

April 8, 1969

H. SLAVIN

3,436,892

METHOD OF PRODUCING CONCRETE PANEL ASSEMBLIES

Filed Dec. 27, 1966

Sheet 1 of 2

FIG. 1

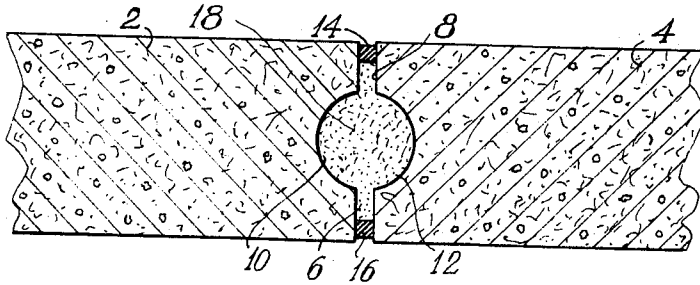


FIG. 2

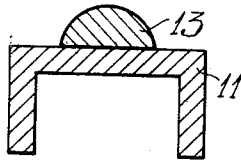


FIG. 3

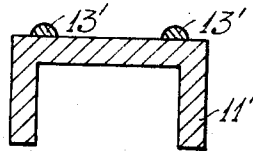
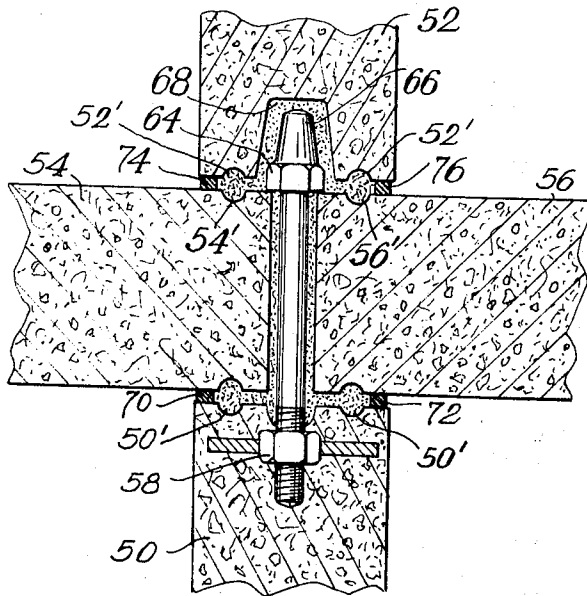


FIG. 6



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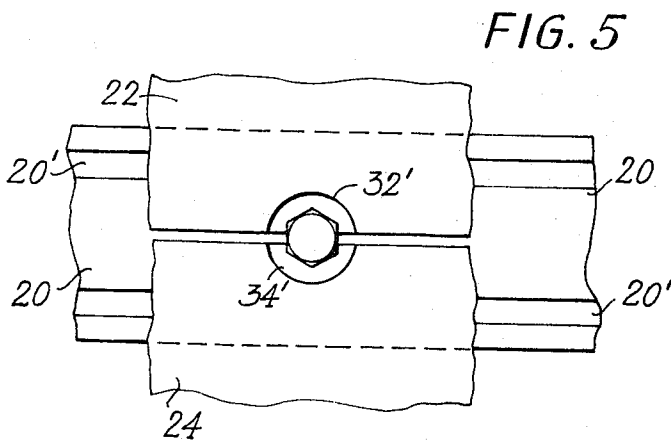
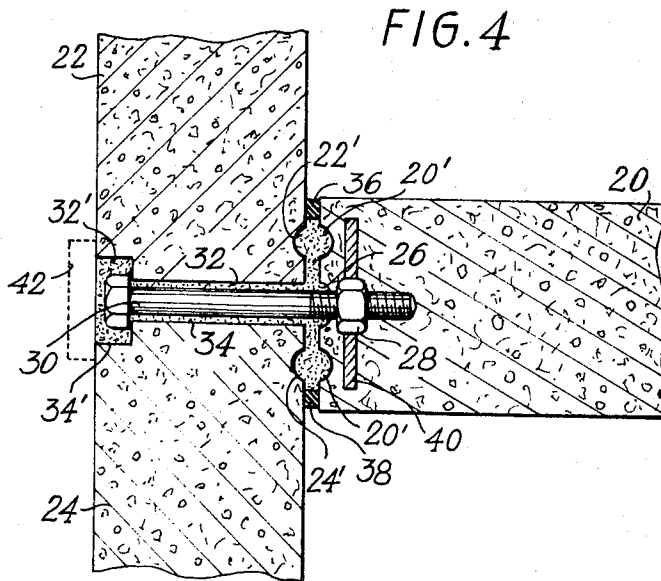
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Sheet 2 of 2



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3,436,892
METHOD OF PRODUCING CONCRETE PANEL ASSEMBLIES

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24,937

Int. Cl. E04g 21/14; E04b 1/04, 1/41

U.S. Cl. 52-747

6 Claims

ABSTRACT OF THE DISCLOSURE

A method of producing concrete panel assemblies, particularly in the production of prefabricated concrete buildings, comprises casting the concrete panels with longitudinally-extending grooves along the mating surfaces and with a threaded nut embedded in at least one panel and accessible through a mating surface, grinding down the mating surfaces to make them smooth, flat and parallel to each other when two panels are joined together, applying a sealing strip along the longitudinal edge on each side of the mating surface of a panel, assembling the latter panel with another by passing a threaded bolt through said nut of the one and in engagement with the other, with the mating surfaces of the two panels slightly spaced by the seals, and introducing a settable binding agent into the space between the mating surfaces.

The present invention relates to a method of producing concrete panel assemblies, and finds particular use in the production and use of concrete panels in the fabrication of concrete building structures.

Several systems have heretofore been devised for the production of prefabricated concrete building structures. Insofar as known to me, in most or all of these systems concrete elements (e.g., floors, ceilings, partitions) are produced at the factory without complete or any finish, all or part of the painting, carpentry work, installation of the electrical, plumbing and other fixtures and devices, etc., being done at the site after erection of the building. In addition, the concrete panels are produced so that during the erection of the building they are assembled with a substantial gap between mating surfaces (e.g., at least 3-5 cm.), which gap is filled with concrete as the building is erected. Such systems thus involve a considerable amount of labor at the site, usually as much as 40-50% of the total labor in the production of the building, which severely limits the advantage of prefabricated production.

I have now devised a system for the production of concrete panels and their use in the construction of concrete building structures in which substantially all the production and finishing of the structure take place at the factory site, leaving little more than the assembly of these parts to be done at the erection site. Such a system permits a very substantial savings in time and labor in the production of building structures. Moreover, the system enables closer control of the quality of the work and of the working conditions since substantially all the work is performed at the factory. Other advantages will be apparent, such as the increased susceptibility of the system to mechanized volume production, the more productive utilization of equipment, and the quicker turnover of capital. Together with these advantages, the system I have devised also permits a substantial amount of variation in the building structures constructed.

The present patent application is directed to one aspect of this system, namely to a method of producing concrete panel assemblies. Filed concurrently with the present application are the two following additional patent applications directed to other aspects of the system;

namely, application No. 604,941 and application No. 604,991.

While the novel features of the present patent application are particularly useful with the others in my new system, it will be appreciated that they could also advantageously be used in other systems.

Briefly, according to the invention, there is provided a method of producing concrete panel assemblies, particularly in the production of prefabricated concrete building structures, characterized in the steps of casting the concrete panels with mating surfaces for joining each with another and with a threaded nut embedded in at least one panel and accessible through an opening in a mating surface thereof; grinding down said mating surfaces to convert them to smooth, flat surfaces adapted to extend substantially parallel to each other when two panels are joined together; applying a sealing strip along the longitudinal edge on each side of the mating surface of a panel; assembling the latter panel with another by passing a threaded bolt through said nut of the one panel and in engagement with the other panel with the mating surfaces of the two panels slightly spaced from each other by said sealing strips; and introducing a settable bonding agent into the space between said mating surfaces.

As far as I am aware, this is the first time it has been proposed to grind down the mating surfaces of concrete panels before joining them together. This feature, together with the other features of my overall system, permits the concrete panels to be manufactured in substantially finished condition at the factory, and then erected at the erection site in a very simple and efficient manner with very little additional labor required.

According to another novel aspect of the present invention, a plurality of concrete panel assemblies to be joined are first assembled so that the spaces between the mating surfaces interconnect, the settable bonding agent being applied under sufficient pressure to reach and fill the spaces in all or a plurality of the assemblies. For example, all the concrete panels for one or two apartments may be applied under sufficient pressure, for example 2 or 3 atmospheres, so as to reach and fill the spaces in the panels of the one or the two apartments. A plurality of application points may be provided if needed for the one or two apartments. It is thus seen that the bonding agent (e.g., concrete grout) is applied after the panels are assembled, and not before, as the common practice. This arrangement decreases the time of assembly and also decreases the chances of damaging the finish of the panels being assembled.

According to a further feature, the bolt is threaded at one end into the nut and has an enlarged head at its opposite end, the panel receiving the head of the bolt being formed with a recess to accommodate the enlarged head. In another form, the head of the bolt is conically shaped, and the panel receiving the head of the bolt is formed with a conically shaped recess. These bolts thus also serve as centering or registering pins for automatically registering the panels being assembled (e.g. wall panels), without the need to measure and mark the locations.

Further features and advantages of the invention will be apparent from the description below.

The invention is herein described with reference to the accompanying drawings which illustrate, by way of example only, several preferred embodiments of the invention. In the drawings:

FIG. 1 is a partial sectional view of one form of concrete panel assembly produced in accordance with the invention;

FIG. 2 is a sectional view of a plate used in the mould for making the panel of FIG. 1;

FIG. 3 is a view similar to FIG. 2 of a variation;

FIG. 4 is a partial sectional view of another form of concrete panel assembly produced in accordance with the invention;

FIG. 5 is a partial plan view of the assembly of FIG. 4; and

FIG. 6 is a partial sectional view of still a further form of concrete panel assembly produced in accordance with the invention.

With reference first to FIG. 1, there is shown an assembly of two concrete panels, such as may be used for joining two floor panels of a building.

Each of the floor panels 2 and 4 is to be joined at its mating surfaces 6 and 8, respectively. These panels are preferably produced in accordance with the method and apparatus described in my above-referenced patent application No. 604,941. Each is formed with a longitudinally extending groove, 10, and 12, at the mating surfaces, this groove being produced by utilizing a plate, such as shown in FIG. 2, as the bottom plate or top plate of the mould, as the case may be. The panels are preferably produced in a vertical mould as described in my above-referenced patent application No. 604,941. The plate 11 constitutes the bottom or the top plate of the mould and is formed with a substantially semi-cylindrical rib 13 centrally thereof, so as to produce the grooves 10 and 12 in the cast concrete panels.

If desired, instead of one centrally formed rib 13 there may be two (or more) ribs, such as shown at 13' on plate 11' in FIG. 3.

The mating surfaces of the two panels 2 and 4, so formed, are then ground down to convert them to smooth flat surfaces adapted to extend substantially parallel to each other when the panels are joined. In joining these surfaces, seals 14 and 16, preferably of rubber or plastic strips, are applied along the longitudinal edges of the mating surfaces of panels 2 and 4 and space these surfaces from each other. As an example, the seals could be of 5-10 mm. in thickness, spacing the mating surfaces 6 and 8 from each other a corresponding amount. Means are applied for holding the panels under pressure against the seals, such as by the use of hydraulic jacks or by special clamps, and then the settable bonding agent, in the form of a fine concrete grout 18, is applied under pressure to fill the space between the surfaces, the seals preventing the grout from flowing out of the joint.

FIG. 4 illustrates an assembly of three concrete panels, such as may be used for joining a floor panel 20 to a pair of wall panels 22 and 24. Panel 20 is formed with a longitudinally extending groove 26. The end face on one side of the groove 26 mates with a front face of panel 22, and the end face on the opposite side of the groove 26 mates with a front face of panel 24. Each of these mating surfaces is formed with a longitudinally extending groove, as shown at 20' and 22' and 24', respectively. These mating surfaces are all ground down, as described, to convert them to smooth flat surfaces extending substantially parallel to each other when the panels are joined.

The assembly of FIG. 4 utilizes, in addition to the concrete grout 26 applied to the joint as described above, a pair of securing members in the form of a nut 28 carried by panel 20 and a bolt 30 passing between the meeting end faces of panels 22 and 24. For this purpose, each of the mating end faces of these panels is formed with a semi-circular groove 32 and 34 (FIG. 4) extending transversely of the panel from one side to the other, the groove being of increased diameter, as shown at 32' and 34', at the side of its respective panel opposite to panel 20. The nut 28 is embedded within panel 20 at the time the latter is cast. It is shown as carried by a member 40 to which it is welded, but preferably it is a part of the reinforcing wire assembly used in producing concrete panels in accordance with my above-referenced patent application No. 604,991. While one nut 28 is

shown in FIG. 4, actually there would be a plurality of them, e.g. six) in each panel 20, each nut adapted to receive a bolt 30 for joining panel 20 with panels 22 and 24.

In making the assembly, and assuming that the mating surfaces have first been ground down as described above, rubber seals 36 and 38 are applied to the mating surfaces. Bolts 30 are then applied to the nuts 28, with the shank of the bolt slightly spaced from the surfaces of circular grooves 32 and 34 and the head of the bolt slightly spaced from the enlarged grooves 32' and 34'. The concrete grout is then applied under pressure to fill all these spaces. A temporary plate 42 is used to cover the recesses 32' and 34' to prevent the exit of the concrete grout, plate 32 being removed after the grout has set.

FIG. 6 illustrates a four-panel assembly, which may be used in joining a pair of wall panels 50 and 52 to a pair of floor panels 54 and 56. In this case, panel 50 carries the nuts 58 corresponding to nuts 28 in FIG. 4. The fourth panel 52 obviates the need for the temporary cover plate 42 in FIG. 4. The mating surfaces are all formed with longitudinal grooves, shown as 50', 52', 54' and 56'. The head of the bolt 64 is conically shaped, as shown at 66, and panel 52 is formed with a conically-shaped recess 68 to accommodate it with some space between the two. The bolts also serve as registering pin for registering the panels, as described earlier.

In making this assembly, all of the mating surfaces are first ground down at the factory. At the erection site, the rubber seals 70 and 72 are applied between panel 50 and panels 54 and 56, and rubber seals 74 and 76 are applied between the latter panels and panel 52. The bolts 64 are threaded into the nuts 58 (e.g. six per panel side), and the concrete grout is then applied under pressure to fill all the spaces blocked-out by seals 70, 72, 74 and 76.

It will be appreciated that substantially the same arrangement as illustrated in FIG. 6 could be used for a three-panel assembly where a single apertured panel is used in place of the two panels 54 and 56.

The foregoing assemblies merely illustrate several examples of various types that could be produced in accordance with the invention. As each building structure would involve a number of concrete panels, each would utilize a number of such assemblies, according to the individual design requirements of the building.

In producing a plurality of the panel assemblies, for example in erecting a complete apartment, the assemblies, are arranged and assembled (by the nuts and bolts illustrated, or by hydraulic jacks where none are included), so that the spaces between the mating surfaces to be subsequently filled with the concrete grout all interconnect. The concrete grout is then applied under pressure, for example 2 or 3 atmospheres, so that it reaches and fills all the spaces in all the assemblies. A plurality of application points for each apartment or group of apartments may be provided if necessary.

It is thus seen that the concrete grout is applied after the panels are assembled, not before or during, as in other methods. The concrete panels can therefore be erected in an extremely efficient and quick manner with the expenditure of very little labour at the erection site and with little danger of damaging the finish of the panels.

I claim:

1. A method of producing concrete panel assemblies, particularly in the production of prefabricated concrete building structures, comprising: casting the concrete panels with mating surfaces for joining each with another and with a threaded nut embedded in at least one panel and accessible through an opening in a mating surface thereof; grinding down said mating surfaces to convert them to smooth, flat surfaces adapted to extend substantially parallel to each other when two panels are

joined together; applying a sealing strip along the longitudinal edge on each side of the mating surface of a panel; assembling the latter panel with another by passing a threaded bolt through said nut of the one panel and in engagement with the other panel with the mating surfaces of the two panels slightly spaced from each other by said sealing strips; and introducing a settable bonding agent into the space between said mating surfaces.

2. A method as defined in claim 1, wherein a plurality of concrete panel assemblies to be joined are first assembled so that the spaces between the mating surfaces interconnect, the settable bonding agent being applied under sufficient pressure to reach and fill the said spaces in all the assemblies.

3. A method as defined in claim 1, wherein said settable bonding agent is concrete grout.

4. A method as defined in claim 1, where the mating surfaces of at least one of the concrete panels being joined is formed with at least one longitudinally extending groove which is filled with the settable bonding agents.

5. A method as defined in claim 1, wherein said bolt has an enlarged head, the other panel receiving the head of the bolt and being formed with a recess to accommodate said enlarged head.

6. A method as defined in claim 5, wherein the head of the bolt is conically shaped and the panel receiving the head of the bolt is formed with a conically-shaped recess.

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