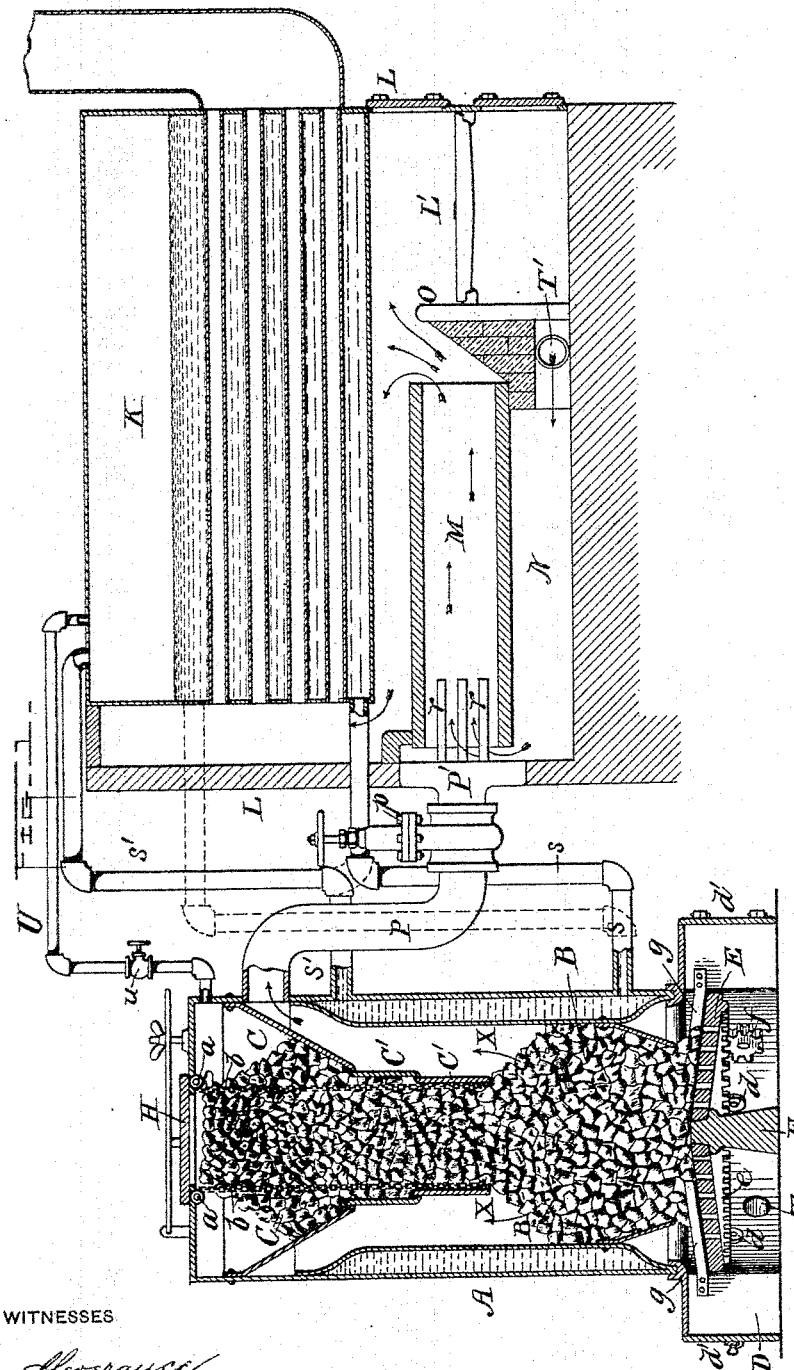
(No Model.) 2 Sheets—Sheet 1.

O. W. KETCHUM.

STEAM BOILER GAS PRODUCING FURNACE.

No. 491,359. Patented Feb. 7, 1893.



WITNESSES

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(No Model.) 2 Sheets—Sheet 2.

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FIG. 2.

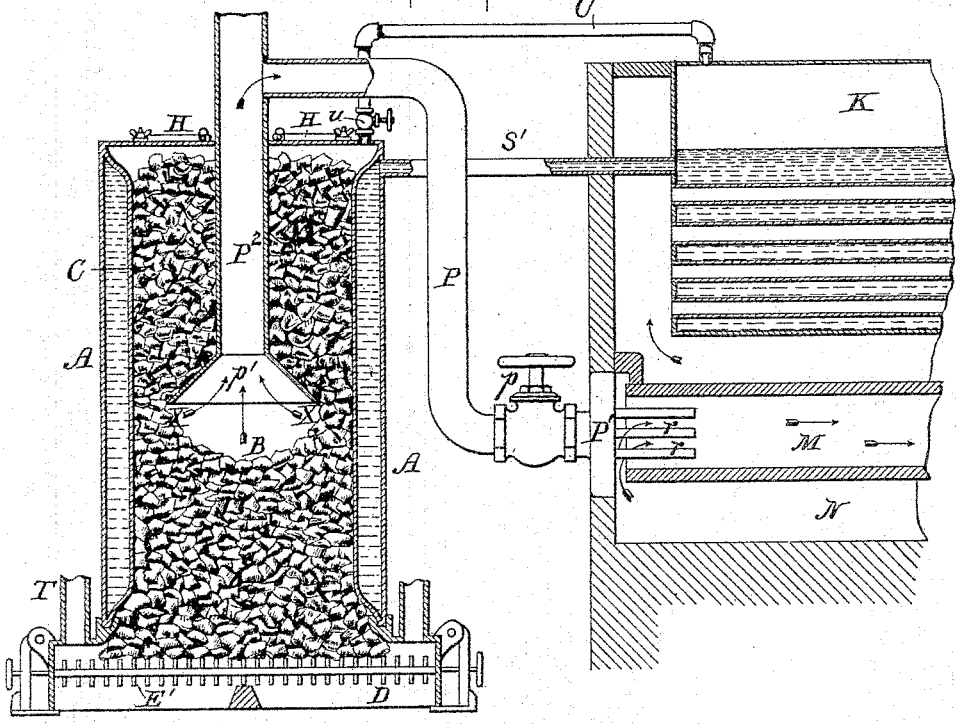
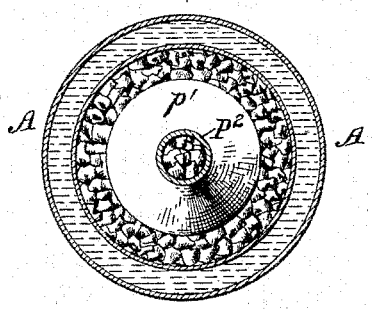


FIG. 3.



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UNITED STATES PATENT OFFICE.

OLIVER WILLIAM KETCHUM, OF TORONTO, CANADA.

STEAM-BOILER GAS-PRODUCING FURNACE.

SPECIFICATION forming part of Letters Patent No. 491,359, dated February 7, 1893.

Application filed June 10, 1891. Serial No. 395,793. (No model.)

To all whom it may concern:

Be it known that I, OLIVER WILLIAM KETCHUM, a subject of the Queen of Great Britain, residing at Toronto, in the county of York, Province of Ontario, Canada, have invented certain new and useful Improvements in Steam-Boiler Gas-Producing Furnaces; and I do hereby 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 relates to steam boiler furnaces, and more particularly to devices connected with such furnaces, for securing a regular and even feed of fuel to the gas producing fire-pot of the furnace; also to means for producing a more even combustion and uniform gasification of the fuel, and to devices for utilizing the heat of the gases as generated and for burning the gases while hot in a special combustion chamber connected by pipe or flue directly with the junction of the fuel feeding reservoir and the fire pot for the purpose of conducting off the mixture of producer gas made by partial combustion of the fuel and volatile gases distilled from the coal in the feeding reservoir, whereby a better and more even quality of gases may be supplied to the combustion chamber connected with the steam boiler or other furnace.

The objects of my invention are to provide for converting the fuel into a uniform quality of high grade fuel gas before it is consumed in the combustion chamber; also to provide for utilizing the heat evolved during the production of the gas for heating water contained in the water jacket of the producing furnace, and circulating therefrom into the boiler and for utilizing the heat resulting from the subsequent complete combustion of the gas in the combustion chamber of the boiler; also to provide for the combustion of the gas while it is at the high temperature at which it is produced; also to provide suitably connected water circulating pipes adapted to maintain an active and uniform circulation of water between the boiler and water jacket of the fire pot or producer and always keeping said water jacket full of water, thereby protecting the shell from overflowing and the resulting straining and leaking; also to provide for driving gas out from the top of the fuel reservoir or producer by means of a steam jet thereby preventing explosions when the top door is open.

In carrying out my invention, I provide a double wall or water jacketed producing furnace preferably composed of iron to prevent the formation and adhesion of clinker, and a fuel feeding reservoir preferably provided with adjustable telescopic sections for raising or lowering the height of the fuel bed in the fire pot according to the quality of the coal being used and the volume of gas it is desired to produce. I also provide a separate combustion chamber for the gases connected by a suitable pipe or flue with the fire-pot at its junction with the fuel reservoir, so as to draw off a mixture of gases composed of gas resulting from partial combustion of the fuel and of volatile gases distilled from the coal in the fuel reservoir, whereby the coal may be partially coked and gasified before it is supplied to the fire-pot, thereby securing more even gasification and a more uniform yielding of gas. I also provide a rotary grate in connection with fixed scraper bars for removing the ash and clinker without stopping the operation of the furnace. I also arrange water circulation pipes between the water jacket of the producer and the boiler composed of a pipe leading from the top of the water jacket to the top of the boiler and of a pipe leading from the bottom of the boiler to the bottom of the jacket. I also connect the top of the steam boiler with the top of the fuel reservoir by a steam pipe provided with a valve for the purpose of admitting a sufficient supply of steam into the top of the fuel reservoir to drive out explosive gases before opening the top door and thereby preventing injurious explosions when the door is opened and air admitted.

I will now particularly describe my improved furnace by reference to the accompanying drawings, in which:—

Figure 1 represents a vertical section of the apparatus; Fig. 2 represents a vertical section of the apparatus in a slightly modified form. Fig. 3 represents a horizontal section through the water jacket gas producing furnace.

The gas producing furnace, A, is prefer-

ably made cylindrical and provided with double walls, forming a water space, as shown. It is divided into the fire pot and gas producing chamber B, at the bottom, and the fuel feeding reservoir C, at the top. The fire pot is preferably provided at the bottom with a rotary perforated grate E, as shown in Fig. 1, supported centrally by the post F, and circumferentially by the rollers *d*, fixed in the side walls of the ash pit D. The grate is provided near its periphery with a downwardly extending toothed flange or rack *e*, with which there meshes a toothed pinion *f*, for turning the grate. Scraper bars *g*, are secured to the sides of the ash pit and arranged just above the grate, so that as the latter is turned the bars will scrape its top surface and aid in removing ash and cinder.

The ash pit D, is provided with doors, *d'*, and also has connected with it an air blast pipe T. In the modified form of furnace shown in Fig. 2. the grate is composed of toothed bars E', adapted to be turned for shaking down ash and clinker.

The fuel feeding reservoir C, is preferably made at the top in the form of an inverted cone, as shown in Fig. 1, and may be provided with two sliding telescopic sections C' C', extending downward to the fire pot or gas producing chamber. Two or more chains, *b*, *b*, are attached at their upper ends to shafts or rollers *a*, and extend down through the fuel reservoir and connect at their lower ends with the lower sliding section C', of the fuel reservoir for raising such section to the desired height when it is desired to increase the depth of the body of fuel in the fire pot so as to generate gas more rapidly or so as to adapt the furnace for better gasifying the particular kind of coal being used. A gas flue X, is formed at the junction of the fuel reservoir C, and the fire pot B, and such flue is connected by pipe P, directly with the separate combustion chamber M, in the steam boiler furnace L. Pipe P is provided with a controlling valve *p*, and with an enlarged head P', set in the wall of the furnace L. This enlarged head P' is provided with a number of burner tubes *r*, projecting horizontally into the combustion chamber M. The combustion chamber M, is preferably composed of fire-brick, for better retaining the heat, and is supported at its rear end by the bridge wall O, so as to form an air heating space N, below it. An air blast pipe T', enters through the base of the bridge wall O, admitting air into the heating chamber N, and the air for supporting combustion is highly heated by passage through such chamber N, before admission to the combustion chamber M. As the air enters the combustion chamber it passes up between and around the burner pipes *r*, so as to supply each jet of gas with an abundance of hot air and thereby produce perfect combustion. The combustion chamber M, will radiate about as much heat downward as it will upward toward the boiler, and by my improved construction I utilize the heat radiated downward for heating air as above set forth. I provide the usual fuel grate L', ash chambers and doors at the front of the boiler furnace, so that coal, may be burned in the boiler furnace whenever the gas producing furnace is not in operation. The bridge wall O, is inclined from below upward so as to deflect the hot gaseous products from the combustion chamber M, up against the boiler.

The steam boiler K, is of the ordinary tubular variety and is connected by suitable water circulation pipes with the water jacket of the gas producer. Where it is convenient to arrange the top of the water jacket a foot or more below the water level in the boiler, as indicated in Fig. 1, I connect the top of the water jacket by pipe *s'* with the top or crown of the boiler, and the bottom of the jacket by pipe *s* with the bottom of the boiler. By these connections water is drawn from the bottom of the boiler to the bottom of the producer jacket and hot water and steam are forced out of the top of the jacket into the top of the boiler, thereby maintaining an active and uniform circulation between the boiler and water jacket of the producer, and always keeping such jacket full of water, protecting the shell and preventing straining of the parts with resulting leakage. The feed water pipe preferably connects with the lower end of the water jacket. Good results may also be obtained by causing water to flow from near the water level of the boiler to the bottom of the water jacket, and then forcing it from the top of the jacket to the bottom of the boiler as indicated by dotted lines. By this circulation of water I also secure the advantage of utilizing the heat evolved during the combustion and gasification of the fuel for generating steam.

Heretofore much annoyance has been caused by the accumulation of gas in the top of the fuel reservoir, which when the door is opened, would form with the inrushing air an explosive mixture, which sometimes exploded with violence, resulting in deranging the fuel and blowing dust and ashes into the gas. I overcome this difficulty by connecting the top of the boiler by a steam pipe U, having a valve *u*, with the top of the fuel feeding reservoir, and before opening the top door, admitting a sufficient supply of steam to drive out the gas. This device and method of operation have given satisfactory results in practice.

In the modification shown in Fig. 2 the fuel reservoir is made annular and surrounds the gas escape flue P^2, which is arranged centrally in the furnace and is provided at the bottom with a flaring mouth *p'*, which forms a gas collecting space X, at the junction of the fire-pot and fuel reservoir. The gas pipe P, leads from the central flue P^2, to the combustion chamber, M as explained in connection with Fig. 1. The flue P^2, may also extend to any other furnace where it is desired

to burn the gas. Fuel supply doors H, are provided at the top of the fuel reservoirs.

The operation of my improved furnace is very simple and is as follows:—Water being supplied to the boiler and to the jacket surrounding the gas producing chamber and fuel reservoir, a fire is kindled on the grate and air supplied either through pipe T, or through the door of the ash pit. After a sufficient body of fuel is well ignited, I prefer to blow in the air by means of a steam jet injector and thus maintain combustion and gasification of the fuel. After the fire is well started the fuel reservoir is filled with bituminous or soft coal through the door H, after which such door is tightly closed and held in place by a screw and cross bar. The hot fuel gas as now generated in the fire pot passes up in contact with the fuel reservoir, causing distillation of the fuel, and the volatile vapors set free from the coal pass out below the lower end of the fuel reservoir and mix with the fuel gas, and the resulting mixture of gases passes directly through pipe P, into combustion chamber M, where air is supplied through pipe T′ and the heating chamber N. The air currents are broken up by the numerous burner pipes *r*, and intimately mixed with the small streams of gas issuing through such burner pipes, causing perfect combustion. The hot gaseous products on passing from combustion chamber M, are caused to impinge upon the bottom of the boiler and thence pass through the flues thereof to the smoke stack. The fire-pot and its connections being surrounded by water, the heat which would otherwise be radiated from this portion of the apparatus passes into the water and aids in the production of steam. Two or more steam boilers may be connected with one gas producer, or gas may be conducted from the producer to any other form of furnace where a fuel gas is desired.

Whenever during the operation of the furnace it becomes necessary to refill the fuel feeding reservoir C, steam is first admitted by opening valve *u* in pipe U, till the accumulated gas is driven down and out of the reservoir, then door H is opened and the reservoir filled with fuel without danger of an explosion resulting from inflowing air.

By means of the revolving grate E and scraper bars *g* secured to the wall of the ash pit the fire may be cleaned of ash and clinker without stopping the operation of the furnace.

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

In combination the furnace having a combustion chamber beneath the same, a bridge wall O, therein, a grate L′ between said bridge wall and one end of combustion chamber, a chamber M extending from the bridge wall toward the other end of the combustion chamber with a space between it and the bottom and end of the combustion chamber for the admission of air, a gas producer and, a pipe connecting said gas producer with the chamber M, substantially as described.

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

OLIVER WILLIAM KETCHUM.

Witnesses:

JOSEPH DEAN,

W. G. SHAW.