H. FERREE.

METAL REINFORCEMENT FOR BUILDING PURPOSES.

APPLICATION FILED JAN. 28, 1908.

988,326. Patented Apr. 4, 1911.

2 SHEETS—SHEET 1.

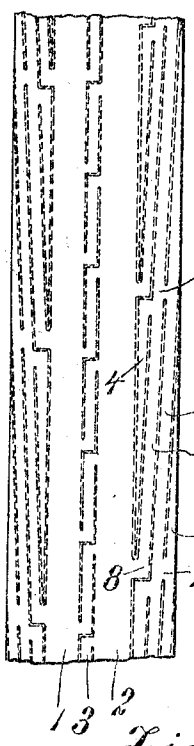

Fig. 1.

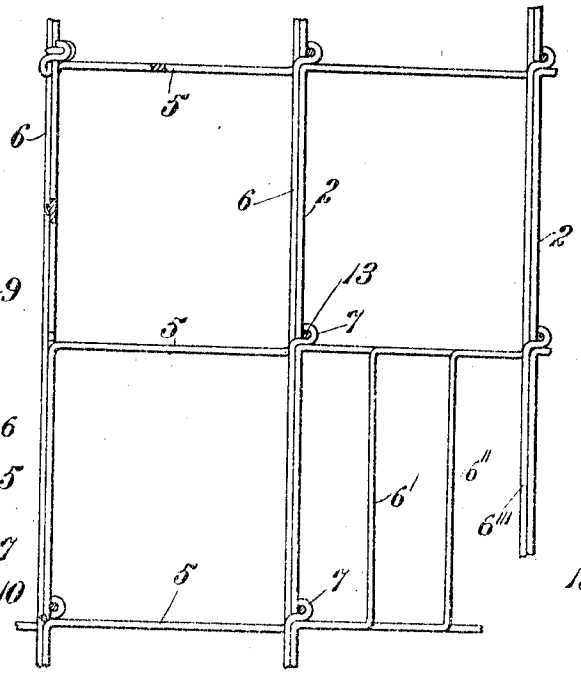

Fig. 2.

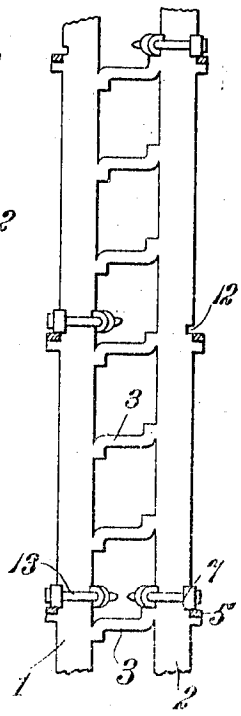

Fig. 3.

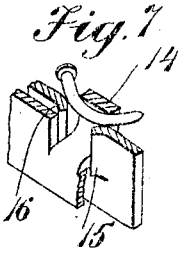

Fig. 7

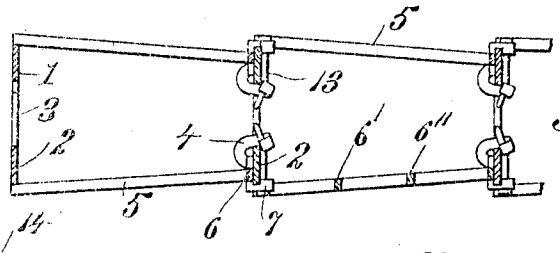

Fig. 4.

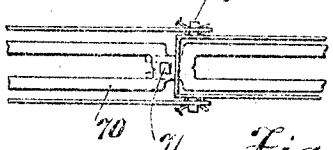

Fig. 6

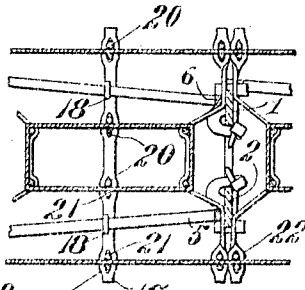

Fig. 5.

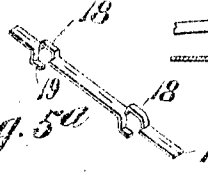

Fig. 5a

WITNESSES

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2 SHEETS—SHEET 2.

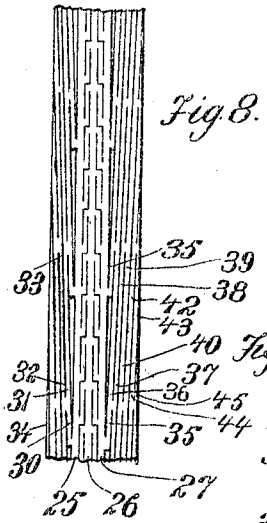

Fig. 8.

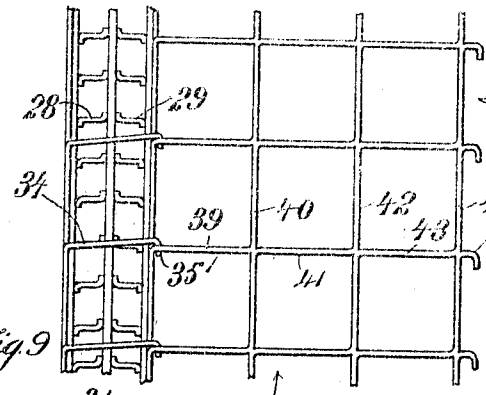

Fig. 9

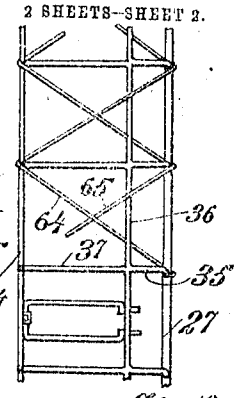

Fig. 10

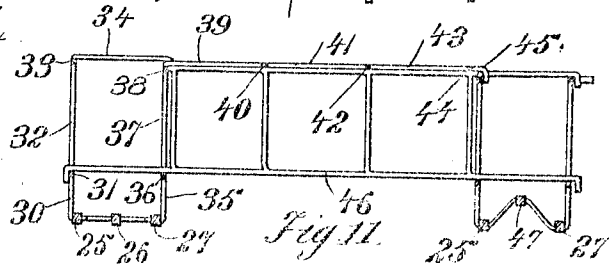

Fig. 11

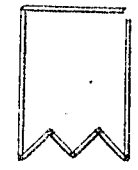

Fig. 12.

WITNESSES

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HAROLD FERREE, OF SAN FRANCISCO, CALIFORNIA.

METAL REINFORCEMENT FOR BUILDING PURPOSES.

988,326. Specification of Letters Patent. Patented Apr. 4, 1911.

Application filed January 28, 1908. Serial No. 412,983.

To all whom it may concern:

Be it known that I, HAROLD FERREE, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented a new and useful Metal Reinforcement for Building Purposes, of which the following is a specification in such full and clear terms as will enable those skilled in the art to construct and use the same.

This invention relates to an expanded metal used for reinforcing concrete and other plastic materials used in building of houses, bridges and any other structures of that character.

The object of the invention is to produce a girder that may be made in the shop and which may be erected in the field with the least possible expense, each girder being so related to every other girder, or stud, for precisely the same reinforcement is used in walls or columns, as to make it possible to join any number together and form a complete structure ready for the placement of the materials which are to form the body of the wall, floor slab, post or column as the case may be.

Another object of the invention is to make it possible to use a very light form for the reception of the concrete where concrete is to be used and to make said form of such cheap material as to make it possible to leave it on the wall, or in the wall as the case may be, for it is intended that this material shall be used where it is desired to build hollow walls to prevent them from "sweating."

Another object of the invention is to make a wall that will be so easily secured together and taken apart that it will be possible for men of other trades than the one putting up the wall to open that portion of the wall necessary for the placement of piping and conduits of all kinds. The particular means used for this purpose consists of a fastening for the various sections of the wall which is locked by the driving of a nail into a hook in one of the wall members, no clenching or other act being required.

Another object of the invention is to make a reinforcement that will, in the case of girders, have the material connecting the top and bottom members of the girders so placed as to meet every possible stress placed on the material of which the compression part of the girder is made.

Another object of the invention is to provide means for reinforcing the material of which the forms are made at such points as may be necessary to prevent the ramming of the concrete from breaking the material and allowing the concrete to spill out of the form. The materials of which the forms are made may be heavy paper board, close wire cloth, or even a cheap fabric such as jute or gunny cloth.

Another object of the invention is to make an expanded metal that is capable of fabrication into a number of forms to give any desired strength to the reinforcement used, and to make the reinforcement self supporting when the same is erected thereby doing away with the necessity of the erection of expensive wooden forms to hold the concrete or other plastic material in place while the same is setting.

In the drawings, in which the same numeral is applied to the same part throughout, Figure 1 is a plan of the metal used in making one of the members of a wall, Fig. 2 is a side elevation of two of such members in place and secured together, one showing a plaster carrying surface in one square thereof, Fig. 3 is an edge view of one of said members showing the means used for securing another to it, Fig. 4 is a plan view of two of said wall members and a part of a third, Fig. 5 is a plan view of the same wall showing the means used for holding the forms in place during the setting of the concrete, Fig. 5[a] is a perspective view of one of the spacing bars used for the purpose of holding the centering at the desired distance from the material making up the reinforcement, Fig. 6 is a plan view of an expanded metal wall, the several members of which are secured together by driving nails under a loop, as illustrated in Fig. 7, Fig. 7 is a sectional view of the locking means used for metal partitions, Fig. 8 is a plan of the metal showing the form of the cuts where other forms of girders are to be produced, Fig. 9 is a plan of a floor slab using the metal shown in Fig. 8, and having an additional beam running from one deep beam to another, Fig. 10 is an edge view of the floor slab in the direction of the arrow and showing the end of the shallow beam, Fig. 11 is an edge view of the floor slab in the direction of the arrow and showing the shallow beam in side elevation, Fig. 12 is an edge view of a deep beam showing how the same

cutting may be modified when it is desired to have a greater number of tension members in the bottom of a beam.

The form of the expanded metal shown in Figs. 1 to 5 inclusive is best adapted for use in a wall. It has the heavy stud members 1 and 2 which are joined by means of the members 3. It will be observed that if the metal of a sheet is pulled sidewise after the same has been cut in the manner shown in Fig. 1 that the members 3 will twist unless they are the same thickness as they are wide, and for the purposes of this form of the invention it is intended that the said members shall be cut from material at least as thick as they are wide in order that they may not twist. And it will also be noted that the metal forming the members 1 and 2 is expanded in the plane of said members, while the metal forming the other part of the structure is expanded by pulling the parts at ninety degrees with the plane of the sheet from which the metal is slitted. If Fig. 1 is examined it will be noted that on each side of the members 1 and 2 there are several series of members which repeat one above the other. The member 4 is a pointed member tapering out at a point near the stud 2, the next member 5 is a parallelogram which is connected with the stud at 8 and which is connected with the member 6 at 9, said member 6 being connected near its lower end with the pointed member 7 and also with the member 5 of the series below and of which it is the direct extension. Now when the slitted material is pulled at ninety degrees with the plane of the plate it will be noted that the member 5 may be pulled down till it is horizontal, as shown in Fig. 2, and the member 6 will move in a plane parallel with the plane of the member 2. When the metal has been expanded the two pointed members 4 and 7 will then be left free and will be formed into hooks, one of which passes in front of the adjoining stud member 2 and the other of which is bent into a hook which passes to the rear of the stud 2, but it will be noted that as the distance between the two members 4 and 7 is less than the width of the stud 2 and that the face of the wall is to be as nearly in one plane as it is possible to make it, it will be necessary to notch the stud 2 at 12 to allow the hook 7 to pass close enough to allow the same to come within the plane of the adjacent horizontal member 5, and since the hook 4 will not be in the same plane as the back of the stud member 2 it will be bent slightly at an angle with the vertical and its face will incline from the general plane of the wall as shown in Fig. 4. The object of this construction is to provide means for securing the sections of studding together without any other means than a hammer and a nail. The nail 13 is driven into the hook 7 and as it passes into the hook 4 the fact that said hook is slightly out of line with the hook 7 causes it to force the nail into a bent position which secures the nail firmly in place with no other means than the hammer used to drive the nail in. It can, of course, be pulled out without very much difficulty, although it holds securely enough unless an attempt is made to pull it out, and then the wall may be opened for the insertion of conduits of any kind and since it does not require special tools and training to drive a nail there is no objection to the men who take the wall apart putting it together again, as is the case where the ordinary wall is opened and where it requires a person having the skill of that trade to again place the wall in condition for progressing to the next step of the work.

In Figs. 6 and 7 is shown a wall composed of thin sheets which are secured together by means of a loop 14 and a hole in the adjacent plate. The hole in the plate is punched so that its edges flare as shown at 15 and 16, the object being to cause the nail with which the two sets of plates are secured to clench in the same way as is done with the nail 13 in the form of the invention shown in Fig. 4.

In Fig. 5 there is shown the forms used for the purpose of making the wall complete without the use of supports other than that of the metal in the wall. The material of which these forms may be made will depend on circumstance, but it is intended to use any fabric like material that may be cheap enough, such for example as gunny sacking, heavy paper or straw board, galvanized iron, or any other suitable material. The forms are held in place by means of the needles 17 which are simply narrow pieces of sheet metal which have slits punched in them at the desired intervals. To prevent them from being displaced when the concrete is being placed in the wall they are bent so as to conform to the bars 5 at 18 and they have a tongue 19 which is pulled or bent up close to said bars 5 when the needles have been put in place. Since the weight of the material will press against the fabric and tend to burst it, the wires 20 are laced through the slits in the needles and run the entire height of the wall, and the fabric or sheet metal is held in place against the wires by means of a nail 21. If necessary additional wires may be laced over the outside of the wall at will, using the projecting points of the needles to secure them to the structure. To hold the inner forms in place in each of the sections it is necessary to use needles of the form shown at 22, and since they will pass close to the stud members they are simply placed behind the hooks 7, and on the other side the needle is placed behind the vertical member 6, thus holding the form securely in position. It is very necessary to provide means for producing a

hollow space in the walls in order that they may not sweat and destroy the interior finish of a building, where the structure is to be finished as a building, and in any event the strength of the wall is very much increased by making the wall with the space shown for the reason that as the position of the material recedes from the center of the structure its strength increases.

In Fig. 4 it will be noted that there are additional members 6′, 6″ and 6‴ which may be made to give the face of the wall additional strength as desired. This effect is formed by cutting the metal as shown in Fig. 8, and it may be repeated to any extent that may be deemed necessary, so long as the final cut produces the pointed hook 7.

In Fig. 8 is shown a form of metal cutting which is used when beams are to be made after the metal has been expanded. It will be noted that this form of the invention has the heavy bars 25, 26 and 27 connected by means of the members 28 and 29. On the left hand side of Fig. 8, there will be noted the members 30, 31, 32, 33 and 34, to the latter of which is secured the hook 35′. This hook 35′ is for the purpose of connecting one side of the beam with the other side in order that the side strains of the slabs may be properly taken up across the top of the beam. To connect one beam with another of the set, the expanded metal may be made to extend to a greater distance from the beam than is the case with the first form of invention the members 35, a vertical, 36, a horizontal, 37 a vertical, 38 a horizontal, 39 a horizontal extending in a horizontal plane at right angles with the beam, 40 a horizontal extending in a plane parallel with the direction of length of the beam, 41 similar to 39, 42 similar to 40, 43 similar to 41, 44 similar to 42, and 45 which is turned down into a hook, are formed in the metal the form of cut to make such a structure being shown at the right of Fig. 8. It may be possible that still another beam will be necessary to connect one set of beams with the other and this beam is shown at 46 in Fig. 11. It may also be necessary to increase the amount of material in the bottom of the beam and this is done by raising one of the long members as shown at 47 at the right hand end of Fig. 11. This may be increased to any extent that may be found necessary as shown in Fig. 12 where there are three bars shown in the center of the beam near the bottom thereof.

In the form of the invention shown in Figs. 8 to 12 it may be necessary to provide additional means to take up the stresses in the floor slabs or beams and this may be done by lacing diagonal wires 64 and 65 through the beam as shown in Fig. 10.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is as follows, modifications within the scope of the claims being expressly reserved.

1. In an expanded metal structure, two studs connected by a series of expanded members, said connecting members being entirely in the plane of the studs, and a series of expanded metal members extending in substantially parallel planes from the studs, and at right angles with the face of the sheet of metal from which the structure has been expanded, as set forth.

2. In an expanded metal structure, two studs connected by means of a series of expanded members, expanded members extending substantially at right angles with the plane of the studs, and hooks connected with the last-mentioned members and adapted to secure said members and studs to a second set of studs and members, as set forth.

3. In a means for securing metal plates one to another, a stud member, a hook adjacent said stud and having its inner face substantially parallel therewith, a second hook adjacent said stud and having its inner face at an acute angle therewith, the two hooks being substantially in the same plane, as set forth.

4. In an expanded metal structure, a series of metal studs connected by means of bars, other sets of studs adapted to be connected with the first sets, hollow forms adapted to be supported by the metal structure, and needles to space the forms at given distances from the metal structure, as set forth.

5. In an expanded metal structure, two studding members, a series of expanded metal bars securing the two studs together, said expanded bars being in the plane of the two bars, other expanded metal plates extending in a direction substantially at right angles with the two studs, said expanded bars lying in a plane at right angles with the sheet from which they are cut, as set forth.

6. In an expanded metal structure, two studding members, a series of expanded metal bars connecting the studding members, like sets of studs and bars connected with the first set, forms outside the structure and secured thereto, and forms carried by the studding members within the metal structure, as set forth.

7. In an expanded metal structure, two studding members, a series of expanded metal bars connecting the two studding members, like sets of studs and bars connected with the first set, forms within the metal structure, and means to space the forms at a given distance from said metal structure, substantially as set forth.

8. In an expanded metal structure, two studding members, a series of expanded metal bars connected with the studding

members, forms outside the metal structure, forms inside the metal structure, means to space the forms at a given distance from the metal structure, said means consisting of a needle having means to secure it to the metal structure and also having openings therein whereby the forms may be secured thereto, as set forth.

9. In an expanded metal structure, a series of studs connected by series of expanded bars said bars being bent in the plane of the metal of the studs, a series of other expanded metal bars bent in planes at right angles with the plane of said studs, and a third series of bars connecting the ends of the second series of bars and lying substantially parallel to the studs, as set forth.

10. In an expanded metal structure, a series of studs, a series of bars connected with the studs and lying in the plane thereof, a series of expanded metal members carried by the studs and being at right angles with the plane of said studs, and hooks carried by said members and adapted to secure one set of studs and bars to another set of the same kind, as set forth.

11. In an expanded metal structure, two studs, a series of expanded metal bars connecting the studs and lying in the plane thereof, connecting bars lying in a plane at right angles to the studs, and at one edge of each stud, and connecting hooks at the ends of each of said connecting bars, as set forth.

In testimony whereof I have set my hand this 18 day of January A. D. 1908, in the presence of the two subscribed witnesses.

HAROLD FERREE.

Witnesses:

C. P. GRIFFIN.

C. SANDERS.