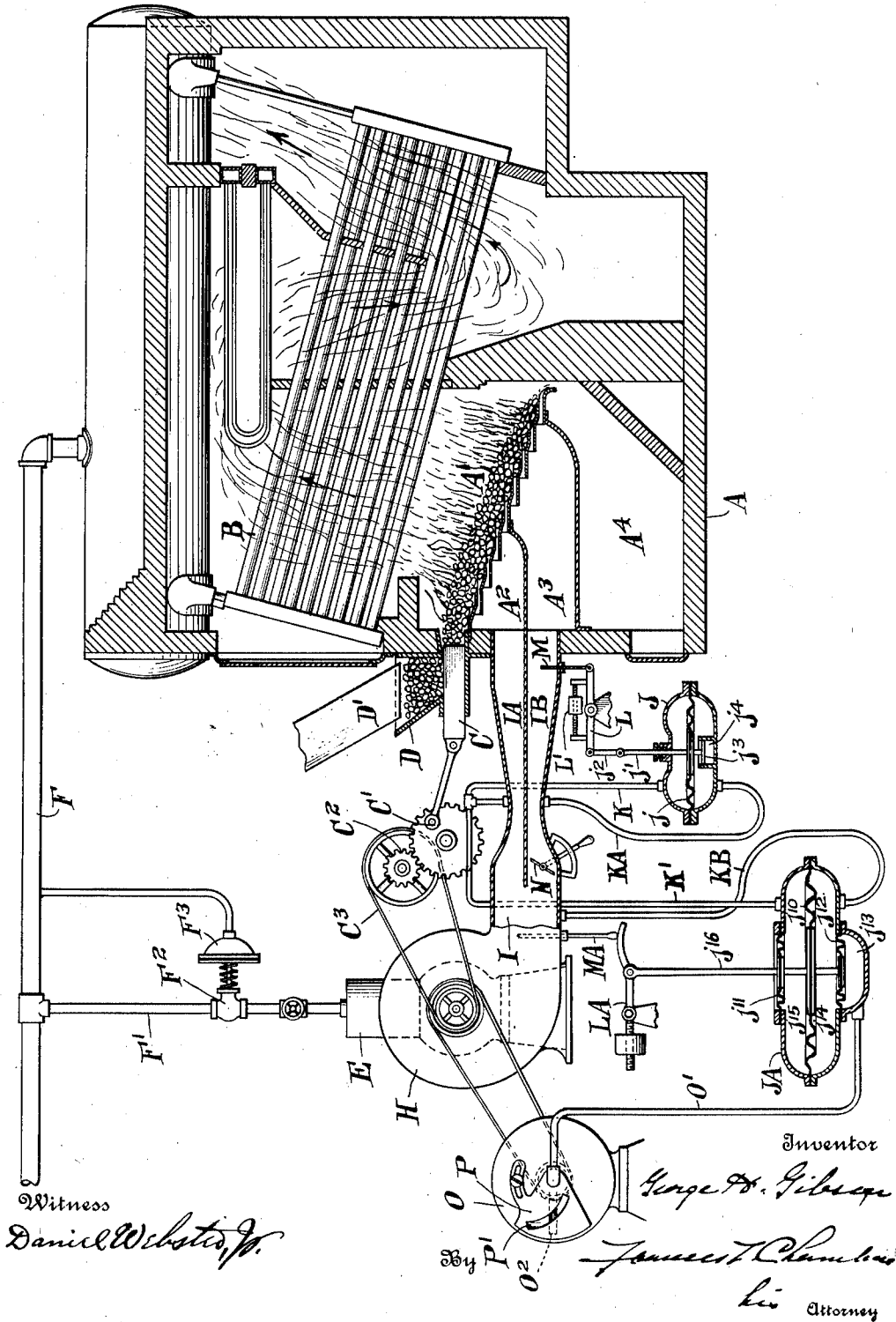


G. H. GIBSON.
FURNACE REGULATION.
APPLICATION FILED NOV. 9, 1915.

1,360,285.

Patented Nov. 30, 1920.



UNITED STATES PATENT OFFICE.

GEORGE H. GIBSON, OF MONTCLAIR, NEW JERSEY.

FURNACE REGULATION.

1,360,285.

Specification of Letters Patent.

Patented Nov. 30, 1920.

Application filed November 9, 1915. Serial No. 60,623.

To all whom it may concern:

Be it known that I, GEORGE H. GIBSON, a citizen of the United States of America, residing in Montclair, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Furnace Regulations, of which the following is a true and exact description, reference being had to the accompanying drawings which form a part thereof.

The object of my present invention is to provide improved means for regulating the supply of air for combustion in a boiler or other furnace having a fuel bed which is actually or in effect divided into two sections in one of which the coal is subjected to a coking operation whereby the volatile matter is distilled out of the coal, and in the other of which the coke residue of the coal from which the volatile constituents have been distilled is burned to ash. The traveling fuel bed maintained by an ordinary automatic stoker is of this character. The rate at which air is fed into the coking section of the fuel bed is a practical measure of the rate at which combustible gas is generated in and passes away from this section. The second section may advantageously be supplied with a sufficient excess of air for the complete combustion in the space above the fuel bed, of the combustible gas rising from the first section of the fuel bed. The efficient operation of a furnace equipped with a stoker of this type requires the two supplies of air to be carefully proportioned to one another as well as to the quantity of coal consumed. This result may be obtained by the use of the present invention.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, and the advantages possessed by it, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of my invention.

The one figure of the drawings is a diagrammatic elevation partly in section, of a steam generating plant having provisions for passing regulated and proportioned streams of air through two zones or sec-

tions of a fuel bed maintained by an automatic stoker.

In the construction shown in the drawing I have illustrated the application of my invention to a steam generating plant of the kind in which an automatic stoker is employed to continuously feed fuel on to the inclined grate A' of a furnace A. The ashes and cinders fall off the lower edge of the grate A' into an ash pit A⁴. As shown, the grate A' is perforated to permit the passage through the fuel bed of primary and secondary air from the air chambers A² and A³ respectively beneath the grate. The air supplied to the chamber A² does not completely burn the fuel on the portion of the grate A' adjacent the chamber A². The air is supplied to the chamber A³ in excess of that required to burn to ashes the coke fuel on the section of the grate A' adjacent the air chamber A³. The excess or free air in the gaseous products rising from the lower section of the fuel bed completes the combustion of the gasified fuel products issuing from the upper section as the commingled products pass into and through the spaces beneath the tubes of the water tube boilers B shown as heated by the fuel burnt on the grate A'.

In the conventional form illustrated the stoker comprises a reciprocating plunger C which withdraws coal from the hopper D supplied to the latter through a chute D' and forces it into the upper head of the fuel bed in successive relatively small charges. As shown the plunger C is reciprocated through the crank C', suitable intermediate gearing C², and a belt C³ by the engine E which is shown as directly connected to, and driving the forced draft blower H. As shown, the engine E receives steam through the branch pipe F' from the main steam supply pipe F leading from the steam drum of the boiler B. The amount of steam supplied the engine E and hence the speed of the latter is regulated by the pressure generated in the boiler. The regulating means comprising a regulating valve F² and a diaphragm device F³ subject to the steam pressure and tending to open and close the valve F² accordingly as the steam pressure falls and rises. The outlet pipe I from the blower H is connected to the chambers A² and A³ by branch conduits IA and IB which are shown as comprising each a Venturi section. With this arrangement it will be ap-

parent that the difference between the pressures at the small cross section portions of the conduits IA and IB will be a function of the ratio between the rates of flow through the two conduits. By maintaining a predetermined ratio between these pressures it is therefore possible to maintain a predetermined ratio between the rates of flow through the two branch conduits. This is accomplished with the apparatus shown by means of a damper M and a fluid pressure device J controlling the damper, divided into two chambers by a flexible diaphragm j . The device J comprises a casing with one chamber connected by the pipe K to the small diameter portion of the conduit IA, and the other chamber connected by the pipe KA to the small diameter portion of the conduit IB. The diaphragm j is connected by a stem j' and link j'' to a lever L on which the damper M which is vertically movable rests. A weight L' adjustably mounted on the lever L forms a means for bringing the damper lever and connected diaphragms into balance. A dash pot piston j^3 working in the dash pot chamber j^4 prevents the damper regulating means from hunting. An adjustment of the ratio of the rates of flow in the conduits IA and IB may be had by the manually adjusted damper N.

Advantageously the flow controlling provisions already referred to are combined with means for proportioning the total amount of air supplied to the furnace to the fuel supplied to the furnace. As shown, the means for accomplishing this result comprise a small blower O which is driven by the engine E and therefore is driven at a speed proportional to the rate at which coal is fed into the combustion space of the furnace by the stoker plunger C. The blower O is formed with a central inlet connected by the pipe O' to the chamber j^{13} of a fluid pressure damper regulating device JA. As shown, the blower O is formed with a radial slot O² and is provided with an adjustable damper P formed with an inclined slot P'. By adjusting the damper P, the outlet from the blower O formed by the intersection of the slots O² and P' can be moved toward or away from the axis of the blower with the effect of decreasing or increasing the suction of the pump. The fluid pressure device JA comprises three chambers j^{13} , j^{14} and j^{15} . The chamber j^{14} is separated from the chamber j^{13} by the flexible diaphragm j^{12} . The chambers j^{14} and j^{15} are separated by a flexible diaphragm j^{10} substantially larger in area than the diaphragm j^{12} . The outer wall of the chamber j^{15} is formed with a central opening closed by a diaphragm j^{11} of the same area as the diaphragm j^{12} . A central stem j^{16} connected to the diaphragms j^{10} , j^{11} and j^{12} , is connected to a lever LA on

which rests the vertically movable damper MA projecting into the conduit I at a point between the blower and the division of the conduit into its branches IA and IB. The chamber j^{15} is connected by a pipe K' to the small diameter portion of the conduit IA and the chamber j^{14} is connected by the pipe KB to the conduit I and thus serves to transmit the static pressure of the conduit I to the chamber j^{14} .

With the arrangement described it will be apparent that the damper MA will be automatically adjusted to preserve a constant ratio between the differential of the static pressures in the body of the pipe I and at the small cross section portion of the conduit IA on the one hand, and the pressure in the chamber j^{13} on the other hand. The latter pressure is a function of the stoker speed of operation, and the differential pressure referred to is a function of the rate at which air is supplied to the furnace. The device JA operates therefore to proportion the total amount of air supplied to the furnace to the amount of coal supplied. The device J operates, as will be readily apparent to those skilled in the art, to maintain a predetermined ratio between the amounts of air supplied to the furnace through the conduits IA and IB. This ratio may be adjusted by the adjustment of the manually controlled damper N.

In my co-pending application, Serial No. 375,728, filed April 22nd, 1920, as a division of this application I have generically claimed novel features possessed in common by the apparatus disclosed herein, as well as in said divisional application, and by other forms of apparatus disclosed by said divisional application.

While in accordance with the provisions of the statutes I have illustrated and described the best forms of my invention now known to me, it will be apparent to those skilled in the art that changes can be made in the form of my invention without departing from its spirit, and that some features of my invention can be used without a corresponding use of other features of the invention.

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

1. In a furnace normally operating with a fuel bed divided into a coking section, and a coke consuming section, the combination with means for supplying separate streams of air to the two fuel bed sections, of means jointly responsive to the rates of flow of the two streams for regulating the ratio between said rates of flow.

2. In a furnace, the combination of stoker mechanism for maintaining a fuel bed traveling from its fuel supply end to its ash discharge end, means for supplying primary

air to the fuel bed adjacent its fuel supply
end, separate means for supplying secondary
air to the fuel bed adjacent its ash discharge
end, means jointly responsive to the amounts
5 of primary and secondary air passing to the
fuel bed and flow regulating means actuated
thereby and tending to maintain a prede-
termined ratio between said amounts of
primary and secondary air.

3. In a furnace having separate primary 10
and secondary air supplies and a fuel sup-
ply mechanism, means for proportioning the
total amount of air supplied to the amount
of fuel supplied, and means for dividing the
total air supplied into predetermined pri- 15
mary and secondary portions.

GEORGE H. GIBSON.