

No. 766,275.

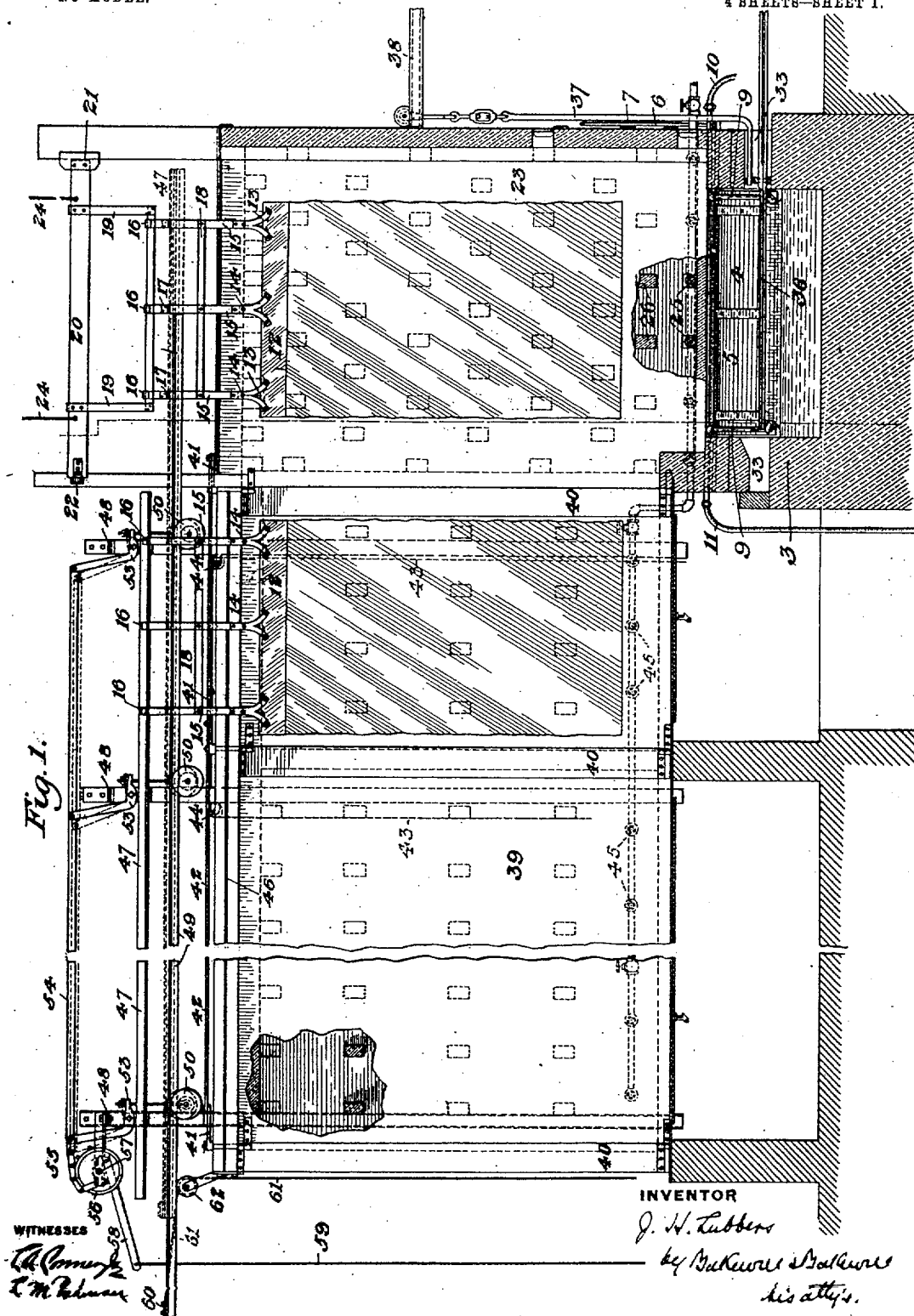
PATENTED AUG. 2, 1904.

J. H. LUBBERS.
APPARATUS FOR DRAWING GLASS.

APPLICATION FILED SEPT. 5, 1899.

NO MODEL.

4 SHEETS—SHEET 1.



No. 766,275.

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NO MODEL.

4 SHEETS—SHEET 2.

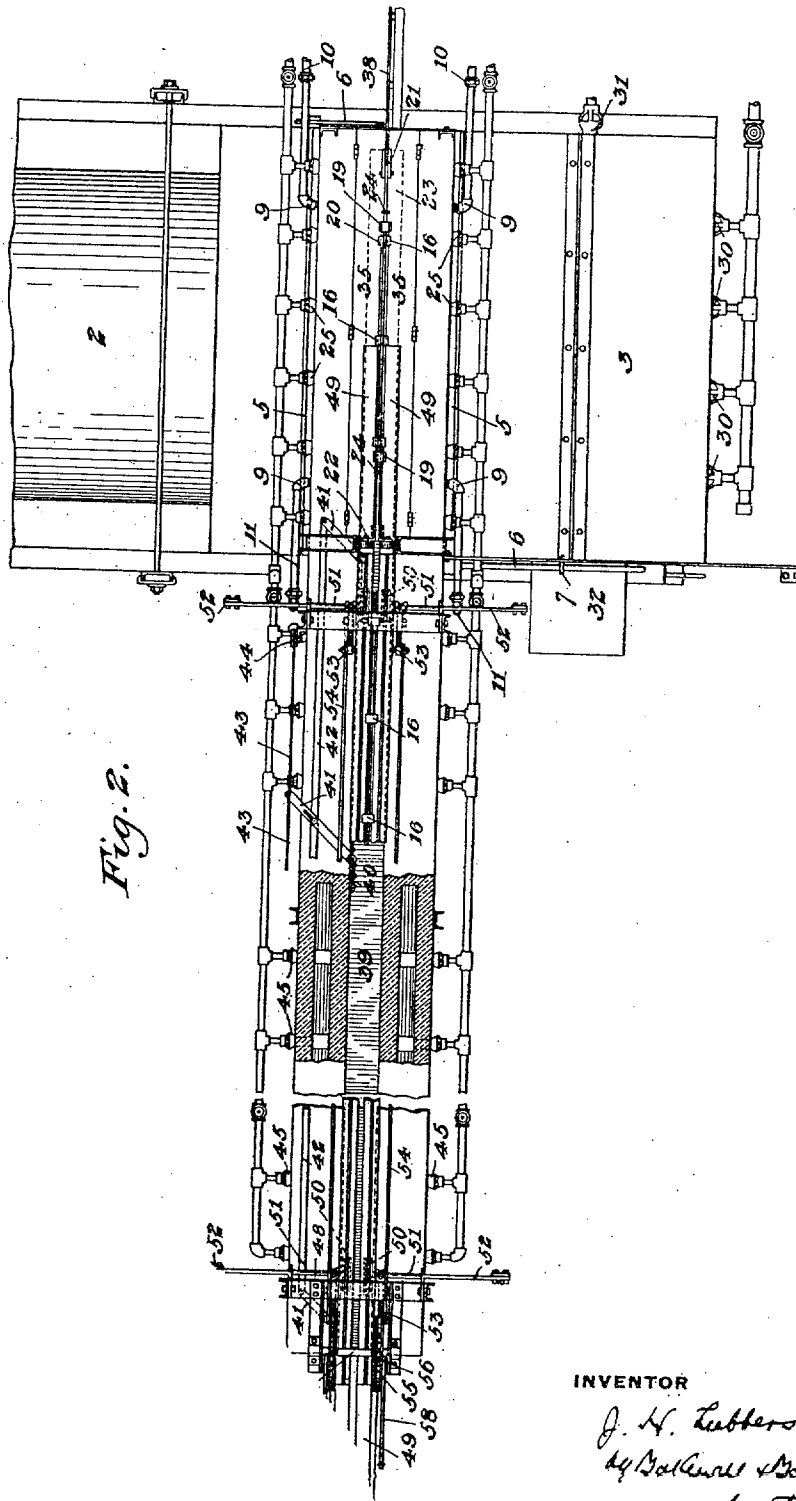


Fig. 2.

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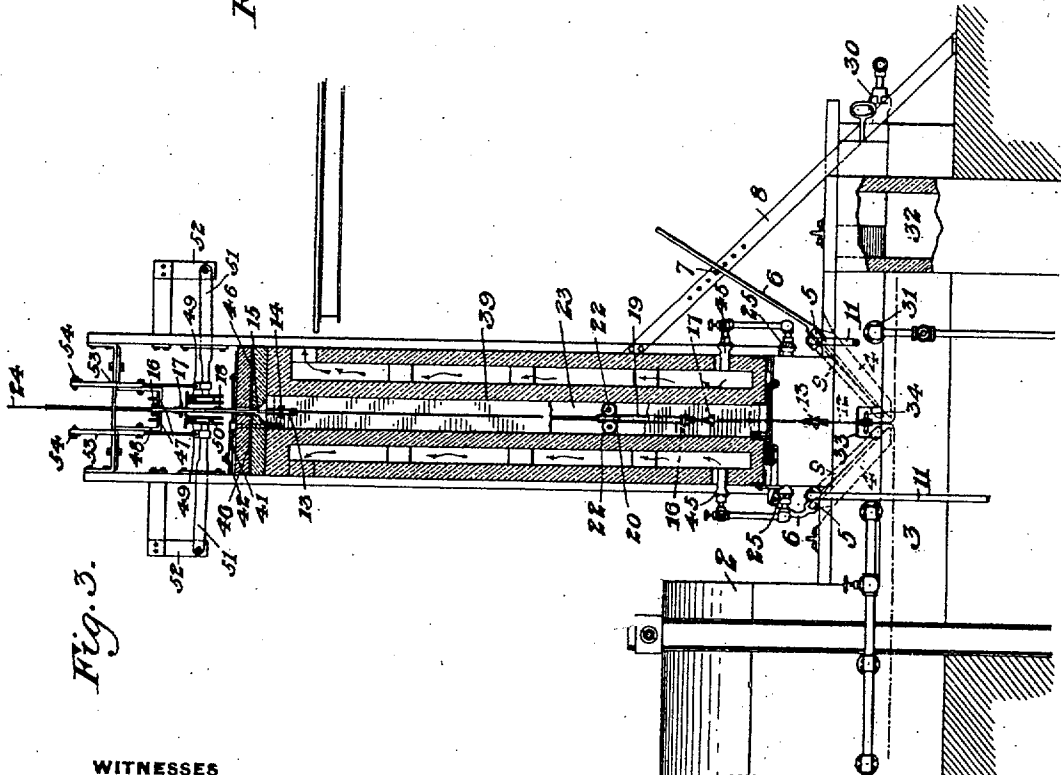
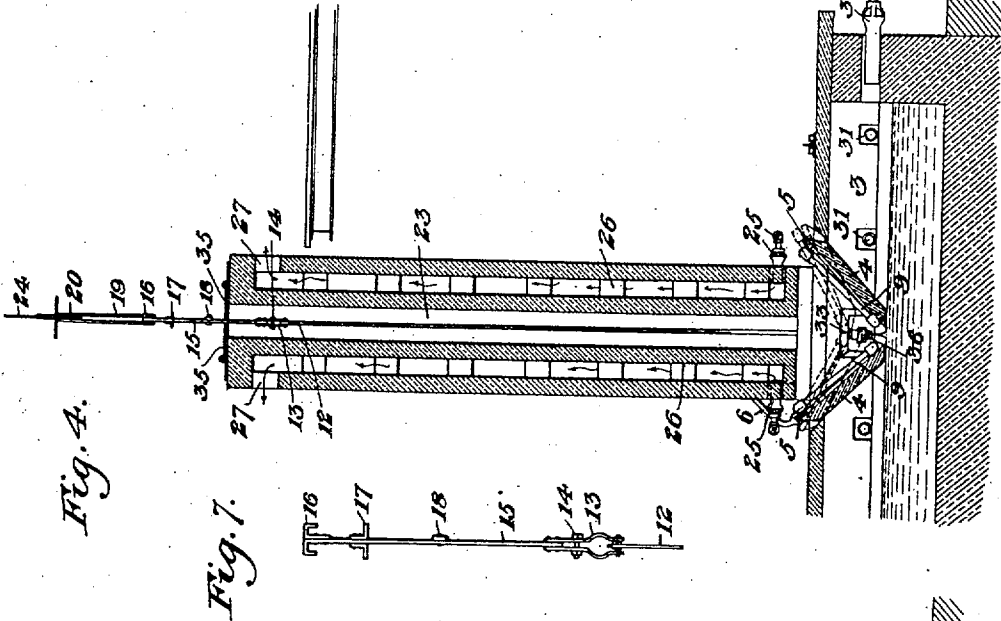
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APPLICATION FILED SEPT. 5, 1899.

NO MODEL.

4 SHEETS—SHEET 3.



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No. 766,275.

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APPLICATION FILED SEPT. 5, 1899.

NO MODEL.

4 SHEETS—SHEET 4.

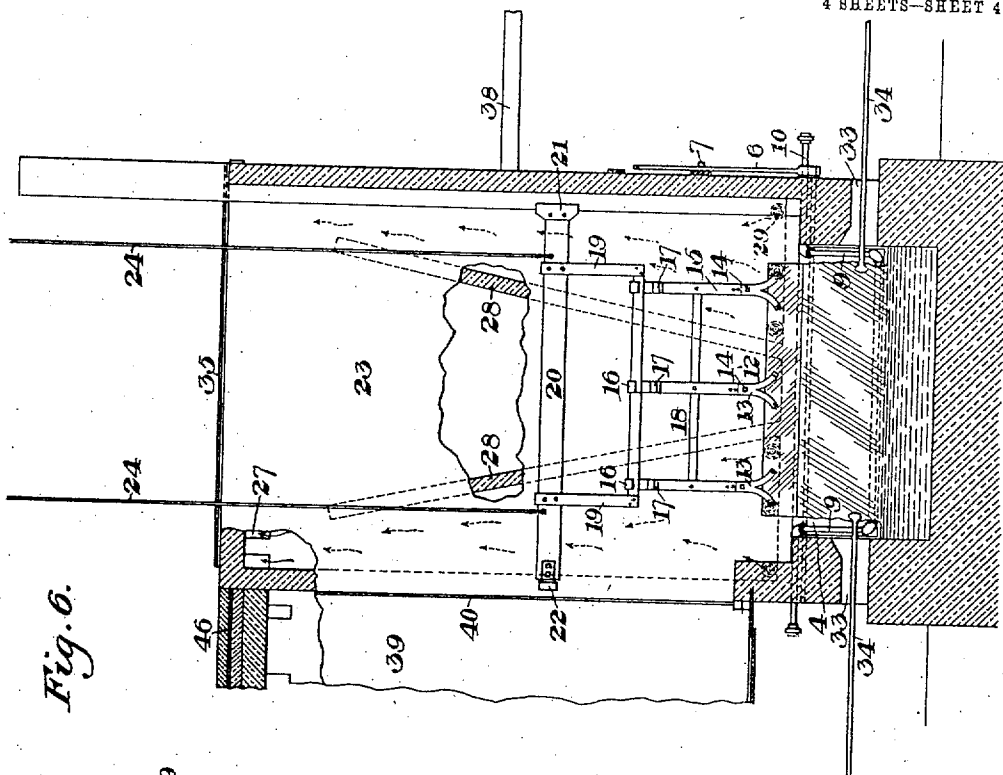


Fig. 6.

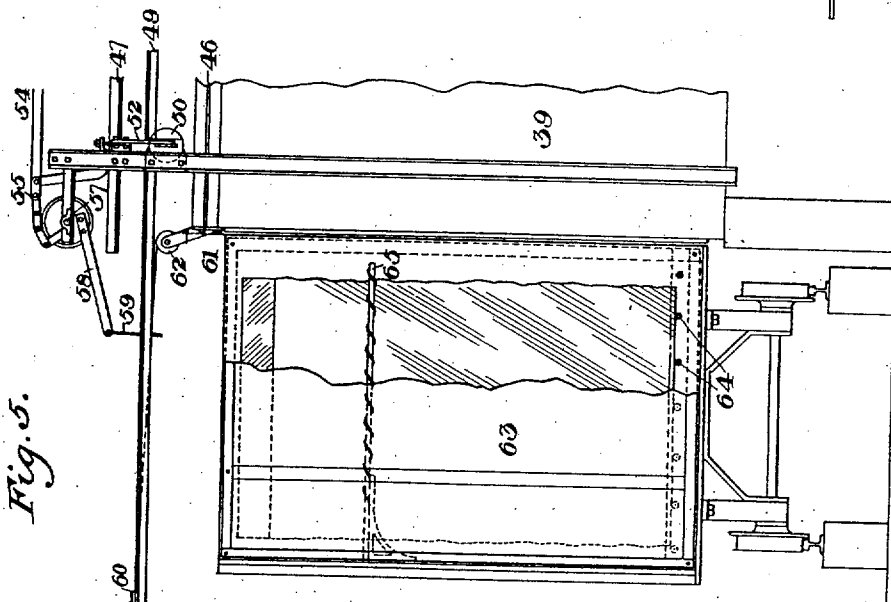


Fig. 5.

WITNESSES

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UNITED STATES PATENT OFFICE.

JOHN H. LUBBERS, OF NEW KENSINGTON, PENNSYLVANIA.

APPARATUS FOR DRAWING GLASS.

SPECIFICATION forming part of Letters Patent No. 766,275, dated August 2, 1904.

Application filed September 5, 1899. Serial No. 729,436. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. LUBBERS, of New Kensington, in the county of Westmoreland and State of Pennsylvania, have invented
 5 a new and useful Improvement in Apparatus for Drawing Glass, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

10 Figure 1 is a longitudinal section, partly broken away, showing the drawing-chamber and leer of my improved apparatus. Fig. 2 is a top plan view, partly broken away. Fig. 3 is a vertical cross-section through the leer,
 15 partly broken away, to show the drawing-frame in its chamber. Fig. 4 is a cross-section of the drawing-chamber, showing the sheet after it has been severed. Fig. 5 is a side elevation, partly broken away, showing the receiving-car at the end of the leer. Fig. 6 is
 20 a longitudinal vertical section of the drawing-chamber, partly broken away, and showing my preferred construction of muffle-walls; and Fig. 7 is a detail end view of the bait-
 25 holder.

My invention relates to the formation of glass articles, such as sheets or cylinders, by drawing such articles from a body of molten glass within a suitable furnace or chamber, and
 30 it is designed to overcome the numerous difficulties which have heretofore prevented the obtaining of commercial glass sheets or articles in this manner.

To that end it consists in shields arranged
 35 over the body of molten glass and adapted to protect the bath at the point at which the sheet is drawn from the surrounding heat; further, it consists in a chamber into which the sheet passes as it is drawn and which prevents breakage; in mechanism arranged to
 40 hold the edges of the sheet as formed and prevent its narrowing in width, this mechanism being preferably arranged to also pull or stretch the glass, so as to keep it of the proper
 45 width; further, in means for supplying heat to the drawing-chamber; in a drawing-chamber arranged to cool the intermediate portion of the glass sheet in advance of the edge

portions, so as to prevent warping or bowing; also in devices for cutting off the lower end
 50 of the sheet from the bath after it has been drawn the desired length and in a leer which leads from the drawing-chamber and in which the glass is gradually annealed and cooled, so that it may be saved, and, further, it consists
 55 in certain combinations and features of construction, as hereinafter more fully described, and set forth in the claims.

In the drawings, in which I show my invention arranged for drawing glass sheets, 2 represents the end portion of a tank-furnace for making glass, and 3 an offset chamber or fore-hearth portion containing the molten glass from which the sheets are drawn, the glass
 65 flowing into this chamber from the main furnace or tank. In the roof of the chamber 3 is a transverse slot or opening within which are placed the tilting shields or partitions 4 4, which normally extend downwardly to or
 70 nearly to the surface of the molten glass. These shields, which are preferably of refractory material, are secured to transverse bars 5, projecting over the roof, and they may be turned by levers 6, held in any adjusted position by pins 7, placed in holes in inclined
 75 braces 8. By this means the shields may be adjusted vertically to vary their distance above the glass-bath, and consequently the heat at the point of drawing the sheet.

In order to allow a more rapid drawing of
 80 the sheet than would otherwise be possible, I preferably provide cooling devices, which in the form shown consist of U-shaped water-cooling pipes 9, which rest upon the shields and swing therewith, these water-cooling pipes
 85 being provided with suitable inlets 10 and outlets 11, by which a continuous flow of water may be maintained therethrough. These cooling devices are not, however, necessary, though the drawing must be done more slowly
 90 if they are not used.

The glass-drawing operation is carried out between the shields by means of a bait 12, which may consist of a piece of sheet-glass or a metal strip, the glass sheet, if such is used, 95 being clamped between the forked jaws 13 of

the drawing-tool or bait-holder. These jaws are preferably provided with asbestos knots which contact with the bait, the jaws being drawn together by suitable bolts 14. The vertical bars 15 of the drawing-tool are joined by a transverse bar 18 and are provided with upper oppositely-projecting hooks 16 and with lower oppositely-projecting lugs 17.

In the drawing operation the hooks 16 are engaged by the spring-jaws 19 of the drawing-frame 20, this frame having a guide 21 at one end engaging a vertical strap in the end of the chamber 23 and rollers 22 at the opposite end, which contact with the walls, as shown in Fig. 3, thus keeping the frame in the proper position during lifting. The drawing-frame is supported and moved vertically by chains or wire ropes 24, which may pass over suitable pulleys to a winding-drum actuated in any desired manner.

The drawing-chamber 23, into which the sheet rises as it is formed, is preferably made with hollow walls, forming muffles, which are heated by suitable gas-burners 25, projecting into their lower portions, the flames and gases rising between spacing-bricks 26 and escaping through suitable outlet-ports 27 at the tops.

I have found in practice that where the horizontal zones of the drawing-chamber are equally heated in a horizontal direction, as the edge portions of the glass will cool more rapidly than the intermediate portion, the sheet will be warped or curved, and to prevent this action I preferably form the drawing-chamber so that the sheet receives more heat in its outer portions than its intermediate portions, thus counteracting the quicker cooling of its outer portions and preventing warping or twisting of the sheet. Thus in Fig. 6 I show each hollow wall or muffle as provided with outwardly-inclined baffle plates or partitions 28. The burners 29 are located at the outer sides of these baffles, so that the rising heat-currents will heat the outer portions to a greater extent than the central or intermediate portions. This is an important feature of my invention, since if the heat is not applied more to the edge portions than to the intermediate part of the sheet the glass tends to warp, and I intend to cover the same, broadly, irrespective of the particular construction for obtaining this result.

The muffle-chambers may, if desired, be open at their lower ends, so as to receive the heat from the furnace and the extension thereof, and in any form the heat of the walls is gradually decreased upwardly, so that the temperature of the sheet will be gradually reduced to prevent breakage during the setting or stiffening thereof.

The forehearth or extension 3 is preferably provided with end heating-burners 30 and a side burner 31, these being employed to keep the glass in the outer portion of the bath of

the same consistency or temperature as that in the inner portion next to the main tank. The gases from these burners may be taken off through a downtake-flue 32.

In the opposite sides of the chamber 3 and between the shields are provided holes 33, through which asbestos-faced tongs 34 may be inserted. When the sheet is being drawn, the operators insert these tongs from time to time, as may be necessary, and seizing the edge portions of the glass draw or stretch it outwardly, so as to keep the sheet of about the same width and prevent its narrowing down. These portions of the sheet may be merely held against narrowing, if desired, though I prefer to positively pull or stretch the glass in a horizontal direction. The upper end of the drawing-chamber is closed by hinged inwardly-projecting plates or dampers 35, which will swing upwardly to allow passage therethrough of the drawing tool and frame.

In carrying out the drawing operation the bait-holder is lowered until the bait enters the bath and being heated thereby the glass will adhere to it. The holder is then slowly and steadily lifted, and as the bait rises the molten glass adhering to it will be drawn upwardly from the bath and assume the form of a sheet as it emerges, and this operation is continued until a sheet of the desired length has thus been drawn slowly upward. The thickness of the glass sheet so formed is easily changed by regulating the temperature of the molten glass and changing the position of the shields and the speed at which the bait is drawn upwardly.

After the desired length of sheet has been obtained it may be severed from the glass in the bath by means of shears 36, supported from a suitable hanger 37, moving on track 38, as shown in Fig. 1, the shears being inserted through one of the holes 33, or, if desired, the lower end of the sheet may be cut from the glass in the tank by lifting the shields a short distance and allowing the heat or flames to cut off the sheet near the level of the bath by a melting action, the shields then being swung down to their normal position.

As the sheet is drawn upwardly within the drawing-chamber its temperature is gradually reduced and the sheet becomes set or stiffened into form. After it has been severed at its lower end it is lifted into the position shown in Fig. 4 and thence taken through an annealing-leer 39. This leer connects with one end of the drawing-chamber, and the leer is normally cut off from this chamber and itself separated into different chambers by horizontally-swinging dampers 40, provided with projecting levers 41, connected by rod 42. These dampers are actuated by a cord 43, connected to one of the lever-arms and passing down over a suitable pulley 44. The

leer-walls are preferably made hollow and heated by suitable burners 45, which may be regulated so that the temperature will be gradually lowered as the glass sheet is carried
5 through the leer.

The top of the leer-chamber is closed by plates 46, a narrow slot being left between their inner ends for the passage of the sheet-holder. The leer is provided above the top
10 of the annealing-chamber with parallel longitudinal bars 47, supported upon suitable hangers 48, with a narrow space between them for the bait-holder. Below and in line with these stationary bars are movable bars 49, having
15 downwardly-projecting webs which fit within grooved pulleys 50, carried upon shafts 51, pivoted at their outer ends to brackets 52. These pulleys are moved vertically by bell-crank levers 53, having depending links provided
20 with straps taking about the inner portions of the shafts. The bell-crank levers are actuated by connecting-rods 54, the ends of which are connected by chains 55 to sprocket-wheels 56, secured to a common shaft 57.
25 One of the wheels or pulleys is provided with a lever-arm 58, having a depending cord 59, by means of which the shaft may be rocked, and the supporting-pulleys 50 thus raised or lowered simultaneously. The two movable
30 bars are connected at their outer ends by a plate 60 and are moved longitudinally over the supporting-pulleys by a cord 61, passing over a pulley 62.

After the drawn sheet has been cut off and
35 raised into the position shown in Fig. 1 the movable bars are slid forward on each side of the bait-carrier until the bars are beneath the lugs 17. The bait carrier or holder is then lowered to allow the lugs to rest on these
40 bars and carry the weight of the sheet and holder, the spring-jaws of the drawing-frame springing outwardly and releasing themselves from the hooks 16. The dampers 40 are then opened, and the movable bars are lifted and
45 drawn rearwardly so as to bring the sheet into the first chamber of the leer. The pulleys 50 are then lowered, allowing the hooks 16 of the bait-holder to rest on the stationary bars. The dampers are then closed. Another drawing-tool, with a bait clamped there-
50 in, is then hung on the frame 20, and the bait being lowered into the bath another sheet is drawn, as before. The movable bars are again slid forward and engaged with the lugs
55 17 of the next bait-holder. The pulleys and movable bars then being lifted and the dampers opened, the bars are drawn rearwardly, thus bringing the first sheet into the next chamber of the leer and the second sheet into
60 the first chamber. The dampers 40 are then closed. These operations are continued, and the sheets as they emerge from the leer may be received upon a car 63. (Shown in Fig. 5.) This car is provided with supporting-
65 rods 64 for the glass sheets and with sepa-

rating-bars 65, which are wound with asbestos and project between the sheets. The bait-holders are detached from the sheet at this point, the car being moved along slightly as each sheet is inserted until its interior is
70 filled, when it may be moved away and another car brought into position.

The advantages of my invention will be apparent to those skilled in the art, since apparatus is provided by which sheets or other
75 articles of glass of an even thickness and fine finish may be drawn directly from a molten bath.

The advantages of my invention result from the obtaining of a practical apparatus by
80 which glass sheets or articles may be drawn directly from a bath of molten glass. The drawing-chamber prevents cracking and destroying of the article, and many of the other features assist in giving a practical apparatus
85 for obtaining successful results.

The apparatus may be used to draw cylinders or other forms by changing the shape of the bait, the shields may be arranged so as to slide vertically rather than swing, the wa-
90 ter-cooling devices may be changed or done away with, if desired, the drawing-chamber may be heated in many other ways than that shown, the leer may be formed as an upward extension of the drawing-chamber, the con-
95 struction of the leer may be altered, and many other changes may be made in the form and arrangement of the parts without departing from my invention.

I claim—

1. In apparatus for drawing glass, the combination with a chamber containing molten glass, of means for heating the same, a shield arranged to protect the molten glass at the point at which the article is drawn, from the
105 surrounding heat, mechanism for drawing the glass upwardly out of contact with any forming-surface, and a drawing-chamber into which the article passes as it is drawn; substantially as described. 110

2. In sheet-drawing apparatus, the combination with a heated chamber containing molten glass, of glass-drawing mechanism arranged to draw the glass upwardly out of contact with any forming-surface, shields ar-
115 ranged to protect the glass at the point at which the article is drawn, from the surrounding heat, and radiating surfaces arranged to artificially cool the article as it is formed; substantially as described. 120

3. In apparatus for drawing glass, the combination with a chamber containing molten glass, of means for heating the same, a shield arranged to protect the glass at the point at which the article is drawn from the surround-
125 ing heat, a radiating device arranged to cool the article by radiation or conduction as it is formed, and a drawing-chamber into which the article is drawn; substantially as described.

4. In apparatus for drawing glass, the com- 130

combination with a chamber containing molten glass, and glass-drawing mechanism arranged to draw the glass upwardly therefrom out of contact with any forming-surface, of a drawing-chamber into which the glass article passes, and which is arranged to retard its cooling; substantially as described.

5 5. In apparatus for drawing sheet-glass, the combination with a chamber containing molten glass, and glass-drawing mechanism arranged to draw the glass upwardly therefrom out of contact with any forming-surface, of a chamber into which the sheet passes, said chamber being arranged to retard the cooling of the outer portions of the sheet relatively to the intermediate portion; substantially as described.

10 6. In apparatus for drawing glass, the combination of a furnace or chamber containing molten glass, glass-drawing mechanism arranged to draw an article upwardly out of contact with any forming apparatus, and a leer system arranged to anneal the glass during and after drawing; substantially as described.

15 7. In apparatus for drawing sheet-glass, the combination with a chamber containing molten glass and glass-drawing mechanism, of grippers arranged to seize the edge portions of the sheet to prevent its narrowing; substantially as described.

20 8. In apparatus for drawing sheet-glass, a chamber containing molten glass, glass-drawing mechanism, and grippers arranged to stretch the glass transversely as the sheet is formed; substantially as described.

25 9. In apparatus for drawing glass, a chamber containing molten glass, glass-drawing mechanism, shields arranged to protect the glass at the point where the sheet is drawn, from the surrounding heat, and a drawing-chamber arranged to retard the cooling of the glass and prevent breakage; substantially as described.

30 10. In apparatus for drawing sheet-glass, a tank containing molten glass, glass-drawing mechanism arranged to draw a sheet upwardly out of contact with any forming-surface, a drawing-chamber into which the sheet is drawn, and which is arranged to retard its cooling, and a leer extending from the drawing-chamber; substantially as described.

35 11. In apparatus for drawing sheet-glass, a chamber containing molten glass, shields arranged to protect the glass at the point at which the sheet is drawn, a drawing-chamber into which the sheet passes, grippers arranged to seize the edge portions of the sheet to prevent narrowing, and a leer leading from the drawing-chamber; substantially as described.

40 12. In glass-drawing apparatus, a chamber containing molten glass, glass-drawing mechanism, vertically-adjustable shields arranged to protect the glass at the point where the drawing is carried out, from the surrounding

heat and a drawing-chamber into which the article passes as it is drawn; substantially as described.

45 13. The combination with a chamber containing molten glass, means for heating the glass in said chamber, glass-drawing mechanism, swinging shields arranged to protect the glass at the point of drawing from the applied heat, and mechanism for adjusting the shields to different positions; substantially as described.

50 14. The combination with a chamber containing molten glass, and means for heating the same, of glass-drawing mechanism, shields arranged to protect the glass at the point of drawing from the applied heat, and water-cooled pipes arranged to cool the article as it is drawn; substantially as described.

55 15. In apparatus for drawing sheet-glass, a chamber containing molten glass, glass-drawing mechanism, and gripping-tongs arranged to be inserted through side holes in the chamber to hold the edges of the sheet; substantially as described.

60 16. In glass-drawing mechanism, a chamber containing molten glass, drawing mechanism arranged to draw the glass upwardly therefrom out of contact with any forming-surface, and a vertically-extending drawing-chamber arranged to inclose the article as it is drawn upwardly; substantially as described.

65 17. The combination with a chamber containing molten glass, and a glass-drawing mechanism arranged to draw the glass upwardly therefrom out of contact with any forming-surface, of a vertically-extending drawing-chamber into which the article passes, and means for heating said chamber to prevent sudden cooling of the glass; substantially as described.

70 18. The combination with a chamber containing molten glass, and glass-drawing mechanism, of a drawing-chamber into which the article passes, said chamber having hollow walls, means for directing heat within the walls, and partitions arranged to heat the outer portions of the walls more than the intermediate portions; substantially as described.

75 19. The combination with a chamber containing molten glass, of a vertically-movable drawing-frame, a drawing-tool detachably supported thereon, and a leer having supports for the drawing-tool; substantially as described.

80 20. In glass-drawing apparatus, the combination with a chamber containing molten glass, and glass-drawing mechanism arranged to draw the glass upwardly therefrom out of contact with any forming-surface, of a drawing-chamber into which the glass passes, said chamber being arranged to retard the cooling, and shears arranged to sever the lower end of the article from the glass of the bath; substantially as described.

21. In apparatus for drawing glass, the combination with a chamber containing molten glass, and glass-drawing mechanism arranged to draw the glass upwardly therefrom out of
5 contact with any forming-surface, of a drawing-chamber into which the glass article passes, and which is arranged to retard its cooling, said chamber having hollow walls and

means for introducing heat within said walls; substantially as described. 10

In testimony whereof I have hereunto set my hand.

JOHN H. LUBBERS.

Witnesses:

MARSHALL H. REÑO,
L. A. CONNER, Jr.