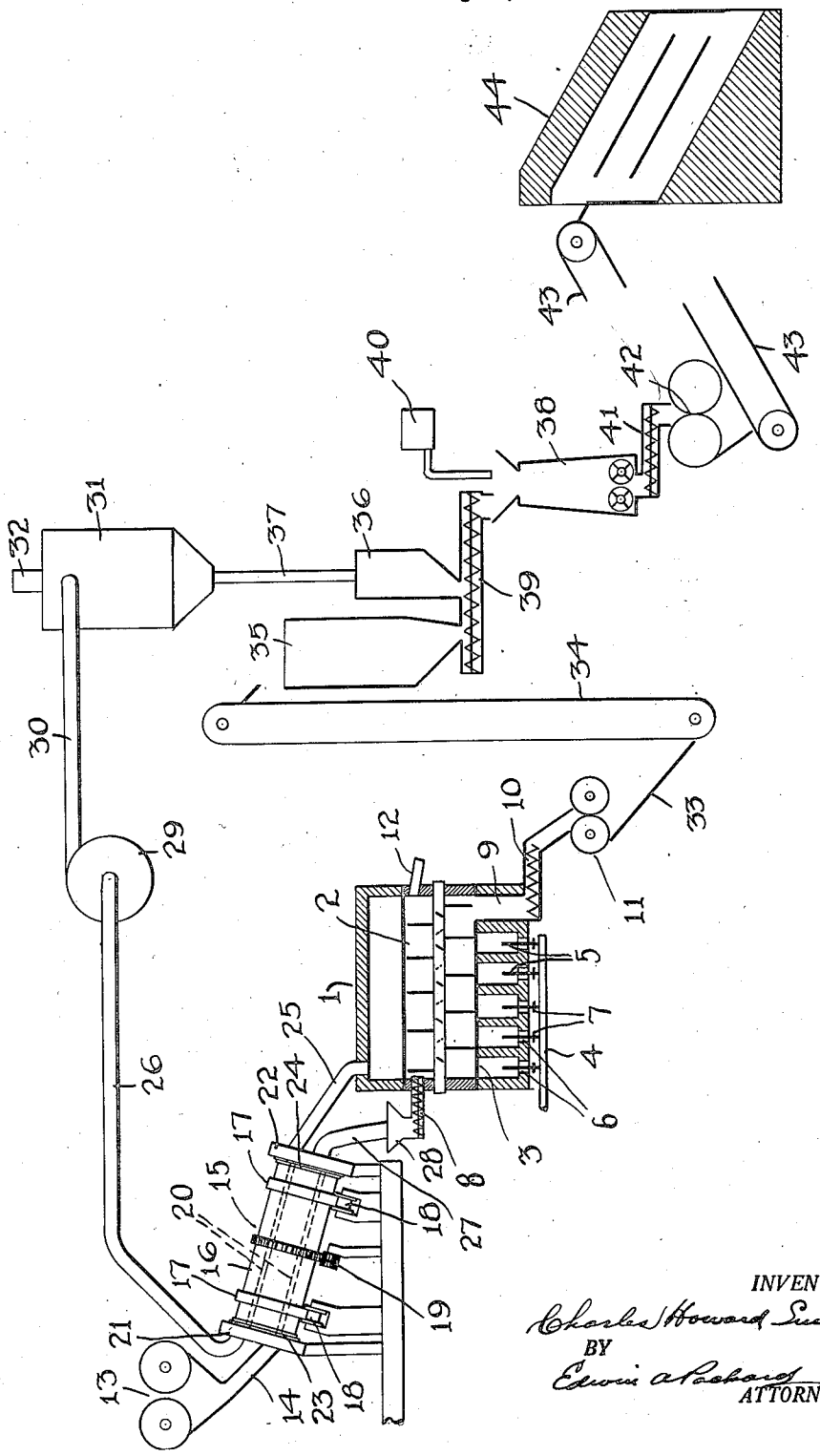
Jan. 22, 1924. 1,481,627

C. H. SMITH

TREATING OF COAL AND MANUFACTURE OF BRIQUETTES

Filed Aug. 9, 1920



INVENTOR.
Charles Howard Smith
BY
Edwin A Packard
ATTORNEY

Patented Jan. 22, 1924. 1,481,627

UNITED STATES PATENT OFFICE.

CHARLES HOWARD SMITH, OF SHORT HILLS, NEW JERSEY, ASSIGNOR TO INTERNATIONAL COAL PRODUCTS CORPORATION, OF RICHMOND, VIRGINIA, A CORPORATION OF VIRGINIA.

TREATING OF COAL AND MANUFACTURE OF BRIQUETTES.

Application filed August 9, 1920. Serial No. 402,153.

To all whom it may concern:

Be it known that I, CHARLES HOWARD SMITH, a citizen of the United States, and a resident of Short Hills, in the county of Essex and State of New Jersey, have made certain new and useful Improvements in the Treating of Coal and Manufacture of Briquettes, of which the following is a specification.

The invention relates to the manufacture of briquettes made from coal by a process which involves two distillations.

A two-stage distillation to which the present invention is particularly applicable may be in short described as follows:—The coal is partially carbonized in a retort at a maximum temperature, for example approximately 950 degrees F. and in a manner to produce a relatively uniform residue. This partially carbonized residue is crushed, a hydrocarbon binding material as coal tar pitch is added, and the mixture is fluxed and formed into briquettes, referred to as raw briquettes. The raw briquettes thus produced are carbonized at a higher temperature, for example approximately 1850 degrees F. Pitch is added to provide a binding material and to bring the hydrocarbon volatile matter in the briquette to the desired amount, for example eleven per cent (11%) to seventeen per cent (17%), whereby when the raw briquette is properly carbonized the resulting briquette is a firm coherent structure. Such a process as that just referred to is described and protected by U. S. Patent No. 1,276,429 dated August 20th, 1918.

According to the present invention a certain quantity of raw coal dust is obtained from the coal to be or in process of being prepared for conversion into briquettes and is added to the partially carbonized residue of the coal prior to a termination of the fluxing operation. This raw coal dust can be relied upon to provide some of the hydrocarbon volatile matter of the raw briquette. It also provides material of a character which adapts itself to or is adaptable for use with the crushed partially carbonized residue so that a briquette of fine grain and excellent quality is realized.

The invention also involves the obtaining of the raw coal dust for use in the briquetting operation.

According to the preferred manner of realizing the invention this raw coal dust is produced and obtained from the mass of raw coal which is thereafter carbonized to produce the uniform partially carbonized residue—prior to the introduction of the coal relatively freed from dust into the retort where it is carbonized.

The invention is concerned with the process and apparatus whereby the features above referred to as well as others hereinafter clearly described are enabled to be realized.

As illustrating a specific apparatus or plant in which the invention may be embodied and performed reference is made to the sole figure of the drawings forming a part of this specification, wherein an apparatus or plant is diagrammatically indicated. In this figure certain parts entering into the apparatus as a whole are shown in section.

Referring now to the drawing in detail, 1 designates a furnace-retort, frequently referred to as the "primary" as in the retort of this furnace-retort an initial or preliminary partial carbonization takes place. The retort proper is designated as 2 and the combustion chamber of the furnace surrounding the retort is designated as 3. Fuel for supporting combustion is supplied to the combustion chamber 3 through a gas supply pipe 4 by means of branch pipes 5. Air is supplied to the combustion chamber 3 in any suitable manner, as through passageways 6 regulated by dampers 7. Dry crushed coal is fed to the interior of the retort 2 by any suitable feeding means, as 8. The manner in which the dry crushed coal is obtained will presently be described in detail. The coal which enters the retort 2 at one end, to wit, the charging end thereof, by the feeding means 8 is delivered from the other end of the retort through discharge passageway 9 to and by suitable conveying means 10 to a crusher, as 11. Within the retort the coal is subjected to a relatively low maximum temperature, to wit, an average maximum temperature of 950° F. and is constantly mixed or agitated while within the retort whereby the residue delivered from the retort through the passageway 9 is a relatively uniform partially distilled coal. The moisture, vapor and gases evolved

during the partial distillation in the retort 2 pass therefrom, as through pipe or conduit 12, to any suitable gas cleaning and collecting apparatus or to any other place where the gas is to be utilized.

Reference has heretofore been made to the fact that dry crushed coal is fed to the interior of the retort by the feeding means 8. This dried crushed coal is obtained by passing coal through suitable crushing and conveying means, as through crusher 13—which may be referred to as the raw coal crusher—by means of which the coal is crushed to the desired fineness and with the formation of dust which results from the crushing operation. The crushed coal with the dust therein passes, as by means of chute 14, to the interior of a suitably constructed dryer 15. This dryer comprises a rotatable tubular shell 16 which is in effect a cylindrical shell that has tracks, as 17, mounted upon suitable anti-friction rollers, as 18. Suitable means, as 19, are provided for revolving the shell. The shell also carries longitudinally extending lifters, as 20. The axis about which the shell rotates has a slight slope with respect to the horizontal and because of this and of the lifters contained therein the material is constantly agitated or turned over within the shell as it rotates and the material also gradually passes along and through the shell. The dryer has suitable heads, as 21 and 22, which are shown as fixed heads, and the chute 14 feeds the coal through the fixed head 21 to the interior upper end portion of the shell 16. Suitable sealing means as 23 and 24 are provided between the heads 21 and 22 on the one hand and the ends of the tubular shell 16 on the other, whereby a relatively tight joint exists between the heads and the shell. The drying of the coal within the shell is effected by means of hot products of combustion—frequently referred to herein as hot gases—which are conveyed by means of conduit 25 leading from the combustion chamber 3 of the furnace on the one hand to and through one of the fixed heads, for example head 22, of the dryer on the other hand. The hot products of combustion or hot gases pass through the tubular shell of the dryer, out through the head 21 to a pipe or conduit 26.

It will readily be appreciated that the coal which enters the dryer at the uppermost end thereof directly contacts with or is directly contacted by the hot gases flowing through the interior of the tubular shell with the result that all portions of the coal within the shell become relatively dry and this dry raw coal passes from the head 22 through a conduit or chute 27 to hopper 28 of the feeding means 8. A suitable fan, as 29, which from some points of view operates as an exhauster and from other points operates as a pump, serves as a means to draw the hot products of combustion through the shell at a considerable velocity with the result that the raw coal dust which is within the coal—and some of which has been produced as a result of the crushing of the coal in the raw coal crusher 13—is swept from the coal while being dried, leaving the pieces of dry coal delivered from the dryer clean and relatively freed from dust. This method, therefore, performs two functions; that of delivering relatively clean coal freed from dust to the interior of the retort and the collecting of a substantial quantity of raw coal dust in a relatively dry condition. From the fan 29 the products of combustion laden with dust are passed by means of conduit or pipe 30 to the interior of a suitable dust separating means, as 31, which is specifically a cyclone separator that is relied upon to separate the dry coal dust from the products of combustion and to collect the coal dust. The products of combustion freed from dust leaves the separating means 31, as through a pipe or opening 32 provided therefor.

Reference has heretofore been made to a crusher 11; said crusher may be considered as the crusher for the partially carbonized coal and it functions to render the partially carbonized coal in a relatively fine condition suitable for briquetting. From the crusher the partially carbonized coal or coal residue is conveyed, as by chute 33 and elevator 34, to a hopper or storage bin 35 provided for that purpose. A small hopper or storage bin, as 36, is provided to receive the raw coal dust delivered to it from the cyclone separator as by means of a pipe or conduit 37. A fluxer 38 is provided to receive a proportioned amount of crushed partially carbonized residue and of the raw coal dust delivered to it by conveying means 39.

It will be appreciated that the crushed partially carbonized coal and the coal dust are fed to this conveying means from the hoppers 35 and 36 and in some constructions of this conveying means there may be more or less of an intimate mixing of the crusher coal and the raw coal dust. Pitch to serve as a binding material may be added to the mixture from any suitable source of supply, indicated as by 40. The fluxer 38 is provided with the necessary attachments as, for example, steam supply pipes and the like, whereby the fluxer can function to render the material being treated in a condition suitable for briquetting. From the fluxer the material passes by any suitable conveying means designated as 41 to a briquetting press, as 42. From the briquetting press the briquettes pass to and upon a cooling conveyor 43 where the briquettes have time to cool and set prior to their introduction into the furnace-retort 44 in the retort of which the briquettes are carbonized at a rel-

atively high temperature, for example 1850 degrees F. The briquettes remain in the retort of this furnace until a firm coherent structure has been developed as a result of the heating and carbonizing which takes place therein. This furnace-retort 44 may be referred to as the secondary or briquette carbonizing furnace.

From what has preceded, it will be manifest (*a*) that the raw coal is crushed and dried in a manner to deliver at one place relatively clean small pieces of coal freed from dust and to collect at another place a substantial quantity of relatively fine dry coal dust; (*b*) that pieces of coal freed from dust, so to speak, are introduced into a retort where the same is partially carbonized; (*c*) that hot products of combustion from the furnace of a furnace-retort wherein the coal is partially carbonized pass into and through the dryer and is employed to sweep the coal dust from the pieces of coal during the drying operation; (*d*) that coal dust remains entrained in the hot products of combustion until a separation is subsequently effected by the dust separating means. It will here be remarked that because of the utilization of the hot products of combustion for this purpose no explosion will take place no matter what proportion of dust may be in the drying and conveying gaseous medium; this because the hot products of combustion constitute in effect an inert gas. (*g*) That coal when partially carbonized is subsequently crushed and that this crushed partially carbonized coal and the raw coal dust are brought together and mixed prior to the termination of the fluxing operation and preparatory to the forming of briquettes. It will here be noted that the bringing together of the crushed partially carbonized coal and coal dust is preferably effected prior to their introduction into the fluxer as herein outlined and that the desired amount of pitch is preferably added to the mixture. (*f*) That the briquettes including the raw coal dust are subsequently cooled and thereafter carbonized in a manner to produce carbonized briquettes of firm coherent structure.

In the manufacture of briquettes by a two-stage distillation process, such as herein outlined, I have found it advisable in many respects to employ a certain quantity of coal dust in conjunction with partially carbonized coal and a method and apparatus are outlined herein whereby coal dust in substantial quantities can be produced and collected for use at the place desired. The use of coal dust at the place indicated also facilitates the manufacture of briquettes that are easily carbonized and of fine quality.

The improvements herein set forth are not limited to the precise construction and arrangement shown and described for they may be embodied in various forms and modifications without departing from the spirit and scope of the invention.

I claim as my invention:

1. In the handling and treating of coal the method involving passing coal through apparatus comprising a crusher and dryer, passing a stream of hot products of combustion through the dryer in direct contact with the coal therein and employing said stream of hot products of combustion to entrain particles of dust within the coal and produced by the crusher and conveying the raw coal dust entrained to a dust separating means where the raw coal dust is collected, passing the dry coal from the drier to the interior of a retort and herein partially carbonizing the coal, crushing the partially carbonized coal, fluxing the same, adding raw coal dust obtained in the manner outlined prior to the termination of the fluxing operation, and forming briquettes from the fluxed material.

2. In the manufacture of briquettes the method which comprises passing coal through a crusher and a dryer, while the coal is passing through the drier also passing a stream of hot products of combustion through the dryer in direct contact with the coal therein and employing said stream of hot products of combustion to entrain particles of dust that are within the coal, conveying the raw coal dust thus entrained to a dust separating means where the raw coal dust is collected, passing the dry coal from which the raw coal dust has been taken to the interior of a retort, partially carbonizing the coal in the retort crushing the partially carbonized coal delivered from the retort, fluxing the same, adding some of the coal dust thus collected to the crushed partially carbonized coal prior to the termination of the fluxing operation, and forming briquettes from the fluxed material.

3. In the manufacture of briquettes, the method which comprises crushing raw coal and thereafter subjecting it to the action of a dryer, passing hot products of combustion from the furnace, of a furnace-retort, wherein coal is being partially carbonized, to and through the dryer to dry the raw coal and to sweep, from the raw coal, dust therein, separating the raw coal dust from the hot gases and connecting the raw coal dust passing the pieces of dry raw crushed coal from which dust has been thus removed to the retort of a furnace-retort and partially carbonizing, crushing the partially carbonized residue, mixing this crushed partially carbonized residue and some of the separated raw coal dust, fluxing the mixture, forming briquettes, and subsequently carbonizing the briquettes.

4. The manufacture of briquettes by the method which comprises partially carbonizing coal in a retort of a furnace-retort, crushing the partially carbonized residue, fluxing the residue, forming briquettes, and subsequently carbonizing briquettes thus produced; and which method is characterizer by subjecting raw coal to be briquetted to a preliminary crushing and drying operation, delivering coal from the preliminary crushing and drying operation to the retort of the furnace-retort and therein partially carbonizing such coal, said drying being effected by hot gases from the furnace of the furnace-retort and which hot gases pass in direct contact with the coal being dried, collecting by means of said hot gases raw coal dust within the coal and produced from the coal by the crushing operation, and adding raw coal dust thus obtained to the partially carbonized residue prior to the termination of the fluxing operation whereby the added raw coal dust becomes a part of the briquettes which are subsequently carbonized.

5. The manufacture of briquettes by a method which involves the partial carbonizing of coal in a retort of a furnace-retort, the crushing of the partially carbonized residue, the fluxing of the residue and the forming of briquettes therefrom, and the subsequent carbonizing of the briquettes thus produced; the method being characterized by the initially subjecting of the coal to crushing and drying in a manner whereby coal is delivered to the retort in a dry condition and in small pieces, and whereby raw coal dust within the coal and produced as a result of the crushing operation is collected in a dry condition, which drying of the coal and the collecting of the dry raw coal dust are dependent upon the employing of the hot products of combustion from the furnace of the furnace-retort; and also being characterized by the adding of the raw coal dust thus obtained to the crushed partially carbonized residue prior to the termination of the fluxing operation whereby the raw coal dust becomes a part of the briquettes which are subsequently carbonized.

6. The manufacture of briquettes by a method which involves the partial carbonizing of coal in a retort of a furnace-retort, the crushing of the partially carbonized residue, the fluxing of the residue, the forming of briquettes of the fluxed material and the subsequent carbonizing of the briquettes thus produced; and characterized by the initial subjecting of the coal to a drying and a crushing operation in a manner whereby coal is delivered to the retort in a hot and dry condition and in small pieces, and whereby coal dust within the coal and produced as a result of the initial crushing operation is collected, which drying of the coal and the collecting of the dry coal dust is dependent upon the employing of the hot gaseous products from the furnace of the furnace-retort; and further characterized by the adding of the raw coal dust thus obtained to the crushed partially carbonized residue whereby the raw coal dust becomes a part of the briquettes which are subsequently carbonized.

7. An apparatus of the class described comprising in combination with a furnace-retort having a retort wherein coal is partially carbonized and a furnace that provides a combustion chamber on the exterior of the retort for heating the latter, of an associated crusher and dryer arranged to crush coal and to dry the coal preparatory to the introduction of the coal into the retort, means between the associated crusher and dryer whereby dry crushed coal is fed to the interior of the retort, a dust collector, means extending from the combustion chamber of the retort to the dryer and from the drier to the dust collector whereby hot products of combustion from the combustion chamber can be passed into the dryer and in direct contact with the coal whereby dust particles that are within the coal or that are produced as a result of the crushing operation can be removed from the coal being dried, can be conveyed from the coal and can be separately collected in the dust collector, a second crusher, a fluxer, means for conveying partially carbonized residue from the interior of the retort into the second crusher, means for conveying the crushed partially carbonized residue to the fluxer, means for introducing the raw coal dust from the dust collector to a position where the coal dust is mixed with the crushed partially carbonized coal prior to the time that the coal passes from the fluxer, a briquetting press, and means for conveying the fluxed material from the fluxer to the briquetting press.

8. In combination in a plant for the manufacture of briquettes, a furnace retort having a retort wherein coal is partially carbonized and a furnace that provides a combustion chamber on the exterior of the retort for heating the latter, associated crusher and dryer arranged to crush coal and to dry the coal preparatory to the introduction of the coal into the retort, means between the associated crusher and dryer whereby dry crushed coal is fed to the interior of the retort, means extending from the combustion chamber of the retort to the dryer whereby hot products of combustion from the combustion chamber can be passed into the dryer and in direct contact with the coal and whereby dust particles that are within the coal or that are produced as a result of the crushing operation can be removed from the coal being dryed and conveyed therefrom, a dust collector, means leading from

the associated dryer and crusher to the dust collector whereby the dust-laden products of combustion are passed to the latter where dust is separated from the hot products of combustion, a second crusher, a fluxer, means for conveying partially carbonized residue from the interior of the retort into the second crusher, means for conveying the crushed partially carbonized residue to the fluxer, means for introducing the raw coal dust from the dust separator to the crushed partially carbonized coal, a briquetting press, means for conveying the fluxed material from the fluxer to the briquetting press, a second furnace-retort, and means for conveying the briquettes to a position where they can be charged into the retorts of the second furnace-retort.

9. An apparatus for the manufacture of briquettes comprising in combination a primary retort wherein coal is partially carbonized, a crusher into which the partially carbonized residue from the retort is delivered, a fluxing apparatus for receiving the crushed partially carbonized residue, a briquetting press for receiving the material from the fluxer, a secondary furnace wherein briquettes are carbonized, and a cooling belt for receiving the briquettes delivered from the press preparatory to the introduction of the briquettes into the secondary furnace, which apparatus is characterized by having an associated crusher and dryer and also a dust collector or dust separating means arranged and operatively associated with the rest of the apparatus so that hot products of combustion from the combustion chamber, which is on the exterior of the primary retort, are by suitable means conveyed to the crusher and dryer whereby they are employed to dry the coal preparatory to the crushed coal entering the primary retort and also to remove raw coal dust from the dry crushed coal and so that the products of combustion laden with raw coal dust are by suitable means conveyed to the dust collector or dust separating means where the raw coal dust is collected, the apparatus also having means whereby the raw coal dust thus collected is introduced into or mixed with the crushed partially carbonized residue.

This specification signed this 3rd day of Aug. A. D., 1920.

CHARLES HOWARD SMITH.