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Huber et al.

[11] **3,819,145**

[45] **June 25, 1974**

[54] **INSERT ASSEMBLY FOR CAST COMPOSITE INGOT**

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[73] Assignee: **Armco Steel Corporation,** Middletown, Ohio

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[52] **U.S. Cl.** **249/205,** 164/112, 164/334, 249/93

[51] **Int. Cl.** **B22d 17/24**

[58] **Field of Search** 249/205, 91, 93; 164/98, 164/108, 112, 334

[56] **References Cited**

UNITED STATES PATENTS

1,484,434	2/1924	Thompson	164/334 X
2,161,116	6/1939	White	164/112 X
3,621,561	11/1971	Higbee et al.	164/76 X

FOREIGN PATENTS OR APPLICATIONS

100,165	2/1937	Australia	164/112

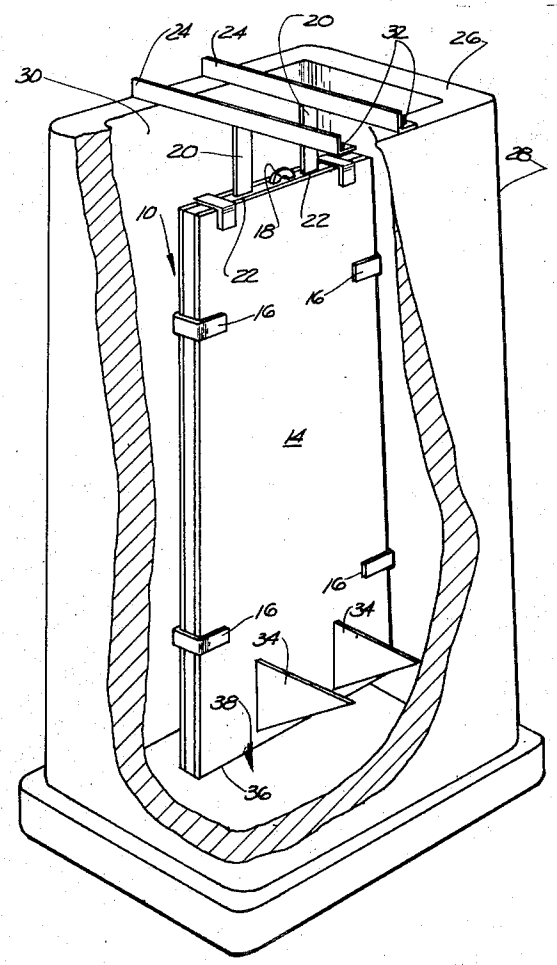
Primary Examiner—R. Spencer Annear

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[57] **ABSTRACT**

A core insert assembly for use in an ingot mold to produce a composite ingot having a thin stainless steel core. The core insert assembly comprises a plate of stainless steel with at least its major surfaces covered by metallic protective layers. Means are provided at the top of the core insert assembly by which it may be supported within the ingot mold and means are also provided to prevent excessive lateral movement of the core insert assembly within the ingot mold.

9 Claims, 5 Drawing Figures



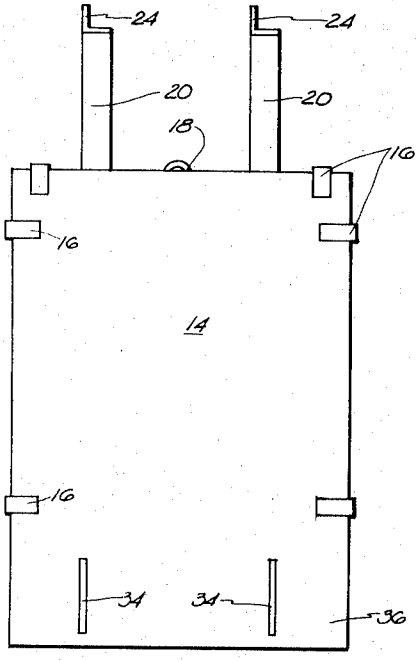


FIG. 1

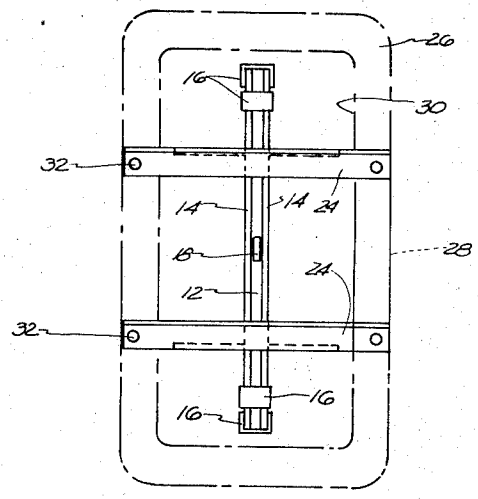


FIG. 3

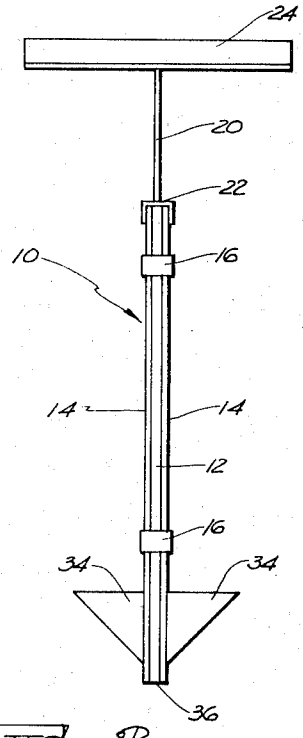


FIG. 2

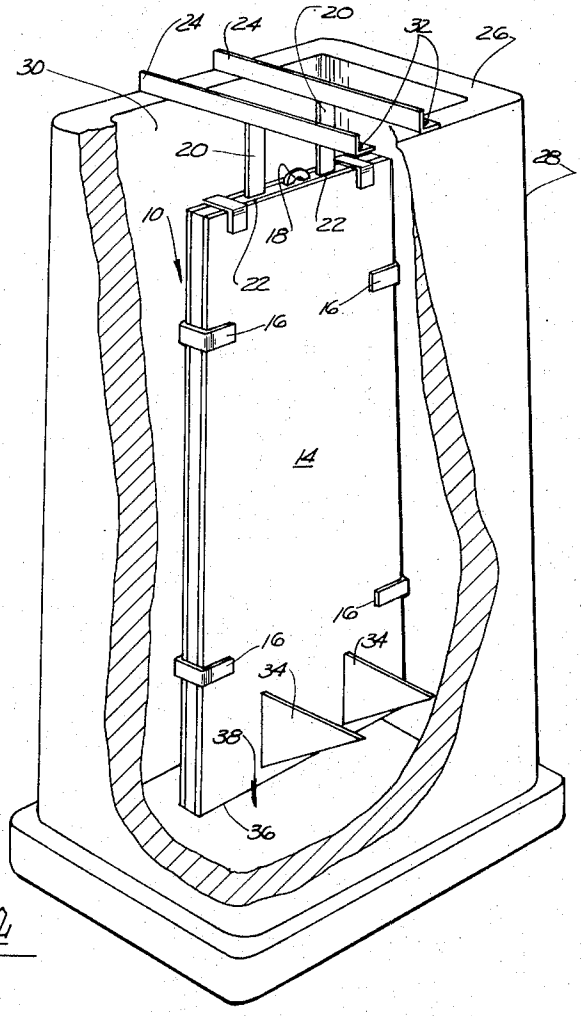


FIG. 4

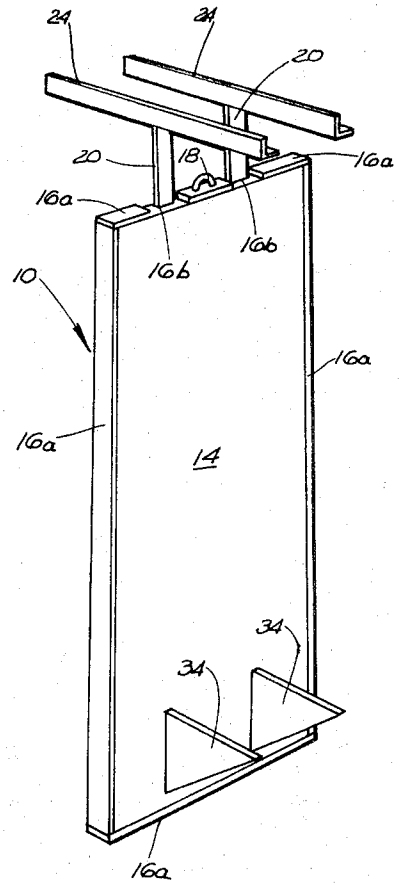


FIG 5

INSERT ASSEMBLY FOR CAST COMPOSITE INGOT

BACKGROUND OF THE INVENTION

The method of U.S. Pat. No. 3,621,561 and the improvements of this invention arose out of a desire to find a structural material capable of resisting corrosive attack, but within a competitive pricing system. The method of said patent provided the answer — a composite metallic strip having a core of stainless steel surrounded by two relatively thick outer layers of carbon or low alloy steel.

Briefly, in the practice of the method of said patent, a stainless steel plate whose thickness is at least about 0.5 percent, but preferably about 2–8 percent, of the total ingot, is secured vertically in sandwich relationship between protective metallic chill plates (made of metal such as carbon steel or ingot iron) through the center or other desired position of a mold. Into the two cavities formed by positioning the protected stainless plate composite in the mold, a casting metal such as molten carbon steel or low alloy steel is poured. After solidification of the casting metal the composite ingot is stripped and processed by the conventional steps which may include: surface conditioning, heating, hot rolling, cold rolling, annealing, shearing, and coiling.

While the ultimate product in sheet or strip form was a superior structural material for certain corrosive environments, the procedure to achieve same was not without its problems.

For example, as a structural member and for effective protection against corrosion, uniformity of metallic layers within the composite product is desired. However, this requires rather precise positioning of the protected core within the mold prior to teeming thereof. Without this positioning and some means to anchor the protected core, there would be a tendency for the core to float and/or shift within the mold. This would generally affect the symmetry and soundness of the resulting ingot.

Heretofore, costly and time consuming procedures were followed to secure the core within the mold. Initially, the practice in positioning a stainless steel plate in a mold was to weld legs on the bottom of the plate and then weld the other end of the legs to a base plate that was held in place between the mold and its supporting stool. The top of the stainless steel plate was held in position by welding bars to the mold after the stainless steel plate was in position.

This procedure necessitated preparing the composite assembly on the stool followed by lifting into place the surrounding mold. Further, the presence of the base support legs interferred with the flow of the molten metal. This was evidenced by problems in rolling and/or by the discovery of a lamination or pipe in the ingot butt. Finally, by suspending the core assembly in accordance with the present invention, problems due to the erosion of the legs during teeming are avoided.

Thus, it will become apparent by the description hereinafter that a core assembly is provided which can be constructed and stored in advance of casting, and then placed in the mold when desired. Only minutes are required for readying the mold with an insert for the casting of a composite ingot.

SUMMARY OF THE INVENTION

This invention relates to the construction of a core assembly for use in practicing the method taught in U.S. Pat. No. 3,621,561.

The core assembly comprises a plate of stainless steel substantially enveloped by the protective metallic chill plates or layers. At the top of the encased stainless steel plate suspension means are provided which contact the top rim of the mold to support the core assembly within the mold but spaced from the walls thereof. To prevent substantial lateral movement of the assembly within the mold, means projecting perpendicularly from the assembled core are provided.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front view of an ingot mold insert assembly constructed in accordance with the teaching of this invention.

FIG. **2** is a side view of the insert assembly shown in FIG. **1.**

FIG. **3** is a top view of the said insert assembly, with a surrounding ingot mold shown by phantom lines.

FIG. **4** is a perspective view of the insert assembly of FIGS. **1–3,** disposed within an ingot mold, a portion of which is broken away to reveal certain details thereof.

FIG. **5** is a perspective view of the insert assembly illustrating alternate means to secure the protective plates to the stainless steel plate.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As has been noted previously, this invention is directed to improving the product resulting from the method taught and claimed in U.S. Pat. No. 3,621,561. This patent discloses a method for producing a metallic composite ingot, which may be processed into sheet or strip form, having a thin stainless steel core therethrough. The product, as processed, was found to be an excellent structural material for applications in moist environments where pitting-type corrosion is a primary problem.

To effect such protection, the material selected for the protective layer as well as the casting metal must be anodic to stainless steel, the core metal. For a more detailed discussion of the phenomenon of corrosion, reference is made to the aforementioned patent. In any event, it will suffice to say that the core insert assembly of this invention consists of a stainless steel plate substantially surrounded by a layer of carbon steel or any other suitable material that is anodic to stainless steel.

Turning now to a consideration of the core insert assembly **10** of FIGS. **1–3,** it will be seen that a stainless steel plate **12** has been provided with protective plates or layers **14,** which for purposes of illustration may be considered ingot iron plates, contiguous with the major surfaces of the plate **12.** Disposed about the edges thereof, tie bars **16** are welded or secured to the protective layers **14.** As an alternative to this, narrow protective strips or plates **16a** similar to the layers **14,** may be used with their edges welded to layers **14** except for one or more small gaps **16b,** preferably at the top edge of the insert assembly **10,** to permit the escape of gases. Such a construction would substantially encase the stainless steel plate **12** within the protective material

and is illustrated in FIG. 5 wherein like parts have been given like index numerals.

By arranging the above in the manner described and shown, preliminary bonding between the contiguous surfaces of plate 12 and layers 14 is rendered unnecessary. As will be seen hereinafter, this permits any entraped air therebetween to escape, and for the independent expansion of the stainless steel plate and protective metallic layers during the casting operation. Bonding, such as by welding, may be effected to attach a lifting eye 18 to the upper edge of the insert assembly 10.

Projecting above the assembled plate 12 and layers 14 are one or more support arms 20. These arms are welded as at 22 to the stainless steel plate 12. At the opposite ends of the support arms 20, transverse suspension arms 24 are secured as by welding. As best seen in FIG. 3, the arms 24 lie on the top 26 of the mold 28 to suspend the insert assembly 10 within the center of the mold cavity 30. Near the ends of the transverse suspension arms 24, holes 32 have been provided to receive hot top nails (not shown) which are driven into the mold top 26 to prevent the insert assembly 10 from excessive shifting or floating during teeming.

At the lower or opposite end of the assembled plate 12 and layers 14, one or more means 34 are secured to the exterior of the layers 14 to serve as guides in placing the insert assembly within the mold 28. In addition, the means 34 prevent excessive lateral movement of the insert assembly by holding it at or near the center of the mold cavity 30.

For purposes of an exemplary showing the means 34 are illustrated as being a pair of triangular members affixed to either side of the insert assembly 10. Preferably the means 34 are made of high melting point material such as the casting metal so that they will maintain their integrity long enough to perform their positioning function. The means 34 may be welded to the layers 14.

It should be apparent, particularly from FIG. 4, that the final size of the insert assembly is dictated by the size of the mold 28. For example, in a standard 20 × 40 inch ingot mold, the assembly should be dimensioned so as to leave a clearance of about 2 ½ inches along the sides, and approximately 5 inches between the insert bottom edge 36 and the stool 38.

With this arrangement, one side pouring as well as split pouring of the cast metal may be practiced without obstruction and without excessive shifting of the insert assembly 10.

Modifications may be made in the invention without departing from the spirit of it.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. For use in an ingot mold from which a composite ingot having a thin stainless steel core shall be produced, said ingot mold having walls and resting on a stool which serves as a bottom, a rectangular core insert assembly having peripheral side, top and bottom edges and opposite faces, said core insert assembly comprising a rectangular plate of stainless steel with at least its major surfaces covered by rectangular, metallic, protective plates of substantially the same length and width dimensions, means connecting edge portions of said protective plates to maintain said plates in position on said stainless steel plate, means at said top edge of said core insert assembly to suspend said core insert assembly within said mold with said bottom edge of said assembly spaced from said mold bottom, said side edges of said assembly spaced from the adjacent ones of said mold walls and said assembly faces spaced from those mold walls they face, and means near the opposite end of said core insert assembly to prevent excessive movement of said assembly faces toward and away from said mold walls they face.

2. The structure claimed in claim 1 wherein said suspension means comprise at least one arm projecting upwardly from said top edge of said core insert assembly and terminating in an elongated member perpendicular thereto, said last named member being of a length sufficient to overlie the top edges of said mold.

3. The structure claimed in claim 1 wherein said means to prevent excessive lateral movement of assembly faces toward and away from the adjacent mold walls comprise at least one pair of members, each member of said pair projecting perpendicularly from one of said faces of said core insert assembly.

4. The structure claimed in claim 1 wherein said metallic protective plates are anodic to said stainless steel plate.

5. The structure claimed in claim 1 wherein said positioning means comprise a pair of arms in parallel spaced relationship affixed to said top edge of said core insert assembly and projecting upwardly therefrom, each of said arms terminating in an elongated member perpendicular thereto and of a length sufficient to overlie the top edges of said mold, and means to secure said elongated members to the top edges of said mold.

6. The structure claimed in claim 2 including means to secure said elongated member to said top edges of said mold.

7. The structure claimed in claim 1 wherein said connecting means comprise a plurality of strap-like metallic members spaced about the edges of said core insert assembly, each of said connecting members extending transversely of and about its respective edge of said core insert assembly with the ends of said connecting member being affixed to adjacent portions of said protective metallic plates.

8. The structure claimed in claim 1 wherein said connecting means comprise a plurality of metallic strips of the same material as said protective metallic plates, said strips extending longitudinally of the edges of said core insert assembly and being welded to adjacent edges of both of said protective metallic plates whereby said stainless steel plate is substantially encased by said strips and said protective metallic plates.

9. The structure claimed in claim 8 wherein said strips are discontinuous along the top edge of said core insert assembly forming at least one gap for the escape of gases from between said stainless steel plate and said protective metallic plates.

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