No. 744,670. PATENTED NOV. 17, 1903.

B. ZWILLINGER.

PROCESS OF CARBONIZING MATERIAL.

APPLICATION FILED JUNE 5, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

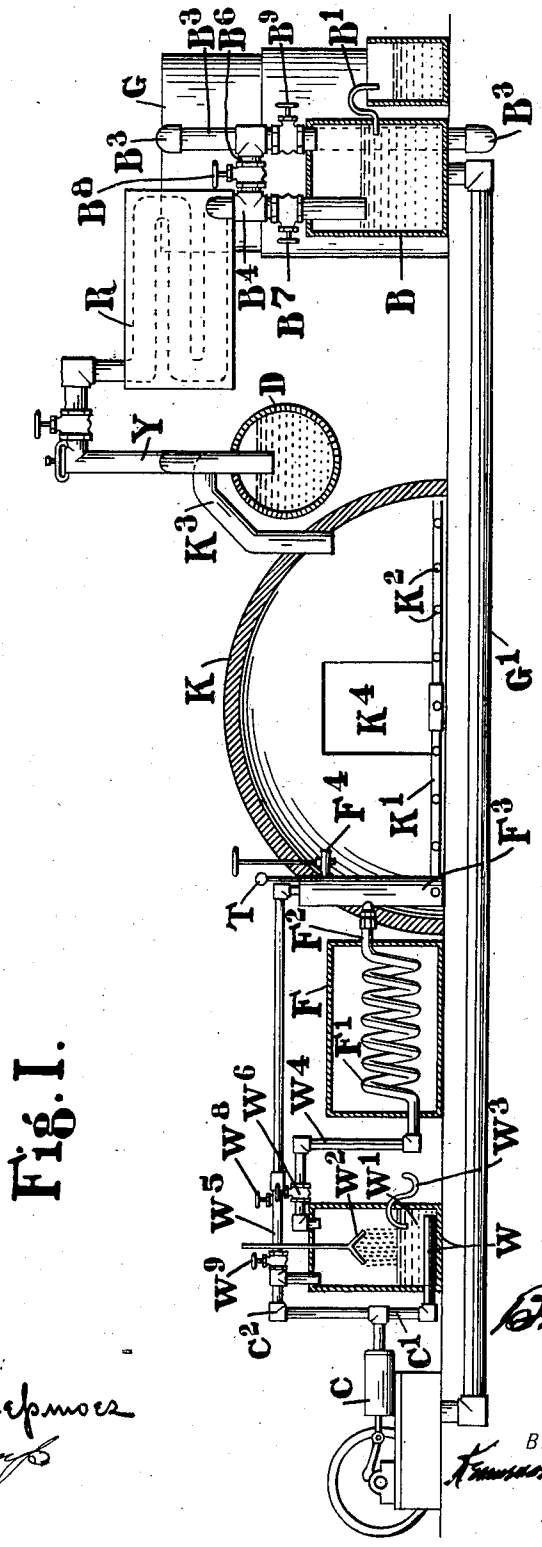



Fig. I.

WITNESSES:

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Conrad E. Kemp

Bernhard Zwillinger

INVENTOR

BY Kenyon Bradley & Kenyon

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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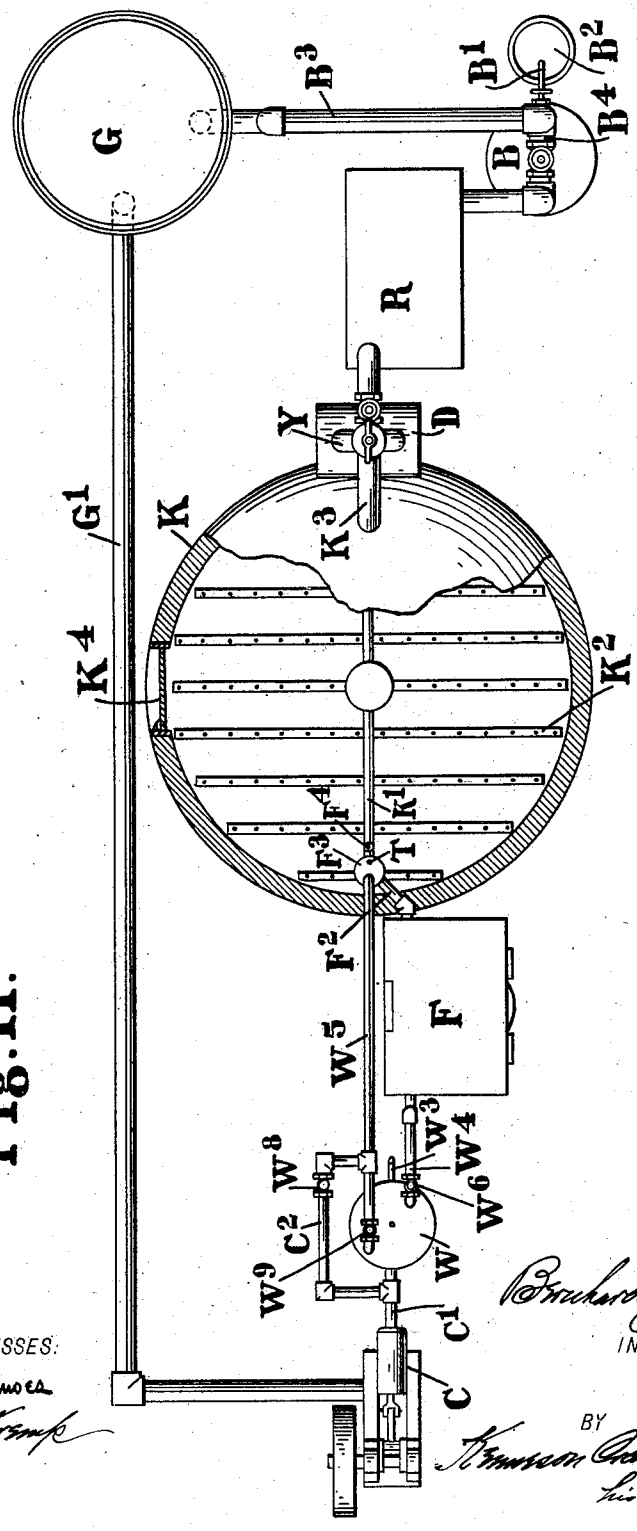



Fig. II.

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No. 744,670. Patented November 17, 1903.

# UNITED STATES PATENT OFFICE.

BERNHARD ZWILLINGER, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN FUEL AND DISTILLATION COMPANY, A CORPORATION OF NEW JERSEY.

## PROCESS OF CARBONIZING MATERIAL.

SPECIFICATION forming part of Letters Patent No. 744,670, dated November 17, 1903.

Original application filed November 23, 1899, Serial No. 738,017. Divided and this application filed June 5, 1903. Serial No. 160,266. (No specimens.)

*To all whom it may concern:*

Be it known that I, BERNHARD ZWILLINGER, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Processes of Carbonizing Material, of which the following is a specification.

My invention relates to a process of carbonizing wood, peat, and other material carbonizable at a relatively low heat—say not exceeding 800° Fahrenheit—and has for its object to produce a process by which such other carbonaceous materials may be readily and efficiently carbonized.

To these ends my invention consists in the process hereinafter claimed.

This application is a division of an application, Serial No. 738,017, filed by me November 23, 1899.

In the accompanying drawings I have shown an apparatus suitable for carrying out the process hereinafter described.

In the drawings, Figure I is a sectional side elevation of the apparatus, and Fig. II is a plan view with the kiln partially broken away and in section.

Stated generally, the process consists in carbonizing wood or other material carbonizable at a heat, say, not exceeding 800° Fahrenheit by the use of the so-called "permanent" gases heated by external means to about the temperature at which the carbonization of the wood or other material takes place.

I effect the carbonization of wood by partially deoxygenizing atmospheric air and then effecting the carbonization of the wood by passing this air in a heated condition through the said wood, carrying off with it the so-called "permanent" gases and storing the surplus, and when a sufficient quantity of gases from the wood has been obtained the carbonization of the material is continued and finished under the exclusion of deoxygenized air, employing only the gases from the wood. There is a further refinement or adjunct in my process by which after carbonization has been effected the charge is cooled down by the employment of the permanent gases in a cooled condition or other gases for the most part devoid of free oxygen.

I will now proceed to describe the apparatus and the process in its various phases.

In the drawings, K represents an ordinary kiln or beehive-oven.

C represents an air-compressor.

W represents a washer.

D indicates a hydraulic main.

R represents a cooler, B a vessel in the nature of a Wulff bottle, and G a gas-holder.

The kiln K is preferably provided with a side door $K^4$ and with a system of pipes $K^2$, practically covering the floor of the said kiln and perforated for the distribution of the gas to the kiln. The air-compressor C is connected by a pipe G′ below the level of a body of water W′, contained in the washer W. The washer W also contains a sprayer or sparger $W^2$. The function of the washer is to partially deoxygenize the air pumped through the same at the beginning of the carbonizing operation. A siphon $W^3$ serves to regulate the water-level in the washer. The washer W is connected by a pipe $W^4$ to the coil F′ of a heater F, by which the air and permanent gases are heated prior to the introduction of the same into the kiln K. The coil F′ is in turn connected by pipe $F^2$ to a drum $F^3$, to which a suitable pyrometer T may be connected. The drum $F^3$ is connected by pipe K′ to the pipe system $K^2$ and on the floor of the kiln, a suitable valve $F^4$ being provided for purposes hereinafter described. A pipe or conduit $K^3$ leads from the kiln $K^2$ to a drum or hydraulic main D, from which a pipe Y leads to a cooler R, where the gases are cooled and condensed. A pipe $B^4$ leads from the cooler to a vessel B in the nature of a Wulff bottle. The water-level in the Wulff bottle is regulated by the siphon B′. A pipe $B^3$ leads from the Wulff bottle to the gas-holder G, which gas-holder is used as a store-holder for the surplus gases. There is a by-pass connection $B^6$ between the pipe $B^4$ and the pipe $B^3$. Valves $B^7$, $B^8$, and $B^9$ are provided for purposes hereinafter to be described. A pipe G′ connects the gas-holder G with the air-compressor C. A pipe $C^2$ connects with a pipe $W^5$, which intervenes between the drum $F^3$ in the kiln and the

washer W. A valve $W^6$ is provided to control the flow of fluid through the pipe $W^4$, connecting the pipes in the heater, and a valve $W^8$ is provided to control the flow through the pipe $C^2$, a valve $W^9$ being likewise provided in the pipe $W^5$.

I may state in general that the air-compressor serves to propel the gases in order to heat them, the carbonization taking place in the kiln K, a hydraulic main cooler and Wulff bottle serving to condense the less-volatile products.

Having described the apparatus, I shall proceed to describe the process in its various phases. I proceed as follows: A quantity of atmospheric air is forced by the air-compressor through the washer and from thence passes through the coil of the pipe F′ into the kiln. The products of combustion pass out of the kiln through the pipe $K^3$ and hydraulic main D and then pass to the condenser or cooler R, from which they proceed to the gas-holder, from which they may be returned on the same circuit as before. After the carbonization process is concluded the kiln and the charge therein may be cooled by circulating the permanent gases as follows: by taking the store of permanent gases from the gas-reservoir G, conducting them to the compressor C and from thence through the pipes $C^2$ and $W^5$ to the kiln and then passing the gases out of the kiln through the coil R and through the by-pass pipe $B^4$, the Wulff bottle B being cut out by manipulating the proper valves. It is also unnecessary to pass these gases through the washer or deoxygenizing apparatus. It will be understood, however, that I do not herein claim the cooling process, as the same forms the subject-matter of an application filed by me February 24, 1902, Serial No. 95,161.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

The herein-described process of carbonization, which consists in preliminarily deoxygenizing atmospheric air, heating the resultant gas to such a temperature as to effect the carbonization of the carbonizable material in the kiln at a temperature not exceeding 800° Fahrenheit, and acting upon the said material with the said heated gas, removing the products of carbonization and thereupon continuing the carbonization by heating and circulating the said products of carbonization through the kiln so as to effect the carbonization at a temperature not exceeding 800° Fahrenheit.

BERNHARD ZWILLINGER.

Witnesses:
CONRAD KREMP,
GEO. E. MORSE.