

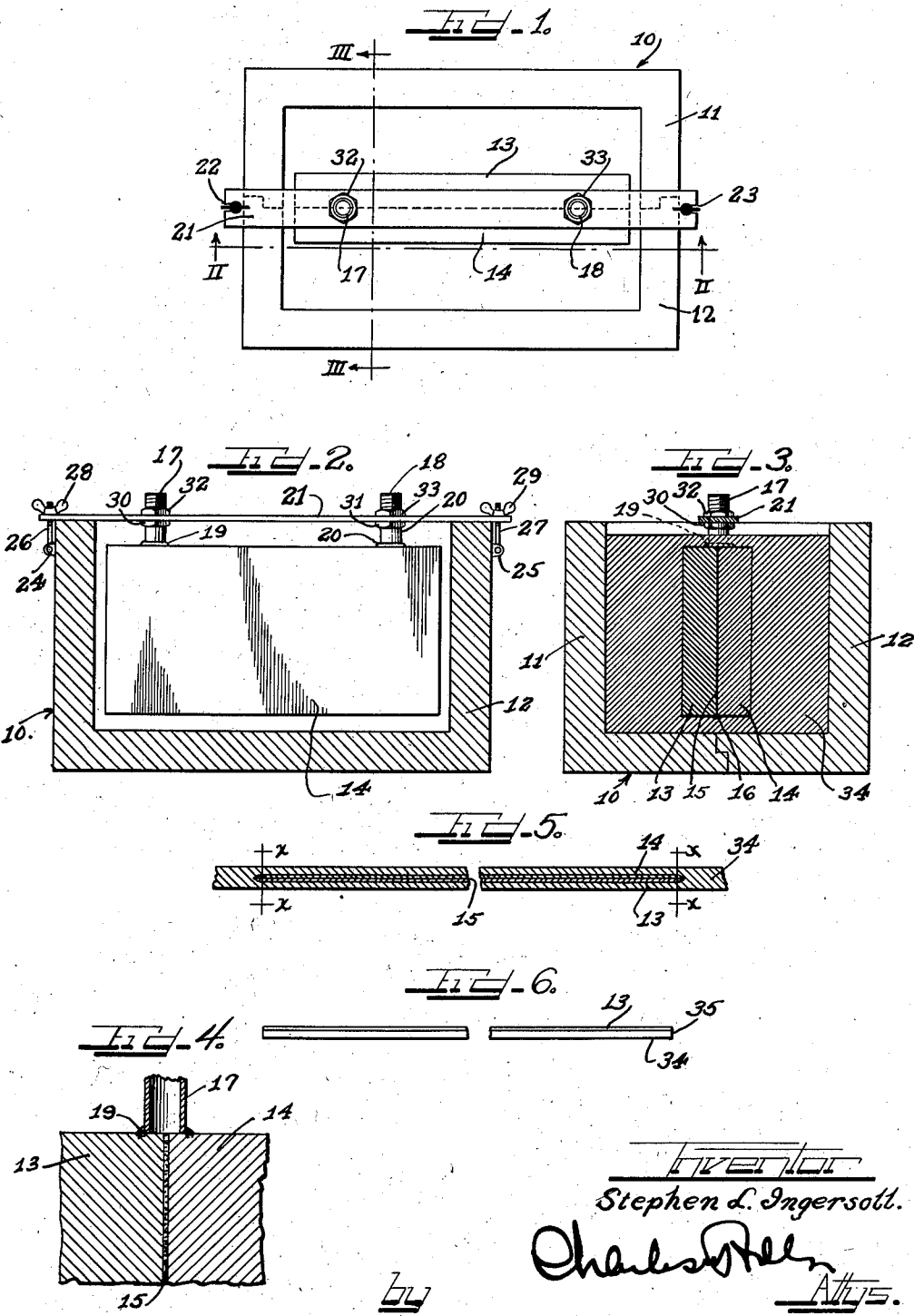
Sept. 28, 1937.

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2,094,538

METHOD OF CASTING COMPOSITE METAL INGOTS

Filed Nov. 15, 1934



UNITED STATES PATENT OFFICE

2,094,538

METHOD OF CASTING COMPOSITE METAL
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Application November 15, 1934, Serial No. 753,079

12 Claims. (Cl. 22—203)

This invention relates to a method of making composite metal ingots and includes apparatus for carrying out the process.

The invention also relates to a method of making composite bimetal articles composed of dissimilar metals.

More specifically this invention relates to a method of mounting slabs of metal in a mold so that molten metal may be cast entirely around the slabs.

This application is a continuation-in-part of my application Serial No. 712,893 filed February 26, 1934.

According to this invention a pair of metal slabs are placed in juxtaposed relation with a separating medium therebetween. The adjoining edges of the slabs are welded together to form an envelope between the slabs for the separating medium. The slabs are then inserted in a mold and a molten metal is cast entirely around the slabs. Great difficulty has been encountered in accurately positioning the slab insert in the proper spaced relation from the walls of the mold so that the molten metal will flow entirely around the slabs to form an ingot with the slabs at the center thereof. In my copending application above referred to I have pointed out that the slab insert may be suspended, by means of bolts anchored into the top surface of the slab, from a supporting bar which rests on the top of the mold. In many instances, however, the bolts soften and melt during the casting operation so that the slab is permitted to drop to the bottom of the mold. I have now found that it is desirable to weld breather pipes or vent tubes along the top surfaces of the slabs in communication with the space between the slabs for permitting the escape of gases from the envelope formed between the slabs. I have also discovered that these breather pipes or tubes provide excellent means for supporting the slab insert in proper position in the mold. The tubes therefore perform a dual function of venting the space between the slabs and supporting the slabs in proper position. Since the tubes are hollow and of a greater diameter than the heretofore suggested bolts they can rapidly dissipate heat during the casting operation and are not melted.

It is therefore an object of this invention to provide venting and supporting means for slab inserts used in preparing composite metal ingots.

Another object of this invention is to provide a process for forming composite metal ingots whereby a metallic slab insert can be positioned in spaced relation from the walls of a mold.

A further object of this invention is to provide apparatus for securely positioning metal slabs in a mold so that molten metal may be cast entirely around said slabs.

A further object of this invention is to provide a process for the formation of composite metal ingots which prevents the overheating of the slab metal forming the core of the ingot.

Other and further objects of this invention will be apparent to those skilled in the art from the following specification and drawing which form a part of this specification.

On the drawing:

Figure 1 is a top plan view of a sectional mold having a pair of welded together metal slabs mounted therein.

Figure 2 is a vertical cross-sectional view taken substantially along the line II—II of Figure 1.

Figure 3 is a vertical cross-sectional view taken substantially along the line III—III of Figure 1.

Figure 4 is an enlarged fragmentary cross-sectional view illustrating the method in which a breather pipe is welded to the insert slabs.

Figure 5 is a broken cross-sectional view of an ingot prepared according to this invention which has been rolled into sheet form.

Figure 6 is a broken end elevational view of a composite sheet of metal prepared according to this invention.

As shown on the drawing:

In Figures 1, 2 and 3, the reference numeral 10 indicates a conventional ingot mold composed of half sections 11 and 12. A pair of rectangular metal slabs 13 and 14 in juxtaposed relation with a separating material 15 therebetween are mounted in the mold. The slabs 13 and 14 are welded together along adjoining peripheral edges as shown at 16 (Figure 3) to provide an envelope for the separating material 15.

According to this invention metal pipes or tubes 17 and 18 are welded at 19 and 20 to the top of the metal slabs 13 and 14 so that the pipes will be in communication with the space between the slabs. The weld 16 obviously does not extend across the space covered by the pipes 19 and 20. The pipes 17 and 18 extend above the top of the mold as shown in Figures 2 and 3.

A supporting bar or rod 21 of sufficient length to extend across the top of the mold 10 is provided with apertures permitting the pipes 17 and 18 to extend therethrough. The ends of the bar 21 are bifurcated as at 22 and 23 (Figure 1) and the bar rests on top of the side walls of the mold as shown.

The side walls of the mold are provided with

integral lugs or ears 24 and 25. Bolts 26 and 27 are pivoted in the ears 24 and 25 and are adapted to be swung into the bifurcated ends 22 and 23 of the rod 21. Wing nuts 28 and 29 are threaded onto the bolts 26 and 27 for clamping the bar 21 onto the mold 10.

The pipes 17 and 18 are threaded as shown in Figures 2 and 3. Nuts 30 and 31 are screwed down over the pipes 17 and 18 in equal spaced relation from the top of the slabs 13 and 14. These nuts 30 and 31 are positioned below the supporting bar 21 and serve to space the slabs at a proper distance from the supporting bar. The bar is then inserted over the pipes 17 and 18 with the ends of the pipes extending thereabove. Nuts 32 and 33 are then threaded around the pipes 17 and 18 to clamp the bar 21 in fixed position with respect to the slabs.

This method of mounting the slabs in the mold securely holds the slabs in the proper spaced relation from the walls of the mold and at the same time provides means for venting the space between the slabs to prevent an overheating of the slabs during the casting operation and to allow escape of gases from the envelope formed between the slabs. If desired, air, nitrogen or other gas may be blown thru the pipes to control the cooling of the slabs during the heating operation. For example, a compressed air line may be secured to pipe 17 and air may be circulated thru the space between the slabs escaping thru the other pipe 18.

As shown in Figure 3, metal 34, of another composition, is cast entirely around the slabs 13 and 14 to form the composite ingot with the slabs as a core therein. The breather pipes 17 and 18 are preferably of the same composition as the cast metal 34 so that the pipes are fused to the cast metal and form a part of the ingot. The nuts 30 and 31 prevent the slabs from rising in the mold during the casting operation while the nuts 32 and 33 prevent the slabs from dropping to the bottom of the mold. The supporting bar 21 is securely affixed in proper position on the mold by means of the bolts 26 and 27.

It should be understood that a plurality of supporting bars 21 may be used when large ingots are being formed. Thus, a bar 21 may extend across the width of the mold with one breather pipe extending therethrough while another supporting bar may extend across the width of the mold at the other end thereof with the other breather pipe extending therethrough.

The invention provides for the dual use of the breather pipes in that they serve as vents for the space between the slabs and at the same time provide means for supporting the slabs in the mold.

After the ingot has solidified it is stripped from the mold and rolled into sheet form as shown in Figure 5 wherein the cast metal 34 is integrally united to the slabs 13 and 14 and forms a backing for the slabs which have now been rolled into thin sheet form as indicated. The slab metal separating medium 15 between the rolled slabs 13 and 14 has prevented these metals from joining so that when the rolled ingot shown in Figure 5 has its peripheral edges clipped off along the lines X-X, two composite metal sheets such as the sheet 35 shown in Figure 6 are formed. The sheet 35 is composed of a thin surface layer of the slab metal 13 backed with a layer of the cast metal 34 integrally united therewith.

The slab metals may be any ferrous or non-

ferrous metals such as stainless steel alloys, copper or the like while the cast metal may be any other metal such as mild steel, iron or the like. The process is particularly useful in joining ferrous metal with slabs of non-ferrous metal, such as copper or alloys thereof which usually have a melting temperature of at least 300° F. lower than that of the poured ferrous metal. The separating medium selected will depend upon the composition of the slab metals. For example chromic acid (CrO₃) or chromium oxides, red lead, sodium silicate and the like may be used with stainless steel slabs while one or more of these materials or copper oxides may be used with copper slabs.

Having now described my invention, I am aware that numerous details of the process and apparatus may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim:

1. The method of forming composite metal ingots, comprising the steps of placing metal slabs in juxtaposition with an interstice therebetween containing a weld preventing material, sealing said slabs together about their edges whereby to enclose such interstice, securing a breather pipe to said slabs in a manner providing communication with the interstice, depending said slabs from said breather pipe, ventilating said slabs by forcing a cooling medium through said vent pipe into such interstice, and casting entirely about said depending slabs a molten metal of different characteristics than the slab metal concurrently with such ventilation.

2. The method of forming composite metal ingots, comprising the steps of placing metal slabs in juxtaposition with an interstice therebetween containing a weld preventing material, sealing said slabs together about their edges whereby to enclose such interstice, securing a breather pipe to said slabs in a manner providing communication with the interstice, depending said slabs from said breather pipe, casting entirely about said depending slabs a molten metal of different characteristics than the slab metal, and ventilating said slabs by forcing a gas through said vent pipe into such interstice.

3. The method of forming composite metal ingots, comprising the steps of forming an envelope by placing metal slabs in close face to face relation with a weld preventing material between such faces and sealing together the edges of said slabs, securing a plurality of vent pipes to an edge of such envelope and in communication with the interior thereof, depending said envelope from a plurality of said vent pipes, casting entirely about said depending envelope a molten metal of different characteristics than the slab metal, and ventilating said envelope by forcing a cooling medium through a part of said vent pipes into the envelope and conducting such cooling medium from the envelope through other of said vent pipes.

4. The method of forming composite metal ingots, comprising the steps of placing metal slabs in juxtaposition with an interstice therebetween containing a weld preventing material, sealing said slabs together about their edges whereby to enclose such interstice, securing a breather pipe to said slabs in a manner providing communication with the interstice, depending said slabs from said breather pipe, and casting

entirely about said depending slabs a molten metal of different characteristics than the slab metal.

5 5. The process of forming bimetals which comprises placing two metal slabs in juxtaposed relation with a separating compound therebetween, welding a pair of breather tubes in spaced relation to the adjoining edges of the top end of the slabs to communicate with the space between the slabs, sealing the slabs together to form an envelope for the separating compound, blowing compressed air through one of the breather tubes and casting a high melting metal around the slabs.

15 6. The process of forming bimetals which comprises placing two metal slabs in juxtaposed relation with a separating compound therebetween, sealing the edges of the slabs to form an envelope for the separating compound, venting the space between said slabs to permit escape of gases, and casting a metal around said slabs having a melting point at least about 300° F. above the melting point of the slabs.

20 7. The process of forming bimetals which comprises placing two metal slabs in juxtaposed relation with a separating compound therebetween, welding a pair of breather pipes in spaced relation to the adjoining edges of the top ends of the slabs to communicate with the space between the slab, sealing the slabs together to form an envelope for the separating compound, blowing a gas through one of the breather pipes and casting a metal around said slabs having a melting point at least about 300° F. above the melting point of the slabs.

30 8. The process of forming a bimetal article, comprising the steps of placing two metal slabs in juxtaposed relation with a separating material therebetween, welding a breather pipe to an edge of the slabs to communicate with the space therebetween, sealing the edges of the slabs to form an envelope for the separating material and casting around said slabs a metal having

a higher melting temperature than the slab metal.

9. The process of forming a bimetal article, comprising the steps of placing two metal slabs in juxtaposed relation with a weld preventing substance therebetween, sealing the edges of the slabs to form an envelope for the weld preventing substance, venting the space between said slabs to permit escape of gases, and autogenously bonding a second metal having different characteristics than the metal of said slabs to said slabs by casting said second metal around said slabs.

10. The process of forming a bimetal article, comprising the steps of placing two metal slabs in juxtaposed relation with a weld preventing substance therebetween, sealing the edges of the slabs to form an envelope for the weld preventing substance, venting the space between said slabs to permit escape of gases, and pouring around said slabs a molten metal of higher temperature than the melting temperature of said slabs.

11. The process of forming a bimetal article, comprising the steps of placing two metal slabs in juxtaposed relation with a weld preventing substance therebetween, sealing the edges of the slabs to form an envelope for the weld preventing substance, venting the space between said slabs to permit escape of gases, and casting around said slabs a metal having a higher melting temperature than the metal of said slabs.

12. The process of forming a metal article, comprising the steps of placing two metal slabs in juxtaposed relation with a weld preventing substance therebetween, sealing the edges of the slabs to form an envelope for the weld preventing substance, venting the space between said slabs to permit escape of gases, and pouring around said slabs a molten metal of higher temperature than the melting temperature of said slabs.

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