April 27, 1965 J. N. HORNAK 3,179,989

CONTINUOUS CASTING MOLD

Filed March 1, 1962

FIG. 1.

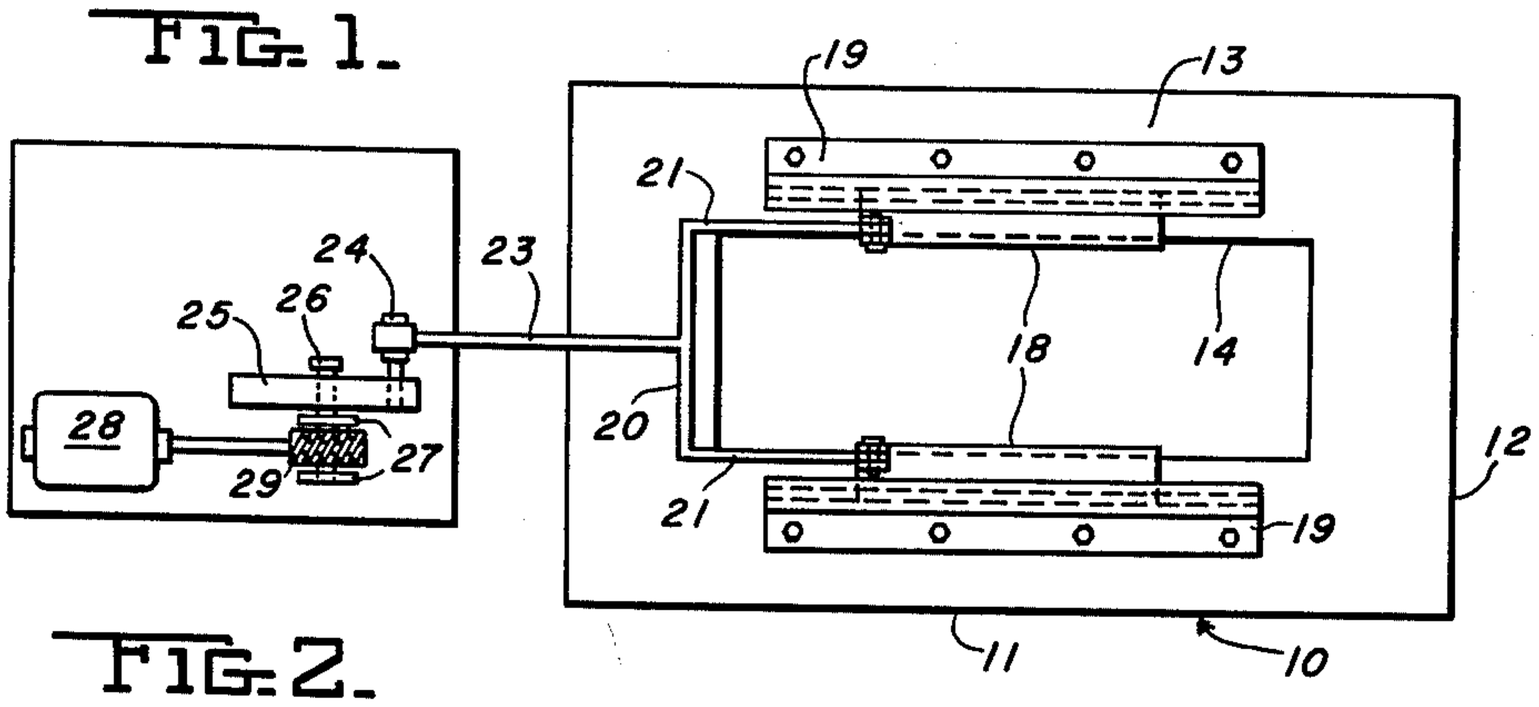


FIG. 2.

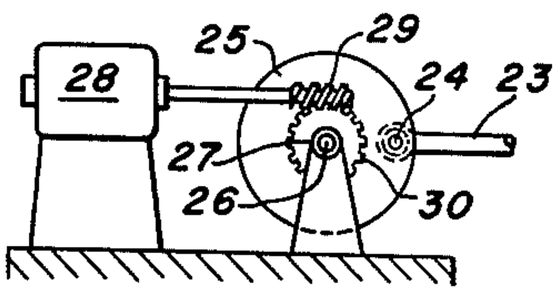


FIG. 3.

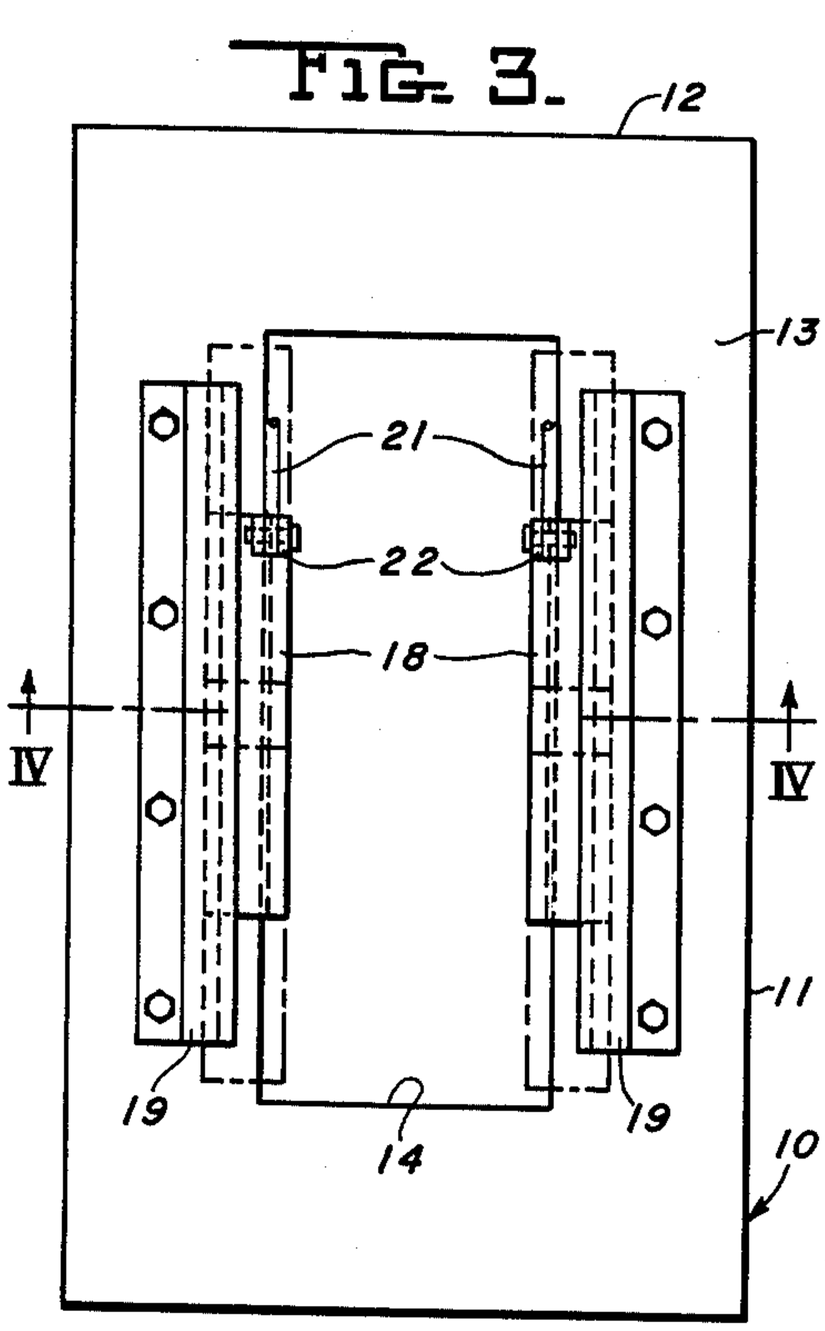
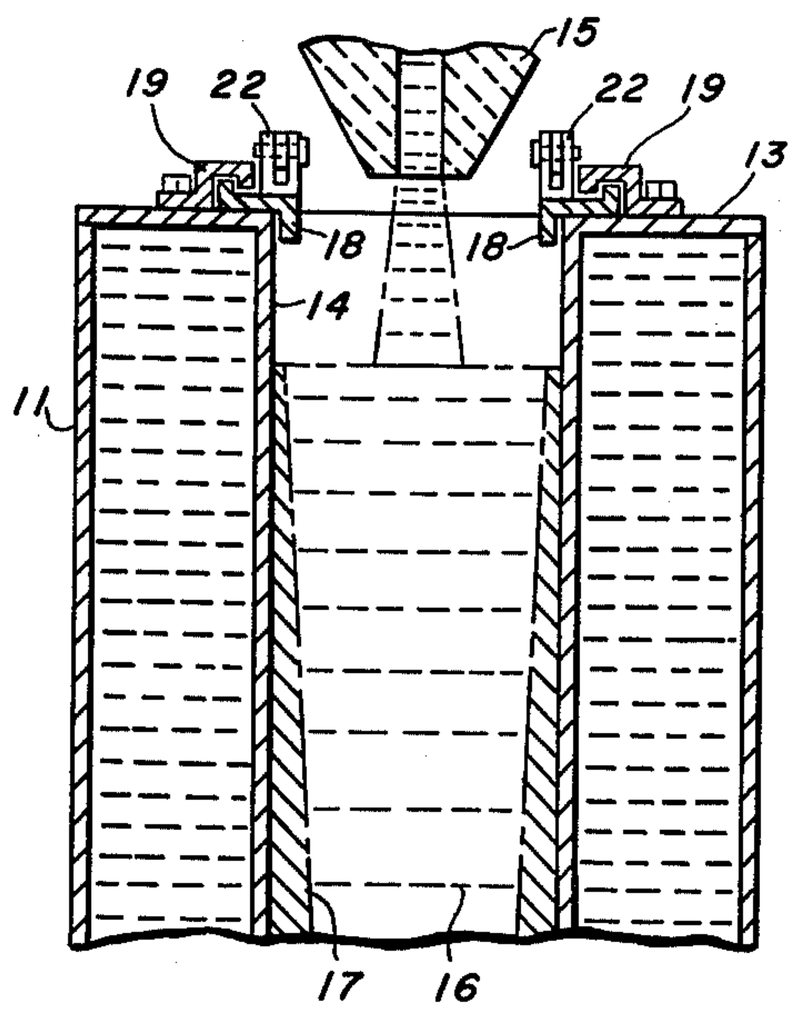


FIG. 4.



INVENTOR.
JOHN N. HORNAK
By Donald G. Dalton

Attorney

United States Patent Office

3,179,989
Patented Apr. 27, 1965

3,179,989

CONTINUOUS CASTING MOLD

John N. Hornak, Homestead Park, Pa., assignor to United States Steel Corporation, a corporation of New Jersey

Filed Mar. 1, 1962, Ser. No. 176,641
5 Claims. (Cl. 22—57.2)

This invention relates to the continuous casting of a billet or slab of indefinite length by pouring molten metal through a tubular mold and, in particular, to an improved mold for such operation.

Difficulty has been encountered in continuous casting, particularly in the case of slabs having a width several times their thickness, because of breakouts through the skin of the casting after it has emerged from the bottom of the mold. These breakouts are apparently caused in the following manner. Crusts or skulls are formed on top of the mold adjacent the mid-point of the slab width by unavoidable spittings, splashing or divergence of the stream of molten metal descending into the mold from the nozzle of the teeming ladle thereabove. Any such accumulation is quickly frozen on the top edge of the mold which is water-cooled, and remains fixed there until manually removed, customarily upon a shut-down of the casting facilities. If, before removal, these crusts or skulls grow sufficiently to extend downwardly into the mold, the molten metal therein will, if it rises to a high level, tend to weld to the crusts as it solidifies, causing tears in the skin of the slab being cast which eventually result in breakouts.

I have invented a novel mold for continuous casting having means for preventing the difficulty caused by the aforementioned accumulation of crusts or skulls on top of the mold. Such means preferably comprises angle bars reciprocable along the longer sides of the top of the mold and means for actuating them slowly but continuously during the pouring operation. The bars receive the spittings or droplets of molten metal which would otherwise be deposited on top of the mold and movement of the bars distributes the accumulation, preventing the formation of sizable crusts or skulls.

A complete understanding of the invention may be obtained from the following detailed description and explanation which refer to the accompanying drawings illustrating the present preferred embodiment. In the drawings:

FIGURE 1 is a plan view of a continuous-casting mold having my invention applied thereto;

FIGURE 2 is a side elevation of a portion of FIGURE 1;

FIGURE 3 is a plan view of the mold having the invention applied thereto, to enlarged scale with parts omitted; and

FIGURE 4 is a partial section through the mold, taken on the plane of line IV—IV of FIGURE 3, showing the ladle nozzle thereabove.

Referring now in detail to the drawing, a tubular mold **10** has sides **11** and ends **12** of double-wall construction for the circulation therethrough of cooling water by suitable connections (not shown) and a top **13**. The mold walls are preferably made of plates of metal of high thermal conductivity such as copper. The mold cavity or opening therethrough is designated **14**. As shown, it has a length several times its width and is thus shaped for casting a slab by the teeming of molten metal into cavity **14** from a ladle nozzle **15**, as indicated at **16**. A skin **17**

forms on the casting as a result of freezing of the metal in contact with the cooled mold walls and increases in thickness as the casting descends through the mold.

The mold as described above is conventional. My improvement consists in the combination therewith of shielding bars **18** slidable along the longer sides of the top **13** of the mold. The bars are preferably of angle section and one flange thereof extends downwardly into cavity **14** for a short distance while the other rides flatwise on top **13**. The latter is provided with keepers **19** and the bars shaped to interfit with them to afford guided movement of the bars and retain them in proper relation to the mold side walls **11**.

The means for reciprocating bars **18** along the top of the side walls **11** of the mold comprise a connecting rod in the form of a fork **20** the tines **21** of which are bent at right angles and pivoted to clevises **22** on the bars adjacent one end thereof. The shank **23** of the fork is pivoted to a crank pin **24** in a disc **25**. The disc is mounted on a shaft **26** journaled in bearings **27**. A motor **28** suitably mounted drives a worm **29** meshing with a worm wheel **30** on shaft **26**. Thus energization of motor **28** causes continuous reciprocation of bars **18** at a low frequency, say ten strokes per minute.

It will be evident that the bars **18** shield the side edges of the top of the mold cavity from scabs of metal which would otherwise be formed thereon by splashing or divergence of the molten stream. Movement of the bars distributes the deposits and prevents their accumulation to an extent such that crusts or skulls would result, which might run downwardly into the mold cavity, with the possibility of tearing the skin **17** of the slab being cast.

The invention acts in three ways to prevent this from happening. First, the overhanging fin, if one is formed, is shorter and thinner, and is thus less likely to form a weld of sufficient strength to cause a serious tear in the ingot skin. This results because, with the invention, the spatter from the ladle nozzle is distributed over a greater area, i.e., all along the bar **18** instead of merely in the small area never uncovered by bar **18** as it travels back and forth. Second, the overhanging fin does not line up directly with the skin of the ingot being formed, since any fin formed depends from the bar **18** and not from the edge of the mold. Instead of being in alinement with the ingot skin, furthermore, the fin depends into molten metal. Third, the continuous reciprocation of the bars **18** ensures that, if welding should begin, the weld is immediately broken, before it has time to attain the thickness and strength that would make it a possible cause of a tear in the ingot skin sufficiently serious to cause a breakout.

The invention has the advantage of being both simple as to structure and effective as to performance.

Although I have disclosed herein the preferred embodiment of my invention, I intend to cover as well any change or modification therein which may be made without departing from the spirit and scope of the invention.

I claim:

1. The combination with a tubular continuous-casting mold rectangular in cross-section, having pairs of opposed side walls, of a shielding bar slidable along the top of at least one of said walls, and means for sliding said bar along one of said walls.

2. The combination defined in claim 1, characterized by said shielding bar being of angle section with one flange extending downwardly into said mold.

3. The combination defined in claim 1, characterized

by said means including crank means and a connecting rod pivotally connected thereto and to said shielding bar.

4. The combination defined in claim 1, characterized by a way on said top of one of said walls guiding movement of said shielding bar therealong.

5. The combination defined in claim 1, characterized by said bar-sliding means including means for reciprocating said shielding bar.

References Cited by the Examiner

UNITED STATES PATENTS

2,503,819	4/50	Gunn et al.	22—200.1 XR
2,871,530	2/59	Wieland	22—57.2
2,905,989	9/59	Black	22—57.3

MICHAEL V. BRINDISI, *Primary Examiner.*

RAY K. WINDHAM, *Examiner.*