

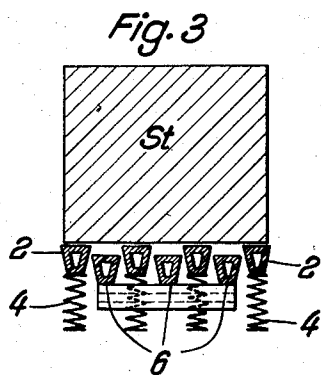
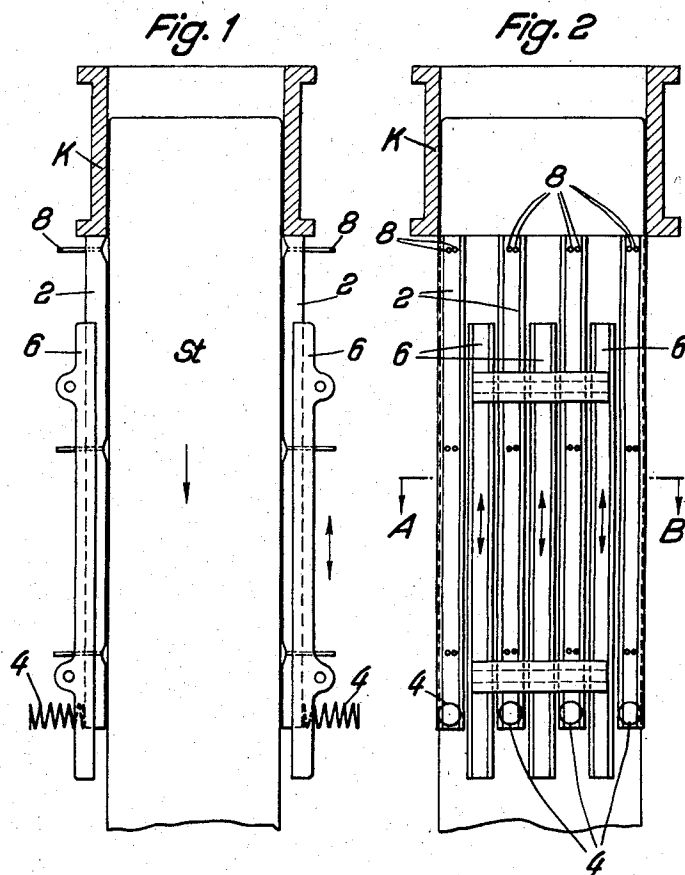
July 21, 1959

A. BUNGEROTH ET AL
CONTINUOUS CASTING PLANTS

2,895,190

Filed Sept. 11, 1956

4 Sheets-Sheet 1



Inventors
Adolf Bungeroth
Karl Georg Speith
Hans Schrewe
By their attorneys
Hawson and Hawson.

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Fig. 4

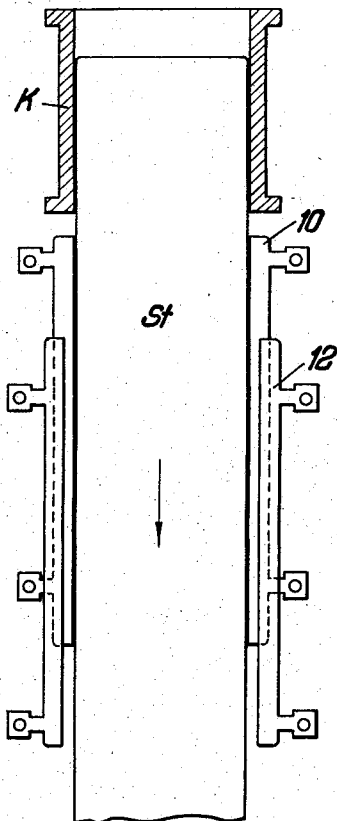


Fig. 5

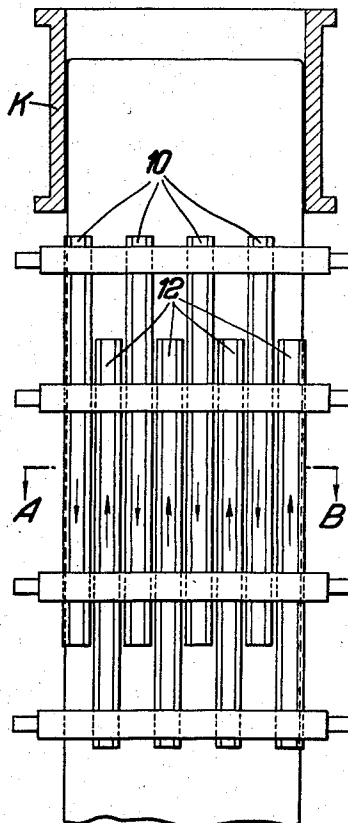
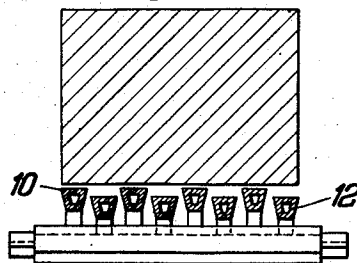


Fig. 6



Inventors
Adolf Bungeroth
Karl Georg Speith
Hans Schrewe
By their attorneys
Harrison and Harrison.

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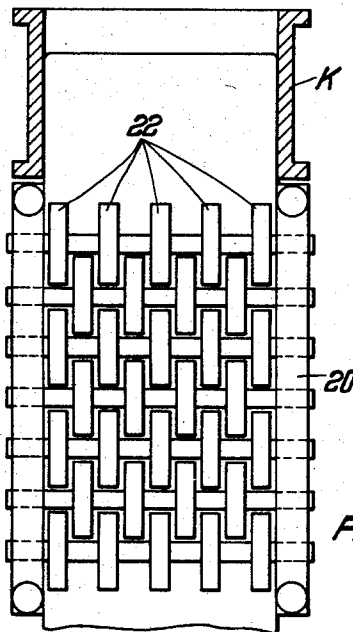
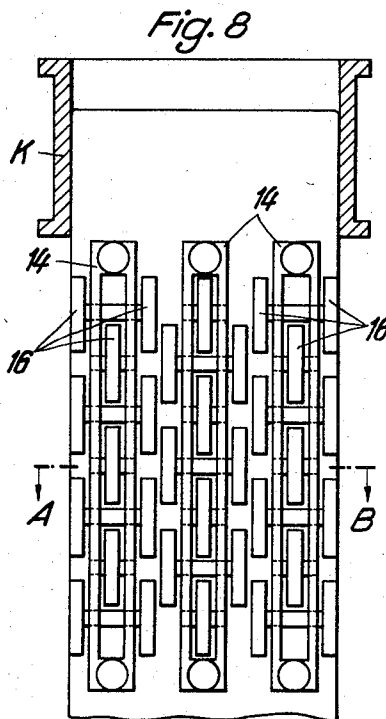
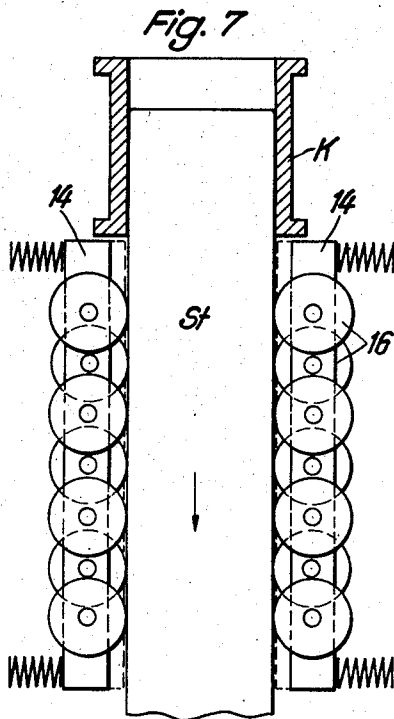
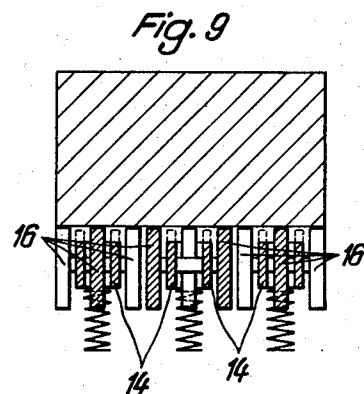


Fig. 10



Inventors
Adolf Bungeroth
Karl Georg Speith
Hans Schrewe
By their attorneys
Howan and Howan

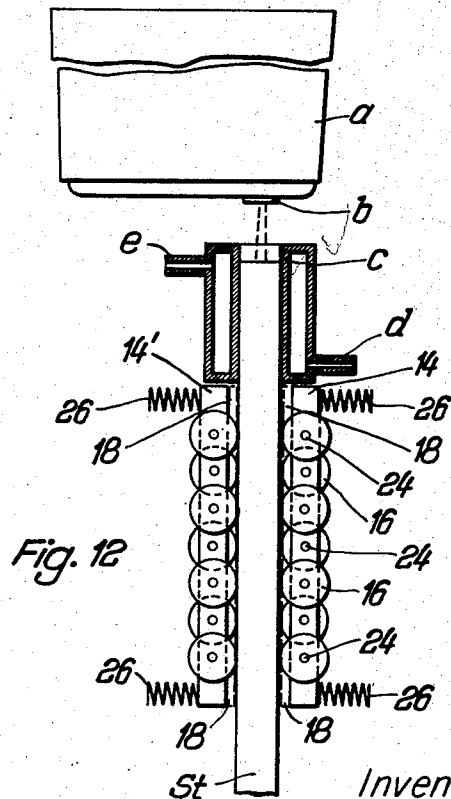
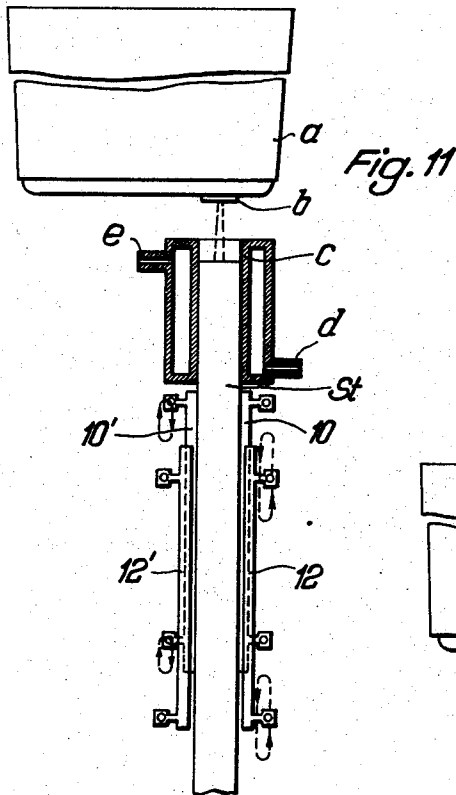
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Inventors
Adolf Bungeroth
Karl Georg Speith
Hans Schrewe
By their attorneys
Hawson and Hawson.

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2,895,190

CONTINUOUS CASTING PLANTS

Adolf Bungereoth and Karl Georg Speith, Duisburg-Huckingen, and Hans Schrewe, Duisburg-Ungelsheim, Germany, assignors to Mannesmann Aktiengesellschaft, Dusseldorf, Germany, a German corporation

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Claims priority, application Germany September 12, 1955

7 Claims. (Cl. 22—57.2)

This invention relates to a device for guiding a casting in a continuous casting plant which includes at least one vertically arranged mould.

It is known to equip such devices with rolls which are arranged opposite to each other within a certain distance below the mould. The function of these rolls is to hold a piece that initially forms the bottom of the mould when casting is started. As soon as this bottom piece is pressed downward by the casting the rolls touch the casting itself and hold the latter and control the speed of descent in accordance with the casting speed.

It is further known to fit rollers between said rolls and the lower edge of the mould. These rollers also bear upon the casting. The casting, after leaving the mould, has a comparatively thin solidified shell while its core is still liquid. The pressure exerted by the liquid core easily produces these small bulges. Said rollers are used to prevent the formation of these bulges on the casting. It has been found, however, that these rollers do not prevent the formation of bulges in the space between the mould and the rollers.

The invention consists in a device for guiding a casting in a continuous casting plant consisting of at least one supporting element arranged below the mould and including a plurality of longitudinally extending members the axes of which are parallel to the axis of the casting.

The spacing between the longitudinally extending members of the supporting element is sufficiently small to prevent the formation of bulges of the casting but is sufficiently large to allow a cooling agent to pass between them in order to reach the casting. For this purpose, the spacing between the longitudinally extending members is preferably between 1 to 5 centimetres. This is a distance between the longitudinal members within which a bulging of the casting is made impossible. There is a certain connection between, on the one hand, the speed of descent and the casting speed and, on the other hand, the extent of the spacing. The greater the speed of descent, the smaller must be the spacing, because with increasing speed of descent less time is available for the formation of a strong outer skin.

Either all longitudinally extending members of the supporting element or at least some of them may be rigidly connected with the mould. The longitudinally extending members of the supporting element or at least some of them may be connected rigidly or some may be connected movably to the mould. In case of the connection being a rigid one, at least some of the longitudinally extending members may be connected resiliently to the mould. In either case of the connection being a rigid or a movable one, at least some of the longitudinally extending members may be connected adjustably to the mould.

It is not necessary for all longitudinally extending members to bear upon the casting continuously, although the design may provide for this. It is suffi-

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cient if some of the longitudinally extending members continuously bear upon the casting. Thus the device may be so designed that at least some of the longitudinally extending members are temporarily and periodically withdrawn from the casting. These longitudinally extending members are movable in the direction of their longitudinal axis and in a direction perpendicular thereto.

In practice a stationary longitudinally extending member alternates with a movable one or, if all longitudinal members are movable, alternately one of them will bear upon the casting while the adjacent one will not touch the casting. In this case, the longitudinal members bearing upon the casting accompany the downward movement of the casting, whereas the other longitudinal members, which are withdrawn from the casting, carry out an upward return movement, upon completion of which they will again bear upon the casting. The movements must be controlled so that the periods during which the longitudinally extending members bear upon the casting overlap and that the casting is not left at any time without an external support.

Movable moulds are known which carry out an upward and downward movement. It is possible, of course, to regulate the movements during which the longitudinally extending members are withdrawn from or bear upon the casting so that they coincide with the movement of the mould in order to accompany or to effect a continual or sudden emerging of the casting.

The length of the axially moving longitudinal members must be such that the friction between them and the casting is sufficient to hold the weight of the casting during the descending motion.

It is advantageous if at least some of the longitudinally extending members are constructed to permit the circulation within the members and/or application to the casting of cooling agents and/or lubricants. For this purpose, suitable inlets and outlets must be provided.

It is possible, instead of using lubricants or in addition to these, to reduce the friction between the casting and the supporting element by providing the latter also with rolls. These bear upon the casting instead of the longitudinally extending members, so that the casting need not slide along the stationary members but practically rolls off. It is advantageous if these rolls are fitted to the supporting element, to use longitudinally extending members which are channel-shaped. The rolls must be so numerous and their arrangement such that they provide, in practice, a strong external support for the casting. For this purpose, the rolls are arranged in columns in such manner that the axes of rotation of the rolls in any column are intermediate to the axes of rotation of the rolls in the adjacent column or columns.

Finally, a combination of both alternatives is possible by providing the sides of the channel-shaped longitudinal members with projections extending towards the casting. As a result, the channels, on the one hand carry the rolls and cause these to bear upon the casting, and, on the other hand, the sides of the channels project to such an extent that they bear in addition to the rolls upon the casting like sliding bars.

Some embodiments of the invention will now be explained in further detail with reference to the accompanying drawings, in which

Figures 1 and 2 are side and front views partly in section illustrating a device according to the invention in which some longitudinally extending members are rigidly connected to the mould and some are arranged movably,

Figure 3 is a sectional view taken along the line A—B of Figure 2,

Figures 4 and 5 are side and front views illustrating

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a device according to the invention in which all longitudinally extending members are movably arranged,

Figure 6 is a sectional view taken along the line A—B of Figure 5,

Figures 7 and 8 are side and plan views illustrating a device according to the invention which is provided with rollers,

Figure 9 is a sectional view taken along the line A—B of Figure 8,

Figure 10 illustrates a device according to the invention with rolls arranged in a frame, and in which

Figures 11 and 12 are diagrammatic views of two embodiments of a complete plant.

In all figures "K" refers to a mould and "Sr" refers to a casting.

Figures 1, 2 and 3 illustrate an arrangement according to the invention in which longitudinally extending members 2, which form one part of a supporting element are rigidly connected with the mould K and in which their lower ends are resiliently or adjustably arranged. Springs 4 cause the members 2 to bear firmly upon the casting Sr even when the casting has shrunk or has become slightly conical as a result of the cooling process.

Longitudinally extending members 6, which form the other part of the supporting element and which are located between the members 2, can be individually or collectively moved and bear upon the casting in a predetermined cycle. They accompany the downward movement of the casting or even accelerate and assist the latter by exerting a certain drawing action upon the casting. After being moved over a predetermined distance they are withdrawn from the casting, lifted by suitably controlled movements and bear again upon the casting.

A cooling agent for the members 2 and 6 and also for the casting may be supplied through apertures 8 in said members, which may be hollow. The cooling agent, if also required for the casting, leaves the hollow members 2 and 6 on their sides facing the casting. In the same way, lubricants may be applied to the castings.

An arrangement of a supporting member having stationary longitudinal members only, all of which are mounted at a distance to each other and connected with their upper ends to the mould K, but in which their lower ends are rigidly, resiliently and/or adjustably arranged, is not illustrated.

It may possibly be advantageous to arrange generally the stationary longitudinal members independently from the mould and to make provision for the upper ends of the longitudinal members to be mounted resiliently and/or adjustably but very closely below the mould. For such an arrangement and in particular if stationary moulds are used, it may be advantageous to assist the motion of the casting by providing additional devices, for instance, shaking and/or vibrating mechanisms.

Figures 4, 5 and 6 illustrate a device according to the invention in which all longitudinal members are movably arranged and are brought to bear alternately upon the casting either individually or in groups. In the embodiment illustrated in these figures, longitudinally extending members 10 bear upon the casting and accompany its descent while longitudinally extending members 12 have already completed the downward movement and are withdrawn from the casting so that they may be lifted upwards to bear again upon the casting. Of course, more than two groups of longitudinal members may be provided which alternately bear upon the casting.

Figures 7, 8 and 9 illustrate a device according to the invention in which longitudinally extending members 14 of a supporting element are additionally provided with rolls 16. These are arranged in columns, and their axes of rotation in any column are intermediate to the axes of rotation of the rolls in the adjacent column or columns. For mounting the rolls it is advantageous to use longitudinally extending members which are channel-

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shaped and designed like a frame so that the rolls 16 may also be rotatably mounted in the channels in order to form a strong support for the casting. A drive may be provided for all or at least some of the rolls so that the motion of the casting is assisted.

The sides of the longitudinal members 14 carrying the rolls are preferably provided with projecting flanges 18 which bear upon the casting Sr like guide bars. Further, these guide bars may be rigidly connected with the mould K or may be arranged independently from the mould and may be resilient and/or adjustable at the top and/or at the bottom.

Figure 10 illustrates a supporting element including only two channel-shaped longitudinal members wherein the rolls are mounted on axles extending between these two members. The axis of rotation of the rolls are arranged in the same way as described in connection with the embodiment illustrated in Figures 7 to 9. The two channel-shaped members form a frame 20 which may be rigidly connected to the mould K, or which may be arranged independently from the mould and may be resiliently and/or adjustably mounted at the top and/or the bottom. A drive may be provided for all the rolls 22 or some of them.

As a result of arranging the device according to the invention closely below the mould, the starting bolts, which in previous arrangement were required to be very long and which were, therefore, unwieldy may be considerably shortened.

Further, as the supporting elements are provided in suitable lengths and as several of them may be provided as a combination, the motion of the casting is assisted so that the provision of separate transport rolls may not be necessary.

Finally, the devices according to the invention, if arranged directly in connection with the mould or adjoining its lower end, practically represent an extension of the mould having more intense cooling facilities, so that it may even be possible to reduce the length of the mould.

The devices according to the invention are arranged on at least two opposing sides, preferably the two longer sides, of castings having rectangular cross-section, and should practically surround castings of circular or polygonal cross-section.

Figure 11 illustrates a continuous casting plant according to the invention.

A molten material leaves a ladle *a* by way of a spout *b*, which may be sealed by a plug, and reaches a cooling mould *c* which is open on either side. The supply and the removal of a cooling agent is effected through two connecting sockets *d* and *e*. The circulation of the cooling agent causes the casting Sr to have a largely solidified surface when it leaves the lower end of the mould. A supporting element is provided to support this surface against the ferrostatic pressure prevailing inside the casting. Longitudinally extending members 10, 12, 10' and 12' of this supporting element are parallel to the axis of the casting. The longitudinal members 10, 12, 10', and 12', in the embodiment illustrated in the drawing are movably arranged so that they bear alternately upon the casting Sr, accompany the downward motion of the casting and, after completing an upward movement again bear upon the casting (see also Figures 5 and 6).

The longitudinal members 10 and 10' in the embodiment illustrated have completed the upward movement and bear upon the casting, whereas the members 12 and 12' have accompanied the downward motion of the casting and are already withdrawn from the casting Sr in order to be returned to their upper position. The movement of the bars 10, 12, 10' and 12' is effected by a suitable mechanism.

Figure 12 illustrates the same continuous casting plant in which the molten material leaves the ladle *a* through a spout *b* and reaches the cooling mould *c*. The two connecting sockets *d* and *e* are provided for the supply

and the removal of the cooling agent, and the casting *S* leaves the lower end of the mould *c* with a largely solidified surface. Channel-shaped longitudinal members 14 and 14' are provided, which are parallel to the axis of the casting and which are resiliently mounted (see Figures 7, 8 and 9). The hollow spaces between the channel-shaped members 14 and 14' are provided with rolls which run on axles 24. These rolls ease the motion of the casting *S*, whereas the channel-shaped members 14 and 14' urged by springs 26 bear upon the casting *S* through projecting flanges 18 facing the casting. It is not necessary that all longitudinal members on the side facing the casting are provided with the projections 18. The effect of the longitudinal members and the rolls as regards the support of the casting, therefore, is combined in this arrangement. A drive may be provided for all or some of the rolls 16 in order to accelerate the motion of the casting.

What we claim as our invention and desire to secure by Letters Patent of the United States is:

1. In a continuous casting plant, a device for guiding a casting moving vertically downward comprising longitudinally extending members arranged around the casting, certain of said members being substantially movable as a group from an upward position to a downward position and being movable with respect to others of said members whereby said certain of said members may be moved downwardly as a group relative to said other members along with the casting and in gripping engagement therewith during downward movement of said certain of said members.

2. In a continuous casting plant, a device comprising a plurality of longitudinally extending members arranged round the casting, the spacing between the members being sufficiently small to prevent the formation of bulges in the casting, but sufficiently large to allow a cooling agent to pass between them, some of said members being substantially stationary and others of said members being movable along with the casting in engagement therewith and movable vertically upward out of engagement with the casting.

3. A device according to claim 2, wherein the spacing between the longitudinally extending members is between 1 and 5 centimetres.

4. In a continuous casting plant, a vertical mould having a first group of longitudinally extending vertical members below the mould parallel to the direction of movement of the casting leaving the mould and adapted

to fit against the surface of the casting, the upper ends of said first group of members being connected to the lower end of the mould, and a second group of longitudinally extending members fitting between the members of said first group, said second group of longitudinally extending members being movable downwardly as a unit along with the casting as it moves from the mould over a predetermined distance and disengageable from the casting for upward movement to the upper position for repeated engagement and downward movement with the casting.

5. In a continuous casting plant, a device for guiding a casting moving vertically downward comprising a first set of vertical axially extending members having their upper ends connected to the mould, means for urging the lower ends of said first set of members inwardly against the casting, and a second set of axially extending members adapted to move downwardly in contact with the casting and to move upwardly after being withdrawn from the casting.

6. In a continuous casting plant, a first set of longitudinally extending members adapted to grip the casting and to move downwardly therewith from an upward position and over a predetermined distance, after which they release the casting and are returned to their said upward position, and a second set of members adapted to move relative to said first set of longitudinally extending members and with the casting and to grip the casting while the first set of members is being raised to said upward position.

7. In a continuous casting plant, a vertical mould having two groups of longitudinally extending vertical members below the mould, each of said groups of members being independently and alternately movable with respect to each other from an upward position to a lower position whereby each group of members alternately grips the casting and moves downwardly therewith from said upward position over a predetermined distance to said lower position, releases the casting upon arriving at said lower position, and returns to said upward position.

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