Aug. 28, 1934. G. CAVAGLIERI 1,971,331

BUILDING RECONSTRUCTION

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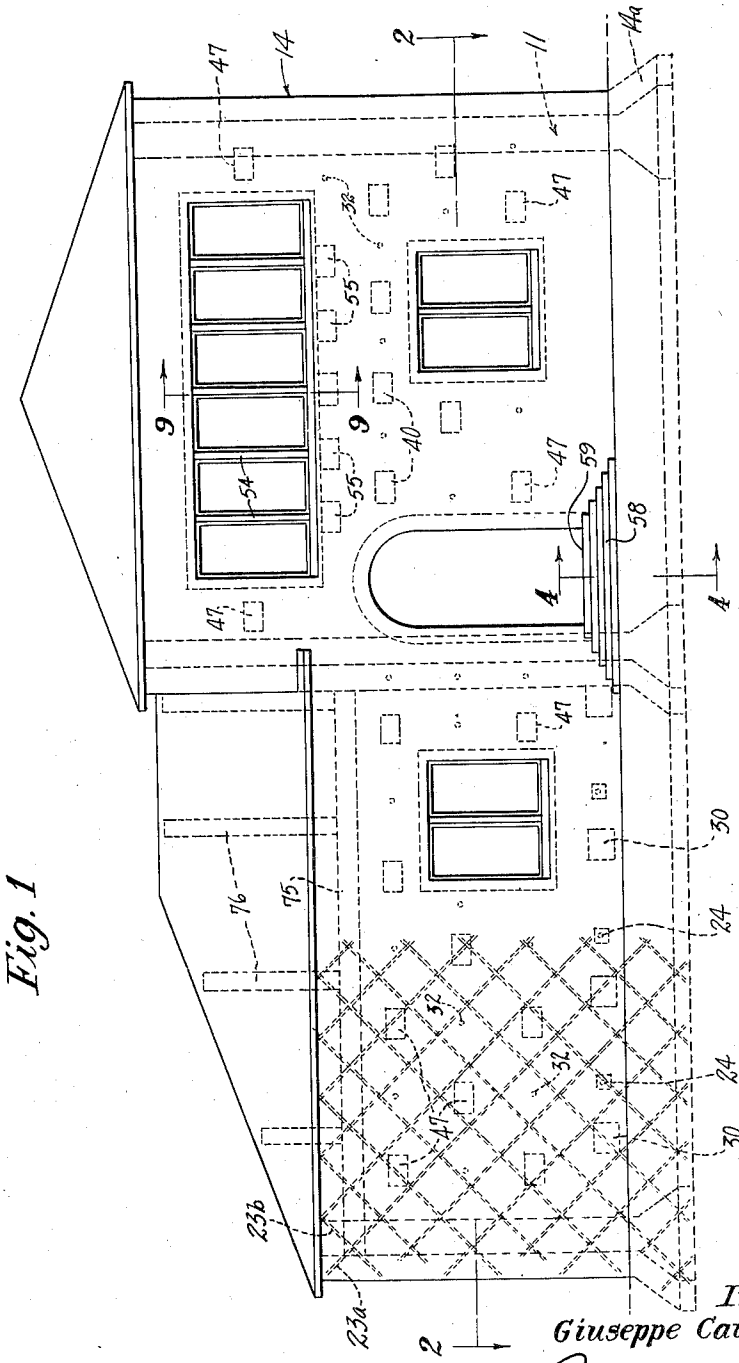


Fig. 1

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Filed Sept. 6, 1933 4 Sheets-Sheet 2

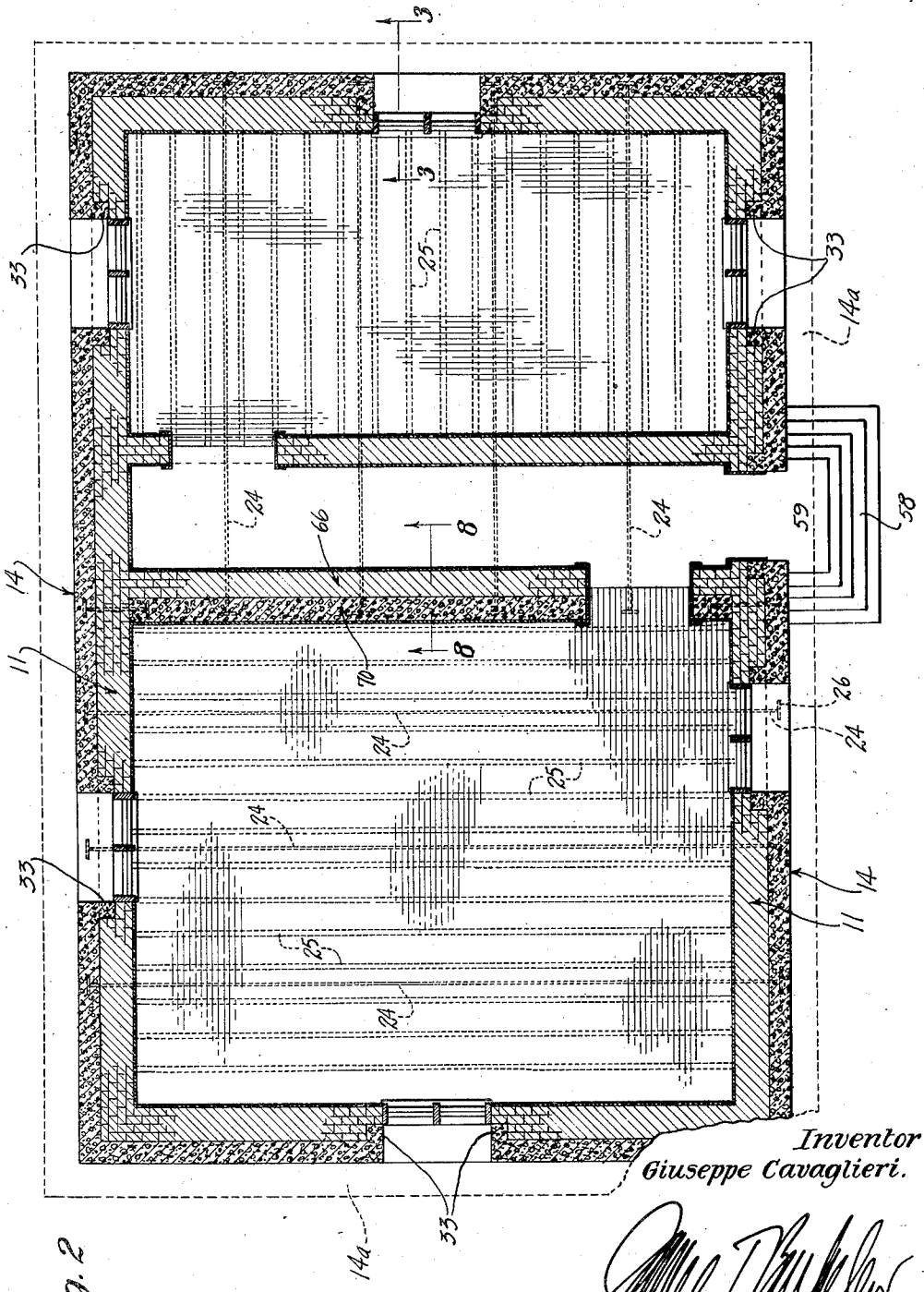


Fig. 2

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Filed Sept. 6, 1933 4 Sheets-Sheet 3

Fig. 3

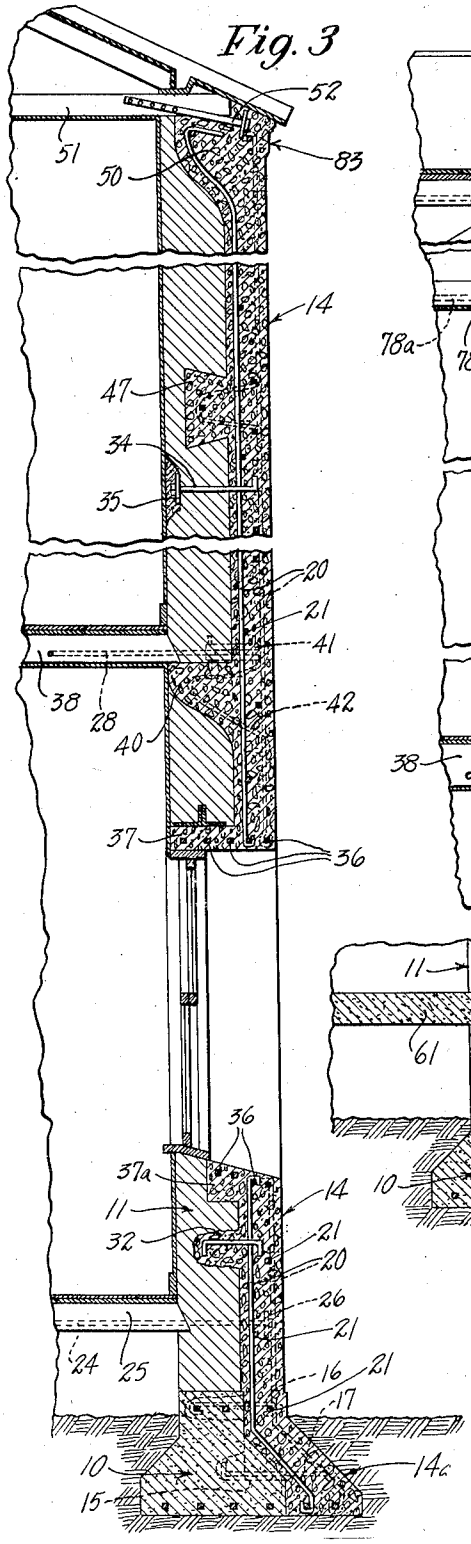


Fig. 5

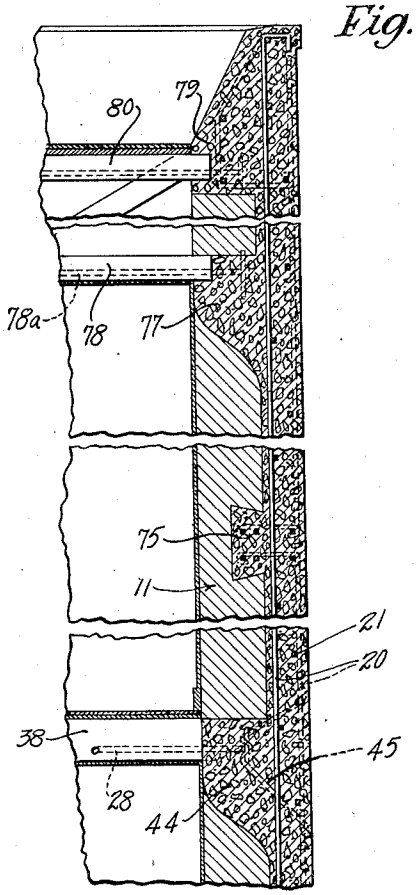
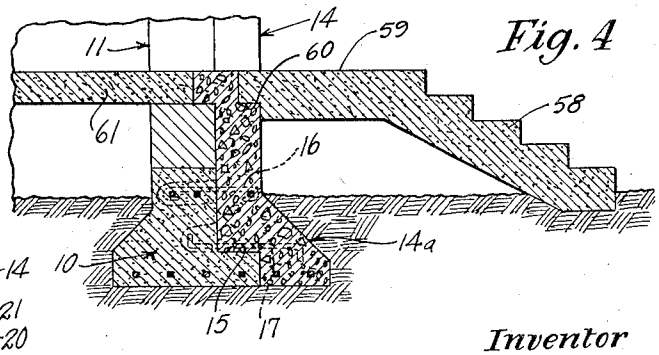


Fig. 4



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BUILDING RECONSTRUCTION

Filed Sept. 6, 1933 4 Sheets-Sheet 4

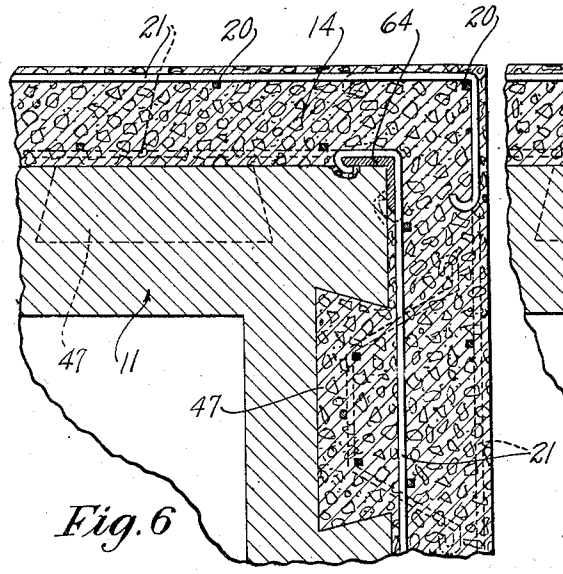


Fig. 6

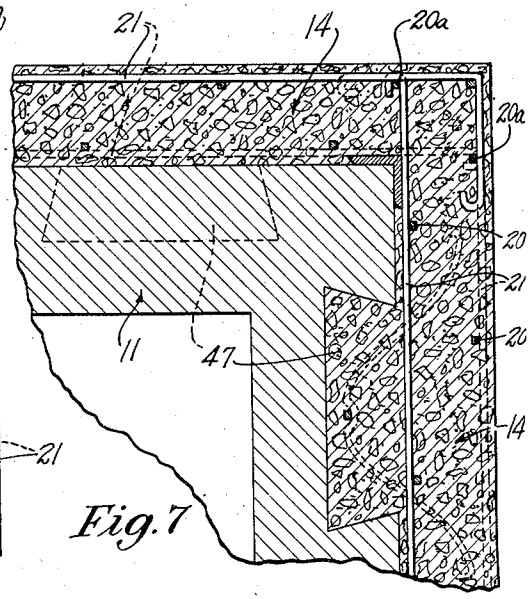


Fig. 7

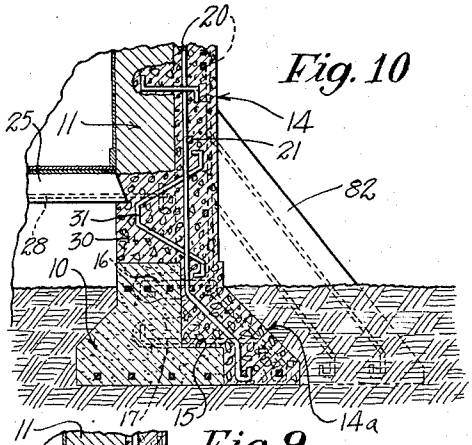


Fig. 10

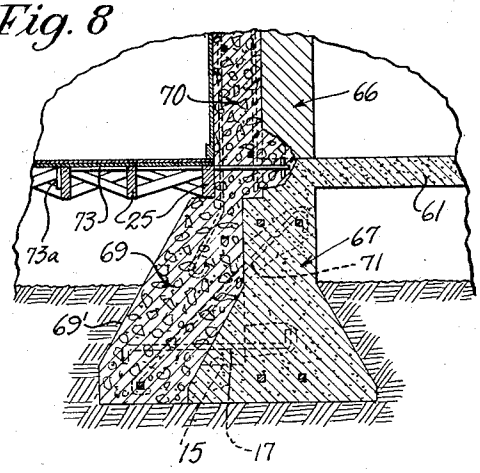


Fig. 8

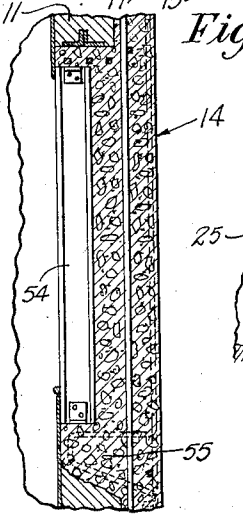


Fig. 9

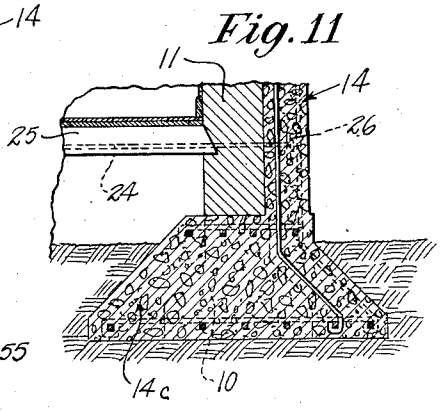


Fig. 11

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UNITED STATES PATENT OFFICE

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BUILDING RECONSTRUCTION

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Application September 6, 1933, Serial No. 688,319

13 Claims. (Cl. 72—1)

This invention relates generally to reconstruction and repair of buildings, but more particularly to the repairing and strengthening of buildings damaged by earthquake shocks. In many buildings so damaged, there remains at least a large portion of the wall structure and the elements carried thereby, such as the floors and roof. The bearing walls have become so weakened, however, that they might collapse following a relatively small shock and the building is rendered unfit for further human habitation even though the walls have been actually destroyed in but relatively small areas. The question presented is between reconstruction and replacement of the damaged buildings. Replacement involves wrecking the old structure and losing the value of a considerable amount of still serviceable building material in addition to the cost of the new building. Thus it is frequently less costly to repair the damaged structure than to rebuild anew, since repairing may salvage much of the original structure, including lighting, heating, and plumbing fixtures, interior decoration and the like, and other equipment.

Another factor to be taken into consideration is that in communities where earthquake hazard is known to exist, the building codes have generally become much more stringent than in the past, and repair work must meet the same requirements as new construction as to strength, type of materials, construction details, fireproofing, etc.

It thus becomes a general object of my invention to devise an economical method of repairing damaged buildings, that is in itself inexpensive, that does not require fundamental alteration of the original structure, and that permits the full use of all existing structure and fixtures that are undamaged, thus saving replacement costs on these items as far as possible.

Another object is to provide a reconditioned structure of calculable strength that may be made as strong as required by building codes. This will result in many cases in a building of greater strength than the original one, as the repaired structure may now be designed to withstand horizontal loads as well as increased vertical loads. In order that the completed structure have actually its designed strength, it is desirable that the original walls, now of questionable strength, be required to carry as little of the total loads as possible, and the new, sound structure be relied upon to carry substantially all of the live and dead loads.

A further object of the invention is to provide a safe structure. This condition requires that there be no danger from falling objects such as loosened ornaments, cast stone trim, brick walls, and any other objects not adequately secured to the main structure, in this case the new structure. This will require elimination of certain decorative features, and the bonding together of the old and new elements to act as a unit. As an additional contribution to safety, the building materials are preferably of a fireproof nature.

These and other objects are attained in a building repaired and strengthened in accord with my invention, by erecting a new bearing wall against the outside of the old original bearing wall, tying the two walls securely together, and providing the new wall with projections embedded in the old wall which are located at selected places either to take directly the loads before imposed on the old wall, or to transfer the loads in the old wall to the new one. These projections are of such number as to each only take a relatively small load, and are so placed that no section of any large extent of the old wall is loaded, but the loads are carried to the footings chiefly by new structure and not the old. The main function of the old wall is now to carry interior decorating, pipes, electric wires, and other fixtures already attached to or placed within the wall. While the bearing walls are designed to resist longitudinal and horizontal forces, additional rigidity and stability is given to the building by tying together opposite bearing walls by means of anchors embedded in the new wall structure.

Inasmuch as my invention is particularly adapted to structures supported by exterior bearing walls, I have shown and described my invention mainly in this aspect but it will be realized that the application of my improved reconstruction system need not be limited to exterior bearing walls, nor to structures in which all of the loads are carried upon bearing walls, but is applicable to any bearing wall either interior or exterior.

Structures of the bearing wall type are generally of masonry construction, and because of the wide prevalence of brick as a building material, I have shown my original structure to be of brick masonry, but my invention may be applied to other materials than illustrated. Also, I have shown the new construction to be of cement concrete because of the particular adaptability of this substance to reconstruction work, but it will be realized that the application of my invention is independent of the building materials used.

Without further preliminary discussion, it will be more readily understood from the following description how the above and other objects and advantages of my invention are attained. Throughout the following description of a typical preferred embodiment of my invention, reference is had to the following drawings, in which:

Fig. 1 is a side elevation of a building reconstructed according to my invention;

Fig. 2 is a plan view of the first floor of the building on line 2—2 of Fig. 1;

Fig. 3 is a broken vertical section of an exterior bearing wall on line 3—3 of Fig. 2;

Fig. 4 is a fragmentary vertical section on line 4—4 of Fig. 1;

Fig. 5 is a broken vertical section of a bearing wall illustrating variational forms of construction details;

Fig. 6 is an enlarged fragmentary horizontal section of a corner of the building showing placement of the reenforcing steel;

Fig. 7 is a view similar to Fig. 6 but showing a variational arrangement of reenforcing steel;

Fig. 8 is a fragmentary vertical section of an interior bearing wall and footing on line 8—8 of Fig. 2;

Fig. 9 is a fragmentary vertical section on line 9—9 of Fig. 1;

Fig. 10 is a fragmentary vertical section of an exterior bearing wall and footing showing variational forms of construction details; and

Fig. 11 is a fragmentary vertical section of a variational form of footing in which the original wall is undercut.

The building shown in Figs. 1 and 2 is a typical brick building, partially one story and partially two story, with exterior and interior bearing walls, and is intended to illustrate some of the typical conditions that may be encountered in reconstruction work and the preferred treatment for the several conditions. Fig. 2 illustrates generally how the original building is surrounded or encased in a shell of new concrete. These new concrete bearing walls are tied together and to the old original brick wall so that the whole coacts as a unit.

The concrete walls are designed to be of sufficient strength to withstand the horizontal and vertical loads imposed upon them as bearing walls, and are provided with projections extending into the original brick structure in order to transmit to the concrete the loads formerly carried by the original walls, all in a manner that will be explained. It is felt the invention will be best understood by first discussing in detail several of the construction features and then considering the general application of the several features to the plan as a whole.

Fig. 3 illustrates a typical footing 10 supporting an exterior brick wall 11, and against the exterior of which has been formed the new concrete wall 14 having a footing portion 14*a*. As an aid in tying the two footings together to act as a unit, portions of the old one are cut away to form a shelf 15 having a horizontal surface upon which footing 14*a* bears (see also Fig. 4). The length of this shelf parallel to the wall may vary according to conditions; it may either extend the entire length of the wall, or may be divided into several sections separated by intervals of the original footing. Anchors 16 and 17 are securely set in the original foundation, and then the exposed ends are subsequently embedded in the new wall, the anchors being supplied at suitable intervals determined by the loads carried. In this manner the two footings are tied together to prevent relative settling of the new structure and to distribute the entire load over both footings 10 and 14*a*.

Concrete walls 14 are provided at both the inner and outer faces with reenforcing steel, shown by vertical and horizontal bars 20 and 21, respectively, placed according to the dictates of good design and giving to the wall rigidity to resist the horizontal forces set by building codes. Use may be made of these reenforcing bars to hook over them the ends of the wall anchors. Thus anchor 16 is so placed as to pass around a horizontal bar 21, although the anchors may be only turned up at their ends, as is anchor 17, in order to develop a sufficient bond between the new and the old work.

As indicated by bars 23*a* and 23*b* in Fig. 1, the reenforcing bars may be inclined oppositely to the vertical to extend diagonally to the wall face. This produces a wall particularly resistant to a combination of loadings as often occurs during an earthquake.

As a further means for tying the walls together to form a rigid unit, the tie rods 24 (Figs. 2 and 3) extend between opposite walls 14 and may conveniently be placed underneath the floor and between floor joists 25. The ends of a tie rod 24 are preferably provided with a plate 26 in order to securely embed the end of the tie rod in the concrete wall.

While it is the general purpose of the new wall structure to relieve the old of vertical loads so that no large extent of the old brickwork is heavily loaded, yet the floor joists 25 of the first floor are in general so close to the foundation that the original brick may be safely used to carry their loads directly to foundation 10 as is illustrated in Fig. 3. However, at horizontal intervals of about 5 or 6 feet the joists are connected to the wall by means of joist anchors, see Fig. 10, and it is desirable that these anchors be securely affixed to the new concrete structure. This is accomplished by shoring up joist 25 to carry its load temporarily while the bricks are removed from wall 11, from a point approximately even with the top of the joist down to the top of footing 10 and for a horizontal extent of any convenient length, say equal to the spacing between joists; and this space is then filled with a block of concrete 30 which forms a support for the joist and securely embeds anchor 28 therein. This block 30 is subsequently joined monolithically with wall 14 so as to become a part thereof, a random length of reenforcing steel 31 being embedded in block 30 and wall 14 to make the joint more secure, so that anchor 28 is now attached to the new bearing wall. It will be evident that similar treatment at each end of the joist provides between opposite walls 14 a tie comprising joist 25 and the two anchors 28.

Walls 11 and 14 are tied together at frequent intervals by means of some such anchor as 32 (Fig. 3) which is firmly set in a hole hollowed out in the brick work leaving one end exposed to become subsequently embedded in the concrete work placed against the old brick. In order to preserve the interior finish it is desirable that the anchors be set in the wall from the outside as illustrated at 32, particularly where the surrounding brick work is still reasonably firm. Where, however, the brick work has become shattered, and in which case the interior finish is undoubtedly damaged, it becomes preferable to use an anchor 34 (Fig. 3) which has a plate 35

on its inner end, held in place by a nut. Plate 35 may be of adequate size to hold securely the loosened brick against the new concrete wall. The plate is covered with mortar leveled to the face of the brick work and the interior decoration is then replaced.

Brick buildings are frequently provided with cast stone trim about door and window openings, a feature that has been discovered to be quite undesirable. In an earthquake of even moderate intensity this cast stone trim is very liable to become loosened and in falling constitutes a source of grave danger to persons outside the building. I therefore remove all this trim about the door and window openings and fill the space so occupied with concrete which is joined monolithically to the wall. Typical placement of concrete at a window head 37 and sill 37*a* is illustrated in Fig. 3, while conditions at the jamb are indicated in Fig. 2 where the concrete is returned at 33 to the window frame, thus giving a deep reveal. Where necessary or desirable, the concrete may extend clear through the wall to the interior trim, as indicated at the head of the window in Fig. 3 where the concrete has been reenforced with additional steel bars 36 so as to aid the lintel angle in carrying the load across the opening. Several of the steel bars 36 run entirely around the window to form a reenforced concrete frame around the opening so that there will be no danger of falling fragments or of collapse under unusual stress.

At the second floor, certain of the floor joists 38 are selected to be supported directly by the new wall, and it is preferable that those joists so selected should be those provided with anchors 28, though it will be readily apparent that other or more joists may be so selected if desired. As with joist 25, joists 38 are temporarily shored up while an opening is made in wall 11. This opening is later filled with a block of concrete 40 monolithic with wall 14 and forming a ledge projecting inwardly from the inner face thereof to be a support for joist 38. This projecting ledge has a substantially horizontal upper surface upon which the joist rests so that the load is transmitted directly to the wall 14 without passing through any of the brick work. In this case the brick is broken away to allow an extension 41 to be fastened at one end to anchor 28 and the other end embedded in the new concrete so that any pull on the anchor is resisted by the new wall. A short length of reenforcing steel 42 is bent to pass into ledge 40.

A variational form of projecting ledge is illustrated in Fig. 5, where a block of concrete 44 has been formed in the brick wall to receive joist 38. As described in connection with Fig. 10, the vertical dimension of block 44 is such as to embed the end of joist 38 within the block rather than to support the joist upon its upper surface. Under these circumstances, a sufficient amount of brick work has been removed so that the end of joist anchor 28 is available to be embedded within block 44 and no extension on the joist anchor is needed. However, if desired, the reenforcing bar 45 passing into the projecting ledge may be wrapped around the inner end of the joist anchor as illustrated in the figure.

Another type of load receiving projection on the inner side of wall 14 is illustrated in Fig. 3 by block 47, which is shown in plan in Fig. 6. Block 47 extends into wall 11 to any convenient point, about midway of the wall, and forms a ledge adapted to receive the weight of the superincumbent brick together with any concentrated load imposed upon the brick vertically above the ledge and to transmit such load to concrete wall 14. A projection may have any longitudinal horizontal dimension desired depending upon the location of the ledge in the wall and upon the load it is intended to carry. Projection 47 is provided with reenforcing steel which may be arranged in any suitable way, variational forms of arrangement being illustrated in Figs. 3, 6 and 7. While the top, bottom, and end surfaces of the ledge may be formed at right angles to the inner face of wall 14, yet it is preferred that they be oblique thereto so that the ledge dovetails into the brick wall and thereby additionally serves to anchor the two walls together against relative horizontal movement.

While projecting portion 47 of the concrete wall differs somewhat in shape from projecting portions 30, 40, and 44 previously described as supporting the various floor joists, yet it will be observed that all these projecting portions or ledges perform the same general function, i. e., they receive superincumbent loads and transmit said loads to the concrete wall 14, and are all load receiving projections or ledges as termed herein. The location and function of the various projections will determine their size and shape, thus when it is desired to support the various floor joists, the supporting ledges must be of a shape and size to extend clear through wall 11 to reach the joist.

Fig. 3 illustrates a method of supporting roof and ceiling joists where the roof is sloped as illustrated in Fig. 1. In this case the brick at the top of the wall is removed so that wall 14 is formed with a projection 50 fitting up under the joists 51 and the eaves of the roof in order to embed in the wall joist anchor 52. In this manner the roof is supported on the top of the wall, and the wall is tied across its top to the opposite wall to brace it against transverse movement.

One of the first steps in reconstruction work is the preparation of openings in the original wall to receive the load receiving projections of the new concrete wall. Although other satisfactory arrangements of the load bearing projections may be devised, having proportionately a greater or smaller number of ledges and different relative placements, the arrangement herein described and illustrated may be considered typical. Among the locations most suitable for the ledges, are the points of application of concentrated loads to the brick wall such as occur in connection with the supporting of floor joists, roof trusses, and the like. Referring to Fig. 1, it will be seen that a selection of certain of said points results in a horizontal row of ledges 30 preferably placed at the ends of those joists having anchors, for the reasons described, through any other suitable interval between ledges may be selected. However, it is preferred that the ledges be not too close together, for sufficient of the original brick work must be left to carry the loads of the original structure during the reconstruction work.

Another point of concentrated loading occurs at the bottom of the posts 54 between windows, see Fig. 1, and it is preferable that a ledge 55 be formed beneath each of these individual posts in the manner illustrated in Fig. 9. In accordance with this same principle, there will be a row of ledges 40 which receive certain of the loads of the second floor joists. In this manner the

original brick work may be relieved entirely of a large portion of the concentrated loads which are thus carried directly to the new concrete bearing wall.

After locating the ledges carrying concentrated loads, as mentioned, there are selected positions for ledges of the type illustrated at 47 in Fig. 3. These latter ledges carry the weight of the superincumbent brick work together with any loads on points directly above; and preferably are not located in vertical rows but are slightly staggered, so as to be more uniform in their action and more effective in transmitting a larger proportion of the load to the new bearing wall. The exact number and locations of ledges 47 depend upon the conditions existing in any given structure, though a typical arrangement is shown in Fig. 1. The maximum load transference will occur when any vertical line in the wall will pass through one or more ledges.

Although the several ledges embedded in the old wall will have a certain effect in tying the two walls together, particularly if the ledges are made with inclined faces as mentioned in connection with ledges 47 in Fig. 3, it is preferred to provide several anchors 32 spaced at intervals throughout the wall. Whether anchors 32 are sufficient, or anchors 34 are required, and the spacing between anchors, are matters of detail to be determined by the strength and rigidity of any given wall. The purpose of these anchors is to tie the brick work to the concrete wall at small intervals so that there will not be any large expanses of brick work which might shake loose in even a minor earthquake. These anchors, as well as tie rods 24 extending through the building between opposite walls, are all placed before pouring of the new concrete wall so that their exposed ends may be embedded in the new wall.

Before erecting the new bearing wall, the old brick work is cleaned of any plaster, ornaments, or other objects which might interfere with the bond between the concrete and the brick. Also, it has been found desirable to cover the brick work with a priming or bonding coat of dense cement which may be conveniently applied by means of the "Gunite" process, a method well known in the trade, although any other method may be used. The advantages derived from such a dense priming coat are two-fold; first, the priming coat adheres firmly to the brick work and also to the subsequently poured concrete so as to form a good bond between the two walls; and second, the priming coat prevents the absorption by the brick of moisture from the wet concrete, which absorption prevents proper setting of the concrete. However, if the brick is first thoroughly soaked with water, the priming coat may be omitted, and the concrete is poured in direct contact with the brickwork. Adequate wetting of the brick allows the concrete to set properly and to bond satisfactorily with the old work.

Under certain circumstances it will be quite satisfactory to place the forms, pour the concrete, and rely upon tamping of the freshly placed mix to fill the prepared openings for the ledges. The forms will then be raised progressively as the concrete is poured so that opportunity may be had for such tamping, as it is necessary that the openings in the old wall be completely filled in order to secure good load transferring contact between the old work and the new. In general, however, it is preferred to build up the individual ledges by hand or by several applications of "Gunite" material so that all the openings in the wall are filled approximately flush with the wall face before the concrete forms are erected. The pouring of the wall then follows so closely upon the formation of the ledge that a strong bond is secured, and the several ledges become just as much a monolithic, integral portion of the wall as if they had been poured simultaneously with it.

Forming the ledges independently has several advantages. The concrete, being forced into the prepared opening, adheres very well to the brick work and penetrates all the crevices, assuring that the completed ledge entirely fills the opening in the brick wall. When applied with an air gun, the force of placing the concrete produces a dense material having somewhat greater strength than concrete placed with the ordinary methods. A construction advantage is had in that where several ledges are to be placed close together, such as ledges 55 under window posts 54, so that the brick is materially weakened if all the openings are made simultaneously, alternate openings may be made in the brick and then filled with concrete so that the wall is restored to its normal load carrying capacity before the balance of the openings are made and subsequently filled. In this manner the ledges may be placed closer to one another without endangering the strength during the repair work, so consequently a somewhat greater latitude is allowed in choosing suitable positions for the ledges.

In addition to the construction details discussed above, there are other features or variations on the foregoing that will be readily understood from the preceding discussion.

Fig. 4 illustrates how a wall may be poured in behind concrete steps. Steps 58 are provided with a landing platform 59 having at the inner end a bearing face 60 that formerly rested on top of footing 10, the inner vertical face of platform 59 meeting the vertical end surface of floor slab 61. To permit the reconstruction, steps 58 are removed from their former position by being moved horizontally away from the wall. Wall 14 fills in the space at the end of floor slab 61 and above footing 10 formerly occupied by platform 59, and is now provided with a niche having a bearing shelf adapted to receive surface 60 and the inner end of platform 59 in the same manner in which it was previously supported. The stairs may now be moved against the new wall to be supported thereby.

Fig. 6 illustrates a method of reenforcing a corner of the building. An angle iron 64 is laid with its legs parallel to the sides of the building at the corner of the original brick wall and in such a manner as to bear thereagainst throughout its entire length. Reenforcing bars 21 at the inner surface of wall 14 are then bent around the back of the angle and hooked at their ends over the farther leg of the angle as indicated, to be held firmly in place. Any strain upon a reenforcing bar is communicated to the angle which bears against the original brick work, but because of the large area of contact the brick will not crush; whereas were the same force applied only over the area of the single reenforcing bar, the brick work would crush thus allowing the bar to slip. A similar arrangement might be used at the outer corner of wall 14 for horizontal bars at the outer face of the wall, but since the concrete against which they press is relatively stronger than the brick work, it is sufficient to merely place a single vertical

bar 20 at the corner of the wall around which the reenforcing bars may turn. A variational form of reenforcing at the corner is indicated in Fig. 7 wherein horizontal bars 21 on the inner faces of a wall 14 extend onwardly beyond the corner to a meeting with either the vertical or horizontal steel in the outer face of the intersecting wall. Although bars 21 may hook over any bars at the outer face, they are here shown as hooked over specially positioned verticals 20*a*.

The reconstruction of an interior bearing wall is illustrated in Fig. 8. Wall 66 of brick is supported on concrete footing 67 which also carries concrete floor slab 61. As before, a shelf or shelves 15 are formed on the footing and anchors 17 are set in place, then a new concrete footing is formed against the old one, the footing extending upwardly to form a new bearing wall 70. In place of the horizontal wall tie 16, there is used a diagonally disposed reenforcing bar 71 to reenforce and tie together the two footings. The exterior inclined face 69' of the footing 69 extends above the ground surface in order to form a shelf at the top of the footing adapted to receive floor joist 25 to support the flooring; although where the footing is on the exterior wall and so exposed, it is desirable that the inclined face extend upwardly only to the grade line as indicated in Figs. 3 and 4. The wooden flooring is held against the wall by means of an anchor 73 one end of which is buried in the new concrete and the other end of which, after spanning two or three floor joists, is hooked over a floor joist at 73*a*.

In general, the application of my invention to an interior bearing wall involves no departure from the principles explained in connection with an exterior bearing wall; and the new structure may be placed on either side of the old structure, the location being determined by the particular conditions of the job. In any event, all interior decoration along one face of the wall must be replaced.

An extension of the load receiving ledges results in a continuous ledge or beam as at 75 in Figs. 1 and 5. Such a beam has several applications; it may be used in a relatively thick blank wall where it is possible to run a continuous member along one or more sides of the structure to form a unitary tie between walls and to give a lateral rigidity to the concrete wall; or the beam may also be used where there are relatively large concentrated loads applied as by roof trusses 76, the beam then distributing the load evenly over a relatively large portion of the new bearing wall. The one beam may provide distribution of vertical loads, and resistance to horizontal earthquake forces.

A typical construction in a flat roof building with a parapet wall is illustrated at the top of Fig. 5. The wall is provided with ledge 77 similar in construction to the ledge 44, for supporting the ceiling joist 78 and receiving the anchors 78*a* on those joists. The wall then extends upwardly to form a parapet around the flat roof and is thickened at 79 to the combined dimension of both walls in order to receive and support the roof joist 80. The great thickness of the parapet, together with additional reenforcing, makes it very strong and able to withstand great horizontal load.

A method of lending to the wall additional transverse support is illustrated in Fig. 10, where the wall is provided with a buttress 82 extending from the bottom of the footings upwardly on the wall to any desired height. Where the wall is quite long and is not supported on the interior by partition or bearing walls intermediate the end walls of the building, the exterior wall may be reenforced by means of the buttress against lateral movement and so made materially stronger than it was before.

A variational form of footing is illustrated in Fig. 11. The original structure is undercut to form an opening to receive footing 14*c* beneath the original wall, the footing 14*c* being an integral part of the new wall. This undercutting may remove all or a part of the old foundation, and is shown in Fig. 11 as removing all of footing 10 so as to support wall 11 directly. The length of the footing parallel to the wall may vary to suit conditions; but in any case the new footing will be formed in short sections leaving the wall supported by footing 10 while footing 14*c* is being placed. The intervening sections of footing 10 may be left in place or subsequently replaced with new concrete as desired. The width of footing 14*c* perpendicular to the wall may be any desired distance; but the footing preferably extends inwardly such a distance that the loading is not eccentric on the footing base.

If a first floor joist is supported as in Fig. 10 above footing 14*c*, the block 30 may be poured with the footing which then, in effect, extends upwardly to the joist.

From the foregoing it will be evident how masonry structures that are inherently unable to withstand horizontal forces of the magnitude set up by earthquakes, can be enclosed in a shell of reinforced concrete able to provide the necessary horizontal strength. Furthermore, the concrete structure may be designed to any required strength by using horizontal beams, enlarged footings, buttresses, and so forth, to greatly strengthen the building against horizontal forces; and the new and old work may be so joined as to insure the safety of the reconditioned buildings, since the full designed strength of the new concrete is utilized. Regardless of any irregularities in the shape or mass of the original building, it may be so tied together and strengthened, without relying on the original and now weakened walls, as to securely resist any tension, compression, torsion, or combination stresses imposed by earthquake—all without any extension or changes in the previously erected walls.

It will also be readily apparent that the invention may be applied to structures having discontinuous wall footings for it provides means for tying together detached wall bearing portions.

Although all cast stone trim and attached ornaments have been removed from the brick wall, the new concrete wall may be decorated in any suitable manner without affixing thereto any separate objects which are in danger of being shaken loose. The concrete forms may be provided with moulds to figure or contour the concrete in any desired form or shape around doors, windows, or other places, as under the roof at 83 (Fig. 3) to provide any design or relief that concrete is adapted to take; and any ornamentation thus affixed to the wall is integral therewith and in no danger of being detached. Because of the ease with which concrete lends itself to such architectural treatment, the beauty of the original building need not be lost.

Having illustrated a typical embodiment of my invention by describing various construction details as applied to a typical building, it is to be understood that various changes in design,

materials, and methods of construction, may be made by those skilled in the art without departing from the principles of my invention; and, therefore, it is to be understood that the foregoing description is to be considered illustrative of rather than restrictive on the broader claims appended hereto.

I claim:

1. A wall structure comprising an original bearing wall, a footing for said wall having portions removed to form ledges, a new bearing wall formed, with its own footing, superficially against the original wall and its footing, the footing for the new wall resting in part on said ledges, and anchors tying said footings together against relative movement.

2. A structure comprising an original bearing wall, a joist originally supported by said wall, a new bearing wall formed against said original wall, a joist anchor attached at one end to the joist, a componental ledge portion projecting from the newly formed wall and into the original wall, said joist being supported on said ledge, and a joist anchor extension attached to the joist anchor and embedded in the new wall.

3. A building structure comprising original walls meeting at a corner, an angle iron placed over and in contact with the corner with its legs parallel to the walls, new reinforced concrete walls erected against said original walls, and horizontally extending reinforcing bars in the concrete walls, the ends of the bars being bent around the back of the angle and hooked over one leg to anchor the bars against movement.

4. A wall structure comprising an original bearing wall, an original footing for said wall, a new footing parallel to the original footing and extending beneath the original bearing wall for at least a portion of its length to replace the original footing, and a new bearing wall formed against the original wall and resting on the new footing.

5. A structure comprising an original bearing wall, a joist originally supported by said wall, a new bearing wall formed against said original wall, a joist supporting projection componental of the new wall extending into the original wall and under the joist, and a joist anchor attached to the joist and anchored in the new wall.

6. A structure comprising an original bearing wall, a joist originally supported by said wall, a new bearing wall formed against said original wall, a joist supporting projection componental of the new wall extending into the original wall and under the joist and forming an end thrust surface against which the end of the joist bears, and a joist anchor attached to the joist and anchored in the new wall.

7. A building structure comprising original exterior bearing walls, joists originally supported at their ends by said original walls, new bearing walls formed outside and against the original walls, joist supporting and thrust projections formed as components of the new wall, extending into the original wall, and affording support and end thrust bearing for the joists.

8. A building structure comprising original exterior bearing walls, joists originally supported at their ends by said original walls, new bearing walls formed outside and against the original walls, joist supporting and thrust projections formed as components of the new wall, extending into the original wall, and affording support and end thrust bearing for the joists, and joist anchors attached to the joists and anchored in the new wall.

9. A building structure comprising original exterior bearing walls, joists originally supported at their ends by said original walls, new bearing walls formed outside and against the original walls, joist supporting and thrust projections formed as components of the new wall, extending into the original wall, and affording support and end thrust bearing for the joists, and tie rods extending through the building in the direction of the joists and anchored in opposite new wall structure.

10. A building structure comprising original walls meeting at a corner, an angle iron placed over and in contact with the corner, new reinforced concrete walls erected against the original walls and around the corner, and horizontally extending reinforcing bars embedded in the concrete of the new walls and around the corner and bearing against the angle iron.

11. A wall structure comprising an original wall with an opening therein, a new bearing wall formed with a footing against the original wall and its footing, and an opening framing projection componental of the new wall projecting into the original wall and surrounding the opening in the original wall.

12. A wall structure comprising, an original bearing wall and footing, a single new bearing wall and a new footing lying directly beneath the new wall, the new wall and footing bearing laterally in face to face contact with the original wall and footing, and ties securing the two walls laterally together at spaced points over substantially their entire faces of contact.

13. A wall structure comprising, an original bearing wall and footing, a single new bearing wall and a new footing lying directly beneath the new wall, the new wall and footing bearing laterally in face to face contact with the original wall and footing, and projections componental of the new wall spaced over its contact face and projecting into and engaging the original wall to take load and horizontal thrust therefrom.

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