July 12, 1949. R. R. COLBURN 2,476,135

FURRED CONCRETE BUILDING WALL

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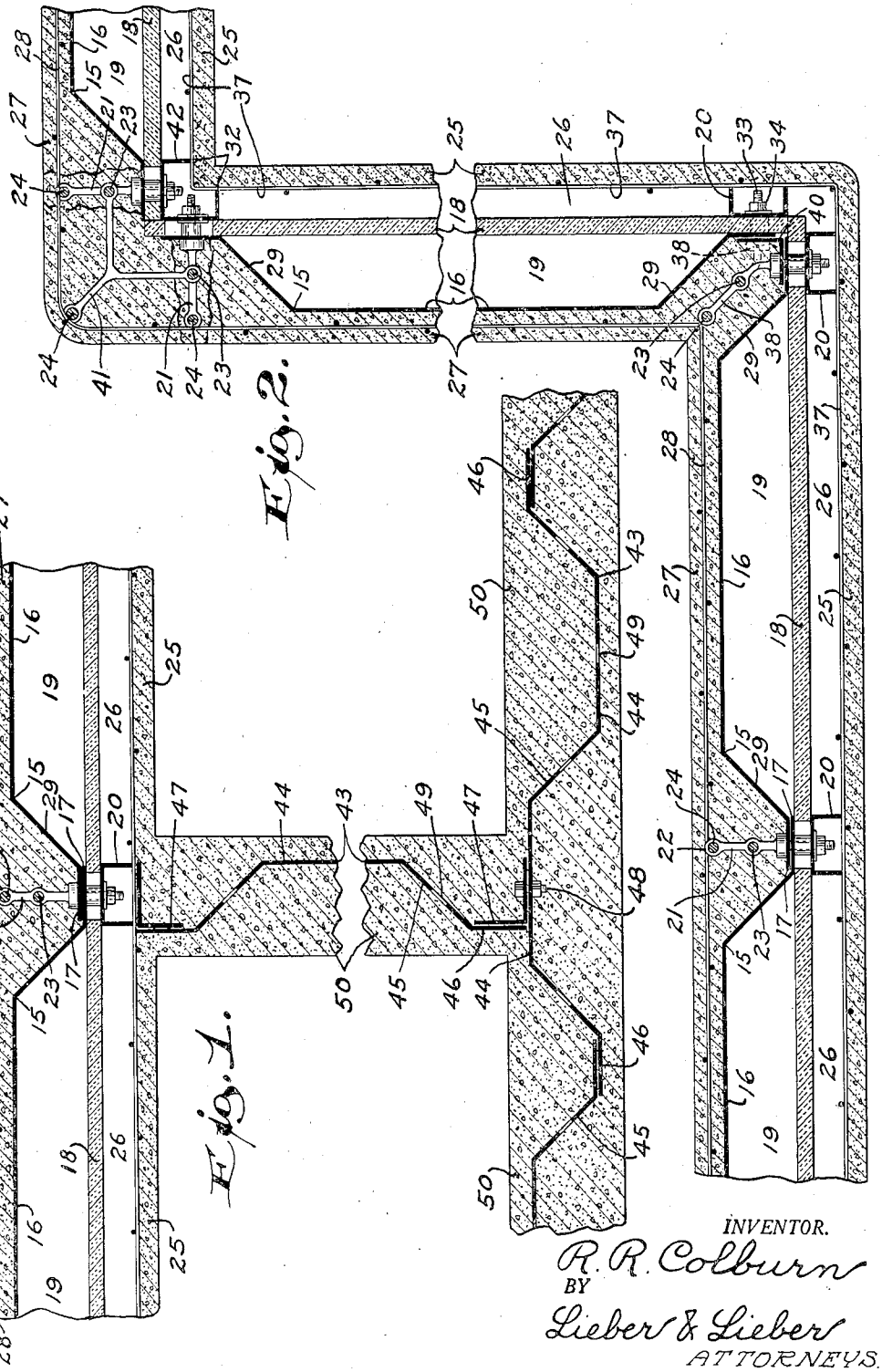


Fig. 2.

Fig. 1.

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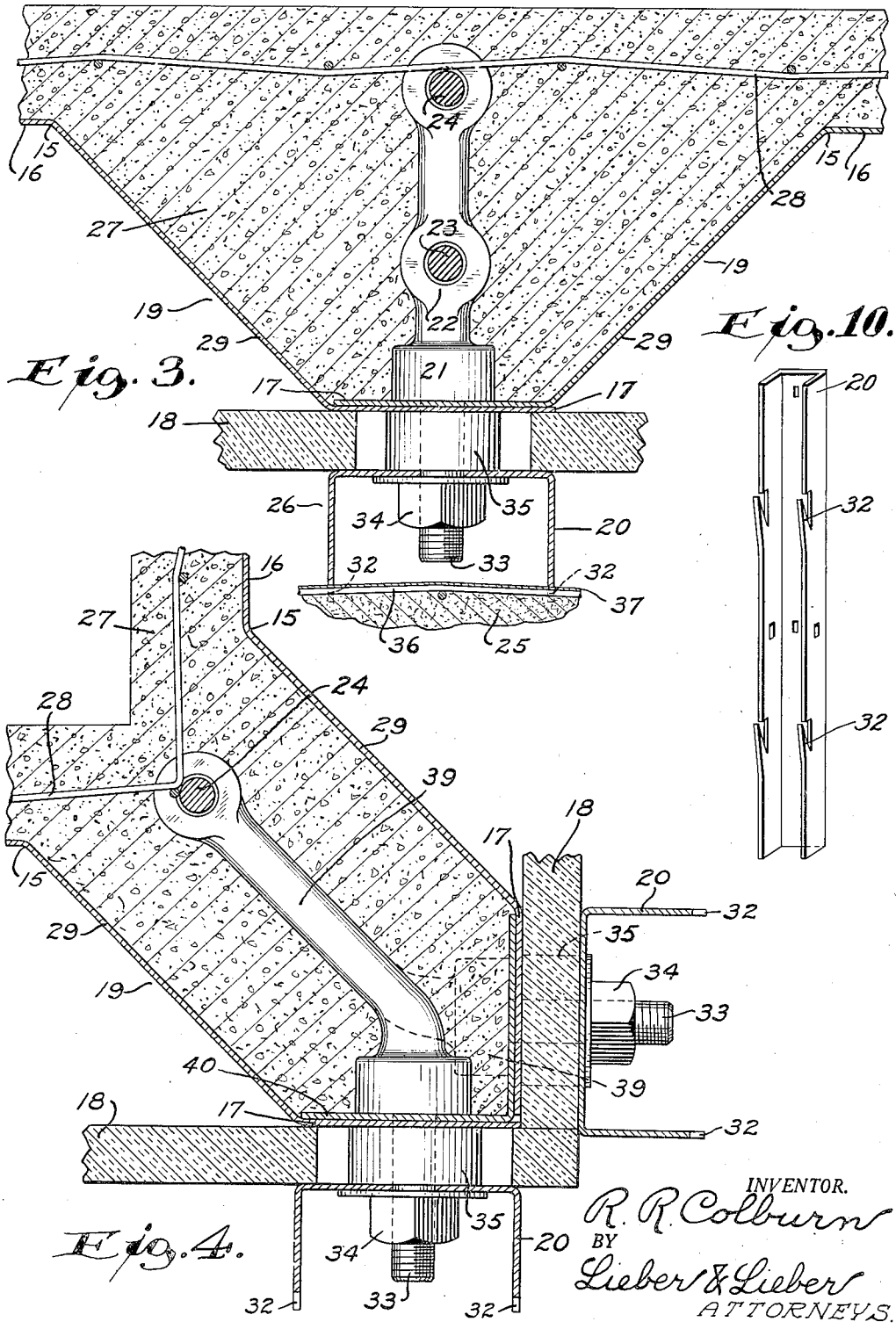


Fig. 3.

Fig. 10.

Fig. 4.

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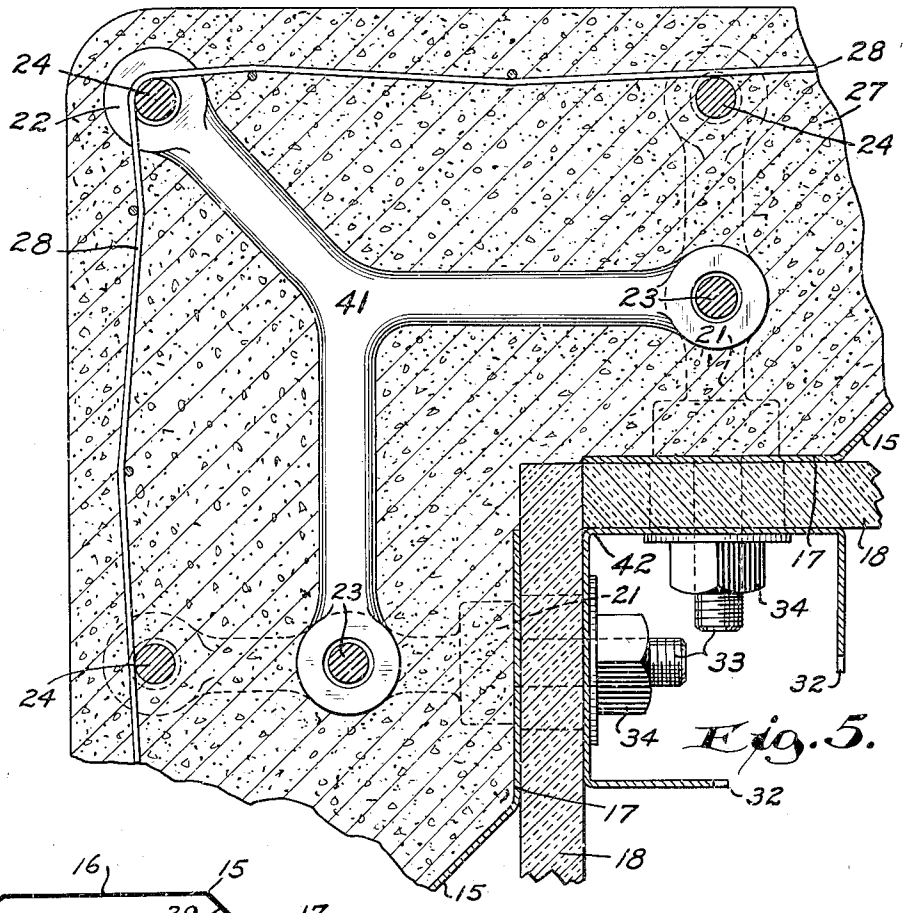


Fig. 5.

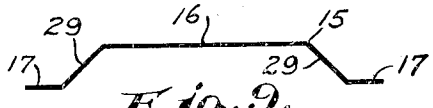


Fig. 9.

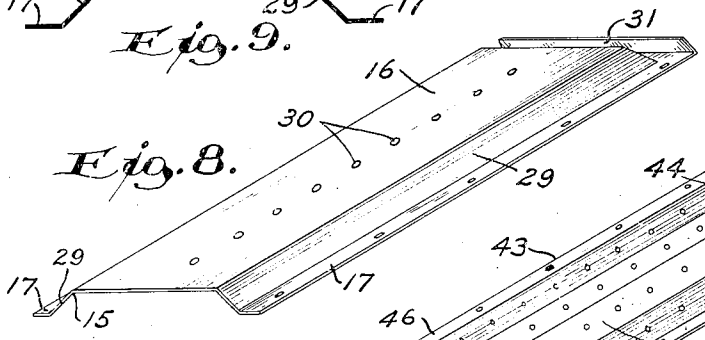


Fig. 8.

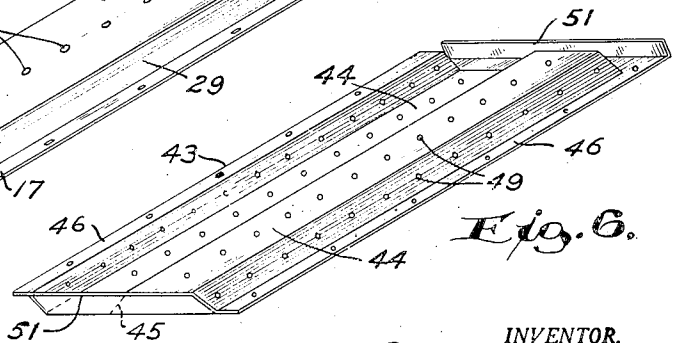


Fig. 6.

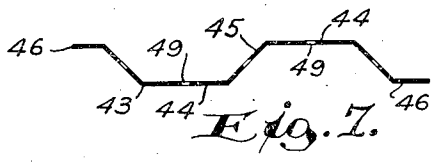


Fig. 7.

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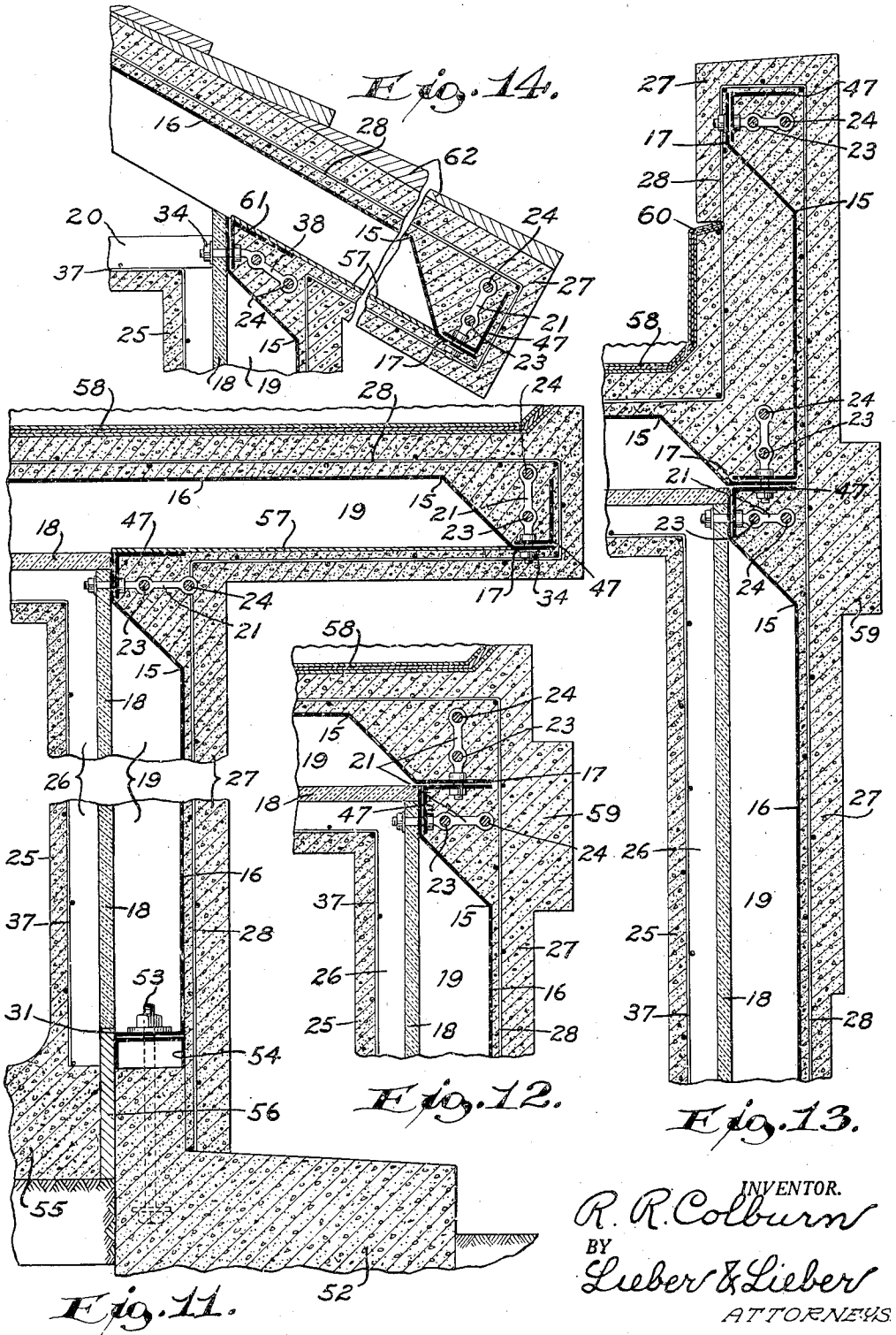


Fig. 14.

Fig. 11.

Fig. 12.

Fig. 13.

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UNITED STATES PATENT OFFICE

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FURRED CONCRETE BUILDING WALL

Richard R. Colburn, Waterloo, Iowa

Application February 4, 1944, Serial No. 521,081

5 Claims. (Cl. 72—48)

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This invention relates in general to improvements in the building art, and relates more especially to various improvements in the construction of buildings formed primarily of structural and metallic materials and of concrete or the like.

A general object of my present invention is to provide a new and practical system of constructing durable, compact and attractive buildings, in an expeditious manner and at low cost.

While wood has heretofore been the principal material used in the construction of dwellings and many other buildings of various types, good lumber is becoming increasingly scarce and more costly to procure, so that the future building industry faces a serious problem in connection with the possible availability of wood for building purposes. The metal working industries have however been greatly expanded in recent years so that new markets for metal products will undoubtedly be sought in the future, and concrete ingredients including cement, have always been relatively available in unlimited quantities. It is therefore a foregone conclusion that the building industry of the future will be obligated to utilize such materials as steel and concrete, in order to replace the wooden structures of the past as far as possible, and the use of these substitute materials will result in more durable and stronger buildings. While some smaller buildings have heretofore been formed of concrete blocks and of concrete cast in forms about metallic re-enforcement, these prior concrete structures have been relatively bulky and expensive to utilize in dwellings and the like; and it has heretfore also been difficult to provide most effective ventilation of the external walls and sufficiently thin but durable inner walls in the previous concrete building assemblages.

It is therefore a more specific object of the present invention to provide an improved combined concrete and metal building construction which is exceedingly flexible in its adaptations, and which is especially useful as a substitute for wooden assemblages in the construction of relatively low-priced dwellings and other buildings.

Another specific object of this invention is to provide a durable and effectively ventilated and heat insulated wall assemblage formed primarily of inexpensive prefabricated metal plates and fittings concealed within concrete, and which may be quickly and effectively constructed to meet various requirements with the aid of ordinary laborers.

A further specific object of my invention is to

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provide a composite metal and concrete structure which is relatively permanent and fireproof, as compared to prior wooden structures for similar purposes, and which may be expeditiously utilized in the formation of the external and internal walls, floors, ceilings, roofs, and other parts of various types of buildings.

Still another specific object of the invention is to provide a compact and thorougly re-enforced concrete building construction especially useful in the formation of weather exposed walls, and which is moisture-resistant and well insulated against heat transmission, besides being exceedingly strong.

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

A clear conception of the improved features involved in the present invention, and of the mode of constructing various parts of buildings embodying the improvements, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the numerous views.

Fig. 1 is a horizontal transverse section through a diagrammatic fragment of a typical outer and inner wall assemblage embodying the invention;

Fig. 2 is a similar section through a diagrammatic fragment of an irregular outside wall embodying my improved inner and outer corner constructions;

Fig. 3 is an enlarged transverse section through one of the straight wall stud or re-enforced uprights of the improved concrete outer wall assemblage;

Fig. 4 is a similarly enlarged transverse section through one of the inner or internal corners of the wall;

Fig. 5 is a likewise enlarged transverse section through one of the outer or external corners of the wall;

Fig. 6 is a perspective view of one of the perforated metallic partition re-enforcing pans;

Fig. 7 is a diagrammatic transverse section through the pan of Fig. 6;

Fig. 8 is a perspective view of one of the metallic outer wall re-enforcing pans adapted to span the studs or re-enforced uprights;

Fig. 9 is a diagrammatic transverse section through the pan of Fig. 8;

Fig. 10 is a perspective view of a fragment of one of the stud or upright re-enforcing and furring channels;

Fig. 11 is a somewhat diagrammatic vertical

section through a typical outer wall, foundation and flat overhung type of roof;

Fig. 12 is a likewise diagrammatic vertical section through a fragment of an outer wall having a banded type of cornice and flat roof, associated therewith;

Fig. 13 is a similar section through a fragment of an outer wall having a parapet type of cornice and flat roof, associated therewith; and

Fig. 14 is another similar section of an outer wall fragment and sloping flat-pitch roof.

While the invention has been shown and described herein as being advantageously applicable to dwellings and other diverse and relatively small buildings, it is not to be assumed from this limited disclosure that the improved features are not more generally applicable to other building structures, because some of these features are in fact capable of diverse usage in various types of re-enforced concrete assemblages.

Referring to the drawing, each of the improved outer walls of the re-enforced concrete building construction shown therein, comprises in general a series of rigid plates or pans 15 having flat outer surface portions 16 disposed in a common plane and being provided with integral flat inner opposite side portions or flanges 17 overlapping each other; flat heat insulating sheets or boards 18 coacting with the overlapped flanges 17 to provide an extensive air space 19 adjoining the flat portion 16 of each pan 15; a rigid furring channel 20 coacting with the inside surfaces of the boards 18 adjacent to each set of the overlapped flanges 17; interchangeably similar rigid fittings or fastening elements 21 uniting each set of the overlapped flanges 17 with the boards 18 and channels 20 and with each other and having eyes 22 for supporting parallel re-enforcing rods 23, 24 respectively, disposed externally of the pans 15; a layer of concrete or plaster 25 suspended from the inwardly extending side flanges of the channels 20 to provide other air spaces 26 between the successive furring channels; an impacted deposit or outer layer 27 of concrete coacting with the outer flat surface portions 16 and with the flanges 17 of the pans 15 and having the elements 21 and the rods 23, 24 embedded therein; and a plane layer of re-enforcing material or wire mesh 28 also embedded in the concrete layer 27 parallel to the pan portions 16 and being suspended from the outer rods 24, see Figs. 1, 2 and 3.

The rigid plates or pans 15 are preferably formed of sheet metal and as shown in detail in Figs. 8 and 9, and the flat outer portions 16 are connected with the flat edge flanges 17 by means of integral sloping sections 29. The flat portions 16 of the pans 15 may be provided with anchorage perforations 30 for the concrete layer deposit 27, and the pan assemblages should preferably be of uniform width but may be of diverse lengths. Some of the pans 15 may be additionally provided with end flanges 31 and adjoining sloping portions as indicated in Fig. 8, and when the pans are assembled, the adjacent sloping side sections provide approximately triangular columns of concrete at the upright stud portions of the wall, which are re-enforced by the rods 23, 24 and are devoid of sharp corners. The sloping end portions of the pans 15 likewise provide concrete sills of durable construction, thus producing a strong wall re-enforced by a checkerwork of columns and sills. The furring channels 20 each comprising a web and a pair of flanges formed integral with the opposite sides of the web are also preferably formed of sheet metal, and are provided with hooks 32 along the opposite flanges thereof as depicted in Fig. 10; and the clamping elements 21 have threaded shanks 33 which extend through alined holes in the flanges 17 and channels 20, and are adapted to receive the clamping nuts 23 as indicated in Fig. 3. The insulating boards 18 may be formed of any suitable fibrous heat insulating material, and in order to prevent excessive clamping of these boards 18, spacing collars 35 may be inserted between the flanges 17 and the channels 20 as also shown in Fig. 3. This assemblage of elements will permit firm interconnection of the pans 15, channels 20 and boards 18, and rigid proper positioning of the elements 21 and re-enforcing rods 23, 24. The plaster layer 25 may be applied to metal lath or wire mesh 36 applied to the hooks 32 of the channels 20 as likewise shown in Fig. 3, and the wire mesh 36 may be provided with a backing sheet 37 of cloth or paper. The outer re-enforcing wire mesh 28 may be secured to the outer rods 24 at local places or spots in any suitable manner, and the concrete layer 27 is preferably impacted into the triangular column spaces formed by the adjoining pans 15 and against the flat portions 16 of these pans with the aid of a cement gun.

The inner or interior corners of the outer walls are preferably constructed as shown in Figs. 2 and 4, by utilizing slightly modified clamping and retaining elements extending diagonally away from these corners. As shown in Fig. 3, clamping elements 38 each having two rod supporting eyes 22 may be utilized, and as shown in Fig. 4, clamping elements 39 each having but a single eye 22 for supporting a re-enforcing rod 24 may also be used. Each of these modified clamping and rod supporting elements 38, 39 has an inner threaded shank 33 cooperating with a nut 34 to clamp an angle iron 40 against the adjacent meeting pan flanges 17, and to further clamp the flanges 17 and furring channels 20 against the meeting ends of the insulation sheets 18. The outwardly projecting portions of the modified fastening elements 38, 39 are disposed at forty-five degree angles with respect to their shank axes, and the position of the successive superimposed elements 38, 39 is reversed, so that alternate elements will clamp the two meeting pans 15 to the two flanges of the unitary corner angle iron 40. Spacing collars 35 may be employed as shown, and the inner and outer wire mesh 37, 28 may be bent at the inner and outer corners as indicated in Fig. 2, the outer wire mesh 28 being attached to the re-enforcing bar or rod 24. It will be apparent that this interior corner assemblage provides ample and sturdy re-enforcement at the inner corners of the outer wall.

The outer or external corners of the outer walls are preferably constructed as shown in Figs. 2 and 5, by utilizing re-enforcing rod spacing members or spiders 41 in addition to the ordinary clamping and rod supporting elements 21 shown in Fig. 3. As shown in Figs. 2 and 5, the elements 21 which are nearest the outer corners, coact with the side flanges 17 of the corner pans 15, and with specially formed box-shaped channels 42 coacting with the meeting edges of the insulation sheets 18. The spiders 41 are interposed between the successive clamping elements 21 and engage the inner re-enforcing rods 23 which coact with these elements, and provide supports for corner rods 24 to which the outer wire mesh 28 may be attached. The inner wire mesh 37 is suspended from hooks 32 formed on

the box channels 42, and both the inner and outer wire mesh 28, 37 may be bent at the corners as shown. This external corner assemblage also provides a durable re-enforced corner, and outer rods 24 may also be applied to the clamping elements 21 nearest the outer corners, as indicated in solid lines in Figs. 2 and 5.

The improved internal partitions of my reenforced concrete building assemblage may be formed as specifically shown in Figs. 1, 6 and 7, and each of the partitions comprises a series of relatively rigid multiple plates or perforated pans 43 each having two or more laterally spaced parallel flat portions 44 of rather extensive area connected to each other by a sloping intermediate portion 45, and also having opposite side edge flanges 46 adapted to overlap the side flanges of the adjacent pans 43; angle irons 47 for connecting the edge flanges 46 with the flat portions 44 of the pans 43 of crossing or intersecting partitions; bolt and nut assemblages 48 for attaching the angle irons 47 to the perforations 49 of adjacent pans 43; and a layer of concrete 50 impacted against the opposite sides of the assembled plates or pans 43 and against the angle irons 47 and merging with the plaster or concrete layer 25 of the adjacent outer walls. The pans 43 may each be formed of a single sheet of metal with the aid of punches and dies, and the perforations 49 are preferably disposed in straight rows and serve the dual purpose of providing attaching zones for the angle irons 47 and of uniting the concrete 50 on the opposite sides of the pans 43. Each pan 43 may also be provided with opposite upper and lower edge flanges 51 as shown in Fig. 6 for effecting attachment of the pans to other structure.

The formation of the sheet metal pans 15, 43, and of the angle irons 40, 47, channels 20, 42, and clamping elements 21, 38, 39 is such that these parts may be quickly and conveniently assembled in diverse combinations and length so as to provide re-enforcing elements for various ceiling heights, for window and door openings of different sizes, and for the floors and ceilings as well as for the walls. The pans, clamping elements, and other sheet metal parts may also be readily bent to different shapes in the field, so as to facilitate the application of various types of ceilings, roofs and overhead coverings to the assembled walls and partitions as shown in Figs. 11 to 14 inclusive, each of which will be generally described.

As shown in Fig. 11, the improved outer walls of the buildings embodying my invention are preferably erected upon a solid foundation 52 of concrete or the like and are anchored to this foundation 52 by means of anchor bolts 53 coacting with metal channel plates 54 and with lower flanges 31 formed on the adjacent pans 15. The floors 55 of the building may also be formed of concrete and are separated from the foundation 52 by expansion joints or plates 56 with which the insulation plates 18 coact. The outer concrete layer 27 may rest directly upon the foundation 52, and the inner plaster or concrete layers 25 of the outer walls as well as the concrete 50 of the partitions may be caused to merge directly with the floors 55. This type of assemblage will obviously provide a sturdy and moisture-resistant support for the outer walls and inner partitions of the building, and the ceilings and upper room floors may obviously be constructed in the same general manner as the outer

walls, with the aid of pans 15, insulation boards 18 and other elements hereinbefore described.

As specifically illustrated in Fig. 11, the overhung type of roof shown therein, is formed by extending the upper horizontal pans 15 outwardly beyond the adjacent outer walls, and by applying angle irons 47 and re-enforcing rods 23, 24 to clamping elements 21 which connect the angle irons 47 with the outer flanges 17 of these pans 15. The re-enforcing wire mesh 28 is positioned around the projecting portions of the pans 15 and concrete 27 may then be impacted against the pan and a temporary form plate 57 positioned as shown. One or more layers of roofing paper 58 may be finally applied to the top of the roof to complete the same, thus producing a sturdy waterproof overhung roof assemblage.

As specifically shown in Fig. 12, the banded type of cornice and flat roof shown therein is formed without extending the upper horizontal pans 15 beyond the lower vertical pans 15 of the outer walls, but the outer flanges 17 of the upper pans are rigidly connected to the upper flanges of the side wall pans by means of clamping elements 21 disposed at right angles to each other and coacting with angle irons 47. The re-enforcing bars of the horizontal element 21 are disposed horizontally beneath the angle iron 47 and the re-enforcing bars carried by the upper clamping element 21 are disposed above the angle iron 47, and a concrete projection 59 may be formed adjacent to these horizontal re-enforcing bars to thereby complete the cornice. As in the case of Fig. 11, the top of the roof is also provided with suitable roofing paper 58 or the like, thus providing a simple and neat appearing cornice type of flat roof structure.

As specifically depicted in Fig. 13, the parapet type of cornice and flat roof construction shown therein, is formed in a manner similar to that of Fig. 12, but the parapet extension may be produced by applying additional metallic pans 15 to the outer flanges 17 of the horizontal pans 15 which form the roof. The upper flanges 17 of these additional pans may be provided with angle irons 47 and clamping elements 21 carrying horizontal re-enforcing bars as shown, and the wire mesh 28 is carried upwardly around these additional pans 15 and concrete may be applied as shown to produce the parapet. The roofing paper 58 of this modified assemblage may have its edges 60 embedded within the parapet as indicated, and this modification obviously provides a sturdy and attractive parapet type of roof which may also be provided with a cornice 59 similar to that of Fig. 12.

Referring specifically to Fig. 14, the sloping flat pitch roof construction illustrated therein, may again be formed by utilizing pans 15 and angle irons 47, together with distorted angle irons 61, and bent clamping elements 38 in order to secure the desired pitch of the roof. In this modification the roof pans 15 coact with the distorted angle irons 61 and project outwardly and downwardly beyond the outer wall. Angle irons 47 and ordinary clamping elements 21 are applied to the outermost flanges 17 of the sloping pans 15, and the re-enforcing wire mesh and the rods carried by the elements 21 may be embedded in concrete 27 as shown. The concrete roof thus formed may be provided with suitable shingles 62 to produce an attractive and sturdy sloping roof structure.

From the foregoing detailed description of the various features of the present invention, it will

be apparent that a sturdy and durable building may be quickly produced with the aid of the improved re-enforcing members and clamping elements of the present improved construction. After the structural elements of the walls, partition and roof have been properly assembled, the concrete **27** is preferably impacted thereagainst with a cement gun so as to thoroughly embed and conceal the re-enforcing rods **23**, **24** and the wire mesh **25**, **27**, and the double air spaces **19**, **26** cooperate with the insulation boards **18** to provide perfect insulation and to prevent moisture from passing through the walls. The improved building construction can be produced with the aid of common labor and without necessity of utilizing skilled labor, and various designs and types of buildings can obviously be produced with the present invention. The sheet metal re-enforcing pans may be formed in various sizes preferably corresponding in width to the standard distances between ordinary studding used in wooden buildings, and these pans may be constructed with the aid of punches and dies, while the angle irons may be formed of standard angle stock. The clamping elements may be formed of steel, and ordinary steel rods and standard wire mesh may be utilized for re-enforcing purposes, so that the improved buildings may be assembled and produced at moderate cost and in a durable manner.

It is especially noteworthy, that when the sheet metal pans are set up vertically, the sloping side edges provide stud depressions into which concrete may be shot to provide re-enforced columns which are integral with the intervening wall portions; and when the pans are disposed horizontally they likewise provide re-enforced joists formed integral with the remaining adjacent portions of the floors or ceilings with which they cooperate. The sloping end portions of the pans also cooperate with the transverse end flanges thereof to provide re-enforced concrete window and door sills, headers, and lintles; and the sloping tops of all of the adjoining wall pans also provide strong re-enforced concrete plates. The improved pan formations therefore provide a concrete wall which is amply re-enforced by vertical and horizontal integral re-enforced beams in all of which re-enforcing rods may be embedded with the aid of a concrete gun and without using the ordinary removable forms. The invention has proven highly successful and flexible in its adaptations, and can obviously be utilized for diverse purposes. It is also to be noted that while wire mesh has been utilized as a re-enforcement for the cementitious layers, any foraminous sheet material may be substituted for the wire mesh, and no unnecessary limitation should be placed upon any of the specific terms used herein.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of use, 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 building wall comprising, a series of unitary rigid pans each having an outer plane area and integral relatively wide opposite side flanges off-set inwardly with respect to the intervening plane area, the outer areas of adjacent pans lying in a common plane and the inner flanges of adjacent pans overlapping, insulation board coacting externally with the successive sets of said overlapping flanges and being spaced from said outer pan areas to provide air spaces between the pans and the outer surface of said board, a furring channel having a web coacting with the internal surface of said board adjacent to each set of said pan flanges and also having at least one integral flange extending inwardly away from said web and board, fastening elements uniting each set of said overlapped pan flanges with the adjacent channel web to clamp the intervening board in place, a sheet of plaster suspended from the inner free edges of said channel flanges and being spaced from said board to provide other air spaces adjoining the inner surface of said board between successive channels, reenforcing rods carried by said fastening elements outwardly of said common plane, and a layer of concrete coacting with said pan areas and having said rods embedded therein.

2. A building wall comprising, a series of unitary sheet metal pans each having an outer plane area and integral relatively wide opposite side flanges off-set inwardly with respect to the intervening plane area, the outer areas of adjacent pans lying in a common plane and the inner flanges of adjacent pans overlapping, insulation board coacting externally with the successive sets of said overlapping flanges and being spaced from said outer pan areas to provide air spaces between the pans and the outer surface of said board, a U-shaped furring channel having a web coacting with the internal surface of said board adjacent to each set of said overlapped pan flanges and also having integral flanges extending inwardly away from the opposite sides of said web and from said board, fastening elements uniting each set of said overlapped pan flanges with the adjacent channel web to clamp the intervening board in place, a sheet of plaster suspended from the inner free edges of said channel flanges and being spaced from said board to provide other air spaces adjoining the inner surface of said board between successive channels, reenforcing rods carried by said fastening elements outwardly of said common plane, and a layer of concrete coacting with said pan areas and having said rods embedded therein.

3. A building wall comprising, a series of unitary rigid pans each having an outer plane area and integral relatively wide opposite side flanges off-set inwardly with respect to the intervening plane area, the outer areas of adjacent pans lying in a common plane and the inner flanges of adjacent pans overlapping, insulation board coacting externally with the successive sets of said overlapping flanges and being spaced from said outer pan areas to provide air spaces between the pans and the outer surface of said board, a furring channel having a web coacting with the inner surface of said board adjacent to each set of said pan flanges and also having at least one integral flange extending inwardly away from said web and board, fastening elements uniting each set of said overlapped pan flanges with the adjacent channel web to clamp the intervening board in place, a sheet of plaster suspended from the inner free edges of said channel flanges and being spaced from said board to provide other air spaces adjoining the inner surface of said board between successive channels, reenforcing rods carried by said fastening elements inwardly and outwardly of the plane areas of said pans adjacent to each set of said overlapped flanges, and a layer of concrete coacting with said pan areas and having said rods and portions of said fastening elements embedded therein.

4. A building wall comprising, a series of unitary sheet metal pans each having an outer plane area and integral relatively wide opposite side flanges off-set inwardly with respect to the intervening plane area and connected thereto by inclined intervening portions, the outer areas of adjacent pans lying in a common plane and the inner flanges of adjacent pans overlapping and coacting with said inclined portions to form outwardly open grooves, insulation board coacting externally with the successive sets of said overlapping flanges and being spaced from said outer pan areas to provide air spaces between the pans and the outer surface of said board, a furring channel having a web coacting with the inner surface of said board adjacent to each set of said pan flanges and also having at least one integral flange extending inwardly away from said web and board, fastening elements uniting each set of said overlapped pan flanges with the adjacent channel web to clamp the intervening board in place, a sheet of plaster suspended from the inner free edges of said channel flanges and being spaced from said board to provide other air spaces adjoining the inner surface of said board between successive channels, reenforcing rods carried by said fastening elements within and outwardly beyond each of said grooves, and a layer of concrete coacting with said pan areas and having said rods embedded therein.

5. A building wall comprising, a series of unitary rigid pans each having an outer plane area and integral relatively wide opposite side flanges off-set by inclined portions inwardly with respect to the intervening plane area, the outer areas of adjacent pans lying in a common plane and the inner flanges of adjacent pans overlapping and coacting with said inclined portions to form outwardly open grooves, insulation board coacting externally with the successive sets of said overlapping flanges and being spaced from said outer pan areas to provide air spaces between the pans

and the outer surface of said board, a furring channel having a web coacting with the inner surface of said board adjacent to each set of said pan flanges and also having integral flanges extending inwardly away from said web and board, fastening elements uniting each set of said overlapped pan flanges with the adjacent channel web to clamp the intervening board in place, a sheet of plaster suspended from the inner free edges of said channel flanges and being spaced from said board to provide other air spaces adjoining the inner surface of said board between successive channels, reenforcing rods carried by said fastening elements within and outwardly beyond each of said grooves, a sheet of foraminous material secured to the outermost rods, and a layer of concrete coacting with said pan areas and having said rods and foraminous material embedded therein.

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