May 7, 1940. G. P. LESSMANN 2,200,115

TERMINAL OUTLET FOR INDUSTRIAL FURNACES

Filed April 25, 1939

Fig. 1.

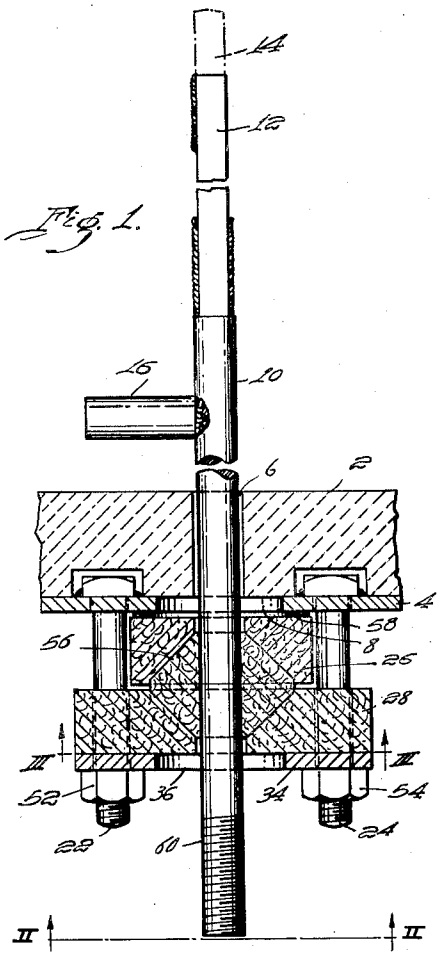


Fig. 3.

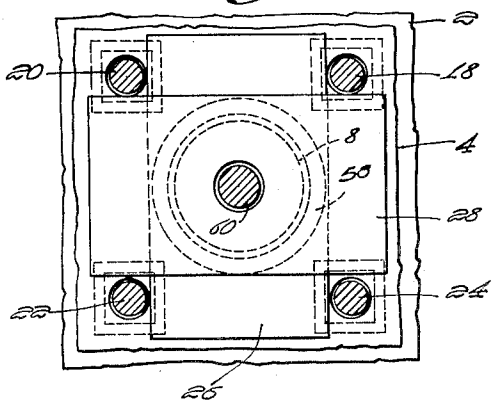


Fig. 4.

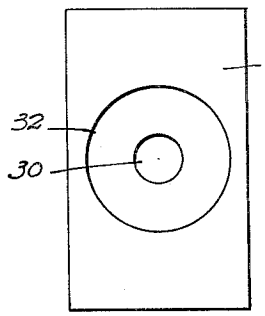
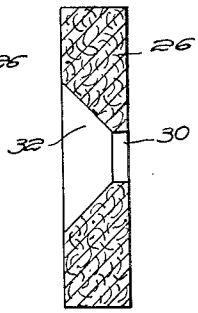


Fig. 5.



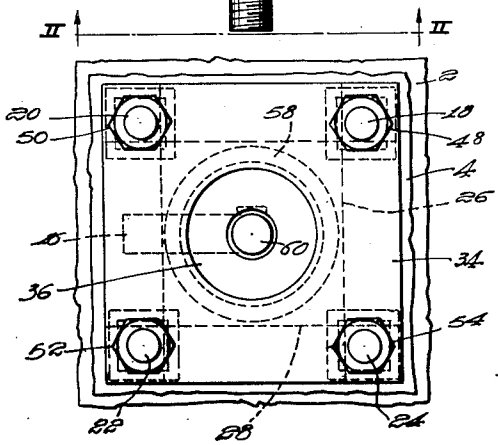


Fig. 2.

Fig. 6.

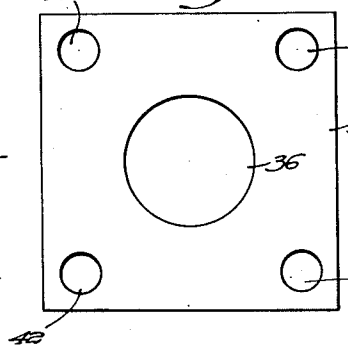
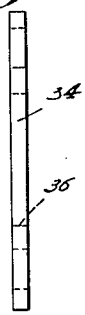


Fig. 7.



WITNESSES:

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TERMINAL OUTLET FOR INDUSTRIAL FURNACES

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8 Claims. (Cl. 174—151)

In electric furnaces, particularly of the type encased in a metallic shell, means must be provided to convey electric power from outside of the furnace to the electric heating means within the furnace. For this purpose, an outlet conductor or terminal of some sort, connected at one end to the electric heating means and at the other end connectible to power lines, passes through the wall of the furnace and a hole in the shell. A terminal outlet structure is generally employed to secure the conductor in position with respect to the hole in the shell, and in a manner to prevent the conductor from contacting the metal shell. My invention relates to such a terminal outlet strucure, and, preferably, for a furnace in which a charge is to be heat-treated while enveloped in an inert or protective gaseous atmosphere so that the terminal outlet structure must not only position the conductor with respect to the hole in the shell, but must also be gas-tight to prevent leakage or seepage of the atmosphere through the terminal outlet structure.

It is an object of my invention to provide a terminal outlet structure which is simple of design and assembly, economical of manufacture, and one which will be reliable and permanent in use.

It is a further object of my invention to provide a terminal outlet structure which will be gas-tight, and which will not be subject to breakage because of pressure applied thereto in order to secure a gas-tight construction.

It is still another object of my invention to provide a terminal outlet structure which will position the outlet conductor in the hole of the shell through which it passes by a simple and novel means, so that the possibility of short-circuits or other faults to the metallic shell is substantially eliminated.

In accordance with my invention, I secure to the shell a plurality (in the particular instance, four) of elongated, outwardly-extending bolts, in spaced relation about the hole. A plurality of pieces of asbestos board are crossed in the spaces between the bolts and are provided with openings which can encompass the conductor. Because the boards are crossed, they co-operate with the conductor so that the conductor cannot be moved, although, without the conductor, each board might have one degree of freedom of movement, that is, movement in one direction. A steel pressure plate has holes fitting the bolts, and the aforesaid insulating boards are clamped with packing provisions to insure a gas-tight structure between the plate and shell by nuts on the bolts.

My construction, as briefly described above, has certain definite advantages. One of these advantages lies in the simplicity by which the asbestos boards can be made. They do not need apertures fitting around the bolts, but it is sufficient to make them of a width to snugly fit between bolts. This construction eliminates drilling bolt-holes in the boards, and also the necessity of aligning the bolts and such holes during the assembly of the terminal outlet structure.

Another advantage of my invention lies in the manner in which the boards are clamped. Clamping pressure is distributed over a substantial area of the faces of the boards so that no indiscriminately applied and concentrated pressures will cause cracking of the boards due to bolt forces.

The above and other objects, features and advantages of my invention will be apparent from the following description of a specific embodiment thereof, taken in conjunction with the drawing, in which:

Figure 1 is a sectional view of a terminal structure for an outlet conductor coming through a wall of a furnace;

Fig. 2 is a view taken on the line II—II of Fig. 1;

Fig. 3 is a view taken on the line III—III of Fig. 1, with the clamping plate and bolt nuts removed;

Fig. 4 is a view of the large side of one of the asbestos boards;

Fig. 5 is a longitudinal, vertical sectional view of the board of Fig. 4;

Fig. 6 is a view of the flat side of the clamping plate; and,

Fig. 7 is an edge view of the plate of Fig. 6.

My invention, as has already been indicated, is particularly adapted to electric furnaces which are provided with electric heating means. The electric heating means is preferably of the resistor ribbon type and the furnace may have two, or considerably more, outlet conductors for these resistor ribbons. The number of outlets, of course, is a matter determined in the design of the furnace, and it is sufficient for the purpose of describing my invention to show but one outlet conductor and terminal outlet structure therefor.

Accordingly, in Fig. 1, a furnace wall 2 is shown but fragmentarily and the outside of this wall is encased by a metallic sheath or shell 4, as is customary with furnaces of this type. However, it should be distinctly understood that the shell 4 may, in some instances, be but a plate em-

bedded or secured to the wall purposely to provide a means to secure a terminal outlet structure in accordance with my invention.

The wall 2 is provided with a hole 6, and the shell 4 is provided with an enlarged hole 8 so that the outlet conductor 10 may pass therethrough. The outlet conductor may be a rod of suitable alloy and its inside end may be welded to a bar 12 which, in turn, may be welded to an end 14 of a resistor ribbon. If desired, a second end 16 of another resistor ribbon may also be welded or otherwise secured to the outlet conductor 10.

The furnace wall 2 is itself electrically insulating, but the metallic shell 4 is, of course, a conductor of electricity. Accordingly, it is necessary to provide a terminal structure which will maintain the conductor 10 away from the edges of the hole 8 in the shell 4. Moreover, since my invention is particularly adapted for furnaces employing a protective atmosphere within their heating chamber, the terminal outlet structure must, in addition, seal the openings 6 and 8 so that none of the protective atmosphere can leak or seep out, or atmospheric air leak or seep into the furnace.

The terminal outlet structure comprises, in this specific embodiment, four bolts 18, 20, 22 and 24, arranged at the corners of a quadrilateral and, preferably, a square or rectangle. The shell 4 is provided with suitable apertures through which the bolts may pass, and the heads of the bolts are welded to secure them in place to the shell in a gas-tight manner so that there can be no leakage of gas through the bolt-holes in the shell. Crossed between the bolts are two boards, 26 and 28 made of an electricity-insulating material, such as, for example, asbestos. The boards are similar in construction but assembled differently in the terminal outlet structure to obtain an outlet structure to maintain the conductor fixed in position.

The structure of each of the boards is shown more particularly in Figs. 4 and 5, and comprises a central opening 30, conically countersunk, or otherwise formed in any suitable manner to provide an enlarged, tapered cavity 32.

The boards are rectangular in shape and are of a width substantially equal to the distance between pairs of aligned bolts, that is, one of the boards 28 is of a width substantially equal to the minimum distance between the pair of bolts 18 and 20, and the pair of bolts 22 and 24; while the board 26 is of a width substantially equal to the minimum distance between the pair of bolts 18 and 24 and the pair of bolts 20 and 22, as shown in greater detail in Fig. 3. The length of these boards is somewhat greater than the corresponding dimensions of the quadrilateral between the four bolts. Accordingly, it may be observed that each board has one degree of freedom of movement only. Thus, for example, the board 28 can slide in the direction of its length only, and the board 26 can slide in a direction at right angles to the possible sliding direction of the board 28.

If now the boards are made to surround the conductor 10, it is obvious that the conductor is fixed in position, since one of the boards prevents sliding movement of the conductor in the one direction and the other in the perpendicular direction. The conductor, therefore, will be centered or properly positioned, with respect to the hole 8 in the shell 4, if the asbestos boards are clamped in their respective positions, shown in Fig. 3. To this end, a rigid clamping plate 34, which may be of steel, is provided having an enlarged central hole or opening 36 and holes 38, 40, 42 and 44 through which the bolts 18, 20, 22 and 24 may, respectively, pass. Suitable nuts 46, 50, 52 and 54 clamp the asbestos boards between the plate 34 and the shell 4. The boards 26 and 28, and the plate 34 are, of course, first slipped over the conductor 10 before the nuts are applied to the bolts and tightened.

Since the conductor passes through the asbestos boards and the openings 30 in each of the boards, and has only slight clearance with respect thereto, it is obvious that the boards are maintained and positioned with the cooperation of the conductor 10 and since each of the boards prevents movement in any direction perpendicular to the conductor 10, with respect to Fig. 1, the terminal outlet structure therefor rigidly positions the conductor 10, not only with respect to the hole 8 of the shell 4, but also with respect to the central hole 36 of the plate 34, it being understood that the last two holes are sufficiently large with respect to the conductor 10 so that insulating clearance is provided.

The cavities 32 of the boards aid in rendering the terminal structure gas-tight. In assembling the boards on the conductor 10, the cavity of the inner board 26 faces the cavity of the outer board 28, with a compressible packing material, such as, for example, asbestos rope 56 interposed. A gasket 58 is also provided around the hole 8. When the nuts are tightened on their respective bolts, the packing 56 is compressed tightly against the tapered sides in the boards defining the cavities, and also against the surfaces of the conductor 10 which it contacts.

It is obvious that enough packing 56 must be used to assure a gas-tight joint. The required amount can be judged by the distance between the boards 26 and 28. In the assembled structure, it is preferred to have a very slight clearance between these boards when the nuts are completely tightened so that the packing must necessarily be pressed against the conductor 10. The structure, therefore, completely seals the terminal outlet since the gasket 58 prevents leakage of protective atmosphere between the shell and the lower board, and the packing 56 prevents leakage of atmosphere along the axis of the conductor 10.

It may be observed that the outer end 60 of the conductor 10 is threaded to permit the bolting on of power cable lugs after the assembly of the terminal output structure.

One of the marked advantages of my construction lies in the distribution of the clamping pressure of the bolts through the asbestos boards which, obviously, will be transmitted through a substantial area of the plate 34 and the cavities 32 to the gasket 58.

In accordance with the objects of my invention, therefore, I have provided a terminal structure in which only the plate 34 has holes which align with the bolts 18, 20, 22 and 24, while the boards 26 and 28 are merely positioned between the bolts. It is obvious that a number of bolts other than four may be employed as, for example, three bolts arranged in a triangle with three asbestos boards to insure cancellation of the freedom of movement of each board. It is, therefore, obvious that equivalents of my invention will be apparent to those skilled in the art and I desire that the appended claims be so considered.

I claim as my invention:

1. A terminal outlet structure primarily for an electric furnace, comprising the combination with a metallic shell for said furnace provided with a hole, and a conductor passing through said hole, said conductor being of smaller diameter than said hole; of a plurality of insulating boards having means through which said conductor passes, means for confining said boards each to different directions of freedom of movement parallel to said shell, means to clamp said boards to said shell, said means cooperating with said boards and conductor for fixing said conductor away from the edges of said shell that define the said hole therein.

2. The structure of claim 1 in which the last said means includes an outer plate and bolts extending from said shell and passing through suitable holes in said plate.

3. A terminal outlet structure primarily for an electric furnace, comprising the combination with a metallic shell for said furnace provided with a hole, and a conductor passing through said hole spaced from its edges; of a plurality, in excess of two, of bolts extending outward from said shell and spaced about said hole, a plurality of crossed, insulating boards between said bolts and fitted to spaces between the said bolts, said boards having aligned openings substantially fitting the said conductor through which said conductor passes, at least one of said openings in said boards being countersunk on the side toward another of said boards, compressible packing in the countersunk portion, a plate having openings through which said bolts pass, and also an enlarged opening through which said conductor passes, and fastening means on said bolts for compressing said boards between said shell and said plate.

4. The structure of claim 3 including a gasket between the shell and the board adjacent to it.

5. A terminal outlet structure primarily for an electric furnace, comprising the combination with a metallic shell for said furnace provided with a hole, and a conductor passing through said hole spaced from its edges; of a plurality, in excess of two, of bolts extending outwardly from said shell and spaced about said hole, at least two insulating boards fitted to, and in spaces, between said bolts and substantially contacting the said bolts on the sides toward said spaces, said boards having openings through which the conductor passes, said boards being crossed so as to maintain the position of said conductor against displacement.

6. A terminal outlet structure primarily for an electric furnace, comprising the combination with a metallic shell for said furnace provided with a hole, and a conductor passing through said hole spaced from its edges; of four bolts extending outward from said shell, and spaced about said hole, forming a pair of crossing spaces between opposed pairs of said bolts, an insulating block in one of said spaces substantially contacting said bolts on the sides toward one space, a second insulating block having a side toward the first said board and disposed in the other of said spaces, substantially contacting said bolts on the sides toward said other space, said boards having apertures in the overlapping parts of said spaces and through which said conductor passes, a rigid plate abutting the other side of the second said insulating board, said plate having an aperture through which said conductor passes spaced from its edges, and additional apertures through which the said bolts pass, and means to clamp said boards between said shell and said plate.

7. The structure of claim 6 in which the contiguous parts of said openings on said boards are enlarged and tapered, and a compressible packing is inserted in said parts in contact with said conductor, and a gasket is provided between said shell and said boards.

8. A terminal outlet structure primarily for an electric furnace, comprising the combination with a metallic shell for said furnace provided with a hole, and a conductor passing through said hole spaced from its edges; of a plurality, in excess of two, of bolts extending outward from said shell and spaced about said hole, a plurality of crossed, insulating boards between said bolts and fitted to spaces between the said bolts, said boards having aligned openings substantially fitting the said conductor, at least one of said openings in said boards being countersunk on the side toward another of said boards, compressible packing in the countersunk portion, and means to clamp said boards to said shell whereby said packing is compressed against said conductor.

GERHARD P. LESSMANN.