

[54] **DEVICE FOR OSCILLATING A
CONTINUOUS CASTING MOLD**

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[51] Int. Cl..... **B22d 27/08**

[58] Field of Search..... **164/83, 260, 261,
164/281, 282**

[56] **References Cited**

UNITED STATES PATENTS

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3,581,806	6/1971	Neumann et al.....	164/83 X
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FOREIGN PATENTS OR APPLICATIONS

1,496,098	9/1967	France.....	164/83
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[57]

ABSTRACT

In a continuous casting plant, a mold is mounted in a mold table which is supported on a rigid frame by oscillating means. The oscillating means includes a bell crank attached to the mold table and pivotally supported on the rigid frame. A drive member and power transmission rod mounted on the support frame pivot the bell crank lever which in turn oscillates the mold table and mold. Guide members symmetrically arranged about the power transmission rod extend between the mold table and the support frame to which they are pivotally attached.

11 Claims, 2 Drawing Figures

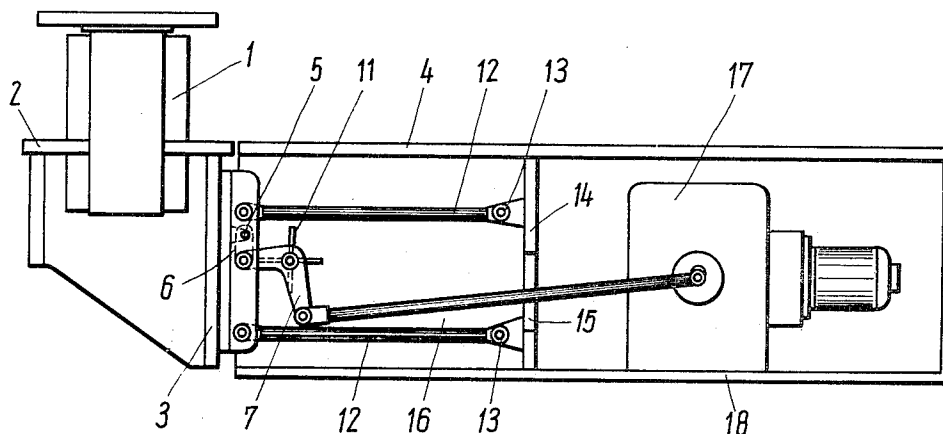


Fig. 1

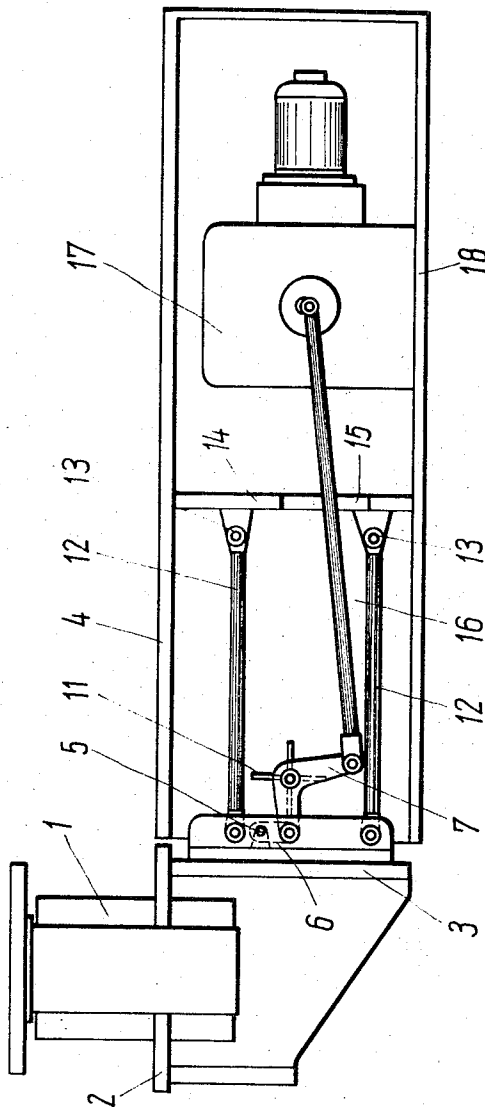
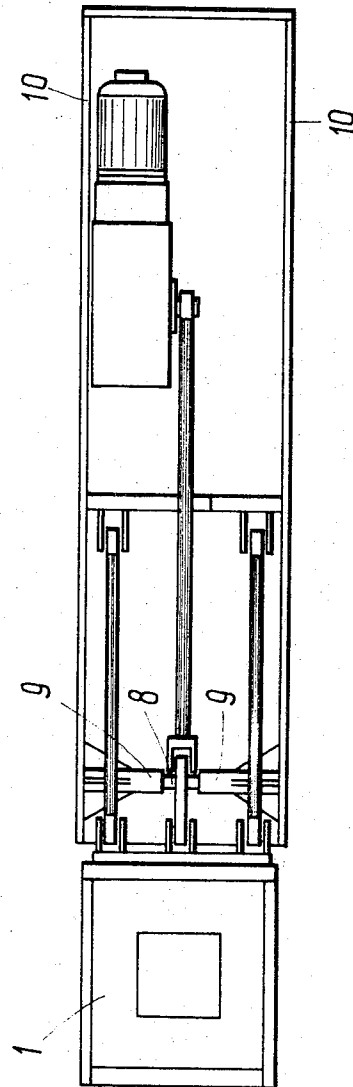


Fig. 2



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DEVICE FOR OSCILLATING A CONTINUOUS CASTING MOLD

SUMMARY OF THE INVENTION

The present invention is directed to a device for oscillating the mold in a continuous casting plant and especially in the continuous casting of steel, and, more particularly, it is directed to an oscillating arrangement mounted on a single rigid frame.

In the continuous casting of metals, especially steel, the mold has been oscillated to assure that the casting as it solidifies separates from the mold wall. The manner in which the mold is oscillated is of particular importance in the effective operation of the continuous casting plant. In the past the oscillation has been effected by means of gear motors with eccentric drives with the movement of the drive being transmitted to the mold table through thrust rods. The amplitude of the oscillation movement is relatively small not amounting to much more than 2 to 3 cm and based on the size of the mold. Since the space on the casting platform adjacent the mold is utilized for other purposes, the oscillating apparatus is generally located below the mold and, as a result, a rather complicated linkage arrangement is required in connecting the drive motor of the oscillating device to the mold.

Where the oscillating device is positioned below the mold it has been found to entail considerable disadvantages. Initially, long cantilever arms are required which are subject to a natural sagging effect which results in the inaccurate transmission of the oscillating action to the mold. Further, due to the multiple joints involved in the linkage, a certain amount of play develops which distorts the oscillating action. If for reasons of space a lower platform is provided on the frame associated with the mold for supporting the oscillating apparatus, then different natural frequencies result in the different parts of the frame and a detrimental effect on the oscillating action is experienced. Because of the various problems experienced in the past, it has not been possible to oscillate the mold so that the oscillating curve is purely sinusoidal, as is preferably required in continuous casting operations.

The arrangement in German Pat. No. 1,176,800 is exemplary of the prior art arrangements which are complicated by multiple support points, and involved linkage arrangement, as well as various articulated connections located either on different frame parts or on different platforms of the frame. However, the most serious difficulty involved in such an arrangement is that the guide members are joined together with the drive members at the mold itself and the two different functions of these members act through the same element. The use of complicated lever linkages is unfavorable since, when repairs are necessary, other parts of the continuous casting plant must be replaced, such as the guide frame or the supporting rolls. As is well known from experience, it takes considerable time to disassemble such apparatus and during the disassembling period the entire unit is taken out of operation.

Another example of the prior art is German Pat. No. 1,233,107 which uses a scissor type linkage to take into account the arcuate path of travel from the mold. Where a change in the direction of travel of the casting is involved relatively long periods of time are necessary to effect the change-over from the straight to the arcuate path of travel.

Accordingly, the present invention is directed to the problem of improving the suspension for the oscillation equipment used with continuous casting molds. On one hand, the problem concerns the oscillatory behavior of the equipment so that any metallurgical disadvantages in the material being cast can be eliminated, and on the other hand the problem is directed to increasing the useful life of the oscillation equipment and also to provide improvements directed to the assembly and disassembly of such apparatus. Therefore, in accordance with the present invention, the problems experienced in the prior art are overcome by arranging the oscillation apparatus and suspending the mold on a single rigid support frame. By virtue of this arrangement the necessity of a second platform for the oscillating equipment is obviated and it also avoids the inclusion of any extraneous vibrations developed in separate frame parts. By providing a more compact construction, it is possible to reduce the number of support points which would otherwise cause considerable play to develop in the oscillating equipment. Furthermore, the length of the connection between the drive means and the mold can be reduced so that the problems of sag or flexure originating from the elasticity of the connecting member are lessened. In one embodiment of the invention, the continuous casting mold and its mold table along with the power transmission linkage and its drive means, which effects the oscillating action, and the frame on which the oscillating equipment is mounted, form a replaceable assembly. With such an arrangement the difficulties previously experienced in making repairs are eliminated, since the assembly can be removed as a unit and replaced by another assembly which is ready for use. Further, it is no longer necessary to fit all of the parts together on the site, and it is easier to check the various elements of the apparatus when it is located on a single frame as compared to the situation where it extends between two spaced platforms.

Another feature of the invention involves the positioning of the power transmission member which transmits the oscillations to the mold in spaced relationship between the symmetrically arranged guide members for the mold. The guide members are secured to the frame in pivotal bearings. In this arrangement the member conveying the oscillations to the mold is maintained separate from the guide members. Accordingly, the oscillation transmitting member supports the load of the mold and the mold table and affords the exact transmission of the oscillations to the mold. On the contrary, the guide members transmit only the movement of the mold as it is oscillated and such movement may be rectilinear as well as arcuate.

In another feature of the invention a bell crank or angle lever is rotatably mounted on the support frame and in turn supports the mold and mold table while the movement or oscillation of the mold is directed by the guide members which form the intersections of a parallelogram enclosing the rod which transmits the oscillations to the bell crank. With this arrangement it is possible to combine the support of the mold and mold table with the exact transmission of oscillation. This characteristic of the invention is achieved by the relative arrangement of the guide members and the oscillation transmission rod. Further, the arrangement of the guide members in the corners of a parallelogram affords adequate space for the oscillation transmitting member.

Yet another feature of the invention is the formation of the support frame by a plurality of frame members extending longitudinally from the mold table with other frame members extending transversely to the longitudinal ones. The arrangement of the rigid support frame avoids, to the extent that it is possible to do so, the distortions which were experienced in the prior art. A further feature of the invention involves the manner in which the bell crank or angle lever is rotatably mounted and supported from both sides of the support frame. Therefore, with the separation of the supports for the oscillating apparatus between the longitudinal and transverse frame members of the frame, a rigid structure is afforded which is not subject to vibrational stress.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a side elevational view of one embodiment of the invention; and

FIG. 2 is a plan view of the embodiment shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

As shown in FIGS. 1 and 2, a continuous casting mold 1 is secured on a mold table 2 and, in turn, a bracket type construction 3 is secured to the mold table and extends from it in the direction of the passage of the casting or strand through the mold. Extending laterally from the bracket type construction 3 is an elongated rigid support frame 4. The combination of the mold 1, mold table 2 and bracket construction 3 are arranged to be moved relative to the support frame 4 and for this purpose a fixture or projection 5 is provided for articulating the combination to oscillating apparatus mounted on the rigid support frame 4. The oscillating apparatus includes a strap or link 6 secured at one end to the projection 5 and at its other end to a bell crank or angle lever 7. The bell crank 7 is pivotally mounted on a pin 8 which is supported at its opposite ends in pedestals 9 secured to the longitudinally extending opposite side frame members 10 of the frame 4. The pedestals are reinforced by ribs 11 which extend along them to the sides of the frame.

Extending between the bracket 3 of the mold table and the frame are two pairs of guide members or rods 12 arranged one pair above and one pair below the bell crank 7. It can be noted in FIGS. 1 and 2 that the guide members 12 are arranged symmetrically about the bell crank 7 and form the corners of a parallelogram within which the bell crank is enclosed. At their ends opposite the bracket 3, the guide members 12 are pivotally connected to a frame member 14 extending transversely between the side frame members 10. When oscillating movement is transmitted through the bracket to the mold table and mold, the reaction of the guide members is transmitted only to the transverse frame member 14.

As indicated in FIGS. 1 and 2, an opening 15 is provided through the transverse frame member 14 and a power transmission rod 16 extends from a drive member 17 to the end of the bell crank 7 remote from the bracket 3. The rod 16 transmits the movement from the drive member 17 to the bell crank which converts it into an oscillating movement for the mold 1. The drive member 17 is mounted on the bottom frame member 18 of the support frame 4.

The invention is not limited to the arrangement shown in the drawing and various embodiments can be provided based on the inventive concept disclosed. For example, another rod 16 could be arranged on the opposite side of the drive member 17 so that greater forces could be more easily transmitted to the mold. The oscillation forces are transmitted through the bell crank 7 which is supported solely by the pin 8 which is in turn supported within the bearing pedestals 9 on the opposite side members 10 of the frame.

What is claimed is:

1. Apparatus for oscillating a mold in a continuous casting plant comprising a rigid support frame, means for supporting the mold, means for oscillating the mold mounted on said support frame and articulated to said means for supporting the mold, spaced guide members attached to said means for supporting the mold and pivotally secured to said support frame for guiding the oscillating movement of the mold, said means for oscillating the mold comprises a drive member mounted on said support frame and spaced from said means for supporting the mold, a power transmission rod attached on said drive member and extending therefrom toward said means for supporting the mold, a bell crank pivotally mounted on said support frame intermediate its ends and one end of said bell crank attached to said power transmission rod at a position remote from said drive member, and the other end of said bell crank attached to said means for supporting the mold.

2. Apparatus, as set forth in claim 1, characterized in that said support frame comprises a plurality of elongated frame members extending outwardly from said means for supporting the mold and at least one other frame member extending transversely of said elongated frame member and located intermediate the ends of said elongated frame members.

3. Apparatus, as set forth in claim 2, characterized in that one of said elongated frame members forming a bottom support for said frame, and said drive member being mounted on said elongated frame member forming the bottom support and being located on the side of the transversely extending other said frame member remote from said means for supporting the mold.

4. Apparatus, as set forth in claim 3, characterized in that the transversely extending other said frame member having an opening therein through which said power transmission rod extends from said drive member to said bell crank.

5. Apparatus, as set forth in claim 2, characterized therein that two pair of said guide members being arranged with each pair disposed on and spaced symmetrically from an opposite side of said power transmission rod and said guide members forming the corners of a parallelogram enclosing said power transmission rod, one end of each guide member of the two pairs of said guide members being secured to said means for supporting the mold and the opposite ends of said guide

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members being pivotally secured to the transversely extending other said frame member.

6. Apparatus for oscillating a mold in a continuous casting plant comprising a single rigid support frame for the mold, means for rigidly supporting the mold, means for oscillating the mold mounted on said support frame and articulated to said means for supporting the mold and to said support frame, said means for oscillating the mold extends transversely from the mold, spaced guide members for supporting said means for supporting the mold from said support frame extending transversely from the mold, said guide members articulated to said means for rigidly supporting the mold and to said support frame so that said guide members guide the oscillating movement of the mold, whereby the mold is completely articulatedly guided, supported and oscillated from said single rigid support frame.

7. Apparatus, as set forth in claim 6, characterized therein that said means for supporting the mold comprising a mold table having an opening therein to receive the mold, a bracket secured to said mold table and extending therefrom in the direction of passage of the continuous casting issuing from the mold, and a fitting on said bracket for receiving said means for oscillating the mold.

8. Apparatus for oscillating a mold in a continuous casting plant comprising a rigid support frame, means for supporting the mold, means for oscillating the mold mounted on said support frame and articulated to said means for supporting the mold, spaced guide members attached to said means for supporting the mold and pivotally secured to said support frame for guiding the oscillating movement of the mold, said means for sup-

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porting the mold comprising a mold table having an opening therein to receive the mold, a bracket secured to said mold table and extending therefrom in the direction of passage of the continuous casting issuing from the mold, a fitting on said bracket for receiving said means for oscillating the mold, said means for oscillating the mold includes a drive member, a power transmission rod attached to said drive member, a bell crank pivotally mounted on said support frame intermediate its ends and having one end attached to said power transmission rod and the other end connected to said means for supporting the mold, and a link secured at one end to said fitting on said bracket and at its opposite end to the end of said bell crank connected to said means for supporting the mold, said link extending in the direction of the passage of the continuous casting issuing from the mold.

9. Apparatus, as set forth in claim 7, characterized in that said mold table, said frame, said means for oscillating the mold, and said guide member along with the mold being arranged as a replaceable assembly.

10. Apparatus, as set forth in claim 2, characterized in that a pedestal being mounted on each of the opposite elongated side frame members of said support frame, a shaft secured within said pedestal at its opposite ends, and said bell crank being pivotally positioned on said shaft.

11. Apparatus, as set forth in claim 10, characterized in that a plurality of reinforcing ribs being secured to each said pedestal and extending along the surface of said pedestal to said support to which said pedestal is attached.

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