APPARATUS FOR SEPARATING MAGNETIZABLE CASTINGS FROM CASTING MOULDS OF SAND OR SIMILAR MATERIALS

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An apparatus for removing magnetizable castings from a mould of foundry sand comprises a plurality of magnets mounted in a casing and spring biased towards a basic position therein. The magnets are collectively movable towards the casting exposed in the mould and individually adjustable against the spring bias to the surface shape of the casting so that at least a substantial number of magnets simultaneously contact the casting. In this position the magnets are locked relative to the casing and are collectively retracted, thereby extracting the casting from the mould.

5 Claims, 3 Drawing Figures
APPARATUS FOR SEPARATING MAGNETIZABLE CASTINGS FROM CASTING MOULDS OF SAND OR SIMILAR MATERIALS

BACKGROUND OF THE INVENTION

The invention relates to an apparatus for separating magnetizable castings from casting moulds of sand or similar materials at the end of a guiding track on which the casting moulds, with castings therein, are placed closely together in a row and are advanced stepwise towards a knocking-out station at which the mould material is caused to drop onto a conveyor after the castings have been removed.

The apparatus is primarily intended for use in connection with foundry equipment of the kind operating with a mould consisting of uniform mould parts presenting at least one pouring cavity at each joint in the mould and being produced successively from foundry sand in which a chamber is compressed between a pair of opposed plates which carry semi-patterns corresponding to the castings to be produced. After having been so compressed, the mould part is displaced onto the guiding track aligned with the chamber and is caused to join the row of earlier produced mould parts which at the same time are advanced one step forward on the guiding track. As required, one or more cores can be placed in the pouring cavity, which is still open, in the mould part added last. When the pouring operation proper has taken place, the casting mould continues its movement of advance through a cooling section of a suitable length and then arrives at the knocking-out station where the castings and the mould part material can be separated from each other on a conventional knocking-out grate.

Another possibility of separating castings and mould material from each other consists in removing the castings from the mould while the latter is still located on the guiding track. By this means the castings may be treated in a gentler manner and, in addition, various environmental disadvantages, such as a high noise level and inconvenience caused by dust, may be avoided or reduced.

SUMMARY OF THE INVENTION

The main object of the invention has been to provide an apparatus which makes it possible to perform such a removal of the castings magnetically and in such a way that one and the same apparatus should be applicable for removing castings of literally speaking any optional shape and size.

The apparatus according to the invention is characterized in that at the knocking-out station a plurality of magnets are provided which from a starting position are movable first collectively in the direction towards the freely exposed end of the row of casting moulds and next individually in dependence on the shape of the surface of the castings facing the magnets, until each of the plurality of magnets is in contact with said surface, means being provided to subsequently lock the magnets together and means to collectively move them back towards their starting position. During or after the termination of this return movement the castings can be released from the magnets and be delivered for further treatment by means of a separate conveyor.

Due to their individual mobility the total number of magnets, or at any rate a sufficient number thereof, can jointly engage the castings effectively, and the subsequent interlocking of the magnets ensures the maintenance of this engagement during the removal of the castings from the mould and during their transport to the delivery position. It can thus be taken for granted that the total magnetic force is distributed evenly between the total number of magnets or a large number thereof, which is a presupposition for the satisfactory functioning of the apparatus, since the tractive force exerted by each individual magnet will usually be too small for securely holding the castings.

In order to further improve the holding fast of the castings, each magnet may after having after into contact with the castings be individually rotatable around an axis at right angles to its contact surface. By such a rotary movement the magnet will be able to scratch away sand, if any, at the point of contact with the castings, which is a condition for the establishment of direct contact between the magnet and the castings.

In a practical embodiment of the apparatus according to the invention the magnets are mounted in a common casing, which is displaceable towards and away from the freely exposed end of the row of casting moulds, and are separately displaceable in the same direction in relation to the casting between a basic position advanced towards the row of casting moulds and a retracted position, and in addition they are spring biased towards the basic position. In this basic position the various magnets will normally have their fronts or active faces located in one and the same plane which is at right angles to the direction of displacement, and in most cases the different parts of the surface of the castings facing the magnets will be spaced at unequal distances from the said plane, that is to say from the magnets to be brought into contact with the different parts of the castings. When the common casing is displaced over a length, which at least corresponds to the largest one of the said distances and preferably is somewhat larger, all of the number of magnets will successively be brought into contact with the castings and next be pressed back relative to the casing against the action of the spring bias. In the position in which the magnets have hereby assumed, the various magnets can be interlocked, expeditiously by being individually locked to the casing, and the casing can then be displaced back, during which movement the magnets carry the castings along with them. After the castings have been released from the magnets, the interlocking of the latter can be eliminated, the spring bias then causing the magnets to be once more brought into the starting position or basic position so as to be ready for another operation.

The invention will now be fully described with reference to the diagrammatical drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view, partially in vertical section, of an embodiment of the apparatus according to the invention with the magnets in the starting position or basic position.

FIG. 2 is a view similar to FIG. 1 and shows part of the apparatus, likewise in side elevation and partially in vertical section, after the magnets have engaged the casting, and

FIG. 3 is a sectional view of the casing of the apparatus with a single magnet, shown in longitudinal section.
DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1 and 2 show the discharge end of a guiding track 1 which supports a casting mould consisting of a number of identical mould parts 2 holding a casting 3 at each joint 4 in the mould. In the embodiment shown, the guiding track 1 is terminated with a short section comprising a frame 5 which carries a hook 6 for holding back the casting 3 which is exposed in the end of the casting mould after the preceding mould part 2' has been pushed out over the end of the guiding track 1 and has dropped onto a conveyor 7. The hook 6 forms one arm of a bell crank, the other arm of which is connected to a hydraulic or pneumatic cylinder 8 which serves for moving the hook 6 between the holding position shown in FIG. 1 and the released position shown in FIG. 2. In order that the hook 6 may always engage the casting 3 correctly, the frame 5 is adjustable for wards and backwards in relation to the guiding track 1, depending on the thickness of the mould parts 2. This adjustability has in the drawing been indicated by a toothed rack 9 on the underside of the frame 5 engaging a pinion 10, FIG. 1, which can be turned by means of a hand wheel 11, FIG. 2, and can be locked in the position desired.

Aligned with the freely exposed end of the casting mould a box-shaped casing 12 is provided which by means of a bracket 13 is suspended from a carriage 14 which is displaceable on a pair of horizontal, parallel guides 15, between which a drive cylinder 16 is mounted, the piston rod 17 of which engages the carriage 14. The box-shaped casing 12 contains a plurality of parallel, rod-shaped magnets 18, which will be described in greater detail in the following and which together cover an area corresponding to a substantial portion of the cross-section of the casting mould. Between this mould and the casing 12 a stripper plate 19 is provided which has a hole for each of the magnets 18 and which is suspended displaceably from the guides 15 by means of an additional carriage 20. The stripper plate 19 is displaceable towards and away from the casing 12 by means of a drive cylinder 21 supported by the bracket 13 of the casing. In the position shown in FIG. 1, the casing 12 with the magnets 18 is located above a conveyor 22 for carrying away the released castings 3.

FIG. 3 shows parts 23 and 24 of the rear and front walls of the casing 12, and a cylindrical guide tube 25 secured in these walls. A supporting body 26 is accommodated displaceably in the guide tube 25, and at its front end this body is provided with a permanent magnet 27 which is isolated from the supporting body 26 by means of non-magnetic intermediate piece 28. The part of the supporting body 26 located between the walls 23 and 24 has a circumferential recess 29 containing a magnetizable powder or grain material, and the guide tube 25 is surrounded by a magnet coil 30 which, when energized, actuates the powder or the grains in the recess 29 and thereby locks the supporting body 26 to the guide tube 25.

In the embodiment shown, the permanent magnet 27 is carried by a spindle 31 which is journaled in the supporting body 26 and the rear portion of which is designed with a steep-pitch thread 32 engaging one or more projections, not visible, in a sleeve 33 which is secured to the rear wall 25 of the casing and in the position shown in FIG. 3 extends slightly forwards past the rear end of the spindle 31. The sleeve 33 is surrounded by a pressure spring 34 which with its ends abuts against the wall 23 of the casing and the rear end of the supporting body 26, respectively.

With the components in the starting position shown in FIG. 1, the drive cylinder 21 is first actuated so that the stripper plate 19 is pulled in towards the casing 12, thus causing the magnets 18 to project through the holes of the stripper plate. Next, the drive cylinder 16 is actuated for displacement of the casing 12 and the stripper plate 19 towards the casting mould, and during the last part of this movement the various magnets 18 get into contact with the casting 3 as shown in FIG. 2. After a magnet 27 has got into contact with the casting 3, its support 26 will during the continued displacement of the casing 12 be pressed back relative to the casing against the action of the spring 34, and the steep-pitch thread 32 in the spindle 31 will thereby cause a revolving movement to be imparted to this spindle, and thereby to the magnet 27, so that the front face of the magnet will scratch away or mill away particles of sand, if any, on the casting.

After the termination of the forward movement of the casing 12, that is to say in the position in FIG. 2, the hook 6 is released by an actuation of the drive cylinder 8, and the magnet coils 30 are energized, so that all of the magnets 18 are now locked to the casing. By means of the drive cylinder 16 the casing 12 is now returned to the starting position shown in FIG. 1 while carrying along the casting 3, and in this position the casing can be released from the magnets by means of the stripper plate 19, so that the casting drops onto the conveyor 22. Subsequently, the current to the magnet coils 30 can be switched off, so that the springs 34 urge the various magnets to their basic position shown in FIGS. 1 and 3. Simultaneously, the drive cylinder 8 causes the hook 6 to return to the position shown in FIG. 1, so that during the next step of advance of the casing mould the hook will plough into the surface of the succeeding mould part 2 and engage the next piece of casting.

Even if the two conveyors 7 and 22 for the moulding sand and the castings, respectively, are shown as a single grate conveyor with a partition 35 between the two advancing tracks, it will be obvious that two entirely separate conveyors of any optional kind may be used in this place.

For the sake of completeness it should be mentioned that electromagnets may be used instead of the permanent magnets 27, and that the locking of the magnets 18 in the position shown in FIG. 2 may be effected in other ways than by means of the magnet couplings shown, the sole condition to be fulfilled by the locking mechanism being that it can be actuated and released at will with the magnets in any position, dependent on the shape of the surface of the castings, and in the released position permits the individual displacement of the magnets.

In addition it should be pointed out that the movement of the magnets 18 collectively need not be a movement of displacement, but may for example be a pivoting movement around an overhead axis which is either parallel to or at right angles to the direction of advance of the casting mould.

We claim:

1. An apparatus for separating magnetizable castings from a sand mould consisting of a succession of mold
parts which are horizontally advanced stepwise to a mold breaking station at which each mold part is successively allowed to drop away so as to expose its respective casting comprising a carrier frame mounted in front of said mold breaking station so as to be displaceable towards and away therefrom, a plurality of magnets mounted in said carrier frame and protruding towards said mold breaking station, said magnets being individually displaceable relative to said carrier frame between an extended basic position and a retracted position, means biasing said magnets towards said basic position and permitting their individual retraction as they are brought in contact with the exposed casting by displacement of said carrier frame towards said mold breaking station, and means for locking said magnets in their retracted positions relative to said carrier frame during the displacement thereof away from said mold breaking station whereby said casting is pulled and separated from a remaining mold part.

2. An apparatus as claimed in claim 1, wherein said magnets during their retraction movements are individually rotatable around axes perpendicular to their front faces in contact with the casting.

3. An apparatus as claimed in claim 1, further including a stripper plate disposed between said carrier frame and said mold breaking station, said stripper plate having apertures for receiving said magnets and being displaceable both in conjunction with and relative to said carrier frame.

4. An apparatus as claimed in claim 1, wherein each magnet has a supporting body which is displaceable in a guide tube in said carrier frame and which, after the contact of the magnet with the casting has been established, can be locked in the guide tube by the actuation of a magnet coil surrounding the guide tube, in connection with a magnetizable powder or grain material in one or more recesses in the supporting body.

5. An apparatus as claimed in claim 4, wherein the supporting body is tubular and contains a rotatable spindle which is rigidly connected to the magnet and is provided with a steep-pitch thread engaging one or more guiding projections fixed in the carrier frame for bringing about the turning of the magnet during its retraction in relation to the carrier frame.