(No Model.) 3 Sheets—Sheet 1.

M. F. McCARTHY.

FIRE PROOF BUILDING.

No. 455,687. Patented July 7, 1891.

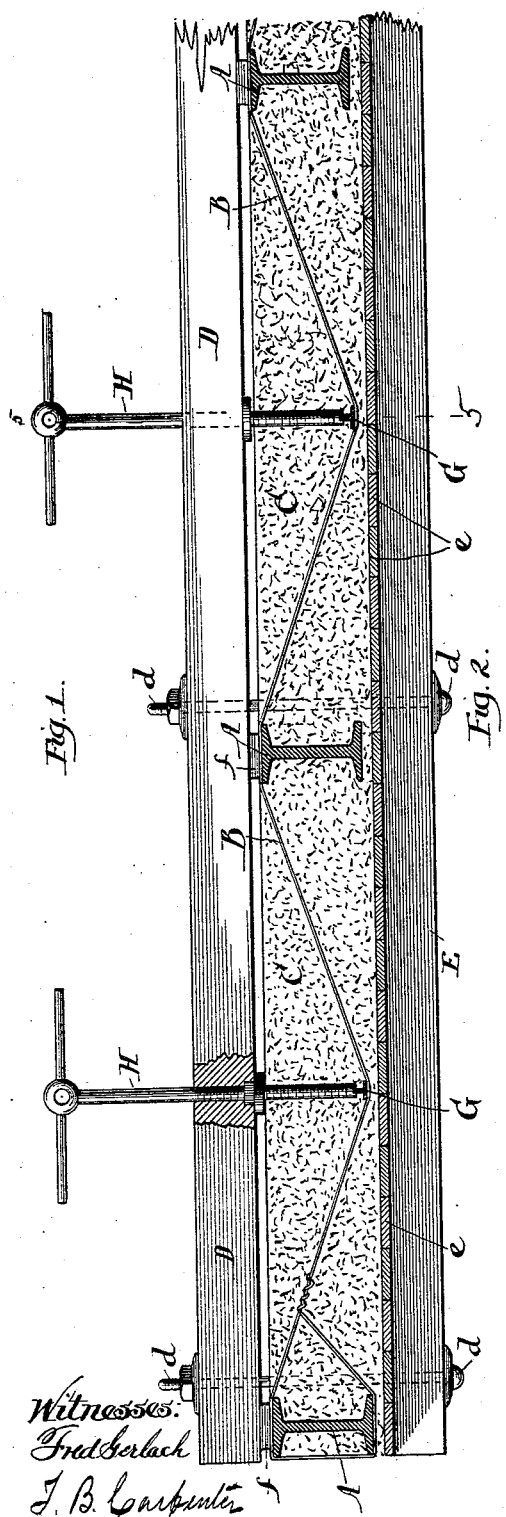


Fig. 1.

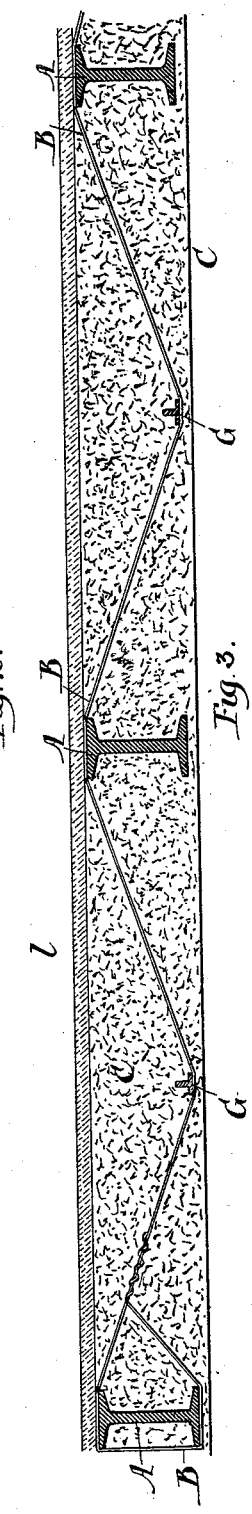
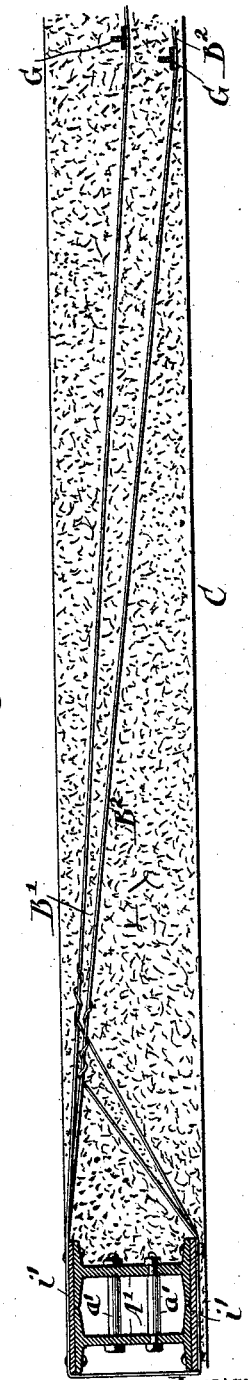


Fig. 2.

Fig. 3.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 4.

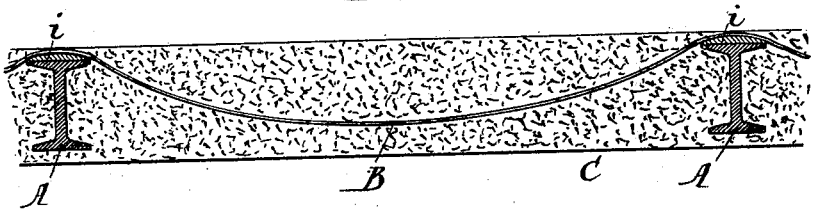


Fig. 5.

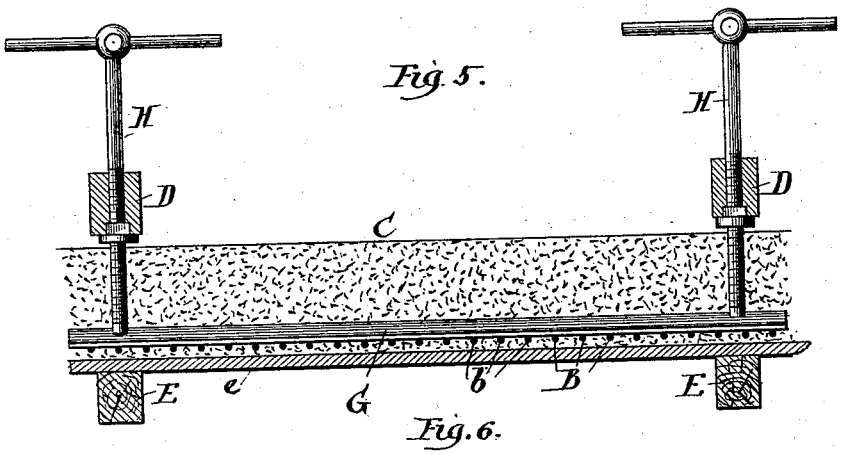
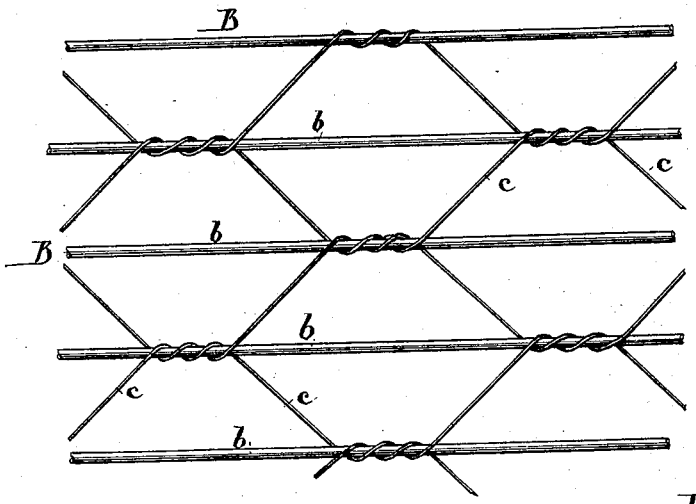


Fig. 6.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 7.

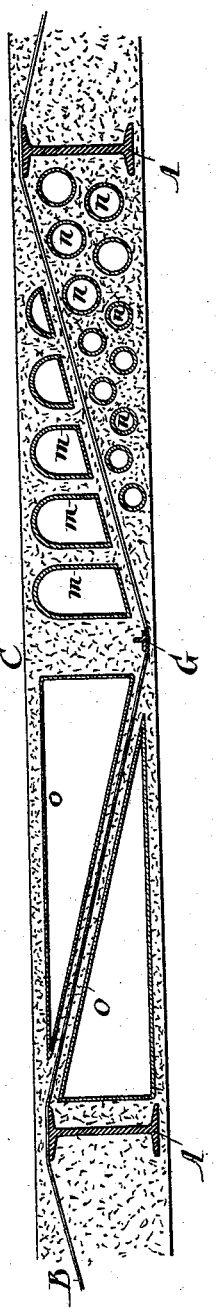


Fig. 9.

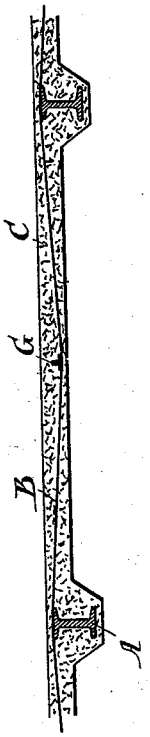
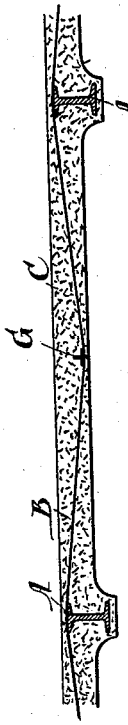


Fig. 8.



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UNITED STATES PATENT OFFICE.

MITCHELL F. McCARTHY, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE UNITED STATES FIRE PROOFING COMPANY, OF SAME PLACE.

FIRE-PROOF BUILDING.

SPECIFICATION forming part of Letters Patent No. 455,687, dated July 7, 1891.

Application filed February 24, 1891. Serial No. 382,342. (No model.)

To all whom it may concern:

Be it known that I, MITCHELL F. McCARTHY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Fire-Proofing Buildings, of which the following is hereby declared to be a full, clear, and exact description, sufficient to enable others skilled in the art to which such invention appertains to make and use the same.

The invention designs to provide a fire-proof floor, ceiling, or roof, such as shall be suitable for use in hotels, warehouses, or other buildings and in bridges, viaducts, &c.; and the improvement has for its object to furnish a floor of simple and compact structure, easily and quickly laid, and capable of withstanding heavy loads or strains, the invention serving more especially as a substitute for the cumbrous terra-cotta and tile fillings that are commonly employed in connection with so-called "fire-proof" constructions.

According to the proposed plan a plastic concrete of suitable composition is laid between the series of beams or girders which constitute the skeleton frame for the floor. A fabric or netting ordinarily of metal wire is drooped across from beam to beam between and over the same, so as to be embedded with the beams in the plastic compound. The weight or load is thus carried in large measure by the fabric itself, which is supported at the tops of the beams and in such relation utilizes the full depth of the unweakened beam as an efficient means for sustaining and distributing the load. The use of the fabric in the relation proposed powerfully supplements whatever tenacity may inhere in the concrete and as well the strength due to its support and thrust at the beams, so that the thickness of flooring otherwise necessary if a simple concrete filling were used is very markedly reduced, and indeed enables a plastic compound to be employed where, except for the improvement, it would prove impracticable and insufficient.

As a substitute for terra-cotta or hollow-tile floor constructions the use of the fabric in manner proposed not only dispenses with the need of tie-rods extending from beam to beam and of the cost and trouble in fitting the same, but avoids the drilling of the beams, so that these remain unweakened, and for any given load or strain are required to be of much less than the ordinary depth or thickness. The total weight of structural iron or steel entering into the floor or roof is in consequence greatly diminished without in the least impairing its efficiency, while the floor is laid quickly and at less expense than results from handling and setting large numbers of fragile tile, which must be previously baked and prepared.

By proper adaptation of the improvements and of the compound selected as a filling spans or arches of much wider reach can be successfully bridged than is practicable by the older methods in vogue. The expanse of the foundation-footings is materially reduced, as well also the weight of the columns, carriers, girders, and beams, so that the use of the invention enables higher structures for any given foundation to be erected, or, if the height be the same, essentially lessens the load to be carried, and in consequence the cost of columns, beams, and other structural parts.

The exact nature of the improvements will more fully appear from the description following and be clearly pointed out in claims at the conclusion of the same.

In the accompanying drawings like letters of reference denote like parts of structure throughout.

Figure 1 shows in sectional view a floor structure embodying the invention, with beams, fabric, and filling, and the temporary staging in position, as usual in the process of manufacture. Fig. 2 is a sectional view of the completed floor with its surface coat or finish, the temporary staging being removed. Fig. 3 is a sectional view of a modified form of floor structure, exhibiting a compound beam and double fabric suitable for wide spans or unusual loads. Fig. 4 is a sectional view of a floor with simple catenary droop to the fabric. Fig. 5 is a sectional view on line 5 5 of Fig. 1, and Fig. 6 a plan view of a portion of the fabric or netting. Figs. 7, 8, and 9 exhibit modified shapes or types of the floor structure.

Extending in usual fashion to the walls or

girders of the building are the series of beams A, arranged at proper distance apart with reference to the load they carry. The beams may be of wood or iron, and in the form shown are of the familiar I-pattern generally adopted for structural purposes. Over the tops of the beams A is carried the fabric or netting B, preferably made of metal wire and having its main strands *b*, which extend from beam to beam, inmeshed or interlaced with the cross-strands *c* to constitute a stout support. The strands *b* are generally made heavier than the cross-strands *c*, because subjected to a greater duty in carrying the load. The strands *c* serve as braces or stays in distributing the strain and furnish with the main strands *b* proper interlocks to aid in thoroughly embedding and retaining the concrete filling C. At the outset the free terminal of the fabric B is lapped around the last or end I-beam of the series, Figs. 1 and 2, and has its strands *b* secured together, as shown, for the purpose of holding the fabric against slip or displacement. The fabric is laid from beam to beam over the tops thereof and droops between the same, so that ordinarily the main portion of the concrete filling C at the center of the arch or span shall there be above the line of the netting. The fabric may be drooped between the I-beams in simple catenary form, Fig. 4, or, as preferred in practice, is strained to assume a position under tension, in which the strands *b* will act somewhat as chords or braces in carrying the load and in withstanding sudden shocks or strains. A temporary staging is provided, which acts to retain the plastic cement until it has properly set or hardened within pockets that exist between contiguous beams. The staging consists of the girders D, mounted upon the I-beams A, and by through bolts and nuts *d*, carrying the lower companion girder E and the floor-boards *e*, arranged slightly below the I-beams A. The upper timbers D generally rest upon spacing-blocks *f*, Fig. 1, at the I-beams, which blocks enable the workmen to obtain ready access beneath the timbers D, so that the flooring can there be smoothly finished beneath and at the proper level. The temporary flooring having been located in proper position with the fabric drooping from beam to beam and over the same, a metal cross-bar (T-iron) is preferably placed at the sag or lowest level of the fabric in position beneath the screw-jacks H. By adjusting the jacks H so as to bear upon the cross-bars G the fabric B is brought under tension or strain, which latter is capable of nice adjustment, and is rendered substantially equal for the several pockets of the floor, so that the strains on I-beams A are evenly distributed at both sides. The presence of the cross-bars G enables the jacks H to be applied to the fabric with substantially uniform effect throughout.

Any of the usual concretes or plastic compositions which set or harden upon exposure can be employed as a filling for the floor-pockets, preference being had for those which are tenacious and fire-resisting, light, and capable of withstanding severe crushing strains as well. Experience has shown that a compound consisting of fibrous material—such as asbestus, sawdust, or cork—incorporated with plaster-of-paris, caustic lime, and hydraulic cement is quite satisfactory for the purpose. The ingredients named may be variously combined as follows: fibrous material, twenty-five to eighty per cent.; hydraulic cement, three to ten per cent.; caustic lime, two to five per cent.; plaster-of-paris, fifteen to fifty per cent. The fibrous material is predominant and insures lightness. The plaster-of-paris renders the composition quick to harden and enables it to readily cement with any resinous or fibrous substance and produces a tough resisting compound that cannot be readily fractured by sudden jars or blows. The caustic lime acts as a preservative for metal and wood and prevents disintegration and corrosion, besides being a better non-conductor of heat. The hydraulic cement contributes to the fire-resisting qualities of the material and to its hardness and tendency to set rapidly. Greater lightness is attained by increasing the proportion of the fiber ingredient. The material is mixed with water to about the consistency of stiff mortar and is filled into the floor-pockets, so as to completely incase the netting B and inclose the I-beams A both above and below. A cap *i*, Fig. 4, of stout paper or the like, may be set over the upper face of the beams A to receive the fabric B. The caps *i* serve as guards to prevent the fabric from being torn or otherwise injured by contact with the joists or beams. The floor-pockets are filled in succession, and when the entire series is completed and the composition has sufficiently set the temporary staging is removed and shifted to new position. The lower ends of the jacks H are easily withdrawn from the filling compound in which they are embedded, and the holes thus left are filled in. A top dressing *l*, Fig. 2, of finer quality of cement can be laid across the flooring, if desired, although in many instances the body filling itself may be carried to the upper level indicated for the top dressing, and thus complete the protection of the I-beams against exposure.

For spans of unusual reach—say twenty feet or more—or where the load to be carried is unusually great, a compound beam, Fig. 3, consisting of a double I-beam A′, secured together by spacing-bolts and sleeves *a*′, can be substituted for the simple I-beam ordinarily employed. Protecting caps or plates *i*′ are arranged at the upper and lower faces of the compound beam, and in the example shown a double fabric or netting B′ B^2 is extended from beam to beam to sustain the filling and the superposed load. Cross-bars G are mounted, as usual, in effecting the desired tension

upon the fabric. It is obvious that instead of the double netting there may be three or more distinct fabrics distributed at various distances apart and embedded within the filling if the load to be carried should require such additional strength to be given.

For a ceiling finish the under part of each pocket may be arched or cambered, Fig. 8, or left in truss-like form, Fig. 9, if desired. Such constructions serve also to reduce the body of the filling, so that the dead weight thus carried by the fabric is correspondingly lessened. To the same end it may be advisable at times to provide a series of hollow tiles or cores *m n o*, Fig. 7, previously prepared and of proper size and contour to be sustained in place from the temporary staging. Plastic composition can be snugly tamped about such cores, the shape and material whereof serve, in lieu of the composition which they displace, as a means for strengthening the filling and rendering it solid.

In lieu of the fabric or netting proper it may be advisable or sufficient at times, especially where the strain is comparatively slight, to provide a series of simple strands alone, such strands being arranged side by side at proper distances apart, (as with the fabric,) and drooping over and between the I-beams in like fashion as if the fabric were employed. Obviously modifications in detail, such as the skill of the mechanic may effect or improvements which none the less involve substantially the same elements of structure here disclosed, are equally included within the scope of the invention.

It will be understood that the improvements herein described may be practiced without using the particular composition set forth, which latter forms no part of the present invention, and is in no wise included as part thereof.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the beams, of the wire strands extending over and drooped between the same, and the concrete filling wherein said beams and strands are embedded, substantially as described.

2. The combination, with the beams, of the wire fabric extending over and drooped under positive tension between the same, and the concrete filling wherein said beams and fabrics are embedded, substantially as described.

3. The combination, with the beams, of the wire fabric extending over and drooped under positive tension between the same, the cross-bar bearing against said fabric, and the concrete filling wherein said beams, bar, and fabric are embedded, substantially as described.

4. The method of laying floor structures, which consists in drooping a wire fabric over and between contiguous beams, embedding the beams and fabric in plastic concrete, and maintaining the fabric under tension while the concrete filling hardens or sets, substantially as described.

5. The combination, with the beams, of the wire strands extending over and drooped between the same, and the pocket filling sustained by said strands, substantially as described.

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