June 14, 1938. S. R. McKAY 2,120,709

BUILDING CONSTRUCTION

Filed Feb. 8, 1932 2 Sheets-Sheet 1

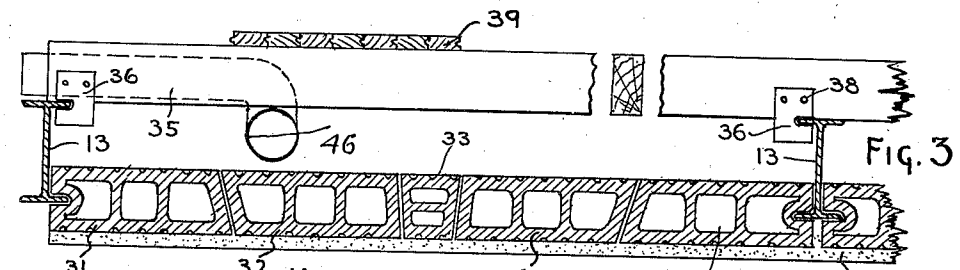


FIG. 3

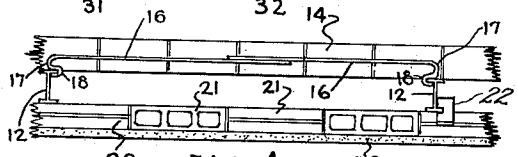


FIG. 4

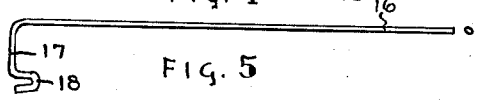


FIG. 5

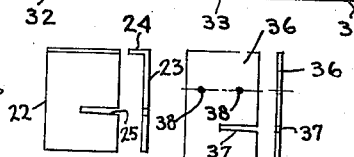


FIG. 6 FIG. 7 FIG. 8 FIG. 9

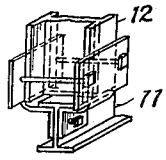


FIG. 10

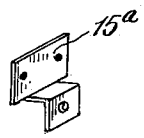


FIG. 11

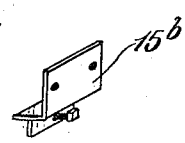
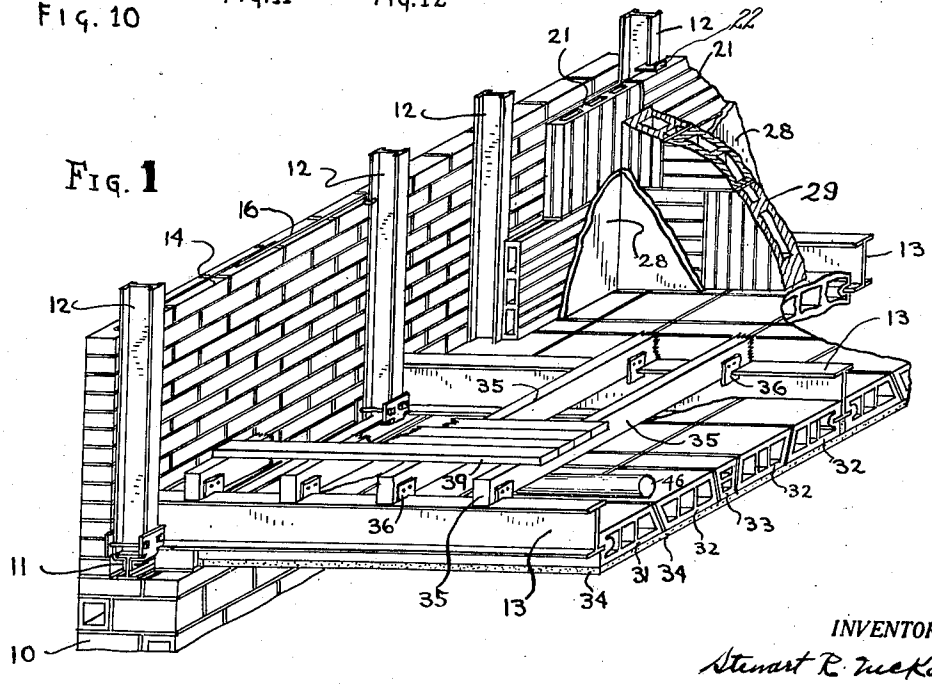


FIG. 12

FIG. 1



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BUILDING CONSTRUCTION

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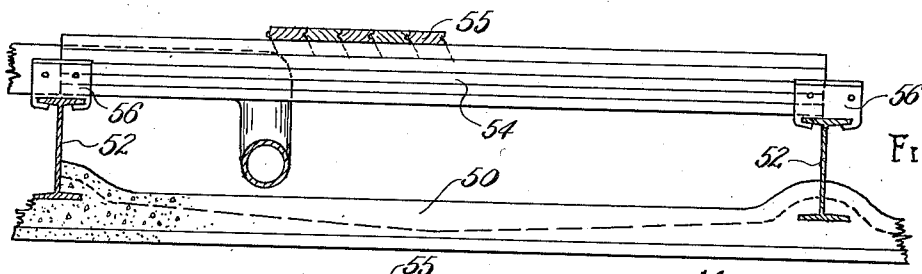


FIG. 13.

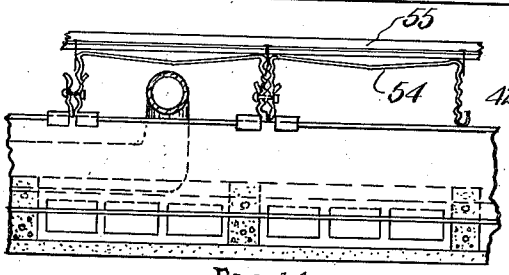


FIG. 14.

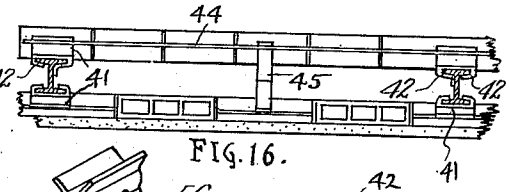


FIG. 16.

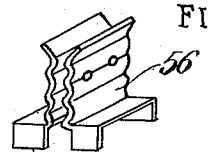


FIG. 15.

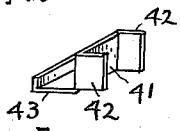


FIG. 17.

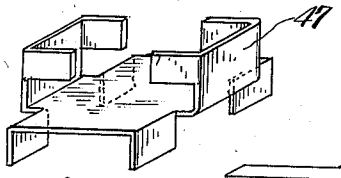


FIG. 18.



FIG. 19.

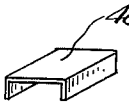


FIG. 20.

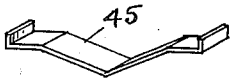


FIG. 21

FIG. 2

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UNITED STATES PATENT OFFICE

2,120,709

BUILDING CONSTRUCTION

Stewart R. McKay, Cleveland, Ohio

Application February 8, 1932, Serial No. 591,497

4 Claims. (Cl. 72—43)

This invention relates to building construction and especially to a type of construction adapted for use in residences or other similar buildings.

It is well known that present types of construction are not satisfactory as applied to residences because the buildings are not fireproof and are too expensive. In addition, the present types of construction do not adapt themselves readily to the use of new building materials and present many construction difficulties. Thus steel framework, even though it has many advantages which are well known to the building industry, has not been very widely employed in residence construction because it could not be adapted to the type of construction heretofore used in this field.

The residence buildings which have heretofore been designed to use steel framework have not been satisfactory as they have failed to secure the advantages of the steel framework, either as to rigidity of construction, its fire-resistant qualities, or as a means of securing a reduction in the cost of construction.

It is one of the objects of the present invention to provide a type of building construction which is adapted to employ a steel framework.

Another object of the present invention is to provide a type of building construction which is adapted to employ a steel framework and which can be erected at a very low cost.

A further object is to provide the type of building construction which is adapted to employ fire-resistant materials and in which the steel framework will be thoroughly insulated.

A further object is to provide a combination floor and ceiling incorporating a chamber for service pipes and ducts, such as pipes for hot and cold water, for drains, etc., and ducts for hot and cold air.

Another object is to provide an outside wall having a hollow tile backing and which is constructed in such a manner that plaster can be applied directly to the tile without furring or other intervening structure.

Another object of the present invention is to provide reenforcing means for a wall constructed of clay tile or brick.

Another object of the invention is to provide a building wall incorporating air chambers as insulating means.

A further object is to provide a construction employing steel framework to support the superstructure and to reenforce the walls.

Another object is to provide a combination floor and ceiling construction having a tile or concrete arch supported on the lower flange of an I-beam with wood sleepers or sheet metal pans to support the floor surface.

Another object is to provide a building construction employing a steel framework in which the frame members are free of shearing stresses and which has its members locked together to provide a rigid construction.

Other objects and features of novelty will be apparent from the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a fragmentary perspective view of a portion of a building embodying my invention and showing features of the construction of the floor, walls, and the framework, with parts broken away or shown incomplete so as to more completely illustrate other parts;

Fig. 2 is a fragmentary perspective view of a building employing modified forms of the floor and wall construction provided by my invention, with parts broken away or shown incomplete in order to more completely illustrate other parts;

Fig. 3 is an enlarged view showing the construction of the combination floor and ceiling employed in the building shown in Fig. 1;

Fig. 4 is an enlarged plan view showing the construction of the outside wall employed in the building shown in Fig. 1;

Fig. 5 is an enlarged plan view of one of the reenforcing bars employed in the wall shown in Fig. 4;

Fig. 6 is a plan view of an anchor plate employed in the wall shown in Fig. 1;

Fig. 7 is a side view of the plate shown in Fig. 6;

Fig. 8 is a plan view of an anchor member used to secure the wood sleepers to the floor pans;

Fig. 9 is a side view of the anchor member shown in Fig. 8;

Fig. 10 is a perspective view of the joint between one of the studs and the header showing one form of clamp employed to secure these members together;

Fig. 11 is a perspective view of one of the parts employed in the clamp shown in Fig. 10;

Fig. 12 is a perspective view of another of the parts employed in the clamp shown in Fig. 10;

Fig. 13 is a view showing details of the construction of the combination floor and ceiling employed in the building shown in Fig. 2;

Fig. 14 is a view of the floor employed in the building shown in Fig. 2, showing the manner of securing the floor pans to the joists;

Fig. 15 is a perspective view of one of the

clamps employed to secure the floor pans to the joists;

Fig. 16 is a plan view showing the construction of the wall employed in the building shown in Fig. 2;

Fig. 17 is a perspective view of one of the anchors employed in the wall shown in Fig. 16;

Fig. 18 is a perspective view of one of the clamps employed in the building shown in Fig. 2 to secure the studs and headers together;

Fig. 19 is a perspective view of one of the members employed in the building shown in Fig. 2 to secure the wood rafters to the steel headers;

Fig. 20 is a perspective view of one of the members employed to secure the joists to the headers; and

Fig. 21 is a perspective view of one of the members employed in the wall shown in Fig. 2 to tie the inner and outer wall portions together.

In Figs. 1 and 2 I have illustrated portions of a building embodying my invention, the parts shown including portions of the outer wall, portions of two floors which may be either the ground or upper floor, and a part of the roof support. The framework consists of light steel I-beams and includes headers 11, studs 12 and joists 13. The headers 11 preferably extend entirely around the building and the joists and studs rest directly on the headers so that the weight of the frame and the weight of the super-structure is transmitted directly between the frame members rather than through the members employed to secure the frame together. A clamp adapted to secure the studs and headers together is shown in Figs. 10, 11 and 12. The clamp therein illustrated comprises angular members 15a and 15b which are bolted to the end of the stud 12 and engage the web of the header 11. Another form of clamp is employed in the building shown in Fig. 2. This clamp is indicated generally by the reference character 47 and is shown in detail in Fig. 18. The joists 13 rest on the headers 11 and are held in place by means of a section of channel iron 48 which is welded on the bottom of the joist and fits over the edges of the header.

As heretofore constructed, building walls of brick or tile, or both, have usually been of a thickness equal to that of two or three rows of bricks. This has been necessary as the walls were used to support the super-structure or because a wall of this thickness was required to give the wall the lateral strength necessary to keep it from collapsing either inwardly or outwardly. In a building having a steel framework, the weight of the superstructure is carried by the framework and the walls are relieved of this load, while the wall provided by my invention is reenforced and is secured to the steel framework so that it can be made on a single thickness of brick and still have sufficient lateral strength to be free from danger of collapse.

It has been found that there is considerable seepage of moisture through outside walls constructed of brick and backed with hollow tile. This has made it impractical to plaster directly on the tile as the moisture either spotted the plaster or caused it to loosen and fall off. It has been necessary, therefore, to fur and lath the wall before plastering and this has greatly increased the cost of construction. With the wall provided by my invention, it is possible to plaster directly on the hollow tile without furring or lathing the wall.

Referring to the drawings, it will be seen that in Fig. 1 there is a foundation wall indicated generally by the reference character 10. This wall can be constructed in the well known manner from brick, tile, cement blocks, or other suitable materials. A beam or header 11 is placed on top of a wall 10 and studs 12 and joists 13 are secured to this beam. It is expected that the studs 12 will be spaced four or five feet apart, the exact spacing being dependent upon the size of the building and the location of the doors and windows. As will be seen in Fig. 1, the beam 11 and the studs 12 are spaced inwardly of the outer edge of the foundation wall so that a curtain wall 14, constructed of a single row of bricks, can be built on the foundation outside of the framework. The weight of the wall 14 is therefore carried by the foundation rather than by the framework. As stated above, a wall constructed of a single row of bricks has very little lateral strength so the wall provided by my invention incorporates means to reenforce the wall and give it greater lateral strength.

The construction of the wall 14 and the reenforcing means employed will be better understood by reference to Fig. 4 which is a plan view of the wall, and to Fig. 5 which shows one of the reenforcing members which is embedded in the wall. The wall 14 is constructed of brick and mortar or cement in the usual manner except that at intervals, varying from four to nine courses, reenforcing members 16 are embedded in the cement between the rows of brick. As illustrated in Fig. 5, the member 16 is a bar or rod having its end bent at an angle and having an arm 17 terminating in a hooked extremity 18 which is adapted to engage a flange of the I-beam 12. The arm 17 is preferably of such a length that the longer portion of the bar 16 will be positioned substantially in the middle of the wall 14. Reenforcing bars are secured to each of the studs and these bars either overlap or closely approach each other so that the wall is reenforced throughout substantially its entire length. Reenforcing means are not required for every course of brick, and it is expected that the rods will be spaced from four to nine courses apart, the exact spacing depending upon the amount of reenforcing needed. Thus, if the studs 12 are close together less reenforcing will be required than if the studs are relatively far apart. As the reenforcing bars are embedded in the mortar or cement and are held by the weight of the superimposed wall, they cannot pull out of the wall, and, as their ends are firmly locked over the edges of the studs the wall is securely attached to the framework. This construction permits the outer wall to be built from a single row of bricks while, at the same time, it insures that the wall will have sufficient lateral strength.

The construction of the wall 20 which constitutes the inner portion of the outside wall is also shown in Fig. 1. It is contemplated that this wall will be built of hollow tiles 21 of a type well known to the trade. As will be seen in Fig. 1, the foundation wall 10 extends inwardly of the beam 11 providing a ledge over which the floor arch extends. The construction of the floor arch will be fully explained in detail below. The wall 20 rests on the floor arch and is directly over the foundation wall 10 so that the weight of the wall 20 is carried by the foundation. The tiles 21 are preferably placed with the air chambers alternately vertical and horizontal, as illustrated in Fig. 1. It has been found that this construction increases the insulating quality of the tile as it increases the dead air space. If

the tiles are positioned with the air chambers all in the same direction, a poor joint at one point will open up not only the tiles adjacent the joint but an entire row. When the tiles are positioned as shown in Fig. 1, a poor joint affects only the tiles adjacent the joint.

In order to secure the tiles to the steel framework anchor plates 22, such as are shown in Figs. 6 and 7, are fitted over the flanges of the studs 12 and are embedded in the joints between the tiles. The anchor plates 22 are preferably constructed of angular pieces of sheet steel and have a short arm 24 at one end while the longer portion 23 has a notch 25 cut in one side. The notch 25 is of a size adapted to receive a flange of an I-beam. The anchor plates lock the tiles of the inner wall to the framework thereby reenforcing the wall while, at the same time, the framework is stiffened and made more rigid by being attached to the inner and outer walls.

It will be seen that the inner wall portion 20 and the outer wall portion 14 are spaced apart and that there is an air space between the two. It will also be seen that the two wall portions do not contact, so there is no danger of moisture seepage from the outer wall portion to the inner wall portion. If any water does seep through the outer wall it will run down the inside of the wall 14 and will not reach the inner wall 20. Because of this fact it is possible to apply the plaster 28 directly on the tile without furring or lathing.

It will also be seen that the steel framework is entirely enclosed by the masonry walls so that it is insulated and protected from fires which would warp or permanently injure the framework if it were unprotected.

A modified form of wall construction embodying my invention is shown in Fig. 2. The wall therein illustrated is similar to that shown in Fig. 1 and comprises separate non-communicating inner and outer portions which are locked to the steel framework by means of anchors 41. The construction of the anchors 41 will be best understood by reference to Fig. 17. Each anchor has a pair of wings 42 which are adapted to be bent around the flanges of an I-beam and has a portion 43 which is adapted to be embedded in the masonry wall. A reenforcing rod 44 is also embedded in the outer portion of the wall to give the wall greater lateral strength. The inner and outer wall portions can be secured together at points between the studs by means of tie-bars 45, one of which is shown in Fig. 21. The ends of this bar are adapted to be embedded in the masonry work, while the center is offset so that if any moisture seeps through the outer wall it will flow only to the center of the tie-bar, and because of the inclined inner portion, the moisture will not reach the inner wall.

In addition to the novel form of wall construction described above, the building provided by my invention incorporates a combination floor and ceiling having numerous advantages. The construction of the floor and ceiling is best shown in Fig. 3. The combination floor and ceiling is supported on beams or joists which are indicated by the reference character 13 and which, in turn, are supported either on the foundation wall or by the steel headers. It is contemplated that the beams 13 will be spaced about four or five feet apart. Hollow tile arches indicated generally by the reference character 30 are built between the beams 13 and are supported on the lower flanges of the beams. The arch 30 comprises shoe tiles 31 at each end which are adapted to fit over a flange of the floor beam and suitable intermediate tiles 32 and 33. The tiles are secured together by cement or mortar while the lower face of the arch is plastered as at 34 to form the ceiling of the room below. It will be seen that the arch constructed in this manner encloses the lower portion of the floor beams and protects them in case of fire. It has been found that arches constructed in this manner have great strength and provide a foundation on which to build partition walls, as at 29, between the rooms of the finished building.

The floor may be supported on wood sleepers 35 which run transversely of the floor beams and which rest on the tops of beams 13. The sleepers 35 which may be 2 x 4s or 2 x 6s are preferably secured to the beams 13 by means of anchor plates 36. As will be seen in Figs. 8 and 9, the anchor plate 36 is a flat steel plate having a notch or recess, as at 37, which is adapted to receive a flange for the I-beam and having a pair of holes 38 through which nails or spikes can be driven into the sleeper. The anchor plates hold the sleepers securely, keeping them from moving lengthwise and holding them so they will not tip over. A floor composed of suitable boards 39 is secured to the top of the sleepers 35 in the usual manner.

As will be seen in Fig. 3, the combination floor and ceiling provided by my invention has an open space or chamber between the ceiling and the floor. This is an important feature of the building provided by my invention as pipes 46 for water and heat etc., as well as the ducts for hot or cold air or for an air conditioning system, can be placed in this chamber. In buildings which have been constructed heretofore with steel frames, it has been customary to support the arch 30 either on the upper flange of the I-beams or between the flanges. This left no space above the arch in which to place pipes, etc., and it was necessary, therefore, to position them beneath the arch and to conceal them by means of a suspended ceiling. As the construction provided by my invention eliminates the need for a separate ceiling, it greatly reduces the cost of construction.

A modified form of the combination floor and ceiling construction embodying my invention is shown in Figs. 2 and 14. In this form of construction, the arch which is indicated generally by the reference character 50, has reenforced concrete beams 51 which reach between the floor beams 52. Hollow tiles 53 are placed in the arch between the beams 51 and are held by the cement which is poured around them. It is contemplated that this arch will be supported on the lower flange of the beams 52 and that the lower face of the arch will be plastered as at 53 so as to form the ceiling of the room below. Instead of wood sleepers, steel pans 54 are employed to support the floor. The pans 54 are substantially U-shaped and rest on the tops of the beams 52 and have corrugated side portions which fit closely together. The pans may be secured to the joists by means of clamps 56, one of which is illustrated in Fig. 15. The boards 55 for the floor surface are positioned on top of the steel pans 54 and are held in place by means of nails which are driven into the joint between the steel pans. As the pans fit tightly together, the nails are held by friction and, in addition, as the edges of the pans are corrugated, the nails are bent so that they will not pull out. Instead

of the boards, a composition or cement floor can be applied on top of the pans.

This type of combination floor and ceiling construction, like that described above, provides a chamber between the floor and the ceiling in which pipes, ducts, etc., may be placed. As it substitutes steel pans for the wood sleepers, this construction is more nearly fireproof. While the tile arch was described in connection with wood sleepers and the reenforced concrete arch in connection with steel pans for the floor supports, it should be understood that either form of arch may be employed with either form of floor construction.

While I have illustrated and described in detail certain constructions embodying my invention, it should be understood that changes may be made without departing from the spirit of the invention as defined in the appended claims.

Having thus described my invention, I claim:

1. In a double walled steel frame building, a structural steel framing for supporting the load comprising spaced vertical structural steel members including spaced vertical members having outside and inside flanges, an outside laid-up masonry wall adjacent the outer face of said flanged members, members embedded in said wall and interengaged with the outside flanges of said vertical members, a separate inside wall adjacent the inside face of said vertical members and spaced from said outside wall, and means for connecting said inside wall with the inside flanges of said spaced vertical members.

2. In a double walled steel frame building, a structural steel framing for supporting the load comprising spaced vertical structural steel members including spaced vertical members having outside and inside beveled flanges, an outside wall adjacent the outer face of said flanged members constructed of a single thickness of bricks, reenforcing members between courses of said bricks, means for connecting said reenforcing members with the outside flanges of said vertical members, a separate inside wall adjacent the inside face of said vertical members and spaced from said outside wall, and means for connecting said inside wall with the inside flanges of said spaced vertical members.

3. In a double walled steel frame building, a structural steel framing for supporting the load including spaced vertical flanged structural steel members, an outside laid-up masonry curtain wall adjacent the outer face of said vertical structural members of said framing, members embedded in said wall and having V-shaped slots engaging the flanges of said upright members with a wedge or clamp action for securing said outside wall to said framing, a separate inside wall adjacent the inside face of said vertical structural members of said framing and spaced from said outside wall providing open spaces therebetween, and means for connecting said inside wall to said upright members of said frame.

4. In a double walled steel frame building, a structural steel frame for supporting the load including spaced upright I-beams, an outside laid-up masonry curtain wall adjacent the outer face of said I-beams, metallic members embedded in said wall and having V-shaped slots engaging the flanges of said I-beams with a wedge or clamp action for connecting said outside curtain wall with said steel frame, a separate inside wall adjacent the inside flanges of said I-beams and spaced from said outside wall to provide an open space therebetween, and means for connecting said inside wall to the inside flanges of said I-beams.

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