

June 3, 1924.

E. O. RHODES ET AL

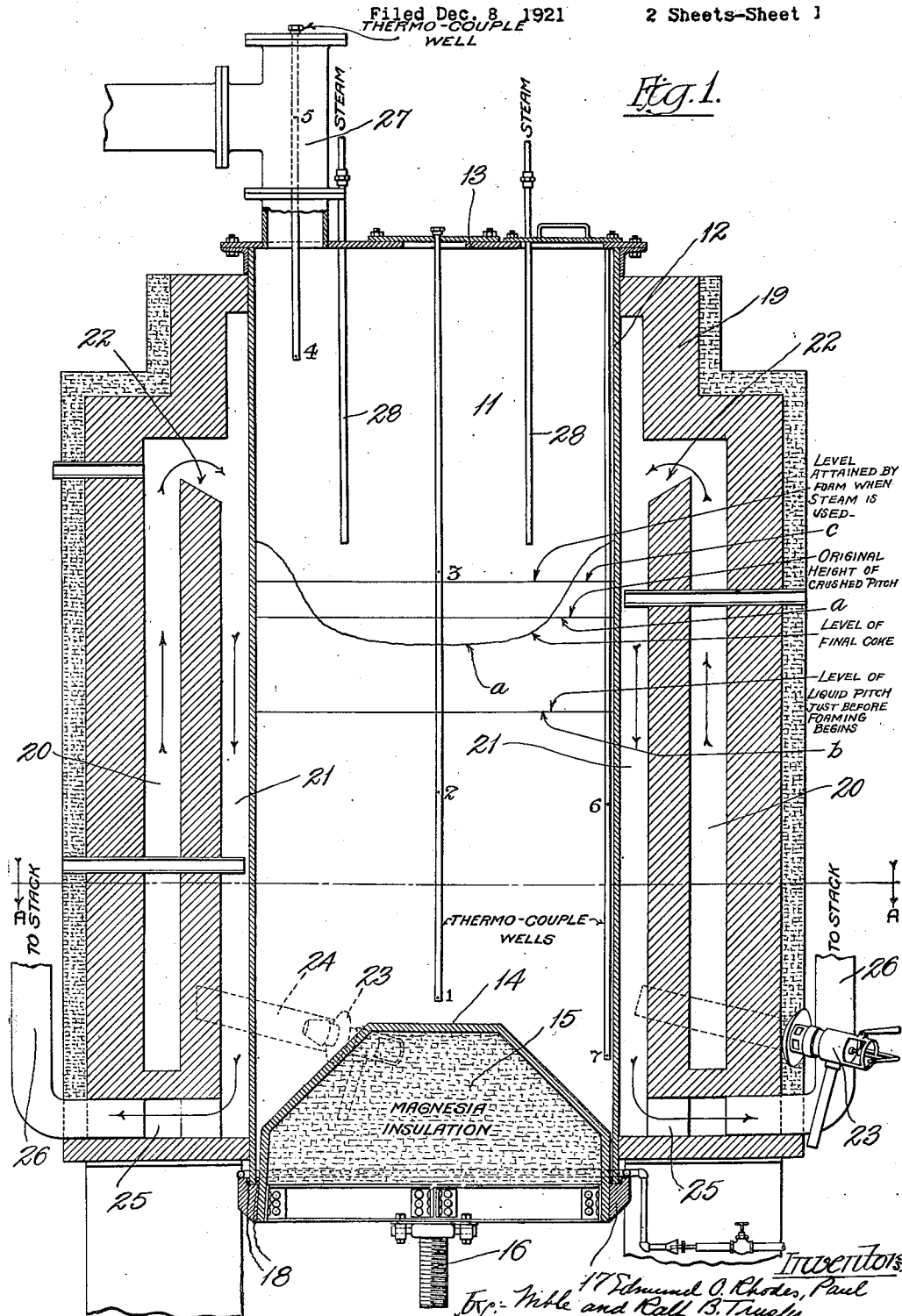
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CARBONIZATION OF CARBONACEOUS MATERIALS

Filed Dec. 8, 1921
THERMO-COUPLE
WELL

2 Sheets-Sheet 1

Fig. 1.



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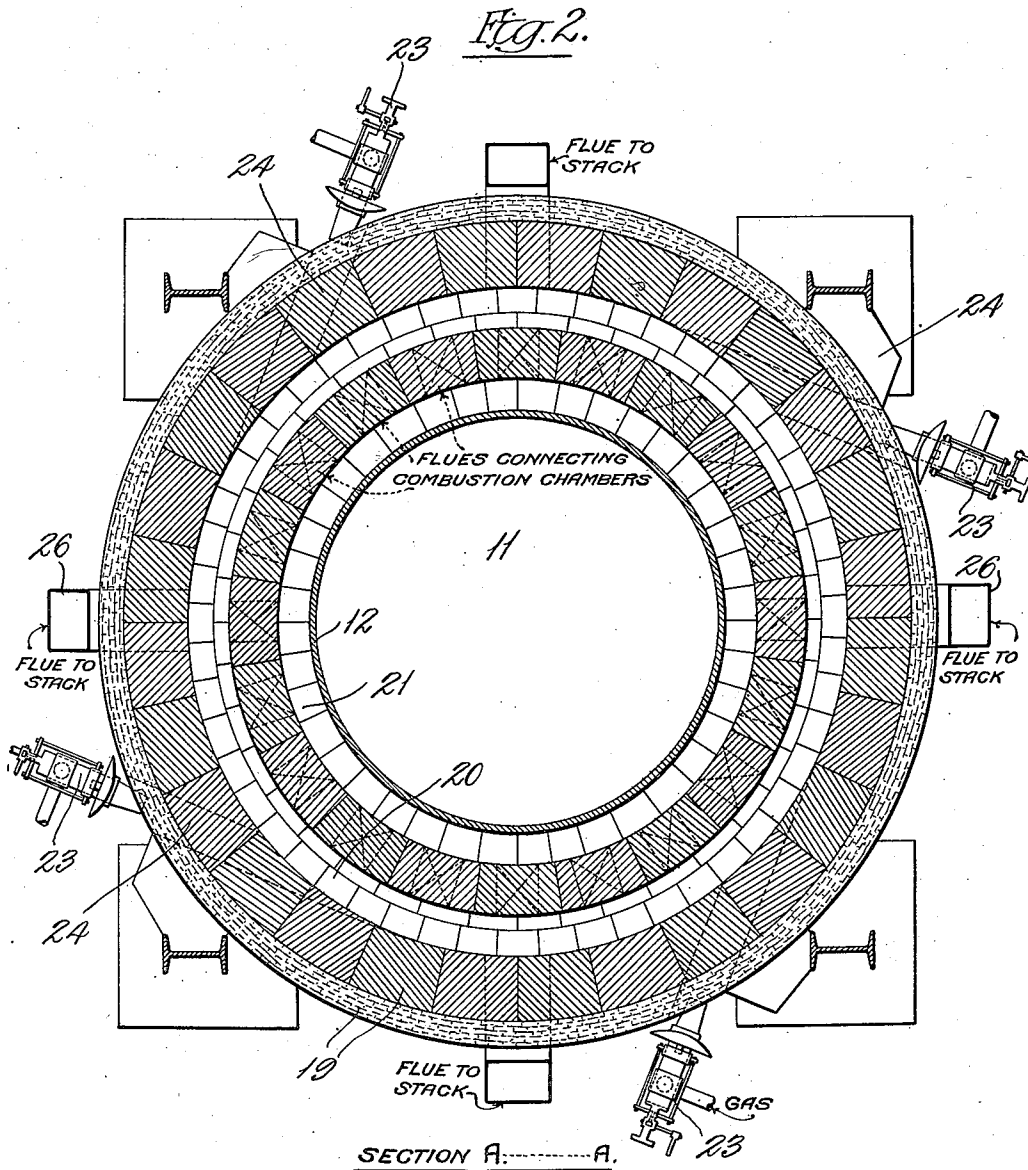
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CARBONIZATION OF CARBONACEOUS MATERIALS

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2 Sheets-Sheet 2



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By: Munday, Clark & Carpenter, Attys.

UNITED STATES PATENT OFFICE.

EDMUND O. RHODES AND PAUL WIBLE, OF CHICAGO, ILLINOIS, AND RALF B. TRUSLER, OF PITTSBURGH, PENNSYLVANIA, ASSIGNORS TO AMERICAN TAR PRODUCTS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE.

CARBONIZATION OF CARBONACEOUS MATERIALS.

Application filed December 8, 1921. Serial No. 520,792.

To all whom it may concern:

Be it known that we, EDMUND O. RHODES and PAUL WIBLE, both citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, and RALF B. TRUSLER, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Carbonization of Carbonaceous Materials, of which the following is a specification.

This invention relates to the coking of carbonaceous materials of that type, which, during the application of the coking heat liquefy prior to the formation of the coke and thus, as the distillates and gases evolve, give rise to violent frothing, bubbling and other phenomena that has made the satisfactory handling of such materials, while coking, a problem of great difficulty; the invention is of especial importance in the coking of pitch and has for objects to effect the coking of coal-tar pitch and analogous carbonaceous materials on a commercial scale, while restricting frothing and foaming of the pitch during the coking process to a degree which avoids boil-overs and waste of pitch or its distillates and yet permits the coking or distillation process to be carried on in a retort apparatus of commercially practicable dimensions.

In the carbonization of coal-tar pitch, and analogous materials, the pitch, which has been charged into the oven, or retort, absorbs heat from the side walls and by such preliminary heating, the pitch, if charged into the retort in the solid form, becomes entirely liquid. In its liquid state, the pitch continues to absorb heat from the side walls of the retort and, as the liquid pitch circulates freely in the retort, its temperature remains practically uniform throughout the liquid mass. In this preliminary stage of heating up the pitch, the volume of the liquid pitch increases but a slight amount. The heating up period is continued and, as the distillates evolve, the pitch starts to boil and foam, such foaming being caused by the rapid evolution of vapors and distillates from the pitch. This evolution of vapors and attendant foaming is accompanied by a sharp rise in the level of the pitch and because, for a time, the quantity of distillate evolved increases, the level of

the pitch continues to rise. Finally, the quantity of distillate evolved per unit of time reaches a maximum, and then starts to decrease. Concurrently, the pitch level commences to fall and continues to do so until a level is reached which, in some cases, may be below the original level of the melted pitch. This decrease in volume of the melted pitch is explained by the fact that a considerable amount of distillate is removed during the period of foaming and boiling. At the completion of the boiling and foaming period, the transformation of pitch to coke begins. At first the pitch is thick, but entirely liquid. Gradually its consistency changes until it becomes a dough-like or rubbery mass. While this change in the consistency of the pitch is taking place, there is a further evolution of gas. The liberation of this gas within the plastic mass of pitch causes the latter to rise in a manner analogous to that of dough. Finally the gas evolution decreases to such an extent that the forming coke, which by this time has become very stiff, is no longer forced upwardly. At this stage, the material immediately in contact with the side walls is hard coke, whereas that in the center of the oven or retort, being insulated from the walls by the layer of hard coke, is still somewhat plastic. Toward the end of the coking operation, the amount of gas that is evolved is comparatively small. At that time, shrinking commences and as the material in the center of the oven or retort gives up the residue of its volatile matter, it shrinks in volume. Such shrinking or contraction of the mass of forming coke causes the material to pull away from the side walls of the retort, so that when the coking operation is completed the coked mass may be removed without difficulty from the retort, by any suitable discharging apparatus.

The above described period of boiling and foaming has given rise to great difficulties in the carbonization of coal-tar pitch. Unless the retort or distilling chamber be made of enormous dimensions, as compared with the quantity of pitch treated in the retort, a boil-over is almost certain to occur, with great waste of pitch and valuable distillate and with attendant danger of fire. The use of retorts or stills of dimensions greatly in excess of the quantity of material treated

involves not only a huge expense of installation, as compared with the available production of distillate and coke, but also the employment of quantities of heat greatly in excess of that actually required to effect coking of the material. By the present invention, such foaming and bubbling of the pitch is checked, so that boil-overs are prevented, and a maximum yield of distillate and coke is accomplished in a retort apparatus of commercially practicable size and at a commercially practicable rate of coking, without waste of heat.

In addition to the general objects recited above, the invention has for further objects such other improvements or advantages in operation and results as are found to obtain in the apparatus and process hereinafter described or claimed.

In the accompanying drawings, forming a part of this specification, and showing, for purposes of exemplification, a preferred form and manner in which the invention may be embodied and practiced, but without limiting the claimed invention specifically to such illustrative instance or instances:

Figure 1 is a vertical sectional elevation of a retort apparatus especially designed for practicing the improved process of the present invention; and

Fig. 2 is a horizontal sectional elevation of the same, taken in a plane indicated by the line A—A of Fig. 1.

The same characters of reference designate the same parts in each of the several views of the drawings.

In its present embodiment, the invention is applied to the carbonization of coal-tar pitch, in which the invention has an especially important application, and, for convenience, the present description will be confined to this use of the invention. Features of the invention, however, may be susceptible of other valuable applications; consequently the scope of the invention is not confined to the specific use and specific embodiment herein described as an illustrative example.

Referring to the drawings which illustrate a structural embodiment of apparatus for carrying out the improved carbonizing process of the invention, there is shown at 11 a retort chamber constructed preferably of a cylindrical metallic shell 12 having a removable cover 13. The lower end of the retort chamber 12 is normally closed by a removable bottom 14, preferably of conical configuration and adapted, as shown in Fig. 1, to project upwardly within the retort chamber 11. The bottom 14 is filled with insulating material indicated at 15, and is preferably supported on a screw-threaded upright 16, which may be lowered by means of any preferred type of mechanism (not shown) for the purpose of removing the

bottom 14 from the lower end of the retort chamber 11 to discharge the finished coke from the retort chamber. When in the closed position shown, a recessed ring 17, secured to the sides of the aforesaid bottom 14 receives the lower extremity of the cylindrical shell 12, and, if desired, a packing, indicated at 18, may be provided at the point of engagement of the lower end of the shell 12 with the ring 17 to provide a substantially leak-tight joint.

The heat for carbonizing the pitch charged into the retort chamber 11 is derived from a heating wall assembly 19 that surrounds the shell 12. This heating wall assembly is constructed of suitable refractory material, built up to form an outer shell surrounding the cylindrical shell 12 of the retort chamber and constituted of an outer annular vertical flue 20 and an inner annular vertical flue 21, the inner flue 21 directly surrounding the shell 12. At its upper end, the outer flue 20 communicates with the inner flue 21 through an annular passageway 22, permitting the heating gases to pass from the top of the outer flue 20 into the inner flue 21. Heating gases are supplied to the outer flue 20 by means of a plurality of, in the present instance four, gas burners 23, which project into inlet flues 24 that extend tangentially into the outer flue 20 at an upward slope in order to cause the hot gas to rise in the flue 20 and to obtain a uniform distribution of the heat. The inlet flues 24 also supply the air to support combustion in the flues. The hot gases in the outer flue 20 rise and pass through the annular outlet 22 and downwardly through the inner flue 21, from which said gases exhaust into exhaust channels 25 at the bottom of the inner flue 21, and thence pass out into the stack flues 26.

In carrying out the improved pitch coking process of the invention, crushed pitch is charged into the retort chamber 11, to about the level indicated at *a*, and combustion is maintained in the heating flues surrounding the retort chamber 11, the temperature being preferably a little above that at which the pitch was originally formed in the distillation of the tar. As the pitch absorbs the heat extraneously developed in the flues 20 and 21 it melts and sinks to about the level indicated by the line *b*. As the heating continues, the foaming and bubbling of the melted pitch begins with considerable evolution of distillate and gases which pass out of the top of the retort through the distillate outlet 27. The present invention prevents this foaming of the pitch from reaching the top of the retort chamber and thus causing a boil-over. For this purpose the retort chamber 11 is equipped with a plurality of, for example two, pipes 28 which extend through the top

13 of the retort and project downwardly into the interior thereof, said pipes 28 preferably terminating at a level somewhat above that of the height of the crushed pitch
 5 originally charged into the retort chamber. As soon as the foaming and bubbling of the pitch begins a quantity of gas is introduced into the retort through the pipes 28. This
 10 gas has a mechanical action on the pitch foam and bubbles which causes them to be checked, and to subside at a level just below that of the outlets of the pipes 28, as indicated by the line *c*. If an inert gas is employed, the action of the introduced gas is
 15 probably entirely mechanical. Almost any gas will accomplish the desired results. We have discovered, however, that steam is especially suitable for checking the foaming and bubbling of the pitch, as it does not
 20 tend to retard the progress of the distillation and may be easily separated by condensation from the recovered distillate. Moreover, the introduction of the steam greatly assists the passage of the distillate
 25 and gases out of the retort chamber.

When the bubbling stage has been completed, the steam may be turned off. The coking of the pitch progresses until the final coke is formed, the top of the coke being
 30 indicated by the wavy line *a*. The finished coke may be readily discharged from the retort chamber by lowering the bottom 14.

The invention as hereinabove set forth may be variously embodied within the scope
 35 of the claims hereinafter made.

We claim:

1. The process of carbonizing pitch which consists in applying an extraneously developed heat to a mass of pitch to melt the
 40 pitch and then reduce it to coke, withdrawing the evolved distillates and gases from the pitch mass, and injecting steam over the top of the pitch mass when in the liquid stage, to restrict the level of foaming and
 45 bubbling of the pitch; substantially as specified.

2. The process of carbonizing pitch which consists in heating a mass of pitch to melt the pitch and then reducing it to coke, withdrawing the evolved distillates and gases
 50 from the pitch mass and injecting steam over the top of the pitch mass when in the liquid stage to restrict the level of foaming and bubbling of the pitch; substantially as specified.
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3. The process of carbonizing pitch which consists in applying an extraneously developed heat to a mass of pitch to melt the pitch and then reduce it to coke, withdrawing the evolved distillates and gases from
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the pitch mass, and injecting a gaseous medium over the top of the pitch mass when in the liquid stage, to restrict the level of foaming and bubbling of the pitch; substantially as specified.

4. An improvement in the art of carbonizing pitch by heating which consists in injecting a gaseous medium in counter-current directly into the foaming and bubbling zone of the pitch to check such foaming and bubbling; substantially as specified. 65

5. An improvement in the art of carbonizing pitch by heating which consists in injecting steam in counter-current directly into the foaming and bubbling zone of the
 75 pitch to check such foaming and bubbling; substantially as specified.

6. The process of carbonizing carbonaceous materials of the character described which consists in heating a mass of such material to melt it and then reduce it to coke, withdrawing the evolved distillates and gases from the mass and injecting steam over the top of the mass when in the liquid stage to restrict the level of foaming and
 85 bubbling of the mass of material; substantially as specified.

7. The process of carbonizing carbonaceous materials of the character described which consists in heating a mass of such material to melt it and then reduce it to coke, withdrawing the evolved distillates and gases from the mass and injecting a gaseous medium over the top of the mass when in the liquid stage to restrict the level
 95 of foaming and bubbling of the mass of material; substantially as specified.

8. An improvement in the art of carbonizing carbonaceous materials which foam and bubble when subjected to coking heat which improvement consists in injecting a gaseous medium directly into the zone of foaming and bubbling material to check such foaming and bubbling; substantially as specified. 100

9. An improvement in the art of carbonizing carbonaceous materials which foam and bubble when subjected to coking heat which improvement consists in injecting steam directly into the zone of foaming and bubbling material to check such foaming and bubbling; substantially as specified. 105

10. An improvement in the art of carbonizing pitch by heating which consists in injecting an inert gas into the foaming and bubbling zone of the pitch to check such
 115 foaming and bubbling; substantially as specified.

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