# United States Patent [19]

Rocher

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[54] HOT TOP MAINTAINING SYSTEM FOR AN INGOT MOLD


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[52] **U.S. Cl.** .................................. **249/106,** 249/197
[51] **Int. Cl.** .................................. **B22d 7/10**
[58] **Field of Search** .................... 249/106, 197–202; 164/371



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,178,783 | 4/1965 | Ednell et al. | 249/106 |
| 3,421,731 | 1/1969 | Koch et al. | 249/197 |



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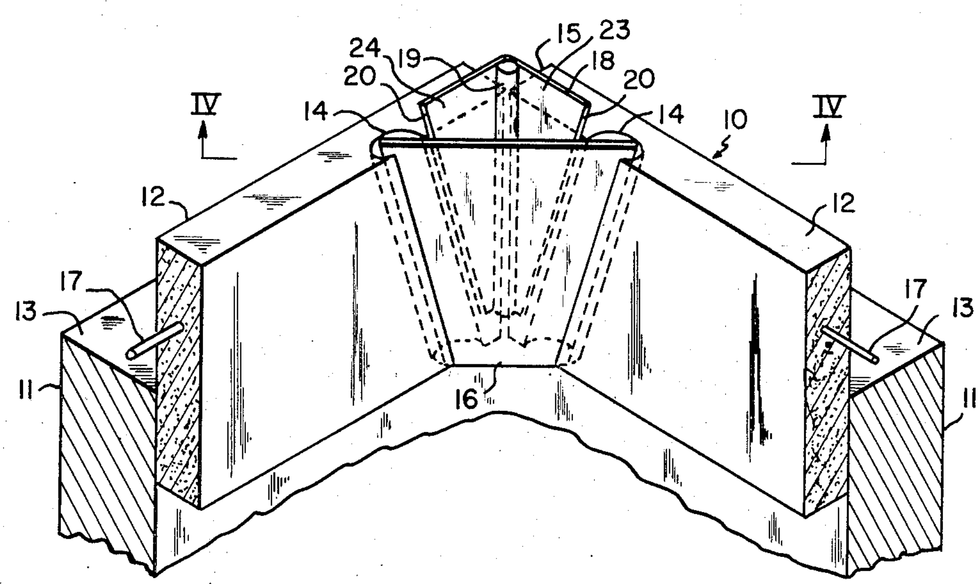
*Attorney, Agent, or Firm*—Webb, Burden, Robinson & Webb



[57] **ABSTRACT**

The improved hot top maintaining system permits disposable hot top sideboards to extend above the ingot mold. A chill wedge is used in combination with a wedge plate positioned within converging grooves of adjacent sideboards. The chill wedge, after insertion, is flush against the wedge plate and the adjacent sideboards and provides a chill zone at the sideboard juncture so as to immediately solidify the metal and retain it within the hop top system.

**4 Claims, 7 Drawing Figures**

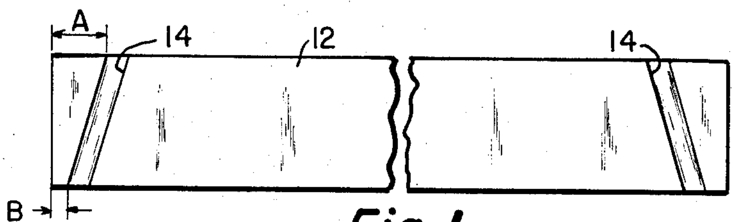



Fig. 1

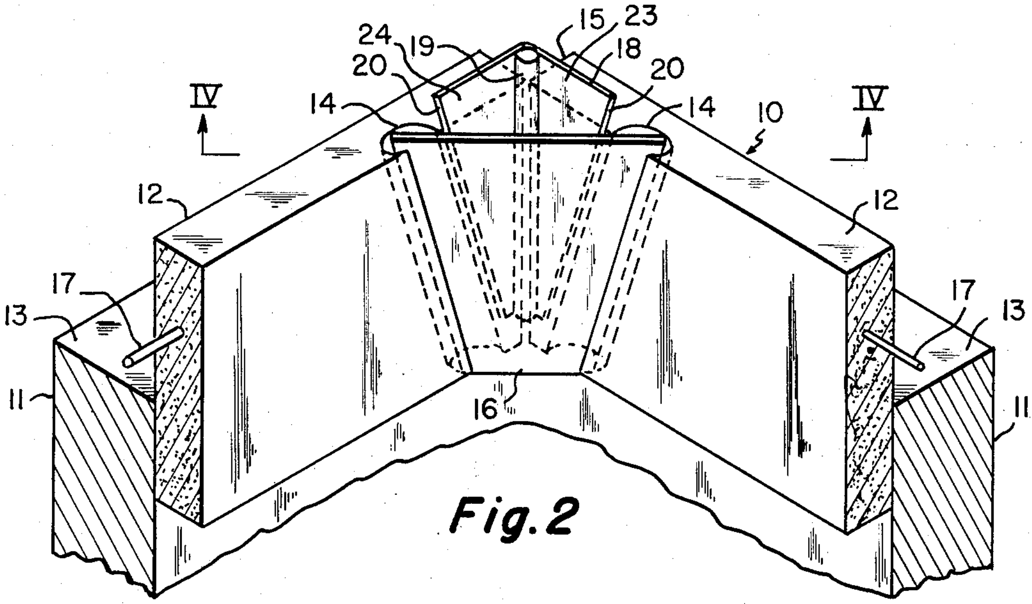



Fig. 2

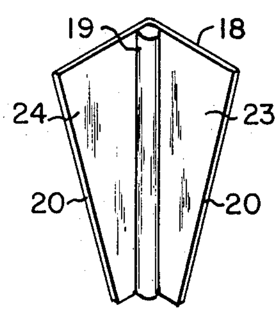



Fig. 3

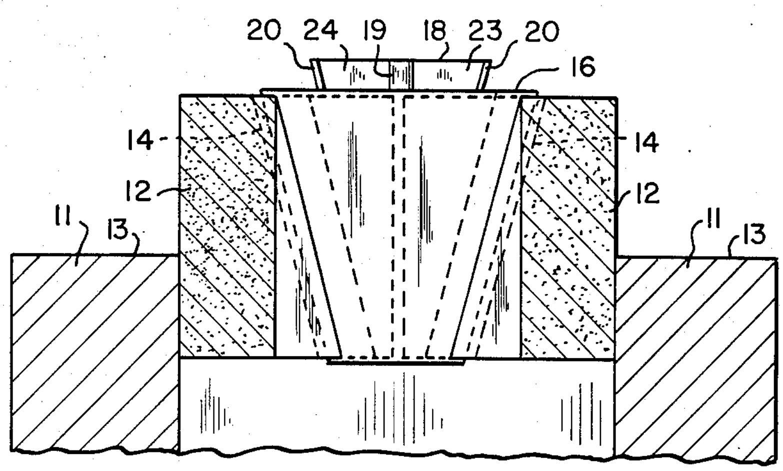



Fig. 4

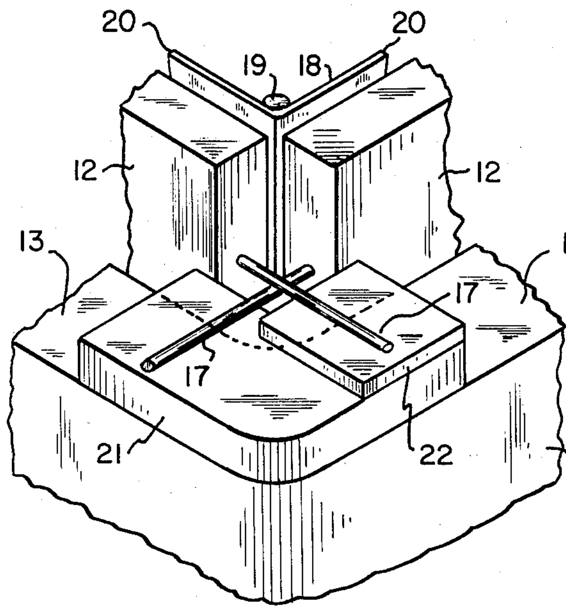



Fig. 5

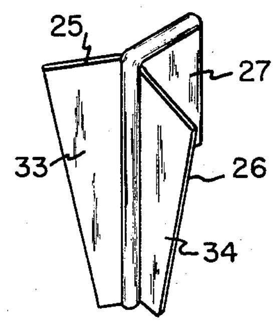



Fig. 6

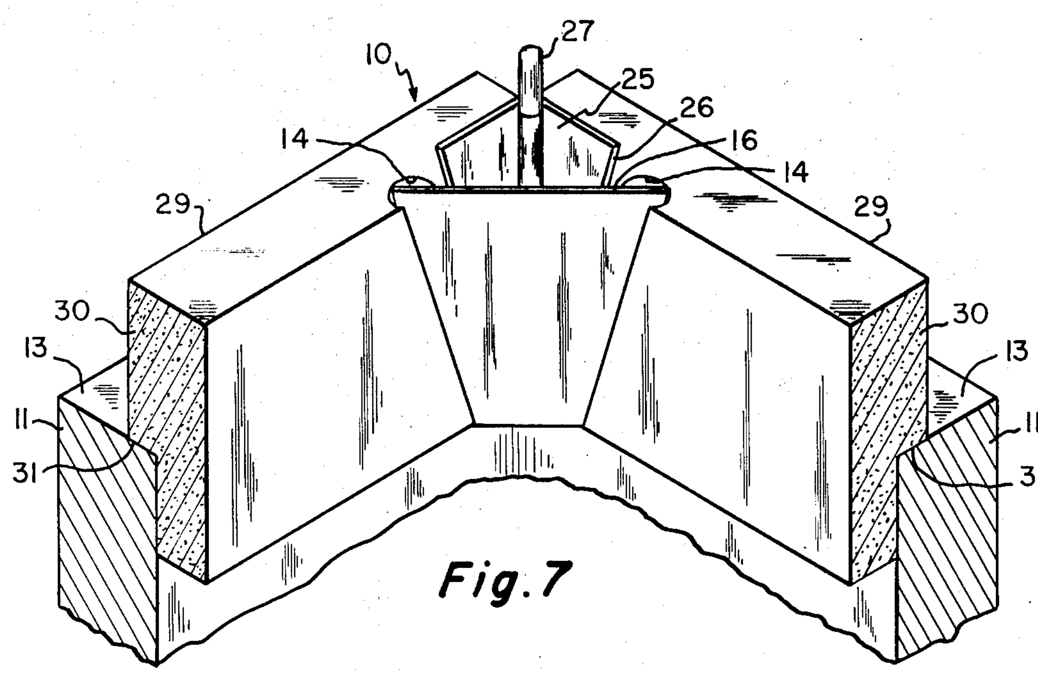



Fig. 7

# HOT TOP MAINTAINING SYSTEM FOR AN INGOT MOLD

## FIELD OF THE INVENTION

My invention relates to hot top systems and, more particularly, to a hot top retaining system which permits the sideboards to be positioned adjacent the ingot mold walls so as to extend above the top of the ingot mold.

## DESCRIPTION OF THE PRIOR ART

Hot top systems employed in the teeming of killed steel ingots and the like are normally of the disposable type which comprises sideboards held in place within the ingot mold interior by various clips, wedges, rods or the securing means or are of the permanent type in which a refractory lined metal casing is positioned atop of the ingot mold. The permanent hot top system normally includes refractory brick, but various forms of replaceable refractory linings have been suggested.

In order for any hot top system to be effective, it must be substantially filled with molten metal to provide an adequate reservoir of molten metal. Generally, the hot top volume varies from 10 to 15 percent of the total volume depending on the particular system. Therefore, for a given mold size, a known and reoccurring ingot weight is obtained. However, it is often advantageous to alter the ingot weight for a given mold size to provide particular slab cuts or bloom cuts necessary to make an ordered weight. Without flexibility for a given mold size, good steel is often discarded to make the necessary weight, thereby substantially reducing the overall yield of the product. In practice it is often necessary to provide 5,000 pounds of steel to obtain a 1,000 pound larger slab simply because there is no flexibility for a given mold size and a larger mold size must be used.

Steel manufacturers occasionally attempt to set disposable hot top systems well into the ingot molds where a lighter than normal weight is obtained from a given mold size. This, however, increases the likelihood of hot top "floaters" since it is difficult to secure hot top boards any appreciable distance below the top surface of the ingot mold.

## SUMMARY OF THE INVENTION

My invention increases the range of ingot weights from a given mold size by providing a hot top maintaining system which can be set into the ingot mold in known fashion or can be retained in place so that the upper portion of the hot top is above the ingot mold upper surface. This then maximizes ingot to slab or bloom yields and gives the steel provider a new range of flexibility. In addition, my hot top maintaining system decreases the likelihood of hot top "floaters" by adding additional retaining means to an already acceptable hot top maintaining system. My hot top maintaining system can be easily set in place by the worker irrespective of the intended position of the hot top system in relation to the ingot mold.

My invention is an addition to the hot top maintaining system described in U.S. Pat. No. 3,421,731 of which I am a co-inventor. In the system described in the aforementioned United States patent, each sideboard has a pair of inclined grooves on the inner face near the ends thereof. Adjacent sideboards define converging grooves toward the mold corner and accommodate a wedge means to retain the sideboards against the ingot mold walls. I have added to that system a chill wedge formed of two intesecting faces, each having a downwardly inclined distal edge to engage the wedge means while each face of the chill wedge is flush against the sideboard. The chill wedge is constructed to assure the solidification of the metal at the corner formed by the intersecting faces which is in alignment with the corner formed by the adjacent sideboards.



## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevation of a hot top sideboard;

FIG. 2 is an isometric through an ingot mold corner showing the construction of my hot top maintaining system;

FIG. 3 is an isometric of my chill wedge;

FIG. 4 is a section taken along section lines IV—IV of FIG. 1;

FIG. 5 is an isometric showing the support structure for my hot top maintaining system;

FIG. 6 is an isometric of a modified chill wedge; and

FIG. 7 is an isometric of an ingot mold corner showing a modified form of my hot top maintaining system.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

The hot top maintaining system, generally designated **10**, cooperates with an ingot mold **11** to provide a reservoir of liquid metal which fills the cavity formed during solidification of certain metals such as killed steels. The ingot mold **11** is normally four sided and, therefore, four sideboards **12** are normally employed to form the hot top maintaining system **10**. The sideboards are of the disposable preformed type and the composition thereof does not form a part of the invention.

Each sideboard **12** has a pair of grooves **14** formed on the inward face near the opposing ends of the sideboard **12**. These grooves **14** are outwardly inclined with regard to each other, FIG. **1**. Specifically, the distance designated A between the top edge of the sideboard and the top of the groove **14** is greater than the distance designated B between the bottom edge of the sideboard and the bottom of the groove **14**. The depth of the groove **14** may also be decreased along the length of the groove to increase the wedging effect, but such a change in depth is not mandatory.

End adjacent sideboards **12** provide adjacent grooves **14** which have a resultant inclination so as to converge downwardly toward the ingot mold corner, FIG. **2**. In assembled relationship, a wedge plate **16** is inserted in the adjacent grooves **14** of end adjacent sideboards **12** so that increasing outward force is exerted upon the sideboards **14** as the wedge plates **16** are moved downwardly along the grooves **14**. This wedging action forces the sideboards **12** against the respective walls of ingot mold **11**. The sideboards **12** are positioned so that their upper portion is above the top surface **13** of the ingot mold **11**, FIG. **2**. A space **15** is formed by the adjacent sideboards **12** in the corner positions. This space **15** is aligned with and closed off by the mold corner below the upper mold surface **13** and is unrestrained above the ingot mold.

A chill wedge **18** is formed of two perpendicularly intersecting faces **23** and **24**, each having its distal edge **20** inclined inwardly at approximately the same angle as the angle of convergence of the wedge plate **16** when in place, FIG. **3.** The purpose of the chill plate **18** is to assure solidification of the molten metal so that it will not escape through the space **15** and escape along the upper surface **13** of the ingot mold **11.** For this purpose the chill plate faces **23** and **24** can be made of a relatively thick steel but since the real need for the chill zone is in the corners formed by the end adjacent sideboards, I have found that a steel rod can be secured along the intersection formed by the two faces, thus allowing a relatively thin sheet steel to be used for faces **23** and **24.** A three-fourths inch steel rod spot welded on the interior corners of a 16 gauge mild steel chill plate has proven more than adequate.

The distal edges **20** engage the wedge plate **16** while the faces **23** and **24** are flush with the end adjacent sideboards **12,** thereby creating an additional wedging action which forces the sideboards **12** outward against the mold walls, FIGS. **2** and **4.** The interior corner of the chill plate **18,** including rod **19** positioned therealong, is in alignment with the space **15** thereby providing sufficient chill to cause immediate solidification and prevent molten metal spillage out of the space **15.**

In order to facilitate supporting the sideboards **12** while the wedges **16** are being installed, rods **17** are molded into the sideboard so as to extend out of the ends thereof. Other support structures, both internal and external, can be employed but rods add to the reinforcement of the sideboard itself. These rods **17** of end adjacent sideboards **12** rest on a wooden block **20** which is positioned in the corner along the upper surface **13** of ingot mold **11,** FIG. **5.** To assure a perfect alignment of the sideboards, the block **20** has a slightly elevated section **22** so as to avoid interference between rods **17** of adjacent sideboards **12.** As a practical matter, a simple block of wood can be employed and the rods **17** of adjacent sideboards **12** can merely rest on one another since the total wedging action is sufficient to maintain the hot top system in place.

A chill wedge **25** can also be employed in which a metal fin **27** extends rearwardly from the exterior surface of the corner of the intersecting faces **33** and **34,** FIG. **6.** The fin **27** extends into the space formed by the end adjacent sideboards. The purpose of the fin **27** is to increase the chilling effect in the corner and not to



totally fill the aforementioned space.

The sideboards may be designed to include the support means as an integral part of the board itself. Sideboards **29** are molded to include an enlarged upper section **30** which provides a shoulder **31** which rests on the upper surface **13** of ingot mold **11** to facilitate installation of wedge plate **16** into the grooves **14** of the sideboards **29,** FIG. **7.** Chill wedge **25** having a rearward fin **27** positioned in the space between sideboards **29** is illustrated in this particular embodiment. In addition to providing the support means for installation of the hot top maintaining system **10,** the enlarged upper section **30** provides additional insulation for the hot top in the area surrounding the hot top system above the ingot mold.

I claim:

**1.** A hot top system for an ingot mold comprising:

A. a plurality of end adjacent sideboards each having a pair of outwardly inclined grooves formed on the inward face near the ends thereof;

B. means for supporting the sideboards against the ingot mold walls so that the upper portion of the sideboards extend above the ingot mold;

C. a wedge plate insertable into adjacent grooves of end adjacent sideboards so as to converge downwardly toward the ingot mold corner and retain the sideboards against the ingot mold walls; and

D. a chill wedge having perpendicular intersecting faces, each face inclined downwardly along the distal edge thereof to matingly engage the converging wedge plate, each face being flush against the adjacent sideboard and the intersection of the faces being aligned with a corner formed by the end adjacent sideboards, said wedge plate and chill wedge extending below the ingot top mold.

**2.** The hot top system of claim **1** wherein the sideboards include an enlarged shouldered upper portion resting atop the ingot mold walls to form the supporting means for the sideboards.

**3.** The hot top system of claim **1** wherein support bars extend out of the sideboard ends.

**4.** The hot top system of claim **3** wherein the supporting means comprises blocks positioned atop of the ingot mold corners so as to support the bars extending out of the sideboard ends.

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