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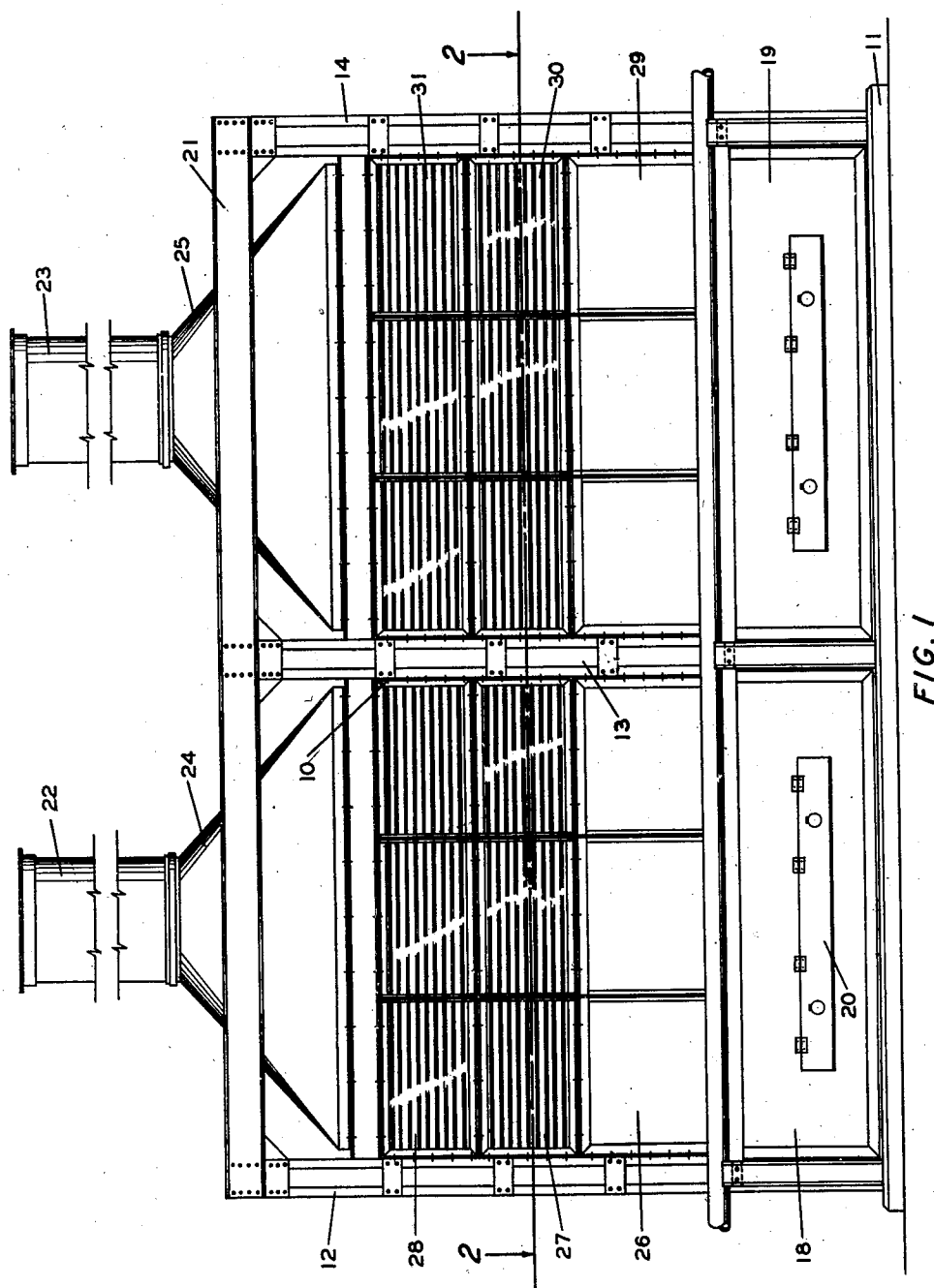
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2,315,833

PANEL FURNACE CONSTRUCTION

Filed Sept. 28, 1939

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

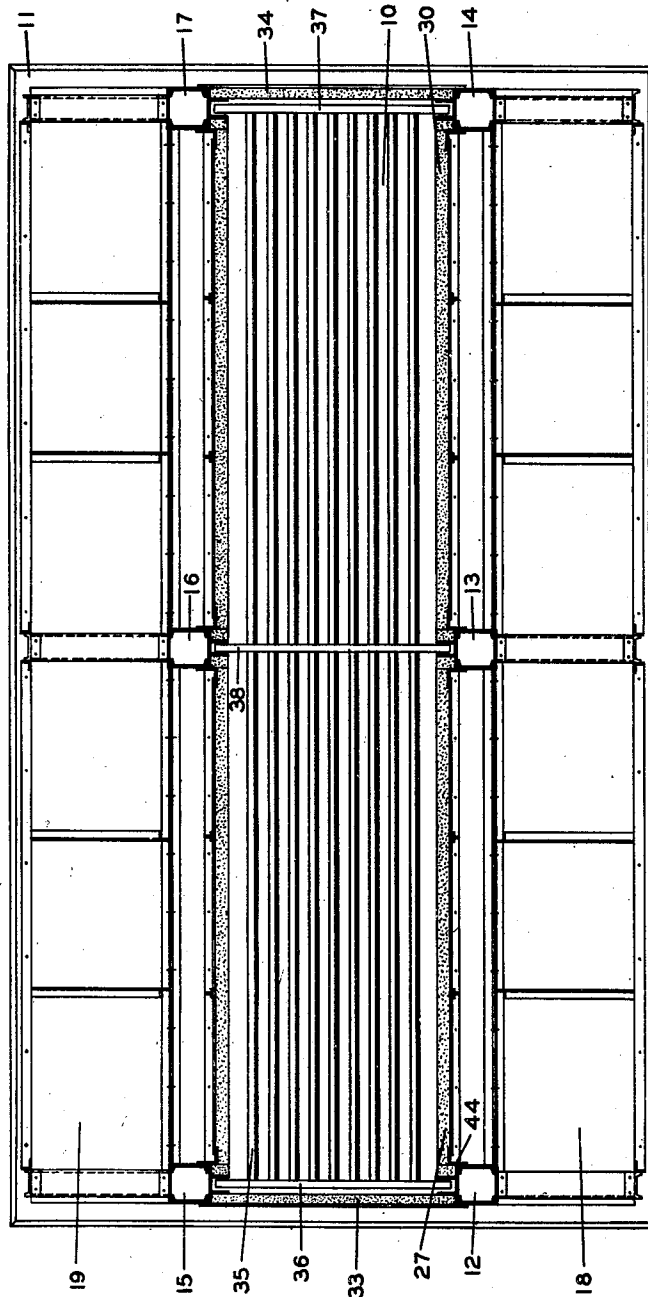


FIG. 2

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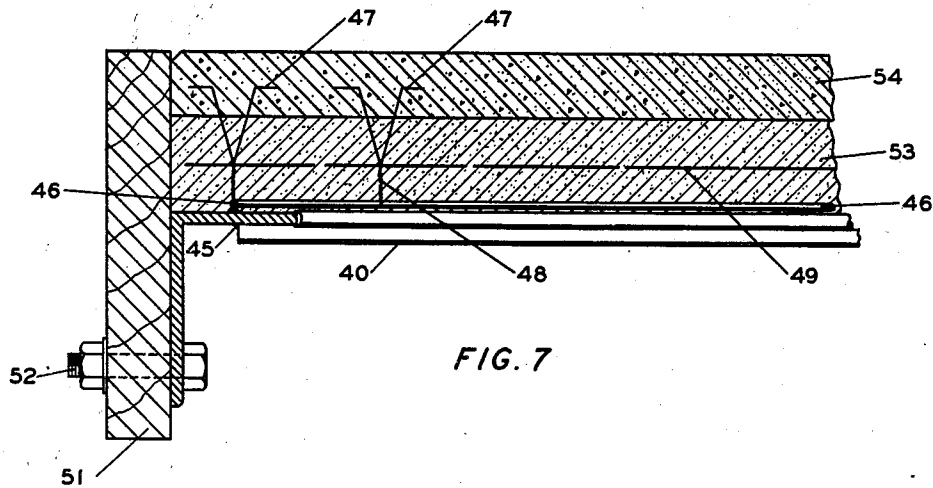


FIG. 7

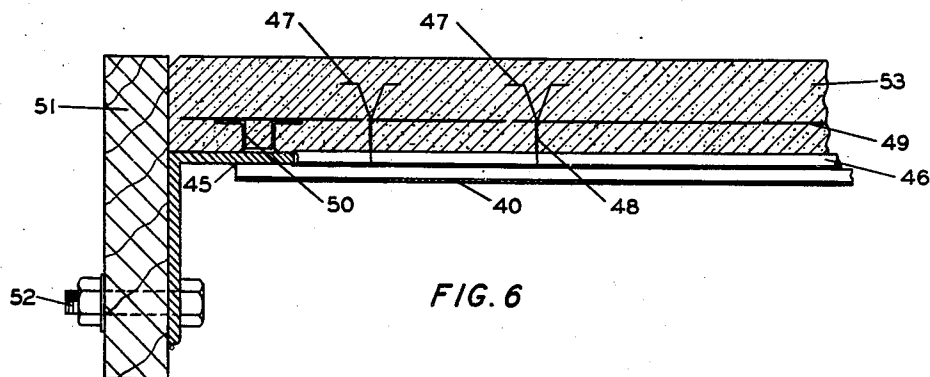


FIG. 6

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PANEL FURNACE CONSTRUCTION

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3 Claims. (Cl. 72-101)

This invention relates to a sectional furnace construction wherein the side walls of the furnace are made in sections, which sections are removable from the main furnace body for repair purposes when needed or are removed from the furnace to allow access to the tube banks within the furnace.

Heretofore in the oil industry or any industry where large banks of tubes have been heated within a furnace, it has been one of the practices to build up the furnace of brick construction. This type of furnace had an inner layer of fire brick and an outer layer of brick of cheaper quality and not possessing the heat resisting qualities of the fire brick or tile. The whole furnace is built up from the ground by experienced bricklayers and once completed is an integral structure. If anything goes wrong with the wall construction of the furnace or the tubes within the furnace, it is necessary to allow the furnace to cool to the point where a man can enter the furnace and make the necessary repairs. This is a long and tedious operation and requires that the furnace be out of operation over a long period of time namely while the furnace is cooling, being repaired and being brought up to heat again. The repair work is exceedingly difficult in view of the confined quarters and usually becomes a very expensive operation. Furnaces have been built with a metal backing and lined with fire brick, but these furnaces add nothing to the solid brick furnaces for repair purposes.

Other furnace constructions, comprise an inner layer of fire brick, an outer layer of steel or some plastic composition and a layer of insulating material between the two. While the steel plate and insulating material can be removed in this instance to get to the fire brick, very little time is saved over making the repairs from the inside. The supported side wall type of furnace with an inner layer of tile, insulating layer and steel panel backing is also known to the art. The steel backing in this type furnace can be removed and the tile reached from the outside. The tile of this furnace has high heat storage and will not cool quickly. The tile are heavy and expensive, which increases the weight of the structure to support them and thus the total cost of the furnace is materially increased. Insulating brick got away from the high heat storage factor of the tile, but these brick are very expensive and also require means of support. They are supported on rods which makes removal of any brick in the side wall quite a problem.

The industry has felt the need over a consider-

able period of time, for a panel furnace construction, where a panel could be removed from the wall of the furnace, tubes repaired within the furnace or the section repaired or a new section added to the furnace. The industry has wanted a panel construction wherein the refractory and insulating material had low heat storage, low cost, could be repaired easily and could be constructed in a short time. This type of construction has numerous advantages to the industry. If a section of the wall of the furnace burns out, it is not necessary to completely cool the furnace, but the panel can be removed, a new panel can be placed in the wall and the furnace is back in operation in a very short period of time. The damaged section can be repaired at leisure without holding the furnace out of operation. If it is the tubing that is in need of repair, by removing the sections or panels a workman can gain access to the tubes without crawling inside the furnace. This leads to speedier repair jobs on the furnaces and also less dangerous working surroundings for the workmen.

The sections must be made light in weight so they can be handled easily and must possess sufficient strength to withstand the usage in furnace wall construction. The panel of the present invention has a metal backing on which is placed a castable refractory material suitably reinforced. The metallic backing member is corrugated and framed with a structural member so the member may be made as light as possible to keep the weight down and also have the member possess sufficient strength. The castable refractory member is reinforced in much the same manner that concrete is reinforced with metallic reinforcing.

Any castable refractory material may be used and several have been found which are suitable. The refractory material must have good resistance to spalling, low coefficient of expansion and contraction, good insulating properties, heat resistance, low density, moldable, and possess sufficient strength to withstand its use in furnace construction.

It is an object of the invention to provide a sectional or panel side wall construction for a furnace.

A further object of the invention is to provide a sectional or panel side wall construction for a furnace wherein the panels have a backing of sufficient rigidity to support the wall of the furnace and are coated with a layer or layers of heat resisting, insulating material.

It is still a further object of the invention to

provide a panel or sectional wall furnace construction wherein the panel or panels can be removed after the furnace is constructed without disturbing the remaining structure of the furnace.

It is still a further object of the invention to provide a furnace construction which can be built at the site of use with the panels being molded at this point and the whole furnace being constructed with a minimum of expense and without the use of skilled tradesmen.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings, forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevational view of the furnace fully assembled,

Figure 2 is a sectional view of the furnace assembly taken on the line 2-2 of Figure 1,

Figure 3 is a plan view of one panel member of the furnace assembly showing the backing and reinforcing members before the insulating material has been cast in place,

Figure 4 is a sectional view of the panel taken on the line 4-4 of Figure 3,

Figure 5 is a sectional view of the panel taken on the line 5-5 of Figure 3,

Figure 6 is a cross-sectional view of the panel showing the backing, re-inforcing and insulating material in place in a mold, and

Figure 7 is a cross-sectional view of a modified panel construction.

In the drawings wherein for the purpose of illustration is shown a preferred embodiment of our invention, the numeral 10 represents the furnace structure as a whole with 11 representing the base upon which the furnace structure rests. Solidly mounted on the base 11 are the buckstays 12, 13 and 14, and 15, 16 and 17 shown in Figure 2 which serve the purpose of supporting columns for the furnace structure. At the bottom of the furnace structure are wind boxes 18 on one side of the furnace and 19 on the other side, controlled by doors 20 which allow the proper portion of air needed to support combustion to enter to the burners. Belt channels 21 tie the buckstays together at the top thereof and tend to make a rigid supporting member. The top of the furnace has stacks 22 and 23 which connect with the furnace proper through transition pieces 24 and 25 to carry away the products of combustion from the furnace. The side wall of the furnace is shown as made in sections 26, 27 and 28; and sections 29, 30 and 31 which are supported, one on top of the other and at the same time each section is fastened to the buckstays by means of angle irons 44 being located to the buckstays and the angle irons 44 being welded to the backing of the panel. The end wall 33 of the furnace is of the same panel construction as the side wall panels and is attached to the buckstays in the same manner. The end wall 34 may be of the same construction as the side panels or may be so constructed as to form a door into the furnace.

The tubing within the furnace is shown at 35 and said tubing connects into headers 36 and 37 at each end of the furnace. The burners are in the bottom of the furnace and are of well known construction in the furnace art. The hot gases pass up into the furnace around the tubes and out through the stacks at the top of the furnace.

The panel construction in the area of the furnace shown by sections or panels 26 and 29 are somewhat different from the sections higher up. This area is within the highest temperature zone within the furnace and the insulating layer must be of a thicker construction to withstand the additional heat. Where the sections join into the buckstays there is a space left the width of the buckstays. Between the buckstays also run supporting members 38 for the tubes. The space is filled by a plastic insulating material, the same as used on the panels in order to have a completely insulated furnace interior.

Referring now more particularly to Figures 3 to 7, the details of construction of the individual panels are more clearly shown. The backing 40 of each panel is of metal, which metal is of corrugated construction, as shown in Figures 3 and 5. Figure 3 shows the panel before the insulating material has been added thereto. Attached all the way around on each side of the metallic member 40 are the angle irons 41, 42, 43 and 44 which are attached to the member 40 by welding 45 as shown in Figures 6 and 7. Reinforcing wire 46 is laid on the metallic member 40, run back and forth across the metallic member 40 and welded to the ridges of the corrugated metallic member 40. Within the valleys of the metallic member 40 and wrapped around the reinforcing member 46 are the reinforcing wires 47 which are twisted as at 48 and the upper ends spread outwardly. The numeral 49 represents a layer of approximately 2-inch mesh wire netting, attached to the reinforcing members 47 and spaced from the main body of the metallic backing 40. Reinforcing members 50 may be added around the edges of the backing member 40 to serve as a support for the outer edges of the mesh member 49 and add greater rigidity to the panel at the edges. The member 51 serves as a mold and is bolted to the angle iron by bolts 52. With the form 51 in place, the panel is ready to have the insulating material 53 in Figure 6 poured into place or as in Figure 7, the two layers 53 and 54 poured in place.

In assembling and casting the panel sections, the backing or corrugated member 40 is already cut to the proper size and is ready to receive the channel irons 41, 42, 43, and 44. The channel irons are welded to the member 40 in the position clearly shown in Figures 6 and 7. After the angle irons are in place, the reinforcing member 46 is placed on the member 40 and welded at some points to the angle irons and at others on the ridges of the corrugated portions in the member 40. The reinforcing wires 47 are next run through the valleys of the member 40 and around the reinforcing member 46. The wire 47 is twisted as shown in Figures 6 and 7 for a distance spaced from the member 40. The ends of the wires 47 are left straight and the mesh netting 49 is slipped on over the wires after which the wires 47 are spread out as shown. The members 50 have been welded to the member 40 before the mesh screen 49 has been added. Next the form 51 is bolted into place and the panel is ready to receive the castable refractory material.

The refractory material must be one that is light in weight so that the sections may be large enough to be economical and yet not be too large for handling. The material must be heat resisting and also be a good heat insulator. In most instances one layer of refractory material is sufficient to provide both the heat resisting and in-

insulating qualities, but with increased temperatures it becomes necessary to use two layers at times. Where two layers of refractory material are employed, the outer layer may be selected for its heat resisting qualities while the inner layer may be chosen for its insulating properties. The refractory material must further have a low coefficient of expansion and contraction so as not to pull loose from the metal backing upon heating and cooling.

The property of moldability is one of prime importance and makes the panel construction possible and economical. It is very advantageous to cast the panels at the point of use and not be troubled with the problem of having to ship the panels from some point of manufacture and assembly. The refractory material is mixed with water, and a plastic is made. This plastic is placed on the metallic backing and within the form 51 and allowed to cure properly. About the middle of the curing period the surface of the refractory material is given a slight trowling to smooth it off. When cured the forms are removed and the sections are ready to be put in place.

The sections 27 and 28, in the area of the furnace where the temperature is somewhat lower than the area closer to the burners, may have the panel construction shown in Figure 6. In the area of the furnace defined by the panels 26 and 29, the temperature is much higher and a material of much higher heat resistivity must be used. The two layer panel construction of Figure 7 is very suitable for this purpose.

Applicants' present panel construction has been shown in the box type of furnace because this type furnace lends itself well to illustration purposes. It is to be understood however, that this type furnace was chosen only for illustrative purposes and that the present panel can be used in any type furnace construction along this general line and applicants do not wish to restrict their invention to any one particular type furnace. It is to be further understood that while the description of the present panel construction in a furnace has been directed to the panel section being in the side wall of the furnace, the side wall was chosen only for illustrative purposes and the panel can be used in the ceiling or flooring of the furnace as well as the side wall and the sections connected together in the same manner as the sections are connected in the side walls.

It is to be understood that the form of our invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in shape, size, arrangement of parts, and choice of refractory materials, may

be resorted to without departing from the spirit of our invention, or the scope of the subjoined claims.

Having thus described our invention, we claim:

1. A furnace structure at least partially enclosed with removable panel sections, said panel sections being provided with supporting members and comprising a corrugated steel backing, metallic reinforcing including a reinforcing rod welded to the corrugated steel backing at the ridges of said corrugations, said metallic reinforcing being embedded in a refractory lining cast directly upon the backing and substantially coextensive therewith providing the inner wall of the furnace exposed to high temperatures, the panels being provided with flanges extending rearwardly and secured to said supporting members so as to be removable as a unit from the furnace.

2. A furnace structure at least partially enclosed with removable panel sections, said panel sections being provided with supporting members and comprising a corrugated steel backing, metallic reinforcing including a reinforcing rod welded to the corrugated steel backing at the ridges of said corrugations, metallic wire attached to the reinforcing rod and a wire netting spaced from the backing and secured to the wire, said metallic reinforcing being embedded in a refractory lining cast directly upon the backing and substantially coextensive therewith providing the inner wall of the furnace exposed to high temperatures, the panels being provided with flanges extending rearwardly and bolted to said supporting members so as to be removable as a unit from the exterior of the furnace.

3. A furnace structure at least partially enclosed with removable panel sections, said panel sections being provided with supporting members and comprising a corrugated steel backing, metallic reinforcing including a reinforcing rod welded to the corrugated steel backing at the ridges of said corrugations and wire secured to said rod, insulating material cast directly upon the backing and coextensive therewith, the reinforcing rod being embedded in the insulating material, a refractory lining cast directly upon the insulating material and coextensive with the backing, the reinforcing wire being embedded in the insulating material and extending there-through into the refractory lining, said refractory lining providing the inner wall of the furnace exposed to high temperatures, the panels being provided with flanges extending rearwardly and secured to said supporting members so as to be removable as a unit from the exterior of the furnace.

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