

Feb. 15, 1949.

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2,461,999

SEPARABLE MOLD AND REFRACTORY TROUGH ASSEMBLY

Filed April 16, 1945

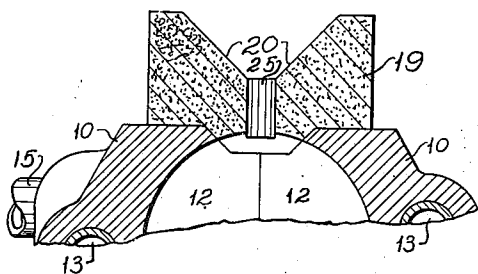


FIG. 5

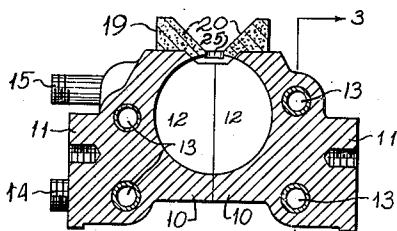


FIG. 2

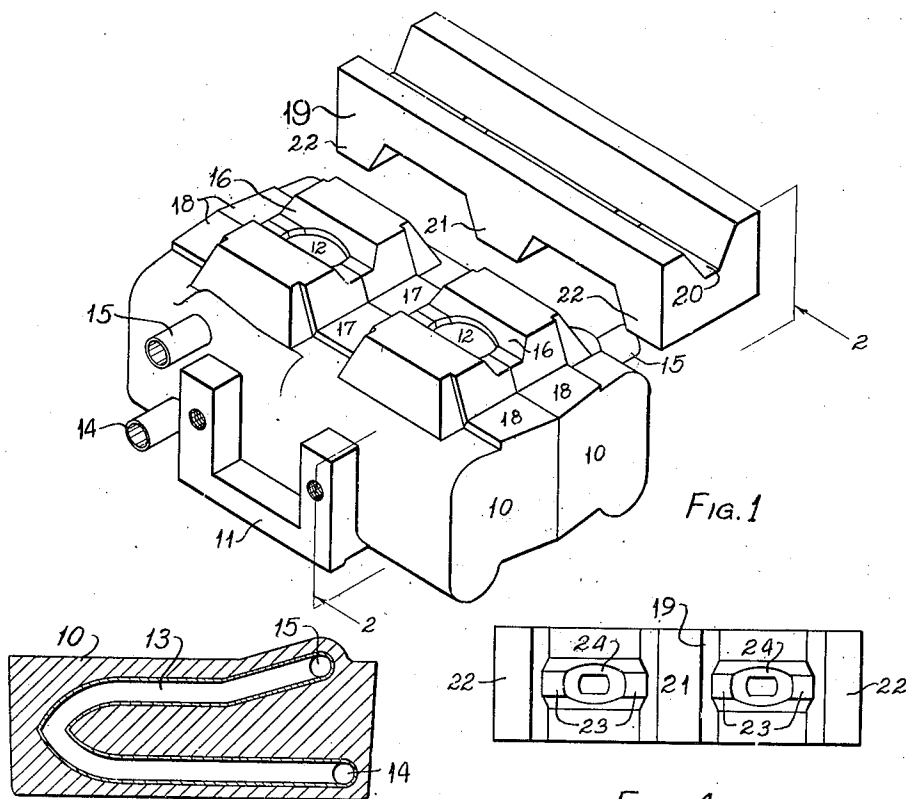


FIG. 1

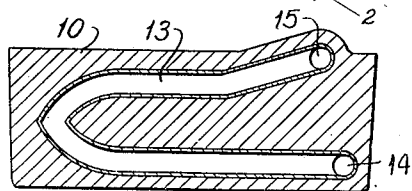


FIG. 3

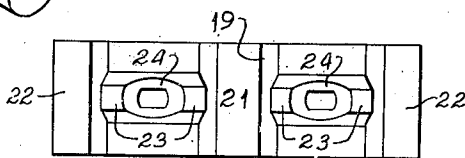


FIG. 4

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2,461,999

SEPARABLE MOLD AND REFRACTORY
TROUGH ASSEMBLYPearson M. Payne, Denver, Colo., assignor to P.
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Application April 16, 1945, Serial No. 538,434

2 Claims. (Cl. 22-134)

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This invention relates to metal-casting means and apparatus, and more particularly to such means and apparatus employing chill-type, separable moulds in cooperation with section-
alized, refractory pouring tracks or troughs, and has as an object to provide an improved interlocking construction of mould and cooperating
trough section.

A further object of the invention is to provide an improved, cooperative, interlocking association of refractory pouring trough section with a chill-type mould whereby the size and protrusive extent of sprues, heads, and buttons formed on the finished castings is minimized.

A further object of the invention is to provide an improved arrangement of chill-type mould and refractory trough section interengageable to positively position and hold the trough section in the desired relationship with its associated mould.

A further object of the invention is to provide an improved association of chill-type mould and refractory trough section cooperable to facilitate production of solid, homogeneous, dense castings of high quality.

A further object of the invention is to provide an improved design and construction for refractory pouring trough sections pressed from moulding sands and adapted for use with chill-type moulds.

A further object of the invention is to provide an improved design and construction for chill-type, separable mould sections adapted to be fed with molten metal through associated refractory trough sections.

With the foregoing and other objects in view, my invention consists in the construction, arrangement, and combination of elements hereinafter set forth, pointed out in my claims, and illustrated by the accompanying drawing, in which—

Figure 1 is an isometric view of a chill-type mould unit and associated pouring trough section embodying the principles of the invention as related just prior to cooperative interengagement. Figure 2 is a cross section taken on the indicated line 2-2 of Figure 1 with the trough section interengaged with the mould unit. Figure 3 is a longitudinal section taken substantially on the indicated line 3-3 of Figure 2. Figure 4 is a bottom plan view of the refractory trough section shown in Figure 1. Figure 5 is a fragmentary, detail section, on an enlarged scale, illustrating a modified construction of certain of the elements shown in Figure 2.

The improvements of the instant invention are primarily adapted for use in, on and with continuous casting machines of the general type shown and described in my United States Patent No. 2,326,164, dated August 10, 1943, and pend-

ing application for United States patent filed April 17, 1943, Serial No. 483,537, now abandoned, which machines include a plurality of separable, chill-type, mould assemblies disposed in end-abutting relation peripherally of a rotatable table for automatic separation and closed registration of the mould unit elements as an incident of table rotation and for supporting cooperation with refractory pouring trough sections adapted to receive and function as a flow channel for molten metal wherewith the moulds are to be charged. The pouring trough sections are normally pressed from "green" sand and withstand but a single contact with molten metal and are, in any event, destroyed when the mould unit elements are separated for discharge of their moulded charge, thus requiring continuous replacement of pouring trough sections in cooperating relation with the mould units in advance of molten metal inflow, and one of the important considerations of the instant invention is the provision of means operable to facilitate registration of a pouring trough section on and in proper operative relation with its associated mould unit. Further, conventionally associated separable mould assemblies and pouring trough sections are commonly productive of relatively heavy and extensively protrusive sprues, buttons, or heads which must be broken or cut away from the finished castings through expenditure of considerable time and labor and frequently with undesirable damage to the castings, hence an additional objective of the instant invention is an arrangement of means and operative relationships whereby the size and length of pouring gate may be reduced for the practical elimination of objectionable heads and sprues.

Each separable mould unit or assembly of the improvement consists of two identical mould halves or elements, designated generally by the numeral 10, suitably supported and arranged for contacting registration of their cavity-recessed faces at the mould-completing limit of their range of separation and hingedly related for such separation of their contactable faces as will permit escape of the moulded charge from the assembly. In usual practice, one of the elements 10 is secured to a fixed bracket carried by the rotatable table of the casting machine and the complementary element 10 is secured to and for oscillation with an arm or yoke hingedly associated with said table or bracket, suitable mounting ribs 11 tapped for the reception of attaching means, such as lag screws, preferably being provided on the exterior wall of each element 10 opposed to its cavity-recessed face to facilitate proper removable and replaceable association of the element with its supporting member. Each element 10 is formed with

recesses or cavities 12, two to each element 10 in the example illustrated, opening through its face engageable by the complementary element and adapted to register with the corresponding cavities of the said complementary element to complete the desired mould impression when the said associated elements are closed together in the manner illustrated, the cavities 12 of each of the elements preferably closely approximating one-half of the mould impressions completed thereby and being contoured to the desired shape of the finished casting to be produced, the cavities in the illustrated embodiment being designed to form grinding balls of spherical shape.

The elements 10 are formed of suitable metal, such as copper, or the like, adapted to withstand the temperatures of the molten metal incoming thereto, preferably by casting or moulding, and are arranged to be cooled for functioning as chill-type moulds by means of a continuous circulation of cooling fluid therethrough. For cooling purposes, the elements 10 may be cast as hollow blocks and provided with suitable pipe nipples or like connections operatively engageable with a fluid circulating system, in the manner shown in my patent and patent application above noted, but a somewhat simpler and less expensive procedure for providing the desired positively-sealed and non-leaking fluid flow channel within each element 10 is to form a separate flow channel of suitable size and shape from tubular material, such as pipe, and embed the so-formed channel in the element 10, with the ends of said channel projecting exteriorly beyond the element, at the time the element is cast or moulded. Application of the preferred procedure is evidenced in the drawing, wherein the numeral 13 designates a length of pipe or tubular material bent or otherwise worked to approximate, elongated U-shape and having its free end portions bent into substantially perpendicular relation with the plane of its yoke, which unit is embedded in the associated element 10 with one of its legs adjacent and paralleling the bottom of the said element to dispose its perpendicularly-related end 14 as an intake connection intersecting and projecting exteriorly beyond the element wall opposed to its recessed face and adjacent one end of said element, and its other leg in substantially parallel relation with and above said first leg, for a major portion of its length, and then diverging upwardly away from said first leg to position its perpendicularly-related end 15 as an outlet connection in spaced, substantially parallel relation with the intake 14 and somewhat more remote from the proximate end of the element 10 than the said intake, thereby offsetting the pipe ends 14 and 15 out of vertical alignment to facilitate their connection with the fluid circulating system wherein the length 13 is to be operatively included. Upward divergence of the end portion of the yoke upper leg away from the yoke lower leg is provided to elevate the flow channel outlet relative to the upper section thereof and thus insure that said upper leg is maintained filled, throughout most of its length, with cooling fluid which may escape through the outlet only when displaced by fluid incoming through the intake 14 and lower leg, so that fluid is always uniformly present within and for cooling effect on the element 10 when the intake 14 is connected with a source of fluid supply. Obviously, the intake 14 and outlet 15 of each element 10 is respectively connected, in any suitable

or convenient manner, with fluid inflow and fluid outflow lines comprising a circulating system operatively related with a source or supply of cooling fluid and serving the separable mould assemblies of a given casting machine.

Upper, longitudinal, meeting corners of the elements 10 forming each mould assembly are correspondingly rabbeted to form, when the complementary elements are in closed registration, a channel 16 centrally, longitudinally, and opening upwardly through the top surface of the mould assembly and defined by a flat, horizontal bottom longitudinally bisected by the plane of separation between the elements 10 and upwardly diverging side walls. The channel 16 has a depth such as to cut into and across upper segments of the mould impressions formed by the registered cavities 12, the channel bottom being thus disposed in a plane parallel with and spaced somewhat below the horizontal plane tangent to the apices of the said mould impressions, so that said mould impressions intersect the channel bottom in open areas of relatively considerable extent. Perpendicular to the channel 16 and transversely of the mould assembly upper surface, a relatively wider and deeper channel 17, having a flat, horizontal bottom and upwardly diverging side walls, cuts through the channel 16 and top surfaces of the elements 10 intermediate and in non-intersecting relation with the mould impressions for disposition of its bottom in a plane spaced below and parallel with that of the bottom of the channel 16, and rabbets 18, each corresponding to a longitudinal half of the channel 17, are formed, one transversely of and across each end of the mould assembly, in spaced, parallel relation with the channel 17 and with their bottoms coplanar with that of the latter channel, in such disposition as will permit cooperation of the adjacent rabbets 18 on end-abutted mould assemblies to form a transverse channel corresponding to the channel 17.

The channels 16 and 17, rabbets 18, and adjacent top surfaces of the elements 10 comprise a positioning and supporting seat engageable by and for the proper relative mounting of a refractory pouring trough section indicated generally by the numeral 19, one of which sections is provided for each mould assembly and operatively associated therewith in advance of molten metal flow to said assembly. The trough sections 19 are pressed in a suitable mould, or otherwise formed to the desired size and shape, from refractory material, such as moulder's sand, and may be used either as moulded "green" and without baking or curing or after baking and curing, as operating conditions, facilities and materials may warrant, considerations of operating speed, economy, and efficiency usually favoring use of the trough sections in "green" condition. Irrespective of method of manufacture or ultimate conditioning, each trough section 19 is formed as a compact, integral, homogeneous unit, of a length equal to that of the mould assembly, substantially rectangular in plan with its end margins slightly converging to insure close fit against adjacent trough sections of mould assemblies mounted on a circular table. The upper surface of the trough section 19 is interrupted and longitudinally traversed by a continuous groove 20 defined by a flat bottom and upwardly-diverging side walls, which groove opens through both ends of the section 19 and constitutes a flow channel for the reception and direction of molten metal, and the under sur-

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face of said trough section is shaped to provide an intermediate transverse rib 21 adapted to fit and seat within the channel 17 of the mould assembly, transverse end ribs 22 adapted to fit and seat against the rabbets 18 of the mould assembly, and a longitudinally median rib 23, interrupted by the rib 21, adapted to fit and seat within the mould assembly channel 16, said ribs 21, 22, and 23 depending from the trough section under surface to such extent and in such relationship as will dispose the remaining under surface areas of the section in bearing engagement with plane upper surface areas of the mould assembly when the trough section is mounted on and with its ribs engaging the corresponding channels and rabbets of said assembly. Portions of the trough section rib 23 traversing the mould impressions of the assembly are spherically recessed, as at 24, to conform with and complete said impressions, thereby reducing the thickness of the flow channel bottom immediately above each of the mould impressions, and a pouring gate 25 opens through the bottom of the groove 20 centrally of each mould impression completing recess 24 and consequently at the thinnest bottom portions of said groove for supply of molten metal from the flow along said groove to and for filling of the mould impressions.

With the cooperating mould assembly and trough section constructions shown and described, it is feasible to provide and use a pouring trough section that is fully adequate in strength and rigidity and yet characterized by pouring gates of such depth as to leave on the finished casting only a slight button which is not at all objectionable when the product is a grinding ball, or the like, and thus obviate, in many cases, the need for a subsequent cutting or breaking operation on the castings produced. Also, the short pouring gates may be reduced in extent of open area without danger of plugging through the freezing of metal therein, and the completion of the mould impressions by means of the refractory trough material insures relatively slower setting of the metal at the top of the casting and full escape of gases from the casting interior through said portion of slower setting as well as an adequate supply of still fluid metal for the filling of shrinkage cavities, pipes, and fissures. Obviously, the interengageable ribs, channels, and rabbets of the improved construction cooperate to conveniently and precisely position each trough section in the desired operative relation with its mould assembly, thus facilitating servicing of the casting machine during its operation.

As is indicated in Figure 5, variation in the depth of pouring gate 25, when and as desired in specific operations, is readily had through variation in the overall depth of the trough section 19 while the other dimensions and relationships of the section remain the same, such variation in overall depth being reflected as variations in the thickness of the bottom of the groove 20 above the ribs 21, 22, and 23.

Since many changes, variations, and modifications in the specific form, construction, and arrangement of the elements shown and described may be had without departing from the spirit of my invention, I wish to be understood as being limited solely by the scope of the appended claims, rather than by any details of the illustrative showing and foregoing description.

I claim as my invention:

1. In a continuous casting machine having a plurality of end-abutted separable mould and refractory trough section assemblies each comprising relatively-movable, complementary mould elements formed with correspondingly-recessed, opposed faces interengageable on a vertical plane in registration of their recesses to form a mould-cavity-defining unit having a closed top surface, and a longitudinally-grooved refractory trough section longitudinally traversing the closed unit top surface, means for locating and retaining the trough section in flow communication through a short gate passage with the mould cavities of its associated unit, said means comprising opposed rabbets longitudinally of the upper meeting corners of said mould elements in intersecting relation with mould cavity recess upper portions cooperable to form an upwardly-opening channel intersecting the unit top surface and the mould cavities, upwardly-opening lateral channels intersecting said mould unit top surface and said first channel, depending, integral, lateral and longitudinal ribs on said trough section engageable with the corresponding unit channels to dispose the trough section longitudinal rib in covering relation with the intersected mould cavities, concavities on the under surface of said longitudinal rib disposed to register with and complete the unit mould cavities, and gates opening through the trough section floor and longitudinal rib concavities for registration with the intersected mould cavity upper portions when the trough section ribs are engaged in and with the unit channels.

2. In a separable mould and refractory trough assembly having relatively-movable, complementary, correspondingly-recessed mould elements interengageable on a vertical plane in registration of their recesses to form a mould-cavity-defining unit having a closed top surface, and a refractory trough section cooperatively engageable in longitudinal relationship with the closed unit top surface, means constituting a short gate flow passage from said trough section to the unit mould cavities, said means comprising an upwardly-opening channel longitudinally of said unit top surface in intersecting relation with the mould cavity upper portions, an integral rib longitudinally of and depending from the trough section under surface for registering engagement within said channel, concavities in the under margin of said rib disposed to register with and complete the intersected mould cavities, and gates opening through said trough section floor and rib concavities; together with coacting mould unit lateral top surface channels and trough section laterally depending ribs interengageable to registrably locate and retain said trough section longitudinally of the unit.

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