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2,208,705

TUNNEL OVEN USED FOR THE CARBONIZATION AT LOW TEMPERATURES
OF OIL SHALE, LIGNITE, COAL, AND SIMILAR MATERIALS

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2 Sheets-Sheet 1

Fig. 1

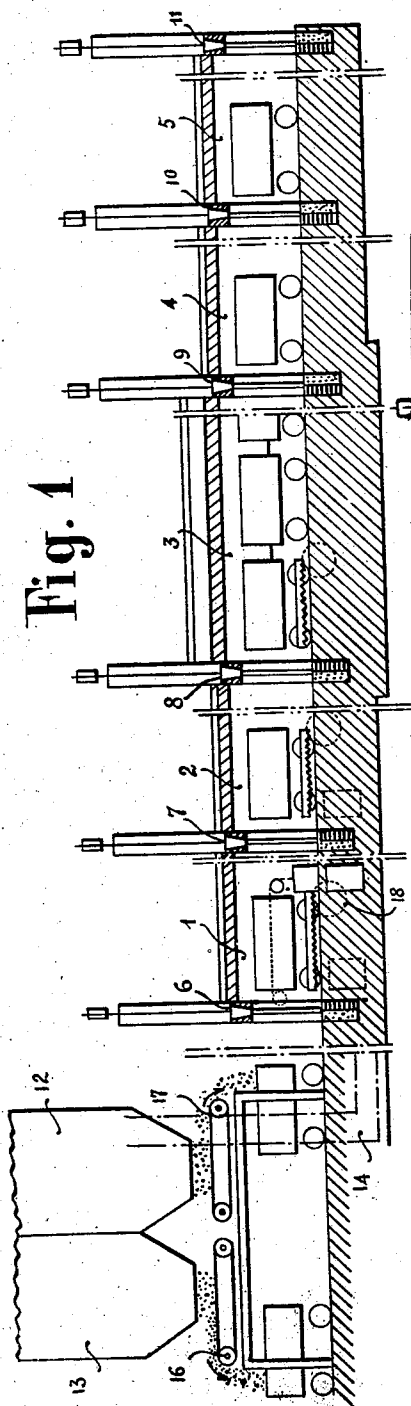
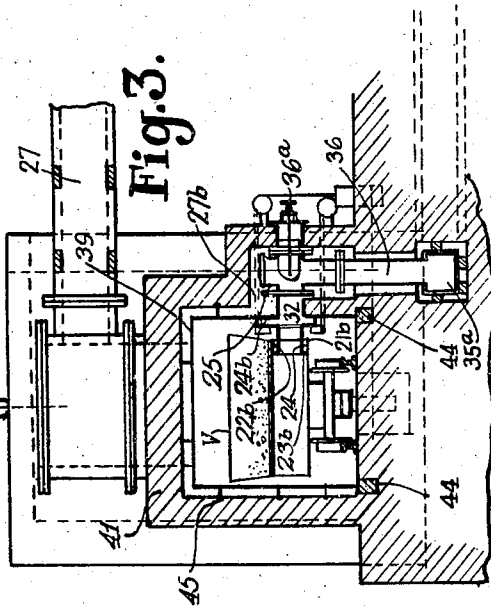


Fig. 3.



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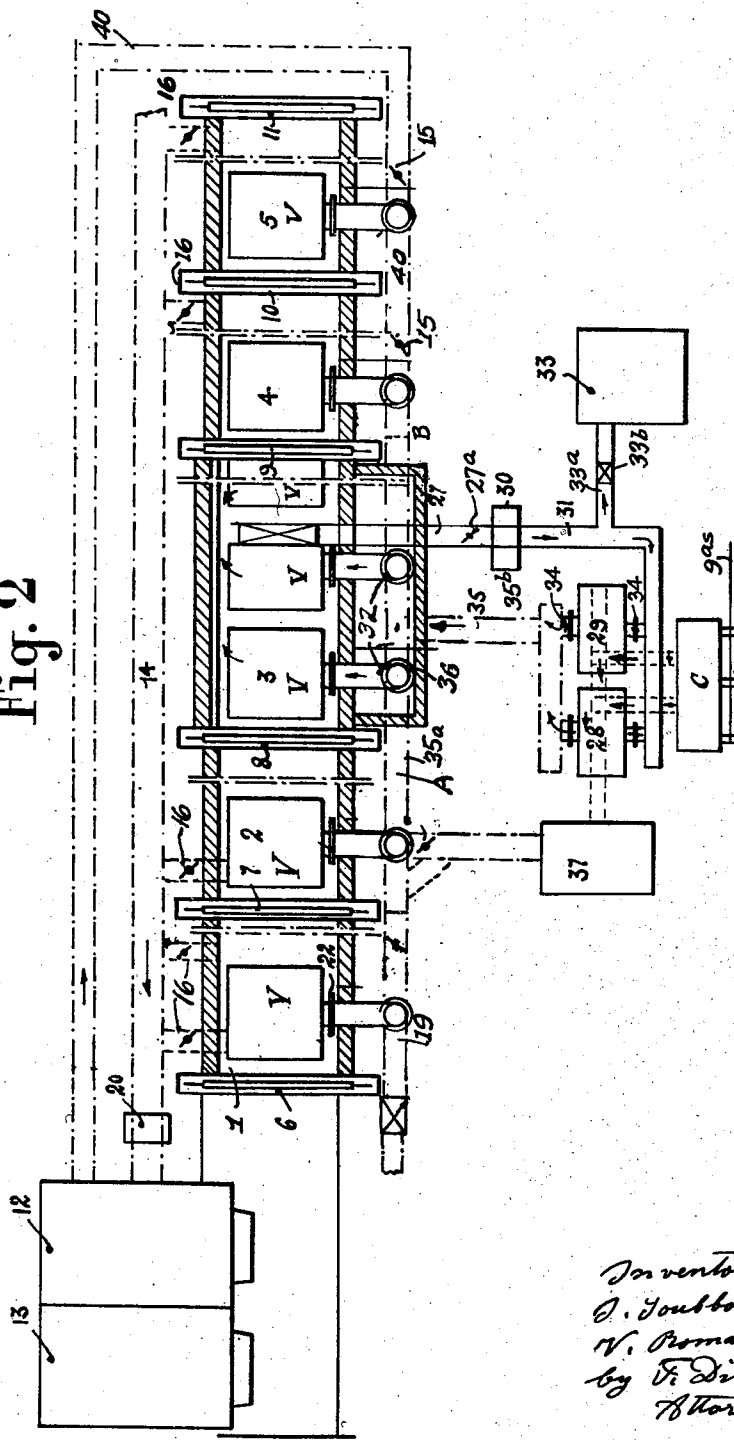
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Fig. 2



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UNITED STATES PATENT OFFICE

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TUNNEL OVEN USED FOR THE CARBONIZATION AT LOW TEMPERATURES OF OIL SHALE, LIGNITE, COAL, AND SIMILAR MATERIALS

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2 Claims. (Cl. 202—98)

Our invention relates to tunnel ovens for the carbonization of oil shales, lignite, coal and similar materials in general and in particular to that class of tunnel ovens in which the material to be treated is supported by a vehicle with bottom permeable to gas, this vehicle being moved from one position to the other in a suitable manner intermittently or continuously. Heating, viz, distilling of the material is effected by a direct contact with the hot gas introduced under or over the supporting bed permeable to gas and forced through the material to be treated by means of fans, whilst the vehicles themselves are divided horizontally in two zones by means of seals in order to force the entire current to pass through the material.

The tunnel ovens of this class are divided by vertical partitions into separate compartments for drying, distilling and cooling the material, whilst the preheating is effected either by waste combustion gases or by gas and vapours produced by the carbonization, and the distilling of material is effected by steam with vapours and gas generated by carbonization. The distilling current having traversed the material is led to reheaters and is reintroduced into the material under treatment. The excess of gas, steam and vapours of carbonization having traversed the oven longitudinally is finally led to condenser.

Cooling is effected in these ovens either by water or steam. The separation of the distillation compartment from the outer air is effected by means of tight doors. The number of working compartments known is 3 plus lock-chambers.

In all ovens of this class, for instance according to the German Patent No. 576,276 to Koulshinski dated May 10, 1933, or British Patent No. 278,694 to Groendal dated November 8, 1928, the reheaters are situated in the body of the oven and are separated from the chamber of distillation only by a brick wall. Each vehicle is connected with its individual reheater and fan and all the reheaters are placed in the same heating tunnel, and heated by the same current of combustion gas.

Such arrangement makes difficult a proper controlling of temperatures and the cleaning of the tubes of the reheaters from the coke formed through the cracking of hydrocarbons necessitates an interruption of the operation for days in order to cool the heavy brickwork construction of the block including the oven and the reheaters.

Our invention tends to eliminate these difficulties and to yield a new and more effective apparatus in which the operations are easily controlled,

the utilization of heat is perfect, the cleaning of reheaters does not necessitate the interruption of the treatments, the construction is cheaper, and appropriated to a rapid changing of temperatures, and in which the distillation compartment is separated from the outer air in a way making impossible the penetration of air into the vapours and gas of carbonization.

The tunnel oven constituting the subject matter of the present invention is characterized by the following improved features of construction.

1. The separation from the oven body and spacing therefrom of the reheaters of gas-vapours of carbonization used for distillation, these reheaters being located in battery or in batteries and their number being independent of the number of vehicles in the distillation compartment. The reheaters are connected to the interior of the distillation compartment, through a collector parallel to the oven, with connecting ducts leading to a distributing channel parallel and situated outside the oven from which rise the pipes with horizontal members leading to the vehicles inside the oven. The main ducts and individual pipes leading to vehicles are provided with dampers, valves or plugs, so that the currents are distributed always in a most convenient way and their temperature can be easily controlled and established.

Each reheater is connected to its fireplace or to a common fireplace, and to the ducts for heating gases and gases and vapours of carbonization, by means of ducts with dampers, so that each reheater can be isolated from the others for cleaning or other purposes. In combination with this system only one fan can be used, and this fan is placed in the duct evacuating the vapours and gases of carbonization so that it distributes these vapours and gases between the condenser and reheaters.

2. In connection with the system outlined in above paragraph, the invention foresees an optional introduction in the heating circuits of the hydrocarbon gas and vapours or carbonization, likewise of other gases of different natures and temperatures, successively. This permits to obtain the most varied combinations of treatment convenient to each particular case.

3. In order to reduce the length of the oven to a minimum and utilize the heat of combustion gases in most effective way, the oven is connected with bunkers, in which the material to be treated in the tunnel oven is dried and preheated by waste combustion gas led from the central reheating battery through the preheating compartment.

ment of the oven into the bunkers. The bunkers cool these gases which are led to the cooling compartment of the tunnel oven where they are used as a cooling medium. The gas leaving the cooling compartment is then used for heating the material, f. i. for drying it in bunkers. Thus the heat of the carbonized material is recuperated in most effective way without loss of calories not avoidable in the case of cooling by steam or water.

4. In order to have a perfect separation of the distillation chamber from outer air, without using lock-chambers, the tunnel-oven is arranged so that the distillation compartment is preceded by two preheating compartments and followed by two cooling compartments, these four compartments being filled with practically oxygen-free combustion gas, the pressure of which is higher than the outer air. Such arrangement precludes any possibility of penetration of outer air in the distillation compartment. This arrangement is completed with a system of dampers in the ducts communicating the heating and cooling compartments with ducts distributing the heating or cooling gases and collecting the outlet gases from these compartments. These dampers which are opened or shut in a convenient way before and after the opening of the doors, permit in addition to introduction of steam for scavenging hydrocarbonic vapours in the distillation compartment, to preclude any mixing of heating or cooling gas with air and of this gas with the vapours of distillation.

5. The invention includes a special construction of the tunnel oven, which reduces its cost and makes it readily adaptable to the variation of temperatures which might be very wide in the treatment according to the present invention. This construction consists in an inner incomplete lining made preferably of thin sheet-iron fixed elastically to the outer brick work or concrete walls of the outer tunnel, by means of rods or similar members; permitting free dilatation of the inner jacket. The inner space between the tunnels or jackets is free and can be filled with neutral gas or light insulating material and can be partitioned. The lower rims of lateral sides of the inner jacket are connected to the floor of the oven by means of sand rills or similar seals. This construction reduces very considerably the cost of the oven, because the free space between the two jackets is equivalent to a thick brick wall. It also permits to increase considerably and in a cheap way the width of the oven.

The invention will now be described with reference to the accompanying drawings, wherein:

Fig. 1 is a vertical sectional view of the tunnel oven for the treatment of material at a low temperature, portions being shown in side elevation.

Fig. 2 is a horizontal view of the tunnel oven in Fig. 1 with portions in top plan.

Fig. 3 is a cross section on a larger scale through the compartments.

The tunnel oven shown in Figs. 1, 2 and 3 consists of 5 compartments, 1, 2, 3, 4, 5 communicating with one another through doorways with gas-tight doors 6, 7, 8, 9, 10 and 11; 12 and 13 indicate storage bins or bunkers used for preliminary preheating and drying. Compartments 1 and 2 are used for final preheating to a temperature somewhat lower than that of the beginning of distillations. Compartment 3 is for distillation and compartments 4 and 5 are for cooling.

The heating of material in the compartments 1—2 is effectuated by means of combustion gases

coming from the reheaters 28—29 and passing through the economizer 37, where they are cooled to a proper temperature. Fan 20' blows these gases through duct 19 with branches provided with dampers 15 into the pipes 36 leading to the vehicles. The dampers 15, are used in order to deviate the current during the opening of doors. Similar dampers 16 are located in the ducts connecting the compartments 1 and 2 to the collecting ducts 14. The gases are fed from the preheating and cooling compartments to the bunkers by a subsidiary fan 20.

The vehicles being loaded in a convenient mechanical manner such as by conveyers c from the bunkers in a room protected from air enter in the tunnel and traverse it by means of convenient moving devices, as trains or individually, each moving device in each compartment being independent for each train of vehicles or for each vehicle.

Heating gas enters under a surface permeable to it of vehicles through the inlet pipes with plugs 36 communicating with the closed space under these surfaces by means of convenient sealing devices. A device of this kind is shown in Fig. 3 being applied to a car with perforated bottom containing a closed box under this bottom. Other vehicles and sealing devices may be also used. In the example shown in Fig. 3 the car is provided with a sliding pipe 21, 22^b its guide, 23^b collar pressing the packing of asbestos when the pipe is engaged to the inlet pipe 32 leading from the vertical pipe 36. This inlet pipe is provided with flange 25^b, whilst the flange 24^b of the sliding pipe 21 is adapted to be drawn in engagement with 25^b by means of grapples at ends of the rods 27^b connected with a mechanism outside the oven which engages or disengages the coupling device.

The same system of introducing the heating medium is applied in the distilling and cooling compartments. The heating media are distributed to the respective compartments from lateral ducts 19, 35^a and 40, which are arranged in alignment but are separated from one another by partitions which can be removed from cleaning the ducts. Duct 40 leads cool combustion gas from the top of the bunkers. Outlet ducts of cooling compartments deliver gas to the duct 14.

Duct 27 evacuates the gas-vapours of carbonization from compartments 3 and 4 and is provided with a damper 35 and a fan 30 for blowing them into the condenser 33 through pipe 31 and its branch 33^a having a damper 33^b, and also reheaters 28, 29 through pipe 34, closing dampers 34^a and opening ducts 34^b and 34^c communicating re-heaters with ducts of gas-vapours of carbonization 34 and the hot combustion gas from the fireplace c, or fireplaces respectively.

Duct 35 carries re-heated gas-vapours of carbonization to the portion 35^a of duct 15 and is equipped with damper 34^b. 36 in Fig. 3 with plug is an example of different possible regulating devices.

Only two re-heaters in one battery and one channel 35^a and outlet channel are shown in the drawings, but there can be any suitable number of re-heaters, batteries and ducts provided.

Fig. 3 shows in vertical cross section the tunnel consisting of an outer jacket 41 of brickwork and an inner jacket or lining 39 in sheet-iron. 44^a is a sand seal, and 45 are connecting rods for suspending the lining, or the suspension can be effected (as well as the sealing) in different

ways, so that rods and seals are shown as examples only.

Having thus described the invention, what is claimed is:

- 5 1. In a tunnel oven of the character described, a tunnel, partitions dividing said tunnel into compartments for successively preheating, distilling, and cooling oil shale, lignite, coal and like material being treated, the distilling compartment being located between the preheating and cooling compartments, means for progressively moving through said tunnel from one compartment to another in step by step movements, vehicles having foraminous load carriers and side 10 ports under the load carriers, said means adapted for maintaining the vehicles stationary in each compartment for a predetermined length of time, inlet and outlet ducts located at opposite sides of said oven and having branches leading therefrom 15 and opening into said compartments through side

walls thereof, the branches of the inlet duct being adapted for communicating with the side ports of the vehicles, valves for controlling flow of gaseous heating and cooling media through said ducts and their branches, a reheater at one side of said oven located externally of the oven and communicating with the inlet duct, a condenser, and a valve controlled evacuating duct leading from the distilling compartment to said condenser and to said reheater. 5 10

2. The structure of claim 1 including bunkers for holding a supply of material to be delivered into the receptacles and treated in the oven, a duct, for delivering gases, from the preheating and cooling compartments, into said bunkers for 15 preheating material therein, and a duct for delivering coal gases from said bunkers to said cooling compartments.

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