

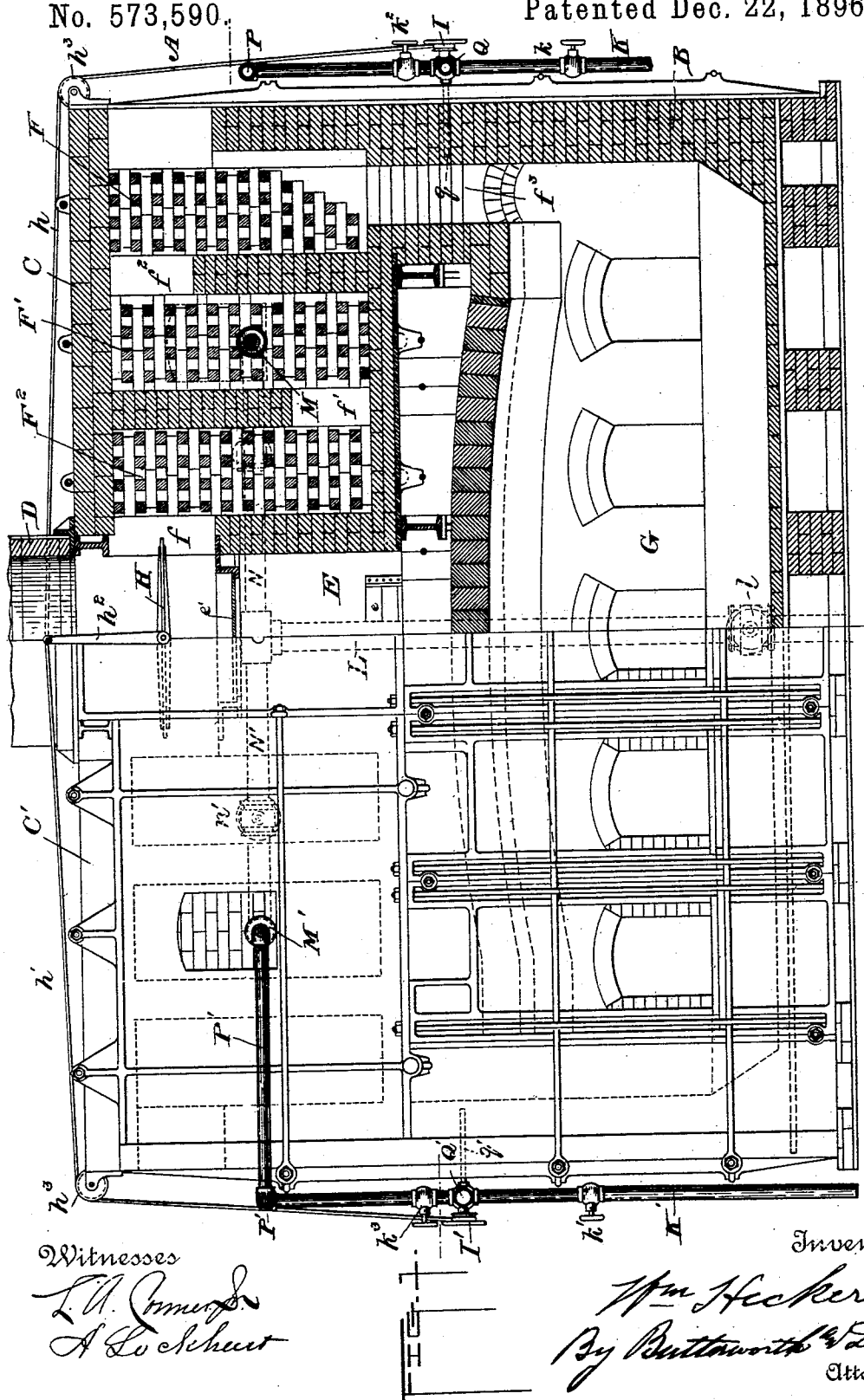
(No Model.)

2 Sheets—Sheet 1.

W. HECKERT.
FURNACE FOR IRON WORKING.

No. 573,590.

Patented Dec. 22, 1896.



Witnesses

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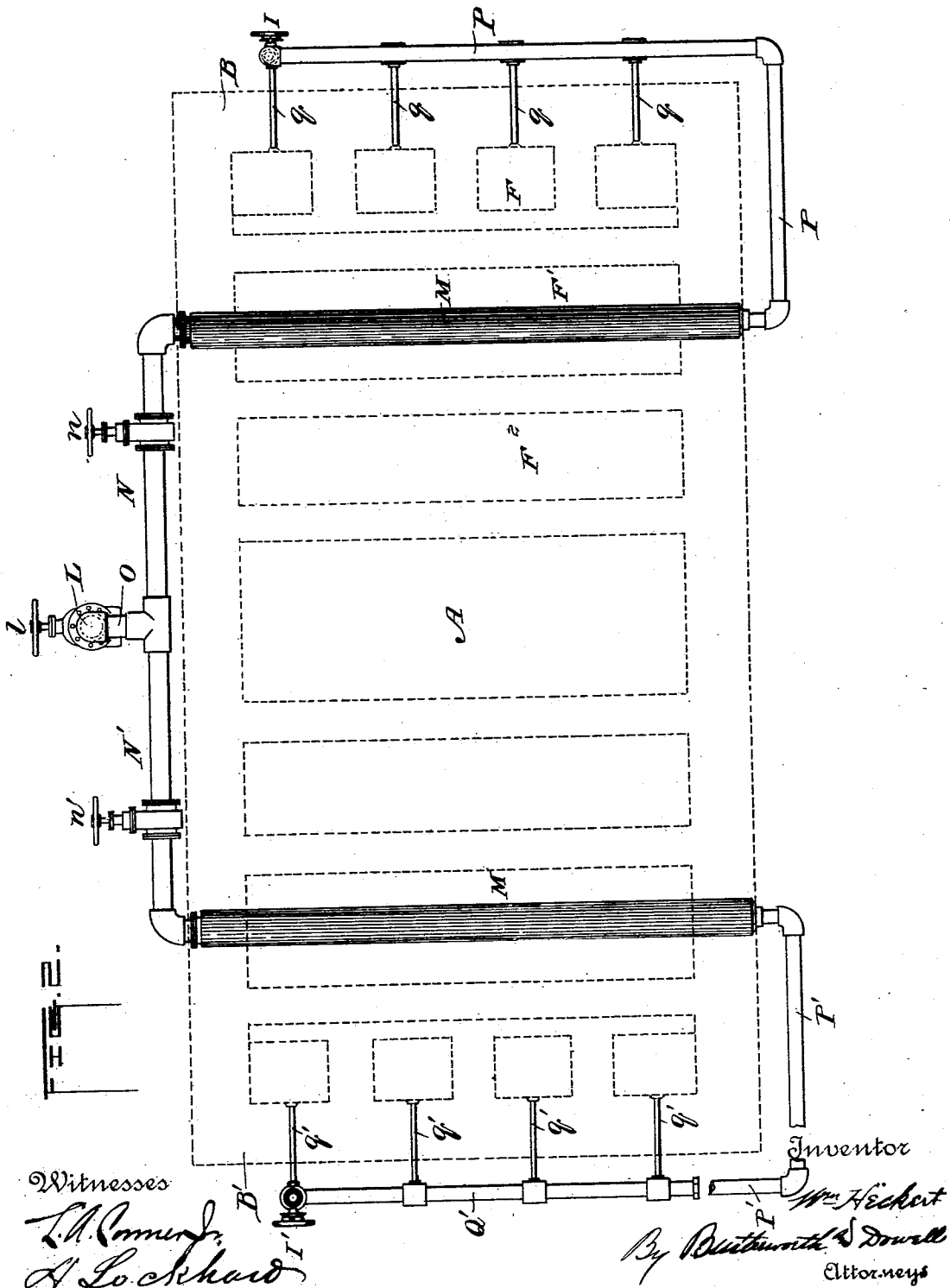
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UNITED STATES PATENT OFFICE.

WILLIAM HECKERT, OF FINDLAY, OHIO.

FURNACE FOR IRON-WORKING.

SPECIFICATION forming part of Letters Patent No. 573,590, dated December 22, 1896.

Application filed November 6, 1891. Serial No. 411,071. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HECKERT, a citizen of the United States, residing at Findlay, in the county of Hancock and State of Ohio, have invented certain new and useful Improvements in Furnaces for Iron-Working; 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.

My present invention relates to improvements in furnaces for iron-working of the same general character as the furnace illustrated in Patent No. 446,971, dated February 24, 1891.

The object of the invention is to provide a furnace of the character above mentioned, adapted to operate upon the well-known regenerative principle, which shall be simple in construction and so organized as to produce superior results by the smallest possible expenditure of fuel, and in which the supply of fuel may be easily controlled and the mechanism for supplying fuel to the regenerating-chambers reversed simultaneously with the reversal of the furnace, so as to prevent waste of fuel which frequently results from the neglect or failure of the attendant of the furnace or watchman to cut off the fuel-supply on reversing a furnace of the usual construction.

Another object is to provide an apparatus by which the heat of the furnace may be utilized in adapting the furnace for making or fixing fuel-gas for its own consumption, the furnace being also connected with a source of supply of natural gas which may be used when desired.

With these objects in view my invention consists in the improved construction and arrangement of parts, all substantially as hereinafter described, and particularly pointed out in the claims at the end of this specification.

In the accompanying drawings, in which like letters of reference are used to designate like parts of the apparatus, Figure 1 represents a front elevation, partly in section, of a regenerating-furnace embodying my invention; and Fig. 2 is a plan illustrating the furnace in dotted lines and showing the gas-making apparatus applied thereto in full lines.

A designates the furnace as a whole; B B', the end walls thereof; C C', the roof or cover; D, the stack, and E the hot-air chamber which is arranged above the reducing-chamber G and provided with air-inlet *e* and outlet-opening *e'*, controlled by suitable slides or valves substantially the same as in the aforesaid patent.

F F' F² designate a series of regenerating-chambers which are arranged above the reducing-chamber G and connected with the latter chamber and stack by suitable conduits or flues, as shown at the right of Fig. 1, three chambers being shown at each side of the hot-air chamber, but of course a greater or less number of such chambers may be used.

It will be understood, of course, that the parts of the furnace at the left of Fig. 1 are exactly similar to the construction and arrangement of the regenerating-chambers and flues shown in section at the right side of said figure. Above the hot-air chamber is placed the reversible valve H, which controls the conduits leading to the regenerating-chambers and to the stack. This valve may be operated by means of suitable pull cords or ropes *h h'*, secured at one end to an arm or bell-crank lever *h²*, attached to the valve or valve-shaft. These cords *h h'* are carried over pulleys *h³ h³* at each side of the furnace, and the free ends of the cords extend downward to sheaves or pulleys upon the stems of regulating-valves I I', to which they are attached, said valves I I' being provided with ordinary hand-wheels, which when turned will cause the rope to pull upon the arm *h²* and shift the valve H either to the right or to the left for the purpose of reversing the furnace, and at the same time the supply of fuel-gas will be cut off at that side of the furnace at which the conduits connecting the regenerating-chambers with the stack are opened.

The several chambers F F' F² have checker-work built therein, as shown, and are separated by division-walls which have openings or conduits *ff' f²*, connecting the several chambers alternately at the top and bottom thereof, so as to cause the heated air and gases to circulate up and down through the chambers and the checker-work therein. Flues or conduits *f³*, preferably four in number, connect the chambers F² G, though more or less may

be used, if desired. The valves I I' are adapted to regulate and control the admission of gas derived from either of two sources, that is, from a supply of natural gas, which
 5 may be admitted through pipes K K', or artificial gas, which may be obtained from any suitable source of supply, as from a producer or tank containing petroleum or other
 10 suitable oil and connected by a pipe L with the gas apparatus of the furnace, as herein after described. The pipes K K' are provided with cut-off valves $k k'$ below the regulating-valves and with similar valves $k^2 k^3$
 15 above the same, and the pipe L is provided with a regulating-valve l for controlling the admission of liquid or gaseous fuel to the gas-making apparatus. For ordinary purposes, and in localities where natural gas
 20 may be easily obtained, the furnace may be operated in the usual manner by the use of natural gas admitted through the pipe K or K' and its connections with a suitable
 25 source of supply; but in order to adapt the furnace to make its own gas I provide suitable drums or tanks M M', one at each side of the furnace, which preferably extend transversely through the regenerating-chambers
 30 and the checker-work therein from front to rear of the furnace, the central chambers being most desirable for this purpose. These tanks may be connected with the supply-pipe L by means of suitable pipes N N' O and
 35 couplings therefor, the pipes N N' being provided with cut-off valves $n n'$. At the front of the furnace the drums M M' are connected by means of pipes P P' with the pipes K K'. Each pipe P P' extends from the point of
 40 connection with the drum to the outer side or end of the furnace and runs thence backward parallel with the drum to the pipe K or K', with which it connects by a suitable coupling.

Q Q' designate pipes which connect with the pipes K K' at one end and are provided
 45 with a series of reduced burners $q q'$, which may project through the furnace-walls into the regenerating-chambers F², or into the flues connecting therewith, for the purpose
 50 of supplying the several chambers or flues with gas. When the latter is used, the air being more or less confined, the gas or fuel injected or conveyed directly into the flues will thoroughly mix with the air contained
 55 therein, thereby materially aiding combustion and intensifying the heating of the volatile products and the gases which pass through the reducing-chamber and regenerating-chambers to the stack. The pipes Q Q' are made larger than the burners, so as
 60 to insure a uniform pressure at all the burners, and the burners may each be provided with a regulating-valve by which the supply of fuel thereto may be controlled.

By means of the gas-making apparatus and
 65 attachments connected therewith the heat of the furnace may be utilized in converting hydrocarbon or other suitable oils into fuel-

gas for use with the furnace, and at the same time the furnace is equipped with connections by which natural gas may be used when
 70 it is not desired to have the furnace make its own gas, and in either case the supply of fuel may be regulated and controlled according to requirements. By connecting the
 75 valve H with the regulating-valves I I' at either side of the furnace the supply of fuel-gas to the flues will be cut off at one side and
 80 turned on at the other simultaneously with the reversal of the furnace, so that all danger of waste of fuel by reason of the neglect or
 85 failure of the attendant or watchman to properly cut off the gas-supply when the furnace is reversed is avoided. The regenerating-chambers being located above the
 90 furnace and provided with conduits or openings communicating with adjacent chambers alternately at the top and bottom thereof, together with the checker-work built in each
 95 of said chambers, which constitute in effect a series of flues connecting the reducing-chamber with the stack, provides a very efficient means of utilizing to the fullest extent the regenerative principle or action of the
 100 furnace, so that it is adapted to perform its several functions with the least possible expenditure of fuel, and the general arrangement is simple, compact, and comparatively inexpensive.

The operation of my invention will be understood from the foregoing description to be
 105 substantially as follows: The furnace being suitably charged and the valve H arranged so as to connect the stack with the upper portion of the conduit f , communicating with the inner chamber of the series of regenerating-chambers at one side of the furnace,
 110 while the upper portion of the inner chamber at the opposite side of the furnace is connected with the hot-air chamber and air-inlet, (the regenerating-chambers at that side
 115 of the furnace being supposed to have been previously heated,) and the chamber or basin G being charged with reduced ore or pig metal, combustion is begun by admitting fuel-gas in the usual way through suitable nozzles
 120 having their outlets arranged to deliver the gas beneath the previously-heated regenerating-chamber. The air drawn in through the heated chamber and circulating down the same and up and down again through the
 125 series of regenerating-chambers and the checker-work therein will be highly heated and intensify the heat in the reducing-chamber. The outgoing heated volatile products and gases escaping up through the other
 130 regenerating-chambers and circulating in a serpentine course through the same and through the checker-work therein will heat said chambers and checker-work, and the heat of these parts will be utilized when the
 furnace is reversed in heating the incoming air or gas with which the furnace is supplied, in accordance with the well-known regenerative principle. The heat of the regenerating-

chambers will serve also to heat the drums or retorts M M', containing crude petroleum or other suitable oil or unfixed gas, and thus produce or fix the gas to be supplied to the furnace through the reduced burners q q'. When, however, it is not desired to have the furnace make its own gas, the regulating-valve l and the cut-off valves n n' k² k³ will be closed, and thereupon natural gas may be admitted to the furnace through the pipes K K' and the valves controlling the same.

It will of course be understood that the construction and arrangement of parts thus described may be modified in a number of ways without departing from the spirit of my invention, and hence I do not wish to be understood as limiting myself to the exact construction described and shown.

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

1. The combination in a regenerative furnace of the reducing-chamber, the stack, the regenerating-chambers and flues or conduits connecting the reducing-chamber and stack with the regenerating-chambers, the reversible valve controlling the conduits which connect the regenerating-chambers with the stack and with the hot-air chamber the drum or retort located in one of said regenerating-chambers, the fuel-supply pipe connecting with said drum, and the feed-pipe provided with a series of reduced burners leading into the flues or conduits which connect the regenerating-chambers with the reducing-chamber below said regenerating-chambers substantially as described.

2. The combination with the reducing-chamber, the stack and central hot-air chamber, of a series of vertically-arranged regenerating-chambers on each side of said hot-air chamber provided with alternate top and bottom openings connecting said chambers with each other, and openings connecting the re-

generating-chambers with the stack and with the hot-air chamber, checker-work within said regenerating-chambers, a drum located in one of said regenerating-chambers and a pipe leading therefrom and provided with burners for supplying gas below the regenerating-chambers directly into the hot air before entering the reducing-chamber, a valve for controlling the conduits which connect the regenerating-chambers with the hot-air chamber and stack, and regulating-valves arranged upon the fuel-conveying pipes, substantially as described.

3. In a regenerating-furnace, the combination with the reducing-chamber, the hot-air chamber above the same, the stack, the regenerating-chambers on opposite sides of the hot-air chamber each provided with checker-work and openings or conduits connecting the same with each other also openings connecting the regenerating-chambers with the hot-air chamber, and the stack and flues connecting same with the reducing-chamber, of a reversible valve controlling the conduits which connect the regenerating-chambers with the hot-air chamber and the stack, a drum arranged in one of the regenerating-chambers and connected to supply-pipes located on opposite sides of the furnace, the said pipes having fuel-burners leading directly into the conduits or flues which connect the regenerating-chambers with the reducing-chamber, regulating-valves arranged upon said pipes, and means for reversing the furnace and closing the fuel-regulating valves from either side of the furnace, substantially as described.

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

WILLIAM HECKERT.

Witnesses:

JOHN H. BOLTON,

CHARLES VAN DENBURG.