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PROCESS FOR BENDING GLASS SHEETS

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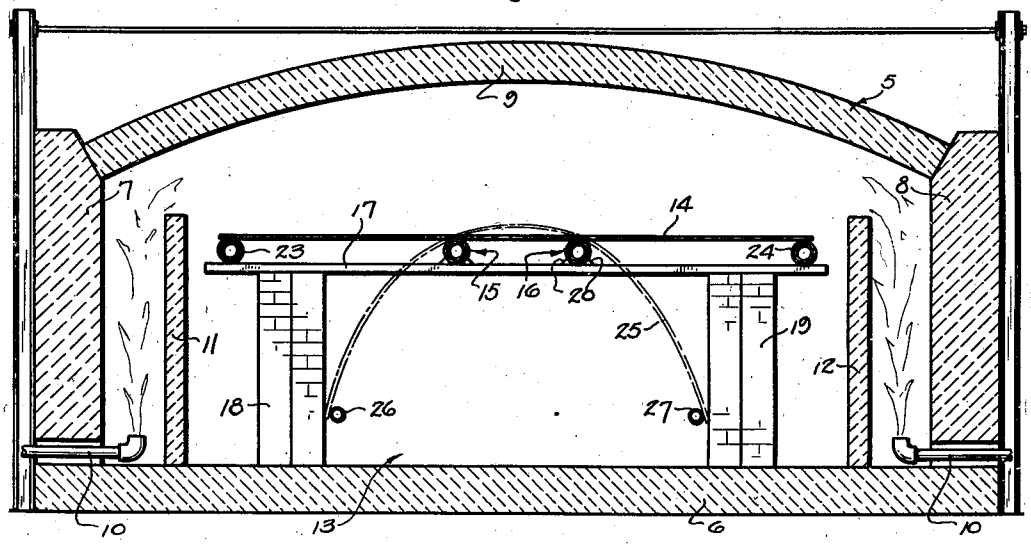


FIG. 1.

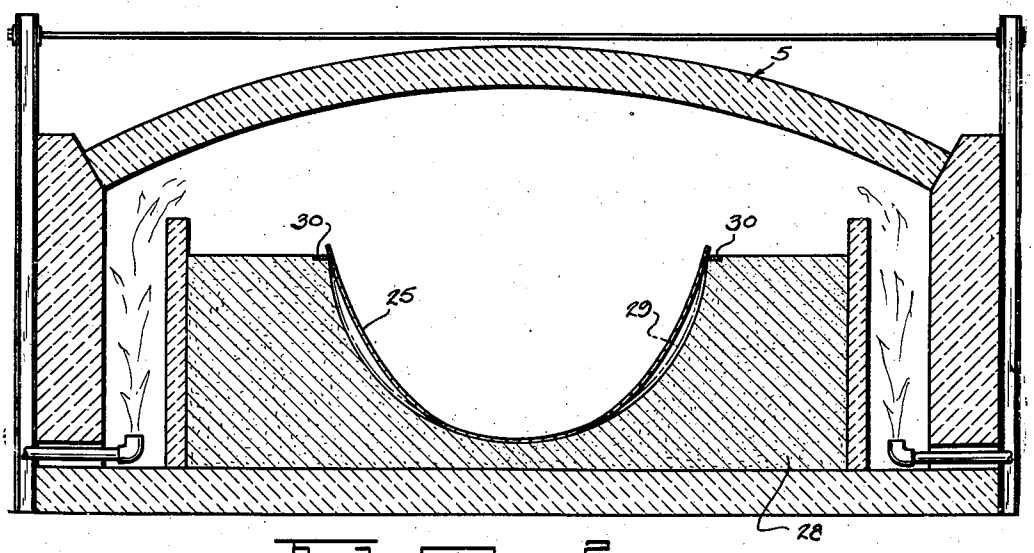


FIG. 2.

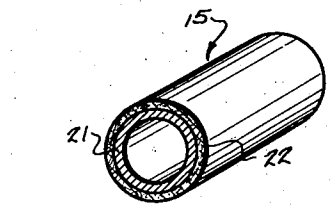


FIG. 3.

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PROCESS FOR BENDING GLASS SHEETS

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8 Claims. (Cl. 49—84)

The present invention relates to an improved process for bending glass sheets or plates and is of particular utility in the processing of relatively deep bends such as, for example, substantially U-shaped or full semi-circular bends, although the invention is of course not restricted thereto.

Among the objects of the invention is the provision of a process for bending glass sheets or plates wherein the liability of breakage of the glass is reduced to a minimum; wherein the bent sheets or plates will be of an improved surface quality relatively free from distortion; wherein a minimum amount of burning and pitting of the glass is obtained; and which is far superior, from a practical standpoint, to present day methods of bending.

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 drawing.

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

Fig. 1 is a vertical transverse sectional view through a furnace illustrating the initial step of the bending process;

Fig. 2 is a similar view illustrating the finishing step of the process; and

Fig. 3 is a perspective sectional view of one of the sheet supporting rolls.

The process provided by the invention consists of a so-called over and under method of bending glass sheets or plates, being of especial utility in the forming of relatively deep bends. Briefly, the process includes two principal steps; the first being the over-bend, wherein the glass sheet is bent over a suitable support or supports to effect a partial bend, and the second or finishing step being the under-bend in which the position of the partially bent sheet is reversed and supported in such reversed position, preferably in a concave mold, wherein the sheet is bent to the final predetermined curvature.

In carrying out the invention, and particularly in the practice of the initial bending step or over-bend, the apparatus illustrated in Fig. 1 of the drawing may be employed. This apparatus comprises a heating furnace 5 of any suitable construction; the type of furnace illustrated being merely shown by way of example. In this case, however, the furnace comprises a bottom 6, opposite vertical side walls 7 and 8 and an arch 9. The furnace may be heated by the plurality of gas burners 10 projecting through openings in the side walls 7 and 8 adjacent the bottom 6. The flames from the burners are directed upwardly toward the arch 9 by vertical baffle walls 11 and 12 disposed inwardly of the side walls 7 and 8 respectively, said baffle walls terminating some distance beneath the arch 9, so that the heating flames are directed upwardly and pass into the heating chamber proper of the furnace adjacent the arch.

The heating chamber proper is designated 13 and the initial step of bending the glass sheet 14 is adapted to take place therein. The glass sheet 14 is supported in a horizontal position, preferably upon a pair of spaced parallel rolls 15 and 16, which rolls are disposed inwardly of the opposite ends of the sheet, with the distance between the rolls depending upon the radius and circumference or girth of bend desired. These rolls, which constitute parallel lines of transverse support for the sheet, are mounted at each end upon a horizontal beam or the like 17 carried at its opposite ends by posts or the like 18 and 19. The supporting rolls 15 and 16 are adapted to be maintained in fixed position during the bending operation and this may be accomplished by the chock or wedge blocks 20 or in any other desired manner.

While the sheet supporting rolls 15 and 16 may be of any desired construction, it is preferred that they be of asbestos or asbestos covered so as not to mar the surface of the glass. As shown in Fig. 3, each roll may consist of a cylindrical metallic body or core 21, having a covering 22 of asbestos.

After the supporting rolls 15 and 16 have been properly spaced with relation to one another and secured in position, the flat sheet of glass 14 to be bent is laid thereon. In order to prevent the weight of the ends of the sheet from breaking the glass, the said sheet may also be supported at its opposite ends upon rolls 23 and 24; said rolls being also mounted at their opposite ends upon the beams 17 and being movable with respect thereto.

The glass sheet 14 is then heated to the desired temperature and as the glass begins to soften and the supporting action of the rolls 23 and 24 is no longer necessary, the said rolls are removed from beneath the sheet; whereupon the opposite end portions of the heated sheet will be permitted to drop or bend downwardly by gravity, as indicated by the broken lines 25.

In order to limit the downward movement of the opposite end portions of the sheet, there are provided fixed transverse stop members 26 and 27,

the position of these members depending entirely upon the type of bend desired. The stop members 26 and 27 may consist either of small guide rolls or of iron sections, such as straps or angles. Since the outer edges of the glass sheet are usually trimmed off after bending, iron sections may be used. However, it is preferred that asbestos covered rolls, such as shown in Fig. 3 be used, if the contacting lines would be visible in the completed bend.

The bending of the glass sheet over the rolls 15 and 16 does not result in the sheet being bent to the final predetermined curvature, but results only in a partial or initial bend as explained above.

In making the finishing or under-bend, the position of the partially bent sheet is reversed, the sheet being supported in such reversed position and bent to the final predetermined curvature while so supported. Thus, the partially bent glass sheet 25 can be placed in a concave sand mold 28 (Fig. 2) or supported in some other desired manner. The mold 28 or other support can be arranged within the furnace 5 or in a separate furnace which may be of the same construction as furnace 5 or of any other desired construction.

After the partially bent glass sheet has been placed in the mold 28, it is reheated to cause a softening of the glass and this softening of the glass will cause it to drop and take the shape of the mold as indicated at 29, the curvature of said mold corresponding to the final predetermined curvature desired of the sheet.

The mold 28 is preferably a customary sand mold provided at its upper edges with the customary metal guide strips 30 and it is desired that when the glass sheet is originally placed in the mold the glass will not contact these metal strips. To avoid this, wooden strips or wedges (not shown) may be placed between the glass and metal strips 30 to compensate for the differential in heat absorption between the glass and metal during the early stage of the heating cycle. These wooden strips or wedges gradually burn out, leaving the glass in contact with the metal strips during the balance of the heating cycle.

Any desired time and temperature cycle that will bend the glass can be used, the same cycle being preferably followed for both the over-bend and under-bend, with the exception that a little more time and care may be given to finishing the sheet in the mold than in bending it over the rolls. While not essential, it is preferred that the glass be allowed to cool between the first and second bends as it simplifies the physical handling of the glass from the rolls to the mold. By way of example, an average cycle for ¼ inch polished plate glass may be as follows:

When making the over or initial bend, the glass sheet is allowed to remain in the furnace for approximately three hours, during which the temperature is gradually raised to approximately 1000 degrees F. A soaking period of approximately one hour at this temperature is permitted, after which the temperature is sharply increased to from 1200 degrees F. to 1300 degrees F. to effect the bending. The glass is allowed to cool after which its position is reversed and it is placed in the mold 28; where it is again heated, as above described, to effect the bending and final shaping in the mold. To assist in ironing the glass in the mold, a gas jet or wooden blocks may be used.

It has been found, as a result of actual practice, that the process of over and under bending above described is far superior, from a practical standpoint, to present day methods of bending and results in a finished product of greatly improved surface quality and exceptional freedom from distortion. This is due in a large measure to the fact that there is no drag or slippage of the glass sheet over the supporting rolls 15 and 16, and likewise, there is relatively little slippage between the glass surface and mold surface which would tend to mar the glass. Consequently, sheets of large size can be supported and bent just as readily as small sheets. Also, in this process, each side of the glass is exposed approximately one-half the total bending time to those conditions which are considered of maximum severity, which results in a reduced amount of burning and pitting of the glass. As pointed out above, this process is of especial value in the making of any relatively deep bend, and is therefore not limited to the forming of substantially U-shaped or semi-circular bends.

It is to be understood that the form of the invention herewith shown and described is to be taken as the preferred embodiment of the same, 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 subjoined claims.

I claim:

1. The process of bending glass sheets, which consists in supporting the sheet to be bent in a horizontal position upon spaced parallel lines of transverse support disposed inwardly of the ends of said sheet, heating the sheets to cause the outer ends thereof to bend downwardly over said lines of support to form a partial bend, reversing the position of the partially bent sheet and supporting it in such position, and in then heating the sheet to cause the bending thereof to the finished predetermined curvature while so supported.

2. The process of bending glass sheets, which consists in supporting the sheet to be bent in a horizontal position inwardly of the ends of said sheet, heating the sheet to cause the outer ends thereof to drop downwardly by gravity to form a partial bend, reversing the position of the partially bent sheet and supporting it in a concave mold, and in then heating the sheet to cause it to take the shape of said mold.

3. The process of bending glass sheets, which consists in suporting the sheet to be bent in a horizontal position upon spaced parallel lines of transverse support disposed inwardly of the ends of said sheet, heating the sheet to cause the outer ends thereof to bend downwardly over said lines of support to form a partial bend, limiting the downward movement of the ends of the sheet by mechanical means engageable by said sheet, reversing the position of the partially bent sheet and supporting it in such position, and in then heating the sheet to cause the bending thereof to the finished predetermined curvature while so supported.

4. The process of bending glass sheets, which consists in supporting the sheet to be bent in a horizontal position inwardly of the ends of said sheet, heating the sheet to cause the outer ends thereof to drop downwardly by gravity to form a partial bend, limiting the downward movement of the ends of the sheet by mechanical means engageable by said sheet, reversing the position of the partially bent sheet and supporting it in

a concave mold, and in heating the sheet to cause it to take the shape of said mold.

5. The process of bending glass sheets, which consists in supporting the sheet to be bent in a horizontal position upon spaced parallel lines of transverse support disposed inwardly of the ends of said sheet, supporting the sheet at the opposite ends thereof, heating the sheet, withdrawing the support from the ends of the heated sheet causing said ends to bend downwardly by gravity over the lines of transverse support to form a partial bend, reversing the position of the partially bent sheet and supporting it in such position, and in then heating the sheet and causing it to take the final predetermined curvature while so supported.

6. The process of bending glass sheets, which consists in supporting the sheet to be bent in a horizontal position inwardly of the opposite ends thereof, also supporting the opposite ends of said sheet, heating the sheet, removing the support from the opposite ends of the heated sheet thereby causing said ends to drop downwardly by gravity to form a partial bend, reversing the position of the partially bent sheet and supporting it in a concave mold, and in heating the sheet to cause it to take the shape of said mold.

7. The process of bending glass sheets, which consists in supporting the sheet to be bent in a horizontal position upon spaced parallel lines of transverse support disposed inwardly of the ends of said sheet, supporting the sheet at the opposite ends thereof, heating the sheet, withdrawing the support from the ends of the heated sheet causing said ends to bend downwardly by gravity over the lines of transverse support to form a partial bend, limiting the downward movement of the ends of the sheet by mechanical means engageable by said ends, reversing the position of the partially bent sheet and supporting it in such position, and in then heating the sheet and causing it to take the final predetermined curvature while so supported.

8. The process of bending glass sheets, which consists in supporting the sheet to be bent in a horizontal position inwardly of the opposite ends thereof, also supporting the ends of said sheet, heating the sheet, removing the support from the opposite ends of the heated sheet thereby causing said ends to drop downwardly by gravity to form a partial bend, limiting the downward movement of the ends of the sheet by mechanical means engageable by said ends, reversing the position of the partially bent sheet and supporting it in a concave mold, and in heating the sheet to cause it to take the shape of said mold.

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