

Oct. 4, 1927.

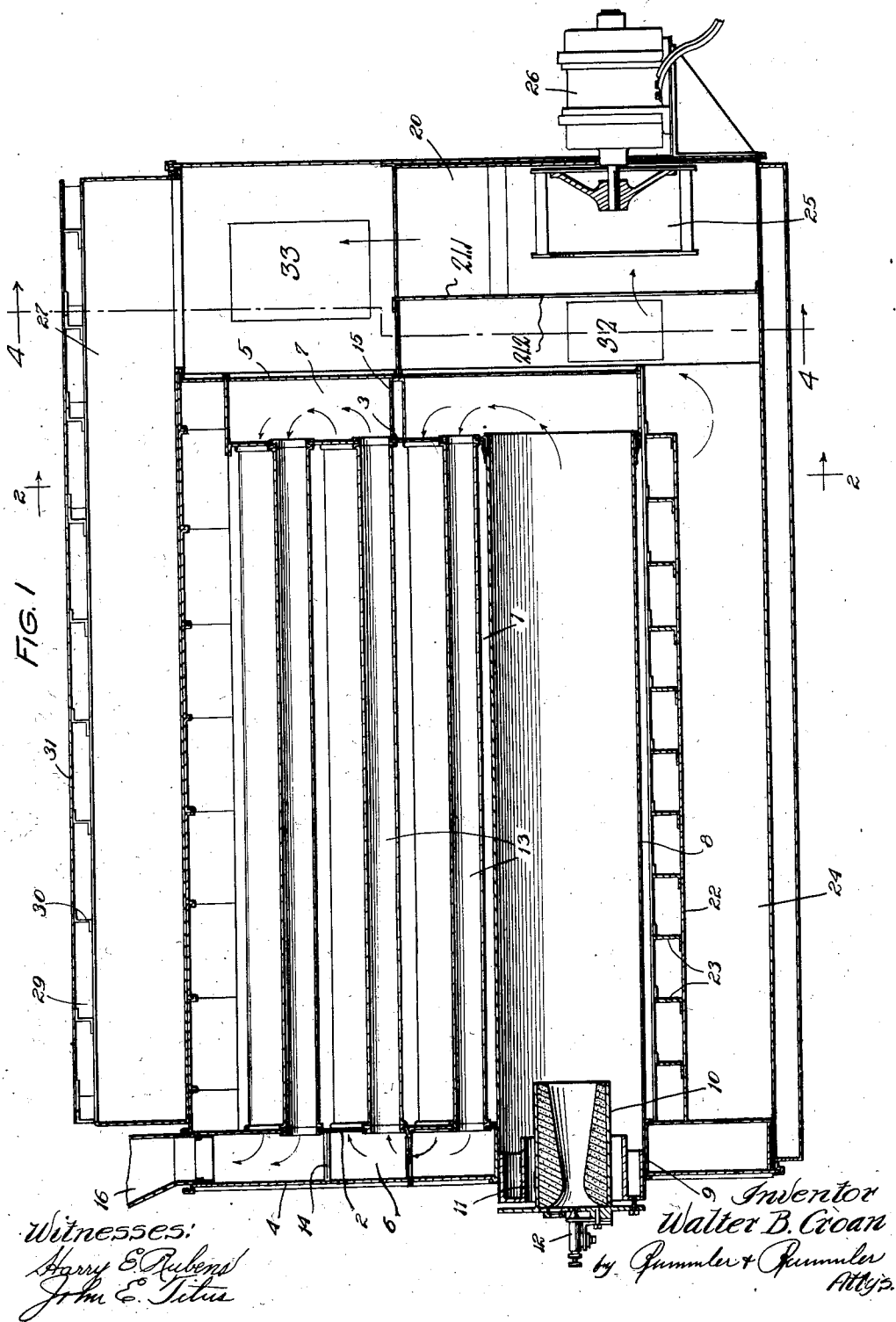
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W. B. CROAN

DIRECT AIR HEATER

Filed Feb. 6, 1926

3 Sheets-Sheet 1



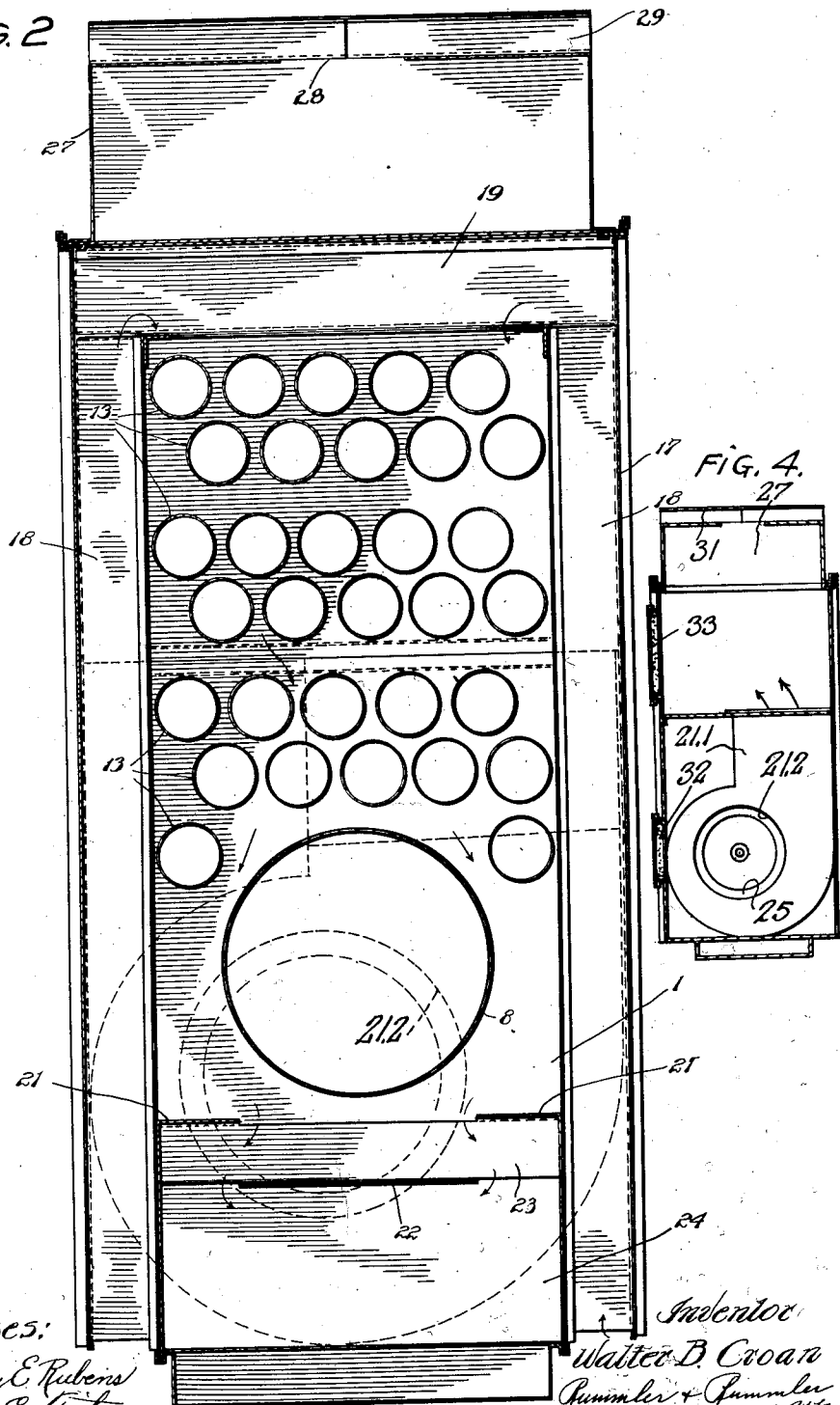
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3 Sheets-Sheet 2

FIG. 2



Witnesses:

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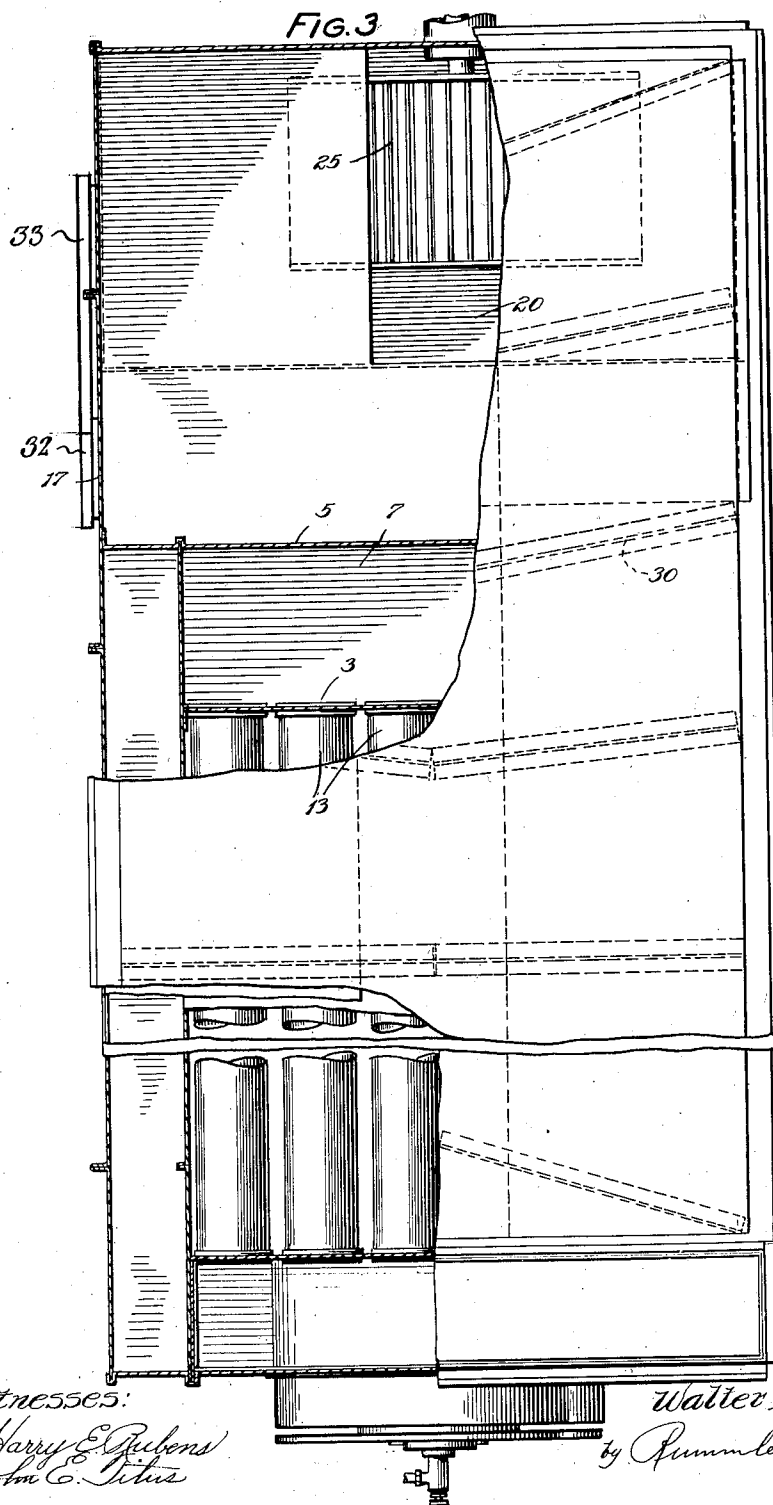
1,644,180

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DIRECT AIR HEATER

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3 Sheets-Sheet 3



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Patented Oct. 4, 1927.

1,644,180

UNITED STATES PATENT OFFICE.

WALTER B. CROAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO DRYING SYSTEMS, INC., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

DIRECT-AIR HEATER.

Application filed February 6, 1926. Serial No. 86,460.

This invention relates to improvements in furnaces in which the intermediate heating mediums, such as steam or water, are dispensed with, and the air is heated by direct contact with the walls of the passages for the burnt gases. This type of heater is, accordingly, designated herein as a direct air heater.

Heretofore, a difficulty met with in such furnaces has been that the high temperatures of combustion melted the walls of the furnace. A medium, such as water, was required to cool the walls in contact with the burning gases, and the heat was transferred to the water and then re-transferred to the heating air by radiation. Also, in furnaces heretofore used, a fibrous lagging was employed to insulate the heating spaces, and the heat absorbed by the lagging was completely lost.

The main objects of this invention are to provide a furnace in which the air is heated by direct contact with the walls of the combustion and fire tubes or flues, to eliminate the heat lost in the water-type boilers in the intermediate medium; to provide an air circulation by which the tubes and walls of the furnace are effectually cooled below the melting point; to provide a cellular insulating space around the furnace through which the air to be heated is drawn, and therein receives the initial heating, and also serves to insulate the furnace; to provide a furnace for heating air directly, which is adapted for sheet metal construction; to provide a direct air heating furnace in which the air drawn around the combustion tube is previously heated a sufficient amount to avoid chilling the burner gases before the combustion is completed, without raising the temperature of the metal walls of the combustion tube above the danger point; and to provide a furnace of high efficiency, in which the temperature of the exhaust gases is as low as practical, and in which the heat of combustion is almost completely transferred to the air being heated.

An illustrative embodiment of this invention is shown in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional elevation of the furnace.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a plan view of the furnace with

parts broken away and parts shown in section.

Fig. 4 is a transverse section through the rear end of the furnace, with parts broken away.

In the drawings is shown a furnace constructed throughout of sheet metal, a high temperature resisting material, such as "Duralloy", being used in the hotter regions. The heating chamber 1 is provided with tube supporting walls 2 and 3 near the front and rear walls 4 and 5 respectively, providing the end header spaces 6 and 7.

The combustion tube 8 is anchored in the inner tube wall 3 and extends through a thimble 9 which spans the space between the walls 2 and 4. The combustion tube 8 is slidable in the thimble 9 to allow for expansion. In the outer end of the combustion tube 8 is inserted the burner nozzle 10, and an annular combustion air inlet passage 11 is provided around the nozzle tube 10. A spray nozzle 12 is directed into the center of the tube 10 and supplies the fuel for combustion.

A nest of fire tubes 13 is supported in the partitions 2 and 3 above the combustion tube 8, and suitable baffle plates 14 and 15 are supplied in the header chambers to direct the burning gases from the combustion tube back and forth through the fire tubes to the exhaust gas outlet 16. The jet of oil spray is ignited at the inner end of the nozzle 10 and is mixed with combustion air drawn through the annular space 11. The resulting combustion is nearly completed at the end of the large tube 8, and the heated gases are then passed through the small tubes 13 so that the heat may be extracted and transferred to the air which is to be used for heating.

An outer shell 17 is provided around the heating chamber 1 and forms the lateral insulating spaces 18, the space 19 over the top of the heating chamber and the fan chamber 20 at the rear.

The upper part of the heating chamber 1 is open, providing an air passage up through the lateral spaces over the top, and down through the nest of fire tubes and past the combustion tube in direct contact with the tube walls.

Below the combustion tube 8 two horizontal plates 21 are supplied along the sides of the chamber 1, and a horizontal baffle

plate 22 is supported directly under the opening between the plates 21, by means of a plurality of transversely extending Z-plates 23. Below the plate 22 is a longitudinal passage 24, which communicates to the inlet of the suction fan 25, located in the chamber 20 and driven by the motor 26. The chamber 20 is formed by means of the fan casing 21.1 which has an inlet aperture 21.2 in the forward wall, through which the air is drawn from beneath the fire tube.

The baffle plate 22 and the transverse partitions 23 serve to distribute the low pressure from the fan 25 along the length of the chamber 24, so that the air is evenly distributed throughout the length of the heating chamber.

From the fan, the air is discharged into the upper receiving chamber 27, which is located on the top of the furnace. A longitudinal central opening 28 is provided in the top of the chamber 27 and communicates with the series of passages 29 which are formed by the vertical partitions 30 between the top sheet 31 and the upper wall of the chamber 27. This arrangement is provided to distribute the air leaving the furnace. Suitable clean-out doors 32 and 33 are provided in the side walls of the rear portion of the furnace.

This furnace, as described, is well adapted for evenly heating large volumes of air to substantially normal temperatures. The residual heat lost when the furnace is stopped, amounts to approximately the amount of heat absorbed by the sheet metal walls. This amount of heat is, of course, comparatively small, and renders the furnace extremely efficient in heating installations where the furnace is frequently started and stopped. The incoming air flowing through the insulating spaces 18 provides an efficient heat insulation, and the heat absorbed therein is retained.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

I claim:

1. In a direct air heater, a heating chamber, a shell around the sides and over the top of the heating chamber forming a heat insulating space closed at the ends and open at the bottom, and means for circulating air upwardly through the insulating space and then downwardly through the heating chamber to prevent loss of heat in the heating chamber.

2. In a direct air heater, a heating chamber, a combustion tube, a nest of fire tubes above the combustion tubes, said tubes extending through the heating chamber, means for directing the burning gases from the combustion tube through the fire tubes, a shell over the sides and top of the heating chamber forming a heat insulating space, and means for circulating air upwardly through the insulating space at the sides of the heater and then downwardly through the heating chamber in direct contact with said tubes.

3. In a direct air heater, a heating chamber having fire tubes extending therethrough, cellular insulating spaces over the sides and top of the heating chamber, a receiving chamber over the top of the air heater, and means for circulating air upwardly through the insulating spaces at the sides, then downwardly through the heating chamber in direct contact with said tubes and then through said receiving chamber.

Signed at Chicago this 4th day of February, 1926.

WALTER B. CROAN.