

L. B. TEBBETTS, 2D.  
COMPOSITE METAL ARTICLE.  
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1,079,035.

Patented Nov. 18, 1913.

Fig. I.

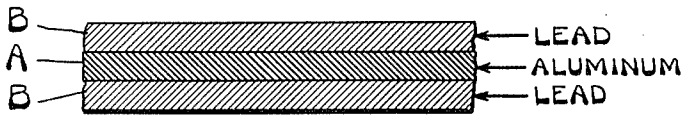
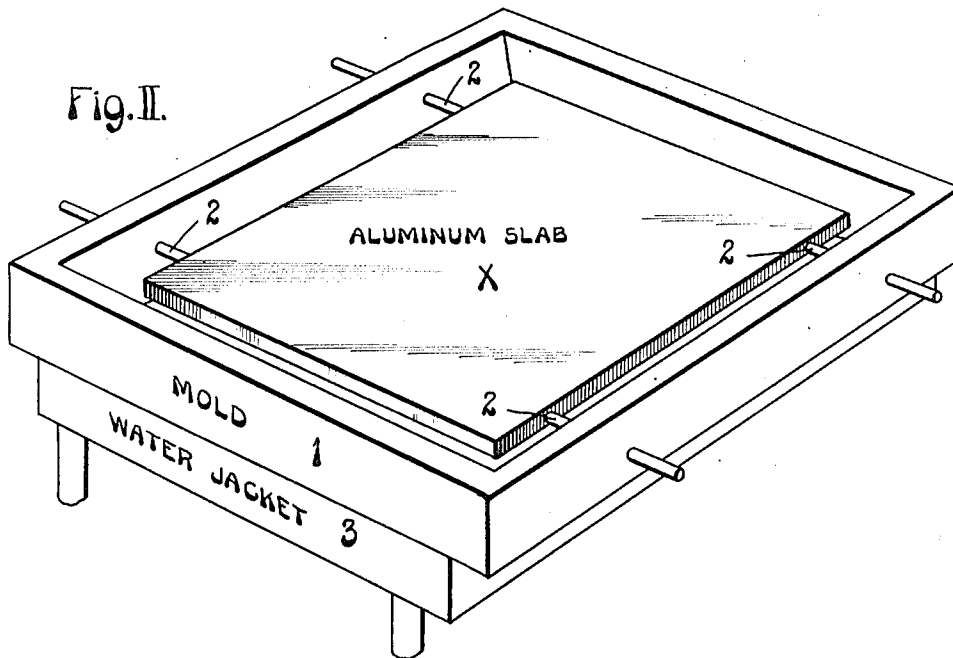


Fig. II.



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# UNITED STATES PATENT OFFICE.

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## COMPOSITE METAL ARTICLE.

1,079,035.

Specification of Letters Patent.

Patented Nov. 18, 1913.

Application filed September 23, 1912. Serial No. 721,819.

*To all whom it may concern:*

Be it known that I, LEWIS B. TEBBETTS, 2d, a citizen of the United States of America, residing at the city of St. Louis, and State of Missouri, have invented certain new and useful Improvements in Composite Metal Articles, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to composite metal articles, such as metallic sheets, made of layers of different metals having varying properties, the object in the production of such a composite metal article being to provide, in the same unitary metal body, layers of metal of a specifically useful function, and another layer of metal of a specifically useful function different from that of the first named.

A further object of my invention is to provide a composite metal body composed of certain specific metals of different nature so united to each other as to prevent the alloying of metal in one layer with the different metal in an adjoining layer.

It is a well known fact that soft metals, such as tin and lead, are of such nature as to be highly valuable for various uses; especially where the metals to be employed are subjected to chemical action and therefore liable to corrosion. These metals being soft are, however, unsuitable for use alone in many instances, owing to their lack of rigidity, strength and stiffness.

My improvement contemplates the production of a composite metal article in which soft metals, such as tin and lead, either individually or combined, or having included therewith other non-corrosive soft metals, are used as the outer elements of the composite metallic article, and in which the desired rigidity, strength and stiffness is afforded by an intermediate element or core of plain aluminum, or aluminum alloy. The invention also contemplates the production of such a metallic body in a manner to avoid alloying of the outer metals with the core metal so that the virtues of the soft metals will not be altered, thereby acquiring a composite metal article in which the outer soft

metals will be of the same meritorious nature as they would be if used individually, with the aluminum core or intermediate element affording all the requisite rigidity, strength and stiffness lacking in the soft metals it serves to reinforce.

In the drawings: Figure I is a cross section, illustrating my composite metal. Fig. II is a perspective view, showing the mold utilized in producing ingots of my composite metal.

My composite metal comprises an intermediate layer A of aluminum or aluminum alloy, and outer layers B of other metal, softer than the aluminum or aluminum alloy, the softer metal being, for instance, lead, tin, an alloy of lead and tin, or an alloy of lead and antimony. If the inner layer is aluminum alloy, such alloy may comprise either not over 1½% of manganese, and the balance aluminum, or not over 2% of copper and the balance aluminum. The alloy of lead and tin used in the outer layers may comprise these metals in equal proportions, or in any other suitable proportions, and the alloy of lead and antimony should comprise not over 16% of antimony and the balance lead.

To produce a commercial composite metal, made up of individual layers, including an inner layer of aluminum or aluminum alloy, and outer layers of softer metals, such as those I have referred to, and in which the layers are permanently united, without the different metals in the adjoining layers being alloyed with each other, to the great detriment of the product, it is essential that the layers be joined by the process I will proceed to set forth.

For the sake of simplicity I will, in the following description, refer to the intermediate layer of my composite metal article as of aluminum, with the understanding that such term includes an aluminum alloy such as I have mentioned. I first produce a slab X of aluminum, which is rolled to a desired thickness. This slab is introduced into a mold and suitably supported therein, for example, in the manner illustrated in Fig. II, in which the slab is shown supported by pins 2 mounted in the walls of the mold.

These pins, or any substitute therefor, are utilized to so support the slab X that it will be free of contact with the bottom of the mold and the mold walls. The slab having been properly placed in the mold, I next pour molten soft metal into such mold that is of the description utilized for the production of the outer layers of my composite metal. This molten metal is sufficient in quantity to inclose the aluminum slab and, when the molten metal becomes cooled, there is present in the mold an ingot comprising an outer incasing body of the soft metal employed and an inner or core body of aluminum. Cooling of the ingot in the mold is preferably facilitated by circulating water through the water jacket 3. The ingot of metal comprising an aluminum core and outer casing of soft metal is then taken from the mold and, having been scraped and brushed, is rolled in a rolling mill until the metal has been reduced to a desired thickness, say, about one-fifth of the original thickness of the ingot, the initial rolling operation being one involving severe and rapid pressure by the rolls. When the ingot has been rolled as mentioned, it is in a condition that may be termed "broken down", and, thereafter, the slab that has been produced by the initial rolling may be rolled to any necessary further degree by passing it between the rollers the same as in rolling a slab or sheet composed of only a single layer of metal.

I desire to here state that I am aware efforts have heretofore been made to produce composite metal articles in which metals softer than aluminum have been fused to such aluminum, but, in so far as I am aware, all of these efforts have involved the carrying out of a method that resulted in the aluminum being alloyed with the metal fused thereto, as distinguished from my composite metal in which the aluminum is so united to the metal as to avoid fusing of the two metals, thus providing for each retaining its original identity and merits.

If the elements of a composite metal article, such as enter into my composite metal article, are combined by following the steps heretofore proposed to be followed, the outer metals are deteriorated in nature to such a degree as to render the product of little commercial value as compared with the commercial value of my composite metal article for the use intended. For illustration, if a layer of tin is fused to a layer of aluminum, the two metals become alloyed at their junction, resulting in an alloy at this point of such brittleness as to detract materially from the ductility of the product. As another example, if the two layers of metal are aluminum and lead, and these are fused to

each other, a dross-like alloy is derived, which prevents satisfactory union of the two metals, and produces such a soft substance at the junction of the metals as to render the product very inferior in nature as compared with my product in which the metals are unalloyed, and each metal retains its original identity.

When a composite metal such as herein described is so produced as to result in an alloy of the outer soft metal and the aluminum in the intermediate layer, the number of layers of metal is increased by the presence of two layers of alloy at opposite sides of the layer of aluminum. Therefore, inasmuch as alloys of tin and aluminum and lead and aluminum are useless in the arts, the product is depreciated in a degree proportionate to the existence of the alloys therein. The presence of such alloys detracts greatly from the utility of the composite metals for the reason that the metals cannot be properly worked in various operations necessary to manufacturers, such as spinning, drawing and stamping. This is due to the alloys weakening the composite metal and rendering it only of such strength as is indicated by its weakest part, viz., that comprising the alloy.

It is well to add in conclusion that the highly desirable characteristic of my composite metal article, namely: the feature of the aluminum and soft metal layers of the metal being unalloyed with each other, is derived by reason of the aluminum core being in an unmolten state when the soft metals are placed therearound in a suitable mold, thereby causing the molten soft metals to be chilled by the aluminum during the molding operation, without opportunity for the alloying of the aluminum with the soft metals. The subsequent operations of rolling the cast ingot result in the unalloyed metals being caused to adhere directly to each other; consequently, when all of the steps necessary to the production of my metal have been carried out, a metal article is acquired in which the outer soft metals and the aluminum core are present in unalloyed condition, and each metal is susceptible of performing its individual function, as contemplated, without detrimental effect thereon by the other metal.

I claim:—

1. In a composite metal product, an intermediate element comprising aluminum, and outer elements of metal softer than said intermediate element; the said outer elements directly adhering to said intermediate element and unalloyed therewith.

2. In a composite metal product, an intermediate element of aluminum, and outer elements of metal softer than said inter-

mediate element; the said outer elements directly adhering to said intermediate element and unalloyed therewith.

5 3. In a composite metal product, an intermediate element comprising aluminum, and outer elements comprising lead directly adhering to said intermediate element and unalloyed therewith.

4. In a composite metal product, an inter-

mediate element comprising aluminum, and 10 outer elements comprising lead and tin directly adhering to said intermediate element and unalloyed therewith.

LEWIS B. TEBBETTS, 2D.

In the presence of—

A. J. McCAULEY,

E. B. LINN.