M. V. SMITH.

PROCESS FOR CASTING METALS.

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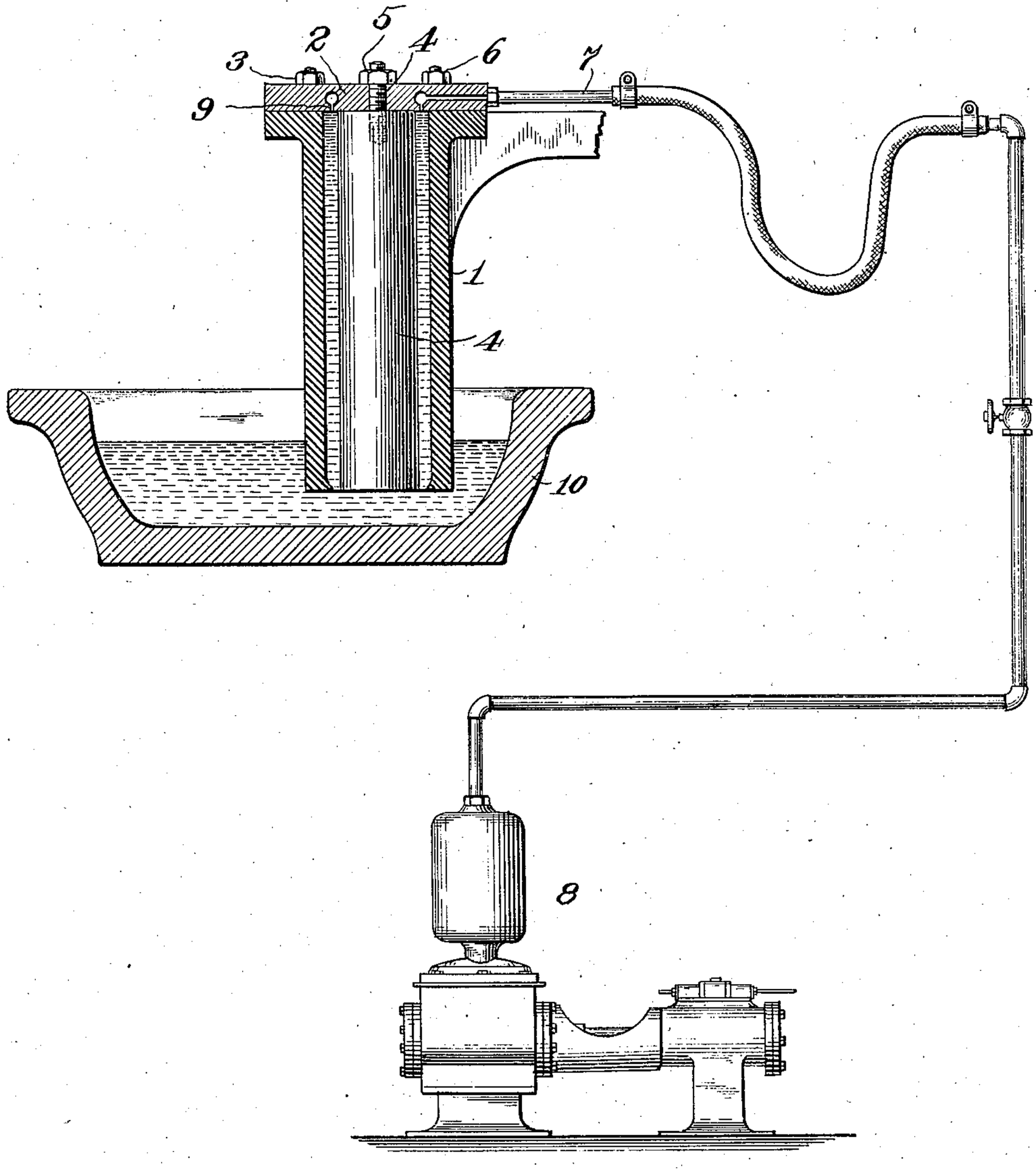

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PROCESS FOR CASTING METALS.

No. 914,679. Specification of Letters Patent. Patented March 9, 1909.

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To all whom it may concern:

Be it known that I, MARTIN VAN BUREN SMITH, a citizen of the United States of America, and a resident of the city, county, and State of New York, have invented an Improved Process for Casting Metals, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

My invention consists in an improved process for casting metals, and particularly to a process for casting copper upon a core of iron, steel or other metal.

When copper is applied in a molten state around a core of other metal such as iron or steel which has been properly prepared to receive it, such copper in cooling contracts around the core and is caused to adhere so closely to the surface thereof as to cause the two metals to be practically one. The adhesion appears to be a mechanical one due to the copper entering minute interstices contained in the core, so that there is virtually a bonding between the two metals, which, if properly effected, makes them inseparable, and enables the product as a whole to be treated as if it were one integral piece of metal. An iron or steel core covered with copper in this way may be rolled and drawn down to fine wire, but the proportion of copper and core is substantially maintained. The success of this process is necessarily dependent upon the union between the two metals, and, to insure this proper union, the surface of the core is first treated by being rendered as smooth as possible, then cleaned so as to remove any surface dust, and is finally treated with a chemical whereby every trace of grease is removed. The cleaning is conveniently effected by a sand blast, this cleaning not only the extreme outer surface, but also the exposed pores. The chemical treatment also cleans out the pores as well as the outer surface, leaving the material in a condition to receive the copper when applied with great pressure. The shrinkage of the molten copper upon the comparatively cold core forces particles of copper into the pores or interstices, as above set forth, with the result that, under the best conditions, union is almost perfect. I have found, however, that the best conditions have been difficult to obtain in the past, and that perfect union has not always resulted even though the conditions appeared to be ideal. It seems that air has been locked in between the surface of the core and the shell, thereby preventing adhesion. To prevent entrapping air it has been attempted to plunge a mold, open at the bottom, into a crucible of copper, whereby the copper shall be forced upward between the mold and the core, expelling the air upward as it rises. This has only obviated the trouble to a limited extent for the reason that the metal in rising will not force all the air upward, a thin skin of air seeming to cling to the face of the core, in spite of the metal rising around it. Moreover, the pores themselves also contain more or less air which is not expelled in this way. Furthermore, it will be well understood, to plunge a mold of any depth into a crucible of this description necessitates the employment of a very deep crucible with a very large quantity of molten copper contained therein. It is very difficult to keep such a large mass of molten metal at an even temperature, and while this difficulty is not, perhaps, unsurmountable, it is a very serious one commercially.

In carrying out my invention I exhaust the air away from the face of the core, and apply the molten copper thereto only as the air is exhausted. By this means I get rid of not only the air contained freely around the face of the core, but the air which would otherwise cling to the face thereof and be contained within the surface pores is also carried off, so that the core is in an ideal condition to receive the copper, and, upon cooling, the said copper will form a perfect union therewith. Again, by mounting the core in a mold open at the bottom and connected at the top with air exhausting means, I am enabled to utilize atmospheric pressure for lifting the copper into the mold as the air is exhausted therefrom, whereby the mold may be dipped at its lower end into a shallow crucible such as contains but a comparatively small quantity of the molten metal. The specific gravity of copper being somewhere between 8.5 and 9.0, the atmosphere will theoretically support a column thereof between three and four feet in height. This enables me to readily employ a mold about three feet in depth, which is ample for the purpose.

Another convenience in the employment of my present invention is that, after the mold has been filled, it may be lifted out of the crucible without it being necessary to close the lower end thereof mechanically, as

the air pressure will hold up the molten metal contained therein until it has cooled to a point where it will not flow, though the lower end of the mold may be closed after the mold is removed from the crucible, if desired. It will be understood that in the old way of casting by plunging the mold into a deep crucible, it was necessary to close the lower end of the mold before removing the same from the crucible, and this has proved to be a difficult task and has involved expensive apparatus.

In order that my invention may be fully understood, I will now proceed to describe a simple form of apparatus in which the process may be carried out, and also to describe the process in detail as carried out in such apparatus, and will then point out the novel features in claims. Such an apparatus is illustrated in the accompanying drawing, the mold and crucible being shown in sectional elevation, and the exhausting apparatus in side elevation.

The mold comprises a body portion 1, and a cap 2 secured thereto by bolts 3. A core 4 is supported by the cap piece 2, being bolted thereto by means of a bolt 4, which is tapped into the core, and which passes through the cap 2, and is provided on the outside thereof with a nut 5. The inside bore of the mold 1 is larger than the outside diameter of the core 4, the space between the mold and core being the space for receiving the molten copper, and the width thereof constituting approximately the thickness of the shell of copper upon the core when the casting is completed. The upper cap is provided with a hollow chamber 6 which is connected by means of piping or hose 7 with a suction pump 8 or other exhausting apparatus. The chamber 6 communicates with the space between the mold and the core through minute orifices 9. The orifices 9 are preferably so small that the molten copper will not pass through them, though they will be large enough to permit the discharge of all the air. A shallow crucible 10 is provided, such crucible containing a mass of the molten material which is to be cast around the core 4.

In carrying out the process, the mold with the core therein will be plunged at its lower end into the metal contained in the crucible 10, and air will then be exhausted from the mold by means of the exhausting apparatus 8. As the air is exhausted from the mold, and hence from the face of the core 4, the copper will be gradually drawn up into the mold, until finally the mold is filled. When the mold is so filled the same may be removed from the crucible and the copper allowed to cool. The vacuum will preferably be maintained until the copper is cooled sufficiently to cause it to set, or, if preferred, the lower end of the mold may be mechanically closed in the usual manner. As the copper contracts it will be forced into the pores of the metal core 4, until finally the union between the shell and the core is complete. The cap and the mold may now be freed from each other by removal of the bolts 3, and the mold removed. The mold will readily come away from the shell of copper because the contraction thereof will have caused the same to shrink away from the inner surface of the mold, as will be well understood. By removing the nut 5, the core with the shell of copper thereon may be removed from the cap, and the casting process will now be complete.

What I claim is:

1. The herein described process of applying to a core of one metal an outer shell of another metal which consists in mounting the core in a mold, exhausting the air from the mold and the surface of the core, and causing the other metal to flow into the mold around the core in the same direction the air flows therefrom.

2. The herein described process of applying an outer shell of copper to a core of another metal which consists in first preparing the surface of said metal core in such a way as to leave the external pores open, in then exhausting the air from the surface of the said core, and in then surrounding the core with molten copper and allowing the copper to cool, whereby, in cooling, the shrinkage will force portions thereof into the exposed pores of the core, substantially as specified.

3. The herein described process of applying an outer shell of copper to a core of other metal, which consists in mounting the core in a mold having an open bottom, plunging the bottom of the mold into a shallow crucible containing molten copper, and exhausting air from the space between the mold and the outer surface of the core, whereby to remove air from the surface of the core, and to cause the molten copper to be forced upward into the mold around the core by atmospheric pressure.

4. The herein described process of casting, which consists in mounting a core in a mold having an open bottom, plunging the bottom of the mold into a shallow crucible containing molten metal, exhausting the air from the mold, whereby to remove air from the surface of the core and to cause the molten metal to be forced upward into the mold around the core by atmospheric pressure, and in maintaining the cast metal in position by atmospheric pressure until it sets after removing the mold from the crucible.

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Witnesses:
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