United States Patent

Becke

[15] **3,682,236**

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[54] **AUTOMATIC MOLDING PLANT WITH VERTICALLY SPACED CONVEYING PATHS**

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Dec. 11, 1969 Germany.....P 19 62 131.9

[52] **U.S. Cl.** **164/324,** 164/130, 198/19

[51] **Int. Cl.** **B22d 47/02**

[58] **Field of Search** ...164/18, 130, 323, 324; 198/19

[56] **References Cited**

UNITED STATES PATENTS

3,029,482	4/1962	Burnett	164/324 X
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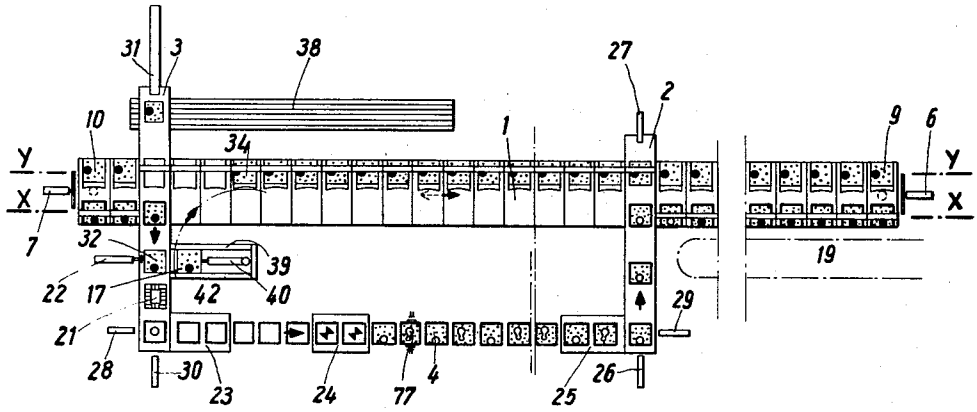
[57] **ABSTRACT**

An automatic molding plant and operational method having a plurality of traverse carts or bogies to convey box molds. The molds are transferred from a sidetrack at a loading station and are ready for casting, then to a casting station or train and from there to an unloading station by way of a cooling track comprising at least two conveying paths positioned in different horizontal planes. Liftable and/or lowerable end sections are provided at the ends of the conveying paths, and the sidetrack is connected with one conveying path through the loading and unloading stations. Transferable weighting members are placed in the box molds in front of the casting station and are conveyed from the unloading station to the loading station on the traverse carts. After part of the cooling track has been traversed, the mold packs are separated from the box molds, and the box molds are returned to the molding machine while the mold pack traverses the remainder of the cooling track in an undamaged manner.

24 Claims, 5 Drawing Figures



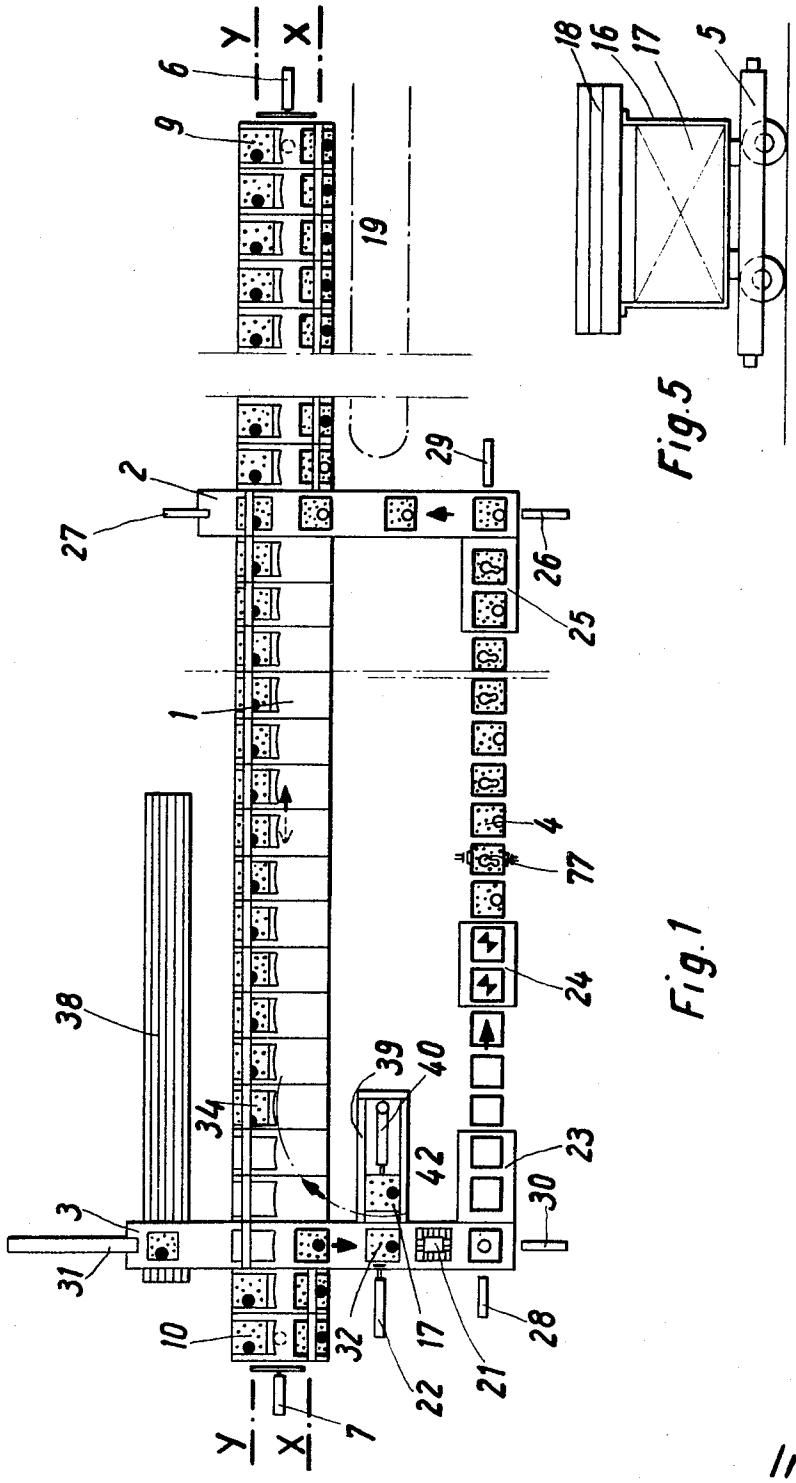


Fig. 1

Fig. 5

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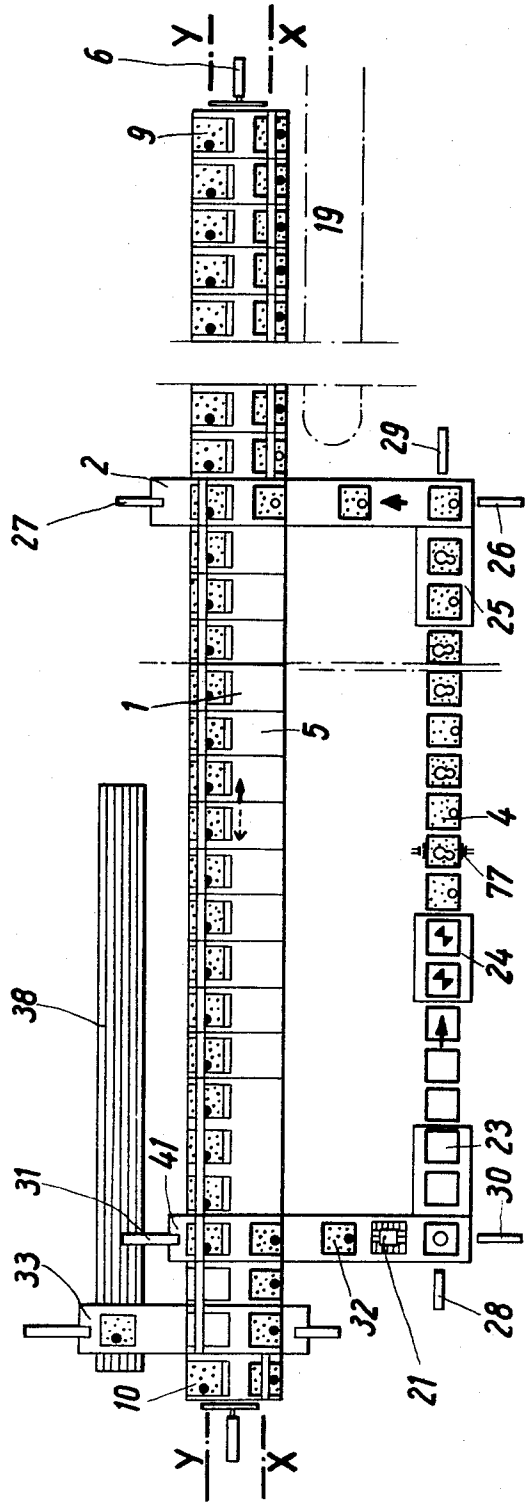

Fig.2

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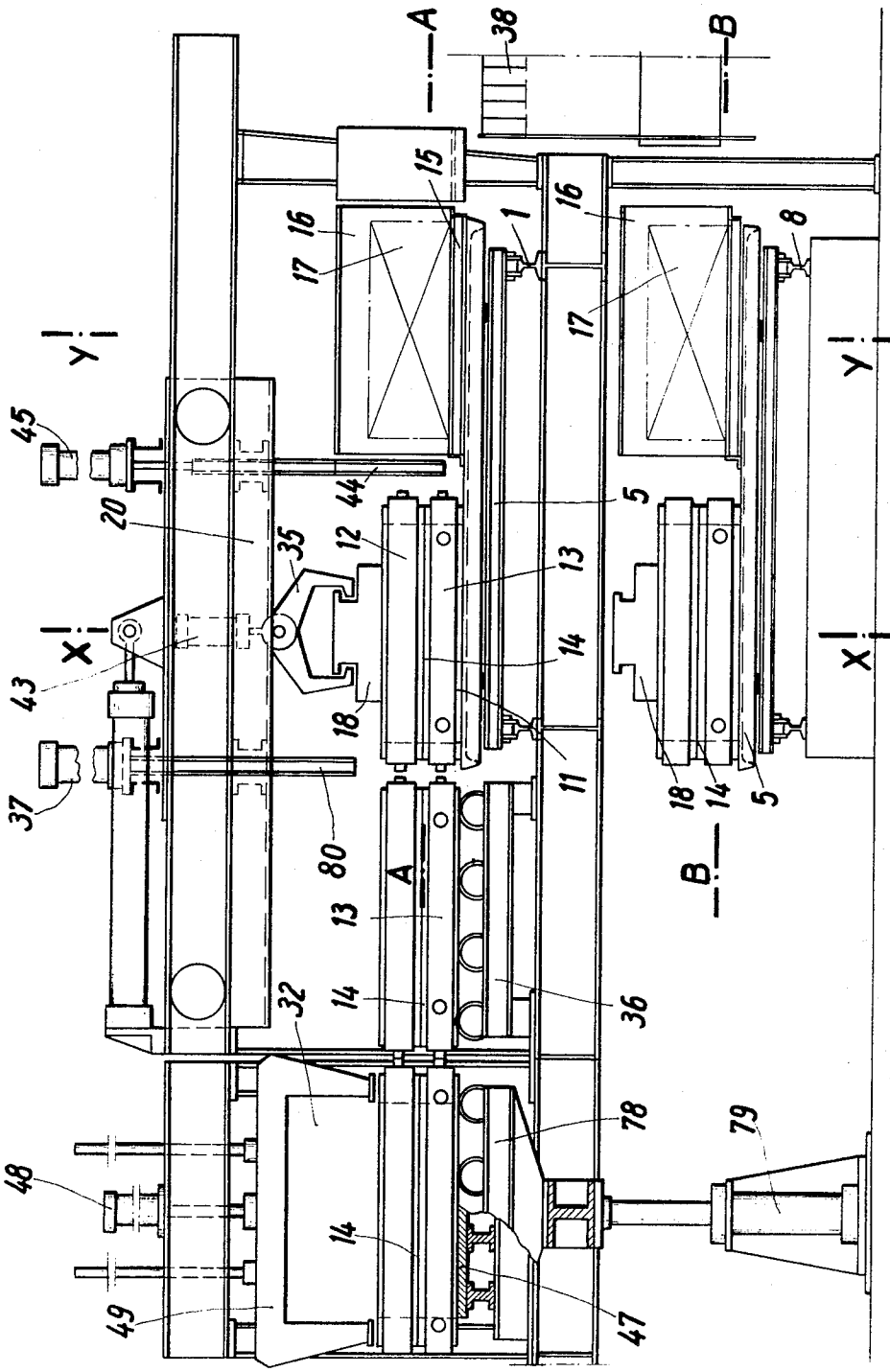

Fig.3

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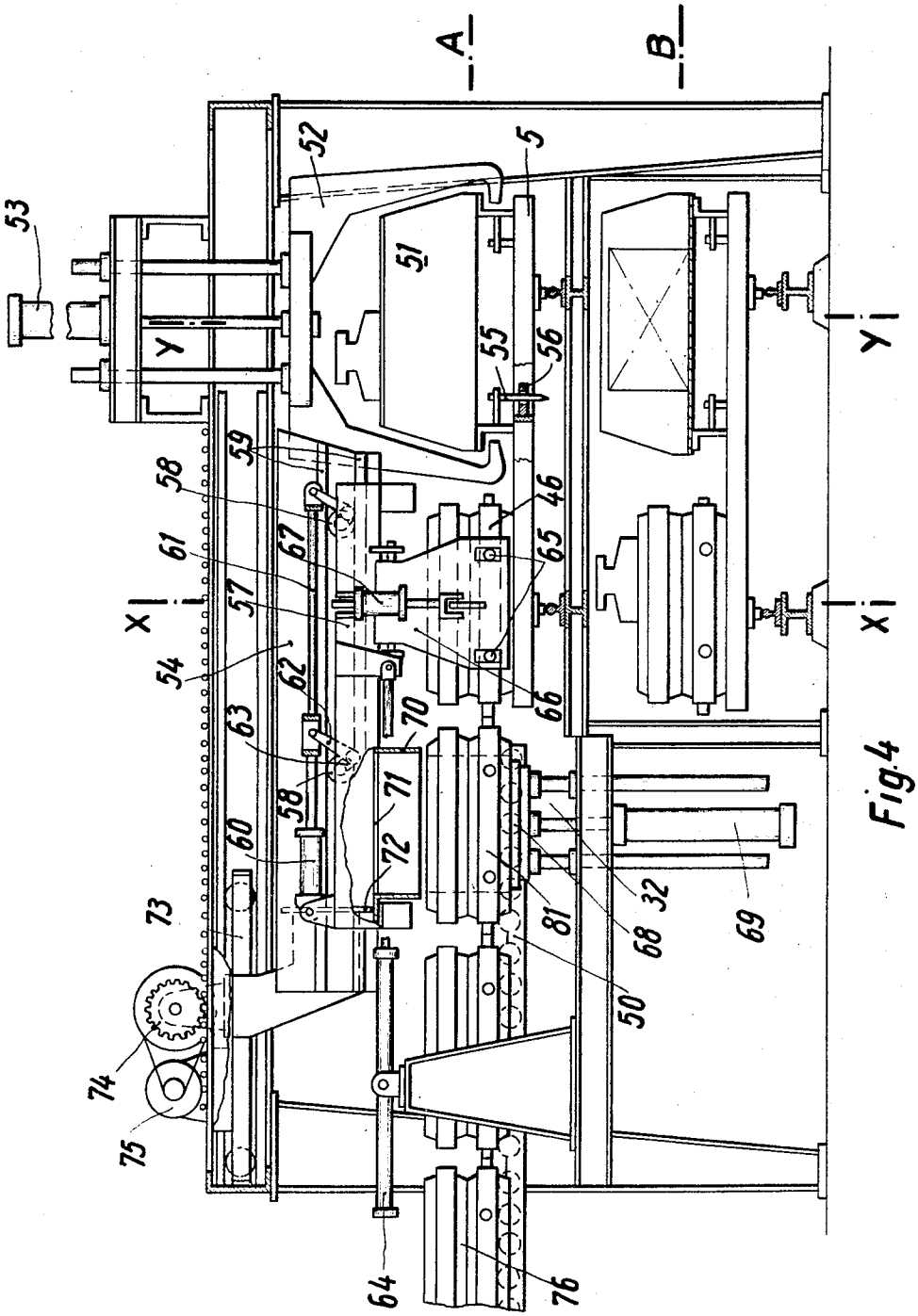

Fig 4

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AUTOMATIC MOLDING PLANT WITH VERTICALLY SPACED CONVEYING PATHS

BACKGROUND OF THE INVENTION

The present invention relates to an automatic molding plant wherein a plurality of traverse bogies or carts conveys the molds, which were transferred from a sidetrack at a loading station and are ready for casting, to the casting station and from there to the unloading station by way of a cooling train or track. Transposable weighting elements are placed on the molds in front of the casting station and are conveyed from the unloading station to the loading station on the traverse bogies. After part of the cooling train has been traversed, the mold boxes are separated from the sand pack, whereupon the boxes return to the molding machine, while the undamaged sand pack traverses the second part of the cooling train. The expression "mold pack" used in the following description means the sand and casting on a pack without a box.

Modern molding processes should have low space requirements with respect to the basic area necessary and should be readily adaptable to various cooling periods of different castings. They also should make do with as small a number of boxes or foundry flasks as possible. A conventional molding plant is shown, for example, in U.S. Pat. No. 3,029,482, wherein two rows of box molds are conveyed side-by-side on a horizontal rail conveyor guided in one plane, the closing and emptying of the box molds taking place at certain locations of the loop sections and the box molds traverse the path twice by transposition.

Also, traverse tracks are known wherein the traverses are loaded with molds at the molding station, with the weighting being effected at the casting station. Then, the conveying of the molds through the cooling path until the emptying step is conducted in only one plane, whereas the return of the empty traverse carts, which are unused for the cooling of the molds, is effected in a second plane and mostly underneath the cooling train.

In case of long cooling periods, the plants known heretofore with rail conveyor result in a very large space requirement, due to the large radii of curvature of the rail tracks. Furthermore, many boxes are required because the boxes must pass through the entire cooling path. Also traverse bogies or carriages have large space requirements, since the cooling of the molds takes place only in one plane.

SUMMARY OF THE INVENTION

It is an aim of the present invention to overcome the problems and disadvantages encountered in the conventional molding plants.

The present invention has an object, among others, of providing an automatic molding plant which has a low requirement of basic area and offers an adaptation to various cooling periods. Besides, as few boxes as possible are required, even in case of long cooling periods, and the castings are to have the possibility of cooling off uniformly in the undestroyed or undamaged sand pack after ejection from the box. Furthermore, the construction of the plant and the devices employed therein are simple and safe in operation.

An essential feature of the present invention resides in that at least two conveying paths which are positioned in different horizontal planes and covered with molds are provided in a superimposed relationship. Liftable and/or lowerable end sections are provided at the ends of these conveying paths, and the sidetrack is connected with a conveying track through the unloading station and through the loading station.

The traverse bogies are provided with at least two deposit points, and at least one free storage place or area being provided for receiving the mold. At least one further storage place within a U-shaped trough is provided for receiving the ejected mold packs and for transporting the weighting elements. At two places, a device is arranged for transposing the weighting elements between the mold and the U-shaped trough of the traverse bogie, and the molds and mold packs conveyed on the traverse bogies determine vertical and parallel planes of circulation, between which the mold packs ejected from the box molds are transferred. Such a simple construction in accordance with the present invention also has, in addition to the sidetrack with the separator, the molding machine and the manipulator, a traverse track for the weighting, pouring, and cooling of the molds extending in several horizontally superimposed rail planes. Since at least two deposit points are provided on the individual traverse trains, the mold packs are placed into the various vertically parallel-disposed track planes by transferring the same.

Starting with the basic concept of the present invention, various individual construction features result. For the design with a pivotal transfer or conveying device, the unloading station can be constructed with a triple traverser carriage disposed displaceable above the conveying path, in such a manner that a mold pack pusher, a weighting element transposer and a box mold transfer member are provided therein. A suitable design of the weighting element transposer can be such that a controllable clamp is provided in the movable triple traverser carriage and engages in a fitting carrying section or profile of the weighting element.

It is also possible to provide different solutions for the individual components other than the ones described herein without departing from the general idea of the present invention. For example, it is suggested to provide a triple traverser carriage in the unloading station, which station is connected with a mold pack transfer means. This mold pack transfer means can be designed in the shape of a swivel chute which can be pivoted between a receiving position when joined to the charging or ejector station and a discharging position in parallel to the longitudinal axis of the traverse bogies and exhibits a conventional feed drive (pivotal transfer means). Since it is desired that the swivel chute be in contact with the U-shaped trough of the traverse bogie as tightly as possible, circular-arc-shaped fittings are suitably provided between the swivel chute and the U-shaped trough of the traverse bogie.

An advantageous feature of the present invention for the unloading step, particularly the unloading of large box molds, results from another distribution of the individual operations by conducting the unloading of the mold packs and the transposion of the weighting elements in one station, whereas the transfer of the box mold onto the roller train, the ejection, and the transfer of the mold pack into the trought of the traverser carriage are conducted in a further station. A transfer

device is disposed above the track of the box molds in a displaceable, as well as liftable and lowerable manner and is provided with gripper arms pivotable on both sides of the box mold and firmly grasping the box mold due to the contour thereof. A vertical transfer means for the mold pack is realized by providing, above the box mold transfer device, a stationary chute adapted to the dimension of the mold pack with an opening in the bottom above the mold pack ejector having the size of the mold pack and with a transfer or pushing member adapted to the cross section of the chute, the operating path of which corresponds to the distance from the pusher or ejector to the plane Y of the traverse train. For the operation of a vertical transfer means, it is necessary to construct the troughs so that they can be lifted off in the upward direction and are centered in the horizontal position when placed on the traverser by means of centering devices.

An advantageous operating method which can be conducted with the above-described molding plant resides in unilaterally discharging, in the unloading station, the mold pack, which is present in a trough on the traverser carriage, onto a vibration train or track, whereas the box mold travels on the other side after the transfer of the superimposed weighting element for ejecting the mold pack into the zone of the ejector or pusher.

The empty box molds travel in the sidetrack to the molding machine and, after the molding and the production of the molds ready for casting, to the feeding or loading station. The weighting element is transposed onto the U-shaped trough of the traverser carriage at the unloading station and is conveyed thereby to the loading station. The ejected mold pack is pushed into the U-shaped trough of a traverser carriage by a mold pack transfer means, whereby the mold packs are introduced into the different, vertically parallel track planes.

In the loading station, the weighting element is transposed from the U-shaped trough onto the mold ready for casting. The traverser carriages travel along the casting train, in each case laden with weighting elements, molds with boxes and mold packs, up to an end section or terminal of the first conveying path, and are thereat transposed into a second conveying path lying in a different track plane, so as to travel along this latter path until reaching the other end section of the conveying path, and are once again transposed into the track plane of the first conveying path.

BRIEF DESCRIPTION OF THE DRAWING

These and further features, objects and advantages of the present invention will become more apparent from the following description which shows, for purposes of illustration only, several embodiments in accordance with the present invention and wherein:

FIG. 1 is a schematic plan view of a molding plant with a pivotal transfer means according to the present invention;

FIG. 2 is a plan view similar to FIG. 1 with a vertical transfer means;

FIG. 3 is a front view of a triple traverser carriage;

FIG. 4 is a front view of a vertical transfer means; and

FIG. 5 is a view at right angles to the conveying direction of a traverser carriage with a trough.

DETAILED DESCRIPTION OF THE DRAWING

Referring now to the drawing, the conveying paths within the traverse track are disposed in two vertical planes X and Y and in two horizontal planes A and B as shown in Fig. 3. In the embodiment of FIG. 1, a conveying path 1 is illustrated which is connected with a sidetrack 4 via a loading station 2 and an unloading station 3. As seen in FIG. 3, a conveying path 8 with an impact or impulse drive 6 is disposed in a lower horizontal track plane B underneath the conveying path 1 on which traverser carriages 5 or bigies, which are in contact with each other, are movable with the aid of an impact or impulse drive 7. Between these conveying paths 1, 8, the traverser carriages 5 can be vertically transposed by means of lowerable and raisable end sections 9, 10.

The traverse bogies or carriages 5 have on one side thereof a depositing or storage place 11 for storing the box mold 14 composed of a cope 12 and a drag 13 as shown in FIG. 3 and, on the other side, a further depositing place 15 within a U-shaped trough 16, which, in each case, is provided fixedly on the traverser carriages 5 as in FIG. 3 or vertically removable as in FIG. 4. The U-shaped trough serves for receiving mold packs 17 consisting of the casting surrounded by molding sand. The cross-section of the trough, in this connection, is adapted to the dimension of the mold pack, so that the sand is supported or shored on three sides as seen in FIG. 5. A weighting element 18 is placed on the box molds 14 on the traverse track or path 1, 8 and is carried on the path without box molds between stations 2 and 3, by the U-shaped trough 16.

The box molds are poured at the casting train 19. After traversing the cooling path in the plane X—X, the box molds pass into the zone of the unloading station 3, as shown in FIG. 1, with triple traverser carriage 20 shown in FIG. 3. Numeral 21 denotes a box mold cleaner, and numeral 32 a sand pack ejector. In the sidetrack 4, numeral 23 represents a separator, numeral 24 represents a single- or double-molding machine, numeral 77 is a turning means for the drags, and numeral 25 is an assembly or finishing means. The box molds are propelled through the sidetrack 4 by the push cylinder 28 with the counter cylinder 29. The transportation of the box molds through stations 2 and 3 is correspondingly effected by push cylinder 31, 26, cooperating with the counter cylinders 30 and 27, respectively.

In the embodiment of FIG. 1, a pivotal transfer means 42 is provided between the ejection or discharge station 32 and the traverser carriages 5. This pivotal transfer means 42 consists of a swivel chute 39 into which can be ejected, one mold pack 17 with the aid of the impact drive 22. Thereafter, the swivel chute 39 pivots through a right angle and pushes, with the aid of an ejection device 40 installed therein, the mold pack 17 into the U-shaped trough 16 of the position 34. For transposing the weighting elements 18, the clamp 35 with lifting cylinder 43 is provided. A vibrating conveyor 38 takes over the sand packs with the casting transferred by the pack pusher 44. By means of the hoisting drive 45, the pusher 44 can be raised to such an extent that it moves past the transposed weighting element during the return of the triple traverser carriage 20. A second pusher 80 with hoisting drive 37 is lowered, after the advancement of the carriage 20, into

the range of the molding boxes and pushes the boxes during their return ride onto the roller conveyor **36**. The ejection station **32**, according to FIG. **3**, operates in such a manner that the mold pack remains at its level on the stationary plate or platform **47**, whereas the drive **48** with the yoke **49** strips the box off in the downward direction. During this procedure, the box remains stationary on the roller conveyor section **78** which is lowered against the force of the hoisting drive **79**.

In the embodiment shown in FIG. **2**, a mold pack is pushed onto the vibrating track **38** in a station **33** with a double traverser carriage which is provided with the same device as the triple traverser carriage for transposing the weights and transferring the mold packs. A weighting element is transposed from the box mold in the conveying plane X to a trough in the conveying plane Y. In the subsequent station **41**, which is shown in FIG. **4**, the box mold **46** is transferred from the traverser carriage **5** onto the roller conveyor **50**, and the trough **51** is lifted by means of the gripper **52** with drive **53** to the level of the U-shaped chute **54**. Upon the lowering thereof, the trough is centered with respect to its position to the traverser carriage by means of pins **55** which fit into corresponding bores **56**. A box mold transfer means **57** has runners or small rollers **58** traveling in rails **59** on both sides of the U-shaped chute **54**. By means of the drive **60** via rod **61** and lever **62**, the transfer means can be lifted with cranks **63** in order to be able to freely transfer especially heavy box molds. In this connection, the box molds are seized at the trunnions or pins **65** by the gripper arms **66** pivotable by means of the drive **67**. The forward movement of all box molds on the roller conveyor **50** and in the gripper **66** is effected by the drive **64**.

At the ejection point **32**, the mold pack is ejected from the box **81** by the butt plate **68** by means of the drive **69** in the upward direction through the box holder **70** and the bottom opening **71** into the U-shaped chute **54**. Then, the mold pack is transferred by the butt plate **71** attached to the carriage **73**, with the aid of the rack and pinion drive **74** and the motor **75**, through the U-shaped chute **54** into the trough **51** which had been raised to the same level. The empty boxes **76** then return to the molding machine **24** by way of the sidetrack **4**.

The chutes **39**, **54** as well as the troughs **16** are adapted to the breadth of the molding sand pack **17** with respect to their breadth, whereas the weighting element **18** is adapted, to the width of the trough **16** with respect to its length as shown in FIG. **5**.

The mode of operation of the automatic molding plant will now be explained hereinbelow with reference to a plant as shown in FIGS. **1** and **3**. The starting point is a traverser carriage **5** present in the unloading station **3** wherein, on the deposit point **15** within the U-shaped trough **16**, a mold pack **17** is disposed, while on the storage place **11** there is initially deposited a poured mold **14** composed of a cope **12** and a drag **13** with a weighting element **18** placed thereon. With the aid of the triple traverser carriage **20**, the weighting element **18** is first gripped by the clamping device **35** and lifted with the aid of a hoisting device **43**, while a pack pusher **44** is placed into its lowermost position by its associated lifting device **45**. The box pusher or ejector **80** is in its upper position. At this point, the triple traverser carriage **20** is first moved to the right. During this step, the mold pack **17** is pushed out of the U-shaped trough **16** toward the vibrating train **38**, and the weighting element **18** is placed on the U-shaped trough **16**. Thereafter, the pack pusher **44** is placed into its highest position, and the box pusher **80** is moved into its lowermost position by the drive **37**. At this point, the triple traverser carriage **20** moves toward the left, and the box mold **14** relinquishes the deposit point **11** while all molds **14** disposed in front thereof are advanced by one step or stage.

Thus, a new mold **14** passes into the zone of the ejector drive **48**, which releases the mold packs **17** by pressing the box downwardly on the roller conveyor **78** via the yoke **49** against the holding force of the drive **79**. The mold pack comes to a standstill on the fixed plate **47** and is moved by the pusher **22** toward the pivotal transfer means **39**. The presently empty boxes travel into the box cleaning device **21**, then are separated in the separator **23**, and fed to the molding machine **24** which molds the copes and drags. Only the drags are turned in the turning unit **77**, and then the cores are inserted. In the closing or finisher device **25**, the finished molds are then produced which are deposited in the loading station **2** by the drive **26** onto the depositing point **11** of a traverser carriage. The weighting element **18** positioned on a trough **16** in the unloading station **3** is placed on the box mold on the storage point **11** by means of similar devices shown in FIG. **3**. Thereafter, the molds **14** travel through the casting train **19** for the casting operation. At the end of the conveying path in plane A, the traverser carriages **5** are lowered at station **9** to the conveying path in plane B and, at the end thereof, are again lifted at station **10**, to the conveying path in plane A. The traverser carriage **5** leaves the unloading station **3** with empty depositing points **11**, **15** with the weighting element **18** being placed on the U-shaped trough **16**. Now, the empty traverser carriage **5** arrives in the zone of the pivotal transfer means **39** which has received the mold pack **17** from the ejector **32** and pushes the pack into the U-shaped trough **16** of the traverser carriage **5** at position **34**. Thereafter, the traverser carriage **5** travels with unoccupied depositing points **11** along the conveying path of planes X–A to the loading station **2**. On this conveying path, the mold packs **17** are disposed within the U-shaped troughs **16** carrying the weighting elements **18**.

On the conveying path in plane B, the traverser carriages **5** have both depositing points occupied as shown in FIG. **3**. In case longer cooling periods are prescribed, the troughs **16** and traverser carriages **5** can be lengthened for receiving two or more mold packs. By the fact that the width of the chutes **39**, **54** and the troughs **16** is adapted to the dimensions of the mold packs, the mold packs cannot disintegrate, and the casting remain covered with sand along the entire conveying path and cool off uniformly.

While I have shown and described several embodiments in accordance with the present invention, it is to be clearly understood that the same is susceptible of numerous changes and modifications as will be apparent to one skilled in the art. I, therefore, do not wish

to be limited to the details shown and described herein, but intend to cover all such changes and modifications as are encompassed by the scope of the present invention.

I claim:

1. Automatic molding plant including mold boxes; a sidetrack with means for forming molds in said boxes; traverse carriage means for conveying the box molds, which are ready to be cast and transferred from the sidetrack, to a casting train by way of a loading station and from there to an unloading station by way of a cooling path; transferable weighting means adapted to be placed on the molds before the casting train; the cooling path including at least two conveying paths arranged one above the other in horizontal planes for the traverse carriage means conveying the box molds; end sections provided at the ends of the conveying paths adapted to be raised and/or lowered to vertically transpose said traverse carriage means between said paths; the sidetrack connected with one of the conveying paths by means of the loading and unloading stations; and the traverse carriage means including at least two depositing sections, wherein at least one depositing section is adapted to receive the box mold and at least one other depositing section includes a U-shaped trough mounted to receive ejected mold packs and conveys the weighting means.

2. Automatic molding plant according to claim 1, wherein means for transferring the weighting means between the mold and the U-shaped trough are located at the loading and unloading stations, and the box molds and mold packs conveyed on the traverse carriage means define vertically parallel conveying planes, between which the ejected mold packs are transferred.

3. Automatic molding plant according to claim 1, wherein a triple traverse carriage means is provided at the unloading station, and a mold pack transfer means is connected with the triple traverse carriage means.

4. Automatic molding plant according to claim 3, wherein means for transferring the weighting means between the mold and the U-shaped trough are located at the loading and unloading stations, and the box molds and mold packs conveyed on the traverse carriage means define vertically parallel conveying planes, between which the ejected mold packs are transferred.

5. Automatic molding plant according to claim 3, wherein the mold pack transfer means is a pivotal transfer means having a swivel chute pivotable between a receiving position at the connection to an ejection station for ejecting the mold pack and a discharge position where the swivel chute is operatively associated with the U-shaped trough, and the mold pack transfer means having a discharge drive.

6. Automatic molding plant according to claim 5, wherein means for transferring the weighting means between the mold and the U-shaped trough are located at the loading and unloading stations, and the box molds and mold packs conveyed on the traverse carriage means define vertically parallel conveying planes, between which the ejected mold packs are transferred.

7. Automatic molding plant according to claim 6, wherein the lateral and bottom portions of the swivel chute and the U-shaped trough are adapted in the manner of a circular arc.

8. Automatic molding plant according to claim 3, wherein the triple traverse carriage means is displaceable located above one of the conveying paths, and the unloading station includes mold pack pusher means, means for transversing the weighting means, and box mold transfer means.

9. Automatic molding plant according to claim 8, wherein means for transferring the weighting means between the mold and the U-shaped trough are located at the loading and unloading stations, and the box molds and mold packs conveyed on the traverse carriage means define vertically parallel conveying planes, between which the ejected mold packs are transferred.

10. Automatic molding plant according to claim 9, wherein the mold pack transfer means is a pivotal transfer means having a swivel chute pivotable between a receiving position at the connection to an ejection station for ejecting the mold pack and a discharge position where the swivel chute is operatively associated with the U-shaped trough, and the mold pack transfer means having a discharge drive.

11. Automatic molding plant according to claim 8, wherein the means for transferring the weighting means includes a selectively controllable clamping device engaging into a corresponding carrying contour of the weighting means.

12. Automatic molding plant according to claim 1, wherein said unloading station includes a first station provided for unloading of the ejected mold packs and transfer of the weighting means, and a second station provided for transposing the box molds onto a roller conveyor and the ejection and transfer of the mold packs into the U-shaped troughs of the traverse carriage means.

13. Automatic molding plant according to claim 12, wherein means for transferring the weighting means between the mold and the U-shaped trough are located at the loading and unloading stations, and the box molds and mold packs conveyed on the traverse carriage means define vertically parallel conveying planes, between which the ejected mold packs are transferred.

14. Automatic molding plant according to claim 12, wherein box mold transfer means is located above the conveying path of the box molds in the second station so as to be displaceable, raisable and lowerable.

15. Automatic molding plant according to claim 14, wherein the box mold transfer means includes gripper arms pivotable on both sides of the box mold and fittingly grasping the box mold.

16. Automatic molding plant according to claim 15, wherein means for transferring the weighting means between the mold and the U-shaped trough are located at the loading and unloading stations, and the box molds and mold packs conveyed on the traverse carriage means define vertically parallel conveying planes, between which the ejected mold packs are transferred.

17. Automatic molding plant according to claim 14, wherein a stationary chute is provided above the box mold transfer means and has dimensions corresponding to the mold pack dimensions, an opening corresponding to the size of the mold pack being provided in the bottom of the stationary chute above a mold pack ejector means, and pusher means corresponding to the cross-section of the stationary chute and having a travelling path which corresponds to the distance from

the mold pack ejector means to the plane of one of the conveying paths.

18. Automatic molding plant according to claim 17, wherein means for transferring the weighting means between the mold and the U-shaped trough are located at the loading and unloading stations, and the box molds and mold packs conveyed on the traverse carriage means define vertically parallel conveying planes, between which the ejected mold packs are transferred.

19. Automatic molding plant according to claim 1, wherein the U-shaped troughs have means for allowing the same to be lifted off upwardly and means for centering the same in the horizontal position when placed on the traverse carriage means.

20. Automatic molding plant according to claim 19, wherein a first station provided for unloading of the ejected mold packs and transfer of the weighting means, and a second station provided for transposing the box molds onto a roller conveyor and the ejection and transfer of the mold packs into the U-shaped troughs of the traverse carriage means.

21. Automatic molding plant according to claim 20, wherein box mold transfer means is located above the conveying path of the box molds in the second station so as to be displaceable, raisable and lowerable.

22. Automatic molding plant according to claim 21, wherein the box mold transfer means includes gripper arms pivotable on both sides of and fittingly grasping the box.

23. Automatic molding plant according to claim 22, wherein means for transferring the weighting means between the mold and the U-shaped trough are located at the loading and unloading stations, and the box molds and mold packs conveyed on the traverse carriage means define vertically parallel conveying planes, between which the ejected mold packs are transferred.

24. Automatic molding plant according to claim 21, wherein a stationary chute is provided above the box mold transfer means and has dimensions corresponding to the mold pack dimensions, an opening corresponding to the size of the mold pack being provided in the bottom of the stationary chute above a mold pack ejector means, and pusher means corresponding to the cross-section of the stationary chute and having a travelling path which corresponds to the distance from the mold pack ejector means to the plane of one of the conveying paths.

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