E. DANNER.

PROCESS OF DRAWING MOLTEN MATERIAL IN CYLINDRICAL FORM.

APPLICATION FILED FEB. 21, 1916.

1,218,598.

Patented Mar. 6, 1917.

5 SHEETS—SHEET 1.

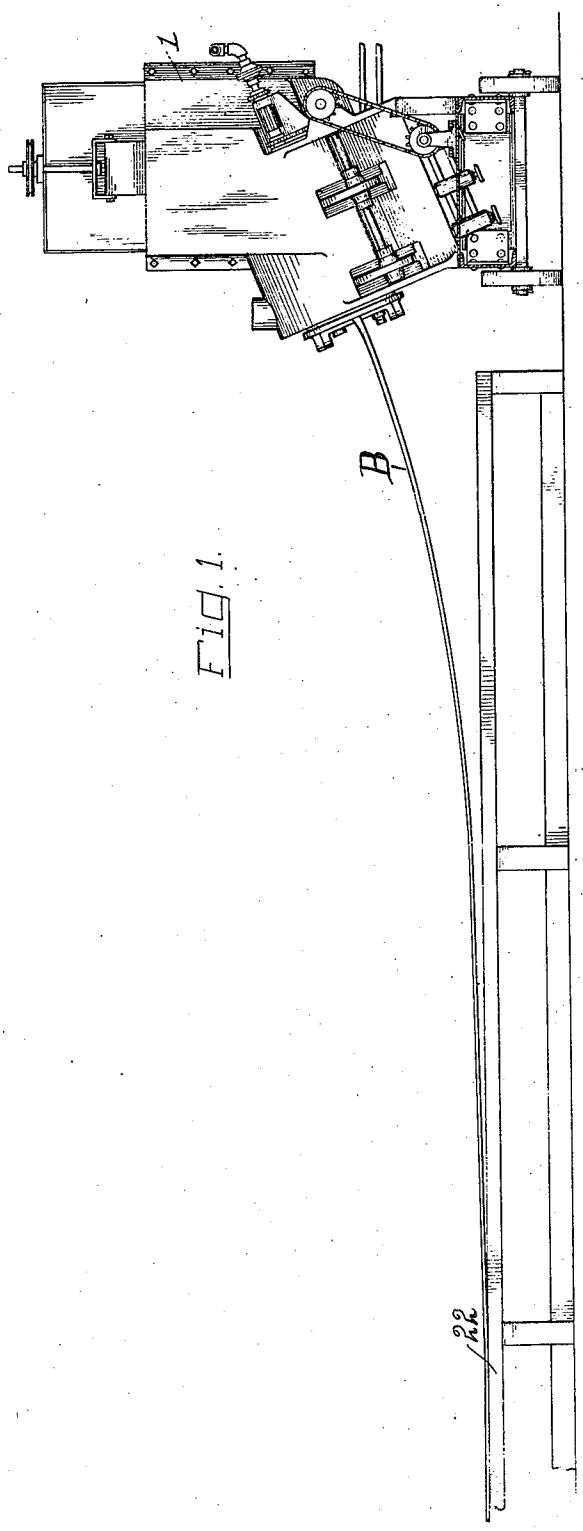

Fig. 1.

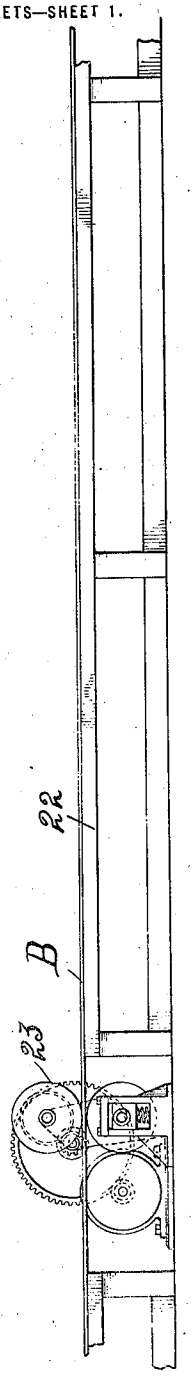

Fig. 2.

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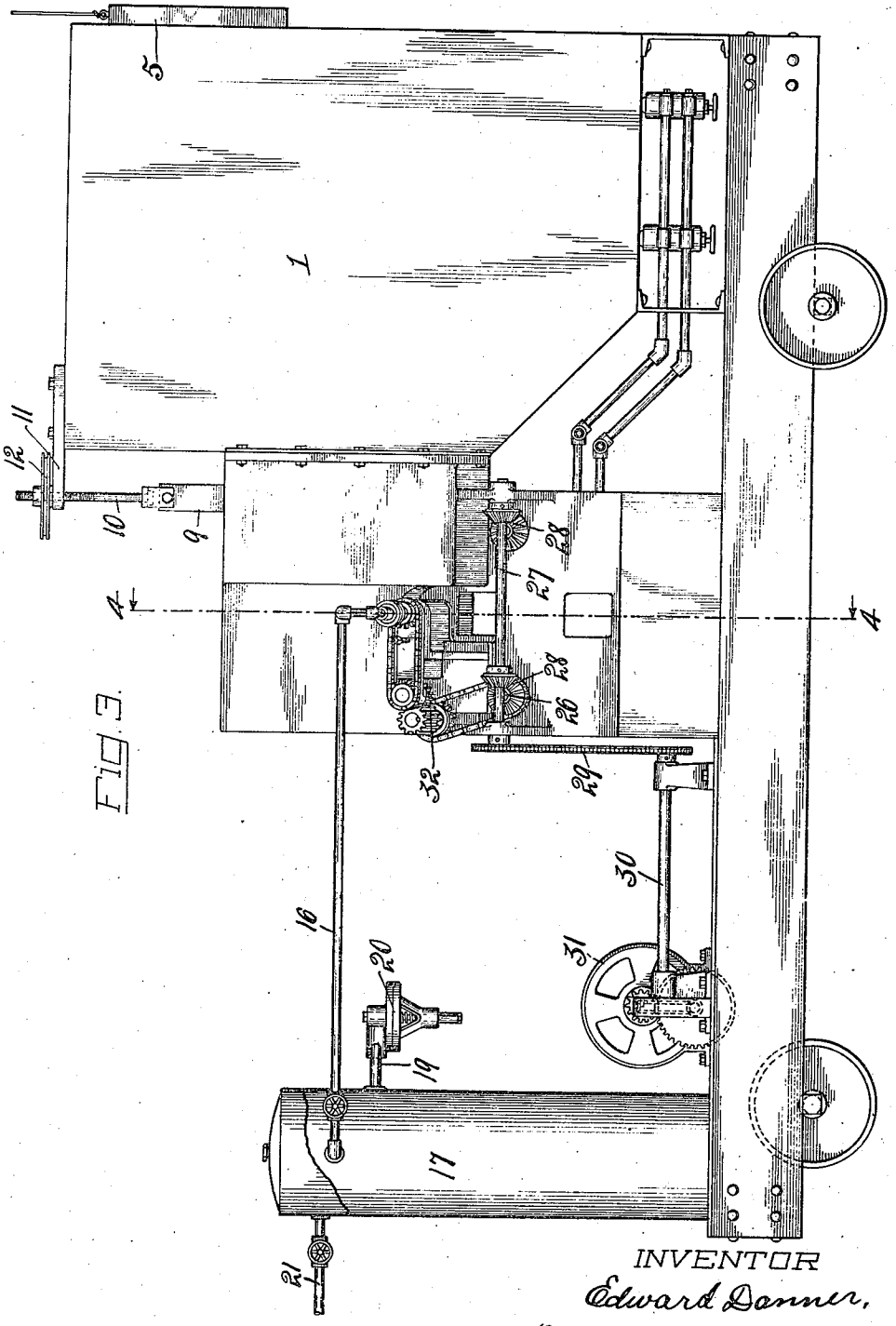

Fig. 3.

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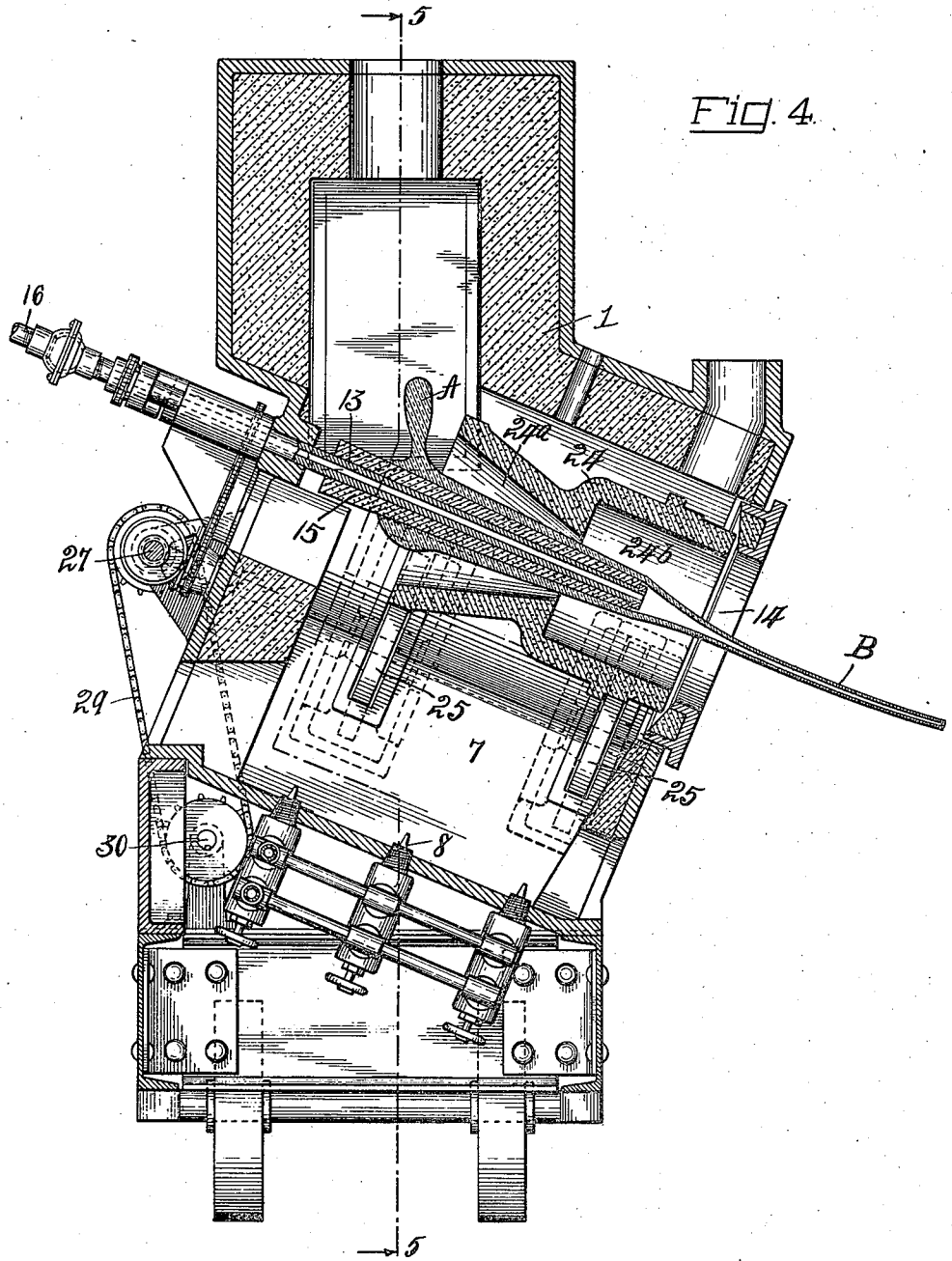
5 SHEETS—SHEET 3.

Fig. 4.



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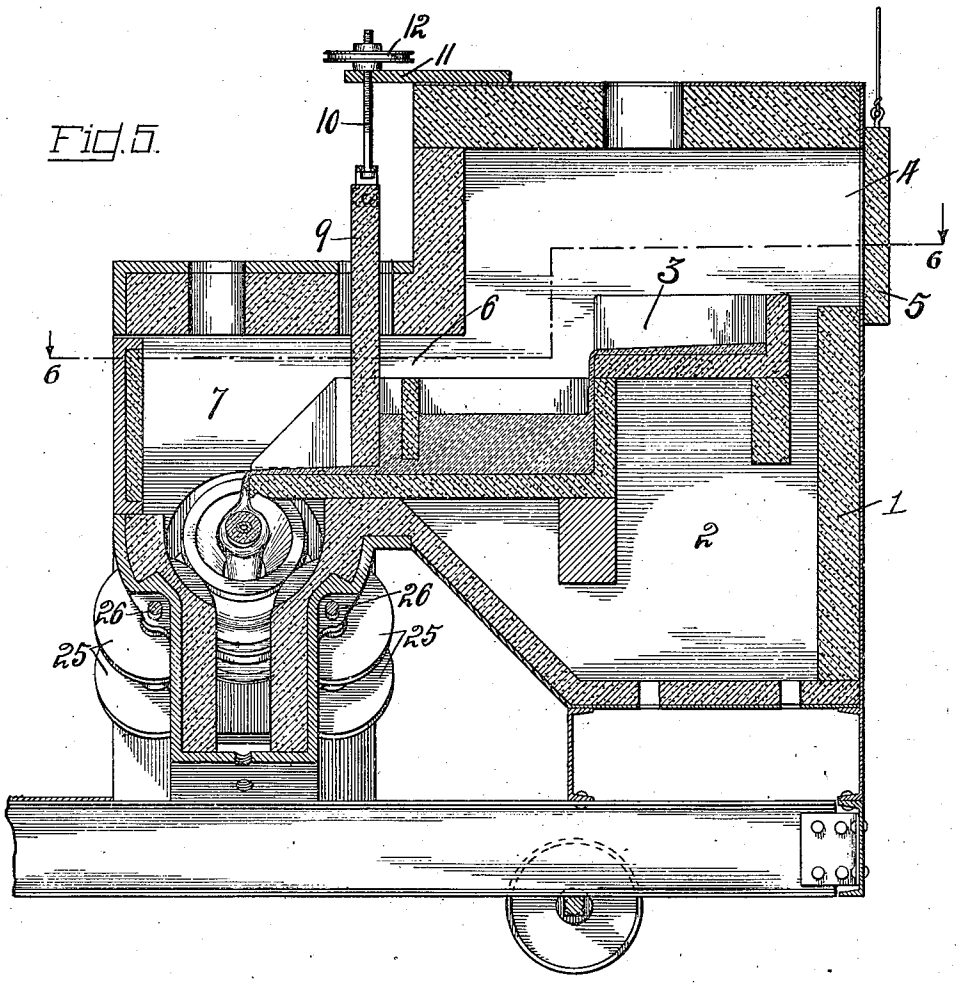
5 SHEETS—SHEET 4.

Fig. 5.



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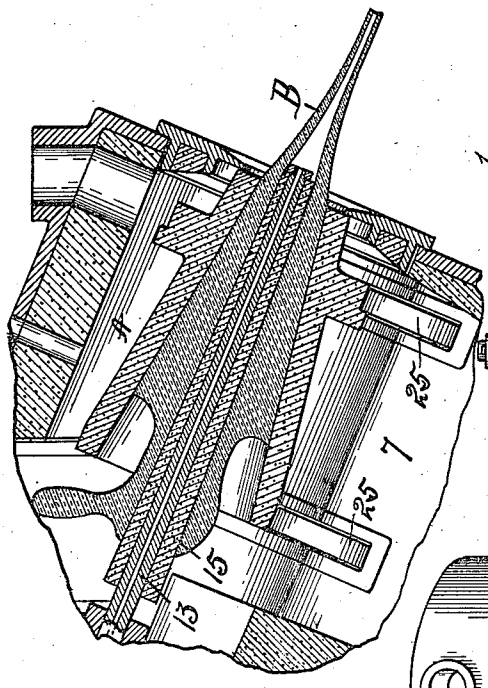

Fig. 7.

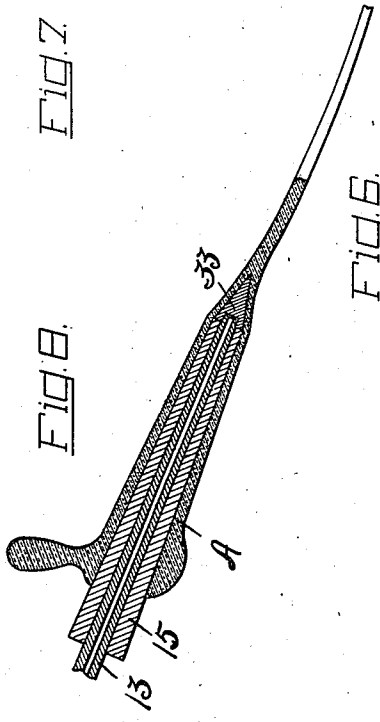

Fig. 8.

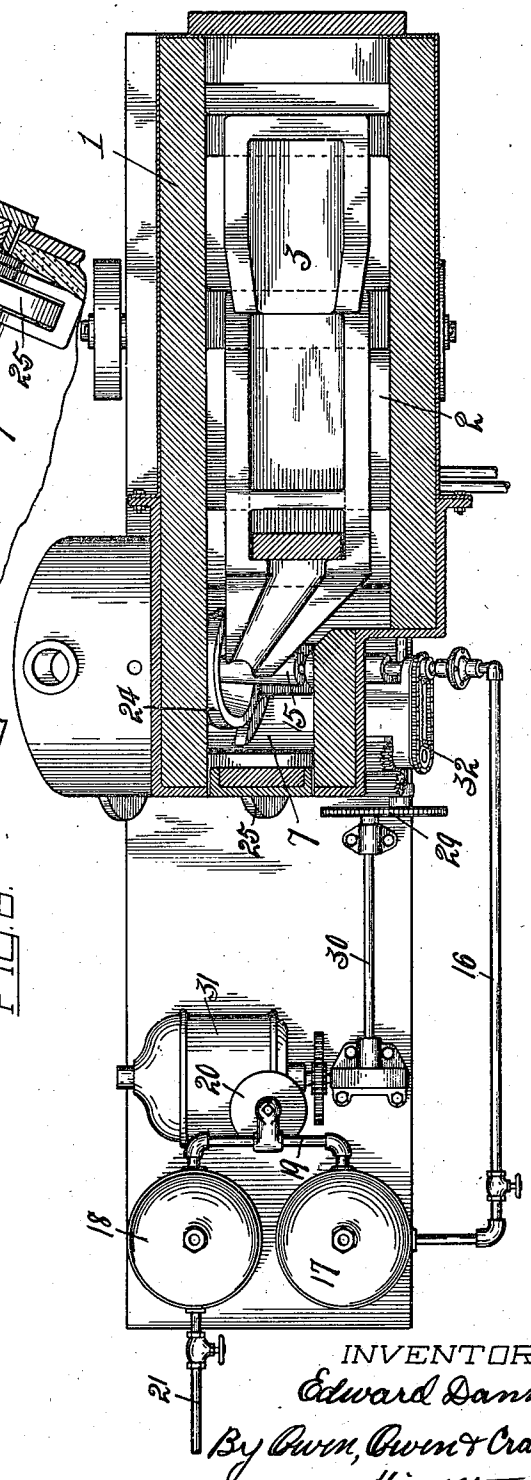

Fig. 6.

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UNITED STATES PATENT OFFICE.

EDWARD DANNER, OF TOLEDO, OHIO, ASSIGNOR TO THE LIBBEY GLASS COMPANY, OF TOLEDO, OHIO, A CORPORATION OF OHIO.

PROCESS OF DRAWING MOLTEN MATERIAL IN CYLINDRICAL FORM.

1,218,598. Specification of Letters Patent. Patented Mar. 6, 1917.

Application filed February 21, 1916. Serial No. 79,660.

To all whom it may concern:

Be it known that I, EDWARD DANNER, a citizen of the United States, and a resident of Toledo, in the county of Lucas and State of Ohio, have invented a certain new and useful Process of Drawing Molten Material in Cylindrical Form; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates more particularly to the glass working art, and especially to a process for continuously drawing glass or other molten material in cylindrical form.

The primary object of my invention is the provision of an improved process for drawing glass in cylindrical form in a simple, rapid, inexpensive and continuous manner, whereby the output is materially increased and a material saving in expense and labor effected over the methods heretofore employed.

The invention is fully described in the following specification, and while it is capable of being carried out and practised by numerous apparatus, only a few of such apparatus are illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of an apparatus employed for practising the invention with the outer end portion of the cylinder supporting way and the cylinder drawing means removed. Fig. 2 is an elevation of one form of cylinder drawing means and an associated portion of the cylinder supporting way. Fig. 3 is an enlarged rear elevation of the apparatus, with a part broken away. Fig. 4 is an enlarged section on the line 4—4 in Fig. 3, with the member from which the cylinder is drawn in the form of a blow-pipe for drawing tubing. Fig. 5 is a section on the line 5—5 in Fig. 4. Fig. 6 is a plan view of the apparatus with a portion in section on the line 6—6 in Fig. 5. Fig. 7 illustrates a slight modification of a portion of the tube drawing process; and Fig. 8 is a sectional view of the blow-pipe adapted for the drawing of material in solid cylinder form therefrom.

Referring to the drawings, 1 designates a furnace having a fire chamber 2, in the upper portion of which is disposed a trough 3, to which molten material, which for convenience may be termed glass, is preferably transferred from another furnace and maintained in its molten state by the presence of a high heat within the furnace, as by the burning of gas, oil, or other suitable fuel therein. The molten glass is introduced into the furnace 1 through an opening 4 in its upper portion, which opening is closed by a door 5.

The discharge end of the trough 3 extends through an opening 6 in one side wall of the furnace and projects into an adjoining furnace chamber 7, which is provided with its own heating means, as for instance, from gas or oil burners 8 located in the bottom thereof. The flow of molten glass from the discharge end of the trough 3 is controlled by a gate 9, which extends down through the top wall of the passage 6 of the furnace and into the trough, being mounted for vertical movements to vary the size of the opening between its lower end and the trough bottom, as is apparent. The gate 9 may be suspended from a threaded stem 10, which projects up through a support 11 on the furnace top and has an adjusting wheel 12 threaded onto its upper end and resting on the support 11. It is preferable to make the trough 3 of stepped formation, as shown in Figs. 5 and 6, it being found in practice that the flowing of molten glass from one level to another of the trough tends to eliminate air bubbles therefrom. With the present apparatus the molten glass, when introduced into the furnace, is deposited on the upper step or level of the trough 3 and then flows therefrom to the lower level of the trough, in which it is partially banked by the gate 9.

A member 13, which, if the apparatus is to be used for tube drawing, may be termed a blow-pipe, is mounted on an incline in the furnace chamber 7 transversely of the discharge end of the trough 3 and below the same in position for the molten glass to be deposited thereon as it flows from the discharge end of the trough. This blow-pipe

is rotatably mounted in the rear wall of the chamber 7 and has its front or free end terminating in register with an opening 14 in the front side of the furnace. The portion of the blow-pipe 13 within the chamber 7 is preferably covered with a shell 15 of fire clay, or other suitable heat-resisting material, and this shell is preferably gradually reduced in diameter toward its outer end. The end of the blow-pipe 13, which projects through the rear wall of the chamber 7, has connection, through a pipe 16, with a low-pressure air tank 17, which in turn receives its supply of air from a high-pressure tank 18 through an intermediate connection 19, (see Figs. 3 and 6). The connection 19 between the two tanks is provided with a pressure reducing valve 20 so that the pressure in the tank 17 may be reduced to any desired extent irrespective of the pressure in the tank 18. 21 designates a supply pipe which leads into the high-pressure tank 18 from any suitable source of air pressure supply. While it is preferable to connect the blow-pipe passage with a source of air under constant pressure, it is found that tubing can be drawn if air under atmospheric pressure alone is permitted to flow from the discharge end of the blow-pipe into the tubing.

It will be understood in the carrying out of my process in the drawing of tubing that a small stream of glass A is caused to flow continuously, during an operating of the apparatus, from the trough 3 down onto the shell 15 of the blow-pipe 13 at a distance from the outer or discharge end of the blow-pipe, and to wind on and flow down the blow-pipe toward and from its discharge end in an evenly formed film or covering thereon, as the blow-pipe is rotated, as best illustrated in Fig. 4. The fluidity of the glass causes it to flow down the inclined blow-pipe and to pass from the discharge end thereof in the form of a tube, the size of the tube, within certain limits, being determined by the amount of air discharged therein through the blow-pipe 13, the temperature of the glass at the point at which it leaves the blow-pipe, or the speed of drawing of the tubing, or by all of these causes, as is apparent to persons skilled in the art. The glass tubing, which is designated B, extends downward and forward from the discharge end of the blow-pipe, and rests on a supporting trough or guide-way 22 provided therefor in advance of the furnace, as illustrated in Fig. 1. This tube supporting trough is of considerable length, and provided therein at a considerable distance from the furnace is a tube drawing device 23 of any suitable or convenient form. In practising my invention, in connection with the drawing of tubing of approximately $\frac{3}{16}$ of an inch in diameter, it has been found that very satisfactory results are obtained by placing the tube drawing means 23 at approximately 100 feet from the furnace and operating the drawing means so that the tubing B is drawn from the blow-pipe at the rate of approximately 140 feet per minute. It will be apparent, however, that the length of the trough 22, the distance of the drawing means 23 from the furnace, and the speed of drawing of the tubing from the furnace may be varied as desired or found necessary to meet different or changing conditions without departing from the spirit of the invention, it being understood that the specific description herein given is merely illustrative of one form of apparatus for practising the invention and is not intended to limit or restrict the scope of the claims herein. It will be understood that after the tubing B passes through the drawing means 23 it may be cut into lengths of any desired size for subsequent handling.

It is found preferable in practice to project the outer end portion of the blow-pipe 13—15 into a shell or casing, which, in the present instance, is in the form of a cylinder 24, thereby protecting the glass on the blow-pipe from the direct action of the heat within the chamber 7, which heat is instead radiated to the glass on the blow-pipe from the walls of said shell or casing 24. This shell or casing is preferably, but not necessarily, mounted for and rotated within the furnace chamber 7 concentrically around the blow-pipe in order that the wall of the shell or casing 24 may be uniformly heated and thereby effect a uniform distribution of radiant heat to the entire glass surface which flows down the blow-pipe within the shell. For this purpose the shell or cylinder 24 is mounted on two sets of transversely spaced rollers or wheels 25, which are carried by respective shafts 26 mounted without the furnace at the sides of the chamber 7 thereof. The rollers or wheels 25 project into the chamber 7 in supporting relation to the shell or cylinder 24 through registering openings in the furnace wall. The shafts 26 are rearwardly inclined, substantially in parallel relation to the axis of the blow-pipe, and are in connection at the rear of the furnace with a drive shaft 27 through respective sets of bevel gears 28, (Fig. 3). The shaft 27 has chain and sprocket connection 29 with a shaft 30, which has driving connection with a motor 31, or it may lead to any other suitable source of power. One of the shafts 26 is in driving connection with the outer end portion of the blow-pipe 13 at the rear of the furnace through a suitable connection 32, which, in the present instance, comprises gears, sprocket wheels, chains, etc.

The shell or casing 24 illustrated in Fig. 4 is provided at its inner end with a funnel-shaped opening or passage 24ª, which gradually reduces in diameter toward the outer

or drawing-off end into an enlarged passage portion 24b, which has its outer end opening to the atmosphere through the furnace wall opening 14. The portion 24a of the passage is reduced to adjacent the surface of the glass on the blow-pipe, but in slightly spaced relation thereto, and the blow-pipe projects through such reduced portion of the shell and into the enlarged portion 24b thereof. It is thus evident that the escape of the highly heated products of combustion from within the furnace to the atmosphere through the reduced portion of the shell 24 is restricted, and that the projecting of the discharge end of the blow-pipe into the exposed chamber 24b causes a slight cooling of the glass to increase its consistency before leaving the end of the blow-pipe to facilitate the drawing of the glass therefrom. It is not necessary, however, to make the shell or casing 24 in the form shown or to terminate the discharge end of the blow-pipe therein, as the invention has been practised by extending the conical portion of the cylinder passage to the end of the cylinder, or in other words, to adjacent to the furnace outlet opening 14 and projecting the discharge end of the blow-pipe outward through the opening 14 and a short distance therebeyond. The shell or cylinder 24 is preferably made of fire clay or other suitable heat-resisting material.

It is evident from the foregoing description that in practising my improved glass tube drawing process, molten glass is permitted to flow down onto the rotating inclined blow-pipe at a distance to the rear of its discharge end and to wind around, be evenly distributed over, and flow down the blow-pipe, due to the gravity action of the glass in conjunction with the inclination of the tube and also to the drawing action of the means 23, or other suitable drawing means on the glass tubing. As the glass flows down the blow-pipe it passes through the highly and uniformly heated, gradually restricted passage 24a of the shell 24, and thence from said highly heated portion into a cooler zone, as for instance, into an enlarged outer end portion 24b of the shell passage, which is in communication with the atmosphere, thus causing a slight cooling or increasing of the consistency of the molten glass at the point of drawing thereof from the blow-pipe and over the temperature thereof within the restricted portion of the shell. The glass quickly cools and acquires a substantially permanent set form as it leaves the end of the blow-pipe and emerges into the outer cooler atmosphere through the furnace opening 14. The air pressure discharged into the tubing from the blow-pipe 13, while preferably of only one or two ounces pressure when drawing small tubing, is constant in its action instead of spasmodic or periodical, as in the case of manually blown tubes, and tubing of more uniform and perfect character is therefore produced than with the manual and other processes heretofore employed.

In case it is desired to utilize my process for the drawing of molten material in solid cylindrical form it is only necessary to close the communication between the interior of the blow-pipe and the source of air supply, or it can be accomplished by closing the discharge end of the blow-pipe by mounting an imperforate tip 33 on the discharge end of the blow-pipe, as shown in Fig. 8, which tip is preferably of conical form.

It is found in practice that glass drawn in cylindrical form with my process is not only uniform and more perfect in its formation, but is also practically free from the presence of air bubbles therein, due probably to the flowing of the glass in a small stream onto the blow-pipe and its winding on and flowing in a thin, film-like body down the blow-pipe, such action apparently causing an elimination of air bubbles from within the glass.

While I have above described the glass as flowing down the blow-pipe free from contact with the inclosing shell 24, it has been found in practice that the conical portion of the tube inclosing shell may be partially filled with glass and the thickness of the glass film on the portion of the tube without the restricted end of the shell regulated by the size of the restricted end of the passage or the width of the annular space between the blow-pipe and restricted end of the shell passage, as illustrated in Fig. 7. To obtain this action, the flow of the molten glass from the trough 3, when the drawing is first started, is greater than the outlet passage in the blow-pipe inclosing shell will permit to pass therefrom, thus causing a backing-up of the molten glass within the conical portion of the shell, after which the feed of glass to the blow-pipe is reduced so that it is approximately equal to the drawing of the glass from the end of the blow-pipe.

This invention also contemplates the flowing of molten glass from the trough 3, or other source of supply, into the blow-pipe inclosing shell or cylinder without first having contact with or flowing onto the blow-pipe. In such case the rotating of the shell which would preferably be in the same direction to the direction of rotation of the blow-pipe would cause an even distribution of the molten glass around the blow-pipe and permit it to continuously flow from the discharge end of the blow-pipe in the form of a tube. These methods are not as practical, however, as the first above described, namely, of permitting the glass to flow onto and around the blow-pipe free from contact

with the wall of the inclosing shell, unless possibly at the point of passage of the blow-pipe through the restricted end of the conical passage of the shell, as there is not so much possibility of collecting and retaining air in the glass with the form first described as with the modified forms described.

I wish it understood that the forms of apparatus herein described for practising my invention are made for the purpose of illustration and not to restrict the scope of the invention as defined in the claims, and that the process is not limited to use in connection with any particular apparatus.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The method of continuously forming tubing from molten material, consisting in supplying molten material to the outer surface of a rotating member, drawing the material from said member in tubular form, and introducing fluid into the drawn tubing through said member.

2. The method of continuously forming tubing from molten matter, consisting in supplying matter in a fluid state to and evenly distributing it on the outer surface of a blow-pipe at the rear of its discharge end and at one side of its axis, drawing the matter from the discharge end of the blow-pipe in tubular form, the blow-pipe being inclined to facilitate such drawing, and introducing fluid into the tubing through the blow-pipe during the drawing operation.

3. The method of continuously forming tubing from molten matter, consisting in supplying matter in a fluid state to and evenly distributing it on the outer surface of a rotating blow-pipe at the rear of its discharge end, drawing the matter from the blow-pipe in tubular form, and introducing a constant stream of fluid of even pressure into the tubing through the blow-pipe during the drawing operation.

4. The method of forming tubing from molten matter, consisting in supplying matter in a fluid state to and evenly distributing it on the outer surface of an inclined rotating blow pipe at the rear of its discharge end, drawing the matter from the discharge end of the blow-pipe in tubular form, and introducing fluid into the tubing through the blow-pipe during the drawing operation.

5. The method of forming tubing from molten matter, consisting in supplying molten matter to and evenly distributing it on the outer surface of a blow-pipe at the rear of its discharge end, maintaining the matter in a highly heated atmosphere while on the blow-pipe, drawing the matter from the discharge end of the blow-pipe in tubular form, and introducing a fluid into the tubing through the blow-pipe during the drawing operation.

6. The method of forming tubing, consisting in supplying molten matter to and evenly distributing it on the outer surface of a blow-pipe at the rear of its discharge end and in a highly heated atmosphere, drawing the matter from the discharge end of the blow pipe in tubular form, the blow-pipe being inclined to facilitate such drawing, and introducing fluid into the tubing through the blow-pipe during the drawing operation.

7. The method of forming tubing from molten matter, consisting in positioning a rotating blow-pipe within a furnace in which a high heat is maintained, supplying molten matter to the surface of the blow-pipe at the rear of its discharge end, drawing the matter from the discharge end of the blow-pipe in tubular form, and introducing a constant pressure fluid into the tubing through the blow-pipe during the drawing operation.

8. The method of forming tubing from molten matter, consisting in positioning a rotating blow-pipe in inclined position within a furnace in which a high heat is maintained, supplying molten matter to the surface of the blow-pipe at the rear of its discharge end, drawing the matter from the discharge end of the blow-pipe in tubular form, and introducing a constant pressure fluid into the tubing through the blow-pipe during the drawing operation.

9. The method of forming tubing from molten matter, consisting in permitting molten matter to flow onto a rotating blow-pipe at the rear of its discharge end, drawing the matter from the discharge end of the blow-pipe in tubular form, and introducing fluid into the tubing through the blow-pipe during the drawing operation.

10. The method of forming tubing from molten matter, consisting in permitting a stream of molten matter to flow onto an inclined rotating blow-pipe at the rear of its discharge end and at one side of its axis, drawing the matter from the discharge end of the blow-pipe in tubular form, and introducing fluid into the drawn tubing through the blow-pipe during the drawing operation.

11. The method of forming tubing from molten matter, consisting in rotating a blow-pipe in a high temperature, permitting a stream of molten matter to flow onto the blow-pipe at the rear of its discharge end, drawing the matter from the discharge end of the blow-pipe in tubular form, and introducing fluid into the drawn tubing through said blow-pipe.

12. The method of forming tubing from molten matter, consisting in rotating a blow-pipe in inclined position in a highly heated atmosphere, permitting molten matter to flow in a regulated stream onto the blow-

pipe at the rear of its discharge end, drawing the matter from the discharge end of the blow-pipe in tubular form, the drawing being facilitated by the inclination of the blow-pipe, and introducing a fluid under a light constant pressure into the tubing through the blow-pipe during the drawing operation.

13. The method of forming tubing from molten matter, consisting in permitting the molten matter to flow onto a highly heated blow-pipe at the rear of its discharge end, the blow-pipe being rotated to wind the matter thereon and being inclined to permit a gravity flow of the matter down the blow-pipe in encompassing relation thereto, drawing the matter in tubular form from the discharge end of the blow-pipe, and introducing fluid under a light pressure into the tubing through the blow-pipe during the drawing operation.

14. The method of forming tubing from molten matter, consisting in rotating a blow-pipe in inclined position within a highly heated chamber, permitting molten matter to flow onto the blow-pipe at the rear of its discharge end, to wind thereon as the blow-pipe rotates and to flow down the same in encompassing relation thereto and toward its discharge end, drawing the matter in tubular form from the discharge end of the blow-pipe, and introducing a fluid of predetermined pressure into the tubing during the drawing operation.

15. The method of constantly drawing glass tubing, consisting in permitting a regulated stream of molten glass to flow constantly onto a rotating blow-pipe at the rear of its discharge end, whereby the glass is wound around and evenly distributed on the discharge end portion of the blow-pipe, constantly drawing the glass in tubular form at uniform speed from the discharge end of the blow-pipe, and introducing a constant pressure fluid into the tubing through the blow-pipe during the drawing operation.

16. The method of constantly drawing glass tubing, consisting in permitting a regulated stream of molten glass to flow constantly onto an inclined rotating blow-pipe at the rear of its discharge end whereby the glass is wound around and evenly distributed on the discharge end portion of the blow-pipe, constantly drawing the glass in tubular form at uniform speed from the discharge end of the blow-pipe, and introducing a constant pressure fluid into the tubing through the blow-pipe during the drawing operation.

17. The method of forming glass tubing, consisting in permitting molten glass to flow in a regulated stream onto a rotating inclined blow-pipe disposed in a highly heated chamber, constantly drawing the glass at a predetermined speed from the discharge end of the blow-pipe, and introducing fluid under light pressure into the tubing through the blow-pipe during the drawing operation.

18. The method of forming glass tubing from molten matter, consisting in constantly supplying glass in a molten state to and evenly distributing it on the outer surface of an inclined blow-pipe disposed in a highly heated temperature, drawing the matter from the discharge end of the blow-pipe in tubular form, and introducing a stream of fluid under light pressure into the tubing through the blow-pipe during the drawing operation.

19. The method of continuously forming glass tubing, consisting in constantly supplying molten glass to and evenly distributing it on the outer surface of a rotating inclined blow-pipe at the rear of its discharge end, constantly drawing the glass from the blow-pipe in tubular form and at uniform speed, and introducing fluid under light pressure continually into the tubing through the blow-pipe during the drawing operation.

20. The method of continuously forming glass tubing, consisting in permitting molten glass to flow in a regulated stream onto an inclined rotating blow-pipe at the rear of its discharge end, the glass winding around and flowing down the blow-pipe and from its discharge end in evenly distributed tubular form, applying radiant heat uniformly to the glass on the blow-pipe, drawing the glass at a constant continuous speed in tubular form from the discharge end of the blow-pipe, and introducing a fluid under a light pressure into the tubing through the blow-pipe during the drawing operation.

21. The method of forming glass tubing from molten matter, consisting in rotating a blow-pipe within a furnace and projecting the blow-pipe into a shell-like member which has a restricted portion through which the discharge end of the blow-pipe projects, applying radiant heat to the outer surface of the blow-pipe from said shell, the heat at the discharge end of the blow-pipe being of lower temperature than the heat applied to the blow-pipe at the rear restricted portion of said shell, permitting molten glass to flow in a regulated stream onto the blow-pipe at the rear of the restricted portion of the shell, and thence to flow down and around the blow-pipe in evenly distributed form, drawing the glass from the discharge end of the blow-pipe in tubular form, and introducing fluid under light pressure into the tubing through the blow-pipe during the drawing operation.

22. The method of forming glass tubing, consisting in constantly rotating a blow-pipe in inclined position in a furnace and encompassing the discharge end portion of

the blow-pipe with a rotating shell disposed within the furnace and through the medium of which radiant heat is uniformly applied to the blow-pipe, depositing molten glass in a constant regulated stream onto the blow-pipe at the rear of its discharge end whereby the glass winds around and is evenly distributed over the discharge portion of the blow-pipe and flows down the same, drawing the glass in tubular form at a constant uniform speed from the discharge end of the blow-pipe, and constantly introducing a fluid under light pressure into the tubing through the blow-pipe during the drawing operation.

23. The method of forming glass tubing, consisting in permitting molten glass to continually flow in a regulated stream onto an inclined blow-pipe which is constantly rotating at uniform speed whereby the glass winds around and flows toward the discharge end of the blow-pipe, drawing the glass from the end of the blow-pipe at a continuous constant speed, introducing a fluid under light pressure into the tubing during the drawing operation, the glass being maintained in a high temperature during the flowing of the same onto and down the blow-pipe with the temperature diminished at the discharge end portion of the blow-pipe.

24. The method of continuously drawing molten material in cylindrical form, consisting in supplying molten material to the outer surface of a rotating member, and drawing the material from said member in cylindrical form.

25. The method of continuously drawing molten material in cylindrical form, consisting in supplying molten material to the outer surface of an axially inclined elongated circular member, and drawing it from said member in cylindrical form.

26. The method of continuously drawing molten material in cylindrical form, consisting in supplying molten material to the outer surface of an inclined rotating circular member, and drawing the material from said member in cylindrical form.

27. The method of continuously drawing molten material in cylindrical form, consisting in constantly supplying material to the outer surface of an inclined rotating member of elongated circular form, and continually drawing the material from said member in cylindrical form the portion of the material on the member being of tubular form.

28. The method of drawing molten material in cylindrical form, consisting in supplying molten material to and evenly distributing it on the outer surface of an inclined rotating member of elongated circular form, maintaining the material in a highly heated temperature while on the member, and drawing the material from one end of said member in cylindrical form.

29. The method of drawing molten material in cylindrical form, consisting in positioning a rotating elongated circular member within a furnace in which a high heat is maintained, supplying molten material to the surface of said member at the rear of its drawing-off end, and drawing the material from an end of said member in cylindrical form.

30. The method of continuously drawing molten material in cylindrical form, consisting in permitting molten material to flow onto an elongated circular rotating member at the rear of its drawing-off end, and drawing the matter from an end of said member in cylindrical form.

31. The method of continuously drawing molten matter in cylindrical form, consisting in permitting a stream of molten matter to flow onto an inclined rotating member of elongated circular form at the rear of its drawing-off end, and drawing the matter from an end of said member in cylindrical form.

32. The method of drawing molten matter in cylindrical form, consisting in rotating an elongated circular member within a furnace, permitting molten matter to flow in a regulated stream onto said member at the rear of its drawing-off end, maintaining said member in a high temperature which is diminished at the drawing-off end portion of the member, and drawing the matter from said member in cylindrical form.

33. The method of drawing molten material in cylindrical form, consisting in constantly rotating an elongated circular member in inclined position in a furnace and encompassing the drawing-off end portion thereof with a rotating shell disposed within the furnace and through the medium of which radiant heat is distributed to the member, depositing molten matter in a constant regulated stream onto said member at the rear of its drawing-off end whereby the matter winds around and is evenly distributed over a portion of said member and flows down the same, and drawing the matter in cylindrical form at a constant uniform speed from the drawing-off end of said member.

34. The method of forming molten material in cylindrical form, consisting in permitting the molten material to flow onto one portion of a rotating member of elongated circular form transversely thereof, and drawing it from another portion of the member in complete enveloping relation thereto.

35. The method of forming molten material in cylindrical form, consisting in permitting the material to flow in a regulated

stream onto one portion of a rotating member of elongated circular form and to be discharged evenly thereover, and drawing it in cylindrical form from another portion of the member lengthwise thereof and in a plane at an angle to a vertical.

36. The method of forming tubing in a continuous manner, consisting in permitting molten material to flow onto one portion of a rotating member, and drawing the material in tubular form from another portion of said member lengthwise thereof, the interior of the tubing being in communication with a source of fluid supply through said member.

37. The method of forming tubing in a continuous manner, consisting in permitting molten material to flow onto one portion of a rotating member, and drawing the material in tubular form from another portion of said member lengthwise thereof in substantially a horizontal plane, the interior of the tubing being in communication with a source of fluid supply through said member.

38. The method of drawing molten material in cylindrical form, consisting in constantly rotating an elongated circular member in a furnace and encompassing the drawing-off end portion thereof with a shell disposed within the furnace and through the medium of which radiant heat is distributed to the member, depositing molten matter in a constant regulated stream onto said member at the rear of its drawing-off end whereby the matter winds around and is evenly distributed over a portion of said member and flows down the same, and drawing the matter in cylindrical form at a constant uniform speed from the drawing-off end of said member.

39. The method of drawing molten material in cylindrical form, consisting in constantly rotating an elongated circular member in inclined position in a furnace and encompassing a portion thereof with a shell disposed within the furnace and through the medium of which radiant heat is distributed to the member, depositing molten matter in a constant regulated stream, onto said member at the rear of its drawing-off end whereby the matter winds around and is evenly distributed over a portion of said member and flows down the same through said shell, and drawing the matter in cylindrical form at a constant uniform speed from the drawing-off end of said member.

In testimony whereof, I have hereunto signed my name to this specification.

EDWARD DANNER.