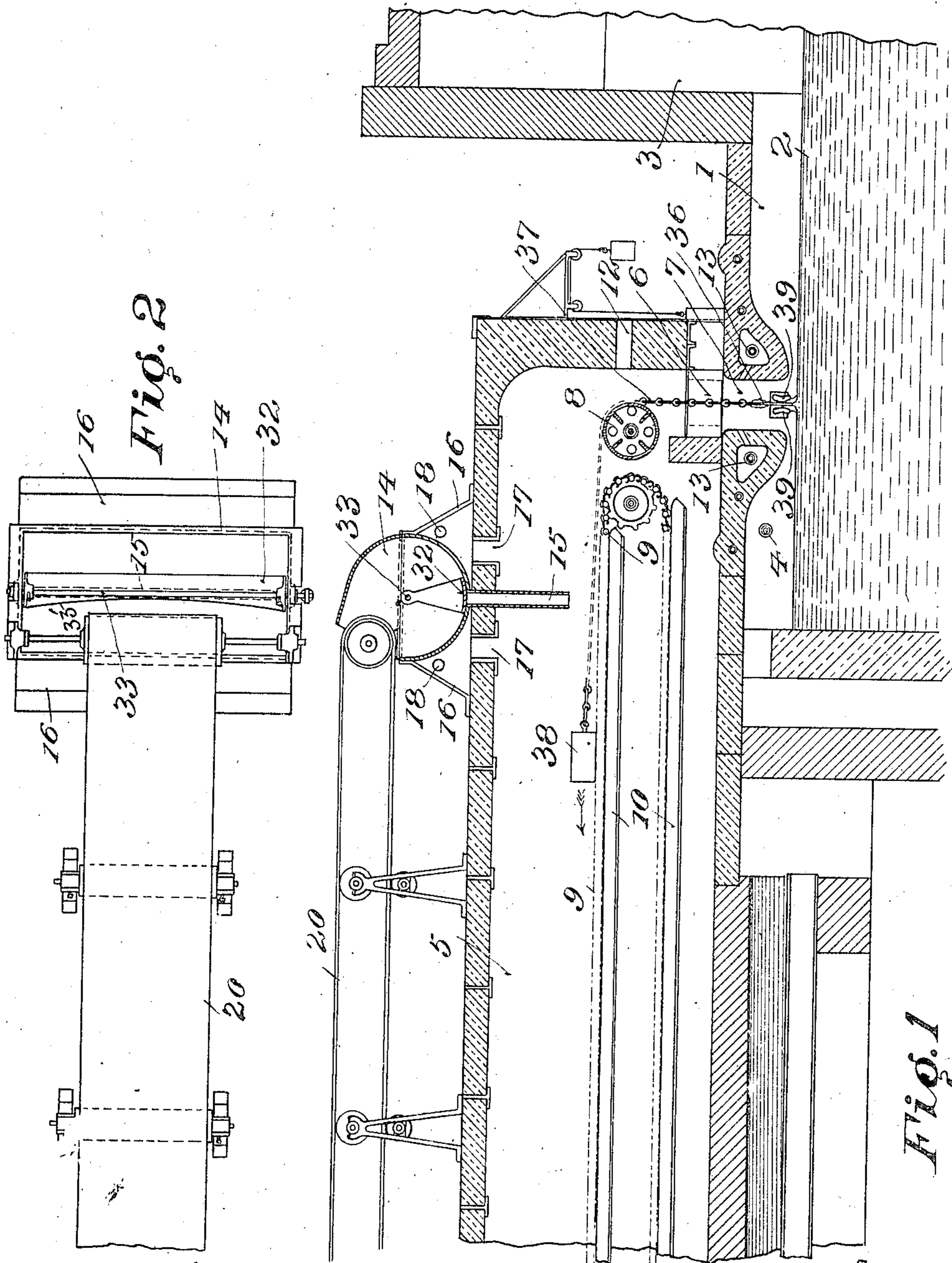


J. PLAYER.
METHOD AND APPARATUS FOR THE PRODUCTION OF SHEET GLASS.
APPLICATION FILED OCT. 1, 1908.

952,354.

Patented Mar. 15, 1910.

3 SHEETS—SHEET 1.



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Witnesses

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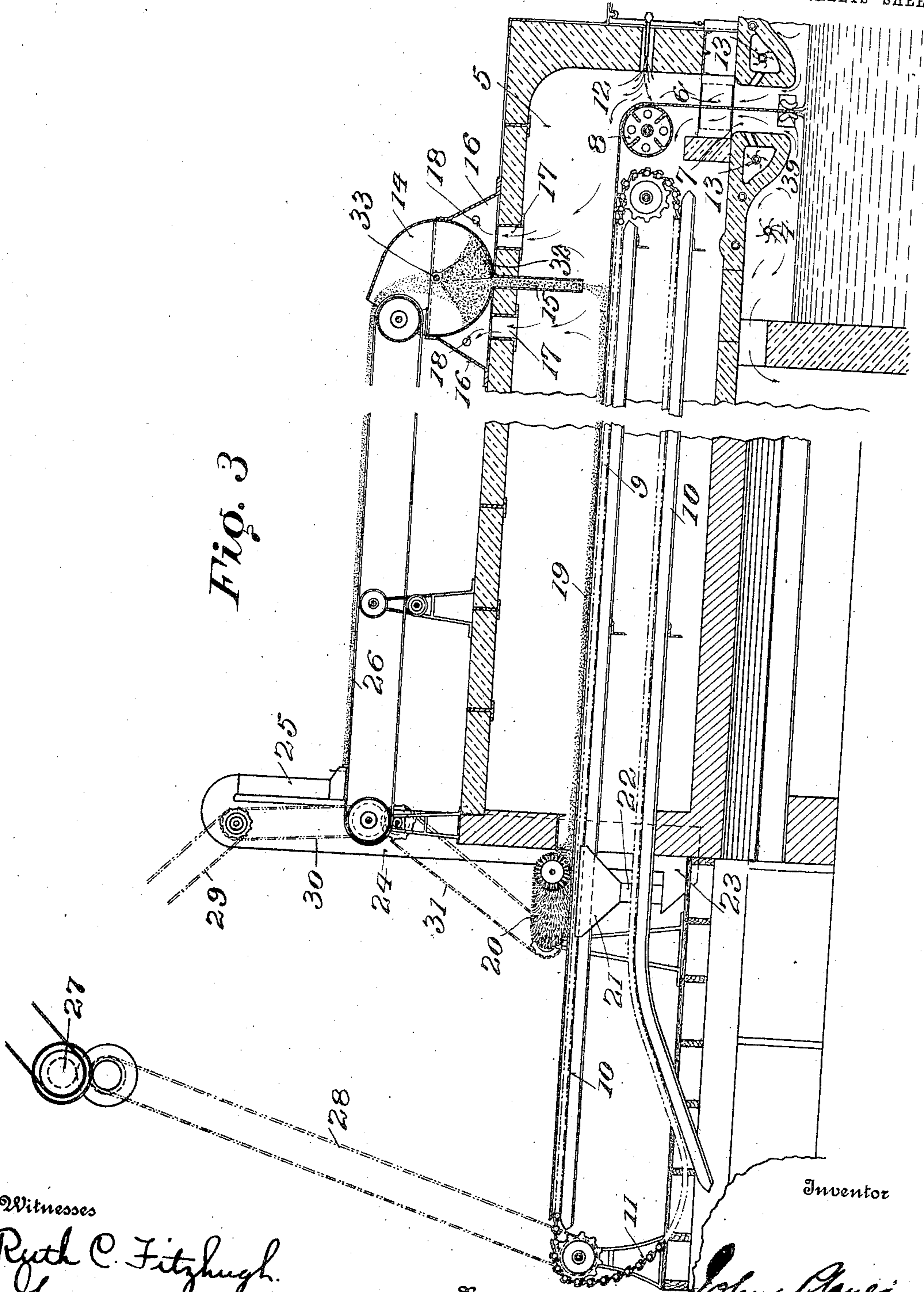


Fig. 3

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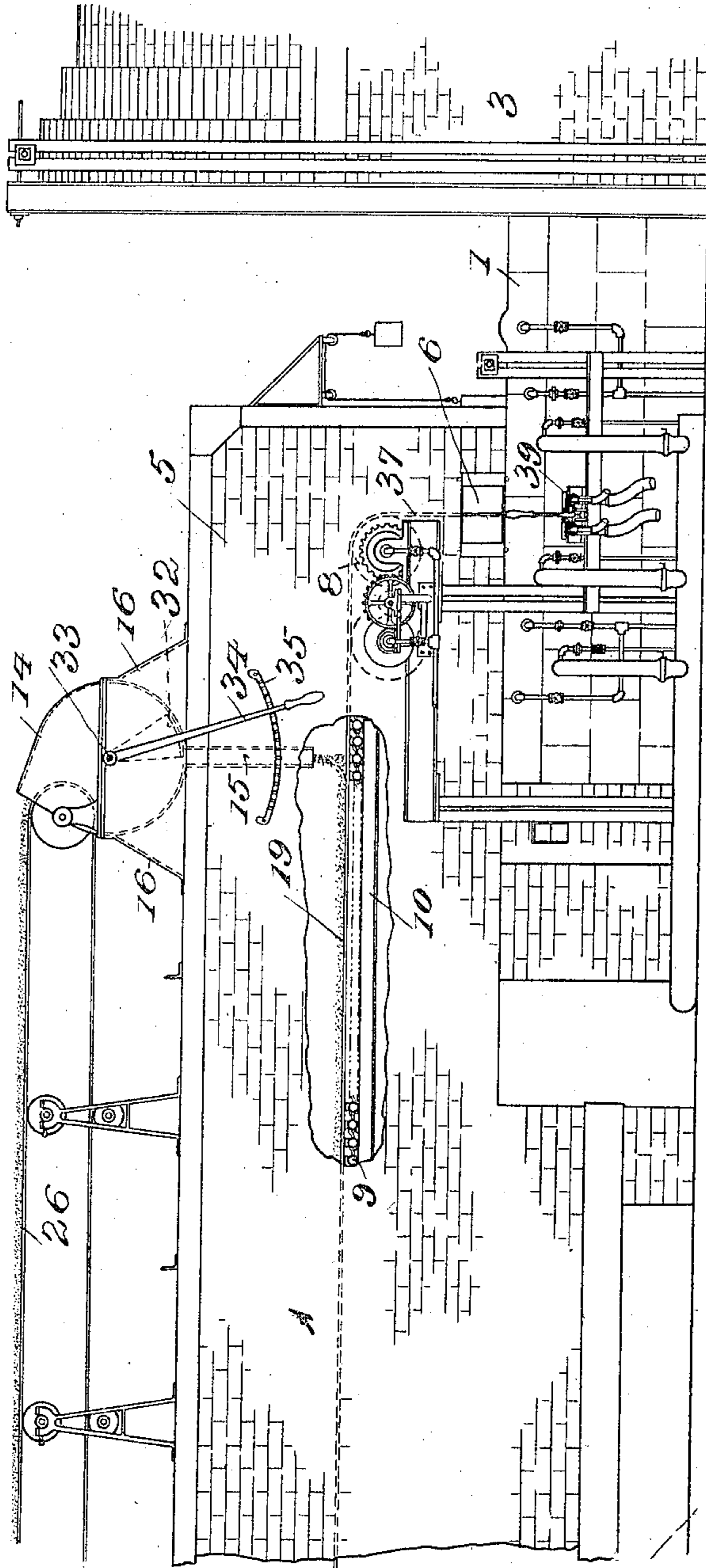
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3 SHEETS—SHEET 3.

Fig. 4



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JOHN PLAYER, OF RIVER FOREST, ILLINOIS.

METHOD AND APPARATUS FOR THE PRODUCTION OF SHEET-GLASS.

952,354.

Specification of Letters Patent. Patented Mar. 15, 1910.

Application filed October 1, 1908. Serial No. 455,659.

To all whom it may concern:

Be it known that I, JOHN PLAYER, of River Forest, Illinois, have invented a new and useful Method and Apparatus for the Production of Sheet-Glass, which invention is fully set forth in the following specification.

This invention relates to the art of drawing sheet glass, and more particularly to the drawing of a continuous sheet of glass and annealing the same.

Heretofore it has been proposed to draw a sheet of glass by inserting a suitable bait in a mass of molten glass and slowly lifting the bait out of the mass of molten glass, while simultaneously counteracting the tendency of the sheet to narrow during the drawing operation, and then turning the upwardly moving sheet over a suitable bending roll onto a substantially horizontal carrier by which it was passed into the annealing leer. In this method, the draft was generally applied to the bait by positively connecting it to a suitable source of power, and after the sheet of glass has been drawn a sufficient length to be turned over the bending roll and placed upon the horizontal carrier, suitable devices, actuated from a suitable source of power, have been provided for positively gripping the sheet and advancing it, said devices being either independent of the carrier or coacting with the carrier to effect the positive gripping of the sheet. This means of effecting the drawing action upon the sheet is objectionable, not only because the gripping devices are liable to mar the sheet where they grip the same, but because their construction and operation tend to unnecessarily complicate the mechanism as a whole. Furthermore, in annealing the sheet of glass according to the methods heretofore practiced, the sheet has been passed into the annealing leer and onto a suitable carrier by which it was advanced through the long leer in which the temperature gradually decreases from that end of the leer where the sheet enters to the exit end of the leer. By this method the upper surface of the sheet is directly exposed to the atmosphere of the leer, while the under surface of the sheet is more or less protected from the atmosphere of the leer by its contact with the carrier, and it has been found that the continuous sheet sometimes cracks owing to the unequal contractions occurring

while the sheet passes through the leer. Particularly is this the case where the leer is at all exposed to sudden changes in atmospheric conditions such as drafts and the like.

Another object of the present invention, therefore, is to draw the sheet of glass and continuously pass it into and through the annealing leer, while protecting it from the uneven contraction and other disadvantageous results incident to the methods heretofore employed.

With these objects in view, the invention consists, first, in a method of drawing sheet glass by preparing a mass of molten glass, drawing the sheet upwardly, and preferably vertically, from said mass, and then turning the drawn sheet from its upward or vertical position to an approximately horizontal direction onto a suitable carrier, and continuing the drawing operation by applying the draft to the drawn portion of the sheet through the frictional contact of said sheet with the carrier.

To initiate the drawing operation, a suitable bait is lowered into the mass of molten glass attached to cables or chains, which extend vertically upward into the forward end of the leer and over a suitable horizontal roll, hereinafter characterized as the bending roll, and are then attached to a weight resting on, but not otherwise attached to, the carrier in the leer. When the bait has become sufficiently heated to cause the glass to adhere thereto, the machine is started and the weight is slowly carried along by the carrier table, and, the mass of this weight being such that its inertia would not be overcome by the pull of the sheet being drawn, the bait is slowly raised from the mass of molten glass, drawing glass from the molten mass in sheet form in a manner well known to those skilled in the art. Suitable means are provided for overcoming the tendency which the drawn sheet of glass has to narrow during the drawing operation, and as the operation proceeds the drawn sheet is advanced upward into the forward end of the leer over the bending roll, by which its direction is changed from the upwardly to a substantially horizontal direction and rests on the carrier, which carrier may be of any suitable construction, such, for example, as a carrier table composed of bars extending transversely across

the leer and connected at their opposite ends to a pair of endless carrier chains or cables. The annealing leer and the carrier (or carriers, if the same is in sectional form) are necessarily of very considerable length, in order that the necessary time may intervene between the entrance of the sheet at the forward end of the machine and its exit from the rear end, to enable the sheet to be slowly and evenly cooled, and thereby annealed, and the weight of the long extent of sheet at any one time within the leer produces a frictional contact of the sheet with the carrier table, which in many instances will be amply sufficient to afford all the draft necessary to continue the drawing operation without the direct gripping of any positively driven gripping device on the sheet. In case the weight of the sheet itself is not found sufficient (as, for example, when a very thin light sheet is being drawn) to afford the necessary draft for continuing the drawing operation, the method of the present invention includes the step of augmenting the weight of the sheet by superimposing upon the sheet suitable material to afford the necessary frictional contact of the sheet with the table to provide the required draft. Preferably, the material thus employed for augmenting the weight is in the form of a finely powdered, highly refractory material which is deposited, preferably by a continuous operation, upon the surface of the drawn sheet after it has been turned into its horizontal position upon the carrier. Preferably said powdered material consists of finely powdered plumbago delivered to the sheet from a reservoir located above the carrier, though any other suitable material would be within the scope of the present invention.

As before stated, after the sheet of glass is drawn, it is advanced upwardly into the front end of the leer. In thus moving upwardly from the point where the glass is drawn into sheet form near the surface of the molten glass, the sheet may be either advanced upwardly within a closed heated chamber forming, as it were, a vertical closed connection extending from the surface of the molten mass to the leer, or the drawn sheet may be advanced through the open atmosphere where it is cooled by contact with the external atmosphere, and then passes into the leer. In this latter case, it is necessary to reheat the sheet before it passes over the bending roll, in order that the sheet may be safely bent over the roll without breakage. Moreover, as will hereinafter appear, this reheating will also constitute the first step in the annealing process. For the purpose of illustrating the invention, the drawn sheet is herein shown, however, as being advanced upwardly through a closed chamber in a heated atmos-

phere, and then turned from its upward direction over the bending roll, without contact with the external atmosphere, though preferably additional heat is supplied to the sheet at the bending point. It is to be understood, however, that whether the drawn sheet is advanced upwardly through a closed chamber in a heated atmosphere, as herein shown, or is advanced upwardly through an open space, wherein it is exposed to the external atmosphere, is immaterial for the purposes of the present invention, either form of procedure being within the spirit of this invention.

Secondly, the invention consists in the process of annealing sheet glass by placing the same in a properly heated condition on a suitable carrier at one end of an annealing leer and passing the same on the carrier through a constantly lowering temperature in the leer while the upper surface of the sheet is protected from contact with the atmosphere of the leer. The sheet may be passed through the leer either on a continuous or a sectional carrier table of any suitable construction, and the upper surface protected by any suitable medium which will permit a very slow radiation of the heat of the sheet, while at the same time amply protecting the sheet from any sudden changes in the temperature of the leer, which would result in breakage of the sheet. Preferably the material thus employed to protect the upper surface of the sheet is the finely pulverized material imposed upon the surface of the sheet to augment its weight to assist in the drawing operation, such as finely powdered plumbago, and the same is delivered onto the upper surface of the sheet near the forward or hotter end of the leer by any suitable mechanism, which, in the present instance, is a conduit leading down from a suitable hopper and extending across the face of the sheet from one edge thereof to the other.

As the sheet emerges from the leer fully annealed, it is preferably advanced onto a cutting table, which may be simply an extension of the carrier on which the sheet rests within the leer, and the powdered protecting material is removed therefrom by any suitable mechanism, and is returned to the forward end of the leer to be used again in the operation.

In order to prevent any sudden chilling of the sheet by depositing material upon its surface whose temperature is too much below that of the sheet itself, it is preferred to heat the powdered material before it is delivered to the surface of the sheet at the forward end of the leer.

Thirdly, the invention consists in an apparatus for the continuous production of sheet glass, in which apparatus there is combined a receptacle containing a molten-mass

of glass, a heated chamber which may be the forward end of the leer located above said receptacle, means for drawing a sheet of glass consisting of a bait, and suitable means for elevating the bait in a substantially vertical direction and passing it over a suitable bending roll, and a substantially horizontal moving carrier located in the leer, upon which the sheet rests during the drawing operation, the frictional contact between the sheet and the carrier affording the draft necessary to draw the sheet of glass from the mass of molten glass in the receptacle.

In that embodiment of the invention shown in the drawings forming a part of this application, the carrier table within the leer and the leer itself are shown as extending substantially horizontal from front to rear. It may be, and in some cases is, however, somewhat inclined either upward or downward from the horizontal, and when inclined downwardly from the horizontal the draft of the sheet on the table is rendered more effective to accomplish the drawing of the sheet from the working chamber or receptacle. Where the carrier table and leer are thus inclined, the inclination need not necessarily be very marked or depart to any very great extent from the horizontal, and such inclinations either above or below the horizontal are intended to be included in the expression "substantially horizontal" used in the description and the claims herein.

Fourthly, the invention consists in a leer chamber having a substantially horizontal carrier therein, combined with means for continuously drawing a sheet of glass and depositing it upon said carrier table, means for depositing a suitable covering, preferably of powdered material, upon the upper surface of the sheet on said carrier table, and means for removing said covering material at or near the exit end of the leer. Preferably, there is combined with the means for depositing the covering material upon the glass, means whereby said material may be heated prior to its deposit upon the glass, and a carrying device whereby the material which is removed from the glass at or near the exit end of the leer is carried back to the front end of the leer to be reheated and re-used.

The invention further resides in certain detailed steps in the methods above described, and in certain improvements in the details and construction of the apparatus mentioned, which shall be hereinafter more specifically described and then pointed out in the claims. The methods of my invention may be varied within certain limits without departing from the spirit of the invention, and the apparatus is capable of being embodied in a variety of physical structures. One embodiment of the apparatus by which the methods constituting a part of

the invention may be carried into practical operation is illustrated in the accompanying drawings, in which—

Figure 1 is a central, vertical, longitudinal section of the forward end of the leer and of the working chamber, showing also the fragmentary end of the melting furnace and of the carrier for returning the powdered material and the hopper from which said material is deposited upon the surface of the glass sheet; Fig. 2 is a detailed top plan view showing the carrier and the hopper for the powdered material; Fig. 3 is a central, vertical, longitudinal section through the entire apparatus, which is broken away in the center to shorten the figure; and Fig. 4 is a side elevation of Fig. 1.

Referring to the drawings, in which like reference numerals indicate corresponding parts throughout the several views, the reference numeral 1 indicates a receptacle containing a mass of molten glass 2 delivered into said receptacle from any suitable source, as from a melting furnace 3, which is here shown as in open communication with the working receptacle, to the end that the hot gases from the furnace may pass directly into the receptacle 1, for the purpose of maintaining the same at the proper temperature, reliance being also placed on a suitable burner or burners 4 on the opposite side of the receptacle 2 from the furnace 3. Located on a plane above that of the receptacle or working chamber 1 is a leer 5 whose forward end projects over the working chamber 1 and has an opening 6 in the bottom part of its forward end, which opening is immediately above and in line with an opening 7 through the cover of the working chamber or receptacle 1, the openings 6 and 7 combined constituting a closed passage-way leading from the receptacle 1 into the forward end of the leer 5. Within this forward end of the leer 5 is a bending roll 8 which may be either a power-driven roll or an idler roll driven by the frictional contact of the sheet of glass as it passes over said roll. Within the leer 5 there is placed a carrier table 9, here shown as substantially horizontal, and as extending from end to end of the leer in a substantially horizontal direction, the rear portion 10 of said table projecting from the rear end of the leer and forming a cutting table. Any other suitable table may be employed, and the carrier table, instead of being one continuous carrier table as here shown, may, if desired, be made up of several sections. As here shown, however, the same is a continuous carrier table consisting of transverse bars carried by a pair of sprocket chains 11 passing over suitable sprocket wheels and driven from any suitable source of power. The forward end of the leer 5 is heated in any suitable manner, as by means of the

hot gases passing upward through the openings 6 and 7 from the working chamber 1, augmented by the heat from burners 12 in the forward walls of the leer, and, if desired, still further augmented by burners 13, 13, located in the walls of the tile covering to the working chamber 1. Mounted on the top of the forward end of the leer 5 is a suitable hopper or receptacle 14 having a spout or delivery chute 15 extending therefrom down through the top wall of the leer to a point somewhat above the carrier table 9. Surrounding the lower part of the hopper 14 is an exterior casing 16 which is in open communication through ports or holes 17 with the interior of the leer, and which is provided with small exit ports 18 formed through the walls of the casing 16, the construction being such that the hot gases will be permitted to circulate around the lower portion of the hopper 14 within the casing 16, admission of the gases being from the leer 5 through the ports 17, and the escape of the gases being through the ports 18.

Any suitable means may be provided for removing the covering material 19 from the surface of the glass as it issues fully annealed from the rear end of the leer, and as here shown, said means consist of a revolving brush 20 placed at an angle across the surface of the glass at the exit end of the leer, and acting to brush the powdered covering material from the surface of the glass into the enlarged mouth-end 21, of a conduit 22, leading to the bottom end 23, of an elevator 24, of any suitable construction, and by means of which the powdered material is elevated and delivered through the spout 25, onto an endless carrier 26, by which it is returned to and deposited in the hopper 14.

For the purpose of driving the endless carrier 9, the brush 20, the elevator 24, and the carrier 26, a power shaft 27 is connected by suitable driving belts or sprocket-chains 28, 29, 30 and 31, with the various elements to be driven, all of which will be readily understood by an inspection of Fig. 3.

In order to regulate the amount of powdered material delivered from the hopper 14 onto the surface of the continuously moving sheet of glass, a suitable valve 32, Fig. 1, is mounted within the hopper 14 so as to normally close the upper end of the delivery spout 15. The bottom of the hopper 9 is preferably formed curved or arc-shaped in cross-section, and the valve 32 is shaped to conform to said surface, and is mounted on a rock-shaft 33, having a handle 34, rigidly secured thereto and normally engaging a notched bar or ratchet 35 (see Fig. 4) on the exterior of the machine. The valve 32 preferably is not of the same width entirely across the bottom of the hopper 14, its for-

ward or controlling edge being formed on a curve, as shown at 33', Fig. 2, to the end that the opening of the delivery spout 15 is first uncovered at the center, and then as the opening is further moved the opening gradually widens, thus depositing a greater amount of covering or weighting material at the center than at the edges of the sheet. It will be understood, however, that the working edge of the valve 32 might be made straight so that the covering or weighting material would be deposited in equal thickness entirely across the sheet.

For the purpose of initiating the operation, there is provided a bait 36 of any suitable construction, as for instance a metal bar, which is attached to one end of chains 37, the other end of which is attached to a weight 38.

Operation: The molten glass 2 in the working chamber or receptacle 1 having been properly tempered, the bait 36 attached to the chains 37 is lowered over the bending roll 8 through the openings 6 and 7 until the bait rests within the mass of molten glass, the weight 38 attached to the other end of the chains 37 resting upon the carrier table 9. The valve 32 being closed, the machine is started, the carrier slowly moving the weight in the direction indicated by the arrow in Fig. 1, thus slowly elevating the bait from the mass of molten glass 2, which as it emerges from the molten glass, draws a sheet of glass after it. For the purpose of overcoming the narrowing tendency of the sheet, any suitable means are employed, as the gripping fingers 39, 39, which engage the edge portions of the sheet and restrain it against the tendency to narrow. The sheet of glass having been drawn from the surface of the molten mass of glass 2, is slowly advanced as a drawn sheet upward through the openings 7 and 6 into the forward end of the leer 5 and over the bending roll 8, heat being supplied from the working chamber and from the burners 12 and 13 to insure the sheet being sufficiently plastic at the bending roll 8 to turn thereover without breakage. The drawn sheet having been advanced upward through the openings 7 and 6 and over the bending roll 8, is deposited upon the carrier table 9, and after the forward end of the sheet is advanced past the spout 15 for delivering the powdered material, the operator (in case it is desired to augment the weight of the sheet or to practice the annealing process described herein), operates the valve 32 by means of the handle 34, setting it into the position required to deliver the desired amount of the powdered material, as plumbago, onto the surface of the moving sheet of glass. As the sheet slowly advances through the leer, moving toward the exit end thereof, the temperature of the leer gradually decreases from the forward

end to the exit end thereof, and the sheet is moved on the carrier through the leer slowly enough to permit it to gradually and uniformly lose its heat, thus accomplishing the annealing of the sheet. The rapidity with which the sheet thus parts with its heat may be largely controlled, not only by the decrease in temperature in the leer, but by the amount of covering material delivered to the upper surface of the sheet. Moreover, this covering material serves to protect the sheet from any cold drafts or other cooling means, which might set up an uneven contraction of the sheet, resulting in its breakage.

When the bait emerges from the exit end of the leer, it is cut off from the sheet, and thereafter the drawing of the sheet is accomplished purely by the weight of the sheet resting upon the carrier table, augmented, if desired, by the covering of plumbago or other suitable material. As the sheet emerges from the exit end of the leer, the revolving brush 20 acts to sweep off the covering material and delivers it to the elevator 24, by which it is elevated and delivered to the carrier 26, and thence to the hopper 14. The material when it reaches the hopper 14 will contain more or less heat, but for the purpose of insuring that it shall be warm enough to avoid any chilling action when it is delivered to the surface of the warm sheet, the hot gases in the chamber 16 surrounding the hopper 14 serve to heat the mass of powdered plumbago in the hopper, when it is again delivered through the spout 15 on to the surface of the sheet.

While various covering materials might be employed within the spirit of my invention, I prefer to employ powdered plumbago, since the latter, in case it falls from the sheet and gets into the bearings or in contact with other moving parts of the mechanism, not only would not injure the same nor interfere with their movement, but would, on the contrary, act as a lubricant.

What is claimed is:—

1. The method of drawing sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass and resting it upon a suitable carrier, and then continuing the drawing operation by applying the draft to the drawn portion of the sheet through the frictional contact of said sheet with the carrier.

2. The method of drawing sheet glass, which consists in preparing a mass of molten glass, drawing the sheet upwardly from said mass, then turning the drawn sheet from its upward to an approximately horizontal direction onto a suitable carrier, and continuing the drawing operation by applying the draft to the drawn portion of the sheet through the frictional contact of said sheet with the carrier.

3. The method of drawing sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass and resting it upon a suitable carrier, augmenting the weight of the sheet by superposing suitable material thereon, and continuing the drawing operation by applying the draft to the drawn portion of the sheet through the frictional contact of said sheet with the carrier.

4. The method of drawing sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass and resting it upon a suitable carrier, augmenting the weight of the sheet by superposing finely divided material thereon, and continuing the drawing operation by applying the draft to the drawn portion of the sheet through the frictional contact of said sheet with the carrier.

5. The method of drawing sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass and resting it upon a suitable carrier, augmenting the weight of the sheet by superposing finely divided plumbago thereon, and continuing the drawing operation by applying the draft to the drawn portion of the sheet through the frictional contact of said sheet with the carrier.

6. The method of making sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass and resting it upon a suitable carrier, retarding radiation of heat from one surface of the sheet by the application of a suitable covering, while passing the sheet through an atmosphere of gradually decreasing temperature.

7. The method of making sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass and resting it upon a suitable carrier, retarding radiation of heat from one surface of the sheet by the application of a covering of powdered material while passing the sheet through an atmosphere of gradually decreasing temperature.

8. The method of making sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass and resting it upon a suitable carrier, retarding radiation of heat from one surface of the sheet by the application of a covering of powdered plumbago while passing the sheet through an atmosphere of gradually decreasing temperature.

9. The method of making sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass, reheating said sheet after the cooling incident to the drawing operation, resting the reheated sheet on a suitable carrier, retarding the radiation of heat from the upper surface of the sheet by the application of a

suitable covering, and then passing the covered sheet through an atmosphere of gradually decreasing temperature.

10. The method of making sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass, reheating said sheet after the cooling incident to the drawing operation, resting the reheated sheet on a suitable carrier, retarding the radiation of heat from the upper surface of the sheet by the application of a covering of powdered material, and then passing the covered sheet through an atmosphere of gradually decreasing temperature.

11. The method of making sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass, reheating said sheet after the cooling incident to the drawing operation, resting the reheated sheet on a suitable carrier, retarding the radiation of heat from the upper surface of the sheet by the application of a covering of powdered plumbago, and then passing the covered sheet through an atmosphere of gradually decreasing temperature.

12. The method of making sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass, reheating said sheet after the cooling incident to the drawing operation, resting the reheated sheet on a suitable carrier, retarding the radiation of heat from the upper surface of the sheet by the application of a suitable heated covering, and then passing the covered sheet through an atmosphere of gradually decreasing temperature.

13. The method of making sheet glass, which consists in preparing a mass of molten glass, drawing a sheet of glass from said mass and resting it upon a suitable carrier, retarding radiation of heat from one surface of the sheet by the application of a suitable heated covering while passing the sheet through an atmosphere of gradually decreasing temperature.

14. In an apparatus for drawing sheet glass, the combination of a receptacle containing a mass of molten glass, a horizontally extending leer in a plane above said receptacle, a bending roll in one end of said leer, a sheet-glass carrier in the leer, means drawing a sheet of glass from said receptacle over said bending roll onto said carrier, and means augmenting the weight of the sheet on the carrier.

15. In an apparatus for drawing sheet glass, the combination of a receptacle containing a mass of molten glass, means drawing a sheet of glass therefrom, a carrier on which the drawn sheet is deposited and which continues the drawing operation solely by the frictional contact of the sheet with the carrier.

16. In an apparatus for drawing sheet glass, the combination of a receptacle containing a mass of molten glass, means drawing a sheet of glass therefrom, a carrier on which the drawn sheet is deposited, and means depositing weighting material on said sheet during the drawing operation.

17. In an apparatus for drawing sheet glass, the combination of a receptacle containing a mass of molten glass, means drawing a sheet of glass therefrom, a carrier on which the drawn sheet is deposited, and a hopper above said carrier and from which pulverized material is deposited during the drawing operation.

18. In an apparatus for drawing sheet glass, the combination of a receptacle containing a mass of molten glass, means drawing a sheet of glass therefrom, a carrier on which the drawn sheet is deposited, means depositing weighting material on said sheet during the drawing operation, and automatic means removing said material from the sheet.

19. In an apparatus for drawing sheet glass, the combination of a receptacle containing a mass of molten glass, means drawing a sheet of glass therefrom, a carrier on which the drawn sheet is deposited, a hopper above said carrier and from which pulverized material is deposited during the drawing operation, and a revolving brush removing said material from the sheet.

20. In an apparatus for drawing sheet glass, the combination of a receptacle containing a mass of molten glass, means drawing a sheet of glass therefrom, means depositing a weighting material on said sheet, and means heating said material prior to its deposit.

21. In an apparatus for drawing sheet glass, the combination of a receptacle containing a mass of molten glass, a leer in a plane above said receptacle, a carrier in said leer, means initiating the drawing of a continuous sheet of glass from said receptacle and depositing it on said carrier, means supplying heat to said sheet where it enters the leer, and means depositing a covering material on said sheet during the drawing operation.

22. In an apparatus for drawing sheet glass, the combination of a receptacle containing a mass of molten glass, a leer in a plane above said receptacle, a carrier in said leer, means initiating the drawing of a continuous sheet of glass from said receptacle and depositing it on said carrier, the continued drawing of the sheet being due to the frictional contact of the sheet with the carrier, means depositing a heated covering material on said sheet, and automatic means removing said material from the sheet.

23. In an apparatus for drawing sheet glass, the combination of a receptacle con-

5 taining a mass of molten glass, a leer in a
plane above said receptacle, a carrier in said
leer, means initiating the drawing of a con-
tinuous sheet of glass from said receptacle
and depositing it on said carrier, a hopper
10 containing pulverized material and from
which said material is deposited on said
sheet, means heating the material in said
hopper, means removing said material from
the sheet, and means returning the removed
material to the hopper.

24. In an apparatus for drawing sheet
glass, means for drawing a sheet of glass, in-

cluding a carrier on which the drawn sheet
rests, a hopper located above the carrier and 15
containing pulverized material, and from
which said material is deposited on the sheet,
and adjustable means regulating the rate of
deposit of said material.

In testimony whereof I have signed this 20
specification in the presence of two subscrib-
ing witnesses.

JOHN PLAYER.

Witnesses:

WILLIAM A. ADAMS,
ST. CLAIR L. HITE.