Nov. 13, 1923. 1,473,665

E. BERTHELON

FURNACE

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Fig. 1.

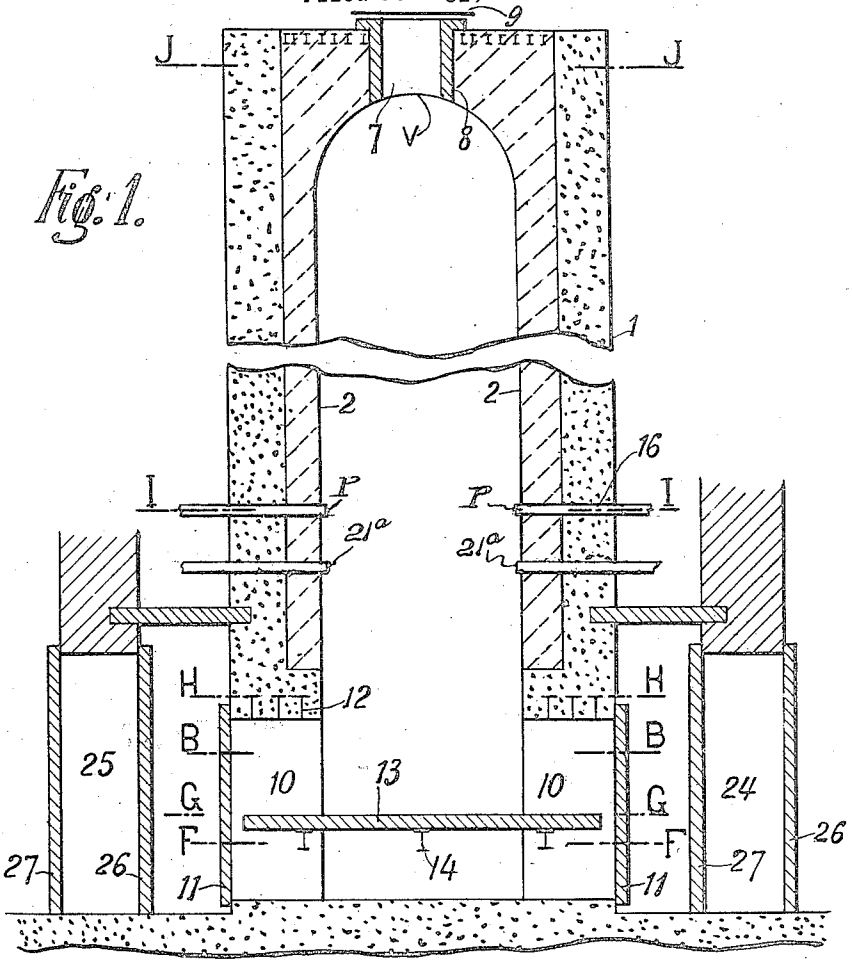
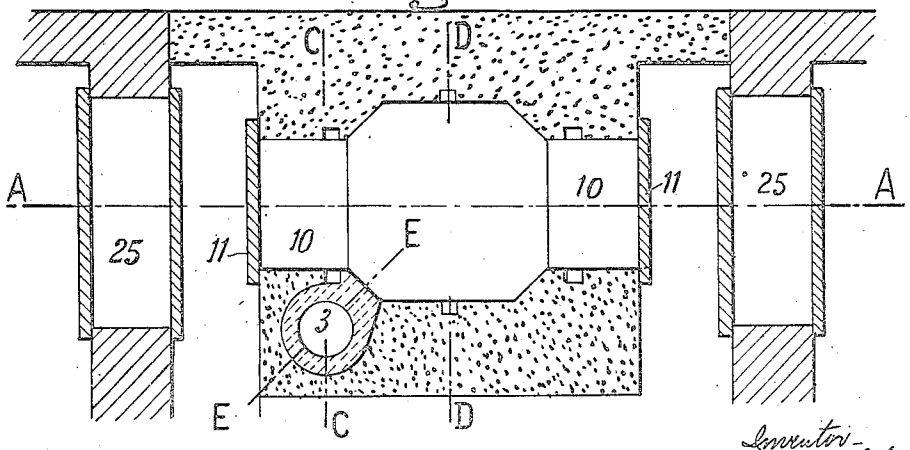


Fig. 2.



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Fig. 3.

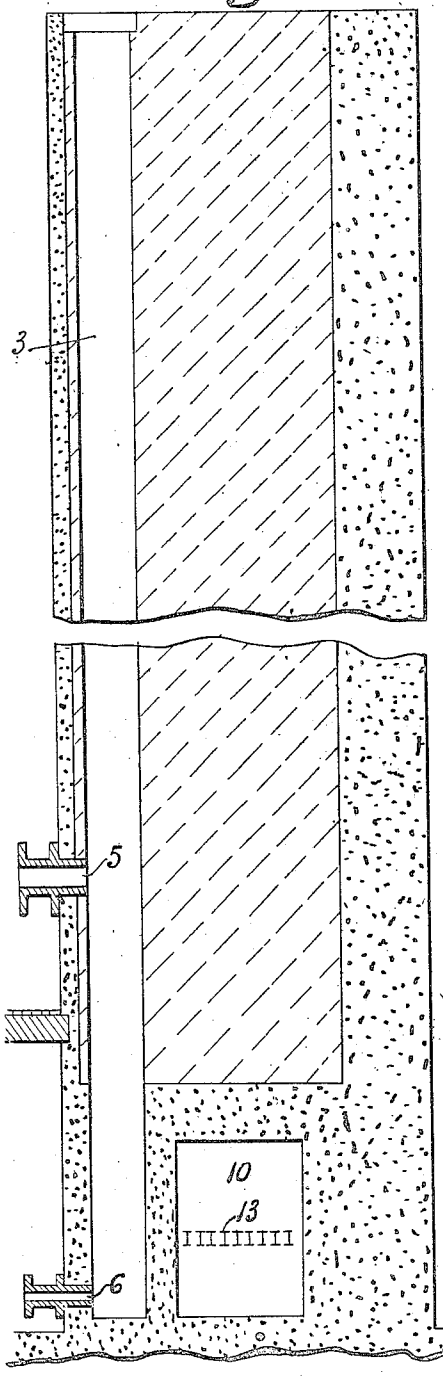
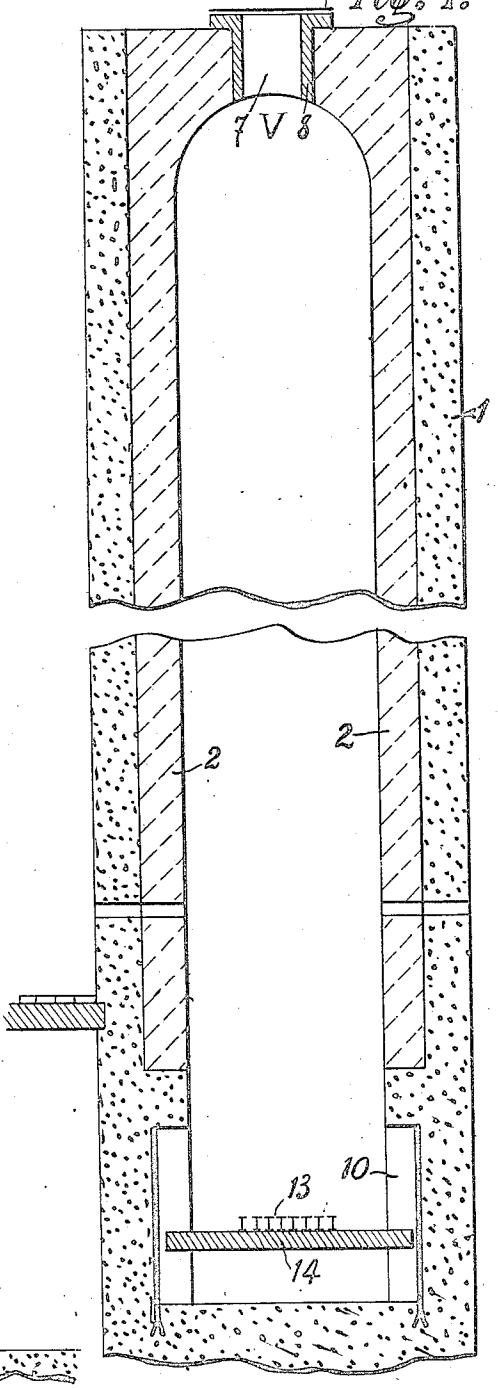


Fig. 4.



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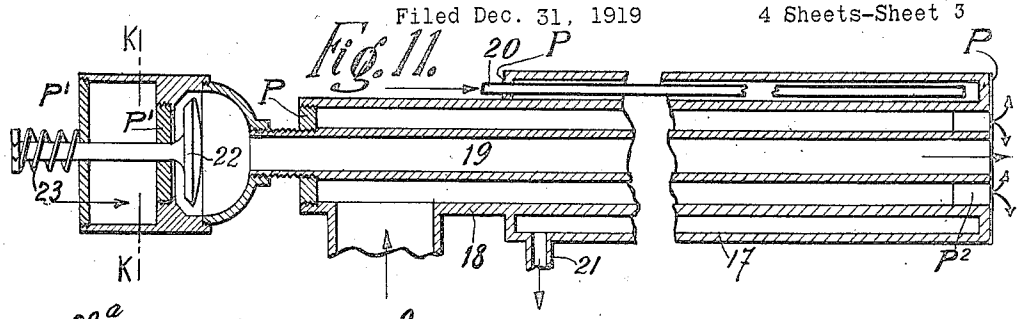


Fig. 11.

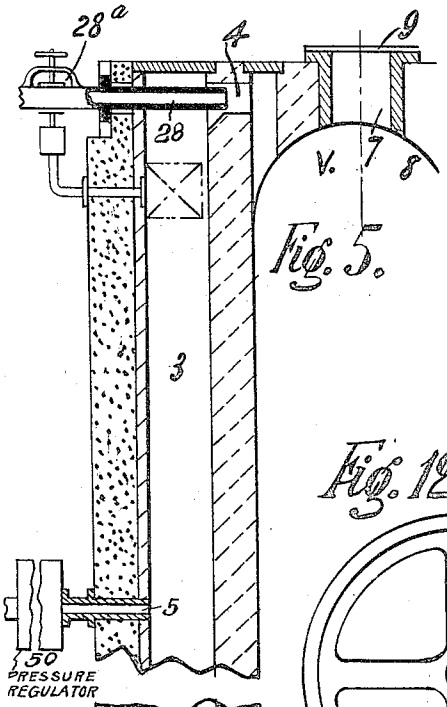


Fig. 5.

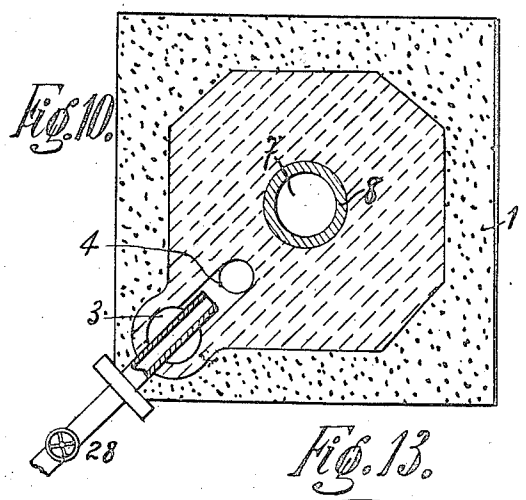


Fig. 10.

Fig. 12.

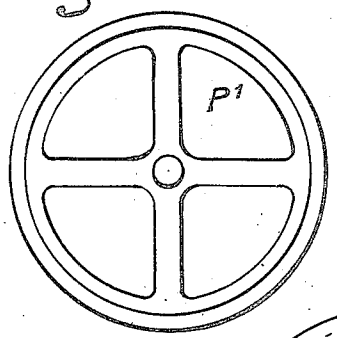
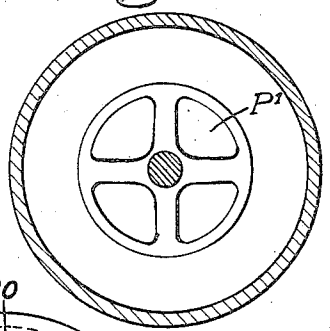


Fig. 13.



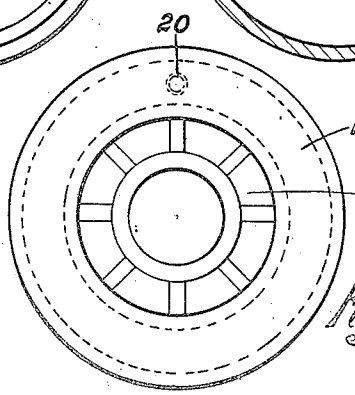


Fig. 14.

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Fig. 6.

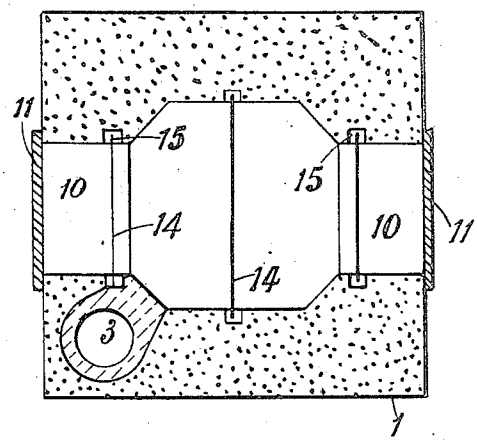


Fig. 7.

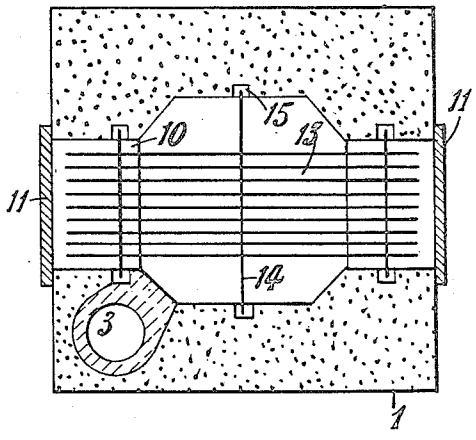


Fig. 8.

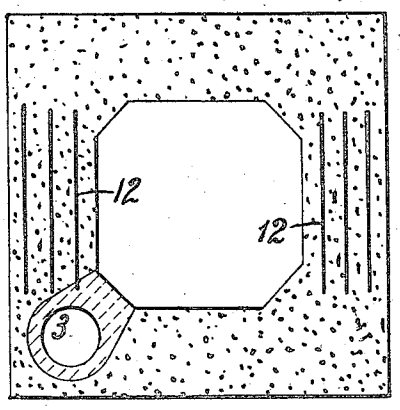
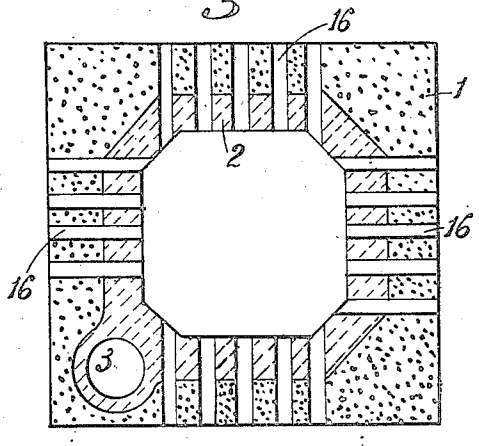


Fig. 9.



Inventor.
Edmond Berthelon
By- B. Singer. Atty.

Patented Nov. 13, 1923. 1,473,665

UNITED STATES PATENT OFFICE.

EDMOND BERTHELON, OF AX-LES-THERMES, FRANCE.

FURNACE.

Application filed December 31, 1919. Serial No. 348,710.

To all whom it may concern:

Be it known that I, EDMOND BERTHELON, citizen of the Republic of France, residing at Ax-les-Thermes, Ariege, France, have invented certain new and useful Improvements in or Relating to Furnaces (for which I have filed an application in France, September 2, 1918, Serial No. 103,770); and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention refers to a carbonizing furnace oven kiln and the like wherein it is possible to carry out continuously the carbonization of combustible substances, whilst recovering the by-products and gases arising from the operation.

The accompanying drawings to which reference is made, show the following diagrams:

Figure 1 is a vertical section of the oven on the line A—A, Figure 2.

Figure 2 is a sectional plan on the line B—B Figure 1.

Figure 3 is a cross section on the line C—C Figure 2.

Figure 4 is a cross section on the line D—D Figure 2.

Figure 5 is a transverse section on the line E—E Figure 2.

Figure 6 is a sectional plan on the line F—F Figure 1.

Figure 7 is a sectional plan on the line G—G Figure 1.

Figure 8 is a sectional plan on the line H—H Figure 1.

Figure 9 is a sectional plan on the line I—I Figure 1.

Figure 10 is a sectional plan on the line J—J Figure 1.

Figure 11 is a longitudinal section of a nozzle and Figure 12 is an end view thereof, left hand side.

Figure 13 is a cross section on the line K—K Figure 11 and Figure 14 is an end view of the same, right hand side.

Referring to the drawings, the carbonization takes place in an oven 1, the walls 2, of which are capable of withstanding the action of the heat and are made of fireproof material.

The said furnace or oven, which may be of any section, is shown in the drawing as of a square section outside. The interior section, which is intended to hold the substances to be carbonized, is bounded by eight sides, four of which are parallel to the outer sides.

Within the masonry triangles so formed and each confined by external sides and a non-parallel inner side, may be provided ducts 3 intended to receive the gases which are evolved in the oven or enter the same. This arrangement makes it possible to reduce the volume of masonry and, if the ducts were not utilized they would diminish the loss of heat by conduction by producing heat insulating strata of air. In the drawings one duct only is shown. The gases originating in the oven are conveyed to said duct 3 by passing through the connecting duct 4 which is inclined in such manner that the gaseous products which condense therein during their passage flow into the duct 3 without returning to the oven.

The duct 3 communicates with the outside through the apertures 5 and 6. The aperture 5 is fitted with a connecting branch tightly connected by suitable means. From said connecting branch the gases are conveyed to refrigerating apparatus, condensers, washers, etc., not shown in the drawings, through which they circulate under the influence of suction fans.

After treatment the residual gases may be utilized for various purposes. If need be, a portion of said gases may be returned to the furnace or may be burnt, as hereinafter explained. The aperture 6 is provided with a connecting branch which in practice may be provided with a tap used to evacuate the substances capable of condensing when gases pass through the duct 3. The upper portion of the oven is formed by a vault V in which is arranged an aperture 7 for the introduction of the substances to be carbonized. The walls of said aperture are protected against the friction of the substances to be introduced by means of a cylinder 8 of cast iron or plate. The said aperture is closed by a plate 9 which may be fixed in any suitable manner to insure tightness, and prevent the return of air into the oven during the working of the exhausters.

In fact during working the pressure in the oven is kept slightly below the atmospheric pressure, but at the time of charging and before the opening of the plate 9, the interior pressure at the aperture 7 is high as stated hereinafter and is sufficient for the gases to tend to escape from the interior of

the oven to the exterior, which makes it possible to avoid the stopping of the exhausters and the circulation of a mixture of air in the sheaths, the pipe system, the apparatus etc.

The result is a loss of gas which can be reduced to a minimum by charging very speedily and maintaining the pressure in the oven low enough for the escape to be reduced to the minimum. Such loss is compensated to a small extent by the facility with which voluminous and cumbersome combustible materials can be introduced.

Openings 10, preferably provided opposite, are made in the walls of the oven at the base thereof and may be stopped airtight by means of movable doors 11. Above said openings the masonry is supported by T-shaped irons 12, and in order to prevent the masonry of the angles being cut off by the fastenings of the latter, the openings are of a smaller width than the inner width of the oven. The removal of the carbonized material is effected through the openings 10.

Above the bottom of the oven is arranged a false bottom or grate 13 resting upon transverse bearers 14. Said grate may be vertically displaced by causing the bearers to slide in the vertical grooves 15 provided in the masonry work and consisting, in practice, of a U-shaped iron fixed therein, which prevents the crumbling away of the masonry under the action of friction of the bearers during displacement. The bearers 14 may be adjusted at the requisite height according to the nature of the carbonized material, so that space between the upper wall of the openings 10 in the walls and the grate may be such that the slope formed by the carbonized combustible matter will correspond with the angle of repose and hence such matter cannot fall down of its own accord and the material may be held on the grate without interfering with the closing of the doors.

For that purpose the grate bars are longer than the internal width of the oven but short enough not to interfere with the closing of the movable doors 11.

The heating is effected by the combustion either of one portion of the combustible material or by the combustion of the gases provided from any source and particularly of a portion of the gases coming from the oven itself, recovered and burnt after obtaining the by-products.

In practice the heating takes place by combustion of a portion of said gases and of a portion of the combustible material. For that purpose the air and the gas are introduced through a row of connections arranged in suitable holes 16 provided at a certain height above the openings 10 and leading into the oven. Each of these connections is formed by concentric tubes 17, 18 and 19 kept with the requisite space between them by full plates P and open plates p^1 and p^2, which may be screwed on, brazed or connected by autogenous welding or soldering or other suitable method of fixing. Each assembly P of elements 17, 18, 19, p, p', p^2 forms a nozzle.

The central tube 19 conveys air which reenters the oven when the pressure is less than atmospheric pressure. The gas enters into place in the annular space formed by the tubes 18 and 19 and can only escape through the open plate p^2, which furthermore insures the prompt cooling of the central tube by the conduction of heat from tube 19 to tube 17 through the metallic walls of the open plate p^2. The gas tube 18 is enveloped in tube 17 which forms a water chamber. The water is supplied by tube 20 located between the tubes 17 and 18 and ending in the parts exposed to the heat on the side of the oven, which insures efficient cooling. The water escapes from the nozzle through the tubulure 21. Owing to the concentric arrangement of the gas which envelopes the air at the outlet of the nozzle, the combustion of the gas is produced before the air acts on the combustible material. The tube 19 conveying the air is provided with a valve 22 which prevents the gas from being driven back when the interior pressure is caused to rise above atmospheric pressure, for the purpose of loading the combustible material and opening the plate 9. The said valve is held by a spring 23 which rests externally upon the plate of a valve box open at P' forming a guide. The temperature in the oven may be regulated at will, either by the quantity of air admitted or by removing more or less of the carbonized material resting on the grate, which promotes the descent of the material for the purpose of facilitating at will the formation of either carbonic acid at a low temperature, or of oxide of carbon and hydrogen formed at a high temperature, at the expense of the water, either hygrometric or injected, as hereinafter explained. Below the rows of nozzles, sprayers 21^a are provided, the water discharge of which may be regulated at will for the purpose of cooling down the carbonized material between the grate and the nozzles.

The treatment of the combustible material in the oven proceeds as follows:

The combustible material charged through the opening of the cylinder 8 is maintained as far as possible at the same level by loading a sufficient quantity to compensate for the depression due to the carbonization and the removal of the carbonized material which occurs in the lower part, through the openings 10. At the height of the nozzles, the combustible material is raised to the maximum temperature and whilst the upper layers are heated by the hot gases, the lower

layer which has passed through the maximum temperature is cooled down before reaching the grate, by means of sprays of water the supply of which can be regulated at will and makes it possible to allow only sufficient cool carbonized material to reach the grate. The steam formed is drawn up towards the upper layers and becomes heated whilst approaching the zone of the nozzles, thus partly restoring the calories taken up by the carbonized material raised to red heat after having passed along the nozzles. This carbonized material is withdrawn from above the grate by causing the slope formed between the grate and the upper interior ridge of the openings 10 to partially collapse when the doors 11 are open. As the grate does not occupy the full width of the oven, but only the width of the openings 11, the carbonized combustible material falls upon the bottom of the oven itself and forms a slope which does not interfere with the closing of the movable doors 11 because it is held back by the wall. In order to permit the removal of the carbonized material continuously without stopping the working of the oven by preventing the return of air under the grate, the doors 11 of the oven lead into airtight chambers 24 and 25 served by the doors 26 and 27, one of which only opens at the same time, as when the staff or the materials enter or are introduced into caissons under water. Hence this arrangement allows a permanent opening of the doors 11 and the permanent removal of the carbonized material.

The pressure obtaining in the oven must be less than that obtaining in the airtight chamber so as to avoid any return of gas capable of inconveniencing the workmen. Such a result is easily obtained, as under normal working, the pressure in the oven is kept below the pressure of the ambient atmosphere. The doors 11, however, must be closed and the workmen must retire when the pressure in the oven is raised above the atmospheric pressure to carry out the charging.

The gases evolved in the oven pass into the duct 3 and hence into the tubulure 5 which conveys them to the refrigerators, washers and exhausters which take them back to the oven, through the nozzles, and in practice means are provided whereby the pressure may be regulated at will. Such pressure indicating means is here indicated diagrammatically at 50. Such variation of pressure in the pipes makes it possible to regulate at will the pressure in the oven. The gas deviated from the oven may be used to feed evaporating apparatus, dryers, motive power etc., and the calorific power may be varied at will by maintaining in the oven a more or less high temperature to facilitate the formation either of carbonic acid or oxide of carbon, as previously stated.

In order to prevent the formation of coke in the oven or to reduce the same at the expense of oils and tars due to the high temperature of escaping gases, the latter are immediately cooled down partially by the injection of water with the aid of a sprayer 28. The supply of such sprayer may be regulated by any suitable means such as a cock 28^a. The temperature may be regulated so as to avoid the condensation of the products to be collected in the refrigerator and remain sufficient to ensure the condensation of the larger portion of oils and tars. The latter deposit at the bottom of the duct 3 and may be taken out by the cock 6. Such cooling of the gases in duct 3 permits furthermore to avoid that the heat of the oven be transmitted to the walls of the sheath to such a point as to allow the formation of coke at the expense of the tars and oils, and the decomposition of the substances which have to be recovered. In order to increase the deposit and to avoid removals, the section of the duct 3 must also be as large as possible so that the speed of the gases may be slow. The duct may furthermore contain substances offering large surfaces to the gases, which facilitates deposit of tar as, for instance, of wood or charcoal and generally of materials easy to remove for cleaning, in case of obstruction.

This invention includes a carbonizing oven the distinguishing features whereof are:

Claims:

1. An oven of the class described having means to return thereto the gases originating therein, and means to regulate the gas pressure within the oven.

2. An oven of the class described having a chamber to which material to be treated is fed, a second chamber below and communicating with the first named chamber, of greater length than the width of the first named chamber and having discharge openings at opposite ends and closures for said openings, a grate in said second chamber and spaced below the first named chamber, and receiving chambers spaced from said second named chamber and having openings spaced from said discharge openings and closures for said openings.

3. An oven of the class described having a grate forming a false bottom, means to convey air and gases to the interior of said oven at a point above and spaced from the grate, and means to spray water in the interior of the oven at a point above the grate and near said gas and air admitting means.

In testimony whereof I affix my signature in presence of two witnesses.

EDMOND BERTHELON.

Witnesses:

GERMAINE CHAISE,

RENÉ FOMBONNE.