No. 880,482.

C. F. COX. PATENTED FEB. 25, 1908.

APPARATUS FOR THE MANUFACTURE OF HOLLOW GLASSWARE.

APPLICATION FILED APR. 20, 1907.

5 SHEETS—SHEET 1.

Fig. 1.

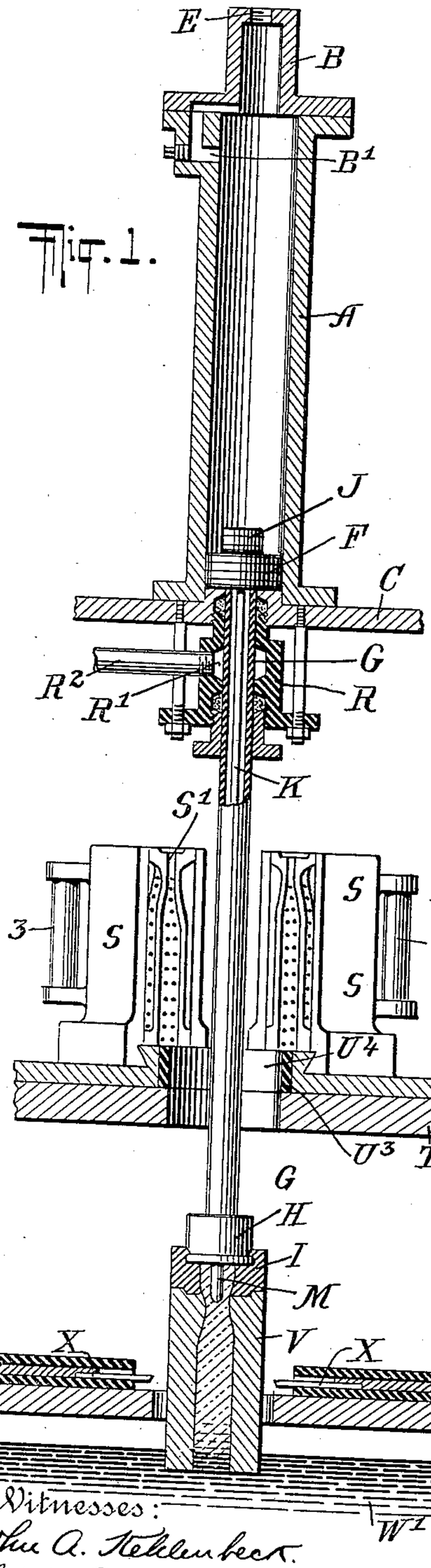
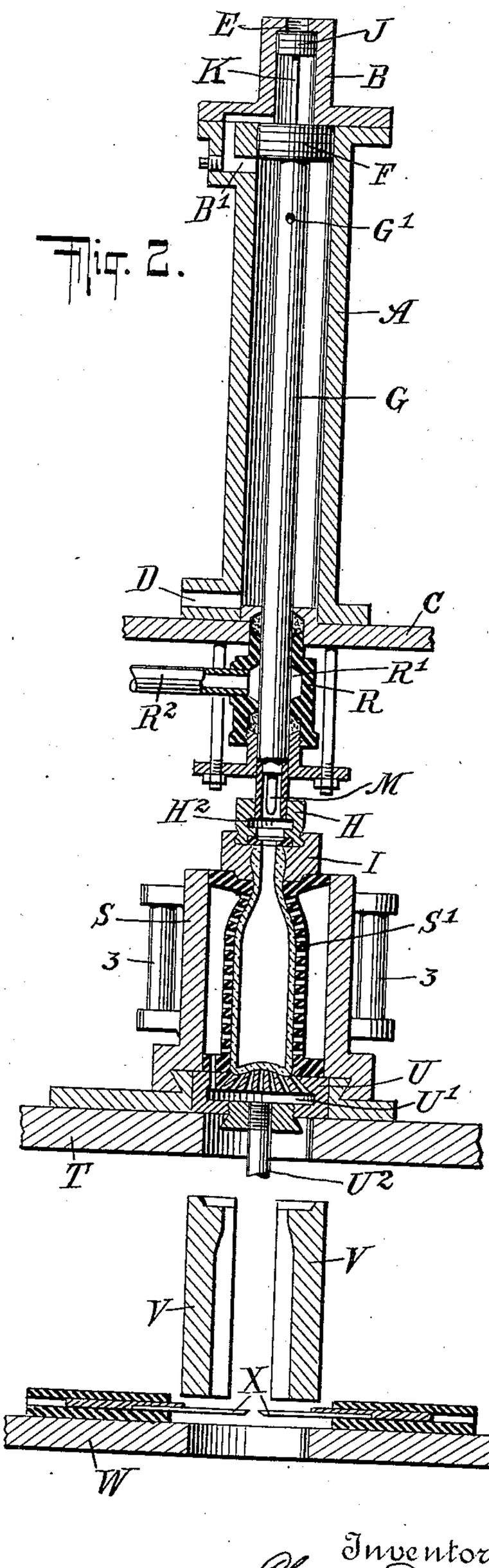


Fig. 2.



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G. V. Rasmussen

Inventor
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5 SHEETS—SHEET 2.

Fig. 3.

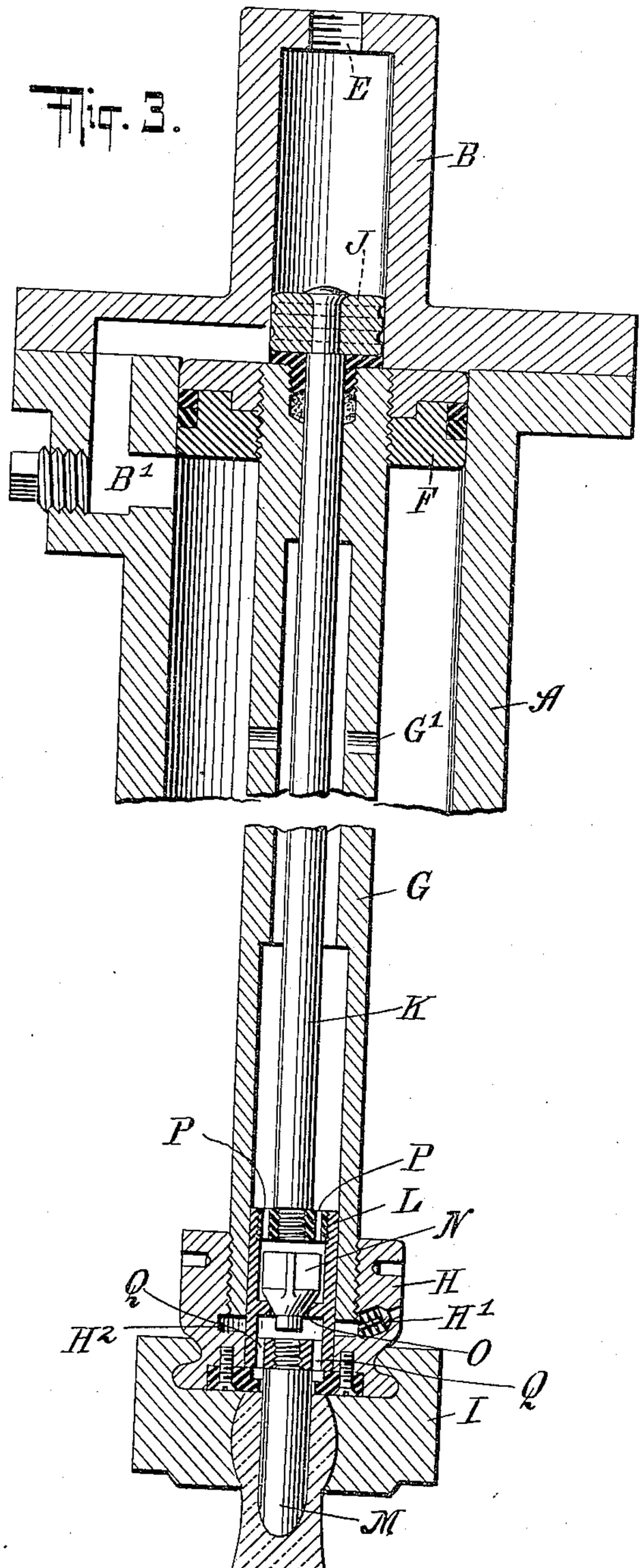

Fig. 4.

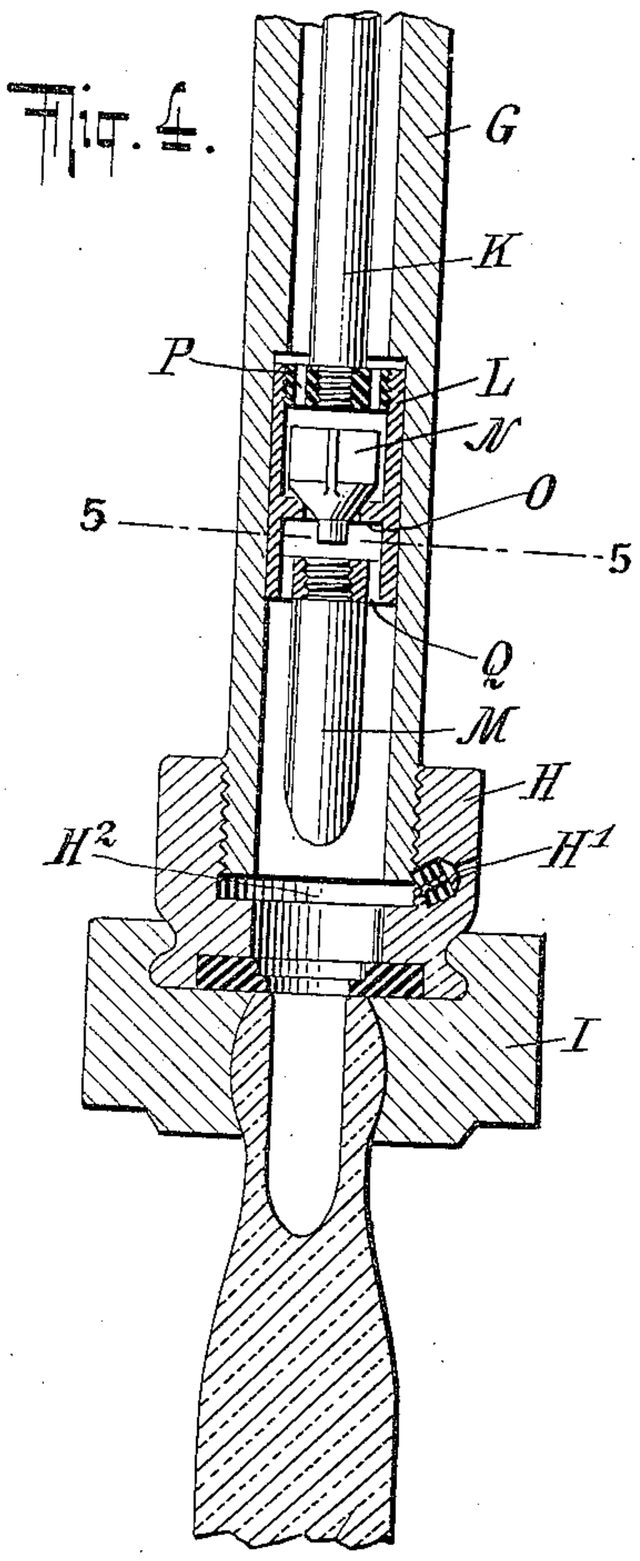

Fig. 5.

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5 SHEETS—SHEET 3.

Fig. 11.

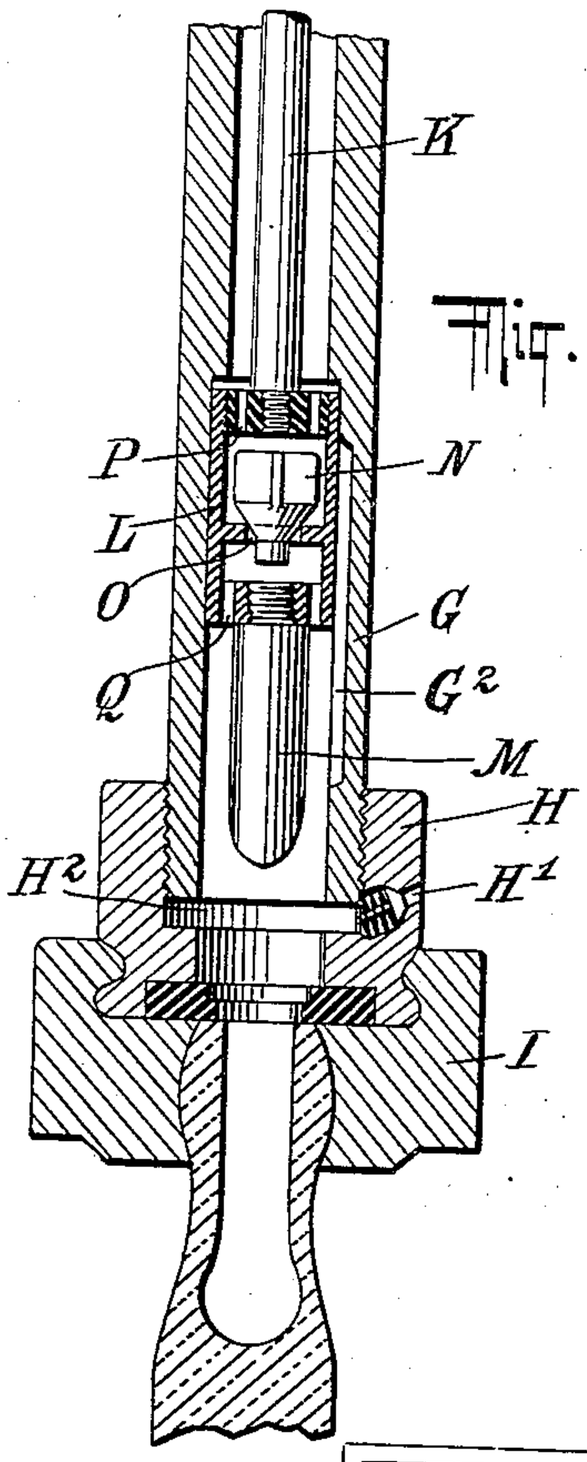
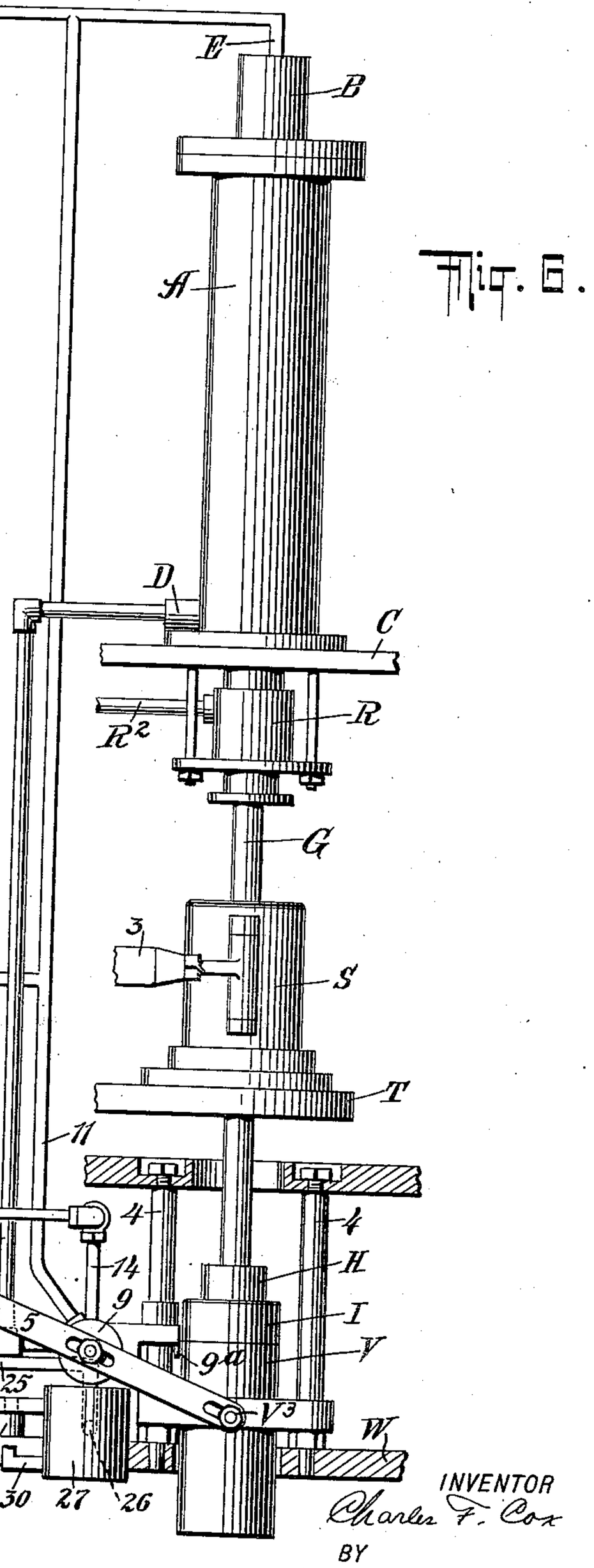


Fig. 6.



WITNESSES

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5 SHEETS—SHEET 4.

Fig. 7.

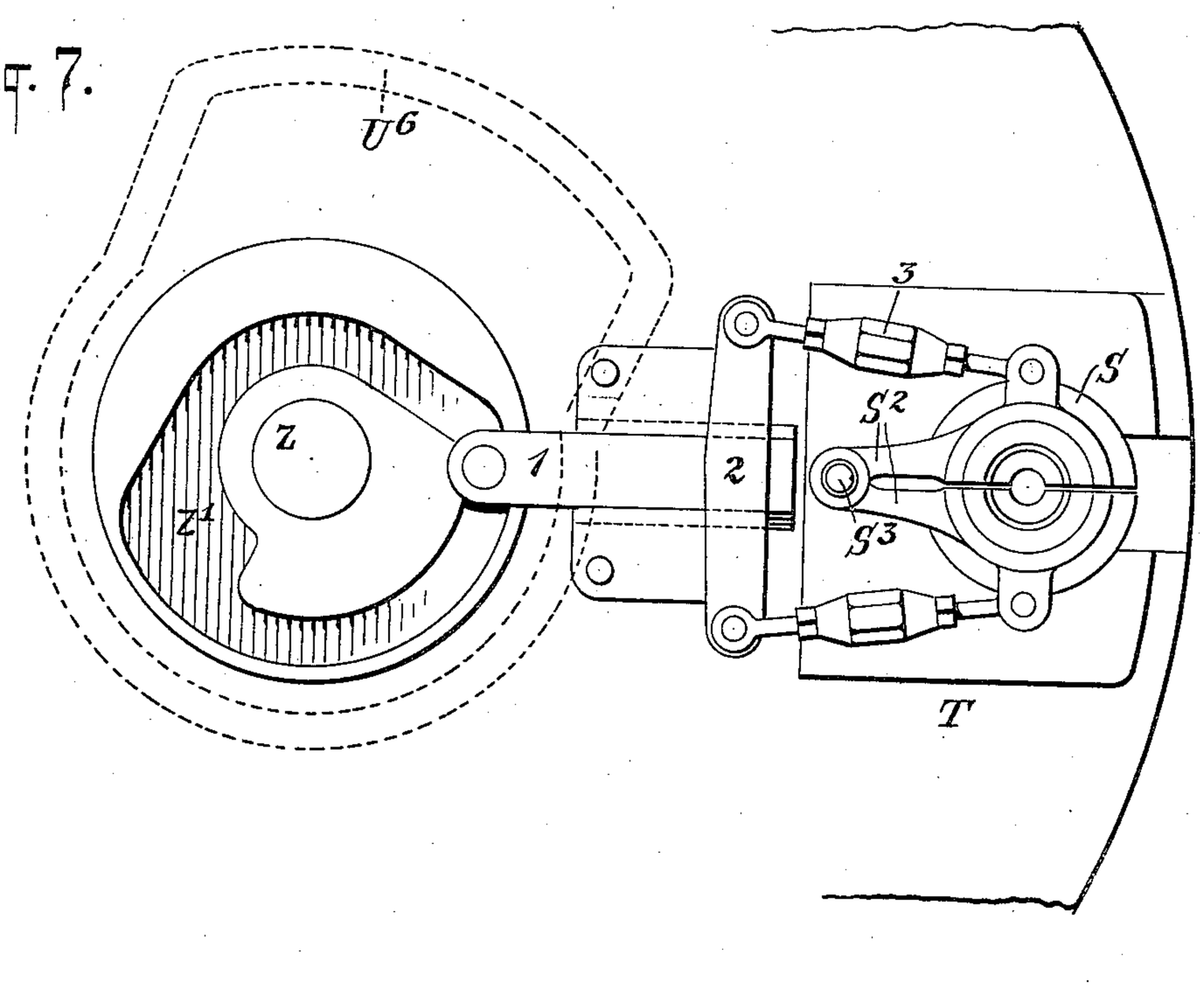


Fig. 8.

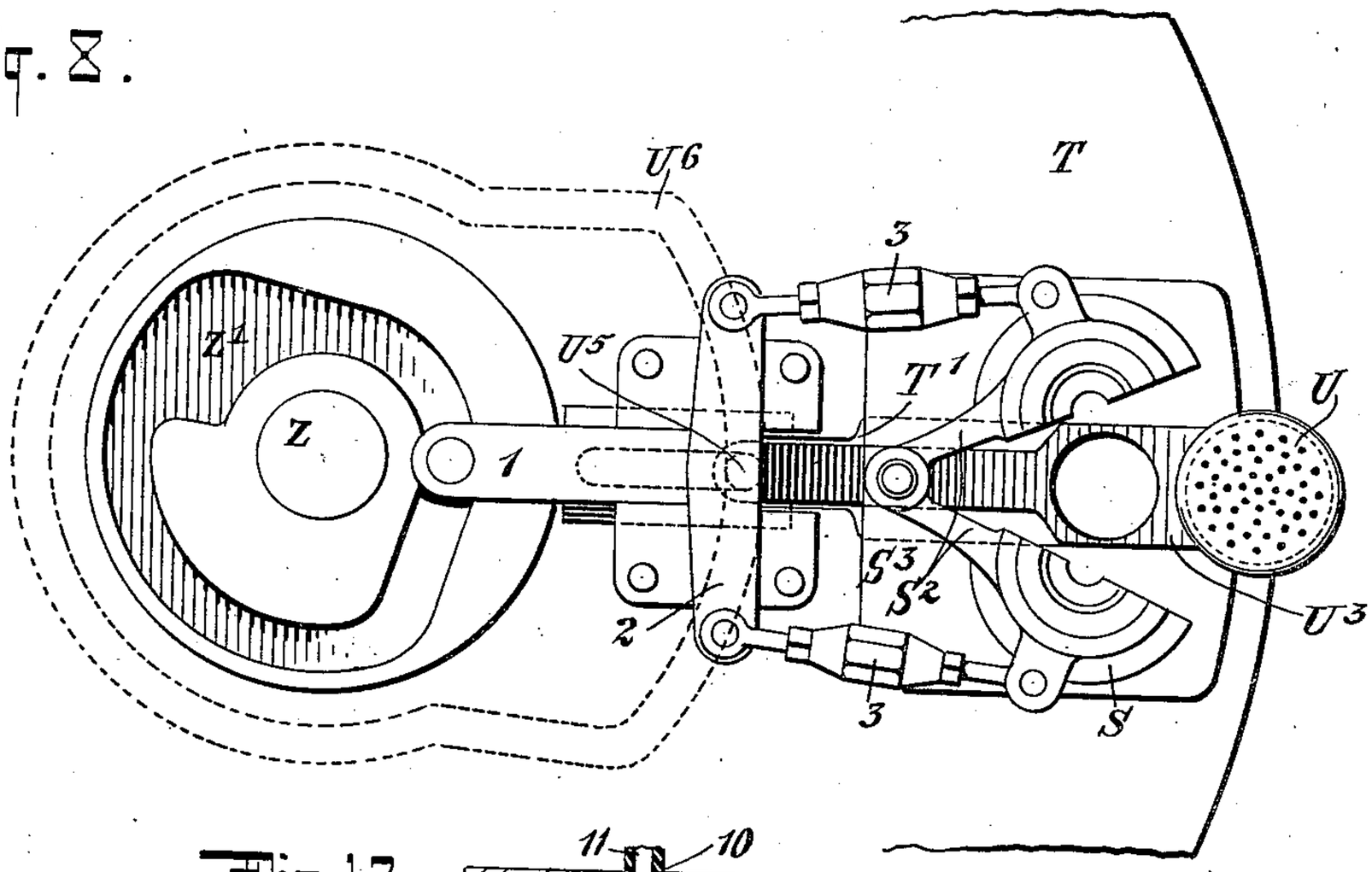
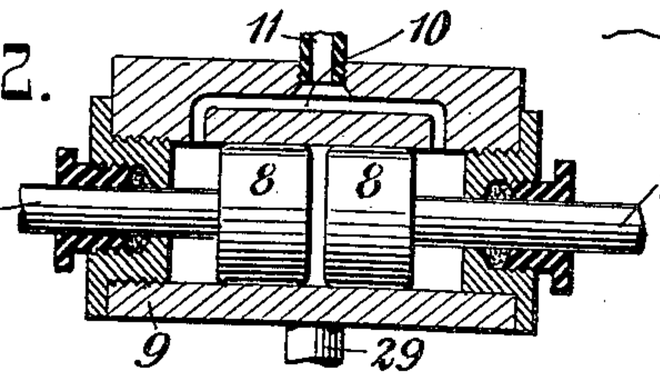


Fig. 12.



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APPLICATION FILED APR. 20, 1907.

5 SHEETS—SHEET 5.

Fig. 9.

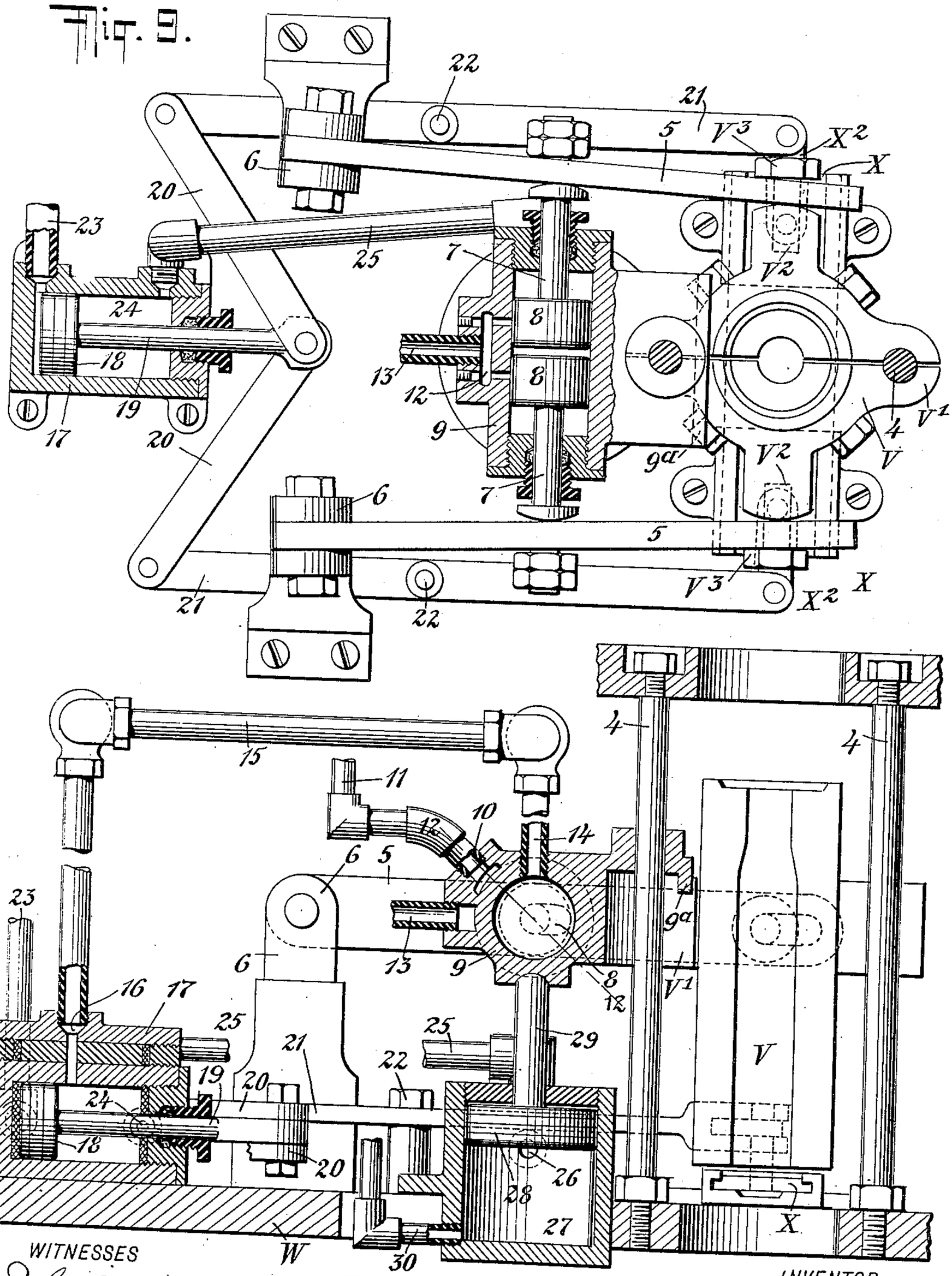

Fig. 10.

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UNITED STATES PATENT OFFICE.

CHARLES F. COX, OF BRIDGETON, NEW JERSEY.

APPARATUS FOR THE MANUFACTURE OF HOLLOW GLASSWARE.

No. 880,482. Specification of Letters Patent. Patented Feb. 25, 1908.

Original application filed November 18, 1905, Serial No. 287,917. Divided and this application filed April 20, 1907. Serial No. 369,308.

To all whom it may concern:

Be it known that I, CHARLES F. COX, a citizen of the United States, and resident of Bridgeton, county of Cumberland, and State of New Jersey, have invented certain new and useful Improvements in Apparatus for the Manufacture of Hollow Glassware, of which the following is a specification.

My invention relates to apparatus for the manufacture of hollow glassware and has for its object to provide a simple and efficient apparatus for manufacturing such glassware.

The invention will be fully described hereinafter and the features of novelty will be pointed out in the appended claims.

Reference is to be had to the accompanying drawings, in which

Figure 1 is a sectional elevation of a portion of a machine for manufacturing glassware according to my invention; Fig. 2 is a sectional elevation showing the parts in a different position; Fig. 3 is an enlarged detail section thereof; Fig. 4 is a similar view with the mechanism in a different position; Fig. 5 is a horizontal section taken on the line 5—5 of Fig. 4; Fig. 6 is an elevation with parts in section showing the apparatus in conjunction with the means for raising and lowering the blank mold; Figs. 7 and 8 are top views of the mechanism for opening the vacuum finishing mold showing the same in two different positions; Figs. 9 and 10 are respectively a top view with parts in section, and a sectional elevation of the mechanism for raising and lowering the blank mold, and for opening and closing the same; Fig. 11 is a sectional elevation of a slightly modified construction; and Fig. 12 is a section on line 12—12 of Fig. 10.

A represents a cylinder provided at its upper end with a reduced bore B, with which it is connected by a by-pass B′; said cylinder is supported upon a table C. The cylinder A is connected with a convenient compressed air supply at D, and the reduced portion B is also connected with such source of compressed air at E. A piston F, secured to a hollow piston rod G having openingss G′, is adapted to work in the cylinder A, in the manner to be more fully described hereinafter. To the free end of this piston rod G is secured as by a screw thread a head H, which in turn carries a neck mold I. A second piston J, is secured to a piston rod K located inside of the hollow piston rod G. This second piston rod K carries at its free end a valve cage L which snugly fits the inside of the piston rod G and has secured to it a plunger M. A valve N is located inside of the valve cage L and engages a seat O on said cage, which is further provided with openings P and Q. A stuffing box R is supported by the table C, and is provided with a chamber R′ connected by a pipe R^2 with a vacuum pump of any well known description.

S is a mold casing carrying the perforated finishing mold S′. The mold casing S and mold S′ are made in two sections and are capable of being opened and closed as shown in Figs. 1 and 2. This opening and closing of the finishing mold may be accomplished in any convenient manner, as by supporting each section of the mold and mold casing on swinging arms S^2 fulcrumed at S^3 upon the table T.

A movable bottom U is adapted to slide into position beneath the mold S′, when said mold is in the closed position as shown in Fig. 2, through the medium of suitable mechanism described hereinafter. This sliding bottom U is provided with a chamber U′ connected by a pipe U^2 with a convenient vacuum pump.

V is a blank mold made in two sections and adapted to be raised and lowered in any convenient manner, a particular mechanism for this purpose being described hereinafter. This blank mold V is adapted for air-tight connection with the neck mold I for the purposes to be more clearly brought out hereinafter.

W is a supporting table located over the receptacle containing the molten glass W′ and carrying knives X adapted to be brought together by suitable mechanism.

The perforated bottom U is attached to a slide U^3 moving in a slideway T′ of the table T. This slide has an opening U^4 of a proper size to allow the piston rod G and the neck mold I to pass therethrough. The slide U^3 has a pin U^5 working in a cam groove U^6 in a suitable part attached to the shaft Z. This shaft is provided with another cam member, having a groove Z′, which operates on a rod 1 attached to a cross head 2, and suitably guided so as to reciprocate in the same direction as the slide U^3. To the cross head 2 are pivoted links 3, which are connected with the arms S^2 of the mold casing S, pivoted at S^3 as hereinbefore stated. The two cam grooves U^6 and Z′ are so arranged that when the finishing mold is closed, the bottom U

will be in registry with the sections of the mold, but when the mold is open, the opening U^4 will be in axial alinement with the piston rod G.

The blank mold V (see Figs. 6, 9 and 10) consists of two sections having lips V′ which when the mold is closed, fit around vertical rods 4 along which the blank mold is adapted to slide up and down. Each of the mold sections is provided with an outwardly extending bolt V^2, each having a nut V^3. These bolts are engaged loosely by arms 5 which are fulcrumed at 6 and carry or support the mold sections, which are guided rectilinearly by a suitable member, such as the rib 9^a. The arms 5 are moved inward or outward, carrying the blank mold sections in a like direction, by means of rods 7 projected from pistons 8, suitable nuts or other abutments being provided on each piston rod at each side of the respective arms 5. The pistons 8 are arranged within a cylinder 9, and are pressed toward each other as shown in Figs. 9 and 12, as long as compressed air from the pipe 11 (connected with the inlet E at the top of the cylinder A) enters the cylinder 9 through a port 10 (Figs. 10 and 12) having branches leading to the ends of the cylinder. When the pistons are in this position, they close ports 12 leading from the cylinder 9 to a pipe 13 which is connected with the inlet D at the lower end of the cylinder A. At the center of the cylinder 9 is located another air inlet port 14, which is connected, by a pipe 15, with the outlet 16 of a cylinder 17, containing a piston 18. This piston is connected by a piston rod 19 with toggle links 20, connected with levers 21, fulcrumed at 22. With the other ends of the said levers are connected links X^2, pivotally attached to the knives X mounted to slide in suitable guideways X′. The cylinder 17 has two inlets 23 and 24 respectively at its opposite ends. The inlet 23 is connected with a source of compressed air supply, together with the inlet E of the cylinder A and the inlet 10 of the cylinder 9, as indicated in Fig. 6. The inlet 24 is connected by a pipe 25 with a port 26 in a cylinder 27. This cylinder contains a piston 28 which by means of a rod 29 engages and is adapted to lift the cylinder 9 and the parts connected therewith, among them the blank mold V. The cylinder 27 has a compressed air inlet 30 at its lower portion.

It will be understood that flexible or other loose connections will be provided in the pipes 11, 13 and 15 so as to preserve the connection of the cylinder 9 with said pipes during the upward and the downward movements of said cylinder.

The port 30 is connected with the source of compressed air permanently, while the connection of the ports E, 10 and 23 with the source of compressed air is made and interrupted at the times specified hereinafter. The diameter of cylinder A should be larger than that of cylinder 27.

It will be understood that when the machine is at rest, compressed air entering the cylinder 27 at 30 will hold the piston 28 and, through its intermedium, the cylinder 9 and blank mold V, in the upper position shown in Figs. 2 and 10. At the same time, compressed air passing from the port 26 of the cylinder 27 through the pipe 25 to the port 24 of the cylinder 17 will have shifted the piston 18 to the left, causing the knives X to close toward each other. Furthermore, the air entering the cylinder 17 at 24 will have passed from the port 16 through the pipe 15 to the central inlet 14 of the cylinder 9, thus causing the pistons 8 to move apart, and the blank mold V to open. At the same time, since in moving apart the pistons 8 have uncovered the ports 12, the air entering at 14 will have reached the pipe 13 and through it the inlet D at the bottom of the cylinder A, causing the piston F, head H, and neck mold I to rise. As soon as the piston F clears the by-pass B′ as shown in Fig. 2, the air passing up through B′ will lift the piston J and plunger M. The compressed air passes from the cylinder A through the openings G′ into the hollow piston rod G and closes the valve N. The ports E, 10 and 23 are disconnected from the source of compressed air, and the connections of the vacuum pump or other suction device with the pipes R^2, U^2 are likewise interrupted. The finishing mold S and the slide U^3 for the mold bottom U are in the position illustrated by Fig. 8.

To recapitulate, the position of rest of the several parts is as follows: The pistons F, J and the parts connected therewith (neck mold I, plunger M) are raised as shown in Fig 2; the valve N is closed as shown in Fig. 4; the finishing mold S′ is open and its bottom U moved aside as shown in Fig. 8, while the opening U^4 alines with the axis of the pistons F, J; the blank mold V is raised and open, and the knives X are closed below the blank mold. The piston 28 and the cylinder 27 form a cushioning device tending to keep the mold V in its upper position.

To start the operation, air is admitted simultaneously or about so to the inlets E, 10 and 23. The admission of air at the latter port causes the piston 18 to be moved to the right and thus opens or separates the knives X by means of the toggle links 20 and levers 21. The entrance of air at the inlet 10 causes the pistons 8 to move together as shown in Fig. 12, thus closing the blank mold V as shown in Fig. 9. The air flowing into the extension B of the cylinder A first presses down the piston J only, so as to cause the plunger M to be projected downwardly beyond the head H, this relative position being shown in Fig. 1.

The movement of the pistons 8 toward each other has closed the ports 12 and thus disconnected the port D at the bottom of the cylinder A from the compressed air supplied through the inlet 30. There is therefore no counter-pressure in the lower part of the cylinder A, and the pistons J and F, after coming together, move downward in unison until the neck mold I engages the blank mold V. Then the blank mold is forced downward owing to the fact that the diameter of the piston F is larger than that of piston 28, so that there is a preponderance of pressure on the piston F. The neck mold I, head H, and piston rod G pass through the opening U^4 of the slide U^3, and the blank mold passes through the table W into the molten glass W′, this being the position of parts shown in Fig. 1. Connection is then established between the pipe R^2 and the vacuum pump or other suction device. Inasmuch as the openings G′ of the piston rod G are in communication with the chamber R′, see Fig. 1, air will be sucked out through the openings P and Q (Fig. 3) lifting the valve N, and exerting a suction within the blank mold V, it being understood that the plunger M fits loosely in the bottom plate of the head H. The glass is thus sucked up into the blank mold V as shown in Fig. 1, and drawn forcibly against and around the plunger M and against the head H and neck mold I. The material is thus driven into the neck mold with considerable force and perfectly shaped therein. Thereupon the supply of compressed air to the inlets E, 10 and 23, is interrupted. The downward pressure on the piston F and on the blank mold V having ceased, the upward pressure of the air admitted to the cylinder 27 through the inlet 30 will cause the piston 28 to rise, lifting the blank mold V together with the neck mold I and the other parts resting on the blank mold, through the medium of the head H and piston rod G. When the piston 28 and the blank mold V have risen to the position shown in Figs. 2 and 10, air will pass from the outlet 26 through the pipe 25 to the port 24 of cylinder 17, and will thus drive the piston 18 over to the position shown in Figs. 9 and 10. This will cause the knives X to move toward each other below the blank mold V and to cut off any glass adhering to the bottom of said mold. As the piston 18 uncovers the port 16 of the cylinder 17, air will pass from the pipe 25 to the pipe 15 and to the port 14 of cylinder 9. This will cause the pistons 8 to move apart, separating the blank mold sections. The upward movement of the blank mold V has raised the neck mold I and the parts connected therewith only a portion of their upstroke. The remainder of the upward movement of these parts is brought about as follows: When the pistons 8 move apart to open the blank mold V, they allow air to pass from the inlet 10 through the pipe 13 to the inlet D at the bottom of the cylinder A. The air lifts the piston F and the parts connected therewith. The blank adhering to the neck mold I is thus raised into the finishing mold S′, which is still in the open position illustrated by Fig. 1. As soon as the openings G′ enter the cylinder A, compressed air flowing into the hollow piston rod G will close the valve N. As the area of the said valve and of the cage L is smaller than that of the piston F, the upward pressure on the piston will prevail. In order to enable the said piston to start readily from its lower position, such piston is beveled or rounded at its edge so that the air will get under it, and a like construction is employed for the pistons J and 28.

When the piston F at the end of its upstroke uncovers the by-pass B′, the compressed air will pass into the extension B and raise the upper piston J, and with it the valve cage L, so as to withdraw the plunger M from the neck of the glass blank, as shown in Figs. 2 and 4. The bottom U is then slid under the blank, and the finishing mold S′ is closed, these parts taking the position shown in Figs. 2 and 7. Suction through the pipe R^2 is then discontinued, and applied through the pipe U^2, so as to produce a vacuum in the chamber U′. This chamber being in communication with the casing S, and the mold S′ as well as the upper wall of the chamber U′ being perforated, the air entering the glass blank either through imperfect joints or through a valve H′ to be described presently, causes the glass to expand to the sides and bottom of the finishing mold, which of course, corresponds to the shape of the article it is desired to form. In the present illustration this article is a bottle, but it is to be understood that all kinds of hollow glassware may be made according to my process.

When the article is small, sufficient atmospheric air will generally enter through imperfect joints. Where the leakage is insufficient, I may provide a special suction valve H′, as shown in Figs. 3 and 11, opening inwardly and communicating with an annular chamber H^2 of the head H. This chamber is so arranged that during the first operation of drawing the glass into the blank mold, the valve cage L shuts off said chamber H^2 from communication with the space in which suction is created. When the valve cage has been raised, as in Fig. 2, the chamber H^2 is open to the interior of the piston rod G, and thus air may enter through the valve H′ into the bottle, which is being pressed outwardly against the perforated finishing mold S′ by the suction applied on the outside of said mold.

When the article has been formed in the manner just described, the two parts of the mold casing S and the mold S′, are sepa-

rated, or, in other words, the finishing mold is opened, after which the neck mold I is opened and the finished article removed.

After the article has been removed, the sliding bottom U is again moved aside (Fig. 8) to allow the parts carried by the piston rod G to descend and repeat the operation, as hereinbefore described.

It will thus be seen that in using my apparatus suction is successively applied in opposite directions, that is, suction is first used to force the glass toward the neck of the bottle (in the present illustration) so as to mold the said neck which is generally beaded, and then suction is applied from the outside, while atmospheric air has access to the inside of the article, for the purpose of expanding said article toward the bottom of the bottle. The material is therefore subjected successively to opposite strains.

In Fig. 11 I have shown a slight modification in the construction of the piston rod G and valve cage L. These parts are substantially the same as in Fig. 4, but in the inner wall of the piston rod G I have added a longitudinal groove G^2, which is slightly longer than the valve cage L. The operation in this case will be substantially the same as above described, differing only in the following particular:—When compressed air is admitted to the cylinder A at D, and the pistons F and J rise together, the neck mold I with the blank adhering thereto, will be lifted as before described. When the piston F reaches the top of the cylinder A, and compressed air passes through the by-pass B′ to the extension B, the piston J is lifted further and the valve cage L is thus caused to move upward within the piston rod G. At the moment that the lower end of the valve cage L gets above the lower end of the groove G^2, compressed air from the upper part of the hollow piston rod G will pass through the same groove G^2 to the lower end of said piston rod and into the hole which has been formed in the blank by the plunger M. This puff of compressed air will cause the hole formed by the withdrawal of the plunger to be expanded, as will be understood by comparing the showing in Fig. 4 with that in Fig. 11. This expansion of the cavity facilitates the finishing of the blank in the mold S′. This operation involving an enlargement of the cavity formed by the plunger M, is recommended for hollow articles of relatively large size.

It will be observed that in both species of my invention described hereinbefore, the narrow end or neck of the blank is directed upward during the entire operation, so that the influence of gravity is always in the same direction and all side strains and injury are avoided that might be caused by inverting the blank during the process of manufacture. As the position or direction of the blank remains the same (that is, with the neck pointing in the same direction) during both suction operations, the blank is subjected simply to longitudinal strains exerted successively in opposite directions and a uniform action of both forces is the result, with a regular shaping of the article. The two suction operations are upward and downward respectively and the injection of air, is downward in the second example or species described. These features, however, need not all be employed conjointly, as various modifications may be made without departing from the nature of my invention as defined in the claims.

This present application is a division of one filed by me in the United States Patent Office on November 18, 1905 Serial No. 287,917, on which Letters Patent No 851,163 were issued to me on April 23, 1907.

I claim:

1. In apparatus for manufacturing hollow glassware, a blank mold, a finishing mold located at a different level from the blank mold, and a neck mold vertically relatively to both of said first-named molds, to transfer the blank from the blank mold to the finishing mold, all of said molds being located in alinement.

2. In apparatus for making hollow glassware, a finishing mold, a blank mold movable vertically beneath the finishing mold and a neck mold movable through the finishing mold to transfer the blank from the blank mold to the finishing mold.

3. In apparatus for making hollow glassware, a finishing mold, a blank mold beneath the finishing mold, and a neck mold or blank carrier movable through the finishing mold to transfer the blank from the blank mold to the finishing mold all of said molds being located in alinement.

4. In apparatus for making hollow glassware, a blank mold, a cushioning device tending to keep said mold in its upper position, means for forcing the blank mold down to contact with the molten glass, and means for drawing glass into the said mold by suction.

5. In apparatus for manufacturing hollow glassware, a horizontally separate blank mold provided with an opening in its bottom for the introduction of the molten glass, a neck mold movable vertically in relation to said blank mold, and a horizontally separable finishing mold located at a higher level than the blank mold, and arranged to receive the blank which has been lifted from the blank mold by the vertical movement of the neck mold.

6. In apparatus for manufacturing hollow glassware, a vertically movable separable blank mold, a neck mold movable vertically in unison with the blank mold and also having an additional vertical movement inde-

pendently of the blank mold, means for causing the blank mold to open as it approaches its upper position and before the neck mold performs its independent movement, and a finishing mold into registry with which the blank carried by the neck mold is brought by such additional, independent movement of the neck mold.

7. In apparatus for making hollow glassware, a finishing mold, means attached to the mold for producing hollow glassware within the mold, a movable bottom for said mold, and a blank carrier movable through said mold.

8. In apparatus for making hollow glassware, a finishing mold, a transversely movable bottom for said mold, provided with an opening, and a blank carrier movable through the mold and the opening in the bottom.

9. In apparatus for mixing hollow glassware, a mold casing, a finishing mold having apertures through which suction may be applied and supported from the mold casing by a perforated partition and a movable bottom having apertures registering with the apertures in said perforated partition and other apertures through which suction may be applied.

10. In apparatus for making hollow glassware, a finishing mold having apertures through which suction may be exerted to expand the blank, a blank carrier for bringing a blank upward into said mold, and a transversely movable bottom for said mold, said bottom having an opening for the passage of the blank carrier, and a suction chamber with upwardly directed apertures.

11. In apparatus for making hollow glassware, a cylinder containing a piston for the upward movement of the blank mold, another cylinder arranged to receive compressed fluid from the first when the said piston is near its upper position, and a piston arranged in the second cylinder and connected with a cutter adapted to work beneath the raised mold.

12. In apparatus for making hollow glassware, a cylinder containing a piston for the upward movement of the blank mold, another cylinder arranged to receive compressed fluid from the first when said piston is near its upper position, a piston arranged in the second cylinder and connected with a cutter adapted to work beneath the raised mold, a third cylinder arranged to receive compressed fluid from the second at the end of the cutter's operation, and piston mechanism within the third cylinder to open or close the blank mold.

13. In apparatus for making hollow glassware, a cylinder containing a piston connected with a neck mold or blank carrier, a plunger fitted to slide within the blank carrier, and a supplementary piston connected with the plunger to operate the same.

14. In apparatus for making hollow glassware, a hollow piston rod having end openings through which suction may be exerted, and additional openings through which, according to their position, air may be admitted into the rod under pressure, or withdrawn therefrom by suction, a valve located between the two sets of openings and adapted to become seated when the interior of the rod is under pressure, and means for moving the piston rod.

15. In apparatus for making hollow glassware, a cylinder having an extension with a by-pass leading thereto, a piston movable in the cylinder and controlling said by-pass, a hollow piston rod connected with said piston and carrying a neck-mold, said rod having openings which at one time receive compressed air from said cylinder, and at another time are within a suction chamber, a valve cage movable in the piston rod adjacent to the neck mold and having a through passage, a valve adapted to close said passage when the interior of the piston rod communicates with the cylinder, a plunger and a plunger rod connected with said valve cage, and a piston connected with the plunger rod and movable into the extension of the cylinder.

16. In apparatus for making hollow glassware, a cylinder having an extension with a by-pass leading thereto, a piston movable in the cylinder and controlling said by-pass, a hollow piston rod connected with said piston and carrying a neck-mold, said rod having openings which at one time receive compressed air from said cylinder, and at another time are within a suction chamber, a valve cage movable in the piston rod adjacent to the neck mold, and having a through passage, a valve adapted to close said passage when the interior of the piston rod communicates with the cylinder, a plunger and a plunger rod connected with said valve cage, and a piston connected with the plunger rod and movable into the extension of the cylinder, the piston rod having a by-channel through which a puff of compressed air may pass during the inward movement of the plunger.

17. In apparatus for making hollow glassware, a finishing mold having apertures through which suction may be exerted to expand the blank, a neck mold having a passage adapted to communicate with the interior of the article, and an inwardly opening valve controlling the connection of said passage with the outside air.

18. In apparatus for making hollow glassware, a finishing mold having apertures through which suction may be exerted to expand the blank, a neck mold having a passage adapted to communicate with the interior of the article, a chamber surrounding said passage, and a valved channel leading

from said chamber to the outside air, and a valve cage movable within the neck mold and having a through passage controlled by a valve therein, and adapted for connection with a suction device or exhausting means, said cage being adapted to control the communication of said annular chamber with the passage of the neck mold.

In testimony whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

CHARLES F. COX.

Witnesses:
PAUL M. WILLIAMS,
REUBEN A. FOGG.