

[54] **SPLASH ARRESTER APPARATUS**

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[51] Int. Cl. **B22c 19/04, B22d 7/12**

[58] Field of Search.....164/133, 136, 337, 156, 256, 164/150; 249/200, 206

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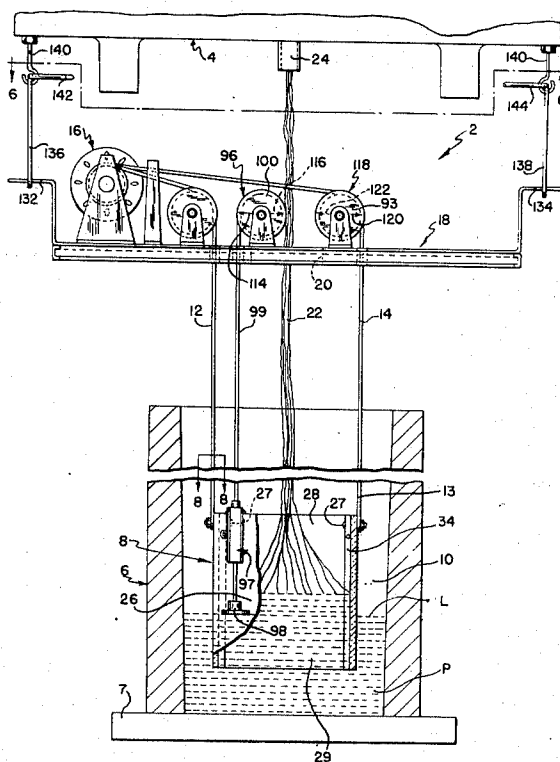
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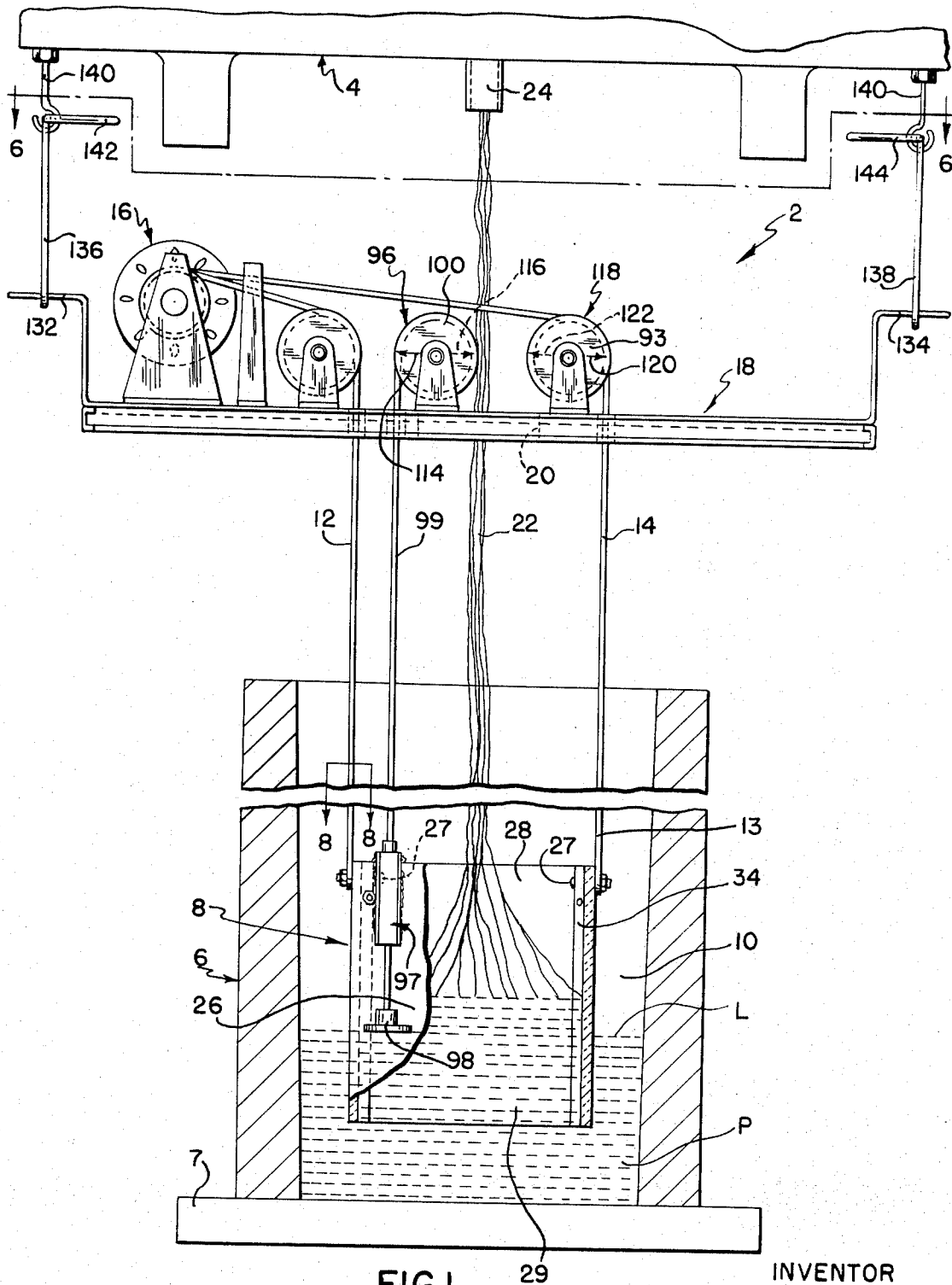
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[57] **ABSTRACT**

A splash arrester apparatus adapted for use in pouring molten metal into a mold including an open ended arrester device of refractory material adapted for positioning within the mold in spaced relation from the walls thereof, and adapted to encompass the stream of molten metal being poured into the mold. An actuating assembly is provided to progressively raise the arrester device in the mold while maintaining the outlet end submerged in the molten metal filling the mold. The arrester device may be used alone or equipped with a baffle-like impact member to receive the flow of molten metal entering the mold and change the shape of the stream to reduce the force of the molten metal striking the pool of molten metal contained in the arrester device and/or in the mold cavity.

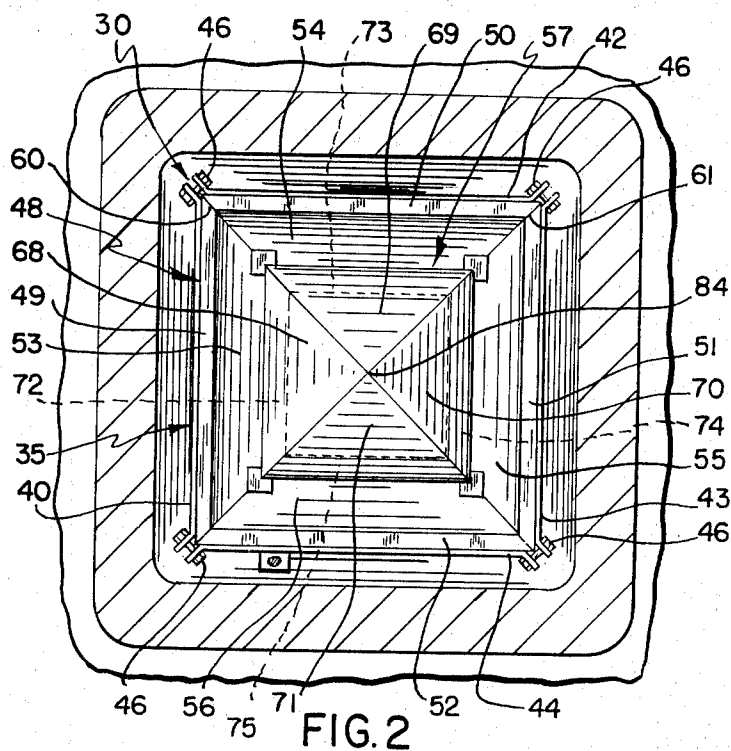
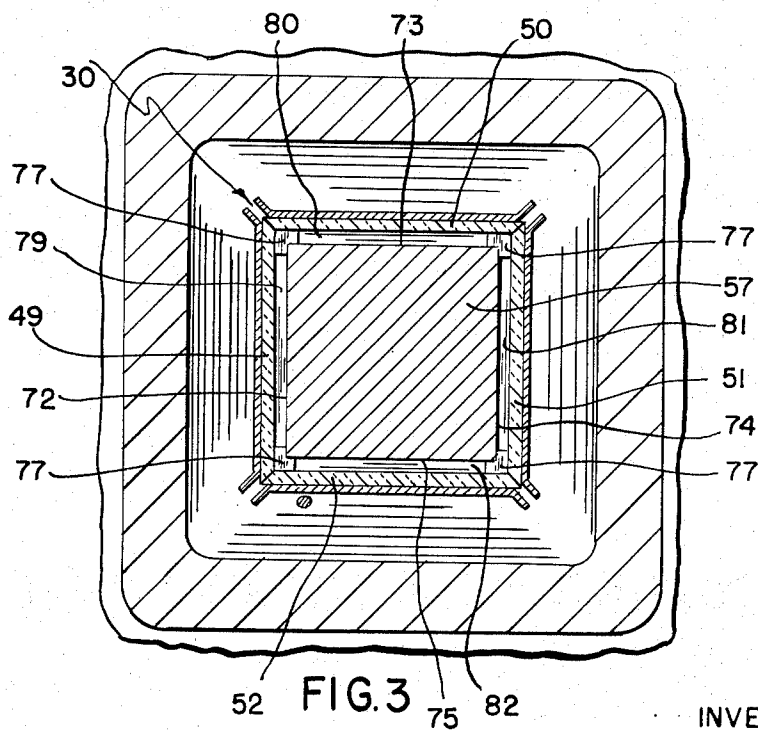
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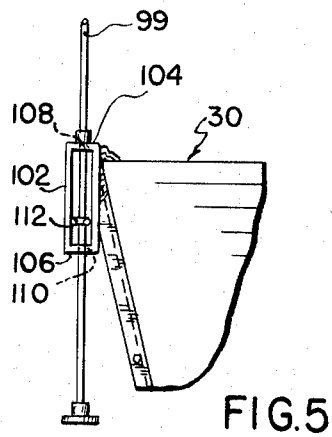
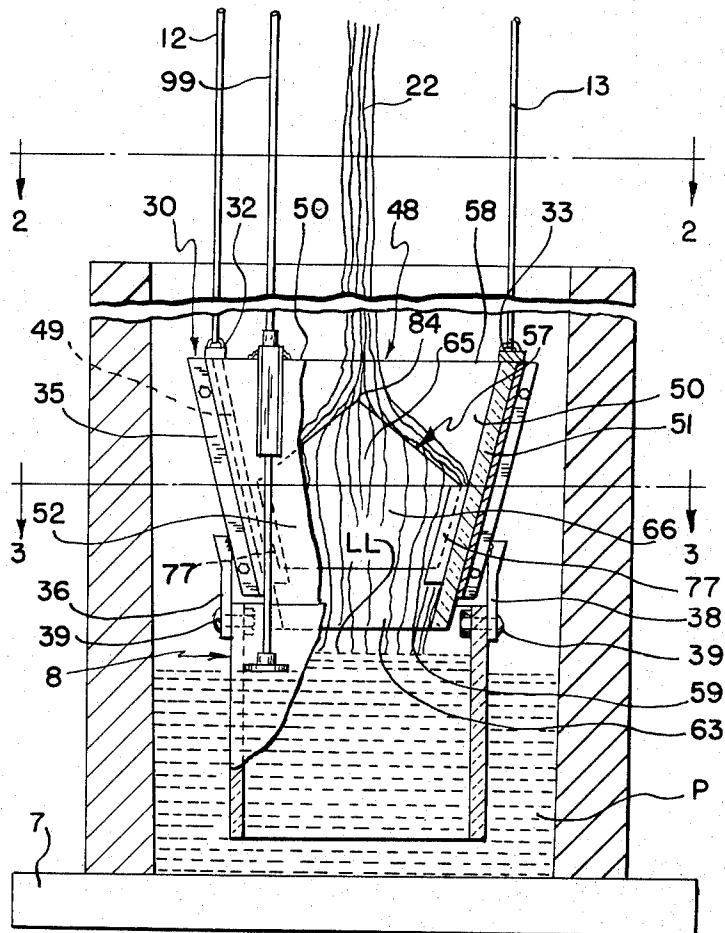


FIG. 4

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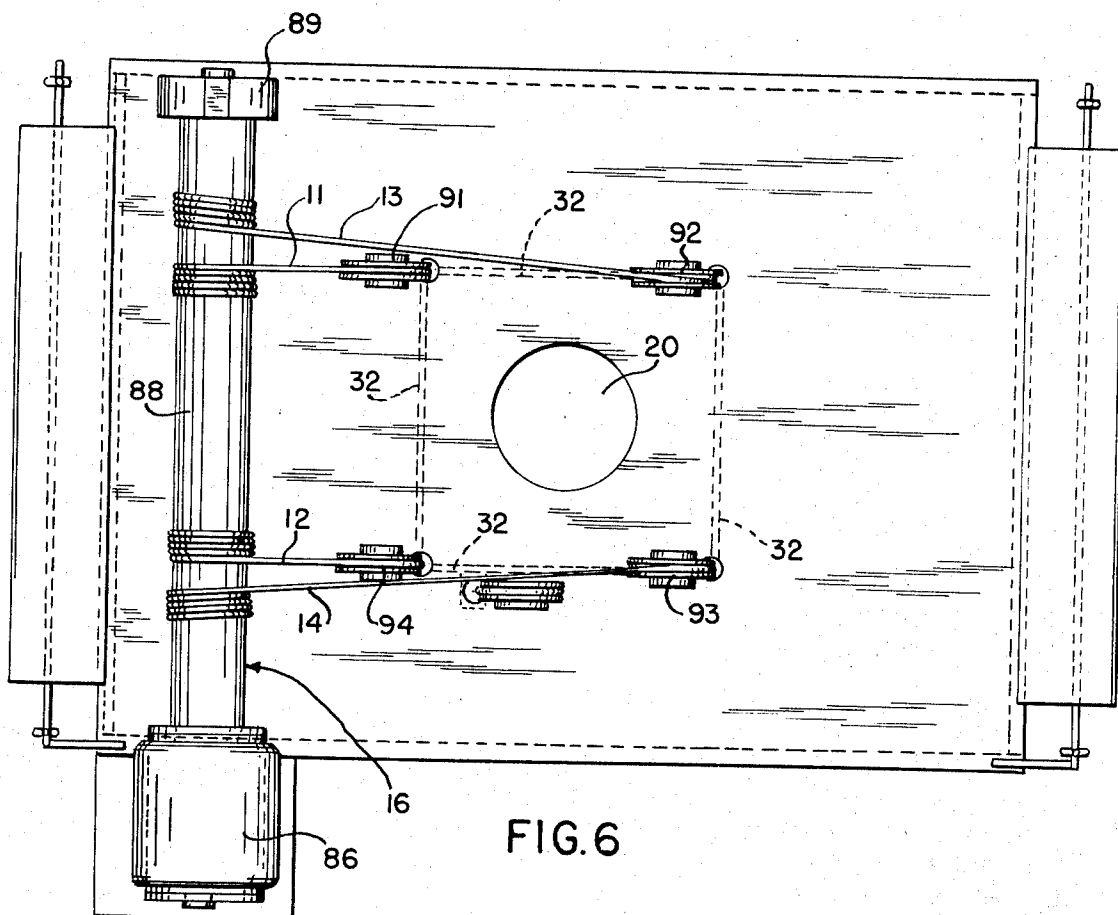


FIG. 6

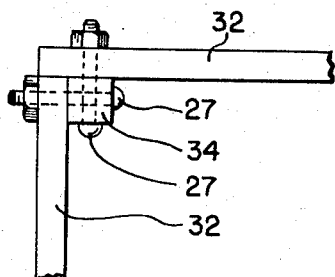


FIG. 8

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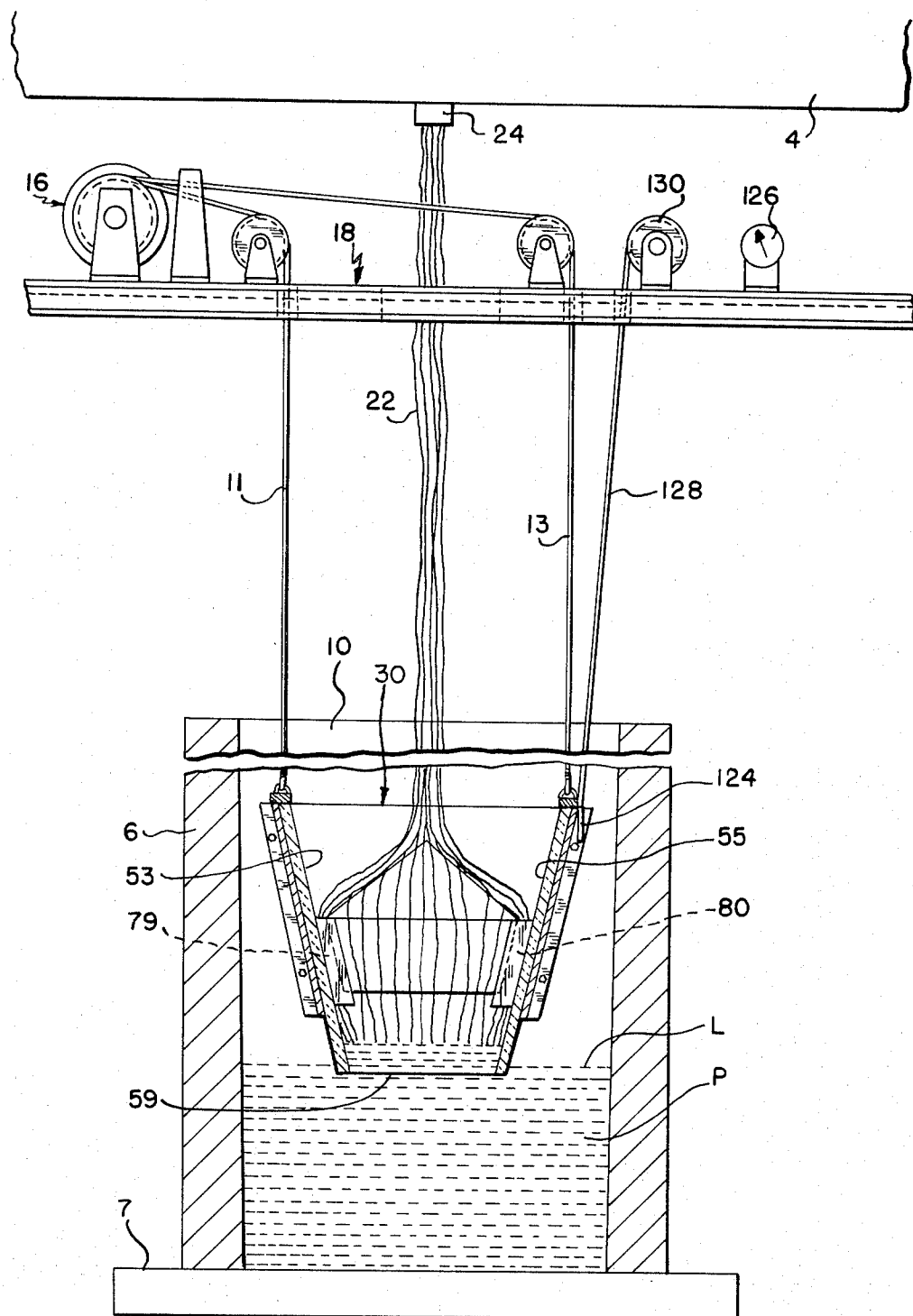


FIG. 7

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SPLASH ARRESTER APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to the pouring and/or casting of metal, such as iron and steel, and more particularly relates to an improved apparatus and method for pouring and/or casting of ingots to eliminate or minimize defects in the finished product thereof.

The aforementioned defects are present in many forms, such as scabs and cracks, which are formed in numerous ways. For example, scabs may occur as a result of splashing of the molten metal onto the ingot mold walls as the molten metal is poured into the ingot mold. These scabs may also occur as a result of a surge of the molten metal above the general level of the molten metal in the mold. This occurs as a result of the teeming stream causing waves in the pool of molten metal in the mold. Surge may also occur as the result of air bubbles which are caused by the teeming stream striking the pool of molten metal in the ingot mold. As these bubbles rise to the surface of the pool, they cause some of the metal to rise higher than the general level of the pool. When this area of greater height subsides, a wave is generated which washes against the mold wall above the level of the molten pool. Another form of surge may result as the teeming stream enters the pool of molten metal forcing the metal ahead of it to the bottom of the pool, then across the bottom of the pool, and then up the sides of the ingot mold causing some of the molten metal to be deposited on the walls of the ingot mold at a level higher than the general level of the molten pool. As the metal is splashed or washed onto the walls of the ingot mold, it becomes oxidized resulting in an imperfect partial fusion with the body of the ingot which covers it at the completion of the pouring process.

Some of the causes of scabs are also the causes of cracks. When a layer of metal is deposited on the ingot mold wall as a result of a surge or waves, the uppermost edge of the deposited metal tends to turn in toward the center of the mold. As a result of oxidation and cooling of this edge, only marginal welding or fusion with the body of the ingot takes place as the level of the molten pool rises above this edge and solidifies. Subsequently, any stress in the area due to shrinkage of the mass will result in a parting of the surface skin at this edge. In addition, these cracks may also be caused as a result of currents caused in the molten pool by the teeming stream. That is, as the teeming stream enters the molten pool forcing the metal ahead of it to the bottom, across the bottom, and then up the walls of the mold, a current of sufficient velocity may be generated to heat up the mold walls causing some fusion or welding of the walls to the body of the ingot as the molten metal solidifies. During shrinkage of the molten mass upon cooling, the areas between these fused or welded spots may be subjected to sufficient stress causing a rupture or parting of the surface which progresses deeper into the mass as shrinkage proceeds.

Heretofore, numerous devices have been employed to eliminate or minimize the occurrence of the above mentioned defects, but which have not been entirely satisfactory. For example, the prior apparatus employed a tundish or distributing ladle into which the teeming stream was directed. The distributing ladles were provided with openings to allow the molten metal

to pour freely into the ingot mold. While these distributing ladles did tend to reduce the force of the teeming stream, in most cases the force was still sufficiently great to generate defects of an undesirable nature.

In other instances, splash arrester devices were employed which comprised sheet metal cylinders that were either placed in the bottom of the molds or suspended from the top of the mold. As these devices were made of metal having a melting point below that of the molten metal being poured, portions of these devices would melt allowing trapped bubbles or gases to escape creating surges and waves. In cases where melting was non-uniform, solid portions would sink into the solidifying ingot resulting in a non-uniform composition. These former devices have varied greatly in length and have covered an insufficient cross sectional area of the mold cavity. Arresters of the longer type have proven to be cumbersome to handle while those of the shorter type provide no protection once the molten metal rises above the height of the arrester.

SUMMARY OF THE INVENTION

A splash arrester apparatus adapted for insertion into a mold during pouring of a stream of molten metal into the mold, such as in forming ingots or the like, comprising, an open-bodied member including an inlet means adapted to encompass the stream and an outlet means adapted to be disposed in submerged relation in a pool of molten metal formed in the mold during the pouring process. The inlet means and the outlet means are disposed in fluid communication with one another and comprise a refractory material having a melting point higher than the melting point of the molten metal in the mold. A selectively actuatable means is operably associated with the open-bodied member for progressively raising the same within the mold as the level of the molten metal rises therein. The member is generally polygonal in configuration including a plurality of slab members secured in end-to-end relation defining a passageway between the inlet means and the outlet means. In one form, an impact member may be mounted interiorly of the open-bodied member intermediate the inlet means and the outlet means to change the cross-sectional shape of the stream of molten metal as it flows therethrough. When an impact member is utilized, the interior surfaces of the open-bodied member are inclined toward one another in a direction from the inlet means to the outlet means being adapted for seating engagement with the impact member for changing the shape of the stream flowing to the apparatus. The impact member is supported in spaced relation from the member defining elongated openings therebetween for converting the stream of molten metal entering the apparatus into ribbon-like streams before it reaches the lower end of the open-bodied member. A level sensing device is provided for selectively controlling the movement of the apparatus in relation to the level of the molten metal contained in the mold.

By this arrangement, molten metal may be poured into an ingot mold whereby the disturbance to the standing pool of molten metal, such as surges or waves, is maintained at a minimum. As a result, any defects in the form of scabs and/or cracks are either eliminated or greatly minimized.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary, partially in cross-section, side elevation view of the splash arrester apparatus of the present invention shown positioned within an ingot mold.

FIG. 2 is a fragmentary, cross-sectional view taken along the line 2—2 of FIG. 4;

FIG. 3 is a fragmentary, cross-sectional view taken along the lines 3—3 of FIG. 4;

FIG. 4 is a fragmentary, cross-sectional view of another embodiment of the splash arrester apparatus of the present invention;

FIG. 5 is a fragmentary, side elevation view of the level sensing device of the present invention when viewed from the right hand side of FIG. 4;

FIG. 6 is a top plan view taken along the line 6—6 of FIG. 1;

FIG. 7 is a fragmentary, elevation view of another embodiment of the splash arrester of the present invention; and

FIG. 8 is a fragmentary view taken along the line 8—8 in FIG. 1.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

The splash arrester apparatus of the present invention is illustrated in FIG. 1, generally at 2, being adapted for use in teeming of molten metal, such as steel, iron or the like, from a ladle 4 into an ingot mold 6 which is mounted in a conventional manner on a support base 7. In one form of the invention, the apparatus 2 includes a splash arrester member 8 which may be suspended within the mold cavity 10 from one end of the cables 11, 12, 13 and 14 (FIG. 6). The cables may be connected at their opposite ends to a suitable winch mechanism, such as at 16, which operates to initially lower the splash arrester 8 into the mold cavity 10, and then progressively raised the latter as the molten metal fills the mold cavity 10 during the teeming operation. The cables may be supported by a suitable support member, such as a platform 18, which may be suspended from beneath the ladle 4. As shown, the platform 18 includes an opening 20 through which the teeming stream 22 may pass upon being poured from the teeming nozzle 24 in the ladle 4.

In the embodiment shown in FIG. 1, the splash arrester member 8 comprises an elongated, hollow body or shell 26 having an upper end adapted for connection to the respective cables such as by bolts 27 or the like, and a lower end adapted to be submerged in the standing pool P of molten metal during the teeming operation. The body 26 may be of any suitable configuration in horizontal cross section, such as polygonal or the like, but is preferably shown as being generally square (FIG. 6). It is to be understood that polygonal as referred to herein includes circular forms as well. An inlet opening 28 is provided adjacent to the upper end adapted to encompass the teeming stream 22 and an outlet opening 29 is provided directly adjacent the lower end adapted to be disposed beneath the surface of the pool P to enable the molten metal in the teeming stream 22 to pass downwardly directly into the molten metal in the pool P at a point beneath the level L. Preferably, the entire body 26 is made of a refractory material, but only that portion submerged in the pool P

need be made of such a material. A suitable material for this purpose would be fire clay, aluminum oxide, zirconia, or any other material having a melting point higher than that of the molten metal being poured.

In the form shown, the body 26 comprises a plurality of flat slab-like members 32 (FIG. 6) which may be secured to one another end-to-end relation, such as by the bolts 27 (FIG. 8), defining therebetween a generally vertically-oriented passageway of substantially uniform cross sectional area. Referring now to FIG. 8, the bolts 27 may be supported on a joining block, such as at 34, with the respective bolts being alternately disposed, such as one above the other to connect the adjoining ends of the respective slab members.

Preferably, the body or shell 26 (FIG. 1) should be of a shortened design requiring minimum clearance between the top of the ingot mold 6 and the platform 18, such as approximately 24 inches. Preferably, smallest outside dimension of the body should be at least 35 percent of the smallest transverse dimension of the mold cavity.

Referring now to FIG. 4, there is shown another form of the present invention wherein the splash arrester member 8 is mounted in aligned relation beneath the lower end of a distributor member 30, which may also be used alone as a splash arrester device in a manner to be discussed more fully hereinafter. In the form shown in FIG. 4, the teeming stream 22 first enters the distributing member 30 where the velocity of the flowing molten metal is reduced, and then flows downwardly into the arrester member 8 and outwardly into the mold cavity as previously described.

As shown, the distributor member 30 comprises an inverted-truncated body which may be of any suitable cross-sectional configuration, but preferably is generally rectangular or square, and of a symmetrical design. The distributor member 30 may include an outer support frame 35 to which the cables, such as 12 and 13, may be detachably secured, such as by eyebolts 32 and 33, for raising and lowering the entire assembly within the mold cavity. The frame 35 may be made of any suitable material, such as steel or the like, with the splash arrester member 8 supported beneath the frame, such as by metal plates 36 and 38. The plates 36 and 38 may be attached to the frame 35 in any suitable manner, such as by welding or the like, and may be detachably secured to the upper end of the splash arrester member 8, such as by bolts 39 or the like.

As shown in FIG. 2, the frame includes generally flat side plates 40, 42, 43 and 44 which may be connected to one another at their adjacent ends in any suitable manner, such as by bolts 46 or the like. Further, the frame 35 supports a liner 48 of refractory material to insulate the frame from the molten metal during the pouring process. The liner 48 includes a plurality of generally flat slab-like members 49, 50, 51 and 52 having interior surfaces 53, 54, 55 and 56, respectively, which are supported in inclined relation by the frame being inclined downwardly and inwardly toward one another and adapted to support an impact member 57 in spaced relation therebetween. As all the slab-like members are shown as being identical in configuration, only one, such as 50, will be described in detail herein.

The slab-like member 50 may be of any suitable configuration, but as shown, is preferably generally wedge-

shaped including generally parallel upper and lower edges 58 and 59 (FIG. 4), respectively, and inclined side edges 60 and 61. Preferably, the side edges 60 and 61 are inclined so that the respective slab-like members are tapered so as to be narrower adjacent the lower edge. In addition, each of the respective side edges 60 and 61 may be beveled, such as at an angle of 45°, to enable tight seating engagement of the side edge of one slab-like member with the confronting side edge of the adjacent slab-like member. By this arrangement, the respective slab-like member will be wedged together to prevent sliding movement downwardly with respect to the frame 35 when in the installed position. As shown, liner 48 (FIG. 4) projects downwardly beyond the frame 35 defining an outlet end 63 adapted to be submerged in the pool P of molten metal when the distributor member 30 is used independently of the arrester member 8 in a manner which will be described in greater detail hereinafter.

The impact member 57 preferably includes a baffle-like upper portion 65 and an inverted truncated lower portion 66 which is adapted for seating engagement with the liner 48. As shown in FIG. 2, the upper portion may be of a generally pyramid-like configuration including generally smooth deflecting surfaces 68, 69, 70 and 71 which are adapted to deflect the molten metal outwardly toward the interior surfaces 53, 54, 55 and 56, respectively, of the liner 48. Preferably, the respective deflecting surfaces are inclined downwardly and outwardly, such as an angle of approximately 30° to 70° with respect to the horizontal terminating in the lower portion 66 (FIG. 4). Preferably, the slope of the deflecting surfaces is substantially steep to enhance the rapid transfer of molten metal therealong to prevent solidification of the same in the distributor member 30. Referring now to FIG. 2 and FIG. 3, the lower portion 66 is defined by generally flat side walls 72, 73, 74 and 75 which have a reverse inclination with respect to the deflecting surfaces of the upper portion 65 being inclined generally downwardly and inwardly toward one another. Further, the impact member 57 may be supported in spaced relation with respect to the surrounding liner 48 by means of insulating spacers 77 which support the respective side walls 72, 73, 74 and 75 in generally parallel relation with respect to the confronting surfaces 53, 54, 55 and 56 of the liner 48 to define generally elongated passageways 79, 80, 81 and 82 therebetween, respectively, to provide a path for the flow of molten metal through the distributor member 30.

Referring again to FIGS. 2 and 3, the passageways 79, 80, 81 and 82 are preferably rectangular in transverse cross section having their lengthwise dimension equal to approximately three or more times greater than the widthwise dimension to permit the stream of molten metal flowing therethrough to occupy a cross sectional area greater than the cross sectional area of the orifice in the teeming nozzle while at the same time sufficiently narrow whereby the stream velocity and penetration into the standing pool of molten metal is minimized. In addition, this arrangement obviates the need for separate discharge nozzles and results in molten metal being discharged uniformly in ribbon-like streams having substantially less impact force than the teeming stream 22.

Preferably, the upper portion 65 of the impact member 57 is positioned a sufficient distance interiorly of the frame 35 to prevent the molten metal from splashing over the upper marginal edge, such as at 58, of the liner 48. Preferably, the volume occupied by the upper pyramidal portion 65 of the impact member 57 is equal to 7 percent or more of the interior volume of the distributor member 30 defined by the portion of the respective liner side surfaces above the upper extremity of the passageways 79, 80, 81 and 82 and a plane extending generally horizontally through the apex, such as at 84, of the upper portion 65 (FIG. 4). Further, the maximum transverse dimension of the opening adjacent the lower edge 59 of the distributor member is less than the minimum transverse dimension adjacent the upper end of the arrester member. Furthermore, the lower edge 59 of the distributor member may be positioned interiorly of the arrester member adjacent the upper end thereof, but if desired, may be positioned above the upper end of the arrester member by a distance of about 5 feet more so long as the force of molten metal striking the standing molten metal in the pool within the arrester member is maintained within acceptable limits.

As previously stated, the distributor member 30 may function as a splash arrester independently of the splash arrester member 8. This may be simply achieved by detaching the splash arrester member 8 from the lower end thereof, as shown in FIG. 7.

Referring now to FIGS. 1 and 6, the winch mechanism 16 may include a suitable drive mechanism, such as an electric motor 86, which may be supported on the platform 18 in any suitable manner well known in the art. As shown in FIG. 6, a drive shaft 88 extends transversely of the platform being drivingly connected at one end to the electric motor 86 and journaled for rotation at the other end in a support bearing 89. Cables 11, 12, 13 and 14 are wrapped circumferentially about the shaft 88 in a conventional manner so as to be paid off or taken up upon rotation of the shaft 88 to lower or raise the arrester member 8, as desired. Preferably, the cables 11, 12, 13 and 14 are entrained about the pulleys 91, 92, 93 and 94 mounted on the platform 18. The respective pulleys may be secured to the platform in any suitable manner as well known in the art, and are preferably positioned about the opening 20 so as to align the opening 20 generally centrally with respect to the arrester member 8.

The motor 86 may include a suitable control panel as well known in the art, (not shown) adapted for operation at a remote location for controlling the raising and lowering of the arrester member. As it is extremely difficult for an operator to determine the level of the molten metal in the mold cavity 10, a level sensing device 96 may be provided to accomplish such. In one form shown in FIG. 1, the level sensing device comprises a float mechanism 97 which may be secured to the arrester member 8. As shown, the float mechanism 97 is disposed externally of the arrester member 8 and includes a float member 98 which is adapted to float on the surface, such as at L, of the molten metal in the pool P. In the form shown, the float member 98 is attached at one end of a flexible cable 99. The cable 99 is connected at its opposite end to a spring-loaded take up reel 100 mounted on a platform 18 adapted to

receive the cable 99 in coiled relation thereabout. Preferably, the weight of the float 98 and cable 99 is sufficient to cause uncoiling of the cable 99 so that the float member 98 will float on the surface of the molten metal in the pool P, while the force acting on the cable 99 by the takeup reel 100 is sufficient to coil the cable 99 thereabout upon raising of the float member 98. Referring now to FIG. 5, the cable 99 may be supported at the side of either the arrester member 8 (FIG. 1) or distributor member 30 by a bracket 102 which is adapted to slidably receive the cable 99 therethrough. As shown, the bracket 102 includes a pair of upper and lower arms, 104 and 106, respectively, having generally axially aligned openings 108 and 110 therethrough adapted to slidably receive the cable 99. A collar member 112 is affixed to the cable 99 and is disposed between the arms 104 and 106 being adapted to engage the upper and lower arms upon upward and downward movement of the cable 99 with respect to the bracket 102, respectively. In the form shown in FIG. 1, the float member 98 is positioned above the lower end of the arrester member 8 while the lower end of the arrester member 8 is always submerged in the pool P. As shown in FIG. 1, the face of the takeup reel 100 may be provided with indicating means 114, such as an arrow, to indicate angular movement thereof, and thus the relative position of the collar 112 with respect to the arms 104 and 106. For example, in FIG. 1 the arrow may be disposed in a position pointing directly to the left as seen in FIG. 1 when the collar 112 is disposed in abutting engagement with the lower arm 106, whereas, the arrow may be disposed in a position pointing directly to the right, as indicated by the dotted lines at 116, when the collar 112 is disposed in engagement with the upper arm 104. By this arrangement, movement of the arrow from the left hand position to the right hand position will indicate to the operator a movement of the float 98, and thus, the rising level of the molten metal in the pool P. When the arrow 114 reaches the position indicated at 116, the operator will then raise the arrester member 8 by operating the motor 86 to bring the arm 106 up into engagement with the collar 112. The motor is then stopped until movement of the indicator 114 shows that the level of liquid metal in the ingot has again reached the point where the collar 112 is in engagement with the arm 104. Thereupon, the motor will again be operated to raise the arrester so as to repeat the cycle until the ingot is filled to the desired level.

In conjunction with the float mechanism 97, the level sensing device 96 includes a position indicator 118 to indicate the position of the arrester member 8. In the form shown, the position indicator 118 may include one of the aforementioned support pulleys, such as 93, on the face or side of which may be disposed an indicating means 120, such as an arrow. In the form shown, the pulley 93 and takeup reel 100 have substantially the same diameter so that upon each revolution equal amounts of the cable 99 and cable 14 will be paid off or taken up. By this arrangement, when the arrow 114 moves, for example, from the left hand position to the right hand position, the operator may actuate the winch mechanism 16 to cause the pulley 93 to rotate from the right hand position to the left hand position, indicated by the dotted lines 122. Likewise, when the arrow 114

moves from the right hand position 116 back to the left hand position, the operator again can actuate the winch mechanism to cause the arrow 120 to move from the left hand position to the right hand position. Preferably, the winch mechanism 16 should be actuated just prior to the arrow 114 reaching the same angular position as the arrow 120 to prevent contact of the collar 112 with the upper arm 104. By this arrangement, the arrester member 8 will always be in the raised position with respect to the float member 98, and thus, will eliminate the possibility of the level L of the molten metal in the pool P rising above the float member 98.

Referring now to FIG. 7, there is shown another form of level sensing device which may be utilized with the present invention. As shown, a suitable temperature sensing element 124, such as a thermostat or the like, may be connected to the distributor member 30 (and/or arrester member 8) in spaced relation to the standing pool P to test the temperature of its location with reference to the level of the molten metal. The thermostat 124 may be operably connected to an indicating element 126 by a suitable conductor 128. An indicating element 126 may be provided which may be equipped to either visually indicate to an operator when to actuate the winch mechanism or provide a signal to a suitable control device as well known in the art (not shown) to automatically actuate the winch mechanism 16 to progressively raise the distributor member 30 (and/or arrester member 8) as the level L of the standing pool P rises in the mold 6. A takeup reel 130 may be mounted on the platform exteriorly of the mold 6 to maintain the conductor 128 in generally taut condition and to prevent contact thereof with the molten metal in the mold.

The platform 18 may be made of any suitable material, such as sheet steel or the like, being of suitable thickness to support the various components of the splash arresting apparatus. In the form shown, the platform 18 is provided with a pair of support flanges 132 and 134 which project outwardly away from one another and are adapted to be detachably supported, such as by gravity, on a pair of swing-like hanger members 136 and 138, respectively. The hanger members 136 and 138 are preferably detachably supported in swingable relation from the lower end of the ladle 4 by means of hook-like members, such as at 140. Each of the hanger members 136 and 138 may be provided with inwardly projecting lever-like handles 142 and 144 to enable the respective hanger members to be swung or pivoted outwardly from under the flanges 132 and 134 when it is desired to remove the platform 18 from beneath the ladle 4.

In a typical operation of the embodiment shown in FIG. 1, the apparatus 2 is positioned adjacent the upper open end of the mold 6 and lowered to a position adjacent the bottom of the mold cavity 10. The body 26 may be lowered into contact with or just slightly above the support base 7. In any event, the outlet opening 29 at the lower end of the body 26 should be restricted initially to a cross sectional area less than the main cross sectional area of the teeming stream 22 so that the level LL of the molten metal confined within the body 26 of the arrester member 8 will be above the level L of the standing pool of molten metal in the mold cavity 10 when the molten metal is initially poured into the mold

6. The teeming nozzle 24 may then be opened, and the molten metal poured into the arrester member 8 with the initial and subsequent splashing being contained therein. When the level L of the pool P reaches a predetermined height with respect to the upper extremity of the arrester member 8, the molten metal will contact the float member 98 causing the latter to float on the surface thereof and be raised as the level L rises in the mold cavity 10. As the float member 98 rises, the arrow 114 on the face of the takeup member 100 will rotate, such as in a clockwise direction to indicate to the operator that the level L is rising in the mold cavity 10. When the arrow 114 has been rotated to approximately the position indicated by the arrow at 116, the operator may then actuate the winch mechanism 16 so that the arrow 120 on the face of the pulley member 93 will be rotated from its initial position, such as pointing to the right in FIG. 1, to the position indicated by the arrow at 122. As the float member 98 is arranged to always be positioned above the lower end of the arrester member 8, the outlet opening 29 adjacent the lower end of the arrester member will be maintained in submerged relation in the molten metal pool so that the molten metal in the teeming stream will strike the molten metal confined within the arrester member 8, and the force of the same will be substantially dissipated within the arrester member 8 before it is discharged through the outlet opening into the standing pool P of molten metal in the mold cavity 10. As the volume of the molten metal entering the mold 6 is generally uniform, the relation between the level LL in the arrester member 8 will remain substantially constant with respect to the level L in the pool P. Therefore, the portion of the body 26 submerged beneath the level L of the pool P will act as a barrier to reduce the turbulence within the pool P so that the flow through the outlet opening in the body 26 is substantially uniformly downwardly and then outwardly reducing the washing of molten metal onto the walls of the mold cavity 10 adjacent the level L. As the level L reaches the top of the mold 6, the teeming stream 22 is shut off, and the molten metal in the arrester member 8 will flow outwardly filling the remainder of the mold cavity 10 until the level LL and the level L reach a common point within the mold cavity. Subsequently, the arrester member 8 is raised outwardly of the mold cavity and the ingot thus formed is allowed to cool and solidify.

Referring now to FIG. 4, when the splash arrester member 8 is used in conjunction with the distributor member 30, it operates essentially as described above except that the force of the entering molten metal is substantially reduced. Similarly, the apparatus is lowered into the mold cavity 10 to initially position the lower end of the splash arresting member 8 adjacent to the support base 7 as previously described. The teeming nozzle may then be opened to enable the molten metal to pour downwardly into the distributor member 30. The distributor member 30 is positioned within the mold cavity so that the apex 84 of the impact member 57 is substantially axially aligned with the teeming stream 22. In this manner, a uniform distribution throughout the entire surface of the upper portion 65 may be achieved. The molten metal is diffused outwardly and downwardly by the upper portion 65 of the impact member 57 with the initial splatter or splashing

of molten metal being retained within the distributor member by the confronting liner walls 53, 54, 55 and 56 (FIG. 2). The molten metal will then be directed downwardly through the elongated passageways 79, 80, 81 and 82 (FIG. 3) being baffled inwardly by the respective confronting liner walls in a reverse direction to the flow along the upper surfaces 68, 69, 70 and 71 of the upper portion 65. As the molten metal flows through the aforesaid passageways, it is formed into relatively thin ribbon-like streams so that the entire volume of the molten metal is spread over a larger area to reduce the velocity of the molten metal as it leaves the lower end of the distributor member 30. By effectively reducing the velocity of the molten metal, the effective force of the metal striking the pool of molten metal contained within the arrester member 8 is substantially reduced as compared to the embodiment illustrated in FIG. 1. Again, as the level L of the pool P of molten metal rises in the mold cavity 10, the apparatus may be progressively raised while maintaining the outlet end of the arrester member 8 in submerged relation in the pool P in the manner previously described.

When so desired, the distributor member 30 may be used alone (FIG. 7). In such a case, the distributor member 30 is initially lowered into the mold cavity to position the lower edge 59 adjacent to the base 7 in a manner similar to that described with respect to the arrester member 8. In this form, the lower edge 59 may be submerged in or positioned slightly above the surface of the pool P, as desired. In addition, either the float type level sensing device (FIG. 4) or the temperature-sensitive type level sensing device may be employed. In the form shown in FIG. 7, the temperature-sensitive type level sensing device is employed, and as the level L of the pool P rises to a predetermined distance with respect to the temperature sensitive element 124, the distributor member will be progressively raised, either manually by an operator or automatically, in the manner previously described. When the lower edge 59 of the distributor member is disposed in submerged relation in the pool P, (FIG. 7). The molten metal will pour through the lower end of the distributor member 30 in ribbon-like streams directly into the standing pool P of molten metal. As the distributor member 30 is arranged to provide a tortuous wide path for the flow of molten metal therethrough, the velocity and force of the molten metal striking the pool P will be substantially reduced thereby effectively reducing the splashing and washing of the molten metal onto the wall of the mold 6.

I claim:

1. A splash arrester for insertion into a mold during the pouring of a stream of molten metal from a ladle into the mold comprising,
 - an arrester device having a hollow body of refractory material,
 - said body being open unrestrictedly at the top and bottom and being adapted to encompass said stream of molten metal as it flows from the ladle,
 - to discharge it through the bottom of the device into a pool of molten metal formed in the mold during the pouring operation,
 - means positioned above the mold and operatively connected to the device for raising and lowering it within the mold,
 - a level sensing device carried by the body,

an indicating means disposed exteriorly of the mold for indicating the position of the sensing device with reference to the level of the molten metal within the mold, and

means for automatically raising the device progressively as the level of the molten metal rises in the mold.

2. A splash arrester for insertion into a mold during the pouring of a stream of molten metal from a ladle into the mold comprising,

an arrester device having a hollow body of refractory material,

said body being open unrestrictedly at the top and bottom and being adapted to encompass said stream of molten metal as it flows from the ladle,

to discharge it through the bottom of the device into a pool of molten metal formed in the mold during the pouring operation,

means positioned above the mold and operatively connected to the device for raising and lowering it within the mold,

the device including an impact member which is mounted within the body intermediate the top and bottom thereof and which coacts with the body to form spaced channels within the body through which the molten metal is discharged in ribbon-like form from the body, and

a second body in the form of a hollow member which is carried by the body and depends therefrom and into which the molten metal discharged from the body is further encompassed.

3. A splash arrester for insertion into a mold during the pouring of a stream of molten metal from a ladle into the mold comprising,

an arrester device having a hollow body of refractory material,

said body being open unrestrictedly at the top and bottom and being adapted to encompass said stream of molten metal as it flows from the ladle,

to discharge it through the bottom of the device into a pool of molten metal formed in the mold during the pouring operation,

means positioned above the mold and operatively connected to the device for raising and lowering it within the mold,

the device including an impact member which is mounted within the body intermediate the top and bottom thereof and which coacts with the body to form spaced channels within the body through which the molten metal is discharged in ribbon-like form from the body,

the impact member having a substantially pyramidal shape, the apex of which is adjacent the vertical center of the body and the base of which cooperates with the body to form channels through which the molten metal flows,

the body of the device having walls which diverge upwardly and outwardly from the bottom, and

the impact member having a portion thereof shaped so as to be complementary to the slope of the walls whereby the impact member is held by gravity in its position within the device.

4. An apparatus according to claim 2, wherein a platform is positioned between the ladle and the mold, and

wherein the means for raising and lowering the device are mounted on the platform.

5. An apparatus according to claim 4, wherein the platform is detachably connected to the ladle and is suspended from it during the pouring operation.

6. An apparatus according to claim 2, wherein the device includes an impact member which is mounted within the body intermediate the top and bottom thereof and which coacts with the body to form spaced channels within the body, through which the molten metal is discharged in ribbon-like form from the body.

7. An apparatus according to claim 4, wherein the raising means comprises an electric motor and sheaves mounted on the platform, together with cables which extend over the sheaves and are operatively connected to the motor and to the arrester device respectively.

8. An apparatus according to claim 6, wherein the impact member has a substantially pyramidal shape,

the apex of which is adjacent the vertical center of the body, and

the base of which cooperates with the body to form channels through which the molten metal flows.

9. An apparatus according to claim 1, wherein the top of the lower member is spaced from the bottom of the upper member and

wherein the bottom of the lower member is adjacent the level of the molten metal within the mold.

10. An apparatus according to claim 2, wherein the level sensing device comprises a float which is adapted to engage the level of the molten metal within the mold and is carried by the body but is movable with respect thereto.

11. An apparatus according to claim 2, wherein the smallest outside transverse dimension of the body is at least 35 percent of the smallest transverse dimension of the cavity.

12. An apparatus according to claim 2, wherein said body is generally polygonal in configuration, in top plan, including

a plurality of slab members secured in end-to-end relation and defining a passageway between the open top and bottom thereof.

13. An apparatus in accordance with claim 2, wherein

said body includes a frame, and a lining of refractory material carried by said frame.

14. A splash arrester for insertion into a mold during the pouring of a stream of molten metal from a ladle into the mold comprising,

an arrester device having a hollow body of refractory material,

said body being open unrestrictedly at the top and bottom and being adapted to encompass said stream of molten metal as it flows from the ladle,

to discharge it through the bottom of the device into a pool of molten metal formed in the mold during the pouring operation,

means positioned above the mold and operatively connected to the device for raising and lowering it within the mold,

a level sensing device in the form of a thermocouple which is carried by the body and is sensitive to the heat within the mold, and

means actuated by the thermocouple for indicating variations in the change in temperature in the mold in the region of the sensing device.

15. A splash arrester for insertion into a mold during the pouring of a stream of molten metal from a ladle into the mold comprising,
 an arrester device having a hollow body of refractory material,
 said body being open unrestrictedly at the top and bottom and being adapted to encompass said stream of molten metal as it flows from the ladle, to discharge it through the bottom of the device into a pool of molten metal formed in the mold during the pouring operation,
 means positioned above the mold and operatively connected to the device for raising and lowering it within the mold,
 a platform positioned between the ladle and the mold,
 said means for raising and lowering the device being mounted upon the platform, and
 an indicator mounted on the platform for indicating the position of the device with reference to the level of the molten metal within the mold.
16. An apparatus according to claim 2, wherein a level sensing device is carried by the body, and an indicating means is disposed exteriorly of the mold for indicating the position of the sensing device with reference to the level of the molten metal within the mold.
17. An apparatus according to claim 8, wherein the volume of the impact member above its base is at least equal to 7 percent of the volume enclosed by the walls of the body between the base and a horizontal plane passing through the apex of the impact member.
18. An apparatus according to claim 8, wherein the slope of the pyramidal portion is between 30° and 70° with respect to a plane passing horizontally through the base of the impact member.
19. An apparatus according to claim 16, wherein the level sensing device comprises a float which is adapted to engage the level of the molten metal within the mold and is carried by the body but is movable with respect thereto.
20. A splash arrester for insertion into a mold during the pouring of a stream of molten metal from a ladle into the mold comprising,
 an arrester device having a hollow tubular body of refractory material said body being open unrestrictedly at the top and bottom and being adapted to encompass said stream of molten metal as it flows from the ladle and to discharge it axially through the bottom of the device into a pool of molten metal formed in the mold during the pouring operation,
 means positioned above the mold and operatively connected to the device for raising and lowering it within the mold,
 a level sensing device carried by the body, and
 an indicating means disposed exteriorly of the mold for indicating the position of the sensing device with reference to the level of the molten metal within the mold.
21. An apparatus according to claim 20, wherein a platform is positioned between the ladle and the mold, and
 wherein the means for raising and lowering the device are mounted on the platform.
22. An apparatus according to claim 21, wherein

- the platform is detachably connected to the ladle and is suspended from it during the pouring operation.
23. An apparatus according to claim 20, wherein the device includes an impact member which is mounted within the body intermediate the top and bottom thereof and which coacts with the body to form spaced channels within the body, through which the molten metal is discharged in ribbon-like form from the body.
24. An apparatus according to claim 21, wherein the raising means comprises an electric motor and sheaves mounted on the platform, together with cables which extend over the sheaves and are operatively connected to the motor and to the arrester device respectively.
25. An apparatus according to claim 23, wherein the impact member has a substantially pyramidal shape,
 the apex of which is adjacent the vertical center of the body, and
 the base of which cooperates with the body to form channels through which the molten metal flows.
26. An apparatus according to claim 25, wherein the volume of the impact member above its base is at least equal to 7 percent of the volume enclosed by the walls of the body between the base and a horizontal plane passing through the apex of the impact member.
27. An apparatus according to claim 25, wherein the slope of the pyramidal portion is between 30° and 70° with respect to a plane passing horizontally through the base of the impact member.
28. An apparatus according to claim 20, wherein the smallest outside transverse dimension of the body is at least 35 percent of the smallest transverse dimension of the cavity.
29. An apparatus according to claim 20, wherein said body is generally polygonal in configuration, in top plan, including
 a plurality of slab members secured in end-to-end relation and defining a passageway between the open top and bottom thereof.
30. An apparatus in accordance with claim 20, wherein
 said body includes a frame, and
 a lining of refractory material carried by said frame.
31. A splash arrester for insertion into a mold during the pouring of a stream of molten metal from a ladle into the mold comprising,
 an arrester device having a hollow tubular body of refractory material said body being open unrestrictedly at the top and bottom and being adapted to encompass said stream of molten metal as it flows from the ladle and to discharge it axially through the bottom of the device into a pool of molten metal formed in the mold during the pouring operation,
 means positioned above the mold and operatively connected to the device for raising and lowering it within the mold,
 the device including an impact member which is mounted within the body intermediate the top and bottom thereof and which coacts with the body to form spaced channels within the body, through which the molten metal is discharged in ribbon-like form from the body,

the impact member having a substantially pyramidal shape,
the apex of which is adjacent the vertical center of the body, and
the base of which cooperates with the body to form channels through which the molten metal flows, and
the volume of the impact member above its base being at least equal to 7 percent of the volume enclosed by the walls of the body between the base and a horizontal plane passing through the apex of the impact member.

32. A splash arrester for insertion into a mold during the pouring of a stream of molten metal from a ladle into the mold comprising,

an arrester device having a hollow tubular body of refractory material said body being open unrestrictedly at the top and bottom and being adapted to encompass said stream of molten metal as it flows from the ladle and to discharge it axially through the bottom of the device into a pool of molten metal formed in the mold during the pouring

operation,
means positioned above the mold and operatively connected to the device for raising and lowering it within the mold,

the device including an impact member which is mounted within the body intermediate the top and bottom thereof and which coacts with the body to form spaced channels within the body, through which the molten metal is discharged in ribbon-like form from the body,

the impact member having a substantially pyramidal shape,

the apex of which is adjacent the vertical center of the body, and

the base of which cooperates with the body to form channels through which the molten metal flows, and

the slope of the pyramidal portion is between 30° and 70° with respect to a plane passing horizontally through the base of the impact member.

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