Sept. 12, 1944. R. R. COLBURN 2,358,147

CONCRETE STRUCTURE

Filed Nov. 6, 1942

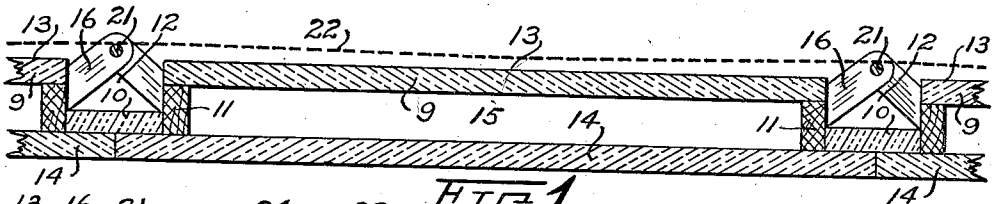


FIG. 1.

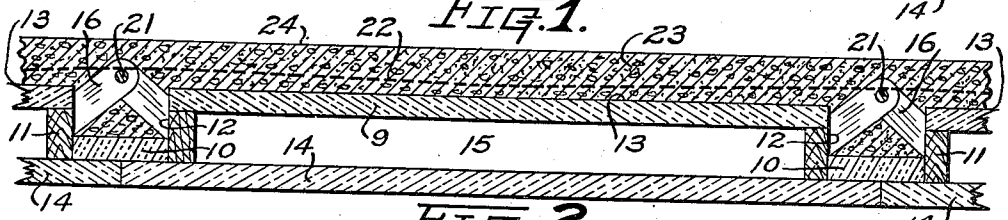


FIG. 2.

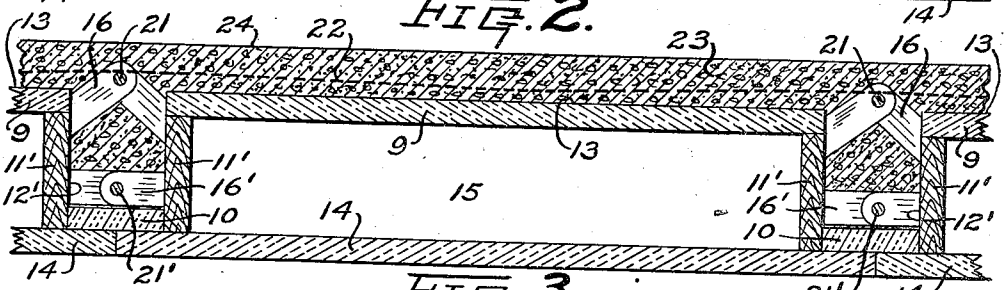


FIG. 3.

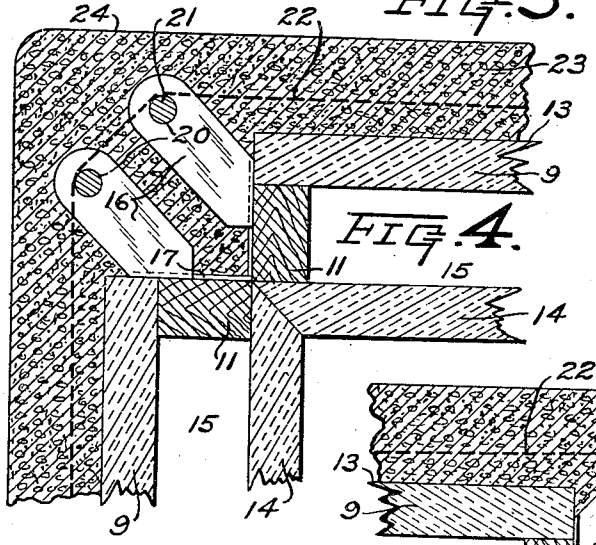


FIG. 4.

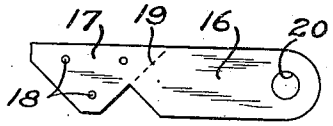


FIG. 6.

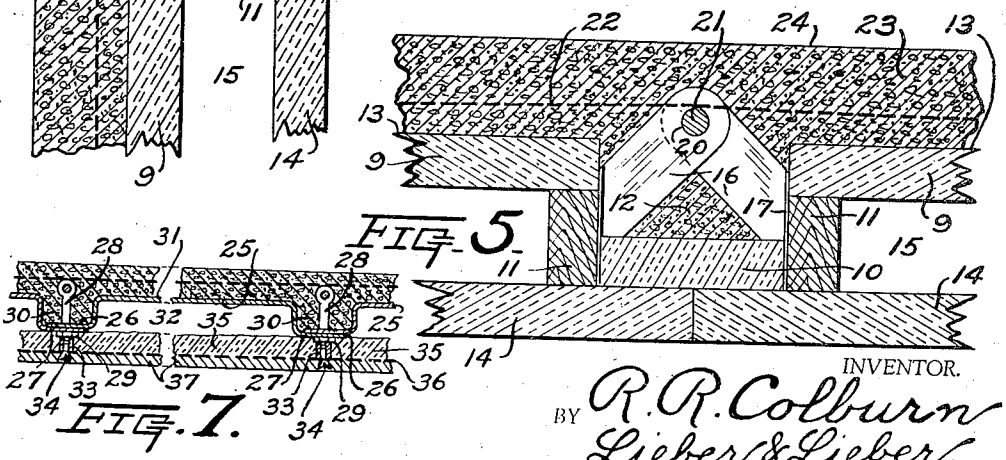


FIG. 5.

FIG. 7.

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CONCRETE STRUCTURE

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4 Claims. (Cl. 72—16)

My invention relates generally to improvement in the art of building, and relates more specifically to improvements in concrete structures and to an improved method of producing such structures.

Generally defined, an object of the present invention is to provide a new and useful re-enforced structure, and an improved method of producing the same.

It has heretofore been common and universal practice in the art of concrete construction, to utilize either of two standard methods of producing re-enforced concrete walls. In accordance with one of these prior construction methods, sections of the wall were prefabricated either in block or slab form suitably reenforced, and the sections were subsequently assembled and united in various ways to produce the final wall. This sectional method of construction, while resulting in the production of a wall having relatively uniform texture and strength, also introduced numerous joints between the sections which were subject to subsequent cracking and necessitated considerable repair; and in order to obtain the requisite strength in such sectional walls, it was also necessary to make the blocks and slabs rather heavy and bulky. The final construction of these pre-fabricated sectional walls also involved considerable skilled labor and other expense, thereby making the cost of these prior wall assemblages prohibitive for many purposes. In accordance with the other of these prior construction methods, preliminary wooden or metal forms were erected, reenforcing elements were properly positioned between the forms, and bulk concrete was finally poured into the forms around the re-enforcement and permitted to set, whereupon the casting forms were removed. This method besides being laborious and costly, frequently resulted in the production of walls which were not of uniform texture throughout large areas, and the external surfaces were usually rough and required considerable ultimate finishing by coating or otherwise in order to provide smooth and presentable final surfaces. The casting or pouring method furthermore required the use of relatively skilled labor, and the enclosing forms did not permit inspection of the work until after the walls were finished and the forms had been removed. Both of these prior methods of wall construction therefore possess many disadvantages and objections, and cannot be utilized for numerous purposes because of the expense involved and also due to the bulk and extreme weight of the final structures.

It is therefore a more specific object of my present invention to provide an improved monolithic re-enforced concrete wall structure, which is relatively light but extremely durable in construction, and which is also homogeneous in texture throughout its entire area.

Another specific object of the present invention is to provide a simplified and exceedingly strong building wall or floor assemblage which can be formed primarily of suitably re-enforced concrete, without necessity of utilizing either precast blocks or slabs, or complicated and costly pouring forms.

A further specific object of my invention is to provide a properly insulated and re-enforced concrete wall which is adapted to be utilized in conjunction with standard window and door assemblages in order to construct attractive and moderately priced buildings.

Still another specific object of the invention is to provide improved supporting and re-enforcing means for concrete wall, ceiling and floor structures, which can be quickly and conveniently applied, and which will subsequently become an integral part of and prevent undesirable cracking or other deterioration of the assemblages.

Another specific object of the present invention is to provide a simplified and effective method of producing re-enforced concrete structures without objectionable joints, and with the aid of relatively simple forms which finally constitute an integral part of the completed assemblies.

A further specific object of my invention is to provide an improved method of manufacturing monolithic re-enforced concrete buildings in an expeditious manner, with least waste of material, and at minimum cost.

Still another specific object of the invention is to provide a new and highly efficient method of constructing durable jointless one-piece re-enforced concrete walls with simplified equipment, and in a manner which will permit unobstructed inspection of all portions of the work at all times.

These and other specific objects and advantages of my invention will be apparent from the following detailed description.

A clear conception of the various features constituting my present improvement, and of the method of producing walls of several types embodying the invention, may be had by referring

to the drawing accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the several views.

Fig. 1 is a somewhat diagrammatic and fragmentary transverse horizontal section through a typical form and re-enforcement assemblage, of a typical wall built in accordance with my improved method, before the concrete has been applied;

Fig. 2 is a similar sectional view of the same wall structure, but with the concrete finally applied;

Fig. 3 is a similarly diagrammatic and fragmentary transverse vertical section through a typical floor or ceiling structure utilizing forms and reenforcements similar to that of the wall of Figs. 1 and 2;

Fig. 4 is an enlarged transverse horizontal section through a typical corner at the junction of two outer walls such as shown in Fig. 2;

Fig. 5 is a similarly enlarged transverse horizontal section through one of the columns or studs forming part of the improved wall of Fig. 2;

Fig. 6 is a likewise enlarged plan view of one of the re-enforcing rod supporting cleats used in the embodiment of the invention shown in Figs. 1 to 5 inclusive; and

Fig. 7 is a somewhat diagrammatic and fragmentary transverse horizontal section through a modified type of my improved wall structure.

While the invention has been shown and described herein as being advantageously applicable to several types of outside wall assemblages and to only one form of floor or ceiling construction, it is not my desire or intention to thereby unnecessarily restrict the scope or utility of the improvement.

The present invention however does have special utility when applied to the construction of monolithic re-enforced concrete walls, and in accordance with the improved method, I first erect a single form having relatively extensive flat surfaces lying in a common plane and separated by parallel upright grooves. Thereafter I temporarily but firmly position at least one upright re-enforcing bar or rod parallel and adjacent to each groove but spaced from the form structure. I then attach a plane layer of foraminous re-enforcing material to the upright rods in spaced relation to the flat surfaces of the form sections and approximately parallel to the common plane thereof so that uninterrupted and plane portions of the foraminous layers span each groove. The monolithic wall is subsequently finally completed and finished by impacting concrete mixture at high velocity laterally against the flat form surfaces and within the grooves to an extent sufficient to completely embed the rods and the foraminous material within the layer of concrete.

Referring specifically to Figs. 1, 2, 4, 5 and 6 of the drawing, the type of initial backing form shown therein, may be produced primarily from sheets of insulation board or the like of standard twenty-four inch width. Each of the outer sheets **9** may have a three-inch strip **10** removed from one vertical edge thereof, and the sheets **9** and strips **10** may thereafter be secured to wooden spacer strips or bars **11** as shown in Figs. 1 and 2 to form upright parallel recesses or grooves **12** separating the outer flat surfaces **13** of the successive sheets **9** which lie in a common plane. Each of the inner sheets **14** may be maintained at full twenty-four inch width, and these sheets **14** may be secured to the wood bars **11** so as to provide sealed air spaces or chambers **15** between the sheets **9**, **14** and the successive stud or column forming grooves **12**. A durable and rigid backing form having twenty-four inch centers between stud grooves **12** is thus provided.

The next step of my improved method is the attachment of the re-enforcing elements to the form assemblage just described, and this may be readily accomplished with the aid of cleats **16** such as shown in Fig. 6. These cleats **16** may be formed of sheet metal, and each cleat has a triangular portion **17** provided with nail holes **18** and adapted to be bent at right angles to the cleat along a score line **19**, and is also provided with a re-enforcing rod receiving opening **20**. The cleats **16** may be nailed to the wood bars **11** in the manner shown in Figs. 4 and 5, with the openings **20** of the successive superimposed cleats in vertical alinement. Upright re-enforcing bars or rods **21** may then be inserted in the alined openings **20**, and these rods **21** will be firmly positioned parallel and adjacent to the grooves **12** but out of direct contact with the form. Foraminous re-enforcing material **22** such as welded wire mesh, in continuous sheet form, may thereafter be attached as by wiring, to the successive parallel rods **21** and also to the cleats **16** if desired, whereupon the re-enforcing assemblage is completed. Care should be taken to have the portions of the sheet material **22** which spans the open sides of the grooves **12** in substantially flat condition and devoid of kinks or indentations.

When the form and re-enforcement assemblage has been thus completed as illustrated in Fig. 1, it is ready for the concrete, and the final concrete layer **23** may be impacted against the outer flat surfaces **13** and within the recesses or grooves **12**, preferably with the aid of compressed air which delivers the fluent concrete mixture in the form of a spray from a portable gun at high velocity. The use of such a spray gun permits the concrete to be quickly and uniformly applied throughout the entire re-enforced and exposed area, and the use of compressed air as a conveying medium for the concrete aggregate is also advantageous since the cooling effect resulting from the expansion of the suddenly liberated compressed air enhances the drying and setting of the concrete. By virtue of the fact that the concrete receiving form is entirely open and free from obstruction on the side to which the re-enforcing rods **21** and foraminous material **22** are applied, the progress of the work and the condition of the concrete layer **23** are constantly visible for inspection, and the operator is thus able to produce a smooth and finished outer surface **24** on the concrete portion of the wall. After the concrete layer **23** has been applied, the exposed surfaces of the inner sheets **14** may be coated with a layer of plastic, paint, or other surfacing material thereby completing the wall assemblage and producing a simple, compact and durable monolithic re-enforced concrete wall the strength of which is greatly enhanced by the successive studs or columns and which will not crack at the zones of these columns due to the plane and uninterrupted disposition of the foraminous sheet material **22** across the grooves **12**.

This method of re-enforced wall construction may also be advantageously applied to floors and ceilings of a building, as well as to outer and

inner walls, as shown in Fig. 3. Since the walls are vertically disposed, whereas the floors and ceilings are disposed horizontally, it may be desirable to additionally re-enforce the latter by making the horizontal parallel beams or joists heavier and by applying additional re-enforcement therein. As illustrated in Fig. 3, the depth of the grooves 12' is increased by using wider spacer strips or bars 11', and modified cleats 16' are applied within each of the grooves 12' to support an additional re-enforcing rod 21'. Otherwise, the floor or ceiling structure may be the same as the wall structure, and the concrete layer 23 may be applied in the manner previously described to produce a simple, compact and durable monolithic re-enforced concrete floor or ceiling of great strength.

While the use of the sheets 9, 14 of insulation board, and of the wooden bars 11, is entirely satisfactory for producing the improved re-enforced concrete structure by the improved method, it may in some cases be desirable to prefabricate portions of the forms and to somewhat enhance the durability and strength thereof by constructing parts of the forms of metal, plastic, or other material which is stronger than the insulation board and wooden strips. Such a modified wall assemblage is shown in Fig. 7, wherein the open sided form is constructed of a series of strong pans or plates 25 of interchangeably similar structure, each having offset flanges 26, 27 at its opposite vertical edges adapted to overlap the adjacent flanges 27, 26 of the adjoining sections or plates 25. The flanges 26, 27 of the prefabricated plates 25 are provided with a series of perforations adapted to be brought into alinement with each other for the reception of eye-bolts 28, and the coacting plate flanges may be clamped together by means of lock nuts 29 coacting with the threaded reduced ends of the eye-bolts, thus producing the successive stud or column forming grooves 30 between the alined plane outer surfaces 31 of the successive form plates 25. Re-enforcing rods 21 may be inserted within the alined eyes of the superimposed eye-bolts 28 and welded wire mesh or other foraminous re-enforcing sheet material 22 may be secured to the rods 21 and eye-bolts 28 in an obvious manner, and a concrete layer 23 may thereafter be impacted against the surfaces 31 and within the grooves 30 so as to completely embed the re-enforcing elements, as previously described.

In order to provide air chambers or spaces 32 within walls of the modified type, the extreme inner ends 34 of the eye-bolts 28, beyond the threading thereon, may be split, and each bolt may be embraced by a spacer sleeve 33 between the lock nut 29 and the split end 34. Blanket insulation 35 may then be placed against the outer plate flanges 27 and about the sleeves 33, whereupon metal lath 36 or other foraminous sheeting may be positioned against the sleeves 33 over the ends of the eye-bolts 28 and fastened in place by spreading the split end 34 of each bolt. The modified wall structure may be finally completed by impacting or otherwise applying plaster 37 or fine concrete mixture against the metal lath 36 and insulation 35, thus producing a simple, strong and extremely compact monolithic re-enforced concrete wall assemblage, which is exceedingly durable and of highly finished appearance.

From the foregoing detailed description of several embodiments of the improvement, it will be apparent that my present invention provides an improved monolithic re-enforced concrete building wall structure which is simple, compact and extremely durable in construction, and which can be quickly and effectively produced with the improved method herein described. The present improved structures while being less bulky and thinner than the prior cement block, sectional concrete slab, and poured concrete wall structures, are more homogeneous and of uniform texture throughout their entire areas, and can be more rapidly assembled with the new method at greatly reduced cost and with relatively unskilled labor. The improved walls are also adaptable to present building methods and dimensions, by virtue of the fact that insulation sheets 9, 14, or pre-fabricated plates 25 of standard widths, may be used so as to produce standard distances between the stud or joist centers, thereby permitting the use of standard wooden or metal window and door frames in conjunction with these concrete walls. Because of the fact that the improved forms are one-sided and are entirely open and free from obstruction on the side from which the re-enforcing elements are supported, it is easy to apply the concrete layer 24 uniformly since all portions of the work are at all times visible to the operator, and a smooth final outer surface 24 is also readily obtainable. The mode of supporting the re-enforcing rods 21 and the disposition of the foraminous sheet material 22 in a plane approximately parallel to the outer surfaces 13 without irregularities at the grooves 12, are also important features of the present invention, and result in the provision of structures which will not crack or weaken at the studs and joists. The use of compressed air in order to impact the concrete against the forms and around the re-enforcing elements, is also desirable in order to enhance the speed of construction, and the improved cleats 16 may be readily produced at moderate cost and can be quickly applied so as to effectively support the re-enforcement. The improved method has been carried on with a high degree of success, and is adapted to facilitate the construction of buildings of re-enforced concrete and at a minimum cost.

While my improvement has been shown and described herein as having been applied primarily to the construction of outer walls, floors, ceilings, and to one type of corner construction, the improved method is applicable to the effective construction of interior and exterior corners, to the attachment of partitions to walls, to the construction of internal partitions, to the formation of upper and lower plates, sills, lintels and other building details. The specific type of hardware used in applying the method to such details of construction, and of cutting and fitting various elements without the use of tools, forms no specific part of the present application which covers primarily the improved wall or floor structure and the method of producing such structures.

It should therefore be understood that it is not desired to limit this invention to the exact steps of the method or to the precise details of construction of the walls, herein shown and described, for various modifications within the scope of the appended claims, may occur to persons skilled in the art.

I claim:

1. A re-enforced concrete wall, comprising, a series of metallic pans each having a plane area and inwardly off-set integral opposite side flanges overlapping the adjacent flanges of adjoining pans to form outwardly open approximately up-

right recesses, clamping elements firmly uniting each pair of overlapping flanges and having vertically alined openings disposed outwardly beyond said recesses and beyond the common plane of said areas, re-enforcing rods confined within said vertically alined openings, foraminous sheet material suspended solely from said rods and elements and being disposed parallel to and spaced outwardly from said plane, and a layer of concrete impacted against said pans and concealing said elements and rods and foraminous material.

2. A re-enforced concrete wall, comprising, a series of metallic pans each having a plane area and inwardly off-set integral opposite side flanges overlapping the adjacent flanges of adjoining pans to form outwardly open approximately upright recesses, insulation sheathing coacting with the inner surfaces of the successive pairs of overlapping flanges to provide enclosed air spaces within said pans, clamping elements firmly uniting each pair of overlapping flanges with each other and with said sheathing and having vertically alined openings disposed outwardly beyond said recesses and beyond the common plane of said areas, re-enforcing rods confined with said vertically alined openings, foraminous sheet material suspended solely from said rods and elements and being disposed parallel to and spaced outwardly from said plane, and a layer of concrete impacted against said pans and concealing said elements and rods and foraminous material.

3. A re-enforced concrete wall, comprising, a series of unitary pans each having a plane area and inwardly off-set integral opposite side flanges overlapping the adjacent flanges of adjoining pans to form outwardly open approximately upright recesses, clamping elements firmly uniting each pair of overlapping flanges and having vertically alined openings disposed outwardly beyond said recesses and beyond the common plane of said areas, re-enforcing rods confined within said vertically alined openings, foraminous sheet material suspended solely from said rods and elements and being disposed parallel to and spaced outwardly from said plane, and a layer of concrete impacted against said pans and concealing said elements and rods and foraminous material.

4. A re-enforced concrete wall, comprising, a series of unitary pans each having a plane area and inwardly off-set integral opposite side flanges overlapping the adjacent flanges of adjoining pans to form outwardly open approximately upright recesses, insulation sheathing coacting with the inner surfaces of the successive pairs of overlapping flanges to provide enclosed air spaces within said pans, clamping elements firmly uniting each pair of overlapping flanges with each other and with said sheathing and having vertically alined openings disposed outwardly beyond said recesses and beyond the common plane of said areas, re-enforcing rods confined with said vertically alined openings, foraminous sheet material suspended solely from said rods and elements and being disposed parallel to and spaced outwardly from said plane, a layer of concrete impacted against said pans and concealing said elements and rods and foraminous material, and a layer of cementitious material disposed against the inner surface of said sheathing.

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