

PATENT SPECIFICATION

(11)

1 600 219

(21) Application No. 19837/78 (22) Filed 16 May 1978 (19)

(44) Complete Specification published 14 Oct. 1981

(51) INT. CL.³ B28B 7/22

(52) Index at acceptance

B5A 1R150 1R214A 1R214H 1R455 2E1A T3P

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(54) IMPROVEMENTS IN OR RELATING TO METHODS OF MAKING BUILDING MODULES

(71) We, ROBIN CONSTRUCTION (PTE) LTD., of Robina House, 1 Shenton Way, Singapore, a Company incorporated in the Republic of Singapore, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to methods of making building modules. In such methods, use may be made of simple moulds or forms for making reinforced concrete modules. The modules may be open at one end and may have side walls, a floor, a roof and an end wall. Precast side walls may be positioned on a fixed floor mould for casting of the floor slab to form an integrated "U" section. With the use of a precast end wall and an adjustable roof shuttering carriage, the roof slab may be cast integrating the "U" section and the end wall to form the desired module.

According to the invention there is provided a method of making a building module, comprising the steps of placing precast side walls into a floor mould so that the side walls form edges of the mould, filling the floor mould with moulding material, allowing the moulding material to set at least partially, moving onto the thus cast floor a movable device having an upper surface which cooperates with the side walls to form a roof mould, filling the roof mould with moulding material, allowing the moulding material to set at least partially, and removing the movable member.

In a preferred method, use is made of simple moulds or forms and combination of precast wall panels for casting together the floor and roof slabs to form an integral section. With this method, side walls and end wall are precast with reinforcements projecting out of the slabs at the top and bottom section for connection to the roof and floor slabs respectively. The projecting reinforcements of the precast wall panels are tied to the reinforcements of the roof and floor slabs before the respective slabs are cast. Thus, a satisfactory connection is achieved between the precast wall panels, floor and roof slabs

from the point of view of strength.

In this preferred method of production, the precast wall panels form the longitudinal sides of the floor and roof moulds. The method makes use of a fixed floor mould and an adjustable roof shuttering carriage for casting of the roof slab. The adjustable roof shuttering carriage is supported from the floor slab. When the roof slab has attained sufficient strength, the adjustable roof shuttering carriage is released and withdrawn from the module so that the module can be taken out from the mould by a crane. With this system, the time of completion of a module is governed by the time required for the floor slab and roof slab to attain the necessary strength for removal from the mould.

The invention will be further described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is a perspective of a casting assembly;

Figure 2 is a horizontal cross-sectional view of the assembly of Figure 1;

Figure 3 is a vertical cross-sectional view of the assembly of Figure 1; and

Figure 4 is a vertical longitudinal cross-sectional view of the assembly of Figure 1.

Manufacturing of reinforced concrete modules is carried out in the workshop. Side walls are cast separately with reinforcements protruding from the bottom and top thereof for connection to floor and wall slabs, respectively. An end wall which is also separately cast has reinforcements protruding from the top face thereof for connection to the roof slab.

Referring to Figure 2, side walls 1 are positioned on a fixed floor mould 3, aligned with an alignment frame 4, and secured in position by clamps 5. In this position, the precast side walls together with the fixed floor mould complete the form of the floor slab. This procedure characterises the device for the completion of the form or mould for casting the floor slab 9. The reinforcements of the floor slab are tied to the protruding reinforcements of the precast side walls. On completing this operation, the floor slab is 100

cast to form the integral "U" section. Thus, on casting the floor slab, the integral "U" section is formed unifying this precast side walls with the floor slab.

5 After a certain preliminary hardness of the floor slab has been achieved, an adjustable roof shuttering carriage 6 is drawn on to the floor slab and positioned by a crane. An end wall 2 is placed by the crane so as to sit on a
10 recessed edge of the floor slab (Figure 4) aligned and secured to the side wall and floor slab by welding. The adjustable roof shuttering carriage is raised to the correct level by jacks 7 (Figure 4). Wing plates 8 (Figure 3)
15 are butted against the side walls to form a tight seal and wedged in position. This operation completes the mould for the roof slab 10, being characterised by the use of simple forms and devices. Reinforcements of
20 the roof slab are tied to the protruding reinforcements from the side walls as well as the end wall. The casting of the roof slab integrates the "U" section and the end wall to form the desired module. This method of
25 casting of the roof slab achieves a satisfactory connection between the end wall and roof slab in respect of leakage control and strength requirements.

When the roof slab has achieved sufficient
30 strength, the adjustable roof shuttering carriage is released and withdrawn from the module. On releasing the alignment frame, the module is lifted out from the casting assembly thereby completing the production
35 procedure.

WHAT WE CLAIM IS:—

1. A method of making a building module, comprising the steps of placing precast
40 side walls into a floor mould so that the side walls form edges of the mould, filling the floor mould with moulding material, allowing the moulding material to set at least partially, moving onto the thus cast floor a
45 movable device having an upper surface which cooperates with the side walls to form a roof mould, filling the roof mould with moulding material, allowing the moulding material to set at least partially, and removing the movable member.
50

2. A method as claimed in claim 1, in which a precast end wall is attached to the side walls and the floor when at least
55 partially set to form an edge of the roof mould.

3. A method as claimed in claim 1 or 2, in which the moulding material is concrete.

4. A method as claimed in claim 3, in which reinforcing is arranged in the floor
60 mould and the roof mould prior to the respective steps of filling with concrete, the reinforcing being attached before the said respective filling steps to reinforcing provided in the precast side walls.

65 5. A method of making a building m-

odule, substantially as hereinbefore described with reference to the accompanying drawings.

6. A building module made by a method as claimed in any one of the preceding
70 claims.

7. A building comprising a plurality of modules, as claimed in claim 6, attached together.

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(Abingdon) Ltd.—1981. Published at The Patent Office,
25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.



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25 casting of the roof slab achieves a satisfactory connection between the end wall and roof slab in respect of leakage control and strength requirements.

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50 the movable member.

2. A method as claimed in claim 1, in which a precast end wall is attached to the side walls and the floor when at least partially set to form an edge of the roof
55 mould.

3. A method as claimed in claim 1 or 2, in which the moulding material is concrete.

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