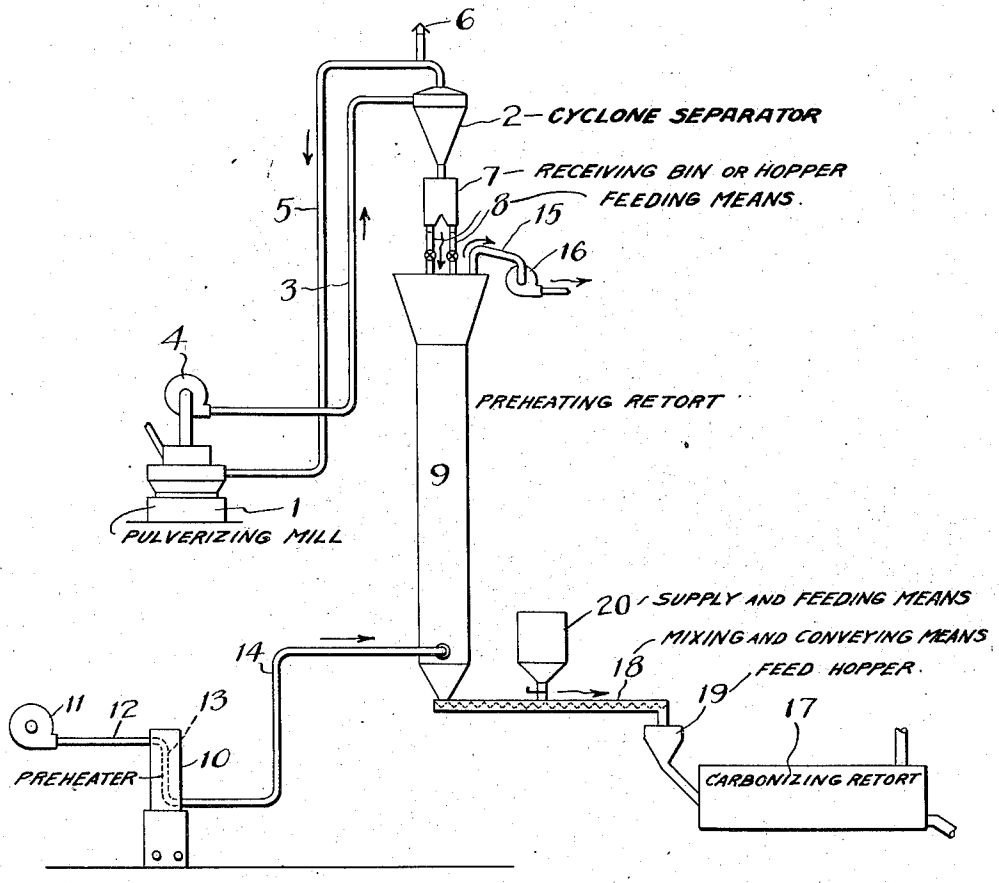
Sept. 9, 1930. W. RUNGE 1,775,323

CARBONIZING OF COAL

Filed June 17, 1925 2 Sheets-Sheet 1

Fig. 1.



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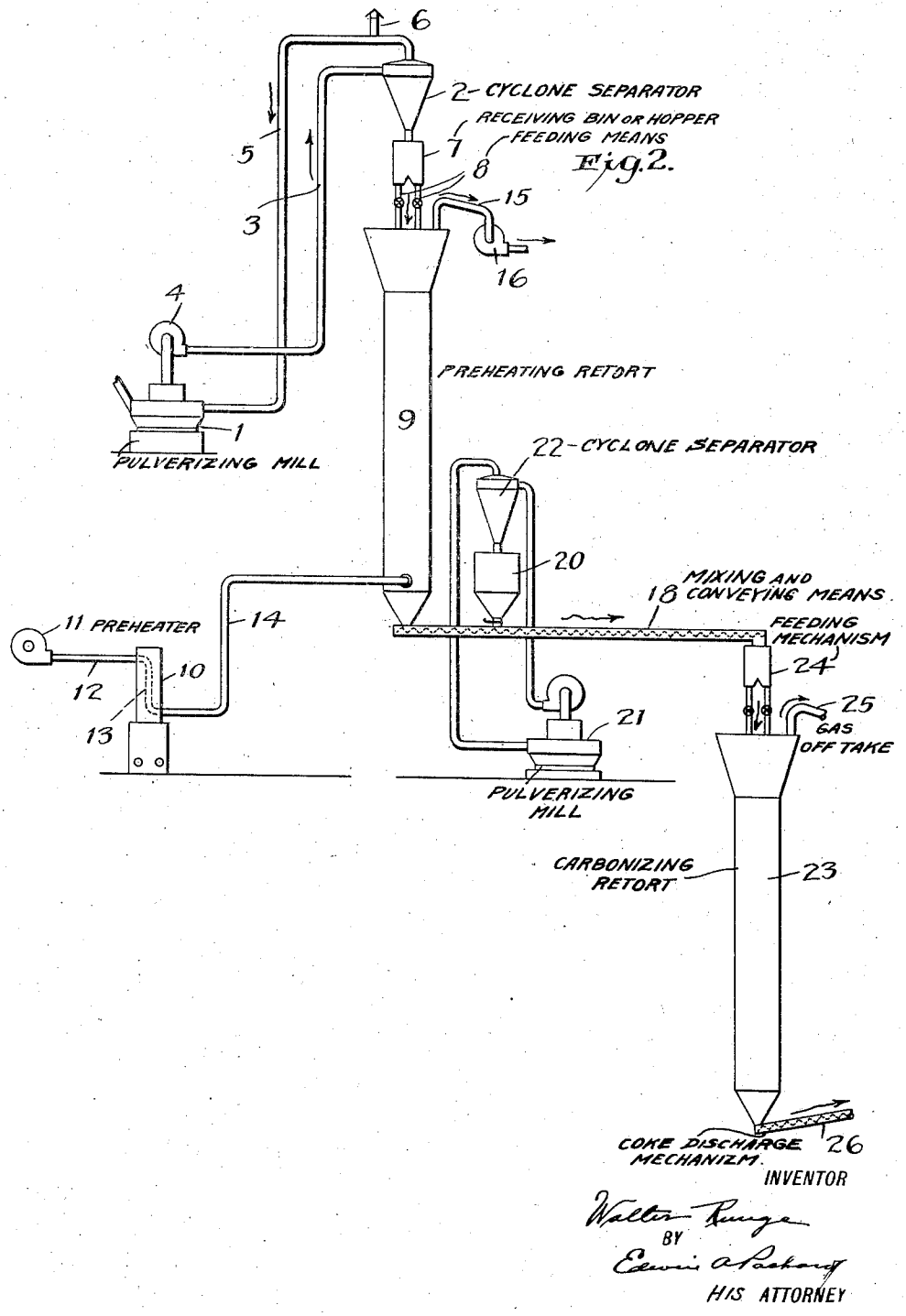


Fig. 2.

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UNITED STATES PATENT OFFICE

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CARBONIZING OF COAL

Application filed June 17, 1925. Serial No. 37,870.

The invention relates to the carbonizing of coal.

According to a broad aspect thereof a certain portion of the coal to be carbonized is subjected to pretreatment, to wit a preheating, under conditions to insure the destroying, or the overcoming, of the agglutinating properties of the coal thus pretreated. Thereafter this pretreated coal is mixed with raw or untreated coal and the two are then carbonized—preferably only partially carbonized—to the extent desired as by any suitable distillation process.

According to a more specific aspect of the invention the coal to be pretreated is subjected to a pulverization and the pretreated product still remains in finely divided form after the pretreatment. That portion of the raw coal which is not preheated is also preferably pulverized and this pulverized raw and untreated coal has mixed with it, or is mixed with, the pretreated pulverized products so that the two are intimately and relatively uniformly mixed and this mixture is subjected to the desired degree of carbonization in any suitable manner.

An object of the mixing of the pretreated and untreated coal is to insure that the mixture during carbonization will have only a limited amount, if any, of adhesive and cohesive characteristics.

The invention is particularly applicable to the treating of what is frequently referred to as bituminous coking coals or high volatile coals for example bituminous coals having a volatile content of say 25% or even upwardly. According to certain more specific aspects of this invention it relates to a process according to which such a coal is pulverized and a portion of the pulverized coal is subjected to a heat pretreatment as in an oxidizing atmosphere having a temperature approximating 600 degrees F. to 650 degrees F. for a sufficient length of time to slightly increase the oxygen content of the pretreated coal, for example from 7½% up to 8½%, and thereafter the pretreated coal is mixed with a certain portion of the pulverized raw coal and the mixture is then subjected to a low temperature carbonization so as to produce semi-coke.

Other aspects of the invention relate to apparatus for carrying out the process to which the invention applies.

As illustrating certain manners and ways in which the invention may be realized, reference is made to the accompanying drawings constituting a part of this specification and in which drawings:—

Figure 1 shows one form of the apparatus; and

Figure 2 shows a further form.

Referring to the drawings in detail and particularly to the apparatus of Figure 1, it will be observed that 1 indicates a means for pulverizing coal, frequently referred to as a pulverizing mill or as a pulverizing apparatus. A cyclone separator is designated by 2 and is arranged so as to receive pulverized coal which is transported to it by the piping 3 and the pressure fan 4 in the piping. Some of the air used in the mill and in the transport of the coal is returned to the pulverizing mill 1 from the cyclone separator 2 by the piping 5. An escape or exit for any surplus air is provided as at 6. The pulverized coal which is separated out in the cyclone separator passes to a receiving bin or hopper 7 and from this it is conveyed by any suitable feeding means 8 to a pretreating retort 9.

It will be noted that a preheater 10 is indicated for preheating air or in fact any other suitable gaseous medium which is caused to flow to the interior of the pretreating retort 9 as by means of the fan 11 through piping 12, 13 and 14. It will be furthermore noted that the air passing through the portion 13 is indirectly heated in the preheater 10. The air or other pretreating medium is introduced into the pretreating retort 9 at temperatures approximating 800 degrees F.

In the pretreating retort 9 the preheated gaseous medium, preferably preheated air, travels upwardly counter to the downwardly moving pulverized material fed into the top of the pretreating retort 9 and the gaseous medium is ultimately withdrawn from the top of the pretreating retort through the piping 15 by means of the exhaust fan 16. In

the pretreating retort shown the upward movement of the hot treating gases is sufficient to cause a delayed settling by gravitation of the coal particles passing downwardly therethrough so that a sufficient time element is insured for effecting the desired pretreating of the coal and so as to destroy or insure the destroying of any adhesive or cohesive or agglutinating properties which it might possess. The pretreating may be carried out according to the process fully described in my copending application Serial No. 748,037 filed November 6, 1924, entitled "Improvements in or relating to the treating of coal."

The pretreated coal settles and collects at the bottom of the pretreating retort 9 and is conveyed therefrom to a carbonizing retort as 17 by any suitable mixing and conveying mechanism as 18 and feed hopper 19. The carbonizing retort 17 may be of any suitable type or construction, for example, it may be of a type such as that shown in the Smith Patent No. 1,415,201 dated May 9, 1922, or of that shown in the Cantieny Patent No. 1,495,573 dated May 27, 1924, or it may be of any other suitable type or construction. It will also be noted that a supply and feeding means is indicated at 20 by which a relatively predetermined amount of raw or untreated coal is fed into the mixing and conveying mechanism 18 under conditions such that the raw coal and pretreated coal can become relatively intimately and uniformly mixed prior to introduction into the carbonizing retort 17.

In this retort 17 the mixture is subjected to any suitable carbonization, for example, any low temperature carbonization wherein the general temperatures are sufficient to substantially reduce the hydro-carbon volatile content of the mixture. It will be manifest that this carbonizing retort 17 must have suitable feeding mechanisms and suitable discharge mechanisms, in short, suitable mechanisms whereby the material can be fed to the retort and whereby the resulting products both solid and gaseous can be removed from the retort as the process functions.

Reference will now be made to the apparatus of Figure 2 which functions in a very similar manner to that of Figure 1. Like reference characters indicate like parts and with like functions in each of the figures. It will be noted that in Figure 2 there is provided a second means for pulverizing coal to wit a second pulverizing mill or pulverizing apparatus 21 and an associated cyclone separator 22 that delivers the separated-out raw or untreated pulverized coal into the supply whereby a relative predetermined amount of raw or untreated pulverized coal is fed into the mixing and conveying mechanism 18 under conditions such that the raw coal and the pretreated coal can become relatively intimately and uniformly mixed prior to introduction into the top of the vertical carbonizing retort 23 hereinafter referred to. The carbonizing retort 23 is preferably of the type wherein there is a counter-current relation existing between falling powdered coal and rising hot gases which are relied upon to effect carbonization of the falling coal.

In the instance of the carbonizing retort 23 the falling powdered coal is in fact a descending powdered coal mixture consisting of raw or untreated powdered coal and the coal which has been pretreated merely to cause it to lose its agglutinating properties without losing any substantial portion of its hydrocarbon volatile content and this mixture is caused or allowed to gravitate in cloud-like form through the carbonizing zone of retort 23 counter to rising hot gases which effect the carbonization in a relatively short time, to wit, in a period not exceeding 60 seconds. The average temperature of the gases which effect this carbonization approximates 1000 degrees F. and the carbonization effected is a low temperature carbonization. This carbonizing retort 23, as previously indicated, is shown as a vertical carbonizing retort and is provided with a feeding mechanism 24 and any suitable gas offtake means 25 and discharge mechanism 26 for effecting a removal of the resulting coke. In this vertical carbonizing retort 23 any suitable degree of carbonization can be carried out and with the feeding of the treated coal with the untreated coal in the manner specified the tendency for the adhesion or cohesion of the particles undergoing treatment is materially lessened.

A specific mode of treating coal in either forms of the apparatus above illustrated is as follows: Taking for example a raw coal having a hydrocarbon volatile content of 34% and an oxygen content of 7½% and subjecting this to a pulverization and a preheating treatment, for example, to a pretreatment by upwardly rising hot air in retort 9 at an average temperature of 600 degrees F.—650 degrees F.—temperature in air—this can be carried out so that the air will delay the precipitating of the particles of the pulverized coal sufficient to permit the destruction of any agglutinating properties of the coal and at the same time to slightly increase the oxygen content of the coal, for example, approximately 1% and so as to only slightly change the general state of division of the particles thus treated and so as to only slightly reduce the hydrocarbon volatile content—to wit—to approximately between 30% to 32%. The coal thus pretreated and preferably while still hot, is then mixed with or has mixed therewith the raw or untreated coal for example, pulverized raw or untreated coal—and thereafter the mixture is subjected to any suitable low temperature carbonization by which the volatile content of the mixture is substantially reduced so that the resulting

product may have retained only a relatively small percent of the hydrocarbon volatile content originally in the coal.

The pretreatment in the pretreating retort 9 is carried out under conditions so as to substantially destroy the agglutinating characteristics of the pulverized coal undergoing pretreatment, so as to only slightly reduce the hydrocarbon volatile content of the coal, so that the product resulting from this pretreatment has practically the same state of division as the original pulverized coal, and so that the degree of fineness is only slightly changed. While the degree of coarseness of the pretreated product is slightly increased as compared with the original pulverized coal, as is readily determinable by comparative screen analysis, still the change in this regard is not great.

In the pretreatment the temperatures for destroying the agglutinating properties are preferably between 500 degrees F. and 700 degrees F. during a time when the coal is in pulverized form and while it is gravitating, counter to rising hot gases for a period of not more than sixty seconds.

From what has preceeded, it will be noted (*a*) that the pretreatment produces a product, or perhaps an intermediate product, in which the agglutinating properties have been substantially destroyed, in other words, there has been produced a product practically void of agglutinating characteristics, (*b*) that this product is mixed with the raw pulverized coal in such a manner that the mixture has at the most only limited agglutinating properties, and (*c*) that this mixture is subjected to the carbonization or distillation described, for example, to a carbonization or distillation such as is employed for the low temperature product of semi-coke. When the mixture is made up of pretreated pulverized coal and raw pulverized coal and is allowed to gravitate counter to rising hot carbonizing gases then the carbonizing process should be completed by the direct action of gases having approximate average temperatures of 1000 degrees F. and during a period of not over sixty seconds.

It will also be manifest from what has preceded that the invention as expressed in the claims may be realized in various modes and types of apparatus without departing from the spirit and scope thereof.

I claim:

1. In the carbonizing of coal the method comprising pulverizing coal, subjecting it to the action of a hot gaseous fluid in such a manner as to substantially destroy its agglutinating properties but under conditions whereby the resulting product retains practically the same state of division as the original pulverized coal and with substantially all of its hydrocarbon volatile content, mixing said resulting product with raw pulverized coal, and subjecting the mixture to carbonizing by means of a gaseous medium having temperatures approximating 1000 degrees F.

2. In the carbonizing of coal the method comprising pulverizing coal, subjecting it to the pretreating action of a hot gaseous fluid in such a manner as to substantially destroy its agglutinating properties but under conditions whereby the coal thus pretreated retains practically the same state of division as the original coal and with only slightly reduced hydrocarbon volatile content, mixing the coal thus treated with raw pulverized coal, and subjecting the mixture to the action of a gaseous medium having temperatures approximating 1000 degrees F. for a period not exceeding sixty seconds and under conditions to effect carbonization.

3. In the carbonizing of coal the method comprising pulverizing coal, subjecting it to the pretreating action of a hot gaseous medium in such a manner as to substantially destroy its agglutinating properties but under conditions whereby the coal thus pretreated retains practically the same state of division as the original pulverized coal, mixing the pretreated coal with raw pulverized coal, and subjecting the mixture to the carbonizing action of a gaseous medium the temperature of which approximates 1000 degrees F. and for a period not exceeding sixty seconds and under conditions to effect carbonization.

4. In the carbonizing of coal the method comprising pulverizing coal and subjecting it for a period not exceeding sixty seconds to a pretreating action of a hot gaseous medium the temperature of which is between 500 degrees F. and 700 degrees F., mixing the coal thus pretreated with raw pulverized coal, and carbonizing the mixture by subjecting it for a period not exceeding sixty seconds to the carbonizing action of a hot gaseous medium, the temperature of which approximates 1000 degrees F.

5. An apparatus for the carbonizing of coal comprising in combination a pretreating retort, a carbonizing retort, means for pulverizing coal, means for conducting pulverized coal from the pulverizing means to a cyclone separator, means for conducting pulverized coal from the cyclone separator to the pretreating retort, means for discharging the pretreated coal from the pretreating retort, and means for conveying the pretreated coal to the carbonizing retort which means includes means for mixing raw coal with pretreated coal while in transit from the pretreating retort to the carbonizing retort.

In testimony whereof I have hereunto signed my name.

WALTER RUNGE.