APPARATUS FOR REMOVING PARTS CAST IN SAND MOULDS

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ABSTRACT

An apparatus for removing castings from foundry moulds each of which is constituted by a mass of sand without a chassis and which travel one behind the other in a moulding line. The apparatus comprises an overhead conveyor having casting-suspending hooks each of which is guided by guide means in the direction of the corresponding mould as the hook descends so as to break up the sand and hook onto an appendix portion, such as a sprue, of the casting and remove the casting from the mould and discharge it.

12 Claims, 11 Drawing Figures
APPARATUS FOR REMOVING PARTS CAST IN SAND MOULDS

The present invention relates to an apparatus for removing parts cast in foundry sand moulds. Usually, after casting, the sand moulds are put on a vibrating grate which separates the metal parts from the mass of sand and separates the sand particles from the cast part. This sand removing operation creates a lot of dust and produces steam owing to the heat of the cast parts. The separated parts must be taken hold of manually so as to be placed on a conveyor belt or suspended from an overhead conveyor. This manual handling is strenuous and unhealthy work for the personnel. Further, the still-hot parts can be marked or damaged by the vibrating grate.

An object of the invention is to provide a mechanical apparatus for removing castings from moulds which eliminates vibration of the moulds for freeing the sand and said manual intervention in the vicinity of the moulds and permits a simultaneous removal of the parts and their conveyance to the finishing operation.

The invention provides an apparatus for removing cast parts from moulds applicable to sand foundry moulds which have no chassis, at least at the moment of removal (that is moulds constituted by a simple coherent mass of sand) and of the type having an overhead conveyor, wherein the overhead conveyor is provided with suspending hooks each of which cooperates in turn with a guide element and with a cast appendix of a casting to be removed from each mould so as to penetrate the corresponding mass of sand, hook said appendix, the extract casting from the mass of sand and discharge it.

In this apparatus, which is particularly adapted for mass-production casting lines where the runners and the gates are always in the same position in the moulds and the moulds in the same position in the lines, the hooks break the masses of sand and seize the castings by their casting sprues. The casting removing operation causes the minimum displacement of sand so that the creation of dust and steam is substantially reduced with respect to the known technique of stripping by vibrations. Further, the apparatus can be remote controlled by the operator who is protected or shielded in a control cabin. Finally, there is considerable saving in time by the elimination of manual operations for hooking the castings to the conveyor.

Further features and advantages of the invention will be apparent from the ensuing description with reference to the accompanying drawings.

In the drawings:

FIG. 1 is a diagrammatic assembly view in plan of a single moulding line and an apparatus according to the invention;

FIG. 2 is a diagrammatic elevational view, with a sectional view of the mould, of a first embodiment of the apparatus according to the invention applied to a single moulding line, the apparatus being shown before the start of the casting removing operation;

FIGS. 3 - 5 are similar partial views illustrating various stages of the removal of the casting;

FIG. 6 is a partial perspective view of a detail of the apparatus;

FIG. 7 is an assembly plan view similar to FIG. 1 of a pair of parallel, side-by-side moulding lines and two casting removing apparatuses according to the invention combined with these moulding lines, one apparatus being provided for each line, and

FIGS. 8 - 11 are views similar to FIGS. 1 - 4 of a second embodiment of the casting removing apparatus according to the invention adapted to be employed in particular with the first apparatus in an assembly comprising a pair of moulding lines shown in FIG. 10.

In the embodiment shown in FIGS. 1 - 6, the invention is shown as applied to a single moulding line 1, moving in the direction of arrow f (FIG. 1), for removing castings 2 (FIG. 2 - 5) which have just been cast in sand moulds 3 which are in the form of bare rectangular-sided masses of coherent sand, the moulds having been previously removed from their chassis if they had such a chassis.

The pouring basin 4, the spruce 5 and the runners 6 (FIG. 2) formed in the mould are filled by the casting appendix 7 (FIGS. 4 and 5) which is of course in one piece with the cast part 2 and performs an important function in the invention. The moulds 3 are placed on platforms 8 of the single moulding line 1 which has, as shown in FIG. 2, rollers 9 and guide rails 10.

It is necessary, for the correct operation of the apparatus according to the invention, that the moulds 3 always occupy the same position on the platform 8 and that the cast parts 2 and their appendices 7 always be in the same position in the moulds 3. In other words, the manufacture of the moulds and their positioning on the casting line 1 should be automatic.

The casting removing apparatus according to the invention comprises:

1. A conventional overhead conveyor 11.
2. Casting removing and handling hooks 12 suspended from the overhead conveyor.
3. A device 13 for guiding and actuating the hooks.

The overhead conveyor 11 has been shown diagrammatically. It comprises a fixed rail 14 connecting the casting removing station to the finishing station for the removed castings, a segment or section of rail 15 capable of moving to a position 15a (FIG. 2) in the direction of the moulding line 1 and moving upwardly under the action of a jack, hoisting, or like device which is diagrammatically shown in FIG. 2 by its line of action 16 and is combined with end-of-travel stops and switches (not shown). The conveyor also includes chain links or carriages 17 adapted to roll along the rail 14 and the rail segment 15 in the direction of arrow f (FIG. 2).

Each link 17 is of known type and is capable of hooking or automatically linking up with two adjacent links and unhooking or detaching itself therefrom through the agency of tenons 18 and suitable jaws 19 of known type. Each link 17 has a length at the most equal to that of the section 15 and suspends, through the medium of a pivotal structure 20, a casting removing and handling hook 12.

Each hook 12 is constituted by a rigid bar which is suspended from the corresponding pivotal structure 20 by a suspension rod 21 with which it is rigidly secured. This bar terminates in a lower fork portion 22 having two hooks 23 (see in particular FIG. 6). It also comprises, roughly mid-way of its length, a transverse guide pin 24 which is perpendicular to the bar and cooperates with the single device 13 which guides and actuates the hooks.
The device 13 comprises a guide ramp 25 which is straight in the presently-described embodiment and has two grooves 26 for guiding the pin 24 of each hook (FIGS. 2 and 6); a fixed support 27 for this ramp, the latter being mounted to pivot about a horizontal pin 28; and a fluid-operated jack 29 for shifting the ramp so as to move the hook 12 toward or away from the mould 3. The jack 29 is oriented transversely, that is perpendicular to the moulding line. The lower part of the guide 25 is pivoted to the end of the piston rod of the jack 29 by a horizontal pin 30. The jack actuating means are of known type and have not been shown.

FIG. 2 shows two successive hooks:

a. An upstream hook (relative to the direction of travel of the links 17), this hook being shown at 12 in dot-dash line carried by the rail segment 15 which is in the upper position, and at 12 in full line in an intermediate position of descent, the segment 15 being then at 15 and the hook being engaged in the guide 25 but being in a withdrawn position with respect to the mould 3 which has stopped at the casting removing station.

b. A downstream hook shown in full line at 12 in a waiting position on the rail 14.

1. Approach (FIG. 2).

The moulding line 1 being stationary, a mould 3 containing a part 2 which has just been cast is in front of the apparatus 1 of the invention (FIG. 1). A hook, shown at 12 in dot-dash line in FIG. 2, is stopped on the rail segment 15 which is then in the upper position and the following hook 12 (shown in full line) is stopped on the rail 14 and waits its turn to pass onto the segment 15.

The guide ramp 15 is in an inclined withdrawn position, its upper part being ready to receive the pin 24 of the hook 12 which is carried by the rail segment 15. The latter then descends and the hook descends therewith. At a given moment, the pin 24 engages the guide grooves 26 of the guide 25 which, owing to its inclined position, causes the hook to swing away from the mould 3. The hook stops in the position shown in full line 12 (FIG. 2) at the end of the descent of the rail segment 15 to position 15.

2. The Breaking Up of the Mould (FIG. 3).

The jack or fluid motor 29 is supplied with fluid under pressure and extends. Its piston rod brings the ramp 25 to a position which is roughly vertical at 25 by causing it to turn about the pivot pin 28. Through the agency of the ramp, the jack 29 transmits to the hook a thrust in the direction of the mass of sand constituting the mould 3 into which the hook is even caused to penetrate. The mould 3 is therefore broken up. The travel of the jack 29 is such that the hooks proper 23 engage under the appendix corresponding to the sprue of the casting 2 so as to hook onto this appendix.

3. Seizure of the Casting and Removal From the Mould (FIG. 4).

The lifting means for lifting the rail segment 15 is actuated. This segment rises and causes the hook 12 to rise therewith. The latter hooks in the course of its travel the appendix 7 of the casting 2, raises the latter and progressively removes it from the mould 3. The hook 12 is guided in this movement by the guide ramp 25.

4. Discharge of the Removed Casting (FIG. 5).

The rail segment 15 and the hook 12 continue to rise and the pin 24 emerges from the ramp 25. The hook 12 now holds the casting 2 in suspension by the appendix 7 and the initial mould 3 is no more than a heap of sand 31. The segment 15 stops rising when it is once again in position on the rail. The hook which has returned to its initial upper position 12 is then driven to the right as viewed in FIG. 5 in the direction of the finishing station and the following hook 12, which was in a waiting position on the left in FIG. 5, replaces on the rail segment 15 (in the position shown in dot-dash line in FIG. 2), the hook from which the removed casting is suspended.

The moulding line 1 is fed forward one pitch or step and positions the following mould 3 (FIG. 1) and the casting removing cycle recommences.

As can be seen, there is no need for any operator in the vicinity of the moulds. The moulding line 1 and the overhead conveyor 14 having the segment 15 and links 17 can be remote-controlled by known means for example control means on a control desk shielded from the heat and dust. The control can be automatic.

Further, the removed castings 2 are neither marked nor harmed in the course of their removal from the mould whereas they would be on the conventional vibrating grate.

Moreover, owing to the simple breaking of the mould by the hook 12, disturbance of the sand is minimum so that a minimum amount of dust is created.

Owing to the combination of the suitably-guided hooks 12 and the appendices 7 of the castings 2 suitably placed in moulds 3, each casting 2 is seized and discharged simultaneously with its removal from the mould whereas in apparatuses of known type for removing castings and shaking off sand by vibrations, the casting is first disengaged from the mass of sand and then, a certain time after, seized and discharged. There is therefore a saving in time by the simultaneous character of the operations carried out in accordance with the invention.

Further, there is an avoidance of strenuous efforts required with known apparatuses in which the castings, which are removed from their moulds in groups, must be seized manually to discharge them if no lifting apparatus having electromagnets or other conveyors are available.

FIG. 7 shows diagrammatically in plan the side-hy-side arrangement of two apparatuses I and II according to the invention and applicable to the removal of castings in the case where there are twin moulding lines 1 and 1 which are in side-by-side relation, the moulds 3 of the line 1 being adjacent the moulds 3 of the line 1 which they practically touch or from which they are spaced a short distance.

As can be seen in the arrangement shown in FIG. 7, the modification of the apparatus II is not employed alone but in combination with the apparatus I described hereinbefore (FIG. 1-6).

In this arrangement, the apparatus I shown in FIGS. 1-6 is disposed transversely of the lines 1 and 1 near the line 1. The second apparatus II is disposed at the side of
the apparatus I and parallel to the latter. However, the sand of the mould 3 of the line 1 which has been broken up in the preceding cycle by the apparatus I obstructs the passage of the hook of the apparatus II since this sand 31 is located against the first mould 3 of the line 1 to be broken up. It is therefore necessary to make a passage for the hook of this apparatus II.

This is why the apparatus II — which moreover can be employed alone whenever it is necessary to clear away the sand obstructing the access of the hook to the mould — is arranged as shown in FIGS. 8–11.

The apparatus II, which comprises in the same way as the apparatus I an overhead conveyor for the hooks 12 removing and handling the castings and a device 13 for guiding and actuating the hooks, comprises a spade 32 for clearing away the sand 31 of the mould 3 which has previously been broken up in the line 1 and is the nearest to the apparatus II, so as to allow the hook 12 of this apparatus to act on the mould 3 of the line 1.

This spade 32 is plane, vertical and parallel to the adjacent faces of the moulds and its area corresponds to that of said faces. It is carried by a chassis 33 which is fixed to one end of the piston rod of a jack 34 having an orientation perpendicular to the adjacent faces of the mould and in particular to the face of the mould 3 to be broken up, that is to say, perpendicular to the direction of movement of the lines 1 and 1. The spade 32 and the chassis 33 cooperate with the hook 12 so as to urge it in said perpendicular direction. Above the spade 32 and guide 25 is merely pivoted to the support 27 at 28. The guide 25 has two branches making an obtuse angle at which the pivot pin 28 is located and has two guide faces for the pin 24 of the hooks 12. One of these faces is the double inner groove 26 and the other an outer track 35 formed by the flanges of the section member constituting the guide. The latter is maintained by an abutment 36 in a position for receiving the pin 24 of the downwardly travelling hook 12. It is maintained in the position for guiding the pin 24 of the hook 12 when the latter travels upwardly by another abutment 37. Note that the guide face 39 pertaining to the chassis 33 is in the extension of the groove 26 of the guide 25, below the latter.

The apparatuses operate in the following manner:
The two apparatuses I and II operate simultaneously with a stagger of one mould between the line 1 and the line 1 (FIG. 7).

The operation of the apparatus I corresponds to that described hereinafore. The operation of the apparatus II is as follows:

Position of rest (FIG. 8).

The hook 12 is in its upper position above the ramp 35. A mould 3 is placed in position for the removal of the casting in line 1. A mould 3 of the line 1 has just undergone the breaking up operation and is now merely a heap of sand 31. The spade 32 bears against one face of the mould 3 and separates the heap of sand 31 from the face of the mould 3. The jack 34 is in its extended position. The guide 35 bears against the abutment 36 and is ready to receive pin 24 of a hook 12.

Approach of the hook (FIG. 9).

The jack 34 is actuated so as to draw in its piston rod. The spade 32 moves to the left and shifts the sand 31 on the platform 8 away from the mould 3 and thereby forms a passage 38. The hook 12 descends, first engages in the groove 26 of the guide 25 (position shown in dot-dash line), then continues its descent in the free passage 38 near the mould 3 along the vertical face of which it may be guided. At this moment, the hook 12 is in position for breaking up the mould 3.

Breaking up (FIG. 10).

The jack 34 is supplied with fluid so as to urge the spade 32 in the direction of the mould 3. This spade pushes the hook 12 which breaks up the mould 3 and is placed under the appendix 7 of the casting 2.

Seizure of the casting 2 and removal from the mould (FIG. 11).

The spade 32 in continuing to exert its thrust shifts the hook 12 away from the ramp 25 and returns to its initial position shown in FIG. 8. The hook 12 rises. The pin 24 is not longer engaged in the groove 26 but bears against the track 35 of the guide 25 and on the abutment 36 then pivots the guide 25 unit it abuts the abutment 37. In continuing to rise, the hook 12 moves away from the guide 25, removes the casting 2 completely from the mould 3 and holds it in a suspended position (dot-dash line) before discharging it.

Owing to the spade 32, the two similar apparatus I and II can operate simultaneously for removing the castings of the two moulding lines 1, 1. A high rate of production results.

It will be understood that the apparatus II having a movable chassis 33 with or without a spade 32 is applicable to the removal of castings from masses of sand of a single line such as the line 1. If no spade 32 is provided, the vertical face 39 (FIG. 8) of the movable chassis 33 must have sufficient area to exert a thrust on the hook 12.

Having now described my invention what I claim and desire to secure by Letters Patent is:

1. An apparatus for removing castings from foundry moulds each of which is constituted by a mass of sand without a chassis and which travel one behind the other in a moulding line, each casting having an appendix portion, the apparatus comprising an overhead conveyor having moving suspension hook means for hooking each casting appendix portion, guide means with which each hook means are co-operable in turn so as to be guided in a direction to penetrate and break up the sand of each mould and hook onto said appendix portion of the corresponding casting and extract the casting from the mould and discharge the casting.

2. An apparatus as claimed in claim 1, wherein the overhead conveyor comprises a support rail, a chain of links which are automatically detachable from each other and movable along said support rail, each link carrying one of said hook means, said rail having one rail segment which is capable of supporting a link of the chain when the link is in position on the segment, the segment being vertically movable between a position in which it is in the extension of the rail and a lower position in which the hook means carried by the link supported by the rail segment is in a lowered position for co-operation with the guide means.

3. An apparatus as claimed in claim 1, wherein each hook means comprises a rigid suspension bar having a
transverse guide pin substantially mid-way of the length of the bar, the guide pin being capable of co-operating with the guide means.

4. An apparatus as claimed in claim 1, wherein the guide means comprises guide grooves, and the hook means comprises a pin engageable in the guide grooves.

5. An apparatus as claimed in claim 1, comprising a support, the guide means being pivoted to the support at a point substantially mid-way of the length of the guide means.

6. An apparatus as claimed in claim 1, wherein the guide means is movable and a fluid-actuated jack has a piston rod pivoted to a lower part of the guide means.

7. An apparatus for removing castings from foundry moulds each of which is constituted by a mass of sand without a chassis and which travel one behind the other in a moulding line, each casting having an appendix portion, the apparatus comprising an overhead conveyor having moving suspension hook means for hooking each casting appendix portion, guide means with which each hook means are co-operative in turn so as to be guided in a direction to penetrate and break up the sand of each mould and hook onto said appendix portion of the corresponding casting and extract the casting from the mould and discharge the casting, a chassis, a spade which is carried by the chassis and is vertical and parallel to a face of the mould to be broken up, the spade being below the guide means and the chassis being movable in translation in a direction perpendicular to the moulding line.

8. An apparatus as claimed in claim 7, comprising a fluid-actuated jack having a piston rod extending in a direction perpendicular to the moulding line and connected to the chassis for shifting the chassis.

9. An apparatus as claimed in claim 7, wherein the spade co-operates in succession with each hook means for urging the hook means toward said face of the mould to be broken up in a direction perpendicular to the moulding line.

10. An apparatus as claimed in claim 7, wherein the guide means has two branches which make an obtuse angle therebetween, a support being provided to which the guide means is pivoted in the region of said obtuse angle, two abutments being provided to limit the pivoting of the guide means.

11. An apparatus as claimed in claim 1, wherein the guide means comprises groove means and an outer guide track, and each hook means has a pin engageable with the groove means and track.

12. A structure comprising a first apparatus and a second apparatus for removing castings from foundry moulds each of which moulds is constituted by a mass of sand without a chassis and which travel one behind the other and in side-by-side relation in two moulding lines, each casting having an appendix portion, the first apparatus being associated with one of the moulding lines and the second apparatus being associated with the other moulding line and being located adjacent the first apparatus and downstream of the first apparatus relative to the direction of travel of the moulds in the moulding lines, each apparatus comprising an overhead conveyor having moving suspension hook means for hooking each casting appendix portion, guide means with which each hook means are co-operative in turn so as to be guided in a direction to penetrate and break up the sand of each mould and hook onto said appendix portion of the corresponding casting and extract the casting from the mould and discharge the casting, said second apparatus further comprising a chassis, a spade which is carried by the chassis and is vertical and parallel to the moulding line and to a face of a mould in the second moulding line, which face is to be broken up to allow the hook means to engage the corresponding appendix portion, the chassis being movable transversely of the moulding lines so as to move the spade between a position in which the spade is against said face of the mould and a position in which the spade is spaced away from said face and pushes back the broken-up sand of a previously-removed casting on the first moulding line.

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