Feb. 7, 1939. W. J. HAWKINS 2,146,429

OVEN

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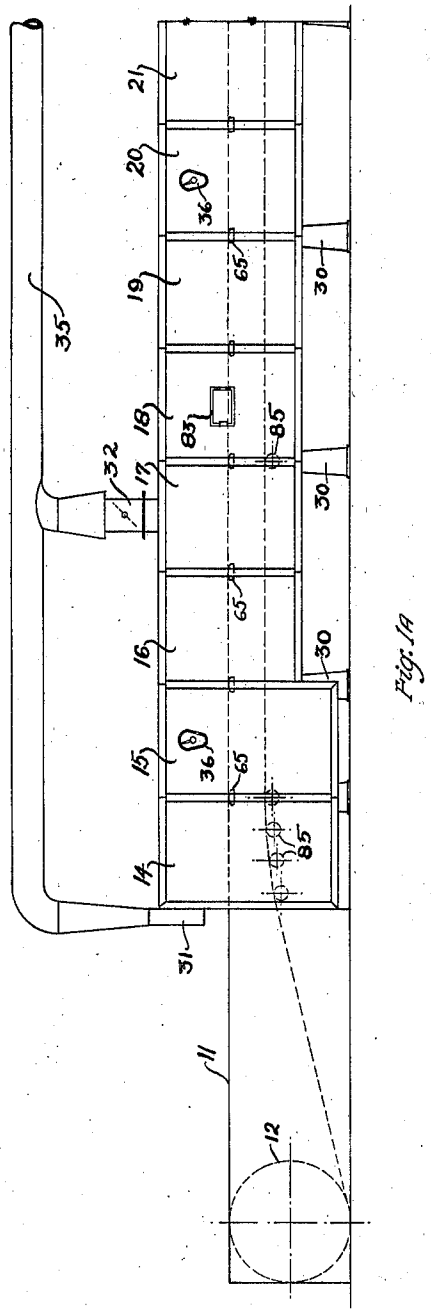


Fig. 1A

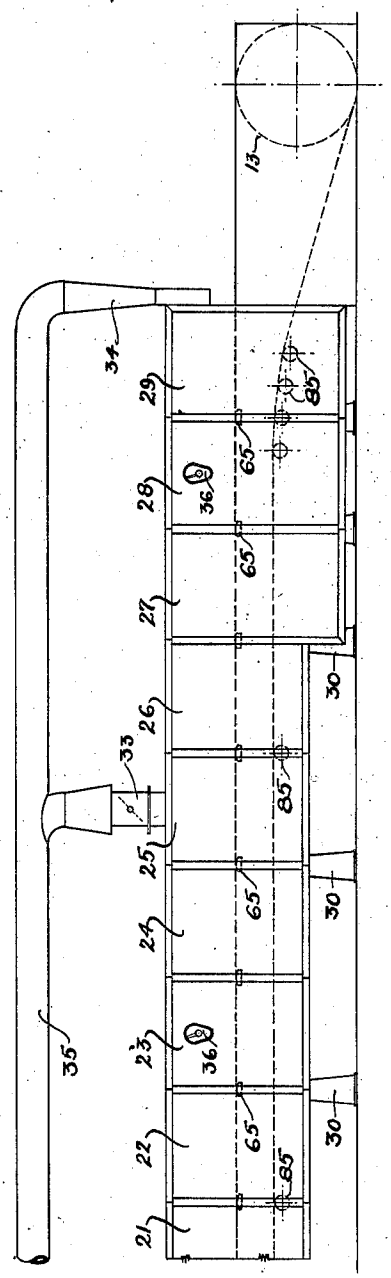


Fig. 1B

WILFORD J. HAWKINS
INVENTOR

BY Henry Savage
ATTORNEY

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OVEN

Filed June 8, 1937 8 Sheets-Sheet 2

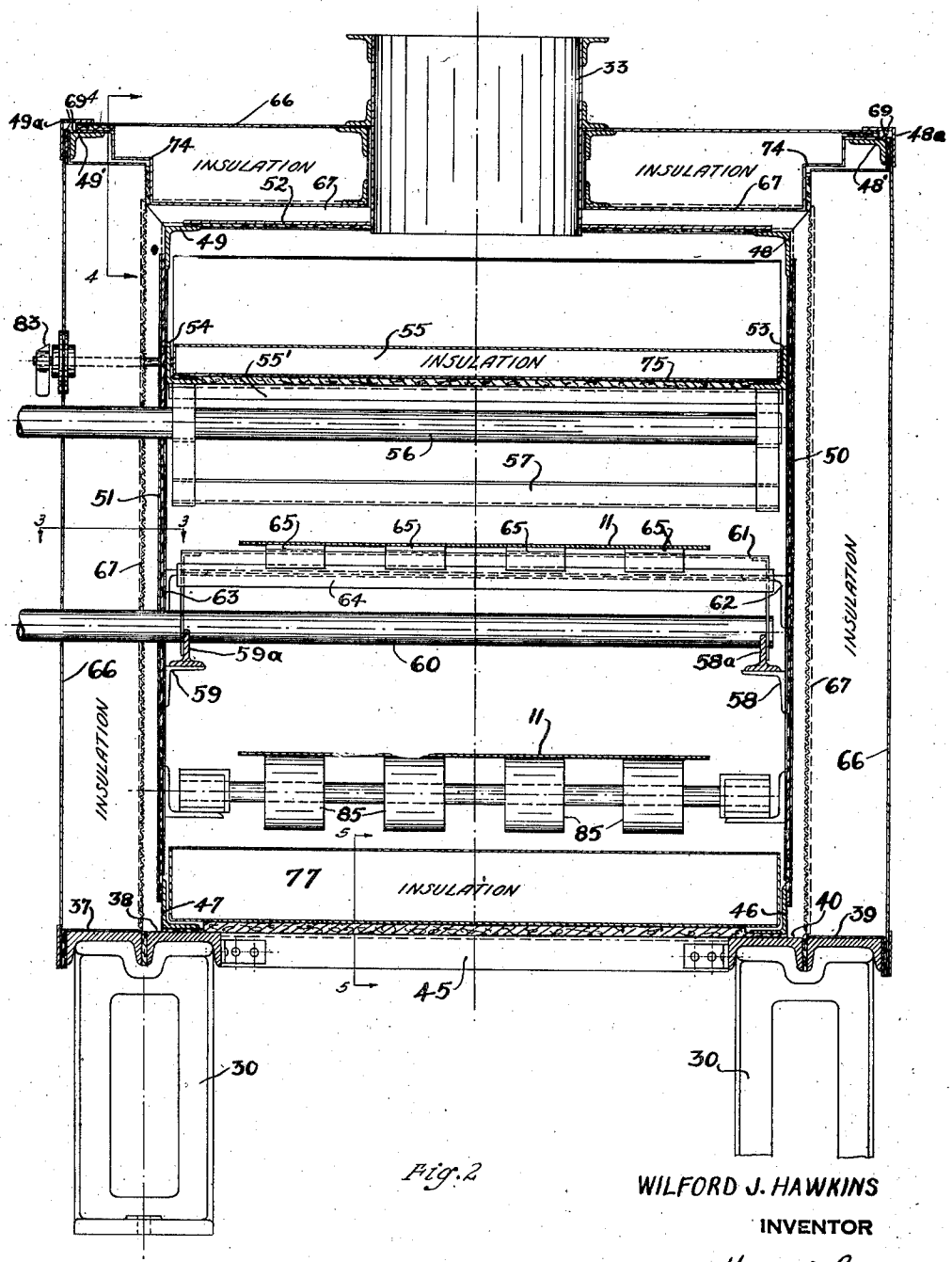


Fig. 2

WILFORD J. HAWKINS
INVENTOR

BY Henry Savage
ATTORNEY

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Filed June 8, 1937 8 Sheets-Sheet 3

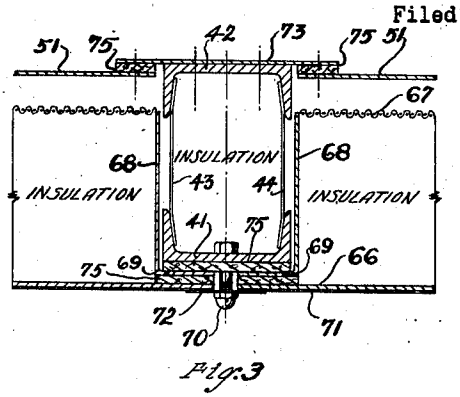


Fig. 3

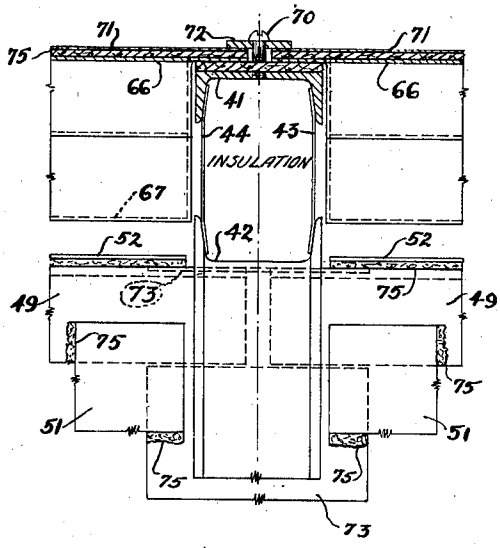


Fig. 4

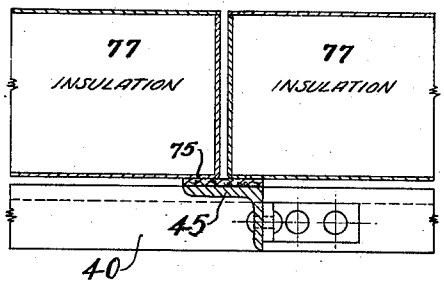


Fig. 5

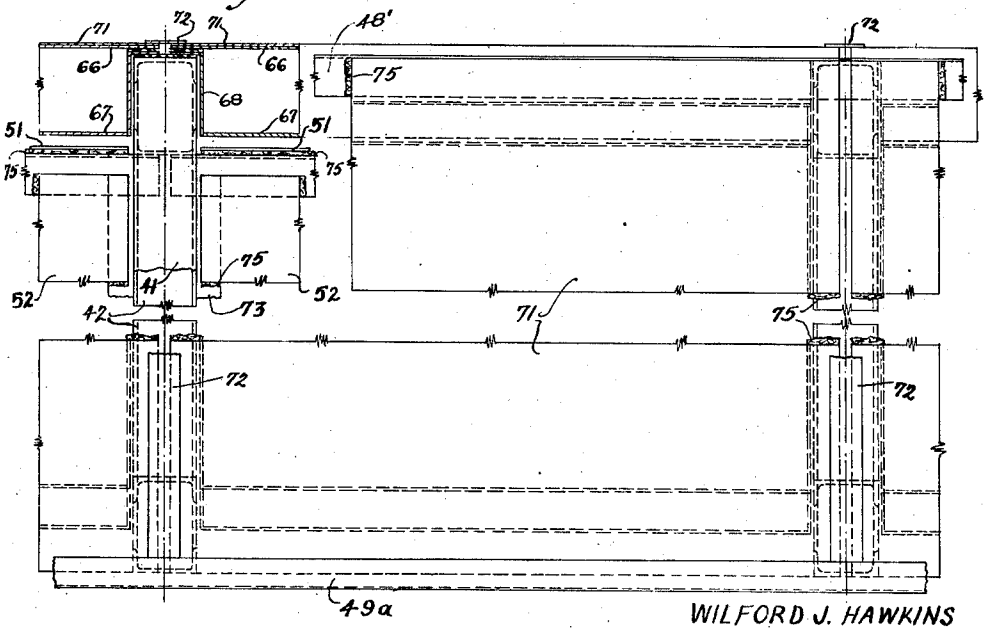


Fig. 6

WILFORD J. HAWKINS
INVENTOR

BY Henry J. Savage
ATTORNEY

Feb. 7, 1939. W. J. HAWKINS 2,146,429

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Filed June 8, 1937 8 Sheets-Sheet 4

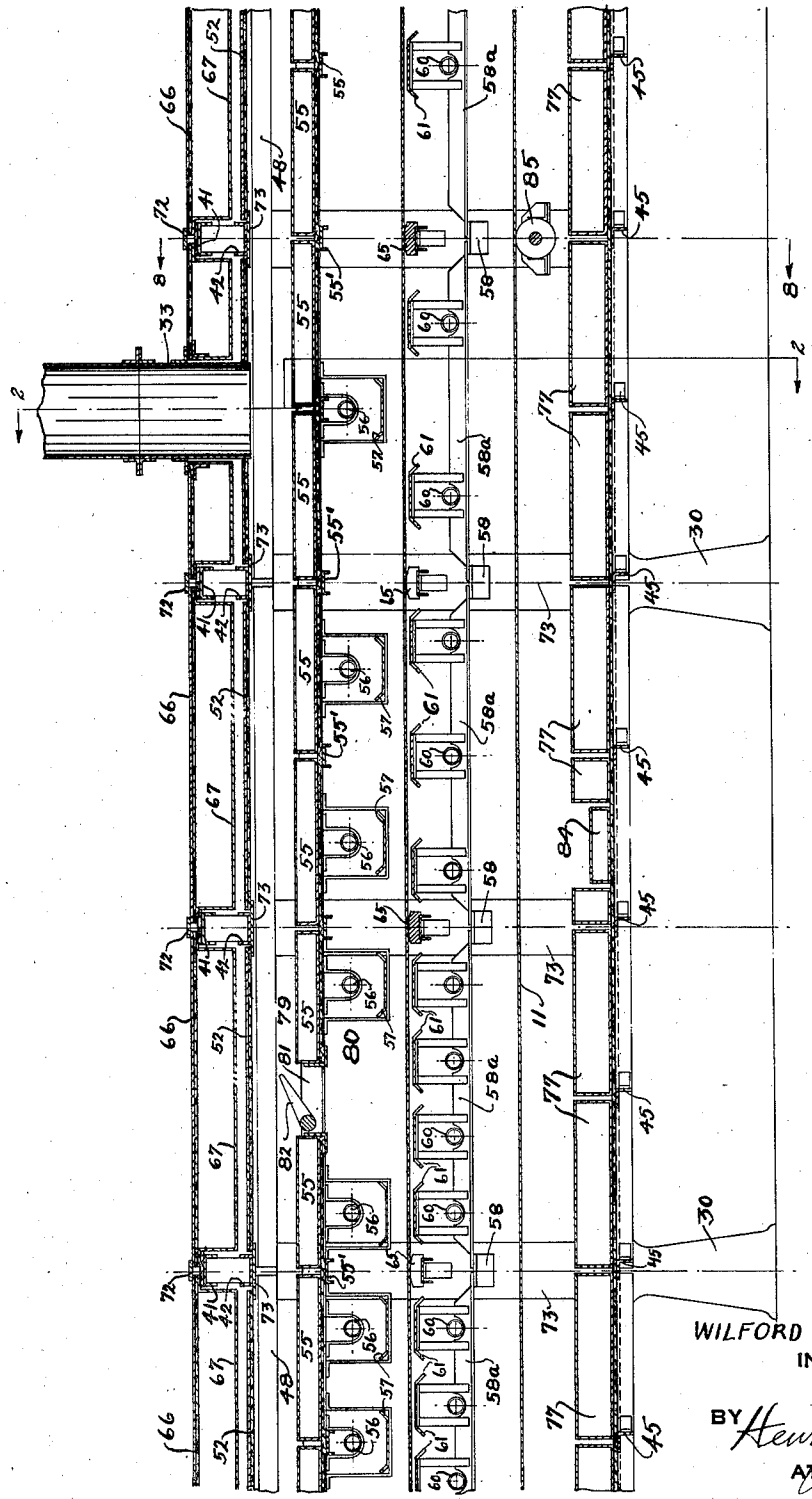


Fig. 7

WILFORD J. HAWKINS
INVENTOR

BY Henry Savage
ATTORNEY

Feb. 7, 1939. W. J. HAWKINS 2,146,429

OVEN

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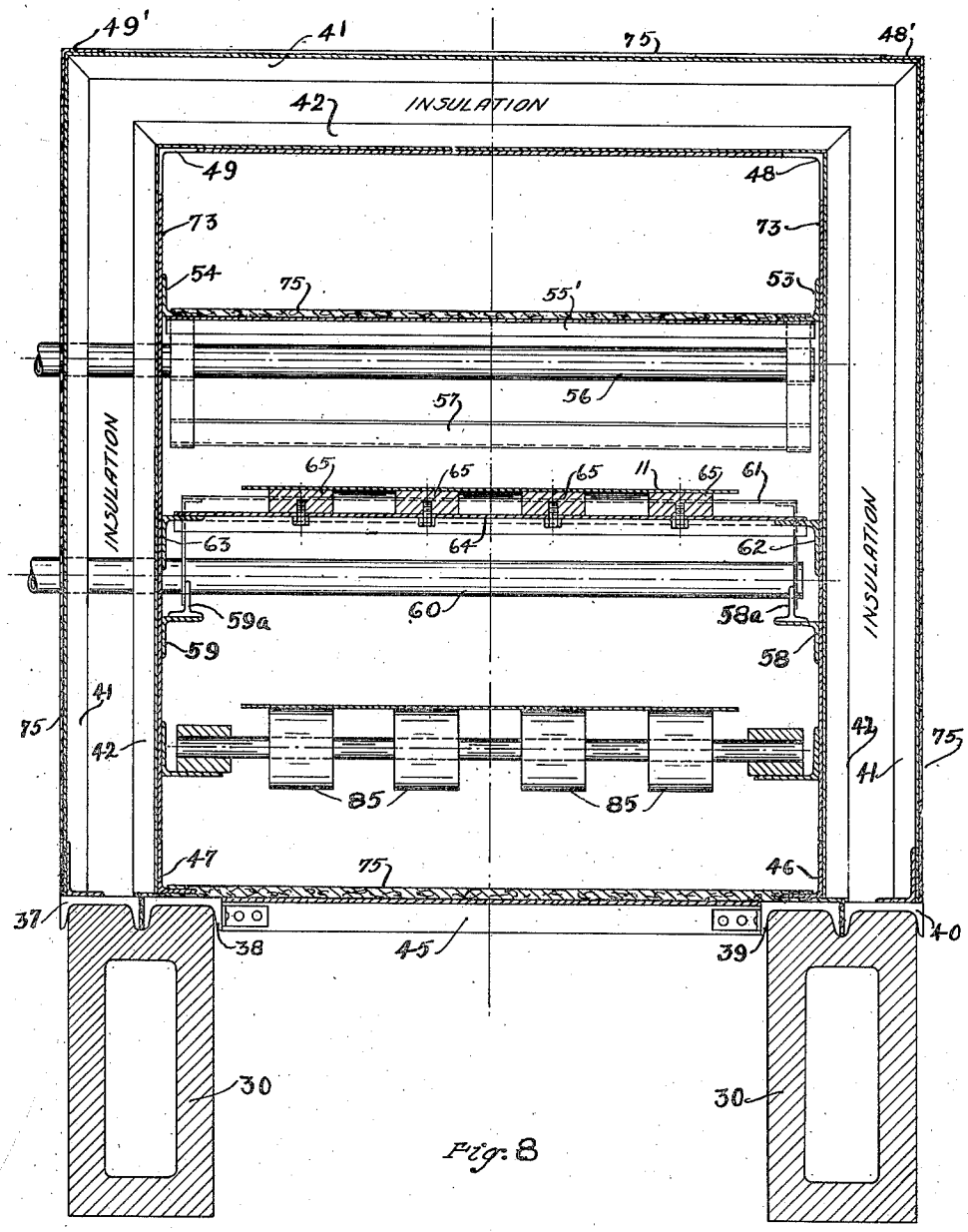


Fig. 8

WILFORD J. HAWKINS
INVENTOR

BY Henry Savage
ATTORNEY

Feb. 7, 1939. W. J. HAWKINS 2,146,429

OVEN

Filed June 8, 1937 8 Sheets-Sheet 6

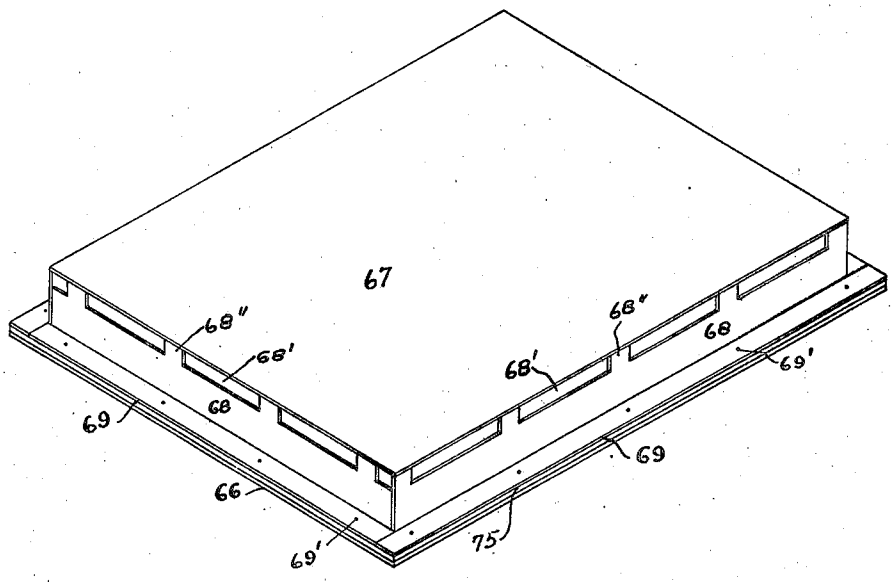


Fig. 9

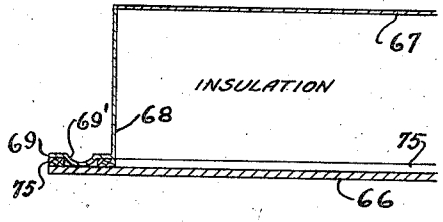


Fig. 10

WILFORD J. HAWKINS
INVENTOR

BY Henry J. Savage
ATTORNEY

Feb. 7, 1939. W. J. HAWKINS 2,146,429

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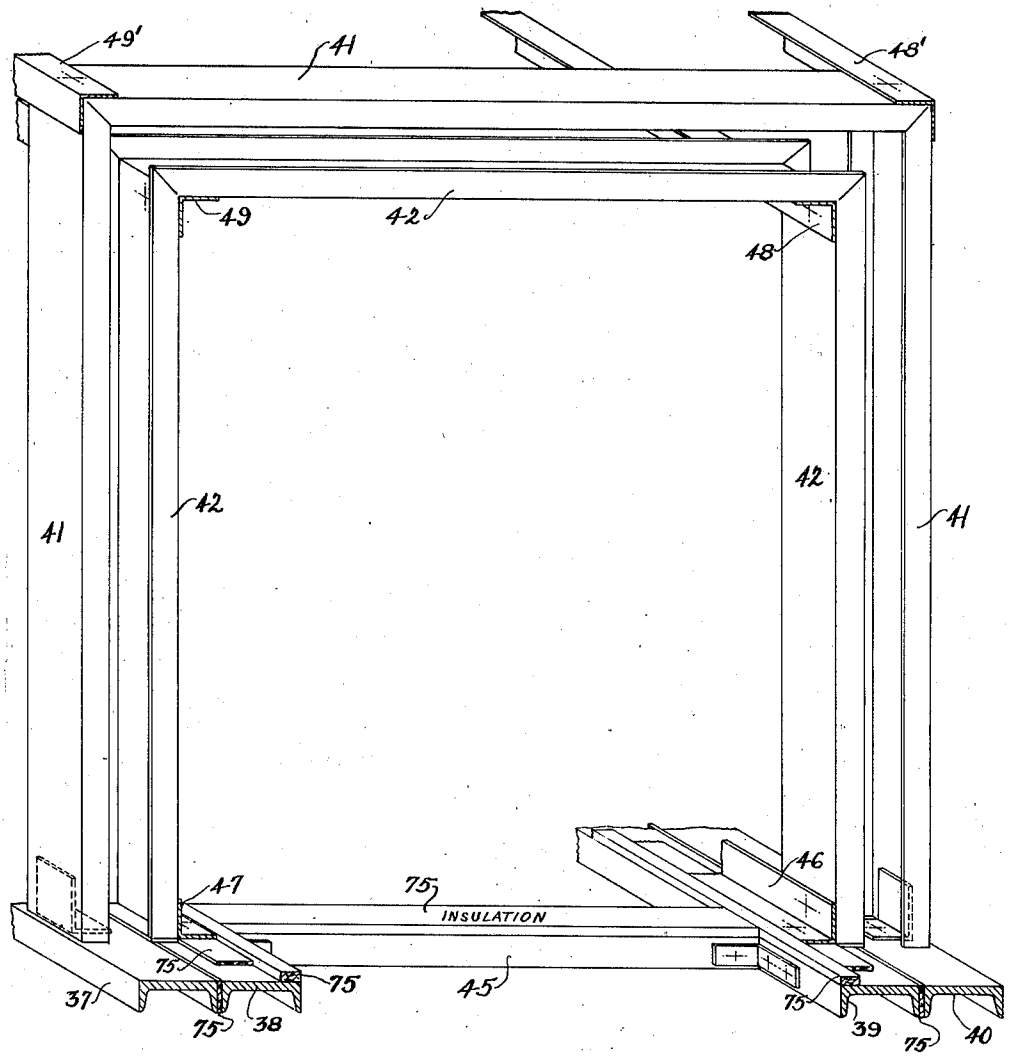


Fig. 11

WILFORD J. HAWKINS
INVENTOR

BY Henry J. Savage
ATTORNEY

Feb. 7, 1939. W. J. HAWKINS 2,146,429

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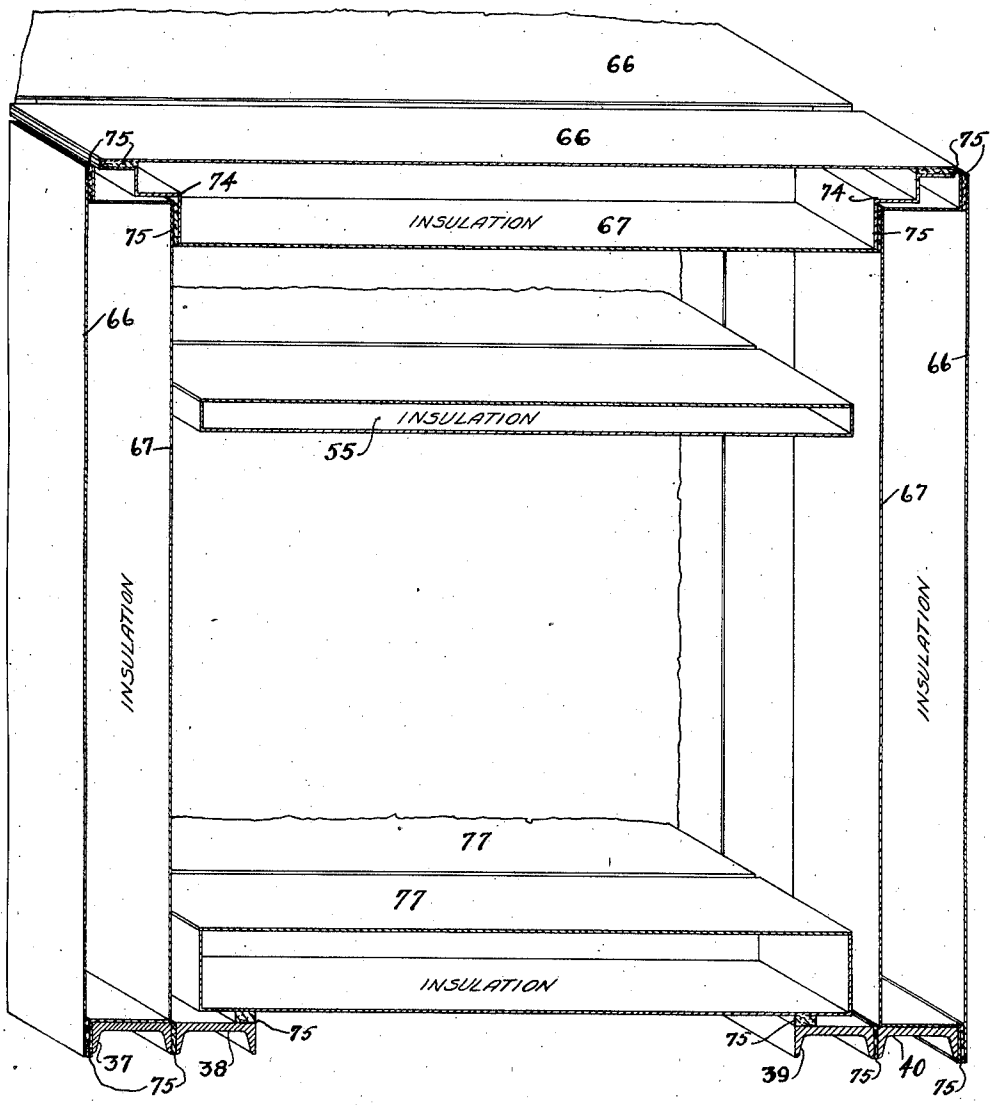


Fig. 12

WILFORD J. HAWKINS
INVENTOR

BY Henry J. Savage
ATTORNEY

Patented Feb. 7, 1939 2,146,429

UNITED STATES PATENT OFFICE

2,146,429

OVEN

Wilford Judson Hawkins, Claiborne, Md., assignor to National Biscuit Company, New York, N. Y., a corporation of New Jersey

Application June 8, 1937, Serial No. 147,029

14 Claims. (Cl. 107—57)

My invention pertains to ovens and particularly to continuously operating ovens, that is, ovens wherein the products to be baked, dried or heated are fed continuously at one point to an endless conveyor which carries them progressively through the oven, either with uniform or step-by-step motion, and delivers them at another point, although many features of the invention are applicable to ovens of other types.

Such ovens have been built of brick or of steel and iron frames securely fixed together and covered with heat insulation. These ovens are very long, often times being several hundred feet in length, and if any part fails to function or gets out of adjustment anywhere along the line, it can be reached for repair only with great difficulty, usually only after tearing out a part of the brick work or heavy insulation. Also such ovens are of fixed dimensions or length and they cannot be changed to suit new operating conditions, but each oven is designed and built for a specific type of work. If a longer or shorter oven is required for a new or different product, an entirely new oven must be designed. Even such a small alteration as changing the number or location of gas burners, or the passages for hot gases through the oven, often necessitates tearing down and rebuilding a large part of the oven.

The present invention has for its principal object to overcome the above noted and other objections that heretofore have been inherent in large or automatic ovens. More specifically an object of the invention is to provide an oven made in sections, which are substantially identical except for the end sections, so that an oven of any length or capacity can be constructed by incorporating the proper number of sections.

Another object is to provide an oven built up in sections wherein each section may be controlled independently of the other sections, and access may be had to any section without disturbing any other section.

Another object is to provide heat insulation for an oven which is built up in separate panels or sections, any one of which can be removed to give access to the interior of the oven.

Another object is to construct the insulating panels so as to minimize the transmission of heat from the inner to the outer walls through their metal edges.

Another object is to construct an oven so that access may be gained at any point to adjust, repair or alter the interior parts adjacent that point or within any section merely by removing a unit section or panel of insulation.

Still another object is to construct an oven with passages, chambers and control means so as to govern the distribution of heat and to prevent drafts in those parts or zones of the oven where their existence would be detrimental.

The above and other objects and advantages of the invention, that will be apparent to those skilled in this art, are attained by the embodiment of my invention that is illustrated in the accompanying drawings, wherein:

Figs. 1A and 1B, together, comprise a side elevation of an oven (partly diagrammatic) embodying my invention.

Fig. 2 is a sectional view through a typical panel or section of the oven, taken as on the line 2—2 of Fig. 7.

Figs. 3, 4 and 5 are detail views of typical sections taken as on the lines 3—3, 4—4, and 5—5 of Fig. 2.

Fig. 6 is a top plan, partly in section and partly broken away, showing the typical construction of a top panel.

Fig. 7 is a longitudinal section of three adjacent sections or panels.

Fig. 8 is a typical cross section of the oven taken through one of the oven frames, as on the line 8—8 of Fig. 7, the removable insulating panels or covers being omitted so as to show the steel frame more clearly.

Fig. 9 is an isometric view of one of the removable side panels.

Fig. 10 is an enlarged sectional view of one edge thereof.

Fig. 11 is an isometric view of one of the frame members.

Fig. 12 is an isometric view showing the relative positions of the insulating panels.

Referring to Figs. 1A and 1B, I have shown my invention embodied in a band oven in which the endless band 11 passes around the drum 12 at the entrance end of the oven and extends through the oven to the opposite end where it passes around the drum 13. One of the drums 12 or 13 is driven from a source of power so that the band is driven continuously. The articles to be treated in the oven are deposited on the upper run of the band near the entrance end of the oven and after passing through it are delivered at the opposite end fully baked or otherwise heat treated.

The oven housing, or oven proper as it may be termed, is made up from a number of sections 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28 and 29, which are supported on pedestals 30, and are all substantially alike in construction except that the end sections extend somewhat lower to

accommodate the dip of the lower run of the band 11. Certain of the sections are provided with draft outlets or connections 31, 32, 33 and 34, all of which lead to a common pipe 35, which is connected to a suitable blower or stack to create a controlled draft within the upper part of the oven. Each draft connection is controlled by a damper or other means, as may be desired. In the drawings I have indicated dampers in the draft connections 32 and 33 but the other connections are likewise controlled by similar dampers or by slides which are not shown in detail because, per se, they form no part of the present invention. Certain of the sections are also supplied with regulating means 36 for controlling the flow of gases from the baking chamber to a draft chamber within the upper part of the oven, as is more clearly shown in Figs. 2 and 7. While I have shown these draft controlling means and connections in certain of the oven sections they may of course be located wherever it is found most desirable to accomplish the desired control of the oven.

All of the sections 14 to 29 are constructed substantially the same and as best shown in Figs. 2, 7 and 8. All of the pedestals 30 on each side of the oven are connected at the top by stringers which extend the full length of the oven and each of which consists of two channels, 37, 38 and 39, 40, secured side-by-side with their flanges turned downward. At each section of the oven an inverted U-shaped frame composed of two channels 41, 42 has the lower ends of its depending legs secured to the stringers, as best shown in Figs. 8 and 11. These two channels are spaced apart and have their flanges turned toward one another and the space between them is filled with insulation, as best shown in Figs. 3, 4 and 8, the insulation being held in place by retaining plates, 43, 44, made from insulating material.

The stringers are connected together by sills 45, which preferably are formed from angle iron, as best shown in Figs. 7, 8, and 11, and some of which coincide with the U-shaped frames and others are intermediate the U-shaped frames, the spacing of these sills being dependent upon the width of the lower insulating panels of the oven presently to be described. Angle irons 46, 47, are secured to the inside of the vertical frames at the bottom and similar angles 48, 49, are secured to the frames near the tops to serve as securing means for the inside sheet metal panels 50, 51 and 52, as best shown in Fig. 2. Similar angles 48' and 49' connect the tops of the outer channels 41 (Figs. 2 and 11) and serve as supports or abutments for the flanges 69 of the top and side insulating panels, presently to be described. Finish strips 48a and 49a cover the upper corners to give the oven a finished appearance. Angles 53, 54, are secured to the inside of the frame members and together with the cross-channels 55' form supports for the intermediate insulation panels 55. These angles also serve as supports for the gas burner pipes 56 and the deflectors 57, as best shown in Figs. 2, 7 and 8. Brackets 58, 59, serve as supports for the inverted T's 58a and 59a which in turn support the lower gas burners 60, and the lower deflectors 61. Brackets 62, 63, secured to the inside of each leg of the U-shaped frames serve as supports for the cross-channels 64, with supporting shoes 65, for the upper run of the band 11, as clearly shown in Figs. 2, 7, and 8. These shoes 65 are staggered on the adjacent legs so as to cause even wear on the lower side of the band, this staggered relationship being shown in Fig. 7, where alternate shoes are shown in section.

All of the sections 14 to 29 are substantially identical and any number of them may be used to produce an oven of the desired length or capacity. Each section of the oven is enclosed by removable panels which are detachably secured to the U-shaped members so that any of them can be taken off to give access to any part of the oven for adjustment or repairs. The bottom of each section is also closed by removable insulating panels, there being preferably two panels to close the bottom of each section. This is merely for convenience in handling since the panel could be made in a single piece for closing the bottom of the section if desired, but these lower insulating panels are more convenient to handle if made in smaller sections.

Each of these insulating panels as shown in Figs. 2, 3, 4 and 9 consists of an outer piece of sheet metal 66, and an inner lining 67, which may be of sheet metal or wire mesh, the two being connected together by the edge strips 68 so as to provide a space of several inches between them which is filled with insulation. The edge pieces or strips 68 are bent outwardly so as to overlie the front covers 66 and extend beyond the insulation to provide flanges 69 that abut against the outer channels 41 of the vertical frames and are removably secured by bolts 70. The strips 68 are secured to the cover plates 66 by any suitable means as by spot-welding at 69'. In order to minimize the transmission of heat outward through the strips 68 they may be cut-away in part as at 68' so that the strips are connected to the inner lining 67 only by the narrow tongues 68'', which may be welded thereto. Preferably the outer cover 66 is covered by a piece of polished sheet metal 71 (see Fig. 3) and a similar strip of polished metal (such as Monel metal) 72 is used to cover the joint between the abutting flanges 69. Narrow plates 73 are secured to the inside of the channels 42 of the vertical frames (see Figs. 3, 4, and 8) and the removable sheet metal cover plates 50, 51, and 52, are secured to them and the angles, 46, 47, 48, 49 by any suitable securing means so that they may be readily removed. The plates 50, 51, 52 are spaced slightly from the insulating panels, as clearly shown in Figs. 2 and 3.

As shown in Figs. 2 to 6, narrow strips of insulating material 75 are placed between all joints of these covers and insulating panels where otherwise there would be metal to metal contact. The purpose of these narrow strips of insulating material is to prevent noise and rattles and to give a yieldable surface against which to secure the insulating panels. They also serve in some measure to prevent or retard the transmission of heat to the other parts of the oven frame.

The two side panels and top panel for each section are constructed substantially the same and as just described, for all sections, except that the side edges of the top panels are rabbeted out, as shown at 74 (Fig. 2) to fit over the inside top corners of the side panels.

The lower insulating panels 77 are constructed substantially the same as the side and top panels, except that they do not have the finishing plate 71 nor the flanges 69. Their construction is clearly shown in Figs. 2, 5, 7, and 12, and need not be described in detail since to do so would be a repetition of the description of the top and side panels. The lower panels 77 close the oven at the bottom and each one is preferably made of sub-

stantially half the length of an oven section. These insulating panels are supported on the sills **45** and can be removed through the bottom of the oven frame by lifting one of them above the adjacent one and then taking it out through the bottom after having first turned it through an angle of 90°. By having all of these insulating panels (top, side and bottom) easily removable, access may be gained to any part of the oven without destroying any part of it or having to tear down any brick work or other permanent part. All of the insulating covers are removable, but usually only those on the side opposite the gas pipes **56**, **60** will be taken off. Generally access can be had to the oven from one side to make all adjustments and repairs and it is not necessary to remove the covers through which the gas burner pipes extend, which may therefore be fixed to the frames in some cases.

The insulating panels when fitted to the frames form a continuous chamber which is divided by insulating panels **55** (Figs. 2 and 7) into an upper chamber **79**, which may be called a draft chamber, and a lower chamber **80**, which is the baking chamber, in which the gas burners are located and through which the upper run of the band **11** passes. These intermediate insulating panels **55** are constructed the same as the bottom panels **77** except they are not necessarily as thick. Draft passages **81** are provided in or between certain of the intermediate panels **55** so as to afford communication of the baking chamber **80** with the draft chamber **79**, these passages being controlled by dampers **82**, which are connected to be operated by handles **83** on the outside of the oven.

The draft connections **31** to **34** communicate directly with the draft chamber **79** so as to withdraw gases therefrom. By proper regulation of the dampers **82** and the control means in the draft connections **31** to **34**, any desired direction or rate of flow of gases through the baking chamber can be obtained and different rates of flow of gases to or from the baking chamber can be obtained in different sections of the oven in accordance with different baking conditions. For example: In the first sections of the oven where the wet dough is subjected to the highest heat so that the greatest amount of vapor is driven off from the dough and the largest amount of hot gases are furnished from the gas burners, a greater draft will be induced to take care of this larger volume of gas, while in the later stages of the baking operation a very gentle or slight draft may be produced. In some types of ovens and for baking some articles where such close regulation of draft and distribution of heat is not necessary, the panels **55** and dampers **82** can be dispensed with.

As shown in Fig. 1A, one or more of the insulating panels is provided with an inspection door **83** so that the conditions within the oven may be observed.

I have also found it desirable to provide means for relieving pressure within the oven in case of an explosion of gas or if for any reason an undue pressure exists. To relieve this pressure I provide an explosion panel **84** in one or more of the bottom insulating panels **77**, this explosion panel being held in place by yieldable means which will give way upon an undue rise of pressure within the oven before the pressure gets too high to cause serious injury or springing of the heavy insulating panels.

The return or lower run of the band **11** is supported on rollers **85**.

The insulating panels on one or both sides of the oven are provided with openings for the gas pipes or burners **56**, **60**, the number of which may be different in each section of the oven depending upon baking conditions. Thus when the articles to be baked require a high initial temperature followed by a lower baking temperature, there will be more gas burners in the sections at the inlet end and the number will then decrease toward the exit end of the oven. On the contrary, when a high browning or finishing heat is required, the number of burners may be increased in the sections near the exit end. Thus any number and arrangement of gas burners may be provided in all sections of the oven which makes the oven very flexible for baking different articles. The intermediate panels (**16** to **26**) are all substantially identical and interchangeable in arrangement so that an oven of any length or capacity can be built up by varying the number of these sections.

The lower run of the band **11** is shown returning through the hot oven, but all or any part of it may return below the lower insulating panels **77**, and any number of the oven sections may extend downward to the floor as do the end sections.

Having illustrated and described one form of my invention, what I claim and desire to protect by Letters Patent is:

1. In an oven, an oven housing comprising a plurality of similar sections connected together, an endless conveyor having one run passing through all of said sections and carrying the articles to be baked, one end section providing an entrance for said conveyor and the opposite end section providing an outlet, the said run of the conveyor being spaced from the top walls of the sections, heating elements in the sections above and below said run, insulating panels in each section above said run and heating elements dividing the section into an upper draft chamber and a baking chamber, outlet openings from the baking chamber to the draft chamber in certain of said sections, regulating means in said outlet openings to control distribution of heat in the baking chambers and the passage of gases from the baking chamber, and draft outlets in certain of said draft chambers.

2. An oven comprising top, bottom, side and end walls, said walls being formed from removable insulating panels supported from a frame and providing a continuous closed chamber, inner removable insulating panels supported on said frame and spaced from the top panels and dividing the closed chamber into an upper draft chamber and a baking chamber, outlet openings between certain of said inner panels, regulating means in said openings to control the distribution of heat in the baking chamber and the passage of gases from said baking chamber to said draft chamber, and draft means connected to said draft chamber to withdraw the gases therefrom.

3. An oven comprising two stringers, one on each side, a plurality of spaced inverted U-shaped frames having the lower ends of their legs secured to said stringers, cross-sills secured to said stringers and extending across the oven, a top and two side insulating panels closing the space between each adjacent pair of frames, means for removably securing said panels to the vertical legs and tops of said frames, an insulating panel closing the bottom space between each adjacent

pair of cross-sills, said bottom panels being removably supported on said cross-sills, said top, side and bottom panels enclosing a continuous chamber in said oven.

4. An oven comprising two stringers, one on each side, a plurality of spaced inverted U-shaped frames having the lower ends of their legs secured to said stringers, cross-sills secured to said stringers and extending across the oven, a top and two side insulating panels closing the space between each adjacent pair of frames, means for removably securing said panels to the vertical legs and tops of said frames, an insulating panel closing the bottom space between each adjacent pair of cross-sills, said bottom panels being removably supported on said cross-sills, said top, side and bottom panels enclosing a continuous chamber in said oven, a cross beam connecting the vertical legs of each of said frames intermediate their ends, and intermediate insulating panels removably supported on said cross beams, said intermediate panels dividing said continuous chamber into an upper draft chamber and a lower baking chamber.

5. An oven comprising two stringers, one on each side, a plurality of spaced inverted U-shaped frames having the lower ends of their legs secured to said stringers, cross-sills secured to said stringers and extending across the oven, a top and two side insulating panels closing the space between each adjacent pair of frames, means for removably securing said panels to the vertical legs and tops of said frames, an insulating panel closing the bottom space between each adjacent pair of cross-sills, said bottom panels being removably supported on said cross-sills, said top, side and bottom panels enclosing a continuous chamber in said oven, a cross beam connecting the vertical legs of each of said frames intermediate their ends, and intermediate insulating panels removably supported on said cross beams, said intermediate panels dividing said continuous chamber into an upper draft chamber and a lower baking chamber, outlet openings between certain of said intermediate panels, and regulating means in said openings to control the passage of gases from said baking chamber to said draft chamber.

6. An oven comprising two stringers, one on each side, a plurality of spaced inverted U-shaped frames having the lower ends of their legs secured to said stringers, cross-sills secured to said stringers and extending across the oven, a top and two side insulating panels closing the space between each adjacent pair of frames, means for removably securing said panels to the vertical legs and tops of said frames, an insulating panel closing the bottom space between each adjacent pair of cross-sills, said bottom panels being removably supported on said cross-sills, said top, side and bottom panels enclosing a continuous chamber in said oven, and an explosion relief panel releasably held in one of said bottom panels.

7. In an oven, a plurality of inverted U-shaped frames, means for supporting said frames in spaced relation, each frame comprising inner and outer U-shaped members spaced apart, insulation material in the space between said members, top and side insulating panels between each pair of frames, the panels having projecting flanges overlying and removably secured to said outer frame members.

8. In an oven, a plurality of inverted U-shaped frames, means for supporting said frames in spaced relation, each frame comprising inner and outer U-shaped members spaced apart, insulation material in the space between said members, top and side insulating panels between each pair of frames, the panels having projecting flanges overlying and removably secured to said outer frame members, and sheet metal panels spaced from said insulating panels and removably secured to said inner frame members.

9. In an oven, a number of spaced pedestals arranged in two parallel rows, a stringer connected to the tops of the pedestals in each row, a plurality of inverted U-shaped frames spaced apart and with the lower ends of their legs connected to the opposite stringers, a plurality of sills connected at their opposite ends to said stringers, a removable insulating panel closing the space on each side and top between each two adjacent U-shaped frames, each panel comprising inner and outer metal sheets spaced apart with an insulating filling between them, the edges of the inner sheet being bent outward to lie adjacent the edge portions of the outer sheet whereby to provide side flanges, said flanges overlying and secured to said U-shaped frames, bottom insulating panels removably supported on said sills and closing the spaces between said frames where secured to said stringers, each bottom panel comprising two spaced metal sheets with insulating filling between them.

10. In an oven, a number of spaced pedestals arranged in two parallel rows, a stringer connected to the tops of the pedestals in each row, a plurality of inverted U-shaped frames spaced apart and with the lower ends of their legs connected to the opposite stringers, a plurality of sills connected at their opposite ends to said stringers, a removable insulating panel closing the space on each side and top between each two adjacent U-shaped frames, each panel comprising inner and outer metal sheets spaced apart with an insulating filling between them, the edges of the inner sheet being bent outward to lie adjacent the edge portions of the outer sheet whereby to provide side flanges, said flanges overlying and secured to said U-shaped frames, bottom insulating panels removably supported on said sills and closing the spaces between said frames where secured to said stringers, each bottom panel comprising two spaced metal sheets with insulating filling between them, each of said U-shaped frames comprising two channel members with their flanges turned toward each other and spaced apart, heat insulation filling the space between said channels, and inner sheet metal panels removably secured to the inner channel member and spaced inwardly from said top and side insulating panels.

11. In an oven, a frame comprising two parallel bottom stringers, a number of inverted U-shaped frames with the lower ends of their legs connected to the respective stringers, and a horizontal sill joining the stringers adjacent the lower ends of each inverted frame.

12. In an oven, a frame comprising two parallel bottom stringers, a number of inverted U-shaped frames, each U-shape frame comprising two concentric channels spaced apart with their flanges facing each other, the lower ends of the channels being secured to the respective stringers, and cross-sills connecting the stringers adjacent the lower ends of the channels.

13. In an oven frame, two parallel bottom stringers, each stringer comprising two channels secured side by side with their flanges turned

downward, a number of frame members each comprising two channels spaced apart with their flanges facing toward each other and bent to inverted U-shape so that one lies within the other, the lower ends of the legs of the outer channel being secured to the two outer stringer channels, the lower ends of the legs of the inner channel being secured to the two inner stringer channels, and a horizontal sill joining the inner stringer channels adjacent the lower ends of said frame member channels.

14. In an oven, an insulating panel comprising an outer metal plate and an inner metal lining spaced apart, the inner lining having side strips extending toward the outer plate and flanged outwardly to overlie the plate, said flanged portions being secured to said plate adjacent its edges, said side strips having spaced cut-away portions so as to be joined to the inner lining by narrow tongues, the space between said plate and lining being filled with heat insulation.

WILFORD JUDSON HAWKINS.