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PROCESS FOR COMPOSITE CASTING

Filed Nov. 22, 1929

Fig. 1.

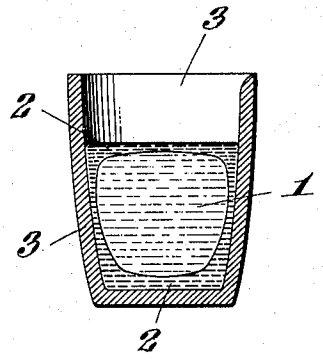
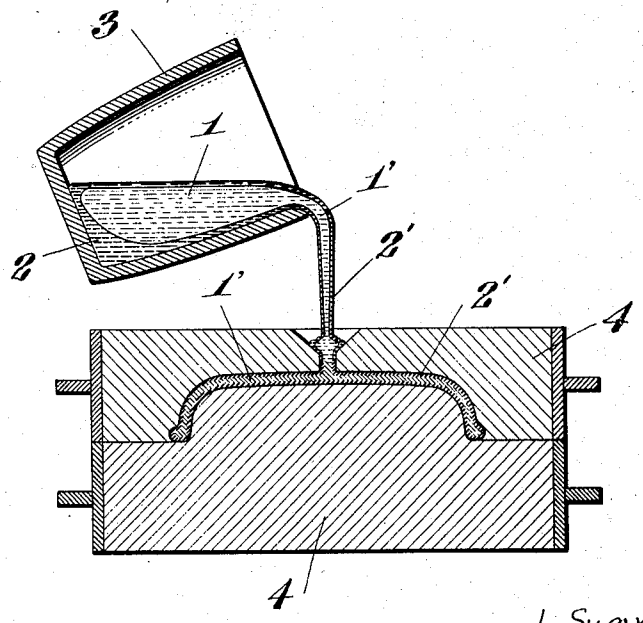


Fig. 2.



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PROCESS FOR COMPOSITE CASTING

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Our invention relates to a novel process for casting two different kinds of metals melted and mixed together and the one sheathed on the other. The invention consists in that two kinds of simple metals or alloys which do not readily make alloy with each other, one metal having qualities of less specific gravity, higher melting point and greater surface tension, than the other which of course, must have more specific gravity, lower melting point, less surface tension than the former and moderate adhesive power as regards the former, when melted jointly or separately and mixed together and poured into the mould, the metal of lower melting point is sheathed uniformly over the metal of higher melting point at any desired thickness.

The object of the invention is to provide a novel process for metal sheathing by merely casting two metals, one of which forms the core and the other forms the sheath, both provided with aforesaid relative qualities. Thus the whole surface of a cheap and strong metal, such as iron, may be coated to any desired thickness with a comparatively small quantity of a costly and excellent metal such as copper, in a very simple and economical way so that the defect of the core metal may be remedied while keeping its excellent nature, and the merit of the sheath metal may be satisfactorily developed.

According to the present invention, two kinds of simple metals or alloys of a different nature are melted jointly or separately and are mixed together in a vessel and then poured into the mould.

With a peculiar relation, the two metals do not become mingled together in the mould, but the core metal becomes evenly sheathed with the other metal.

The relations between two metals, which form the essential feature of the present invention, are that they differ in their melting point, specific gravity, and surface tension; that they never make an alloy even though they are stirred up at the pouring temperature of the metal of the higher melting point; that the metal of the higher melting point has less specific gravity and greater surface tension, and that the sheath metal has a moderate adhesive power to the core metal when they are brought in contact at melting state.

The accompanying drawings illustrate the method of carrying out the present invention,

Fig. 1 shows a sectional side elevation of metals melted together in a vessel. Fig. 2 is a sectional side elevation showing the vessel inclined so as to pour molten metals into a mould.

From evidence, it is believed that when two kinds of metals which do not make alloy with each other, are melted and mixed together in a vessel, the metal of greater specific gravity occupies the lower part of the vessel and the metal of less specific gravity takes the upper position, and in the combination of two metals which have special qualities as above mentioned, the boundary line between the different metals is formed as shown in Fig. 1. If molten cast iron (specific gravity about 7.2, melting point about 1300° C.) and copper (specific gravity 8.8, melting point 1083° C.) are put together in the same vessel, the cast iron (1) first tends to take a spherical shape of the least surface area while the copper (2) at the bottom, by its adhesive power to cast iron and to the surface of the vessel rises up between the cast iron (1) and the inner surface of the vessel (3) due to the capillary action caused between them as in the case of water and glass tube, because of the fact that the surface tension of cast iron (1) is greater than that of copper (2) at the same temperature. In this manner, if molten metal in the vessel is not too deep, the copper ascending in between the iron and vessel reaches to the uppermost surface of the molten metal and covers all over the surface as shown in Fig. 1. Hence, if the vessel (3) is inclined in this state and molten metals therein are poured into the mould (4), the mixture consisting of iron (1′) in the centre and copper (2′) at the outside runs into the mould as shown in Fig. 2, and results in a special casting, the core of which is iron sheathed with copper.

The temperature of molten metals, especially at the time of pouring into the mould (casting temperature) and the depth of

molten metals in the vessel affect the performance of the sheathing action. Therefore there are certain necessary conditions for the accomplishment of the said sheathing action as follows:—

1. Two metals to be used for sheathing purpose should differ in their specific gravity and melting point between less specific gravity and higher melting point, the other with greater specific gravity and lower melting point.

2. Two metals should not make alloy with each other at their casting temperature. Even if they are stirred up in the same vessel they should soon separate from each other after stirring stops.

3. Two metals should be adhesive to each other at casting temperature, provided they never make alloy.

4. The sheath metal should have less surface tension relative to the core metal at the same temperature, in other words, the sheath metal should have far more fluidity than the core metal at the same temperature.

5. The sheath metal should have its best fluidity down to the lowest temperature, forming an unbreakable coating down to solidification.

Combination of simple metals or alloys fulfilling the above essentials are such as cast iron (iron alloys) and copper or copper alloys; cast iron and lead; cast iron and tin; cast iron and other non-alloying heavier metals; zinc and lead; aluminium and lead etc., the former of each combination forming the core metal and the latter the sheath.

It is rather rare to find a combination of metals which completely satisfy the above essentials, most metal generally lacking one or more of the important qualities. Moreover, when simple metals or alloys are melted, oxides of metals or slugs formed at the surface of molten metals give hindrance to the perfect formation of the metal sheath.

Thus it becomes necessary to add some auxiliary agents for supplementing or augmenting the desired quantities and preventing the undesirable reactions. In view of preventing the oxidation of molten metals, one or more deoxidizing agents, such as aluminium, phosphorus, magnesium and arsenic may be added into the molten metals before being poured into the mould. For removing slugs and protecting the surface of the molten metals, one or more fluxes, such as ammonium chloride, borax, alum, and chalk may be used.

In the following, a practical example for carrying out the present invention is explained:

Gray or white cast iron is first melted and then 5 to 50 percent of bronze is added thereto.

To the molten mixture, the amount of which is called one hundred percent, the following percentages of auxiliary agents are added.

	Per cent
Phosphorus	0.01 –0.03
Arsenic	0.002–0.005
Borax	0.03 –0.06
Aluminium	0.10 –0.60
Chalk powder	0.015–0.025

After the above procedure is performed, the mixture is stirred up and after having remained at rest for a while is poured into the mould.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed we declare that what we claim is.

1. A process for casting two different kinds of metals with one metal acting as a core and the other metal as a surrounding sheath, said metals having the property of not alloying with each other, one metal having less specific gravity, higher melting point and greater surface tension than the other and the other metal having greater specific gravity, lower melting point and less surface tension and being provided with moderate adhesive power to the former, and having a good fluidity and being adapted to form a strong sheath when solidified; said process consisting in mixing and melting said metals together in a vessel while being stirred, then permitting said metals to remain at rest for a while thereupon pouring them into a mould and permitting them to solidify, thereby forming a sheathing of the metal of lower melting point around the metal of higher melting point.

2. In a process for casting two different kinds of metals as set forth in claim 1 in which the metal of higher melting point is selected from iron and the metal of lower melting point is selected from a group consisting of copper, copper alloys, lead and tin.

3. In a process for casting two different kinds of metals as set forth in claim 1 in which the metal of higher melting point is selected from zinc and aluminium and the metal of lower melting point is selected from lead and lead alloys.

4. A process for casting two different kinds of metals as set forth in claim 1 in which the metals are selected from a group consisting of cast iron, copper, copper alloys, lead, tin, zinc, aluminium and lead alloys are mixed, melted and stirred together with a suitable quantity of auxiliary agents containing phosphorus arsenic, borax, ammonium chloride, aluminium powder and chalk powder.

5. A process for casting non-alloying metals to form a core of one metal and a sheathing of the other metal, which process consists in melting from 5% to 50% of cast iron with 95% to 50% bronze thereby form-

ing a 100% unalloyed mixture; then adding the following amounts of auxiliary agents: 0.01% to 0.03% phosphorous, 0.002% to 0.003% arsenic, 0.03% to 0.06% borax, 0.10% to 0.60% aluminium and 0.015% to 0.025% chalk powder; then stirring said agents well in the mixture to rest a suitable length of time, thereupon pouring the mixture into a mould and permitting it to solidify thereby forming a core with a surrounding sheathing.

In testimony whereof we have affixed our signatures.

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