

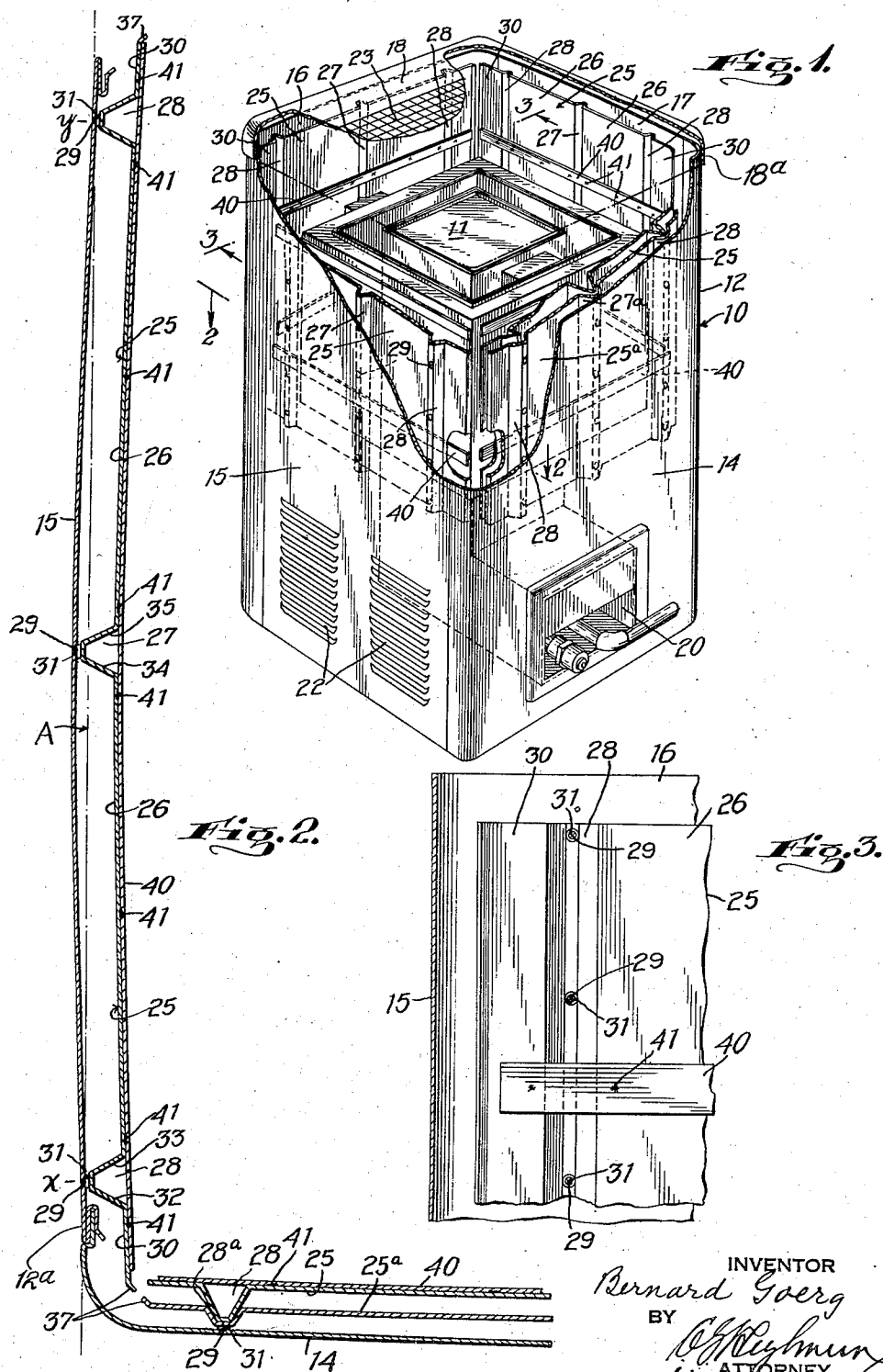
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WALL STRUCTURE

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## UNITED STATES PATENT OFFICE

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## WALL STRUCTURE

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My invention relates to wall structure and more particularly to enclosing jacket walls for furnaces and boilers, and to enclosing wall structure for similar type of apparatus wherein variations in temperature of the apparatus affect the temperature of the jacket wall and cause the latter to make undesirable noises in expanding or contracting.

One of the objects of my invention is to provide a wall structure for furnaces and like apparatus which is of improved construction and arrangement of parts.

A further object is to provide a wall structure for furnaces and the like which is effectively prevented from making undesirable noises upon its expansion or contraction, such as may be caused by changes in temperature thereof.

The invention consists in the novel construction and combination of parts, to be more fully described hereinafter, and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawing, to be taken as a part of this specification, I have fully and clearly illustrated a preferred embodiment of my invention, in which drawing—

Fig. 1 is a perspective view of a gas-fired warm air furnace in which my invention is embodied, parts being broken away to disclose more clearly the present invention;

Fig. 2 is an enlarged fragmentary plan section taken on the line 2—2 of Fig. 1; and

Fig. 3 is an enlarged fragmentary vertical section taken on the line 3—3 of Fig. 1 and showing a portion of my improved wall construction in side elevation.

Referring now in detail to the construction illustrated, the reference numeral 10 indicates, in its entirety, a warm air furnace unit. The unit 10 comprises an interiorly arranged furnace proper 11 and an outer enclosing jacket structure 12. In so far as this invention is concerned, the furnace 11 may be of any suitable construction and may be fired in any desired manner. Those skilled in this art will recognize the furnace 11 as being of the gas-fired type. I have not shown the gas burner, the interior structure of the combustion chamber, the flue passages, the radiator, etc., as these elements may be of conventional construction and their detail structure forms no part of the present invention.

The enclosing jacket 12 is shown as comprising four upright side walls 14, 15, 16, and 17, respectively, and a top wall 18. The jacket walls are generally rectangular in shape and are joined

together in any suitable manner along their longitudinal and transverse meeting edges to form a substantially rigid enclosure for the furnace 11. For example, the vertical meeting edges of the side walls may be secured to each other by a suitable seam or joint indicated at 12a in Fig. 2, and the top wall 18 be provided with a depending peripheral flange 18a, which, when the top wall is in place, fits around the top transverse edge portions of the side walls to aid in holding said walls in rigid rectangular relation. One of the walls, for example, the wall 14, is provided in its lower part with an opening which receives the outer end of a duct 20, and the latter functions to supply combustion supporting air to the furnace 11. The usual control and gas flow connections for the furnace may extend through the duct 20.

The furnace 11 is shown as being of the gravity type. The air to be heated enters the unit through one or more louvered openings 22 formed in the bottom of the jacket and contacts the heated outer surfaces of the furnace 11 therein. As the air becomes heated, it rises and flows upward and around the furnace surfaces and then outwardly through a grilled supply opening 23 formed in the top wall 18. The furnace shown is merely illustrative of a well known type. With other furnaces of this type, return air ducts from the space to be heated may be connected to the openings 22 and supply ducts leading to the space to be heated may be connected to the supply opening 23, all in a manner well known to those skilled in this art.

As is common in structures of this type, the upright jacket side walls 14, 15, 16, and 17 are each provided with an inner liner wall or radiation shield 25 which is spaced inwardly from its respective jacket wall. As each liner 25 is spaced from its jacket wall, it serves to minimize heat loss by radiation through the jacket and thereby assures a more efficient absorption of the furnace heat by the air flowing upwardly over the exterior surfaces thereof.

In so far as the broader aspects of the invention are concerned, the inner liners 25 may be of any desired construction. In the drawing, each of the inner liners 25 is shown as comprising a pair of vertically arranged intermediate wall sections 26 separated by an intermediate vertical groove 27, and each of the wall sections 25 is formed at its two vertical outer edges with marginal vertical grooves 28. Each liner-25 also includes a marginal vertical wall section 30 ar-

ranged at the outer side of each marginal groove 28.

Each liner is shown as being formed advantageously from one integral piece of sheet metal and as being fixed to its respective jacket side wall by spot-welding, indicated at 29. Each liner is provided along the apices of its intermediate and marginal grooves 27 and 28 with outwardly extending bosses 31, suitably spaced from one another. The spot-welding is indicated at 29 and is effected between these spaced bosses and the jacket wall. The bosses 31 may be suitably formed in each of the grooves 27 and 28 by pressing the metal outwardly in any well known manner. The grooves 27 and 28 serve the double purpose of spacing the intermediate and marginal wall sections 26 and 30 from their respective jacket wall and of fixing the wall sections to their jacket wall. The intermediate groove 27 also serves as a means for spacing the intermediate wall sections 26 from one another.

It will be appreciated that from a functional viewpoint, it is not essential that the wall sections 26 be in one piece or that the marginal wall sections 30 be a part of the wall sections 26. Therefore, each of the marginal grooves 28 may be considered as being formed by marginal attaching flanges 32 and 33 formed, respectively, on the adjacent vertical edges of the wall sections 30 and 26, and joined together at their outer meeting edges to form the grooves 28. Likewise, the intermediate groove 27 may be considered as being formed by intermediate flanges 34 and 35 extending outwardly from the adjacent vertical outer edges of the two wall sections 26, and joined together at their outer edges to form the groove 27.

As the wall sections 26 and 30 are spaced from their respective jacket wall, they form radiation shields between the furnace and such jacket wall. Obviously, any practical number of wall sections 26 may be provided for each jacket wall, depending upon their desired width and the width of the jacket wall. The outer marginal edge 37 of each marginal wall section 30 is not attached to its jacket wall, as it lies closely adjacent to a similar outer edge of the liner of the adjacent jacket wall and cooperates therewith to form a radiation shield and vertical air space between the liner and jacket at each vertical corner of the jacket. If desired, the marginal wall sections 30 may be omitted and the outer marginal edge of each wall section 26 extended to points closely adjacent the vertical corners of the jacket.

It is noted that the front jacket wall 14 is also provided with a second inner wall or radiation shield 25a, which is constructed like the wall 25 and is interposed between the wall 25 and the wall 14. The wall 25a is also provided with grooves 27a and 28a which receive the grooves 27 and 28, respectively. The spot-welding secures both grooves 27, 27a and 28, 28a to the wall 14.

As is common in structures of the type disclosed, the jacket walls 14, 15, 16, and 17 are formed of relatively light or thin gauge, sheet metal, for example, 22 gauge. Sheet metal of this character is freely flexible and when relatively flat furnace jacket walls, such as those shown, are formed from such metal, the changing temperature of the walls due to variations in furnace operation, causes the walls to expand and contract in their respective planes; and, as each wall is joined to other walls at its outer edges and is held thereby, it will buckle or bow,

as it expands, to one side or the other of the plane it normally occupies when cool. This uncontrolled buckling or bowing of a wall, in whole or in part, is not sufficient to affect the appearance of the jacket to the casual observer; but it does have the undesirable result of making objectionable noises, such as a snapping or popping sound as the bows or buckles are formed, or as they become flattened or straightened, or as the wall snaps from one side to the other of its normal plane. This action is somewhat like that produced by pressing the bottom of an oil can. This undesirable characteristic in furnace jacket walls is therefore sometimes referred to as the "oil can" effect.

In accordance with the present invention, this objectionable characteristic of prior furnace jacket walls is effectively overcome in a simple and inexpensive way. Each jacket wall in which the "oil can" effect might be produced when installed and operated, is given an initial outward bow of relatively small magnitude, and the wall is continually held in this pre-bowed shape by a tying means which extends laterally across the bowed wall and is fixed at its opposite ends with respect to spaced portions of the pre-bowed wall. While variations in the amount of pre-bowing of the wall may be had without departing from the present invention, I prefer that the magnitude of the pre-bowing be just enough to prevent the wall from flattening or straightening out when the wall is at the lowest temperature it will have when in service. One typical example falling within this definition of preferred magnitude of bow, is a 22 gauge sheet metal furnace jacket wall 28 inches in overall width, wherein the center of the bow is spaced from the plane which the wall would occupy if flat, a distance of one fourth of an inch when the wall is at room temperature. With a structure of this type, an increase in temperature of the wall above this low point will only result in increasing the magnitude of the initial bow. The "oil can" effect can be overcome if the wall is initially bowed inward as well as when it is bowed outward. However, I prefer the outward bow because it results in a jacket which is neater in appearance and also because it is provided by a more simple and inexpensive construction.

The drawing shows a construction wherein each of the upright side walls 14, 15, 16, and 17 is pre-bowed in the manner just explained, and wherein each wall is held in its pre-bowed position by one or more tie members 40 extending horizontally across the inner sides of the walls and said members being suitably fixed at the ends thereof and at intermediate points by spot-welding, as indicated at 41, to the wall sections 26, and the latter, as previously described, are fixed by spot-welding of the flanges 32, 33, 34, and 35 to their respective jacket side walls. Thus, each of the tie members is fixed at its opposite ends with respect to the pre-bowed wall. While the number of tie members 40 used on each wall may be varied to suit particular conditions, I have found that two such tie members on the jacket wall construction shown, is sufficient. The tie members may be formed from any material suitable for the purpose explained. By way of example, the tie members 40 are formed from band iron, 16 gauge, and one inch wide. Tie members formed of material of this type perform the additional function of stiffening the jacket well.

In Fig. 2, I have shown in enlarged plan section the wall 15 and the way in which it is held in its

pre-bowed shape. In order that the invention might be more clearly understood, I have shown the wall 15 as bowed to a greater extent than would normally be preferred. The plane which the wall would normally occupy were it not bowed, is indicated by the dot-and-dash line A. This plane passes through the spaced points X and Y located on the wall 15. The liner 25 does not interfere with the bowing of the wall 15, because the two wall sections 26 are separated by the groove 27. The bowing of the wall 25 will result in the flanges 34 and 35 being disposed at a smaller angle than the flanges 32 and 33 of the grooves 28.

It is to be understood that while I have shown in Fig. 2 the wall 15 as being bowed away from the plane it would normally occupy, which is indicated by the line A, and while this line passes through the points X and Y located, respectively, adjacent the outer edges of the bow, and while the tie members are shown as being fixed with respect to the wall adjacent points X and Y, my invention is not to be so limited in all of its aspects; for, in so far as the broader aspects of this invention are concerned, the wall may be bowed away from any plane extending in the same general direction as the wall and passing through spaced points on the wall which are not at the outer edges of the bow, and the ends of the tie member may be fixed with respect to the wall at regions adjacent the last-mentioned points.

Furthermore, while I have shown the invention as being embodied in a jacket wall for a warm air furnace, it is not limited to such use; for, it might equally as well be applied to a wall for a boiler, or for an air conditioning unit, or for any other apparatus of this type which changes in temperature and would likely have the above-defined "oil can" effect.

What I claim and desire to secure by Letters Patent of the United States is:

1. In furnaces and like apparatus wherein the enclosing wall structure thereof expands and contracts when in service due to changes in temperature thereof, a continuous wall forming a part of said enclosing wall structure and being formed of thin and freely flexible sheet metal and being joined along two opposite sides thereof to other parts of said apparatus; said wall being flexed to form an initial bow therein which is of definite but small magnitude at a minimum temperature below which the furnace is not normally

subjected; said bowed wall being arranged with its concave surface facing inward and with the general direction of curvature being across said wall between said two opposite sides; liner wall means disposed across the inner concave surface of said bowed wall and comprising a plurality of wall sections arranged in side-by-side relation, and each wall section being spaced from said bowed wall and having a pair of opposite side edges disposed approximately parallel to said two opposite sides of said bowed wall and to similar side edges of other wall sections, the adjacent side edges of adjacent sections being spaced from one another; said liner wall means also including flange means providing a fixed connection between each of said adjacent side edges and said bowed wall, there being at least two such flange means and they being located, respectively, at opposite sides of the highest point of curvature of said bowed wall; and a tie member extending lengthwise across the inner side of said liner wall and between said two opposite sides of said bowed wall and being fixed at its ends to adjacent wall sections at opposite sides of said two flange means.

2. In wall structure for furnaces and like apparatus subjected to temperature changes when in service, an outer enclosing wall formed of thin and freely flexible sheet metal and being joined along two opposite sides thereof to other parts of the furnace; said outer wall being flexed to form an initial outward bow therein which is of definite but small magnitude at a minimum temperature below which the wall does not normally go; the general direction of curvature of the initial bow being across said outer wall between said two opposite sides; an inner liner wall secured to the inner surface of said outer wall and comprising intermediate and marginal attaching flanges fixed to said bowed wall and arranged approximately parallel to one another and to said two outer sides of said bowed wall, and said attaching flanges being separated from one another by wall sections forming, respectively, a part of said liner wall and being spaced from said bowed wall by said flanges, there being at least two marginal flanges and they being located, respectively, adjacent said two outer sides of said bowed wall; a metal strap extending lengthwise across said wall sections and said attaching flanges and being fixed to said wall sections at the opposite sides of said attaching flanges.

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