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J. M. W. KITCHEN.

MEANS FOR REGULATING COMBUSTION.

APPLICATION FILED DEC. 18, 1901.

NO MODEL.

Fig. 1,

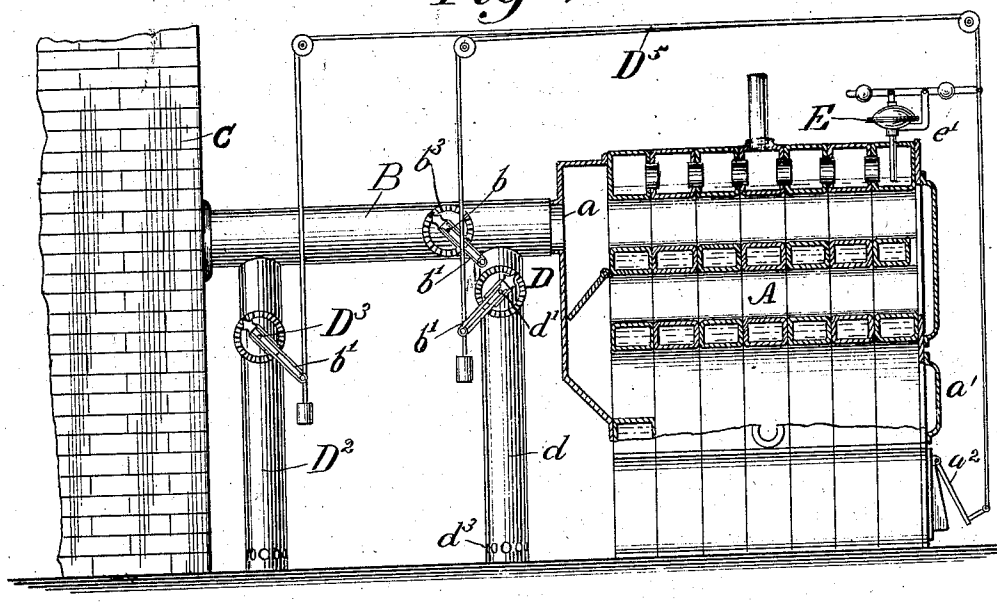


Fig. 2,

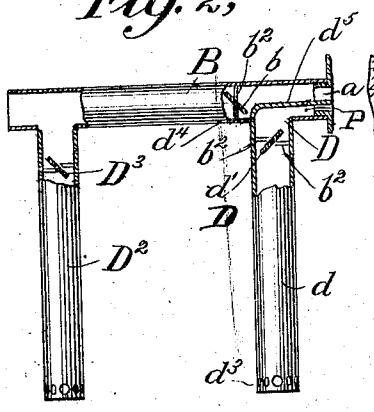
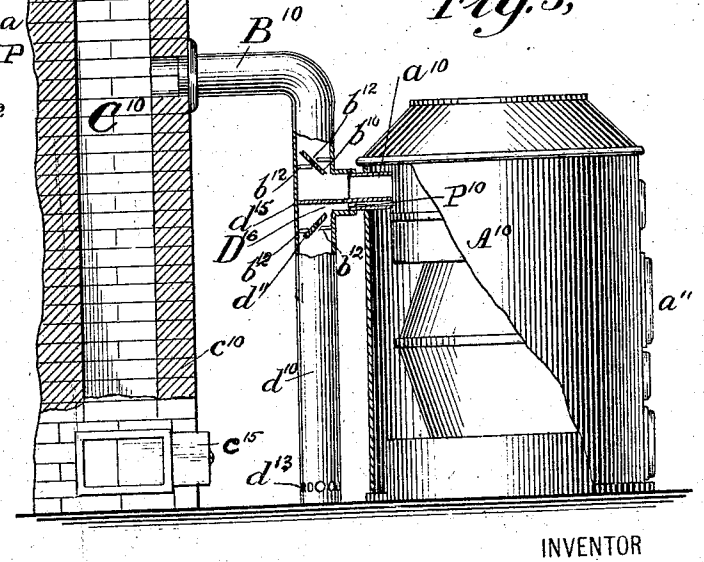


Fig. 3,



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No. 762,913. Patented June 21, 1904.

UNITED STATES PATENT OFFICE.

JOSEPH M. W. KITCHEN, OF EAST ORANGE, NEW JERSEY.

MEANS FOR REGULATING COMBUSTION.

SPECIFICATION forming part of Letters Patent No. 762,913, dated June 21, 1904.

Application filed December 18, 1901. Serial No. 86,365. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH M. W. KITCHEN, a citizen of the United States, residing in East Orange, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Means for Regulating Combustion, of which the following is a specification.

My invention relates to heating or power-producing apparatus; and it has for its purpose to regulate the process of combustion in such apparatus.

More particularly, my invention has for its purpose in its application to such apparatus economy in the use of fuel and the regulation of the rapidity of and the equalization of the rate of combustion. The emission of gaseous products of combustion from the heating apparatus and its attachments in the use of my invention is also prevented.

I will describe a fuel-consuming apparatus having my invention embodied therein, together with a modification of the same, and then point out the novel features thereof in the claims.

In the accompanying drawings, Figure 1 is a view, partly in elevation and partly in vertical section, of a heating apparatus having my invention applied thereto. Fig. 2 is a detail view, partly in vertical section, showing interior features thereof. Fig. 3 is a view, partly in vertical section, showing a modification of my invention.

Similar letters of reference designate corresponding parts in all of the figures.

A represents a heating or power-producing apparatus of any suitable construction.

My invention can be used in connection with most of the forms of heating apparatuses ordinarily in use, but preference is given to those species having large vertical extensions with adequate gas-containing space above the level of the feed-door of the apparatus and which have provision for the exit of products of combustion at the highest level of the combustion-chamber or near the highest level by an opening leading into the smoke-flue. I have designated such an opening by the reference character *a*.

a' represents a feed-door opening of the heating apparatus.

B represents a flue or conduit through which the smoke and gaseous products of combustion pass from the combustion-chamber to a chimney or smoke-stack C.

D represents a horizontally-disposed inlet, which, in conjunction with a horizontally-disposed passage P, provides a means for the introduction of fresh air for combustion into the combustion-chamber about where the products of combustion leave the combustion-chamber. The passage P for the introduction of air into the combustion-chamber may consist of a separate passage in the smoke-flue B, (see Fig. 2,) formed by a partition or wall d^5, leading from the inlet D. The wall d^5 extends horizontally in the smoke-flue from a portion of the periphery of the inlet-opening D through the opening *a*. Instead (see Fig. 3) a vertical smoke-flue may be provided with a horizontally-arranged partition d^5, which divides the flue B into two separate and distinct passages, which passages are superimposed, the upper one being for the products of combustion and the lower one being for air for combustion. This disposition secures a quick and easy flow of air for combustion into the combustion-chamber through being in harmony with the naturally-induced horizontal stratification of gases under the force of gravity and avoids friction due to a structural interposition of the partition into parts of the routes traversed by the two currents, which when the apparatus is in use are of different densities. The partition d^5 serves to keep separate the two currents as well as to deflect the air for combustion to the combustion-chamber. Continuous with the lower passage is a vertically-arranged conduit *d*, which will be hereinafter referred to as the "dependent" conduit. In this form the partition d^5 extends to or into the combustion-chamber.

In all the forms of my invention the means providing for the introduction of air for combustion should communicate with the combustion-chamber at as high a level in its relation to the combustion-chamber as may be

practical in order that air for combustion may be thoroughly diffused through and mixed with the hot unconsumed gases at this high level and so as to secure the greatest production of heat at the highest level in the apparatus. Its introduction should be above the top of the feed-door line of the apparatus A. This high level is important on account of the tendency of hot gases to seek the highest level, and therefore entering air for combustion when introduced at such a high level will have a better opportunity to mix with these gases before the latter leave the combustion-chamber. The high introduction of air thus provided for and a more perfect combustion of the unoxidized gases at this high level secures a more intense heat at this high level, which is of advantage in heating and power-producing processes. This high introduction of air also secures a longer time to effect an admixture and diffusion of the gases with the air as the air gravitates downward to the fuel mass. By introducing a large amount of the air for combustion above the fuel mass a much more complete combustion of the fuel is effected than if most of it is introduced through the grate. By introducing the air at a high point any special structure providing for this introduction is measurably protected from injury from the intense heat of flame infringement. By meeting the outgoing volatilized gases just before they find their exit from the combustion-chamber with the incoming air for combustion there is a better opportunity given for the admixture of the two and their consequent igneous union than if the air were introduced at a low level—as, for instance, through the aperture in the feed-door—in which cases the light hydrocarbon gases float up and outward in advance of the air introduced; hence are likely to escape into the smoke-flue unconsumed. Another reason for having the passage for air communicating with the combustion-chamber at the highest practical level and adjacent the point of exit of the products of combustion from the combustion-chamber is that the passage will serve to receive and convey to the dependent conduit *d* excessive productions of gases, and when the gases enter this conduit they temporarily shut off the air for combustion.

The means providing for the introduction of air to the combustion-chamber should in all cases be of such size and proportions as to admit of sufficient air for the combustion process. In the preferred forms of my invention provision is made for the passage of large quantities of air, and provision is also made for varying the quantity of air to be introduced. In some forms I employ an adjustable damper or valve *d'*. This form of means is employed in the forms of invention shown in Figs. 1 and 2. In other forms of invention I vary the cross-sectional area of the passage or conduit for air for combustion, so that no adjustable damper or valve is required for the passage or conduit. I may, however, in such forms of invention provide an adjustable damper or valve. The partition d^3 serves to deflect the air for combustion toward the combustion-chamber.

In the preferred forms of my invention an important function of the damper *b* is that of obstructing the flue B, so as to divert into the dependent conduit *d* excessive gaseous products. In the performance of this function the damper *b* is located closely adjacent the inlet D between that inlet and the chimney C. The damper *b* when more or less closed also tends to hold back in the upper part of the combustion-chamber the hot combustible gases, and thus gains time for their admixture with air for their combustion and for the better conveyance of the heat produced to the absorbing medium.

The dependent conduit *d* has a lower vertical end which rests on the floor at a point perpendicularly below that of its junction with the horizontal air-passage D and besides acting as a supporting-column has for its purpose to act as a passage for air for combustion, as a temporary overflow-reservoir for excessive productions of smoke and gaseous products, and for the return of the smoke and gaseous products to the combustion-chamber through atmospheric pressure acting upwardly in the dependent conduit. It serves the function just stated principally when the damper *b* is obstructing the flue B. The conduit is immediately open to the atmosphere at its lower vertical end or near its lowermost part, but is impervious the balance of its length except at its uppermost end. In connection with the passage P the dependent conduit also acts as a means for the automatic cutting off of the air for combustion through the entrance therein of the gaseous products of combustion and the downward replacement of the cool fresh air. It is obvious that when the gas under more or less pressure enters the air-passage and dependent conduit from the combustion-chamber the air therein is displaced downward against the force of atmospheric pressure acting upwardly, thus preventing air for combustion entering the combustion-chamber, and therefore reducing the rate of combustion. As the gaseous pressure decreases by finding vent past the damper *b*, which should always be partly open, the gases are forced back by atmospheric pressure acting upwardly in the dependent conduit and then further supplies of air for combustion find admission to the combustion-chamber. In practice such automatic action results in securing equalization of rate of combustion as well as economy of fuel through the burning of combustible gases in the combustion-chamber which would otherwise be lost, and also by reducing temporarily the

combustion of solid fuel. The dependent conduit in performing the functions stated prevents the emission of gases and products of combustion from the apparatus. The size of the dependent conduit may vary, as also its shape. It is usually disposed vertically; but it may be sinuous or otherwise shaped. It should be long enough to contain a substantially vertical column of air of sufficient length to counterbalance the gaseous pressure acting downwardly in it; but all angles or unnecessary length of conduit are avoided to prevent friction of the air for combustion passing through it.

The damper d' is usually placed in the upper part of the dependent conduit d or in that part of the air-passage which is adjacent the inlet D.

b^2 represents stops for the dampers b and d'. Two stops are provided for the damper d', and sometimes two stops are provided for the damper b. In some forms of the invention the lower stop b^2 is replaced by a wall d^4, (see Fig. 2,) which extends upwardly to the axis of the damper and then closes the lower part of the flue B. (See Fig. 2.) The wall d^4 has the function of preventing downdrafts in the flue B passing beyond the damper b toward the combustion-chamber and of keeping at a high level the current of products of combustion.

The stop b^2 for the dampers b and d' are preferably so arranged as to prevent the dampers being turned in undesired directions. It is preferable always to have the damper b turned in such direction as to deflect the gases and other products of combustion away from the bottom of the flue B and for the damper d' to be turned so as to deflect air toward the combustion-chamber. The stops b^2 conform to the inner contour of the flue B and dependent conduit d and prevent leakage around the peripheral edge of the dampers. The damper d' is preferably a solid damper—that is, when it is in its closed position it completely closes the passage of the dependent conduit.

It will be observed from Figs. 2 and 3 that the means which provide for the introduction of air deflects the air for combustion and facilitates its quick flowage into the combustion-chamber and also separates the two currents of air for combustion and the products of combustion until the cavity of the combustion-chamber is reached.

In preferred forms of my invention I provide auxiliary means to regulate the intensity of draft in the chimney or smoke-stack. This may be and preferably is a second dependent conduit D^2, projected from the flue B at a point near the chimney. The dependent conduit D^2 contains a damper D^3. When this damper is open, the natural draft in the chimney draws more or less air through the dependent conduit D^2. When the damper D^3 is shut, the draft operates through the flue B. In some cases the lower part of the flue of the chimney C, containing a damper c, acts as a check-draft. Other forms of check-drafts may also be used for this purpose.

b' represents a handle which is applied to operate any damper embodied in my invention. b^3 represents a circular ratchet with which a handle b' may coact. The ratchet may also be provided with marks or a dial which will indicate the internal positions of a damper to which the damper may be turned.

E, Fig. 1, represents a regulator which is operated from the apparatus A. This regulator may be made to operate any or all of the dampers embodied in my invention. If this is to be done, a flexible medium D^5 may be extended from the controlling-lever e' of the regulator E to the handle b' of the damper to be operated. The regulator E may be of any desired construction. In this case it acts automatically when the steam-pressure in the heating apparatus is sufficiently high to reduce draft and admission of air through its connection with the several handles of the dampers involved in my invention. The regulator E may also be made to operate the ash-pit-door damper a^2.

In the modified form of my invention shown in Fig. 3, A^{10} represents a heater. a^{11} represents the feed-door opening. B^{10} represents a smoke-flue. a^{10} is an opening leading from the combustion-chamber to the smoke-flue. D^{10} represents an air-inlet. P^{10} represents a horizontally-disposed passage; d^{15}, an impervious horizontally-disposed partition; d^{10}, a dependent air-conduit; d^{11}, a damper; b^{10}, a damper in the flue B^{10}; C^{10}, a chimney-flue; c^{10}, the walls of the chimney. b^{12} represents stops. c^{15} represents a chimney-flue check-draft, and d^{13} represents air-apertures in the dependent conduit d^{10}.

Having thus described my invention, the following is what I claim as new:

1. In a heating or power-producing apparatus the combination of a combustion-chamber comprising an exit for waste gaseous products and a gas-retaining cavity impervious to the upward and lateral passage of gases except at the exit for waste gaseous products of combustion, a conduit for conveying away said gaseous products, means located closely adjacent said combustion-chamber for introducing air for combustion into said chamber at a level below the level of the exit for waste gaseous products and at about where the products of combustion leave said chamber, means for deflecting a vertically-rising current of air into a horizontal current, means for the conveyance of said horizontal current to said chamber in a stratum or level below and entirely separated from contact with the waste products of combustion in said conduit, and means for varying the amount of air thus introduced.

2. In a heating or power-producing apparatus the combination of a combustion-chamber

comprising an exit for waste gaseous products of combustion, a horizontally-disposed conduit for said waste gaseous products, an air-inlet adjacent to said chamber, means for the introduction of air for combustion in said chamber at a level above the feed-door of said apparatus but below the level of the exit for waste gaseous products, said means comprising a horizontally-disposed impervious partition running from said air-inlet to said chamber for entirely separating outgoing gaseous products of combustion from ingoing air for combustion and disposed at a level to convey said air in a stratum below the level traversed by the gaseous products of combustion passing through said exit into said conduit, and means for regulating the amounts of air thus introduced into said chamber.

3. In a heating or power-producing apparatus, the combination of a combustion-chamber, a smoke-flue, means located closely adjacent said chamber for conveying a horizontal current of gaseous products of combustion from said chamber to said flue, means for controlling the passage of said products, means for the conveying and introduction of a horizontal current of air for combustion into said chamber at a level above the feed-door of said chamber at about where the products of combustion leave said chamber, and means for keeping said products and said air entirely separated from contact with each other outside of said chamber, said products being thereby conveyed in a stratum at a level above the level traversed by said horizontal current of air for combustion.

4. In a heating or power-producing apparatus the combination of a combustion-chamber comprising a gas-retaining cavity above the feed-door level of said apparatus, a conduit for conveying away the waste gaseous products from said chamber, means closely adjacent said combustion-chamber for conveying hot gases through the higher levels of said conduit, means for controlling the passage of said hot gases, means for the passage of a horizontally-moving current of air at a level below the level traversed by said products in said conduit into the said chamber at a point about where the said waste products leave said chamber, means for entirely separating and keeping apart said air and said products in said conduit, said means for the passage of said current of air comprising a horizontally-disposed passage impervious in its walls except an opening at one end communicating with said chamber and an air-inlet at the other end, and a vertically-disposed air-conduit connecting with and opening into said passage at said inlet and being open to the atmosphere at a low enough level to prevent emissions of gaseous products of combustion from the lowest opening of said dependent conduit, but being otherwise impervious in its walls.

5. In a heating or power-producing apparatus, the combination of a combustion-chamber comprising a gas-retaining cavity above the feed-door of said apparatus, a passage for conducting waste gaseous products of combustion from said chamber and means for controlling the passage of said gaseous products, an air-passage for receiving unvitiated air for combustion from a level below the level of the feed-door of said apparatus and for conveying the said air vertically upward, means for deflecting said air into a horizontally-moving current, means for conveying said air in a horizontal current at a level below the level traversed by said gaseous products and entirely separated from said gaseous products for the introduction of said air into the upper level of said combustion-chamber at about where the said waste gaseous products leave said chamber, and means for controlling the amount of air thus introduced.

6. In a heating or power-producing apparatus, the combination of a combustion-chamber, a smoke-conduit communicating therewith, a horizontally-disposed air-inlet in the lower part of said conduit located closely adjacent to said chamber, an impervious partition in said conduit extending from said inlet to said chamber and disposed to form two horizontal passages in said conduit, one of the passages being for the conveyance of air for combustion into said chamber in a horizontal current at a level below said partition, the other passage, superimposed above the first named, being for the conveyance of waste gaseous products of combustion at a level above said partition, and means for controlling the passage of air for combustion and waste gaseous products of combustion through said passages.

7. In a heating or power-producing apparatus the combination of a combustion-chamber, a smoke-flue, means located closely adjacent said chamber and connecting said chamber and said flue and comprising a horizontally-disposed air-inlet and a horizontally-disposed impervious partition running from said air-inlet to said chamber for receiving and deflecting a vertically-moving induced current of air for combustion into a horizontally-moving current, means for the conveyance of said air into said chamber at a level below said partition, means for retaining the passage of waste gaseous products of combustion through said smoke-flue in a stratum superimposed above said horizontally-moving air-current, and means for the control in measurable amounts of said air and said waste gaseous products of combustion.

8. In a heating or power-producing apparatus, the combination of a combustion-chamber, a smoke-flue, a chimney, a horizontally-disposed air-inlet located at the lowest level of said flue and close to said chamber, means comprising a horizontally-disposed partition for deflecting and conveying said air from said inlet to the higher levels of said chamber in

a current or stratum entirely separated from and traversing a level below the level of the current of outgoing waste gases in said flue, means for the retention of both currents in the relative positions here stated and for preventing through utilization of the force of gravity the emission of gaseous products of combustion from said apparatus through said inlet, means for controlling and measuring the amount of air introduced through said inlet, said means for conveying air introducing said air into said chamber at about the place of exit of waste gases of combustion from said chamber into said smoke-flue, and means near said chimney and between said inlet and said chimney for varying the draft of said chimney.

9. The combination of a heating or power-producing apparatus comprising an automatic regulator, a smoke-conduit, an air-inlet in the lowest part of said conduit located closely adjacent to the combustion-chamber of said apparatus, a dependent air-conduit connected with said air-inlet, means for controlling the passage of air through said dependent conduit, means for controlling the passage of gases in said smoke-conduit, an impervious partition running from said inlet to said chamber for keeping separate the currents of air for combustion and waste gaseous products of combustion traversing said smoke-conduit, a chimney communicating with the smoke-conduit, a check-draft for said chimney and means for controlling air passing therethrough, and means connecting said regulator with the said controlling means for communicating motion from said regulator to said controlling means.

10. In combination with a combustion-chamber, a smoke-flue therefor, a damper in said smoke-flue, a partition-wall in the lower part of said smoke-flue and adjacent said damper for preventing downdrafts, and means for introducing air for combustion into the combustion-chamber about where the products of combustion find their exit from the combustion-chamber in a current separated from the current of products of combustion traversing said smoke-flue.

11. In a heating or power-producing apparatus, the combination of a combustion-chamber, a smoke-conduit communicating with said chamber, a horizontally-disposed air-inlet in said conduit, a partition extending from the said air-inlet to said chamber, said conduit and said partition forming two horizontally-disposed passages, the lower of said passages being for air for combustion and the other at a higher level being for waste gaseous products of combustion, and a dependent conduit extending from said inlet for air, said dependent conduit having a vertical disposition at its lowest part and being immediately open to the entrance of air for combustion at a point between the level of the feed-door of the apparatus and the level of the floor on which the apparatus rests, but being impervious at its walls at other of its parts except at the point of connection with said inlet.

12. In a heating or power-producing apparatus, the combination of a combustion-chamber comprising at a level above the feed-door of said apparatus a gas-retaining and gas-mixing cavity impervious at its walls to the upward and lateral passage of gases except at an opening for the exit of waste gaseous products of combustion, a conduit for conveying away said waste gaseous products, an air-inlet adjacent said opening in said chamber, means comprising a partition extending from said air-inlet to said chamber for deflecting air entering said inlet and for keeping the said air separated from waste gaseous products and for conducting said air into said combustion-chamber at about the point where the waste gaseous products of combustion leave said chamber, means for controlling the air thus introduced and for controlling the waste gaseous products in said conduit, and means for preventing the emission of gaseous products of combustion downwardly through said air-inlet against the force of atmospheric pressure acting upwardly through said inlet.

13. In a heating or power-producing apparatus, the combination of a combustion-chamber comprising a gas mixing and retaining cavity located above the level of the feed-door of said apparatus and being impervious to the upward and lateral passage of gases through its walls at levels above said door except at an exit for waste gaseous products of combustion, said exit for gaseous waste products, a smoke-flue, a structure interposed between said exit and said flue comprising an air-inlet located closely adjacent said exit and an impervious partition extending from said inlet to said chamber for deflecting air for combustion and for conveying said air to said chamber and for keeping said air separate from waste gaseous products passing from said exit to said flue, said structure being arranged to convey said air from said inlet to and into said chamber in a stratum or current below the level traversed by said waste gaseous products through said exit, and means for controlling the passage of waste gaseous products and of air for combustion passing through said structure.

14. In a heating or power-producing apparatus, the combination of a combustion-chamber having a gas-retaining dome or cavity in its upper part and above the feed-door of the apparatus, a smoke-flue exit, means for introducing unvitiated air for combustion directly into the higher levels of said combustion-chamber, said means comprising an air-inlet and a partition running from said inlet to said chamber at a level lower than said smoke-flue exit for deflecting air for combustion and for keeping said air separated from the waste gaseous products of combustion until said air is intro-

duced into said chamber, said means allowing for the introduction of said air into said chamber at about where the said waste gaseous products leave the chamber, said means also comprising a vertical air-conduit impervious at its walls except at an upper opening connecting with said air-inlet and except an opening for the free inflow of air at a level between the feed-door level and the level of the floor and at a point about vertically below said air-inlet, and means for controlling the amount of air passing through said inlet and of waste gaseous products passing through said smoke-flue exit.

15. In combination with the combustion-chamber of a heating or power-producing apparatus, a conduit for conveying away waste gaseous products from said chamber, an air-inlet in said conduit located close to said chamber, a dependent air-conduit connected with said air-inlet and directly open to the atmosphere at its lower end, an impervious partition running from said inlet to said chamber, means for controlling the flow of air through said inlet and by deflection quickening the flow, and means in addition to said partition for conveying said air to said chamber in a current entirely separated from said waste gaseous products, said dependent conduit and said combustion-chamber being constructed with impervious walls and disposed to retain within their cavities through atmospheric pressure acting upwardly therein hot gaseous products except at the exit provided for the waste gaseous products of combustion.

16. The combination of a combustion-chamber comprising a gas-retaining cavity above the level of the feed-door of said combustion-chamber, a chimney, a conduit for waste gaseous products of combustion, an air-inlet close to said combustion-chamber, an air-passage running from said inlet to said combustion-chamber constructed to entirely prevent contact of the air passing therethrough with the gaseous products in said conduit, a dependent conduit impervious at its side walls, communicating with said passage and connecting therewith at said inlet and having an opening for the admission of air at its lower end and at a level low enough to prevent hot gases escaping from said lower end, a damper to control the air passing through said inlet, a damper for controlling the waste gaseous products of combustion located close to said inlet and between said inlet and said chimney, and means for separately controlling the draft in said chimney.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOSEPH M. W. KITCHEN.

Witnesses:

GEO. E. CRUSE,

JOS. P. MCELDUFF.