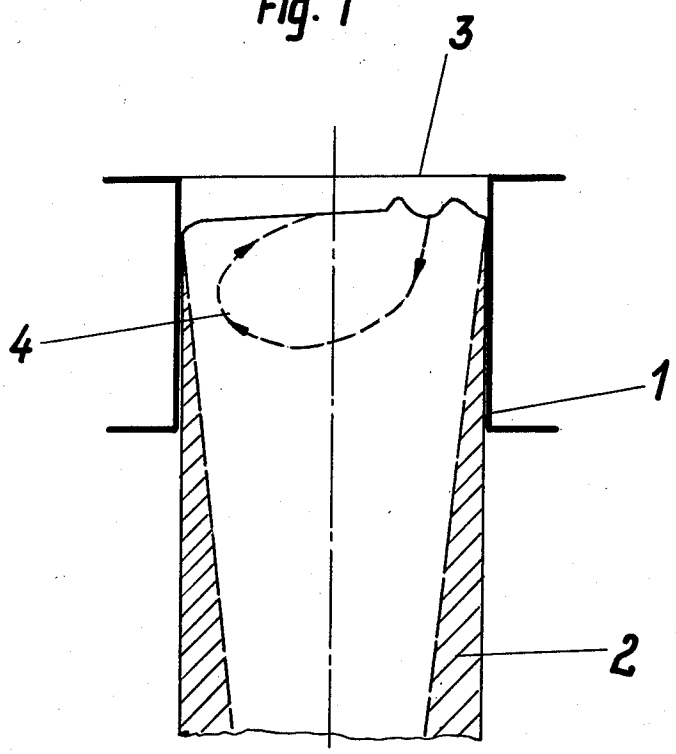
July 12, 1960 B. TARMANN 2,944,310

METHOD OF CONTINUOUS CASTING

Filed Feb. 13, 1958

Fig. 1



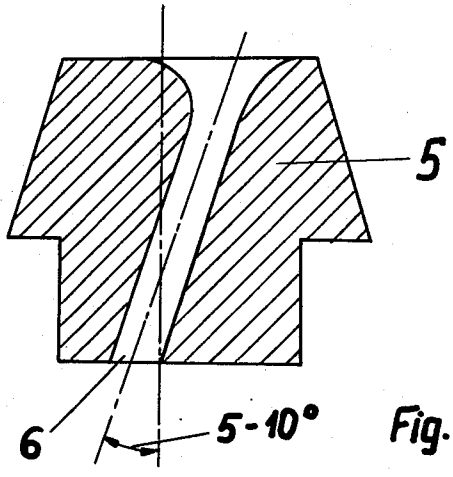


Fig. 2

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METHOD OF CONTINUOUS CASTING

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1 Claim. (Cl. 22—200.1)

This invention relates to a method of continuous casting, particularly for the continuous casting of refractory metals.

It is customary in continuous casting plants to pour the molten metal in one or more jets into the mold. The jet impinges the surface of the metal bath in the mold in most cases at right angles to said surface and adjacent to the axis of the billet. When the molten metal is poured in several jets, the distribution of the points of impact of the jets on the surface of the metal bath is chosen so that the inflow of the hotter molten metal in any of the jets does not disturb the uniform growth of the solidified skin of the metal in the mold. A current caused by the inflowing molten metal would reduce the development of the solidified skin and would cause the skin to melt through at that point of the billet where the current reaches the skin zone.

The teeming currents agitate also the slag particles which are entrained by the molten metal. They are carried by the jet from the surface of the metal bath into the depth thereof and are sometimes urged into the pasty part of the metal bath, where they are occluded during the solidification of the metal. They are the cause of structural defects and sometimes of a breakthrough of the still molten core through the skin. Slag particles which settle on the skin of the billet insulate the molten metal behind them against the cooling action of the mold wall and thus reduce the progress of the solidification at this point. The teeming jet may also urge the oxide skin forming on the surface of the metal bath against the mold wall, where it is then moved downwardly in intervals together with the billet during the lowering movement of the latter. This results in laps and laminations at the skin portions of the billet and consequently in indentations having rounded corners and uneven boundary surfaces at the periphery of the billet.

In order to prevent the formation of such cold shuts it has already been proposed to cover the metal bath and to maintain it is continuous agitation by a mechanical or electromagnetic device. This will stir the oxide and slag layers into the metal bath and will promote the formation of structural defects in the billet.

To avoid all these disadvantages it is proposed according to the invention to select the number and location of the points of impact as well as the angle of impact of the teeming jets on the surface of the metal bath so that the teeming jet itself causes a current in the metal bath whereby the desired temperature distribution and a movement of the metal bath are achieved.

If the teeming jet impinges the surface of the metal bath in a mold for continuous casting next to one point of the wall of the mold, the jet will cause a current which flows below the surface of the metal bath to the opposite point of the wall of the mold and rises along the skin layer which is solidifying there; then the current

will proceed on the surface of the metal bath toward the teeming jet. Before reaching the teeming jet this current is braked by the wave crest which is formed around the teeming jet. At this point the entrained slag particles and any oxide skin which may be formed are held on the surface of the metal bath whereas the lower particles of the current are entrained by the suction of the teeming jet and perform an additional part of the cycle.

The slag particles which are entrained by the teeming jet rise to the surface of the metal bath at the opposite end of the mold owing to their low weight and float on the surface of the oxide skin, from where they can easily be removed.

The desired current can be given the desired direction and intensity by an inclination of the teeming jet. This will also ensure that the teeming jet does not move too close to the skin so that the danger of a retardation of the growth of the solidified skin next to the teeming point as a result of the higher temperature of the inflowing molten metal is avoided.

The invention will be explained with reference to an illustrative embodiment shown in the drawing. Fig. 1 is a sectional view of a mold having a mold cavity of symmetrical elongated cross-sectional shape. Fig. 2 shows a gate according to the invention.

The jet of molten metal causes in the metal bath in the mold the formation of a current, which, as is indicated by the dash line 4, proceeds in the direction toward the opposite wall of the mold and is diverted by the solidifying skin toward the surface of the metal bath at a distance from the wall. On the surface of the metal bath the molten metal flows toward the teeming jet and is entrained by the same for a new cycle. This current of molten metal entrains also the inflowing slag particles, which rise to the surface of the metal bath on the opposite side of the mold near the skin and float there owing to their low weight. These slag particles are sometimes urged toward the teeming jet but are held back at the wave crest forming around the teeming jet before they reach the teeming jet itself. At this wave crest the slag particles can easily be skimmed off.

To obtain a current flowing in a predetermined direction the molten metal is supplied to the mold through a gate 5, the channel 6 of which is inclined with respect to the axis of the mold. The angle of inclination must be selected in accordance with the flow energy and the width of the mold and may suitably amount to 5–10°.

I claim:

A method for the continuous casting of metals which comprises forming a bath of molten metal in a mold, and pouring at least one jet of molten metal on the surface of said bath by passing molten metal through an elongated, straight confining conduit the axis of which is inclined with respect to and crosses the longitudinal axis of said mold below said surface, said conduit having an outlet for discharging said metal which outlet is sufficiently closely spaced above said surface to cause said jet to impinge on said surface at an angle of 5–10 deg. with respect to the axis of said mold, whereby a current flowing along a substantially closed path which extends in a plane which is at right angles to said surface is produced in said bath.

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