E. G. COOK.

METHOD FOR PRODUCING HOLLOW METAL BODIES.

APPLICATION FILED SEPT. 8, 1916.

1,250,802.

Patented Dec. 18, 1917.

2 SHEETS—SHEET 1.

FIG. 1.

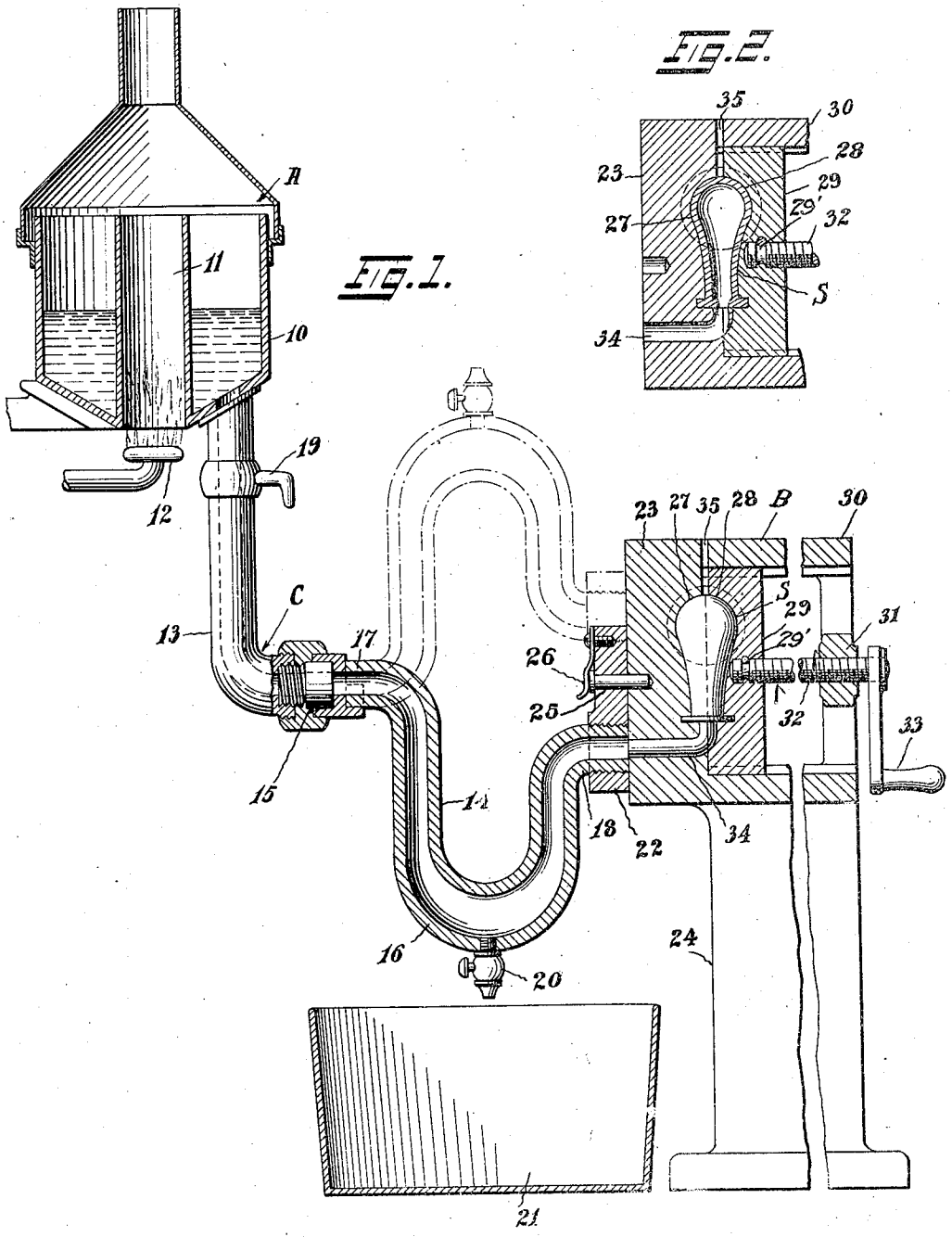


FIG. 2.

Witnesses:

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Inventor:

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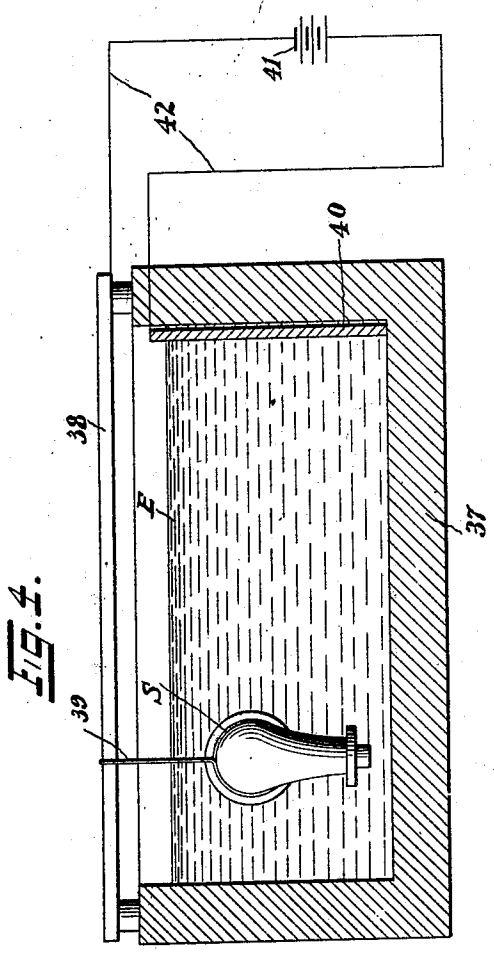


Fig. 4.

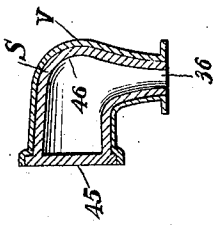


Fig. 6.

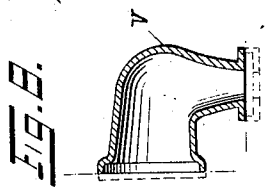


Fig. 8.

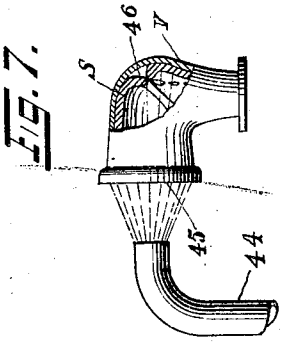


Fig. 7.

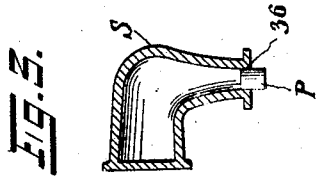


Fig. 3.

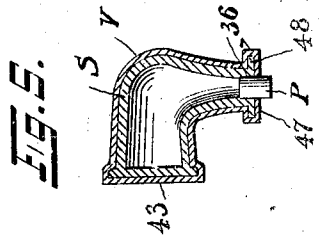


Fig. 5.

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By his Atty. F. H. Richards

UNITED STATES PATENT OFFICE.

EDWARD G. COOK, OF LONG ISLAND CITY, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO COPPER PRODUCTS COMPANY, A CORPORATION OF MAINE.

METHOD FOR PRODUCING HOLLOW METAL BODIES.

1,250,802. Specification of Letters Patent. Patented Dec. 18, 1917.

Application filed September 8, 1916. Serial No. 118,974.

To all whom it may concern:

Be it known that I, EDWARD G. COOK, a citizen of the United States, residing at Long Island City, in the county of Queens and State of New York, have invented certain new and useful Improvements in Methods for Producing Hollow Metal Bodies, of which the following is a specification.

This invention relates to electrodeposition in general, and more especially to methods for electrolytically depositing metals, such as copper, on molds for the purpose of making hollow metal vessels, in which the molds are removed after the metal has been deposited.

In the manufacture of hollow metal-vessels formed exterior to mold-cores by electrodeposition, great difficulty has been experienced in removing the mold-cores from the hollow vessel so formed. With solid metallic mold-cores it was practically impossible to produce such hollow metal bodies at all. By means of the apparatus disclosed in my co-pending application, Serial No. 118,975, filed September 8th, 1916, simultaneously herewith, hollow metal bodies are formed, and with these hollow metal bodies, the manufacture of such hollow vessels has been greatly simplified. The present method contemplates producing such hollow male-mold forms of a metal, alloy or material, of low fusion point, electro-depositing a metal of higher fusion point on such hollow-male mold form, and then removing the mold from such deposited metal by fusion, preferably by heat directed to the interior of the male-mold form.

These and other features, capabilities and advantages of the invention will appear from the subjoined detail description of one specific embodiment of the apparatus for carrying out such method, illustrated in the accompanying drawings, in which

Figure 1 is a schematic view, partly in section, of an apparatus for forming a hollow metal mold.

Fig. 2 is a sectional view of the mold parts for forming such hollow mold.

Fig. 3 is a section of a mold after having been produced.

Fig. 4 is a sectional view illustrating an apparatus for electrically depositing a metal on a hollow mold.

Fig. 5 is a sectional view of the mold after a metal has been deposited thereon.

Fig. 6 is a sectional view showing the mold with metal deposited thereon after two faces of the deposited metal has been removed so as to facilitate the mold removing operation.

Fig. 7 is an elevational view illustrating the mold with the deposited metal thereon, and the means for removing the mold.

Fig. 8 is a sectional view of the completed article.

In the embodiment illustrated, Fig. 1 shows a mold metal reservoir A, a sectional mold B disposed at a lower level than the reservoir A, and a conduit for connecting said reservoir with said mold B.

The reservoir A comprises essentially an annular container 10 to be filled with a metal fusible at a relatively low temperature, a passage 11 through the middle of such container 10, through which is directed the heat or flame from a torch 12, or any other suitable heating medium.

The conduit C comprises essentially a fixed pipe connection 13 and a removable pipe connection 14. The fixed pipe connection 13 has its upper end connected to the bottom of the container 10 and terminates in a bearing 15 at its lower end for receiving one end 17 of the removable connection 14, which is substantially in the form of a goose neck having a loop portion 16 enlarged relatively to the remaining portion of the pipe connection 14. The end 17 of the pipe connection which engages the bearing 15 is preferably disposed at a higher level than the other end 18 of the pipe connection 14 when the goose neck is disposed in its downwardly hanging position. The fixed pipe connection 13 is provided with a valve 19 whereby the communication through the pipe connection 13 may be shut off, and thus the passage from the container 10 shut off.

The goose neck 16 is provided with a valve 20 whereby when the goose neck is disposed in its downwardly hanging position, the liquid contained in said pipe connection 13 below the valve 19 and in the pipe connection 14, may be discharged into the receptacle 21.

The end 18 of the pipe connection 14 is

secured to the pivotal block 22 which is pivotally and removably connected to the frame 23 of the mold B, which frame 23 is illustrated as supported on a standard 24. The block 22 is pivotally connected to the frame 23 by the pin 25 and removably connected to such frame 23 by such pin 25 and the spring 26 on such block, such spring being swingingly mounted so that the pin 25 can be removed and thereupon the block 22 removed from the frame 23.

The frame 23 is provided with a mold face 27 which coöperates with the mold face 28 of the movable section 29 slidably mounted between the standard 24 and the extension 30 of the frame 23. For operating the section 29, there is provided the bearing 31 fixedly connected to the extension 30 and the standard 24 in which the screw 32 is journaled, one end of which screw is connected to the removable section 29 by a groove and pin 29′ and the other of which extends outside of the bearing 31 and is provided with a handle 33 for rotating the same.

The operation of the foregoing is substantially as follows: When the goose neck 16 is swung into its downwardly hanging position, as shown in full line in Fig. 1, the valve 19 is opened, the valve 20 is closed, the mold section 29 secured up tight against the mold face 27, the liquid metal in the container 10, will flow down through the conduit C, and through the passage 34 formed in the frame 23 into and between the mold-faces 27 and 28. As soon as the operator sees that the mold formed by the faces 27 and 28 is filled, which is indicated by the molten metal filling the riser and vent top orifice 35, he will swing up the goose-neck 16, into the position shown in dotted lines, in Fig. 1, thereby shutting off the communication from the end 18 of the conduit goose-neck, to the passage 34, the end 18 being then stopped up by abutting against the upper face of the frame 23, so as to permit the still fluid central portion of the metal in the center of the mold formed by the faces 27 and 28, to discharge through the passage or sprue 34, into the receptacle 21. Due to the low temperature and good heat conducting quality of the frame 23, and movable section 29, which are preferably composed of cast-iron or the like, the metal fed into the same and contacting with the walls of the frame 23 and section 29, is immediately chilled and forms the so-called "chill" or wall body of the fusible mold-core or male-mold to be produced. The un-molten metal within the thin chill, is then allowed to flow by gravity out through the passage or sprue 34, into the receptacle 21, leaving merely the "chill" desired, between the form 23 and the section 29. Thereupon the movable section 29 is quickly drawn away from the frame 23, and the resulting shell or male mold S removed ready for the electro-deposition; and thus far the operation is precisely similar to that shown in my before mentioned co-pending application.

As soon as one mold is so formed, it is only necessary to again draw the movable section 29 tightly against the frame 23, swing down the goose-neck 16, and the action will automatically proceed to form the next mold.

The male-mold or shell S, thus formed, as illustrated in Fig. 3, then has its lower opening 36 closed with a plug P of non-electric conducting material, and is then suspended in an ordinary electrolytic-bath solution E, (Fig. 4) of a metal having a higher point of fusion than the mold forming metal, such as copper, nickel, etc. In the present instance, a tank 37, is illustrated for containing the solution E, in which the bar 38 mounted across the top of the tank is the cathode to which the shell S is connected by the hook 39, and the bar 40 extending into the solution E is the anode, such cathode and anode being connected to a suitable source 41, of electric current by means of the lead-wires 42.

After the current has been turned on, and the shell or male-mold S has been sufficiently coated with the depositing metal, the same is then removed from the bath solution E, and the non-conducting plug P removed, when it will be ready to have the fusible-shell or male-mold S removed from the resulting electro-deposited shell V.

To form the completed article illustrated in Fig. 6, (in this case a phonograph-horn elbow) this is usually done by first cutting or grinding away the end faces 43, and 47 of the deposited shell, so as to expose the end web 45, and remove the bottom flange 48, of the male-mold S, as indicated in Fig. 6, and then applying the flame of a blow-pipe or blast-flame torch 44, while the same is in a vertical position as illustrated in Fig. 7, to the face 45 (Figs. 6 and 7) until the mold shell S has melted away and drops out through the orifice 36. It has been found in practice that if the flame of the torch 44, is first applied to the face 45, until at least partly broken and then to the exterior of the elbow at 46, as illustrated in Fig. 7, the fusible metal at 46 being thus raised to the melting-point and beginning to drop away as at 46, by immediately transferring the torch flame to the interior by way of the orifice already melted in 45, the melting away of the fusible mold-core or shell S will be almost instantaneous, and the remaining metal will frequently crumple up, and drop off very rapidly even without applying the torch to all of the shell S from the interior.

In cases where wax, metals, or alloys, melting at less than the boiling point of

water, are used to form the male-mold or shell S, as for instance the alloy used in fire extinguishing thermo-trips heretofore mentioned as melting at 155° F., instead of using a blow-flame or other direct heat, the shells V containing the male-molds S, may be merely suspended or supported for a short period in boiling water, with equal effect.

It is obvious that various changes and modifications may be made in the several steps of the method, and to the details of construction, without departing from the general spirit of the invention.

I claim:

1. The method of producing hollow metallic bodies comprising:—chilling the surface of a body of metal fusible at a comparatively low temperature contained in a mold to form a hollow mold-core or shell; discharging the entire unchilled fluid metal through the sprue of the shell so as to leave an orifice at the sprue point; closing said orifice with a plug formed of non-electric conducting material; electro-depositing on the exterior of the hollow mold-core or shell a coating of metal of a higher point of fusion than the metal of the mold-core shell; removing the deposited-metal from the mold-core or shell at the end opposite to the orifice end; and removing the inner fusible mold-core or shell from the outer electro-deposited shell by applying heat to the mold-core shell where exposed by the removal of the deposited covering.

2. The method of producing hollow metallic bodies comprising chilling the surface of a body of metal fusible at a comparatively low temperature contained in a mold to form a hollow mold-core or shell; discharging the entire unchilled fluid metal through the sprue of the shell so as to leave an orifice at the sprue point; closing such orifice with a plug formed of non-electric conducting material; electro-depositing on the exterior of the hollow mold-core or shell a coating of metal of a higher point of fusion than the metal of the mold-core shell; removing the deposited-metal from the mold-core or shell at the end opposite to the orificed end; and removing the inner fusible mold-core or shell from the outer deposited shell by applying heat first to the shell where exposed by the removal of the deposited coating, second to the outside of the casing, and third to the interior of the mold core or shell.

3. The method of forming hollow metallic bodies, comprising the following steps; (1) filling a suitable mold cavity having a sprue at the bottom and an air-vent or riser orifice at the top, with a suitable quantity of the metal or material to be molded; (2) and as soon as the outer surface of the body of metal in the mold cavity has been chilled sufficiently to solidify simultaneously cutting off the flow of metal to the mold, and opening the sprue so as to permit the still liquid central contents, of the metal body being formed to flow out through the sprue; (3) removing the molded-body from the mold; (4) electro-depositing thereon an exterior covering or shell of metal or material of higher fusion point than the mold-body; (5) positioning the body so formed so that the mold-body metal will flow out of the same as fast as fused; and (6) submitting the same to the action of a fusing heat.

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