

No. 644,941.

Patented Mar. 6, 1900.

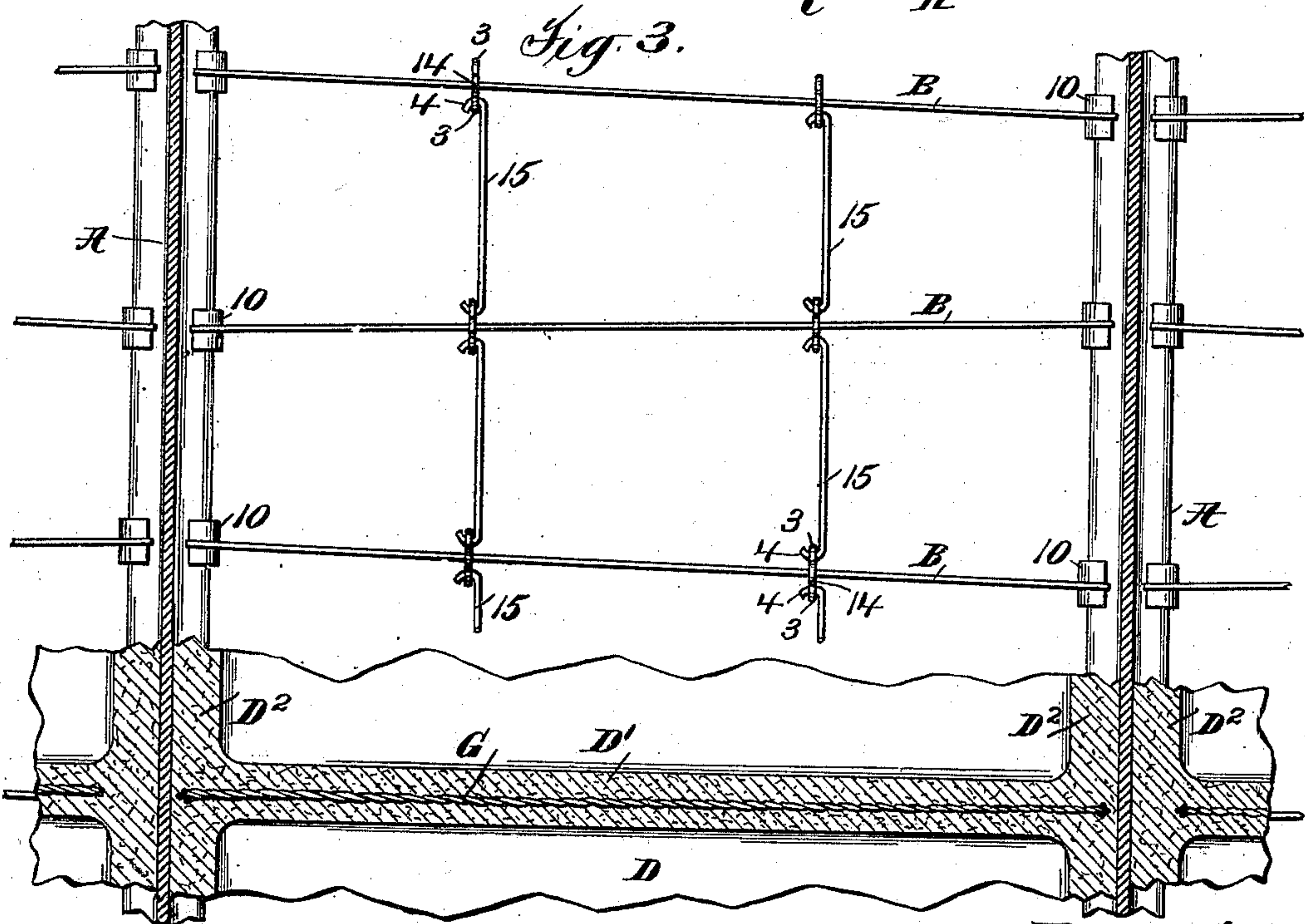
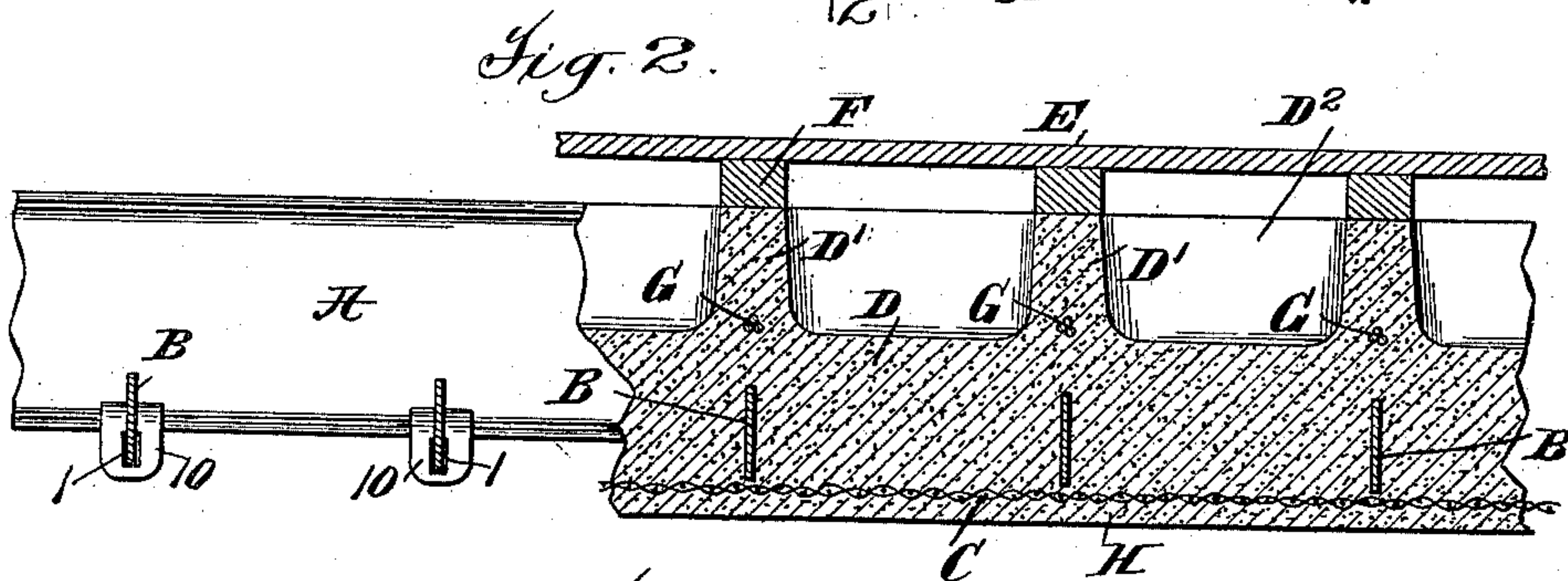
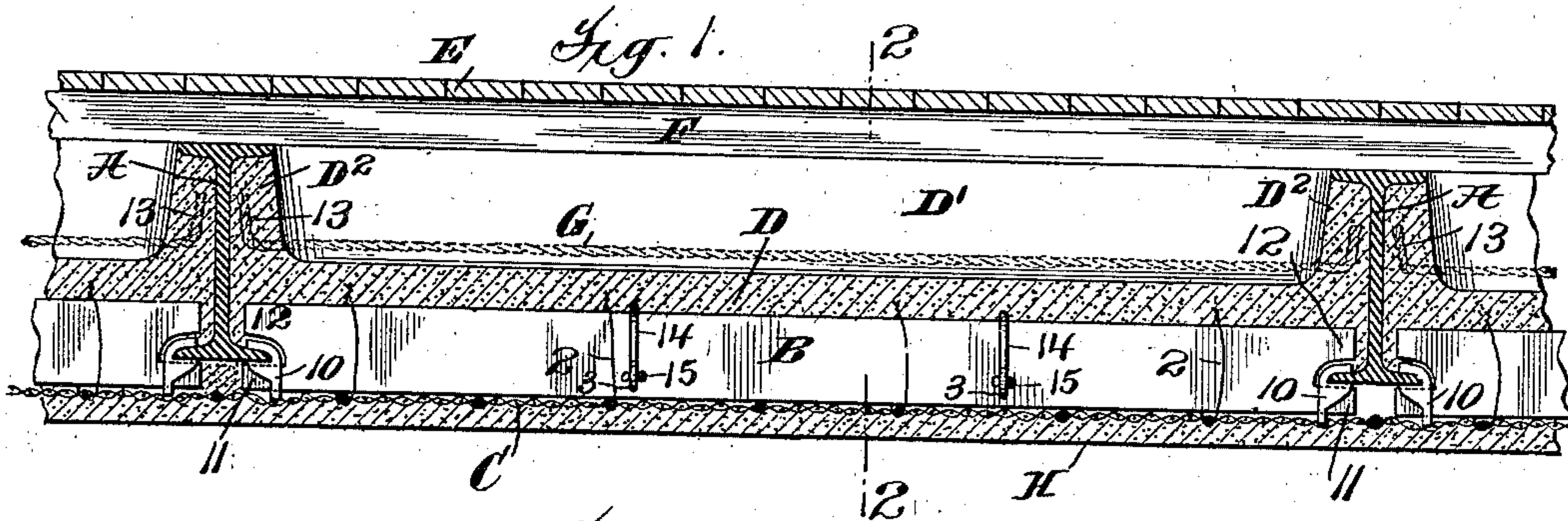
W. ORR.

FIREPROOF CONSTRUCTION.

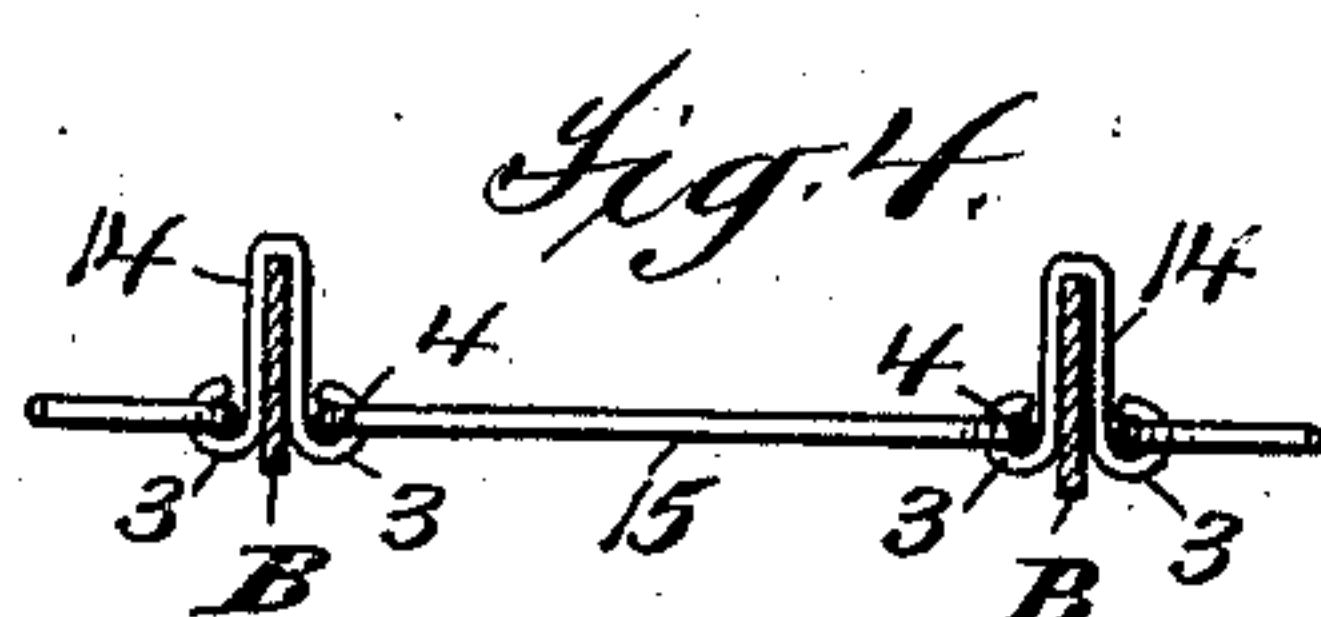
(Application filed Sept. 6, 1898.)

(No Model.)

2 Sheets—Sheet 1.



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(No Model.)

2 Sheets—Sheet 2.

Fig. 5.

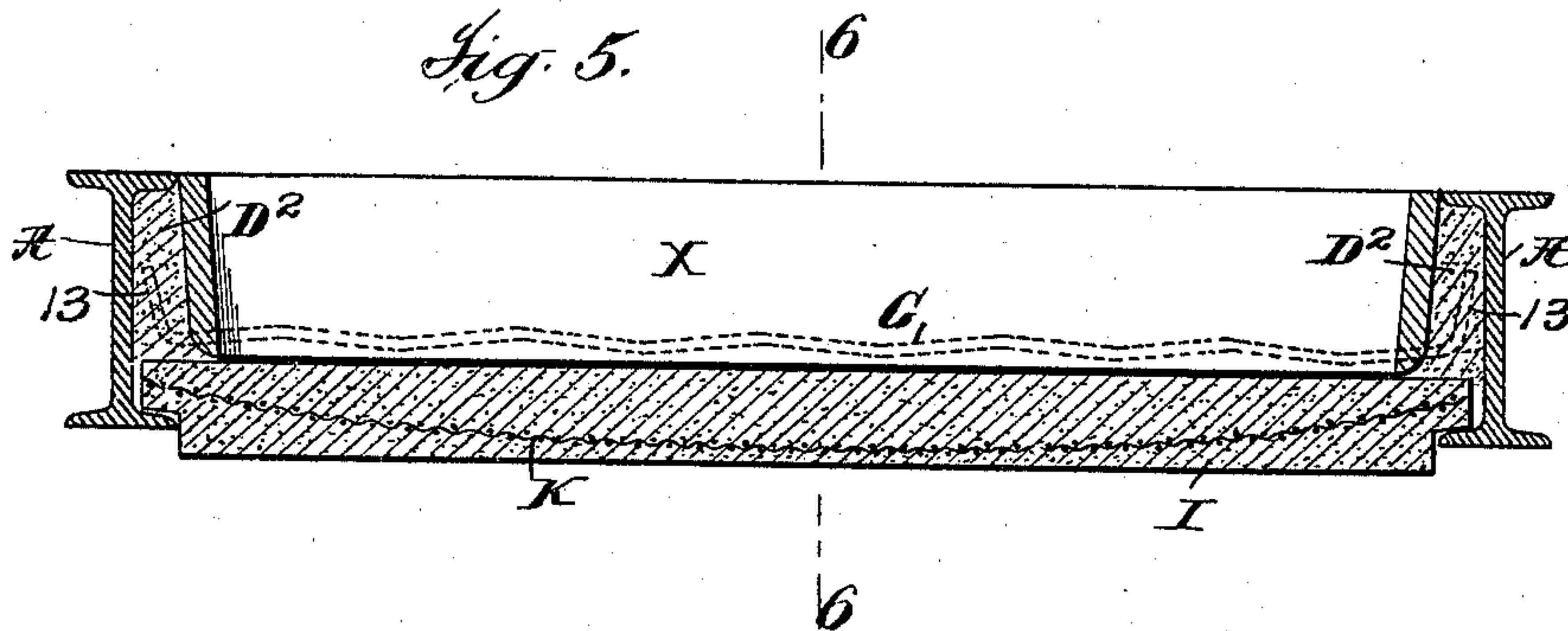


Fig. 6.

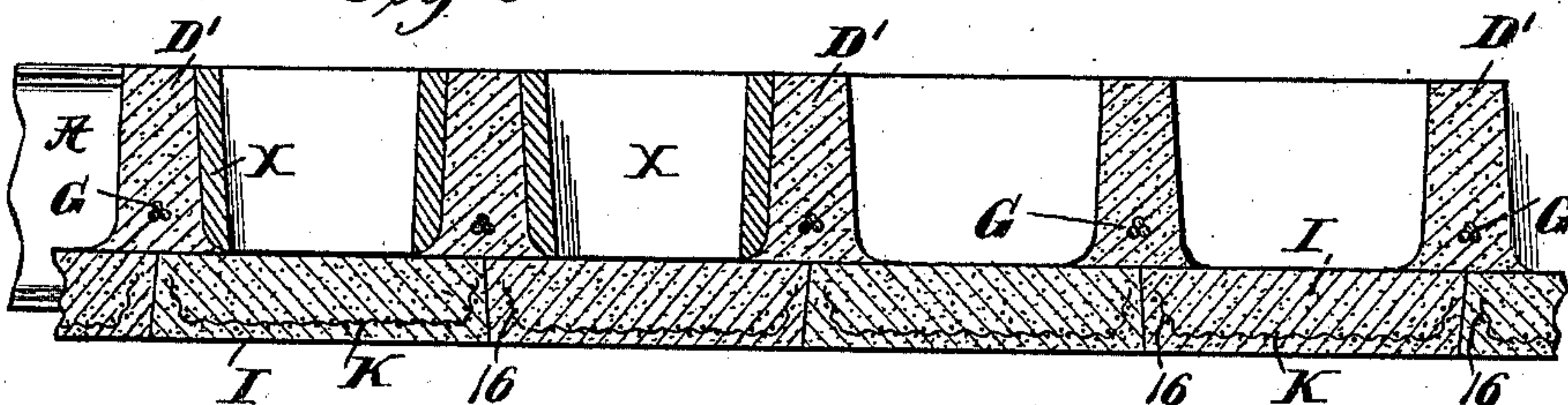


Fig. 7.

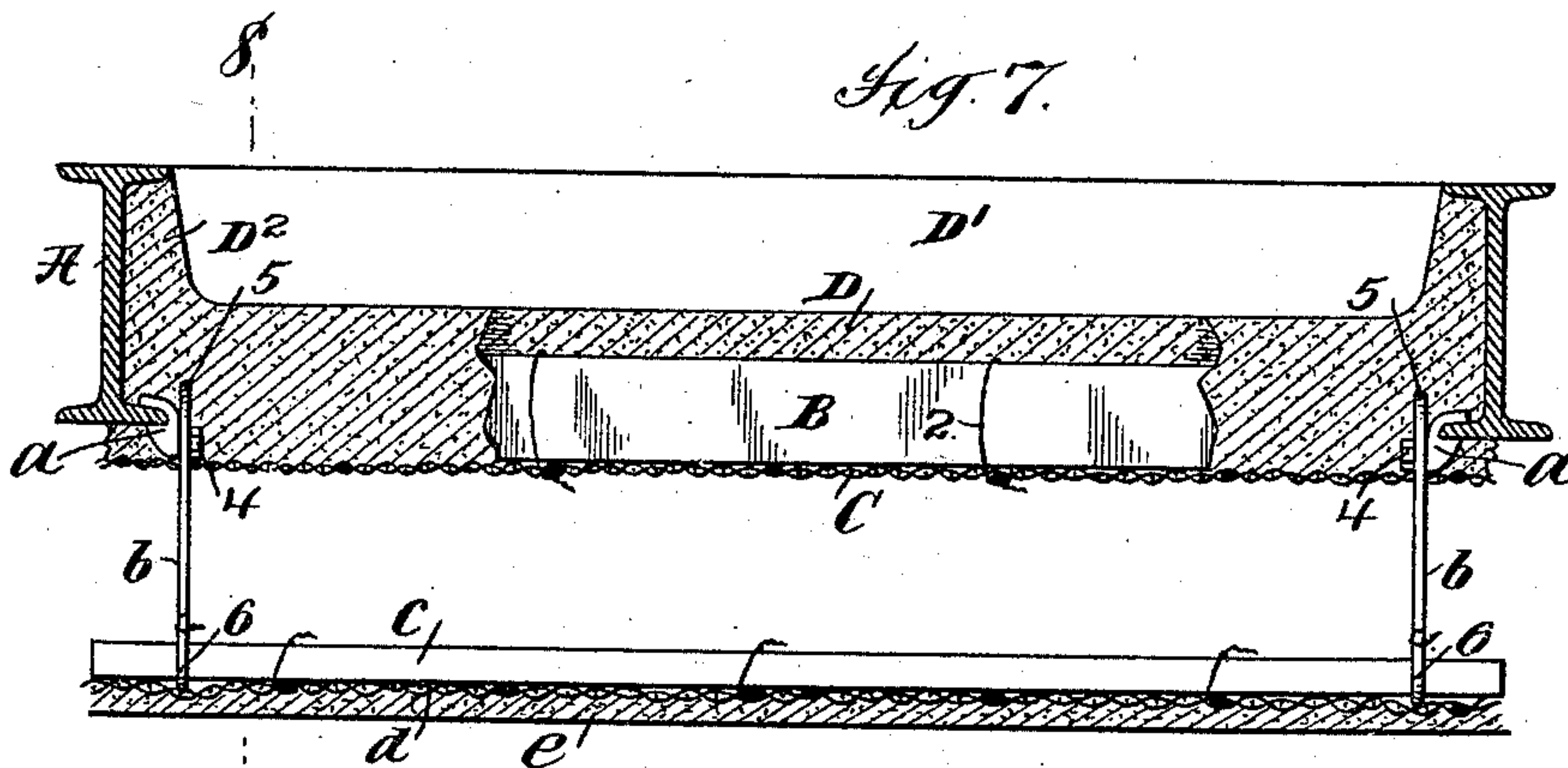
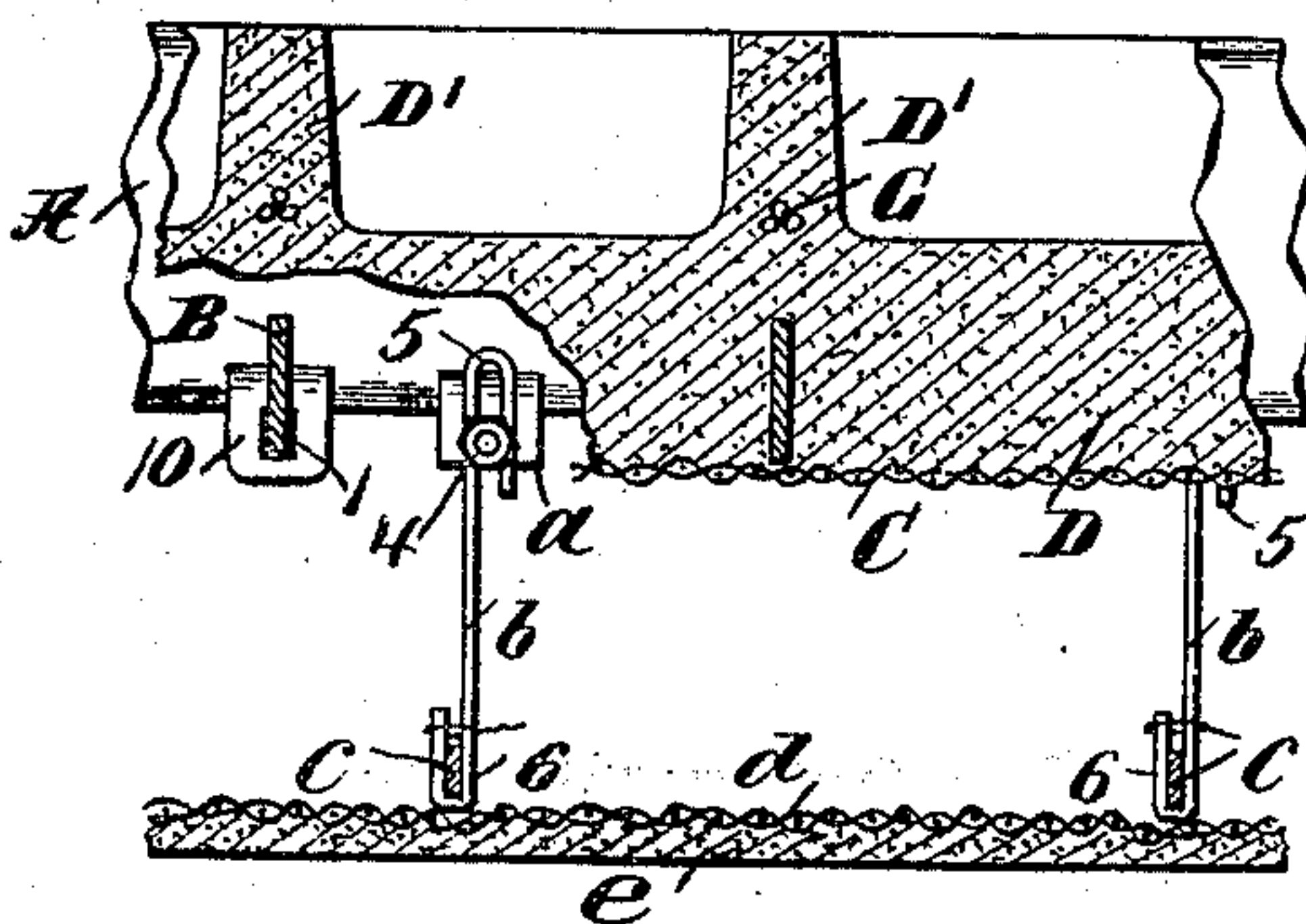


Fig. 8.



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# UNITED STATES PATENT OFFICE.

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WIRE CLOTH COMPANY, OF SAME PLACE.

## FIREPROOF CONSTRUCTION.

SPECIFICATION forming part of Letters Patent No. 644,941, dated March 6, 1900.

Application filed September 6, 1898. Serial No. 690,318. (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 Fireproof Constructions, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to an improved fireproof construction adapted especially for use as a combined floor and ceiling construction, the especial object of the invention being to provide an improved construction employing metal plate-joists and reticulated metal to support a floor of concrete or similar plastic material. I aim particularly at the formation of a construction in which the metal parts employed shall be of light weight and the desired strength and fireproof qualities be secured with a small body of concrete or similar plastic material and which may be built rapidly and cheaply.

Further objects of the invention are to provide adjustable means for supporting a ceiling so that the desired position of the latter may be readily secured and an improved construction of spanner for holding plate-joists in position.

While, however, the invention is adapted for use in fireproof floor and ceiling constructions, the invention includes also certain features of construction and combinations of parts which may be used in other concrete and similar constructions.

As a full understanding of the invention can best be given by an illustration and a detailed description of constructions embodying the same, such a description will now be given in connection with the accompanying drawings, forming a part of this specification and showing the invention as applied in constructions of the preferred forms, and the features forming the invention will then be specifically pointed out in the claims.

In the drawings, Figure 1 is a section of a complete floor and ceiling construction, the section being taken transversely to the floor-beams. Fig. 2 is a cross-section on the line 2 of Fig. 1 with the concrete and plaster removed from

part of the construction. Fig. 3 is a plan view showing a part of the complete construction in section and the preferred arrangement of the joists and spanners. Fig. 4 is a detail cross-section of the joists, showing the spanner construction. Fig. 5 is a view similar to Fig. 1, showing a modified construction embodying certain features of the invention, one of the formers being shown in position as in building the construction. Fig. 6 is a cross-section on the line 6 of Fig. 5, showing a portion of the construction completed and a portion with the formers in place. Fig. 7 is a section similar to Fig. 5, but showing a construction completed with the former removed and the concrete partly broken away for purpose of illustration, this view showing a modified construction of floor and a suspended ceiling with my improved hangers. Fig. 8 is a cross-section on the line 8 of Fig. 7 looking to the left and with the concrete partly broken away.

Referring now particularly to the construction shown in Figs. 1 to 4, A are the floor-beams, which are shown as of the common I form and upon the lower flanges of which are supported metal joists B, shown as formed of thin metal bars extending from beam to beam and arranged edgewise vertically, these joists being notched on their ends to receive the flanges of the beams and clips 10 thereon, the portions of the joists below the notches forming tongues 11, entering slots 1 in the clips below the flanges of the beams, so that the joists are thus held in position on edge, and the tongues 12 above the flanges, resting on the tops of the clips, serving to strengthen the joists at the end and assist in holding clips 10 in place on the flanges of the beams. The joists B thus extend above and below the bottom flanges of the beams A, and on the under side of these joists B is secured in any suitable manner so as to be supported thereby reticulated metal, which is shown as common metallic lathing C or wire-netting, but which may be of any other suitable form and size of openings between the parts or the reticulated metal, either of woven or netted wire, or metal rods or straps, or perforated or expanded metal, so that the concrete or similar



plastic material applied from above will set into the openings between the parts of the reticulated metal and secure the desired anchorage of the concrete, the reticulated metal thus forming tension members embedded in the web of concrete. The lathing C is shown as secured to the joists B by wire ties at suitable intervals; but other means of attachment may be used. With this construction of joists and lathing the latter is supported below the flanges of the beams, so that the filling of concrete D may be packed under the bottoms of the beams, so as to form a fireproof protection of the latter by the same body of concrete by which the floor construction is formed. If desired, however, this space below the bottoms of the beams may not be filled with concrete, but an air-space left, as shown at the right in Fig. 1.

One of the principal objects of the present invention is to provide a floor construction of great strength and the desired fireproof qualities with a comparatively-small body of concrete. This result is secured in the construction shown by forming ribs molded from the concrete or similar floor material and extending upward from the web of material filling the space between the lower parts of the beams and around the webs of the beams, these ribs extending from beam to beam and supporting the flooring, a construction of great strength being thus secured with a large reduction in the amount of the concrete and the formation of large air-spaces extending from beam to beam and between the concrete web and flooring. In building this construction I use formers X, as shown in Figs. 5 and 6, which extend from beam to beam, these formers being of such a size and shape as to secure the formation of the desired air-spaces between vertical ribs of concrete, as above described, when the concrete is filled in between them. These formers may be supported from the beams in any suitable manner and all the concrete filled in from above between the formers, so as to form the web D, as shown in Figs. 1 and 2, filling the space about and above the joists B, which are embedded therein, the fireproofing D<sup>2</sup> of the beam-webs and the vertical ribs D' between the formers projecting upward to or above the level of the top flanges of the beams being shown as formed level therewith. It will probably be found more convenient and preferable, however, that the web D first be formed upon the reticulated metal and embedding the joists B and then the formers X be placed in position upon the web and the concrete be filled in between them and upon the web D to form the ribs D'. The entire bodies of the beams are preferably covered with concrete, as shown, the formers X extending only from beam-flange to beam-flange and being so shaped as to permit the concrete to be conveniently packed in about the ends of the formers to fill the space below the upper flanges of the beams and form web-protecting

bodies of concrete D<sup>2</sup>, extending along the webs of the beams. Upon the vertical ribs D', after the concrete has set and the formers X have been removed, is secured the flooring E, either directly or with floor-joists F, extending longitudinally of and resting upon the ribs D'.

The lathing C forms tension members in the web D, and I preferably strengthen the ribs D' and increase the web-supporting strength of the construction by the use also of tension members within or at the bases of the ribs D', those tension members being embedded in the concrete, so as to add to the strength of the concrete the tensile strength of the members and preferably extending in continuous lengths from beam to beam, so as to get a continuous anchorage or bond through the entire length of the rib. These tension members may be of any suitable form—such as wires, rods, bars, or flat strips—and laid in position upon the concrete when the latter has been filled in to the level at which it is desired to place the tension members. As shown in Figs. 1 to 3, a single tension-rod G is used at the base of each rib D', these tension-rods being shown as formed of a plurality of large metal strands twisted together, so that the concrete will set into the spaces between the strands and secure a better hold of the rods on the concrete. Any other suitable form of tension members may be used, however, either plain or corrugated or roughened in any suitable manner to secure a better hold on the concrete. At their opposite ends the tension-rods G are shown as bent upward, so as to form upwardly-extending portions 13, which are embedded into the concrete bodies D<sup>2</sup> along the webs of the beams, so as to provide an anchorage for the rods G.

The construction shown in Figs. 1 and 2 and above described may be used with the metal joists B arranged at equal distances apart throughout, so as to form rectangular bodies of concrete between them; but I preferably arrange these joists substantially as shown in Fig. 3, with the opposite ends of adjacent joists at different distances from each other, so as to form wedge-shaped bodies of concrete between successive joists, the spaces between the joists and ends of the concrete blocks along each beam thus being alternately wide and narrow. This construction secures much greater strength, as the wedge form of the concrete blocks between the joists effectually prevents any tendency to slip transversely to the beams and relieves largely the sidewise thrust upon the beams. The joists B may be used without spanners; but the use of spanners is preferred, as a stronger construction is thus secured, and the joists B may thus be placed in position more rapidly and with greater accuracy in spacing the joists, which is especially desirable in the construction shown, in which the opposite ends of the joists are spaced differently.

Any suitable form of spanner may be used;



but the spanners shown are very simple, cheap, and efficient and in themselves form a part of the invention. The spanners shown consist of looped metal rods or straps 14, having eyes 3 at opposite ends, which rods are of such length that when placed on top of the joists B and resting thereon the eyes 3 are at the desired level for the connection of the spanner-rods 15, which consist of metal rods of any desired form which are secured in the eyes 3 by hooks 4, the ends of the rods being simply passed through the eyes 3 and then bent or previously bent to form hooks. It will be seen that this construction provides a very simple and efficient form of spanner which may be made from short pieces of otherwise waste metal, no considerable length of any of the pieces being required, while the spanners may be placed in position very rapidly and the desired position of the joists accurately secured, as determined by the length of the spanner-rods 15. With the opposite ends of the joists B placed at different distances apart, as in the construction shown, it will be understood that spanner-rods 15 of different lengths will be employed, as shown in Fig. 3.

The construction thus far described may be used without a ceiling, being complete in itself, or a ceiling of any suitable form may be used therewith, either suspended from the beams or joists B at any desired distance or formed by plaster or similar material applied directly to the under side of the lathing C and the concrete projecting through the openings in the latter, this concrete forming a suitable surface for the plaster. As shown in Figs. 1 and 2, a complete floor and finished ceiling construction is formed by the plaster or similar material H, applied on the under side of the lathing C. If an air-space be used below the beams, as shown at the right in Fig. 1, this plaster ceiling will inclose the bottoms of the beams and aid in protecting the latter.

While the molded web construction shown in Figs. 1 and 2 is preferred and in itself forms a part of the invention, the vertical ribs D', molded on the web, may be used in a construction in which the fireproof web filling the space between the beams is formed otherwise than as shown in Figs. 1 and 2, and, in fact, where this web is not formed by a filling of concrete or similar plastic material, but by previously-formed blocks of any suitable size and form and either solid or hollow, according to the character of the construction.

In Figs. 5 and 6 I have shown a construction in which the fireproof web between the lower portions of the beams is formed by blocks I, previously molded from concrete or similar material, these blocks being shown as of such length as to extend from beam to beam and as supported on the lower flanges of the beams, being notched, so as to extend below and form a protection for the flanges. These molded blocks I are shown as strengthened by a web of lathing K, extending through the

blocks and preferably curved downward between the beams, as shown. This lathing may be flat; but preferably its opposite edges are bent up, as shown at 16, so as to secure a vertical anchorage in the block. It will be understood that in place of the sheets K, which are shown as of common woven-wire lathing, light reticulated metal of any suitable form and mesh may be used or tension-rods of any suitable form embedded in the blocks. Woven wire or perforated metal is preferably used, however, as securing the best results with a light metal construction. These blocks I are preferably formed wedge-shaped longitudinally, as in the case of the concrete blocks molded as previously described between the joists B, and the side edges of these blocks are also preferably inclined to the vertical, as shown in Fig. 6, so that the blocks all lock together when placed in position and secure the desired strength against vertical pressure. After these blocks I have been placed in the position shown in Figs. 5 and 6, so as to form a fireproof web extending between the lower portions of the beams, the formers X are placed upon these blocks at the desired intervals for the formation of the vertical ribs D', as shown in Fig. 5 and at the left in Fig. 6, and between these formers are placed in position, either before any concrete has been filled in or after a portion of the concrete has been applied, the tension-rods G, extending from beam to beam and shown as having the upwardly-bent ends 13, as in the construction previously described, the rods in this construction being shown as corrugated throughout their length, so as to secure a better hold on the concrete and the use of the tensile strength of the rods. These rods are shown in Fig. 6 as of the same twisted-strand construction as in Fig. 1. It will be understood, however, that they may be of other forms or made of twisted wire or corrugated rods or metal strips in any suitable manner. After the tension-rods 13 are in place concrete is filled in to the desired level, so as to form the vertical ribs D' and the concrete filling D<sup>2</sup> about the webs of the beams, after which the formers are removed, leaving the construction complete, as shown at the right in Fig. 6.

In many cases it is desirable to provide a ceiling suspended below the floor, so as to form an air-space between the two, and it is desirable that means for suspending the ceiling be provided by which different air-spaces may be secured, or the ceiling be suspended at different distances from some of the beams, so as to secure a level ceiling in case the bottoms of the beams are not level, or an inclined ceiling below level beams, and I have devised an improved suspended-ceiling construction and an improved hanger for supporting the ceiling below the beam-line and made adjustable, so that the desired position of the ceiling relatively to the beams may readily be secured. This construction is shown in Figs. 7 and 8,



in which the floor construction is the same as shown and above described in connection with Figs. 1 to 4, and the ceiling is formed as follows: Upon the lower flanges of the beams  
 5 are hooked clips *a*, provided with sidewise-extending bolts having nuts 4 thereon, and from these bolts are supported hangers *b*, which are shown as formed of metal rods bent at opposite ends to form hooks 5 6, the  
 10 bolts on clips *a* being passed through the loops of hooks 5 at the upper ends of the hangers *b* and these loops being of such length as to permit a considerable adjustment of the position of the hangers relatively to the clips.  
 15 The hooks 6 at the lower ends of the hangers *b* receive and support ceiling-rods *c*, which are shown as flat bars, but which may be of any other suitable form. From the ceiling-rods *c* is supported the ceiling-lathing *d*,  
 20 which may be of any suitable form, but is shown as common wire-netting, and the ceiling-plaster *e* is applied on the under side of and supported by this lathing, as usual in ceiling constructions. This clip-and-hanger  
 25 construction provides a very simple and convenient adjustable means for supporting ceilings.

While the hangers are preferably formed of a metal strip or rod bent to the desired  
 30 shape and secured in position by the nuts 4, it will be understood that the hangers may be otherwise formed and secured in position by other means, so as to be adjustable vertically for securing the desired position of the ceiling-rods or other ceiling members.

It will be understood that modifications may be made in the constructions shown without departing from the invention and that  
 40 the invention is not limited to the exact form or arrangement of the parts illustrated.

What is claimed is—

1. In a fireproof floor or similar construction, the combination with beams, of a web of fireproof material extending from beam to  
 45 beam and a series of ribs of concrete or similar plastic material molded upon the web and extending upward therefrom and from beam to beam, substantially as described.

2. In a fireproof floor or similar construction, the combination with beams, of a fireproof web extending from beam to beam, tension members in said web, and a series of ribs of concrete or similar plastic material molded  
 50 upon the web and extending upward therefrom and from beam to beam, substantially as described.

3. In a fireproof floor or similar construction, the combination with beams, of a fireproof web extending from beam to beam, a  
 60 series of ribs of concrete or similar plastic material molded on said web and extending upward therefrom and from beam to beam, and tension members embedded in said ribs, substantially as described.

65 4. In a fireproof floor or similar construction, the combination with beams, of a fireproof web extending from beam to beam, and

a body of concrete or similar plastic material molded on said web and forming a series of ribs extending upward from said web and  
 70 from beam to beam and a continuous covering of the beams above the fireproof web, substantially as described.

5. In a fireproof floor or similar construction, the combination with beams, of a fireproof web formed of a series of bodies of fireproof material extending from beam to beam with adjacent bodies tapered longitudinally in opposite directions, and a series of ribs of concrete or similar plastic material molded  
 80 on said web and extending upward therefrom and from beam to beam, substantially as described.

6. In a fireproof floor or similar construction, the combination with beams, of a fireproof web formed of a series of bodies of fireproof material extending from beam to beam with adjacent bodies tapered longitudinally in opposite directions, a series of ribs of concrete or similar plastic material molded on  
 90 said web and extending upward therefrom and from beam to beam, and tension members embedded in said ribs, substantially as described.

7. In a fireproof floor or similar construction, the combination with beams, of a fireproof web extending from beam to beam, tension members embedded in said web, a series of ribs of concrete or similar plastic material molded on said web and extending upward  
 100 therefrom and from beam to beam, and tension members embedded in said ribs, substantially as described.

8. In a fireproof floor or similar construction, the combination with beams, of a body of concrete or similar plastic material forming a web and a series of ribs extending from beam to beam with the ribs extending upward from said web, substantially as described.

9. In a fireproof floor or similar construction, the combination with beams, of a body of concrete or similar plastic material forming a web and a series of ribs extending from beam to beam with the ribs extending upward from said web, and tension members embedded in said ribs, substantially as described.

10. In a fireproof floor or similar construction, the combination with beams, of a body of concrete or similar plastic material forming a web and a series of ribs extending from beam to beam with the ribs extending upward from said web, and metallic tension members embedded in said web and in said ribs, substantially as described.

11. In a fireproof floor or similar construction, the combination with beams, of joists formed of metal plates extending from beam to beam and supported on their edges, and a body of concrete or similar plastic material forming a web and a series of ribs extending from beam to beam with the joists embedded in the web and the ribs extending upward from the web above said joists, substantially as described.



12. In a fireproof floor or similar construction, the combination with beams, of metal joists extending from beam to beam, and a body of concrete or similar plastic material forming a web and a series of ribs extending from beam to beam with the joists embedded in the web and the ribs extending upward from the web above said joists, and tension members extending from beam to beam and embedded in said web, substantially as described.

13. In a fireproof floor or similar construction, the combination with beams, of metal joists extending from beam to beam and arranged to form wedge-shaped spaces between the joists with the successive spaces tapering in opposite directions, and a body of concrete or similar plastic material forming a web and a series of ribs extending from beam to beam with the joists embedded in the web and the ribs extending upward from the web above said joists, substantially as described.

14. In a fireproof floor or similar construction, the combination with beams, of metal joists extending from beam to beam, reticulated metal extending between the beams below said joists and a body of concrete or similar plastic material applied upon the reticulated metal and forming a web and a series of ribs extending from beam to beam with the joists embedded in the web and the ribs extending upward from said web, substantially as described.

15. In a fireproof floor or similar construction, the combination with beams, of joists formed of metal plates extending from beam to beam and supported on their edges, reticulated metal extending between the beams below said joists, and a body of concrete or similar plastic material applied upon the reticulated metal and forming a web and a series of ribs extending from beam to beam with the joists embedded in the web and the ribs extending upward from said web, substantially as described.

16. In a fireproof floor or similar construction, the combination with beams, of joists formed of metal plates supported on their edges and extending above and below the bottoms of the beams and from beam to beam, reticulated metal extending between the beams below said joists and a body of concrete or similar plastic material applied upon the reticulated metal and forming a web and a series of ribs extending from beam to beam with the joists embedded in the web and the ribs extending upward from said web, substantially as described.

17. In a fireproof floor or similar construction, the combination with beams, of joists formed of metal plates supported on their edges and extending above and below the bottoms of the beams and from beam to beam, reticulated metal extending between the beams below said joists and a body of concrete or similar plastic material applied upon

the reticulated metal and forming a web, a series of ribs extending from beam to beam, and a continuous covering for the webs of the beams, substantially as described.

18. In a fireproof floor or similar construction, the combination with beams, of joists formed of metal plates extending from beam to beam and supported on their edges, said joists being arranged to form wedge-shaped spaces between the joists with the successive spaces tapering in opposite directions, and a body of concrete or similar plastic material embedding the joists and forming wedge-shaped bodies between the joists, substantially as described.

19. In a fireproof floor or similar construction, the combination with beams, of joists formed of metal plates extending from beam to beam and supported on their edges, said joists being arranged to form wedge-shaped spaces between the joists with the successive spaces tapering in opposite directions, reticulated metal extending between the beams below the joists, and a filling of concrete or similar plastic material applied upon the reticulated metal and forming wedge-shaped bodies between the joists, substantially as described.

20. In a fireproof floor or similar construction, the combination with beams, of joists formed of metal plates extending from beam to beam and supported on their edges so as to extend above and below the bottoms of the beams, reticulated metal below said joists extending between the beams and below the bottoms of the beams with space between the reticulated metal and the beams, and a body of concrete or similar plastic material applied upon the reticulated metal and forming a web and a series of ribs extending from beam to beam with the joists embedded within the web and the ribs extending upward from the web, substantially as described.

21. In a fireproof floor or similar construction, the combination with beams, of joists formed of metal plates extending from beam to beam and supported on their edges so as to extend above and below the bottoms of the beams, reticulated metal below said joists extending between the beams and below the bottoms of the beams with space between the reticulated metal and the beams, a body of concrete or similar plastic material applied upon the reticulated metal and forming a web, and a series of ribs extending from beam to beam with the joists embedded within the web and the ribs extending upward from the web, and a ceiling of reticulated metal and plastic material suspended below said web, substantially as described.

22. In a fireproof floor or similar construction, the combination with the beams, of a lower layer of fireproof material extending between and under the beams, a metal fabric extending between the beams and embedded in said lower layer, and a structure of plastic material above said layer extending be-



tween the beams and having upright ribs integrally united with said layer, substantially as described.

23. In a fireproof floor or similar construction, the combination with the beams, of a lower layer of fireproof material extending between and under the beams, a metal fabric extending between the beams and embedded in said lower layer and a structure of plastic material above said layer extending between the beams and having upright ribs transverse to the beams integrally united with said layer, substantially as described.

24. In a fireproof floor or similar construction, the combination with the beams, of a lower layer of fireproof material extending between and under the beams, a metal fabric extending between the beams and embedded in said layer, a structure of plastic material extending between the beams and having upright ribs transverse to the beams integrally united with said layer, and metal bars or strips embedded in the ribs of said structure, substantially as described.

25. In a fireproof floor or similar construction, the combination with the beams and a fireproof web extending between the lower portion of the beams, of formers arranged for molding vertical ribs on said web, substantially as described.

26. The combination with a flanged beam, of clip *a* embracing the flange of the beam and having a projecting bolt, a hanger *b* having a vertically-slotted connection with said bolt, and a ceiling member supported by the hanger, substantially as described.

27. The combination with beams and metal plates extending from beam to beam, of spanners between said plates formed of metal loops 14 embracing the plates, and separate

spanner-rods 15 connecting the loops on adjacent plates, substantially as described.

28. The combination with a series of metal plates arranged on edge, of metal loops 14 embracing the tops of the plates, and spanner-rods 15 connecting adjacent loops and having a hook connection therewith, substantially as described.

29. The combination with the beams A and plate-joists B supported on their edges, of the web D in which said joists are embedded and the vertical ribs D' molded on the web in line with the joists, substantially as described.

30. The combination with the beams A, of web D extending from beam to beam, tension members in said web, and vertical ribs D' molded on the web in line with the tension members, substantially as described.

31. The combination with the beams A, and a fireproof web extending between the lower portion of the beams, of formers X extending between the beams and arranged for molding vertical ribs D' on the web, substantially as described.

32. The combination with the beams A, and a fireproof web extending between a lower portion of the beams, of formers X extending between the beams and arranged for molding vertical ribs D' on the web and fireproofing D<sup>2</sup> filling the spaces between the formers and the webs of the beams, substantially as described.

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

WILLIAM ORR.

Witnesses:

EDWIN W. ARNOLD,  
WILLIAM K. PAFF.