Nov. 12, 1929. U. C. THIES 1,735,827

METAL AND CONCRETE BUILDING CONSTRUCTION

Filed June 14, 1926 2 Sheets-Sheet 1

FIG 1

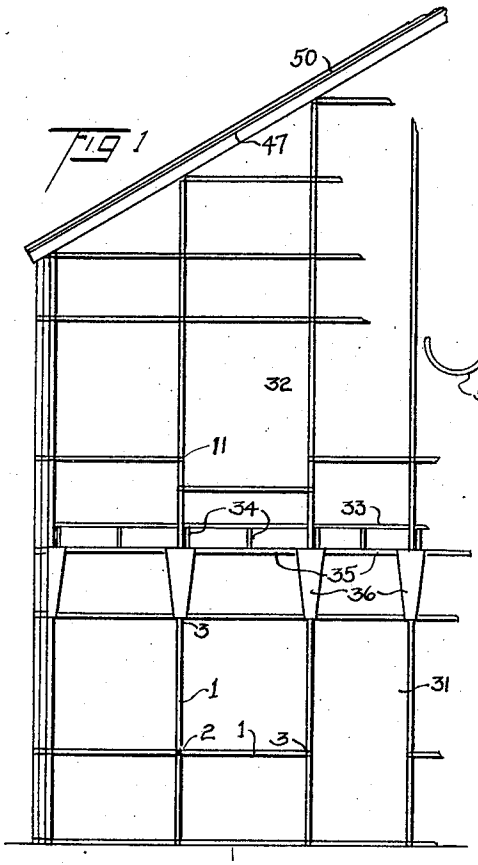


FIG 2

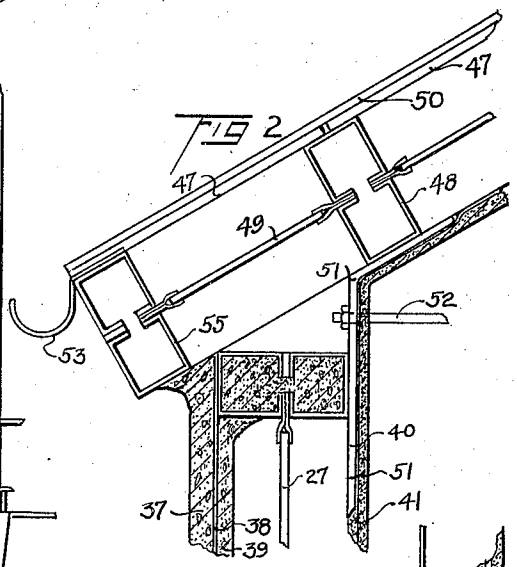


FIG 11

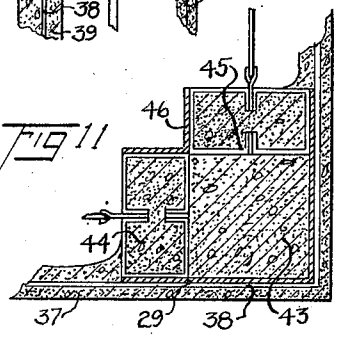
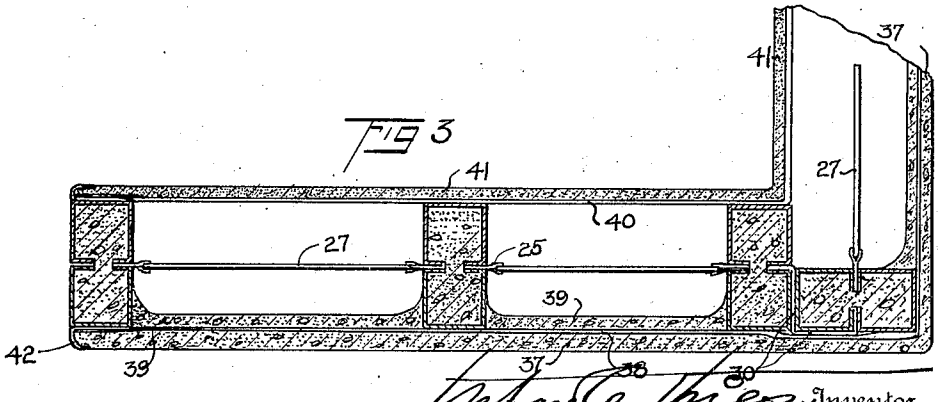
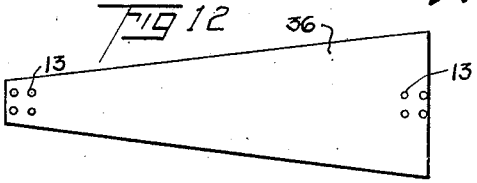


FIG 3



Inventor

FIG 12



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METAL AND CONCRETE BUILDING CONSTRUCTION

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Fig 4

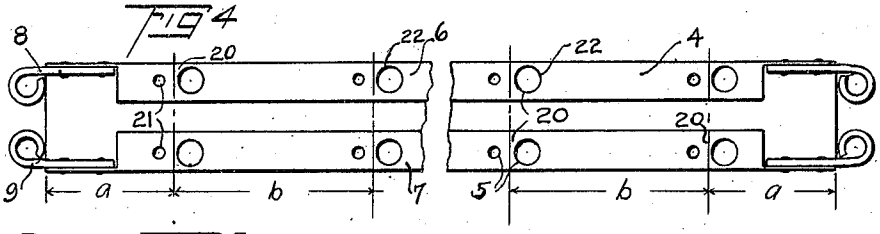
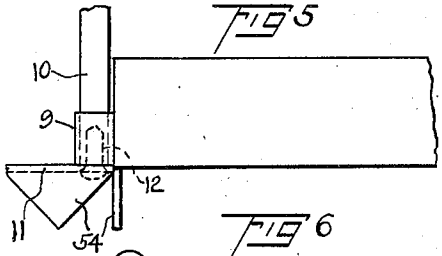


Fig 5



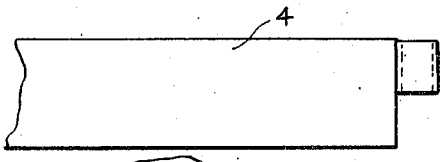


Fig 6

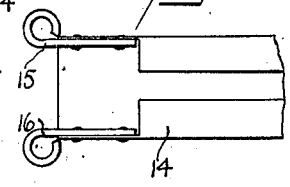


Fig 7

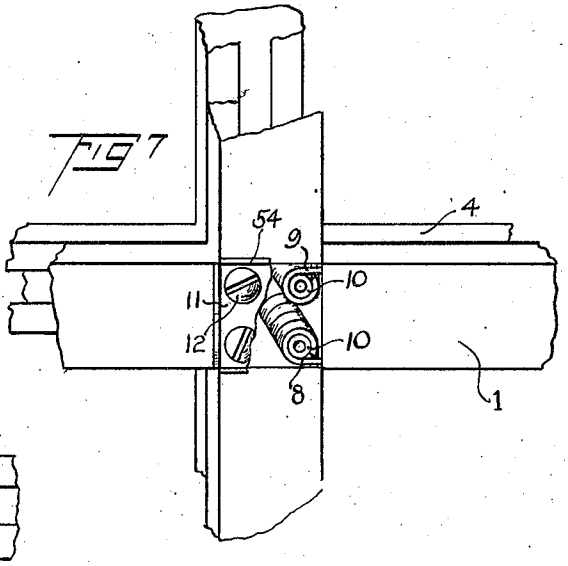


Fig 8

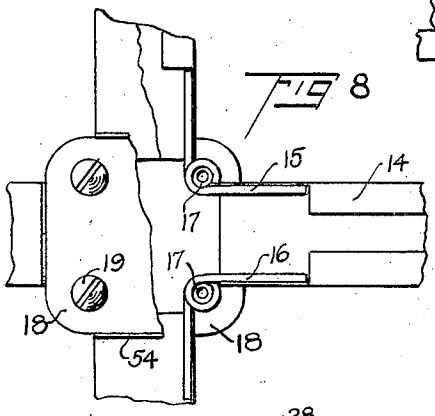


Fig 10

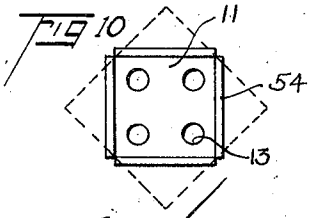
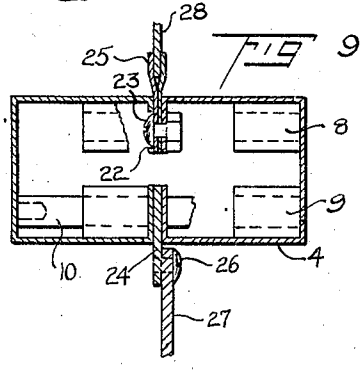


Fig 9



Inventor Ulysses C. Thies

Patented Nov. 12, 1929

1,735,827

UNITED STATES PATENT OFFICE

URBAN C. THIES, OF DAYTON, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE GLOBE-WERNICKE COMPANY, OF CINCINNATI, OHIO, A CORPORATION OF OHIO

METAL AND CONCRETE BUILDING CONSTRUCTION

Application filed June 14, 1926. Serial No. 115,916.

This invention relates to building construction and the primary object of the invention is the provision of a building or structural wall constructed of a rigid structure of sheet metal units which are covered with a surface of cementitious material.

The invention comprehends the erection of a skeleton form defining frame made of hollow elongated sheet metal units joined together at their ends and filled with cementitious material after they have been erected. The wall surface is applied on the outer face of this frame by applying a sheet of expanded metal lath which is then coated with a concrete covering, preferably applied or sprayed by means of the customary concerete gun. The sheet metal parts of the form defining frame are attached together at their inner faces by sheets of material which are then coated with plaster so as to make a finished interior. Between the outer concrete surface and the inner plaster surface there will be dead-air space which may be divided into chambers by means of heat insulating panel pieces attached at their edges to the various members which make up the frame. A further object of the invention is to construct the entire outer wall and roof of a building by means of the form defining frame members mentioned. The four walls of the building are constructed first of the rigidly united sheet metal members and the uprights and cross rails of the entire four walls of the building are then poured full of concrete. The roof is then covered with suitable sheets of material and the cementitious inner and outer coverings or surfaces then applied.

A further object of the invention is the use of the small joint plates by means of which the form defining frame members are attached together at their ends by the use of the bolts passing through the joints and through these plates. The plates are bent outwardly at the corners and form a means by which the expanded metal lath may be fixedly attached to the sheet metal frame members. These outwardly bent corners or ears are inserted through the expanded metal sheet and then bent over the sheets so as to overlap the main body of the plates and thus hold the expanded metal lath and consequently the cementitious surface permanently attached to the sheet metal frame members. The joint plates are made integral with and form a part of any metal parts such as angle irons, which need be fixed to the frame.

A further object of this invention is the construction of the uprights and cross rails of the building in a novel manner by using two hollow elongated sheet metal units placed side by side and attached together at their ends. These units are open along one side and are placed together in mating relation and held in place by means of bolt pins which extend through curl plates applied in pairs at each end of the unit.

A further object of the invention is the use of the frame members and the joint as set forth in my prior application for patent entitled "Partition units and construction" filed February 19, 1926, serial #89,347. The units set forth in that application are used together with a wall covering of cementitious material so as to form the outer wall of the building.

With the foregoing and other objects in view which will be more fully set forth in the following description and the drawings, one form of my invention will now be set forth. In the drawings:

Fig. 1 is a side elevation of part of a wall of a building showing the elongated frame members fastened together in place before the application of concrete or plaster,

Fig. 2 is a vertical section showing the manner in which the roof is attached to a side wall,

Fig. 3 is a horizontal section through one corner of the building,

Fig. 4 is a plan view of one of the frame units,

Fig. 5 is a side view of the unit shown in Fig. 4,

Fig. 6 is a plan view of an end of a modified form of joint or curl plate,

Fig. 7 is a fragmentary view of a joint showing four intersecting members,

Fig. 8 is a modified form of joint corresponding to the unit shown in Fig. 6,

Fig. 9 is a section through a pair of assembled units,

Fig. 10 is a detailed view of a joint plate showing how the edges are bent up,

Fig. 11 is a horizontal section of a modified arrangement of a corner of a building, and

Fig. 12 is a detail of one of the floor supporting fish plates.

Referring more particularly to the drawings by reference numerals, Fig. 1 shows a wall of a building which is constructed of a number of sheet metal frame members 1, each of which is attached at its ends to other frame members as at the joints 2 and 3. Each of these upright or cross rail frame members is made of a pair of mating elongated sheet metal units shown in Fig. 4. The use and construction of these units 4, has been fully set forth in my prior application for patent entitled "Partition units and construction", filed February 19, 1926, Serial #89,247. My present application is concerned with the use of such units in a novel manner by applying concrete or other cementitious material both internally and externally to a structure formed of a number of such units.

The unit 4 is preferably bent from a single piece of sheet metal, such as sheet steel, and is provided with attaching holes 5 on the two inwardly projecting flanges 6 and 7 provided at one side of the unit which is open along its length between these flanges. On the two sides of the end of the unit are curl plates 8 and 9 which are riveted in place to the sides of the unit. These curl plates are each provided with hollow elongated curled ends which have a length substantially half the width of the units, as shown in Fig. 5. The two curl plates 8 and 9 have the curls on the same side of the unit at one end, the curls being provided at the diagonally opposite corners at the other ends of the units. In this manner a number of exactly similar units may be attached together by arranging them in pairs as shown in Fig. 9 so that the curls all extend parallel and are placed end to end. Four sleeves or pins 10 extend through these curl plates at a joint and serve to unite, the different units as shown in Fig. 7. These pins 10 are coextensive in length with four of the curls so they may extend through two complete pairs of units. Joint plates 11 close the openings at the union of frame members as indicated in Fig. 7, and four screws 12, extend through the holes 13, in these plates, and are threaded into the ends of the four pins 10.

Figs. 6 and 8 show a modified form of unit and joint in which the curls extend outwardly from the ends of the units so that the interior of the frame members at the joints will be unrestricted and will permit the free passage of the concrete when the members are filled. Pairs of these frame units indicated 14, are used to form the frame members, the units being provided with curl plates 15, and 16 similar to curl plates 8 and 9 of Figs. 4 and 5. Attaching pins 17, four in number extend through the various curl plates at the joint indicated in Fig. 8, and the joint plate 18 is applied to each side of the joint by use of the screws 19 which thread into the ends of pins 17.

The joint plates 11 and 18 are provided with bent corners 54, which extend out away from the face of the plates, Fig. 10 showing in dotted line position how these corners are bent up.

The various units are provided with a series of attaching holes arranged in groups 20, see Fig. 4. These groups are spaced a uniform distance 6 apart and any suitable uniform distance from the ends of the units as indicated at *a*. There are two holes for each group, a small hole 21 and a large hole 22, which are uniformly spaced from the center lines of the groups. The large holes 22 are of such size as to permit the reception of the head of a screw 23, Fig. 9, by means of which the sheet or strip 24 is attached between adjacent or mating units. The sheet or strip 24, or the pairs of strips 25, are preferably made of sheet metal and are first attached along their lengths to the flanges of one of the units by a number of the screws 23. These screws pass through the small holes 20 of that unit and similar small holes in the strips 25 or 24, the strips 24 and 25 being spaced and arranged uniformly as on the units. The adjacent or mating unit is applied so that the heads of the screws are received between the large holes 22 and the two units then fastened together at their ends by means of the through pins 10. The strips or plates 24 may be provided with interiorly threaded openings for the reception of screws 26 which attach panel piece 27 in place. These panel pieces 27 may be sheet of metal or heat insulation composition. Fig. 9 shows a suitable panel piece 28 held between the two metal strips 25 and one of which may be bent when the panels are applied in place and then bent back to the position shown in that figure. In order to construct a building a number of these frame members composed of pairs of units as previously set forth are attached together at their ends so as to form a rigid self-sustaining sheet metal frame as shown in Fig. 1. At the corners of the building the two walls each end in a sheet metal upright and the two uprights are attached rigidly together by means of steel angle plates 29 the ends of which form and take the place of joint plates 11 or joint plate 18. The angle plates 29, are therefore attached by means of the screws threaded into the pins at the joints. These angle plates extend continuously from the foundation to the roof at the corners of the building and form a space 43, with the uprights themselves at the corners, which is subsequently filled

with concrete. Such a construction as this is shown is section in Fig. 11, as an alternate form of corner construction from that indicated in Fig. 3, where the two uprights are attached by means of bent steel plates 30 which are fastended in place to the inwardly extending flanges of the units.

The various units are anchored in any suitable manner to the foundation and attached together in such a manner as to provide door ways as at 31 and windows as at 32 in Fig. 1. A floor is indicated at 33 which is supported on joints 34 which in turn are mounted on the cross rails or members 35. Fish plates 36 serve to reinforce the cross rails 35 in supporting the joists. These fish plates are mounted so as to take the place of the joint plates below the floor hoists. These fish plates 36 are therefore provided with four holes at each end through which the attaching screws 12 may pass and by means of which the fish plates are mounted rigidly in place on the frame members.

After the erection of the rigid sustaining frame the various frame members are filled with concrete which is poured into the upper ends of the frame units at one or more places at the upper part of the walls or at any of the joints. The concrete for this purpose is preferably used rather thin so that it will flow into the horizontal rails or units as well as filling all of the upright members.

After the frame members have been filled with concrete the outer surface of concrete indicated at 37 is applied, this concrete being applied or sprayed preferably by means of the usual concrete gun. The concrete is applied or sprayed onto the expanded metal lath 38 from the outside of the building. This expanded metal lath is held firmly attached to the outer sides of the frame members by means of the outwardly bent corners 54, of the corner plates 11. These corners are inserted through the expanded metal lath and are then hammered down so as to hold the metal lath in place. After a suitable coating of concrete has been applied to the outside of the expanded metal lath a coating of concrete indicated at 39, is sprayed from the interior of the building so as to form a homogeneous mass with outer surface 37. After the outer wall of concrete has been applied the panel pieces 27 are placed in position by screwing them to the threaded holes in the edge strips 24 or by bending one of the panel retaining strips 25 for placing of the panels.

After the panel pieces 27 have been placed in position a sheet of material 40, which serves as a backing for an inside plaster surface 41, is attached to the inner sides of the frame members by means of the bent corners of the inside plates 11 at the joints, which are made to extend through sheet 40 and are then bent over same to mount them rigidly in position. This sheet 40 may be made of any suitable material such as a heat insulating composition or may be metal lath in the form of expanded metal sheets. The plaster covering 41 is then applied. It will thus be apparent that two dead-air chambers are provided between the inner wall surface 41 and the outer wall of concrete. These dead air chambers obviously function as heat insulators.

Suitable edging strips 42 finish the edges of the concrete or plaster. These strips 42 are metallic strips which are held in place by attaching screws at the joints of the frame and which thus take place at these joints of the plates 11. In this manner the concrete is finished off neatly at the edges of the openings for doors and windows.

When the corners of the building are constructed as shown in Fig. 11 the space indicated 43, between the angle sheet 29 and the vertical uprights 44 and 45 is filled with concrete at the same time the frame members 44 and 45 are filled. The frame members 44 and 45 at their inner ends are held in position by angle plates 46 which are located at the joints so as to take the place of the joint plates 11.

The roof of the building may be constructed of a number of frame members 48 which form a skeleton structure similar to the wall of the building. The panel pieces 49 of the roof may be used in conjunction with the frame structure, if desired or may be omitted altogether. Upon the upper side of the frame members 48 are applied sheets of material 47 to which the shingles or other suitable weather proofing coat is attached. These sheets having their corners overlapping the corners of the joints so that screws may attach the corners of the sheets 47 to the through pins which unite the curls of the frame members. A layer of weather proof material 50 is applied upon the sheets 47. The roof is supported directly from the walls by means of steel angle members 51, which are bolted to the frame at the joints and which replace the joint plates 11, at these locations. The angle plates 51 being attached to the frame members of the roof and of the wall rigidly unite these two parts of the building. Suitable tie-rods 52, may be used to interconnect the walls together. The overhanging portion of the roof preferably ends in a horizontal frame member 55 to which is attached a rain-trough 53 at the joints of the horizontal frame member of the roof.

The inner walls of the building which divide the same into different rooms or sections may or may not be concreted as indicated for the outer building walls. The roof members preferably are not filled with concrete due to the weight which this would entail. The erection of the building by first constructing a rigid, self-sustaining sheet metal structure having hollow uprights and cross rails with concrete or other suitable cementitious mate-

rial is exceedingly rapid and economical, produces a strong permanent structure and is capable of being performed by labor which need not be skilled. It will be obvious that my invention is capable of various modifications and uses and I do not intend to be limited to the precise construction which has been chosen herein for purposes of illustration of my invention.

I claim—

1. A building wall comprising a skeleton self-sustaining frame of hollow rectangular elongated members rigidly attached together at their ends to define a series of rectangles, and filled with concrete, an exterior covering means of cementitious material on the outer face of the frame, an inner wall surface extending between said members and spaced from said exterior covering means to provide a dead-air chamber therebetween.

2. A building wall comprising a self-sustaining sheet metal frame of hollow elongated members attached rigidly together at their ends and arranged in mating pairs and filled with concrete, an exterior covering of concrete on the outer face of the said frame and an inner wall surface extending between said members and spaced from said exterior covering means to provide dead air space therebetween.

3. A building wall comprising a skeleton self-sustaining sheet metal frame of hollow elongated members rigidly attached together and filled with concrete, an exterior sheet of foraminous metal on the outer face of said frame, a coating of concrete on said sheet, a series of rigid panels between the said members, and an inner wall surface of cementitious material on the inner face of said members, said panels being spaced from said inner and outer surfaces to provide dead air spaces.

4. A building wall comprising a skeleton self-sustaining frame of hollow rectangular elongated members rigidly attached together at their ends to define a series of rectangles, an exterior covering means of cementitious material on the outer face of the frame, and an inner wall surface extending between adjacent members and spaced from said exterior covering means to provide a dead-air chamber therebetween.

5. A building wall comprising a self-sustaining sheet metal frame built up of hollow elongated members attached rigidly together at their ends and arranged in mating pairs, an exterior covering of concrete on the outer face of said frame, and a wall surface extending between said members and spaced from said exterior covering means to provide a dead-air space therebetween.

6. A building wall comprising a skeleton self-sustaining sheet metal frame of hollow elongated members rigidly attached together, an exterior sheet of foraminous metal on the outer face of said frame, a coating of concrete on said sheet, a series of rigid panels between the said members, and an inner wall surface on the inner face of said members, said panels being spaced from said inner and outer surfaces to provide dead-air spaces.

In testimony whereof I have hereunto set my hand this 10 day of June, 1926.

URBAN C. THIES.