

July 6, 1926.

1,591,023

M. W. DITTO ET AL

APPARATUS FOR COKING COAL

Filed March 29, 1923

8 Sheets-Sheet 1

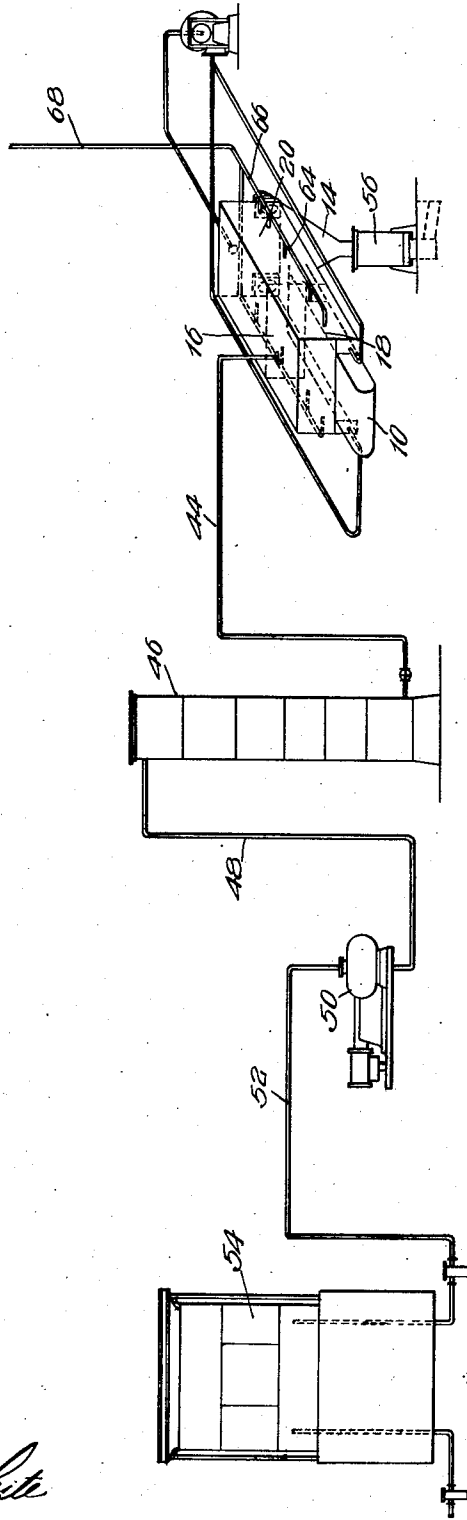


Fig. 1.

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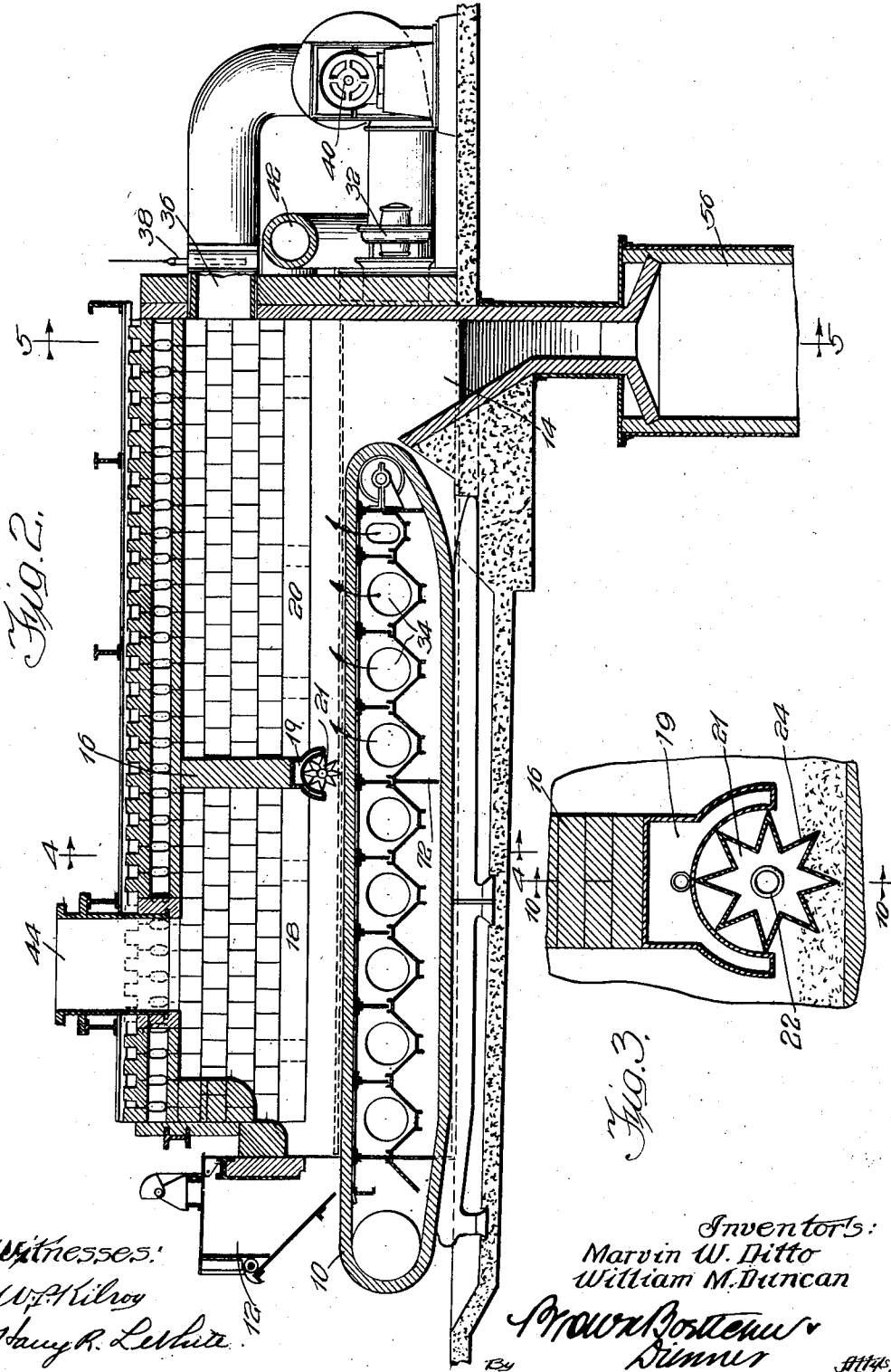
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Fig. 4.

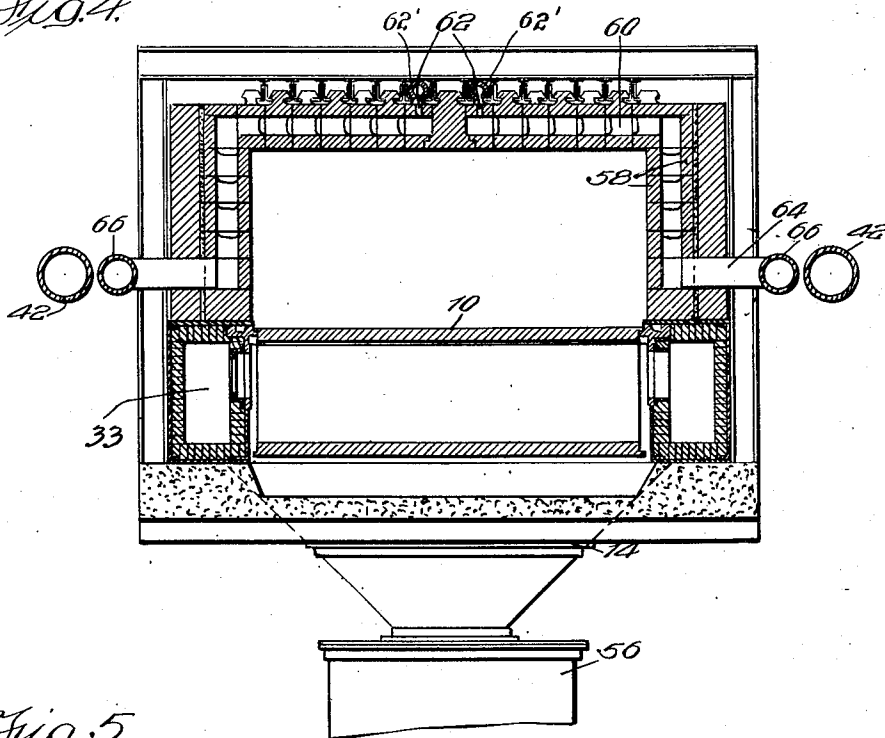
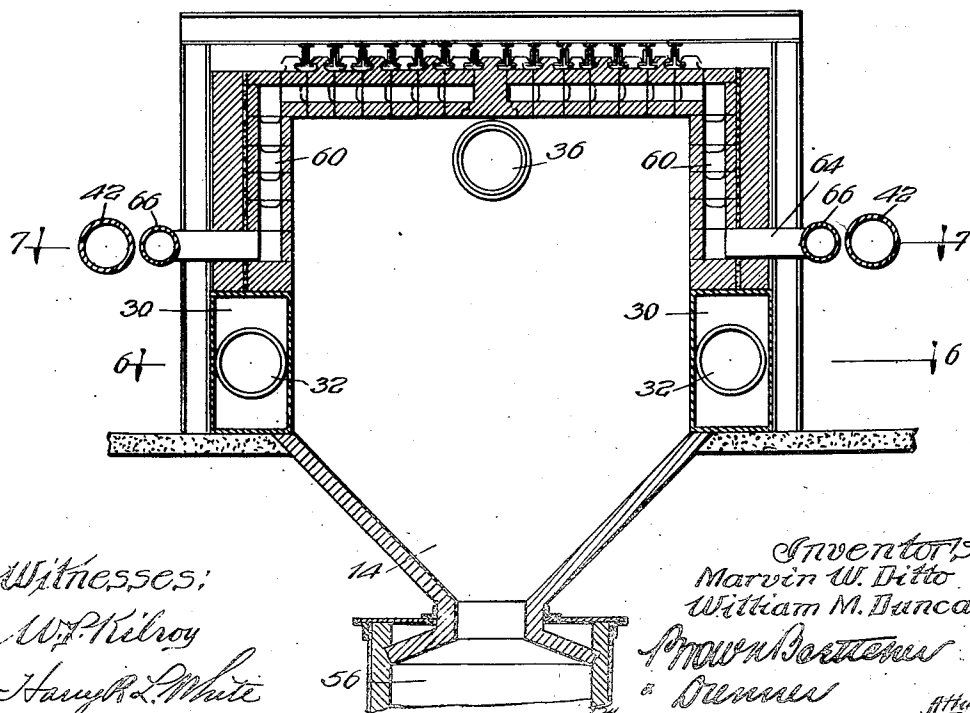


Fig. 5.



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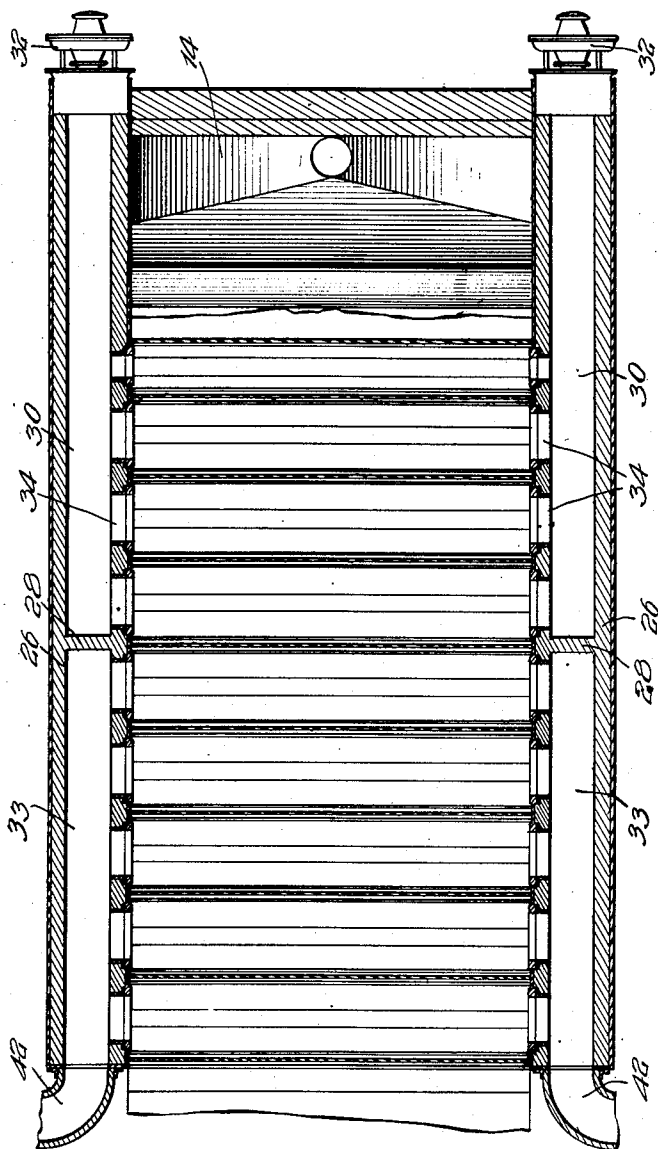
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8 Sheets-Sheet 4

Fig. 6.



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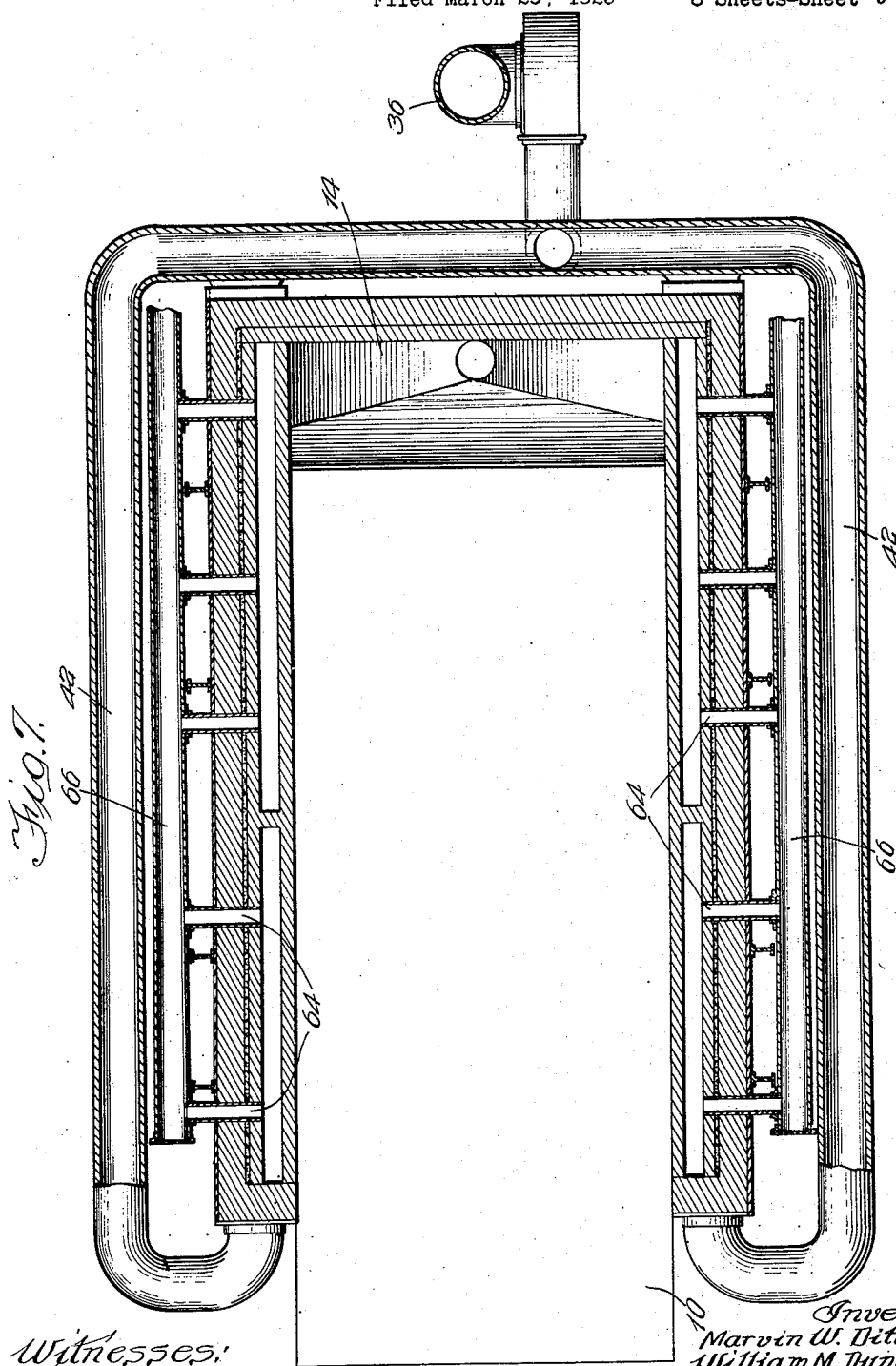
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M. W. DITTO ET AL

APPARATUS FOR COKING COAL

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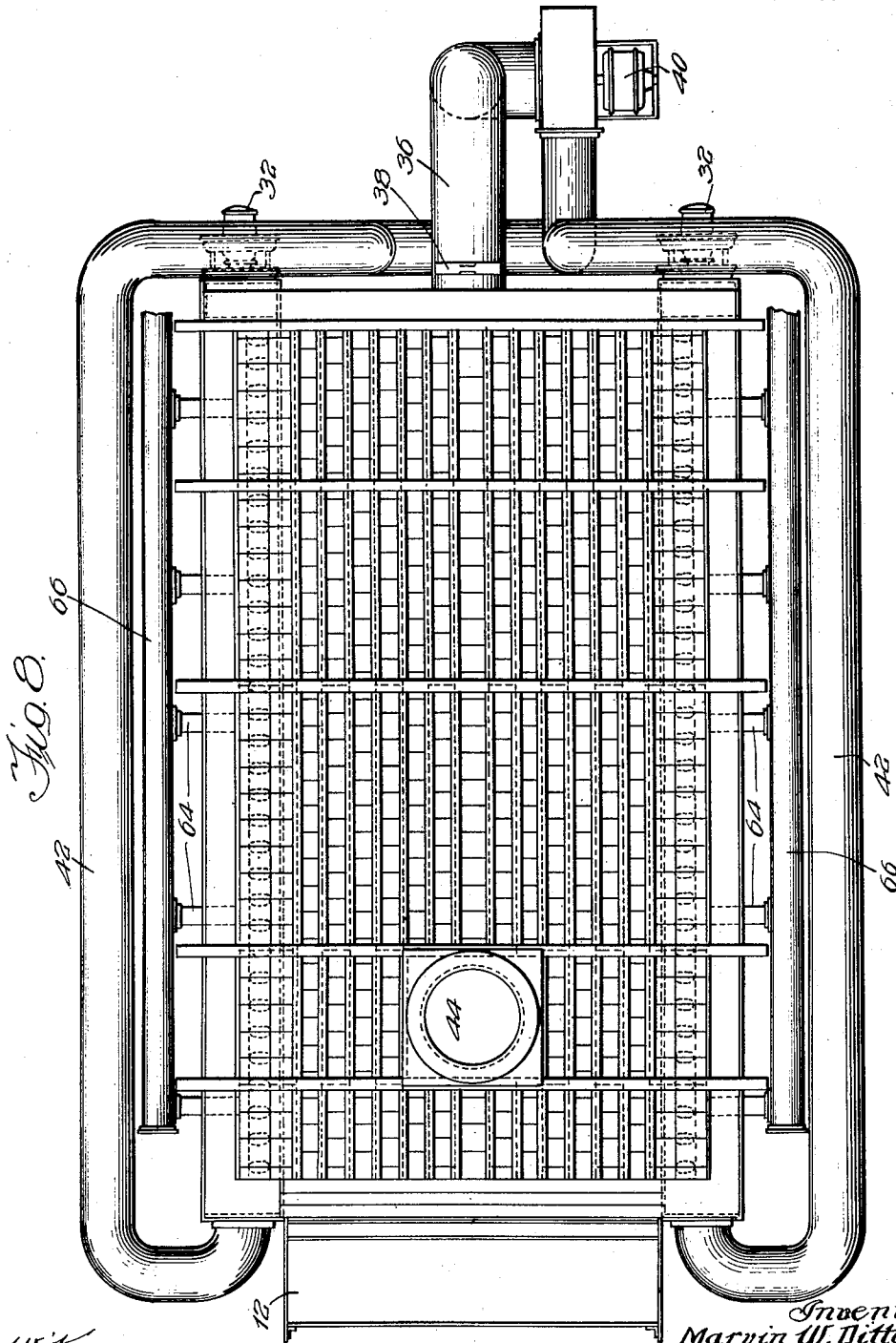
July 6, 1926.

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M. W. DITTO ET AL
APPARATUS FOR COKING COAL

Filed March 29, 1923

8 Sheets-Sheet 6



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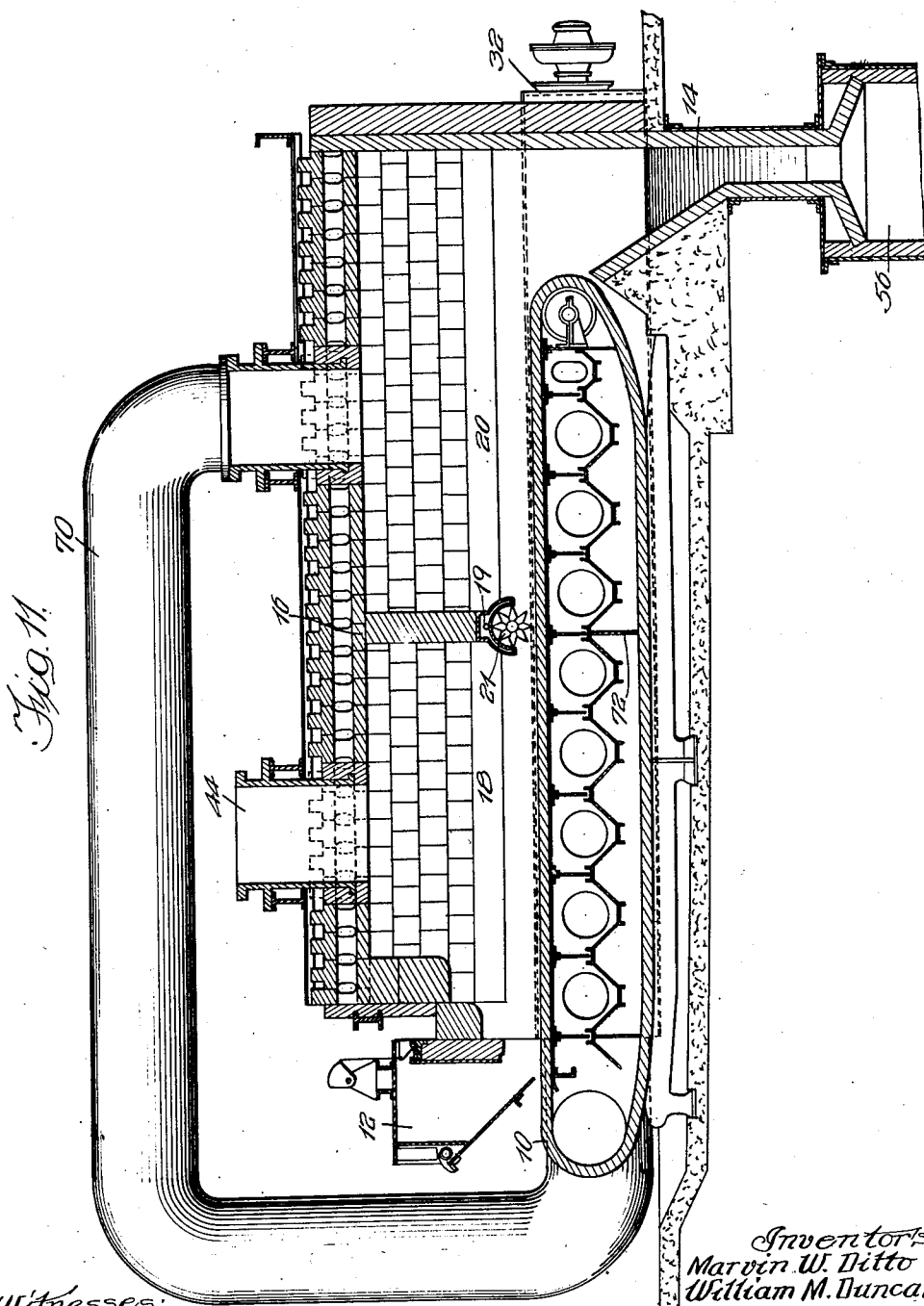
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APPARATUS FOR COKING COAL

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Witnesses:

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M. W. DITTO ET AL
APPARATUS FOR COKING COAL

Filed March 29, 1923 8 Sheets-Sheet 8

Fig. 9.

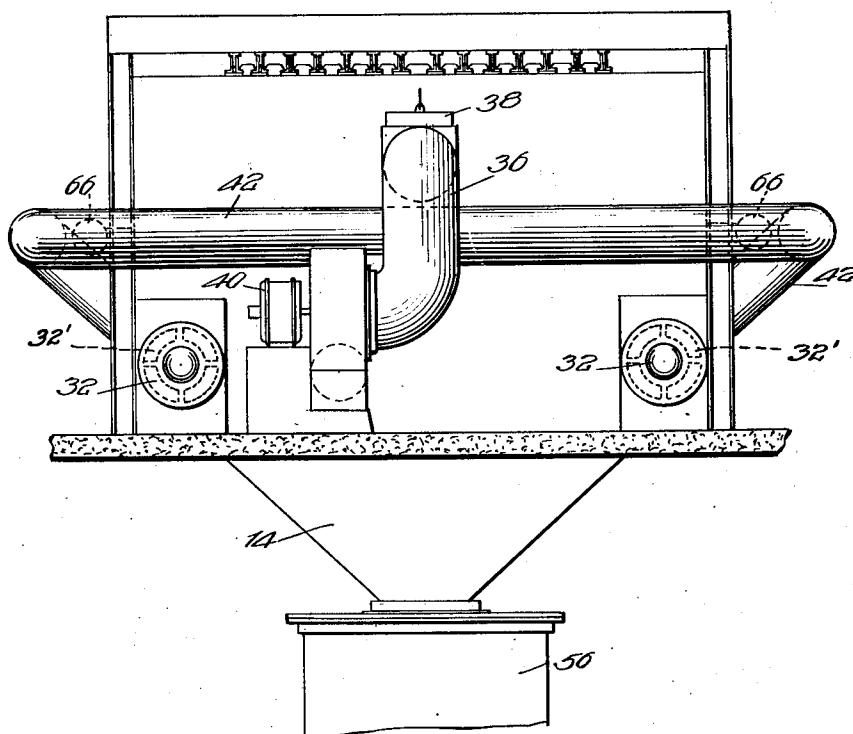
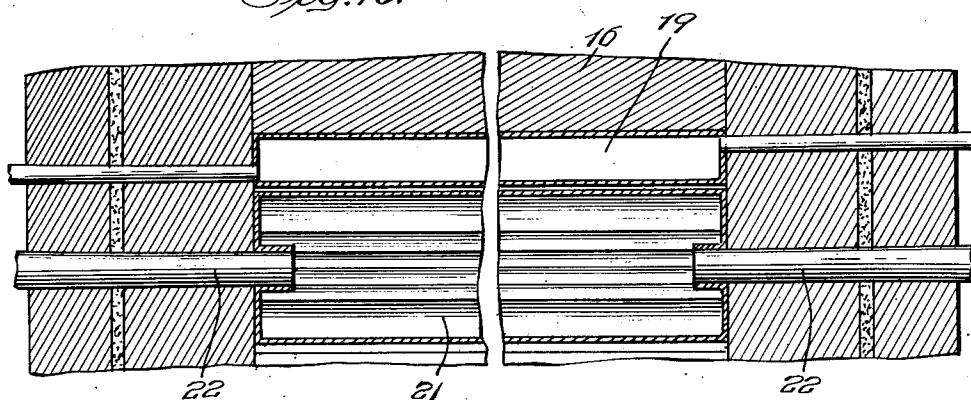


Fig. 10.



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UNITED STATES PATENT OFFICE.

MARVIN W. DITTO, OF NEW YORK, N. Y., AND WILLIAM M. DUNCAN, OF ALTON, ILLINOIS.

APPARATUS FOR COKING COAL.

Application filed March 29, 1923. Serial No. 628,421.

Our invention relates to the utilization of bituminous coal and similar fuel substances such as peat, lignite, and various intermediate by-products from the distillation of crude petroleum or coal.

Among other objects and advantages of the invention may be enumerated the following:

To completely gasify carbonaceous matter such as bituminous coal and save the by-products.

To produce gas by primary distillation of coal utilizing the sensible heat of the gases of the partial combustion of the coal in one zone to supply heat for distilling the coal in a preceding zone of initial introduction.

Another object is the complete gasification of coal where the volatile matter of the coal is distilled out of one zone by the sensible heat contained in the products of combustion from the discharge zone and the sensible heat of blue water gas made from the coke resulting from the primary distillation.

Another object is to utilize the sensible heat of the blue water gas manufactured for the distillation in the primary zone.

Another object is to mix gases resulting from partial combustion of carbonaceous matter with gases resulting from primary distillation of coal with blue water gas manufactured from the residual coke.

Another object is the ability to operate the apparatus and produce gas continuously of varying B. T. U. value at the same time saving the distillate tar oils without exposing them to high temperatures.

Another object is the production of the tar oils classified as being low temperatured products of distillation, the characteristics of said tar oils being different from tar oils obtained in ordinary distillation processes involving high temperatures.

Another object is to surround the moving grates with walls that can be heated either by drawing the products of distillation and combustion through them, or by heating them by the gases formed during the distilling processes thereby preventing the condensation of the tar vapors in the coking retort.

Another object is the more economical use of the heat by carrying on all distillation processes utilizing the sensible heat of

the gases produced in the secondary zone by forcing them through the fuel bed in the primary zone.

Further objects and advantages of the invention will become apparent as the description proceeds.

In the accompanying drawings:—

Figure 1 is a schematic diagram of a complete plant for producing water gas and producer gas according to our invention;

Fig. 2 is a longitudinal section through one type of coking retort;

Fig. 3 is an enlarged detail section of the sealing means;

Figs. 4 and 5 are transverse sections on lines 4—4 and 5—5 of Fig. 2;

Fig. 6 is a horizontal section on line 6—6 of Fig. 5;

Fig. 7 is a horizontal section on line 7—7 of Fig. 5;

Fig. 8 is a plan view of the apparatus shown in Fig. 2;

Fig. 9 is an end view from the coke end;

Fig. 10 is a detail section on line 10—10 of Fig. 3; and

Fig. 11 is a section similar to Fig. 2 of a modification.

In the embodiment of apparatus selected for illustration in Figures 1 to 10, inclusive, the chain grate 10 conveys a continuous stream of material, which will hereinafter be referred to as coal, from hopper 12 through the coking retort to discharge chute 14. A baffle wall 16 divides the space above the grate into two compartments 18 and 20. To provide an effective seal between the chambers, we prefer to terminate baffle wall 16 in a water jacketed semi-cylindrical shell 19, within which a sealing roller 21, also filled with water, is pivoted. Referring to Figs. 3 and 10, it will be seen that roller 21 receives its water supply through the hollow trunnions 22 upon which it is pivoted, and is of star-shaped cross section, so that its ribs 24 will gouge into the bed of fuel moving under the roller as clearly indicated in Fig. 3. This provides a satisfactory air seal between the two parts of the chamber, and with certain types of fuel, may be made use of to effect a desirable breaking up and agitation of the partially coked coal.

The preferable way to operate this apparatus and method is best illustrated in

Figure 2. The steam or motor driven blowers 32 having air admission openings 32' force air into the bus flues 30 which supply the tuyères indicated by 34 on Figure 6. The air flowing through the bed of fuel on top of the travelling grate in the chamber 20 partially consumes the carbonaceous matter in this zone and produces a gas deficient in carbon dioxide and relatively high in carbon monoxide. The temperature of these products of partial combustion is regulated by the amount of air forced into this zone. These gases pass through the conduits 36 and 42 and are discharged into the tuyères in the primary zone and thence through the carbonaceous bed into chamber 18, the sensible heat of the gases being forced into the primary zone thereby distilling the volatile matter out of the coal or carbonaceous matter in the bed at this point. The gases become intermingled with these products of distillation and are then drawn off through opening 44 by a vacuum pump 50 on Figure 1, together with the tar vapors, passing through the cooling tower 46 which also extracts the tar oils. The rate of flow of gas and air are determined by the volume and pressure of the air passing into the chamber 20 and by the vacuum maintained in chamber 18. The conduit 36 is provided with a control valve 38. The air passing from chamber 20 has given up most of its oxygen to the carbonaceous matter to form carbon monoxide and carbon dioxide with a relatively small portion of the fuel being consumed.

The resulting gases at a high temperature can be transferred to chamber 18 by the use of an exhaust fan 40 and delivered through conduit 42 extending along both sides of the retort to sections 33 of the wind chest as shown in Figure 6. These hot gases containing practically no free oxygen are incapable of supporting combustion and have very low heat value. As they pass through the green fuel bed in chamber 18, giving up their heat to the fuel at this point, the distillation of the volatile hydrocarbons takes place and the lean low heat value gas from which the sensible heat has been extracted by the green fuel becomes mixed with the products of distillation from chamber 18 and at certain critical temperatures part of the carbon dioxide is converted into carbon monoxide. The resulting mixed gas is of satisfactory quality to constitute a fuel gas of a type commonly referred to as producer gas, but having considerably higher heating value because of the mixture of the high heat value gas resulting from the primary distillation.

Referring to Fig. 1, these gases pass through conduit 44, scrubber 46, conduit 48, exhauster 50, and conduit 52 to the gas holder 54, from which they may be with-

drawn for heating purposes, operating internal combustion engines, or any other uses for which they are suitable. The scrubber, exhauster and gas holder, in and of themselves, constitute no part of our present invention.

We will next consider the course of the coal through the coking retort. Entering as green coal from hopper 12, it is partially coked, and sometimes slightly oxidized, while passing through chamber 18. It is then more or less agitated and mixed by passage under rolling baffle 21, and during its passage through chamber 20, it is subject to much more lively oxidation, and raised to a fairly high temperature. The resultant material entering chute 14 can be coke of very good quality, and much greater uniformity than can be obtained by any batch process.

While this coke may obviously be employed for any one of a variety of uses, it is peculiarly advantageous to let it fall directly into a water-gas producer 56. In this way, large quantities of heat are conserved, which would be lost if the coke were taken out, and conveyed cold to a water gas plant, where it would have to be reheated.

Combustion on the chain grate may or may not proceed to completion. In the first instance, part 56 functions as a mere ash receiver, while in the second the blue water gas therefrom will pass back through chamber 20 to augment the mass of material and the sensible heat delivered to the green fuel in chamber 18 through conduit 36. In either instance the first and second objects of invention above stated are accomplished, whereas the third object is only attained when the fuel is only coked on the chain grate and finally consumed by making blue water gas in generator 56.

It is highly desirable to avoid the deposition of any condensates on the walls of the coking retort, which would accumulate and form tarry deposits. For this purpose, we construct the coking retort with double walls 58 separated by chambers 60. Near the longitudinal center of the retort a set of apertures 62 is provided for the insertion of gas burners 62', as shown in Fig. 4. From this point the products of combustion pass outwardly to the sides of the retort and downwardly to exit pipes 64 joining headers 66 leading to the stack 68. This maintains the walls of the retort at all times at an appreciably higher temperature than the gases in the retort, and prevents condensation. As the temperature in chamber 20 is somewhat higher than in chamber 18, we preferably heat its walls to a somewhat higher temperature. Upon reference to Fig. 7, it will be observed that three exit pipes 64 are provided for chamber 20 and only two for chamber 18. The vol-

ume of fuel supplied to heat the walls is thus apportioned to secure the proper relative temperatures.

Without further elaboration, the foregoing will so fully explain the gist of the invention, that others may, by applying current knowledge, readily adapt the same for use under various conditions of service. For instance, the equipment illustrated in Fig. 2 includes power means for influencing the flow from chamber 20 to chamber 18. It will be obvious, that under certain conditions of operation, fan 32 and exhauster 50 may be relied upon to maintain the flow through the entire system, and the gases from chamber 20 may be taken through conduit 70 (Fig. 11) devoid of any power means, to chamber 18. While we have illustrated a chain grate with the space beneath it divided by partition 72 to control the delivery of gases to chambers 20 and 18, it will be obvious that other equivalent conveyor means might be substituted. These and many other modifications and variations may readily be made without eliminating certain features which may properly be said to constitute the essential items of novelty involved, which items are intended to be defined and secured to us by the following claims:

We claim:—

1. In combination, a coking retort, conveyor means for moving a stream of coal

through said retort, baffle wall means dividing said retort into two parts, movable means having rolling contact with said stream of coal and forming the terminus of said baffle means to afford a tight seal, means for supplying air to carry on combustion on one side of said baffle wall, and means for delivering the products of said combustion to coke the coal on the other side of said baffle wall substantially without combustion.

2. In combination, a coking retort, conveyor means for moving a stream of coal through said retort, baffle wall means dividing said retort into two parts, movable means having rolling contact with said stream of coal and forming the terminus of said baffle means to afford a tight seal, means for supplying air to carry on combustion on one side of said baffle wall, means for delivering the products of said combustion to coke the coal on the other side of said baffle wall substantially without combustion, and means for heating the walls of the coking portion to prevent condensation of tar vapors thereon.

In witness whereof, I hereunto subscribe my name this 23rd day of March, 1923.

WILLIAM M. DUNCAN.

In witness whereof, I hereunto subscribe my name this 23rd day of March, 1923.

MARVIN W. DITTO.