



G00002



159159

Production of cast concrete refuse chute or other cast concrete tubular construction

Technical field

5 The present invention concerns the production of a cast concrete refuse chute or other cast concrete tubular construction, such as a cast concrete refuse chute for use in multi-storey buildings. The present invention provides a method for producing such a construction, a cast concrete refuse chute or other cast concrete tubular construction so produced, as well as an inner mouldpiece assembly for use in the
10 production of a cast concrete refuse chute or other cast concrete tubular construction.

Background of the invention

Refuse chutes in multi-storey buildings are very common in some parts of the world. Such chutes generally run vertically from floor to floor in the building, a
15 hopper being provided at each storey for access to the refuse chute by residents at that floor level.

Various designs of refuse chutes and methods for their production are known. For example, it is known to erect a simple vertically elongated box structure from bricks or other block building material, but this method is very slow and labour
20 intensive. A further conventional method employs a series of precast concrete 600 mm circular sections, stacked within a rectangular concrete or brick chamber. This method is also very time consuming and relatively expensive.

A further known method involves using an inflated pneumatic rubber tube as an inner mould to form a vertical bore in an elongated cast concrete body, the concrete
25 cast around the rubber tube within outer formwork. This method relies on the tube being inflated to the correct air pressure, and it is difficult to avoid deformation of the tube when the concrete is introduced. Furthermore, the robustness of the rubber tube is limited, and the wear and tear on it can be very severe.

Summary of the invention

The present invention aims at least partially to address the disadvantages of the prior art, and to provide an alternative method and mouldpiece for producing a cast concrete refuse chute or other cast concrete tubular construction.

- 5 In accordance with the invention, there is provided an inner mouldpiece assembly for use in the production of a cast concrete refuse chute or other cast concrete tubular construction, comprising at least two separable mutually complementary elongate components, shaped and sized to provide when assembled a tubular form having a longitudinal axis, at least one of said elongate components having a tapered form to permit removal of that component from the assembly in the axial direction.
- 10

The mouldpiece assembly may have a substantially cylindrical tubular form when assembled, or a tubular form with a substantially rectangular section when assembled.

- 15 In one embodiment, the mouldpiece assembly comprises a first component being a tapered plate-form part, and a second component made up of two plate-form parts hinged along a hinge axis parallel to the longitudinal axis, the first and second plate-form components when assembled providing the tubular form.

- In a second embodiment, the mouldpiece assembly comprises two pairs of components, each component having a tapered L-section form, all four components when assembled tapering in an axial direction and together providing the tubular form.
- 20

- Preferably, at least one of said elongate components has a tapered form provided with one or more lifting jack elements or lifting beams, permitting force to be exerted on that component in an axial direction.
- 25

A portion of the mouldpiece assembly may have a reduced external diameter at one end, to provide a means of locating the assembled mouldpiece with respect to a previously cast concrete refuse chute or other cast concrete tubular construction.

In a preferred form, the mouldpiece assembly includes one or more cover plates for securement to one end of the assembled tubular assembly.

The present invention also provides an inner mouldpiece assembly as defined above, in combination with a sub-assembly for forming a hopper for a cast concrete refuse chute, the sub-assembly comprising at least two mutually complementary box elements, at least one of said box elements having a tapered form. The tapered box element may be provided with projecting tie rods or other means for manipulating the box element.

The present invention further provides an inner mouldpiece assembly as defined above, in combination with an outer mouldpiece assembly comprising a number of substantially planar shuttering components for assembly around the assembled inner mouldpiece.

In a further form, the invention provides a method for producing a cast concrete refuse chute or other cast concrete tubular construction, comprising the steps of:

providing an assembled inner mouldpiece assembly according to any one of the preceding claims;

positioning the inner mouldpiece with its longitudinal axis in the vertical direction;

assembling an outer mouldpiece around said inner mouldpiece;

casting concrete between said inner and outer mouldpiece and allowing the concrete to set;

applying a load to a tapered elongate inner mouldpiece component to break the concrete bond and remove said inner mouldpiece component or components in an upward axial direction; and

removing the remaining inner mouldpiece component or components and the outer mouldpiece.

The present invention also provides a cast concrete refuse chute or other cast concrete tubular construction produced by the method defined above.

Brief Description of the drawings

For a more complete understanding of the present invention and the advantages thereof, the invention will now be further explained and illustrated by reference to the accompanying drawings, in which:

Figure 1 is an isometric view of a cylindrical inner mould assembly;

- 5 Figure 2 is an isometric view from the opposite side of the inner mould assembly of Figure 1;

Figure 3 is a plan view of the inner mould assembly of Figure 1;

Figure 4 is a further plan view of the assembly, illustrating the details of the top of the mould assembly before it is assembled;

- 10 Figure 5 is a further plan view of the assembly with the top cover plates removed;

Figure 6 is a bottom view of the inner mould assembly of Figure 1;

Figure 7 is an elevation view of the bottom end of the assembly;

Figure 8 is an elevation view of the vertical wedge-shaped portion of the assembly of Figure 1;

- 15 Figure 9 is an elevation view of the two-part symmetrical hinged portion of the assembly of Figure 1;

Figure 10 is a plan view of a rectangular inner mould assembly;

Figure 11 is a plan view of the top cover plate for the assembly of Figure 10;

Figure 12 is an elevation view of a first panel portion of the assembly of Figure 10;

- 20 Figure 13 is an elevation view of a second panel portion of the assembly of Figure 10;

Figure 14 is an isometric view of sets of first and second panel portions making up the assembly of Figure 10;

- 25 Figure 15 is an isometric view of a tapered box element assembly for forming a refuse hopper;

Figure 16 is an isometric view of an external mould assembly together with a cylindrical inner mould assembly;

Figure 17 is an isometric view of an external mould assembly, together with a rectangular inner mould assembly;

Figure 18 is an isometric view of a completed cylindrical concrete refuse chute; and

- 5 Figure 19 is an isometric view of a finished rectangular concrete refuse chute.

Detailed description of the drawings

As Figs. 1 and 2 show, cylindrical inner mould assembly 10 consists essentially of two separable part cylindrical elongate portions 11 and 12, which can be assembled
10 to form the cylindrical inner formwork for a cast concrete refuse chute. A first portion is a two-part, symmetrical hinged portion 11 (illustrated in alternative views in Figs. 4, 5, 6 and 9), comprising two elongate part cylindrical opposite halves hingedly interengaged at respective longitudinal edges 13 parallel to the axial direction of the cylindrical mould along a hinge axis, by way of hinges 14.

- 15 The other longitudinal edge 22 of each half of portion 11 is inclined by a few degrees to the axial direction of cylindrical mould 10, such that a wedge-shaped gap remains between edges 14. Cylindrical inner mould assembly 10 is then completed by a second wedge-shaped part cylindrical elongate mould portion 12.

The cylindrical mould assembly 10 is designed to be employed vertically. Each
20 half of mould portion 11 is provided with a lifting lug 17 secured to its top edge, whilst a jacking beam 15 is secured to the top edge of wedge-shaped mould portion 12. Each half of mould portion 11 is provided with a top cover plate 18, whilst mould portion 12 is provided with a top cover plate 19. Jacking beam 15 features a transverse lifting bolt 16, enabling the manipulation of mould portion 12
25 independently of the remaining components of mould assembly 10.

Figs. 1 and 2 depict a mould assembly for fabrication of a refuse chute for one storey of a multi-storey building. The dimensions given in these and other of the figures are purely illustrative, relating to this particular exemplification of the invention.

In the example described, the mouldpiece is 3600 mm long and has a 610 mm external diameter. Wedge-shaped mould portion 12 is 400 mm wide at its top end 20 and 150 mm wide at its bottom end 21, such that it tapers from top to bottom (see fig. 8).

5 As Figs. 1 and 2 illustrate, and Fig. 7 shows more clearly, the bottom end of the mouldpiece has a section 23 of reduced external diameter (590 mm) over a short (100 mm) axial length, to form a spigot end to allow positioning and aligning of the bottom end of the mouldpiece into the cylindrical bore of the top end of the concrete chute of the cast concrete chute section one floor below.

10 In the example, mould portions 11 and 12 are manufactured from mild steel or galvanised steel plate of 4 mm thickness, stiffened with radial plate sections at a 300 mm axial spacing (Figs. 8 and 9), with flat plate forming the edges of the mould portions.

Hinges 14 comprise M14 bolts through complementary longitudinal bushes welded
15 to the opposed edges 13 of the halves of mould portion 11 along the hinge axis at a suitable spacing (Figs. 2 and 9). Cover plate 19 is made from 6 mm steel plate and is secured to the top of mould portion 12, whilst cover plates 18 are secured by M14 bolts 27 to the top edges of the symmetrical halves of mould portion 11. Complementary bolt slots 25 and 26 in cover plate 19 and in the top edge of mould
20 portion 12 allow the assembly 10 to be secured together prior to casting.

Figs. 5 and 6 illustrate more clearly the relationship of the mould portions 11 and 12. It is important that a gap remains throughout the length of the mouldpiece when wedge-shaped mould portion 12 is removed, as will be explained further below.

25 An alternative form of inner mould assembly is shown in Figs. 10-14, namely a rectangular tubular mouldpiece 10A. With reference to these figures, similar reference numbers are utilised as used above with reference to corresponding components of the assembly depicted in Figs. 1-9, with the addition of the suffix "A". The rectangular mould assembly 10A comprises four steel wedge-shaped
30 portions to make up the mouldpiece, two portions 11A being L-form pieces

tapering from bottom to top (as shown in Figs. 12 and 14), and two portions 12A being L-form pieces tapering from top to bottom (as shown in Figs. 13 and 14). Mould portions 12A are provided with diagonal lifting bars 28 welded to the top edges as shown in Fig. 10, and also with jacking beams 15A as shown in Fig. 14.

- 5 The plan view of Fig. 10 shows the assembled mould assembly 10A before fixing thereto top cover plate 19A, showing the position of bolt holes 26A by which the cover plate can be secured. Rectangular cover plate 19A is provided with two cutouts as shown in Fig. 11, to allow access to lifting bars 28 when the cover plate is in place. Once again, dimensions (in mm) are provided on Figs. 10-14 for the particular embodiment described and illustrated. Mould portions 11A and 12A are
10 fabricated from 4 mm thick galvanised steel plate.

Figure 15 illustrates a pair of mutually complementary wedge-shaped steel top and bottom box elements 40 and 41 sized and shaped to form a refuse hopper through the cast concrete at the appropriate position in the refuse chute. Both box elements
15 40; 41 are provided with outwardly projecting tie rods 42; 43 as shown, to facilitate extraction laterally when breaking of the concrete bond (see below). The inner faces 44; 45 of box elements 40; 41 respectively complement the inner mould form, eg. they have the same radius of curvature as the cylindrical inner mouldpiece, as faces 44; 45 are configured to sit flush against the external surface
20 of the inner mouldpiece in the casting of the chute. Box elements 40 and 41 are hollow, fabricated from 4 mm steel plate.

Fig. 16 illustrates the casting process for use with cylindrical inner mouldpiece assembly 10, whilst Fig. 17 illustrates the process for use with rectangular inner mouldpiece assembly 10A. In both processes, similar planar external shuttering or
25 formwork 50 is used, four panels pre-assembled into two L-shaped formwork units as shown in Figs. 16B; 17B. These formwork units can then be simply locked together by quick fastening releasable keybolts 52 engaging with key bolt slots 53, as shown in Figs. 16C; 17C. This external formwork 50 may vary in size in order to incorporate a structural concrete column and any rebar or other concrete
30 reinforcement required.

In use, firstly either cylindrical mould assembly 10 or rectangular assembly 10A is selected as appropriate for the final form of refuse chute desired. In the case of the cylindrical mould, the mouldpiece components are assembled in accordance with Fig. 1, secured by nuts and bolts, with the addition of tying wire around the mould
5 for additional security. In the case of the rectangular mould, the components are assembled in accordance with Figs. 13 and 14 by means of bolts.

Once the inner mould is assembled, it is lifted into position using the lifting lugs or bars with a lifting device such as a crane, and plumbed to ensure it is installed vertically. The outer formwork 50 is then lifted into place and keybolts 52 used to
10 fasten the panels together (Figs. 16 and 17). The outer formwork is also plumbed to ensure it is vertical.

The two wedge-shaped box elements 40 and 41 are introduced at the desired position before closing the outer formwork, and supported by the outer formwork as shown in Fig. 16.

15 Once the formwork is in place, and any rebar added as necessary, the concrete casting takes place. The assembly is ready for de-moulding 24 hours later. In the case of the cylindrical mould assembly 10, the nuts and bolts are first removed, cover plate 19 is removed, and then a hydraulic or mechanical jack is used to raise jacking beam 15 to break the concrete bond. The cylindrical inner mould portion
20 12 is easily jacked up due to its wedge-shaped design.

When mould portion 12 has been removed, the two symmetrical halves of remaining mould portion 11 can be readily collapsed inwardly (and will in fact tend to self-collapse) about hinges 14, and then removed by lifting via lifting lugs 17. The gap between the top cover plates 18 provides sufficient space for the collapse
25 of mould portion 11 to take place.

In the case of the rectangular mould assembly 10A, a similar operation is carried out by means of a hydraulic or mechanical jack or jacking beams 15A to break the concrete bond. Once the two downwardly tapering panels 12A have been jacked out and removed, the remaining two upwardly tapering panels 11A can be simply
30 lifted out.

The next stage is the removal of hopper-forming box elements 40 and 41. Inwardly tapering upper box element 40 is first pulled out by way of welded steel rods 42, then lower box element 41 is removed by way of rods 43.

5 Stripping of the outer formwork is carried out by removal of all keybolts 52, then lifting away each L-shaped formwork unit for use in the next floor of the concrete chute.

The cycle is repeated for the subsequent floor of the building. The installation of the cylindrical mould is simplified by the spigot arrangement provided by the reduced diameter of the bottom end 23 of the mouldpiece, to engage in the top end
10 of the bore of the chute section below, and the same principle can be applied to the rectangular mould assembly if required.

Figs. 18 and 19 illustrate the complete concrete refuse chute 60; 60A respectively cylindrical and rectangular, cast along with a support column 61; 61A. The figures also show concrete floors 62; 62A of two adjacent storeys of a multi-storey
15 building, and the positions of refuse hoppers 63; 63A.

The method of the present invention provides a very simple and effective solution to the problem of casting concrete refuse chutes and other tubular structures of concrete or like mouldable material, allowing all of the formwork to be readily re-used with minimum wear and tear. The final cast product is robust and of precise
20 dimensions.

Although the present invention has been described in detail with respect to the illustrated embodiments, it should be understood that various changes, substitutions and alterations can be made thereto, without departing from the spirit and scope of the invention as defined by the appended claims.

25

CLAIMS

1. An inner mouldpiece assembly for use in the production of a cast concrete refuse chute or other cast concrete tubular construction, comprising at least two separable mutually complementary elongate components, shaped and sized to
5 provide when assembled a tubular form having a longitudinal axis, at least one of said elongate components having a tapered form to permit removal of that component from the assembly in the axial direction.
2. A mouldpiece assembly according to claim 1, having a substantially cylindrical tubular form when assembled.
- 10 3. A mouldpiece assembly according to claim 1, having a tubular form with a substantially rectangular section when assembled.
4. A mouldpiece assembly according to any preceding claim, comprising a first component being a tapered plate-form part, and a second component made up of two plate-form parts hinged along a hinge axis parallel to the longitudinal axis,
15 the first and second plate-form components when assembled providing the tubular form.
5. A mouldpiece assembly according to one of claims 1 to 3, comprising two pairs of components, each component having a tapered L-section form, all four components when assembled tapering in an axial direction and together providing
20 the tubular form.
6. A mouldpiece assembly according to any preceding claim, at least one of said elongate components having a tapered form provided with one or more lifting jack elements or lifting beams, permitting force to be exerted on that component in an axial direction.
- 25 7. A mouldpiece assembly according to any preceding claim, having a portion of reduced external diameter at one end, to provide a means of locating the assembled mouldpiece with respect to a previously cast concrete refuse chute or other cast concrete tubular construction.

8. A mouldpiece assembly according to any preceding claim, including one or more cover plates for securement to one end of the assembled tubular assembly.
9. A mouldpiece assembly according to any preceding claim, in combination with a sub-assembly for forming a hopper for a cast concrete refuse chute, the sub-assembly comprising at least two mutually complementary box elements, at least one of said box elements having a tapered form.
10. A mouldpiece assembly according to claim 9, said tapered box element being provided with projecting tie rods or other means for manipulating the box element.
- 10 11. A mouldpiece assembly according to any preceding claim, in combination with an outer mouldpiece assembly comprising a number of substantially planar shuttering components for assembly around the assembled inner mouldpiece.
12. A method for producing a cast concrete refuse chute or other cast concrete tubular construction, comprising the steps of:
- 15 providing an assembled inner mouldpiece assembly according to any one of the preceding claims;
- positioning the inner mouldpiece with its longitudinal axis in the vertical direction;
- assembling an outer mouldpiece around said inner mouldpiece;
- 20 casting concrete between said inner and outer mouldpiece and allowing the concrete to set;
- applying a load to a tapered elongate inner mouldpiece component to break the concrete bond and remove said inner mouldpiece component or components in an upward axial direction; and
- 25 removing the remaining inner mouldpiece component or components and the outer mouldpiece.
13. A method according to claim 12, the inner mouldpiece comprising a first component being a tapered plate-form part, and a second component made up of

two plate-form parts hinged along a hinge axis parallel to the longitudinal axis, the first and second plate-form components when assembled providing the tubular form, wherein, after the concrete is cast, said first component is removed in by applying a force in an upward axial direction, and then said second component is
5 caused or permitted to collapse about said hinge axis before removal.

14. A method according to claim 12, the inner mouldpiece comprising two pairs of components, each component having a tapered L-section form, all four components when assembled tapering in an axial direction and together providing the tubular form, wherein, after the concrete is cast, the components tapering
10 downwardly are first removed by applying a force in an upward axial direction, and then the remaining components are removed.

15. A method according to any one of claims 12 to 14, wherein said outer mouldpiece and said inner mouldpiece are arranged to form both the cast concrete refuse chute or other cast concrete tubular construction and an adjacent structural
15 load-bearing concrete component.

16. A method according to any one of claims 12 to 15 including forming a hopper for a cast concrete refuse chute, including the steps of:

providing a sub-assembly for forming said hopper, comprising at least two mutually complementary box elements, at least one of said box elements having a
20 tapered form and having a face configured to complement the outer surface of at least a part of said inner mouldpiece assembly;

positioning the subassembly between said inner and outer mouldpieces, said tapered box element tapering inwardly towards the longitudinal axis of the inner mouldpiece, said face placed against the assembled inner mouldpiece assembly;

25 after removal of the outer mouldpiece, applying a load to said tapered box element to break the concrete bond and remove the tapered box element in an outward radial direction; and

removing the remaining box element or elements.

17. A cast concrete refuse chute or other cast concrete tubular construction produced by the method of any one of claims 12 to 16.