(No Model.) 3 Sheets—Sheet 1.

W. ORR.

FIRE PROOF CONSTRUCTION.

No. 471,772. Patented Mar. 29, 1892.

Fig. 1.

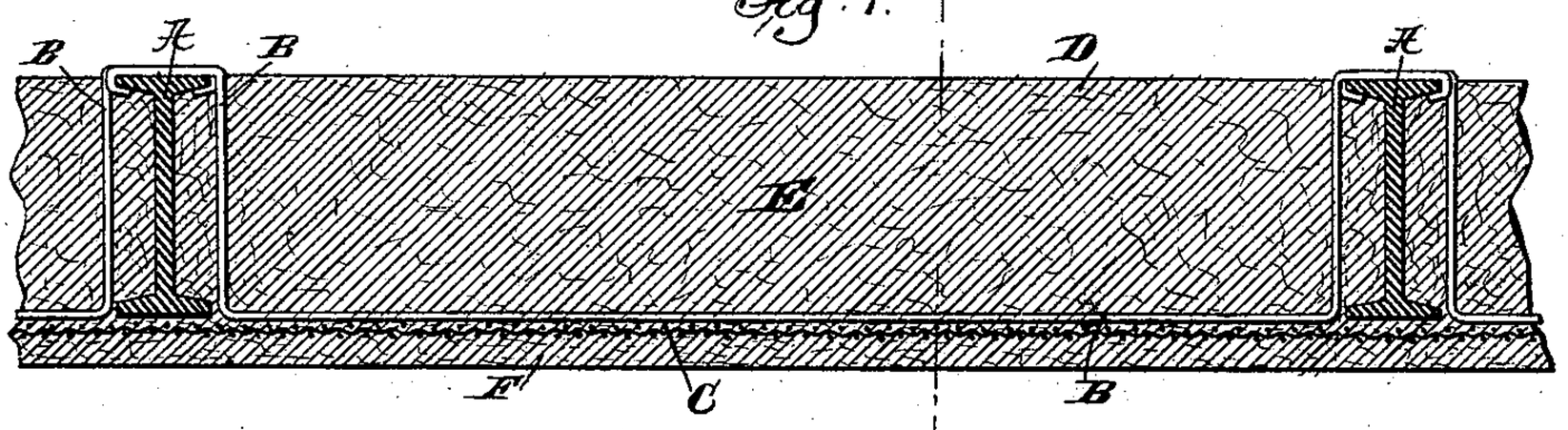


Fig. 2.

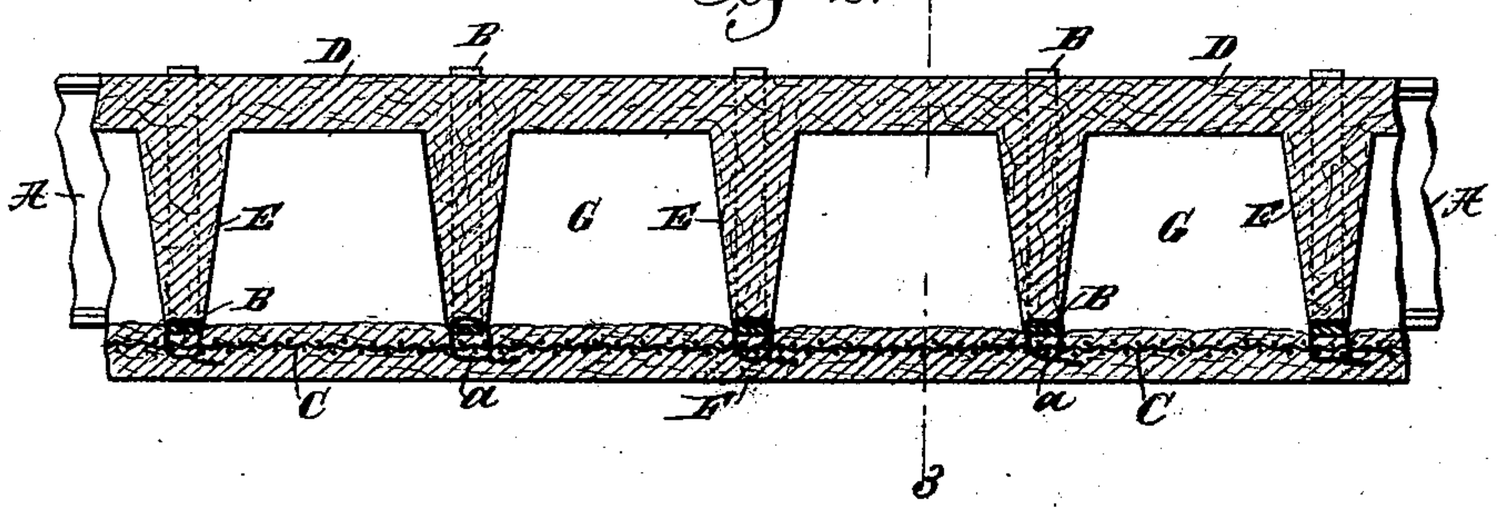
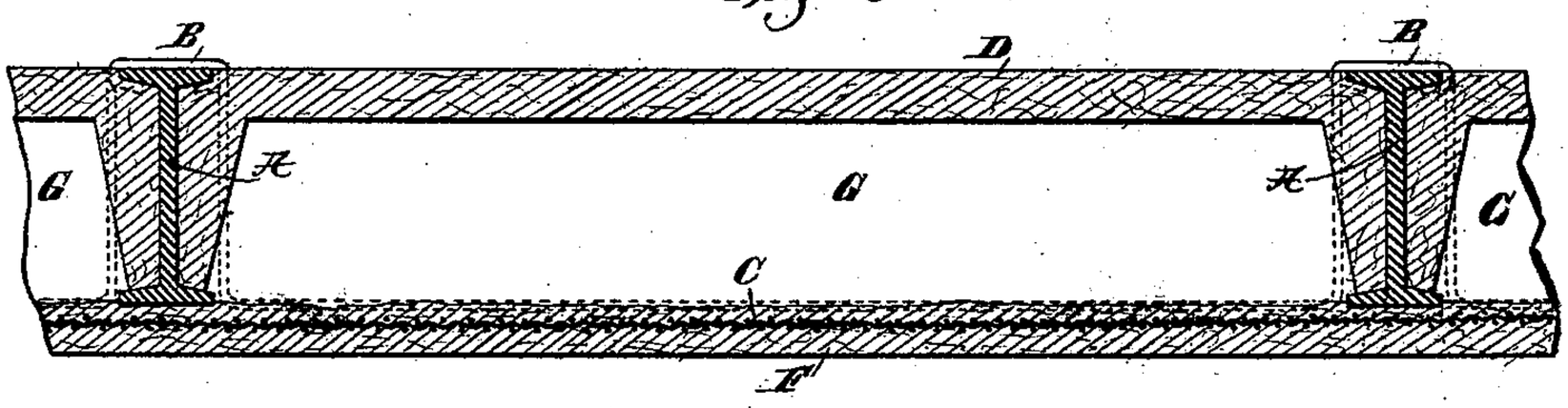


Fig. 3.



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Atty

(No Model.) 3 Sheets—Sheet 2.

W. ORR.

FIRE PROOF CONSTRUCTION.

No. 471,772. Patented Mar. 29, 1892.

Fig 4.

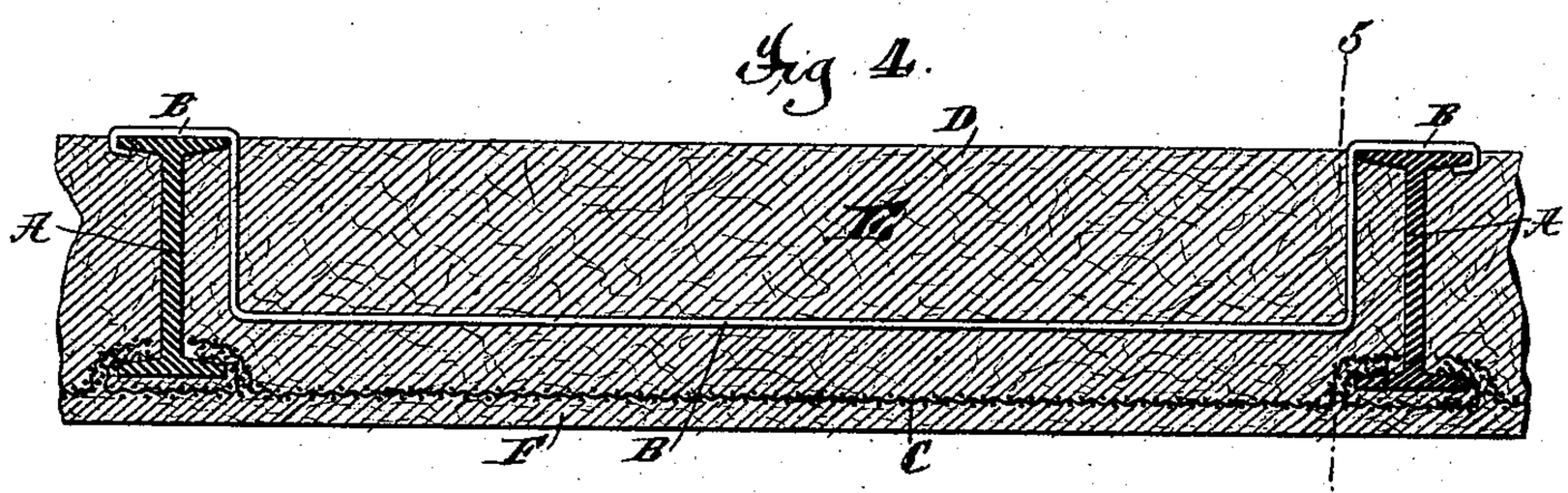


Fig 5.

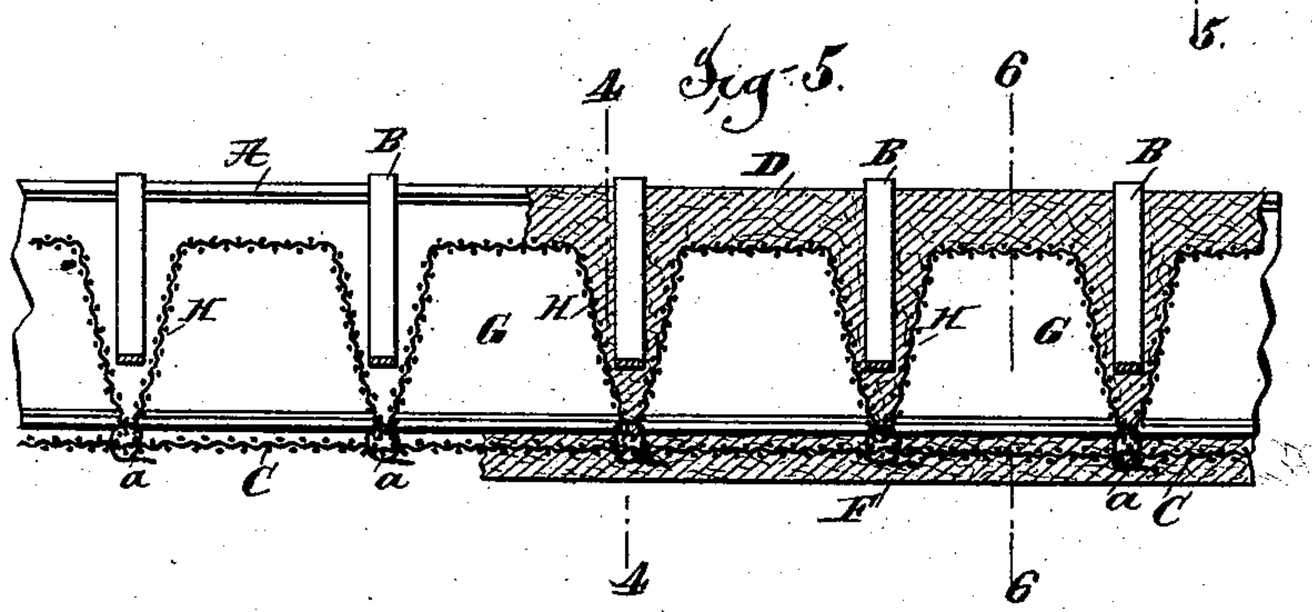


Fig 6.

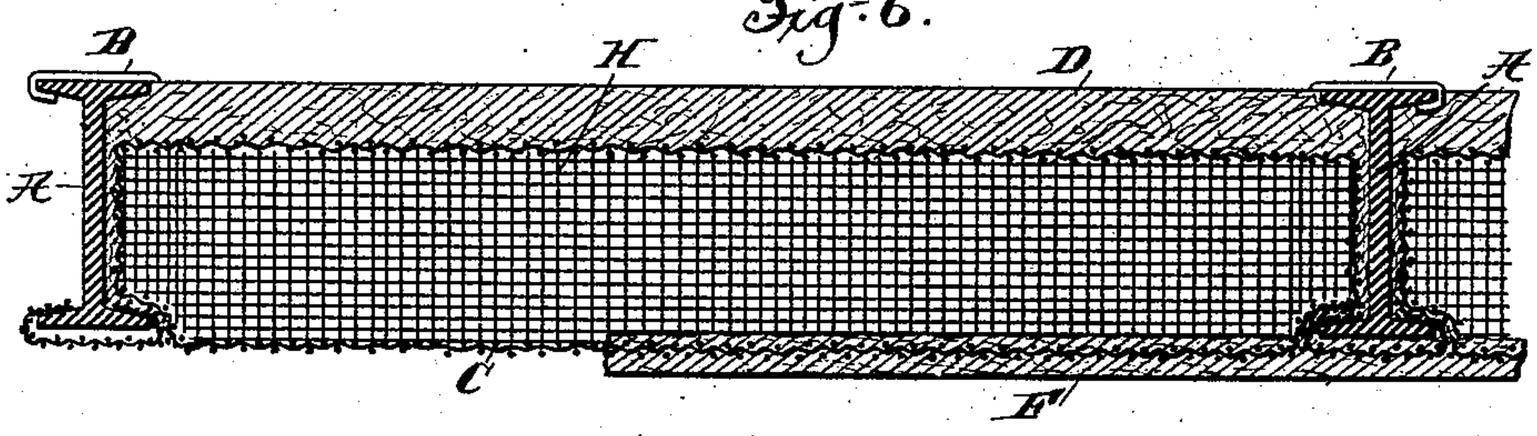


Fig 7.

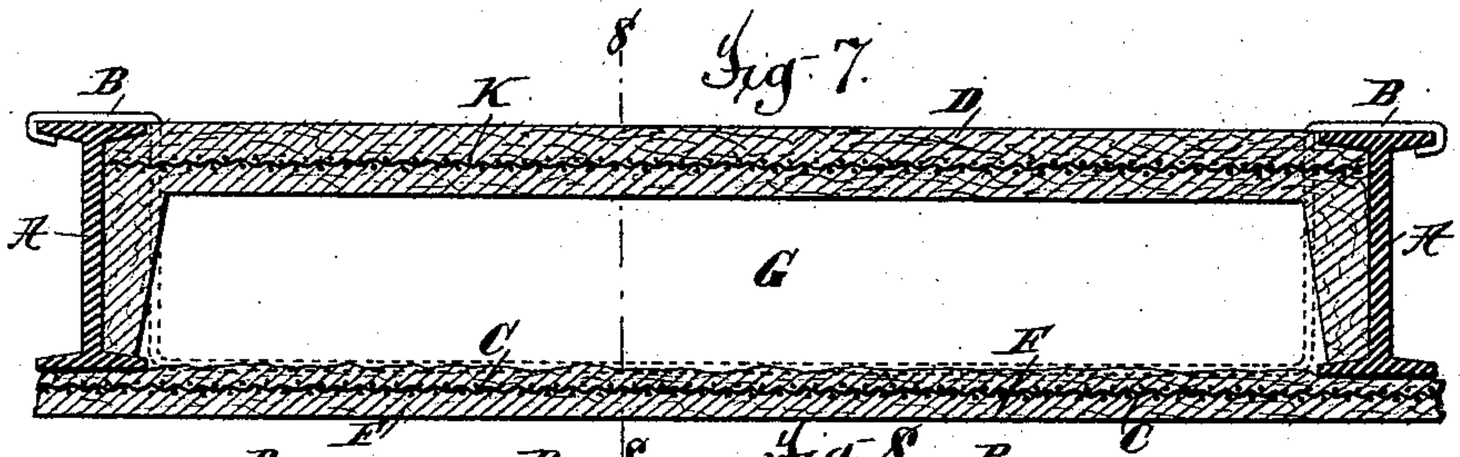
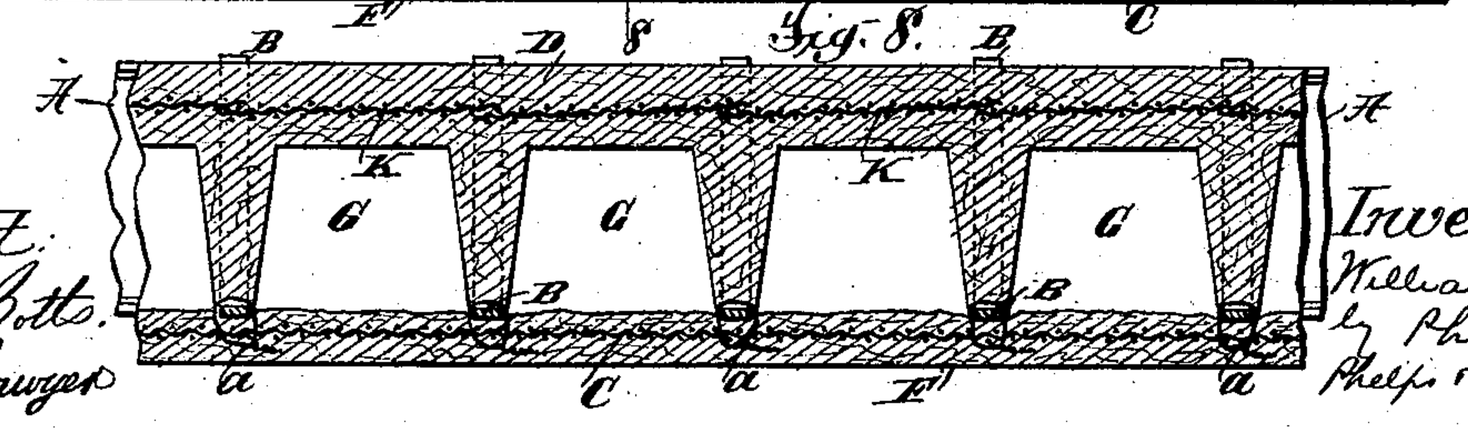


Fig 8.



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(No Model.) 3 Sheets—Sheet 3.

W. ORR.

FIRE PROOF CONSTRUCTION.

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Fig. 9.

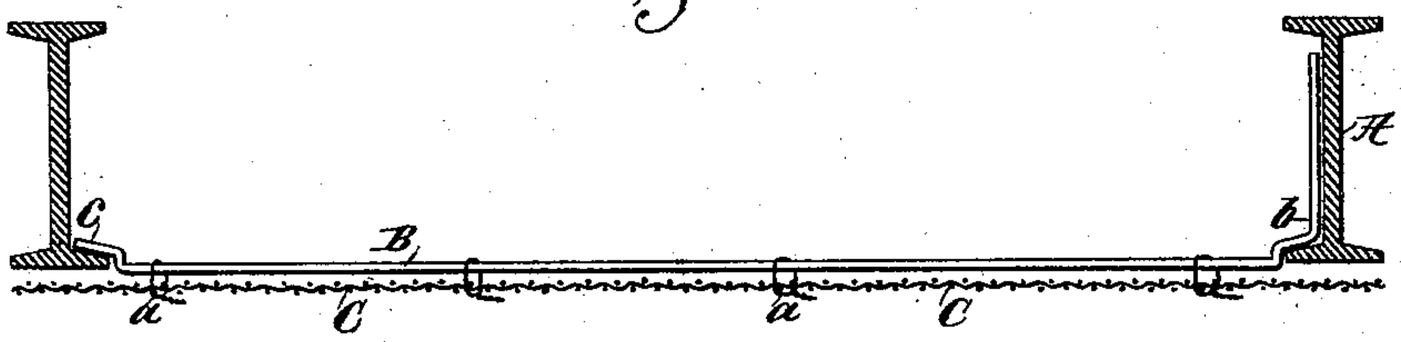


Fig. 10.

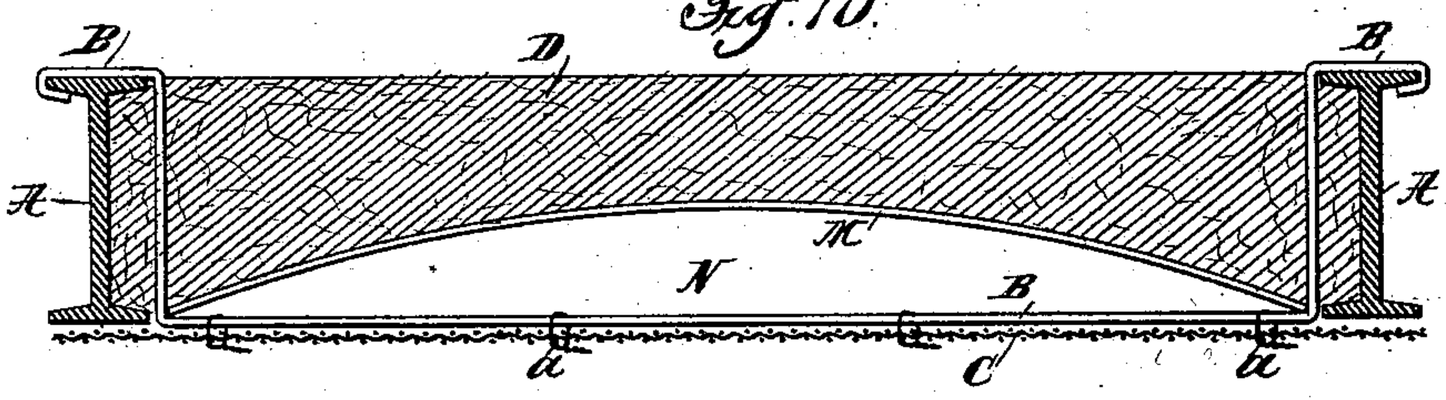


Fig. 11.

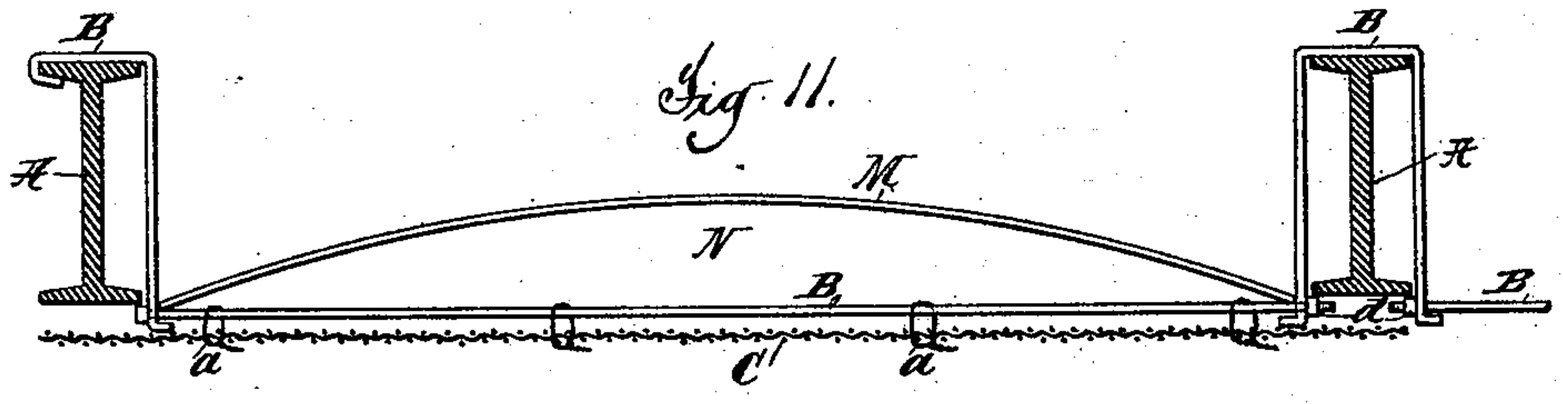


Fig. 12.

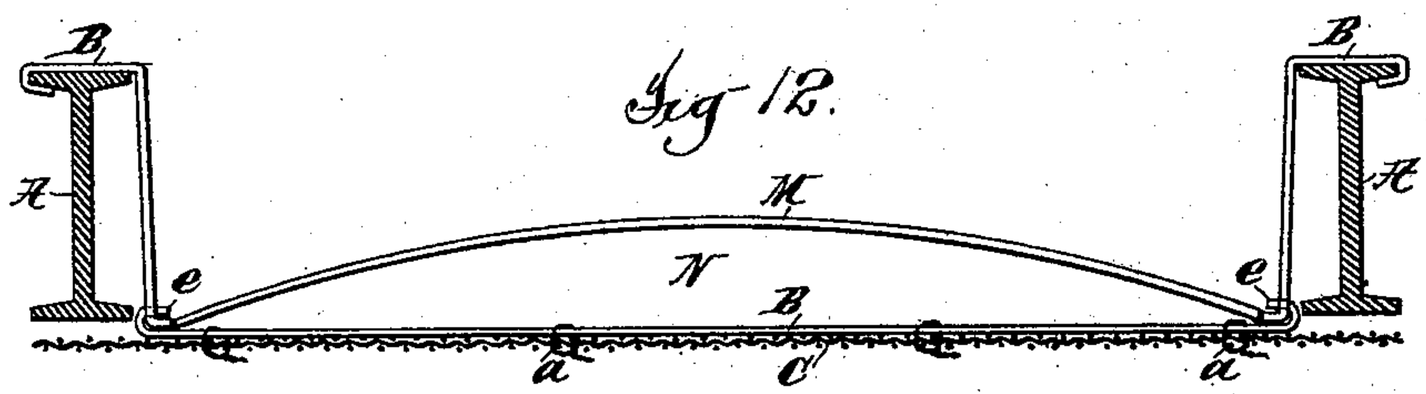
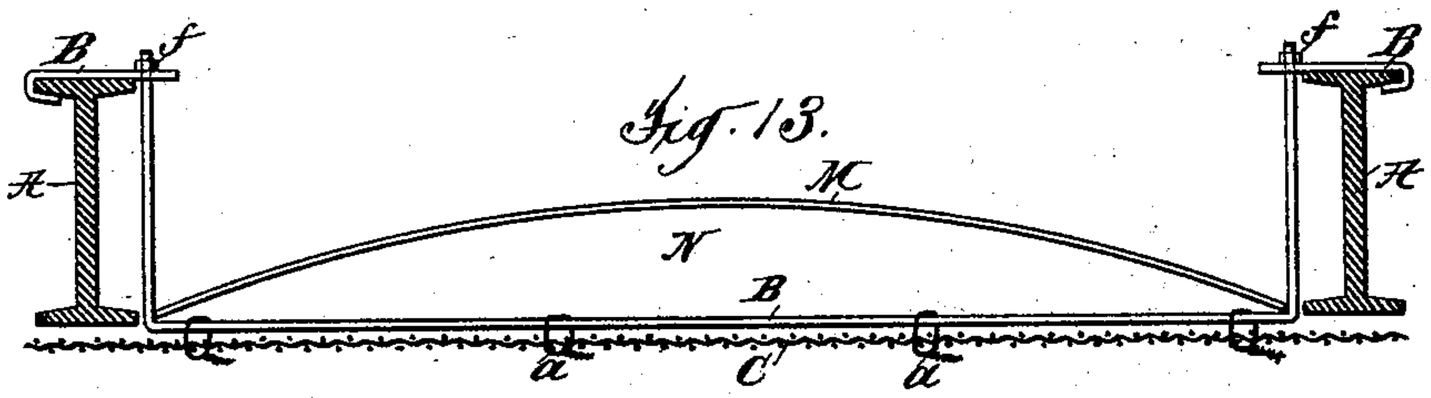


Fig. 13.



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UNITED STATES PATENT OFFICE.

WILLIAM ORR, OF TRENTON, NEW JERSEY.

FIRE-PROOF CONSTRUCTION.

SPECIFICATION forming part of Letters Patent No. 471,772, dated March 29, 1892.

Application filed April 13, 1891. Serial No. 388,680. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM ORR, a citizen of the United States, residing at Trenton, county of Mercer, and State of New Jersey, have invented certain new and useful Improvements in Fire-Proof Construction, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

In fire-proof floor and ceiling construction it is necessary that the floor-beams be thoroughly protected against the action of fire. For this purpose arches of hollow or common brick or tile are generally laid between the floor-beams. This adds greatly to the cost, as the tiling has to be made of great strength to carry the heavy load, and the tile and brick and laying of the same are very expensive. In the case of the arches, also, the under sides of the floor-beams are left exposed unless protected otherwise, as by metallic lathing.

The object of the present invention is to provide an improved floor and ceiling construction which shall avoid the use of these brick arches and similar constructions, thus reducing the weight of the structure, while at the same time all the fire-proof qualities of the brick-and-tile construction are retained.

To this end my invention consists in certain constructions and arrangements of parts, all of which will be particularly described in the following specification, and pointed out in the claims.

For a full understanding of my invention a detailed description of constructions embodying it in its preferred forms will now be given, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a section of a floor and ceiling construction transverse to the beams, showing one application of my invention. Fig. 2 is a section on the line 2 2 of Fig. 1. Fig. 3 is a section on the line 3 3 of Fig. 2. Fig. 4 is a section similar to Fig. 1, taken on the line 4 4 of Fig. 5 and showing a construction employing hollow lathing-blocks. Fig. 5. is a section on the line 5 5 of Fig. 4, showing the hollow-block construction before and after the application of the plastic material. Fig. 6 is a section on the line 6 6 of Fig. 5. Fig. 7 is a section similar to Fig. 3, showing a construction employing a bond of metallic lathing. Fig. 8 is a section on the line 8 8 of Fig. 7. Fig. 9 shows a slightly-modified form of the suspender. Fig. 10 is a section of a construction employing arch-suspenders. Figs. 11, 12, and 13 show different means of supporting the suspenders in the arch construction.

Referring now especially to Figs. 1 to 3, A are the floor-beams of the usual I form; B, suspenders; C, metallic lathing supported by the suspenders, being attached, preferably, by the wire lacings *a*, as shown; D, a body of cement or other plastic material forming a connecting-web between the upper parts of the beams; E, ribs extending downward from the web D and formed of bodies of the same material extending from beam to beam and surrounding the suspenders, and F a body of plastic or other suitable material applied to the lathing C and forming the ceiling. The suspenders D are preferably made of flat iron bars hooked around the top flanges of the beams and bent downward, preferably close to the edges of the flanges, so that the bottom line of the suspender is on or about on a line with the bottoms of the beams. The suspenders may be very light; but they must be of sufficient width to give the cement rib resting thereon sufficient area so that the crushing strength of the cement will about equal the tensile strength of the bar, and both the bar and cement rib must have sufficient strength to support with a sufficient factor of safety the load required. The suspenders are placed at suitable distances apart along the beams, as shown in Fig. 2, and between them and the ribs E in the complete construction, as shown in Figs. 2 and 3, are hollow spaces G, which form air-spaces, decreasing greatly the weight of the structure, while increasing its fire-proof qualities.

The method of making this fire-proof construction is as follows: A series of tapering blocks or formers are supported side by side upon the lower flanges of the beams A, these formers being so constructed that they may be placed in position and then lengthened, so as to rest at both ends upon the flanges, being shortened again for removal. They may, however, be supported by frames or hooks or in any other suitable manner. These blocks are placed at a distance apart equal

to the width of the suspenders, and a suspender is placed between each pair of blocks, closing the spaces between the bottoms of the formers, but leaving a tapering space above them between the formers for cement. The cement or other similar material is then applied from above and fills all the tapering spaces between the formers and about the suspenders, so as to form the ribs E, extending between the vertical arms of the suspender-rods and between them and the beams, so that the cement is bonded together by the suspenders and the load sustained thereby. A sufficient amount of cement is applied so as to give the thickness desired to the web D above the formers, this extending, preferably, to the level of the tops of the beams and suspenders. After the cement has set the formers are removed, leaving the air-spaces G, and the lathing C of woven wire or perforated metal is secured to the suspenders, preferably by lacing by wires *a*, as shown in Fig. 2, these wires being placed about the suspenders before the cement is applied. The usual ceiling of plaster is then applied to the lathing C, completing the construction. With this construction employing the suspenders it will be found that the strength is so distributed that a comparatively small amount of plastic material is required. The floor-load is lessened to one-half that of brick-arch floors and the side thrust against the beams in the ordinary brick or tile arch construction is converted into very nearly a dead-weight upon the beams. A continuous web of plastic material extending from beam to beam is also provided, which web is so supported by the suspenders and ribs that a slight displacement of a beam will not disrupt it and allow it to collapse, as in the ordinary brick or tile construction. Tile could be laid directly upon this cement or a wood floor, the same as upon a filled-in brick-arch floor, except that no filling in would be required, the scantlings resting directly upon the cement.

The suspenders may be employed, also, in combination with the hollow lathing-blocks of my application, Serial No. 284,755, filed September 6, 1888. Such a construction is shown in Figs. 4, 5, and 6, in which the hollow lathing-blocks H extend from beam to beam and are supported by the beam-flanges, these hollow blocks binding together the material of the web D and ribs E. The hollow blocks will preferably be formed by bending sheets of woven wire or perforated sheet metal so as to form the hollow blocks H, having three sides and open below, the fourth side being formed and the blocks closed by the attachment of the lathing-sheet C for the ceiling, which is secured to the bottom edges of the blocks by lacing, as shown, or in any other suitable manner. This construction is preferred, as it enables formers to be used inside the hollow blocks, against which the cement is tamped from above as it is applied; but it will be understood that the blocks H may be closed blocks, if preferred, and their lower sides form the ceiling-lathing; but this provides no firm body against which to tamp the cement. In making this construction the series of open blocks will first be placed in position and the formers, previously described, mounted inside them, the suspenders being placed in position, as shown at the left in Fig. 5, either before or after the insertion of the formers. The spaces between the blocks and about the suspenders are then filled with cement or other material from above, as in the construction employing the formers, the cement being tamped firmly against the formers inside the blocks. After the cement has set the formers are removed and the ceiling applied, the hollow lathing-blocks being left in position and forming part of the complete construction, as shown at the right in Fig. 5. This construction is somewhat more expensive, but is stronger, as the cement is thoroughly bonded by the wire or perforated metal of the blocks. The web of cement can, however, be well bonded together without the use of the hollow blocks by the construction shown in Figs. 7 and 8, in which sheets of woven wire or perforated metal K extend from beam to beam, being lapped over each other above the ribs E. In making this construction the removable blocks or formers are used, as in the construction shown in Figs. 1 to 3, and the spaces are filled even with or a little above the tops of the formers and the sheets of woven wire or perforated metal K then placed in position upon the cement and the filling continued above the sheets until the required amount of cement is spread. The cement thus bonded has the tensile strength of the wire or metal to hold it together, and the latter aids very materially in strengthening and stiffening the construction. Instead of using the removable blocks and forming air-spaces in this construction, a straight centering may be supported under the beams and the plastic material be spread and tamped in from above, as before, so as to form a solid mass of the required thickness, the sheets of woven wire or perforated sheet metal forming a bond, as before.

While I prefer to hook the suspenders over the tops of the beams, it is evident that they may be otherwise supported. Thus in Fig. 9 I have shown a construction in which the suspender is supported by the lower flanges of the beams, the ends of the suspender being bent around the flanges of the beams, with the body of the suspender level with the bottoms of the beams. The ends of the suspender may be extended upward along the web of the beams, as shown at *b* in this figure, or may simply rest upon the flanges, as shown at *c*. When the cement is set, it will be found that the ends are held securely in place and that the structure is of sufficient strength where great weights are not to be supported.

A stronger structure can be made and one

in which the liability of cracking the ceiling-plaster by deflection is more fully avoided by the use of what may be called an "arch-suspender," as shown in Fig. 10. In this construction the bar B is continuous and hooked over the tops of the flanges, as before, and a supporting-bar M of suitable size and length is sprung in between the vertical arms of the suspender, with its ends held in the lower angles of the suspender, where they may be secured in place by lacing or otherwise, if desired. The arch-bar M of the suspender will preferably be of sufficient width and so shaped as to fill the spaces between the formers or hollow blocks of the constructions previously described, so that the cement or plastic material applied from above will fill only the spaces above the arch-bar and air-spaces N will be left below the same. The thrust of the arch is then nearly a dead-weight on the beams, being supported by the horizontal portion of the suspender-bar B, the tensile strength of which in case of excessive load is aided by the beams, against the flanges of which it would rest in case of any elongation.

While I prefer to leave the spaces N open, as above described, as an additional security against possible deflection of the ceiling and to facilitate lacing of the lathing, this space also may be filled with cement, if desired, in which case the lacing-wires will first be attached to the suspenders, as previously described, or other suitable means provided for the attachment of the metallic lathing. If this space be filled, however, it will be seen that most of the floor-load is still transferred to an endwise thrust upon the horizontal portion of the suspender-bar B.

The suspender-bars B need not be formed from a single continuous bar, as it is evident that the same results can be attained by other constructions, some of which I have shown in Figs. 11 to 13. Thus the hooks and the vertical arms of the suspenders may be separate from the horizontal portions and the latter consist of straight bars passing through openings in the lower ends of the vertical arms and adjustably secured in position by nuts *d*, as shown in Fig. 11, each hook supporting one or more bars on only one side of the beam, as shown at the left of the figure, or being provided with two vertical arms, so as to form a support on each side of the beams, as shown at the right of the figure.

The horizontal bars may be formed with hooks *e* at each end, which are hooked through openings in the vertical arms, as shown in Fig. 12, the double-arm construction being applicable, also, to this construction. The vertical arms and horizontal portions may be continuous and the hooks formed of separate pieces, as shown in Fig. 13, the vertical arms being passed through openings in the hooks and secured by nuts *f*, or the connection made in any other suitable manner. In these constructions the arch-bar M may be used, as shown in these figures, or omitted, in accordance with the constructions previously described.

It is evident that many other modifications may be made in the construction shown without departing from my invention, and the constructions shown are selected only as the preferable forms of many in which my invention may be embodied.

What I claim is—

1. The combination, with floor-beams, of a series of suspenders supported by said beams and extending from beam to beam and a body of cement or other plastic material forming a web and a series of ribs extending from beam to beam, said web lying above said suspenders and the ribs extending downward from said web and being supported by the suspenders, substantially as described.

2. The combination, with floor-beams, of a series of suspenders consisting of metal bars supported by the tops of the beams and extending downward toward the bottoms of the beams and then from beam to beam, and a body of cement or other plastic material forming a web and series of ribs extending from beam to beam, said web lying above said suspenders and the ribs extending downward from said web and having the suspenders embedded therein, substantially as described.

3. The combination, with floor-beams, of a series of suspenders supported by said beams and extending from beam to beam, a body of cement or other plastic material forming a web and series of ribs extending from beam to beam, said web lying above said suspenders and the ribs extending downward from said web and being supported by the suspenders, and woven wire or perforated sheet metal extending from beam to beam and forming a bond for said plastic material, substantially as described.

4. The combination, with floor-beams, of a series of suspenders supported by said beams and extending from beam to beam, a body of cement or other plastic material forming a web and series of ribs extending from beam to beam, said web lying above said suspenders and the ribs extending downward from said web and being supported by the suspenders, and hollow metallic lathing-blocks lying between said suspenders and forming bonds for the plastic material, substantially as described.

5. The combination, with floor-beams, of a series of suspenders supported by said beams and extending from beam to beam, a body of cement or other plastic material forming a web and series of ribs extending from beam to beam, said web lying above said suspenders and the ribs extending downward from said web and being supported by the suspenders, and a ceiling of metallic lathing and plastic material supported by said suspenders, substantially as described.

6. The combination, with floor-beams, of a series of arched suspenders supported by said beams and extending from beam to beam, and

a body of cement or other plastic material forming a web and series of ribs extending from beam to beam, said web lying above said suspenders and the ribs extending downward from said web and being supported by the suspenders, substantially as described.

7. The combination, with floor-beams, of a series of suspenders supported by said beams and having a plurality of bars extending from beam to beam, one bar arched above another, and a body of cement or other plastic material forming a web and series of ribs extending from beam to beam, said web lying above said suspenders and the ribs extending downward from said web and resting on the arched bars of the suspenders, substantially as described.

8. The combination, with floor-beams, of a series of suspenders supported on the tops of the beams and extending downward and then from beam to beam, a body of cement or other plastic material extending from beam to beam and supported by said suspenders, and woven wire or perforated sheet metal forming a bond for said plastic material, substantially as described.

9. The combination, with floor-beams, of a series of suspenders supported by said beams and extending from beam to beam and a floor of fire-proof material supported by said suspenders, with air-spaces extending from beam to beam between adjacent suspenders, substantially as described.

10. The combination, with the beams A, of the suspender B, having end bars hooked over the top of the beams and extending downward from the flanges of the beams, and a separate bar supported by said end bars and extending from beam to beam and having an adjustable connection with said end bars, whereby the length of the horizontal bar between the end bars and their position may be adjusted, substantially as described.

11. The combination, with the suspender B, hooked over the tops of the beams and extending downward toward the bottoms of the beams and then from beam to beam, of bars M, sprung into position with their ends held in the angles between the vertical and horizontal parts of the suspender and forming an arch above the latter, substantially as described.

12. The combination, with the beams A, of the suspender B, hooked over the tops of the beams and extending downward from the flanges of the beams and then horizontally from beam to beam, bar M, sprung into position with its ends held in the angle between the vertical and horizontal parts of the suspender and forming an arch above the latter, and metallic lathing C, suspended from the horizontal part of the suspender, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM ORR.

Witnesses:
H. N. COMING,
JAMES J. WILSON.