

March 5, 1935.

A. F. BODENSTEIN

1,992,937

BUILDING CONSTRUCTION

Filed July 20, 1933

Fig. 1.

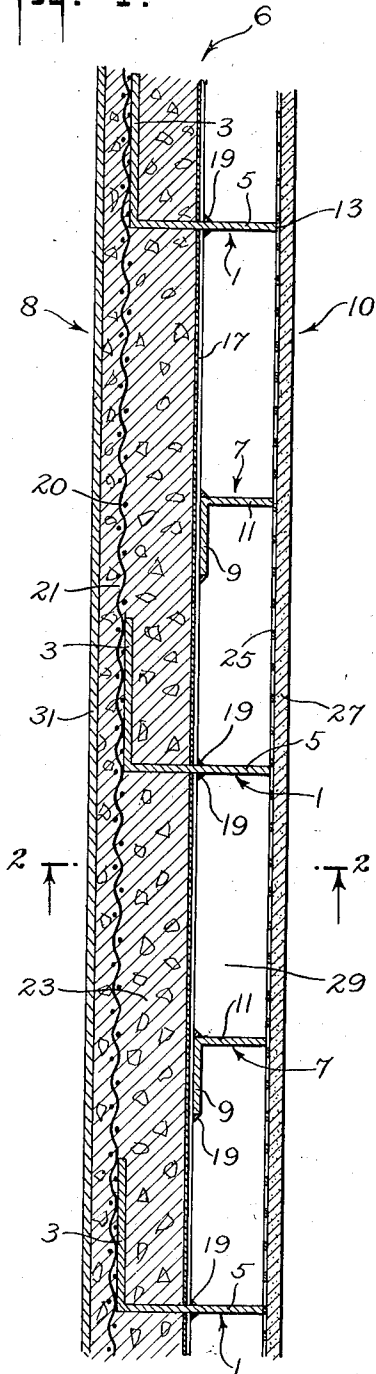
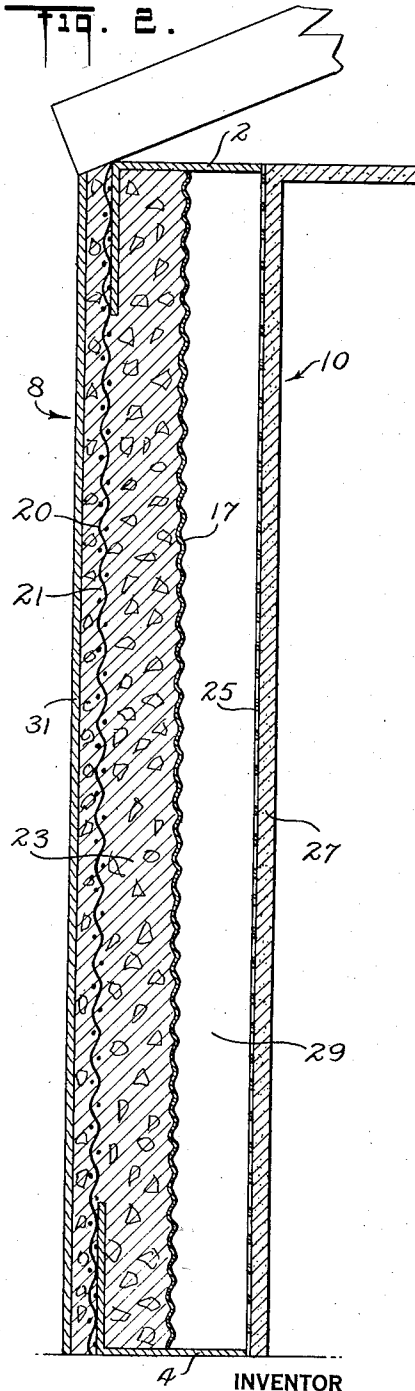


Fig. 2.



INVENTOR  
A. F. Bodenstein  
BY  
Blair Curtis + Dunne  
ATTORNEYS

## UNITED STATES PATENT OFFICE

1,992,937

## BUILDING CONSTRUCTION

Alexander F. Bodenstein, Madison, Wis.

Application July 20, 1933, Serial No. 681,289

18 Claims. (Cl. 72—48)

This invention relates to building construction, and with regard to certain more specific features, to wall construction.

Among the several objects of the invention may be noted the provision of improved re-enforced concrete wall.

Another object is to provide a wall of the character described which may be formed entirely from standard materials.

Another object is to provide an improved wall of the character described which is simple and economical to construct.

Another object is to provide a wall of the character described which is stronger and more efficient than walls formed from the same materials but put up by the known methods of construction.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, in which is shown one of the various possible embodiments of this invention,

Figure 1 is a horizontal section of a wall embodying the invention; and,

Figure 2 is a vertical section of the same wall taken on line 2—2 of Figure 1.

Corresponding reference characters refer to corresponding parts throughout the several views of the drawing.

As conducive to a clearer understanding of the invention, it is pointed out that the present method of employing concrete for the superstructure of walls of smaller factories, of dwelling houses, and the like, has had many disadvantages. For example, even with the type of re-enforcing used it has been advisable to make the walls so thick that the cost of material and the cost of construction oftentimes precluded the use of concrete throughout the outer walls of such buildings. This old type of construction also had the disadvantage that the thicker walls entailed a higher construction cost because of the difficulties involved in the erection of, and the taking down, of the forms used in the pouring of the concrete walls.

This former type of wall construction had the further disadvantage that, if the concrete wall were made thinner, and the strength of the wall was sacrificed, it was not weather proof and did not keep out the dampness during abnormally wet conditions.

It is another object of this application to overcome these disadvantages of the earlier types of concrete wall construction in a practical and economical manner.

Referring now to Figure 1, a wall 6 is shown having an outer section 8, and an inner section 10, the two sections being joined integrally by studs, or uprights, forming bearing supports, generally indicated at 1. These uprights, or studs, may be in the form of angles rolled or bent, as shown, or in the form of I, H or U beams, and may be erected, or mounted in position, in any known manner. If my improved type of wall construction is used for a dwelling house of 20,000–30,000 cubic feet, for example, I have found that a satisfactory construction is obtained by using angle bearing studs 3" x 3" x 1/8" spaced on 32 inch centers. A flange 3 of each angle stud 1 is preferably positioned parallel to the general surface of the wall, whereas the other flange 5, or what I term the main portion of each stud 1, is preferably positioned at right angles to the wall. As shown in Figure 2, the studs 1 are secured at the top and bottom respectively to horizontal top and bottom beams 2 and 4, as by welding, or the like, although other means, such as rivets, may be employed. As shown, these top and bottom horizontal beams are also angles, and may be 3" x 3" x 1/8" for the example above mentioned.

Evenly spaced between the angle bearing studs 1, and separating the sections 8 and 10, are smaller angle studs (generally indicated at 7) which, for purposes of description, I shall term non-bearing studs. These, as the bearing studs, may be erected in position in any convenient manner, and in the type of house above mentioned are preferably placed on 32 inch centers and of the dimensions 1 1/2" x 1 1/2" x 1/8". The studs 7 have flanges 9 which, as the flanges 3, are preferably parallel to the wall; and also have what I term a main portion 11 at right angles to the wall.

For the purposes to be described hereinafter, the flanges 3 are preferably spaced outwardly from the flanges 9, as shown, but the rear edges 13 and 15 of the main portions 5 and 11 respectively are aligned in the same vertical plane.

Secured, preferably by welding, to the flanges 9 of the non-bearing angle studs 7 are sections of sheet iron backing 17; each section extending between adjacent bearing studs 1 and being welded or otherwise attached to the main portions 5, as at 19. (See also Figure 20.) This backing is preferably corrugated, with the crests and troughs of the corrugations running in horizontal directions. Under certain conditions of construction

tion, the backing may be secured to the top horizontal beam 2 and to the bottom horizontal beam 4, as by welding or the like. With this construction, it is clear that the sheet iron backing secured to the bearing studs 1, to the non-bearing studs 7, and to the horizontal beams 2 and 4, acts as a continuous truss, and so re-enforces the studs and renders the whole steel structure more rigid.

Secured to the flanges 3 of the bearing studs 1, and also to the top and bottom horizontal beams 2 and 4, is an open mesh wire screen 20, the interstices 21 of which are large enough to permit concrete to be poured, or sprayed, therethrough. This wire mesh 19 serves as a re-enforcing for a concrete wall 23 to be described hereinafter. The wire mesh may, for example, be chicken wire, or other types of fence wire, and may be secured to the studs and beams in any convenient manner, such as, for example, by wires through holes in the studs and beams, or by tabs (not shown), stamped out of the studs, or beams.

To complete the front or outer wall 8 of the wall construction 6, the concrete wall 23 is formed in such a way that the flanges 3 of the studs 1, and the wire mesh 19 is embedded in the concrete, which is in intimate contact with and backed by the corrugated metal backing 17. The concrete is preferably applied by spraying it against the backing 17 through and around the wire mesh 19 and the flanges 3 of the studs 1. The wall is thus preferably built up until the desired thickness is obtained for the particular conditions required. For the type of house above mentioned, a two inch concrete wall has been found satisfactory.

I have found that when the wall 8 is thus built up, with the arrangement between the backing 17 the wire mesh 19, and the flanges 3, such that the wire mesh is embedded in the wall 23 closer to the outer surface than to the inner surface thereof some advantages are obtained. One of them is that the wire mesh being closer to the outer surface of the wall helps to hold the concrete in place as the wall is built up.

From the foregoing description, it is clear that the concrete wall thus formed has many new advantages. The portions of the studs 1 embedded in the concrete re-enforce it, as does the wire mesh 19 secured to the studs 1 and the beams 2 and 4; and the corrugated iron backing 17 also re-enforces the concrete, adding both its tensile and compressive strength. The corrugations in the backing 17 particularly add to the rigidity and strength of the concrete wall against horizontal perpendicular pressures.

Another advantage of the wall 8 as thus constructed, is that no forms are required for the placing of the concrete, the backing 17 forming a wall against which the concrete may be sprayed in order that the desired thickness may be built up. Further, because of the support given by the backing 17, the concrete wall 23 may be made considerably thinner than the usual wall, thereby permitting a saving in the cost of materials and a saving in the cost of construction.

Another advantage of my improved type of construction is that the relatively thin concrete wall has a fire resistance of a much thicker poured wall, built under the old type of construction. Further, it has more strength than a correspondingly thick ordinary concrete wall, both in compression and tension. Furthermore, the wall thus formed, although relatively thin, is wind proof, water proof and termite proof (there

being no organic material to be attacked), even under abnormal conditions.

Under certain conditions of operation, however, it may be preferable to use a form for the outer surface of the concrete wall 23 in which event the wall would be poured rather than sprayed. Further, brick, stone, stucco or other desired exterior finish 31 may be applied to the concrete wall 23 which serves as a suitable backing.

It is desirable under most conditions of operation to employ materials for the studs 1, the backing 17, the wire mesh 19, and the concrete wall 23, which have approximately the same coefficients of expansion; such a provision together with the rigidity of the structure, hereinbefore described, practically eliminates any cracking of the wall 23.

Referring now to the inner wall 10 of the wall construction, metal lathing 25 is preferably secured to the edges 13 and 15 of the main portions 5 and 11 of studs 1 and 7, the lathing extending between the top and bottom beams 2 and 4, to which it may also be secured by suitable means. This lathing is preferably metal and may be of any desired construction, a primary purpose of the lathing being to form a support for plaster 27 applied to the lathing 25 by known methods.

From the foregoing it is clear that the inner wall 10, as thus formed, is separated from the outer wall 8 by a dead air space 29 the depth of which is determined by the studs. One of the advantages of such an air space is that it provides additional insulation against the flow of heat and moisture.

The wall construction 6 of my invention, as described in the foregoing embodiment, is preferably formed from non-combustible materials throughout with the result that the wall itself will not support combustion. Further, the various parts of the wall are formed from standard materials, which are easily obtained; thus, a comparatively low cost of construction is assured.

As various embodiments might be made of this invention, and as various changes might be made in the construction herein described, all without departing from the scope of the invention, it is to be understood that all matter herein set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. A wall construction including spaced vertical angle bearing studs, vertical non-bearing angle studs spaced between said bearing studs, one set of sides of said angle studs being parallel to the surface of the wall, the bearing stud sides extending to a vertical plane beyond a plane containing the sides of the non-bearing studs, the other set of sides of said angle studs being at right angles to the wall, the edges of these sides being aligned in the same vertical plane; a corrugated sheet metal backing secured to the front surface of the parallel sides of the non-bearing studs, extending between the bearing studs and secured thereto at the right angle sides; wire mesh secured to the front surface of the parallel sides of said bearing studs; a two inch concrete wall containing the said wire mesh, the said parallel sides of said bearing studs and backed by said corrugated sheet metal backing thereby forming a reinforced weather proof, termite proof, fire proof concrete wall; metal lathing secured to the said edges of the right angle

sides of said angle studs; and plaster on said lathing, forming an inner wall spaced from said outer concrete wall by the depth of the right angle sides of said non-bearing studs.

2. In a wall construction having an outer surface and an inner surface, in combination, spaced vertical bearing studs, vertical non-bearing studs spaced between said bearing studs, the inner edges of the studs being aligned in the same vertical plane and the outer edges of the bearing studs being aligned in a single vertical plane but extending beyond the outer edges of the non-bearing studs which are also aligned in a single vertical plane, top and bottom horizontal beams connecting said studs, a corrugated sheet metal backing secured to the outer edges of the non-bearing studs, extending between the bearing studs, secured thereto between the inner and outer edges and secured to the top and bottom horizontal beams whereby a rigid steel frame work is formed; a wire mesh secured to the outer edges of the bearing studs, a two inch concrete wall within which said wire mesh and said outer edges of said bearing studs are embedded, a corrugated sheet member backing said concrete wall, thereby forming a re-enforced weather proof, termite proof and fire proof wall, metal lath secured to the said aligned inner edges of said bearing and non-bearing studs, and plaster on said lathing, forming an inner wall spaced from the outer concrete wall by the non-bearing studs.

3. In a wall construction having an outer surface and an inner surface, in combination, spaced vertical bearing studs, vertical non-bearing studs spaced between said bearing studs, the inner edges of the studs being aligned in the same vertical plane and the outer edges of the bearing studs being aligned in a single vertical plane but extending beyond the outer edges of the non-bearing studs which are also aligned in a single vertical plane; a sheet metal backing secured to the outer edges of the non-bearing studs, extending between the bearing studs, and being secured thereto between the inner and outer edges thereof, a wire mesh secured to the outer edges of the bearing studs; a concrete wall within which said wire mesh and said front edges of said bearing studs are embedded, said concrete wall being backed by said sheet metal backing thereby forming a re-enforced weather proof, termite proof and fire proof wall; metal lath secured to the said aligned inner edges of the studs, and plaster on said lathing, forming an inner wall spaced from the outer concrete wall by the non-bearing studs.

4. A wall construction including spaced vertical bearing angle studs, vertical non-bearing angle studs spaced between said bearing studs, the front set of sides of said angle studs being parallel to the surface of the wall, the bearing stud sides extending beyond the sides of the non-bearing studs, the other set of sides of said angle studs being at right angles to the wall and the rear edges thereof being aligned in a vertical plane, impervious sheet metal backing secured to the non-bearing studs, extending between the bearing studs and secured thereto, re-enforcing open mesh screening secured to the front sides of the bearing studs; a two inch concrete wall within which the re-enforcing open mesh screening and the front sides of the bearing studs are embedded, said concrete wall being backed by said sheet metal backing, metal lathing secured to the said rear edges of said angle studs, and

plaster on said lathing, forming an inner wall spaced from said outer concrete wall by the non-bearing studs.

5. In a wall construction having an outer surface and an inner surface, in combination, spaced vertical bearing studs, vertical non-bearing studs spaced between said bearing studs, the inner surfaces of the studs being aligned in the same vertical plane and the outer surfaces of the bearing studs being aligned in a single vertical plane but extending beyond the outer surface of the non-bearing studs which are also aligned in a single vertical plane; a corrugated sheet metal backing secured to the outer edges of the non-bearing studs, extending between the bearing studs, secured thereto between the inner and outer edges thereof, and secured to the top and bottom horizontal beam whereby a rigid steel frame work is formed and a wire mesh secured to the outer edges of the bearing studs; and a two inch concrete wall within which said wire mesh and the said outer edges of said bearing studs are embedded, said wall being backed by said corrugated sheet backing thereby forming a re-enforced weather proof, termite proof and fire proof wall, and metal lathing secured to the inner edges of the studs to provide a support for plaster.

6. In a wall construction having an outer surface and an inner surface, in combination, spaced vertical bearing studs, vertical non-bearing studs spaced between said bearing studs, the inner surfaces of the studs being aligned in the same vertical plane and the outer surfaces of the bearing studs being aligned in a single vertical plane but extending beyond the outer surfaces of the non-bearing studs which are also aligned in a single vertical plane; sheet metal backing secured to the outer surfaces of the non-bearing studs, extending between the bearing studs, and secured thereto between the inner and outer surfaces thereof, wire mesh secured to the outer surfaces of the bearing studs; a concrete wall within which said wire mesh and the said front surfaces of said bearing studs are embedded said concrete wall being backed by said sheet metal backing thereby forming a re-enforced weather proof, termite proof and fire proof wall; and metal lathing secured to the inner edges of said studs and spaced from the concrete wall by said non-bearing studs, said metal lathing forming a base on which plaster may be supported.

7. A wall construction including spaced vertical metal studs, corrugated metal backing extending between and secured to mid portions of said metal studs, wire mesh secured to one set of edges of said studs; a concrete wall within which said edges of said studs and said wire mesh are embedded said concrete wall being backed by said corrugated metal backing to form a re-enforced concrete wall; and metal lathing secured to the other set of edges of said studs providing a support for plaster and spaced from said concrete wall by said studs.

8. A wall construction including spaced metal studs, metal backing extending between and secured to mid portions of said metal studs, said metal backing also constituting a re-enforcing member, open mesh re-enforcing means secured to one set of edges of said studs, the said edges of said studs and said open mesh re-enforcing means being embedded in concrete backed by said re-enforcing member to form a re-enforcing concrete wall; and metal lathing secured to the other set of edges of said studs providing a sup-

port for plaster and spaced from said concrete wall by said studs.

9. A wall construction including spaced metal studs, metal re-enforcing means extending between and secured to mid portions of said metal studs, said means being adapted to act as a metal backing, open mesh re-enforcing means secured to one set of edges of said studs, concrete in which is embedded the said edges of said studs and said open mesh re-enforcing means, said concrete being backed by said metal re-enforcing means to form a re-enforced concrete wall, the parts of said studs not embedded in said concrete wall extending therefrom to form supports for a plaster backing spaced from said wall.

10. A wall construction including spaced vertical metal studs, corrugated metal backing extending between and secured to mid portions of said metal studs, wire mesh secured to one set of edges of said studs, a concrete wall within which said edges of said studs and said wire mesh are embedded said concrete wall being backed by said corrugated metal backing to form a re-enforced concrete wall; and metal lathing secured to the other set of said studs providing a support for plaster spaced from said concrete wall, said studs, metal corrugated backing and wire mesh co-acting to strengthen and re-enforce the entire wall.

11. In a wall construction, uprights, metal backing secured to the mid portions of said uprights, open meshed re-enforcing means secured to one set of edges of said uprights, said metal backing forming a stop against which concrete may be sprayed to form a concrete wall backed and re-enforced by said metal backing and embedding the said edges of said metal uprights and said open meshed re-enforcing means, said studs extending from said concrete wall thus formed and providing a support for a plaster supporting medium.

12. In a wall construction, metal uprights, sheet metal backing and re-enforcing means secured to said uprights, a concrete wall within which is embedded one set of edges of said uprights said concrete wall being backed by said means to form a wall, re-enforced by said uprights and said means, the portions of said uprights not embedded in said wall extending therefrom to form a support for a plaster supporting medium.

13. In a wall construction, in combination, a series of metal studs having their edges lying in

more than two spaced planes, re-enforcing means secured to some of said edges and lying in one of said planes, a re-enforcing and backing member secured to other of said edges and lying in another of said planes, and lathing means secured to the remaining of said edges and lying in another of said planes.

14. In a wall construction, in combination, spaced bearing studs, non-bearing studs between said studs, a backing member secured to the outer edges of said non-bearing studs, a re-enforcing member secured to the outer edges of said bearing studs and spaced from said backing member, concrete within which said re-enforcing member is embedded said concrete being backed by said backing member, and lathing means secured to the inner edges of said studs.

15. In a cement wall construction, in combination, spaced studs, an impervious metal backing member secured with respect to said studs, re-enforcing means secured to said studs, cement in which is embedded said re-enforcing means, said backing member forming a backing for said cement and rendering the wall moisture proof.

16. In a cement wall construction, in combination, spaced studs, a termite-proof metal backing member secured to said studs between the edges thereof, re-enforcing means also secured to said studs and spaced from said backing member, cement within which is embedded said re-enforcing means, said cement being directly backed by said backing member, and plaster supporting means secured to said studs and spaced from said backing member.

17. In a cement wall construction, in combination, spaced bearing studs, non-bearing studs between said bearing studs, an impervious backing member associated with said non-bearing studs, and re-enforcing means associated with said bearing studs, and cement within which said means is embedded said cement being backed by said backing member.

18. In a cement wall construction, in combination, a supporting member, a non-supporting member, re-enforcing means secured to said supporting member, cement within which is embedded said re-enforcing means, backing means secured to said members and adapted both to back said cement and re-enforce said wall, and lathing means associated with said members.

ALEXANDER F. BODENSTEIN.