

Dec. 20, 1966

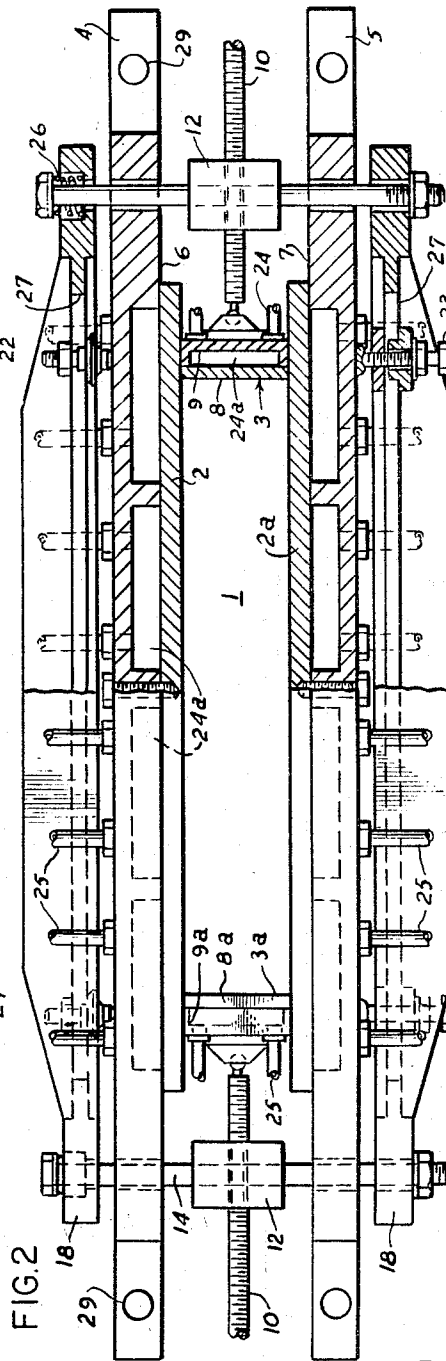
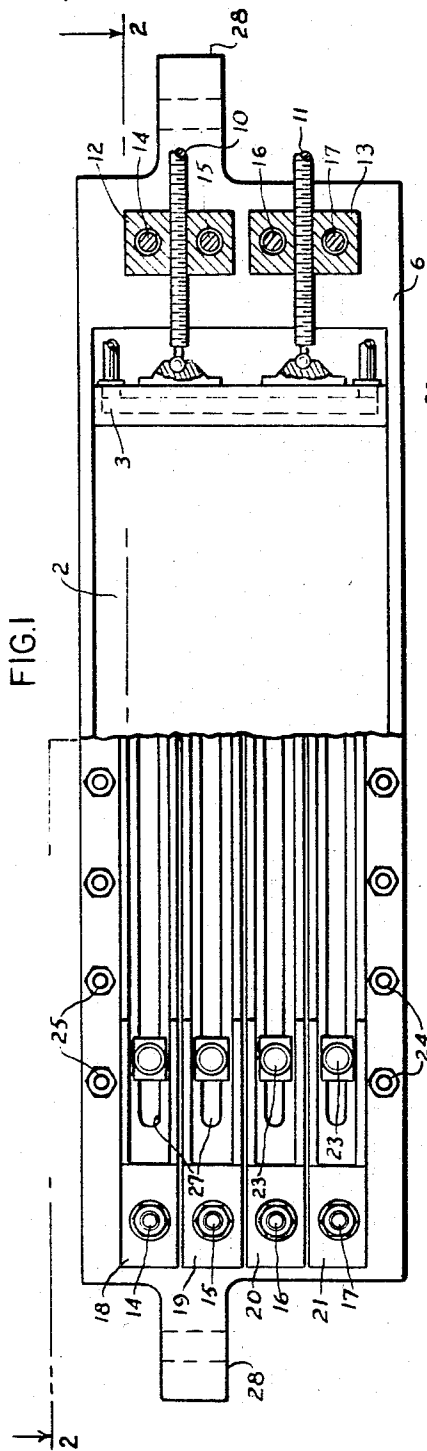
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3,292,216

ADJUSTABLE MOLD FOR CONTINUOUS CASTING INSTALLATION

Filed June 25, 1963

2 Sheets-Sheet 1



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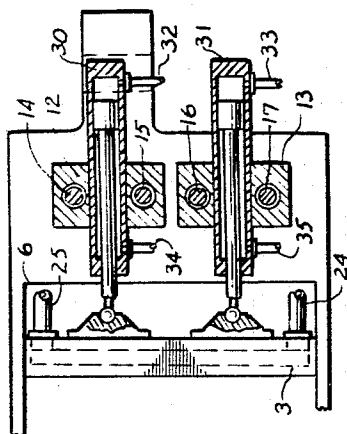
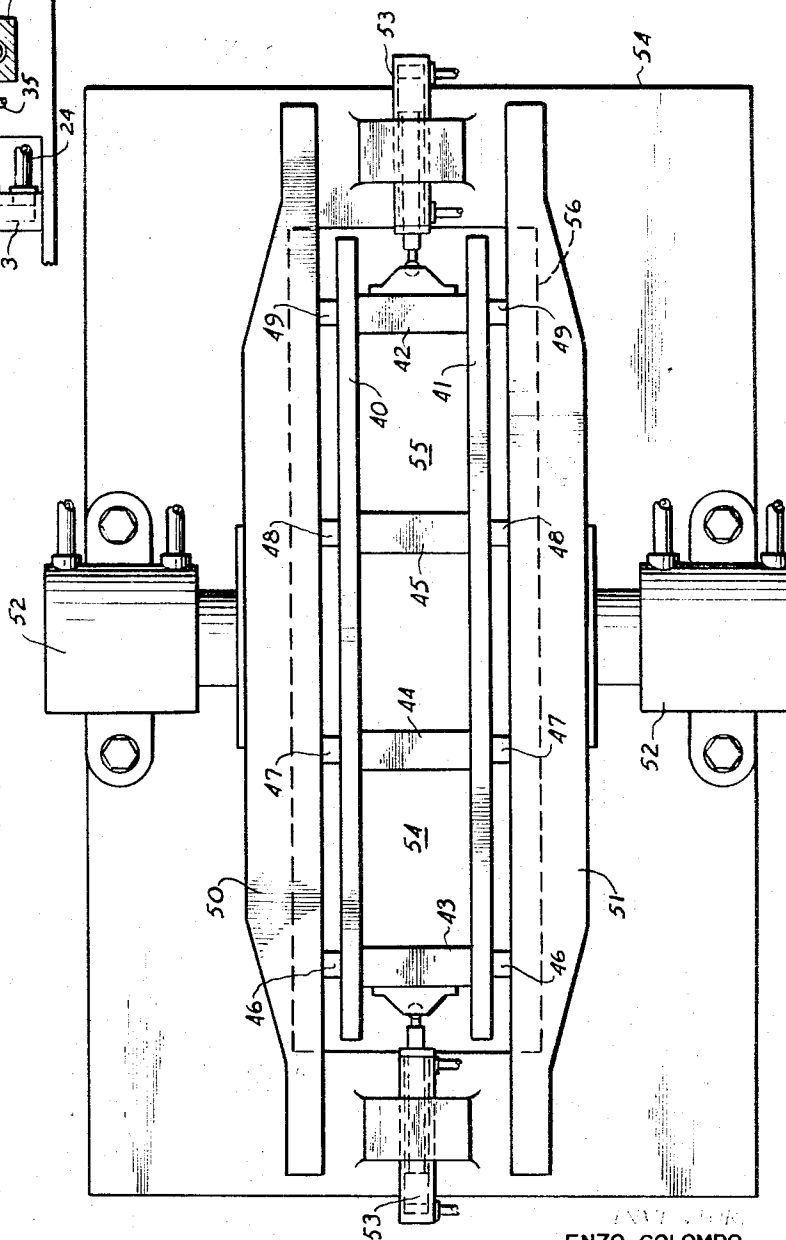


FIG. 3

FIG. 4



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3,292,216

**ADJUSTABLE MOLD FOR CONTINUOUS
CASTING INSTALLATION**

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Filed June 25, 1963, Ser. No. 290,521
2 Claims. (Cl. 22—57.2)

This invention relates to metal casting and, more particularly, to an improved mold for the continuous casting of alloys having high melting points.

In processes employing continuous casting of metal, as for example described in the U.S.P. 2,284,503 (Williams), the mold cost represents a substantial proportion of the total cost of such processing. The cost of the molds arises not only from consumption of the mold during casting of strands, but also in large measure can be attributed to the capital required for purchase of the necessary plurality of molds required in any large production facility.

When individual molds are provided for casting of slabs or strands of different dimensions, the production must be interrupted in order to change molds when the strand size change is required. Such production stoppages are expensive in reducing the tonnage castable by a single facility.

In order to reduce the number of molds required at a casting installation, the art has resorted to providing a mold in which the walls of the mold are made up of elemental modules of predetermined dimensions which are joined together and held in the desired mold configuration. While this does reduce the quantity of molds required in any installation, the assembled molds have some disadvantages in operation. For example, the composite mold is subjected to plate warping at junctions therebetween because of differing mold wall temperatures as, for example, caused by shrinking of the strand and separation from the wall. Such warping and variation in temperature-induced expansion of the elements often leads to destruction of the junctions between the elements. This in turn often causes cracks in the strand which adversely affects the cast material. Unfortunately, the clamping forces required to hold the elements together in the mold wall augment the forces tending to warp the plates and, thus, require construction of the elements from relatively thick plates. However, thickening the plates decreases the cooling effect of the mold walls. The production of the elements is relatively expensive because the elements must be machined to fit very carefully. Even so, it is difficult to achieve a cooling effect which is constant across the entire mold wall and the strand will often tear at the junction between elements.

Although it has been known to utilize a transverse wall inserted between the side walls of the mold formed from elements and to provide means for adjusting the position of the transverse wall as to provide a tapered mold, such molds cannot be changed to accommodate strand dimensions. In order to change the dimensions of the molds, it is necessary to remove the mold since the wall elements can only be changed after such removal, further increasing the cost of operation.

For the casting of nonferrous metals, the art has provided a rectangular mold using a removable transverse wall which fits between the longitudinal walls of the mold, which is arranged inside of an enclosing cooling box. With this arrangement, the required number of molds is diminished somewhat since the transverse wall can be changed to control the dimension of the slab between the transverse walls. However, each cooling box can be used for one thickness only. Thus, considerable numbers of cooling boxes are required for such mold construction. Further, since the transverse walls and the cooling box are inflexible, the packing between the trans-

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verse wall and the cooling box is difficult due to irregular expansion. Also, since the cooling box and inserted transverse walls generate opposite forces, expansions can create uncontrolled forces causing mold warpage and strand damage.

It is, therefore, an object of the present invention to provide a mold for continuous casting of materials having a high melting point in which the dimensions of the mold can be changed rapidly and economically and in which the cooling effect over the mold cavity can be regulated to provide the desired chilling of the strand.

In accordance with these objects, there is provided, in a preferred embodiment of this invention, a mold for continuous casting of metal which is made of longitudinally extending side walls between which are inserted end walls. The end walls frictionally engage and are clamped between the side walls.

Each side or longitudinal wall element is formed from a supporting frame and a face plate coupled to the frame. The frame is provided with passages for the circulation of water therein to cool the face plates which define the mold cavity. The supporting frame is carried upon the mold table. Longitudinally extending beams are positioned adjacent each frame and are clamped together by clamps at the ends of and separated from the frame. Adjustable means such as set screws are provided which extend through the beam and engage the frame at the position of the end walls to enable adjustment of the clamping force thereon. Thus, the end walls may be clamped between the adjacent longitudinal walls by directly applied compression members preventing any bending movement which would tend to distort the face.

Further, the longitudinal mold walls can expand laterally without interference by the end walls.

Since in most strip mills, the slabs cast are of a single thickness, but with varying widths, the end walls are adjustable in positioning by coupling a support containing the cooling chamber to the end wall and providing drive members coupled to each cooling chamber for adjustment of the end wall position as dictated by the desired width of the cast slab.

By providing for interchangeability of the mold plates, fast replacement of destroyed wall elements can be effected.

Also, by changing the dimension of the end walls, various strand cross sections such as trapezoid and rhomboid sections can be easily fabricated.

Having briefly described this invention, it will be described in greater detail along with other objects and advantages thereof, in the following portions of the specification, which may best be understood by reference to the accompanying drawings, of which:

FIG. 1 is a partially sectioned elevation view of a mold fabricated in accordance with the present invention;

FIG. 2 is a partially sectioned elevation view taken along lines 2—2 of FIG. 1;

FIG. 3 is a partially sectioned elevation view of a portion of the mold shown in FIG. 1 utilizing an alternative means for moving the end walls; and

FIG. 4 is a plan view of a mold in accordance with another embodiment of the instant invention.

In FIGS. 1 and 2, there is shown a mold cavity 1 defined by the side wall mold plates 2, 2a and the end wall mold plates 8, 8a. Mold plates 2, 2a are coupled to the frame members 4 and 5 respectively which are provided with the vertically extending wall sections 6 and 7 respectively to form the side walls of the mold. The plates 2, 2a are secured to the frames 4 and 5 respectively by the bolts coupling the plates at the midspan thereof. The mold elements 3, 3a are formed by the plate members 8, 8a and the supporting frames 9, 9a respectively. The mold plates 2, 2a and 8, 8a are not

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sectioned, but are continuous, so that thermal expansion will not open cracks between elements as would be the case with a sectioned or divided structure. The wall elements 3, 3a, 6 and 7 are interchangeable to enable replacement of parts destroyed during molding. Also, in this manner, different wall elements 3 and 3a can be inserted to change the form of the mold cavity from rectangular to trapezoidal, rhomboidal and the like. In order to adjust the position of the wall elements 3, 3a adjusting screws 10 and 11 are coupled thereto as, for example, by ball and socket couplings to enable movement of the wall element 3, 3a to the desired position and to enable inclination of the wall as, for example, to provide a tapered mold often necessary to equalize shrinkage during casting. The screw members 10 and 11 are threadably engaged within the blocks 12, 13 which are respectively coupled to the clamping screws of bolts 14, 15, 16 and 17. The beams 18, 19, 20 and 21 provide support for the mold frames, which supports are adjustable by means of set screws 22 or adjusting screws 23 which can be driven against the wall sections 6 and 7 at the position of the end walls 3, 3a to ensure clamping thereof in the desired position.

By this arrangement, the supporting structure of the mold is provided in an encircling configuration of beams. When clamped against the side wall, the wall elements 6 and 7 are under compressive stress just at the area of contact with the end walls 3 and 3a. Thus, the mold plates 2 and 2a are essentially free of clamping pressures which diminish warping the mold plates.

The mold is cooled by water circulated in passages 24a formed by the mold plates 2, 2a and 8, 8a and the frames 4, 5, 9, 9a, which water is supplied by conduits 24 and drained away by conduits 25. The clamping screws may be provided with springs 26 for resilient connection, to ensure uniform application of the clamping force and prevent destruction over stresses. The beams 18-21 show recesses 27, in which the supports 22a, 23 can be moved, so that for variation of the shape of mold cavity 1 by movement of the inserted wall elements 3, 3a these supports can easily be moved to correspond with the position of the inserted wall elements. In the place of the adjusting screws 10, 11, plungers can be provided, as described below and illustrated in FIG. 3.

In FIG. 3, the wall element of plate 6 and end wall element 3 is shown. In place of the adjusting screws 10, 11, FIGS. 1 and 2, plungers 30, 31 of known design are provided, which are carried by holding means 12, 13, connected to the clamping screws 14-17. The working of the plungers is achieved by conduits 32, 33 if the inserted wall 3 shall be moved to the left and the mold cavity diminished, by conduits 34, 35 if the mold cavity 1 should be enlarged and the inserted wall is moved to the right.

FIG. 4 shows a further embodiment, comprising additional inserted wall elements for casting two strands of smaller dimension in a single mold. The fundamental arrangement corresponds to that of the first embodiment. A pair of side wall elements or plates 40, 41 is provided and transversely inserted wall elements 42-45 are sandwiched between these side wall elements 40, 41. In this embodiment, each wall element is formed by the mold plate. The cooling of these mold plates can be achieved by bore holes similar to the excavation 24a (FIGS. 1, 2) comprising respective feeding and draining conduits. By insertion of additional wall elements 44, 45, two smaller mold cavities 54, 55 are formed. Thus, it is possible to cast with the same mold one or more strands improving the productivity of the plant considerably.

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This embodiment also shows supports 46-49 which are movable to the position of the inserted wall elements as explained in connection with the embodiment shown in FIGS. 1 and 2 by movement along recesses in beams 50, 51. The pressure for clamping the inserted wall elements is achieved by plunger 52, known to the art. The first wall elements 42, 43 being arranged at the outer periphery of the mold are each movable by the pair of plungers 53 (as described in FIG. 3). In this arrangement, two supports (e.g. 46, 48, 47, 49 or 47, 48) take the form of adjustable screws to allow equal pressurizing of the inserted wall elements 42-45. The plungers 52, 53 are fixed to the mold table 54, which comprises an opening 56 permitting passing through of the strand.

What is claimed is:

1. In a continuous casting installation, a mold comprising a mold cavity for forming a strand, said mold cavity being defined by a first and second side wall, a first and second end wall positioned between said first and second side walls, supporting beams positioned astraddle said mold cavity and substantially parallel to said side walls, the position of at least one of said end walls being adjustable along the greater part of said side walls and being held in position by clamping of said end walls between said side walls by using said supporting beams, said supporting beams being clamped together by clamping means positioned at each end of said side walls and including means for applying the clamping pressure to said side walls at the position of said end walls, thereby avoiding bending moments acting on the side walls, said side walls and said end walls being free to move together so that as said side walls expand because of temperature rise during casting, said side walls will not move relative to said end walls, said means for applying clamping pressure to said side walls comprising screws mounted in said supporting beam, said screws being adjustably positioned along said beam and adapted to engage the side walls in clamping engagement.

2. A continuous casting mold comprising a first and second side wall mold plate, a first and second frame member, said first and second side wall plate being respectively secured to said first and second frame member, each of said frame members having channels therein closed by said respective plate to define passages for cooling water flow, a first and second beam member positioned astraddle said mold and extending beyond the ends of said plates and frames, clamping means positioned at each end of said mold for clamping together the respective ends of said beams, a first and second end wall adjustably positioned between said side walls, and second clamping means adjustably positioned in said beams to apply clamping pressure to said frames to clamp said side walls into supporting engagement with said end walls, said second clamping means being positioned at the location of said end walls to avoid bending moments acting on the side walls, said first and second side wall mold plate being free to expand under the temperature of casting without relative motion between said side and end walls.

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