

[54] **DETACHABLE JOINT BETWEEN
CONTINUOUS-CASTING STARTER BAR
AND CASTING**

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[51] Int. Cl. B22d 11/08

[58] Field of Search 164/274

[56] **References Cited**

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[57] **ABSTRACT**

Described is a starter bar having a detachable head which when attached to the bottom of a continuous-casting may be detached from the starter bar by lateral deflection of the leading end of the casting relative to the starter bar. The detachable head consists of a cup-shaped chill plate slidably disposed in a recess in the head end of the starter bar. A key is fixedly attached to the bottom of the chill plate with its upper end projecting upwardly and its lower end depending downwardly from the chill plate bottom into a slot extending transversely of the head portion of the starter bar. The upper portion of the key serves as an anchor for the lower end of a continuously formed casting as it solidifies. In practice, the leading end of a descending continuous-casting supported by a starter bar is deflected by a bending roll which deflection causes the key and attached chill plate to slide laterally out of the recess and slot, respectively, of the starter bar head to thus effect separation of the starter bar from the casting.

2 Claims, 6 Drawing Figures

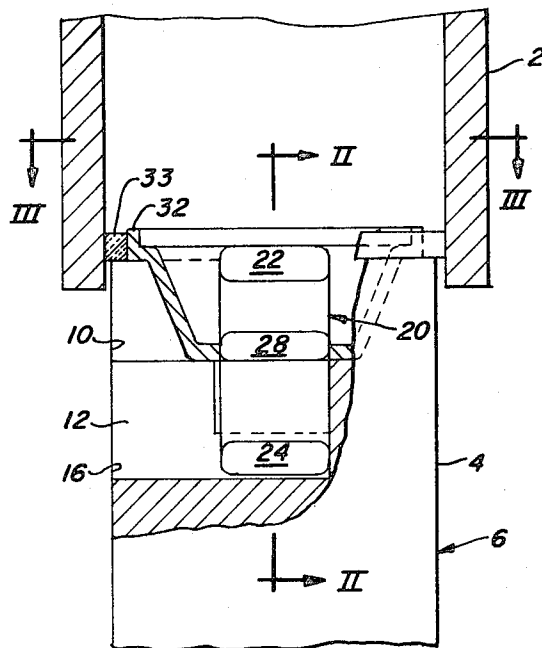


FIG. 1

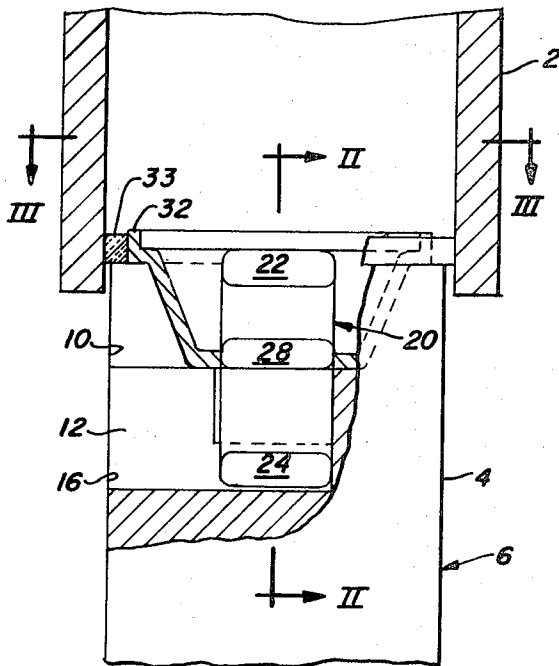


FIG. 2

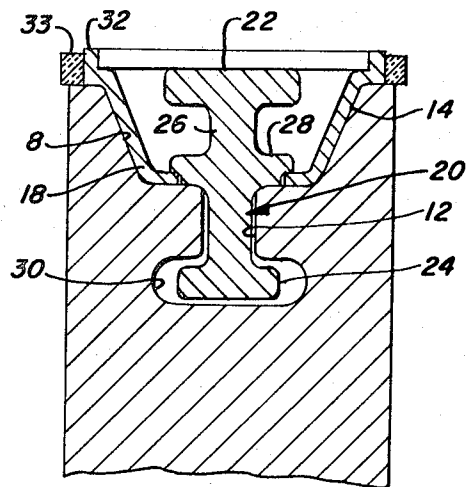
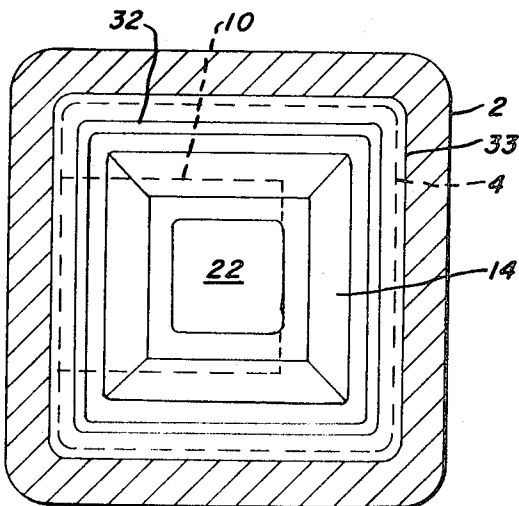
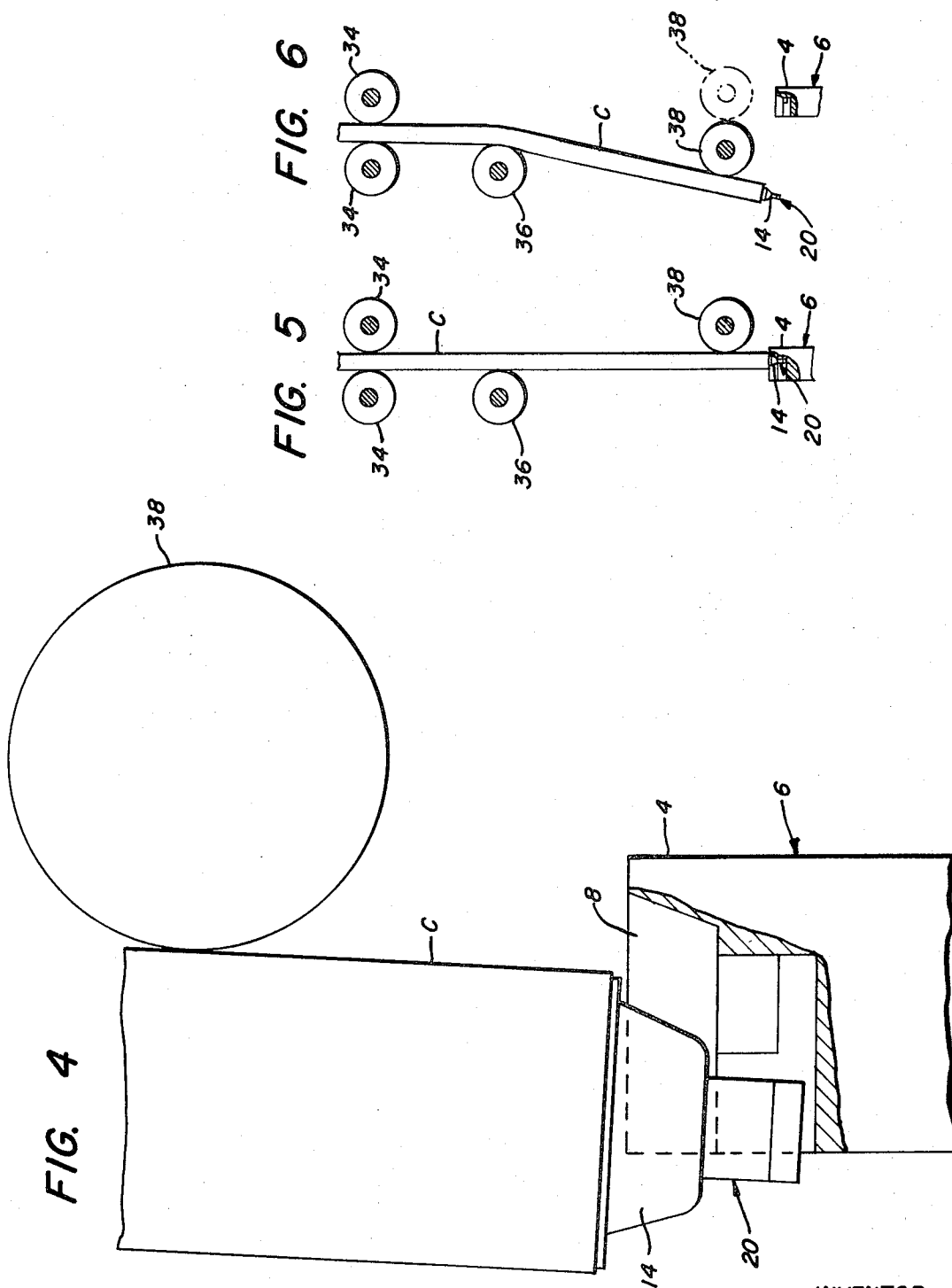


FIG. 3



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DETACHABLE JOINT BETWEEN CONTINUOUS-CASTING STARTER BAR AND CASTING

BACKGROUND OF THE INVENTION

The present invention relates generally to continuous-casting and, more particularly, to a starter bar for continuous-casting having a detachable joint in its head portion adapted to be attached to a continuous-casting.

It is customary in continuous-casting to fit the head end of a starter bar snugly in the lower end of the tubular flow-through chill mold of the caster to temporarily close the bottom of the mold. The starter bar, in addition to closing the discharge end of the chill mold while molten metal is first being poured thereinto, also serves to initiate downward travel of the metal column or casting formed in the mold and support it as it descends from the mold through guide rolls and pinch rolls located below the mold. The starter bar was severed from the casting after the bar had passed through the pinch rolls.

Prior to my invention the starter bar was severed from the casting by torch-cutting the casting a short distance above the top of the starter bar. The starter bar, with a short length of casting attached to the top thereof, was then lowered vertically independently of the casting. At the bottom of its vertical travel, the starter bar was lowered to a horizontal position and transported away. The short length of casting which remained attached to the starter bar was then removed so that the starter bar could be used again at the beginning of a subsequent casting operation. Meanwhile, after severance from the starter bar, the casting was deflected from its vertical path by means of a bending roll and was guided in a curved path from a vertical direction of travel to a horizontal one by means of rolls mounted in a guide frame or rack.

Cutting the casting to separate the starter bar as above described had certain disadvantages inherent therein. For example, it was necessary to remove the short length of casting which remained attached to the starter bar after cutting before the starter bar could be reused. This had to be done manually and usually required considerable time and labor. Another disadvantage was the fact that the cutting torches conventionally used to cut away the lower part of the casting and the starter bar attached thereto required an excessively long time to make the cut. Such factors adversely affected production from the continuous caster.

Prior to my invention, in efforts to eliminate the foregoing disadvantages, various devices were tried whereby an expendable detachable head portion was provided to connect the head end of the starter bar with the bottom of the casting. With this type of arrangement, the starter bar was disconnected from the detachable head after the casting had descended through the pinch rolls. Detachable heads of this type of which I am aware proved unsatisfactory inasmuch as molten metal from the continuous-casting leaked into the joint between the detachable head and the starter bar and froze the two together so that separation could not be accomplished in the manner intended.

SUMMARY OF THE INVENTION

The present invention proposes to provide a detachable head adapted to fit detachably in a recess in the head portion of the starter bar. The detachable head includes a chill plate which is fitted slidably into the recess of the head portion of the starter bar, and a key, preferably in the form of a rail section. The rail section key is fixedly attached, as by welding or the like, to the bottom of the chill plate with the upper portion of the web of the rail section projecting upwardly from the bottom of the chill plate and the lower portion of the rail section web depending downwardly from the chill plate into an inverted T-slot which communicates with the recess in the head of the starter bar. The weld attaching the rail section to the bottom of the chill plate is made around the web where it passes through the plate bottom. Thus, this weld also serves to seal the opening in the chill plate bottom and prevent molten metal from leaking into the recess or the slot therebelow. The

head of the inverted T-slot is proportioned to slidably accommodate the base of the rail section key. The chill plate is complementary in the shape to the recess in the starter bar head and is provided with a circumferential outwardly projecting lip around the top thereof which rests on the top of the starter bar head to support the chill plate. This lip also prevents leakage of molten metal into the recess under the chill plate. A packing of heat-resistant material such as asbestos surrounds the outwardly projecting lip of the chill plate so as to provide a seal between the starter bar head and the inner walls of the casting mold when the starter bar is inserted in the bottom thereof. Adjacent ends of the recess and slot in the head portion of the starter bar are open and communicate with each other so that after initially poured molten metal enters the cup-shaped chill plate and solidifies around the head portion of the rail section key, the rail section key and chill plate are laterally disconnected from the starter bar when the leading end of the casting is laterally deflected by the bending roll.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a vertical sectional view, partly in section, with parts broken away for clarity, showing the starter bar of my invention inserted in the bottom of a continuous-casting mold preparatory to the beginning of a continuous-casting operation;

FIG. 2 is a vertical sectional view taken substantially along the line II—II of FIG. 1;

FIG. 3 is a top plan view of FIG. 1;

FIG. 4 is an enlarged elevational view, partly in section, showing the beginning of separation of a starter bar from a continuous-casting in accordance with the invention; and

FIGS. 5 and 6 are diagrammatic elevational views illustrating the steps of the operation wherein separation of the starter bar and a continuously cast casting is effected in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawing, with particular reference to FIGS. 1, 3 and 4 for the moment, reference numeral 2 designates a tubular flow-through chill mold used for continuous-casting. Reference numeral 4 designates the head portion of a starter bar 6 which is provided with a cup-shaped recess 8 in its upper end having an open end 10 along one lateral edge of the head portion 4. An inverted T-slot 12 is disposed below and in communication with the recess 8. The slot 12 extends transversely across a major portion of the width of the starter bar 6 to an open end 16 which connects with the open end 10 of the recess 8.

A complementary-shaped chill plate 14 having an open bottom 18 is slidably fitted in the recess 8 with its open bottom overlying the upper end of the slot 12.

A key 20, which is substantially in the form of a rail section having a head 22, a base 24, a web 26, and a flange 28 extending on opposite sides of the web 26 intermediate and parallel with the head 22 of the base 24, is disposed in the cup-shaped chill plate 14. The flange portions 28 of the rail section key 20 are undercut and are welded to the bottom portion of the chill plate 14 closing and sealing its open bottom 18 so that molten metal cannot leak from the chill plate. The base 24 of the rail section key is slidably fitted in the head 30 of the inverted T-shaped slot 12. The head 22 of the rail section key 20 projects above the bottom of the chill plate and serves as an anchorage for solidifying metal in the bottom of the mold when continuous-casting is begun as will become apparent hereinafter.

The upper part of the chill plate 14 is provided with an outwardly projecting lip 32 which rests on the upper end surface of the head portion of the starter bar and serves to support the chill plate and also prevent leakage of molten metal into the recess 8. When the starter bar is inserted in the bottom of the mold, a packing 33 of heat-resistant material, such as asbestos, is placed around the lip 32 of the chill plate 14, as best shown in FIG. 1.

In operation, the head portion 4 of the starter bar 6 with the chill plate 18 and rail section key 20 fitted therein, as described above, is inserted in the bottom of the mold 2 and the seal 33 of asbestos or other heat-resistant material is packed between the lip 32 of the chill plate 14 and the inner surface of the mold wall.

Molten metal is then poured into the top of the mold 2 and as this metal reaches the chill plate 14, it starts to solidify and become anchored to the upper portion 22 of the rail section key 20. After the bottom of the casting has solidified in the chill plate 14 and is anchored around the head 22 of the key 20, power-driven pinch rolls 34 cause the starter bar 6 to be moved downwardly out of the flow-through mold while attached to the bottom of the continuous-casting C so that the casting is supported through the pinch rolls by the starter bar. As the leading end of the casting C descends below the pinch rolls, it travels past a fulcrum roll 36 and then past a bending roll 38, which is mounted on the side of the vertical path of the bar and casting opposite the side on which the fulcrum roll is mounted. The bending roll is suitably mounted for movement toward and from the vertical path of the bar and casting. As the leading end of the casting C descends below the axis of the bending roll 34, the bending roll is actuated laterally to the left, as viewed in FIG. 6. At the same time, the leading end of the starter bar enters a vertical guide chute (not shown). When the bending roll is thus moved laterally, it exerts a lateral force in a horizontal plane to deflect the leading end of the casting C, as best shown in FIG. 6. When this happens, chill plate 14 and key 20, which are now attached to the solid bottom of the casting C, are moved laterally out of the recess 8 and slot 12 so that the casting is disconnected from the starter bar. The starter bar continues to move downwardly into the vertical guide while the continuous-casting moves in an arcuate path caused by deflection of its leading end by the bending roll 38 for entry into a curved roller guide (not shown).

I claim:

1. A starter bar for continuous-casting disconnectable from an attached continuously formed casting by lateral deflection of the leading end of the casting, said starter bar comprising an elongated main body portion having a head end, said head end having a substantially cup-shaped recess therein, said recess having at least one open end along one lateral edge of said head portion, said body portion having a transversely extending slot communicating with and disposed subjacent said recess, said slot being substantially in the form of an inverted T and having at least one open end coincidental with the open end of said recess, a complementary chill plate slidably disposed in said recess, a key fixedly attached to said chill

plate with one end projecting upwardly therefrom and its other end depending downwardly therefrom and fitting slidably in said slot, said key being substantially in the form of a rail section, said rail section having a base slidably disposed in the head of said inverted T-slot a web extending slidably upwardly from said base to project above the bottom of said chill plate, and a head on said upwardly projecting web, said web being fixedly attached and sealed to said chill plate at a point intermediate said base and said head of said rail section, said head forming an anchorage for the lower end of a continuously formed casting as it solidifies whereby said key and said chill plate are disconnected laterally from said starter bar when the lower end of said casting anchored to said key is deflected laterally.

2. In a continuous-casting apparatus including a substantially vertically disposed tubular flow-through chill mold for producing a continuous-casting from molten metal poured in the upper end of said mold, and means spaced below said mold for laterally deflecting a casting issuing from said mold, the improvement therewith of a starter bar insertable in the lower end of said mold for attachment with the lower end of a casting forming in said mold and disconnectable from said casting by lateral deflection of the lower end of the casting, said starter bar comprising an elongated main body portion having a head end, said head end having a recess therein extending transversely thereof, said recess having at least one open end along one lateral edge of said head portion, said body portion having a transversely extending slot communicating with and disposed subjacent said recess, said slot being substantially in the form of an inverted T and having at least one open end coincidental with the open end of said recess, a complementary chill plate slidably disposed in said recess, a key fixedly attached to said chill plate with one end projecting upwardly therefrom and its other end depending downwardly therefrom and fitting slidably in said slot, said key being substantially in the form of a rail section, said rail section having a base slidably disposed in the head of said inverted T-slot a web extending slidably upwardly from said base to project above the bottom of said chill plate, and a head on said upwardly projecting web, said web being fixedly attached and sealed to said chill plate at a point intermediate said base and said head of said rail section, said head forming an anchorage for the lower end of a continuously formed casting as it solidifies whereby said key and said chill plate are disconnected laterally from said starter bar when the lower end of the casting anchored to said key is deflected laterally by said deflecting means.

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