July 28, 1953 J. W. INGRAHAM ET AL 2,646,762

METHOD OF FORMING OVEN LINERS

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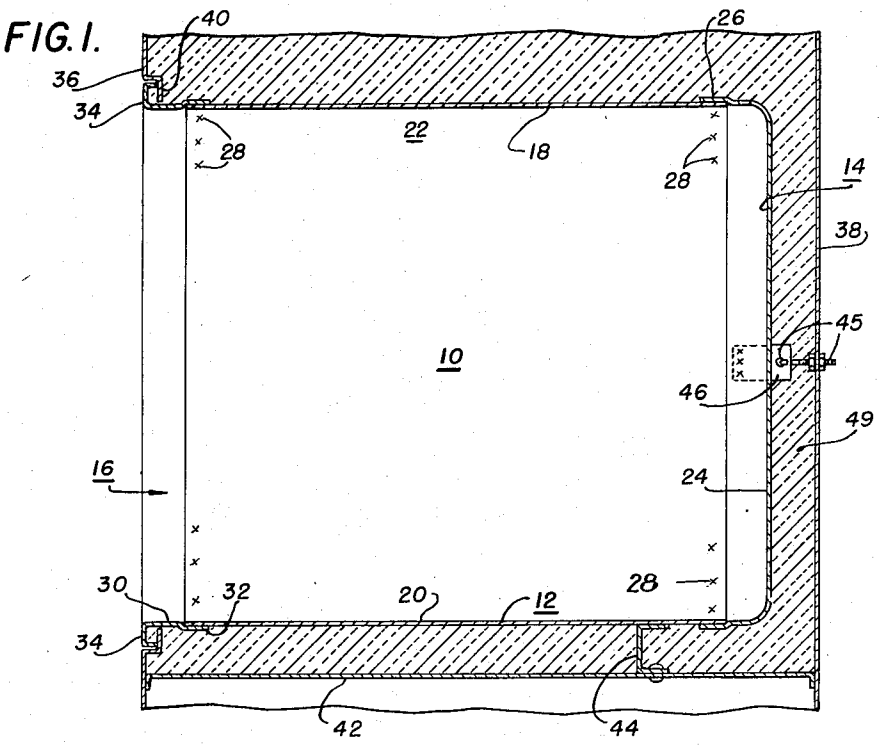
FIG. 1.



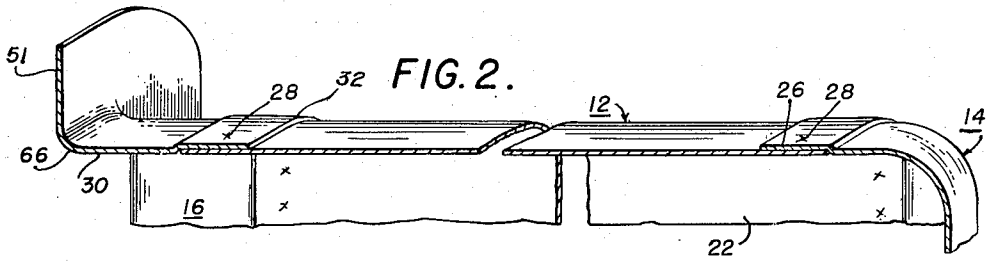


FIG. 2.

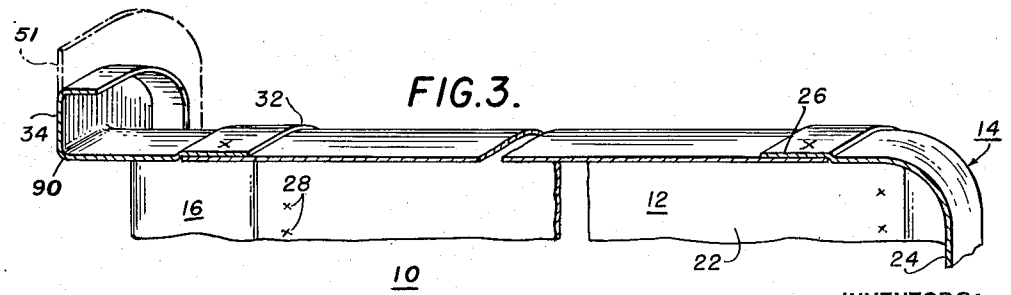


FIG. 3.

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FIG. 4.

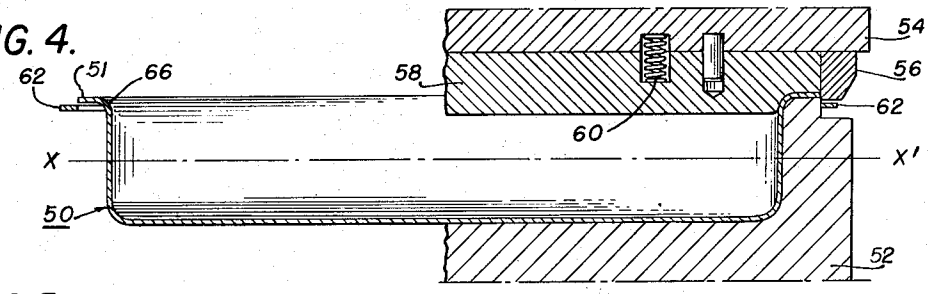


FIG. 5.

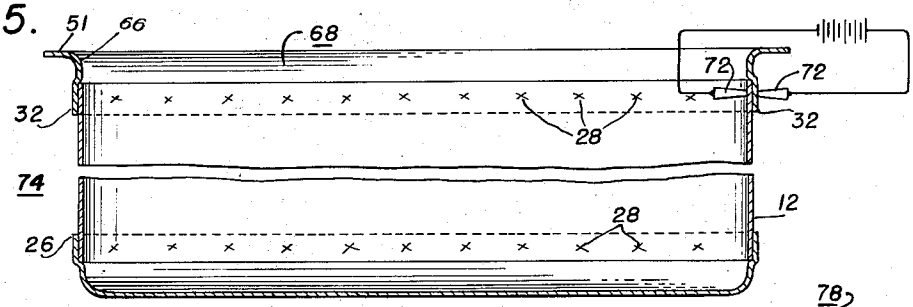


FIG. 6.

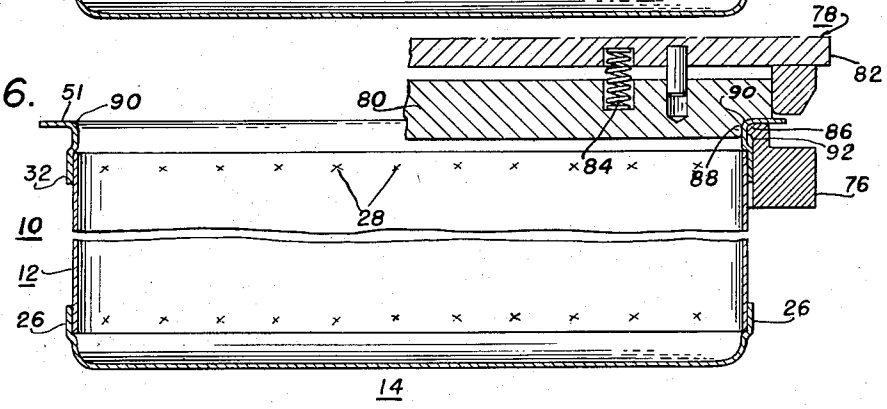
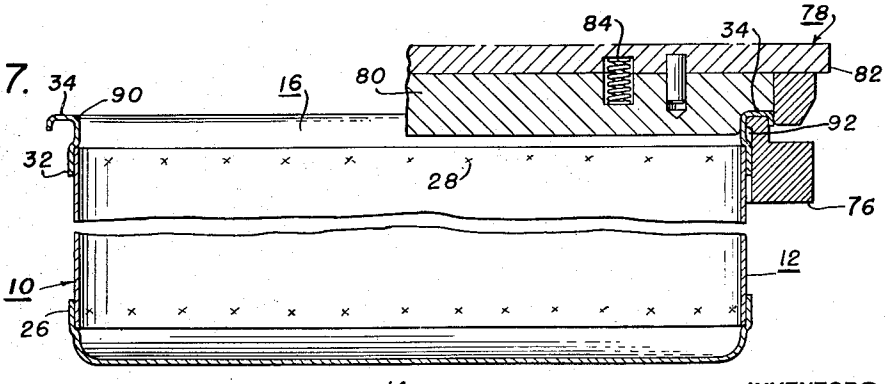


FIG. 7.



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METHOD OF FORMING OVEN LINERS

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1 Claim. (Cl. 113—116)

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This invention relates to ovens and more particularly to a method of making a fabricated sheet metal oven liner.

In a present construction of a welded sheet metal oven liner for an electric range, the oven liner is fabricated of three separately formed pieces. The liner is generally rectangular in cross-section and encloses a substantially cubical baking compartment closed on all sides except the front. The front opening is adapted to be closed by a door. The liner includes an open-throated front flange member, a rear wall member and an intermediate body member, assembled into one rigid unit by spot-welding at numerous points.

Handling of the front member prior to assembly may distort the flange of the front member and impair its trueness. Also, during the welding operation, the liner is subjected to considerable heat, causing expansion of the metal and producing unpredictable thermal stresses which may warp the flange of the front member. Although the flange has a U-shaped cross-section which is highly resistant to normal cooking heat stresses, the high localized heat stresses which occur during the welding operation may impair the trueness of the flange which is so desired for a good seal between the oven door and the liner flange. To correct the warpage incurred in handling and welding, the welded oven liner is placed in a set of dies and the flange is subjected to a final "truing" or "sizing" operation which is intended to restore the flange to its original trueness. However, since the flange is formed with such a rigid cross-section initially, the "truing" operation is not always completely effective.

It is an object of this invention to provide an efficient and simple method of making an oven liner in which the front flange is true, that is, free of distortion.

It is a further object of this invention to provide an effective method of "truing" the front flange of an oven liner after the same has been warped or distorted during its manufacture, such as may be caused by the thermal stresses induced during the welding process and in handling.

These and other objects are effected by the invention as will be apparent from the following description and claim taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a vertical section of a finished oven liner assembled in a range;

Fig. 2 is a partial section of the oven liner, in perspective, showing an intermediate stage of fabrication;

Fig. 3 is a view similar to Fig. 2, showing the completed liner; and

Figs. 4 to 7, inclusive, are schematic sectional

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views showing the oven liner in the various stages of fabrication, in accordance with our invention.

Referring to Fig. 1, a sheet metal oven liner, generally designated 10, is shown having an intermediate body member 12 closed at its rear end by a wall member 14 and having an open-throated front member 16. As well known in the art, the intermediate member is made of sheet metal and is bent to form a tubular structure of rectangular cross-section having a top wall 18, a bottom wall 20 and two side walls 22 (only one shown). The rear wall member 14 is drawn to the shape of a shallow pan and has a vertical wall 24, the marginal portion of which is rounded and extended to provide an outwardly offset peripheral portion 26 which externally embraces the intermediate member to form a rabbet joint therewith. The joint is preferably secured as by spot-welding at a plurality of spots 28. The front member 16 has a rectangular opening defined by a continuous wall 30 having its rear marginal portion extended to provide an outwardly offset peripheral portion 32, similar to the offset portion 26, which externally embraces the front end of the intermediate member to form a rabbet joint therewith. This joint is also secured by spot-welding at a plurality of spots 28. The front member has an outwardly disposed flange 34, which with the wall 30, is U-shaped or channel-shaped.

As shown in Fig. 1, the oven liner is disposed within a range body including a front outer panel 36 and a rear outer panel 38. The front panel has an opening defined by an inwardly displaced flange 40 adapted to abut the liner flange 34. An inner sheet member 42 is horizontally disposed below the oven liner 10 and is joined to the front and rear panels 36 and 38, respectively. The sheet member 42 carries a channel member 44 which acts to support the rear portion of the liner.

The position of the liner is determined by abutment of the liner flange 34 against the front panel flange 40, the liner being maintained in such position by two fastening plates 46 attached to the liner and two hook bolts 45 which have hook portions engaging in openings in the plates 46 and which are adjustably secured to the rear outer panel 38. Also, as well known in the art, the oven may be insulated against excessive heat loss during its operation by a layer of heat insulating material, such as spun glass 49.

According to our invention, the intermediate body member 12 may be formed in any desired manner, as well understood in the art. However, as shown in Fig. 4, the front member 16 and the rear member 14 may be initially integral and may be formed of flat sheet metal stock which is drawn to a shallow pan-like structure 50, by a set of suitable drawing dies (not shown). The structure 50 is later severed along line X—X¹

as well understood in the art. The outer marginal portion of the sheet is unformed and is left in its original planar state, providing a preliminary flange 51. The flange 51 is substantially flat and is, therefore, relatively weak in cross-section in a direction substantially normal to its face. The flange thus lends itself to ready alteration by dies to ultimately provide the flange 34 of the front member, as will be subsequently explained.

As shown schematically in Fig. 4, after the pan is drawn to shape, it is subjected to the action of a restriking and trimming die having a lower member 52 adapted to support the pan and an upper member 54 adapted to restrike and trim the unformed pan portion. Only the right half of the die members 52 and 54 is shown, for clarity, since the left half of the die members is the same. The upper member 54 has a shearing portion 56 and a striking and holding portion 58. The portion 58 is movable vertically with respect to the member 54 and is biased downwardly therefrom by spring means 60. To perform the restriking and trimming operation, the pan 50 is inserted within the die member 52 while the upper die member 54 is in retracted position. On the downward stroke, the restriking portion 58 will strike the pan and hold it against the lower die member, while the shearing portion 56 completes its downward travel to trim the irregular marginal portion 62 of the preliminary flange 51. The effect of the restriking portion 58 is to flatten the surface of the flange, while the effect of the trimming portion 56 is to true the edge of the flange. The flange 51 has a rounded connecting portion 66 of relatively large radius, for a reason which will later be described.

After the above restriking and trimming operation is completed, the pan is severed on line X—X¹ and subjected to the action of rollers (not shown) to provide (as shown in Fig. 5) a preliminary front liner member 68 and the rear member 14 having the peripheral offset portions 32 and 26, respectively. Fig. 5 further shows schematically the method of assembling the front and rear members to the intermediate member 12. The front and rear members are positioned with their offset portions 32 and 26, respectively, in lapping engagement and forming rabbet joints with the intermediate member. They are then rigidly united by spot-welding at numerous positions 28, using spot-welding equipment comprising a pair of opposed electrodes 72 connected to a power supply, to form a unitary oven liner structure 74 in its intermediate stage of fabrication as also shown in greatly exaggerated proportion in Fig. 2.

The liner structure 74 is then inserted in a set of forming dies, which as shown in Figs. 6 and 7, comprise a lower annular die member 76 and an upper forming die member 78 adapted to act on the flange 51 and the rounded portion 66 and to reform them to the final flange 34. The upper die member has a male member 80 and a female member 82 biased vertically by spring means 84, as shown in Fig. 6, and movable with respect to each other. On the downward stroke, die member 80 strikes the flange 51 and the rounded portion 66, compressing them against the lower die member 76 as shown in Fig. 6. The die members 76 and 80 have active portions 86 and 88, respectively, which are different in shape from the rounded flange portion 66 in that they have a smaller radius of curvature. Thus, the rounded portion is reformed to a rounded portion 90 of smaller radius, by the dies 76 and 80. A stretching action is imparted to the metal, particularly at the rounded portion 90, during this reforming operation, which eliminates any irregularities or warpage which may have been incurred by the flange during any of the preceding operations or in handling.

After the die members 76 and 80 come together, the die member 82 will move downwardly, as shown in Fig. 7, to complete its stroke. The outer marginal portion of the flange 51 will be bent downwardly to complete the flange 34 as it appears in the completed liner 10. Although not shown, the lower die member 76 may be of the well-known gate type which permits insertion of the work piece from the side instead of the top. Also, as shown in Figs. 6 and 7, the lower die member may be cut away at portion 92 to afford relief and clearance for the offset portion 32 when the oven liner is withdrawn from the die.

It will now be seen that we have provided an oven liner having a front flange which is greatly improved in trueness at no added cost. The final "sizing" operation in conventional usage has been eliminated and the flange is submitted to a final forming operation in its stead. Since the metal is not merely subjected to an ineffective striking action, but a stretching and reforming action to form the flange, the warping stresses will be relieved and there will be practically no tendency for the metal to creep back.

Although an oven door has not been shown in connection with the drawings, it will readily be seen that with the oven liner formed in accordance with the process above described, any conventional door may be used to close the oven, and the required seal between the liner flange 34 and the door will be greatly improved and better baking results will be obtained.

While we have shown our invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof.

What we claim is:

The method of forming an oven liner having an open side comprising the steps of forming a member having a tubular wall encompassing the oven adjacent said open side, a preliminary flange extending outwardly from the tubular wall substantially in the plane of the open side and a connecting portion of relatively large radius joining the tubular wall and the flange, joining other wall portions of the liner to said member by welding, and thereafter reforming said connecting portion to a smaller radius of curvature and bending back the outer marginal portion of said preliminary flange to provide a channel or U-shaped portion of the liner around said open side.

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