No. 762,912. PATENTED JUNE 21, 1904.

J. M. W. KITCHEN.

MEANS FOR REGULATING COMBUSTION.

APPLICATION FILED FEB. 15, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

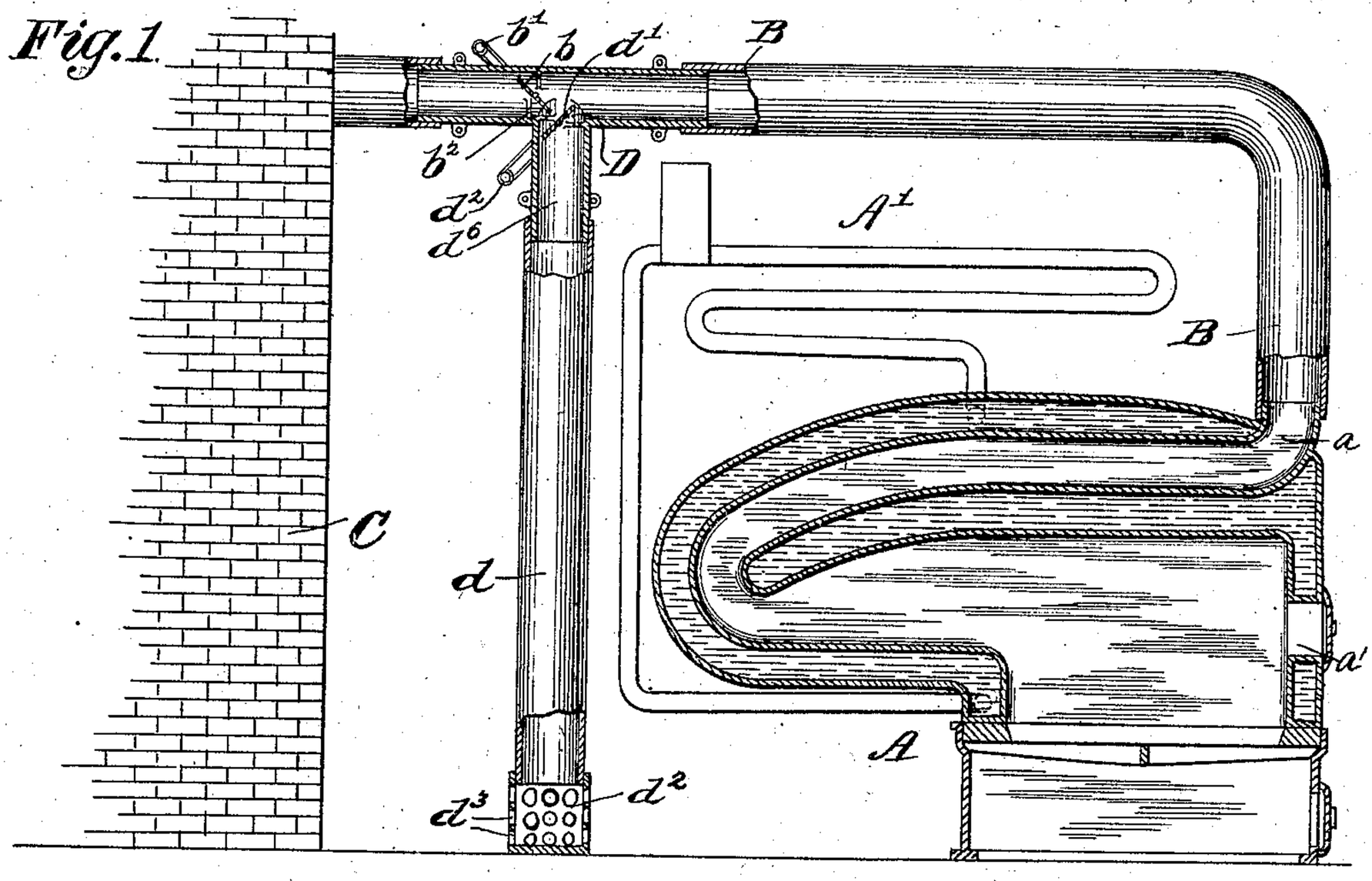


Fig. 2.

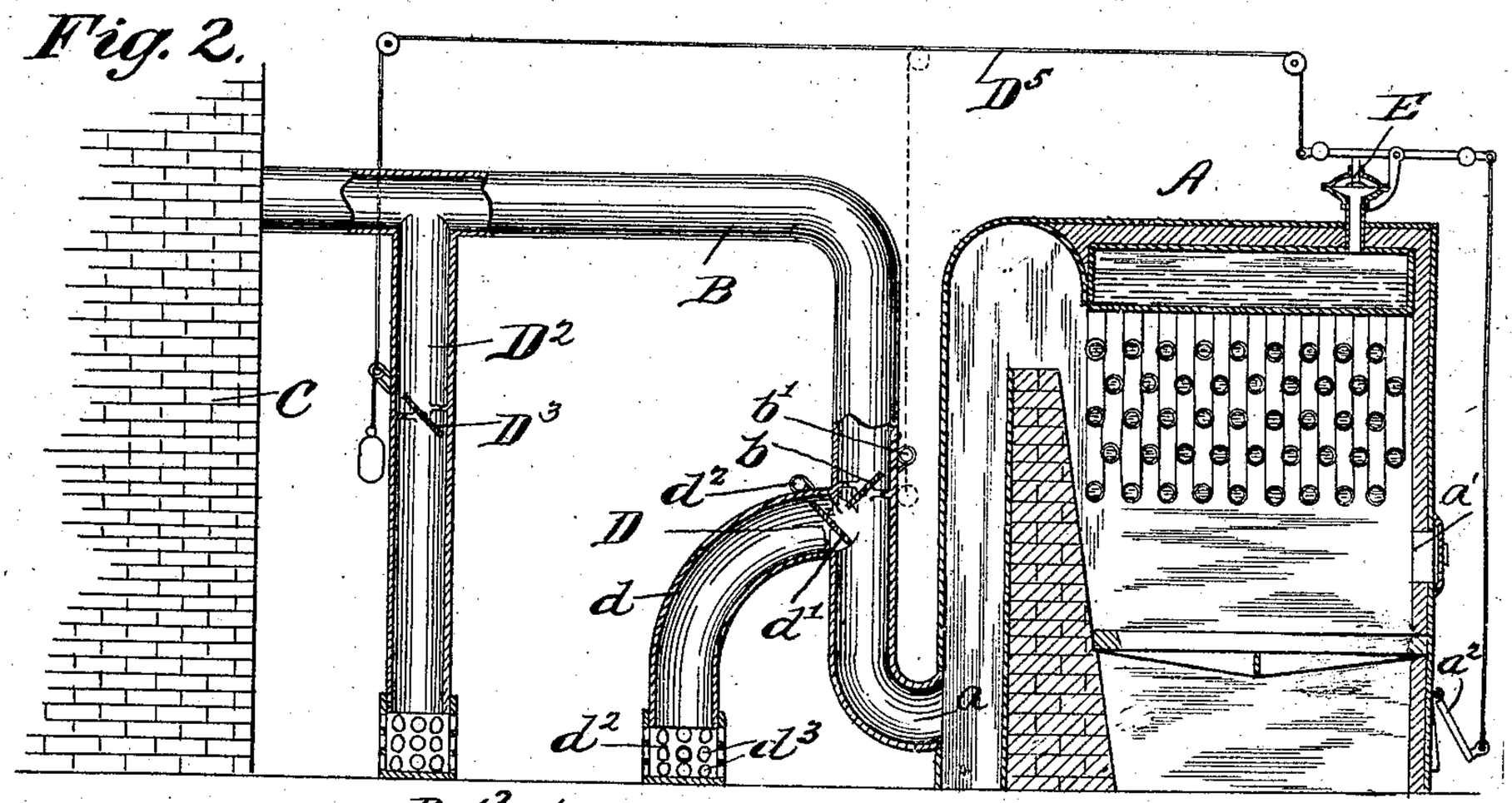


Fig. 4.

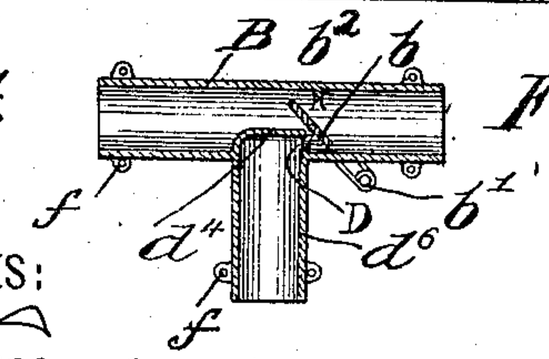
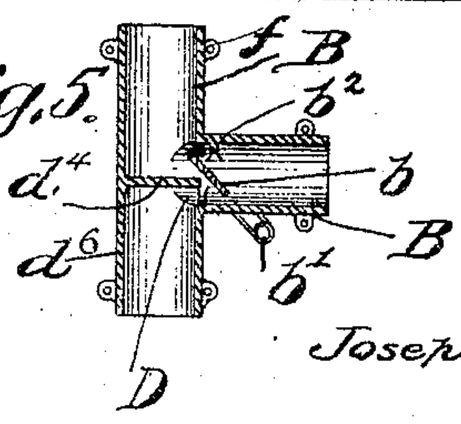


Fig. 5.



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No. 762,912. PATENTED JUNE 21, 1904.

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MEANS FOR REGULATING COMBUSTION.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

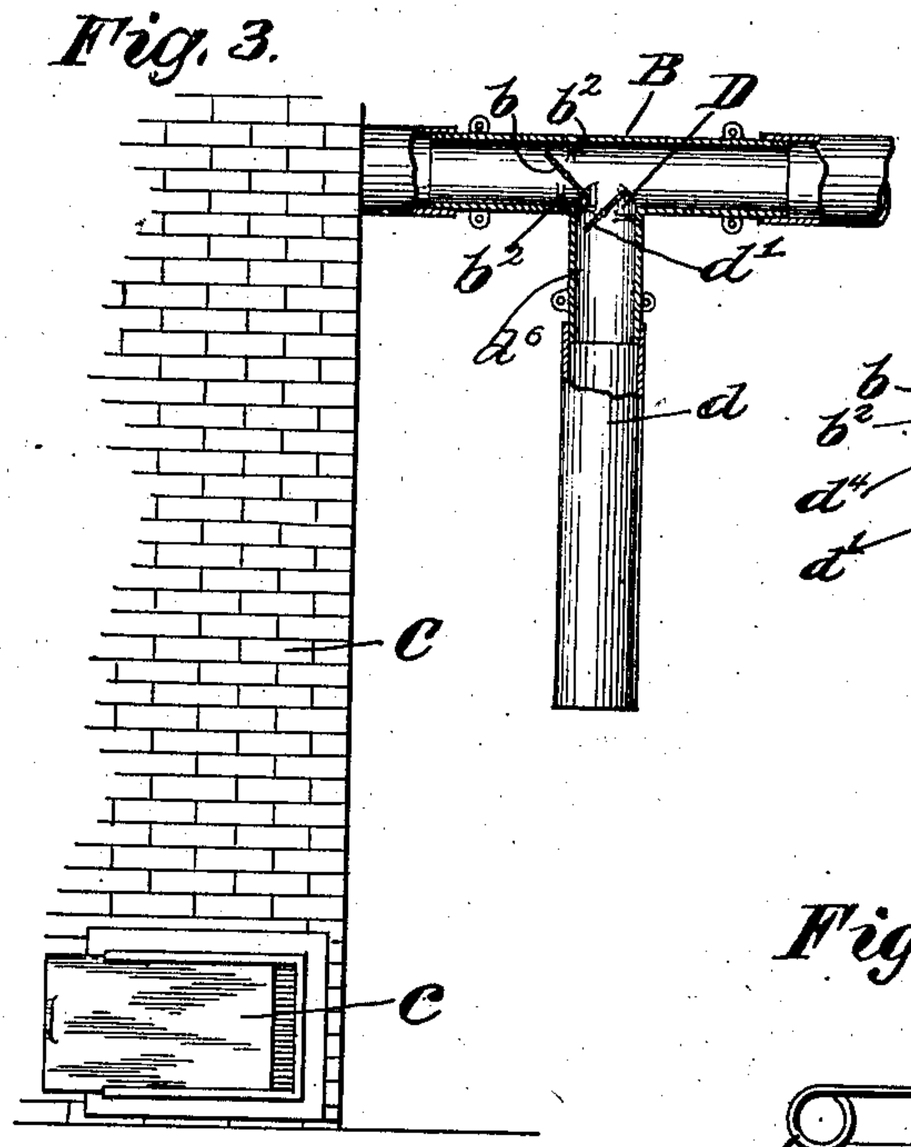


Fig. 6.

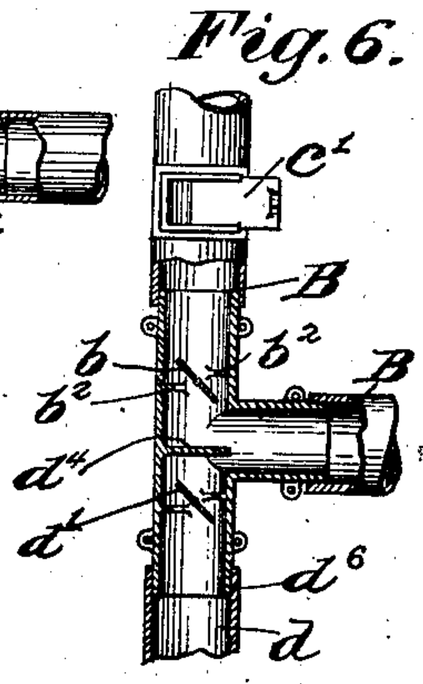


Fig. 7.

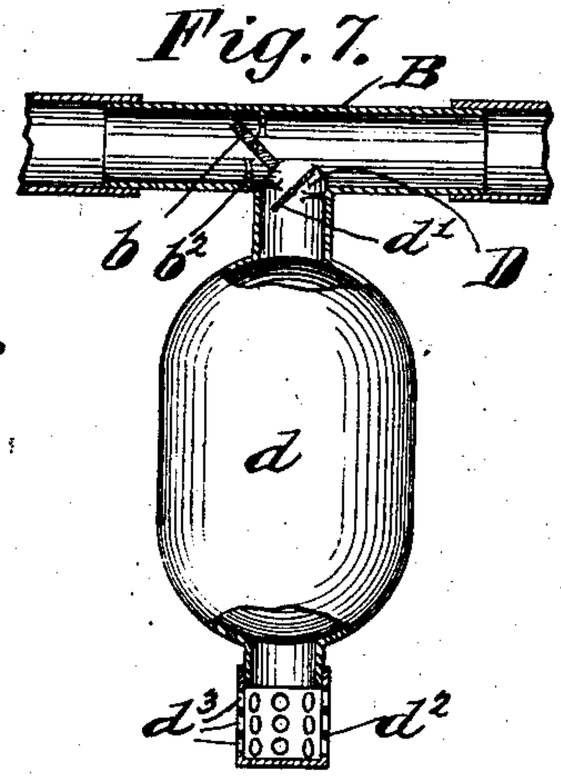


Fig. 11.

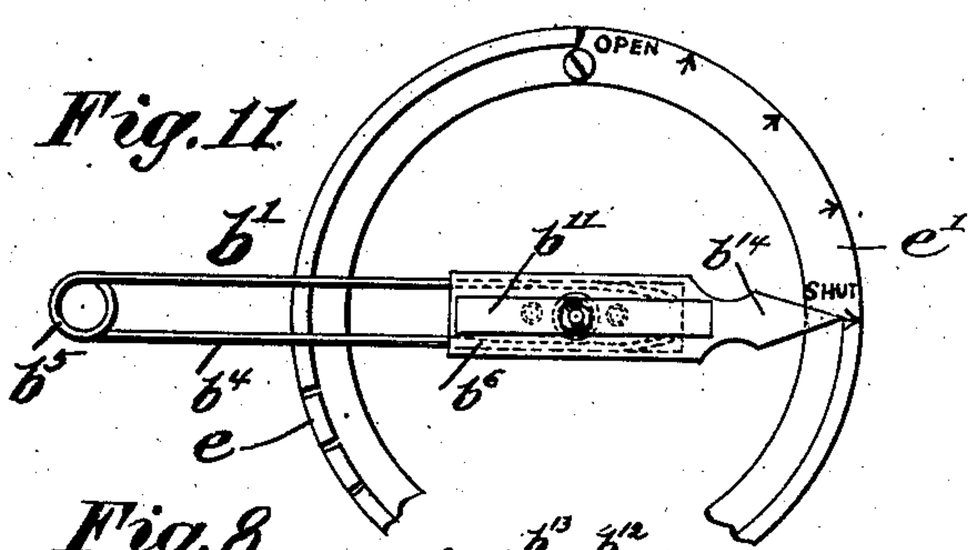


Fig. 9.

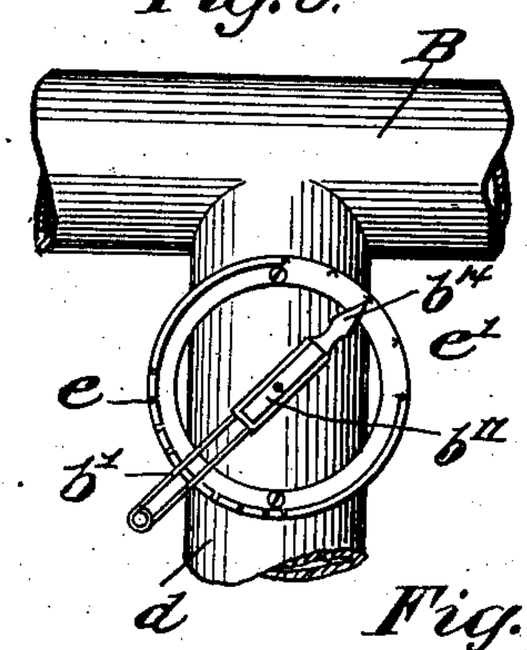


Fig. 10.

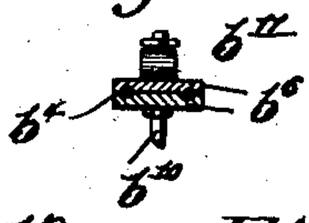


Fig. 8.

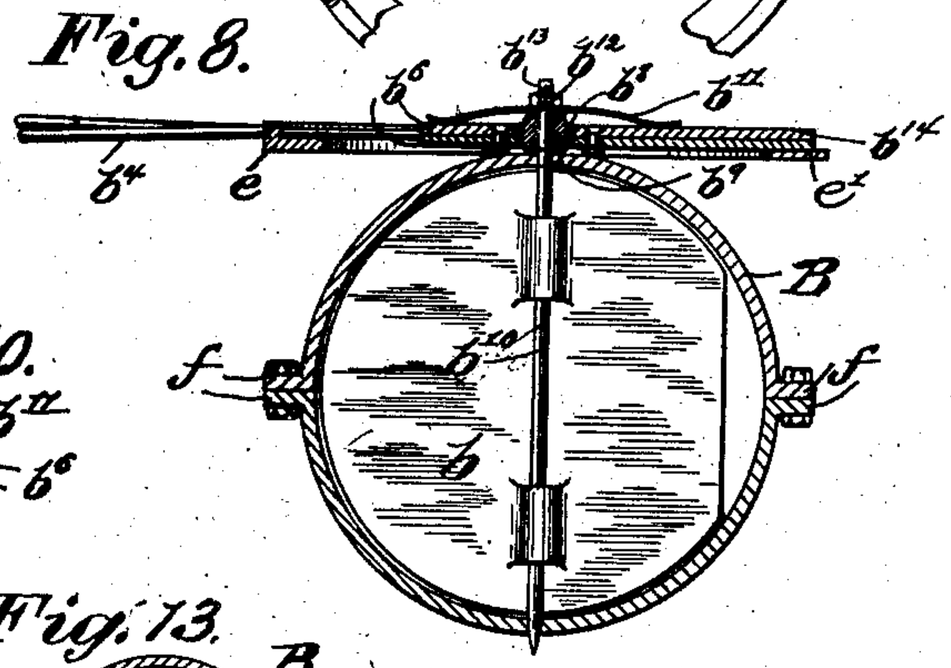


Fig. 12.

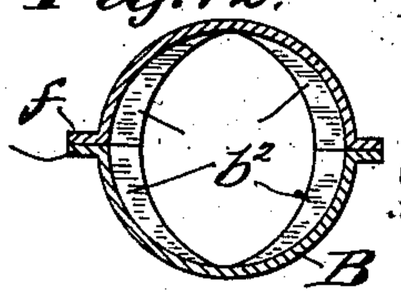
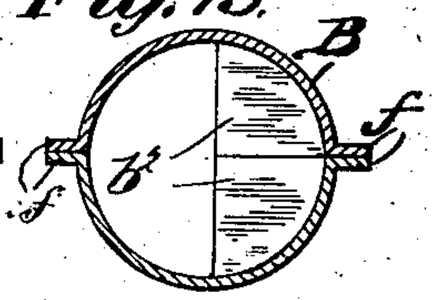


Fig. 13.



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No. 762,912. 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. 762,912, dated June 21, 1904.

Application filed February 15, 1901. Serial No. 47,492. (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, in the 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 and power-producing apparatus and their attachments; and it has for its object to regulate the process of combustion in such apparatus. It is particularly adapted for use where an even temperature is desired—as, for example, in greenhouses.

I will describe a heating apparatus having my invention applied thereto, together with several modifications of my invention, and then point out the novel features in the claims.

In the accompanying drawings, Figure 1 is a view, partly in vertical section, of a heating apparatus embodying my invention. Fig. 2 is a view, partly in section, showing a modification of my invention. Fig. 3 is a detail view, partly in section, of another modification. Figs. 4, 5, 6, and 7 are each detail views of still further modifications. Fig. 8 is a detail cross-sectional view showing a damper involved in my invention and a damper-handle. Fig. 9 is a detail view in elevation. Figs. 10 and 11 are detail views on a slightly larger scale than Fig. 9. Figs. 12 and 13 are detail cross-sectional views.

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

A represents a hot-water boiler or any other heating or power-producing device of ordinary construction burning coal or other fuel and having a combustion-chamber and heat-absorbing cavities providing for the retention in its upper levels and for admixture there of air and buoyant gases without allowing of their upward escape otherwise than through the smoke-exit of the device, a common provision in such devices, and which devices have fuel-feed doors or other feed-orifices at considerably lower levels than the top of the gas-retaining cavities.

A′, Fig. 1, represents a system of radiating pipes which may extend through a greenhouse or other structure for heating it.

B represents a smoke-flue provided between the combustion-chamber of the apparatus A and a chimney C.

D represents an inlet or aperture which is provided in the smoke-flue B. This aperture may be located at a point in the smoke-flue between the apparatus A and chimney C, and it is preferably located as close as possible to the exit-opening *a* in the heating apparatus through which the products of combustion find their exit into the smoke-flue. This is shown more clearly in Figs. 2, 4, 5, and 6. Extending downwardly from the conduit B and in communication with this inlet or aperture D is a conduit *d*, which is herein referred to as the "dependent" conduit and which is used in all forms of my invention herewithin described and shown. The dependent conduit *d* may be in one piece with the smoke-conduit B, as shown in Fig. 2, or the conduit may fit onto a projecting portion d^6. The joint between the dependent portion d^6 and the upper end of the conduit *d* will be sealed in any desired manner so that gas cannot pass through the joint. In preferred forms of my invention the inlet D will be located at as high a level as possible above the level of the feed-door *a′* of the heating apparatus, and preferably at or above the level of the exit provided for the passage of products of combustion. The dependent conduit *d* and the inlet D are parts of the means provided for conducting air for combustion into the combustion-chamber and which is conveyed thereinto at the highest practical level. Ordinarily the dependent conduit *d* is a long straight vertically-placed tube, and the inlet D is in close relation with some deflecting and conducting means for directing the air for combustion into the combustion-chamber in a horizontal current. A short straight passage from the inlet D to the combustion-chamber is to be preferred; but the various parts which are provided for conducting the air to the combustion-chamber may be otherwise formed. The air may enter the combustion-chamber from the top, as in Fig. 1, or the passage may

be sinuous and enter the chamber from below, as in Fig. 2, in which case part of the route taken by the air is through a part of the heating apparatus. In most cases the air for combustion is introduced into the combustion-chamber at its side near the top and through the smoke-nozzle usually provided in that position. Figs. 3, 4, 5, 6, and 7 show in section the internal structure of forms constructed for attachment in such positions. The introduction of the air for combustion at the highest possible level in the combustion-chamber is for the purpose of tending to overcome the difficulty of securing a quick mixing and diffusion of the air and the volatilized unconsumed gases which have a tendency to form a stratum of unconsumed gas at the highest level in the combustion-chamber and which difficulty is the result of the difference in density of the hydrocarbon gases and of air. By conveying the air to this high level there results a quicker admixture and diffusion of the air and the lighter hydrocarbon gases at that point and a more complete combustion of the gases before they find their exit from the apparatus. This high introduction of air also tends to secure a greater production of heat at the highest level, and hence a more thorough absorption of the heat produced into the media (air, water, or steam) surrounding the transmitting-surfaces of the apparatus. Such media rise as they are heated, and if they are heated to a high degree at the lower levels by the transmitting-surfaces these transmitting provisions fail to convey heat so well to the media from products of combustion of a lower temperature if such products are in the higher parts, and hence these products of a lower temperature at the highest levels are likely to pass out of the combustion-chamber unutilized; but if the heat-absorbing media of relatively low temperature first passes over the lower heat-transmitting surfaces having a low degree of temperature the relatively low degree of heat of such surfaces is absorbed by the media, and then as the media rise progressively the higher degrees of heat from the products of combustion of relatively higher temperature is absorbed by the media at the higher level. By this means of applying heat desirable quickness of motion in the absorbing media is secured and a greater proportion of the heat created from combustion of fuel is utilized. In all forms of my invention the inlet D will be of such a size as to admit all the air required for combustion in all the parts of the combustion-chamber. The conduit *d* is shown as being the same or of a larger diameter as that of the inlet D. The diameter of the inlet D is generally two-thirds of the diameter of the smoke-flue B. The dependent conduit *d* may be of the same shape throughout its length, or it may be varied, as will be seen in Fig. 7, when the main portion of the conduit is laterally enlarged.

b represents a damper which is located in the smoke-flue B. This damper is closely adjacent the inlet D. In some forms of my invention the damper *b* is between the chimney C and the inlet D. In other forms of my invention (see particularly Figs. 4 and 5) the damper is between the inlet D and the exit-opening *a*. A prominent function of the damper *b* is to hold back the products of combustion in the heating-cavities of the apparatus, thus securing the important element of time to effect a better admixture and transfusion of the air and the volatilized gases and their more complete combustion and consequent transmission of the heat thus created through the transmitting-surface to the absorbing media. In the forms of my invention where the damper *b* is provided between the inlet D and the chimney C another function is to obstruct the smoke-flue B, and thereby divert into the dependent conduit *d* gaseous products of combustion. The gaseous products of combustion entering the dependent conduit will be mainly excess products that are usually lost. It will be seen from Fig. 8 that the damper B is cut away at its periphery in order that there shall always be a vent in the smoke-flue for some gaseous products. When gaseous products of combustion enter the dependent conduit, they more or less prevent air for combustion entering the combustion-chamber through the air-inlet, thereby decreasing the rate of combustion in the combustion-chamber As soon as the combustion process is decreased sufficiently atmospheric pressure acting upwardly in the dependent conduit will force the gaseous products back into the combustion-chamber, they being followed therein by air for combustion, which then enters through the inlet D. The dependent conduit *d* must be of a sufficient length to contain a column of air of sufficient size to counterbalance any gas-pressure from the combustion-chamber acting downwardly in the conduit. It is usually carried below the grate-line of the apparatus A and usually to the floor. Being constructed in this manner it prevents the emission of gas into the room containing the apparatus A. The dependent conduit is pervious at its lower end. It is here shown as being completely open and being provided on its end with a hood or cap d^2, having openings d^3. By having the entrance to the dependent conduit for air for combustion at a low level the air used is cooler and more condensed than if the air were taken from a higher level. Hence volume for volume more oxygen is carried into the combustion-chamber than would be the case if warmer air were introduced. This facilitates more intense combustion. Furthermore, such amounts of the cooler air as escape combustion with the gases in the upper parts of the combustion-chamber gravitate more effectively and quickly to the fuel mass in the

fire-pot. It is obvious that the dependent conduit may be extended lower than the floor-line and even to the out-of-doors atmosphere in order that cool and fresh air for combustion may be secured.

The quantity of air passing through the inlet D should be controlled by suitable means. Such means are here shown as consisting of a damper. In some cases the damper is provided in the dependent conduit *d*, and it is located therein closely adjacent the inlet D. I have shown such a damper *d'* in Fig. 6. In Figs. 1, 2, 3, and 7 the damper *d'* is shown as being placed directly in the inlet D. In these forms the damper *d'* serves to deflect the air for combustion toward the combustion-chamber. In Figs. 4 and 5 a single damper is shown for controlling the smoke-flue B and for controlling the inlet D. This damper may conveniently be the damper *b*. In this form of invention the damper has the function of separating the products of combustion from the air for combustion. One of the faces of the damper *b* deflects the products of combustion upward and away from the inlet D, while the other face of the damper deflects downwardly away from the products of combustion the air for combustion and facilitates its flow into the chamber of combustion. The various means provided in my invention for deflecting and directing air for combustion have for their purpose to secure a quick unobstructed flow of the adequate volume of air needed in the combustion process and to obviate the usual objectionable slowness of the indirect downwardly-flowing current of air used in inventions which supply most of the air for combustion above the top of the fuel mass. To further assist in the deflection of the air for combustion to the combustion-chamber, a partition d^4 may be used.

In Fig. 6 I have shown in section a part of a preferred form of my invention, which has a check-draft *c'*, and this form is applied where the smoke-flue extends vertically for a portion of its length. In this case, as also in Fig. 5, the partition d^4 is horizontally projected toward the combustion-chamber. It is obvious that the same arrangement as shown in Fig. 6 may be applied to the smoke-flue B, where it extends for a portion of its length in a horizontal direction. In Fig. 4 the partition d^4 is shown as being in the form of a hood, and the curved portion of the partition assists in the deflection of air for combustion. The partition d^4 also prevents any downdrafts that may be in a portion of the smoke-flue interfering with the proper operation of my invention. The partition d^4 in Figs. 5 and 6 also has the like function.

b^2 represents stops which are provided for the dampers *b d'*. These stops are of such size and contour as to prevent leakage around the periphery of the dampers *b d'*. The lower stop b^2, provided for the damper *b* in Figs. 1, 3, and 7, extends upwardly to about the axis of the damper *b*, as shown in Fig. 12, and acts to prevent down and up drafts interfering with the proper working of my invention.

D^2 represents a second conduit, which is dependent from the smoke-flue B. D^3 represents a damper provided in said conduit. The dependent conduit D^2 is located between the chimney C and the damper *b* and preferably near the chimney, and it constitutes a check-draft. Instead of having a dependent conduit D^2, as shown in Fig. 2, the flue of the chimney C may be extended below the smoke-flue B, and at its end a damper *c* may be provided, as shown in Fig. 3, and for the same purpose. Instead other forms of check-drafts may be used.

E represents a pressure-regulator connected with the apparatus A. This regulator may, through suitable connections D^5, control any of the dampers involved in my invention. It is here shown (see Fig. 2) as being connected with the dampers D^3 and *b* and with the damper a^2 of the ash-pit door. Instead of a pressure-regulator a thermostat or other automatic device may be employed. Each of the dampers D^3, *b*, and *d'* is provided with a handle. I have shown the damper *b* as being provided with a handle *b'* and the damper *d'* with a handle d^2. These handles may be of any convenient design and construction.

In the various figures, *f* represents lugs for bolting the sections together.

In the drawings, Figs. 8, 9, 10, and 11, which show a particular form of damper structure that may be used in my invention, *e'* represents an indicating and retention dial; *e*, slots in which the handle *b'* is pressed by the spring b^{11}. b^{14} is an indicating-pointer. b^4 and b^5 are wire parts of the handle. b^6 is a cast-iron part of the handle. b^9 is a bearing for the pintle b^{10}. b^{12} is a nut. b^{13} is the threaded part of the end of the pintle. B is the smoke-flue. *d* is the dependent conduit. *b* is a damper-blade.

A ratchet and indicating-dial of any desired form and arrangement may be employed in connection with each damper-handle to indicate the position of the damper and retain it in position.

For convenience in making, applying, and operating my invention in connection with heating and power-producing apparatus already installed various elements necessary to my invention may be conveniently contained in a T-shaped structure which is inserted in the course of the smoke-flue of the apparatus as close as possible to the heating apparatus. For convenience I refer to this structure as a T in the specification and claims. One branch of the T is so constructed as to be conveniently attached to the smoke-nozzle of the heating apparatus by an intermediate section of flue-piping. Another branch of the T is made to join onto the part of the smoke-con-

duit leading from the T to the chimney. The other branch of the T is made so as to be attached to a dependent conduit, which has been herein previously described and which is projected downwardly from that branch. In the T are usually two dampers, one for controlling the supply of air for combustion and the other for controlling the passage of products of combustion through the T. Handles for the dampers and means for indicating the position of the dampers and fixing them in position are attached to the T externally. In some simple forms one damper suffices to fulfil both functions, as stated. Means for deflecting the air for combustion are also included in the structure of the T.

Having thus described my invention, what I claim is—

1. In a heating or power-producing apparatus, the combination of a combustion-chamber, the heating-cavities of said apparatus, an air-inlet, a dependent conduit, means for the introduction of unvitiated air for combustion into the highest parts of said combustion-chamber at about where the waste gaseous products of combustion escape from said chamber, means for controlling the passage of air through said inlet, means for deflecting said air toward the combustion-chamber and means for tending to keep apart ingoing air for combustion and outgoing waste products of combustion, said chamber and said cavities being constructed and disposed to receive and retain in their upper levels and above the level of the feed-door of the apparatus air and hot volatilized gaseous products through the force of atmospheric pressure acting upwardly except at the exit provided for the escape of waste gaseous products of combustion, said dependent conduit being vertically disposed and being directly open to the atmosphere in its lowermost end at a level between the said feed-door and the floor-line on which the apparatus rests and connected at its highest end with said air-inlet.

2. In a heating or power-producing apparatus, the combination of a combustion-chamber, a conduit for conveying away gaseous products from said chamber, an air-inlet in said conduit located closely adjacent to said chamber, means for controlling the passage of air through said inlet and deflecting said air to said combustion-chamber, and a dependent conduit, said dependent conduit being connected with said air-inlet and being directly open to the atmosphere at its lower end, said dependent conduit and said chamber being arranged and disposed to retain in their cavities and to prevent through atmospheric pressure acting upwardly in said cavities the escape of gaseous products of combustion therefrom except through the aperture provided in said chamber for the exit of waste gaseous products of combustion, said controlling means being disposed to facilitate and quicken the passage of gases through deflection.

3. In combination with the combustion-chamber of a heating or power-producing apparatus, a conduit for conducting therefrom the gaseous products of combustion, said conduit containing means for controlling the passage of products of combustion therethrough and for deflecting said products away from an air-inlet provided in said conduit adjacent to said combustion-chamber, said inlet providing for an ingress of air for combustion, a dependent conduit connected with said air-inlet for conveying air to said inlet from a level below that of the feed-door of said apparatus, a partition adjacent to said air-inlet providing for the obstruction and holding back of and tending to prevent the flow past said air-inlet into said combustion-chamber and into said dependent conduit of downdrafts in said conduit for gaseous products of combustion, and of means for controlling the passage of air through said inlet and for deflecting air for combustion toward the combustion-chamber.

4. In a heating or power-producing apparatus, the combination of a combustion-chamber, a conduit for conveying away gaseous products of combustion from said chamber, an air-inlet, said inlet being at a level below the level traversed by said products through said conduit and communicating with said chamber at a level below the level traversed by said products in said conduit and at about where the said products leave said chamber, and means for preventing the direct passage of said air from said inlet to the level traversed by said products of combustion, and for controlling the passage of said air through said inlet and for deflecting said air toward the combustion-chamber, said conduit, inlet and means allowing for the entrance to said chamber of all the air needed for combustion in said chamber and allowing for the escape of all gaseous products of combustion generated in said chamber.

5. In a heating or power-producing apparatus, the combination of a combustion-chamber closed to the passage through its peripheral walls of gaseous products of combustion in its highest levels at points other than that provided for the exit therefrom of said gaseous products, a conduit for conducting products of combustion from said combustion-chamber, said conduit having an inlet for air f combustion at about the level of the point of exit from the combustion-chamber of said products of combustion, a dependent conduit extended from said inlet and having a lowest vertical part with an opening at its lower end for the entrance of air for combustion between the levels of the feed-door of said apparatus and the line of the floor on which the apparatus rests, means for controlling the

passage of products of combustion and for controlling the passage of air through said inlet and for deflecting the air toward the combustion-chamber.

6. In a heating or power-producing apparatus, the combination of a combustion-chamber, a conduit for conducting gaseous products from said combustion-chamber and having an inlet for air for combustion, means closely adjacent to said inlet for controlling the gases passing through said conduit and for deflecting the gaseous products of combustion away from said inlet, said means being between the said inlet and a chimney, and means for controlling the passage of air through said inlet and deflecting said air toward the said combustion-chamber, said combination providing routes free from structural obstacles to the passage of gases between said inlet and said combustion-chamber and between said combustion-chamber and said controlling means for the products of combustion that would interfere with a free, quick and unobstructed passage of gases through said routes.

7. In combination with a combustion-chamber providing above its fuel-feed door a cavity for the retention and admixture of air and combustible gases and having an upper convexity or heat-transmitting wall impervious to gases otherwise than through the exit provided for waste gaseous products of combustion, a conduit for carrying away products of combustion and having an inlet therein for air for combustion, located closely adjacent to said combustion-chamber and connecting therewith at about where the products of combustion find their exit therefrom, a vertical dependent conduit extending from said inlet for air, to a level between that of the feed-door and that of the floor-line, and provided at its lowest end with a free aperture opening immediately to the atmosphere, said dependent conduit being impervious to the passage of gases at any point other than through an exit at its junction with the said air-inlet and at the opening at its lower end, means for controlling the passage of air through said dependent conduit and inlet and for deflecting said air toward the said combustion-chamber, and an obstructive damper in said conduit for carrying away the products of combustion.

8. In a heating or power-producing apparatus. the combination of a combustion-chamber constructed for the retention in its higher levels of volatilized combustible gases through the action of atmospheric pressure, means for producing an induced draft in said apparatus, means for introducing air for combustion into said chamber at about where the waste gaseous products leave said chamber, and for preventing through atmospheric pressure emission therethrough of gaseous products of combustion, other gas traversing and retaining cavities in said apparatus, said cavities being constructed and disposed to prevent through atmospheric pressure the emission of products of combustion therefrom except through the exits for waste products of combustion, means for controlling the quantity of air introduced into the combustion-chamber, the said gas traversing cavities chamber and said air-introducing means being disposed at levels to retain therein hot gases at substantially the same level and stratum.

9. In a heating or power-producing apparatus the combination of a combustion-chamber, a fuel-feed door for said apparatus, said combustion-chamber comprising a gas-retaining cavity located above the level of the top of said fuel-feed door, an exit-aperture in the peripheral walls of said combustion-chamber for the exit of waste gases, a conduit for conveying away waste gaseous products of combustion, means for controlling said conduit for said waste gaseous products, an air-inlet located closely adjacent to said combustion-chamber, means for deflecting air received through said inlet and for directing and conveying said air to and through the peripheral walls of said combustion-chamber, and there ending, at a point about where the waste gases find their exit from the said combustion-chamber, a dependent air-conduit impervious to gas at its side walls but having upper and lower openings, the last being open to the atmosphere at a point below the lower level of said feed-door and about perpendicularly below said air-inlet, the upper opening connecting with said air-inlet, said air-inlet and the point of introduction for air through said periphery being at a level above the upper level of said feed-door but at a level entirely below the level traversed by the waste products of combustion after their exit from said combustion-chamber, said elements for air introduction being so constructed and disposed as to avoid the entrance into their cavities of hot gaseous products of combustion while said gases are vertically rising and to avoid the impingement of hot volatilized rising gases or flame with the external peripheral walls of said elements for air introduction.

10. In combination with the combustion-chamber of a heating or power-producing apparatus provided with a gas retaining and admixing eavity above the fuel-feed orifice of said combustion-chamber, a smoke-conduit communicating therewith, means for controlling the passage of products of combustion therethrough and for deflecting said products from air for combustion, means for introducing air for combustion into said combustion-chamber comprising a dependent conduit open to the atmosphere at a point near enough to the floor-line on which the apparatus rests to provide against the emission of products of

combustion from the lower end thereof, and communicating at the upper end with the smoke-conduit, means for controlling the air introduced, means for keeping the air and products of combustion in separate strata, and visible means located externally to said air-introducing means for indicating the position of and for adjusting said controlling means and for retaining said means in any desired position and for thus indicating the amount of air and gases passing through said conduits.

11. In combination with the combustion-chamber of a heating or power-producing apparatus, a chimney, a conduit for conducting products of combustion from said chamber to said chimney and containing means for controlling the passage of said products therethrough and for deflecting away said products from an air-inlet, means independent of said apparatus providing for the control of the draft induced by said chimney, a dependent air-conduit located closely adjacent to said apparatus and having two openings one at the top communicating with the smoke-conduit and with the higher levels of said combustion-chamber and the other at the lowest part of said conduit opening to the atmosphere at a sufficiently-low level to prevent the emission from said lowest opening of products of combustion, and means providing for the deflection of air from said dependent conduit to said combustion-chamber.

12. In combination with the combustion-chamber of a heating or power-producing apparatus providing against the upwardly emission of products of combustion through any part of the walls in the upper levels of said chamber other than through the opening provided for the exit of gaseous products of combustion, a conduit for conducting said products therefrom, a damper in said conduit which when closed provides for a partial passage of gases at one side of said conduit, stops in said conduit providing when said damper is closed against peripheral leakage around said damper at all parts other than where a partial passage of gas is provided for, means comprising a depending conduit for introducing air into the combustion-chamber at about where the gaseous products of combustion leave the combustion-chamber and for taking in said air for combustion at a level so low as to prevent the emission of gaseous products of combustion at its lowest part, a solid damper in said dependent conduit, and stops in said dependent conduit for preventing leakage around the entire periphery of said solid damper.

13. In combination with a combustion-chamber, a conduit for conducting therefrom products of combustion, an inlet for air for combustion in said conduit, a dependent air-conduit extending from said inlet, means for controlling the products of combustion and the passage of air through the air-inlet and for deflecting said air toward the combustion-chamber, said means comprising a damper and a horizontally-disposed partition for also deflecting the air toward the combustion-chamber and to prevent direct drafts between said first-named conduit and said inlet for air, said partition being disposed at a lower level than the level traversed by said products of combustion in said conduit.

14. In combination with a combustion-chamber, a conduit for conducting away products of combustion from said chamber, an inlet in said conduit for air for combustion, a dependent vertical air-introducing conduit extending from said inlet and located closely adjacent to said combustion-chamber, said dependent conduit opening directly to the atmosphere at its lower end, means for controlling the passage of air through the air-inlet and deflecting said air toward the combustion-chamber, said means comprising a damper and a horizontally-disposed partition extending from said inlet toward said combustion-chamber, a damper for controlling the conduit for products of combustion, and a check-draft for separately controlling the induced draft acting in said conduit for conducting away products of combustion.

15. In a heating apparatus, the combination of a combustion-chamber, a conduit for conducting away products of combustion, means for controlling the passage of gases through said conduit, means for introducing air for combustion in said combustion-chamber at a level above the feed-door of said apparatus and below the level traversed by the conducted-away products of combustion, a horizontally-disposed partition for deflecting air for combustion at a level below said partition, and a check-draft, said check-draft and the means for introducing air being arranged on opposite sides of the means for controlling the conduit for products of combustion.

16. In combination with the combustion-chamber and heating-cavities of a heating or power-producing apparatus provided with a smoke-conduit for conveying away the gaseous products of combustion, a dependent air-conduit and gas-reservoir located closely adjacent to said apparatus and communicating at a high level with said combustion-chamber and cavities through or near the aperture provided for the outflow of gaseous products of combustion from said apparatus, means at the upper part of said dependent conduit providing for the deflection toward the said heating-cavities of air for combustion passing through said dependent conduit and for facilitating a quickness of flow of said air, means tending to prevent the passing of gaseous currents between said dependent conduit and said smoke-

conduit in a direction away from said apparatus and the passing to the said apparatus of cold downdrafts in said smoke-conduit emanating from sources other than through said dependent conduit, means for controlling the amounts of air passing through said dependent conduit, means for controlling the passage of products of combustion through said smoke-conduit and for holding back the products of combustion for the purpose set forth, means for fixing in position and for indicating the position thereof of such controlling means, and means for controlling the intensity of the natural draft acting in said apparatus.

17. In combination with a combustion-chamber, and laterally placed to said chamber a closely-adjacent and vertically-disposed conduit divided by a horizontal partition into an upper part and a lower part, the upper part communicating with the said combustion-chamber at a level above the horizontal partition and providing for the conveying away from said combustion-chamber of gaseous products of combustion and provided with a damper for controlling the passage of gases therethrough, the lower part also communicating with said combustion-chamber but at a lower level than that of the said horizontal partition and at about where the gaseous products of combustion leave the said chamber, and said lower part having an opening to the atmosphere for the admission of air at a level below that which would permit the emission of gaseous products of combustion from the lower opening of said lower part, and a damper for controlling the passage of air through said lower part, said horizontal partition being so disposed as to deflect air to the combustion-chamber and to prevent the direct up-and-down passing of gases between the upper and lower parts of said vertically-disposed conduit.

18. In combination with the combustion-chamber of a heating or power-producing apparatus having a smoke-flue, a T provided with means for connection with the smoke-flue, with the combustion-chamber, and with a dependent conduit providing for the conveyance of air for combustion, said T being provided with means for passing air for combustion and gaseous products of combustion therethrough, said T being provided with means for controlling the passage of said air and said products therethrough and being provided with means for preventing peripheral leakage of gases past such controlling means, and said T being provided with means for deflecting air for combustion toward the said combustion-chamber.

19. In a heating or power-producing apparatus, the combination of a combustion-chamber, a smoke-flue, a dependent air-conduit, a detachable structure located close to said chamber and interposed between said chamber and said flue, said structure comprising means for connection with said chamber and with said flue and a passage therethrough for waste gaseous products and a damper for controlling said passage and a passage therein for air for combustion and a damper for controlling said passage for air and for introducing into the combustion-chamber at a level above the level of the feed-door of said apparatus the air needed for combustion in said chamber, said structure also comprising fixed means for preventing an ingress of air for combustion into the combustion-chamber in excess of the amount that after its consumption and in conjunction with volatilized gaseous products is provided an avenue of escape through the said passage for waste gaseous products, said structure also comprising means for the deflection of said air to said chamber and for the connection of said structure with said dependent air-conduit, said dependent conduit extending from said structure and being disposed in a substantially vertical line and being impervious to gases except as to its extreme upper and lower ends and arranged to prevent through the force of atmospheric pressure the emission of products of combustion from its lowest end, and means for externally indicating the relative positions of and for holding in position the dampers controlling the passage of gases through said structure.

20. In a heating or power-producing apparatus, the combination of a combustion-chamber comprising a dome or upper cavity having an exit for waste gases and having an impervious casing or wall in its lateral and upper periphery for the retention of hot gaseous products of combustion at all points except at the exit for smoke and waste gases said cavity being constructed to retain said products through the upwardly action of atmospheric pressure, a smoke-flue extending from said apparatus to a chimney, an air-inlet for air for combustion located closely adjoining said chamber, means for the deflection of an upwardly-moving and substantially vertical current of air passing through said inlet, means for the conveyance of said deflected current into the high levels of said chamber at about where the burned gaseous products of combustion pass out therefrom, said deflected current being conveyed at a level below the level traversed by the outgoing products of combustion that pass through said flue, means to prevent the direct passage of air-currents between said air-inlet and said chimney, means for controlling the amount of air passing through said inlet and means for controlling the gases passing from said chamber to said chimney, said combination being constructed to prevent through the repression of atmospheric pressure the emission of and escape from said combination of gaseous products of combustion

downwardly through said air-inlet, said elements being disposed in their relation to each other at levels to maintain an equilibrious balance of and retention in their cavities of gaseous products of combustion except at the exit for smoke and waste gases.

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,
CHARLES S. JONES.