To all whom it may concern:

Be it known that we, FRANK E. TROUTMAN and CHARLES H. CHRISTIE, of BUTLER, PENNSYLVANIA, have invented a new and useful Improvement in Methods and Apparatus for Casting Plate Glass; and we do hereby declare the following to be a full, clear, and exact description thereof:

Our invention relates to the art of casting plate glass and has special reference to the methods and apparatus described and claimed in our copending applications Serial Nos. 295,483 and 295,486, filed May 7, 1919, and Serial No. 525,327, filed December 28, 1921, wherein the glass to be cast is drawn from a tank or other suitable source into a discharge receptacle having a downwardly opening discharge outlet and having a valve or plunger which is adapted to close the outlet when in its lowest position and which, when raised, permits the glass to flow through the outlet in a vertical column which is received upon a movable casting table and is then rolled into a sheet.

In practicing this method it is found that, even though the glass outlet and the plunger are very carefully constructed and matched, a certain amount of glass will dribble out around the edges of the outlet when the plunger is seated. The small strings of glass resulting from this dribbling action remain hanging around the edges of the outlet and may be carried down with the next charge of glass, thereby impairing the quality of the glass. Small fragments of dirt produced by the grinding action of the plunger upon the outlet and composed of the fire clay of which the plunger and the outlet member are constructed, may also be dislodged and carried down with these dribbling streams or with the outer portions of the descending column of glass, and when such fragments are carried into the finished glass they of course impair its quality.

It is one of the objects of our present invention to dispose of any such dribblings of glass as may escape from the outlet when the plunger is seated, and also to catch and dispose of any impurities such as fire clay fragments that may come through the outlet.

Another object of our invention is to provide improved means for insuring that each charge of glass shall issue from the outlet and fall upon the casting table with a clean leading end, free from dirt, bubbles and solidified glass, and of regular shape.

To this end we provide beneath the discharge outlet a member which we term a "dribble catcher", and which in its preferred form consists of a tubular member which may have downwardly converging sides and which may have projections formed on its inner surface for the purpose of assisting the adherence of glass to its surface. The upper diameter of this annular member is such that it fits loosely within the discharge outlet, leaving a small space around its upper edges through which dribbling glass will descend. A flange extends out around the tubular portion of the dribble catcher to a diameter greater than the diameter of the discharge outlet and serves as a shelf to insure that the descending dribbles of glass will be caught and held.

The dribble catcher not only has the function of catching the dribbles of glass which may issue between the casting operations, but also provides an auxiliary discharge throat for the glass during the casting operation. The tubular portion of the dribble catcher is arranged to cause a portion of the issuing glass to adhere to its surface. This adherence may be promoted by heating the dribble catcher, or by providing projections on its inner surface, or by both of these means. When the plunger is raised and glass starts to descend, the first portions of glass which roll down over the edges of the outlet will come upon the heated surface of the throat portion of the dribble catcher and will adhere, forming a glass-lined discharge throat through which the remainder of the glass passes on its way to the casting table. Since the glass which reaches the casting table has never been in contact with anything except a portion of the glass itself, and since the glass-lined interior of the discharge throat has no chilling effect upon it, the leading end of the glass which reaches the casting table is perfectly clean and has a regular rounded shape, this shape being produced by the checking effect which the dribble catcher has on the outside of the glass, and which permits the inner part of the glass to flow faster than the sides of the column, instead of lagging behind the sides and forming a concave end, as is the case when the glass is merely allowed to flow through the usual bushing.
The adhesion of the outer portion of the issuing glass also serves to catch and hold any dirt or other impurities that may start down with the leading end of the glass when the plunger rises. The portions of glass which carry these impurities are the portions which first engage and adhere to the dribble catcher, thus holding the impurities in place and preventing them from issuing with the discharged glass.

One desirable way of carrying our invention into practice is shown in the accompanying drawings, in which Fig. 1 is a vertical sectional view through the discharge portion of the casting apparatus; Fig. 2 is a bottom plan view of the construction shown in Fig. 1; Fig. 3 is an end elevational view showing the dribble catcher swung to one side of the outlet; and Figs. 4 to 10, inclusive, are diagrammatic vertical sectional views showing the successive stages in which the apparatus is operated.

Fig. 1 of the drawing shows the discharge portion of a glass receptacle which may be a tank constructed and arranged with a runway as shown in our above-mentioned pending applications, or may be any other suitable container for the molten glass that is to be cast. In this figure the numeral 2 represents the bottom of a runway which may conduct the glass from the tank, as shown in our said prior applications, and which communicates with a discharge chamber 3 having vertical side walls 4 and a downwardly converging bottom portion 5 in which is seated a bushing 7 having a discharge opening 8 which may be circular or of any other desired outline. A plunger 9 is arranged vertically above the outlet 8 and may be provided with a downwardly curved end 10 adapted to seat in and close the discharge outlet 8. The plunger 9 is arranged to be raised and lowered by suitable mechanism which is not shown, since this mechanism may be of well known construction.

The discharge chamber 3 may be covered with insulating material, as shown at 11, and is supported upon suitable metal framework 12. The bushing 7 is held in place by means of a flat ring 13 which is secured beneath the discharge chamber by means of bolts 14.

The parts thus far described are shown only for the purpose of illustrating our invention, and may be constructed in a variety of ways.

For the purpose of catching the glass that may dribble out around the sides of the discharge opening 8 while this opening is closed by the plunger 9, and also for the purpose of regulating the flow of glass to produce a smooth leading end, we provide an annular member 15 which we term a dribble catcher, and which, as shown, consists of a tubular shell having downwardly converging sides which fit within a corresponding opening formed in a holder 16. The holder 16 is provided with a flange 17 a short distance below the upper edge of the shell 16. The upper portion of the shell 15 is of the proper diameter to fit loosely within the discharge outlet 8, leaving a small space 18, and when in the position shown in Fig. 1 the flange 17 extends beyond the edges of the outlet 8 and is close to the underside of the bushing 7.

The shell 15 may, if desired, be provided with projections 19 which may be struck up from the sides of the shell, and which assist in causing glass to adhere to the sides of the shell.

The support 16 is carried by an arm 20 which is removably fixed in a socket member 21 which, in turn, is supported by an arm 22 pivoted at 23 to a vertically adjustable hanger 24 suspended from a brace 25 which is secured to the underside of the metal sheathing 26 of the discharge chamber. The arm 22 is extended beyond the pivot 23 and carries an adjustable weight 27 which tends to hold the arm 22 in its horizontal position, as shown in full lines on Fig. 1. In this position a portion of the socket member 21 is received in a fork 28 and is secured therein by means of a key 29 which extends through openings in the fork 28 beneath the socket member 21. The fork 28 is suspended by means of bolts 30 from the arm 22. The vertical adjustment of the hanger 24 is produced by means of a screw-threaded shank 31 which extends through a screw-threaded opening in the bracket 25 and is secured in its adjusted position by means of nuts 32.

Fig. 3 shows in dotted lines the position of the dribble catcher when it is swung to one side of the discharge opening. Flame from a burner 35 may be directed into the interior of the dribble catcher for the purpose of heating it sufficiently to cause glass to adhere to its surface. In order to retain the heat within the dribble catcher, a cover 36 may be secured by means of one or more bolts to the underside of the sheathing 36, and may extend outwardly in such position as to fit over the upper edge of the shell 15 when the device is swung into the position of Fig. 3.

The operation of this device may be best understood by referring to Fig. 4 to 10. Fig. 4 shows, when the plunger 9 is seated in the opening 8, but not tightly enough to prevent the escape of small streams of glass A which, even though the plunger and bushing are very carefully fitted, flow down around the edges of the outlet 8, as shown in this figure. Before the casting operation is started, the dribble catcher is placed beneath the outlet, as shown in Fig. 5, with the upper edge of the shell 15 inserted in the outlet 8, and the flange 17 a short distance below the lower surface of the bushing 7. The dribbling streams A...
descend through the space 18 between the bushing and the shell 15 and adhere to the outside of the shell 15 or are caught on the flange 17.

Fig. 6 shows the condition of the glass just after the plunger 9 begins to rise. A small portion of the glass may flow into the space 18 around the shell 15, carrying with it any dirt or small fragments of fire-clay that may have become dislodged at the edges of the glass outlet. Then the glass adjacent to the bushing flows down around the lower end of the plunger in an annular body, as shown at B, Fig. 6 and enters the upper end of the shell 15. This shell has preferably been heated before being placed in position, and the outside portion of the glass B adheres to the shell 15, as shown at B', Fig. 6, and holds with it, any impurities that are present.

The glass continues to flow through the outlet as the plunger continues to rise, and the central portion C descends at a faster rate than the side portions D, thus producing the appearance shown in Fig. 7. The central portion of the glass continues to descend at a faster rate than the sides, producing the somewhat indented appearance shown at E, Fig. 8, and finally the rounded appearance shown at F, Fig. 9 where the central portion of the glass has caught up with the side portions and has passed them. As the downward flow of glass continues, the sides of the shell 15 are completely covered by adhering glass G, and the central portion of the stream issues, as shown at H, Fig. 10. It will be observed that this issuing glass has never come in contact, after entering the discharge outlet 8, with any substance except the glass adhering to the inner walls of the shell 15. Therefore the issuing glass is clean and hot, and forms the even, rounded leading end H as shown in Fig. 10. The glass thus set in motion flows down in a vertical column and is preferably received on a moving casting table, as described in our above-mentioned prior applications.

After the proper quantity of glass is discharged, the plunger 9 is again lowered until its lower end seats in the discharge outlet 8, and the flow of glass is thus cut off. The key 20 is then knocked out and the dribble catcher is swung down and to one side of the glass outlet, as shown in Fig. 3, where it is replaced by another similar device which has previously been cleaned and heated. The used dribble catcher may be cleaned by immersing it in water to chill the adhering glass and then breaking this glass away.

The shell 15 of the dribble catcher may be made of refractory material instead of metal, but we find it most convenient to make this shell of metal, and to heat it just before it is placed in position beneath the glass outlet. Metal is preferred as the material for the dribble catcher because it radiates heat quickly and so keeps the temperature of its inner surface, after the glass starts to flow through it, low enough to prevent the layer of adhering glass from being melted and washed off by the flowing stream. If desired, the radiation of heat may be increased by means of additional flanges or fins or even by artificial cooling applied after the flow of glass begins, but such added cooling means are not ordinarily required. The sides of the dribble catcher may converge downwardly, as shown, or may be cylindrical, and if the sides are made converging the angle of convergence may be varied in accordance with the nature of the glass, the size of the outlet, and the shape which it is desired to impart to the column of glass as it descends toward the casting table.

Instead of making the dribble catcher removable, as shown, it may obviously be built in around the glass outlet, and may be cleaned off between casting operations by means of a flame. In this case, the glass-lined discharge throat may be composed of glass that is quite fluid, this glass being held in an annular recess in the nature of a trap, formed below the upper edge of the discharge opening 8, and the impurities being caught in this recess at the beginning of the casting operation.

The details of construction herein shown may be also varied in many other respects without departing from our invention, the scope of which is set forth in the appended claims.

We claim as our invention:

1. The method of casting plate glass that comprises flowing the glass through a downwardly opening outlet in a receptacle, checking the descent of the sides of the issuing glass and causing a portion of said glass to form a discharge throat, and discharging another portion of glass through the said glass-lined discharge throat upon a casting table.

2. The method of casting plate glass that comprises flowing the glass through a downwardly opening outlet in a receptacle, checking the descent of the sides of the issuing glass and solidifying a portion of said glass to form an annular discharge throat, and discharging another portion of glass through the said glass-lined discharge throat upon a casting table.

3. The method of casting plate glass that comprises flowing the glass through a downwardly opening outlet and thence through a heated annular member, thereby causing a portion of the glass to adhere to said member, and to form a glass-lined discharge throat for the issuing glass.

4. The method of casting plate glass that comprises flowing the glass through a downwardly opening outlet and thence through
an annular member having downwardly converging sides, and capable of causing glass to adhere to its surface, thereby forming a glass-lined discharge throat for the issuing glass.

5. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet a member adapted to catch the glass that may dribble out around the edges of said outlet.

6. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member having means for catching glass that may dribble through said outlet and composed of material to which glass will adhere, thereby forming a glass-lined discharge throat for the issuing glass, opening the said outlet, and permitting the glass to flow through said annular member upon a casting table.

10. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, bringing beneath said outlet an annular member upon a casting table.

15. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member fitting loosely in said outlet, opening said outlet and permitting the glass to flow through said annular member upon a casting table.

20. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member upon a casting table.

25. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member upon a casting table.

30. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member upon a casting table.

35. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member upon a casting table.

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65. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member upon a casting table.

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100. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member upon a casting table.

105. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member upon a casting table.

110. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member upon a casting table.

115. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member upon a casting table.

120. The method of casting plate glass that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, closing said outlet from above, and bringing beneath said outlet an annular member upon a casting table.
being capable of causing glass to adhere to its surface, opening said outlet and permitting the glass to flow through said member upon a casting table, closing said outlet, removing said annular member, and replacing said annular member with a similar member.

18. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening outlet, a valve for causing glass to issue from said outlet, and means for forming a portion of said glass into a discharge throat for the following portions of glass.

19. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening outlet, a valve for causing glass to issue from said outlet, and means for checking the descent of the sides of the issuing glass and for chilling a portion of said glass to form an annular discharge throat for the following portions of glass.

20. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and an annular member adapted to be placed removably beneath said outlet and to form a discharge throat for the issuing glass.

21. Apparatus for casting plate glass comprising a receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and an annular member adapted to be placed removably beneath said outlet and to form a discharge throat for the issuing glass.

22. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and an annular metal member adapted to be placed removably beneath said outlet and to form a discharge throat for the issuing glass.

23. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and a heated annular member adapted to be placed removably beneath said outlet and to form a discharge throat for the issuing glass, and means for heating said member.

24. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and an annular metal member adapted to be placed removably beneath said outlet and to form a discharge throat for the issuing glass, and means for heating said member.

25. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and an annular member having downwardly converging sides adapted to be placed removably beneath said outlet and to form a discharge throat for the issuing glass.

26. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and a heated annular member having downwardly converging sides adapted to be placed removably beneath said outlet and to form a discharge throat for the issuing glass.

27. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and an annular member having projections on its inner surface adapted to be placed removably beneath said outlet and to form a discharge throat for the issuing glass.

28. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and an annular member having projections on its inner surface adapted to be placed removably beneath said outlet and to form a discharge throat for the issuing glass.

29. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and an annular metal member having projections struck up on its inner surface and adapted to be placed removably beneath said outlet and to form a discharge throat for the issuing glass.

30. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and an annular metal member having downwardly converging sides and having projections struck up on its inner surface, and adapted to be placed removably beneath said outlet and to form a discharge throat for the issuing glass.

31. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and means for catching glass that may dribble out around the edges of said outlet.

32. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and means for catching glass that may dribble out around the edges of said outlet, said dribble catching means comprising a member.
adapted to be removably applied beneath said outlet and having a flange extending beyond the edges of said outlet.

33. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and means for catching glass that may dribble around the edges of said outlet, said dribble catching means comprising an annular member fitting loosely in said outlet and having a flange on its outer surface, the said flange extending beyond the edges of said outlet.

34. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and means for catching glass that may dribble around the edges of said outlet, said dribble catching means comprising an annular metal member fitting loosely in said outlet and having a flange on its outer surface, the said flange extending beyond the edges of said outlet.

35. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and means for catching glass that may dribble around the edges of said outlet, said dribble catching means comprising an annular member fitting loosely in said outlet and having a flange on its outer surface, the said flange extending beyond the edges of said outlet.

36. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and means for catching glass that may dribble around the edges of said outlet, said dribble catching means comprising an annular sheet-metal member having downwardly converging sides fitting loosely in said outlet and having a flange on its outer surface, the said flange extending beyond the edges of said outlet.

37. Apparatus for casting plate glass comprising a glass receptacle having a downwardly opening discharge outlet, means for closing said outlet from above, and means for catching glass that may dribble around the edges of said outlet, said dribble catching means comprising an annular sheet-metal member having downwardly converging sides and having projections formed on its inner surface fitting loosely in said outlet and having a flange on its outer surface, the said flange extending beyond the edges of said outlet.

38. Apparatus for casting plate glass comprising a glass receptacle having an outlet surrounded with fire clay, a plunger having a fire-clay surface adapted to seat in said outlet, and an annular metal member having its upper end received in said outlet and spaced from the walls thereof.

In testimony whereof we, the said FRANK E. TROUTMAN and CHARLES H. CHRISTIE, have hereunto set our hands.

FRANK E. TROUTMAN
CHARLES H. CHRISTIE.