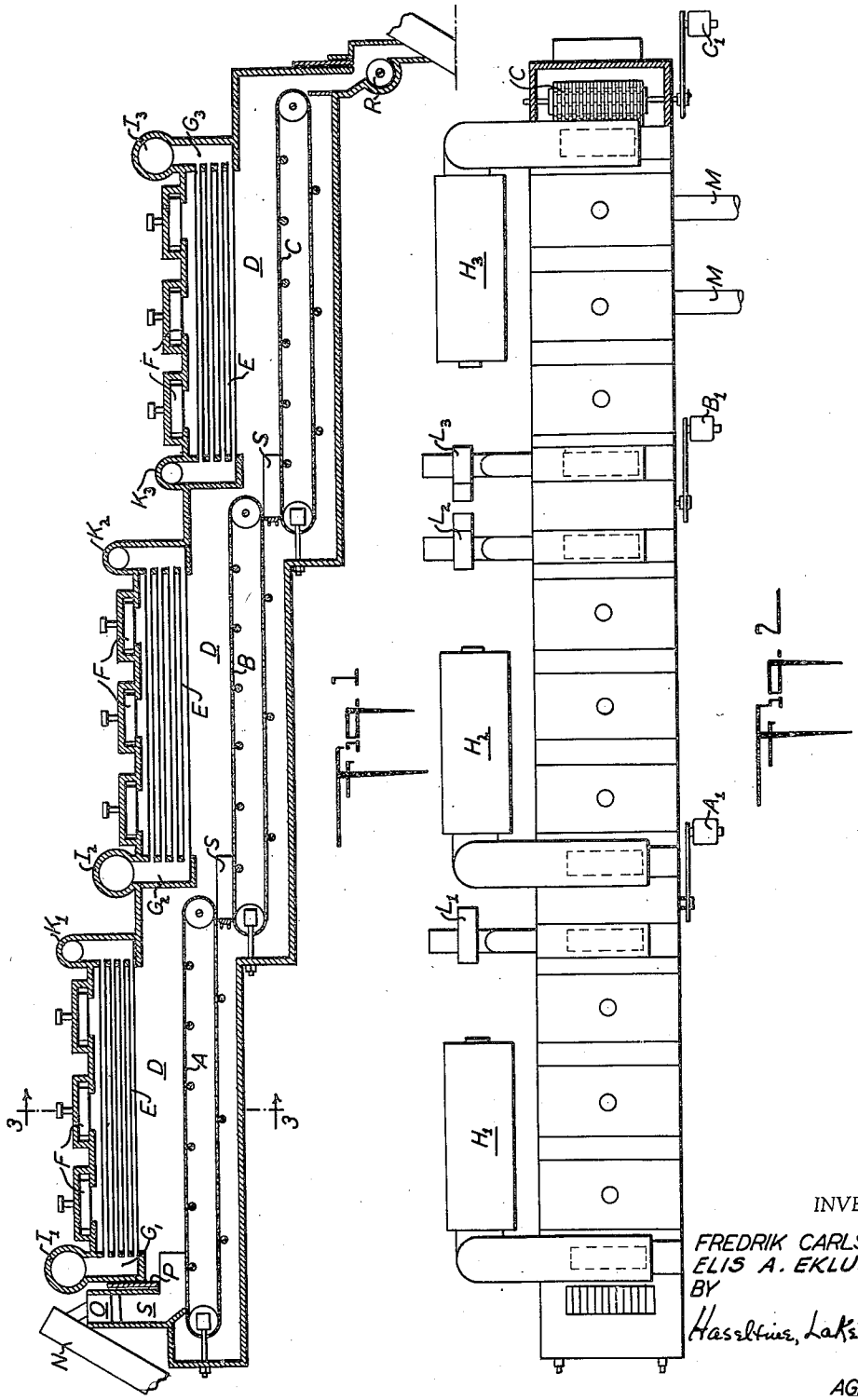
Dec. 9, 1952 F. CARLSSON ET AL 2,621,151

COAL AND THE LIKE

Filed March 10, 1948 2 SHEETS—SHEET 1



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COAL AND THE LIKE

Filed March 10, 1948 2 SHEETS—SHEET 2

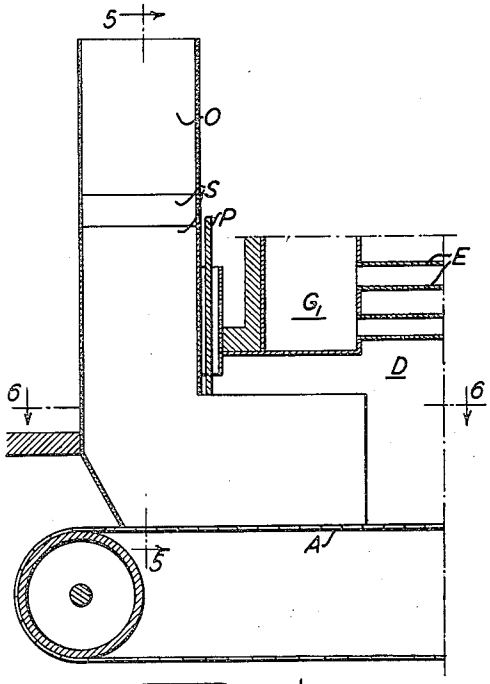


Fig. 4

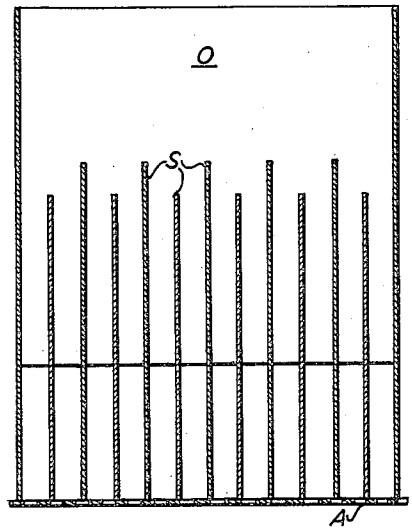


Fig. 5

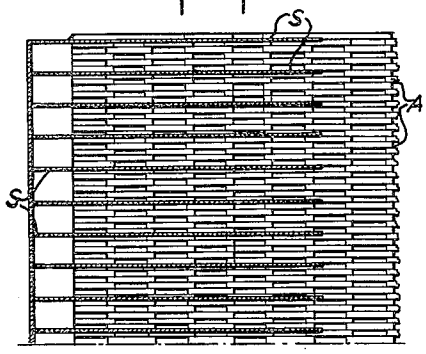


Fig. 6

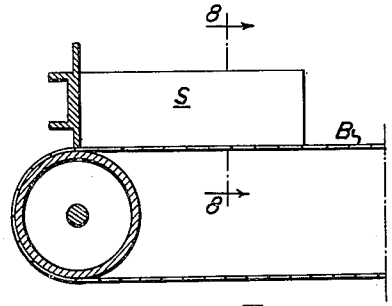


Fig. 7

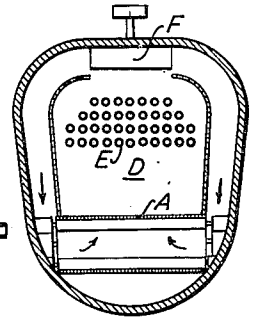


Fig. 3

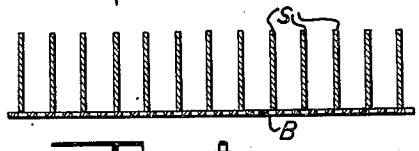


Fig. 8

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COAL AND THE LIKE

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6 Claims. (Cl. 202—15)

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For the dry distillation of bituminous oil shale, coal, browncoal and other carbonaceous material are often used tunnel ovens, through which the material consisting of lumps and therefore penetrable by gases, is transported on a travelling carrier consisting of separate cars provided with perforated bottoms or of an endless chaingrate passing round rollers or the like with a constant velocity through the tunnel, which at both ends is shut off from the atmosphere. The material is charged at one end of the grate and discharged at the other end through a suitable trapping device, preventing the air to enter in the tunnel.

For the heating of the material the distillation gases and the water vapours developed in the process are brought into circulation repeatedly through heating means in which they are heated and then, principally in vertical direction, through the penetrable material, which in this way is heated to the temperature required.

The heating means or heating elements may consist of a number of pipes arranged in the longitudinal direction of the tunnel through which pipes hot gases e. g. combustion gases flow, whereas the distillation gases circulate between and around said pipes.

Whether the material is transported through the tunnel on cars or on a chaingrate the thickness of the layer of material which the heating gases have to pass will be the same in different sections of the tunnel.

The heat transfer to the material depends upon the temperature difference between the material and the combustion gases for which reason it is advantageous that these gases have a high temperature.

As the heating elements only withstand a certain temperature there is a limit to which they can be heated.

By conveying the heating gases, at the feed end of the tunnel, in the same direction as the material, which on account of its moisture and low temperature has a strong cooling effect on the circulating distillation gases and therefore on the heating elements it is permissible to admit the combustion gases here at a temperature of 800–900° C. In this section of the tunnel it is therefore possible to work with a thick layer of material, which is an advantage as the temperature of the distillation gases will decrease considerably when passing through the material for which reason the gases will absorb a higher amount of heat when passing the elements. Further in the tunnel where the temperature of the material has risen, it is necessary, on account of

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reasons mentioned above, to decrease the temperature of the combustion gases. According to the present invention it is suggested to work with a thinner layer of the material in this section of the tunnel whereby a more rapid and even heating is obtained.

When distilling a material with a relatively high content of bitumen the material at a temperature of 270–300° C. is transformed into a sticky mass which of course diminishes the permeability and hampers the heating.

When working at this stage of the process with a thick layer of material which is heated by hot distillation gases ascending from below, whereby the upper part of the layer will be considerably cooler than the lower part, the distillation products formed in the lower part will condense higher up and hamper or prevent the passage of the distillation gases and the carrying out of the process. If according to the present invention a thinner layer is used, this inconvenience will not arise, as there will be only a small temperature difference in the different courses of the layer.

When the main part of the oil products has been expelled, there is no more risk of such a condensation. At this stage the material is to be heated to the final temperature, 475–500° C. in order to expel the last remaining part of the oil. The temperature of the surface of the material is now slightly below the final temperature for which reason the temperature of the combustion gases must be kept relatively low, as otherwise the heating elements will be exposed to a too high temperature. The transfer of heat to the inner parts of the material takes place only by conduction and as the conductivity of the material in general is low, a considerable time is required in order to heat the material thoroughly, for which reason it is suggested according to the present invention to work again in this section of the tunnel with a thicker layer of material.

By working with a thinner layer of material in some sections of the tunnel, the power consumption will be decreased in those parts of the tunnel where from operational point of view it is advantageous to use a thinner layer of material.

The present invention relates also to an arrangement for regulating the thickness of the layer of material when the material is transported through the tunnel in principally horizontal direction on a perforated travelling carrier, which arrangement is characterized thereby that the travelling grate consists of two or more separately driven parts, placed one after another, for the purpose of being able to feed forward the dif-

ferent parts at velocities independent of each other.

If the material consists of slabs, slates or similar flat pieces, which often is the case with bituminous oil shales, the flat sides of the pieces will, when charged on the grate take a substantially horizontal position and therefore offer a very great resistance against the circulation of the distillation gases, when the gases are conducted from below upwards or vice versa through the grate. In order to avoid or reduce this inconvenience guide plates are, according to the invention, applied between the grate and the feed hopper, from which the material is continuously charged on the grate at the entrance end of the tunnel. These guide plates divide the material flowing from the hopper in separate streams. It has been proved that with a suitable space between the guide plates in relation to the size of the material a great deal of the flat pieces take a substantially vertical position on the grate whereby the resistance against the gas circulation will be considerably less than if the flat pieces take a horizontal position. At the transfer of the material from the discharge end of one of the grate parts to the charging end of the next part such guide plates are also applied.

In the accompanying drawings a dry distillation apparatus arranged according to the invention is illustrated in a vertical longitudinal section in Figure 1, in plan in Figure 2 and in a section on the line III—III (Figure 1) in Figure 3. Figures 4–8 illustrate details of arrangements, made in order to prevent at the dry distillation of material consisting of flat pieces these pieces to take a substantially horizontal position on the grate.

The apparatus consists of an elongated tunnel through which the material is transported on the endless grates A, B, C, which are driven by the motors A_1, B_1, C_1, D is the distillation chamber. Above the grates, in the distillation chamber heating elements E are arranged, preferably one for each grate and consisting of a number of pipes, through which hot gases e. g. combustion gases flow. Under the action of the fans F the distillation gases circulate repeatedly through the material on the grates and between and around the pipes. The heating elements may also be constructed in such a way that the distillation gases pass through the pipes and the hot gases between and around them. The heating elements may also be placed at the bottom of the distillation chamber D under the grate or at the side of the distillation chamber D, in which case conduits connecting the distillation chamber D and the heating elements suitably one conduit for each fan, are arranged. For the supply of hot gases to the different heating elements are distribution chambers G_1, G_2 and G_3 arranged in which hot gases from the fireplaces H_1, H_2 and H_3 enter through the pipings I_1, I_2 and I_3. Having passed the pipes E the hot gases are drawn from the collecting chambers K_1, K_2 and K_3 by the fans L_1, L_2 and L_3. The gaseous products formed in the distillation process pass out through the outlets M for condensation and further treatment.

The material which is to be distilled is raised by the bucket elevator N into the feed hopper O, from which it is charged on the same at the movement of the grate A. By means of the sliding plate P the thickness of the material on the grate can be regulated. At the movement of the grate the material is transported to the discharge end of the grate and falls down on the charging end of the grate B, from which it is transported in the same way to the grate C, from the discharge end of which the distilled material is moved through the trapping device R. The drawing shows the different grates horizontal and stepped in relation to each other, but they may also be arranged gently sloping so that the discharge end of the last grate is on the same level as the charging end of the first grate.

By running the grates at different velocities the thickness of the material on the different grates is regulated. If the thickness on the grate A, for instance, is 400 mm. and the grate is running with a velocity of 225 mm./min., whereas the velocity of the grate B is 450 mm./min. the thickness of the material on the latter will be 200 mm.

The feed hopper O is at the lower end provided with partitions or guide plates S which divide the material falling downwards in separate streams, whereby the flat sides of the material is prevented to take substantially horizontal positions on the grate. The arrangement is illustrated in Figures 4–6. Fig. 4 shows a vertical section through the feed hopper. Fig. 5 is a section on the line V—V, and Fig. 6 a section on the line VI—VI (Fig. 4).

Having now particularly described the nature of our invention and the manner of its operation what we claim is:

1. A process for dry distillation of bituminous oil shale, coal, brown coal and other carbonaceous material, which is conveyed through a tunnel oven at the same time as the distillation gases are forced, after heating, to circulate right through the material, which includes the steps of continuously conveying layers of carbonaceous material through three zones formed in the oven, varying the speed of conveyance of each layer through the zones so that the layer being conveyed through the second of said zones will be conveyed at a speed higher than that of the layer being conveyed through the first of said zones and the layer being conveyed through the third zone will be conveyed at a speed lower than that of the layer being conveyed through the second of said zones and thus also automatically varying the thickness of the layers in each zone so that the layer in the second of said zones will be of a thickness less than that of the layer in the first of said zones and the layer in the third of said zones will be of a thickness greater than that of the layer in the second of said zones, such variance of the speed of conveyance and thickness of the layers being made in accordance with the conditions of the carbonaceous material in the zones.

2. A process according to claim 1 further including the steps of arranging the carbonaceous material in the layers so that the flat pieces thereof are arranged in a substantially vertical position in order to reduce the resistance of gases circulating therethrough.

3. An apparatus for dry distillation of bituminous oil shale, coal, brown coal and other carbonaceous material which comprises an elongated oven, three independent perforated movable grates spaced from each other and arranged in the oven for conveying the carbonaceous material therethrough, means for circulating distillation gases through the carbonaceous material as the material is being conveyed through the oven, means in said oven for heating the carbonaceous material and means for feeding

carbonaceous material to a first movable grate, means for driving said first grate at a predetermined speed, means for driving the second grate at a speed higher than that of the first grate and means for driving the third grate at a speed lower than that of the second grate.

4. An apparatus as set forth in claim 3 further comprising means positioned adjacent said feeding means for dividing the material being fed to one of said grates in separate streams.

5. An apparatus as set forth in claim 3 further comprising means adjacent said feeding means for causing the flat pieces of carbonaceous material to take a substantially vertical position on said first movable grate.

6. An apparatus as set forth in claim 3 further comprising a plurality of sets of vertical guide plates, one of said guide plates being positioned adjacent said feeding means and another set being positioned adjacent a second movable grate, said sets of guide plates dividing the material on said gates in separate streams.

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