

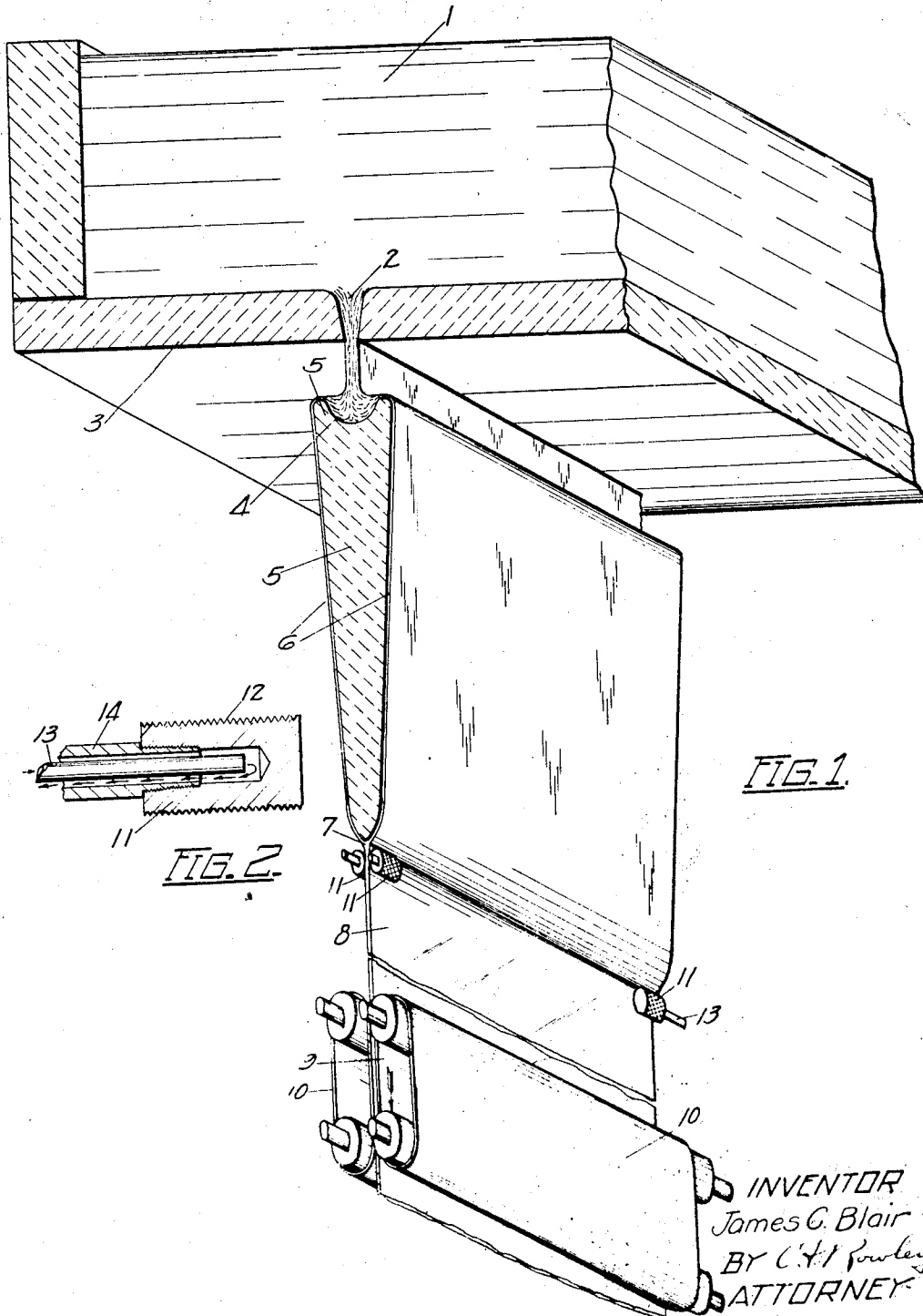
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J. C. BLAIR

DRAWING SHEET GLASS

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UNITED STATES PATENT OFFICE.

JAMES C. BLAIR, OF TOLEDO, OHIO, ASSIGNOR TO THE LIBBEY-OWENS SHEET GLASS COMPANY, OF TOLEDO, OHIO, A CORPORATION OF OHIO.

DRAWING SHEET GLASS.

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To all whom it may concern:

Be it known that I, JAMES C. BLAIR, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented new and useful Improvements in Drawing Sheet Glass, of which the following is a specification.

This invention relates to improvements in the art of making sheet glass, and more particularly to the art of flowing molten glass down a guiding or supporting slab and drawing this glass downwardly from the slab in sheet form.

The present improvement relates to the use in such a sheet producing system of auxiliary drawing and guiding means acting only upon the edge portions of the sheet. These means will ordinarily be in the form of pairs of rollers between which the edge portions of the sheet are gripped. Rollers of this type, for performing a somewhat similar function with an upwardly drawn sheet are disclosed in certain patents heretofore granted to I. W. Colburn, for example, Reissue Patent No. 14794, granted January 27, 1920.

These edge rollers are preferably driven at a peripheral speed somewhat slower than that of the main sheet drawing means, and will function to assist in moving the normally slower and more sluggish edge portions of the flowing streams down and from the supporting slab. The rollers also function to exert a retarding and supporting action on the edge portions of the sheet below the slab and between the slab and the main sheet drawing means. The combined result is to counteract the tendency of the flowing streams, and also of the formed sheet, to become narrower as the sheet is continuously drawn from the slab. These edge rollers also act to cool and strengthen the edge portions of the sheet, and act as an additional guide and straight-edge below the supporting slab, which prevents wobbling of the forming sheet, thus assuring a flatter finished product. Furthermore, with a down-flow device of the type here shown, wherein two converging streams of glass meet at the lower edge of a wedge-shaped slab, the use of these edge-holding rollers beneath the slab aids the natural adhesion of the molten glass and the refractory slab in keeping the streams against the inwardly

sloping faces of the slab, and assures the union of the two streams at the lower edge of the slab.

The above, and other objects and advantages of this invention will be more clearly understood from the following more detailed description of one form of apparatus embodying the principles of this invention.

In the accompanying drawings:

Fig. 1 is a perspective, partially in section, illustrating the use of edge-holding rollers with one form of sheet-producing apparatus.

Fig. 2 is a longitudinal central section through one of the rollers, illustrating the cooling means therefor.

The molten glass 1 flows downwardly through the slot 2 in the bottom 3 of the tank or furnace into a recess 4 in the upper end of a refractory supporting slab or directing member 5. The molten glass overflows or spills from the recess 4 over the upper edges 5 of the slab and flows in thin equal streams 6 down the opposite converging flat faces of the slab. These streams flow together at the lower edge 7 of the slab and the glass sheet 8 is drawn downwardly from these combined streams by the weight of the formed sheet assisted by any suitable form of drawing mechanism such as that illustrated at 9. It is to be understood that the slab 5 will preferably be enclosed in a suitably heated chamber to maintain the flowing streams of glass at the proper high temperature, and that suitable supporting and adjusting means for slab 5 are provided. These features have been omitted in the present disclosure for the sake of clearness.

The drawing mechanism is here shown in the form of a pair of driven belt loops between the downward runs of which the sheet is gripped. It is to be understood that this merely illustrates one form of drawing means that might be used. This drawing means should be located far enough beneath the sheet source to allow the sheet surfaces to become cooled and set so that the likelihood of injury thereto from contact with the drawing means will be reduced to a minimum.

At each edge of the sheet, directly beneath the lower edge 7 of slab 5, where the sheet first takes form, is located a pair of small

metallic rollers 11. These rollers are supported and driven by means at the side of the machine not here shown, and are preferably yieldingly pressed toward one another so that the edge portion of the sheet will be yieldingly gripped between the two rollers. The cylindrical surfaces of the rollers are preferably roughened or knurled as indicated at 12, to assist the gripping action of the rollers on the glass sheet. As indicated in Fig. 2, each roller is cooled by continuously flowing a suitable cooling medium such as water inwardly through a pipe 13 to the center of the hollow roller, the water flowing out through the hollow supporting shaft 14 and around the pipe 13, as indicated by the arrows in Fig. 2. In the Colburn Reissue Patent No. 14,974, referred to above, the details of the supporting, driving and cooling means for these rollers are specifically described and shown, and such a form of apparatus or a suitable modification thereof could be used with an installation of the type shown in the present application.

While suitable speed control means should be used in connection with the driving means for rollers 11, so that the speed of these rollers may be adjusted to conform with that of the sheet 8, it is preferable that the peripheral speed of these rollers be somewhat less than that of the main drawing means 9 by which the sheet is carried away from the lower edge of the slab. In this way an additional tension is exerted on the edge portions of the sheet 8 between the slab and the drawing means 9, which not only aids in keeping the sheet flat and taut, but also overcomes the tendency of the sheet to narrow up as it passes downwardly from the slab. At the same time these positively driven rollers 11 will exert a positive downward drawing action upon the edge portions of the streams 6 as they flow down the slab. This drawing action, in addition to the normal flow of the glass under the influence of gravity, will overcome the usual tendency of a flowing stream to lag behind the more freely flowing central portion.

Furthermore, in a sheet forming system of the design here disclosed, it will be apparent that the inwardly and downwardly flowing streams of glass 6 are held against the converging surfaces of slab 5 merely by the adhesion between the molten glass and the refractory material of which the slab is formed. There is a constant tendency for the force of gravity to draw these streams away from the slab surfaces to which they adhere. The gripping and supporting action of the rollers 11 upon the sheet source directly below the confluence of the two streams 6, assists the force of adhesion between the slab and the molten streams in

holding these streams in place, and assures a union of the two streams along the lower edge 7 of the slab.

Claims:

1. In the art of drawing sheet glass, that improvement consisting in flowing a thin stream of molten glass down the surface of a directing member, drawing this glass downwardly from the member in sheet form, and applying additional drawing and supporting forces to the edge portions of the sheet adjacent the line of sheet formation.

2. In the art of drawing sheet glass, that improvement consisting in flowing molten glass in two separate streams down the opposite converging faces of a directing member, drawing away the two combined streams in the form of a single sheet, and applying additional drawing and supporting forces to the edge portions of the sheet adjacent the line of sheet formation.

3. In apparatus for producing sheet glass, a source of molten glass, a slab or forming member down which glass flows from the source, means for drawing this glass from the slab in sheet form, and auxiliary drawing means acting only on the edge portions of the sheet adjacent the line of departure of the glass from the slab.

4. In apparatus for producing sheet glass, a source of molten glass, a slab or forming member down which glass flows from the source, means for drawing this glass from the slab in sheet form, and pairs of rollers engaging the edge portions only of the sheet adjacent the source of the sheet.

5. In apparatus for producing sheet glass, a source of molten glass, a slab or forming member down which glass flows from the source, means for drawing this glass from the slab in sheet form, and pairs of cooled rollers engaging the edge portions only of the sheet adjacent the source of the sheet.

6. In apparatus for producing sheet glass, a source of molten glass, a slab or forming member down which glass flows from the source, means for drawing this glass from the slab in sheet form, and pairs of driven rollers engaging the edge portions only of the sheet adjacent the source of the sheet.

7. In apparatus for producing sheet glass, a source of molten glass, a wedge-shaped slab down the opposite converging sides of which the molten glass flows from the source, means for drawing away the glass formed from these converging streams in single sheet form, and auxiliary drawing means acting only on the edge portions of the sheet adjacent the line of formation of the sheet.

8. In apparatus for producing sheet glass, a source of molten glass, a wedge-shaped slab down the opposite converging sides of which the molten glass flows from the source, means for drawing away the glass formed from these converging streams in single

sheet form, and pairs of rollers engaging the edge portions only of the sheet adjacent the line of formation of the sheet.

9. In apparatus for producing sheet glass, a source of molten glass, a wedge-shaped slab down the opposite converging sides of which the molten glass flows from the source, means for drawing away the glass formed from these converging streams in single sheet form, and pairs of driven rollers engaging the edge portions only of the sheet adjacent the line of formation of the sheet.

10. In apparatus for producing sheet glass, a source of molten glass, a slab or forming member down which glass flows from the source, means for drawing this glass from the slab in sheet form, and rotary guiding means engaging only the edge portions of the sheet adjacent the sheet source.

11. In apparatus for producing sheet glass, a source of molten glass, a wedge-shaped slab down the opposite converging sides of which the molten glass flows from the source, means for drawing away the glass formed from these converging streams in single sheet form, and rotary guiding means engaging only the edge portions of the sheet adjacent the sheet source.

12. In sheet glass apparatus, a source of molten glass, a slab or forming member

down which glass flows from the source, means for drawing this glass from the slab in sheet form, and means for retarding movement of the edge portions of the sheet being drawn.

13. In sheet glass apparatus, a source of molten glass, a slab or forming member down which glass flows from the source, means for drawing this glass from the slab in sheet form, and means for supporting and retarding movement of the edge portions of the sheet being drawn to maintain the sheet to width.

14. In sheet glass apparatus, a slab, means for flowing molten glass down both sides of the slab, means for drawing the streams from the end of the slab in united sheet form, and means for forming a knurled edge on said sheet.

15. In sheet glass apparatus, a slab, means for forming molten glass down both sides thereof, means for drawing the streams from the end of the slab in united sheet form, and knurled rolls engaging the edges of the sheet for forming knurled edges thereon.

Signed at Toledo, in the county of Lucas and State of Ohio, this 17th day of December, 1923.

JAMES C. BLAIR.