

J. PLAYER.
METHOD AND APPARATUS FOR DRAWING SHEET GLASS.
APPLICATION FILED JULY 28, 1910.

1,032,239.

Patented July 9, 1912.

2 SHEETS—SHEET 1.

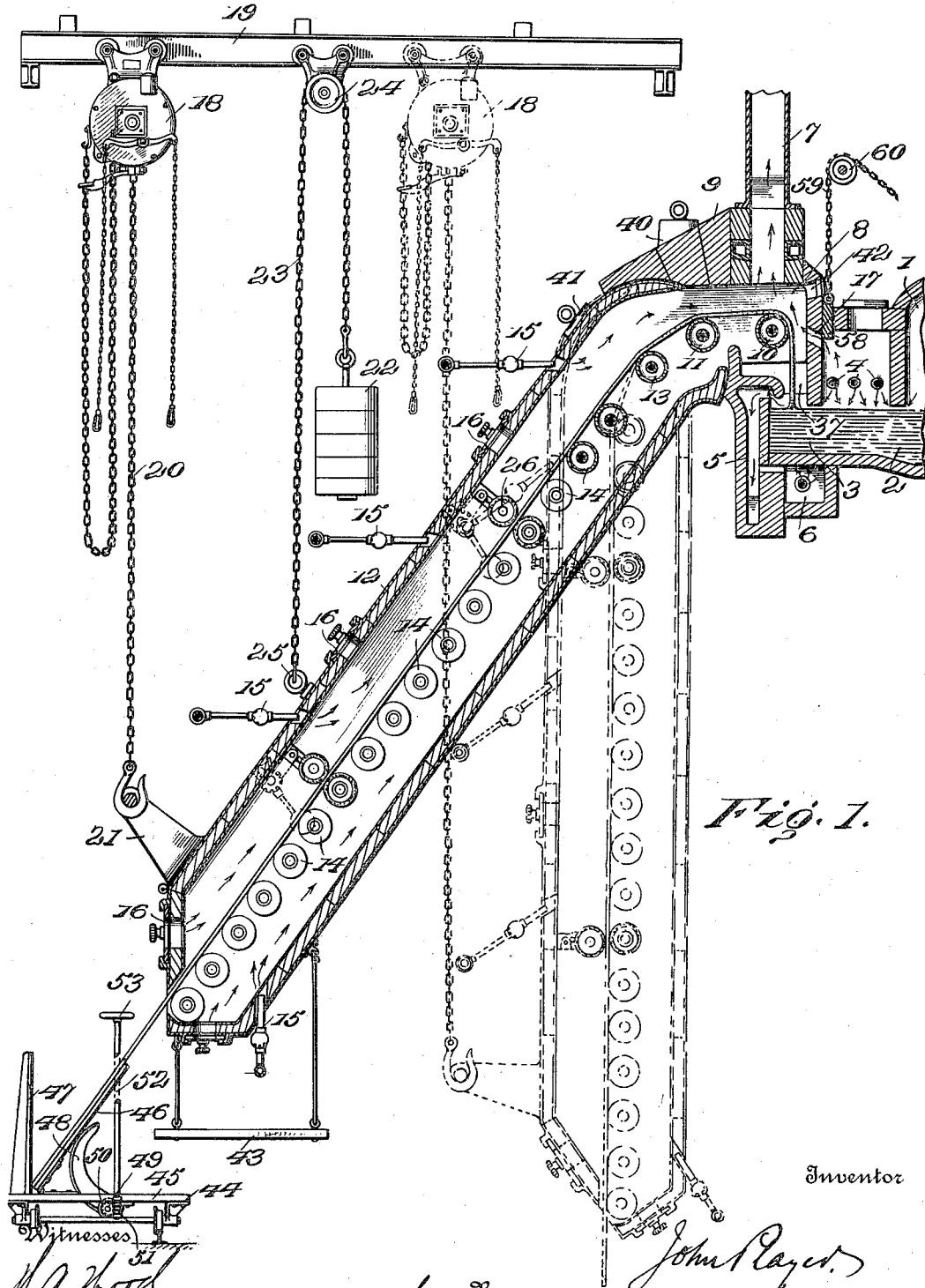


Fig. 1.

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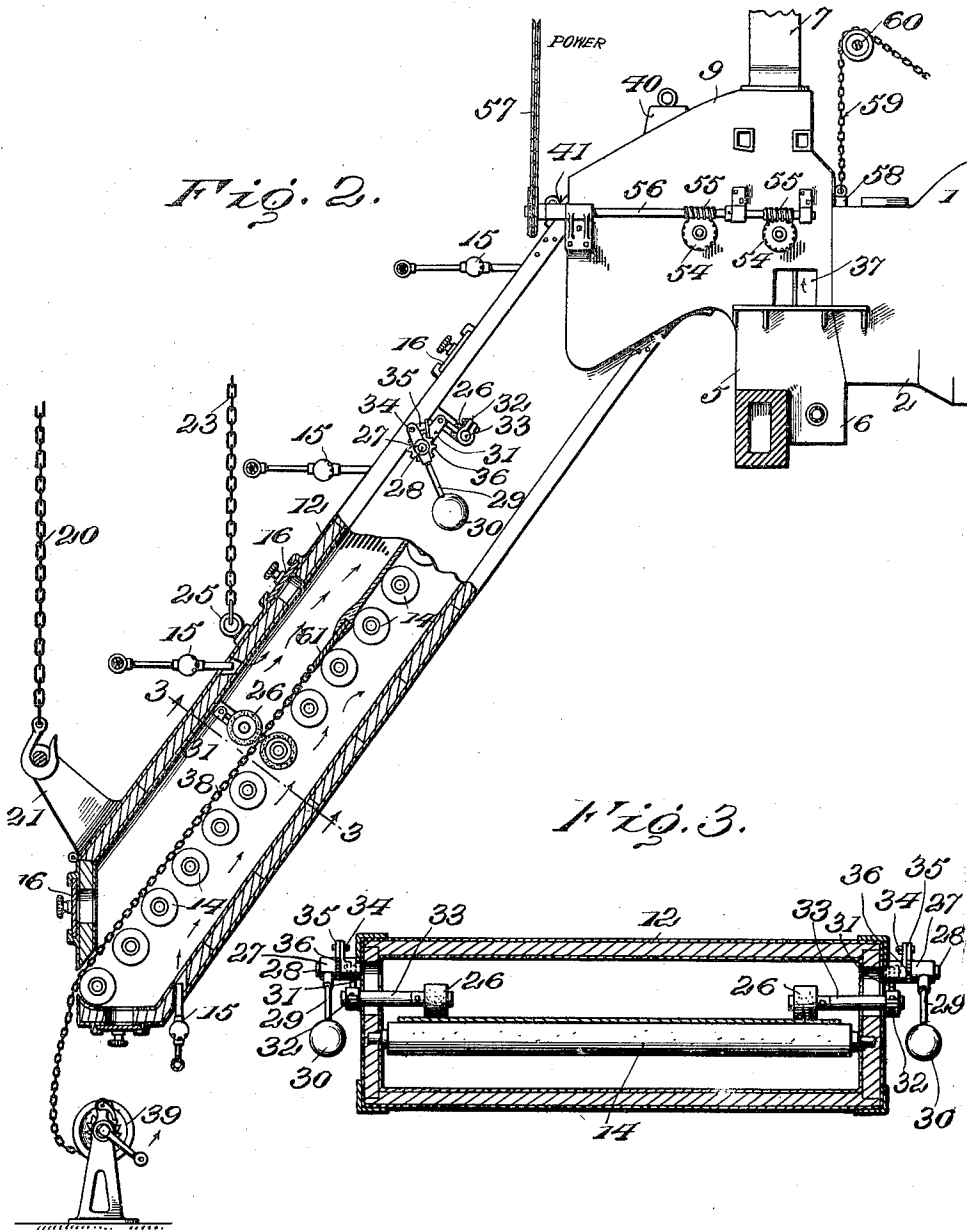
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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR DRAWING SHEET-GLASS.

1,032,239.

Specification of Letters Patent.

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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 Drawing Sheet-Glass, which invention is fully set forth in the following specification.

This invention relates to the art of drawing glass in sheet or plate form from a mass of molten glass.

Hitherto, it has been proposed to draw sheet glass by inserting a suitable bait in a mass of molten glass and then applying power to the bait to draw the same outward and generally upward from the molten mass, and when the drawn sheet has reached the desired length to sever the same from the molten mass and repeat the operation. This has the objection that it is not a continuous process and, therefore, necessarily slow. It has also been proposed to initiate the drawing operation by the use of the bait and after the sheet has been started to apply suitable mechanism for continuing the pull of the sheet, such as gripping rolls or other gripping devices. These devices more or less mar the sheet and result in a necessary complication of the mechanism. In U. S. Patent No. 952,354 granted me March 15, 1910, I have disclosed a process and apparatus designed to overcome these objections by substituting the frictional contact of the sheet of glass with a continuously-moving carrier, and in that process and apparatus dependence is placed upon the weight of the sheet to produce the necessary friction between such sheet and the carrier or additional weight is obtained by superimposing any suitable material such as plumbago upon the surface of the sheet. While I regard this as an improved and efficacious method and apparatus, it is also open to the objection that a continuously-movable carrier with the means for driving the same form a necessary part of the apparatus.

One of the objects of the present invention is to provide a method and an apparatus for drawing sheet glass, in which, after the drawing of the sheet has been initiated, no power should be applied to the sheet either in the shape of gripping rolls or other gripping mechanism or in the shape of a power-driven carrier operating through frictional contact, as in my patent last-named.

A further object is to provide a method and apparatus which shall be continuous in operation, of simple construction and, there-

fore, of small cost and less liable to get out of order than in constructions heretofore proposed.

With these objects in view, the invention consists, first, in a method of drawing sheet glass which consists in utilizing the weight of the sheet of glass itself—that is, the gravity of the sheet—to furnish the power necessary to perform the drawing operation after such drawing operation has been once initiated. The starting of the sheet may be effected in any suitable manner, as by means of a suitable bait immersed in the molten mass and then slowly elevated therefrom by the application of power through any suitable device, as by a chain attached to a suitable windlass driven by hand or a suitable motor. The sheet is then turned, while still plastic, over a suitable bending-roll and passed downward until the length of the sheet has become such that the weight of the drawn sheet will be sufficient to maintain the draft necessary to continue the drawing operation. The sheet is passed over a bending-roll—it is herein shown as passing over a plurality of bending-rolls—and then is permitted to hang vertically downward, in which case no table or support of any kind is necessary for the sheet; or the sheet may be passed on to a support inclined to the vertical at any suitable or desired angle. Said support may be in any suitable form, preferably, in the form of a series of idler rolls preferably mounted upon ball-bearings placed parallel to and in close juxtaposition to each other. Whether the sheet is permitted to fall vertically downward without a table or other similar support, or whether it is inclined at an angle with the vertical and mounted on a suitable and, preferably, anti-frictional support, it is inclosed in a suitable oblong chamber of proper length to serve as a leer, and means are provided whereby heat in addition to that radiating from the sheet may be supplied to the leer chamber if the same is found necessary. As the sheet emerges from the end of the leer, it is cut off in suitable lengths, by a workman standing at the mouth of the leer, and delivered to a suitable carriage for transporting it to cutting tables or to a suitable place of storage.

In drawing sheet glass, there should be a certain rate of movement or draft of the sheet proportionate to the temperature and fluidity of the molten mass from which it

is drawn. In order to insure against the sheet of glass moving downward by gravity more rapidly than is desired to produce the best results, suitable means are provided for controlling the downward movement of the sheet. Any suitable means may be employed for this purpose, and for the sake of illustrating the inventive idea involved, there is herein shown a plurality of friction rolls with means for adjusting the friction of such rolls upon the edge portions of the sheet to resist or check the downward movement of the sheet when such action becomes necessary.

Secondly, the invention consists in a leer chamber extending downwardly from the bending-roll or rolls. This chamber may extend either vertically downward or it may extend at an angle to the vertical. Preferably, the leer chamber is mounted so as to be capable of being turned around an axis located in the axis of one of the bending-rolls or approximate thereto, and means are provided for swinging such chamber so that it will assume either a vertical position or one at an angle to the vertical if that may be found most desirable. Preferably, there is provided in this leer chamber a series of transverse horizontal anti-frictional rolls over which the sheet passes in its downward movement, and with which it contacts when the leer is placed at an angle to the vertical, but which rolls perform no function when the leer is placed in vertical position.

Preferably, the leer chamber consists of metal walls provided with proper heat insulating material, such as asbestos, which is placed, preferably, on both the interior and exterior sides thereof, and for the purpose of facilitating the movement of the leer chamber so as to adjust it either into the vertical or inclined positions the same is preferably connected to suitable counter-weights so that a very small amount of power is required to effect adjustment.

The invention also consists in certain details of construction and methods of operation which will be hereinafter more specifically described and then pointed out in the claims.

The inventive idea involved is capable of receiving a variety of mechanical expressions so far as the apparatus is concerned and certain detailed modifications so far as the method is concerned. For the purpose of illustrating the invention, one of the mechanical embodiments of the apparatus is shown in the accompanying drawings, but it is to be understood that such drawings are for the purpose of illustration only and are not designed to define the limits of the invention, reference being had to the claims appended hereto for that purpose.

In said drawings—Figure 1 is a vertical

central section with the leer shown in inclined position in full lines and in a vertical position in dotted lines; Fig. 2 is a side elevation of Fig. 1 with parts broken away; and Fig. 3 is a transverse section on the line 3—3 of Fig. 2.

Referring to the drawings, 1 is any suitable melting furnace. 2 is a dog house connecting the same with the working chamber 3. The molten glass is maintained in working condition by burners 4 in the dog house and by a flue 5 leading from the end of the working chamber downward to a connection 6 leading to the stack 7. Immediately above the open working slot in the working chamber, there is formed a drawing chamber 8 having a roof or covering 9, from which the stack 7 extends and in this drawing chamber above the working slot in the working chamber is mounted bending-roll 10, while a second bending-roll 11 is mounted in said chamber outside of the first bending-roll. A leer 12 in the form of a long chamber, preferably rectangular in cross-section, is mounted to turn on a transverse axis 13 and has its upper end projecting into the drawing chamber 8, the walls of the leer and of the drawing chamber being struck on corresponding arcs to permit the leer to be turned about its axis while at the same time maintaining the close connection between the drawing chamber and leer.

The leer is provided with a suitable support for the glass while the same is being drawn when the leer is in an inclined position. Such support may be of any suitable form. As here shown, the support consists of a series of idler rolls 14 hung in the leer on axes transverse thereto with the upper surfaces of the rolls in same inclined plane.

For the purpose of regulating the temperature within the leer chamber, suitable burners 15 and dampers 16 are provided at the bottom and at intervals along the chamber, and for the purpose of controlling the temperature of the drawing chamber a flue 17 is open directly from the dog house into the working chamber, preferably about opposite the bending-roll 10, but, if desired, other burners and other flues than those shown may be employed for the purposes indicated.

For the purpose of turning the leer chamber about its axis so as to adjust it to a vertical position or to any desired angle of inclination, suitable means, here shown as a hoisting pulley 18 carried on any suitable super-structure 19, are provided with a chain or a cable 20 extending over the pulley 18 and connected as at 21 to the leer. While only one set of pulley connections are shown, it will be understood that any suitable number may be employed and that any other suitable means for applying power to adjust

the position of the leer may be substituted for said pulley and cable. Preferably, the weight of the leer chamber is counter-balanced by a weight 22 connected to a cable 23 passing over a pulley 24 and connected as at 25 to the leer chamber.

For the purpose of controlling the rate of movement of the sheet downward through the leer chamber, that is, for the purpose of preventing it from moving too fast under the action of gravity, suitable means are provided, here shown in the form of friction rolls 26 (see Fig. 3). These rolls are preferably constructed so as to avoid marring the glass, this being accomplished by facing the rolls with suitable refractory material such as asbestos. Means are also provided for adjusting the friction of these rolls on the sheet of glass. As here shown, such means consist of a sleeve 27 mounted to turn on stub-shaft 28, a lever-arm 29 being rigidly connected to and projecting from the sleeve and bearing the weight 30 on the exterior end thereof. Projecting from the sleeve 27 is also an arm 31 supporting a bearing 32 for the bearing-shaft 33 of the friction roller 26. Mounted on a bracket 34 secured to the wall of the leer chamber is a pawl 35 engaging a ratchet 36 on the sleeve 27. The action of the weight is to supply the frictional pressure of the roll 26 upon the sheet of glass, it being understood that such rolls 26 come immediately opposite one of the supporting rolls 14. The amount of pressure exerted by the rolls 26 upon the glass may be varied by adjusting the position of the weight 30 by means of the pawl and ratchet 35 and 36, the maximum pressure being obtained when the lever-arm 29 extends in a horizontal position and as the said arm is adjusted from such horizontal position the effective action of the weight upon the roll 26 is decreased until it becomes *nil* when the arm 29 is in a vertical position. Any other suitable means for adjusting the pressure of the rolls 26 upon the glass may be substituted for that shown.

For the purpose of initiating the drawing operation a suitable bait may be inserted through the side opening 37 above the working chamber (see Fig. 2), and a chain or other suitable cable 38 connected to the bait is passed downward through the leer chamber and connected to any suitable means for applying power to wind up the chain, such means being here shown as in the form of a windlass 39 (Fig. 2). For the purpose of connecting the chain to the bait, an opening may be provided in the upper wall of the drawing chamber by removing a plug 40 or by removing a plug 41 formed in the upper wall of the leer chamber, an opening 42 provided with a suitable closure being provided through which a hooked rod may be inserted to draw the chain forward and drop it

downward into the working chamber to be connected to the bait, while the other end of the chain may be dropped downward through the leer until it extends through the lower opening therein, where it may be connected to the windlass.

A platform 43 (Fig. 1) is hung to the lower end of the leer chamber 12, upon which a workman stands to cut off the glass when it emerges from the leer, as herein-after described, and immediately below the platform any suitable carriage 44 is provided for receiving the severed sheets. One form of carriage which may be employed is shown in Fig. 1, which carriage consists of a suitable truck mounted on rails and carrying a platform 45, to which is pivoted a sheet-receiving hinged table 46, the hinged end of the table being near vertical standard 47. The hinged table 46 is supported on a cam-shaped bracket arm 48 pivoted to turn on an axis 49 and provided with a worm-gear 50 engaging a worm 51 on a shaft 52 provided with a hand-wheel 53, to the end that as the sheets of glass are delivered to the table 46 the same may be gradually lowered by operating the bracket 48 through the hand-wheel 53.

The bending-rolls 10 and 11 are, preferably, idler rolls when the machine is in normal operation, but at the initiation of the drawing operation it is sometimes found desirable to revolve these rolls by power and for this purpose the shaft of the rolls project through the side walls of the working chamber (see Fig. 2) and are provided with worm-gears 54 engaged by worms 55 on a shaft 56 driven as by chain 57 extending to any suitable source of power. The worm-gears 54 are connected to the shafts of the bending-rolls 10 and 11 by any suitable clutch mechanism, not shown, and when the drawing operation has been fully started said worm-gears may be disconnected from the shafts of the bending-rolls by opening the clutches.

For the purpose of controlling the amount of hot gases passing through the flue 17, there is provided a sliding damper 58 (Fig. 1) of refractory material, such as fire-brick, controlled by a chain 59 passing over a pulley 60.

Operation: The glass in the working chamber 3 having been brought to proper working condition and the bait having been inserted therein and the chain 38 secured thereto and passed downward through the leer to the windlass 39, power is provided to the windlass and the bait is slowly elevated from the molten glass, resulting in the drawing of the sheet now well known in the art. It is, of course, understood that suitable means are provided for overcoming the narrowing tendency of the sheet, but, as such means are well known in the

art, it is not deemed necessary that the same should be specifically shown and described herein. Preferably, I employ width-maintaining devices, such as those shown in my Patent No. 953,973, granted me April 5, 1910. As the drawing of the sheet continues, it is turned over the bending-rolls 10 and 11 and drawn downward by the bait-chain 38 and the bait 61 (see Fig. 2) until the latter emerges at the lower end of the leer, when it is severed from the sheet of glass in any suitable manner. If preferred, however, the bait could be severed from the sheet of glass and removed at any other suitable point on its downward movement through the leer. During the downward movement of the bait and the sheet of glass following the same, if it is found that the weight of the sheet tends to cause the same to move downward too rapidly, the friction rolls 26 are brought into operation and when the bait has been finally removed the pressure of these friction rolls upon the sheet is adjusted so as to cause the sheet to move at the desired speed for producing the best results. After the bait has been removed and the bending rolls 10 and 11 disconnected from the source of power, the drawing of the sheet thereafter continues entirely as the result of the action of gravity upon the sheet of glass in the downwardly-extending leer. There is no draft power other than that of gravity applied to the sheet at all. No gripping mechanism with its complicated driving connections and its marring action upon the sheet is employed. In order that the sheet may be properly annealed during its passage through the leer, the temperature of the leer chamber is regulated by means of the burners 15 and the dampers 16, the leer chamber necessarily being hottest at its upper portion and the temperature gradually decreasing until the bottom of the leer is reached, where, preferably, it should be approximately that of the external atmosphere. In some cases, it may be found that the heat radiated from the sheet of glass will be sufficient to maintain the proper temperature within the leer. Of course, it will be understood that before the initiation of the operation, the entire leer is heated up by the use of the burners 15. It will also be observed that by reason of the fact that the exit end of the leer is at the bottom while the inlet thereof is at the top, the natural rise of the heated air passing on its way to the stack 7 will result in the upper or entrance end of the leer being the hottest and the necessary gradual decrease in temperature to the bottom or exit end of the leer, which is the ideal condition for properly annealing the sheet.

While the construction of the apparatus has been described with some particularity, it will be understood that the invention is

not limited to the specific details of construction thus described for the purpose of clearness and that variations in details of construction may be introduced without departing from the spirit of the invention.

Having thus described my invention, what is claimed is:

1. The method of drawing sheet glass which consists in applying extraneous power to initiate the drawing operation, and then disconnecting said extraneous power and using the action of gravity on the drawn portion of the sheet to continue the drawing operation.

2. The method of drawing sheet glass which consists in initiating the drawing by applying power to draw a sheet, turning the drawn portion of the sheet downward, and then disconnecting the applied power, whereby the continued draft on the sheet is produced by gravity.

3. The method of drawing sheet glass which consists in drawing glass upward in sheet form, and then turning the sheet downward and utilizing the weight of the sheet to continue the drawing operation.

4. The method of forming a sheet of glass which consists in drawing a sheet portion and then using the drawn portion of the sheet to furnish the power to continue the drawing operation.

5. The method of continuously drawing sheet glass which consists in preparing a mass of molten glass, drawing a sheet of glass upwardly therefrom by the application of power, then turning the sheet downward and continuing the drawing operation by said power until the weight of the drawn sheet is sufficient to effect the drawing, and then disconnecting said power and continuing the drawing by using the weight of the downwardly turned portion of the sheet.

6. The method of continuously drawing sheet glass which consists in drawing the glass upward in sheet form, then turning the sheet downward, and then annealing the downwardly turned portion of the sheet while using its weight to continue the drawing operation.

7. The method of continuously drawing sheet glass which consists in drawing a sheet portion and then using the drawn portion of the sheet to furnish the power to continue the drawing operation and keeping the weight of the sheet approximately constant by cutting off the end portions of the sheet as the drawing continues.

8. The method of continuously drawing sheet glass which consists in drawing the continuous sheet first upward and then downward by the action of gravity through an annealing atmosphere, and then severing the annealed portions of the sheet as they emerge from the annealing atmosphere.

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9. In an apparatus for drawing sheet glass, the combination of a drawing chamber, a leer mounted to swing in a vertical plane and connected at its upper end to said chamber, and a bending roll located in said chamber. 5

10. In an apparatus for drawing sheet glass, the combination of a drawing chamber, a leer pivoted at its upper end and opening into said chamber, and a bending roll in the drawing chamber. 10

11. A gravity-actuated sheet-glass draw-

ing apparatus having a downwardly inclined leer, means controlling the angle of inclination of said leer, and means in said leer controlling the downward movement of the glass under the action of gravity. 15

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JOHN PLAYER.

Witnesses:

FRANK F. REED,
EDWARD TOGS.