CONCRETE BLOCK MOLDING MACHINE

FIG. 6.
This invention concerns the casting of blocks or like structural components in concrete or hard-setting plastic material and has for an object to simplify the manufacture of blocks of the kind comprising two spaced side parts or slabs of concrete or the like connected at one or more locations by metal tie rods or bars which have their ends embedded in the said slabs during the casting thereof. Such blocks are highly suitable for the erection of cavity walls, and will be hereinafter referred to for convenience as cavity blocks.

As heretofore produced, these blocks require careful handling both in the "green" state, since the tie members may then easily be loosened in, or even pulled out from, the concrete slabs, and in the "cured" state, because the tie members may then frequently be twisted out of the concrete slabs when the blocks are being lifted by the aid of the tie members, which is the most convenient lifting method and is that generally adopted by the users.

The present invention aims at providing an improved form of cavity block of the kind referred to above which shall be free from the disadvantages mentioned and may readily and safely be handled by means of the tie members, even while the concrete or the like is still green.

According to the invention a reinforced concrete or like block of the kind referred to has the ends of the tie member or members continued within the material of the side slabs as reinforcing members which are so disposed that any force applied to the tie member or one of the tie members is distributed to parts of these slabs remote from the member concerned.

More particularly stated, the block is reinforced by means of a single reinforcing member parts of which extend across the gap between the concrete or like slabs at two or more locations to form the tie members and the remaining parts of which are embedded in the said slabs at relatively widely spaced zones thereof.

Another object of the invention is to provide a construction of machine for the continuous or repetitive production of these blocks, and yet a further object is to provide a mould for use in such a machine.

Hitherto, in machines for the continuous production of concrete blocks, it has been customary to close the bottoms of the moulds by means of pallets usually transported to the mould stations by conveyor means and automatically located to close the moulds during casting and compacting, each block being lowered with the pallet after casting and both being carried away by conveyor for a "curing" process. In a machine working on this principle at the rate of, say, 200 moulding cycles per hour, 1,600 pallets are required for an eight hour day, and, owing to the delay imposed by the curing period, a minimum of 3,200 pallets are required for continuous operation of the machine. This calls for a large stock of accessories, involving much capital investment, and further involves storage space, and the cost, time, and labour in cleaning and handling the pallets.

It is an object of the present invention to avoid these drawbacks, and with this end in view a mould according to the present invention for casting blocks in concrete or the like hard-setting plastic material is provided with a base which is constituted by a two-part table or pallet having the one part displaceable bodily relatively to the other part.

Preferably, the table or pallet is reciprocable towards and away from the mould to close and open the same and the displaceable part is movable downwards from engagement with the block after lowering the table or pallet.

According to a feature of the invention, the relatively displaceable part is formed to support a metallic or other reinforcing member or members for interconnecting the two parts of the block, and may co-operate with a core located within the mould to define two spaced vertical cavity walls.

The two cavities then function to cast the side slabs of a cavity block, and these side slabs are held in spaced relationship by the reinforcing member or members.

The core may, alternatively, be partly formed on or carried by the displaceable part of the table or pallet and partly located within the mould, the two parts being complementarily formed to present the desired core configuration in the closed condition of the mould.

The invention will be more clearly understood from the following description, given by way of example only, of a concrete block casting machine to which the present improvements are applied, and which is illustrated in the accompanying drawings.

In the drawings:

Fig. 1 is a perspective view of a casting machine with some parts broken away for clarity of illustration;

Fig. 2 is a view similar to Fig. 1 showing the parts at a different point in the casting cycle, and showing a cast block partly broken away to reveal a reinforcing member;
Fig. 3 is another view similar to Fig. 1 showing the parts at another point in the cycle, some parts being broken away for clarity of illustration:

Fig. 4 is a fragmentary perspective view of some parts of the machine at one point in the casting cycle.

Fig. 5 is a view similar to Fig. 4 but showing the parts at another point in the casting cycle, and

Fig. 6 is a vertical, cross-sectional view taken on Fig. 1 within one of the cavities of the mould box showing the pallet closing the bottom of such cavity and one of the core parts in position within the recess of one partition of the mould box holding a reinforcing member in place.

The machine is of the automatic type having two mould boxes 1, adapted to be filled with plastic concrete contained in hoppers 2. The concrete is transferred from the hoppers 2 to the mould boxes 1 by means of feed boxes 3 which are traversable from a loading position beneath the hoppers 2 (as seen in Figs. 1–3) to a discharging position above the mould boxes 1 (as seen in Fig. 4). The hoppers 2 are provided with automatic cut-off mechanism, and the movement of the feed boxes 3 between their two positions is preferably effected automatically by a power traversing gear (not shown) which is interlocked with other moving parts of the machine. The feed boxes 3 are of dual funnel shape, as will be seen from the drawings, the feed openings at the lower end of each feed box being spaced apart to register with spaced cavities 1a in the respective mould box 1.

The bottom of each mould box 1 is open and, in the machine hitherto used for casting concrete blocks, this opening is closed by a pallet prior to the casting and compacting, by pressure or vibration or other known method, of the concrete block. In the machine according to the present invention, however, the bottom of each mould box 1 is closed by a vertically reciprocating or pantograph mechanism consisting of a hydraulic ram 6, the points defining a triangle having its apex located centrally near the upper edge of the cavity block 9 and its base located near to and parallel with the bottom edge thereof. The tie portions 8a are parallel with the shortest edges of the spaced concrete slabs 8a.

The central or upper tie portion is constituted by the middle portion of the single length of metal reinforcing rod 6. This latter is bent to an S-shape with the two loops of the S in two different and mutually inclined planes so that their end limbs constitute the respective lower tie portions, as will be evident from the drawings (Figs. 1–3). The reinforcement member 6 thus has its one extremity 6b located near to the centre of the bottom edge of one of the concrete slabs 8a and its other extremity 6c similarly located in the other slab. From these ends 6a, 6c the reinforcement member 6 extends towards the respective outer edges of the slabs 8a near which it turns inwards at right angles to serve as the respective lower tie portions 8a. The member 6a is bent upwards and downwards to form straight, mutually inclined portions the upper ends of which are joined by the upper tie portion.

With this arrangement of combined reinforcement members and tie portions, a cavity block can be lifted safely by means of the upper tie portion, even when the concrete is still "green," without risk of the tie portions being pulled out from the concrete.

It will be understood that the free ends 6a, 6c of the S-reinforcement member 8 may extend beyond the transverse central plane of the block 6, if necessary almost up to the opposite tie portion 6d.

The moulding operation is carried out automatically in the machine illustrated in the drawings. This comprises a vertical framework consisting of four tubular pillars 10. These pillars consist of several longitudinally arranged moveable hydraulic cylinders each of which works four rams 11 supporting a pressure head 12 which carries on its underside four compacting tamps 13. These tamps are so dimensioned and located as to be close fits in the four cavities 1a of the moulds 1. The pressure head 12 has a vertical travel sufficient to allow it to be raised, by hydraulic pressure on the rams 11, above the level of the tops of the moulds 1 to a distance such that the feed boxes 3 can be traversed laterally on the feed tray 14 from the loading position beneath the hoppers 2 to the mould filling position in which the lower ends of the funnel-shaped compartments register with the respective cavities 1a. The tray 14 is then retracted to allow the concrete to fall into the cavities, and after their contents have been so discharged the feed boxes 3 are retracted over the tray 14 to the loading position for recharging again.

The pressure head 12 is then lowered so that the tamps 13 rest on the surface of the concrete in the mould boxes 1. The boxes are then vibrated by means of electric vibrating mechanism 19 supported on brackets on the pillars 10. When the compacting period is ended, the vibrators 13 are automatically switched off and the green blocks 9 are lowered on the pallet 4 by a supporting frame 16 which is guided by means of rollers 17 on the pillars 10. The blocks are initially assisted from the cavities 1a by the weight of the pressure head 12. The frame 16 is secured to the machine parts 6 and carried on hydraulic rams 18.
When the compacted blocks 9 are free of the mould boxes 1, the pallet 4 comes to rest on three sets of rollers 18 carried in side channels supported on front and back pillars 20 mounted on the machine bed. After the pallet has so come to rest, the frame 16 and the lower core parts continue to descend until the latter have been withdrawn from the blocks 8 and are clear of the pallet 4, leaving the green blocks resting on the pallet. Opposite the rollers 18, in front of the machine, are mounted corresponding sets of rollers 21 carried in side channels on a frame 22 which is vertically reciprocable between an upper position in which the rollers are level with the rollers 18 and a lower position to be specified below. The vertical reciprocation of the roller frame 22 is effected by means of a toggle linkage 23 on which the frame is supported, the toggle joint 23c being moved by a pair of pull-rods 24 operated automatically by any convenient form of motive power (not shown).

Between the sets of rollers 21 are two belt conveyors 25, the width of which is slightly less than the space between the slabs 9c. Each conveyor belt 25 is located opposite, and in line with, a corresponding opening 4c in the pallet 4. The top run of the conveyor belts 25 stand proud of the rollers 21 by slightly less than the space between the lower tier portions 8s of the reinforcement 8 and the bottom surface of the block 8c.

As the pallet 4 comes to rest on the rollers 18, a pair of pins 26 (see, especially Figs. 4 and 5) secured on the underside thereof at the leading edges of the pallet 4 engage the flared mouths of slots 27 in the upper ends of levers 28 which are keyed at their lower ends on a common spindle 29. A pull rod 30 is pinned to each lever 29 (on only one such rod is shown in the drawings) and is connected at the other end to a power mechanism (not shown) for swinging the levers 28 and so drawing the pallet 4, with its “green” blocks 9, on to the reciprocable rollers 21. This movement is automatically effected after the core parts 6 have descended clear of the pallet 4.

When the loaded pallet 4 has come to rest on the rollers 21 the pull rods 24 are operated to break the toggles 23 and lower the blocks 9 until the upper tier portions 8s rest on the conveyors 30, which are travelling in the direction of the arrows. The reinforcement members 8 thus support the blocks which are carried by the conveyor belts 30 to a curing location. The empty pallet 4 is then raised by means of the toggle link mechanism 23 and returned by the arms 28 to its position on the rollers 18.

When the empty pallet is in position on the rollers, two reinforcement members 8 are placed in position over the openings 4a (as will be described below), and the frame 16 and core parts 6 are raised, the former engaging and lifting the pallet 4 back into its mould box closing position whilst the core parts each pick up their respective reinforcement member 8 in the grooves 7 to position it accurately in the mould box preparatory to the next casting operation. The pressure head 12 is also raised to permit the feed boxes 3 to be traversed on their feed tray 14 into the cavity charging position, and the casting cycle is repeated.

The mechanism for placing reinforcement members 8 in position on the empty pallet 4 consists of a chute 31 associated with each mould box 1 into which reinforcement members 8 are fed in any convenient manner. The chute terminates in a level gate section 32 having side walls which extend below the level of the floor of the chute 31 to a depth greater than the vertical height of a reinforcement member 8. The base 33 of this gate section is flush with the pallet 4 when the latter is resting on the rollers. The floor of each chute 31 is continued within the chute section 32 as a pair of marginal runners 34 which are hinged on the inward-facing surfaces of the walls of the section so as to be capable of swinging downwards from a horizontal inward-projecting position in which they form supportingledgesto a vertical position in which they lie against the said walls under the control of latch or similar mechanism (not shown). Each gate section 32 is of a length equal to the length of a single reinforcement member 8.

A pick-up fork 35 is carried on the end of a horizontally reciprocable hydraulic ram 36, the external width of the fork 35 being sufficient to pass freely between the mutually inclined portions of the member 8, whilst the internal width of the fork is sufficient to clear the lower core part 6. The leading ends of the fork arms are chamfered and provided with a shoulder 37.

In operation of the feed mechanism, a number of reinforcement members 8 are placed in the chute 31 and slide down to the bottom thereof, the leading member 8 being pushed onto the hinged runners 34 which are supported by the latch mechanism in the raised position. The ram 36 and fork 35 are withdrawn to the position shown in Figs. 1 and 2 until the empty pallet 4 is returned to position on the rollers 18. Automatic trip mechanism then causes operation of the latch to collapse the hinged runners 34 and allow the reinforcement member supported thereon to fall onto the base 33. The ram 36 is thereupon advanced and the chamfered leading ends of the fork 35 pick up the member 8 by the upper tie portion 8a and the shoulders 37 carry it forward with the ram 36 to bring the reinforcement member over the respective gap 4a in the pallet 4. The stroke of the ram 35 is adjusted so that, when the core part 6 is raised through the gap 4a, the tie portions 8a are engaged by the slots 7 in the core part. In this position the fork 35 embraces the core part freely.

As soon as the reinforcement member 8 is so engaged, the ram 36 and fork 35 are withdrawn, preferably by a quick return action, to the fully retracted position and the hinged runners 34 are returned to their horizontal position. The latter are preferably formed at their rearward ends with upstanding detent formations (not shown) which are moved down into the path of the next reinforcement member 8 to prevent it from falling through the gate section 32 during operation of the ram 36. When the runners 34 are returned to the horizontal position, the detents are moved to a vertical position against the walls of the chute 31 out of the path of the next reinforcement member 8, which is thereupon pushed by the weight of the other members in the chute onto the runners. The cycle is then repeated.

The timing of the operations of each of the several components of the machine is preferably controlled by automatic trips operated by the component immediately preceding it in the sequence. All operations may be carried out hydraulically or pneumatically, or if preferred, some or all of them may be carried out by electrical means.

In an alternative design of composite core assembly, which is suitable more particularly for
use where casting is by hand or by semi-automatic machine, the upper part 5 of the core is formed in two abutting parts, separated in the lengthwise direction, each part being hinged at its lower outer end on the replaceable core part 6. In use of this form of core, the abutting upper parts of the core are first swung outward to stand clear of the lower part 6 thereof, and the reinforcing members 3 are inserted into their grooves 1 as before. The two hinged parts are then swung back into position, and locked if desired, and the pallet 4 is raised into the mould-closing position ready for the casting operation as before. On lowering the pallet 4 with the cast “green” block resting thereon, the upper core parts are swung outward and the replaceable part 5 is further lowered to withdraw it from the block. The block is then transferred from the pallet and taken to the curing location.

By suitably designing the core parts, transverse passages may be formed therein, either at the locations of the groove for the reinforcing rods or between the said grooves so that, during the casting operation, concrete may be forced into these transverse passages to form transverse stiffening ribs or webs. Any method of supporting the reinforcing rods may be adopted as desired; for example, small lugs may be welded to the surface of the table or the core parts at the required positions, or the supports may be loose and placed in position on the table or core as required.

The side slabs 8 of a cavity block may be cast in different aggregates. Thus, the mix fed to the cavity for casting the outer slab of the block which will form part of the outer “skin” of a cavity wall may be cast in a denser mix than the inner slab to give the greatest mechanical strength and weather-resistance, whilst the mix for the inner slab may be lighter, and more fibrous, to impart greater heat and sound insulating properties.

Pallets may be formed or secured on the pallet 4 or on surfaces of the mould boxes 1 to form mortor grooves on the edges of the block during casting, and these pallets may be fixed or detachable as preferred.

In the above description of machine for casting concrete blocks it has been stated that the conveyor belts 25 transport the green blocks 9 to a curing location. This may be a curing oven or room in which the blocks are stacked on shelves or trays after removal from the conveyors, or the conveyors may themselves pass through a quick curing oven or tunnel. This latter arrangement would have the advantage that the blocks 9 would not be handled until they have set hard.

What I claim is:

1. A concrete block making machine, a mould box having a pair of spaced-apart vertical openings through same; a vertically reciprocable pallet underlying said mould box and adapted to close the bottom of said openings when at one end of its path of travel; means for shifting said pallet to and from said underlying relationship with the mould box when said pallet is at the opposite end of its path of travel, said mould box having a partition setting off said openings and provided with a recess extending thereinto from the lowermost end thereof, said recess interconnecting said openings; and means for moving a tie member into said recess and said openings for reinforcing the block to be formed by said mould box, and structure for moving said member and the block carried thereby to a position spaced below the mould box, said core part of the member having means for receiving and moving a tie member for the block into the mould box when the member is shifted to a position closing the bottom of the mould box.

3. In a concrete block making machine, a hollow mould box having an open top and an open bottom; a vertically reciprocable member including a pallet and a core part underlying the mould box and closing the open bottom thereof at one end of its path of travel; means for directing material for a block into the top of said box; structure for moving said member and the block carried thereby to a position spaced below the mould box, said core part of the member having means for receiving and moving a tie member for the block into the mould box when the member is shifted to a position closing the bottom of the mould box; and means for moving said member and the block carried thereby to a position spaced below the mould box, said core part of the member having means for receiving and moving a tie member for the block into the mould box when the member is shifted to a position closing the bottom of the mould box.

4. A concrete block making machine as set forth in claim 3 wherein said means for moving the tie member comprises a reciprocable fork adapted to receive the tie member and carry the same into said path of travel of the one section of the table.

5. In a concrete block making machine as set forth in claim 3 wherein said means for moving the tie member comprises a reciprocable fork adapted to receive the tie member and carry the same into said path of travel of the one section of the table, and wherein said machine is provided with feeding mechanism for supplying said fork with tie members as the fork reciprocates.

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