Nov. 13, 1923. 1,473,641

O. POHL

PROCESS OF DRY DISTILLING AND CARBONIZING CRUDE PEAT

Filed Aug. 24, 1921

Fig. 1.

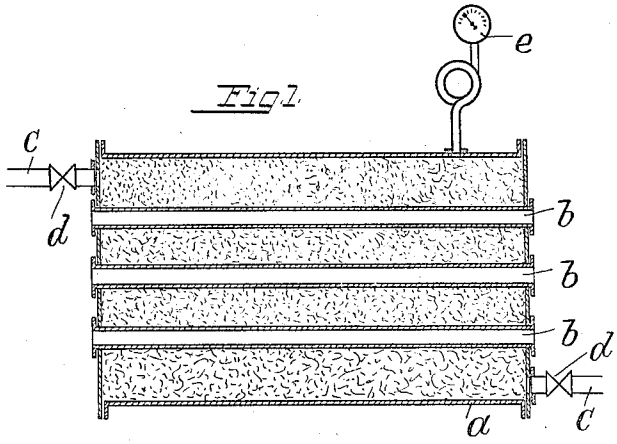


Fig. 2.

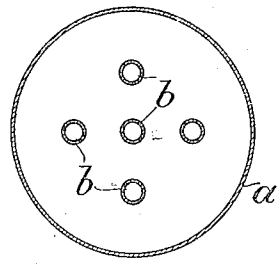


Fig. 3.

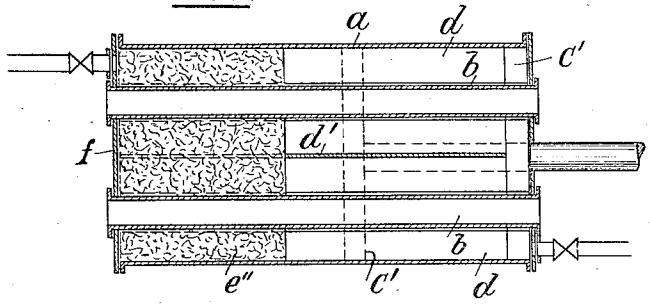


Fig. 4.

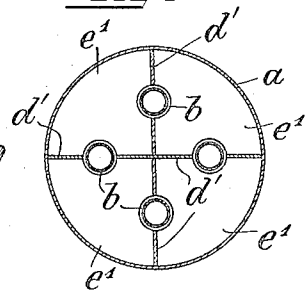
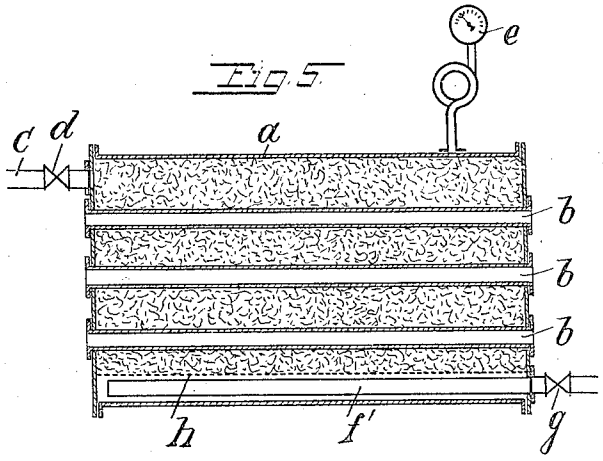


Fig. 5.



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UNITED STATES PATENT OFFICE.

OTTO POHL, OF PLANEGG, NEAR MUNICH, GERMANY.

PROCESS OF DRY DISTILLING AND CARBONIZING CRUDE PEAT.

Application filed August 24, 1921. Serial No. 494,883.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, Dr. OTTO POHL, citizen of Germany, residing at Planegg, near Munich, Bavaria, Germany, have invented certain new and useful Improvements in a Process of Dry Distilling and Carbonizing Crude Peat, for which applications have been filed in Germany as follows: January 23, 1920, Patent No. 337,097; February 23, 1920, Serial No. 23.684; June 22, 1920, Serial No. 24,113; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a process of dry distilling and carbonizing crude peat, or other substances of a similar nature, in a retort and the object of the present invention is to overcome certain difficulties heretofore encountered in similar operations and to make the whole process more economical and paying, all of which will be hereinafter duly explained.

In describing the said invention reference is had to the drawings herewith in which Figure 1 is a longitudinal section and Figure 2 is a transverse section through an existing form of retort adapted for carrying out this improved process. Figures 3 and 4 are similar sections through a retort improved as hereinafter explained, while Figure 5 is a longitudinal section through still another retort embodying an improvement to be hereinafter more particularly described.

As is generally known to those familiar with the subject, crude peat contains up to about ninety-five per cent of water. The coking temperature of the organic substance therein contained begins at about two hundred degrees Celsius. Accordingly, all processes the object of which is to convert peat into coal or coke are based upon heating the crude peat in closed vessels under pressure without a previous removal of the water contained in the material or upon methods in which the water is partially or entirely removed prior to heating, the dehydrated peat being then treated until the organic matter has been converted into coal or coke.

In the method first mentioned pressure is exerted and the peat is heated to temperatures of about three hundred degrees until separation of the watery part from the solid residue, which is in fact pulverized coal, takes place within the retort, there being no distillation of peat nor any production of solid pieces of coke. In the second-mentioned method pressure is applied in some cases, while in others a vacuum is used instead thereof.

In the processes employing a pressure peat bricks or cakes are in many instances heated in closed receptacles and then left to cool so that the volatile intermediate vapors developed are not discharged during the process, but are permitted to remain in those receptacles, where they condense to tarry substances which are absorbed by the small peat coal particles, converting the product obtained direct into a solid substance. Accordingly, also in this case no distillation takes place, nor are any by-products obtained.

This production of by-products is in theory possible in those of the already known processes where a vacuum is made use of. In cases, however, where a vacuum alone is resorted to it is not practicable to obtain a peat coke of but moderate solidity from a crude peat containing some ninety-five per cent of water, because there is no possibility of solidification of the dehydrated peat upon which the solidification of the coke depends.

Now, it is the object of the present process to remove these difficulties and render the distillation of crude peat, whatever percentage of water the same may contain, practicable, even to entire carbonization, under separation of the water, and to obtain at the same time all the by-products which are derivable from distillation in an uninterrupted operation, down to the production of a solid pressure-proof coke.

This object will be substantially obtained by heating the peat under the alternate application of pressure and vacuum. By making use in this process of a retort with radiators extending throughout the same the degree of heat of each individual radiator and of each portion of the peat immediately

surrounding it, may be regulated and controlled independent of the others, so that the gases and vapors produced by the dry distillation and carbonization may be led off from the heated portions and conducted through either warmer or colder portions of peat.

The retort illustrated in Figures 1 and 2, the construction of which is familiar in this art, is very well adapted for carrying out this improved and novel process or method.

The drawing shows a cylindrical retort *a* provided in a suitable way with a supply and discharge opening and extending through the retort from end to end thereof are the pipes *b*. These pipes are disposed symmetrically at suitable distances from each other and are intended to act as radiators receiving a suitable heating medium, and are surrounded on all sides by the peat or other matter intended for treatment. Each of the said pipes *b* may be attended to independently of the others, it being possible in this way to heat all of these pipes and consequently the whole boiler or retort uniformly or to change the temperature in some parts of the vessel, according to requirements, or put any number of the said pipes entirely out of action. Any suitable medium, as gas, superheated steam, electricity, may be used as the heating means. Of course, the shape of the radiators is not limited to the tubular form shown in the drawing, and the cross-section of the retort itself may be changed, as required.

The discharge-pipes *c* are shown as joined to the retort in the range of the upper and lower regions and provided each with a valve *d*, although these escape or discharge pipes and valves may, of course, be provided within the range of any other regions in the retort. These discharge pipes with their controlling or adjusting valves permit of carrying out the process hereinabove set forth, of leading off the gases and vapors produced by the dry distillation and carbonization from the hot regions, either direct or after conducting them through colder or warmer regions. There is further provided a manometer *e*.

In using the apparatus described the process, as improved by the present invention, may be carried out substantially as follows:

The crude peat should be so heated, first by an unequal supply of heat, that only the lower regions of the peat are strongly heated, while the peat in the middle and upper portions of the retort is heated to a lower degree which will not permit of a condensation of the arising steam. The result of this unequal heating is that a portion of the water only is converted into superheated steam, the pressure within the vessel increasing rather rapidly. Contrary to the methods known heretofore employing pressures of not less than sixteen atmospheres necessary for the desiccation of crude peat, it will in the present process be sufficient to reduce this pressure to six to eight atmospheres. When this pressure has been reached, the valve which is provided for the lowermost region should be opened and the steam in the retort compelled to make its way through the peat and the discharge pipe and its valve. The opening of the valve causes a reduction of the pressure and at the same time the escaping steam causes a suction whereby that portion of the water of the peat which has not been converted into steam is carried with it. In accordance with its atmospheric pressure the escaping steam may be converted into energy for the generation of power and heat. This procedure permits of a reduction of the water contained in the peat which in accordance with the quantity of water present in the original matter amounts to about fifty per cent. The operation may and should be repeated until the desired consistency has been obtained.

It has been found that by proceeding as described it is by no means necessary to bring the temperature up to one hundred and ninety degrees (Celsius) and more by a correspondingly higher pressure than the one used in the present process and retain this temperature for a couple or more of hours, but in accordance with the quantity of water contained in the peat matter a desiccation may be speedily attained at a pressure of eight atmospheres and at a temperature which in the hottest places of the unequally heated peat matter is always less than one hundred and ninety degrees. Thus a peat containing ninety per cent of water may be within three hours reduced to a consistency of thirty per cent. Of course by a stronger heating and a corresponding increase of the pressure the time required for the desiccation may be further reduced.

A considerable advantage of this use of a lower pressure and temperature resides in the circumstance that the temperature may be constantly kept beneath the lower limits of the carbonizing temperature of two hundred degrees. Valuable products of distillation evolved only when the peat is being carbonized cannot escape with the steam as long as the temperature is kept at such a low level.

When the peat has been reduced in the manner described to a consistency of, say, thirty percent of water, the temperature may be raised by putting into action the remaining radiators, changing from an unequal heat to a caloric which causes uniform heating to the whole peat and now the carbonization proper may begin. If easily decomposable products of distillation are intended to be secured, operations may be carried on in a vacuum or if any products, as hydrocarbons or substances of similar na-

ture are to be disengaged, as, for instance, when it is desired to obtain a greater output of illuminating gas, the operations may be condensed under pressure. Thus the operator may at will obtain by properly applying pressure and vacuum a larger or smaller quantity of any of the by-products—a circumstance of great importance for the economical management of the carbonization of peat.

As can be seen the whole process is carried through in one tank down to complete carbonizing without the requirement of an additional apparatus.

It has further been found that in carrying out the above described process in which the heating is effected with the alternate use of pressure and vacuum, it may become necessary to give the peat or other matter in the retort a smaller or larger consistency. In order to attain this a plunger may be employed which may be set in motion by a spindle or by any other suitable means. This permits of a further desiccation of the peat by compression, or the desiccated peat may be reduced to any desired solidity or consistency which also controls the solidity and consistency of the coke produced. In addition, this device permits of providing space by a pressing together the contents of the retort which space may be re-filled with a new charge of the raw material. This affords the possibility of filling the whole boiler or retort with desiccated and reduced peat, so that at last a big bulk of desiccated mater may be subjected to carbonization and thereby a great output of the coke obtained. The said plunger may also be used for withdrawing the desiccated and reduced peat from the apparatus.

To obtain the best results from the above described process it is preferred to proceed in such way that simultaneously with the solidification of the charge within the retort the body of compressed peat will by means of axial knives be divided into a plurality of longitudinal pieces.

This cutting facilitates the escape of the moisture during the compression and consequently the peat may be compressed into a more solid and compact mass from within the closed retort. Also the further treatment with a view of drying and carbonizing the solid peat obtained during the compression in the retort will by the cutting apart of the same be considerably facilitated.

The axial blades intended for the cutting of the solidified peat may be attached to the plunger mentioned, or they may be mounted in the rear portion of the closed retort so, that in the former case the axial blades cut into the compressed charge while in the other case the charge between the blades will be solidified by the plunger moving against the charge and the blades. If the axial knives are provided in the rear portion of the retort they may be secured in the sides as well as in the rear wall of the same.

A retort adapted for carrying out this process is illustrated in Figures 3 and 4 showing a movable piston-like compressor plate to which the said knives are attached.

In these two figures the retort has radiators b, a plunger c' and axial knives d' acting against the bodies e'' which are produced by the pressure exerted by the said plunger c'. The drawing exemplifies the said knives as attached to the plunger c' in such positions that they are in radial planes passing through the longitudinal-axes of the radiators and crossing each other in the central line of the cylindrical retort.

Whenever the plunger c' is moved forward into the position indicated by dotted lines in Figure 2, the knives cut into the longitudinal pieces e'' of segmental section (see Figure 4).

In the same manner the knives d' may be attached to the rear part of the inside of the retort a or to the wall f in the rear end of the retort.

If desired the knives d' may be so disposed that they cross the retort between the radiators b.

Furthermore, the knives may be perforated to facilitate the discharge of the water.

In the methods, just described, the charge which is subjected to dry distillation, as, for instance, the crude peat referred to, will during its treatment in a closed retort be more or less consolidated by the plunger in the manner described.

Now it has been found that in carrying out this process a very good compressed peat containing any desired reduced quantity of water will be obtained, if the distillation is interrupted at the moment the water contained in the feed has been substantially diminished. The compressed peat in this partially desiccated state may be taken out of the retort and re-dried by means of the steam which is always produced during the process and which may, preferably, be taken from another retort, provided for carrying out the same process in the same establishment.

However, instead of carrying out the processes in the manner above described for the solidification of the peat, certain methods modified as described and hereinafter set forth may be resorted to. In accordance with such method, the water which is mechanically and colloidally present in the peat is liberated by a small expenditure of the heat and the resulting pressure of the steam developed by the heating of one, several or all of the portions of the charge of peat, and is then together with the peat pressed out of the retort. Preferably, only the inner zones of the retort should be

heated or, if all the zones are heated the inner zones must be more intensively heated, whereby the development of the steam as well as the forces of the pressure are made to operate from inside outward. For this purpose the retort may be provided with one or a plurality of draining pipes, each of which has a valve which is kept closed until the water, which must be separated and forced by the steam into the respective draining pipe or pipes has collected in the same.

A retort constructed for this purpose is illustrated in a longitudinal section in Figure 5 which shows the retort a the radiators b, the steam discharging pipe c with a valve d, a manometer e, and at the bottom a draining pipe f' with a valve g, the said draining pipe being preferably separated from the peat by a perforated jacket h to prevent the entering of peat matter into the said pipe. The rear end of the latter may be open altogether or it may be provided with perforations or slots to enable the water to enter it.

Now, when the innermost of the radiators b is heated, the small steam quantity up to about eight atmospheres which is developed will be sufficient to liberate the water present in the peat and to force it towards and into the draining pipe f' the valve of which is kept closed and will be only opened when a quantity of water has collected and then the steam in the retort will completely expel such water. This process may, of course, be combined with a simultaneous compression of the peat in accordance with the previously described method, though the two methods may be practiced in succession.

It will be understood that the peat in the retort may by the steam developed be made to decompose merely and then expelled together with the water, without draining off water through the valve, by removing the cover of the retort, or it may be expelled from the retort in any other way or by any other suitable means for further treatment outside of the same. For instance, the peat thus consolidated may be put in a press, the water being entirely expelled in the latter and the peat solidified.

What is claimed is the following:

1. The herein described process of distilling and carbonizing crude peat or matter of similar nature in a closed retort, which consists in heating the peat or the like under varying temperature and alternate application of pressure and vacuum.

2. The herein described process of distilling and carbonizing crude peat or matter of similar nature in a closed retort, which consists in independently heating various zones of the peat or the like to different temperatures, and expelling the gases and vapors produced in a zone of a certain temperature through zones of other temperature.

3. The herein described process of distilling and carbonizing crude peat or the like in a closed retort, which consists in heating the peat or the like under alternate application of pressure and vacuum, and at the same time consolidating it.

4. The herein described process of distilling and carbonizing crude peat or the like, which consists in heating the peat or the like under alternate application of pressure and vacuum, and at the same time separating it into a plurality of consolidated pieces.

5. The herein described process of distilling and carbonizing crude peat or the like, which consists in placing crude peat or the like in a closed retort, heating the peat in the retort under alternate application of pressure and vacuum, compressing the peat in the retort, and then removing it in a compressed state from the retort.

6. The herein described process of distilling and carbonizing crude peat or the like, which consists in placing a charge of peat or the like in a closed retort, independently heating under alternate application of pressure and vacuum different zones of the charge in the retort, compressing the charge in the retort and cutting it into separate pieces, and then removing the compressed pieces from the retort.

7. The herein described process of distilling and carbonizing crude peat or the like, which consists in placing a charge of peat or the like in a closed retort, heating the charge, freeing the water that is mechanically and colloidally present in the charge by means of the heat and the pressure of the steam developed thereby, and pressing the water out of the retort.

8. The herein described process of distilling and carbonizing crude peat or the like, which consists in placing a charge of peat or the like in a retort, freeing the water that is mechanically and colloidally present in the charge by heat and steam pressure thus developed, collecting the freed water, and then discharging the water from the retort.

9. In a device for distilling and carbonizing crude peat or the like, a retort containing the peat or the like, radiators extending through said retort, knives within said retort, and means for relatively moving said knives and the peat or the like.

10. In a device for distilling and carbonizing crude peat or the like, a retort containing the peat or the like, a plurality of radiators extending through said retort, a plunger within said retort, and knives radially mounted on said plunger with respect to said retort.

11. In a device for distilling and carbon-

izing crude peat or the like, a substantially cylindrical retort, radiators extending therethrough, a plunger within said retort, and knives mounted on said plunger to cut the peat or the like into segments.

12. In a device for distilling and carbonizing crude peat or the like, a cylindrical retort containing the peat or the like, a plurality of radiators extending through the retort parallel with the longitudinal axis thereof, a plunger within said retort, knives mounted on said plunger to pass between the walls of said radiators nearest to the center line of the retort, and knives mounted on said plunger to pass between the walls of the radiators and the wall of the retort.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

DR. OTTO POHL.

Witnesses:
PAUL DREY,
RICHARD LUZ