July 11, 1950 A. E. SMITH 2,515,060

DIVIDED SUCTION MOLD

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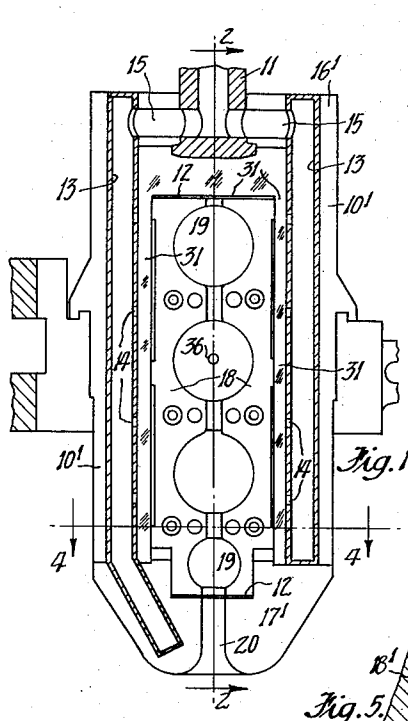


Fig. 1.

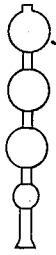


Fig. 1a.

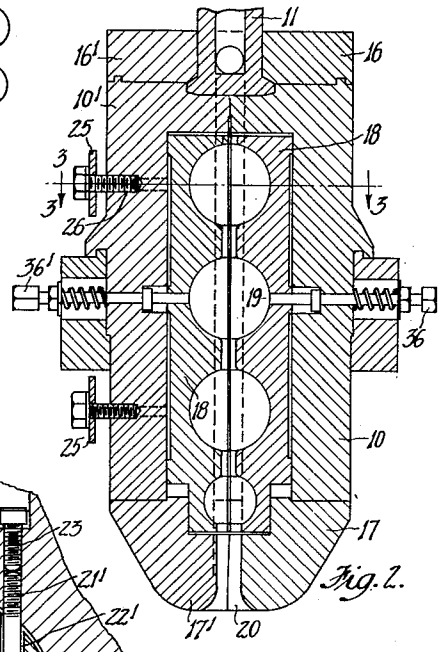


Fig. 2.

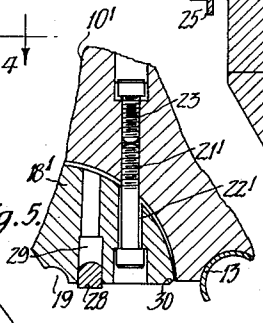


Fig. 5.

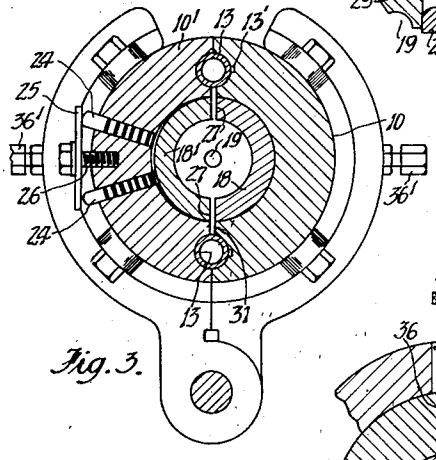


Fig. 3.

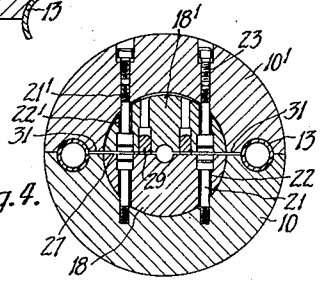


Fig. 4.

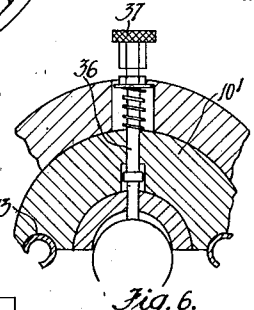


Fig. 6.

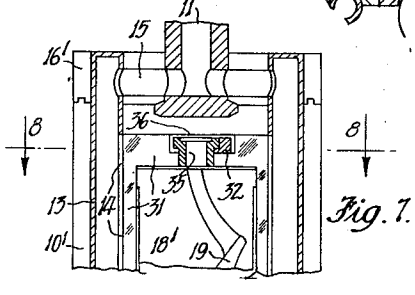


Fig. 7.

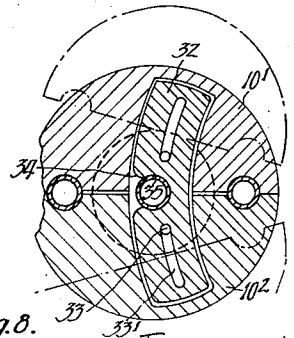


Fig. 8.

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DIVIDED SUCTION MOLD

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Application September 27, 1946, Serial No. 699,735
In Australia September 29, 1945

2 Claims. (Cl. 22—73)

1

This invention relates to improvements in and connected with divided suction moulds and refers particularly but is not limited to moulds for use in the formation of chilled metal castings.

In the specification of my prior application Serial No. 496,496, now matured into Patent No. 2,448,632, there is described divided suction moulds for the purpose referred to and the present invention relates primarily to improvements in such moulds.

The mould described in the aforesaid specification comprises two hingedly connected elongated sections which, when closed, abut against each other in a plane which passes through a mould cavity which is formed partly in one of the sections and partly in the other. The meeting faces of the mould sections are provided on opposite sides of the cavity with longitudinally extending mating grooves which accommodate suction tubes adapted to be placed in communication with a source of reduced pressure whereby the mould cavity may be evacuated through narrow slits formed by and between the meeting faces of the mound sections inwardly of said suction tubes. One end of the mould cavity is connected by a passage with a suction nozzle through which molten metal is drawn to the mould from a suitable receptacle.

The aforesaid prior invention also includes means for supporting a core centrally within the mould cavity and for parting the casting from the mould when the sections of the latter are opened. Such means include a supporting plate slidably mounted in the mould body above the mould cavity and having lost motion means connecting same to the mould sections whereby the centre of such plate is arranged midway between the mould sections when the latter are fully opened.

Now it has been found that when the mould cavity is formed directly in the hingedly connected sections of the mould body as above described, the said sections, which are necessarily subject to high and fluctuating temperatures, are liable to warp to an extent which may preclude effective sealing of the joints therebetween when the sections are closed, and one object of this invention is to provide an improved construction whereby this disadvantage will be obviated or minimised. Another specific object is to provide improved means for separating from the mould sections the castings formed therein.

With these and other objects in view, one broad feature of the invention resides in a divided suction mould comprising a plurality of co-

2

acting body sections, a mould insert accommodated in one at least of said body sections and having a mould cavity therein and means securing said mould insert to the respective body section in such a manner that said mould insert is free to expand independently of said body section.

Preferably each of said mould sections is provided with a mould insert as described, and one of said inserts may also be movable in opposition to resilient means and at right angles to the plane of closure whereby suitable portions of the mating faces of the coacting inserts are maintained in contact when the mould sections are closed. For this purpose, the inner face of the resiliently mounted insert preferably projects somewhat beyond the corresponding face of the corresponding mould section when the mould is open. Furthermore, the inner face of at least one of the inserts is preferably provided with slightly raised contact faces which ensure that narrow suction slits are formed by and between the inner faces of the inserts when the mould is closed.

Another feature of the invention resides in the provision in an upper portion of the mould of a slidable extractor plate arranged and operated in a manner similar to the aforesaid slidable supporting plate described in the aforesaid prior specification, such extractor plate being adapted to support a split boss or other member which communicates with the upper end of the mould cavity whereby the casting formed in the latter will extend to and become attached to said boss. Thus, when the mould is opened, the casting is supported centrally between the sections thereof.

Alternatively the castings may be ejected by laterally slidable ejector pins as hereinafter described.

For a more particular description of the invention reference will be made to the accompanying drawings in which:

Figure 1 is a view in vertical section of a divided mould in accordance with the invention, the plane of the section being coincident with the plane of division between the mould sections.

Figure 1*a* is a view in elevation of the cast produced in the mould shown in Figure 1.

Figure 2 is a view in sectional side elevation and is taken on the line 2—2 of Figure 1.

Figure 3 is a view in sectional plan and is taken on the line 3—3 of Figure 2.

Figure 4 is a view in sectional plan and is taken on the line 4—4 of Figure 1.

Figure 5 is a view corresponding to a part of Figure 4 and is drawn to a larger scale.

Figure 6 is a view in sectional plan illustrating the ejecting operation.

Figure 7 is a view similiar to Figure 1 and shows the upper portion of a mould provided with alternative ejecting means, and

Figure 8 is a view in sectional plan, and is taken on the line 8—8 of Figure 7.

The mould shown in Figures 1 to 6 comprises two hingedly connected elongated body sections 10 and 10', each of which may be of semi-circular form in cross-section as shown and the inner or mating faces thereof are formed adjacent their opposite edges with coacting longitudinally extending semi-circular grooves, each coacting pair of which accommodates, when the body sections are closed, a corresponding suction tube 13 provided at intervals with slits or exhaust openings 14. The suction tubes 13 are suitably retained to one of the body sections 10 as by means of pins 13'.

The upper ends of the suction tubes communicate with suction passages 15 in the sections 16 and 16' of a divided mould head which is formed integrally with or secured rigidly to the corresponding body sections 10 and 10', and the head mould when closed embraces the lower end of a suction head 11. The sections 17 and 17' of a divided suction nozzle are likewise formed integrally with or are suitably secured to the lower ends of the corresponding body sections, and the suction tubes 13 may be continued therein as shown at the left of Figure 1.

The inner face of each body section is formed centrally with a longitudinally disposed recess of semi-circular form in cross-section whereby when the body sections are closed, these recesses coact to form an internal cylindrical recess disposed concentrically about the vertical axis of the mould.

Each of said semi-circular recesses accommodates a corresponding mould insert 18 or 18' which is formed of metal and is of semi-circular shape in cross-section, the upper and lower ends of said inserts being spaced a small distance from the adjacent ends of the corresponding recesses in the respective mould section as shown at 12 whereby said inserts may undergo longitudinal thermal expansion independently of the body sections when the inserts are heated by contact with the molten metal.

Each of the mould inserts is formed in its exposed inner face with a portion of a mould cavity whereby when the mould is closed these cavities coact to form a single cavity 19 corresponding in shape and size to the castings to be formed, and the lower end of such cavity communicates by an extension thereof with a suction passage 20 in the aforesaid sections 17 and 17' of the divided suction nozzle.

The mould insert 18 has its inner face flush with the inner face of the respective body section 10 and is secured thereto by a plurality of set screws 21 which extend at right angles to the inner faces thereof and the heads of which are recessed into the exposed face of the insert on opposite sides of the mould cavity therein. These set screws extend through clearance holes 22 in the insert whereby the latter is securely retained to the said body mould section while at the same time thermal expansion of said mould insert relatively to the body section is freely permitted.

The other mould insert 18' is similarly retained to the body section 10' by set screws 21' which

extend through clearance holes 22', and the insert is capable of undergoing a limiting sliding movement thereon, i. e. at right angles to the plane of the inner face of the insert. The set screws 21' are restrained against movement by lock screws 23.

The mould insert 18' is urged outwardly from the corresponding body section and towards the other half of the mould by any suitable means, and preferably by a plurality of laterally arranged pairs of pressure pins 24 which extend radially through the wall of the body section 10' and bear at their inner ends against the outer peripheral surface of the insert, the said pressure pins of each pair being arranged on opposite sides of that radius which is normal to the closing plane of the mould sections as shown.

The outer ends of each pair of radial pressure pins 24 project outwardly from the body section and abut against the opposite ends of a corresponding transversely disposed flat resilient plate 25 which is supported at its centre by a screw 26 secured to the said body section. Thus each coacting pair of radial pressure pins 24 tends to project the laterally movable insert 18' from the body section 10' but the maximum movement permitted by the heads of the set screws 21' is small.

Accordingly when the mould is opened, the laterally movable insert 18' is forced outwardly by the pressure pins 24 to the full extent of its permitted movement as shown in Figure 5, and in this condition the inner face of said insert projects slightly beyond the inner face of the body section 10' to which it is attached.

During the final stage of the closing movement of the mould however, the thus projected mould insert 18' abuts against the inner face of the coacting insert 18 and is forced inwardly thereby in opposition to the aforesaid resilient projecting means therefor, whereby when the mould is completely closed, the inner faces of said inserts are resiliently maintained in firm mutual contact.

It is necessary however to provide narrow slits 27 between the inner faces of the mould inserts 18 and 18' whereby the mould cavity 19 may be evacuated through the medium of the longitudinally disposed suction tubes 13 arranged on opposite sides thereof.

For this purpose at least one of the inserts is provided with a plurality of slightly raised contact faces 28 which abut against the inner face of the coacting insert when the mould is closed. The height of these projections (which may be of the order of about .005'') thus determines the width of the slits 27, and the contact faces 28 may conveniently constitute the outer ends of a plurality of suitably spaced pins 29 recessed into the face of one of the mould inserts.

The outer longitudinal edges of the inner faces of the mould inserts are preferably bevelled or chamfered as shown at 30 to ensure that the air withdrawal passages are not obstructed due to warping at such edges, while corresponding air withdrawal slits 31 are formed by and between relieved portions of the mating faces of the body sections inwardly of the suction tubes 13 as described in my aforesaid prior specification. The bevelled edges 30 of the mould inserts also provide sufficient clearance 31 to permit of lateral thermal expansion of the inserts within the respective body sections.

It has been found that by forming the mould cavity 19 in the inserts 18 and 18' instead of

directly in the body sections 10 and 10' as disclosed in the aforesaid prior specification, and by so connecting the inserts to the respective body sections that the former are free to expand and contract within the latter, the difficulties heretofore experienced and due to warping of the mould members are substantially obviated. Moreover the provision of means for maintaining the inner mating faces of the mould inserts in resilient contact when the mould is closed further assists in obviating the aforesaid difficulties and ensures that air withdrawal slits 27 of predetermined width are formed therebetween.

In use after the mould is closed and the lower end of the suction nozzle is dipped into a bath of molten metal, the mould cavity 19 is evacuated through the suction tubes 13. Molten metal thus ascends in the cavity and forms a chilled casting therein of the shape shown in Figure 1a, the various balls comprising the casting being subsequently separated by removing the connecting runners.

When the mould is opened, the casting usually tends to remain in one or other of the mould inserts, and the invention includes means for ejecting same. Thus as shown in Figures 1 to 6, each body section may be fitted with one or more radially disposed spring loaded ejector pins 36 which extend slidably through the walls of the body sections 10 and 10' and also through the mould inserts whereby when the mould is closed the inner ends of these ejector pins constitute portions of the surface of the mould cavity 19. When, however, the mould sections are approaching their fully open positions, the outer ends 36' of the ejector pins abut against suitably positioned stops 37 (Figure 6) so that further movements of such pins are arrested. Accordingly during the final opening movement of the mould halves, the inner ends of the ejector pins are projected from the inner surfaces of the mould cavity whereby the casting is separated from the mould and falls into a suitable receptacle.

Figures 7 and 8 show alternative ejecting means comprising a horizontal supporting plate 32 which is slidably supported within the body sections 10 and 10' above the mould inserts 18 and 18', such supporting plate being connected to each body section by lost motion means which, as described in my prior specification, may comprise pins 33 engaging arcuate slots 33' in the lower face of the plate whereby when the body sections are fully opened, the said supporting plate is maintained centrally therebetween. The supporting plate 32 is formed centrally with a slot 34 adapted to receive a divider tubular holder 35 or other suitable member, the interior of which communicates freely with the upper end of the mould cavity, and the interior of the holder communicates with the suction tubes through a narrow head space 36.

Thus when a casting is being formed in the mould, molten metal is drawn upwardly into the divided holder 35 so that when the mould is opened the casting is parted from both of the mould inserts and remains suspended midway therebetween, and is readily removable from the slotted plate 32.

I claim:

1. A divided suction mould comprising a body having a pair of separable sections with mating faces, each section having an elongated recess in its inner face whereby when said sections are closed, said recesses together forming a substantially sealed elongated cavity, an elongated mould insert comprising a pair of separable sections having mating faces, each section of said mould insert being accommodated in said recess in a corresponding one of said body sections with its mating face disposed substantially in the plane of the mating face of the respective body section, each mould insert section being shorter than the accommodating recess to provide a clearance space at at least one end thereof, headed fastening members disposed substantially at right angles to the plane of the mating faces and retaining each mould insert section to the respective body section, each fastening member being secured to the respective section of the body and extending through a clearance hole in the respective mould insert section to permit thermal expansion of said insert section independently of the respective body section, coacting stop means permitting limited sliding movements of one of said mould insert sections on said fastening means therefor, spaced resilient means urging said last-mentioned mould insert section outwardly from said accommodating recess to the extent permitted by said coacting stop means, said mould insert sections being formed in their mating faces with co-operating portions of a common mould cavity, the mating faces of said body sections being provided at one end thereof with co-operating portions of a passage which extends from the exterior of said body and communicates with the corresponding end of the mould cavity and through which molten metal may enter said cavity, said mating faces of the body sections being formed on opposite sides of said cavity therein with longitudinally extending grooves which coact to form suction passages when the mould is closed, said mating faces of the body sections being relieved inwardly of said suction passages whereby narrow air withdrawal passages are formed therebetween when the mould is closed, and a plurality of spaced shallow projecting elements on the mating face of at least one of the mould insert sections for engagement with the mating face of the other mould insert section whereby said coacting faces are separated when the mould is closed to form narrow air withdrawal passages therebetween.

2. A divided suction mould comprising a body having a pair of separable sections with mating faces, each section having a recess in its mating face whereby when said sections are closed said recesses together form a substantially sealed cavity, a mould insert comprising a pair of separable sections having mating faces, each section of said mould insert being accommodated in said recess in a corresponding one of said body sections with its mating face disposed substantially in the plane of the mating face of the respective body section, means retaining each mould insert section to the respective body section to permit thermal expansion of said insert sections independently of the respective body sections and in a direction substantially parallel to the plane of said mating faces, means permitting limited movement of at least one of said mould insert sections relatively to the respective body section and substantially transverse to the plane of the mating faces, a plurality of spaced pressure pins extending slidably through the wall of that body section which accommodates said transversely movable mould insert section, said pressure pins having their inner ends in contact

with said mould insert section, and a plurality of spaced strip springs secured to the exterior of said body section and bearing resiliently against the outer ends of said slidable pressure pins, said mould insert sections being formed in their mating faces with cooperating portions of a common mould cavity, said body being formed with a passage which extends from the exterior of said body and communicates with the mould cavity and through which molten metal may enter said cavity, and said mating faces of the body sections being formed with grooves which co-act to form at least one suction passage when the mould is closed and said mating faces of the body sections and mould insert sections being adapted to form when the mould is closed narrow air withdrawal passages which extend from said mould cavity to said suction passage.

ARTHUR EDGAR SMITH.

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