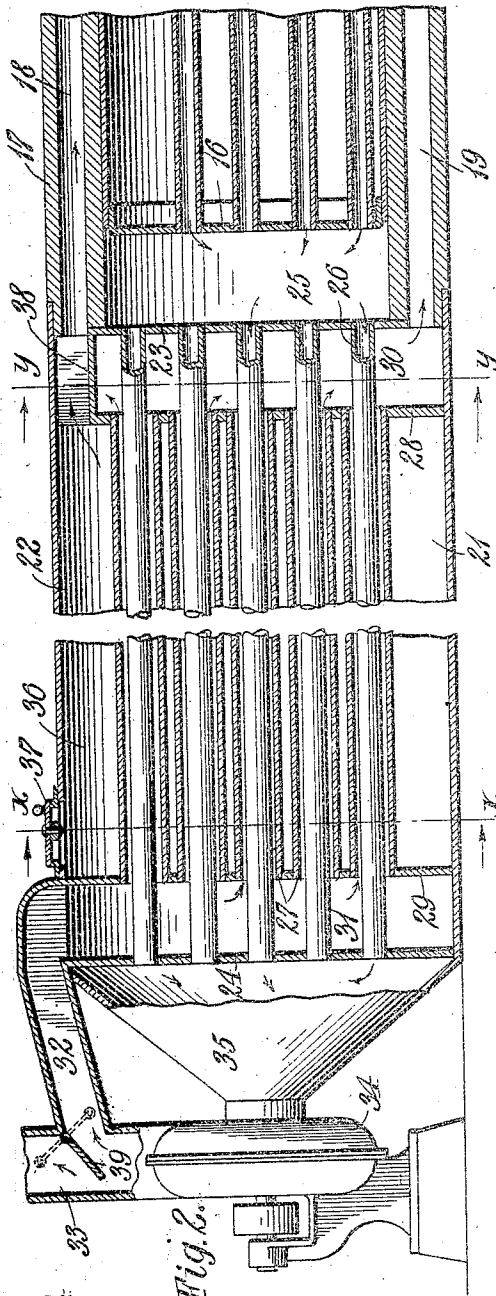


Patented Jan. 6, 1914.

2 SHEETS-SHEET 1.

1,083,845.



Witnesses
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Anna M. Dorr.

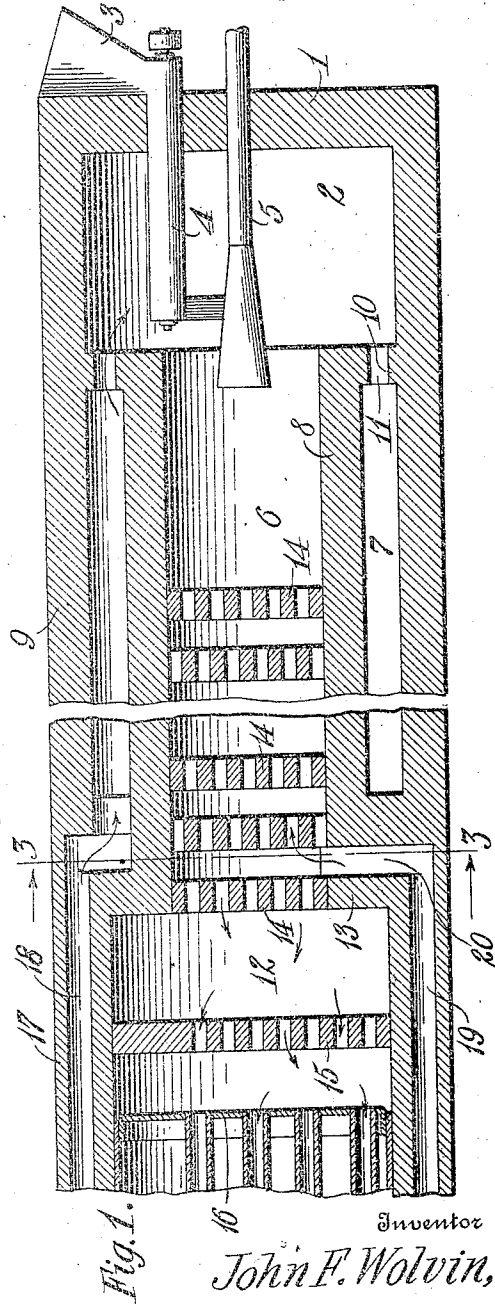


Fig. 1.

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1,083,345.

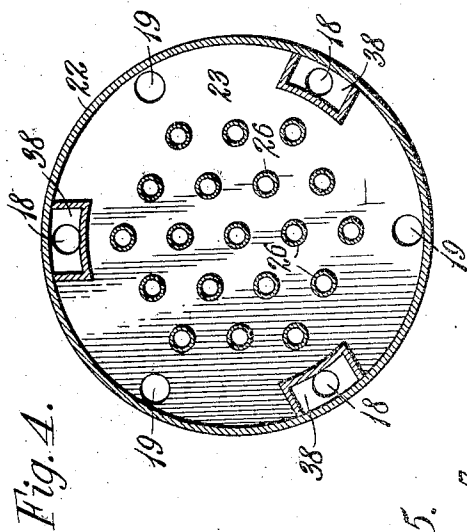


Fig. 4.

Fig. 5.

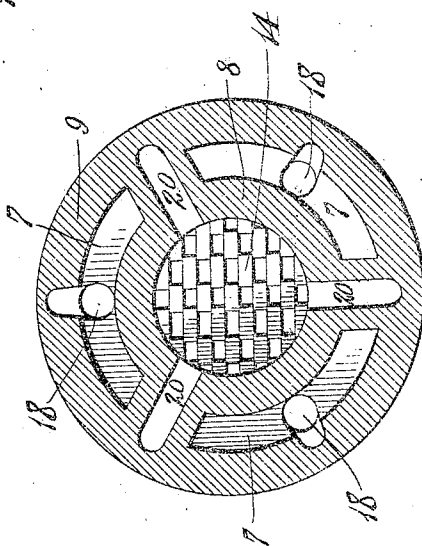
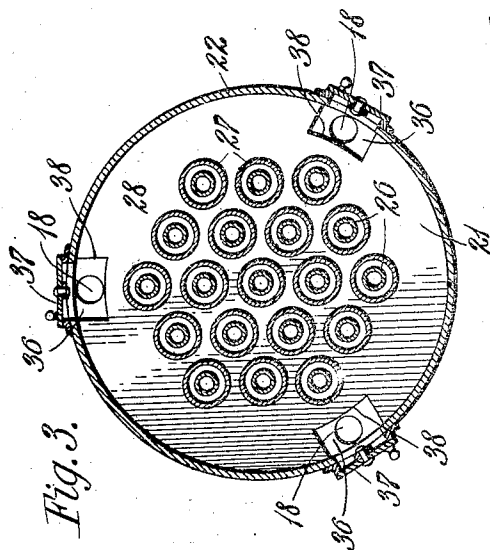


Fig. 3.

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UNITED STATES PATENT OFFICE.

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FURNACE.

1,083,345.

Specification of Letters Patent.

Patented Jan. 6, 1914.

Application filed July 8, 1912. Serial No. 708,159.

To all whom it may concern:

Be it known that I, JOHN F. WOLVIN, a citizen of the United States of America, residing at St. Clair, in the county of St. Clair and State of Michigan, have invented certain new and useful Improvements in Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to furnaces, and more particularly to the type disclosed by my Patent #1,063,489 dated June 3, 1913. The furnace disclosed in this patent is especially adapted for burning crushed or powdered fuel, in which a very high degree of efficiency is secured by the manner in which the fuel and air are introduced into the furnace. In this furnace a fluid supply pipe is used together with means for introducing
20 fuel into the fluid whereby the fuel will be projected or discharged in the combustion chamber of the boiler. It has been found however, that small particles of fuel are liable to escape without being consumed, therefore, the present application has for its object to provide a construction whereby any desired proportion of the products of combustion may be returned to the combustion chamber together with a sufficient quantity of fresh air to maintain combustion, and said returned products and air heated to a high degree of temperature before entering the combustion chamber.

A further object is to provide certain
35 other new and useful features in the construction and arrangement of parts, the invention consisting in the matters hereinafter set forth and more particularly pointed out in the claims reference being had to the accompanying drawings in which—

40 Figure 1 is a longitudinal vertical section through the forward end of a furnace embodying the invention with portions broken away to shorten the figure; Fig. 2 is a similar view of the rear portion of the furnace with portions broken away to shorten the figure; Fig. 3 is a transverse section on the line X—X of Fig. 2; Fig. 4 is a section on the line y—y of Fig. 2; and Fig. 5 is a section on the line z—z of Fig. 1.

50 As shown in the drawings 1 is a suitable structure formed of brick work, in the forward end of which is an air chamber 2, the forward end wall of which forms a support
55 for a suitable hopper 3 from which crushed or otherwise previously prepared fuel is fed

by any suitable means through a tube 4 into a blow pipe 5 for blowing the fuel into the open forward end of the fire chamber 6, steam or other fluid under pressure being
60 employed to blow the fuel into the fire. The means for introducing the fuel into the fire chamber does not, however, form a part of this invention and any suitable means may be used.

65 The structure 1 may be formed cylindrical in cross section as shown if so desired and the fire chamber 6 is preferably tubular in form and located within the structure 1 with a space 7 between its wall 8 and the outer
70 wall 9 of the structure. The forward end of the fire chamber opens into the air chamber 2 through a transverse wall 10 which is provided with openings 11 forming a means of communication between the chamber 2 and
75 the annular space 7 around the fire chamber. The rear end of the fire chamber 6 opens into an expansion chamber 12 through a vertical division wall 13, and arranged at suitable intervals across the rear end of the fire
80 chamber is a series of baffles 14 formed of checker brick work. A similar baffle 15 extends across the expansion chamber 12 at a short distance from the forward end of a tubular boiler 16 which is supported within
85 the structure with its fire tubes extending longitudinally of the axis of the structure. The wall 17 surrounding the boiler is formed with two series of passages 18 and 19, the passages 18 being open at their forward end
90 into the annular space 7 around the fire chamber, and the passages 19 being formed with inwardly extending end portions 20 in the wall 13 which open into the rear end of the fire chamber just forwardly of the rear-
95 most baffle of the series of baffles 14.

100 Located at the rear end of and in alignment with the structure 1 is an air heater 21 comprising a cylindrical outer shell 22 having a front head 23 and a rear head 24. The front head 23 serves to close the rear end of the structure 1 in which a chamber 25 is provided between said head and the rear end of the boiler 16. Extending between these
105 heads and opening through the same are tubes 26 and sleeved upon these tubes are air heating tubes 27 of a considerably larger diameter than the tubes 26 to provide a space around the tubes 26 and the tubes 27 open
110 through partitions 28 and 29 located at a short distance from the heads 23 and 24 respectively. The space between the head 23

and partition 28 forms a chamber 30 into which the channels 19 in the wall 17 surrounding the boiler open at their rear ends the air heating tubes 27 also opening at their forward ends into said chamber 30, and the space between the wall 29 and head 24 forms a chamber 31 into which the rear ends of said tubes 27 open and also in the top of which a pipe or duct 32 is connected, said pipe communicating with the discharge pipe 33 of a blower 34 of any suitable construction, the inlet of which blower is connected with the open rear ends of the tubes 26 by means of a flaring pipe or bell shaped head 35 secured at its outer rim to the periphery of the head 24.

The space within the shell 22 surrounding the air heating tubes 27 between the partitions 28 and 29, forms a chamber 36 into which atmospheric air may be admitted through valves or dampers 37 and this fresh air is drawn from the chamber through short passages 38 opening through the wall 28 at one end and connected to the rear ends of the passages 18 in the wall 17.

In operation the products of combustion from the fire chamber 6 pass rearwardly through the baffles 14 into the expansion chamber 12 and thence through the baffle 15 into the forward ends of the fire tubes of the boiler. In passing through the baffles into the expansion chamber the gases are thoroughly mixed and under favorable conditions with the wall heated to a very high heat, they will be nearly all consumed. The products of combustion issuing from the rear ends of the fire tubes of the boiler into the chamber 25, pass therefrom through the tubes 26 into the breeching 35 and thence into the blower 34 from which they are expelled through the pipe 33.

A valve or damper 39 is provided in the pipe 33 at the point where the pipe 32 leads forwardly therefrom and this damper is so arranged that it may be swung to close either of these pipes or may be placed in mid position and thus direct part of the products of combustion expelled by the blower, into the pipe 32 and part allowed to escape through the pipe 33. Any desired portion of the products of combustion may therefore by a manipulation of the damper 39 be caused to flow forwardly through the pipe 32 into the chamber 31 and thence forwardly through the air heating tubes 27 around the tubes 26 where they will be reheated by the hot gases passing through said tubes 26. From the forward ends of the tubes 27 they issue into the chamber 30 and are drawn forwardly from said chamber through the passages 19 from which passages they issue through the inwardly directed ends 20 thereof into the rear portion of the fire chamber where there is the greatest degree of heat and thus they are caused to mingle with the hot gases and

products of combustion and will be entirely consumed.

To maintain combustion of fuel in the fire chamber, fresh air in the desired proportion to the returned gases, is admitted into the chamber 36 by opening the dampers 37 to the proper extent and this air after having been heated in the chamber 36 by contact with the hot tubes 27 passes through the channels 18 where it is further heated, and thence through the annular space 7 around the fire chamber where it is heated to a very high degree and from which it issues through the openings 11 into the air chamber 2 at the forward end of the fire chamber.

The blower 34 may be driven in any desired manner by an external source of power and acts to maintain the circulation of air and gases through the furnace from end to end thereof. By this arrangement all or any portion of the gases after passing through the boiler tubes may be returned to the fire chamber but these gases are caused to enter the fire chamber near the rear end thereof where the heat is most intense and where they will not pass over the burning fuel and interfere with the proper combustion thereof. Any desired proportion or amount of atmospheric air may be admitted to maintain combustion and this cold air is drawn through in such a manner that it is heated to a very high degree before it enters the fire chamber.

Obviously, changes in the details of construction may be made without departing from the spirit of my invention and I do not care to limit myself to the particular form or arrangement shown.

Having thus fully described my invention what I claim is:—

1. In a furnace, the combination with a fire chamber, of a mechanical suction device for drawing products of combustion from said chamber, means connecting the inlet of said suction device with the fire chamber including a heater comprising tubes through which said products of combustion are drawn by said suction device, conduits connected at one end with the outlet of the suction device, and a chamber through which said tubes and conduits extend having communication with the atmosphere, means for conducting air from said chamber of the heater into the forward end of the fire chamber, and separate means for conducting into the fire chamber the products of combustion which are returned to the heater by the suction device.

2. In a furnace, the combination with a fire chamber, of a heater connected to the fire chamber and provided with a plurality of tubes in longitudinal alinement with the fire chamber for the passage of the products of combustion therethrough from the fire chamber, a suction device connected to the

rear ends of the tubes of the heater to draw the products of combustion through said tubes, a conduit connecting the outlet of the suction device with the rear end of the heater to conduct into the heater around said tubes, the products of combustion discharged by said suction device, means for conducting the products of combustion from the forward end of the heater into the fire chamber, and means for introducing air into the forward end of the fire chamber to maintain combustion therein.

3. In a furnace, the combination with a fire chamber, and a boiler arranged at the rear of the fire chamber, of a heater connected to the rear end of the boiler and comprising a plurality of fire tubes and a plurality of air heating tubes surrounding the fire tubes with a space between them, said heater being also formed with a chamber surrounding the air heating tubes, a suction device connected to the fire tubes to draw products of combustion from the fire chamber through said tubes and discharge the same, a conduit for connecting the outlet of the suction device with the rear end of the air heating tubes, means for connecting the forward ends of the air heating tubes with the fire chamber, means for admitting air to the chamber surrounding the air heating tubes, and means for conducting the air from said chamber into the forward end of the fire chamber.

4. In a furnace, the combination with a structure formed with a fire chamber and a chamber at the rear thereof, a boiler in the rearmost chamber having longitudinal fire tubes, a heater connected to the rear end of the chamber containing the boiler and comprising a cylindrical shell having heads, tubes extending through said shell and opening through said heads, partitions within the shell, air heating tubes surrounding the said tubes and opening at their ends through said partitions, a suction device connected to the rear ends of the tubes opening through the rear head, a conduit connecting the outlet of the suction device with the space between the rear head of the heater and the adjacent partition, means within the outlet from the suction device to control the discharge

of products of combustion therethrough and through said conduit, means for conducting the products of combustion from the space between the forward head of the heater and the adjacent partition to conduct the same into the fire chamber, means for admitting air to the heater, and means for conducting the air from the heater to the forward end of the fire chamber.

5. The combination of a structure formed with a fire chamber and an annular space surrounding said chamber and with an expansion chamber at the rear of the fire chamber having a plurality of passages formed in its outer wall, certain of said passages connecting with the space around the fire chamber and others opening into the rear end of the fire chamber, a boiler having longitudinal fire tubes positioned at the rear of the expansion chamber within the structure with a chamber at the rear of the boiler, a heater having heads at its ends, fire tubes extending longitudinally of the heater and opening through said heads, transverse partitions in the heater spaced from said heads and forming chambers at the ends of the heater, air heating tubes surrounding the fire tubes and opening through the partitions into said chambers, means for admitting air to the heater around the air heating tubes, the passages in the wall of the structure which are connected to the space surrounding the fire chamber being connected to the chamber of the air heater to receive air therefrom, and the passages opening into the rear end of the fire chamber being connected with the chamber in the forward end of the heater, a suction device connected to the rear end of the heater to draw products of combustion through the fire tubes, a conduit connecting the outlet of the suction device with the chamber in the rear end of the heater, and means within the outlet of the suction device for controlling said outlet.

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

JOHN F. WOLVIN.

Witnesses:

LEWIS E. FLANDERS,
ANNA M. DORR.