Jan. 16, 1934. A. V. ABBOTT 1,943,291

PROCESS FOR THE LOW TEMPERATURE DISTILLATION OF COAL

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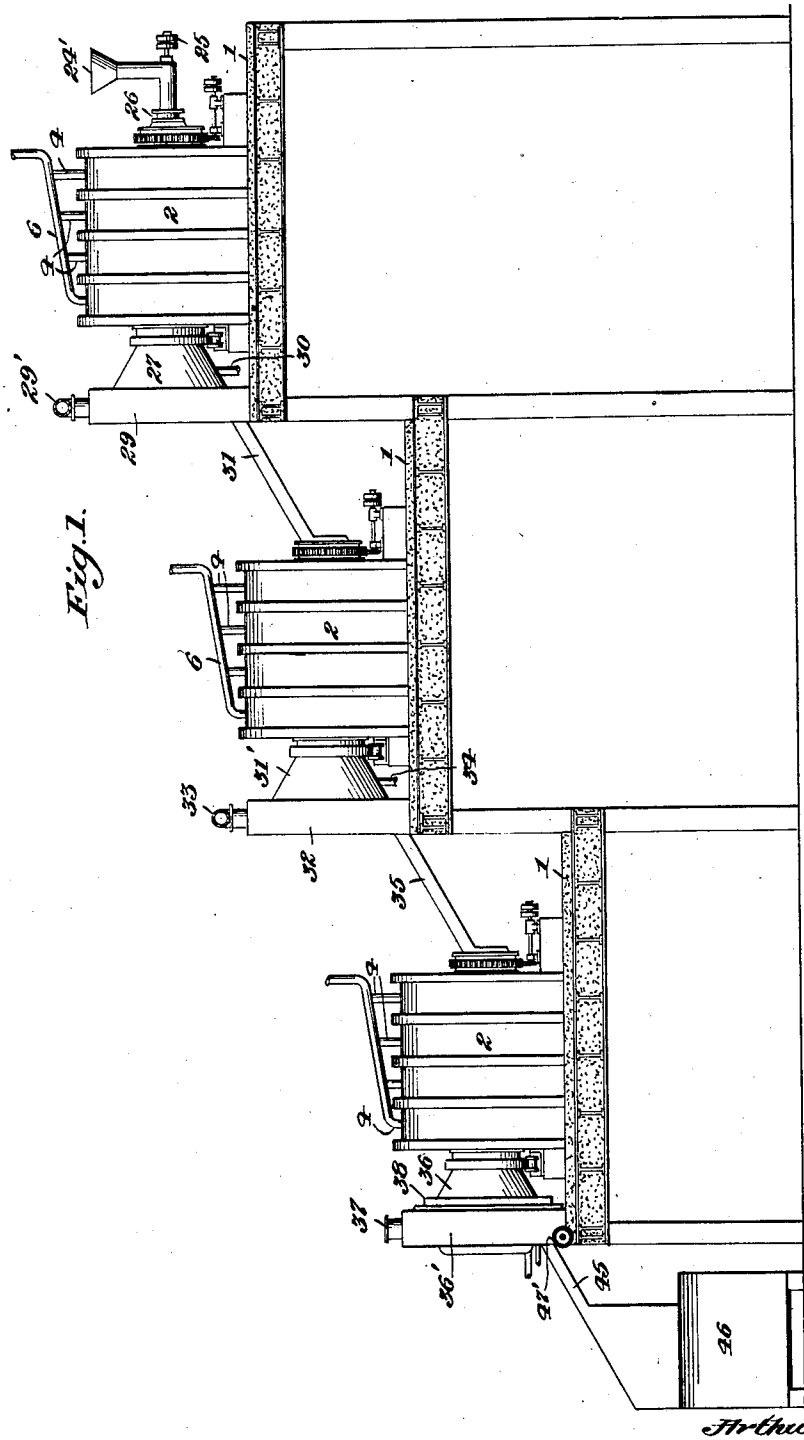


Fig. 1.

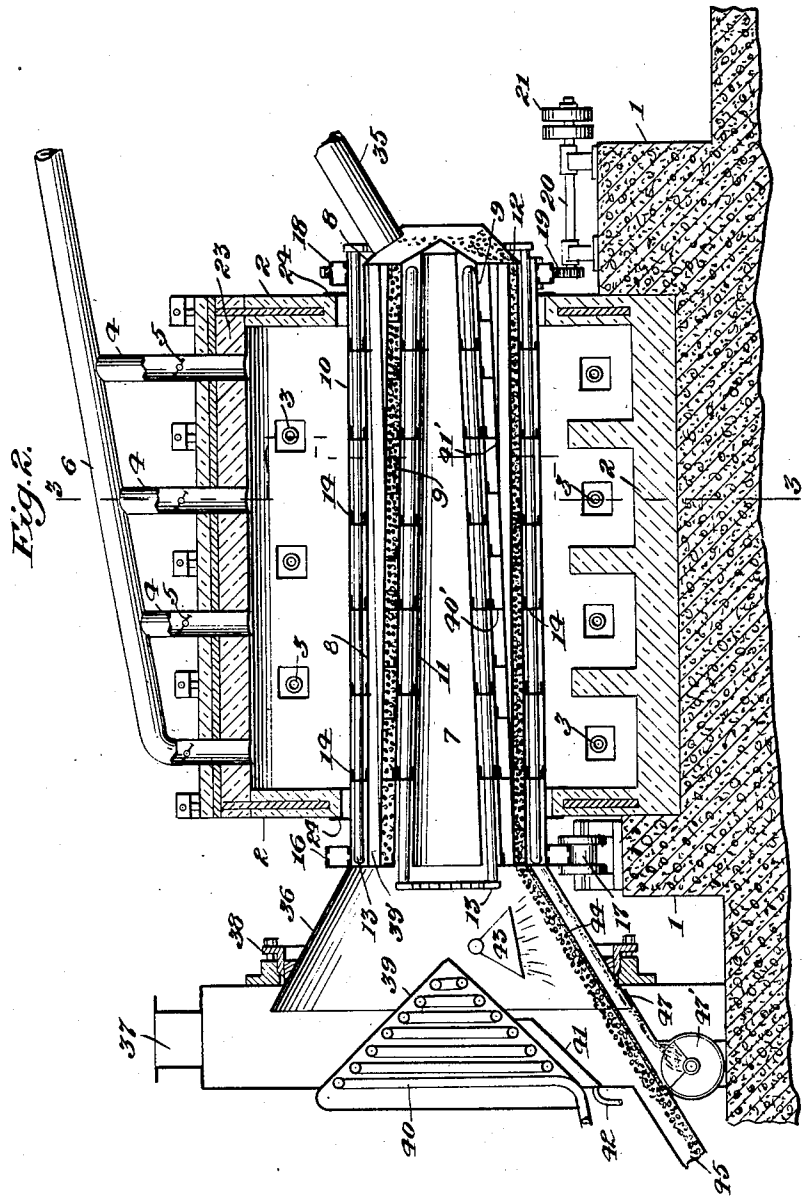
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Fig. 2.



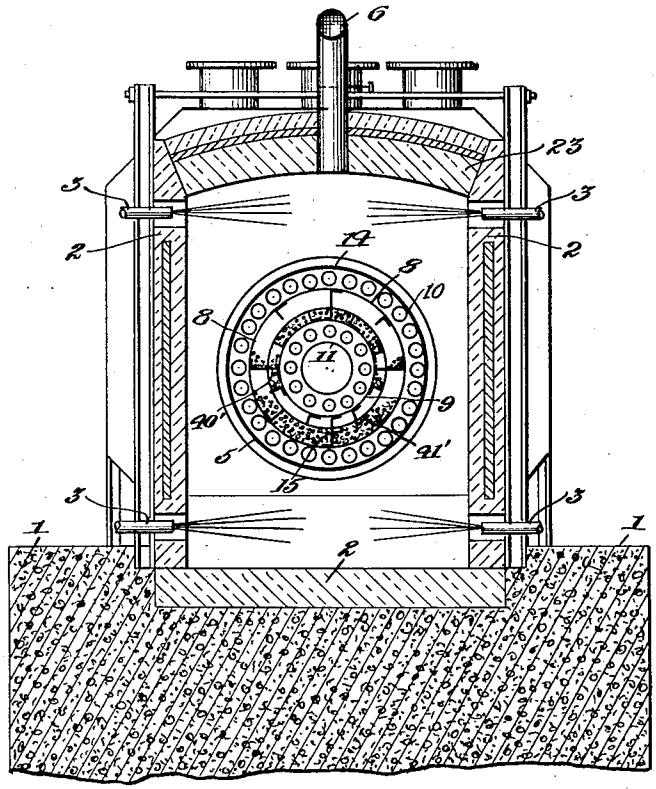
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Fig. 3.



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PROCESS FOR THE LOW TEMPERATURE DISTILLATION OF COAL

Arthur V. Abbott, Richmond, Va.

Application February 4, 1931. Serial No. 513,419

2 Claims. (Cl. 202—22)

My invention pertains to an improved and novel process for the low temperature distillation or carbonization of bituminous coals containing different percentages of volatile matters or of oil bearing shale, and said invention relates particularly to improvements on the type of apparatus and process such as set forth in Patents Nos. 1,593,916 and 1,708,740, dated July 27th, 1926, and April 9th, 1929, respectively.

The main object of the invention is to provide novel, practical and thoroughly efficient means for the low temperature distillation of bituminous coals, whereby a greater volume and higher grade of all of the most valuable by-products from said material is obtained than by any means of equal proportions now employed.

Another object of the invention is to provide a plurality of distillation retorts, preferably three, disposed in stepped relation with each other, said retorts being connected together and each being subjected to a different degree of temperature.

Further objects of this invention are to so construct my improved means that the coal is fed into the fuel heated retort at one end and the vapors and liquid-matter accumulated by its passage therethrough is carried off at its opposite end, while the coal which is calcined to a limited degree is conveyed or fed from said retort to a second retort through a pipe which is adapted to cool said calcined coal during its passage, said coal or material is then passed through a second and more highly heated retort, and the vapors and liquid matter generated in said second retort is carried off at its discharge end to suitable receptacles, while the more thoroughly calcined coal is fed or conveyed through a connecting pipe for discharging said coal into a third retort, the said coal being cooled during its movement through said pipe, the coal or material is then passed through the third and last retort, said last retort being subjected to a higher temperature, and the resultant high grade vapors and gases are cooled and drawn off by suction at the discharge end of the retort to a suitable receptacle, while the high grade coke product is caused to pass over a screen, while being subjected to the quenching operation, the vapor resulting from the quenching operation being caused to pass off and commingle with the said vapors and gases, while the said coke is conveyed through a pipe connection to a suitable coke receptacle, the fluid by-products being led to a suitable conveyor adapted to convey said products to a suitable receptacle for further treatment, while means are connected with the gas cooling means for carrying off any tarry products that usually accumulate thereon.

The foregoing and such other objects as may appear from the ensuing description are accomplished by the construction, arrangement, combination and location of the several parts hereinafter more fully described, illustrated in the accompanying drawings, and particularly pointed out in the claims appended hereto, it being understood that the preferred type of retort is horizontal, but it is readily obvious that retorts having inclined or vertical drums could be evolved, and that other changes in the precise form, proportions and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings forming a part of this specification it will be seen that:

Figure 1 is an elevation of the apparatus employed in carrying out my improved process.

Fig. 2 is an enlarged vertical section of the lowermost end constituting the discharge retort, showing the escape flue above the retort in full lines broken away; the conveyor pipe leading to the inner end of the retort in full lines broken away, and the coke discharge pipes broken away, and

Fig. 3 is a transverse section taken in the plane of the dotted lines 3—3, Fig. 2.

In the embodiment of my invention as illustrated it will be seen that the numeral 1 designates a concrete foundation for the support of each of the three separate refractory structures 2, although any desirable material may be employed in the construction of said foundation for the support of each of the said refractory structures, and said structures are preferably disposed in stepped relation with each other, but may be arranged in any location with respect to each other as will readily permit the feeding and discharge of the coal under treatment from one to another. Fitted within the walls of each of the structures is a series of burners 3 so disposed as to generate the heat required for the process of low temperature distillation or carbonization, while the top of each structure 2 is provided with exhaust outlets 4, fitted with regulators 5, and leading to the flue 6, through which the combustion gases generated by the burners is allowed to escape.

Supported within each structure 2 and extending slightly beyond each end thereof, is a drum-shaped retort 7, composed of a plurality of cylindrical casings 8, 9, 10 and 11 forming the annular distillation chamber 12, and between said casings 8 and 10 are disposed steel flasks or vessels 13, while other steel flasks or vessels 13 are disposed between the casings 9 and 11, each of said flasks being filled with lead, hermetically sealed, and housed within the channel members 14, which are riveted to the casings 8 and 10 and 9 and 11, respectively, said casings being secured together as a rigid unit by the brackets 15.

At the discharge end of the retort is fixedly secured a tire rim 16, adapted to engage with rollers 17 and at the opposite end of said retort is rigidly secured a gear tire rim 18, and the pinion 19 keyed to the shaft 20, and driven by the pulleys 21 for imparting the motive power required to revolve the retort.

The combustion chamber built around the retort has its walls filled in with suitable insulating material, and supports an arch 23, while the circular asbestos flaps 24, serve as diaphragms to prevent the escape of heat and combustion gases around the periphery of the retort.

The feeding end of the uppermost or first retort is equipped with the feed hopper 24' and a suitable conveyer having a driving pulley 25 for said conveyer and a stuffing box 26, while the discharge end is equipped with a truncated cone discharge apron 27 encased within a vapor chamber 29, and connected with the upper end of said chamber is a suction outlet 29' for leading the vapors and gases produced to a suitable receptacle (not shown) while the liquid products are passed out of the connection 30 to any desired receptacle (not shown) while the partially carbonized coal is discharged through the said apron and chamber and fed through a cooling pipe connection 31 to the feeding end of the distillation chamber of a second retort of the same internal structure as the first retort, the discharge end of the second retort being provided with a discharge apron 31', a vapor chamber 32, a suction outlet 33 for the vapor and gases produced created by the passage of the coal through the second retort, said gases produced being led to a suitable receptacle (not shown) the liquid products being passed out through means of the connection 34, to any desired receptacle (not shown), while the more thoroughly carbonized coal is passed through a cooling pipe connection 35 leading from said chamber 32 to the feeding end of the distillation chamber of the third and last retort, the discharge end of which is provided with a discharge apron 36 encased within the vapor and gas chamber 36' surmounted by a suitable suction operated gas or vapor outlet 37, and a stuffing box 38 adapted to render the connection between the gas chamber and the discharge apron absolutely air-tight. A cooling cone 39 is housed within the gas manifold and is disposed concentric with the longitudinal center of the retort and in turn houses the coils 40, and within said manifold is also disposed the tar drip collector 41 with the drip pipe connection 42 depending therefrom.

Suitably disposed within the discharge apron 36 is a water spraying device 43 adapted to serve as a quencher for the hot coke produced as it is discharged from the last retort and caused to pass over a close meshed screen 44, from whence said coke is led into the piping connection 45 and discharged into a suitable receptacle 46, while the liquid by-products are caused to flow through the said screen 44, down the inclined formation 47 and into a suitable discharge outlet 47' and from thence to a suitable receptacle (not shown).

The plurality of casings entering into the construction of each retort are each formed in the shape of a truncated cone, with their larger diameters disposed at the discharge end of the retort, and the casing 8 forming the outer wall of the distillation chamber, is lined with angle iron ribs 39', said ribs running throughout the length of the retort and are slightly inclined inwardly along their entire lengths. To the inner wall of the low temperature distillation chamber are fixedly secured the flanged members 40', said wall being also provided with parallel longitudinal ribs 41' extending the full length of the retort.

It will be understood that each of the three revolving retorts employed are constructed in substantially the same manner, but that each retort is subjected to a different degree of temperature, the uppermost or first retort being subjected to a comparatively low temperature (between 300° C. and 600° C.), the middle or second retort being subjected to a higher temperature (between 650° C. and 750° C.), while the last or lowermost retort is subjected to the highest temperature (between 800° C. and 900° C.), and from this last retort the highest grade of gas, coke and other valuable by-products is discharged into suitable receptacles for further preparation.

The caloric power of the burners is calculated to permit a degree of heat sufficient to not only melt the lead, but also to supply gradually and in a most effective manner the surplus heat which is radiated from the molten lead within the flasks or vessels.

It will be perceived that the high grade gases resulting from the low temperature distillation in the last retort are cooled off by being forced to contact with the surface of the cooling cone extending inside the gas chamber. In this manner and by cooling the distillation gases, their expansion and flow speed are reduced, and greater efficiency will be obtained by the equipment for the separation of tar and oils contained therein.

By the construction with which my operation is carried out it will be obvious that the bituminous material as it is gradually fed through the distillation chamber by being alternately advanced and retarded, in what may be properly termed, a step by step movement through said chamber, the said material is subjected to a different degree of distilling or dessicating action of the heat from opposite sides of the chamber, thus increasing the contact surfaces on which the low temperature distillation takes place.

The operation of my improved apparatus may be briefly described as follows:

The fresh coal is dumped into the feed hopper 24' from whence it is caused to be fed on the outer wall 8 of the low temperature distillation within the first retort which is revolving, the coal being advanced by the construction of said retort as it is forced to travel in a circular and longitudinal movement, so that when the point of circular gravity is reached, as the retort revolves, the coal is caused to fall on the shell 9 of the low temperature distillation chamber, and since shell 9 is lined with the ribs 41' and members 40', forming compartments in which the coal is detained while still in circular motion, said compartments serving to retard the discharge movement of the coal, thereby prolonging its exposure to heat within the retort, as owing to the inclination of the ribs 41' are secured along the outside periphery of the

inner group of cylindrical casings a gradual feed of the coal is obtained and the material is discharged, the resultant by-products being carried off for treatment by means of the outlets 29' and 30, respectively, while the hot coal which has been carbonized to a limited extent is passed through a cooling pipe connection 31 and fed into the distillation chamber of the second retort, the said coal being subjected to the same treatment that was received in the first retort, at a different and higher temperature, the by-products resulting from the treatment within the second retort being carried off through the outlets 33 and 34, respectively, for treatment, and the more thoroughly carbonized hot coal is passed through a second cooling pipe connection 35 and fed into the distillation chamber of the third and last retort, the coal receiving the same treatment while passing through this retort as was experienced in its passage through the first and second retorts, at a different and higher temperature than heretofore employed, the carbonized hot coal being then quenched by water within the said last retort and the high grade resultant vapors and gases are passed out through the outlet 37, while the liquid products are carried off through the outlets 42 and 47', and the carbonized coal or coke product is passed through a conveyor 45 and into a suitable receptacle 46.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

1. The process for the low distillation of bituminous coal, consisting in passing the coal through a distillation chamber in one retort at a comparatively low temperature, then passing the coal through a distillation chamber of a second retort subjected to a higher temperature, thence passing the coal through the distillation chamber of a third retort at a still higher temperature, separately collecting the liquid and vapors produced from the discharging end of each retort, then quenching by water the hot coke produced within the discharge end of said third retort, then passing the gases produced commingled with the vapors emanating from the quenching operation to a container, and finally separating the coke and liquid by-products and conveying them to their respective containers.

2. The process for the low temperature distillation of bituminous coal, consisting in feeding the coal through a distillation zone in each of three retorts, separately collecting the several gaseous and liquid by-products at the discharge end of each retort, subjecting the first retort to a low temperature, subjecting the second retort to a higher temperature, subjecting the third retort to a still higher temperature, cooling the hot carbonized coal produced by passing it through a cooling zone as it is conveyed from one retort to another, quenching by water the hot coke within the discharging end of the third retort, passing off the gases produced mingled with the vapors emanating from the quenching operation through an outlet, and finally separating the quenched coke and liquid by-products at the discharge end of the third retort and conveying the by-products to separate receptacles.

ARTHUR V. ABBOTT.