Jan. 26, 1932. F. LAMPE 1,842,906

APPARATUS FOR THE LOW TEMPERATURE CARBONIZATION OF OIL BEARING MATERIALS

Filed Oct. 29, 1928 2 Sheets-Sheet 1

Fig. 1.

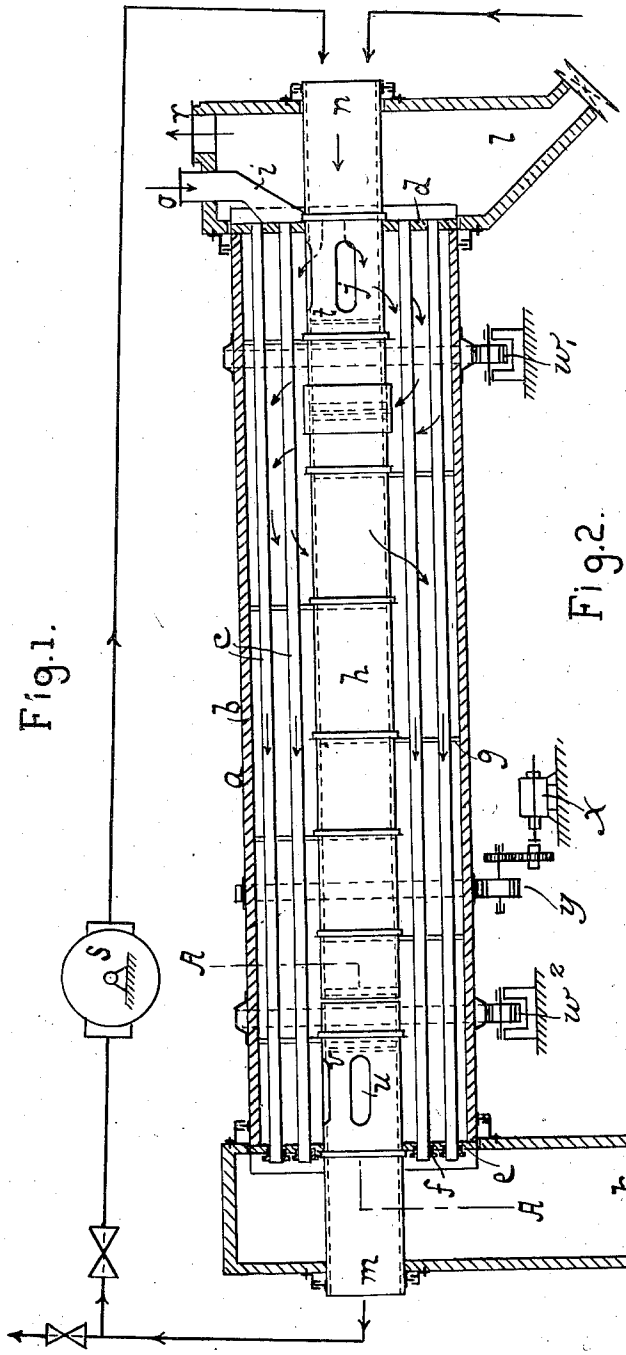
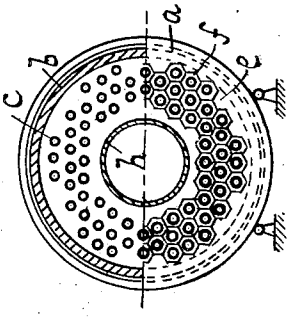


Fig. 2.



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Fig. 3.

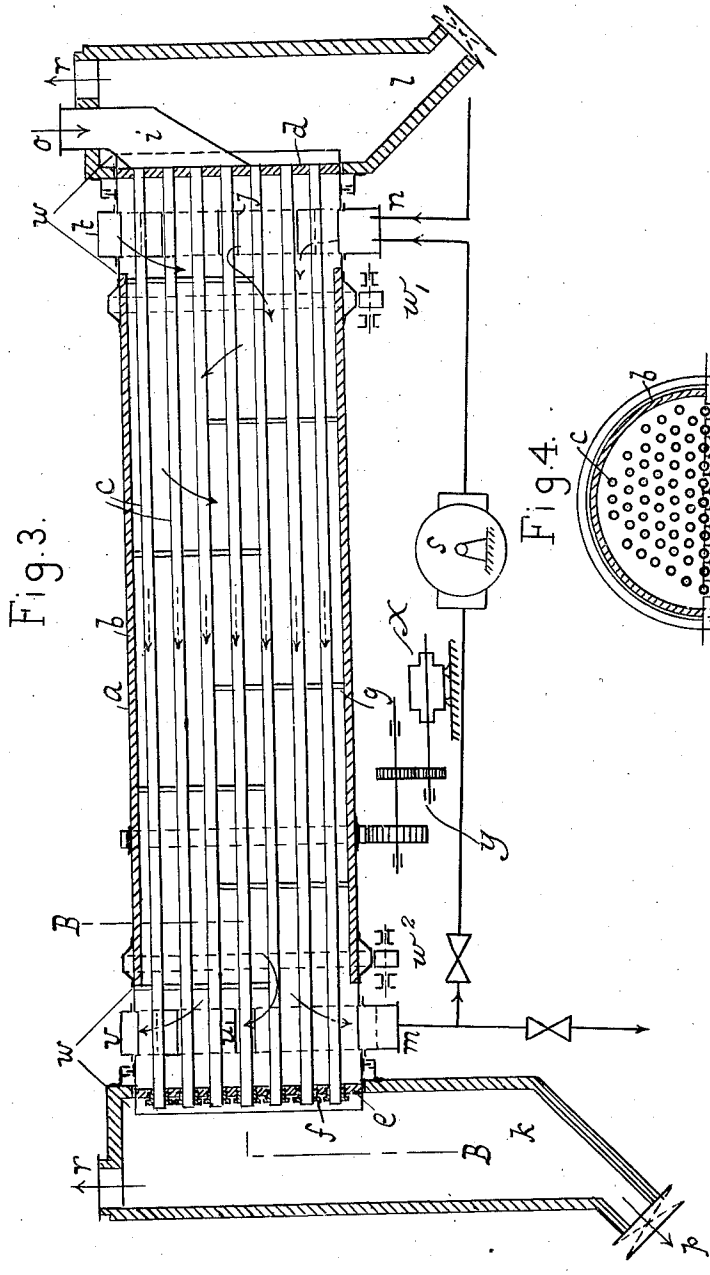


Fig. 4.

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APPARATUS FOR THE LOW TEMPERATURE CARBONIZATION OF OIL-BEARING MATERIALS

Application filed October 29, 1928, Serial No. 315,910, and in Germany December 13, 1927.

This invention relates to improvements in the low-temperature carbonization of bituminous or oil-bearing materials and in apparatus therefor.

The production of tars and oils by the low-temperature carbonization of bituminous or oil-bearing materials is of great technical importance. In the processes usually employed for this purpose, the material under treatment is brought to the requisite carbonization temperature by direct or indirect heating, with or without the employment of scavenging gases. These processes, however, are often attended by considerable drawbacks, which are particularly manifest in the frequently used rotary tube furnaces. These furnaces consist either of a long heated cylinder, or of a sheaf of tubes which are mounted at both ends, and in which the heating gases or vapors transmit the necessary heat to the charge either directly or indirectly. According to this method of working considerable inconveniences arise mainly from the fact that owing to the high temperature the structural materials employed are subjected to extremely troublesome deformation, especially in rotary tube furnaces with widely spaced supports. The result is that there is injurious local overheating, which sets up irregular carbonization of the material and cracks the distilled vapors into less valuable gaseous hydrocarbons. Moreover, the hitherto employed carbonizing apparatus only affords a comparatively low utilization of the tangible heat of the heating gases and a small output.

I have now found that these drawbacks and inconveniences are obviated by passing the bituminous or oil-bearing materials under treatment through a sheaf of tubes which is disposed in the interior of a rotary cylinder covered with non-conductive material in such a manner as to prevent the transmission of heat from the interior to the exterior and bathed by hot gases or vapors, which are passed in the same direction as the charge, or in counterflow. The exhaust heating gases or vapors, are wholly or partially returned to the cylinder, in order to heat the same, and, when desirable, without receiving any other supply of heat.

The material under treatment is passed through the tubes either by means of spirals arranged therein or by inclining the whole apparatus, or by both means. The degree of inclination of the apparatus depends on the grain-size of the material under treatment and may be about 9 to 10 degrees or at the most 11 degrees for passing fine-grained brown-coal without making use of spirals.

In order to prevent sagging of the tubes they may be supported by walls, for instance in the form of plates of sheet metal, which are preferably arranged in staggered relation so that the hot gases pass in a zig-zag course through the rotary cylinder thus efficaciously bathing the tubes.

The improved process will now be further described with reference to the accompanying drawings, which illustrate in longitudinal vertical section in Figure 1 and in cross-section in Figure 2 taken on the line A—A of Figure 1, apparatus according to this invention for carrying out the process. A further modification of the apparatus is illustrated in Figures 3 and 4, Figure 4 being in part a cross-section at right angles taken on the line B—B of Figure 3. The said apparatus consists of a slightly inclined, rotary cylinder a, mounted at two points in the end walls. The said cylinder is built up of or lined with masonry, or is provided with any other internal non-conductive material b, by which means any injurious deformation through heat is prevented and the apparatus, in contrast to types already known, acquires the requisite mechanical strength. The said cylinder is supported by the rollers w^2 and w_1 and is rotated with the aid of the motor x. Inside the said cylinder is disposed a sheaf of tubes, consisting of a number of carbonization tubes c which are accessible and may be provided with devices for turning and loosening the material to be carbonized, the said tubes being fixedly mounted, in a gas-tight manner, in the one end wall d of the drum a but being capable of moving axially in the other end wall e, when they are expanded by heat, a tight joint being ensured

at this end by a stuffing box *f* supplied for each tube, or the stuffing boxes may be replaced by a common packing plate. Provision may also be made for the expansion of the tubes, by replacing the stuffing boxes by an immovable, gas-tight connection and arranging for one of the common end walls to be movable though gas-tight, within the cylinder. The interior of the cylinder is provided with supporting walls *g*, preferably connected with the drum, the latter remaining permanently stable by reason of its being lined with non-conductive material. These walls prevent the troublesome sagging of the individual tubes, and also serve for mounting a guide pipe *h* for facilitating the passage of the heating gases or vapors which pipe is arranged at about the centre of the drum, is free to expand under the influence of heat and is provided with blank flanges.

The charge is introduced into the apparatus at *o*, and is distributed into the carbonization tubes by a suitable feeding device *i*. The charge travels through these tubes in consequence of the rotation and slightly inclined position of the cylinder and is removed at *p* in a spent condition, from the receiver *k*. Both the receiver *k* and the collector *l* for the distillation gases are effectually sealed from the outside. The heating gases or vapors enter the apparatus at *n* and pass through openings *j* in the feed pipe *t* into the drum, through which they flow in the direction indicated by the arrows, bathing the carbonization tubes in their passage. The heating gases may, however, be passed in the opposite direction, so as to travel in counterflow in relation to the charge. The arrangement herein described enables the distillation vapors to be conducted in such manner that they are not exposed at any point to a temperature which is higher than that at which they were formed, so that cracking is prevented. They can be drawn off at either end of the cylinder, according to requirements, for example at *r*. The supporting walls *g* and guide pipe *h* effect favorable transmission of heat to the walls of the carbonization tubes by guiding the heating gases or vapors in a suitable manner. The heating gases and vapors issue through openings *u* into the discharge pipe *v* and pass out of the apparatus at *m*, and they may be returned to the cylinder, either wholly or in part, and without any special reheating, as for example by means of a blower *s*.

If the carbonization process is exothermic, it may be unnecessary to supply heat to the distillation tubes from the outside by means of heating gases or vapors, and in this case the circulation gases or vapors are merely used to effect the uniform distribution of the heat to the materials of the charge.

The possibility of accommodating a large number of carbonization tubes enables an extensive heating surface to be obtained, which allows of a high throughput.

The apparatus may, however, be constructed and operated without the central guide pipe *h*, as shown in Figures 3 and 4 of which Figure 3 represents in longitudinal vertical section an apparatus without such central guide pipe, Figure 4 being a cross-section of the apparatus on the line B—B of Figure 3. In this apparatus the heating gases and also the heating gases returned into the apparatus, if such be employed, are introduced and removed into and from the cylinder through openings *j* and *u*, provided in the outer casing near the ends of the cylinder. The said openings are covered by ringlike channels *t* and *v*, surrounding the casing in a gas-tight manner. Since the ends *w* of the cylinder in which the openings are provided are exposed to high temperatures, they are preferably built of material resisting heat. This apparatus has the advantage over that shown in Figures 1 and 2 that in the space occupied by the guide pipe *h* further distillation tubes can be arranged so that the free space of the cylinder is better utilized.

What I claim is:—

Apparatus for the low-temperature carbonization of oil-bearing materials comprising a rotary cylinder having end walls and covered inside with a non-conductive material, a sheaf of tubes disposed therein mounted in a gas-tight manner fixedly in one end wall of the cylinder and axially movably in the other end wall, two pipes centrally disposed in the end walls and fixedly mounted thereto for passing heating gases into and removing them from the said cylinder and a guide pipe around which said heating gases flow, when the apparatus is in action, and which is concentric with and of about the same cross-sectional area as the said pipes and of a smaller length than the distance between the ends of the said pipes to allow it to expand, provided with blank flanges at its ends and supported by the said two pipes.

In testimony whereof I have hereunto set my hand.

FERDINAND LAMPE.