Jan. 26, 1954 D. PETIT 2,667,452

VIBRATING RETORT

Filed Dec. 30, 1947 3 Sheets-Sheet 1

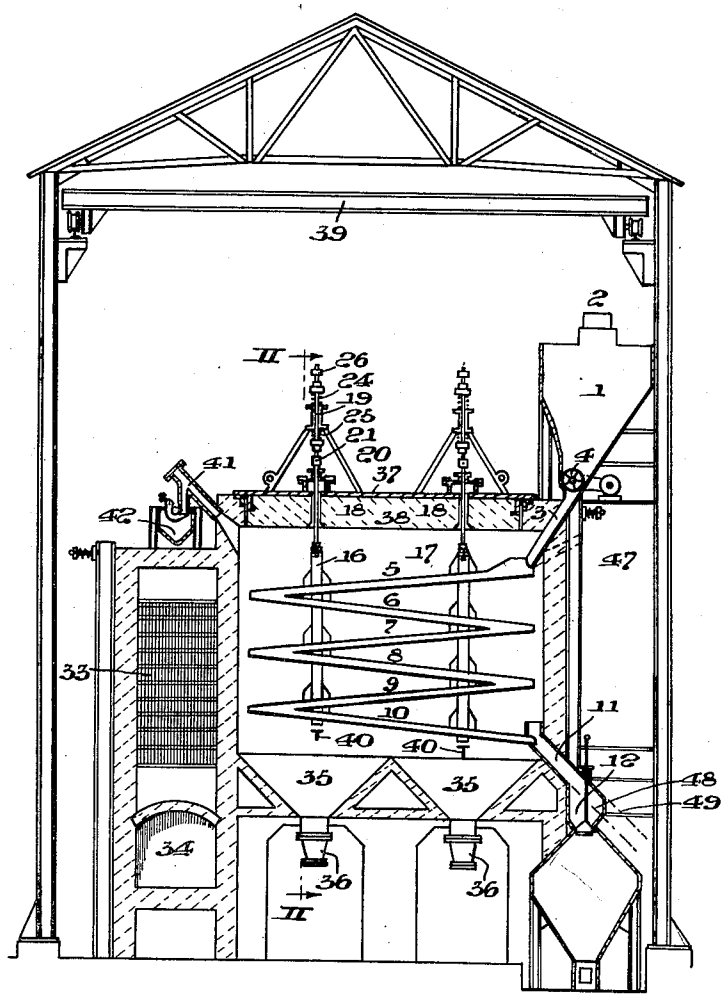


Fig. 1.

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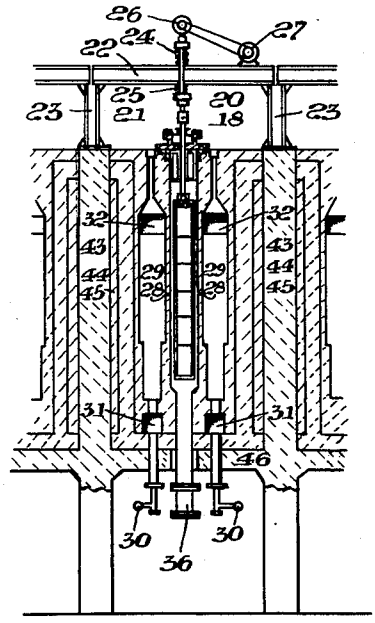


Fig. 2.

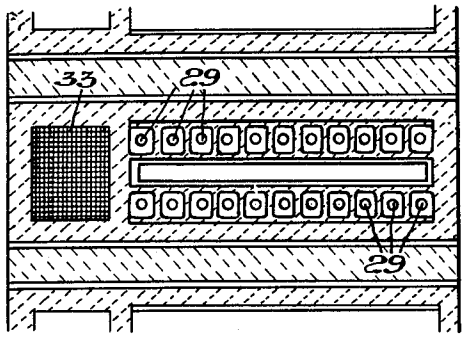


Fig. 3.

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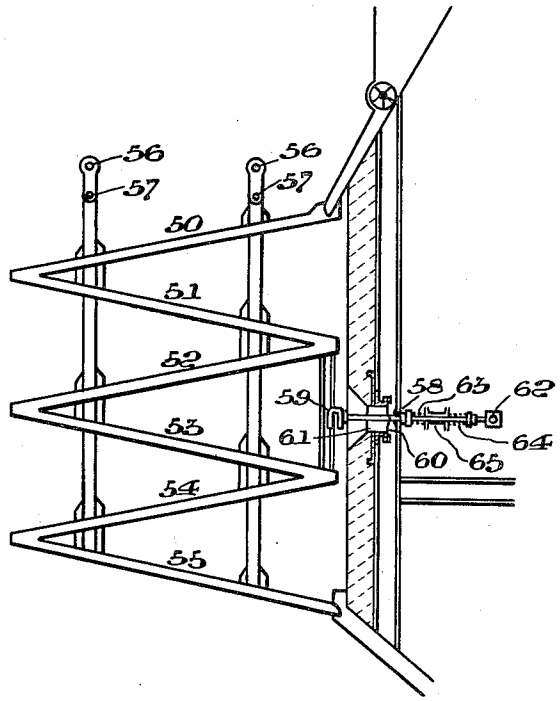


Fig. 4.

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UNITED STATES PATENT OFFICE

2,667,452

VIBRATING RETORT

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Application December 30, 1947, Serial No. 794,735

5 Claims. (Cl. 202—119)

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An object of the present invention is, to provide an oven specially designed for the low temperature distillation of all fuels, but, particularly, of nonmeltable or slightly meltable coals, to obtain a powdered semi-coke; this semi-coke is meant for mixtures with a view to manufacturing metallurgical coke from coals having a high content in volatile substances or for other applications.

The ovens used heretofore to this effect offer various drawbacks, and especially the following:

(1) The mechanical parts operate at the temperature of carbonization which is of the order of 500 to 600° C.

(2) The mechanical parts are complicated.

(3) The speed of carbonization is low, in spite of the mixing devices used.

An object of the present invention is to obviate these drawbacks, namely, by making it possible to keep the coal grains always in a condition of mutual motion, these grains, so to speak, remaining in suspension in the hot atmosphere of the distillation chamber, their surface thus being integrally subjected to the radiation of the heating walls. This facilitates the thermal exchanges and decreases or eliminates the possibilities of fouling.

A distillation oven making it possible to achieve the above objects presents the characteristics resulting from the following description, and, more especially from the appended claims.

A distillation oven in accordance with the invention is shown by way of example in the appended drawings wherein:

Figure 1 shows the distillation oven in longitudinal section.

Figure 2 shows a transverse section of the oven of Figure 1 along line II—II of said figure.

Figure 3 shows, in horizontal section, the body of the oven of Figure 1.

Figure 4 shows a partial elevation of another type of embodiment of the oven of Figure 1.

In the oven of Figure 1, the coal is brought to hopper 1 by a conveying apparatus 2. Its fall in chute 3 is controlled by a variable output distributor 4. From chute 3, the coal falls on the vibrating conveyor which comprises a series of chutes 5, 6, 7, 8, 9 and 10 sloping in a downward circuitous path and arranged in such a manner that the coal may flow, due to the slope and the vibrations, from chute 3 to the output chute 11.

During its conveying, the coal is distilled and it reaches the output aperture 11 in the condition of semi-coke. After going through a sifter

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12 it falls into a hopper 13 whence it is carried away by a conveyor 14. A hand operated plug 15 makes it possible to isolate the sifter from the hopper.

The arrangement of movable chutes 5, 6, 7, 8, 9, 10 is connected by two yokes 16 and 17 so as to hang from rods 18. These rods go through the horizontal door closing the oven through the action of a flexible metal sheet diaphragm 20 which allows the vertical vibrations of the rods while avoiding any exit of the gases.

A sleeve 21 connects the lower part of rod 18 to the upper part 19 so as to facilitate dismantling.

The whole is supported by a frame 22 resting on two side trestles 23.

Between the frame 22 and the rod 19 are provided springs 24 and 25 whose tension may be adjusted at will, so that the conveyor assembly may be subjected to a vertical vibration motion by the action of a device 26 driven by a motor 27.

This vibration device 26 may comprise a weight system, or a cam or an eccentric. It may be replaced by an electro-magnet supplied with alternating current.

The conveyor 5, 6, 7, 8, 9, 10 is located inside a cell whose general arrangement resembles that of a coke oven.

The uprights of this cell, which may comprise corrugated or ribbed walls are formed of a series of vertical flues 29 comprising burners supplied with gas from the pipings 30 and with hot air from the recuperator and brought through the flues 31.

The fumes escape through an horizontal upper channel 32 to come and circulate vertically inside a recuperator 33 and then flow to the chimney through a flue 34. The hot air produced in this recuperator is brought to the burners through the flues 31.

The lower part of the chamber terminates in two hoppers 35 opening on the sifters 36 making it possible to recover the stray dust escaping from the conveyor without any risk of inflammation.

The upper part of the cell is closed by a door comprising a cast iron frame 37 packed with refractory or insulating refractory products 38.

When it is desired to dismantle the conveyor, the sleeves 21 are first uncoupled, then, by means of a traverser, 39, the whole vibration device together with its frame 22 is very easily removed. The door is then removed by means of the same traverser 39, then, finally, the conveyor 5, 6, 7,

8, 9, 10 which rests on two cross pieces 40 when the sleeves 21 are uncoupled.

If it is feared that the movable assembly might rub against the walls of the ovens, these walls might be provided with protecting plates of cast iron facing the suspension yokes.

The gases from the distillation escape through a piping 41, suitably insulated or even heated up to avoid condensations and easy to cleanse, being communicably connected with a barrel 42.

An oven assembly comprises, on each side of the distillation chamber two uprights 28, then two walls of refractory products 43 and two false abutments of red bricks or concrete 44 separated from the refractory products 43 by an insulating layer 45.

The oven itself is supported on a concrete slab 46 which allows an easy circulation underneath.

The cleansing of the surface of the conveyor may be effected by periodically inserting, in place of the fuel or even if deemed necessary, by systematically mixing with the latter small metallic masses which by their energetic friction will polish the metal and make it or keep it fit for the regular conveyance of the fuel.

These metallic masses would be separated from the powdered semi-coke, at the outlet from the oven, by simple passage on a fixed grid or on a movable sifter. Their re-insertion at the head of the conveyor can be effected mechanically and automatically.

To this effect, the metallic masses are introduced in an inclined chute 47 provided with a device preventing the escaping of the gases or the entrance of air and consisting for instance of a flap.

At the outlet, the semi-coke passes on a grid 48 and goes through it, while the metallic masses go outside through a chute 49, after also going through a gas tight aperture.

Any device, for instance a small bucket chain makes it possible to bring back the metallic masses in chute 47.

The above described distillation oven offers numerous advantages and especially the following:

1. No mechanical part works at the carbonization temperature of the order of 500 to 600° C.

2. The fine fuels are treated under such conditions that the speed of carbonization is much higher than in the former methods of mass carbonization, whatever the mixing device used.

3. The chances of fouling of the surface of the conveyor by the adherence of fuel grains more or less softened or tarry are extremely reduced, precisely in the ratio of the time of contact between the grains and the surface of the conveyor which is constantly "bombarded" by the falling of the grains at each period of vibration.

The above described oven allows the treatment of nonmeltable or slightly meltable coals.

This oven also makes it possible to treat the meltable coals provided they are previously treated so as to lose all or part of their meltability.

To facilitate the transmission of the heat, the walls of the cell may be corrugated or may comprise ribs. They are generally built with refractory materials but they also may be built of cast iron or any metal.

The heated cell may contain one or several conveyors.

Superheated steam or any other fluid may be introduced into the cell to facilitate the transmission of heat.

The output of an oven of this system, of given dimensions is a function of the necessary time of stay of the fuel inside it. This time is reduced, as has already been explained, to a minimum, due to the fact that, on one hand, the fuel is carbonized into grains of small dimensions, and, on the other hand, due to the very peculiar conditions under which it is submitted to the action of heat.

The necessary time of stay determines the speed of translation to be applied to the fuel on the conveyor; the latter can be adjusted by the slant given to the elements of the conveyor and by the characteristics of the vibration imparted to it (amplitude and frequency).

A similar device, thus comprising, in principle, a vibrating conveyor enclosed within a chamber can be used for other uses, especially for pre-oxidizing the meltable coal.

In this case, the cell may be heated either from the outside or from inside by a circulation of gases at an appropriate temperature.

Numerous modifications may be made to the above described oven without exceeding the scope of the invention.

In particular (Figure 4), the conveyors 50, 51, 52, 53, 54 and 55 may be suspended by means of flat side irons from the axles 56. These flat irons comprise an articulation 57 allowing an horizontal vibration of the whole. This vibration is controlled by a rod 58 which, by an attachment 59 is fixed on a cross piece connecting the elements of the conveyor. This attachment may easily be released for dismantling.

To ensure the tightness, a flexible metal sheet 60 is fixed on one hand to a frame, on the other hand to rod 58. This metal sheet 60 is protected by a refractory sleeve 61.

The vibrating motion is controlled by a device 62. It is balanced by springs 63 and 64 which may rest on a fixed cross piece 65. This device makes it possible to impart to the whole of the conveyor a vibration which, this time, is horizontal.

What I claim is:

1. A fuel devolatilizing apparatus comprising an enclosed refractory chamber; a fuel inlet means in the upper portion of said chamber; a fuel outlet means in the lower portion of said chamber; a fuel conveying and devolatilizing chute extending between said inlet and outlet means and sloping in a downward circuitous path, receiving fuel at its upper end from said inlet means and discharging fuel at its lower end into said outlet means; a vibrator operatively connected to said chute for transmitting vibrations to both the chute and the fuel in the chute, said vibrator imparting a frequency which causes the fuel to travel down the chute as a suspension just above said chute; distillate take-off means for removing the distillate from the fuel in said chute and from said chamber, and heating means for said chamber and said chute.

2. A fuel devolatilizing apparatus comprising an enclosed refractory chamber; a fuel inlet means in the upper portion of said chamber; a fuel outlet means in the lower portion of said chamber; an upwardly open fuel conveying and devolatilizing chute extending between said inlet and outlet means and sloping downwardly in a circuitous path, receiving fuel at its upper end from said inlet means and discharging fuel at its lower end into said outlet means; a vibrator operatively connected to said chute for transmitting vertical vibrations to both the chute and the downwardly moving fuel to impart a hopping motion to the

fuel particles causing the particles to travel down the chute as a suspension just above said chute; distillate take-off means for removing the distillate from the fuel in said chute and from said chamber, and heating means for said chute.

3. A fuel devolatilizing apparatus comprising an enclosed refractory chamber; a fuel inlet means in the upper portion of said chamber; a fuel outlet means in the lower portion of said chamber; a fuel conveying and devolatilizing chute extending between said inlet and outlet means and sloping downwardly in a circuitous path, receiving fuel at its upper end from said inlet means and discharging fuel at its lower end into said outlet means; a vibrator mounted outside said chamber; means passing thru a wall of said chamber and connected to both said vibrator and said chute, for transmitting vibrations to both the chute and the fuel in the chute, said vibrator imparting a frequency which causes the fuel to travel down the chute as a suspension just above said chute, distillate take-off means for removing the distillate from the fuel in said chute and from said chamber, and indirect heating means for said chamber and said chute.

4. A fuel devolatilizing apparatus comprising an enclosed refractory chamber; a fuel inlet means in the upper portion of said chamber; a fuel outlet means in the lower portion of said chamber; an upwardly open fuel conveying and devolatilizing chute extending between said inlet and outlet means and sloping downwardly in a circuitous path, receiving fuel at its upper end from said inlet means and discharging at its lower end into said outlet means, said chute being removably suspended in said chamber; a vibrator mounted outside said chamber and operatively connected to said chute for transmitting vertical vibrations to both the chute and the downwardly moving fuel to impart a hopping motion to the fuel particles causing the particles to travel down the chute as a suspension just above said chute; distillate take-off means for removing the distillate from the fuel in said chute and from said chamber, and indirect heating means for said chamber and said chute.

5. A coal devolatilizing apparatus comprising an enclosed refractory chamber; a coal-inlet means in a top wall of said chamber; a devolatilized coal outlet means in a bottom wall of said chamber; a coal conveying and devolatilizing chute extending between said inlet and outlet means and formed in a zig zag shape, receiving material at its upper end from said inlet means and discharging at its lower end into said outlet means; an electromagnetic vibrator mounted outside said chamber; means passing through said wall and connected to both said vibrator and said chute for transmitting vibrations to both the chute and the coal in the chute, said vibrator imparting a frequency which causes the coal to travel down the chute as a suspension just above said chute; distillate take-off means for removing the distillate from the coal in said chute and from said chamber, and heating means for said chamber and said chute, heating the coal passing down the chute by indirect heat exchange.

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