METHOD AND APPARATUS FOR USING FOAM PANELS AS FORMS FOR MAKING CONCRETE WALLS

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ABSTRACT
A foam panel concrete form is provided for using concrete reinforcement rods which extend on each side of a joint in the foam panel concrete form and into complementary shaped openings in ties which hold two adjacent panels in a spaced and parallel relationship. The concrete reinforcement rod can pass into the openings in adjacent ties with little resistance in a first rotary position of the concrete reinforcement rod. When the concrete reinforcement rod is rotated to a second rotational position within the openings the reinforcement rod is in a tight frictional fit in the openings for helping to hold adjacent ties and the adjacent foam panels in a fixed relationship with respect to each other during a time when concrete is poured between the foam panels, thereby also serving to re-enforce the concrete after the concrete has cured.
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CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Divisional of U.S. Ser. No. 11/774,707, filed Jul. 9, 2007, entitled IMPROVED METHOD AND APPARATUS FOR USING FOAM PANELS AS FORMS FOR MAKING CONCRETE WALLS, and is incorporated by reference herein in its entirety.

FIELD OF TECHNOLOGY

[0002] The present invention relates generally to ties for concrete wall forming systems of a type using foam panels; and more particularly to a special tie utilized to secure adjacent panel sections together.

BACKGROUND

[0003] While wall forming systems have been in use for many years, the last two decades has seen considerable development in this industry in the use of expanded polystyrene panels as forms for poured concrete walls. After the concrete has hardened, the panels may be left in place on the walls to serve as permanent insulation, or they may be stripped off to reveal the exposed concrete.

[0004] Upon introduction of this new wall forming system, it was found that it was unnecessary to use small “building blocks” to create the form panels to build a form system for receiving poured concrete. Rather, larger and larger panels are now being utilized to create the concrete forms. Developments in this field include U.S. Pat. Nos. 4,765,109 and 4,916,879 to Boeschart, which show how to make right angle corners and “T” intersections, which patents are incorporated herein by reference in their entirety.

[0005] Adjacent sections of foam panels have pre-formed mating tongue and groove connections that hold them together on the main portions of the foam panel sections. But sometimes these tongue and groove portions need to be trimmed off to make a foam panel form that is shorter than the length of a standard foam panel length. When this occurs it is necessary to find another way to hold adjacent foam panels together during the time that the concrete is being poured and cured. Solving this problem in the industry has been difficult and labor intensive, with many proposed solutions being not sufficiently reliable. Accordingly there remains a need for solving this difficult problem.

SUMMARY

[0006] The present invention relates to a foam panel concrete form using concrete reinforcement rods which extend on each side of a joint in the foam panel concrete form and into complementary shaped openings in ties which hold two adjacent panels in a spaced and parallel relationship. The concrete reinforcement rod can slide into the openings in adjacent ties with little resistance in a first rotary position of the concrete reinforcement rod. When the concrete reinforcement rod is rotated to a second rotational position within the openings, the reinforcement rod is in a tight frictional fit in the openings for helping to hold adjacent ties and the adjacent foam panels in a fixed relationship with respect to each other during a time when concrete is poured between the foam panels, thereby also serving to re-enforce the concrete after the concrete has cured.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a perspective view of a preferred embodiment of the present invention providing a concrete form constructed of foam panels;

[0008] FIG. 2 is a perspective view of the preferred embodiment of FIG. 1 of the present invention showing ties formed in the foam panels to hold adjacent foam panels in a spaced parallel relationship and concrete reinforcement rods placed on and in the ties to hold the form sections together and to reinforce the concrete after it has cured, with some reinforcement rods being shown in dashed lines to indicate where they can be placed;

[0009] FIG. 3 is a top view of the structure shown in FIG. 2;

[0010] FIG. 4 is a side view of that portion of a tie in FIG. 3 that is exposed between the two foam panels;

[0011] FIG. 5 is a side elevational view of the foam panel structure shown in FIG. 4, but showing the foam panels in dashed lines and the ties in solid lines;

[0012] FIG. 6 is a side elevational view of one of the corner tie structures shown in the lower right portion of FIG. 7;

[0013] FIG. 7 is a top plan view of one of the corner structures of the present invention;

[0014] FIG. 8 is a side elevational view of one of the sections of a tie used in the lower left and upper right portion of FIG. 7;

[0015] FIG. 9 is a perspective view showing how a fastener is used to connect the structure of FIG. 8 to the structure of FIGS. 10 and 11;

[0016] FIG. 10 is a side elevational view of one of the sections of a tie used in the lower left and upper right portion of FIG. 7;

[0017] FIG. 11 is a side elevational view of one of the sections of a tie used in the lower left and upper right portion of FIG. 7, this section just being longer than the one shown in FIG. 10, but otherwise identical;

[0018] FIG. 12 is a perspective view of the preferred embodiment of FIG. 1 of the present invention showing ties formed in the foam panels to hold adjacent foam panels in a spaced parallel relationship and concrete reinforcement rods placed on and one tie only being illustrated to hold the form sections together and to reinforce the concrete after it has cured, it being understood that other reinforcement rods would be placed in the other aligned holes shown that are of a similar shape;

[0019] FIG. 13 is a perspective view showing how a reinforcement rod is in position to be inserted into an opening in one of the ties;

[0020] FIG. 14 is a perspective view like FIG. 13 but showing how a reinforcement rod has been inserted into an opening in one of the ties in the direction of an arrow;

[0021] FIG. 15 is a perspective view like FIG. 14 but showing how a reinforcement rod has been rotated in the direction of an arrow in the opening in one of the ties to frictionally lock the reinforcement rod against the sliding movement along the line of the arrow in FIG. 14;

[0022] FIG. 16 is a perspective view of adjoining foam panels showing the tongue and groove relationship used to lock adjacent panels together by moving them relatively up or down as shown by the arrow in FIG. 16;
FIG. 17 is a perspective view of abutting foam panel forms wherein the tongue and groove portions are not present, for example because one of the forms needs to be shorter than a standard length of form, and also showing the use of a glue gun to seal the abutting edges together as well as reinforcement rods which are installed after the abutting edges are glued together.

FIG. 18 is a top view of a T-joint of the present invention where one concrete wall to be formed will join with another concrete wall.

FIG. 19 is a perspective view of a top portion of the structure of FIG. 18.

FIG. 20 is a top view of a corner section of the present invention where one concrete wall to be formed will join with another concrete wall.

FIG. 21 is a perspective view of the corner section of FIG. 20, portions of which are also shown in FIGS. 6-11.

FIG. 22 is a perspective view showing how the ties can be held together for shipping purposes in a very compact fashion.

FIG. 23 is a perspective view of a foam panel concrete form which has been pre-assembled and showing in dashed lines places where “jack-o-lantern” type holes can be cut the foam wall to insert reinforcement rods there through; and

FIG. 24 is a perspective view of a foam panel showing “jack-o-lantern lid” shaped holes being cut in the foam wall to insert reinforcement rods there through; and

FIG. 25 is a perspective view of a foam panel showing how a piece of “jack-o-lantern lid” shaped piece of foam is reinserted in the one of the holes after the insert reinforcement rods have been installed, and showing how the a piece of “jack-o-lantern lid” shaped piece of foam is pinned with nails or the like to hold it in place while concrete is being poured into the form.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings wherein like reference numerals designate identical or corresponding parts throughout the several views, FIG. 1 shows a perspective view of a preferred embodiment 10 of the present invention. Foam panels 22 have a tongue portion 22r on one edge and a groove portion 22g on the other edge thereof for mating with one another. The top of each panel 22 has a projection portion 22p. FIG. 2 shows the bottom of the structure of FIG. 1 and shows recessed portion 22r of panels 22 and FIG. 16 shows how the tongue portion 22r fits into the groove portion 22g of adjacent panels 22.

FIG. 5 is an end view, for example, from the front of FIG. 2, but showing the foam panels 22 in dashed lines and ties 11 in solid lines. These ties 11 are made of a solid plastic material which are preferably made of the same material as the ties in the two patents referred to above which are incorporated herein by reference. Each side of the tie 11 has a portion 12 which is molded inside of the panel 22, but of course could be the type that slides down into a groove in panels 22 if desired. Portions 13 have an opening 16 thereof which can be seen in greater detail in FIGS. 13-15, which will be discussed later. A portion 14 of the tie 11 extends between the portions 13 and has a plurality of extension tabs 14r thereof to allow an ultimate user to put a reinforcement rod 21 between adjacent tabs 14r, for example as shown in the rightmost reinforcement rod 21 shown in solid lines in FIG. 2. This allows the concrete to be formed between the foam walls 22 and when it cures the reinforcement rod 21 will be in a proper position to hold the concrete even if it cracks.

Hinge portions 19 allow the concrete forms to pivot to a position wherein the portions 14 and 13 of the tie will be more or less parallel to the interior walls of the foam panels 22. When the form is desired to be used on the job site, it can be folded out to the position shown in FIGS. 2, 3 and 12, for example.

Referring now to FIG. 7, it is noted that a corner portion is shown. In this top view, portions 112 of the corner structure are virtually identical to the portions 12 of the ties 11 of FIG. 5. Essentially, the center section 114, including tabs 114r, have been cut off to make the structure shown in FIGS. 6 and 7. Additionally, a fastener 121 is used and is shown in detail in FIG. 9. This fastener 121 has tabs 121r and 121l thereon which fit into the opening 116 and through the top part 116t of opening 116 and through the bottom part 116b of opening 116. Once the portion 112a, 121b and 121c extend through portions 113, then the handle portion 121h of the fastener 121 is turned so that the tabs 121b and 121r are not aligned with the portion of the opening 116b and 116t so that the parts 113 together as shown in FIG. 7. FIG. 6 also shows the structure at the lower right portion of FIG. 7 before it has been bent into the position shown in FIG. 7.

The other braced portion in the corner of FIG. 7 uses portions 112, 113, hinge 119, etc., similar to that shown in FIGS. 8 and 9, but instead of locking the portions 113 together, a “bow tie” shaped portion 211 is used as shown in FIGS. 10 and 7. This bow tie 211 has openings 216 therein with a top portion 216a and a bottom portion 216b so that the fastener 121 shown in FIG. 9 can be used in the same way to first extend it through opening 116 of the tabs 113 and also through the openings 216 in bow tie 211 to secure the bow tie 211 in place as shown in FIG. 7. FIG. 11 merely shows a longer bow tie 311 with end sections 313 and openings 316.

Referring now to FIGS. 2 and 12 which show the top and bottom, respectively, of a form comprised of two foam panels 22 being held in spaced relationship by a plurality of ties 11 which are formed therein and extend between the two forms 22, it is important to note that sometimes these forms 10 need to be trimmed to be shorter than the standard length because the concrete wall needs to be shorter than a multiple of the length of such standard forms 10. When this occurs, the tongue portion 22t and groove portion 22g, for example as shown in FIGS. 12 and 16, are trimmed off so that they are like shown in FIG. 17. A glue gun with hot glue is applied to these planar edges as shown in FIG. 17 and the adjacent flat edges of foam panels 22 are glued together as indicated by the arrow shown in FIG. 17. Once that has been done, there needs to be something more than merely glue to hold this joint when concrete is introduced. Simply stated, the glue is not always sufficient to prevent the joint from coming apart when the heavy concrete and the pressure exerted on the walls 22 occurs due to the pouring of the concrete. Consequently, once the adhesive or glued joint is formed, then the reinforcement rod 21 is inserted in the step-by-step fashion shown in FIGS. 13-15.

Looking at FIG. 13 for example, the reinforcement rod 21 in the orientation shown, can be slid through the opening 16 in the direction of the arrow. It is noted that when this is done, the top portion 21r of the reinforcement rod 21 extends through the top portion 16t of the opening 16 in portion 13 of the tie 11. Similarly, the lower portion 21o of the
reinforcement rod 21 extends through the lower portion 16b of the opening 16. It will be appreciated that the rod can easily pass into and through the opening 16 in this fashion as shown sequentially from FIG. 13 to FIG. 14 in the direction of the arrow. After the reinforcement rod 21 has been passed through all of the openings at the joint shown in FIG. 17 with the joint glued together, then the reinforcement rod 21 is rotated 90 degrees as shown in FIG. 15. This would typically be done by grasping the reinforcement rod 21 with pliers or a vice grip type of tool because there is a considerable amount of friction involved in rotating the tie 21. Once the tie 21 is so rotated to the position shown in FIG. 15, this will hold the joint 17 together where it has been glued. In fact, it may not be necessary to apply the adhesive between the joint. For each of the openings 16 in the ties, for example as shown in FIGS. 2, 12 and 17, a tie 21 will be inserted in the manner shown sequentially in FIGS. 13-15. While it may not be necessary that every one of these openings 16 has a tie 21 therein, the more ties that are installed, the stronger the joint will be.

[0039] Referring now to FIGS. 18 and 19, a form is shown in a configuration to pour one wall which is perpendicular to and joined with another wall. A bracing structure comprised of inner-connected elements 401, 402, 403, 404, 405, 406, 407, 408, 409, 410 and 411 hold one course or level of foam concrete foam walls 22 together so that additional courses of such elements can be placed above those that are shown in FIGS. 18 and 19 to form a taller concrete form. Of course this can be done as many times as necessary to form a concrete form as tall as desired.

[0040] More importantly to the invention at hand, it is noted that the ties 11 are in place so that a reinforcement rod 21 can be utilized to further hold the joint of the form together by extending the tie 21 through openings 16 sequentially as shown in FIGS. 13-15. It is also noted that FIGS. 18 and 19 show an additional tie 14 which extends between two adjacent tabs 14r and 90 degrees to the reinforcement rod 21 which has previously been installed as noted above. This additional reinforcement rod 21 will further hold the concrete joint together after the concrete has cured. More reinforcement rods 21 can be used between the tabs 14r, and of course, none of these reinforcement rods actually need to be bent down on the end like the ones shown in FIG. 19.

[0041] Referring now to FIGS. 20 and 21, it is noted that a corner section like FIG. 7 is shown with a structure 600 thereon which is similar to the devices shown in U.S. Pat. Nos. 2,765,109 and 4,916,879 to Boeshart, which show how to make right angle corners and which patents are incorporated herein by reference in their entirety. Portions 601 and 602 slip over the extreme outside of the corner and are connected together by braces 603, 604 and 605. Brace 603 extends to member 606 and 607 via members 608 and 609.

[0042] Member 610 is attached at one end to member 603 and at the other end to member 611. Member 612 connects members 610 and 613 together. Similarly, member 620 is attached at one end to member 603 and at the other end to member 621. Member 622 connects members 620 and 623 together.

[0043] Member 630 is attached at one end to member 631 and at the other end to member 635. Member 632 connects members 631 and 633 together. And on the other side, similarly, Member 630 is attached at one end to member 631 and at the other end to member 645. Member 642 connects members 641 and 643 together. Member 646 connects member 641 to member 603 and member 647 connects member 631 to member 603. This structure 600 allows for one course of foam panels 22 to be held in place at a corner and further allows an additional course to be added to the top of the structure 600 shown in FIGS. 20 and 21, and held in place by overlapping members 601, 602, 606, 607, 612, 613, 621, 623, 631, 633, 641 and 643.

[0044] Referring now to FIG. 22, it is noted that a wooden dowel 421 can be utilized to extend through a plurality of ties 11 for the purpose of holding them together for shipping purposes. This dowel 421 is essentially the same or slightly less of a diameter as the opening 16. A hard rubber locking block 450 is frictionally held on the end of the dowel 421 for holding the end of the dowel 421. A hole in the rubber locking block 450 has a diameter than is slightly smaller than the diameter of the dowel, so that rubber locking block 450 can be pushed onto the end of the dowel 421 in the FIG. 22 configuration to hold all of the ties 11 together for shipping purposes.

[0045] Referring now to FIGS. 23-25, it is noted that forms 500 and 501 are essentially identical except that it is necessary, due to the specifications of the wall that the form 501 be shorter in length than the form 500. When this is necessary, it needs to be trimmed off, for example as shown in FIG. 17 on the abutting edges at the joint 502. In FIG. 17, as the courses are added one on top of another, it is very easy to reach over the top and insert the reinforcement rods 21 into the openings 16 sequentially as shown in FIGS. 13-15. When the concrete form made of foam 500 and 501 are already formed having several courses high, then it becomes necessary to insert the reinforcement rod 21 in a different fashion. One such desired way to insert these rods is to cut an opening 503 as shown in dashed lines in FIG. 23. This is done in the manner shown in FIG. 24 and it is cut with a saw 504, for example in the manner that someone would cut a top out of a pumpkin when making a jack-o’-lantern so that the inside of the opening 503 is larger than the portion of the opening 503 outside. By cutting the opening in this fashion, the plug 505 will be wedged back into the opening 503 when the concrete is poured and this will prevent it from popping out of the opening 503 if the hole 503 had straight walls instead of tapered walls.

[0046] Once the opening 503 has been cut and the plug 505 pushed inside the wall, a person would reach through the opening 503 and insert a concrete reinforcement rod 21 through the openings 16 in the exact same manner as shown sequentially in FIGS. 13-15. It can be seen that this can be done at different levels as shown in FIG. 23. After the concrete reinforcement rod 21 has been installed, then the plug 505 is pulled back and reinserted into the opening 503 and nails 506 are used to hold the plug 505 in place. Of course when the concrete is poured between the walls of forms 500 and 501, the force of the poured plastic or liquid concrete pushes outwardly on the foam walls of the forms 500 and 501. The plug 505 will be wedged against the inside of the opening 503 and will remain in place in the position shown in FIG. 25.

[0047] Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.
a first opening disposed in the first tie whereby the dowel is adapted to pass into the first opening with little resistance;
a second tie having one portion thereof adapted to be disposed in a third foam panel and a second portion thereof adapted to be disposed in a fourth foam panel;
a second opening disposed in the second tie whereby the dowel is adapted to pass into the second opening with little resistance;
a first resilient block having an opening therein which is of a second diameter which is smaller than the first diameter of the dowel whereby the dowel can be disposed in tight frictional contact within the opening in the first resilient block to hold the first resilient block attached to one end of the dowel;
a second resilient block having an opening therein which is of the second diameter which is smaller than the first diameter of the dowel whereby another end of the dowel can be disposed in tight frictional contact within the opening in the second resilient block to hold the second resilient block attached to the other end of the dowel; and whereby the first and second ties are disposed between the first and second resilient blocks for shipping purposes.

18. The method of claim 17 wherein the first and second resilient blocks are comprised of rubber.

19-20. (canceled)