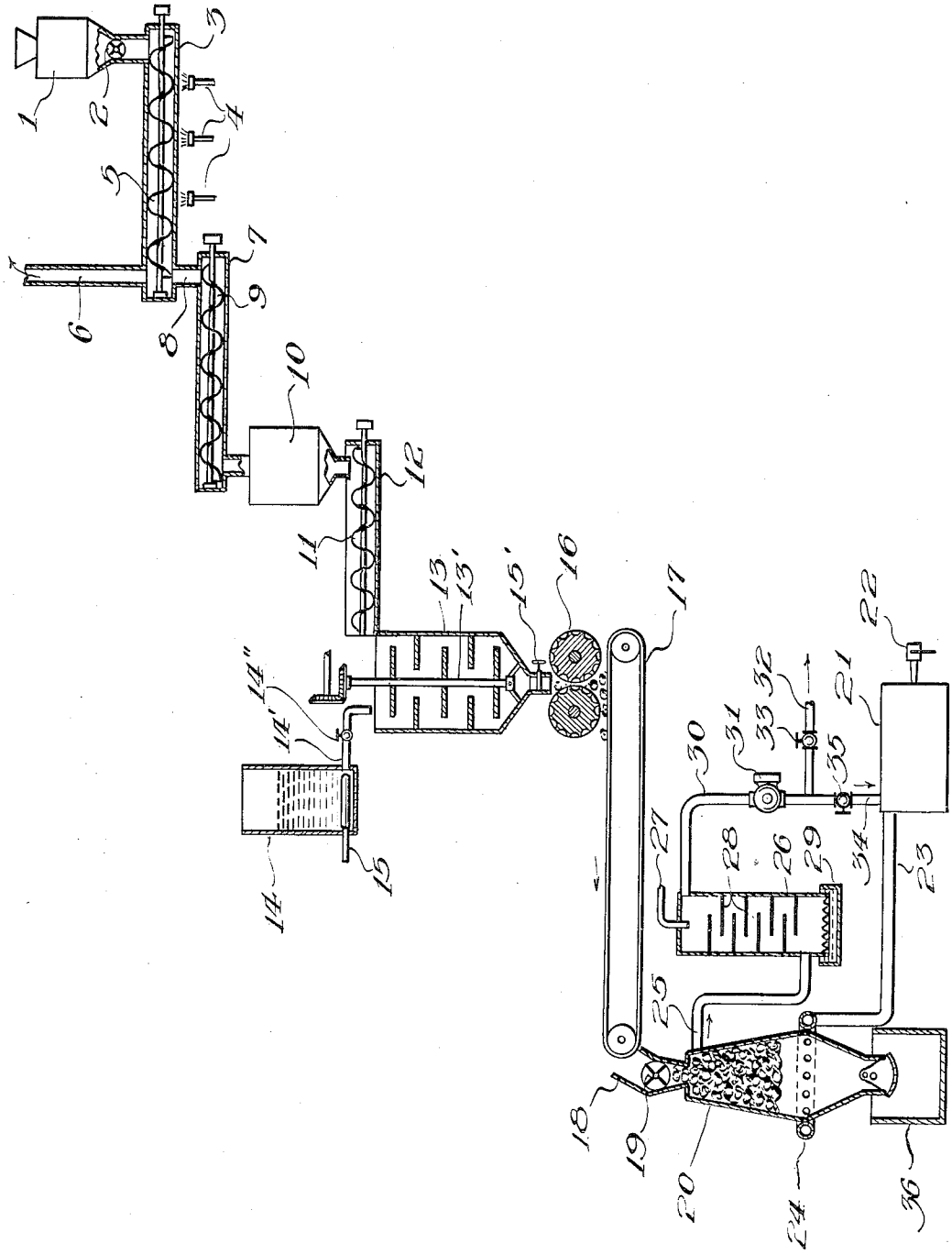
July 4, 1933. A. FISHER 1,916,306

CARBONACEOUS FUEL AND METHOD OF PRODUCING SAME

Filed June 24, 1929



Inventor:
Alfred Fisher,
By Frank L. Bilkuap
Atty.

Patented July 4, 1933 1,916,306

UNITED STATES PATENT OFFICE

ALFRED FISHER, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO UNIVERSAL OIL PRODUCTS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF SOUTH DAKOTA

CARBONACEOUS FUEL AND METHOD OF PRODUCING SAME

Application filed June 24, 1929. Serial No. 373,103.

This invention relates to a process for the production of a carbonaceous fuel from petroleum coke, characterized by a low volatile content and a high crushing strength.

Petroleum coke is produced in large quantities from distilling and cracking processes operating under atmospheric and superatmospheric pressure. I have found that petroleum coke as withdrawn from the expansion or separating chambers of cracking units as a product of the cracking process is not homogeneous insofar as the volatile content in the coke deposited at various points in the chamber is concerned. Hence, this product has had very little value as a fuel due to its high volatile content causing excessive smoke and due to its poor physical structure and low crushing strength, which causes it to rapidly disintegrate into fines, rendering it difficult to transport, handle and burn.

One method proposed for overcoming this difficulty is to mix it with a binder, press it into briquettes and subsequently carbonize the binder. However, the briquette so formed is still an inferior product and has very many disadvantageous features, principally its disintegration upon combustion and the excessive evolution of smoke. While petroleum coke has been produced in this country in quantities of millions of tons, no successful method seems to have been devised by which a satisfactory briquetted fuel could be produced commercially for the reasons outlined above.

As a specific embodiment of my invention I have discovered that by properly treating or conditioning petroleum coke before briquetting, I am able to produce a briquette which has very desirable charactertistics. A briquette made in accordance with the principles of my invention will have a very high fuel value, will burn without objectionable smoke, and will possess a physical structure which permits transportation, handling and combustion without disintegration. Also, the treating of raw petroleum coke before the briquetting of the same, permits, if desired, the manufacture of briquettes without a final carbonization process, and by this means eliminates volatile constituents which give rise to obnoxious odors in use and storage.

In the preparation of petroleum coke for the manufacture of briquettes it has not been heretofore appreciated that it was necessary to condition it prior to any attempt at briquetting. Petroleum coke varies widely in characteristics, and as it is essential in producing satisfactory briquettes to have raw materials of uniform composition, treatment of the raw material is necessary. Hence, one of the salient features of my invention comprises pretreating the coke in such a manner as to render the raw material uniform in physical structure. Another feature comprises the reduction in volatile content to below approximately 5%, and preferably below 3%.

In carrying out my process, the petroleum coke to be briquetted may be crushed to suitable size and passed through a retort in which the volatile matter is reduced below the maximum permitted. The material may be then permitted to partially cool, whereupon it may be further reduced to a finely divided form, if necessary, mixed with a suitable binder, either solid, semi-solid or fluid, and briquetted.

It is to be understood that my invention preferably takes the form of a continuous process, but in its broadest aspects the invention may be carried out either as a continuous process or a batch process, the principles underlying the invention being the same in all cases.

It may be found in many instances that the briquettes thus produced may not require further treatment, such as carbonization, the fuel produced up to this point possessing desirable characteristics both as to ruggedness and combustibility, while in other cases further treatment may be desirable, especially if a briquette having entirely smokeless features is desired. In the latter case the briquette may be passed through an oven or carbonizing chamber to more or less completely remove volatile constituents contained therein which give rise to smoke and a yellow flame upon combustion. This would be the case where the binder employed contains an appreciable amount of volatile matter. It

will be understood that any suitable binder may be used in the process regardless of its origin, for instance, petroleum asphalts, natural asphalts, coal tar pitches, sulphite liquors, and all substances having like properties.

By reference to the single figure in the drawing, which is a diagrammatic side elevational view of apparatus in which the process may be carried out, the operation will be obvious to those skilled in the art.

Referring more in detail to the drawing, the petroleum coke to be treated may be fed to a crusher 1 of conventional design in which the coke may be crushed to proper size, for instance, the material may be reduced so as to pass through, say a 1/4" screen. The lower portion of the crusher 1 may be provided with a rotary valve 2, or like device, capable of forming a seal between the crusher and a retort 3. The retort 3 may take the form of a longitudinally disposed cylinder or tube, heated by a burner or burners 4. The crushed petroleum coke issuing from the crusher 1 may be positively forced through the retort 3, for instance, by means of a screw conveyor or the like 5. The arrangement is such that in the course of its travel through the retort, the volatile content of the coke is progressively reduced to below 5%, and preferably below 3%, depending upon the character of finished product desired. I have found it desirable that the arrangement of the retort, conveyor and the auxiliary equipment appurtenant thereto, be such that, in the course of travel of the coke through the retort, continuous agitation of the coke takes place, in order to prevent the crushed material from caking, and in addition to promote a more rapid heat transference, thereby more efficiently removing the volatile matter.

Although the apparatus described above may advantageously be used, it is to be understood, that the invention in its broadest aspect contemplates the use of any equipment by which the volatile matter may be efficiently removed from the raw coke.

In further illustrating an efficient and economical manner in which my invention may be carried out, the volatile matter distilled from the coke may be passed from the retort 3 to a condenser (not shown) through the line 6, wherein the distillate and combustible gas may be separated and individually collected.

The substantially devolatilized material may then be passed to a cooling conveyor 7 by means of a conduit 8 which may be equipped with a transporting member 9, which may take the form of any well known conveying device. The crushed material upon passing through the compartment 7 is partially cooled, whereupon the same may be passed to a pulverizer 10, in which it may be reduced to a fineness permitting it to pass through a 10 mesh screen, or finer. The pulverizer 10 may discharge the finely divided coke on a conveyor 11, which may be of the screw type disposed in a longitudinally disposed open faced trough 12. Before the admixture of binder, water in such quantity as is found desirable may be added in the course of the travel of the pretreated coke to the mixing machine for incorporating the binder.

The conveyor 11 may discharge the pulverized coke into a mixing and fluxing device 13, which may be of conventional design, having a rotary stirring member 13', suitably driven. A binder which may be natural or artificial asphalt, coal tar pitch, sulphite liquors or the like, may be stored in a suitable container 14, provided with a discharge line 14', controlled by valve 14". If desired, a steam coil 15 may encircle the storage tank 14 to render the binder contained therein less viscous. The discharge line 14' may open into the mixer 13, whereupon the pulverized coke and binder may be thoroughly intermixed in an obvious manner. It is apparent that a desired proportion of binder to pulverized coke can be controlled by the proper regulation of the valve 14" in the line 14'. If desired, a solid binder may be utilized in which event, the binder may be separately ground to a finely divided condition and subsequently thoroughly mixed with the conditioned coke particles. It is to be understood, of course, that the present invention does not contemplate the use of any particular type of binder inasmuch as all types of binders may be used, and further that any suitable method of associating the binder with the coke is contemplated.

A gate 15' may be provided at the lower end of the fluxer 13, by which means the feed to the roll press 16 may be regulated. The press 16 may be of any conventional type, having the capacity to press the plastic blend of binder and petroleum coke under the desired pressure into suitable shapes. The formed briquette may then be dropped upon a conveyor 17 which may deliver the briquette either to storage or for further treatment, as will be hereinafter more fully described.

The product thus formed possesses desirable characteristics as a commercial fuel, the combustion properties being superior to briquetted "green" coke, particularly in regard to the considerably reduced evolution of smoke and production of yellow flame during combustion, and further, will not show the same tendencies to disintegrate during combustion.

In certain instances, especially where an entirely smokeless fuel is desired, it may be expedient to subject the briquette to a secondary carbonizing operation, particularly

with a view to removing the volatile matter which may have entered into the fuel by virtue of the incorporation of the binder.

I have found that attempts to briquette green petroleum coke with a hydrocarbon binder, such as asphaltic residues or the like, and then subjecting the same to carbonization, involve difficulties based on the fact that, for commercial operation, the desired rate of heat input brings about deformation of the briquettes as the volatile matter is evolved. Briquettes produced as above described, by treating the coke before the briquetting thereof reduces this tendency owing to the fact that there is less total volatile matter to be removed, and in addition, the pretreatment has changed the physical and chemical nature of the coke.

Secondary heat treatment of the briquettes can be carried out by the use of various types of carbonizing apparati of which the following will serve as an example. It is to be understood that the following description is for purposes of illustration only, and is not intended to be a limitation of my invention.

In carrying out the secondary heat treatment, the briquettes upon issuing from the roll press 16 may be transferred to a conveyor 17, of any conventional form. The conveyor 17 may carry the briquettes to a trough or conduit 18 which communicates with the upper portion of a carbonizing or baking chamber 20. Interposed in the conduit 18 is a rotary valve 19, or some like device, adapted to admit the briquettes to the carbonizing chamber with the accompanying admission of a minimum quantity of air. The chamber 20 may be of any conventional design, for example, a vertical shaft obtaining its heat from an independent furnace 21, fired by burners 22. Combustion gases from the furnace 21 will be conducted by means of the main 23 to a bustle pipe 24. These gases are thereby distributed at a plurality of points in the lower portion of the chamber 20, under such pressure as is required to overcome the resistance in passing up through the carbonizing zone 20. The spent gases may pass from the carbonizing zone through the main 25 to a scrubber or condenser 26, provided with a water spray 27, baffles 28, or other means to effect contact between the water and the gases. The scrubber 26 may be open at its lower portion and may comprise a serrated shell positioned in the tank 29 to effect a liquid seal. Fixed gases will pass from the scrubber 26 through main 30 and through exhaust fan 31, from which the gases may be discharged to the atmosphere through main 32, controlled by valve 33, or, by means of main 34, controlled by valve 35, be recirculated back through the system for the purpose of controlling the temperature of the inlet gases to the chamber.

The briquettes fed into the secondary carbonizing chamber 20 will pass downwardly in a slowly moving column to the bottom and may be discharged through a water seal 36, or, if desired, may be cooled at the bottom of the chamber by means of steam, water spray (not shown), or other cooling agent.

In the secondary carbonizing operation it will be understood that the briquettes will be gradually heated to the required point in their passage down through the chamber, since the hottest combustion gases enter at the bottom, the spent gases leaving at the top. In submitting briquettes to secondary treatment of this kind, a softening stage is reached. Hence, in controlling the recirculation of a proportion of the spent gases as discharged from the top of the retort shaft and blending them after cooling in a condenser with the gases produced in the furnace a wide temperature range of inlet gases may be obtained, which serves as a ready control of the temperature gradient in the carbonizing zone. Accordingly, the briquettes may be passed through the above mentioned softening stage without deformation or disintegration.

As an example of the operation of my process, a petroleum coke made from a Mid-Continent crude oil, and containing approximately 14% total volatile matter, including about 2% of water, was crushed to pass a 1/4" screen. The crushed material was then subjected to a preheating or conditioning treatment to drive off volatile matter, reaching a temperature of approximately 1000° F., and the volatile content being reduced to approximately 4½%. After partial cooling, the material was further crushed to pass through a 10 mesh screen, after which it was mixed with about 9% of a 165° F. melting point petroleum asphalt binder and pressed into briquettes using a pressure of approximately 3500 pounds per square inch. The briquettes proved to be a satisfactory commercial fuel, and burned with substantially no disintegration and very little smoke. Samples of such material were given a secondary baking treatment at a maximum temperature of approximately 1000° F., which brought about an improvement in the character of the material by removal of volatile matter from the binder. Briquettes so treated showed on combustion test practically no disintegration or objectionable smoking, and were tough and hard, allowing handling without appreciable deterioration.

It is to be understood that the specific figures given in this illustrative run are not to be taken in any sense as a limitation of the invention. The invention in its broadest aspects contemplates the treating of petro-

leum coke before briquetting in order to reduce the volatile content thereof, subsequently mixing the treated coke with a suitable binder and briquetting the mixed product, and if desired further treating the formed briquette to drive off additional volatile matter contained in the coke and the binder.

I claim as my invention:

1. A method for treating petroleum coke to produce a carbonaceous fuel which is substantially smokeless and which burns without substantial disintegration, said method comprising heating the petroleum coke sufficiently to reduce its content of volatile matter below 5% but above 1%, thereafter mixing the treated coke with a binder, and compressing the mixture into a form suitable for handling and use.

2. A method for treating petroleum coke from a cracking process to produce a carbonaceous fuel which is substantially smokeless and which burns without substantial disintegration, said method comprising heating the petroleum coke sufficiently to reduce its content of volatile matter to below 5% but above 1%, thereafter mixing the treated coke with a binder, and compressing the mixture into a form suitable for handling and use.

In testimony whereof I affix my signature.

ALFRED FISHER.