

METHOD AND APPARATUS FOR MOULDING CORED COMPONENTS

TECHNICAL FIELD

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

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
10 blocks" for construction, and are often tailor-made for the components'
specific application in the construction.

Some components have a hollow core, through which girders or other
components pass. These cores are formed in the casting process by casting the
15 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

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.
25 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.

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.

5 Some devices exist which allow an object to be cast around a coring element which is collapsible after the object has set, thereby leaving a hollow core, however, many such devices use complicated mechanisms, making the casting process more costly and time-consuming.

10 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.

15 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 element about which said object may be cast so as to form a hollow core within said object, said casting element being able to
20 adopt an expanded state for casting, and a contracted state for facilitating removal of said coring element from said object, wherein an inner surface of said casting element is adapted to engage a drive element via at least one ramp and pin arrangement, such that movement of the driving element will cause said casting element to adopt said expanded or contracted state.

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 According to a second aspect of the present invention, there is provided a mould for casting an object having a hollow core, the mould including a coring element according to the first aspect of the present invention.

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It will be understood that the term "ramp and pin arrangement" refers to an arrangement involving the engagement of a ramped or inclined surface with a pin or other protrusion such that relative movement between the ramp and pin or protrusion will result in an increase or decrease in the distance
 5 between respective surfaces supporting the ramp and pin or protrusion.

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

10 BRIEF DESCRIPTION OF DRAWINGS

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

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

15 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;

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
 20 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
 25 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;

30 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

5 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
15 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
20 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'
25 of hollow core 12' are greatly reduced due to the tapering angle θ . This however produces a tapered hollow core which is not suitable in many cases.

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.
30 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 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 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.

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 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 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.

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 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, 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 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 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 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 component 10 with a hollow core. To
 5 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 20b
 10 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
 15 can be easily 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
 20 not shown. 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
 25 outwards. An identical situation occurs with core 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
 30 member 23a inwardly, correspondingly pulling in coring element panel 20a towards the centre. 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.

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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
5 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
10 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.

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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 element about which said object may be
5 cast so as to form a hollow core within said object, said casting element being
able to adopt an expanded state for casting, and a contracted state for
facilitating removal of said coring element from said object, wherein an inner
surface of said casting element is adapted to engage a drive element via at
least one ramp and pin arrangement, such that movement of the driving
10 element will cause said casting element to adopt said expanded or contracted
state.
2. A coring element according to claim 1 wherein said inner surface of
said casting element supports at least one pin to be received in a
15 corresponding at least one ramp element supported by said driving element.
3. A coring element according to claim 2 including said drive element.
4. A coring element according to claim 3 wherein said at least one ramp
20 element includes two substantially parallel members forming a channel
therebetween, for receiving said corresponding at least one pin.
5. A coring element according to claim 3 wherein said at least one ramp
element supported by said driving element is inclined so as to cause said
25 casting element to adopt said expanded state upon said drive element being
urged towards said coring element, and to cause said casting element to
adopt said contracted state upon said drive element being urged away from
said coring element.
- 30 6. A coring element according to claim 5 wherein said casting element
consists of four walls, defining a square or rectangle in cross-section.

7. A coring element according to claim 6 wherein adjacent walls are connected by respective deformable regions, which also form corners of said square or rectangle cross-section, to allow the casting element to adopt said expanded or contracted state.

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8. A coring element according to claim 7 wherein an outer surface of said casting element includes deformations thereon to imprint on the hollow core of said object.

10 9. A mould for casting an object having a hollow core, the mould including a coring element according to any one of claims 1 to 9.

10. A coring element substantially as hereindescribed with reference to the accompanying drawings.

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11. A mould substantially as hereindescribed with reference to the accompanying drawings.