No. 886,261. PATENTED APR. 28, 1908

C. W. SMITH.

FURNACE.

APPLICATION FILED DEC. 28, 1905.

2 SHEETS—SHEET 1

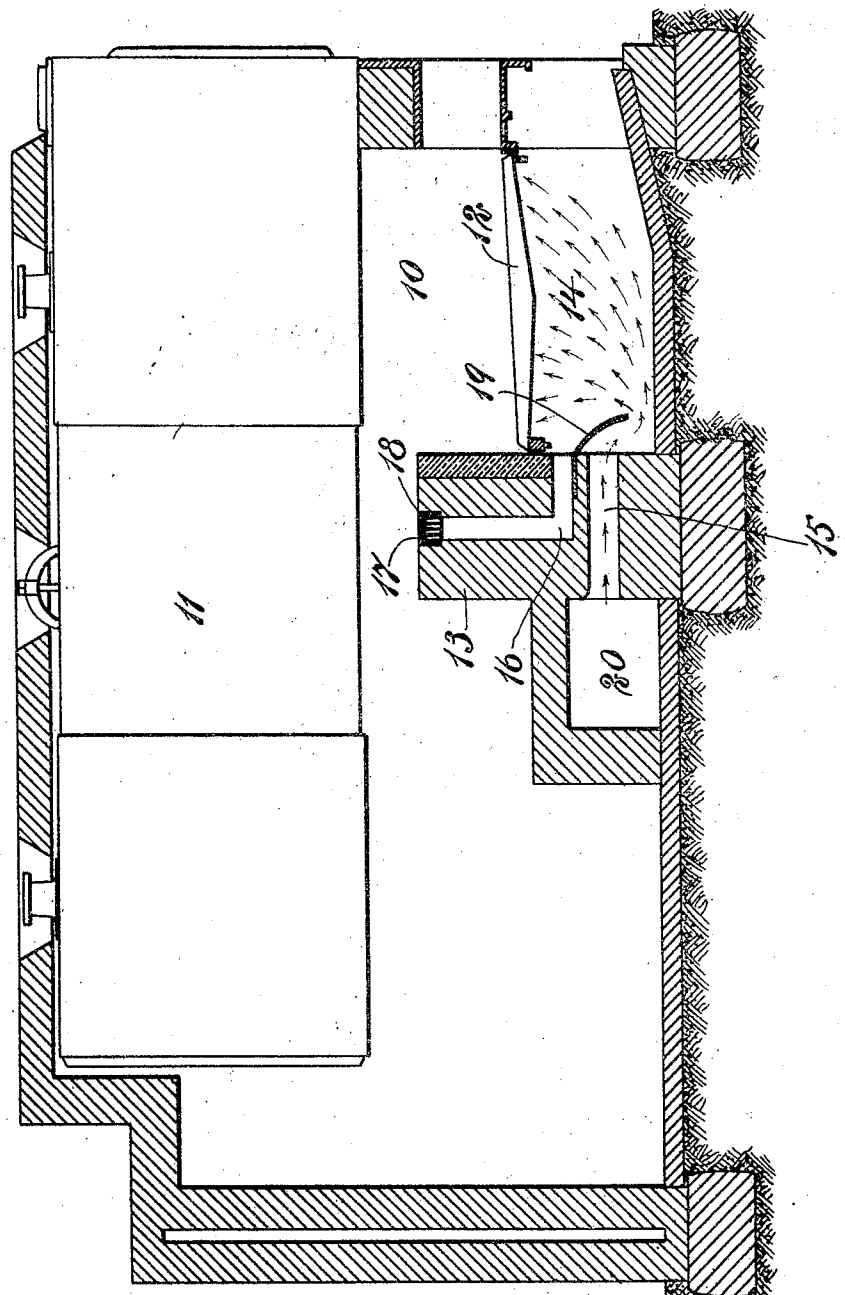

Fig. 1

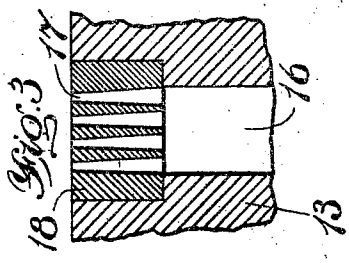

Fig. 3

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2 SHEETS—SHEET 2.

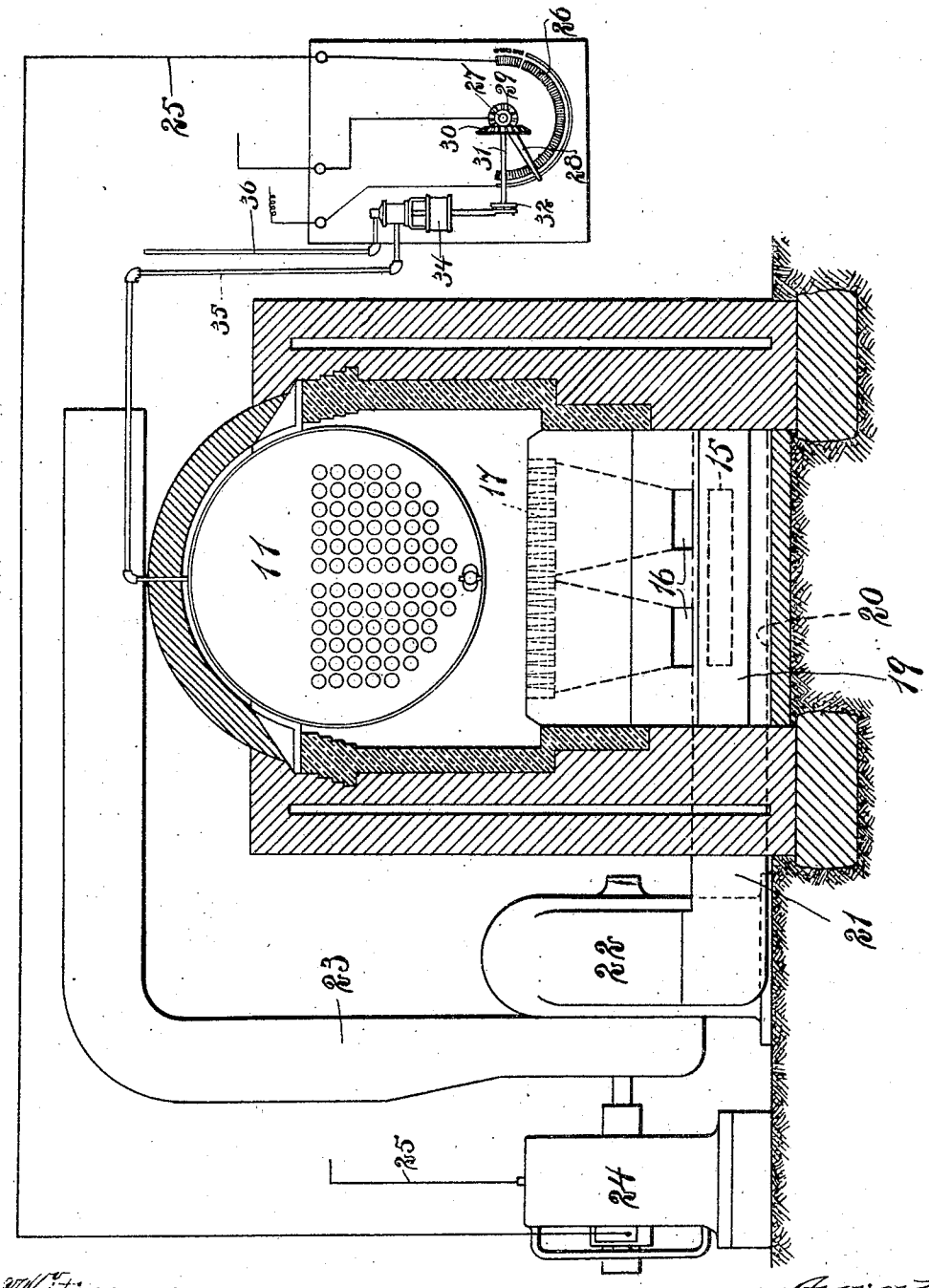

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Fig. 2.

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UNITED STATES PATENT OFFICE.

CLARENCE W. SMITH, OF CAMBRIDGE, MASSACHUSETTS.

FURNACE.

No. 886,261. Specification of Letters Patent. Patented April 28, 1908.

Application filed December 28, 1905. Serial No. 293,577.

To all whom it may concern:

Be it known that I, CLARENCE W. SMITH, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to furnaces and more particularly to those applicable to steam boilers. Its principal object is to provide a furnace which will attain a high degree of efficiency in the consumption of varying grades of fuel. To accomplish this, the exact amount of air required for perfect combustion should be presented to the burning fuel, since too little will result in a deadening of the fire, and waste from partly burned gases, and an excess means the lowering of the fire-box temperature, waste of fuel in heating needless air and the overloading of the stack. The air must also be uniformly diffused through the ash-pit, otherwise blow-holes will be made in the burning fuel, causing wasteful excess of air and the formation of clinker and slag from the intense local action. These desirable results mentioned, which have been heretofore imperfectly attained in plants using forced or induced draft, are secured by my invention.

In the accompanying drawings, in which similar characters designate like parts throughout the several views—Figure 1 is a central vertical longitudinal section through a boiler and its furnace, embodying one form of my invention. Fig. 2 is a transverse vertical section therethrough, and Fig. 3 is a sectional detail through the outlet openings in the top of the bridge-wall.

The furnace 10, as here shown, is formed in the masonry inclosing a boiler 11. It comprises a grate 12 supported between the front of the structure and a bridge-wall 13, and has beneath it an ash-pit 14. Extending through the bridge-wall in a generally horizontal direction, and opening into the ash-pit beneath the grate is a passage or conduit 15. Above this passage a second passage 16, or a plurality thereof, as is shown in the present instance, opens from the ash-pit extending through the bridge wall, first in a horizontal direction and then vertically, diverging upwardly to a considerable number of contracted openings 17. These may be formed of fire-resisting tile 18 set in a recess at the top of the bridge wall so that their tops are flush with the top of the bridge-wall. The openings 17 are preferably tapered, having their minimum diameter at the upper ends. Between the openings of the passages 15 and 16 is situated a deflector 19, which is inclined downwardly from the grate, across the end of the former passage. The deflector may be curved, as illustrated, its convex side being outward.

At the rear of the bridge-wall is a chamber or conduit 20 lying across the furnace and being continued outside the casing by a pipe 21, leading to the movable air-supplying means which is shown as a blower 22, having its outlet delivering to the pipe. From the eye of the blower a pipe 23 extends above the boiler setting and into close proximity therewith, so that the induced current is drawn from a source warmed by the waste heat radiated and convected from the boiler setting, flue, and steam pipes. The fan is driven by a motor 24, which is preferably of the electric type, and which is included in a feed-circuit 25 having a rheostat 26 for controlling the motor speed. The spindle 27 of the rheostat has fixed to it the usual contact-arm 28 and a bevel pinion 29 which meshes with a bevel gear 30 fast upon a shaft 31. This shaft has secured at its opposite extremity a crank-disk 32, the pin of which is connected with some convenient form of pressure-regulating device 34, joined to the boiler by pipe 35, and to a source of water supply under pressure by pipe 36.

In using my improved furnace, air is drawn by the fan through the pipe 23 and forced into the passage 15 in the bridge-wall against the curved deflector, by which it is directed against the floor of the ash-pit, over which it flows and rises in equal diffusion through all parts of the grate. The deflector extending the full width of the fire-box effectually prevents the escape upward of air at the sides of the passage 15, with consequent excess of draft and blow-holes in the fuel at that end of the grate. A part of the air passes into the passage 16 and is delivered by the contracted openings into gases traveling over the bridge-wall. The taper of these openings prevents the accumulation of ash, while their reduced outlets give the ejected air a high velocity and penetrating power, intimately mingling it with the gases even at the ends of the wall where the spaces between it and the shell of the boiler are widest. The secondary air-supply, introduced above the level of the top of fuel

which is essential for complete combustion of the valuable gases distilled off and the prevention of smoke, is thus provided. The air after being warmed in the pipe 23 and conduits 20 and 15 is spread under the grate by the deflector 19 and heated there, and then the air which returns into the bridge-wall on its way to the contracted openings 17 is highly heated before issuing through said openings. If the pressure in the boiler varies from the desired amount, the regulator automatically shifts the contact-arm of the rheostat, thus varying the current delivered to the motor to increase or decrease its speed and that of the fan, thus increasing or decreasing the volume of the air delivered to the furnace as may be necessary. The regulation of air supply to the furnace and consequent steam pressure in the boiler effected by this arrangement is very perfect, but little resistance being offered by the contact-arm to its movement by the pressure regulator. And as the contact blocks and connected resistance coils are numerous, a high degree of sensitiveness is attained. This automatic control of the air-supply and the diffusion of air through the bed of fuel and through the escaping gases, renders but little manipulation of the fire necessary, while the combustion is so perfect as to make it practically smokeless. In drawing the supply of air from that heated by the boiler, it is not only delivered to the fire at a temperature raised to an effective degree, but the boiler-room is also rendered more comfortable by the withdrawal of the hot air.

Though I have described my invention as applied to a steam boiler set in masonry, it will be seen that it is by no means limited to such an application, but that it may be used in connection with furnaces of many types.

I claim:

1. A furnace comprising a grate, a bridge-wall provided with a passage terminating in a series of contracted openings in its upper portion said passage opening beneath the grate and a second passage also opening beneath the grate, means for forcing air to the space beneath the grate, means for distributing the air beneath the grate, and automatic means for governing the air-forcing means responsive to variations of boiler pressure.

2. A furnace comprising a grate, a bridge-wall provided with a passage terminating in a series of contracted openings at its upper portion and a second passage extending through the bridge-wall, both of said passages opening beneath the grate, means for forcing air to the space beneath the grate, a deflector situated between the passage openings and inclined downwardly from the grate, and automatic means for governing the air-forcing means responsive to variations of boiler pressure.

3. A furnace comprising a grate, a bridge-wall provided with a passage terminating in a recess, fire resisting tile formed with a series of contracted openings and set in said recess and a second passage extending through the bridge-wall, both of said passages opening beneath the grate, means for forcing air to the space beneath the grate, a deflector situated between the passage openings, and automatic means for governing the air-forcing means responsive to variations of boiler pressure.

4. A furnace comprising a grate, a bridge-wall provided with a passage terminating in a recess, fire-resisting tile formed with a series of contracted openings and set in said recess, and a second passage extending through the bridge-wall, both of said passages opening beneath the grate, means for forcing air to he space beneath the grate, at deflector situated between the passage openings and inclined downwardly from the grate, and automatic means for governing the air-forcing means responsive to variations of boiler pressure.

5. A furnace comprising a grate, a bridge-wall provided with a passage terminating in a series of contracted openings in its upper portion and a second passage extending through the bridge-wall, both of said passages opening beneath the grate, a deflector situated between the passage openings, and means for supplying air under pressure to said passages, said means comprising a blower, a motor for operating the blower, a rheostat for controlling the motor, a pressure regulator connected with the boiler, and means for communicating movement from the regulator to the rheostat.

6. A furnace comprising a grate, a bridge-wall provided with a passage terminating in a recess, fire-resisting tile formed with a series of contracted openings and set in said recess and a second passage extending through the bridge-wall, both of said passages opening beneath the grate, a deflector situated between the passage openings and inclined downwardly from the grate, and means for supplying air under pressure to said passages, said means comprising a blower, a motor for operating the blower, a rheostat for controlling the motor, a pressure regulator connected with the boiler, and means for communicating movement of the regulator to the rheostat.

7. The combination with a boiler furnace having a grate, of means for forcing air into the furnace independently of fuel supplied thereto, an electric motor for driving the air-forcing means, a rheostat connected with the motor, a pressure regulator associated with the boiler and mechanical connections between the pressure regulator and rheostat whereby the air supply is governed in accordance with the amount of steam required, and definite rates of combustion produced

with an indeterminate fuel supply, said air forcing means having provisions for introducing air to the furnace both below and above the grate.

8. The combination of a boiler, a combustion chamber, means independent of fuel-supplying means for forcing air into said combustion chamber, including an electric motor controlled by conditions within the boiler, the construction and arrangement of the parts being such that substantially all of the air admitted is supplied by said air-forcing means and the control of the combustion effected without regard to damper regulation of the escape of the products of combustion.

9. The combination with a boiler furnace having a grate, of means for forcing air into the furnace independent of fuel supplied thereto, an electric motor for driving the air-forcing means, a rheostat connected with the motor, a regulator associated with the boiler, and connections between the regulator and rheostat, whereby the air supply is governed in accordance with the amount of steam required, and definite rates of combustion produced with an indeterminate fuel supply, the furnace having a free outlet for the products of combustion, the capacity of which is not affected by the operation of the motor, whereby the motor is utilized so that substantially all the air for combustion is introduced and controlled by the motor for supplying air to the furnace.

10. The combination with a boiler furnace having a grate, of means for forcing air into the furnace independent of fuel supplied thereto, an electric motor for driving the air-forcing means, a rheostat connected with the motor, a pressure regulator associated with the boiler, and mechanical connections between the pressure regulator and rheostat, whereby the air supply is governed in accordance with the amount of steam required, and definite rates of combustion produced with an indeterminate fuel supply, the furnace having a free outlet for the products of combustion, the capacity of which is not affected by the operation of the motor, whereby the motor is utilized so that substantially all the air for combustion is introduced and controlled by the motor for supplying air to the furnace.

In testimony whereof I have affixed my signature, in presence of two witnesses.

CLARENCE W. SMITH.

Witnesses:
FRED. W. SMITH,
SIDNEY SMITH.