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METHOD OF CONTINUOUS FLAT METAL CASTING WITH THE FORWARD MOLD STROKE AND PINCH ROLL SPEED SYNCHRONIZED WITH THE SPEED OF THE FORWARD SPEED OF MOLTEN METAL

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Fig. 1.

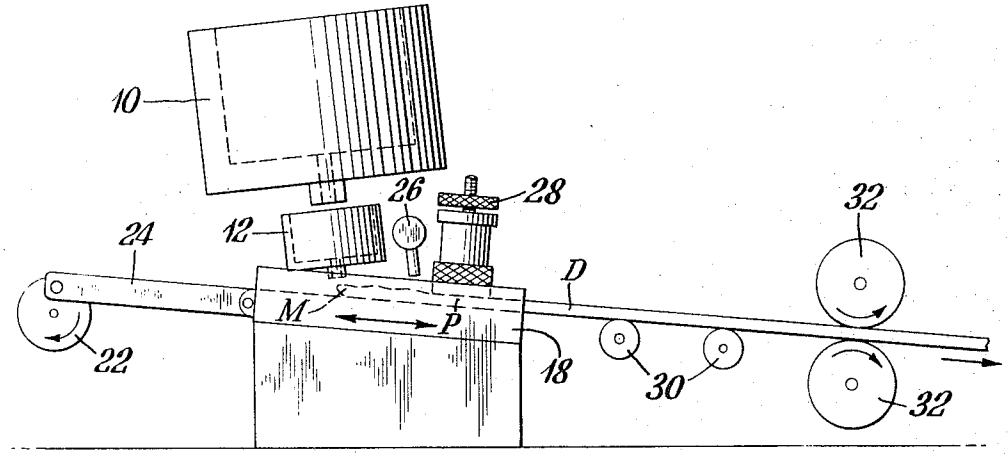
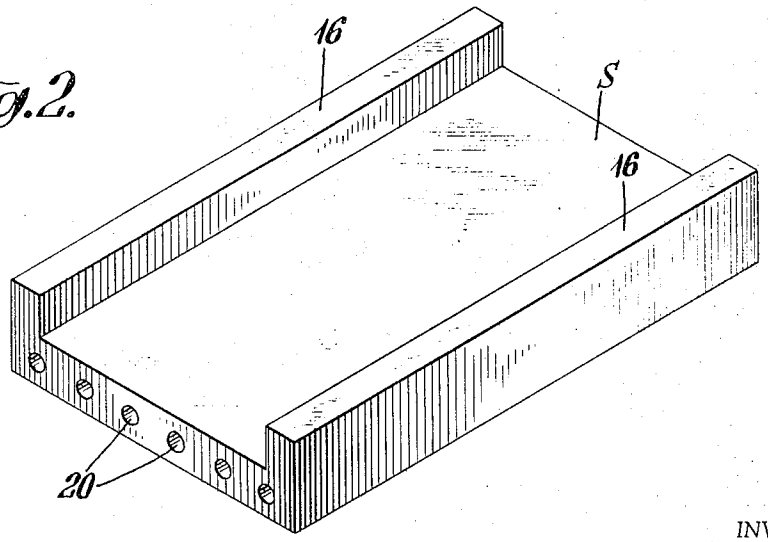


Fig. 2.



INVENTOR.
JOHN W. ROSS

BY Richard S. Sheree Jr

ATTORNEY

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METHOD OF CONTINUOUS FLAT METAL CASTING WITH THE FORWARD MOLD STROKE AND PINCH ROLL SPEED SYNCHRONIZED WITH THE SPEED OF THE FORWARD SPEED OF MOLTEN METAL

John W. Ross, Toronto, Ontario, Canada, assignor to Union Carbide Canada Limited, Ontario, Canada, a corporation of Canada

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3 Claims. (Cl. 22—200.1)

This invention relates to continuous flat metal casting, more particularly of flat metal products with a high width to thickness ratio.

The conventional method of making steel consists of tapping a furnace-heat into a ladle, and teeming the ladle contents into cast iron ingot molds. The molds are stripped, and the ingot is transferred to the soaking pit. From here it is rolled on primary hot mills, surface conditioned, re-heated, rolled on secondary mills, normalized or annealed and finally, rolled on cold mills.

Molds, mold preparation, mold stripping and soaking pit equipment require large investments. Primary hot mills are costly, with big power requirements. The heating processes consume large quantities of fuel. Maintenance and replacement of equipment is high.

The length of time consumed from the ladle to the end of the secondary hot mill is excessive in present practice. The improvement in the economics, therefore, lies in the smaller investment, shorter processing time, reduced inventory of steel being processed, etc.

The main objects of the present invention are to reduce investment, maintenance, processing time, and production costs, preferably by eliminating the ingot molds, soaking pits, blooming mill conditioning, and re-heating.

According to the present invention, molten metal is poured from a ladle, into a skimmer-tundish device, which gives a near constant head. From this device, a pouring nozzle deposits the molten metal onto a reciprocating water-cooled casting mold which provides initial directional motion to the metal cast. Idler rollers support the metal cast to pinch take-out rolls which provide positive motion to the metal for further processing in the rolling mill.

In the drawing:

FIGURE 1 is a vertical side elevation of a machine according to, and for carrying out the process of the present invention; and

FIGURE 2 is a perspective view of the flat surfaced mold employed in FIGURE 1.

As shown in FIGURE 1, molten metal is supplied by a ladle 10, from which the molten metal is poured into a skimmer-tundish device 12, which provides a near constant head and holds back the slag until the end of the pour.

The skimmer-tundish device 12 delivers the molten metal into a casting mold having a bottom with a flat upper surface S constructed of chrome plated deoxidized copper or some superior material, which as shown in FIGURE 2, is provided with side ridges or flanges 16 to maintain metal flow, and which rides on an oil lubricated slide support 18. Water cooling passages 20 extend the length of the mold, and are of such diameter as to allow a water velocity of at least 25 feet per second. Pyrolitic graphite inserts are desirably utilized in order to provide durability and prevent mold erosion due to pouring of hot metal.

A reciprocating mechanism comprising an eccentric 22 and a link 24 moves the mold in the horizontal plane. The forward mold stroke is at the speed of the forward spread of the molten steel as it contacts the initial zone

of the mold surface and the speed of pinch rolls which remove the solidified strip are synchronized with the cast strip speed. The return stroke is rapid, in order to maintain the forward metal flow. The mold stroke ranges from 3 to 6 inches.

A propane burner 26 is positioned immediately downstream from the pouring nozzle. This provides an inert atmosphere and prevents air contamination.

An adjustable thickness control 28 is located immediately downstream of the propane burner, and is used to control the thickness of the metal cast. This is preferably a water-cooled roll, or any device which would control cast thickness of metal.

Support rolls 30 are located at the end of the mold forward stroke, and are required to conduct the metal strip to the pinch rolls.

Pinch take-out rolls 32 are located downstream of the support rolls, and provide forward motion to the metal cast for further processing.

The continuous casting machine is preferably declined at an angle of approximately 6° in order to assist the forward metal flow.

In operation, while the inclined flat mold surface S is continuously reciprocated by the eccentric 22 and continuously cooled by the water in the passages 20, molten metal M from the skimmer-tundish device 12 is continuously poured onto the upper side of an initial zone of the surface S, and spreads laterally and forwardly with a free upper surface. The flanges 16 confine the lateral spread of the molten metal to provide a stream of uniform width.

As the forward spread of this stream passes to an intermediate zone, the water in the passages 20 chills the mold to a plastic state P. Here the roll of device 28 confines the free surface of the plastic metal to provide a stream of uniform depth.

As the plastic metal of uniform thickness thus provided passes to the final zone of the surface S, the water in the passages 20 chills the plastic metal to a solid state D. The solid metal passes on over the supporting rollers 30 into the cup of traction rollers 32 which deliver the solid metal for further processing.

What is claimed is:

1. Method of continuous casting of flat products from molten steel with a high width to thickness ratio, which comprises continuously reciprocating an open top inclined flat mold surface while continuously cooling the same from the underside thereof continuously pouring molten steel from a fixed position tundish onto the upper side of an initial zone of said mold surface to spread laterally and forwardly with a free upper surface, confining the lateral spread of said molten steel to provide a stream of uniform width, the forward spread over an intermediate zone of the cooled surface chilling the steel to a plastic state, confining the free surface of said plastic steel to provide a stream of uniform depth, and passing said uniform depth plastic steel to a final zone of said cooled surface where said plastic steel is chilled to a solid state and delivered therefrom to pinch take-out rolls downstream thereof, the forward stroke of said reciprocation being at the speed of the pinch roll speed which in turn is synchronized with the speed of the forward spread of said molten steel as it contacts the initial zone of said mold surface and the return stroke is at a faster rate in order to maintain the forward metal flow.

2. Method as claimed in claim 1, in which said molten steel in said forward zone is blanketed with a shielding gas.

3. Method as claimed in claim 1, in which the bottom of said solidified steel product is supported for rolling delivery movement.

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J. SPENCER OVERHOLSER, *Primary Examiner.*

R. D. BALDWIN, *Assistant Examiner.*