

METHOD AND APPARATUS FOR MOULDING CORED COMPONENTS

TECHNICAL FIELD

The present invention relates to casting components with a hollow core, and particularly to concrete components.

5 BACKGROUND TO THE INVENTION

Pre-cast concrete components such as blocks and slabs are commonly used in the building industry. These components are used as "building blocks" for construction, and are often tailor-made for the components' specific application in the construction.

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Some components have a hollow core, through which girders or other components pass. These cores are formed in the casting process by casting the concrete around a mould having a cross-section commensurate with the shape of the desired core. For example, if a component is to have a hollow core that is square or rectangular, then the coring element of the mould will be a column having a square or rectangular cross-section. Upon removal of the mould after the concrete has set, there is left a hollow core.

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DISCUSSION OF THE PRIOR ART

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The above method suffers from the disadvantage that it is difficult to remove the coring element from the concrete slab once it is set. The removal is traditionally done by pulling the coring element straight out of the slab. However, immense friction is generated between the faces of the mould and the faces of the core. This problem has previously been addressed by providing a coring element that is tapered away from the direction in which the mould must be removed. This can be seen in Fig. 3.

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A disadvantage of this is that in many cases, the walls of the hollow core must be parallel, to accommodate like-parallel components. Accordingly, it is not always possible to have tapered hollow cores.

It is accordingly an object of the present invention to provide an alternative method and apparatus of casting components having a hollow core, which facilitates the removal of the coring element and which need not form a tapered hollow core.

5 SUMMARY OF THE INVENTION

According to a first aspect of the present, there is provided a coring element for casting an object having a hollow core, said coring element including at least one casting surface about which said object may be cast so as to form a hollow core. The casting surface has at least one deformable region which allows the casting surface to
10 collapse inwardly, thereby facilitating removal of the coring element.

According to a second aspect of the present invention, there is provided a method of casting a component having a hollow core, the method including:

casting the component about a coring element, allowing the component to set;
15 causing an outer face of the coring element to reduce in diameter, thereby providing a space between the outer surface of the coring element and an inner surface of the thusly formed hollow core of the component; and removing the coring element from the component.

20 A preferred embodiment of the present invention will now be described with reference to the following drawings in which;

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 shows a typical building block or component having two hollow cores;

25 Fig. 2 shows an alternatively-shaped building block or component having a hollow core;

Fig. 3 shows two prior art methods of forming a core within a building block or component;

Fig. 4 shows the use of the present invention in its expanded state;

30 Fig. 5 shows the use of the present invention in its contracted state;

Fig. 6 shows the elements of an expansion mechanism for use with the present invention;

Fig. 7 shows the ramped element of Fig. 6 in more detail;

Fig. 8 shows a vertical cross-section of a building component being moulded using the present invention, in its expanded state;

Fig. 9 shows a vertical cross-section of a building component being moulded using the present invention in its contracted state;

Fig. 10 shows a horizontal cross-section of the arrangement of Fig. 7, along the line A-A';

Fig. 11 shows a horizontal cross-section of the arrangement of Fig. 8 along the line B-B' with an optional modification;

Fig. 12 shows a completed building component after removal of the coring element of the present invention; and

Fig. 13 shows the modification of Fig. 11 in more detail.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figs. 1 and 2 show typical components or building blocks which are generally used in the building industry. The block 10 consists of concrete walls 11 and hollow cores 12. The component in Fig. 1 is a brick-shaped component having substantially rectangular hollow cores 12. Alternatively, component 10 may be a desirably-shaped cylinder with a commensurately-shaped core 12.

In Fig. 3, there is shown traditional methods of forming core 12 within component 10. In one traditional method, coring element 13 is inserted within the general casing mould (not shown) and concrete 11 is poured within the mould (not shown) and around coring element 13. Once set, coring element 13 must be removed. This is traditionally done by simply pulling coring element 13 up and out of component 10. This causes great difficulty because tremendous frictional forces are generated between the inner face 12a of hollow core 12 and the outer face of coring element 13. Sometimes, the removal of coring element 13 can damage the inner face 12a of hollow core 12. In an attempt to overcome this problem, traditional methods have provided for an inwardly tapered coring element 14 which forms a commensurately-tapered hollow core 12'. Upon removal of coring element 14, the

frictional forces between the outer surface of coring element and the inner surface 12a' of hollow core 12' are greatly reduced due to the tapering angle θ (θ). This however produces a tapered hollow core which is not suitable in many cases.

5 The present invention provides a solution to this problem as shown in Fig. 4. Coring element 20 consists of a number of panels 20a, 20b, 20c and 20d. Each of these panels is connected via respective collapsible regions 21a, 21b, 21c and 21d. Panels 20a to 20d are made from stainless steel or any other suitable material. Collapsible regions 21a to 21d may be made of any suitable material including metal
 10 polyurethane, rubber or plastic. Alternatively, collapsible regions 21a to 21d may be an integral part of panels 20a to 20d but could form weaker regions which are in themselves collapsible. Once component 10 has set, coring element 20 is collapsed inwardly via collapsible elements 21a to 21d, to cause panels 20a to 20d to be separated from the inner face 12a of the hollow core formed in component 10 (See
 15 Fig. 5). The separation caused between these two faces greatly reduces any friction between the two faces upon relative movement and accordingly greatly facilitates the removal of core element 20 from component 10.

20 Clearly, any means by which panels 20a to 20d can be caused to assume an expanded state and a contracted state may be used, such as a screw-jack. A preferred mechanism however, is described below with reference to Figs. 6 to 10.

In Fig. 6, there is shown an exploded view of individual parts of a coring element 20 which allow faces 20a to 20d of the coring element 20 to be moved
 25 between an expanded state and a contracted state. Central to this process is centre panel 30 having attached thereto, handle 31. Each of faces 30a to 30d of centre panel 30 have a plurality of ramped elements 32a to 32d. The purpose of these ramped elements will be described more fully further below. Panels 20a to 20d are shown disposed about centre panel 30. The inside face of each of the panels 20a to 20d have
 30 corresponding reinforcing elements 22a to 22d. Focusing now on panel 20c, and corresponding reinforcing elements 22c, there is shown pin members 23c disposed along a longitudinally extending reinforcing element 22c''. Upon assembly of each of

the components, pin members 23c engage corresponding ramp element 32c on the corresponding face of centre panel 30. Collapsible connecting elements 21a to 21d are not shown in Fig.6.

5 This engagement feature is shown in more detail in Fig. 7, which illustrates panels 20c and 20d with respective pin members 23c and 23d engaging ramp elements 32c and 32d respectively. Looking at pin element 23c, it can be seen that this is slidably received between ramp members 33c, 34c, 35c and 36c. Any sliding motion experienced by pin member 23c will result in a lateral displacement of pin member
10 23c. Since pin member 23c is fixedly connected to panel 20c, this will equally result in a lateral displacement of panel 20c. An identical effect is experienced by each of the other panels 20a, 20b and 20d.

This effect is now considered in application with reference to Figs. 8 and 9,
15 and focussing on panels 20d and 20b. It will be appreciated that the same effect is experienced by all panels.

Looking now at Fig. 8, there is shown a vertical cross-section of the assembled coring element 20 of Fig. 6 in situ within a hollow core of component 10. In this
20 representation, the entire mould 40 is shown, including coring element 20 with corresponding panels 20b and 20d shown in this cross-section. The material 11 for component 10 is disposed between mould 40 and respective panels of coring element 20, being 20b and 20d. Panels 20b and 20d are caused to be in an expanded position due to centre panel 30. The outward force experienced by panels 20b and 20d upon
25 downward pressure of centre panel 30 (via handle 31) is due to the engagement of pin 23d, which is connected to the back of panel 20d, with ramp element 32d. A corresponding engagement occurs with pin 23b and ramp element 32b for panel 20b. Due to the fixed ramp configuration of ramping element 32b and 32d, and the fixed configuration of pin element 23b and 23d in relation to panels 20b and 20d
30 respectively, upon downward force of centre panel 30, pin 23d is caused to be displaced laterally due to the ramping slopes of ramping element 32d as described above with reference to Fig. 7. Since panel 20d is connected to pin 23d, this causes

panel 20d to be forced outwards. A corresponding action occurs with each of panels 20b, 20a (not shown) and 20c (not shown). In this position, the material 11 for component 10 is poured between mould 40 and the respective faces of the coring element 20. Once material 11 has set, coring element 20 must be removed to leave
 5 component 10 with a hollow core. To accomplish the removal, an upward force is imparted on centre panel 30 via handle 31, causing ramp elements 32b and 32d to rise correspondingly. This situation is illustrated in Fig. 9. Due to the sloping members of ramp elements 32b and 32d, pin elements 23b and 23d are caused to be displaced laterally in an inward direction, which correspondingly causes coring element panels
 10 20b and 20d to be drawn inwardly. The collapsible regions 21a to 21d (not shown) allow for this movement to occur to result in a coring element 20 of smaller dimensions. The result is to form a gap between the inner surface 12a of the component 10 and the outer surface of coring element panels 20a to 20d. With the presence of such a gap, coring element 20, together with centre panel 30 can be easily
 15 lifted from the arrangement, leaving component 10 with a hollow core with walls substantially parallel to each other.

Turning now to Fig. 10, there is shown a horizontal cross-section along the lines A - A' of Fig. 8. Note that in this representation, outer mould 40 is not shown.
 20 Corresponding elements of Figs. 8 and 9 are labeled identically in Fig. 10. Fig. 10 shows the coring element 20 in its expanded position, with centre panel 30 assuming a lowered position within component 10. As described above in relation to Fig. 8, ramp element 32a causes pin member 23a to be displaced outwardly, forcing core element panel 20a to be forced outwards. An identical situation occurs with core
 25 element faces 20b, 20c and 20d, together with their respective elements.

When material 11 has set, and coring element 20 is required to be removed, centre panel 30 is raised, causing ramp element 32a to displace pin member 23a inwardly, correspondingly pulling in coring element panel 20a towards the centre.
 30 This is shown in Fig. 11. An identical situation occurs with each of the other coring element panels 20b, 20c and 20d. Because of the collapsible elements 21a to 21d, coring element 20 is able to assume a reduced dimension, providing a gap between

the outer faces of panels 20a to 20d and the inner surface 12a of the hollow formed in component 10.

Fig. 11 shows a possible modification which may be made to the outer surface of one or more of the panels 20a to 20d (see also Fig. 13 for more detail). As seen in relation to panel 20c, the outer surface can bear a regular, or irregular pattern of deformations 24c. These deformations may also simply consist of roughening of the surface. A corresponding pattern 24c' is then produced on the inner surface 12a. These deformations may also consist of round or diamond-shaped holes or chipped holes created in all surfaces of the panels 20a to 20d. This feature enhances the adherence of the new cement to the surface of the coring element. Clearly, this feature cannot be used in apparatus and methods of the prior art, where the panel is drawn directly upwards for removal. The shape and configuration 24c as shown in Fig. 11 is of course only exemplary, and may take on any other desired form.

Fig. 12 shows the completed component 10 being made of material 11 and having an inner face 12a defining a hollow core 12.

Finally, Fig 13 shows in more detail, the modification of panel 20c as shown in Fig 11. Here, plate 20c has on its outer surface, stud elements 24c. These form corresponding recesses 24c' on the inner surface 12a of component 11.

The arrangement of studs 24c may take on any desired pattern, and may take on any suitable shape such as square, diamond or spherical.

It will be understood by those skilled in the art that the above is only a description of the preferred embodiment and that many modifications and variations may be made within the scope of the invention. Any suitable materials may be used for the core element panels, as well as for the collapsible regions. Additionally, the coring element 20 may take on any desired shape to provide any desired hollow core. Furthermore, the collapsible regions may take on any suitable form and number and

need not be separate elements but may in fact be integrally formed with the face or faces of the coring element.

- Alternatively, the coring element may conceivably be a single sheet
- 5 appropriately shaped to form a single face or desired shape. The sheet may be deformable after casting is complete, to adopt a reduced dimension to form a space between the sheet and the inner face of the hollow formed, thus reducing friction between the face and the object and facilitating removal of the coring element from the object.



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A coring element for casting an object having a hollow core, said coring element including at least one casting surface about which said object may be cast so
5 as to form a hollow core, wherein said casting surface is able to adopt an expanded state for casting, and a contracted state for facilitating the removal of said coring element from said object.
2. A coring element according to claim 1 wherein said casting surface includes at
10 least one region which is collapsible, thereby causing said casting surface to adopt a reduced dimension.
3. A coring element according to claim 2 wherein said casting surface is made up
15 of four panels joined together by four said weaker regions to form a coring element of square or rectangular cross-section.
4. A coring element according to claim 3 wherein said four weaker regions form corners of the square or rectangular cross-section.
- 20 5. A coring element according to any one of claims 1 to 4 wherein said object is a concrete building block.
6. A mould for casting an object having a hollow core, said mould including a coring element according to any one of claims 1 to 5.
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7. A method of casting an object having a hollow core, said method including;
casting said object about a casting surface of a coring element to form a core having an inner surface;
causing at least a portion of said casting surface to contract to move away
30 from said inner surface; and
withdrawing said coring element from said object, leaving a hollow core.

8. A method according to claim 7 wherein said casting surface is made up of a plurality of panels, and said step of causing at least a portion of said casting surface to contract includes causing each of said plurality of panels to move inwards via the collapse of one or more weakened regions connecting said plurality of panels.

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9. A support device for use with a coring element of any one of claims 1 to 5, said support device including means for providing an outward force against an inner surface of said coring element to cause said casting surface to adopt said expanded state, and means for providing an inward force against said inner surface of said coring element to cause said casting surface to adopt said contracted state.

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10. A support device according to claim 9 wherein said device includes a centre panel having at least one ramp element for receiving at least one pin member associated with said casting surface, wherein a movement in a first direction of said centre panel results in a movement in a second direction, substantially perpendicular to said first direction, of said casting surface.

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11. A coring element according to any one of claims 1 to 4 wherein at least a portion of said casting surface includes deformation in said surface.

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12. A coring element according to claim 11 wherein said deformation results from a roughening of said surface.

