B. LOOMIS.

PROCESS OF TREATING BLAST FURNACE GASES AND PREPARING CHAR PEAT.

APPLICATION FILED MAY 28, 1906.

990,891.

Patented May 2, 1911.

3 SHEETS—SHEET 1.

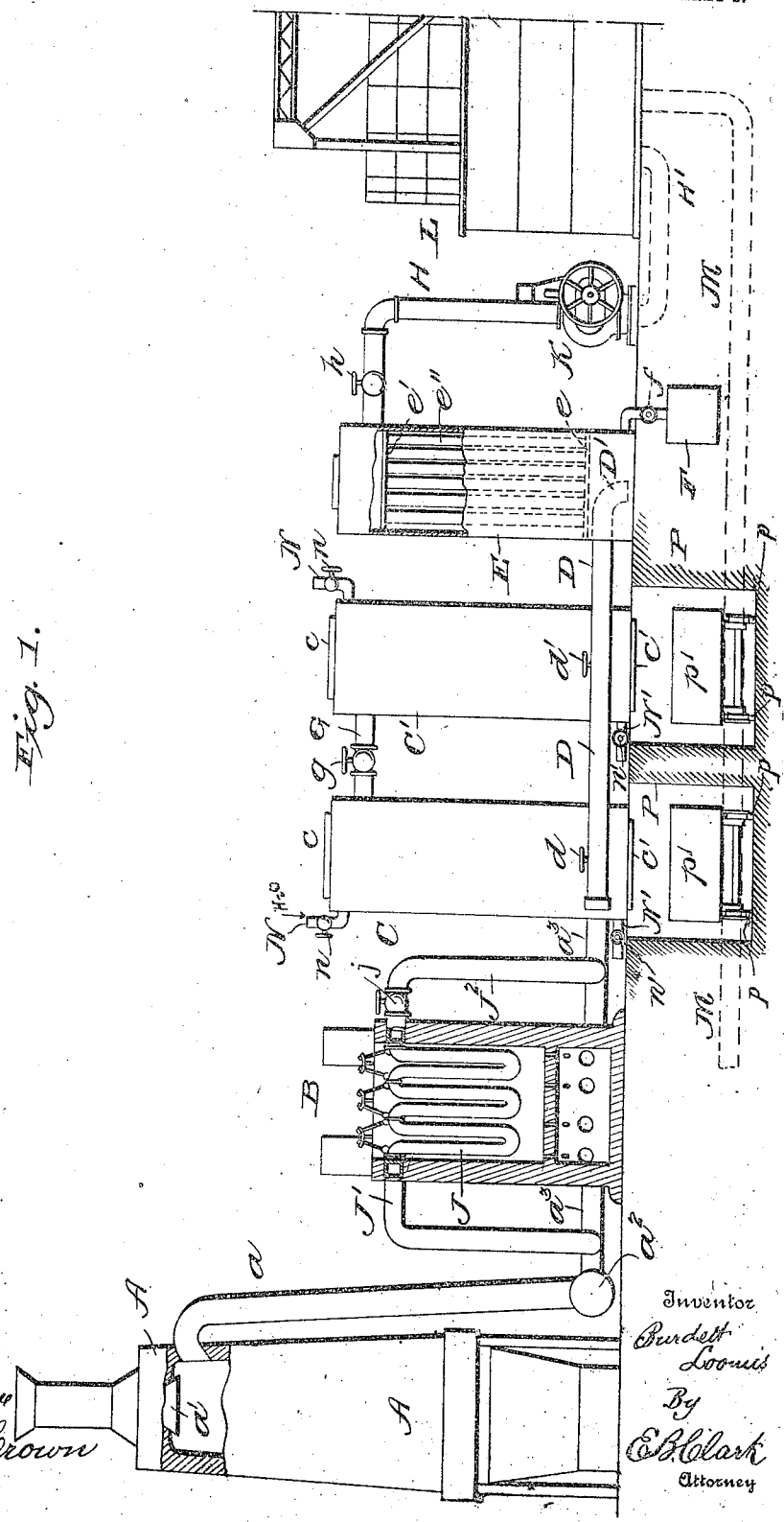

Fig. 1.

Witnesses:
T. L. Mockabee
James F. Crown

Inventor
Burdett Loomis
By
E. B. Clark
Attorney

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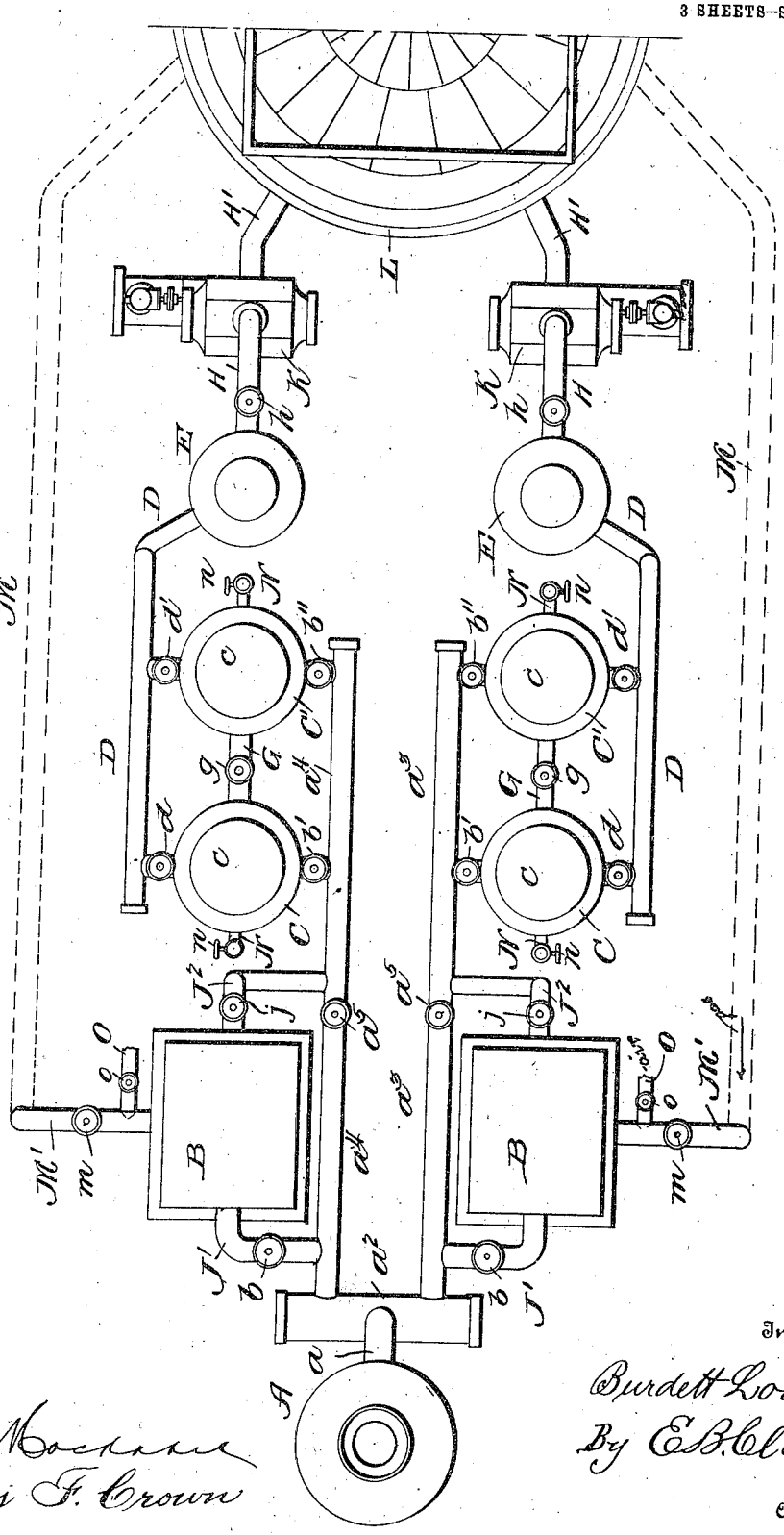
3 SHEETS—SHEET 2.

Fig. 2.



Witnesses

T. L. Mackaye

James F. Crown

Inventor

Burdett Loomis

By E. B. Clark

Attorney

B. LOOMIS.

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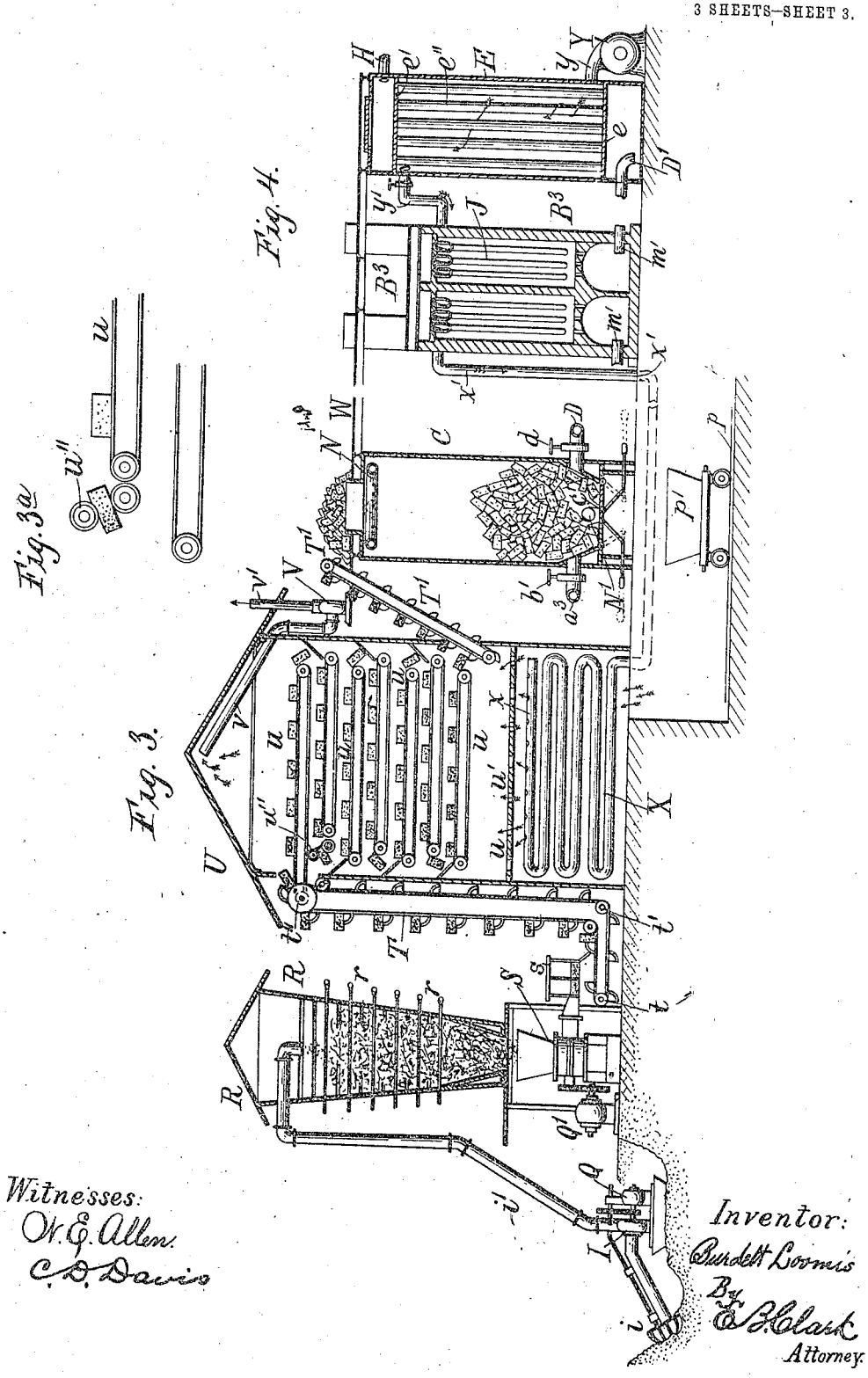

Witnesses:
W. E. Allen.
C. S. Davis

Inventor:
Burdett Loomis
By E. B. Clark
Attorney.

UNITED STATES PATENT OFFICE.

BURDETT LOOMIS, OF HARTFORD, CONNECTICUT, ASSIGNOR TO LOOMIS UTILIZATION COMPANY, A CORPORATION OF NEW JERSEY.

PROCESS OF TREATING BLAST-FURNACE GASES AND PREPARING CHAR-PEAT.

990,891. Specification of Letters Patent. Patented May 2, 1911.

Application filed May 28, 1906. Serial No. 319,148.

To all whom it may concern:

Be it known that I, BURDETT LOOMIS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Processes of Treating Blast-Furnace Gases and Preparing Char-Peat, of which the following is a specification.

This invention relates to a process of charring peat, cleaning, enriching and utilizing blast furnace gases, separating and collecting by-products of condensation from peat vapors and gases.

The object of my invention is to provide for cleaning blast-furnace gases, at the same time charring peat by means thereof and distilling volatile hydrocarbons and other products from the peat, thereby enriching or carbureting the gases and fitting them for use in the smelting operation, or for heating the hot blast stoves, such as regenerative or direct fired furnaces usually connected with blast-furnaces, or otherwise used in iron and steel plants.

In certain localities wood charcoal is used for smelting iron ore in blast-furnaces, but, owing to the rapidly diminishing supply of wood, the expense of charcoal has become almost, if not quite, prohibitive for smelting purposes. A great, and heretofore, profitable industry is therefore threatened with extinction. In these same localities peat bogs are found from which may be excavated an abundant supply of high grade peat which may be effectively and economically utilized in smelting operations. In my process, the peat is first used for cleaning and enriching blast-furnace gases, while, at the same time, the hot gases serve to distil peat and reduce it to coke or char-peat. The volatile matter distilled from the peat and carried by the blast-furnace gases is finally condensed to the condition of peat-tar and peat tar-water. A certain portion of the volatile matter in the peat is converted into rich hydrocarbon gas which serves for enriching the blast-furnace gases. These gases, thus enriched, are practically free from sulfur and are of high calorific value. They serve admirably for various metallurgical operations and as a motive power in gas engines. In my process, part of the enriched gas, after passing the condenser, is returned and burned in a gas heating furnace in which the blast-furnace gases are additionally heated to adapt them for more effectively distilling and charring peat. The gases passed from the blast-furnace are sometimes not sufficiently heated for charring peat and for this reason are additionally heated before admission to the charring chambers. The gases not required for this heating operation may be stored in a holder and withdrawn for other uses. Two varieties or qualities of charred peat-coke will be made which may be designated as peat-coke and peat steam-coke. The peat-coke serves as a substitute for charcoal for the manufacture of refined iron. For this purpose the peat-coke can be consolidated to such a degree that it possesses almost the same strength of compression as coke produced from coal. The peat steam-coke burns with a flame and serves as a fuel for locomotives, and for use in factories and private houses.

From the peat-tar may be manufactured motor oil, gas oil, creosote, paraffin and lubricating oil. The peat tar-water separated in the condenser yields, under proper treatment, ammonium sulfate, calcium acetate, methylic alcohol, commonly known as wood alcohol.

The matter constituting my invention will be set forth in the claims.

I will now describe the details of construction of my apparatus and the method of operating the same by reference to the accompanying drawings, in which.—

Figure 1 represents an elevation of the apparatus with parts in section. Fig. 2 represents a top plan view of the same. Fig. 3 represents a sectional elevation of apparatus for excavating and drying the peat, a pug mill, a peat charring chamber and suitable connecting conveyers for supplying blocks of peat to the charring chamber. Fig. 3ª represents a sectional detail view, on enlarged scale, of a part of the peat drier. Fig. 4 represents a sectional elevation of a condenser and a connected fan blower.

The blast furnace A may be of the usual construction and provided with a charging bell a'. The gas take-off pipe or downcomer a may lead from the top of the furnace in the usual manner and at its lower end connect with a header or main pipe a^2. With this header connect two gas outlet pipes a^3 and a^4 leading into heating furnaces B and B^1 and by connections, preferably, to the

bases of the gas cleaning and peat charring chambers C, etc.

I preferably construct the gas heaters and the peat charring chambers in two series, so that coke in one series may be cooling off, and discharged while the other set is in active operation for cleaning blast-furnace gas and charring peat. For the purpose of illustration, I show two charring chambers connected in each series so that hot gas may be passed up and down in one direction and then reversed and passed in the opposite direction through the series. I will describe one series only and the operation therein as both series will be constructed and operated alike. The charring chambers C and C^1 are constructed of plate steel or boiler iron riveted together in a well known manner and are provided with top charging openings and tight fitting lids c and at the bottom with discharging doors c'. The gas pipe a^3, leading from header a^2 connects by a branch pipe, having a valve b, with the heating furnace B and with the bases of the chambers C and C^1 by means of branch pipes having valves b' and b'', as shown in Fig. 2. A gas outlet pipe D connects by branch pipes having valves d, d' with the bottoms of the chambers C and C^1 and leads from the last chamber into the base of the condenser E where it terminates in a curved dip pipe D^1 having its lower end sealed in the liquid. The chambers C and C^1 are also connected at the top by a pipe G having a valve g, so that hot gases may be passed up and down in either direction through them.

The charring chambers C, C^1 are supported on suitable posts or foundations P, for providing chambers of passage-ways below them in which is laid a track p. On this track are run cars p' adapted to be centered below the discharging doors c' for receiving coke or char peat from the chamber.

The blast-furnace gases may at times be too low in temperature for effectively charring peat; and I therefore provide for heating such gases before admission to the charring chambers. A gas heating furnace B is provided with a series of return-bend pipes J with which connects a pipe J^1, having a valve b, leading from the main pipes a^2, a^3. An outlet pipe J^2, having a valve j, leads from heating pipe J back into main pipe a^3. A valve a^5 is connected in the main pipe a^3 between the branch pipes J^1 and J^2, as shown in Fig. 2. By means of these pipe and valve connections gas may be passed either through the heater B and thence into the charring chambers or directly from the blast-furnace into the charring chambers. After the charring chambers C, C^1, have been filled with peat in bulk or compressed blocks, as shown in Fig. 3, blast furnace gas is preferably passed directly from the furnace through pipe a^3 into and through the chambers till most of the moisture is driven out, and then valve a^5 is closed and valve b opened. The blast furnace gas is now highly heated by passage through pipes J in furnace B and is then passed by pipe J^2 into pipe a^3 beyond valve a^5 and thence into and through the charring chambers till the peat therein is suitably charred. While drying out the bodies of peat in chambers C, C^1, by means of gas direct from the furnace, the top lids c may be open especially during the early stages when much moisture is to be driven off. The heating furnace B is preferably heated by gas drawn off from the holder through pipe M and admitted by pipe M^1, having a valve m into the base of the heater. An air inlet pipe O, having a valve o, connects with pipe M^1 for supplying air to the burner. The burner may be of a well known kind and two or more of them may be arranged at different points in the circumferential wall of chamber B and at the base thereof, as shown.

The condenser E may be of the well known water tube variety, being constructed with upper and lower tube sheets e and e', connected by tubes e'' and provided with upper and lower gas chambers, as indicated in Fig. 1. An overflow tar-water pipe f, having a valve, leads from the lower gas chamber of the condenser into a tar well or box F. A gas outlet pipe H, having a valve h, leads from the upper gas chamber of the condenser to the exhauster K and a pipe H^1 leads therefrom to the holder L. A gas outlet pipe M leads from the holder and conducts gas to heating furnace B and to other furnaces, for use as fuel therein.

With the tops of the charring chambers C and C^1 collect water supply pipes N, having valves n for supplying water to wash out dust and ashes from the charred peat, and cool the same so that it will not be ignited when being discharged from the charring chambers. Discharge pipes N^1, having valves n', are connected with the bottoms of chambers C and C^1 for taking off washwater, carrying dust and ashes from the coke or char-peat.

Suitable apparatus for excavating peat from a bog, drying it, forming briquets and feeding the bricks to a charring chamber is illustrated in Fig. 3. A centrifugal excavating pump I and a connecting electric motor Q are mounted on a barge or other suitable support, and the pump is provided with a rotary cutter i and with a discharge pipe i' leading to the top of a drying crib R. The crib R is provided with slots and a series of supporting rods r at different heights. Below the crib is placed a pug mill S and an operating electric motor Q^1. As the peat is discharged from this mill it is cut into blocks by a cutter s. A conveyer T is passed over rollers t, t', t'' and so ar-

ranged that the blocks of peat will be taken from the pug mill and discharged at the top of the drying chamber U. In this drying chamber is arranged, one above another, a series of horizontal drying belts or aprons u on which the blocks of peat are traversed back and forth through the chamber while currents of hot air are circulated in contact therewith for carrying off the contained moisture. The blocks of peat as delivered from the pug mill are soft and would not make coke sufficiently dense and hard for the most successful use in a blast furnace. I therefore place in the upper part of drying chamber U, preferably at the end of the second drying apron u, a pair of squeezing rollers u'', Fig. 3ª, through which the blocks are passed and squeezed or compressed so as to make them more dense and hard. A second conveyer T^1 carries blocks of dried peat from the lower apron u to the working floor W, above the charring chambers. A perforated horizontal partition u' is placed below the drying belts for distributing currents of hot air through the whole area of the chamber. In a chamber below this partition is arranged a coil or serpentine of hot air pipe X having an upper perforated discharge pipe x adjacent to the partition. Hot air is conveyed to the coil X by a pipe x' leading from a heating furnace or oven B^3, as shown in Fig. 4.

With the lower end of the tube chamber of the condenser is connected a fan blower Y by means of a pipe y. The cold air circulated between the tubes e'' serves to cool and condense the vapors passing through the tubes while, at the same time, the air becomes heated. This heated air is passed off from the upper end of the tube chamber by pipe y' into the series of pipes J of the heating oven or furnace B^3. In these pipes, the air is further heated by burning gas admitted by burners m' in the base of the furnace. This gas will be supplied from the holder L. This heated air is then passed from pipe x' into the coil X in the base of the drying chamber U. On a suitable support near the top of the drying chamber is placed an exhaust fan V, having an inlet pipe v leading from the upper part of chamber U and an outlet pipe v' discharging into the outer air. By means of the devices for heating air and discharging it into the base of the drying chamber and the exhaust fan for drawing off moist air from the top of the drying chamber, the blocks of peat traversed back and forth on the aprons are rapidly dried and prepared for feeding into the charring chamber C.

The charring chambers having been filled with blocks of peat and the blast furnace being in operation, the hot gases discharged through the take-off pipe x into header a^2 are passed therefrom through pipe a^3 and valves b', b, which are open, into the base of charring chamber C. The valve g being open, hot gases will pass up through chamber C, down through chamber C^1, and thence by the gas outlet pipe D into the base of the condenser E. The dust and ashes carried by the blast furnace gases will be arrested in contact with the lower layers of peat. Gases are passed directly from the blast furnace through the charring chambers, until the peat therein is freed from most of the contained moisture and are in the best condition for readily charring and making coke and char-peat. The blast furnace gas is now, preferably, passed thro[illegible] the heater B by closing valve a^5 and opening valve b, thereby causing the gas to pass through the heating pipes J which are heated by burners supplied by gas pipe M^1, and air pipe O. The highly heated blast furnace gas is now passed by pipe J^2 and pipe a^2 through valve b'' into the charring chamber C^1 and is thence passed from the top thereof through pipe G down through chamber C and is taken off at the base thereof through valve d and pipe D to the condenser E. The gases are now drawn off through the condenser by the exhauster and may be passed directly to the holder L. The gas pipe M may conduct part of the gases back to the base of the heating furnace where they are burned to heat furnace B and the blast furnace gases. By means of the hot gases which pass into chamber C^1, the peat is gradually distilled and charred, giving off its volatile hydrocarbons which are mixed with the blast furnace gases. The gases, still hot, pass from the chamber C^1 through upper pipe G and thence through the peat in chamber C where distillation and charring are partially effected and then the gases are passed off through pipe D. After the peat in chamber C^1 has become sufficiently or partially distilled and charred, the inlet valve b'' is closed and the inlet valve b' is opened, admitting heated blast-furnace gases directly into the base of chamber C. Valve d' being closed and valve d opened gas will now be passed from chamber C off through pipe D to the condenser, as before described.

In the condenser there is separated from the gas peat-tar and peat tar-water which flow off through a pipe, having a valve f, into a tank F, which in practice will be provided with a suitable trap or liquid seal. The tar and tar-water are afterward separated and separately treated for obtaining valuable products. The peat-tar yields motor oil, gas oil, creosote and paraffin. The peat tar-water, under proper chemical treatment, yields ammonium sulfate, calcium acetate, and methylic alcohol, or wood spirit. The gas, after passing the condenser, contains a valuable percentage of noncon-

densable carbureted hydrogen, making it sufficiently rich for incandescent gas lighting, for motive power in gas engines, for heating forge furnaces and various other uses.

When it happens that the blast-furnace gases are not hot enough for effectively distilling and charring peat, they are passed first into the heating furace B by closing valve a^5 and opening valve b, and are therein heated by passing through the return-bend pipes J. The valve j' in pipe J^2 being open, hot gas is passed on through pipe a^3 and is admitted therefrom either through valve b' or b'' into one or the other of the chambers C, C^1 where the charring operation is conducted, as above described. For the purpose of heating furnace B and the pipe J therein, gas is drawn from the holder through pipes M and M^1, and valve m being open, is passed to the burner. At the same time, valve o is open, admitting air to the burner. The peat having been properly distilled and charred in the chambers of the first series, the blast furnace gases are shut off therefrom and may be directed into the second series of charring chambers where the charring operation may be repeated substantially as above described. Water may now be admitted through the pipes N into the tops of the chambers containing charred peat for cooling the same and washing out the deposited dust and ashes and at this time the top lids or covers c may be opened for permitting the escape of steam. The waste wash-water, carrying dust and ashes will be passed off through pipes N^1 by opening valves n'. The coke or char-peat, having been washed and cooled, may be discharged from the chambers through the bottom doors c' into cars p', and fed in any well-known manner to the blast-furnace. Charges of ore, char-peat, and limestone will be prepared in substantially the same manner as with wood charcoal and fed to the top of the blast-furnace.

The apparatus herein shown and described is not claimed in this application, as it is made the subject of a copending application, Serial Number 547,494, filed March 5, 1910.

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

1. The process of treating blast furnace gases which consists in passing them while hot through moist peat, thereby arresting dust and ashes, and distilling volatile hydrocarbons from the peat, and carrying the same off with the cleaned gas for use in a heating furnace or hot blast stoves.

2. The process of treating blast furnace gases which consists in passing them while hot through two or more bodies of moist peat first in one direction and then in the reverse direction, thereby arresting the contained dust and ashes, and distilling volatile hydrocarbons from the peat and charring the latter, and carrying off the hydrocarbon vapors with the cleaned gas for use in a heating furnace, hot blast stoves and other places.

3. The process of treating blast furnace gases and preparing peat for fuel which consists in passing hot gases from a blast furnace through a body of moist peat, thereby arresting dust and ashes, and distilling volatile hydrocarbons and charring the peat, and passing off the resulting enriched gas, then, when the peat is charred, shutting off the gas and spraying the char-peat with water for cooling it and washing out the dust and ashes.

4. The herein described method of treating blast furnace gases and utilizing gases which consists in drawing off the hot gases from a blast furnace and passing them through a body of peat thereby arresting the contained dust and ashes, distilling volatile hydrocarbons and charring the peat, carrying off the hydrocarbon vapors with the cleaned gas and passing the enriched product into a heating furnace, or other place of use, washing the charred peat with water to cool it and remove deposited dust and ashes.

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

BURDETT LOOMIS.

Witnesses:
STEWART N. DUNNING,
MABEL L. HAWKINS.