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(54) Casting production apparatus and method

(57) A casting production apparatus comprising: a permanent mould having movable walls and a first base; means for feeding molten metal to said mould; characterised in that said first base is removable from said mould, and by further comprising a second base; a first location and a second location; said first location being arranged inside said mould; said second location being arranged outside said mould; handling means for said first and second base; said handling means moving said first base from said first location to said second location and said second base from said second location to said first location.

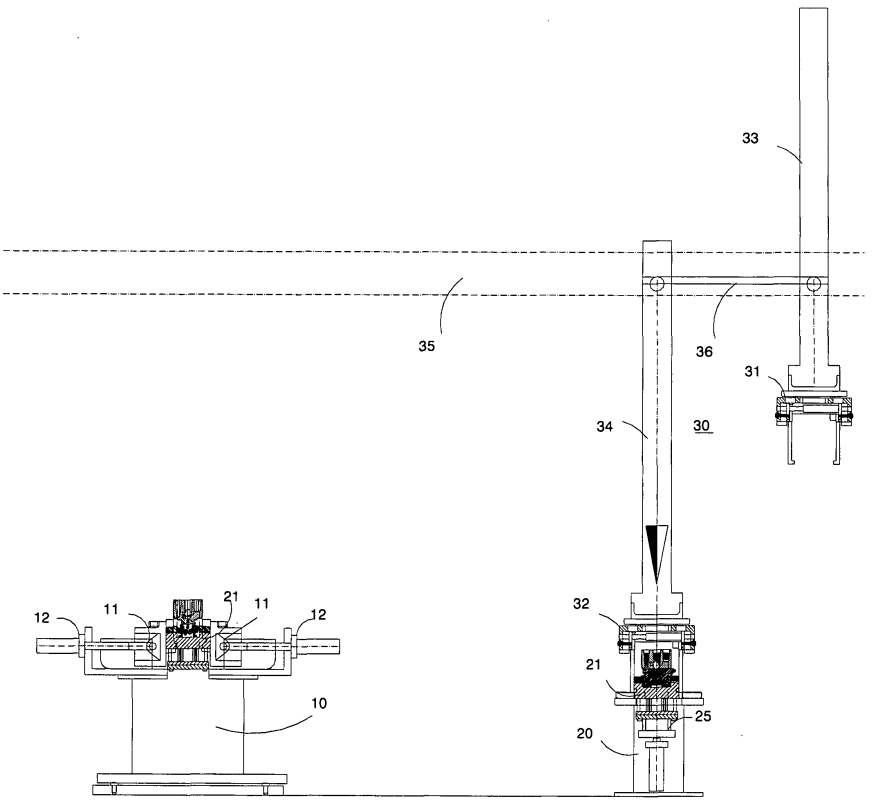

Fig. 1

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Description

[0001] The present invention relates to a casting production apparatus and method, in particular for casting using a permanent mould.

[0002] A permanent mould is a mould used to produce castings, and consists of two or more mutually connected parts with suitable devices to enable molten metal to be inserted. After a suitable waiting time the casting is extracted, as the molten metal has solidified. The mould is constructed in such a manner as to enable the casting to be easily removed.

[0003] The internal cavities of the casting are produced by so-called "cores", i.e. parts usually made of silica sand (or ceramic) plus a suitable binder to maintain the previously impressed shape. The cores are introduced into the mould before inserting the molten metal. The cores usually rest in or are fitted into the mould via suitable slots provided in the mould.

[0004] In the usual production process, the operator (or in some cases an automatic robot system) inserts these cores into the mould. This method of working involves certain drawbacks, as follows.

[0005] The operator is compelled to work in proximity to the mould, with considerable discomfort due to the high temperature of the mould and the small amount of available space.

[0006] The mould productivity is limited by the fact that while the operator is working on it to clean the base or to insert the cores, the mould cannot produce castings.

[0007] An object of the present invention is to provide an apparatus which operates in accordance with a method such as not to present the drawbacks of the known art.

[0008] Another object is to provide an apparatus which enables a higher productivity to be obtained compared with the known art.

[0009] These and further objects are attained according to the invention by a casting production apparatus comprising: a permanent mould having movable walls and a first base; means for feeding molten metal to said mould; characterised in that said first base is removable from said mould, and by further comprising a second base; a first location and a second location; said first location being arranged inside said mould; said second location being arranged outside said mould; handling means for said first and second base; said handling means moving said first base from said first location to said second location and said second base from said second location to said first location.

[0010] These and further objects are also attained by a casting production method comprising the steps of founding by pouring molten metal into a permanent mould comprising a first base; awaiting a predetermined time period to enable the molten metal to at least partially cool; during said time period arranging a plurality of cores on a second base located on a bench positioned at a predetermined distance from said mould; opening said mould and withdrawing said first base by handling means; withdrawing said second base by handling means; placing said first base on said bench positioned at a predetermined distance from said mould; placing said second base in said mould; closing said mould; repeating the previously listed steps.

[0011] Further characteristics of the invention are described in the dependent claims.

[0012] This invention enables the productivity to be increased by 30%-40% compared with a permanent mould system operating by the traditional system as it almost totally nullifies the effect of the time required by the operator or robot to unload the casting from the base and load the new cores onto the base.

[0013] It enables the operator to work in a region external to the mould region and hence in a more comfortable situation.

[0014] The invention enables the operator to operate directly on the base without constraints due to obstructions deriving from the mould itself.

[0015] The characteristics and advantages of the present invention will be apparent from the ensuing detailed description of one embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, in which:

Figure 1 is an apparatus for founding and handling castings, shown in a first position;
Figure 2 is an apparatus for founding and handling castings, shown in a second position;
Figure 3 is a portion of an apparatus for founding and handling castings, shown in a third position;
Figure 4 shows a detail of the apparatus for founding and handling castings.

[0016] With reference to the accompanying figures, an embodiment of an apparatus for founding and handling castings in accordance with the present invention comprises a support body 10 and a mould 11 divided into two parts slidable on the support body 10.

[0017] The support body 10 comprises two arms 12 operable by respective hydraulic cylinders, which enable the two parts of the mould 11 to be opened and closed on command.

[0018] The apparatus for founding and handling castings of the present invention further comprises a bench 20 separated from and sufficiently distant from the support body 10, and hence distant from heat sources.

[0019] The bench 20 is arranged to support the base 21 of the permanent mould 11. The cores 23 are arranged on the base 21, on which the casting 22 is also located after pouring.

[0020] The bench 20 also comprises an expulsion member 25 for the casting 22 plus cores 23.

[0021] The expulsion member is operated by a hydraulic piston which enables whatever is positioned on it to be raised or lowered on command, and hence enables the casting 22 and cores 23 to be expelled.

[0022] The apparatus also comprises a robot 30 with

two grippers 31 and 32 each supported by a rod 33 and 34 respectively.

[0023] The rods 33 and 34 can be made to slide vertically and horizontally on a horizontal guide 35 by suitable members not shown, but known to an expert of the art.

[0024] The rods 33 and 34 are connected together by a bar 36, so that they move horizontally in a synchronous manner.

[0025] The grippers 31 and 32 are arranged to grip the base 21 and to then withdraw or place the combined casting 22 and cores 23 from or on the support body 10 and from or on the bench 20.

[0026] The apparatus for founding and handling castings operates in the following manner.

[0027] Founding takes place by pouring the molten material into the mould 11 and onto the cores 23 and onto a first base 21. After being cast, the casting must remain in position for some minutes to cool sufficiently to enable it to be handled.

[0028] In the meantime a second base is placed on the bench 20 and an operator arranges the cores 23 on the second base.

[0029] When the predetermined cooling time has passed and the operator has terminated his activity, the rod 34 is lowered onto the bench 20 (Figure 1), withdraws the second base with the cores 23, is raised to its operative position for handling purposes, and is made to approach the support body 10 followed by the rod 33.

[0030] The arms 12 are operated to cause the two parts of the mould 11 to withdraw from each other.

[0031] The gripper 33 is lowered into the support body 10, withdraws the first base 21 including the casting 22 and cores 23, and again rises (Figure 2).

[0032] The rods 33 and 34 advance slightly in the direction of the bench 20 and the rod 34 is lowered onto the support body 10, to position the second base 21 on it. The rod 34 rises into its operative handling position and together with the rod 33 moves towards the bench 20.

[0033] The arms 12 are again operated to move the two parts of the mould 11 together.

[0034] The mould 11 is now ready for a new pouring.

[0035] The rod 34 is positioned above the bench 20, is lowered and places the combined first base 21, casting 22 and cores 23 on the bench 20.

[0036] The operator operates the expulsion member 25, and removes the cores 23 to release the casting 22 (Figure 3). The casting 22 can now be withdrawn by suitable means and placed in store for the next operations.

[0037] The operator again arranges cores on the base 21 for the next pouring, possibly after cleaning the base 21.

[0038] Having effected a pouring and while awaiting (partial) cooling of the casting, the operator removes the previous casting and prepares for a new casting.

[0039] A single robot 30 with a single gripper 31 could possibly be used with the penalty of a small loss of working efficiency, but a further bench 20 would have to be added. This bench is required for resting the combined base 21, casting 22 and cores 23 while the base 21 and cores are withdrawn onto the other bench 20 for the new casting. The sole gripper 31 firstly withdraws the (first) combined base 21, casting 22 and cores 23 from the support body 10 and places it on a first bench 20. On the second bench 20, where the operator has placed the second base 21, he arranges the cores 23 and the gripper 31 withdraws the combination and places it on the support body 10.

[0040] The control system for the various operations is not shown as various systems can be used, all known to an expert of the industrial automation art.

[0041] The accompanying figures do not show the crucible (or the furnace or an equivalent system for maintaining the metal molten), as any type can be used for feeding the metal.

[0042] Summarizing, according to the present invention, after pouring the metal, for example aluminium, into the mould, a solidification time for the metal exists which can vary from 2 to 4 minutes before opening it, during which time, with this new permanent mould system comprising two bases, one base is deposited on a bench by means of a robot, and the cores required to produce that determined casting are located on it, to achieve a production improvement compared with traditional systems of at least 30-40% productivity in that, as soon as the casting is extracted from the mould the second base, comprising all the cores, is deposited inside the mould. At the same time the base withdrawn from the mould and containing the casting is deposited on said bench, the casting is extracted from the base and deposited for example on a conveyor belt, then cores are again mounted on the base to resume the casting cycle.

[0043] This invention is able to provide a production system in a new and more convenient manner as it enables many more castings (30%-40% more) to be produced in a unit of time compared with the use of the permanent mould of the known art.

[0044] The system conceived in this manner is susceptible to numerous modifications and variants, all falling within the scope of the inventive concept; moreover all details can be replaced by technically equivalent elements.

Claims

1. A casting production apparatus comprising: a permanent mould having movable walls and a first base; means for feeding molten metal to said mould; **characterised in that** said first base is removable from said mould, and by further comprising a second base; a first location and a second location; said first location being arranged inside said mould; said second location being arranged outside said mould; handling means for said first and second base; said handling means moving said first base from said first

location to said second location and said second base from said second location to said first location.

2. An apparatus as claimed in claim 1, **characterised in that** said handling means comprise at least one vertically and horizontally movable gripper.

3. An apparatus as claimed in claim 1, **characterised in that** said permanent mould comprises means for opening and closing said movable walls on command.

4. An apparatus as claimed in claim 1, **characterised in that** said second location comprises means for extracting the casting produced on said first and second base.

5. An apparatus as claimed in claim 1, **characterised in that** said second location is disposed at a predetermined distance from said first location.

6. A casting production method comprising the steps of founding by pouring molten metal into a permanent mould comprising a first base; awaiting a predetermined time period to enable the molten metal to at least partially cool; during said time period arranging a plurality of cores on a second base located on a bench positioned at a predetermined distance from said mould; opening said mould and withdrawing said first base by handling means; withdrawing said second base by handling means; placing said first base on said bench positioned at a predetermined distance from said mould; placing said second base in said mould; closing said mould; repeating the previously listed steps.

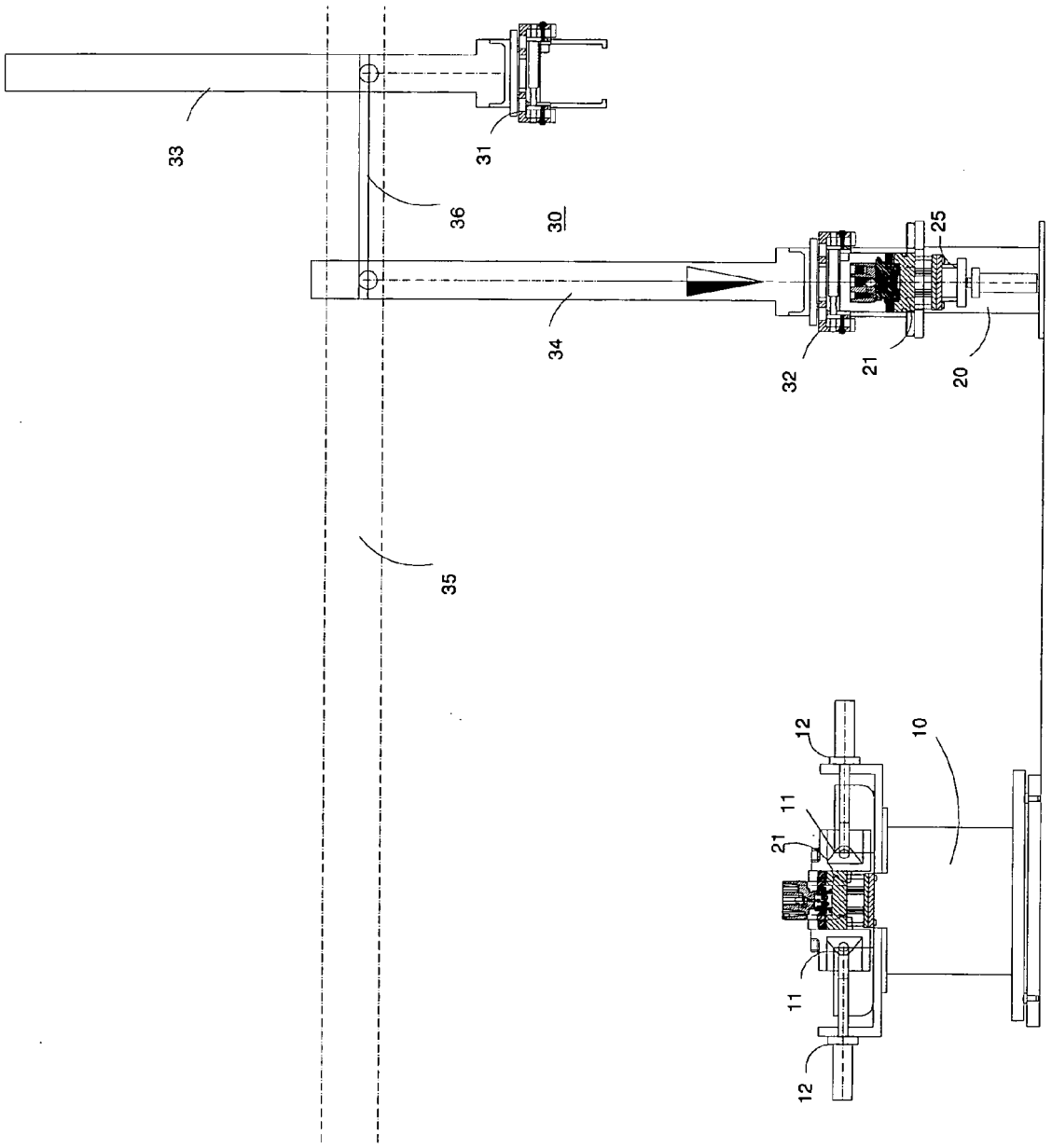

Fig. 1

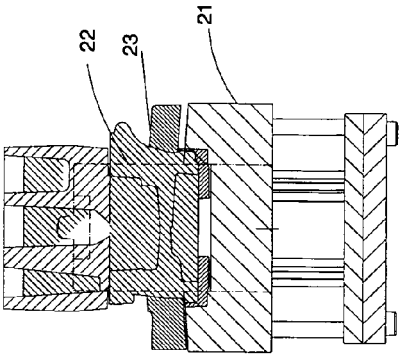

Fig. 4

Fig. 2

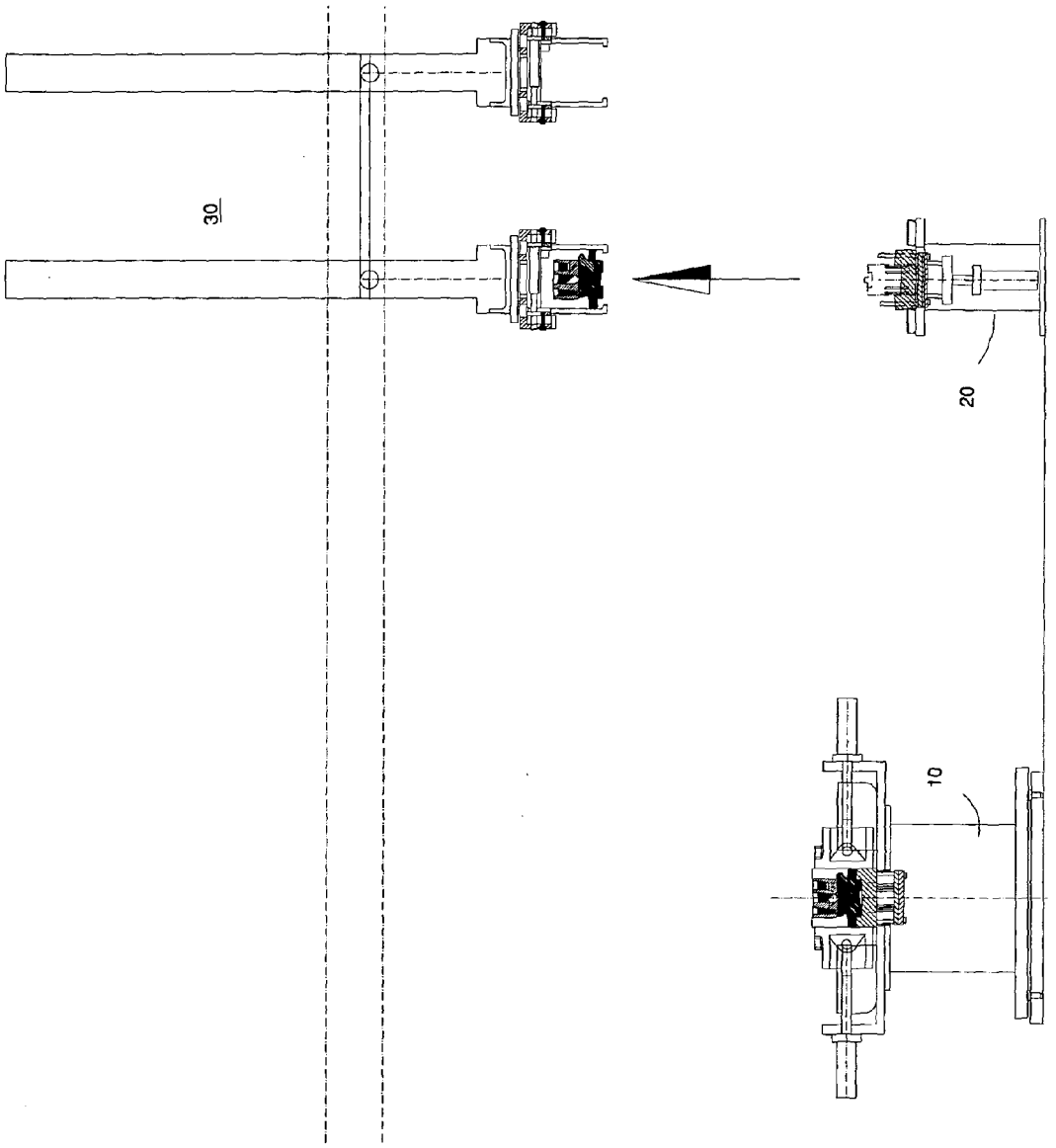

Fig. 3