

April 7, 1942.

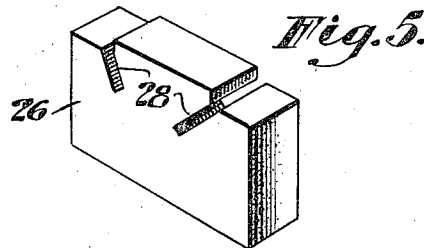
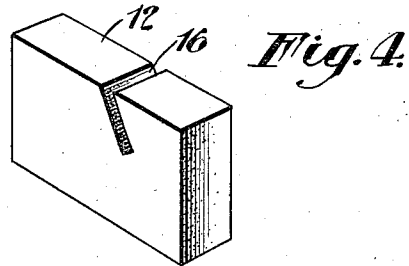
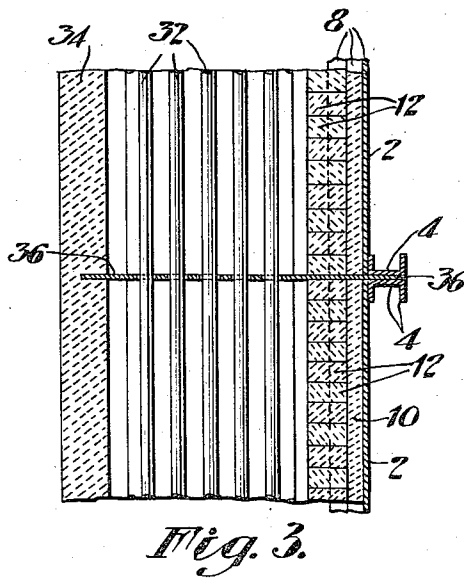
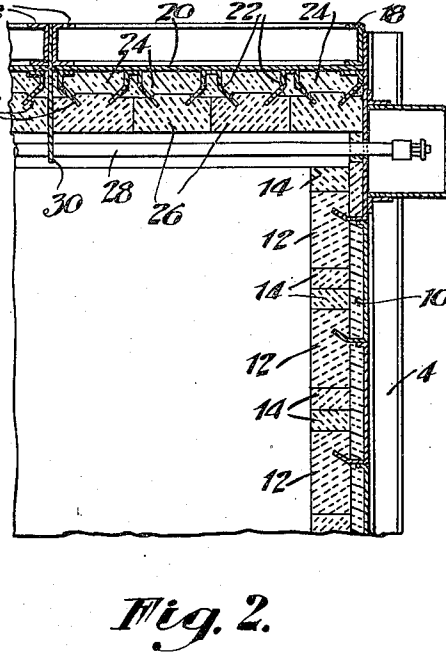
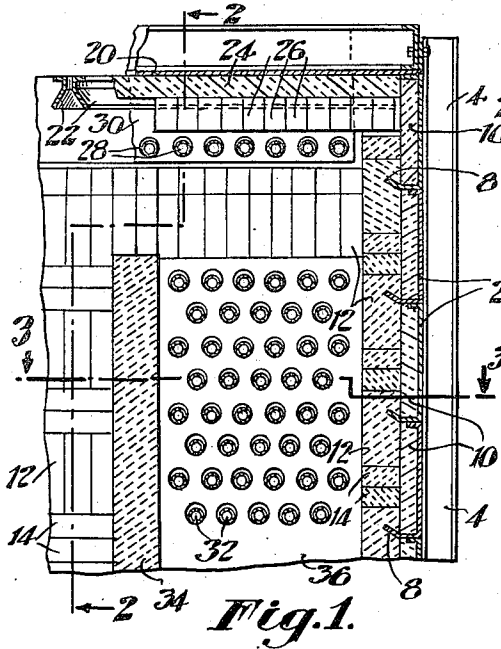
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PIPE STILL FURNACE STRUCTURE

Filed Dec. 14, 1938

2 Sheets-Sheet 1



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PIPE STILL FURNACE STRUCTURE

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2 Sheets-Sheet 2

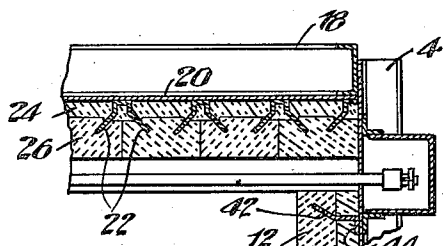


Fig. 6.

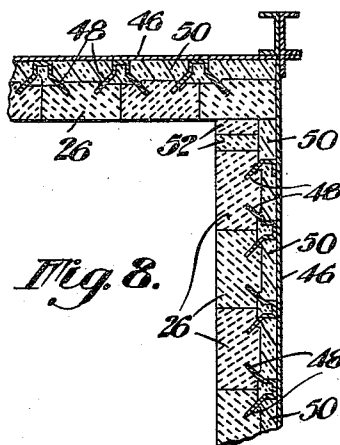


Fig. 8.

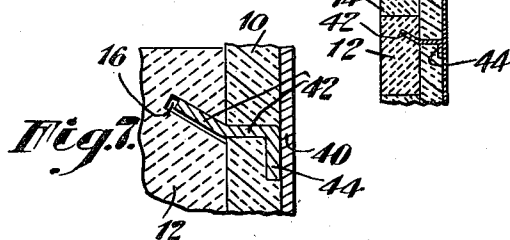


Fig. 7.

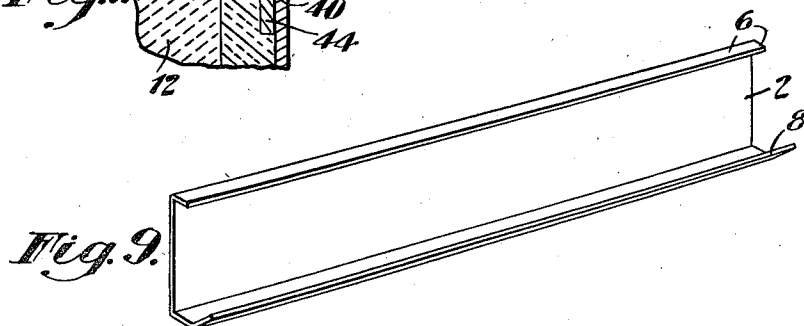


Fig. 9.

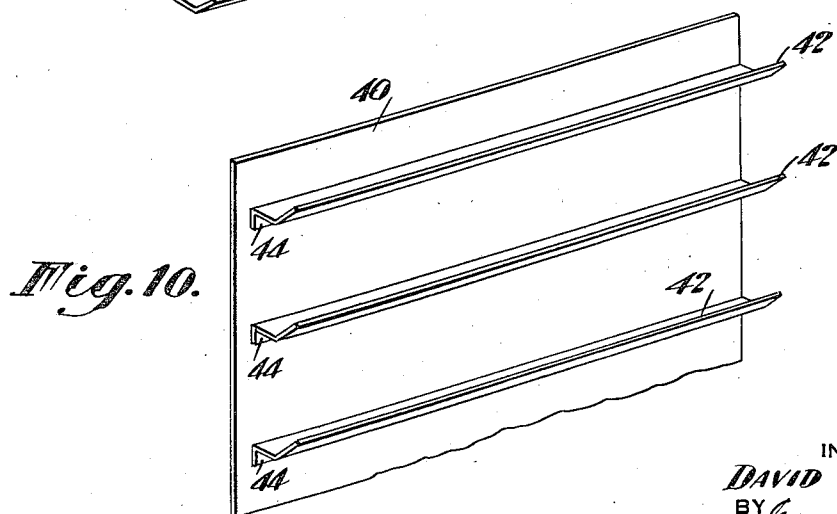


Fig. 10.

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PIPE STILL FURNACE STRUCTURE

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2 Claims. (Cl. 122-510)

This invention relates to improvements in the structure of pipe still furnaces, and more particularly to pipe stills or tubular heaters used for the distillation, cracking or conversion of hydrocarbons such as petroleum oil and its products.

Pipe still furnaces have been used for many years in the processing of petroleum, and these furnaces usually comprise a rather massive structure, sometimes including both outside and inside walls as well as supporting structure for the tubes which make up the coils for heating the oil. The inside walls or lining structure of these furnaces also usually include rather thick fire brick for the protection of any steel reinforcing or outside brick construction. Pipe still furnaces used for the conversion of hydrocarbons into motor fuel constituents often include from 4000 to 6000 feet of heavy tubing which must be supported by the furnace structure.

The primary object of the present invention is to provide a pipe still furnace adapted to perform the usual functions for which pipe still furnaces are used, and at the same time comprise a relatively light structure which is easily assembled.

A further object of the invention is to provide an improved wall structure for furnaces and heaters which is particularly adapted for the construction of pipe still furnaces.

Accordingly, the improved furnace structure of the present invention comprises a wall structure including an outside steel plate provided with inwardly extended flange-like hooks or hangers, a layer of insulation on the inside of the wall plate between the hangers and a layer of refractory heat insulating brick suspended in a specific manner on said hangers and resting against said insulation.

Other objects, features and advantages of the furnace improvement of the present invention will be apparent to those skilled in the art from the following more detailed description thereof taken in connection with the accompanying drawings in which:

Fig. 1 is a broken vertical sectional view of a portion of a pipe still furnace constructed in accordance with the features of the present invention.

Fig. 2 is a vertical sectional view of the portion of the pipe still furnace shown in Fig. 1 taken on the line 2-2.

Fig. 3 is a horizontal sectional view showing a broken portion of the structure of Fig. 1 taken on the line 3-3.

Fig. 4 is a perspective view of one of the porous insulating fire brick used in the wall structures shown in Figs. 1 and 2.

Fig. 5 is a perspective view of a different form of porous insulating fire brick used in the roof construction as shown in Fig. 2, and also in a modified wall structure as shown in Fig. 8.

Fig. 6 is a view similar to that of Fig. 2 showing a modified form of side wall construction.

Fig. 7 is an enlarged broken vertical sectional view showing certain details of the side wall construction illustrated in Fig. 6.

Fig. 8 is a broken horizontal sectional view showing a modified form of side wall construction in which the fire brick shown in Fig. 5 are employed.

Fig. 9 is a perspective view of one of the side wall plate and hanger elements shown in Figs. 1 and 2.

Fig. 10 is a perspective view of the side wall panel and attached flange-like hangers such as that used in the wall construction shown in Fig. 6.

The pipe still furnace constructed in accordance with the preferred form of the invention as shown in Figs. 1 and 2 of the drawings comprises a side wall structure preferably made up of a plurality of panels which are readily assembled. In Fig. 1 each panel comprises a plurality of horizontal plates 2 shown in perspective in Fig. 9. These plates are mounted in vertical series and attached to vertical channel irons 4 by bolting, riveting or welding. The wall of the furnace may be comprised of a plurality of panel sections each of which will consist of a plurality of the plates 2, the ends of which are attached to vertical channel irons 4. Adjacent channel irons of the assembled panels are in turn attached to each other back to back by bolting or by other suitable method of attachment. (See Fig. 3.)

The side wall plates 2 as shown in Fig. 9 include a small right angle flange member 6 and a flange-like bracket 8 comprising an initial 90° horizontal section and an upturned section bent at about 30° to the horizontal. These plates are assembled as shown in Figs. 1, 2 and 3, to form the panels of the outside wall of the furnace.

The remainder of the side wall of the furnace comprises next about 2" of "85% magnesite" insulation 10 mounted immediately on the inside of the plates 2 between the brackets 8, and finally a fire brick lining 4½" thick, composed of rows of fire brick 12 hung on the brackets 8 and two rows of fire brick keys 14 resting on each row of

fire brick 12. The brick 12 are preferably porous insulation fire brick 9 inches long, $4\frac{1}{2}$ inches wide and 3 inches in thickness. The fire brick keys 14 are also of the porous heat insulation type 3" by 3" by $4\frac{1}{2}$ ". As indicated above, the fire brick are supported on the brackets 8 so that they provide a furnace lining $4\frac{1}{2}$ inches thick.

In assembling the side wall structure shown in Figs. 1 and 2, the bracket plates 2 are secured to the supporting channel irons 4, either before or after being set in place, the magnesia insulation preferably in slab form is set against the plates and then the rows of fire brick 12 are placed on the bracket hangers 8. Each of the brick 12 is provided with a slot 16 (Fig. 4) which is deeper than the projection of the bracket 8 beyond the magnesia, so that the brick 12 will rest against the magnesia rather than against the edge of the bracket 8, as shown in enlarged detail in Fig. 7. After the rows of fire brick 12 are in place the small key brick 14 are simply laid on top of the rows of brick 12 to fill the intermediate spaces. Two rows of key brick are preferably used in order to facilitate the removal of any row or part of a row of fire brick 12 for purposes of repair or replacement.

From the description of the side walls shown in Figs. 1, 2 and 3 given above, it is apparent that the side wall of the furnace may be readily assembled as well as readily repaired or replaced in any detail. For example, an entire panel of the side wall may be removed and replaced without disturbing the remainder of the wall, or a side wall plate 2 may be removed by simply removing two sets of keys 14 and two rows of fire brick 12. It is furthermore apparent that the smallest unit in the wall structure may be repaired or replaced without the necessity of disturbing any of the remainder of the wall.

The pipe still furnace as shown in Figures 1 to 3 preferably comprises a roof structure also made up of panels comprising channel irons 18 to which is attached a steel plate 20 which in turn supports attached hanger brackets 22. The remainder of the roof comprises a layer of magnesia insulation 24 between the brackets 22 and fire brick 26 supported on the brackets as shown. The fire brick 26 are shown in enlarged detail in Fig. 5 and each includes a pair of converging slots 28. The brackets 22 extend lengthwise of the roof panels and entirely across the furnace. After the insulation 24 is in place, the fire brick 26 are simply slid onto the end of the brackets until the rows of the fire brick completely cover the inside of the roof of the furnace. It will be noted as shown in Fig. 2, the brackets 22 are bent similar to the side wall brackets 8, but that except for the outside brackets of a panel, they are constructed in duplicate form. It will also be noted that two bracket hangers are required to support a single row of the fire brick 26. The roof panels may be assembled, including brick, on the ground, reverse side up, and then set in place.

The roof of the furnace is supported by the channel irons 18 which are in turn supported by the vertical channel irons 4, by any suitable method of attachment such as by bolting, riveting or welding. The furnace of the present invention however is preferably bolted together so that any sections may be readily removed for repair of the internal structure such as bridge walls and heating tubes. A furnace of this type may also be taken down and assembled in a

different location without material damage to any portion of the structure.

Provision is made in the pipe still furnace structure shown in Figs. 1 to 3 for suitably securing the usual tube sheets or tube supports used in the pipe still furnace. For example, the roof tubes 28 may be supported at intermediate points in holes cut through depending sheets of steel such as the sheet 30 which extends between two rows of fire brick 26 and in fact is mounted between two of the roof panels, so that the sheet 30 is attached directly between the backs of two adjacent channel irons 18, as shown in Fig. 2. Such a tube support may be inserted between all adjacent roof panels.

The furnace shown in Figs. 1 to 3, may also be provided with a tube bank comprising a plurality of tubes 32 mounted at the side of the furnace, back of a bridge wall 34. The tubes of such a tube bank always require intermediate supports, since they are usually from 20 to 30 feet in length, and in the present instance, such supports 36 are provided. Each of the supports 36 comprises a steel plate provided with holes for each of the tubes 32, as shown in Fig. 1. Each of the plates 36 as shown in Fig. 3 is mounted between adjacent side wall panels, so that it extends between the fire brick and insulation of the adjacent panels, and is secured between the vertical channel irons 4. The opposite side of the plate 36 extends into and is attached to the supporting structure of the bridge wall 34.

The modified form of construction shown in Fig. 6 differs only from that shown in Figs. 1 and 2, in that the side wall panel is made up of a steel plate or plates 40 which is secured to the vertical channels 4 in the same manner as in Figs. 1 and 3. In Fig. 6 the hangers for the fire brick 12 comprise horizontal flanges 42 which are welded or riveted to the plate 40. A portion of the panel plate 40, and attached hangers or brackets 42, is shown in perspective in Fig. 10. It will be noted that each of the brackets 42 is provided with a vertical angle section 44 to increase its strength and to facilitate its attachment to the plate 40. This structure and relationship is shown in enlarged detail in Fig. 7 which also shows the relationship of the sizes of the slot 16 in the fire brick 12 to the hanger bracket 42. The longer slot permits the fire brick 12 to rest directly against the insulation 10.

The panel 40 as shown in Fig. 10 represents a form of panel used as the end or corner panel of the furnace wall, since at the left the hanger brackets 42 do not extend entirely to the edge of the panel plate 40 where they would otherwise interfere with the brackets of the adjacent panel, extending at an angle of 90°.

The modified wall structure shown in horizontal section in Fig. 8 is one in which the fire brick 26 (Fig. 5) are employed in the side wall construction. In Fig. 8 each panel plate 46 is provided with vertical hangers or retaining brackets 48 which are substantially identical to the brackets 22 used in the roof construction shown in Figs. 1, 2 and 6. In constructing the side walls shown in Fig. 8, the magnesia insulation 50 is placed between the brackets 48 which are welded or otherwise attached to the plates 46, and then the fire brick 26 are slid down over the brackets from above to build up columns of fire brick to completely line the inside of the wall. Small fire brick 52 of the key type referred to above may be

used to fill any odd spaces such as that in the corner of the structure shown in Fig. 8.

Various additions and modifications may be made in the pipe still furnace structures described in connection with the present invention. For example, a regular gabled roof may be placed on the top of the furnace to protect it from the weather if desired, and heating tubes may be supported on any wall or other part of the structure without altering the invention, as defined by the appended claims. A single row of tubes for example may be supported on all of the side walls by means of supports such as 30, shown in Figs. 1 and 2, mounted between the side wall panels in the manner shown in Figs. 2 and 3.

The panel type of construction not only provides a relatively light furnace, but one in which the furnace gases cannot pass through the walls or roof as in certain brick constructions. Furthermore, air cannot enter the furnace except through the usual air ducts for the burners.

While the improved furnace wall structure of the present invention has been described in connection with its use in pipe still furnaces, it is to be understood that the same wall structure may be used for other furnaces and heaters such for example as metal treating furnaces, tubular boilers, steam plants, and other furnaces.

Having thus described the invention, what is claimed as new is:

1. In a pipe still furnace for heating fluids, an

improved side-wall structure comprising a plurality of vertically extending side-wall panels each comprising a sheet metal backing attached to rigid outside vertical supporting members, adjacent panels being joined together by attaching a vertical supporting member on the side of one panel to the adjacent vertical supporting member on the side of the adjoining panel, a tube sheet secured between the vertical supporting members of two adjacent panels and extending therefrom into the furnace chamber, the portion of said tube sheet extending into the furnace chamber being provided with holes for tubes, and tubes for heating fluids mounted in the holes of said tube sheet.

2. In a pipe still furnace for heating fluids, an improved wall structure comprising a plurality of wall panels each including a sheet metal backing having two opposite edges attached to rigid outside supporting members, adjacent panels being joined together by attaching a supporting member on the side of one panel to the adjacent supporting member on the side of the adjoining panel, a tube sheet secured between the rigid outside supporting members of two adjacent panels and extending therefrom into the furnace chamber, the portion of said tube sheet extending into the furnace chamber being provided with holes for tubes, and tubes for heating fluids mounted in the holes of said tube sheet.

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