

Aug. 25, 1925.

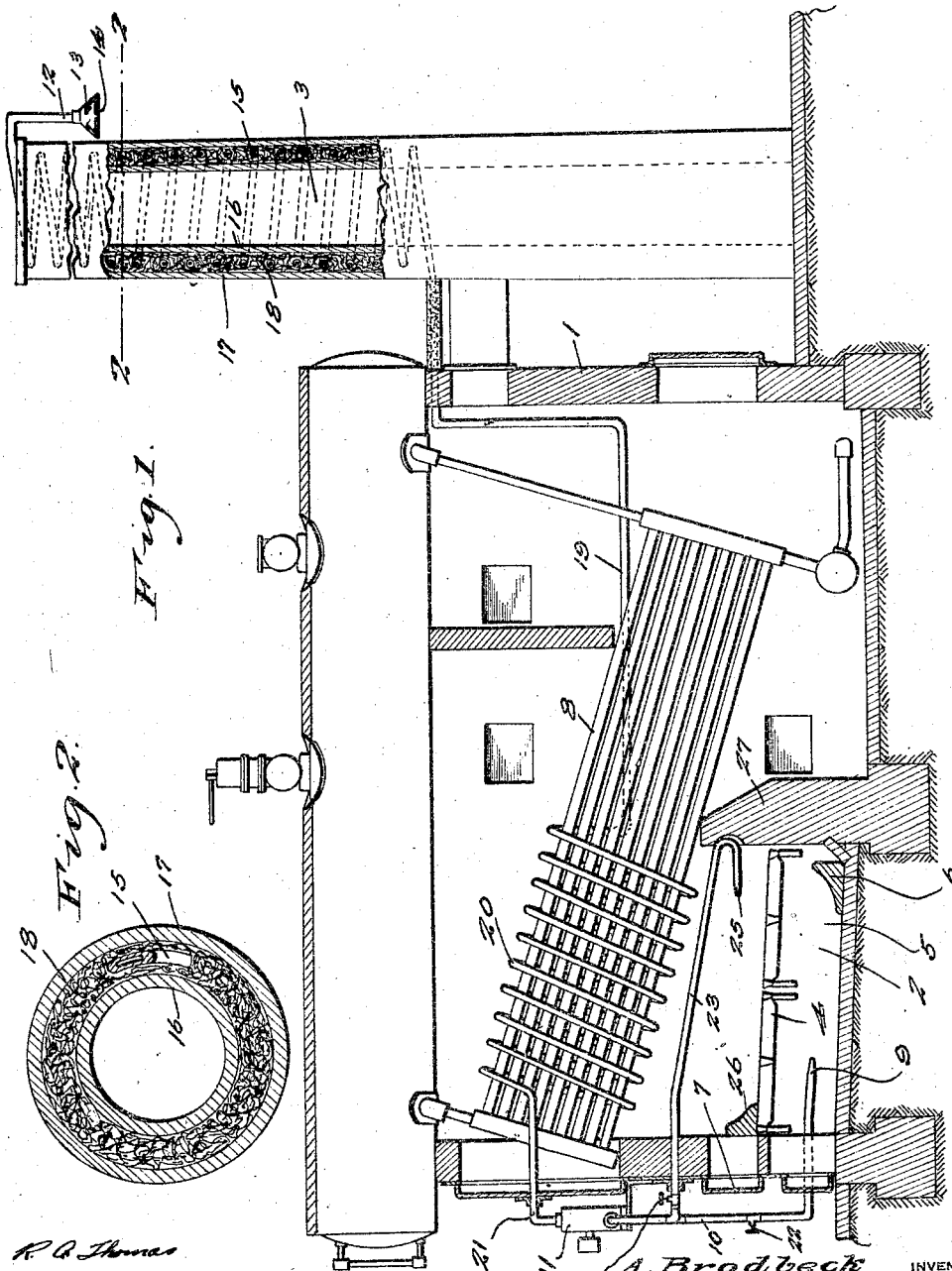
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A. BRODBECK

COMBUSTION PROMOTING DEVICE

Filed June 11, 1923

3 Sheets-Sheet 1



R. Q. Thomas

J. E. Turpin

WITNESSES

A. Brodbeck INVENTOR

BY Victor J. Evans

ATTORNEY

Aug. 25, 1925.

A. BRODBECK

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3 Sheets-Sheet 2

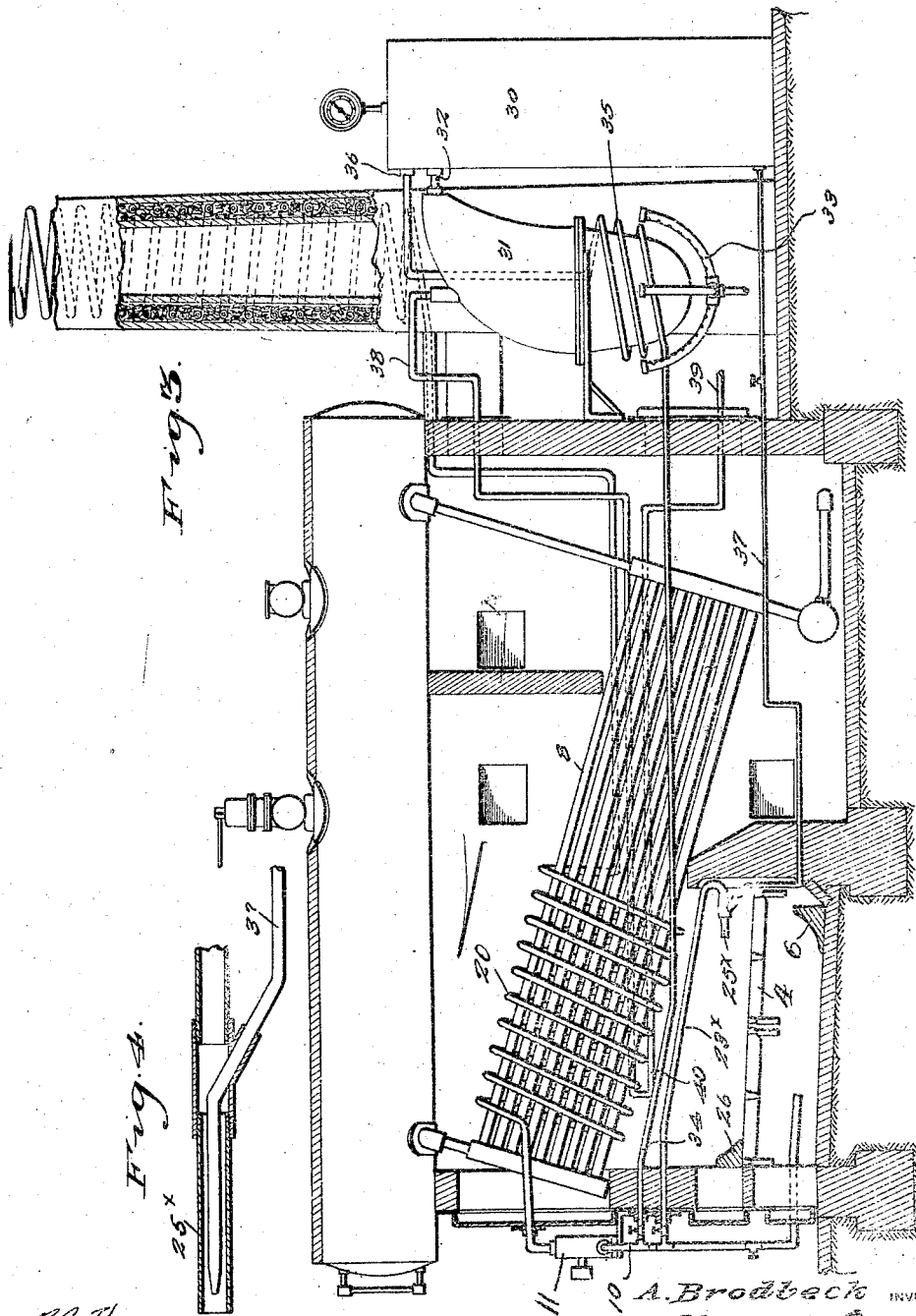


Fig. 3.

Fig. 4.

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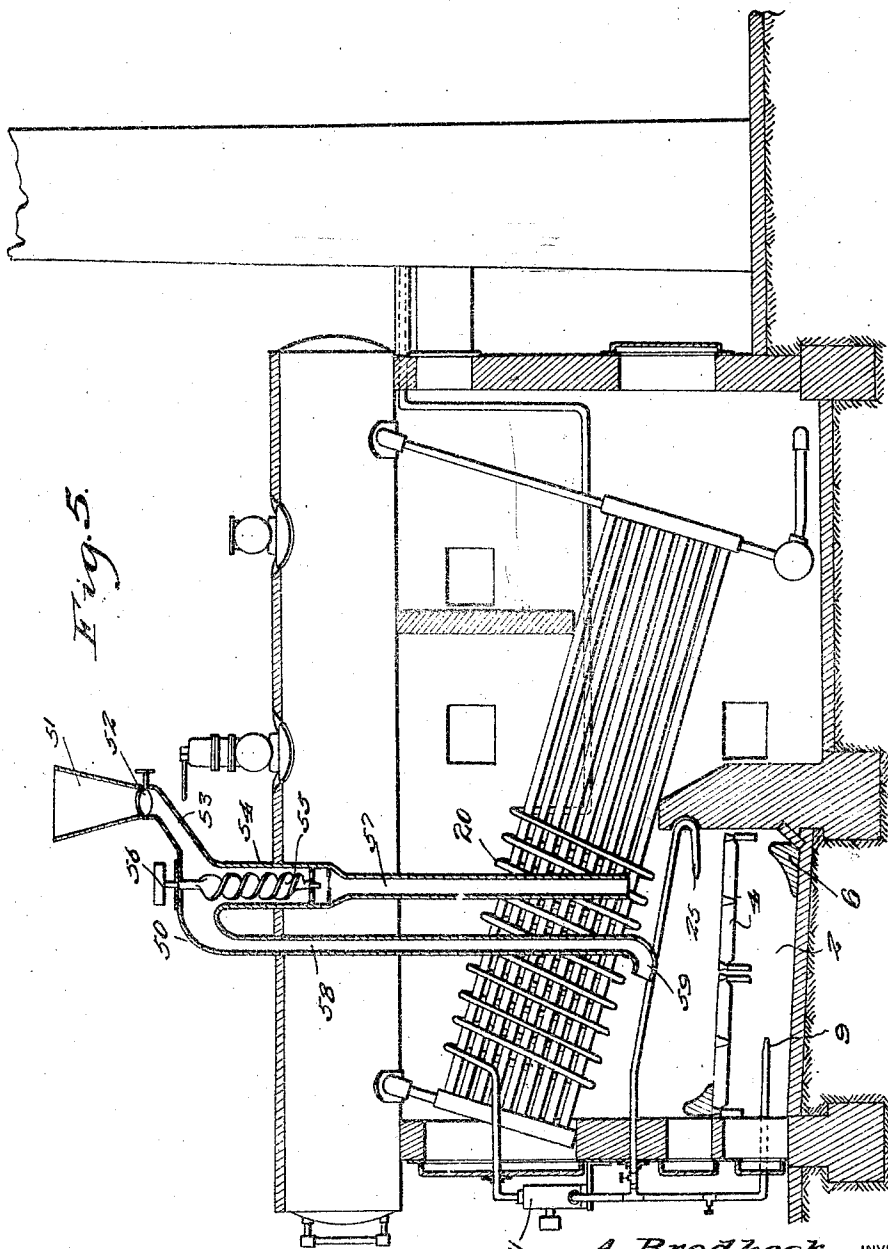
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COMBUSTION PROMOTING DEVICE

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3 Sheets-Sheet 3



R. A. Thomas
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 WITNESSES

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Patented Aug. 25, 1925.

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UNITED STATES PATENT OFFICE.

ADOLPH BRODBECK, OF LOS ANGELES, CALIFORNIA.

COMBUSTION-PROMOTING DEVICE.

Application filed June 11, 1923. Serial No. 644,776.

To all whom it may concern:

Be it known that I, ADOLPH BRODBECK, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Combustion-Promoting Devices, of which the following is a specification.

The general object of my said invention is the provision of a highly efficient economical means for promoting combustion, the heat value afforded by the combustion being designed to be used in the production of steam or hot water for heating purposes or for any other purpose to which it is applicable.

To the attainment of the foregoing, the invention consists in the improvement as hereinafter described and definitely claimed.

In the accompanying drawings, forming part of this specification:—

Figure 1 is a longitudinal vertical section of an apparatus constructed in accordance with my invention and constituting one embodiment of the invention.

Figure 2 is a section taken through the uptake for products of combustion in the plane indicated by the line 2—2 of Figure 1.

Figure 3 is a vertical longitudinal section showing an apparatus constituting a modification of the apparatus shown in Figure 1.

Figure 4 is an enlarged detail longitudinal section of a portion of the equipment shown in Figure 3.

Figure 5 is a longitudinal vertical section showing an apparatus constituting a second modification of the apparatus shown in Figure 1.

Similar numerals designate corresponding parts in Figures 1 and 2 to which reference will first be made.

I have elected to illustrate my improvement in conjunction with a steam boiler furnace 1, having a fire box 2 and an uptake 3 for products of combustion. It is to be distinctly understood, however, that my invention is not restricted in its use to a steam boiler furnace for contributing toward the economical production of steam inasmuch as heat values provided by my improvement may be utilized for any other purpose without involving departure from the scope of my invention as claimed.

The fire box 2 is shown as provided with a grate 4 below which is an ash-pit 5, and in the forward portion of the said ash-pit 5 is

arranged a deflector 6, preferably solid, against which hot air is projected forwardly and by which the said hot air is deflected and directed upwardly and rearwardly through the grate, this end being attained by the disposition of the deflector 6 and serving to assure the presence of an adequate supply of gases and an adequate combustion of the same when the gases are blown through the fire on the grate 4. The temperature of the air, moreover is materially raised by passing directly under the grate in the ash-pit 5, and this manifestly contributes toward complete combustion above the grate. I would have it understood here that appropriate hard fuel is to be consumed on the grate 4, it being within the purview of my invention to supply the said hard fuel through fire doors 7 or by any other appropriate means. I would also have it understood that the arrangement of the deflector 6 is controlled by the arrangement of the boiler 8 in the furnace, the deflector 6 being arranged at the front of the ash-pit 5, and the hot air blast alluded to being directed forwardly against the said deflector when the boiler is inclined oppositely to the boiler shown in Figure 1. The blast of hot air referred to is supplied by a nozzle 9, the said nozzle 9 being connected by a valved conduit 10 with the casing 11 of a suction fan adapted to be electrically or otherwise driven and being preferably arranged exterior of the furnace. Air is supplied to the casing 11 of the suction fan from the atmosphere and preferably from a point adjacent to the top of the uptake or chimney 3. The air induction conduit is numbered 12 and includes as clearly shown in Figure 1 a pendent portion, exterior of the uptake 3 and provided with an enlarged inlet 13, screened as designated by 14 to preclude the possibility of foreign substance finding its way into the induction conduit. The major portion of the induction conduit is tortuous in character as designated by 15 in Figure 1, the tortuous portion of said conduit being arranged between inner and outer walls 16 and 17 of the uptake and being arranged in any appropriate heat conducting substance. It will also be understood in this connection that the inner wall 16 of the uptake is to be of heat conducting substance, while the exterior wall 17 is to be a non-conductor of heat or else arranged at the outer side of appropriate heat preserving or non-conducting

means, designated by 18. The tortuous character of the conduit portion 15 may be brought about in any approved manner compatible with the purpose of my invention.

5 The said conduit portion 15 is shown as coiled, but it is obvious that the tortuous portion may comprise upwardly and downwardly reaching members or may otherwise be rendered tortuous so as to prolong the
10 length of time during which the air entering through the induction conduit is subjected to the action of heat given off by products of combustion before the air enters the portion of the induction conduit in the
15 furnace, the latter portion of the induction conduit being numbered 19. It follows from the foregoing that the atmospheric air en route through the induction conduit portions 15 and 19 will be considerably heated. The
20 conduit portion 19 merges as shown into a conduit portion 20 of tortuous character. The said conduit portion 20 may be arranged in any appropriate manner so as to be heated by the consumption of gases in the fire box 2
25 and by contact with the heated products of combustion while the same are en route from the fire box 2. As shown in the example given in Figure 1, I prefer to make the tortuous portion 20 in the form of a worm
30 the convolutions of which are disposed above the fire box 2 and about the boiler 8. The said tortuous portion 20 of the air induction or supply conduit merges, in turn, into a conduit portion 21 which leads to the casing
35 11 of the suction fan before mentioned. From this it will be understood that atmospheric air will be drawn into the casing 11 by the fan alluded to and will be heated adequately en route to the said fan, and that
40 the fan will operate to supply the said heated air to the conduit 10 and the nozzle 9 for the injection of the said air under pressure against the deflector 6 in the manner and for the purpose before indicated. The valve 22
45 is provided in the conduit 10 so that the amount of air and pressure can be readily regulated in the discretion of the operator. A portion of the atmospheric air drawn into the fan casing 11 and heated en route in the
50 induction or supply conduit described or in another induction or supply conduit (not shown) arranged parallel to the illustrated induction or supply conduit, is delivered to a conduit 23, valved at 24 and terminating
55 in a nozzle 25. The said nozzle 25 and the before mentioned nozzle 9 may be and preferably are provided with elongated horizontal eduction orifices so as to deliver the heated air under pressure in sheets. It will
60 also be understood that in the embodiment illustrated in Figure 1 because of the disposition of the boiler 8, the nozzle 25 is directed rearwardly and toward a deflector 26, preferably solid, the said deflector 26
65 being arranged in the front of the fire box

and above the grate 4, though it will be understood that when the deflector 6 is arranged in the front of the ash-pit the deflector 26 will be arranged in the rear of the fire box and immediately in front of the
70 bridge wall 27, the boiler in that case being inclined oppositely to the boiler 8 shown in Figure 1. It will be noted that the conduit 23 is arranged in the fire box in close
75 proximity to the grate 4 so that en route through the conduit 23 the air will be highly heated or increased in temperature. By the nozzle 25 the highly heated air is jetted against the deflector 26, and by the said deflector 26 the combustible gases including the
80 said highly heated air is directed upwardly in contact with the water tubes of the boiler 8 as well as in contact with the worm 20 to heat the air passing inwardly through the same. Manifestly the continuous blasts of
85 air supplied in the furnace in the manner described will contribute to a free material extent toward complete combustion, and this without extra expense after my novel means is installed except for the driving of the fan
90 in the casing of the combined suction device or blower. It will also be manifest that economy is promoted by the use of one suction device and blower for the two blasts of highly heated air alluded to. When my
95 improvement is employed in conjunction with a steam boiler, the steam is economically produced, and irrespective of the use to which the heat is put there is an infinitesimal quantity of smoke given off inasmuch
100 as the air supply is abundant and is susceptible of being easily and nicely regulated. After serving the desired purpose in the furnace the products of combustion afforded
105 in the manner indicated are utilized while passing up the uptake 3 to heat the incoming air in the tortuous portion 15 of the air induction or supply conduit. In very large furnaces a multiplicity of the air induction
110 or supply conduits may be employed with the result that greater efficiency and economy are attained at no cost other than the initial cost of installing my improvement. Moreover it will be noted that my improvement
115 can be applied to existing furnaces without entailing material change in the furnace, and at small cost.

The embodiment of my invention shown in Figures 3 and 4 is substantially the same
120 as the embodiment shown in Figures 1 and 2, with the addition of a tank 30, a retort 31 in connection at 32 with the said tank, an auxiliary gas burner 33 designed to be supplied with gas from a suitable source of supply and adapted to heat the retort 31, and
125 a valved conduit 34 leading from the conduit 10 similar to the one before described in Figure 1 and coiled at 35 about the retort 31 and connected at 36 with the tank 30 so as to commingle heated air under
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pressure with the gas in the tank. Leading from the tank 30 is a conduit 37 which as best shown in Figure 4 is arranged in the forwardly directed or nozzle portion 25* of the conduit 23* this provision enabling the passage of air in a heated state and under pressure through the nozzle 25* to draw gas or vaporuous fuel through the conduit 37 with the result that the said vaporuous fuel will be jetted against the deflector 26 to be directed by the latter upwardly and rearwardly in close contact with the conduits 34, 23* and the tortuous portion 20 of the air induction or supply conduit as well as the water tubes of the boiler 8 and this in company with the hot air under pressure. Leading into the retort 31 is a conduit 38 which said conduit 38 has its end 39 connected with an appropriate source of hydrocarbon fuel supply, the said hydrocarbon fuel being conducted in a tortuous course 40 to the retort 31 so that said fuel will be adequately preheated before entering the retort and hence will be quickly converted into gas or vapor. The auxiliary fuel means just described can be and preferably is used in addition to hard fuel consumed on the grate 4. I would have it distinctly understood, however, that when desired it is within the purview of my invention to use the commingled gas and hot air alone as a fuel, the hot air in that case being economically produced in the manner hereinbefore set forth in detail.

In the modification shown in Figure 5, I employ an auxiliary fuel supply means 50, the said fuel supply means 50 being designed to be used in conjunction with hard fuel on the grate 4 or to be used alone in the discretion of the manufacturer. I prefer, however, to employ the auxiliary fuel supply means in connection with hard fuel on the grate 4, the said hard fuel being supplied at intervals by any approved means as occasion demands. I also prefer to employ the auxiliary fuel supply means in conjunction with the two elements 9 and 25 for supplying hot air under pressure as before described with reference to Figure 1.

The auxiliary fuel supply means 50 comprises among other elements a hopper 51 for comminuted fuel such as powdered coal, saw dust or the like. At the lower end of said hopper 51 is an appropriate valve 52 for regulating the amount of the flow. In connection at 53 with the lower end of the hopper 51 is a casing 54 in which is a screw-like suction fan 55, designed to be driven by extraneous means applied to the top 56 of the shaft of said fan. A discharge spout 57 extends directly downward from the lower end of the casing 54 to a point above and in close proximity to the fire box 2. A discharge spout 58 leads laterally from the upper end of the casing 54 and then down-

wardly and terminates in a discharge 59 disposed preferably as illustrated. When comminuted fuel is supplied to the hopper 51 by any appropriate means, the suction fan 55 raises the final dust particles in the casing 54 and feeds the said final dust particles into the fire through the discharge spout 58, the end portion 59 of which is provided with a horizontal elongated education orifice. Fuel particles too heavy for the fan 55 to handle fall directly into the fire through the spout 57. Manifestly when the auxiliary fuel supply means 50 is employed in conjunction with the means described for supplying hot air under pressure to the fire box or combustion chamber, an intensely hot fire will be produced and one which obviously can be maintained at very low cost.

When hard or coarse fuel is employed, in any one of the embodiments of my invention, such fuel can be supplied automatically by any of the well known means extant without opening of the doors of the fire box, and in consequence there will be no cold air to chill the fire or the hot portions of the furnace and hence little or no smoke. In this connection it will be appreciated that the hot air supplied under pressure by my novel means is ample to support combustion and hence it is entirely unnecessary to employ or utilize cold air for said purpose.

I would have it clearly understood that it is within the purview of my invention to employ in the embodiment shown in Figures 3 and 4 any appropriate type of gas producing means in lieu of the retort 31 and its appurtenances, and I would also have it understood that any appropriate fuel supply means for comminuted fuel may be employed in the modification shown in Figure 5 without involving departure from the scope of my claimed invention.

I have entered into a detailed description of the construction and relative arrangement of the parts embraced in the present and preferred embodiments of my invention in order to impart a full, clear and exact understanding of the said embodiments. I do not desire, however, to be understood as confining myself to the specific construction and relative arrangement of parts inasmuch as in the future practice of the invention various changes and modifications may be made such as fall within the scope of my invention as defined in my appended claims.

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

1. Combustion promoting means comprising a furnace having a fire box and an uptake connected with said fire box, means for drawing and forcing air, a conduit for leading atmospheric air to said air draw-

ing and forcing means, said conduit having a tortuous portion arranged to be heated by products of combustion arising from fire in the fire box, and means connecting
 5 said air drawing and forcing means and the interior of the fire box for the delivery to the latter of pure heated air under pressure, said connecting means having an eduction orifice in the fire box adjacent to one
 10 end thereof, in combination with a deflector in and adjacent to the opposite end of the box and opposed to said eduction orifice and arranged to direct the air upwardly and longitudinally of the fire box, said tortuous conduit portion disposed above the
 15 space between the eduction orifice and the said deflector.

2. Combustion promoting means comprising a furnace having a fire box and an uptake connected with said fire box, means
 20 for drawing and forcing air, a conduit for leading atmospheric air to said air drawing and forcing means, said conduit having a tortuous portion arranged to be heated
 25 by products of combustion arising from fire in the fire box, and means connecting said air drawing and forcing means and the interior of the fire box for the delivery to the latter of pure heated air under pressure, said conducting means having eduction
 30 orifices in the fire box adjacent to opposite ends thereof, in combination with deflectors in and adjacent to the opposite ends of the box each opposed to one of said
 35 eduction orifices to direct the air upwardly and longitudinally of the fire box, said tortuous conduit portion disposed above the space between each eduction orifice and its
 40 respective deflector.

3. Combustion promoting means comprising a furnace having a fire box and an uptake connected with said fire box, means
 45 for drawing and forcing air, a conduit for leading atmospheric air to said air drawing and forcing means, said conduit having a tortuous portion arranged to be heated by products of combustion arising from
 50 fire in the fire box, and means connecting said air drawing and forcing means and the interior of the fire box for the delivery to the latter of pure heated air under pressure, said conducting means having eduction orifices in the fire box adjacent to opposite
 55 ends thereof, in combination with deflectors in and adjacent to the opposite ends of the box each opposed to one of said eduction orifices to direct the air upwardly and longitudinally of the fire box, and each
 60 eduction orifice and its complementary deflector being arranged in a different horizontal plane from the other eduction orifice and its complementary deflector, said tortuous conduit portion disposed above

the space between each eduction orifice and its respective deflector.

4. Combustion promoting means comprising a furnace having a fire box containing
 65 at an intermediate point in its height a grate, said furnace also having an uptake connected with said fire box, means for
 70 drawing and forcing air, a conduit for leading atmospheric air to said air drawing and forcing means, said conduit having a tortuous portion in the furnace and above the fire box for bringing about heating of the
 75 fire box en route to said air drawing and forcing means, spaced and exposed boiler tubes above the fire box and within said tortuous portion, and means connecting said air
 80 drawing and forcing means and the interior of the fire box for the delivery to the latter of pure heated air under pressure, said conducting means having eduction orifices in the fire box adjacent to opposite ends thereof and at opposite sides of the grate, and
 85 deflectors at opposite sides of the grate and in and adjacent to the opposite ends of the box each opposed to one of said eduction orifices and arranged to direct air upwardly and longitudinally of the fire box, and said
 90 tortuous conduit portion above the space between the eduction orifices and deflectors.

5. Combustion promoting means comprising a furnace having a fire box and an uptake connected with said fire box, means
 95 for drawing and forcing air, a conduit for leading atmospheric air to said air drawing and forcing means, said conduit having a tortuous portion arranged to be heated by
 100 products of combustion arising from fire in the fire box, spaced and exposed boiler tubes above the fire box and within said tortuous portion, means connecting said air drawing and forcing means and the interior of the
 105 fire box for the delivery to the latter of heated air under pressure, said conducting means having eduction orifices in the fire box adjacent to opposite ends thereof in combination with deflectors in and adjacent
 110 to the opposite ends of the box each opposed to one of said eduction orifices and arranged to direct the air upwardly and longitudinally of the fire box, and each eduction orifice and its complementary deflector being arranged in a different horizontal
 115 plane from the other eduction orifice and its complementary deflector, and the said tortuous portion arranged above the spaces between the eduction orifices and deflectors, a gas tank, means for supplying
 120 heated air under pressure to said gas tank, and a conduit leading from said gas tank to one of the eduction orifices.

In testimony whereof I affix my signature.

ADOLPH BRODBECK.