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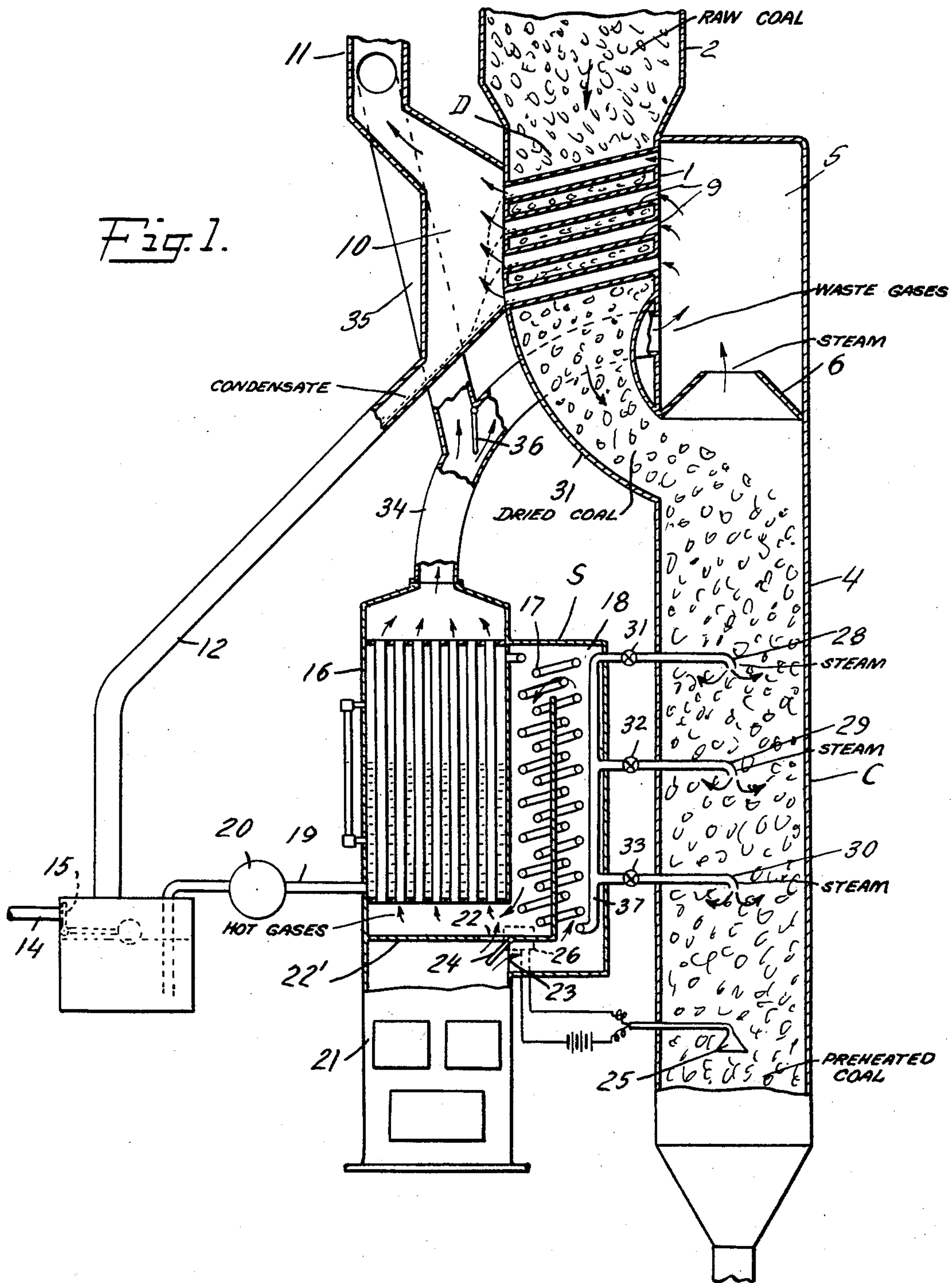
S. W. PARR ET AL

1,907,569

PROCESS OF PREPARING COAL FOR CARBONIZATION

Filed Feb. 25, 1929

2 Sheets-Sheet 1



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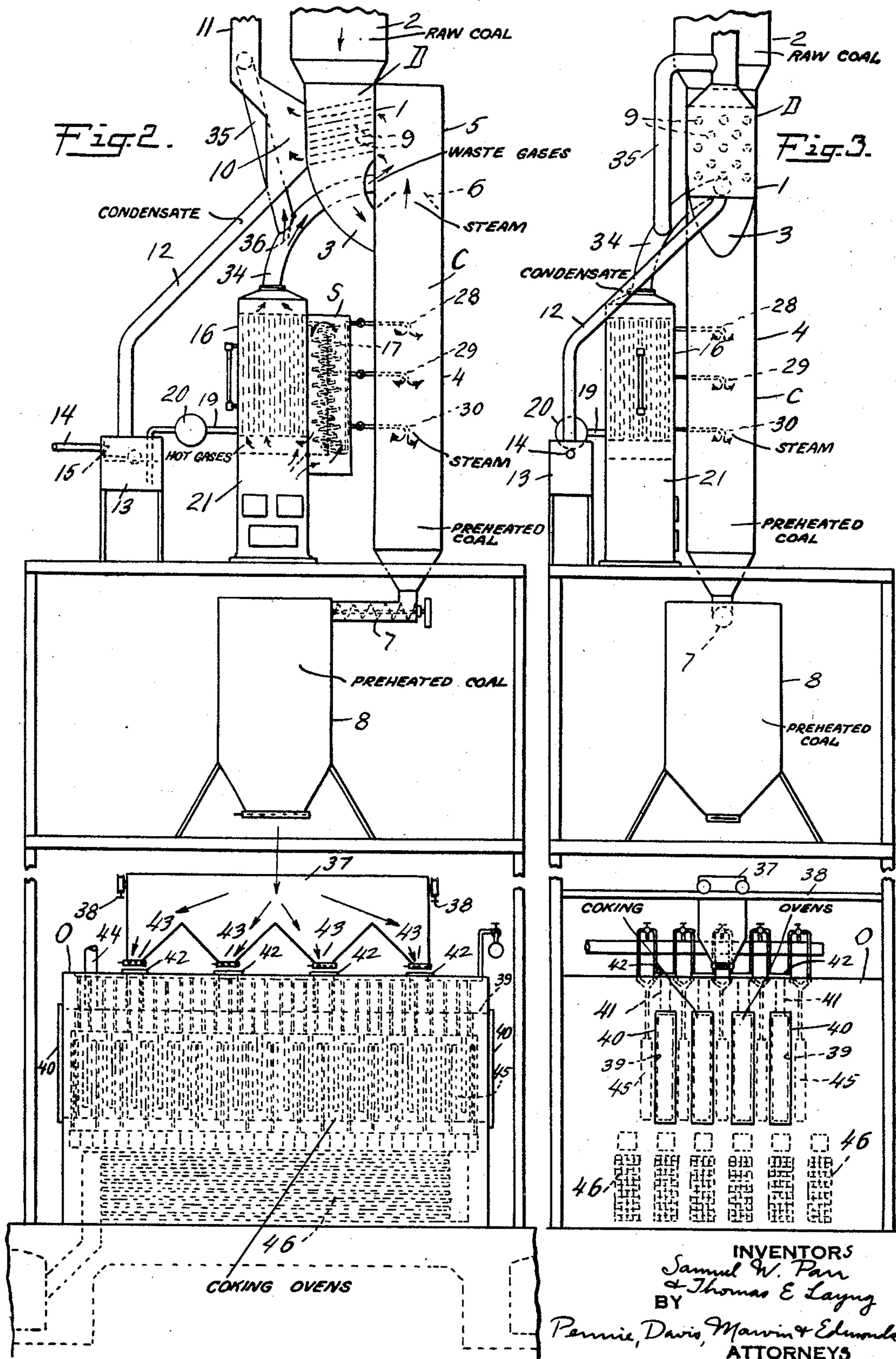
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UNITED STATES PATENT OFFICE

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PROCESS OF PREPARING COAL FOR CARBONIZATION

Application filed February 25, 1929. Serial No. 342,340.

This invention relates to an improved process of coking coal, and includes not only an improved process but an improved apparatus for use in carrying out the process.

herence to permit its satisfactory use as a solid fuel.

We have found that the above and other objectionable features of ordinary by-product coking practice can be substantially eliminated by properly conditioning the raw coal prior to its introduction into the coking ovens or retorts. In accordance with our process, the coal is preheated to a suitable temperature which may range from a value considerably below the critical temperature of softening point to a value slightly above the critical temperature, the preheating temperature being high enough to effect the elimination of a material amount of deleterious oxygen and oxygen compounds from the raw coal. When so preconditioned, the exothermic heat available in the coal may be utilized to advantage during the ensuing carbonization operation, and in accordance with our process, this exothermic heat is utilized either alone or in combination with extraneous heat from the coke oven walls to cause the rapid progression of the pasty stage throughout a mass of the charge of preheated coal. Due to this rapid progression of the pasty stage, the coal charge becomes coherent throughout substantially the entire mass thereof during the coking operation, and the formation of a thin and impermeable plastic envelope and the attendant cracking of the evolved hydrocarbons and delay of the coking operation are largely avoided. When subjected to the described preheating process, Illinois and other so-called "non-coking" coals may be coked, as well as the coking coals.

The above described coking process is disclosed more in detail in our copending applications, Serial No. 332,785, filed January 19, 1929; Serial No. 333,814, filed January 21, 1929, and Serial No. 342,340, filed February 25, 1929.

Various methods and devices may be employed to effect the preheating of the coal to the desired temperature before the introduction thereof to the ovens, and in accordance with the present invention, this preheating is accomplished by an improved process and improved apparatus in which a heated fluid

In ordinary by-product coking practice, a charge of raw coal is introduced directly into an oven or retort, and sufficient extraneous heat is supplied thereto to convert the charge into coke. This method of coking coal is unsatisfactory for several reasons. The portion of the coal charge adjacent the oven walls is first heated to a temperature at which it becomes plastic and is then converted into coke, the plastic condition proceeding slowly inwardly into the coal charge in the form of a very thin plastic layer or envelope. As the plastic envelope progresses inwardly, a layer of coke is formed adjacent the oven walls, and this coke layer forms an insulating barrier which delays the passage of heat from the oven walls to the central portions of the coal charge, thereby materially delaying the coking process and necessitating the use of excessively high oven wall temperatures. The hydrocarbon vapors, which are largely evolved at or above the temperature of plasticity, condense upon coming into contact with the central mass of comparatively cold raw coal, and these condensed vapors form a tar screen on the inner surface of the plastic envelope. The evolved hydrocarbons are largely confined by the tar screen to the outer portions of the fuel charge, and upon coming into contact with the hot oven walls and the hot coke adjacent thereto, these vapors are undesirably decomposed or cracked. This cracking of the evolved hydrocarbon vapors not only adversely affects the value of the by-products obtainable therefrom, but results in a reduction in the amount of heat available for coking the coal, such secondary reactions as the cracking or decomposition of hydrocarbons being endothermic. Further, when coals having a comparatively high oxygen content, such as Illinois and other so-called "non-coking" coals, are subjected to ordinary by-product coking treatment, there is little, if any, tendency of the charge to fuse, and the coke product obtained lacks sufficient co-

is passed directly in contact with a mass of the coal to bring the temperature thereof to the desired preheating value. The idea of preconditioning the coal by passing a heated fluid therethrough is disclosed in our copending application, Serial No. 260,541, filed October 31, 1918, of which this application is a continuation in part.

According to our improved method, the raw coal is first heated out of contact with the atmosphere to a temperature in the neighborhood of 100°C ., and the free moisture therein is thereby driven off. The dried coal is then heated in an air excluding container by passing a heated fluid therethrough until the desired final preheating temperature is attained. The first stage of the preheating process may be conveniently referred to as the drying stage, and the second, the conditioning stage. During the conditioning stage, certain reactions take place which result in the removal of deleterious oxygen and oxygen compounds such as H_2O and CO_2 , and the coal is thereby conditioned for the carbonization process which is to follow. The specific heat of gases such as H_2O and CO_2 is rather high, and the evolution and elimination of a considerable amount of these gases during the preheating stage therefore prevents the subsequent loss of an appreciable amount of heat through the evolution of such gases during the carbonization process. If the reactions just mentioned were allowed to occur simultaneously with the reactions of the carbonization stage, they would have the effect of weakening the binding material to such an extent that coke of an inferior quality would be produced. The gases driven off from the coal during the conditioning stage, as well as the waste heating fluid employed in this stage, are preferably used to supply heat to the coal in the drying stage, and in this manner, substantially all of the heat in the heating fluid is supplied to the coal. The removal of heat from the gases driven off from the coal during the conditioning stage results in the condensation of the water vapor contained therein, and when the heating fluid employed comprises superheated steam, a further economy is effected by supplying the hot condensate from the drying apparatus to the boiler in which the steam is generated. When this procedure is followed, the water is automatically separated from the CO_2 and other waste gases during condensation, and the CO_2 is discharged to the atmosphere. The preheated coal is confined in an oven and sufficient extraneous heat is supplied thereto to cause the coal temperature to increase quickly to and through the pasty stage and up to a final coking temperature of from 650 to 850°C ., or higher.

In certain cases, the temperature to which the coal is preheated should be close to but below the critical temperature or softening

point of the coal, and in order to avoid the sticking of the coal to the walls of the containers and ducts through which it is passed, it is desirable that the preheating be effected uniformly throughout the coal mass so that no portion thereof may become plastic. In any case, since the temperature to which the coal is preheated materially affects the ensuing carbonization operation, it is desirable that the final preheating temperature be uniform throughout the mass of the coal charge. The use of a heated fluid in direct contact with the coal insures the uniform application of heat thereto and minimizes the danger of overheating even the finest particles of the coal charge. The heated fluid supplied to the coal may be heated to and maintained at the desired final conditioning temperature, and in this manner the entire coal charge may be uniformly brought to this temperature regardless of the initial coal temperature and the rate at which the coal passes through the conditioning apparatus.

It has been found that if the rate of heating during the conditioning stage is unduly retarded, certain reactions take place which prevent the elimination of the desired amount of oxygen and oxygen compounds. Thus it is preferred to carry on the conditioning heat treatment at a rapid rate and the desired final preheating temperature should be attained in less than two hours. By employing a heated fluid passing in direct contact with the coal, the coal temperature may be very rapidly increased, and the deleterious oxygen and oxygen compounds are effectively removed by the process of the invention.

Although in the preferred embodiment of the invention, superheated steam is employed as a heating fluid, our invention is not limited to the use of this medium. For example, we may employ for this purpose other fluids such as gases derived from the dry quenching of coke, heated oil or other heated gases or liquids, and our invention, in its broader aspects, includes the use of any suitable fluid heat transferring medium.

In accordance with the process of the present invention, the temperature to which the coal is preheated may vary within certain limits depending upon certain characteristics of the coal under treatment, and upon other factors. In general, it may be stated that the present invention contemplates preheating the coal to a temperature and at a rate such that the oxygen content of the coal is materially reduced, the maximum preheating temperature being not appreciably in excess of the critical temperature or softening point of the coal. In certain cases, the preheating temperature may be high enough so that the exothermic heat available in the coal, when evolved, is capable of further raising the coal temperature from the preheating value to a temperature high enough to insure the autog-

enous progression of exothermic reactions throughout a charge of the preheated coal. When coal so preheated is introduced to the coking ovens, the coal in contact with the oven walls is rapidly raised to the temperature at which exothermic reactions are initiated, the heat liberated by these reactions brings the adjacent coal to and above the temperature of exothermicity, and this action continues autogenously throughout the mass of the charge. The amount of exothermic heat liberated varies somewhat in different coals, but in general, the excess of exothermic heat over heat absorbed by endothermic reactions throughout the period when exothermic reactions are most in evidence has been found to be in the neighborhood of from 65 to 100 B. t. u. per pound of coal. The specific heat of coal at the temperatures under consideration is approximately .34, and accordingly, 65 B. t. u. will raise the coal temperature approximately 106° C. and 100 B. t. u. will raise the coal temperature approximately 163° C. The exothermic reactions ordinarily take place at temperatures slightly above the critical temperature of the coal, and it is thus evident that a preheating temperature of approximately 100 to 160° C. below the critical temperature may be sufficient to cause the above described autogenous progression of exothermic reactions to the center of the coal charge. The process of the invention is not, however, limited to a preheating temperature high enough to insure the autogenous progression described above. In certain cases, the final preheating temperature may be high enough to insure a material reduction in the oxygen content of the coal but still be below a temperature which will insure the autogenous progression of exothermic reactions therein. In such cases, when the preheated coal is carbonized in an oven, the progression of the pasty condition is brought about by a combination of exothermic heat and extraneous heat from the oven walls, and although this progression is not autogenous throughout the mass of the charge, it is rapid enough to prevent the formation of a thin and impermeable plastic envelope in the charge.

The process of the present invention results in the production of a coke having desirable characteristics unobtainable in ordinary by-product coking practice. The coke obtained has an extremely high resistance to crushing strain, is clean and highly porous, and is further characterized by uniformity in structure and quality throughout the mass of the charge. The uniformity in the character of the coke is probably due to the above described rapid progression of the plastic condition throughout the mass of the coal charge, and to the absence of the thin and impermeable plastic envelope which delays the coking operation in ordinary by-product practice.

The improved apparatus preferably em-

ployed in carrying out the process of the invention includes a combined drier and conditioner for preheating the coal to the desired preliminary temperature. The apparatus is preferably arranged to treat the coal continuously, and may conveniently comprise two interconnected substantially vertically disposed air-excluding containers. The upper container or drier is preferably provided with a plurality of heating flues disposed in the path of the raw coal, the gases for heating these flues being obtained from the conditioning container and from other sources as hereinafter described. The conditioning container is provided with suitable means for passing a hot fluid such as superheated steam into direct contact with the coal therein, and means are provided for conducting the waste heating fluid as well as the reduced H₂O and CO₂ gases from the conditioner to the heating flues of the drier. The abstraction of heat from the waste gases in the drier heating flues results in the condensation of the water vapor in these gases, and, when steam is employed as the heating fluid, means are provided for supplying the hot condensed water thus obtained to a boiler in which such steam is generated. Since the desired final preheating temperature is considerably above the boiling point of water, the steam supplied to the conditioner is superheated to the desired temperature in any suitable manner, and automatic temperature responsive means are preferably provided for regulating the degree of superheat in accordance with the temperature of the coal discharged from the conditioner. In order to effect a further economy in the heat consumption of the apparatus, means are preferably provided for conducting the waste flue gases from the steam generating boiler to the drier flues where these gases mingle with and supplement the heat of the waste flue gases from the conditioner. The superheated steam for use as the heating fluid in the preheating apparatus may be generated and superheated by heat from the waste flue gases discharged from the coking ovens or retorts in which the carbonization of the coal is carried out, or a suitable fuel such as gas, oil or coal may be burned to generate and superheat this steam.

If desired, the drying and conditioning of the coal may be carried out in a single container, the raw coal being introduced directly to such container and heated therein by direct contact with a hot fluid to the desired preheating temperature.

The other principal part of the apparatus comprises a group or battery of coking ovens into which the preheating coal is deposited and in which the coking operation proper is completed. The ovens preferably comprise a unitary oven structure including adjacent oven chambers separated by walls containing

heating flues. The oven chambers may be of the horizontal or vertical type, and the dimensions thereof may be variously proportioned to suit the requirements of different installations. Suitable means such as gas burners are preferably provided to supply heat to the flues within the oven walls.

Due to the preconditioning of the coal, the plastic or pasty condition progresses rapidly throughout a mass of the charge thereof when introduced into the coking oven, and the hydrocarbon vapors, which are evolved at and above the temperature of plasticity, escape from the oven through the entire fuel charge and are not confined to the portions thereof along the oven walls. For this reason, the oven wall temperatures employed may be comparatively high without causing appreciable cracking or decomposition of the hydrocarbons. Thus the oven wall temperatures may safely range from 750° to 1000° C., or even higher, the preferred wall temperature being in the neighborhood of 950° C. The final temperature of the coke charge may be varied according to the type of coke desired. It has been found that a superior quality of coke suitable for either domestic or metallurgical purposes can be made by our process at final coking temperatures not exceeding 750 to 800° C., the volatile content of this coke being not in excess of 5%. If a lower volatile content is desired, the fuel charge is allowed to remain in the oven for a longer period, the final coking temperature being thereby increased and the volatile content being correspondingly reduced.

The ovens and the preconditioning apparatus are preferably located in close proximity and suitable means such as a lorry may be provided for carrying the preheated coal from the conditioner to the oven chambers. The preheating apparatus preferably operates continuously and has a capacity sufficient to supply several oven chambers, the charges of preheating fuel for the ovens being accumulated in the lorry or in a suitable hopper or bin.

The various objects and advantages of the invention can best be understood by considering the accompanying drawings which show one embodiment of an improved apparatus by means of which the improved process of the invention may be performed. In the drawings;

Figure 1 is an enlarged sectional view of one embodiment of our improved preheating apparatus;

Fig. 2 is an elevation of the preheating apparatus shown in Fig. 1, together with a coking oven in connection with which the preheating apparatus may be employed; and

Fig. 3 is an end view of the apparatus shown in Fig. 2.

The embodiment of the preconditioning apparatus shown is of a type suitable for

bringing the coal to the desired preheating temperature in two stages, and comprises generally a drier D and a conditioner C. The drier may conveniently comprise a vertical container 1 having an enlarged hopper 2 at the upper end thereof and communicating by means of a curved chute 3 with the conditioner container 4. The conditioner container preferably comprises a vertical cylindrical casing having a gas collecting hood or compartment 5 at the upper end thereof and separated from the body of the container by a coned ledge 6. The lower end of the conditioner container 4 is connected through suitable discharge means such as a screw conveyor 7 to an accumulating bin 8. A plurality of heating flues 9 pass through the drier container 1 from the hood 5 to a compartment 10 which communicates with the stack 11. The flues 9 are inclined toward the compartment 10 so that the condensate from these flues may flow into this compartment. A water pipe 12 connects the compartment 10 with a water reservoir 13, and an auxiliary water supply pipe 14 is connected to this reservoir through a float valve 15.

The fluid for heating the coal in the conditioner container 4 may be supplied by various means, and in the disclosed embodiment, a steam boiler and a superheater are employed for this purpose. The boiler 16 shown is of the vertical fire tube type, and the superheater S comprises a coil 17 located in a heating chamber 18 adjacent the boiler. Feed water is supplied to the boiler 16 from the reservoir 13 through a pipe 19, suitable means such as a pump or injector, conventionally represented at 20, being employed to force the water into the boiler. The heating gases for heating the boiler 16 and the superheater coil 17 may be obtained by burning a suitable fuel in the furnace 21, or may be derived from any other suitable source. The hot gases pass from the furnace 21 to the boiler flues through an opening 22 in the plate 22', and to the superheater compartment 18 through an adjacent opening 23. The division of heating gases between the superheater and the boiler is governed by suitable means such as a damper 24, and the position of the damper is preferably controlled in accordance with the temperature of the coal at the lower end of the conditioner C through a temperature responsive element 25 operatively connected with a thermostatic control device 26. The thermostatic control apparatus may be of any suitable known construction, and is so arranged that the increase above a predetermined value of the coal temperature causes the damper 24 to decrease the supply of heating gas to the superheater S, whereas a decrease in the coal temperature below the predetermined value causes the damper to increase the supply of heating gas to the superheater.

The superheater coil 17 is connected through a pipe 27 to a plurality of steam nozzles 28, 29 and 30 which are located within the conditioner container 4. The amount of steam delivered by these jets is preferably controllable by means of the valves 31, 32 and 33.

The waste heating gases from the superheater S pass through the flues of the boiler 16, and the waste gases from the boiler are conducted through a pipe 34 to the gas collecting hood 5. A by-pass pipe 35 is preferably provided between the pipe 34 and the stack 11, and the flow of waste gas from the boiler to the hood 5 is preferably controlled by a damper 36 located at the point of juncture between the pipes 34 and 35.

The coal collecting bin 8 is provided with a valve controlled discharge opening at its lower end, and a lorry 37, mounted on the tracks 38, is arranged to receive the preheated coal from the bin and to supply it to any one of a plurality of oven chambers 39. The lorry is preferably of such dimensions that it can carry sufficient preheated coal to charge at least one of the oven chambers.

The oven chambers 39 are preferably located within a unitary oven structure O formed of a suitable material such as silica brick or fire clay. In the disclosed embodiment, the oven structure includes four oven chambers, but the number of these chambers may, of course, be varied to suit the requirements of the installation. The ovens in the disclosed construction are of the horizontal type, comprising narrow chambers of considerably greater length than height. The chambers 39 are provided with suitable removable doors 40 at their opposite ends, these doors being removable to permit the discharge of the finished coke from the ovens by suitable pushing apparatus. A plurality of charging ports 41 are provided in the upper wall of each oven chamber, these ports being normally covered by the caps or closures 42, and being disposed to align with the depending valve controlled discharge ports 43 of the lorry 37. The evolved hydrocarbon vapors are conducted from each oven chamber 39 through a suitable up-take pipe 44 and are conducted through suitable apparatus for recovering the valuable constituents thereof.

The oven chambers may be heated in any convenient manner. The oven heating apparatus shown is of a type ordinarily employed in by-product coking practice, and since apparatus of this type is well known in the art, the structure thereof will not be described in detail herein. The oven chambers 39 are heated by the passage of hot combustion gases through a plurality of flues 45 in the oven structure, a suitable fuel such as producer gas being burned to supply the hot gases to these flues. The heat in the

waste gases from the oven flues is conserved by suitable means such as the regenerators 46 which are preferably employed to heat the air used in supporting combustion at the oven burners. The construction and operation of the disclosed type of oven heating means is described more in detail in our co-pending application, Serial No. 320,272, filed November 19, 1928.

In carrying out the improved process by means of the improved apparatus described, the raw coal is continuously delivered in crushed form to the drier container 1 through the hopper 2. Within the drier, the raw coal passes in contact with the heating flues 9, and is heated to or slightly above a temperature of 100° C. Besides raising the sensible heat of the coal to 100° C. or over, this heating drives off the free moisture and further removes any free oxygen which may have been absorbed by the coal from the atmosphere. Since the coal in the drier is indirectly heated, no deleterious gases are brought into contact therewith. The dried coal, at approximately 100° C., enters the conditioner container 4 through the chute 3, and is uniformly heated therein to the desired final preheating temperature by the passage of the superheated steam therethrough from the nozzles 28, 29 and 30. As explained above, the temperature to which the coal is heated in the conditioner may vary between certain limits, being high enough to insure a material reduction in the oxygen content of the coal, but not appreciably higher than the critical temperature of the coal. The superheated steam supplied to the nozzles 28, 29 and 30 is maintained at a temperature such that the overheating of the finer particles of the coal is avoided and the coal is heated rapidly throughout its mass to the desired preheating temperature. The heating of the coal in the conditioner results in the removal therefrom of deleterious oxygen and oxygen compounds such as H₂O and CO₂, thus conditioning the coal for the carbonization operation which is to follow.

The comparatively high initial temperature of the coal entering the conditioner and the flow of the heating fluid through all parts thereof, combine to produce a rapid heating of the coal therein through the prescribed temperature range, and the rate of heating in the conditioner is rapid enough to insure a material reduction in the oxygen content of the coal. The reactions which result in the evolution of H₂O and CO₂ are largely endothermic, and the flow of the superheated steam throughout the coal mass rapidly supplies the heat required to promote these reactions. The specific heat of H₂O and CO₂ gases is rather high and the elimination thereof during the conditioning stage therefore prevents the subsequent loss of consider-

able heat through the evolution of these gases during the carbonization stage.

The gases such as H_2O and CO_2 driven off in the conditioner, together with the waste heating steam, are collected in the hood 5 and pass through the flues 9 of the drier D. The waste gases from the furnace are also discharged into the hood 5 and pass through the flues 9, thus supplementing the heat from the gases obtained from the conditioner container 4. The amount of heat supplied to the coal within the drier may be regulated by varying the amount of waste gases from the boiler 16 which pass through these flues, this variation being accomplished by proper manipulation of the damper 36. The cooling of the gases in the drier flues 9 results in the condensation of at least a portion of the water vapor content of these gases, and this condensed water is carried back to the steam generating boiler 16, through the pipe 12, the reservoir 13 and the pump or injector 20, the CO_2 and other waste gases passing off through the stack 11. Because of this automatic separation of the water from the waste gases by condensation, no foreign gases are carried into contact with the coal by the superheated steam.

The steam for heating the coal in the conditioner is generated in the boiler 16 in the usual manner, water being delivered to this boiler as required by the pump 20 from the reservoir 13. Since a certain amount of the steam escaping from the conditioner container 4 is not condensed in the drier flues, but escapes through the stack, an auxiliary water supply is preferably provided for maintaining a constant water level in the reservoir 13. The steam generated in the boiler 16 passes through the superheater coil 17, pipe 27 and the nozzles 28, 29 and 30, and so comes into direct contact with the coal within the container 4. The temperature to which the steam is superheated is automatically controlled in accordance with the temperature of the coal near the discharge end of the conditioner container 4 by means of the thermostatically operated damper 24. In this manner, the final temperature to which the coal is preheated may be accurately regulated and automatically maintained constant at the desired value. The gases employed in heating the boiler 16 and the superheater coil 17 may be supplied by burning a suitable fuel, or may comprise waste gases from the coke oven heating flues or other sources.

The preconditioned coal is carried by the screw conveyor 7 to the accumulating bin 8, from which it is periodically dropped into the lorry 37 and charged into the oven chambers 39. The walls of the oven chambers are preferably heated to a temperature between 750 and $1000^\circ C.$, or even higher, before the preconditioned coal is introduced. Due to

the above described preconditioning of the coal, the extraneous heat from the oven walls rapidly raises the temperature of the outer layers of the coal charge to and above the critical value and to and above the temperature at which exothermic reactions take place. The extraneous heat from the oven walls and the exothermic heat developed by the reactions taking place in the plastic coal combine to cause the rapid progression of the plastic condition throughout the fuel mass.

The coking operation proceeds until the desired coking temperature is attained, whereupon the doors 40 of the oven chamber 39 are opened and the coke charge is pushed out by suitable means. The final coking temperature of from 750 to $850^\circ C.$ has been found to result in the production of a good grade of coke for domestic or metallurgical purposes, the volatile content of the coke thus produced being not in excess of 5%. Due to the conditioning operation employed, the entire coking operation can be completed in from four to six hours. When coke of lower volatile content is desired, the charge is permitted to remain in the oven for a longer period, and the volatile content of the coke may be thereby decreased even though the temperature of the coke is not raised above 750 to $850^\circ C.$ In certain cases, however, the final temperature of the coke may reach values from 950 to $1000^\circ C.$, or even higher. The process of the invention is thus quite flexible, it being possible to produce coke of any desired volatile content by simply varying the time period during which the charge remains in the oven. Regardless of the final coke temperatures attained, the process of the invention results in the production of a uniform and desirable quality of coke, a rich gas and a uniform tar containing valuable constituents, these advantages, as well as the economies in coking time and heat consumption, being largely due to the reduction in the oxygen content of the coal prior to carbonization, the manner in which the coal is heated up to and through the plastic stage and the utilization of the exothermic heat available in the coal.

It is to be understood that the described process and apparatus may be varied without departing from the spirit of the invention which is not limited to the embodiments illustrated and described, but includes all such modifications thereof as fall within the scope of the appended claim. For example, the entire preconditioning operation may be carried out by the use of a hot fluid in direct contact with the coal in a single container, the heating fluid may comprise an inert gas, a heated oil or various other substances, and many other modifications or omissions may be made without departing from the scope of the invention.

We claim:

The process of preparing coal for carbonization which comprises passing coal through a container, the coal entering the container being cold and wet, passing superheated steam into direct contact with the coal adjacent to the coal outlet of the container, drying and preheating the coal adjacent to the coal inlet of the container by passing the exhaust steam and the gases evolved from the coal adjacent to said coal outlet into heat exchanging relation but out of contact with the coal adjacent to said coal inlet, thereby condensing water vapor from the steam and gases, separating the condensed water vapor from the uncondensed gases, generating steam from the water so condensed, superheating said steam so generated and passing it into direct contact with the coal adjacent to said coal outlet, the coal being heated adjacent to said coal outlet to a temperature higher than the highest temperature of the coal adjacent to said coal inlet.

In testimony whereof we affix our signatures.

SAMUEL W. PARR.
THOMAS E. LAYNG.

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