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INDUSTRIAL HEATING FURNACES

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2 Sheets-Sheet 1

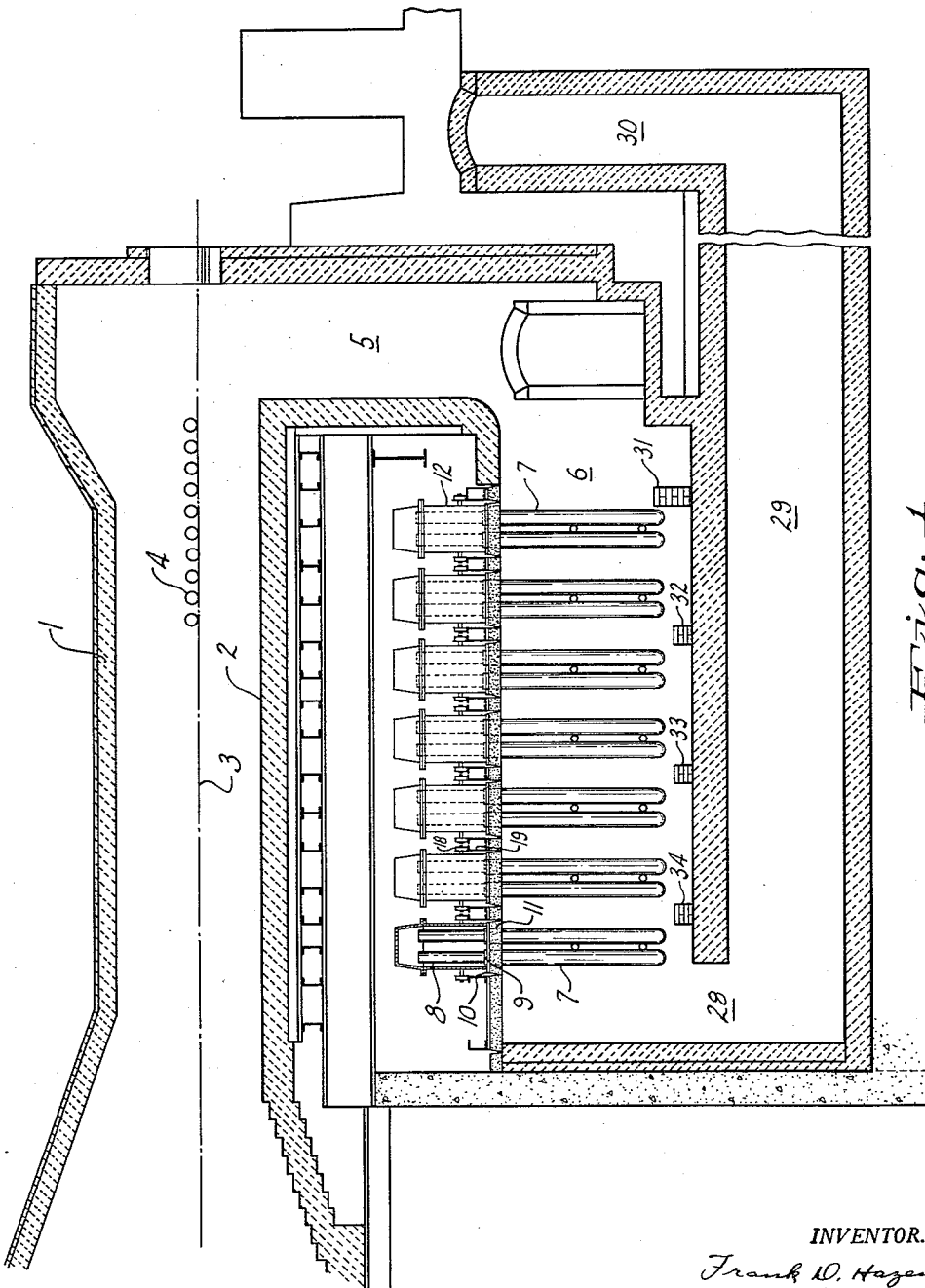


Fig. 1

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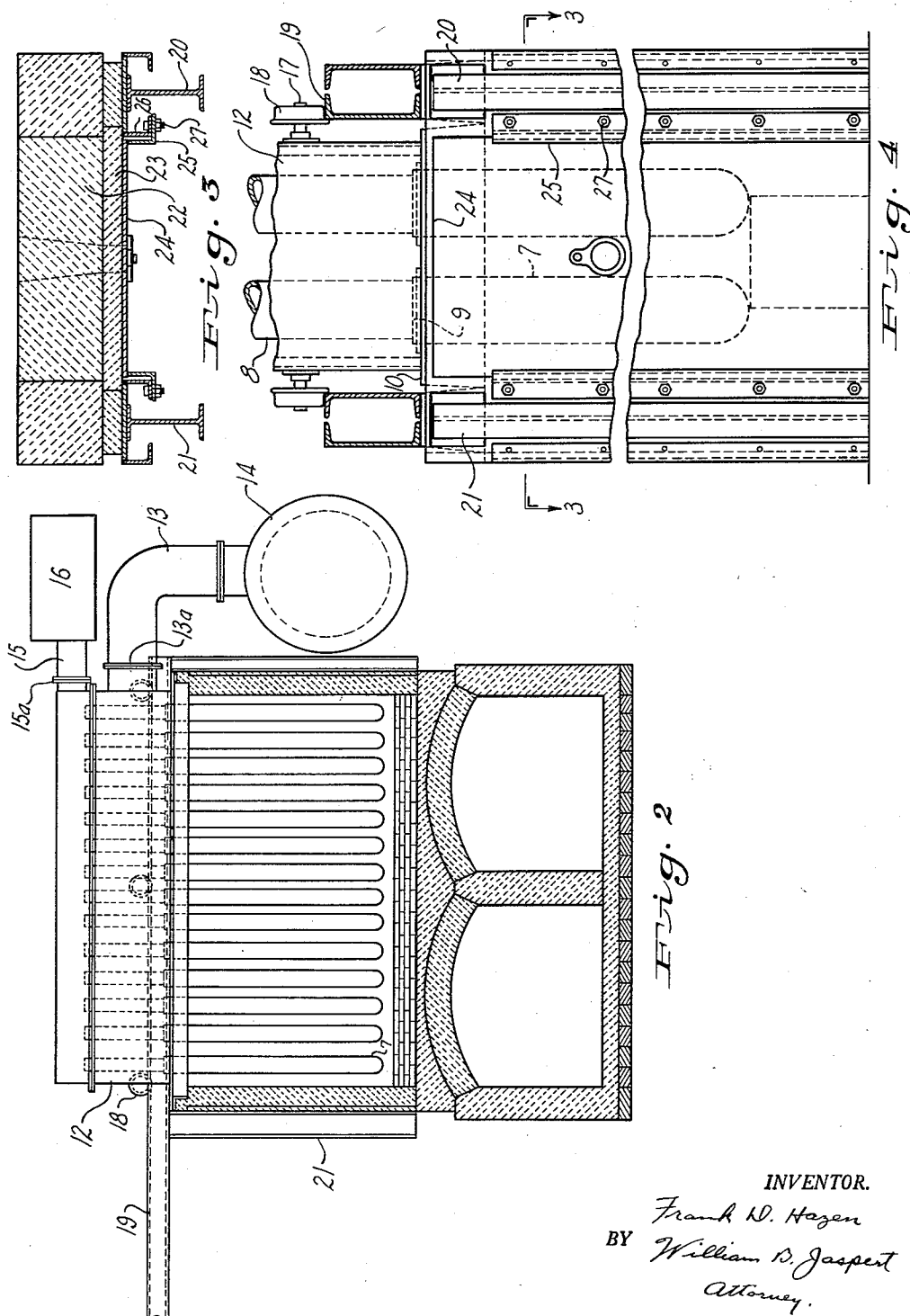
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1

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6 Claims. (Cl. 263—20)

This invention relates to new and useful improvements in industrial heating furnaces, more particularly in furnaces employing recuperator systems for recovering the heat from the products of combustion to preheat air to utilize in the combustion process.

More particularly the invention relates to the mounting of recuperator elements in industrial furnaces in a manner to make them accessible for replacement or repairs, the invention being especially suited where space is limited and where the furnace construction is such that the recuperator elements are located in space not readily accessible for the making of repairs.

It is among the objects of this invention to provide a recuperator structure consisting of units of banks or rows of tubes suspended from header boxes in which the banks of tubes are mounted on rollers and tracks to be slidably removed through separate bulk heads or panels constituting the side walls of the recuperator chamber.

It is a further object of the invention to provide a furnace structure of the above designated character in which the bulk heads for the individual banks of tubes are removable to render the recuperator elements accessible for sliding them out of their position.

These and other objects of the invention will become more apparent from a consideration of the accompanying drawings constituting a part hereof in which like reference characters designate like parts and in which

Fig. 1 is a vertical cross sectional view partially in elevation longitudinally of a furnace embodying the principles of this invention;

Fig. 2 is a vertical cross sectional view transversely of the view of Fig. 1;

Fig. 3 is a cross sectional view of a bulk head taken along the line 3—3, Fig. 4; and

Fig. 4 is a front elevational view of the bulk head and a portion of the recuperator element.

With reference to Fig. 1 of the drawing, the numeral 1 designates the roof of a furnace having a bottom wall 2 for supporting a hearth shown in dash lines at 3 for supporting ingots or billets 4 that are moved from one end of the furnace chamber to the other, such furnaces being known as continuous heating furnaces. The present invention is concerned with furnaces only to the extent of illustrating the relation of the recuperator structure beneath the furnace to which the products of combustion from the furnace passes downward through the passage 5 into a chamber 6.

The recuperator elements consist of banks of tubes 7 in which are disposed smaller inner tubes 8, the tubes 7 being supported by flanges 9 that rest upon plates 10 which support the refractory material 11 such as light weight fire crete. The inner tubes 8 are suspended in the outer tube 7 to maintain an air passage between the outer tube and inner tube for the passage of air to be heated which passes to the header boxes 12 from which it is removed by hot air ducts 13 connected to a manifold 14. This is more clearly shown in Fig. 2. The smaller inner tubes are similarly connected to an air in-

2

let duct 15 leading from a manifold 16 so that the cold air passing from the manifold 16 through ducts 15 into the inner tubes 8 and then through the tubes 8 into the tubes 7 from which they pass upward into the recuperator box will pass through the ducts 13 to the hot air manifold 14.

As shown in Fig. 1, there are double rows of tubes and as appears from Fig. 2, there are 14 tubes in a row and consequently 28 tubes in a bank of tubes that have separate connections from the header boxes to the air inlet and outlet manifold. As shown in Figs. 1 and 4, the header boxes 12 are provided with axles 17 constituting journals for wheels 18 that are supported on tracks 19, the tracks being channel members as shown. The tracks are mounted on buck stays 20 and 21 that are suitably embedded in concrete.

As is more clearly shown in Fig. 3, the side wall of the recuperator chamber 6 consists of a series of bulk heads 22 suitably insulated at 23 and mounted on steel facing 24. These bulk heads are mounted to be removable by means of angles 25 that may be bolted to the flanges of channels 26 fastened to the buck stays 20 and 21. The bulk heads are secured by bolts 27 which when removed permits the removal of the bulk head and the header box with its banks of tubes. For the purpose of utilizing the full capacity of the furnace, it is undesirable to shut down the furnace for any length of time so that the recuperator elements should be accessible for replacement or repairs and for this reason the banks of tubes are removed by propelling the header box 12 by which they are suspended on the track 19. The bulk heads 22 are then replaced and the bolts 27 fastened to seal the recuperator chamber.

So that each bank may be readily disconnected from the cold and hot air ducts, flanges 13a and 15a are provided which, by means of common bolts and packing material, can be readily loosened or fastened for the purpose of removing the header boxes and their suspended tubes.

In the operation of the furnace, the products of combustion from the heating chamber above the recuperator structure pass downwardly through the passage 5 into the recuperator chamber or passage 6, thence downwardly through passage 28 into the flue 29 to the stack 30. Baffle walls 31, 32, 33 and 34 are provided to prevent stratification of the flow of the products of combustion and force it into contact with the tubes 7 in its passage throughout the recuperator chamber 6, the tubes 7 being heated and the cold air delivered to the bottom of the tubes out of the ends of the inner tubes 8 pass around the inner tubes and become heated before again returning to the header boxes 12 and from thence to the hot air manifold 14.

It is evident from the foregoing description of this invention that by simply removing the bulk heads 22 in the manner described and rolling the header boxes with their suspended tubes on the tracks 19, speedy repairs and replacements may be made with a minimum of shut down of the furnace and it is further apparent that by means of the sliding mount of the recuperator elements no head space is required for the removal thereof since they may be quickly removed through the side wall of the recuperator chamber by removing the individual panels for the particular bank that it is desired to replace or repair.

Although one embodiment of the invention has been herein illustrated and described, it will be evident to those skilled in the art that various modifications may be made in the details of construction without departing from the principles herein set forth. For example, since the bulk heads form the walls of the recuperator chamber, each header box and its banks of tubes is a recuperator unit

which may be employed single or in multiples below or above a furnace structure.

I claim:

1. In an industrial heating furnace, a plurality of communicating parallel chambers, one of which being adapted for heating material passing therethrough, and the other being a recuperator chamber, banks of heat exchange tubes in said last-named chamber suspended from header boxes in the path of the products of combustion from said first-named chamber, said header boxes normally forming a continuous roof for said recuperation chamber and being connected to cold and hot air manifold ducts and said header boxes being mounted on wheeled axles to be removable from said recuperator chamber, a side wall of said last-named chamber being constructed of removable bulk heads to provide openings for wheeling the banks of boxes and tubes out of said chamber transversely of the longitudinal axis of said chamber.

2. In an industrial heating furnace, a plurality of superposed parallel chambers, the end of one chamber communicating with the end of the other and the bottom chamber being connected at one end to a stack, the last-named chamber being a recuperator chamber, banks of tubes suspended from header boxes movable on tracks disposed transversely of the longitudinal axis of said last-named chamber and having connections with cold and hot air ducts, said header boxes normally forming a continuous roof for said recuperator chamber, a side wall of said last-named chamber consisting of removable sections for exposing the recuperator tubes for removal from said chamber.

3. In an industrial heating furnace, a plurality of superposed parallel chambers, the end of one chamber communicating with the end of the other and the bottom chamber being connected at one end to a stack, the last-named chamber being a recuperator chamber, banks of tubes suspended from header boxes movable on tracks disposed transversely of the longitudinal axis of said chamber and having connections with cold and hot air ducts, said header boxes normally forming a continuous roof for said recuperator chamber, a side wall of said last-named chamber consisting of removable sections for exposing the recuperator tubes for removal from said chamber, said removable sections having spaced vertical studs, a flange plate secured to said studs and bulkheads

having flanges overlapping the flanges of said plates for receiving fastening means.

4. A heating furnace as set forth in the next preceding claim in which the vertical studs constitute rail supports, having rails mounted thereon, and the header boxes having flanged wheels for rolling movement on said rails.

5. A heating furnace as set forth in claim 3 in which the vertical studs and the bulkheads are provided with heat insulation to constitute a portion of the side wall of the chamber in which the tubes are suspended.

6. In an industrial heating furnace, a plurality of superposed parallel chambers, the end of one chamber communicating with an end of the other, and the bottom chamber being connected at one end to a stack, the last-named chamber being a recuperator chamber having longitudinally spaced rails extending transversely thereof, banks of tubes suspended from header boxes having wheeled axles supported for movement on said rails, said header boxes normally forming a continuous roof for said recuperator chamber and being divided into a cold and hot air chamber having connections with a cold and hot air duct, and the tubes of said banks of tubes consisting of an inner tube communicating with the cold air chamber disposed in an outer tube closed at one end and having its open end communicating with the hot air chamber, the inner and outer tubes being spaced apart to form an air flow passage from the cold to the hot air chambers, and their respective ducts, a side wall of the chamber in which the tubes are suspended consisting of removable wall sections.

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