No. 820,971. PATENTED MAY 22, 1906.

G. H. HARVEY.

APPARATUS FOR DRAWING ARTICLES FROM MOLTEN BATHS.

APPLICATION FILED JULY 5, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

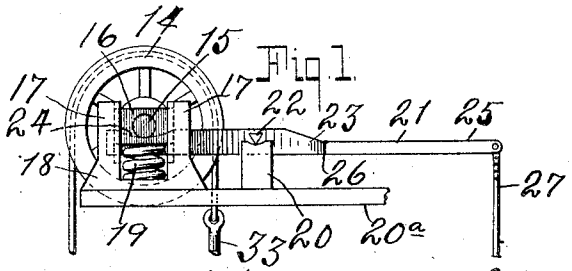
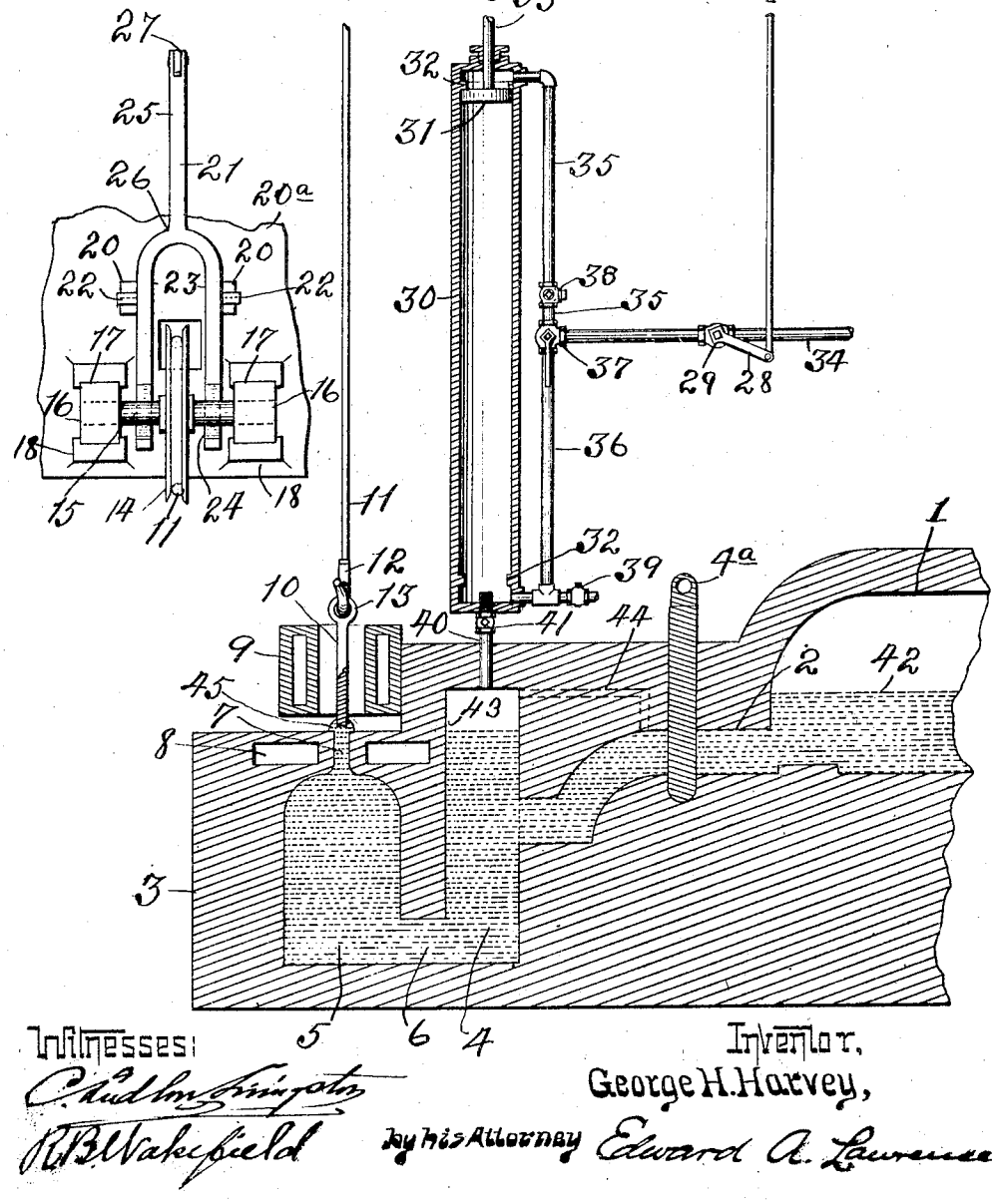


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 4.

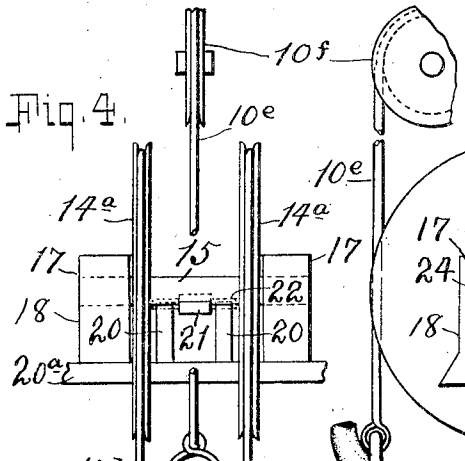
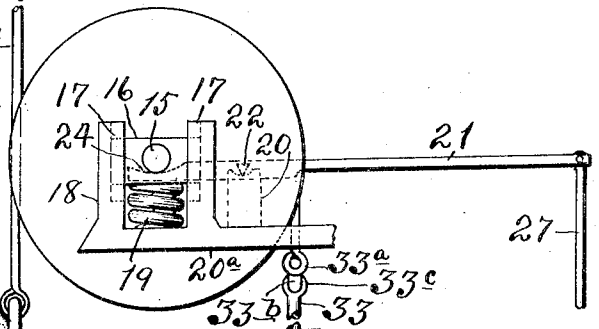
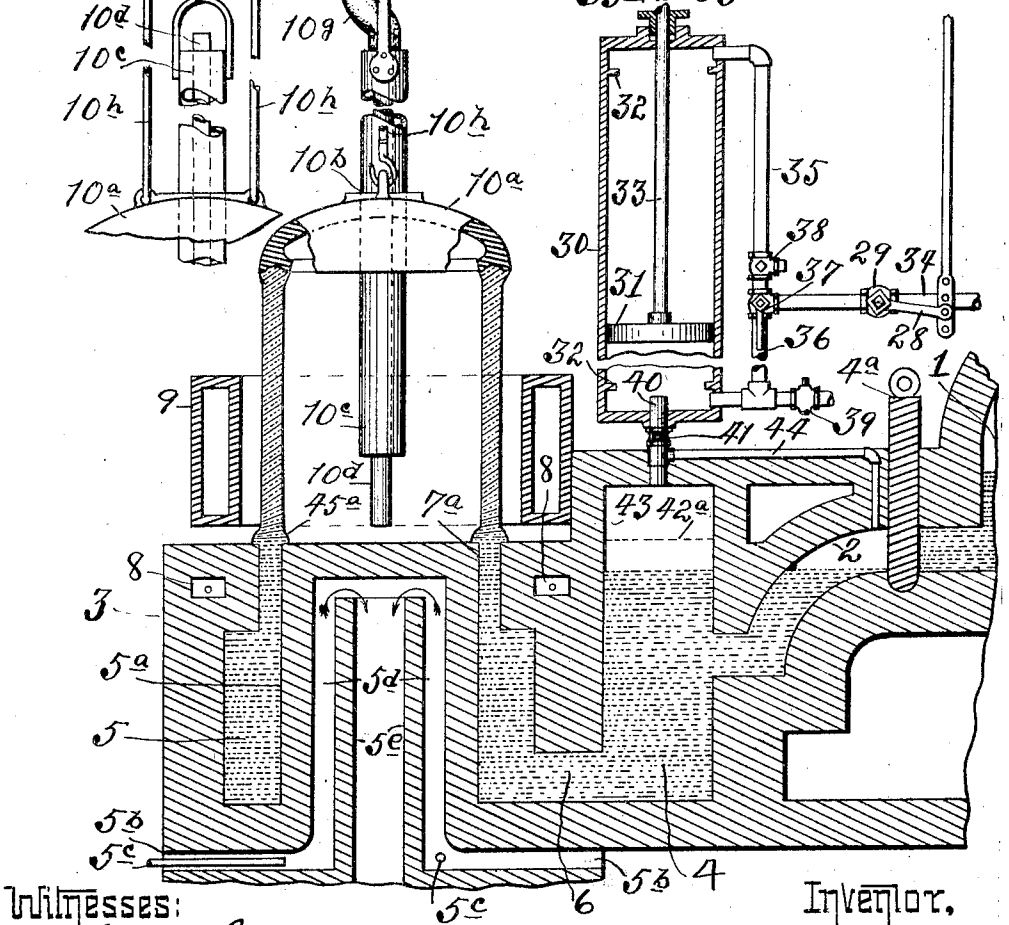


Fig. 3.





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UNITED STATES PATENT OFFICE.

GEORGE H. HARVEY, OF GLENFIELD, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, OF ONE-HALF TO BROWNSVILLE GLASS COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

APPARATUS FOR DRAWING ARTICLES FROM MOLTEN BATHS.

No. 820,871. Specification of Letters Patent. Patented May 22, 1906.

Application filed July 6, 1904. Serial No. 215,284.

To all whom it may concern:

Be it known that I, GEORGE H. HARVEY, a citizen of the United States, residing at Glenfield, in the county of Allegheny and State of Pennsylvania, have invented or discovered new and useful Improvements in Apparatus for Drawing Articles from Molten Baths, of which the following is a specification.

In the accompanying drawings, Figure 1 is partly a vertical section and partly a side elevation showing a preferable arrangement of mechanism for drawing metals in solid form. Fig. 2 is a plan view in detail, showing the sheave and bearings illustrated in Fig. 1. Fig. 3 is partly a vertical section and partly a side elevation showing a preferable arrangement of mechanism for drawing metals in hollow form, and Fig. 4 is a detail front elevation of the mechanism shown in Fig. 3.

My invention relates to apparatus for the drawing of metallic substances while in a molten or semimolten condition, and is designed to provide an improved apparatus for mechanically controlling the outflow of molten or semimolten material through an orifice in a receptacle while under pressure and, further, whereby the weight of the metal being drawn controls the power-actuated means for drawing it and whereby the speed of the draw and the flow of the metal from the orifice at which point the draw is made is rendered practically simultaneous.

In the accompanying drawings, which are, however, simply illustrative of preferable means for obtaining the ends desired, 1 represents an ordinary melting tank or furnace; 2, a passage therefrom and connecting with receptacle 3. 4^a is a gate located in said passage and adapted to regulate the flow of molten metal from said tank or furnace to said receptacle. I have shown the receptacle 3 as an extension of tank or furnace 1; but it may be entirely independent thereof and the metal might be ladled into said receptacle 3 without departing from the spirit of my invention. The receptacle 3 is preferably separated into two compartments 4 and 5, which are connected by a passage 6. Leading from the compartment 5 is an orifice 7, which communicates with the exterior of said compartment.

8 8 represent flues adapted to be either heated or cooled, as the nature of the metal flowing through the orifice 7 requires. If, for instance, the metal shown be molten glass, it would be preferable to increase, or, at least, maintain, the heat of the surrounding wall greater than or equal to the heat of the molten metal, especially the heat of the wall surrounding the orifice 7, for reasons which will be explained hereinafter.

9 represents an exterior cooling agent which if supplied with a cooling medium will absorb the latent heat from the metal being drawn.

10 represents a punty or gatherer and can be of any desired conformation, the object of which is to draw the metal upward, as shown, and the same is formed so that the metal is drawn by it by means of cohesion.

11 represents a cable having a hook 12, engaging an eyelet 13 of the punty 10.

14 represents a sheave over which the cable passes. The spindle 15 of the sheave 14 is journaled in the boxes 16, which are adapted to have a vertical movement between the upright guides 17 17 of the housings 18 18.

19 represents coiled springs adapted to support the boxes 16 16 at each end of said spindle 15.

20^a represents an overhead platform which supports the housings 18 18 and the bearing-blocks 20 20.

21 is a lever having its fulcrum at the V-shaped projections 22 22 and being composed of arms 23 23, extending in front of the spindle 15 and engaging it by means of the upper curved faces 24 24, one of which faces is shown in dotted lines in Figs. 1 and 2. The rear end of said lever is composed of a single arm 25, which is united with arms 23 23 at 26. Near the rear extremity of said lever a rod 27 is loosely secured thereto, the other end of said rod 27 being loosely secured to the stem 28 of an ordinary service-cock 29, which cock is hereinafter termed a "graduating-valve," from the nature of the work it performs

30 represents a cylinder in which a piston 31 is adapted to move between the stops 32 32. The stem 33 of said piston has secured to its upper extremity the free end of the cable 11. 34 represents the main supply-pipe for delivering a fluid under pressure to said

cylinder by means of branch pipes 35 and 36. At the junction of the main pipe 34 and branches 35 and 36 is the three-way valve 37.

38 and 39 are relief-valves.

40 is a pipe leading from the interior of the cylinder to the interior of the compartment 4 of the receptacle 3, and 41 is a valve in said pipe, and 44 is a branch pipe leading from said pipe 40 and discharges into passage 2.

In the operation of my invention, initially assuming the punty 10 to be heated and in the position shown in Fig. 1, I preferably permit the metal 42 to fill the compartments 4 and 5 to the level of the top of the orifice 7. Valve 38 is closed, while valve 37 is sufficiently open to permit the fluid under pressure to flow from pipe 34 through pipe 36 to fill the cylinder 30 and down through pipe 40, filling the space 43 above the metal in compartment 4 and also filling pipe 44. The pressure of the fluid in the space 43 upon the molten metal in compartment 4 would tend to compress said metal, and thus cause it to rise out of orifice 7 and form a knob 45 around the punty 10. When three-way valve 37 is closed to cut off the current from pipe 36, the fluid-pressure would now be contained within the parts described above the molten metal and below the piston 31. The operator would then open the three-way valve 37, so that the flow of the fluid would be from pipe 34 through pipe 35. Valve 38 would be opened and the fluid would pass therethrough into the cylinder 30 above the piston 31. The continued pressure on the upper face of said piston would tend to force the fluid contained beneath it in the cylinder into the space 43, enlarging said space vertically by forcing the metal 42 out of the orifice 7, thus continuing to form a knob 45, while the free end of the cable 11, which is secured to the upper end of the piston-stem, would be drawn downwardly, thus causing the punty, attached to the other end of the cable, to travel upwardly with the adhering metal attached thereto. As the piston continues to travel downwardly the weight of the continuous body of the adhering metal increasing in length becomes heavier, thereby causing the cable 11 to bear more heavily on the sheave 14, which sheave through its spindle 15 and bearing-boxes 16 thus presses downwardly on the springs 19, thus also causing the arms 23 23 to bear down in unison from the fulcrum 22 and the arm 25 to move upwardly beyond the horizontal plane of the fulcrum 22, thus raising the rod 27, connected to the stem 28, thereby increasing the orifice in the graduating-valve 29. This causes a greater flow of fluid above the piston-head and increases the pressure in the cylinder for the purpose of equalizing the increasing weight of the metal being drawn from the orifice 7, or, if desired, slightly exceeding the same. After the metal has been drawn a predetermined height it is detached at its base from the metal remaining in the receptacle and removed with the punty from which it depends, the sheave and actuating parts assuming their normal position, as shown in Fig. 1. A second punty at the proper heat is secured to the cable 11 and the relief-valve 38 opened, so that the fluid can be discharged from above the piston 31. Valve 41 is closed and the three-way valve 37 opened, so that the flow of fluid would be from pipe 34, through pipe 36, into the cylinder 30, below the piston 31, thereby causing the piston 31 to rise in the cylinder 30 and the punty 10 to descend until its lower extremity becomes immersed in the knob of molten metal 45, rising above the orifice 7.

So far I have described in general terms the operation necessary to draw solid bodies from a bath of molten metal. In the drawing of hollow bodies it is preferable to provide some means within the draw to chill the inner wall of the body, and for that reason I have shown in Figs. 3 and 4 modifications supplying the preferable mechanisms necessary to accomplish the results required. Referring to said Figs. 3 and 4, 5^a is a hollow column adapted to permit the molten metal 42 to surround the exterior wall thereof. 5^b 5^b are ports leading into the interior of said column, while 5^c represents means for supplying a gaseous fluid, which fluid is ignited at the exit of 5^c and passes up through the ports 5^d under the inclosed top of said column 5^a and then down and out of the same by means of flue 5^e. The gatherer or punty 10^a has a central opening 10^b, through which extends a depending tube 10^c, carrying a second tube 10^d, which is of a sufficiently less diameter than tube 10^c to permit a passage to be maintained between the inner face of tube 10^c and the outer face of tube 10^d. A cable 10^e is attached to the upper end of said tube and passes over sheave 10^f, from whence it can be operated by any suitable hoisting means. The inner tube 10^d has a flexible pipe 10^g connected at its upper end, and a supply of air, preferably under pressure, is passed down through said pipe 10^d to supply a cooling medium to the interior of the hollow draw. The gatherer 10^a is supported by two cables 10^h, which pass over sheaves 14^a 14^a, the two ends of said cables being attached to a horizontal bar 33^a. 34^b is a link connecting the bar 33^a to the eyelet 33^c of the piston-rod 33. In this case the lever 21 instead of being forked, as in Fig. 2, is a continuous straight rod, the connections therewith being otherwise the same. The orifice 7^a, as shown, represents a circular opening in vertical section. However, the orifice for articles drawn in hollow form may be of any desired design to suit the particular cross-sectional conformation of the hollow article.

In the operation preferably [illegible] neces-

sary to draw hollow articles, assuming the molten metal 42 to be on a level with the dotted line 42^a in compartment 4 of receptacle 6 or with about the top of orifice 7^a and the passage 2 completely filled with molten metal, the gatherer 10^a being lowered in proximity to orifice 7^a and piston 31 raised to its highest position, the operator would open three-way valve 37 to permit a fluid under pressure to pass from pipe 34 through pipe 36 into the cylinder 30, below the piston 31, and thence through pipe 40 to fill the space 43 above the molten metal in compartment 4; likewise the pipe 44 leading to the top of passage 2. After a sufficient compression of the molten metal in compartment 4 has been obtained to cause the metal to be forced upwardly and out through the orifice 7^a to form a knob 45^a above the top of said orifice the gatherer 10^a projects sufficiently into said knob to cause the molten metal to adhere thereto. The depending tube 10^c, carrying the inner tube 10^d, is now lowered through the opening 10^b in the gatherer 10^a, preferably until the inner tube 10^d is in close proximity to the top of the column 5^a. A fluid under pressure passes down through the flexible pipe 10^g from a source of supply (not shown) and discharges within the draw. The three-way valve 37 is now operated to close the passage through the pipe 36 and open the passage from pipe 34 through pipe 35, whereby the fluid passes up through the pipe 35 and maintains a discharge above the piston 31 in the cylinder, which causes the piston 31 to be forced downwardly in said cylinder, in turn forcing the molten metal downwardly in compartment 4 and upwardly in compartment 5 through orifice 7^a. Meanwhile the cables 10^h 10^h, supported on sheaves 14^a 14^a and connected to gatherer 10^a at one extremity and piston-rod 33 at the other extremity, are drawn downwardly at that end by the piston, which causes the other end of said cables to rise, drawing up with them gatherer 10^a, which in turn as it ascends draws up the inclosed form of metal adhering thereto. As the speed of the drawing means regulates the displacement of the metal from compartment 4 to and through the orifice 7^a, it is apparent that as the metal is drawn upwardly from said orifice a continuous supply is automatically maintained to relieve the strain or stretch that would occur at that point were the drawing operation attempted without the accompanying use of means of forcing the molten metal upwardly through the orifice. As the gatherer 10^a, with the continuously-increasing mass of metal pendent therefrom, continues to rise the gradually-increasing weight dependent from the adjacent ends of the cables 10^h 10^h causes said cables to depress the springs 19 and the spindle 15 to press down on the inner end of lever 21, thus raising the outer end of said lever and with the rod 27, which in turn raises the stem 28, gradually opening the graduating-valve 29, and thereby increasing the pressure on the upper side of the piston 31 and counterbalancing the increasing weight of the load of metal pendent from the punty or gatherer. After the draw is completed the metal pendent from the punty or gatherer is detached at its bottom from the metal protruding from the top of the orifice. The draw of metal is then raised beyond the top of the outer cooler 9, if such be used, disconnected from the cables 10^h 10^h, and removed for further treatment.

The punty 10 (shown in Fig. 1) and the gatherer 10^a (shown in Fig. 3) are applicable to the drawing of metals that have an affinity to or will adhere to by contact therewith. In such metals as cannot be drawn as above stated the lower extremity of the drawing-tool is modified to suit the particular requirements. There are numerous devices well known in mechanics—such as clamps, &c.—that could be attached to the end of the drawing-tool by which the metal protruding from the orifice could be grasped for drawing.

By reinforcing the heat in the surrounding wall of the orifices 7 and 7^a I prevent the streaked and scratched appearance that is imparted to glass by being drawn through a shaping-orifice not so heated, for the reason that in viscous metals, such as molten glass, a film forms over the surface of the metal while it is passing through the shaping-orifice, provided the wall of the orifice is not sufficiently heated to prevent a film from being formed. The film is easily scratched by any foreign substances, that may lodge in the orifice, and more particularly by the inner face of the wall of the said orifice, which are more or less roughened by the continued friction of the metal passing therethrough.

I claim as my invention—

1. In the manufacture of an article from molten or semimolten material, means for forcing said material through an orifice, second means for withdrawing the material protruding from said orifice and third means for regulating the flow of material through said orifice by the increase of weight of the material being drawn by said withdrawing means.

2. In the manufacture of an article from molten or semimolten material, means for forcing said material through an orifice, means for withdrawing said material as it is caused to protrude from said orifice and means for increasing the power operating said withdrawing means as the body of withdrawn material increases so that the rate of withdrawal is substantially constant.

3. In the manufacture of an article from molten or semimolten material, means for

continuously forcing said material through an orifice, means for withdrawing material as it protrudes from said orifice and means whereby the power operating said withdrawing means is increased as the body of withdrawn material increases so that the rate of withdrawal is substantially constant.

Signed at Pittsburg, Pennsylvania, this 22d day of June, 1904.

GEORGE H. HARVEY.

Witnesses:
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M. E. HARVEY.