

April 26, 1938.

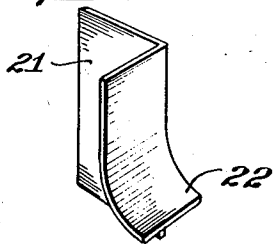
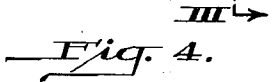
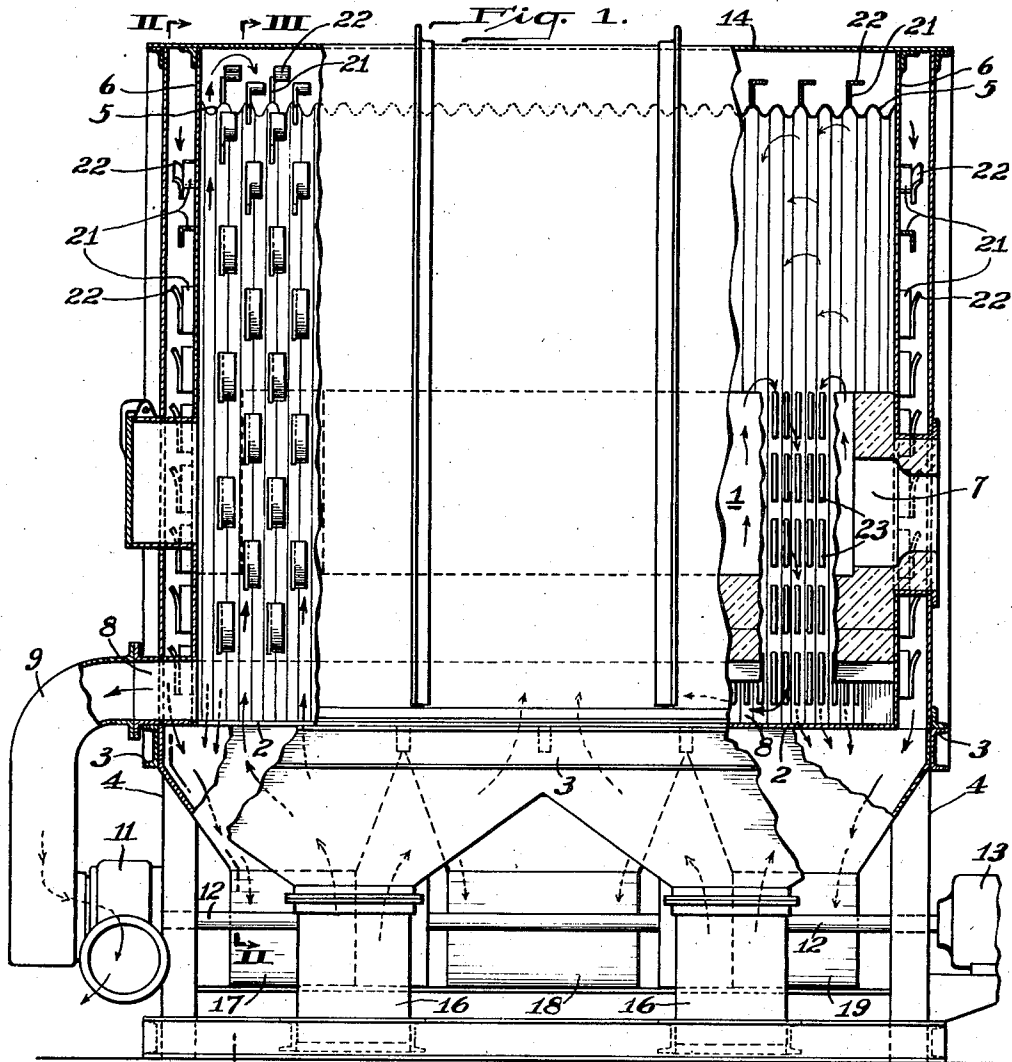
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2,115,057

DIRECT FIRED UNIT HEATER

Filed Jan. 31, 1936

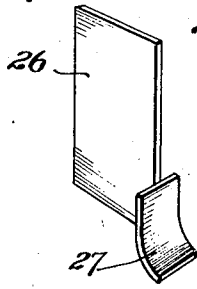
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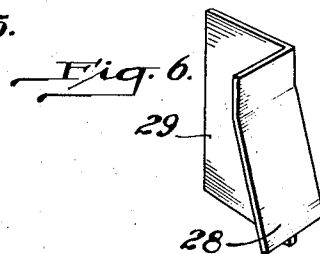
WITNESSES

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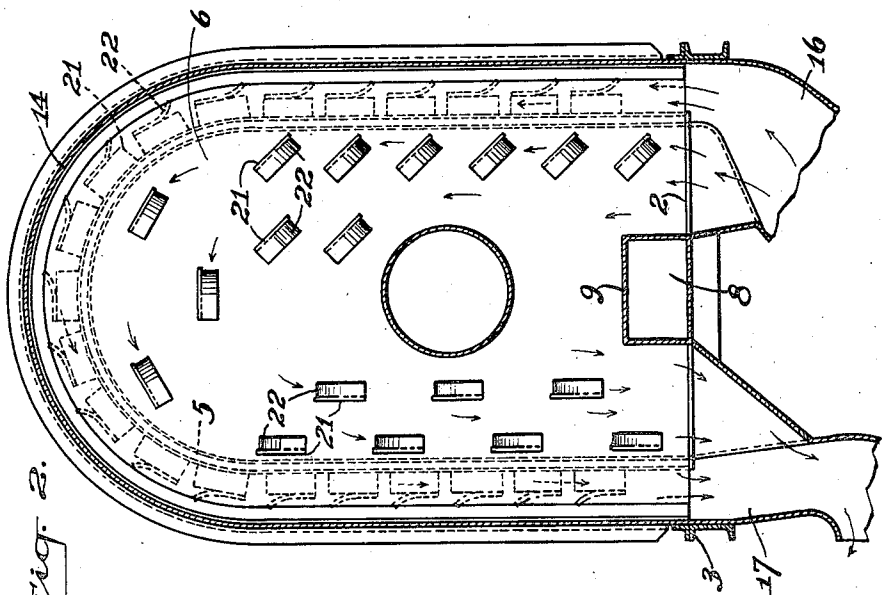


Fig. 2.

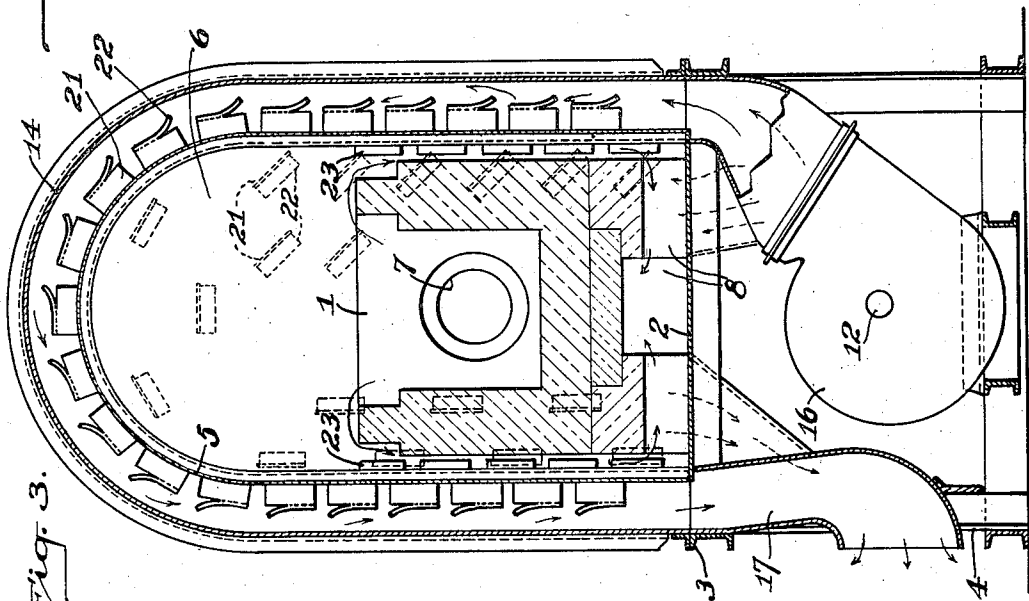


Fig. 3.

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UNITED STATES PATENT OFFICE

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DIRECT FIRED UNIT HEATER

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Application January 31, 1936, Serial No. 61,696

6 Claims. (Cl. 126—110)

This invention relates to direct fired unit heaters, and more particularly to those through which air from a space to be heated is positively circulated.

Unit heaters of the type referred to herein are particularly suitable for heating large spaces such as steel mills, garages, factory buildings and the like. They consist of a combustion chamber in which a very high temperature is maintained by any suitable fuel, an air duct surrounding the chamber, and means for forcing cool air from the space to be heated through the air duct and out of the heater in heated condition. It has been found, however, that even with the wall of the combustion chamber corrugated so as to increase its heat radiating area, these heaters have been inefficient in transferring heat from the combustion chamber walls to the current of air circulated through the heaters. Furthermore, when the heaters are maintained at the high temperatures at which they are supposed to operate, the metal walls of the combustion chambers soon burn through.

It is among the objects of this invention to provide a direct fired unit heater of simple and inexpensive construction which is highly efficient in heating air forced through it, and the metal combustion chamber walls of which do not burn out.

The invention is illustrated in the accompanying drawings in which Fig. 1 is a side view of a unit heater broken away at its opposite ends in three different vertical planes to show its interior construction; Fig. 2 is a vertical section taken on line II—II of Fig. 1 and showing an end wall of the combustion chamber; Fig. 3 is a vertical section taken on the line III—III of Fig. 1; Fig. 4 is an enlarged perspective view of a deflector plate of the type shown in the preceding figures; and Figs. 5 and 6 are two modifications of the deflector plate.

Referring to the first three figures of the drawings, a trough-like fire-box 1 is built up of refractory material on a platform or floor 2 supported on the central portion of an elevated frame 3 which is mounted on legs 4 at its corners. A metal casing 5 is mounted on the edges of floor 2 for enclosing the fire-box with which it forms a furnace provided with a combustion chamber. The casing in cross section is preferably in the shape of an inverted U with its side walls spaced from the fire-box. The sides and top of the casing are preferably corrugated to increase its heat-absorbing and radiating surface area, but its end walls may be flat plates 6 through one of which a

portion of the fire-box projects (Fig. 1). This portion is provided with an opening 7 through which fuel is introduced for combustion in the fire-box. If desired, an oil or gas burner, not shown, can be mounted in this opening.

The gases in the combustion chamber are drawn downwardly between the brickwork of the fire-box and the corrugated casing, beneath the fire-box through flues 8, and out of the furnace through breaching 9 by an exhaust fan 11 adapted to be connected to the usual stack. This fan is driven by a shaft 12 rotated by an electric motor 13 which can be mounted at the opposite end of the heater, as shown in Fig. 1.

The furnace casing is entirely surrounded by a metal shell 14 which is of the same general shape as the casing, but is larger so as to rest on frame 3 beyond floor 2 and provide air spaces or ducts between itself and the side and end walls of the casing. Preferably, as shown in Fig. 2, casing end wall plates 6 extend outwardly to the shell to which they are connected. Mounted below frame 3 is a plurality of suction fans or blowers 16 driven by shaft 12 for drawing in cool air from the space to be heated and forcing it up through the spaces between floor 2 and the shell at one side of the heater and into the air ducts surrounding the casing. At the opposite side of the heater the spaces between the shell and furnace floor form outlets for the air ducts and communicate, preferably by three outlet nozzles 17, 18 and 19, with the space being heated. Any suitable means for directing the flow of heated air issuing from these nozzles may be incorporated therein.

It is a feature of this invention that means is provided for directing the air, being circulated by the blowers through the air ducts of the heater, against the hot metal casing 5 so as to absorb more heat therefrom. Accordingly, a plurality of deflector plates is mounted on the outer surface of the top and side walls of the casing, the plates being formed for directing the circulating air inwardly against the casing. Preferably, each plate is of metal and consists of a fin portion projecting outwardly at right angles to the casing to which its inner edge is welded or otherwise secured. As shown in Fig. 4, the outer portion of the plate is bent at right angles and cut away from the fin for a portion of its length to provide a deflector portion 22 that is curved outwardly. The plates are preferably mounted in staggered relation on the outwardly extending corrugations only of the furnace casing with their deflector portions overlying the inwardly extending corru-

gations. Deflector portions 22 are disposed at the rear of the plates relative to the direction of movement of the current of air through the heater, as shown in Fig. 3.

- 5 Fins 21 provide additional radiating surface for the combustion chamber wall, thereby conducting more heat into the air duct and at the same time preventing the casing from becoming overheated and burning out. To remove still
10 more heat from the combustion chamber and conduct it into the chamber wall, a plurality of metal fins 23 is preferably secured to all of the casing corrugations between the casing and the fire-box side walls, as shown in Figs. 1 and 3.
15 The hot furnace gases are drawn by the exhauster past these inside fins to which they give off a considerable amount of their heat.

The deflector plates are also mounted on end plates 6 of the furnace casing where they deflect
20 the circulated air against the end plates, and radiate heat from the end plates fast enough to prevent them from burning out from the intense heat in the combustion chamber. Also, the deflector plates are preferably arranged in the
25 manner shown in Fig. 2 so as to direct the incoming air diagonally upwardly and across the end plates at their hottest part which is immediately above the fire-box. For this purpose the deflector plates on the air inlet side are inclined inwardly and upwardly, while the upper-
30 most deflectors are mounted for holding the air down away from the tops of the end plates which are much cooler than the portions directly below.

In Fig. 5 a deflector plate is shown which is
35 formed from a flat metal fin 26 to the lower end of the outer edge of which a small plate 27 is connected. The plate extends below the fin and is curved outwardly for deflecting air inwardly across the fin.

40 The deflector plate shown in Fig. 6 is similar to that shown in Fig. 4, with the exception that the laterally bent portion 28 is cut away from the fin portion 29 for the major part of its length. The cut-away portion is bent outwardly in a plane
45 oblique to the remainder of the laterally bent portion.

A direct fired unit heater constructed in accordance with this invention is very efficient because the air circulated through it is caused to
50 scrub against the hot combustion chamber wall and absorb heat therefrom. The deflector plates likewise break up the air stream, causing a turbulence that brings all of the air into contact with the hot surfaces. Another advantage is that intense heat can be maintained in the combustion
55 chamber without danger of burning out the chamber walls, because the deflector plates radiate heat outwardly from those walls fast enough to prevent them from burning.

60 According to the provisions of the patent statutes, I have explained the principle and construction of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it
65 understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A direct fired unit heater comprising a shell,
70 a metal furnace casing disposed therein and forming a combustion chamber in which heat is produced for heating the casing, the side and end walls of said casing being spaced from said shell, means for forcing a current of air upwardly at
75 one side of said unit in the spaces between said

shell and casing side and end walls, the opposite side of said unit being provided adjacent the bottom of the shell with outlets for heated air, and a plurality of deflector plates mounted on the outer surface of said casing end walls, said plates
5 on the air inlet side of said unit being inclined inwardly and upwardly to direct rising air across the central portions of said end walls, and the plates on the air outlet side of said unit extending substantially vertically.

2. A direct fired unit heater comprising a shell, a metal furnace casing disposed therein and forming a combustion chamber in which heat is produced for heating the casing, the side and end walls of said casing being spaced from said shell,
15 means for forcing a current of air upwardly at one side of said unit in the spaces between said shell and casing side and end walls, the opposite side of said unit being provided adjacent the bottom of the shell with outlets for heated air, and a plurality of deflector plates mounted on the outer surface of said casing end walls, said plates
20 on the air inlet side of said unit being inclined inwardly and upwardly to direct rising air across the central portions of said end walls, and the plates on the air outlet side of said unit extending substantially vertically, and said plates having laterally extending portions turned outwardly away from said end walls for directing said air
25 inwardly against the end walls.

3. A direct fired unit heater comprising a shell, a metal furnace casing disposed in the shell and spaced therefrom with its side walls provided with vertical corrugations extending across the top of the casing, means for forcing a current of air upwardly at one side of said unit in the spaces between said shell and the side and end walls of the casing, a plurality of relatively short deflector plates mounted on said casing side walls in substantially straight parallel lines extending vertically of said side walls and across the top of the casing for directing said air against the casing,
35 each deflector plate having a vertical fin portion secured to said casing and a laterally projecting portion for directing air against the casing and a plurality of deflector plates mounted on the outer surface of said casing end walls, said end wall plates being positioned for directing air across said end walls in a predetermined path.

4. A direct fired unit heater comprising a shell, a metal furnace casing disposed in the shell and spaced therefrom with its side walls provided with vertical corrugations extending across the top of the casing, means for forcing a current of air upwardly at one side of said unit in the spaces between said shell and the side and end walls of the casing, a plurality of relatively short deflector plates mounted on said casing side walls in substantially straight parallel lines extending vertically of said side walls and across the top of the casing for directing said air against the casing, the deflector plates in each line being staggered relative to the plates in the adjacent lines and a plurality of deflector plates mounted on the outer surface of said casing end walls, said
60 end wall plates on the air inlet side of said unit being inclined inwardly and upwardly to direct rising air across the central portions of said end walls.

5. A direct fired unit heater comprising a shell, a metal furnace casing disposed in the shell and spaced therefrom with its side walls provided with vertical corrugations extending across the top of the casing, means for forcing a current of air upwardly at one side of said unit in the spaces
75

between said shell and the side and end walls of the casing, the opposite side of said unit being provided adjacent the bottom of said shell with an outlet for heated air, a plurality of deflector
5 plates mounted on said casing side walls for directing said air against the casing, a plurality of deflector plates mounted on the outer surface of said casing end walls, said end wall plates on the
10 air inlet side of said unit being inclined inwardly and upwardly to direct rising air across the central portions of said end walls, and a plurality of metal fins mounted on the inner surface of the casing to conduct heat to the casing.

6. A direct fired unit heater comprising a shell, a metal furnace casing disposed in the shell and spaced therefrom, means for forcing a current of air through the space between the casing and shell, a plurality of fins projecting outwardly
5 from said casing and extending in the direction of said air current, and an integral vane extending laterally of the outer edge of each fin and having an outwardly bent rear end for directing
10 said air inwardly against the casing.

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