Jan. 19, 1932. W. E. NOBBE 1,841,548

APPARATUS FOR PRODUCING SHEET GLASS

Filed March 11, 1930

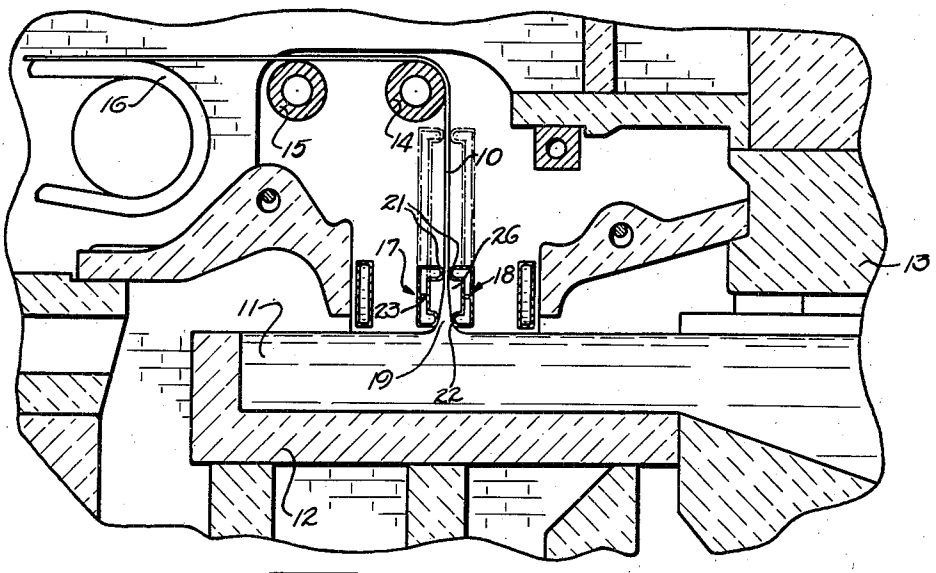


FIG. 1

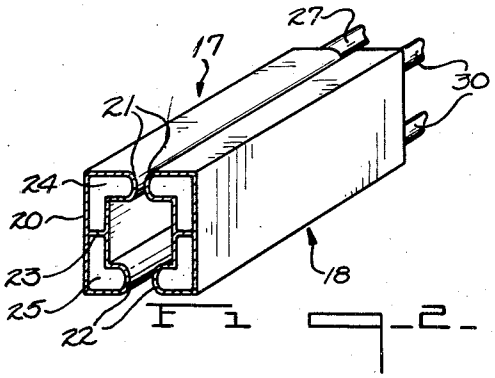


FIG. 2

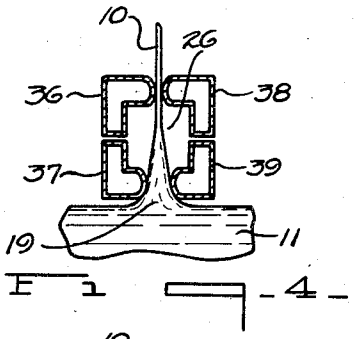


FIG. 4

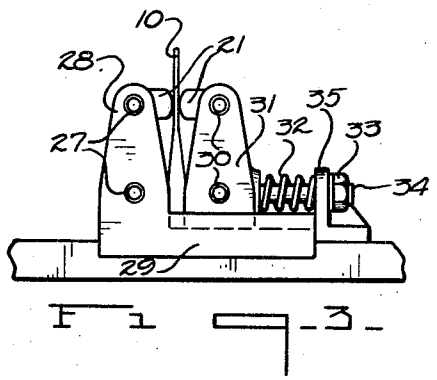


FIG. 3

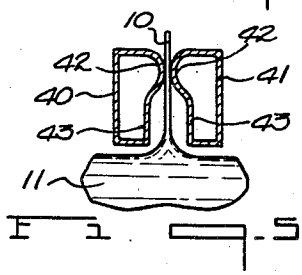


FIG. 5

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UNITED STATES PATENT OFFICE

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APPARATUS FOR PRODUCING SHEET GLASS

Application filed March 11, 1930. Serial No. 434,968.

The present invention relates to improvements in apparatus for producing sheet glass.

While this invention is herein illustrated and described as being used in connection with the Colburn process for producing sheet glass as exemplified in Colburn Patent No. 1,248,809, granted December 4, 1917, it is of course not necessarily restricted to use in such connection, as it can well be adapted to other types of sheet glass forming apparatus.

An important object of the invention resides in the provision of apparatus whereby the formation of surface defects or irregularities in the sheet as it is being drawn will be reduced to a minimum so that a flatter, smoother, and more uniform thickness of sheet may be produced.

Another object of the invention is the provision of an apparatus for minimizing the formation of surface irregularities in the sheet during the formation thereof by subjecting opposite surfaces of said sheet to a wiping or smoothing action.

A further object of the invention is the provision of means of a novel construction for engaging opposite surfaces of the sheet at the base or meniscus thereof and also after it has attained sheet form for flattening or ironing out irregularities in the surfaces thereof.

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.

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

Fig. 1 is a vertical longitudinal section through one type of sheet glass apparatus showing the present invention in use,

Fig. 2 is a perspective sectional view of the wiping or smoothing members,

Fig. 3 is an elevation showing one way in which the wiping members may be mounted,

Fig. 4 is a sectional view of a slightly modified arrangement, and

Fig. 5 is a transverse section of a modified type of wiping member.

In the drawings, 10 designates a glass sheet continuously drawn upwardly from a bath of molten glass 11 contained in a working receptacle or draw-pot 12 and supplied thereto from any suitable type of furnace 13. The sheet 10 is drawn vertically for a suitable distance and then while still in a semi-plastic condition is deflected about the rotatable bending roll 14 into a substantially horizontal plane, said sheet being then passed over a so-called idler roll 15 and draw table 16 into and through an annealing leer, not shown.

In the Colburn process as ordinarily practiced, suitable knurled rollers or other width maintaining means are positioned to engage opposite edges of the sheet at the base thereof to prevent narrowing of the sheet as it is drawn upwardly. According to this invention, however, the usual sheet edge engaging means are omitted and there are substituted therefor the preferably metallic members designated in their entirety 17 and 18 respectively and which are positioned at opposite sides of the sheet adjacent to but spaced slightly above the molten mass 11. These members extend the entire width of the sheet and serve not only to maintain said sheet to width, but also to facilitate the drawing operation and to improve the quality of the sheet produced.

The members 17 and 18 are preferably constructed from a suitable non-corrosive metal such as Monel, nichrome, etc., with each member being in the form of a substantially U-shaped hollow casing and comprising the substantially vertical portion 20 and the inwardly directed portions 21 and 22 at the top and bottom thereof respectively. Each member may also be divided intermediate the upper and lower ends thereof by means of a horizontal partition wall 23 to provide separate upper and lower chambers 24 and 25 through which a suitable cooling medium is adapted to be circulated. By dividing each member into upper and lower chambers, a different type of cooling medium may be circulated

through the chambers or the same medium at different temperatures.

When the members 17 and 18 are positioned at opposite sides of the sheet 10 in the manner illustrated in Fig. 1, it will be seen that the inwardly directed portions 22 of said members engage the base or meniscus 19 thereof, while the inwardly directed portions 21 engage the sheet after it has attained final sheet form. Thus, the inwardly directed portions 21 are longer than portions 22 so that the space between adjacent portions 22 is greater than that between adjacent portions 21. As the glass is drawn upwardly between members 17 and 18, the opposite surfaces thereof will be submitted to a wiping or smoothing action first by the inwardly directed portions 22 and then by the inwardly directed portions 21 which will tend to flatten or iron out any irregularities or defects in the surfaces thereof so that a flatter, smoother sheet of glass of a more uniform thickness will be produced. The inturned end portions 22 are adapted to be arcuately curved so that they fit substantially into the curvature of the sheet meniscus 19, while the portions 21 are adapted to be curved so that they have substantially line contact with the sheet to reduce the area of contact between the sheet and metal members at this point.

The members 17 and 18 further cooperate with one another to shield the sheet during its formative period so as to protect it from hot gases, cold drafts and other atmospheric changes. Thus, said members cooperate to provide a substantially closed compartment 26 through which the sheet is drawn in its early formative stage. If desired, the members 17 and 18 may be relatively taller than as shown by the full lines in Fig. 1 and, as a matter of fact, may extend substantially up to the bending roll 14 as indicated by the broken lines so as to shield the sheet during a greater portion of its upward travel and so that the portions 21 will engage the sheet at a point more closely adjacent the bending roll. At times, it may be found desirable that the inwardly directed portions 22 engaging the sheet meniscus be maintained at a different temperature than the portions 21 engaging the sheet after it is formed and this can be readily accomplished by dividing the members 17 and 18 horizontally into upper and lower chambers 24 and 25 as described hereinabove and then independently circulating a different temperature control medium through said chambers or the same medium at different temperatures. Of course, the partitions 23 may be eliminated if desired.

One way in which the members 17 and 18 may be mounted is illustrated in Fig. 3. Thus, the member 17 is provided at each end thereof with the vertically aligned tubular extensions 27 carried by a support 28 fixedly secured to a base 29. On the other hand, the member 18 is provided at each end thereof with the tubular extensions 30 carried by a support 31 slidably mounted upon base 29 and normally urged toward member 17 by a compression spring 32. However, the inward movement of member 18 is controlled by proper adjustment of the nut 33 upon bolt 34, which bolt is carried by support 31 and projects outwardly through fixed bracket 35. Thus, while the member 18 is yieldably urged toward member 17, it can be readily moved away therefrom to allow for the passage of clay particles or other foreign matter therebetween which may be carried upwardly by the sheet.

The arrangement disclosed in Fig. 4 is substantially the same as that shown in Fig. 1, with the principal exception that instead of providing two substantially U-shaped members having a partition wall intermediate the upper and lower ends thereof, there are here provided four individual members 36, 37, 38, and 39. The members 36 and 37 are arranged at one side of the sheet, while the members 38 and 39 are arranged at the opposite side. It will be seen, however, that these four members are arranged in the same manner and cooperate with one another in the same way to accomplish the same results as do the two substantially U-shaped members 17 and 18.

In Fig. 5, the wiping members 40 and 41 positioned at opposite sides of the sheet are of a slightly different type. Each of these members is in the form of a substantially rectangular hollow casing through which is adapted to be circulated a suitable cooling medium. However, the upper portion 42 of the inner wall of each member is arcuately curved and positioned to contact with the sheet, while the lower portion 43 is spaced from the sheet and substantially parallel therewith. These members are not adapted to engage the sheet until it has attained final sheet form and the portions 42 are adapted to be arcuately curved so that they have substantially line contact therewith. The portions 42 engaging the sheet will have a wiping or smoothing action thereon to smooth or flatten out any surface irregularities therein, while the lower portions 43 of the members will serve as shields to protect the sheet during its formative period.

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. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and means engaging opposite

surfaces of the sheet at the base or meniscus thereof and also after it has attained sheet form for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof.

2. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and stationary members positioned at opposite sides of the sheet and engaging the same at the base or meniscus thereof and also after it has attained sheet form for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof.

3. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and members having portions engaging opposite surfaces of the sheet at the base or meniscus thereof and also having portions engaging opposite surfaces of said sheet after it has attained sheet form for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof.

4. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and members having portions engaging opposite surfaces of the sheet at the base or meniscus thereof and also having portions engaging opposite surfaces of said sheet after it has attained sheet form for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof, said first mentioned portions being curved to fit substantially into the curvature of the sheet meniscus, with said second mentioned portions being curved to have substantially line contact with the sheet.

5. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and a pair of stationary members positioned at opposite sides of the sheet and engaging the same for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof, said members having inwardly directed portions engaging opposite surfaces of the sheet at the base or meniscus thereof and also having inwardly directed portions engaging the sheet after it has attained sheet form.

6. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and a pair of stationary members positioned at opposite sides of the sheet and engaging the same for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof, said members having inwardly directed portions engaging opposite surfaces of the sheet at the base or meniscus thereof and also having inwardly directed portions engaging the sheet after it has attained sheet form, the first mentioned inwardly directed portions being spaced further apart than said second mentioned inwardly directed portions.

7. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and a pair of stationary members positioned at opposite sides of the sheet and engaging the same for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof, each of said members comprising an inwardly directed portion engaging the base or meniscus of the sheet, an inwardly directed portion engaging the sheet after it has attained sheet form, and a vertically disposed portion connecting the two inwardly directed portions and spaced from said sheet.

8. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, a pair of hollow stationary members positioned at opposite sides of the sheet and engaging the same for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof, each of said members comprising an inwardly directed portion engaging the base or meniscus of the sheet, an inwardly directed portion engaging the sheet after it has attained sheet form, and a vertically disposed portion connecting the two inwardly directed portions and spaced from said sheet, a horizontal partition for separating the vertically disposed portion of each member horizontally intermediate its upper and lower ends, and separate means for independently circulating a temperature control medium through said members above and beneath said partition.

9. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, hollow members positioned to engage opposite surfaces of the sheet adjacent to but spaced above the molten mass for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof, a horizontal partition dividing each member into upper and lower chambers, and separate means for independently circulating a temperature control medium through said chambers.

10. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and members positioned to engage opposite sides of the sheet adjacent the molten mass for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof, said members having portions thereof engaging the sheet and portions spaced therefrom and cooperating to form a substantially closed compartment through which the sheet is drawn during its formative period.

11. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and substantially U-shaped members positioned at opposite sides of the sheet adjacent the molten mass, each member comprising a substantially vertically dis-

posed portion spaced from the sheet and inwardly directed upper and lower portions in contact with said sheet for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof.

12. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and substantially U-shaped members positioned at opposite sides of the sheet adjacent the molten mass, each member comprising a substantially vertically disposed portion spaced from the sheet and inwardly directed upper and lower portions in contact with said sheet for producing a wiping action thereupon to flatten or smooth out any irregularities in the surfaces thereof, the upper portions projecting inwardly to a greater degree than the lower portions.

13. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and stationary substantially U-shaped members in the form of hollow metallic casings positioned at opposite sides of the sheet adjacent to but spaced above the molten mass, each member comprising a substantially vertically disposed portion spaced from the sheet, an inwardly directed lower portion engaging the sheet at the base or meniscus thereof, and an upper inwardly directed portion engaging the sheet after it has attained sheet form, said members cooperating to provide a substantially closed compartment through which the sheet is drawn during its formative period.

14. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, stationary substantially U-shaped members in the form of hollow metallic casings positioned at opposite sides of the sheet adjacent to but spaced above the molten mass, each member comprising a substantially vertically disposed portion spaced from the sheet, an inwardly directed lower portion engaging the sheet at the base or meniscus thereof, and an upper inwardly directed portion engaging the sheet after it has attained sheet form, said members cooperating to provide a substantially closed compartment through which the sheet is drawn during its formative period, a horizontal partition separating the interior of each member intermediate its upper and lower ends into upper and lower chambers, and separate means for independently circulating a temperature control medium through said chambers.

15. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and stationary members positioned at opposite sides of the sheet and having portions in contact therewith for producing a wiping action thereupon to flatten or smooth out irregularities in the surfaces thereof and other portions beneath the first-mentioned portions arranged out of contact with said sheet and acting to shield the same.

16. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and stationary members positioned at opposite sides of the sheet and having portions spaced from the sheet and arranged substantially parallel therewith in a manner to shield the same and also laterally offset portions in contact with said sheet for producing a wiping action thereupon to flatten or smooth out irregularities in the surfaces thereof.

17. In sheet glass apparatus, means for drawing a sheet upwardly from a mass of molten glass, and stationary members positioned at opposite sides of the sheet and engaging the same adjacent their upper ends for producing a wiping action thereupon to flatten or smooth out irregularities in the surfaces thereof, the lower portions of said members being spaced from the sheet and acting to shield the same.

Signed at Toledo, in the county of Lucas and State of Ohio, this 10th day of March 1930.

WILLIAM E. NOBBE.