

No. 750,253.

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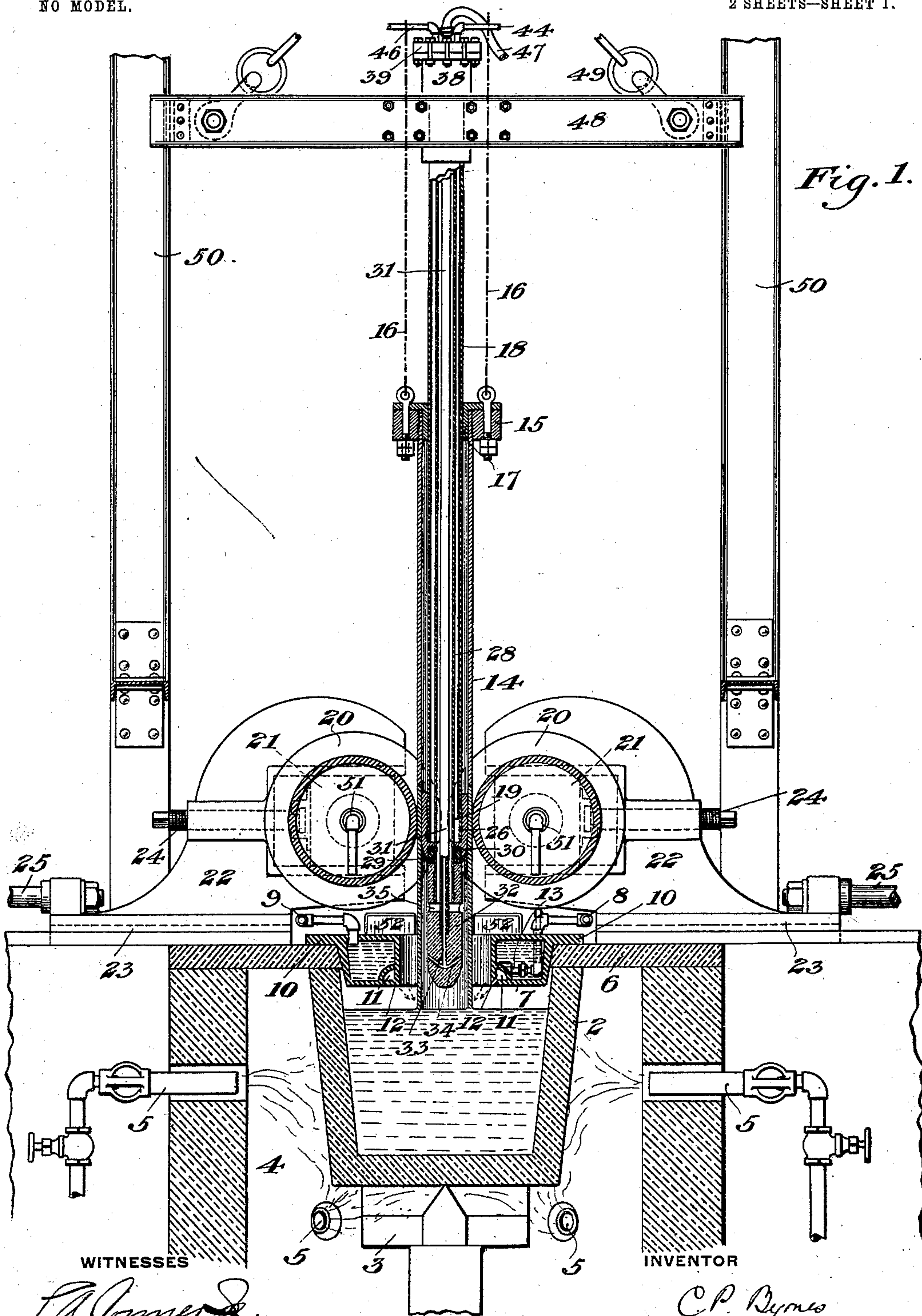
C. P. BYRNES.

METHOD OF DRAWING ARTICLES FROM MOLTEN BATHS.

APPLICATION FILED MAR. 28, 1902. RENEWED JULY 6, 1903.

NO MODEL.

2 SHEETS—SHEET 1.





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2 SHEETS—SHEET 2.

Fig. 2.

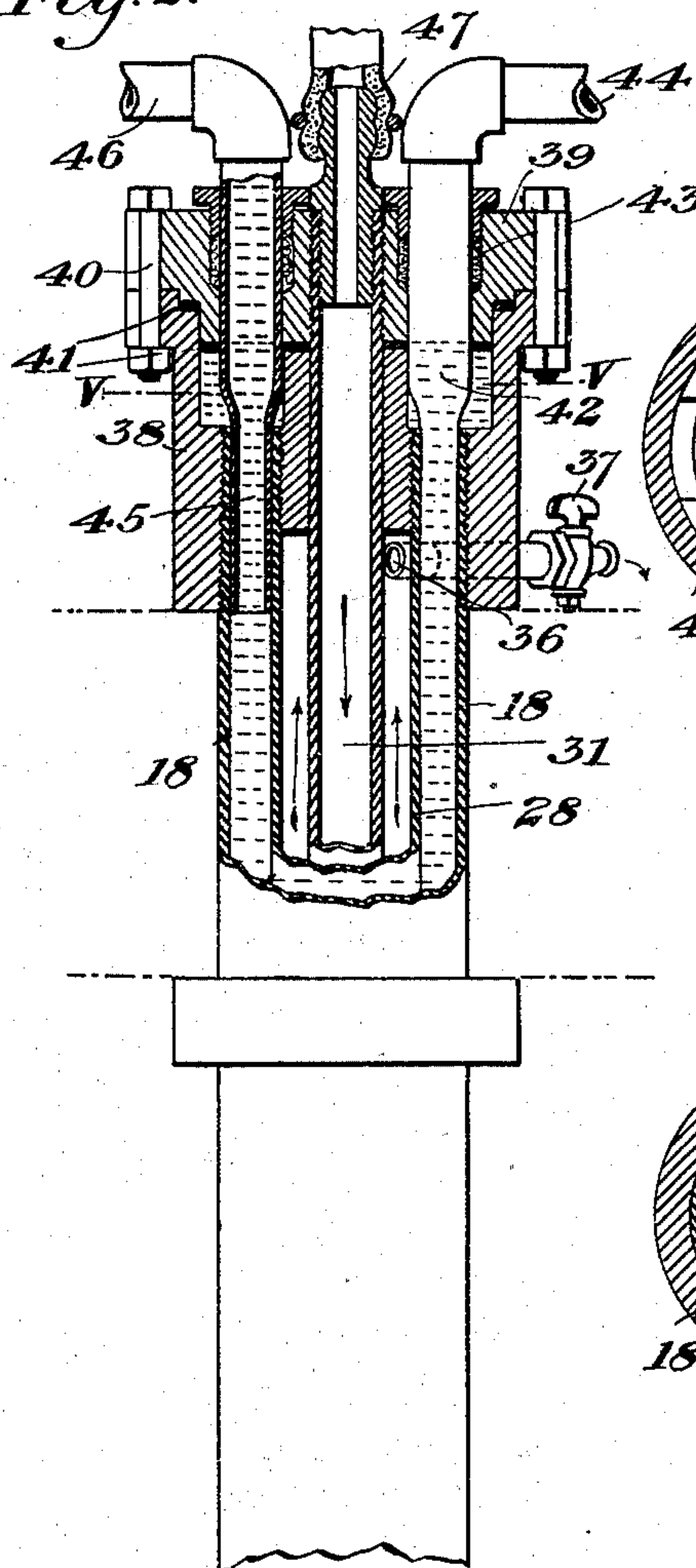


Fig. 3.

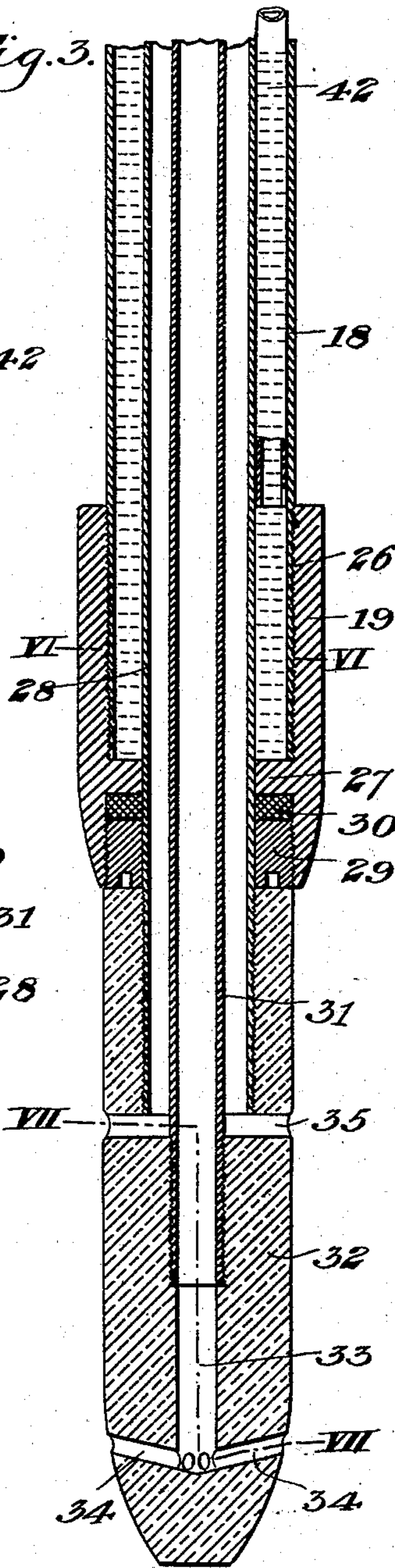


Fig. 5.

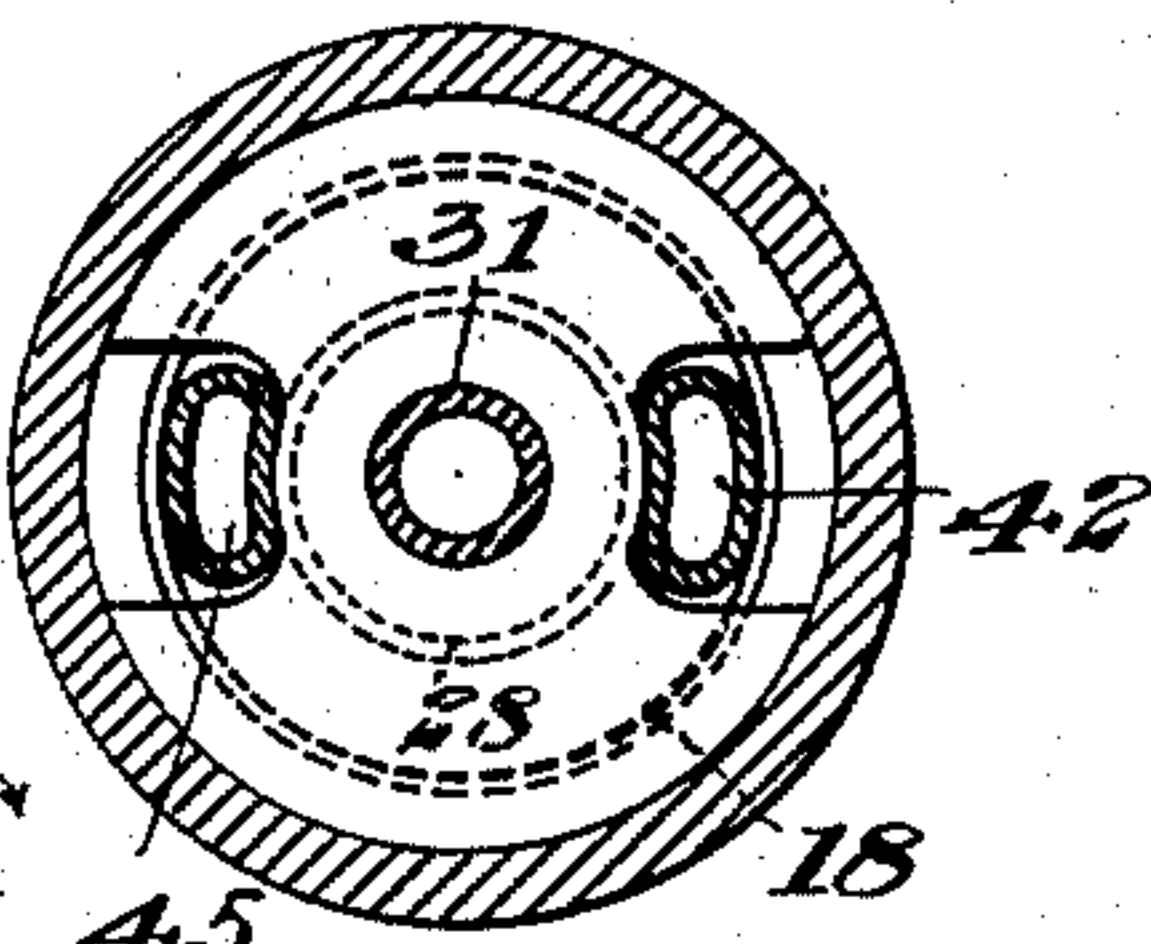


Fig. 6.

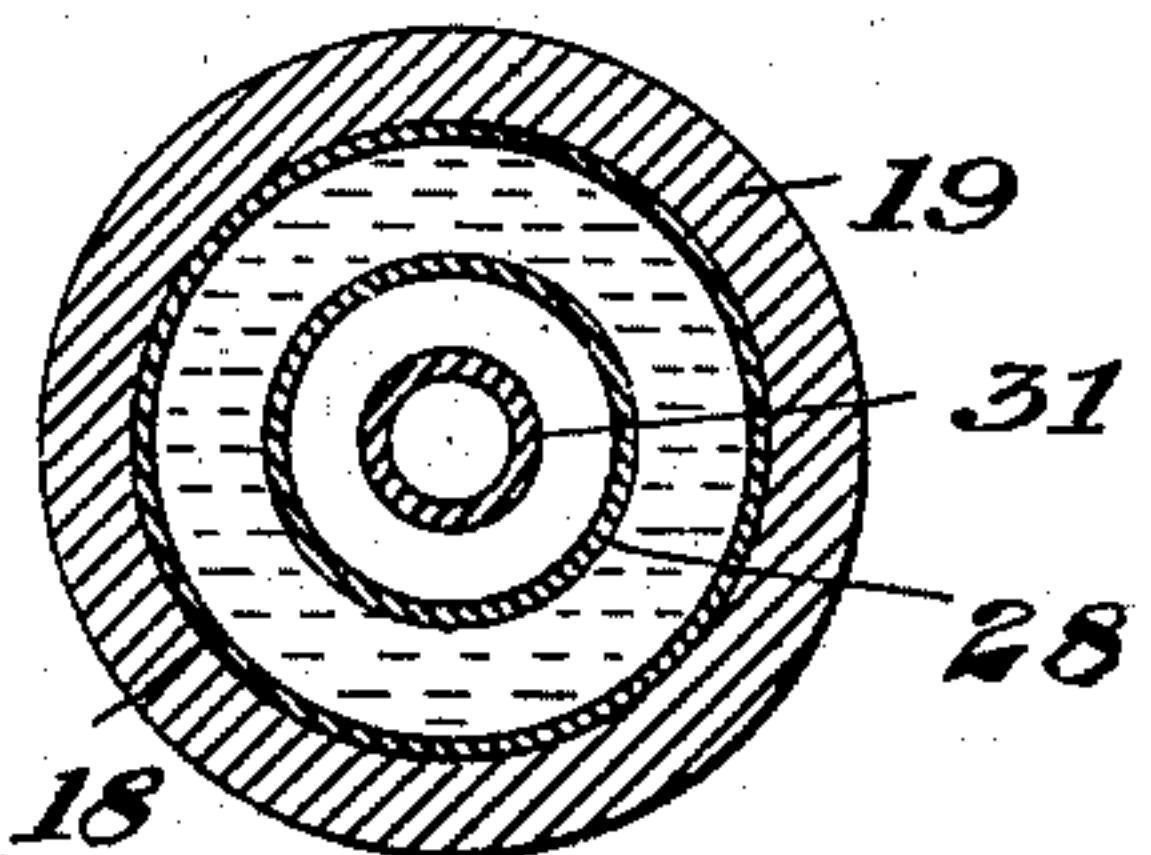


Fig. 4.

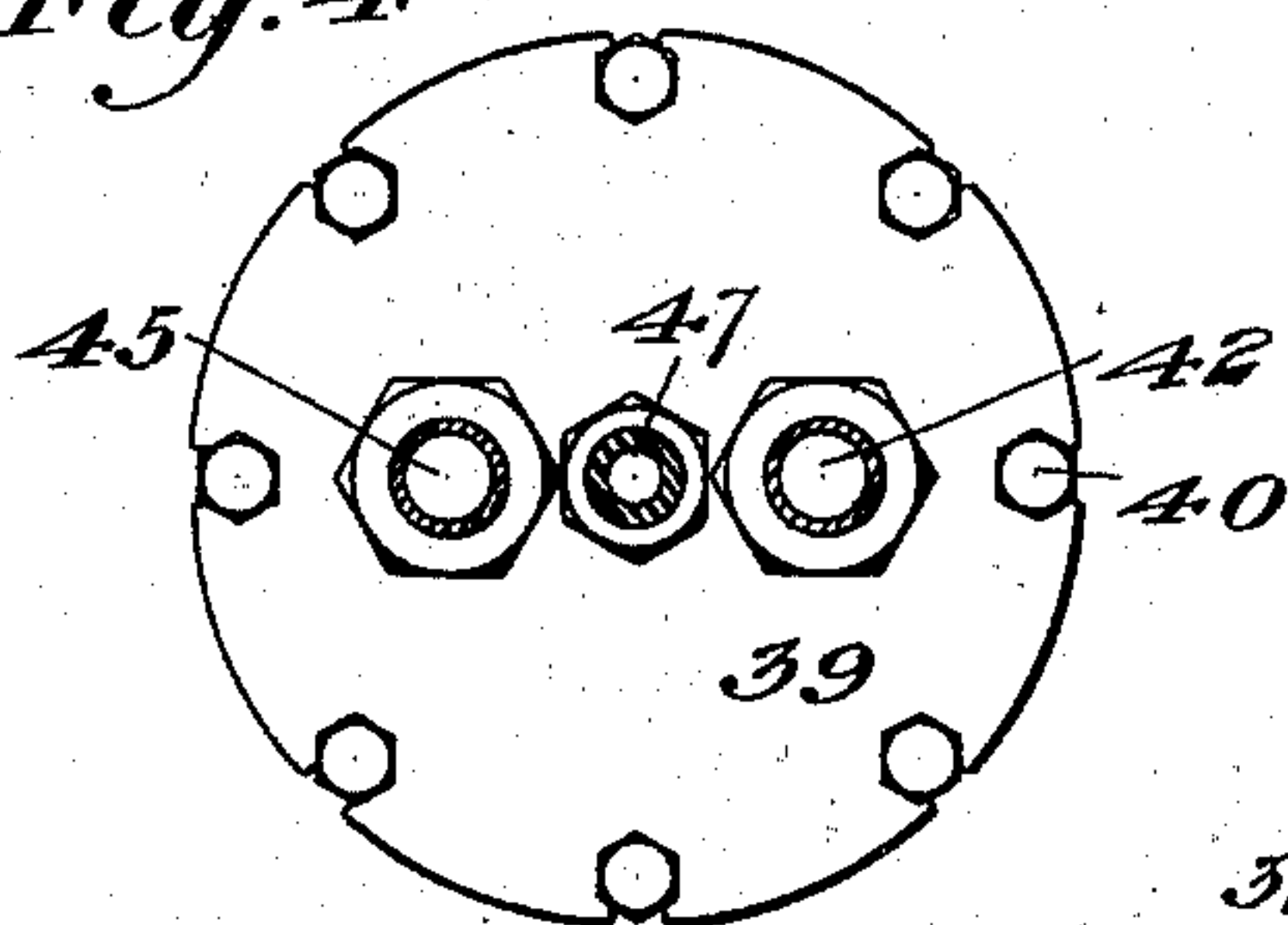
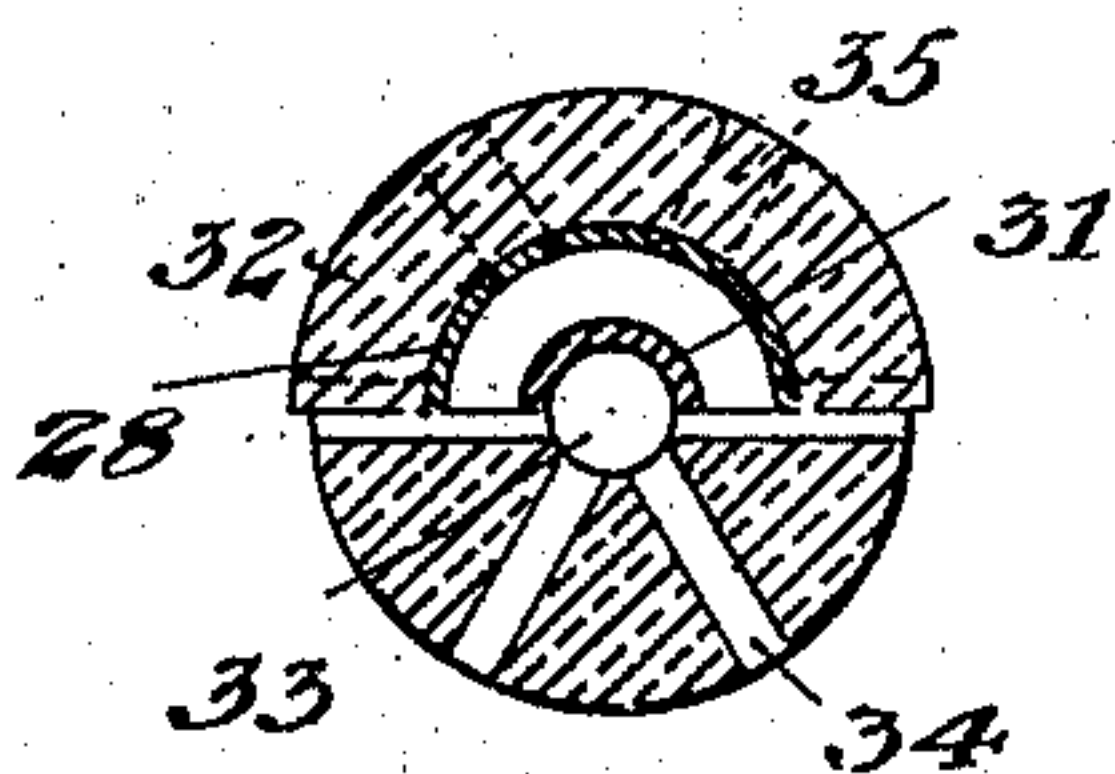


Fig. 7.



WITNESSES

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## METHOD OF DRAWING ARTICLES FROM MOLTEN BATHS.

SPECIFICATION forming part of Letters Patent No. 750,253, dated January 26, 1904.

Application filed March 28, 1902. Renewed July 6, 1903. Serial No. 164,476. (No specimens.)

*To all whom it may concern:*

Be it known that I, CLARENCE P. BYRNES, of Sewickley, Allegheny county, Pennsylvania, have invented a new and useful Improvement in the Methods of Drawing Articles from Molten Baths, 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—

Figure 1 is a front elevation, partly in section, showing one form of apparatus constructed in accordance with my invention. Fig. 2 is an enlarged detailed view showing the upper portion of the mandrel-support. Fig. 3 is a similar view showing the lower portion of the mandrel. Fig. 4 is a top plan view of the same. Fig. 5 is a cross-section on the line V V of Fig. 2, and Figs. 6 and 7 are cross-sections on the lines VI-VI and VII-VII of Fig. 3.

My invention relates to the shaping of metallic substances while in a fluid or plastic condition, and is designed to provide an improved method of and apparatus for forming metallic articles from a molten bath of the metallic substance or alloy.

The invention consists in lowering into a metallic bath a former of the general shape desired for the article and drawing the article upwardly from the bath as an extension of the former.

It also consists in chilling the article at the point of drawing or near this point, in compressing and shaping the article by passing it between rolls, in heating the bath from which the article is drawn, in cutting off such supplied heat from the drawing-point, in the case of hollow articles in supplying a gaseous fluid to the interior of the article being formed, in allowing at least a portion of the gaseous fluid thus applied to escape, in drawing the article over a mandrel, in fluid cooling the mandrel, and in the steps and combination of steps hereinafter set forth and claimed.

In the drawings, in which I show one form of apparatus for carrying out my invention, 2 represents a refractory crucible or pot, which is supported on a vertically-movable carrier 3 within a furnace-chamber 4. The furnace-chamber may be heated by gas-burners 5 or

in any other desirable way. When the pot is in raised position, the applied heat is cut off from the surface of the molten metallic bath therein by means of the refractory cover 6 and the sides of the pot or in any other desirable way.

In order to chill and set the metal at or near the drawing-point, I provide either a chilling device which acts by radiation or by jets of air or gases, or both. In the form shown, where the apparatus is illustrated as arranged for drawing a tube or hollow billet, I show a water-cooled ring 7, having a liquid-inlet pipe 8 and outlet 9. This ring fits within the central upward opening of the top 6 and rests upon its projecting flange 10. In the lower inner portion of this water-cooled ring I form an annular air-chamber 11, having perforations 12, through which the air issues to aid in the chilling.

13 represents the air-supply pipe, which leads to the chamber 11.

The former, which starts the article upwardly at the beginning of the drawing operation, is shown as consisting of a pipe or tube 14, the upper end of which is secured to a hollow cross-head 15, having cables or chains 16 leading upwardly to a hydraulic cylinder or other lifting means. The interior of the cross-head is provided with a ring 17, which fits neatly around the mandrel-stem 18. The ball 19 of this mandrel is of hollow projectile form, as shown in Fig. 3, and is placed between oppositely-located grooved shaping-rolls 20. The peripheries of these rolls correspond to the exterior of the hollow bait, and the rolls shape the article as it is drawn upwardly over the interior mandrel. I have shown the bearings 21 of the rolls as slidingly mounted in sliding supports 22, movable on guideways 23. The roll-bearings are adjusted in the support screw-shafts 24, and the supports are moved back and forth by connections 25 with hydraulic cylinders. The rolls may thus be held in adjusted position or drawn back after the article is formed.

The ball 19 is secured, preferably, by screw-threads 26 at the lower end of the hollow pipe 18, and is provided with an inwardly-projecting ring 27, which fits against the inner con-



centric pipe 28. A screw-threaded follower 29 is screwed up within the lower end of the ball and compresses packing 30 between it and the ring 27. Within the pipe 28 is a central air-supply pipe 31, which extends below the end of the pipe 28. A refractory blow-head 32 is molded about the lower end of the pipes and is provided with a central air-channel 33, from which lead the outlet-ports 34. The air thus supplied to chill the interior of the article being formed is allowed to flow back through inlet-ports 35, leading into the space within the pipe 28 and around the pipe 31, and passes out through a pipe 36 at the upper end of this space. The pipe 36 is provided with a control-cock 37, by which the outlet may be throttled, as desired, to keep the pressure within the article being formed.

The pipe 18 at its upper end is screwed in an annular casting 38, having an upper part 39, which is bolted thereto by bolts 40. Suitable packing 41 is interposed between the two parts. A water-supply pipe 42 extends downwardly within the annular space between the pipes 18 and 28 on one side, and above the ends of the pipes 18 and 28 the pipe 42 is flattened, as shown in cross-section in Fig. 5. It extends upwardly through a stuffing-box 43 and is connected to a feed-pipe 44. This water-supply pipe 42 leads to a point near the lower end of the point 26, while a similar outlet-pipe 45 on the opposite side is cut off near the top of the mandrel and connected through a similar stuffing-box to waste-pipe 46.

The air is supplied to the central pipe 31 through a suitable hose connection shown at 47.

The entire mandrel system is preferably supported upon a vertical sliding cross-head 48, which may be lifted by suitable connections 49, leading to a hydraulic lifting-cylinder. The ends of the cross-head 48 may be guided on side supports 50.

In carrying out my process with the above apparatus the steel or other metallic substance or alloy may be poured into the pot in liquid condition or may be supplied cold and gradually raised to a liquid or plastic state. The parts then being arranged in the position shown in Fig. 1 fluid is supplied to the lifting-cylinder for the bait, which moves upwardly slowly and draws a tubular article from the bath. The air-jets and the water-cooled ring chill the article at or near the point of drawing sufficiently to enable the article to take and hold its shape and an air-pressure is preferably maintained within the bait and article being formed by forcing in the air under pressure, this air also serving to chill the inner part of the article. As the bait is lifted it passes over the mandrel and between the shaping-rolls 20, which, together with the mandrel, shape the article while in

a comparatively plastic condition. These rolls are preferably water-cooled by means of fluid-inlet pipes 51, leading through one trunnion, outlet-pipes being supplied through the opposite trunnions. To prevent the heat from injuring the rolls or other part, I preferably use an upper cover 52, made in two or more parts, which are set around the bait and on the cooling-ring.

The water-cooling of the mandrel prevents its excessive heating and also cools the air fed downwardly into the bait and article. When the article has been drawn to the desired length, the bait-lifting device may be stopped, and the cross-head 48 then lifted to draw the mandrel upwardly to a point above the upper end of the article. The shaping-rolls may be pulled apart and the upper end of the article severed by a hot saw or other suitable device. The lower end of the article may be severed from the bath by lowering the pot and allowing the heat to melt away the lower ends and sever the connections with the molten metallic bath or by other desirable means.

The advantages of my invention result from the shaping of articles direct from a molten metallic bath without casting into ingots and afterward shaping by rolling or otherwise.

The method may be used for shaping flat plates, bars, structural shapes, and other articles by lowering into the bath a bait of proper shape and chilling the metallic bath at the point of drawing. In the case of a plate it would be necessary to mechanically pull out the side edges of the article as formed to prevent gradual narrowing of the plate being drawn from a bath. The apparatus may be widely changed and the steps of the method may be varied without departing from my invention, since I consider myself the first to draw a metallic article upwardly from a molten metallic bath.

I claim—

1. The method of forming homogeneous metal articles, consisting in lowering the lower end of a bait into a metallic bath, and gradually raising the same to form an article depending from the lower end of said bait; substantially as described.

2. The method of forming metallic articles, consisting in lowering a bait or former into a molten metallic bath, drawing the article upwardly, and chilling at or near the drawing-point; substantially as described.

3. The method of shaping metallic articles, consisting in drawing the article upwardly from a molten metallic bath, and chilling the same by radiation at or near the drawing-point; substantially as described.

4. The method of shaping metallic articles, consisting in drawing the same upwardly from a molten metallic bath and applying gaseous cooling fluid at or near the drawing-point; substantially as described.



5. The method of forming a metallic article, consisting in drawing the same upwardly from a molten metallic bath and compressing and shaping the same as it is lifted; substantially as described.

6. The method of shaping a metallic article, consisting in drawing the article upwardly from a molten metallic bath, chilling the article at or near the drawing-point, and rolling the article as it is formed; substantially as described.

7. The method of shaping a metallic article, consisting in drawing the article upwardly from a molten metallic bath, applying heat to the bath, cutting off the heat from the article at the drawing-point, and chilling the article at or near the drawing-point; substantially as described.

8. The method of shaping a hollow metallic article, consisting in drawing the same upwardly from a molten metallic bath, supplying a fluid to the interior of the article being drawn, and chilling the same at or near the drawing-point substantially as described.

9. The method of shaping hollow metallic articles, consisting in drawing the same upwardly from a molten bath over an inner relatively stationary gaseous-supply nozzle, and continuously applying a cooling fluid to said nozzle; substantially as described.

10. The method of forming hollow articles, consisting in drawing them upwardly from a molten metallic bath over a relatively stationary shaping-mandrel, and feeding a gaseous fluid into the interior of the article during its formation; substantially as described.

11. The method of shaping hollow metallic articles consisting in drawing the article upwardly from a molten metallic bath, supplying gaseous fluid to the interior of the article, and allowing at least a portion of the fluid to escape during drawing; substantially as described.

12. The method of forming a hollow metallic article consisting in drawing the article upwardly from a molten bath over a shaping-mandrel and rolling its exterior during the forming of the article; substantially as described.

13. As a new article of manufacture, a drawn metallic article formed directly from a molten or plastic bath; substantially as described.

14. As a new article of manufacture, a hollow tube or billet drawn directly from a molten metal bath; substantially as described.

15. As a new article of manufacture, a rolled metallic article drawn directly from a molten bath; substantially as described.

16. The method of shaping hollow articles consisting in drawing the hollow article upwardly from a bath of molten material and around a depending core above the level of the molten bath, and supplying air to the interior of the hollow article through the depending core; substantially as described.

In testimony whereof I have hereunto set my hand.

CLARENCE P. BYRNES.

Witnesses:

GEO. B. BLEMING,  
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