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METHOD OF PRODUCING MULTIPLE SHEET GLAZING UNITS

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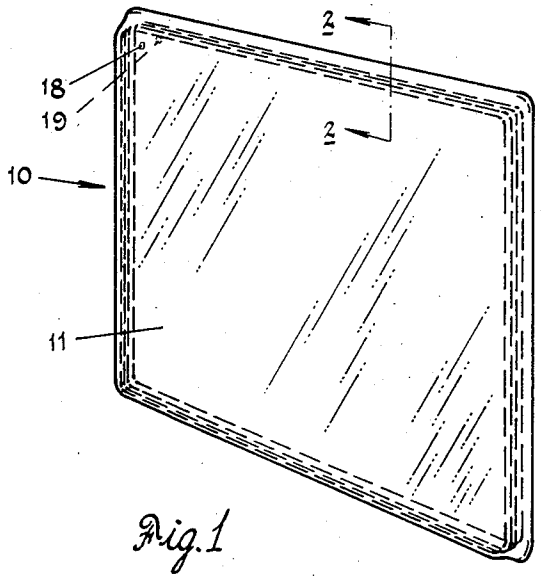


Fig. 1

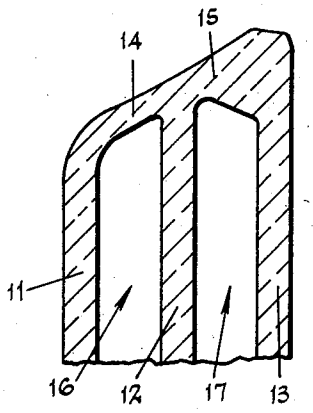


Fig. 2

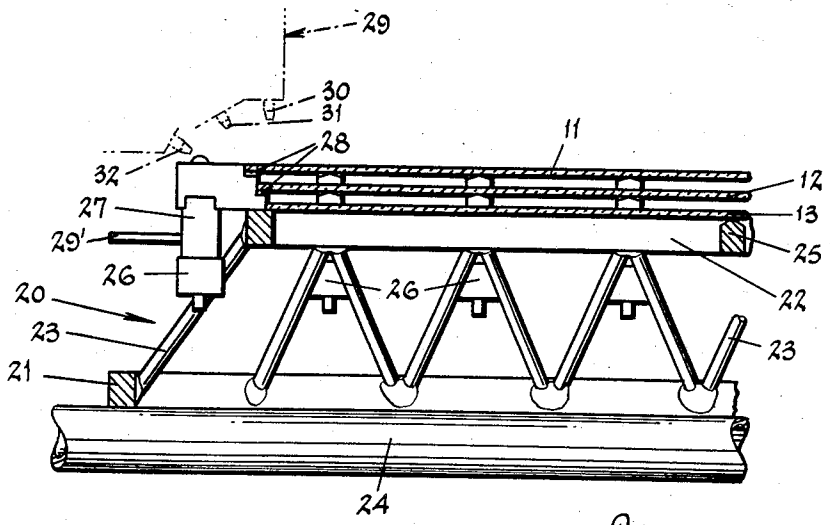


Fig. 3

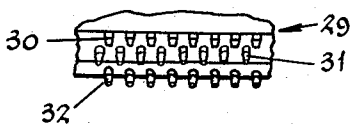


Fig. 4

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METHOD OF PRODUCING MULTIPLE SHEET GLAZING UNITS

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Application April 27, 1953, Serial No. 351,299

8 Claims. (Cl. 49—82)

This invention relates broadly to the production of multiple sheet glazing units. More particularly, it relates to an improved method for producing multiple sheet glazing units having two or more superimposed air spaces enclosed therebetween.

Multiple sheet glazing units may be described generally as comprising two or more spaced sheets of glass which are sealed together entirely around their marginal edge portions to enclose hermetically sealed dead air spaces therebetween. Due principally to their insulating and condensation preventing qualities, such units have become well established fixtures in the building trades and have found wide usage as windows for buildings, show cases, vehicles, refrigerators, and the like.

It has been proposed to form multiple sheet glazing units entirely of glass by causing the edge portions of the spaced sheets to be sealed directly to one another. For example, in a copending application, now abandoned, Serial No. 300,884, filed July 25, 1952, by John A. Woods et al. and assigned to the assignee of this application, there is disclosed a method for producing a multiple sheet glazing unit in which a pair of spaced sheets of glass are sealed directly together around their marginal edge portions to enclose a single air space therebetween. According to the method disclosed therein, one sheet of glass is supported in fixed spaced and superimposed relation above another sheet and the marginal edge portions of said spaced sheets are moved past impinging flames which cause said edge portions to be bent into fused relation with one another.

It will be understood, however, that generally as the number of superimposed sheets or panes of the unit—and consequently the number of air spaces enclosed therebetween—are increased, the insulating and condensation preventing qualities are likewise raised. Of course, these qualities are also dependent on the size of the unit, the air space therebetween, as well as the condition of the air within said space. However, it has been found that while the two pane, single air space units are generally satisfactory when used as windows for buildings, vehicles, and the like, they do not always prove satisfactory under more severe applications. That is, for example, in the case of windows for refrigerators and the like, wherein the temperature differential at opposite sides of the units may reach relatively large proportions, it has frequently been found necessary to provide glazing units having a plurality of spaced panes which enclose two or more superimposed air spaces.

It is the primary object of this invention to provide an improved method for producing all-glass, multiple sheet glazing units of the type described having two or more superimposed air spaces therebetween.

It is another object of this invention to provide a method of producing multiple sheet glazing units of the type described in which three or more superimposed sheets are sealed together entirely around their edge portions by flames impinging thereon.

Still another object of this invention is to provide a method of producing multiple sheet glazing units of the type described in which three or more sheets are mounted in superimposed and fixed spaced relation and the edge portions thereof are moved past impinging flames for causing said edge portions to bend into fused relation with one another.

Other objects and advantages of the invention will become more apparent during the course of the following description when taken in connection with the accompanying drawings.

According to this invention, three or more sheets of glass are mounted on a supporting tray or rack in fixed spaced and superimposed relation one above the other. The supporting tray is then moved continuously through a furnace having concentrated heat sources in the form of burner elements disposed along one or both sides thereof. While so moving through said furnace, the tray is caused to be aligned with said burner elements so as to sequentially align the edge portions of the superimposed sheets with respect to impinging flames from said burner elements in a predetermined manner while moving therepast. The edge portions of each of said sheets, in moving past said impinging flames, are caused thereby to bend into fused relation with the edge portions of the sheet directly superimposed therebeneath to seal the edge portions of each of said sheets together substantially simultaneously.

In the accompanying drawings, wherein like numerals are employed to designate like parts throughout the same:

Fig. 1 is a perspective view of a three sheet, double air space glazing unit produced in accordance with this invention;

Fig. 2 is a sectional view of an edge portion of the unit, taken substantially along the broken line 2—2 of Fig. 1;

Fig. 3 is a transverse sectional view of a tray apparatus for supporting the sheets of the unit prior to and during the edge sealing thereof; and

Fig. 4 is a fragmentary elevational view of the burner element shown in phantom in Fig. 3.

Referring now in particular to the above described drawings, there is shown in Fig. 1 a three sheet, double air space glazing unit, designated in its entirety by the numeral 10 and including spaced glass sheets **11**, **12**, and **13**, the edge portions of which are sealed directly to one another by side portions **14** and **15**. As will be explained more fully hereinafter, these side portions **14** and **15** are formed from edge portions of the adjacent sheets. As shown in Fig. 2, the glass sheets **11**, **12** and **13** and side portions **14** and **15** enclose therebetween two superimposed air spaces **16** and **17**. Dehydration holes **18** and **19** may be formed toward a corner or edge of the outermost sheets **11** and **13**, respectively, for a purpose well known in the art.

According to this invention and as shown in Fig. 3, prior to the sealing of the edges thereof directly together, the sheets **11**, **12** and **13** are mounted in fixed spaced and horizontally disposed face-to-face relation. The uppermost sheet **11** is slightly larger than the intermediate sheet **12**, while the latter is in turn correspondingly larger than the lowermost sheet **13**. Thus, at each side of the assembled group of spaced sheets, the edge portions of each successive lower sheet project slightly inwardly from those of the sheet immediately thereabove.

Of course, the exact amount of projection in each case will depend principally upon the desired thicknesses of the air spaces **16** and **17** between the sheets. In some cases, these thicknesses may be equal and in others, unequal. Regardless of the relationship between the air spaces, however, it will be understood from the description to follow that the aforementioned relationship of

the projecting edge portions of the superimposed sheets will be constant.

The sheets **11**, **12** and **13** are assembled in their fixed spaced relation upon a generally rectangular supporting tray **20** which is, in many respects, similar to the sheet supporting apparatus disclosed in the aforementioned copending application of Woods et al. This tray includes a lower rim **21** connected to an upper rim **22** by struts **23**. The lower rim **21** of the tray is adapted to be moved through a furnace (not shown) over a conveyor means **24**, and the upper rim **22** is adapted to support the edge portions of the lowermost sheet **13**. Braces, such as **25**, may be provided laterally of the upper rim to support the central portions of the lowermost sheet in a substantially flat position.

Bearings **26** are secured to the struts **23** at each side of the tray **20** to rotatably support finger members **27**. Each of the finger members **27** is provided with ledges **28** at its inner end for supporting the edge portions of the intermediate sheet **12** and uppermost sheet **11**. These ledges are formed in step fashion so that each not only supports its respective sheet edge portion but also centers the same with respect to the tray **20** and the other assembled sheets. Of course, the elevation of each ledge **28** will depend on the desired spacing between adjacent sheets.

Thus, it can be seen that prior to the edge sealing thereof, the three glass sheets **11**, **12** and **13** may be assembled in fixed spaced and face-to-face relation, in which each sheet is supported at its edge portions and all are centrally arranged in superimposed relation. In being moved through the furnace over the conveyor means **24**, the tray **20** is caused to be properly aligned with and moved past burner elements **29** disposed along one or both sides of the furnace. In this manner, impinging flames from the burner elements are caused to be played along the edge portions of the glass sheets supported on the tray and moving therepast so as to cause said edge portions to be sealed together, in accordance with the novel method of this invention.

To be more specific, means (not shown) may be provided for aligning the movement of the tray in the desired manner with respect to the burner elements **29**. For example, aligning means may be provided in connection with the burner elements themselves, similar to that disclosed in the aforementioned copending application. Alternatively, aligning means may be provided independently of the burner elements, in a manner, for example, as disclosed in my copending application, Serial No. 339,229, filed February 27, 1953, and assigned to the assignee of the present application.

Additionally, means (not shown) may be provided at a suitable location along the furnace for removing the finger elements **27** for each edge portion of the glass sheets to a non-supporting position just prior to the movement of said edge portions past the impinging flames from the burner elements **29**. For this purpose, each of the finger members is provided with a "knock-out" arm **29'** which is adapted to be engaged by the aforementioned means just prior to the movement of said finger member past said burner element so as to rotate said finger element to a non-supporting position.

As previously mentioned, the burner elements **29** may be disposed along one or both sides of the furnace. Thus, during movement of the tray **20** through said furnace, opposite edge portions of the assembled glass sheets may be either sequentially or simultaneously sealed together. In either case, however, after a first pair of opposite edge portions of the sheets have been sealed together, the tray is oriented in any suitable manner and the operation repeated for the other opposite pair. Thus, it will be understood that during the entire edge sealing operation, the uppermost and intermediate sheets **11** and **12** are at all times maintained in properly spaced relation above lowermost sheet **13** by either the finger members **27** or the just sealed edge portions.

For the purpose of causing flames to be impinged upon the edge portions of the glass sheets when aligned with and moved past the burner elements **29**, each of said burner elements is provided with upper, intermediate and lower rows of aligned nozzles **30**, **31** and **32**, respectively. According to the novel method of this invention, the upper row **30** is arranged so as to direct flames therefrom along a straight line substantially vertically onto the edge portions of the glass sheets. The intermediate row **31**, on the other hand, is arranged in a plane at about 30° to the vertical, and the lower row **32** in a plane at about 60° to the vertical. Thus, as shown in Fig. 3, the flames from the upper row **30** are approximately aligned with the edge of the lowermost sheet **13**, while the flames from each of the intermediate and lower rows of nozzles **31** and **32** are directed angularly toward the edges of the intermediate sheet **12** and lowermost sheet **13**, respectively.

In operation, the flames from the upper row of nozzles **30** will first cause the edge portions of the upper sheet **11** to become softened and bend downwardly onto those of the intermediate sheet **12**. Substantially simultaneously, the edge portions of the intermediate sheet are caused by the intermediate row of nozzles **31** to sag downwardly onto those of the lowermost sheet **13**, which have been caused to curl slightly upwardly due to the initial playing therealong of flames from the lower row of nozzles **32**. As the edge portions of the sheets are advanced further past the impinging flames from the burner element **29**, the edge portions of the uppermost sheet **11**, which have sagged downwardly onto those of the intermediate sheet **12**, will be further caused to sag toward the lowermost sheet **13** under the influence of the flames from the intermediate row of nozzles **31**.

Thus, there is formed adjacent the lowermost sheet an enlarged portion where edge portions of all three sheets are fused together. Toward the completion of the movement of the edge portions past the impinging flames from the burner element **29**, the flames from the lower row of nozzles **32** are further played along the aforementioned enlarged portion of the sealed edge portions to cause a complete fusion thereof. It will also be understood that the fusion of the edge portions of the uppermost sheet **11** with those of the intermediate sheet **12** adjacent said intermediate sheet is further enhanced by the playing of flames therealong from the intermediate row of nozzles **31**.

It will be understood, of course, that the relative positions of the rows of burner nozzles may be changed within the scope of this invention, in order to cause the fusing of the edge portions of the glass sheets in the manner above described. That is, for example, if the thickness of the air spaces between the sheets were to be made considerably smaller than that shown in Fig. 3, the angular relation of the rows of nozzles might be made correspondingly less. In general, however, it is desirable to direct the flames from each of said rows onto the edge portions of the superimposed glass sheets in the manner above described.

After the edge portions of the sheets have been sealed together entirely therearound, the unit **10** may be removed from the tray **20**. According to any of the well known methods, the atmosphere in the air spaces **16** and **17** enclosed within said unit may be dehydrated and, if desired, a vacuum created therein. After the air spaces have been prepared, the dehydration holes **18** and **19** may be hermetically sealed to form the completely sealed unit.

It is to be understood that the application of the novel method of this invention is not to be limited to the particular embodiment shown herein for producing a three sheet, double air space unit. Within certain practical

limits, multiple glazing units having three or more superimposed air spaces may be formed.

It is to be further understood that the form of the invention disclosed herein is to be taken as the preferred embodiment thereof, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. In a method of producing a multiple sheet glazing unit, the steps of mounting three sheets of glass in fixed spaced and face-to-face relation one above another and while maintaining said fixed relationship, bending edge portions of the uppermost of said sheets into fused relation with corresponding portions of the intermediate sheet, and substantially simultaneously bending edge portions of said intermediate sheet into fused relation with corresponding portions of the lowermost of said sheets.

2. In a method of producing a multiple sheet glazing unit, the steps of mounting three sheets of glass in fixed spaced and face-to-face relation one above the other with edge portions of all but the lowermost sheet projecting outwardly from corresponding portions of the next succeeding lower sheet, moving the corresponding edge portions of said sheets past concentrated heat sources, and while maintaining said fixed relationship, directing flames from said heat sources simultaneously onto each of the sheet edge portions to cause the outwardly projecting edge portions of all but said lowermost sheet to bend into fused relation with corresponding edge portions of the next succeeding lower sheet.

3. In a method of the character defined in claim 2, in which flames from said heat sources are directed substantially vertically onto the edge portions of the uppermost of said sheets and approximately aligned with the edge portion of the lowermost sheet.

4. In a method of the character defined in claim 2, in which flames from said heat sources are directed downwardly toward the edge portions of the intermediate of said sheets and at an angle to the plane of said intermediate sheet.

5. In a method of the character defined in claim 2, in which flames from said heat sources are directed downwardly toward the edge portions of the lowermost of said sheets and at an angle to the plane of said lowermost sheet.

6. In a method of the character defined in claim 2, in which flames are directed substantially vertically onto the edge portions of the uppermost of said sheets as well as toward the edge portions of each of the other sheets and at an angle to the plane of each of said other sheets.

7. In a method of the character defined in claim 6, in which the vertically directed flames are approximately aligned with the edge portions of said lowermost sheets.

8. In a method of the character defined in claim 6, in which said flames are directed onto the edge portions of each of said sheets substantially simultaneously.

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