MACHINE FOR THE PRODUCTION OF FOUNDRY CORES AND MOULDS

Inventor: Gerard Bardet, Paris, France
Assignee: Automatisme et Technique, Arcueil, France

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Primary Examiner—R. Spencer Annear
Attorney, Agent, or Firm—Brown, Murray, Flick & Peckham

ABSTRACT
A machine for producing foundry cores.

The machine comprises a barrel or turret for introducing the mixture of sand polymerization constituents into core boxes, a chamber for treating the boxes, communicating with the preceding box, an acceleration device for transferring each barrel from the treatment chamber to a barrel for discharging cores, and at least one transfer barrel connecting the barrel for discharging cores to the barrel for introducing the mixture into the boxes.

10 Claims, 3 Drawing Figures
1 MACHINE FOR THE PRODUCTION OF FOUNDRY CORES AND MOULDS

The present invention relates to a machine for producing cores and foundry moulds. A method and plant for the automatic production of cores and foundry moulds are already known. The method consists of mixing foundry sand with a polymerisation product and to make the mixture harden by passing a catalysing gas through it. In general, an amine is used carried by a carrier gas which can be carbon dioxide.

The installation for the application of this method is provided with means for automatically introducing a mixture of sand and polymerisation products into the core boxes, as well as with means enabling the reaction gas to pass through each box.

As it is, the installation of this invention can be used only for processes for producing cores or similar products which do not require the use of a hardening gas. These other methods can be of the “hot box” type, such as the method in which mixture of sands, thermosetting resin and hardener is used. The mixture hardens under the influence of heat. This hardening in general occurs at average temperatures of the order of 100° to 300 °C.

A second “hot box” method, called the “Croning Process” or “Shell Molding”, consists in enrobing the sand with a novolac resin and a reticulation agent such as hexamethylenetetramine. This mixture hardens under the influence of heat. These temperatures also are average temperatures between 200° and 300°C.

The above temperatures are given by way of example but methods can be envisaged which operate at ambient temperatures or slightly above ambient temperatures, these temperatures making manual intervention possible, without any constraints, as in the “cold box” processes. It is also possible to envisage packing, simultaneously or not, in an inert, protective, or reaction retarding atmosphere; this applies mainly to the sand-binder mixture during its preparation and (or simultaneously) before it is introduced into the core box.

The present invention intends to provide a machine for producing foundry cores, enabling any of the methods, not using a hardening gas, enumerating above to be used, in accordance with the particular properties and characteristics of each method, depending on the types of cores or moulds to be made.

The invention relates, to this end, to an installation characterised in that it comprises a continuously rotating barrel or turret for introducing a mixture of sand and polymerisation constituents into the boxes, a chamber for treating the boxes, communicating with the preceding barrel, a device for accelerating the transfer of each box from the treatment chamber to a barrel for discharging the cores, and at least one transfer barrel connecting the discharge barrel to the barrel for introducing the mixture into the boxes.

In certain cases, it may be advantageous to have a machine comprising protective and temperature controlling facilities to prevent the mixture, prepared before it is introduced into the core box, polymerization too rapidly, and thus: giving the mixture the length of life required for industrial production.

According to a particular advantageous feature, the treatment chamber includes a conveyor for introducing the boxes and transferring them from the injection or blowing barrel to the treatment chamber, as well as a discharge station cooperating with the acceleration device, the paths the boxes follow in the chamber consisting of rollers which can be driven.

According to another feature, the path followed in the treatment chamber is defined by straight segments, linked by angle pieces, at the level of which abutments are provided for each box when it arrives in the angle piece and at least one push-rod to make the box leave the angle piece.

In the above machine, continuous kinematic motion of the various barrels is combined with variable speed of the movement through the treatment chamber, which enables the time the boxes stay in the chamber to be regulated, in accordance with the mixtures or the technology used.

The transfer of the boxes from the injection barrel to the treatment chamber does not present any difficulty. On the other hand, passing the boxes from the treatment chamber to the barrel for discharging the cores, does present some difficulties, since these boxes must be given the speed at which they move on the discharge barrel, and their arrival on the barrel must be synchronized so that the gripping means of the barrel can grip the rods of the boxes.

To this end, according to the invention, the acceleration device consists of a variable speed driving member, synchronised with the barrel for discharging the cores, designed to receive the box so that the speed of the box driven by the acceleration device is identical with the tangential speed of the barrel when the box and the barrel meet, and so that in addition, the receiving means of the barrel are in position to receive the driving rods of the box.

According to an advantageous feature, the variable speed device consists of a slide piece, a reciprocating movement, pushing each box, this slide piece being connected by a connecting rod to a lever, of which the pivoting movement which has a variable angular speed is controlled by an eccentric gear, itself synchronously controlled by the speed at which the boxes move on the various barrels.

To facilitate the operation of the variable speed device, the slide piece consists of a sliding rod carrying a stud, the translatory path of which in the active position, when driving each box, is different from the return path, when empty.

A particularly simple way of obtaining this compound movement is to have the slide piece placed in a sleeve that is turned on its axis in accordance with the forward and backward movement of the slide piece.

The present invention will be described in greater details with the aid of one embodiment of a machine illustrated schematically on the accompanying drawings in which:

FIG. 1 is a plan view representing the whole of the machine.
FIG. 2 is a view of a vertical section, according to the plane II–II of FIG. 1.
FIG. 3 is a view of the vertical section, according to the plane III–III of FIG. 1.

According to FIGS. 1 to 3, the machine for producing foundry moulds and cores utilizes boxes 1 passing from a feed barrel 2 or a shot-injection barrel and a gasification barrel, to a treatment chamber 3 where each box is transferred to the discharge barrel 5 or turret by an acceleration device 4. The core is removed on this
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barrel 5 and the empty box passes onto the transfer barrel 6 or turret and then is returned by it to the shot injection barrel 2.

The boxes 1 move in the machine according to continuous kinematic principle, with the exception of when they move through the chamber 3 where there is a reduction of the speed of the movement of the boxes 1.

The mixture of sand and binder to which, if necessary, is added a hardener or a catalyst to produce the core, is introduced into the box 1 on the shot injection barrel 2. Such boxes, being known, will not be described in detail. This applies also to the means of holding the boxes on the various transfer and working barrels. It should simply be recalled that these boxes comprise two rods 11 and 12 which project downward as shown in FIG. 3 to enable them to be moved through the machine, such means given by way of example not constituting any limitation of the invention.

Depending on the method used for making cores, the barrel 2 can, if necessary, be equipped with a shot injection apparatus or a gasification apparatus provided with a cooling or an atmosphere conditioning apparatus or both, in order to prevent a premature reaction or oxidation of the prepared sand to take place, and finally to ensure that the period before it is introduced into the core box is long enough to be acceptable.

This installation can also comprise a mixer for the preparation of the sand and binding mixture, which installation can also be provided with equipment which enables it to be operated at low temperature, down to 0°C or with an atmosphere conditioner. This apparatus, located directly above the shot-injection mechanism can deliver supplies, as required, into the feed hopper of the machine. It is possible also, instead of refrigeration and conditioning equipment, to consider using solid carbon dioxide during the preparation of the sand, this enabling the two results as regards cold and atmosphere to be obtained simultaneously.

The chamber 3 is designed to enable the boxes 1 to remain under treatment conditions such as a given temperature, during a certain time or else to enable them to wait at ambient temperature. This chamber 3 comprises a roller path 31. The transfer of each box 1 over this roller path is effected with the aid of two rails or guard pieces 22, 32, cooperating with the front vertical rod 11 and the rear rod 12 of the box 1, and serve to move and hold the boxes on the barrel.

The roller path 31 comprises two rows of driven rollers 311 bringing the boxes to the entrance 33 of the treatment chamber. This entrance 33 which is a prolongation of the roller path 31, comprises a group of rollers 311 turning in the same way as the preceding roller 311, as well as a group of rollers 332 perpendicular to the preceding rollers.

A height-control device enables the rollers 331 and 332 to retract alternatively in accordance with the direction of the movement of the box 1. This means that, when the driving rollers 311 bring the box 1 to the entrance 33, the rollers 332 retract and the rollers 331 are in the normal position. The box then meets the abutment 333 imiting its course. At this point, the rollers 331 retract and the rollers 332 support the box and introduce it into the chamber 34. The boxes are moved by the device shown in FIG. 2 and described subsequently.

At the end of the chamber 34, the boxes meet the abutments 341. In this position, each box is on the second return means 342. At that point, like the return means 332 at the entrance to the chamber, there are a series of rollers 343, parallel to the rollers 332, as well as a series of rollers 344 perpendicular to the preceding rollers. The rollers 343 and 344 retract alternatively. Before the box 1 meets the abutments 341, the rollers 343 receive the box, then retract, and the rollers 344 carry the box. The push-rod 35 acting in the direction of the rollers 344, then makes the box 1 pass onto the third return means comprising the rollers 344 parallel to the preceding rollers and initially receiving the box as well as the rollers 345 perpendicular to the rollers 344. After the box 1 has been placed in position above these rollers, the rollers 344 retract and the rollers 345 carry the box. The push-rod 36 then pushes the box to the second part of the chamber 34.

At the exit of the chamber 34, the acceleration device 4 takes charge of the box 1 and transfers it to the barrel 5. This acceleration device and the transfer process will be described subsequently in relation to FIG. 3.

As indicated above, the translation of the boxes 1 through the chamber 34 in one or two parts is effected by at least two driving devices 37 shown in FIG. 2. This device is lodged below the chamber 34. As there are two such devices, only the movement through the first segment of the chamber 34 will be described.

A push-rod, not shown, brings each box 1 into the chamber 34 where it is taken in charge by the pusher device 37 constituted by a carriage 371 which reciprocated on a rail 372, below the chamber 34, by a connecting rod 373, an arm 374 and a second connecting rod 375 controlled by a rotating shaft 376.

The carriage 371 is made to move with the aid of a stop 371a, represented in its active position in FIG. 2. When the carriage 371 moves in the direction of the arrow D (FIG. 2) the stop 371a, studs 11, 12 of the boxes 1 and moves the boxes to the right. On the other hand, when the carriage moves in the direction of the arrow E, the stop 371a tilts as is shown by the arrow F and does not act upon the studs 11, 12. The return of the stop to its active position is controlled by the spring 371b.

In the present case, since the boxes 1 have two driving shafts 11, 12, it is preferable to have two stops 371a, each cooperating with a driving rod 11, 12, projecting downwardly from each box 1.

The movement of the carriage 371 in the direction of the arrow D corresponds to the speed with which the boxes 1 pass through the interior of the chamber. FIG. 2 also enables the lifting control of the rollers 344, described previously, to be seen.

The means used is a lifting jack 3441. This lifting means 3441 is synchronised with the push-rod 35, the rollers 344 being lifted at that moment to enable the box to be transferred.

On the other hand, when the push-rod 36 pushes the box, the rollers 345 are lifted to the level of the third angle return means.

The schematic sectional view in FIG. 3 shows the acceleration device 4. This device comprises a sliding piece 41 consisting of a guide bar 411 and a stud 412 rigidly mounted on it. This sliding piece 41 can pivot about its translational axis, enabling the stud 412 to be placed in position behind the rear driving rod 12 of
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Each box 1. The speed of the sliding piece 41 lengthwise and, as a consequence, the speed of the box 1, is controlled by means of an eccentric gear 42 transmitting its movement to a connecting rod 421 and a lever 422 of which the upper end acts upon the bar 411 through the connecting rod 423. The speed of the movement of the box 1 is controlled by a selection of the length of the lever 442 and of its articulation point with the connecting rod 421, so that, when the front driving rod 11 of the box 1 comes into contact with the barrel 5, the speed of the box 1 is equal to the peripheral speed of the barrel 5 (this is a problem of synchronizing the movement of the acceleration device and the barrel for introducing the driving rod 11 into its housing on the barrel).

The control of the sliding piece 41 is effected by means of the eccentric gear 42, driven synchronously, as FIG. 1 shows, by a driving device 424 driven by a rotating shaft 425, itself driven synchronously, for example, by the barrel 5, or the driving device of this barrel.

To prevent stud 412 from striking the driving rods 11 and 12 of the box which has already been placed in position at the exit of chamber 34, the rotation on its axis of the sliding piece 41 turning during its return movement is obtained by a disengagement jack 413 turning a sleeve 414 in which the bar 411 is splined.

Lastly, the machine according to the invention comprises means for preparing and moving sand. These means, being traditional, will not be illustrated or described.

It is obvious that the invention is not limited to the example of its embodiment herein above described and illustrated. If necessary, other forms and methods of its embodiment can be envisaged without departing from the scope of the invention.

What is claimed is:

1. A machine operable in a continuous kinematic manner for the production of foundry cores with the aid of core boxes, the machine comprising a first continuously rotating barrel for introducing into the core boxes a mixture of sand and a polymerization constituent, a treatment chamber maintained at a predetermined temperature and having an inlet and an outlet, means for delivering core boxes in succession from said barrel to the inlet of said chamber, means for carrying the boxes through the treatment chamber for hardening the mixture in them, a second continuously rotating barrel for ejecting cores from the boxes as it carries them in a circular path faster than they are carried through the treatment chamber, accelerating means for receiving each successive box from the outlet of the treatment chamber and delivering the box to said second barrel along a path tangent to said circular path of the boxes, said accelerating means being formed and constructed to accelerate the speed of each box as it moves toward said second barrel until said speed matches the speed of the boxes moving in said circular path, and a transfer barrel for returning emptied boxes from said second barrel to said first barrel, whereby the boxes travel in a closed circuit continuously.

2. A machine according to claim 1, in which said first-mentioned box-delivering means and said box-carrying means include roller conveyors.

3. A machine according to claim 1, in which the box-carrying means in the treatment chamber are separated into straight sections disposed at an angle to each other, the machine including an abutment for stopping each box when it has traversed the first section, and pushing means for pushing the box along said abutment to the next section.

4. A machine according to claim 1, in which said box-carrying means in the treatment chamber are separated into parallel first and second conveyors and a transfer conveyor for carrying boxes from the first conveyor to said second conveyor, said transfer conveyor including a first group of rollers aligned with said parallel conveyors and a second group of rollers at right angles to the first group, and means for raising the second group of rollers above the first group so that boxes received by the first group of rollers from the first conveyor can be lifted and moved to the opposite end of the transfer conveyor and then lowered onto said first group for delivery to said second conveyor.

5. A machine according to claim 4, including pushing means for pushing boxes on said second group of rollers from said first conveyor to the second conveyor, and then from said first group of rollers onto said second conveyor.

6. A machine according to claim 5, in which said pushing means include fluid pressure cylinders from which push-rods extend, and a push-plate on the outer end of each push-rod for engaging a box.

7. A machine according to claim 1, in which said accelerated means include a variable speed drive synchronized with said second barrel to provide said matching speed when the second barrel and box meet, and to ensure the box being received in the correct location on the second barrel.

8. A machine according to claim 7, in which said variable speed drive includes an axially reciprocating rod, a pivoted lever, means pivotally connecting the lever with said rod, an eccentric gear driven in synchronization with said barrels, a connecting rod pivotally connected to said gear and lever for swinging the lever back and forth, a stud mounted on said rod and traveling in a predetermined path for moving a box ahead when the rod is moved in one direction, and means causing said stud to travel in a different path when the rod is moved in the opposite direction.

9. A machine according to claim 8, in which said last-mentioned means include a sleeve splined on said rod, and means holding the sleeve against longitudinal movement but turning it back and forth on its axis as said rod is reciprocated.

10. A machine according to claim 9, in which said box-carrying means in the treatment chamber are separated into parallel first and second conveyors and a transfer conveyor for carrying boxes from the first conveyor to said second conveyor, said transfer conveyor including a first group of rollers aligned with said parallel conveyors and a second group of rollers at right angles to the first group, and means for raising the second group of rollers above the first group so that boxes received by the first group of rollers from the first conveyor can be lifted and moved to the opposite end of the transfer conveyor and then lowered onto said first group for delivery to said second conveyor.

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