyer, and a heat generating means located directly in the bottom of each of the first pair of the chambers receiving the briquettes for raising the temperature in these respective and independent chambers to desired degrees.

2. Apparatus for the carbonizing of briquettes, comprising a furnace having a plurality of independent chambers, a horizontally disposed flat conveyer in each chamber for supporting and progressively transporting briquettes through the said chambers respectively, the receiving end of one chamber lying immediately adjacent the delivery end of the preceding chamber, the conveyers in the successive chambers being respectively disposed in relatively lower planes than the conveyer in the preceding chamber, chutes adjacent the delivery end of each conveyer adapted to remove the briquettes from the respective conveyers and direct them to the next succeeding conveyer, a heat generating means located directly in the bottom of each of the first pair of the chambers receiving the briquettes for raising the temperatures in these respective and independent chambers to desired degrees, and means for carrying the heat, radiating from the briquettes, from a succeeding chamber to permit the briquettes to cool therein.

3. Apparatus for the carbonizing of briquettes, comprising a furnace having a plurality of independent and lineally aligned chambers, a horizontally disposed flat conveyer in each chamber for supporting and progressively transporting briquettes through the said chambers respectively, the receiving end of one chamber lying immediately adjacent the delivery end of the preceding chamber, the conveyers in the successive chambers being respectively disposed in relatively lower planes than the conveyer in the preceding chamber, chutes adjacent the delivery end of each conveyer adapted to remove the briquettes from the respective conveyers and direct them to the next succeeding conveyer, and a heat generating means located directly in the bottom of each of the first pair of the chambers receiving the briquettes for raising the temperature in these respective and independent chambers to desired degrees.

4. Apparatus for the carbonizing of briquettes, comprising a furnace having a plurality of independent chambers, a horizontally disposed flat conveyer in each chamber for supporting and progressively transporting briquettes through the said chambers respectively, the receiving end of one chamber lying immediately adjacent the delivery end of the preceding chamber, the conveyers in the successive chambers being respectively disposed in relatively lower planes than the conveyer in the preceding chamber, chutes adjacent the delivery end of each conveyer adapted to remove the briquettes from the respective conveyers and direct them to the next succeeding conveyer, and a fire box located directly in the bottom of each of the first pair of the chambers receiving the briquettes and adapted to burn suitable fuel for raising the temperature in these respective and independent chambers to desired degrees.

In testimony whereof, I have hereunto subscribed my name this sixth day of October, 1925.

CHARLES W. SEWELL.