

(No Model.)

F. FURNESS.
FLOOR FOR BUILDINGS.

No. 424,286.

Patented Mar. 25, 1890.

Fig. 1.

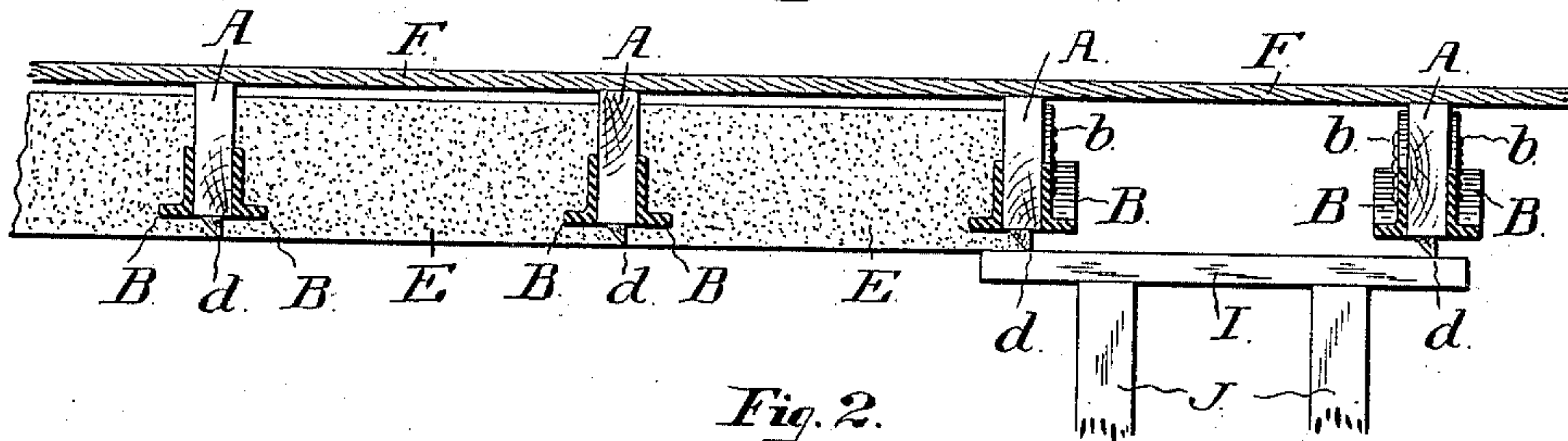


Fig. 2.

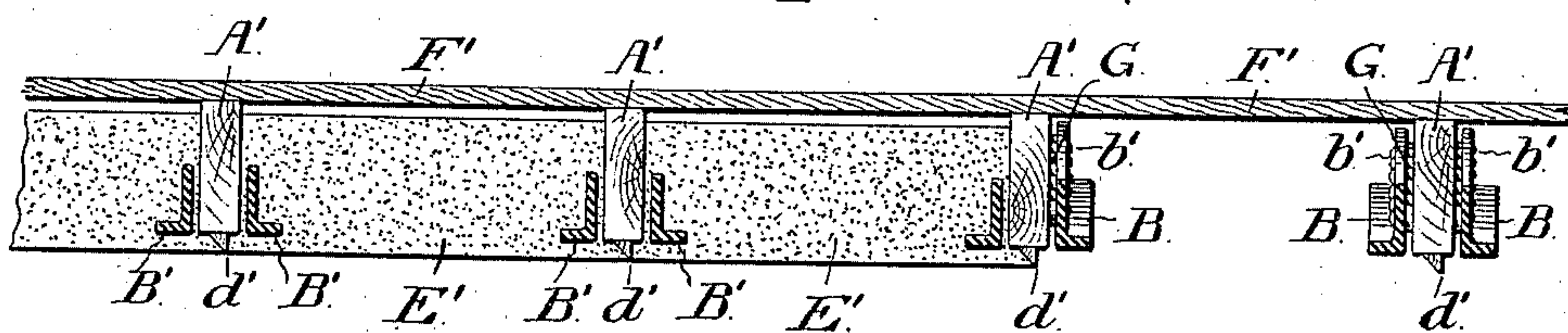


Fig. 4.

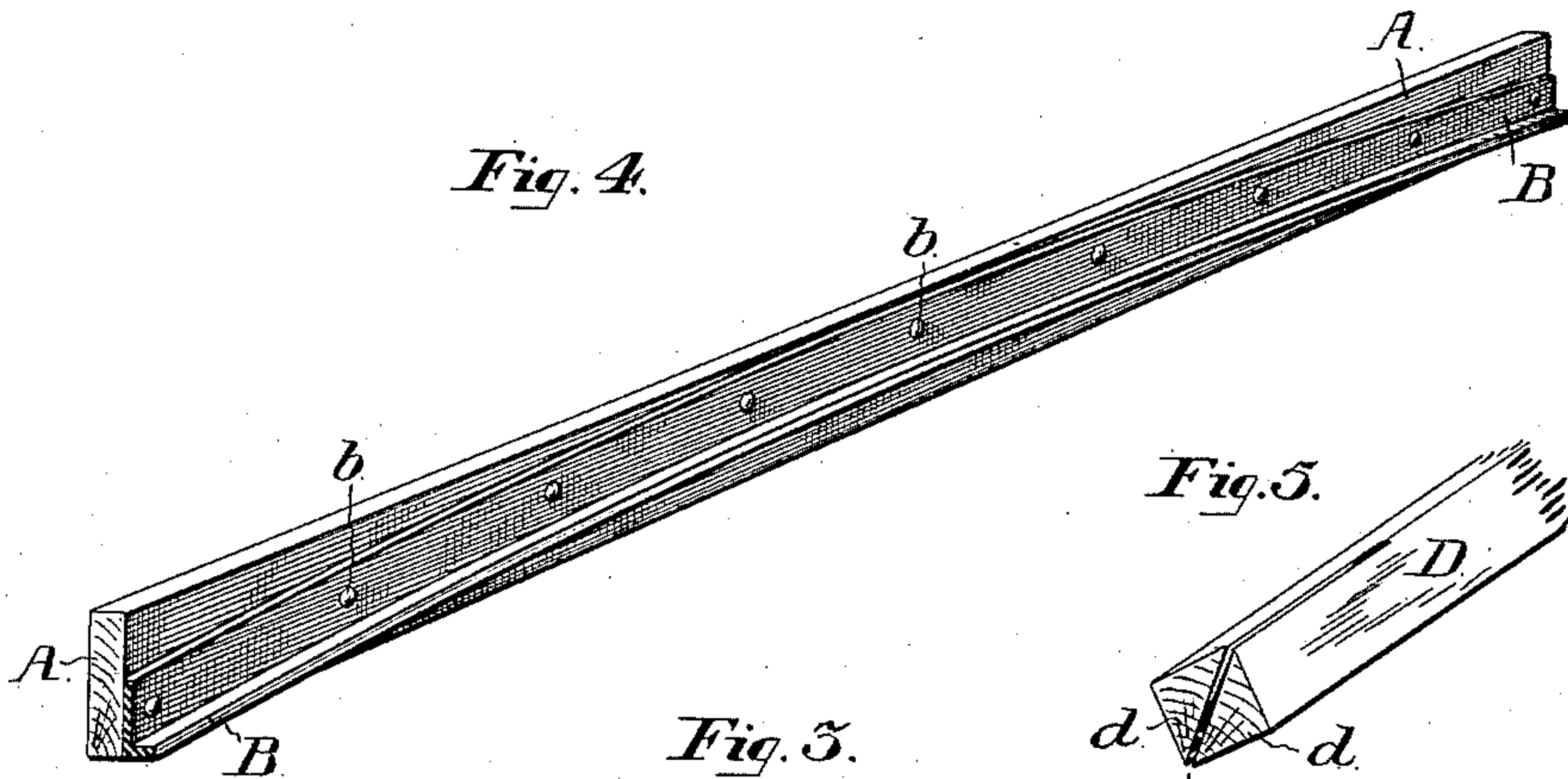


Fig. 5.

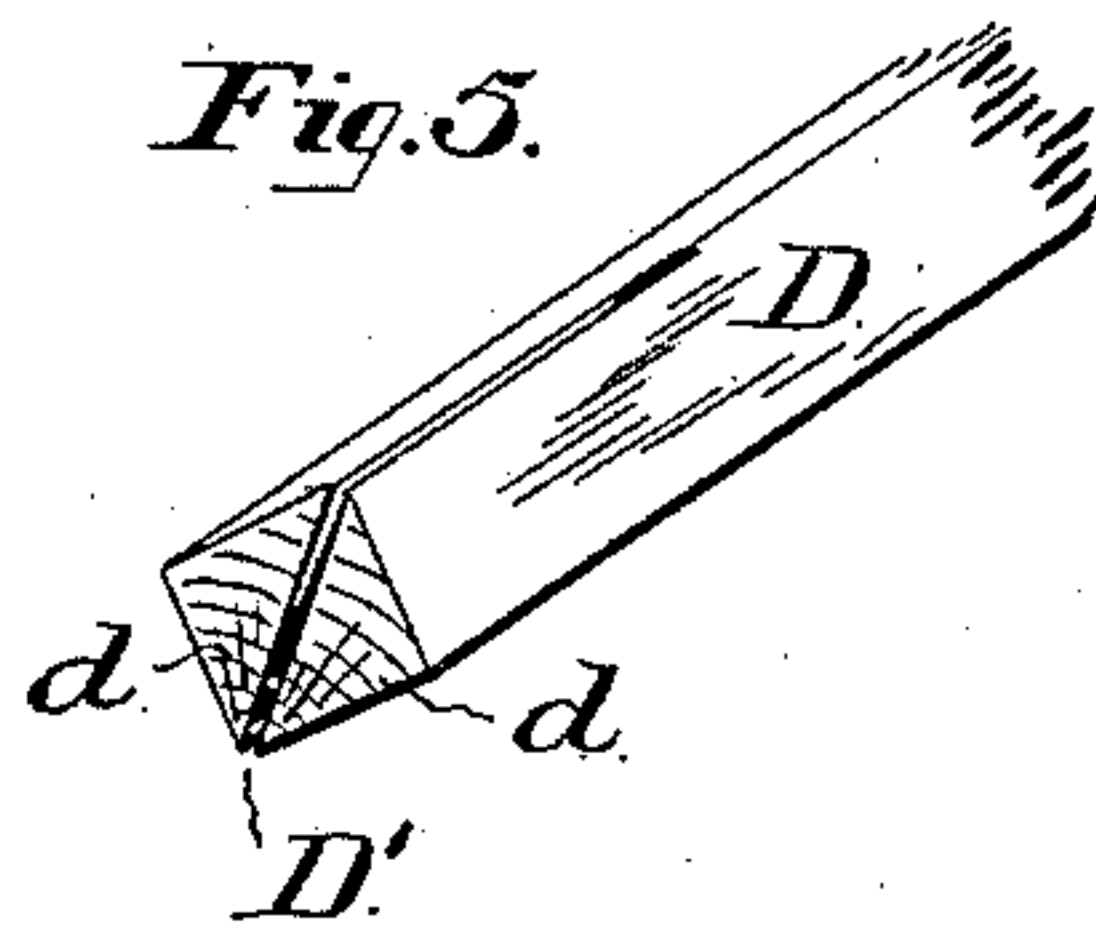
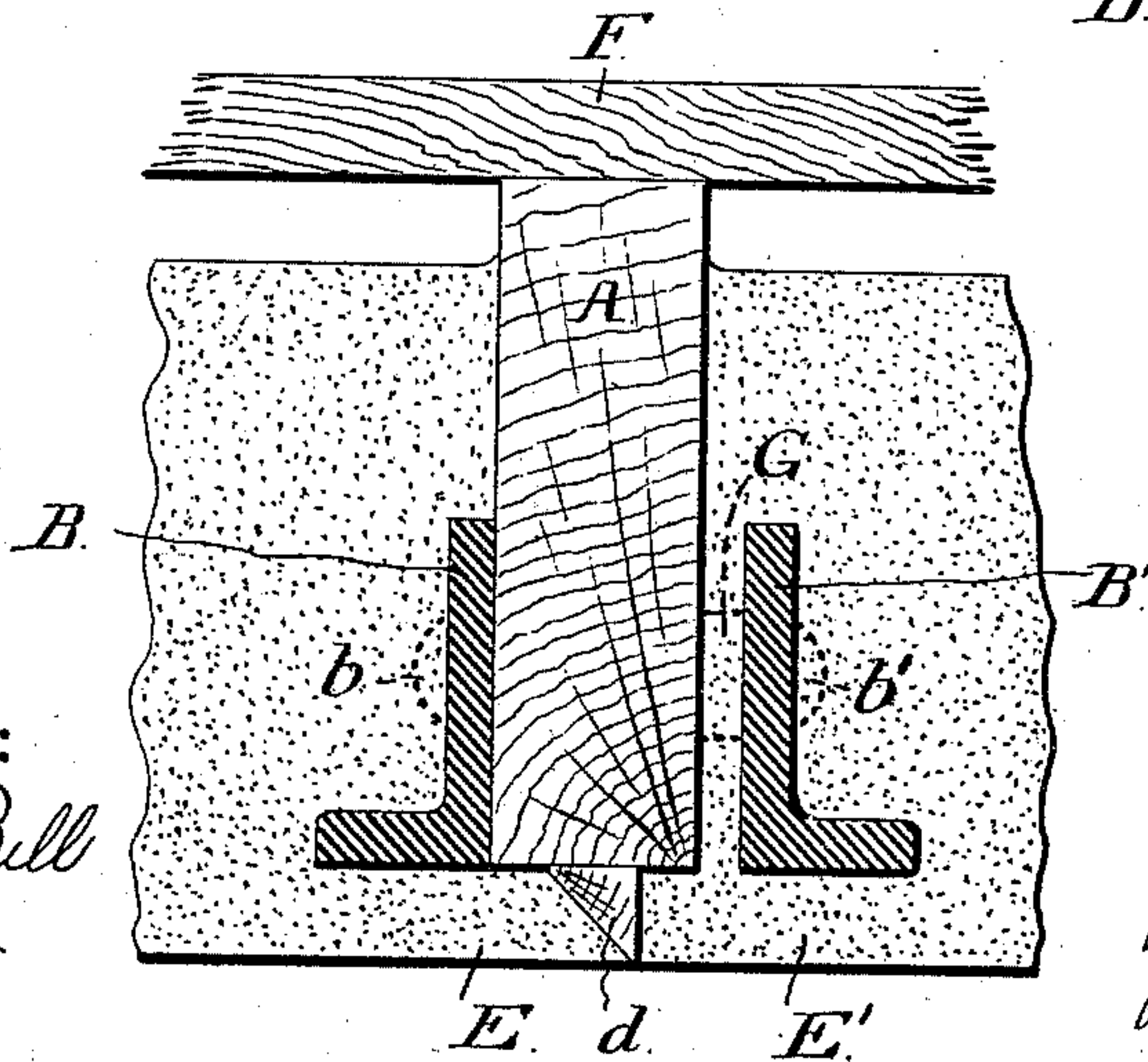


Fig. 3.



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FLOOR FOR BUILDINGS.

SPECIFICATION forming part of Letters Patent No. 424,286, dated March 25, 1890.

Application filed December 20, 1889. Serial No. 334,388. (No model.)

To all whom it may concern:

Be it known that I, FRANK FURNESS, of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Floors for Buildings.

The following is a specification of my said improvements, reference being had to the accompanying drawings, in which—

Figure 1 represents a vertical sectional view through a floor embodying my improvements, certain stages in the construction of the floor being indicated on the right-hand side of the view. Fig. 2 represents a similar sectional view through a floor containing said improvements in a modified form. Fig. 3 is a sectional view, on an enlarged scale, of a floor constructed partly in accordance with the form shown in Fig. 1 and partly in accordance with that of Fig. 2. Fig. 4 is a view in perspective of one of the joists, and Fig. 5 is a detail view illustrating the method by which certain parts used in laying the floor are constructed.

In Letters Patent of the United States No. 416,907, granted to me under date of December 10, 1889, I have specified and shown a fire-proof floor in which the concrete is supported upon iron flanges bolted on each side of timbers whose top and bottom surfaces are not enveloped by the concrete, said timbers being supported upon iron girders. The necessity for such supporting-girders at comparatively close intervals beneath the timbers in this method of construction arises from the fact that the timbers are not adapted to sustain the weight of the concrete through any very long span, unless made so heavy as to be undesirable. Consequently the girders have to be used and are necessarily below the ceiling-line of the room beneath. Furthermore, in the under surface of said floor (which is the ceiling of the room beneath) three different materials occur at intervals—viz., concrete, iron, and wood—the lines of juncture between which require to be heavily coated with plastering, in order to obtain a permanent and uniform surface for the ceiling.

I have found that by the improvements which I am now about to describe I can dispense with the use of subjacent girders and can construct a concrete fire-proof floor with

timbers, the spans of which may be of the full length for which wood is ever employed. Moreover, I can obtain a practically uniform surface of concrete on the under side of the floor, so that the final wash or "white coat" for finishing the ceiling of the room below can be directly applied without the intervention of lathing or plaster, or can be dispensed with altogether should the concrete surface itself be deemed sufficiently decorative for such ceiling.

Referring to Fig. 1 of the drawings, A A represent a series of timbers, which for the purposes of the present description I term "joists," without, however, meaning to imply by the use of the word any limitation as to the dimensions of the timber. These joists may be of the full length for which floor-joists are used in ordinary wooden floors, or may be even longer. The joists need only be supported at their ends; but of course I do not restrict myself to any particular method of supporting them, for while one of the objects of my improvements is to get a long span without the use of girders, yet the other features of value would still remain, even though such girders were employed.

Angle-irons B are bolted to the joists lengthwise therewith; but these angle-irons, instead of being straight like those of my said patent, are bent so as to form a camber, as shown in perspective in Fig. 4 and in section in the right-hand side of Fig. 1. I prefer to apply the angle-irons in the manner shown, so that the ends of the flange are flush with the bottom surface of the joist at each end thereof, and I have found three inches in a floor of eighteen feet to be a convenient height for the apex of the camber.

In lieu of arranging the camber-irons as shown—namely, curving upwardly—it may under some conditions be found desirable to reverse the curve of such camber-irons with like beneficial results. It will be understood that in either case no serious deflection of the camber-irons can take place without a shearing action upon the bolts used to secure them in position, and while I prefer as a rule to employ the camber-irons curved in the direction shown in the drawings I desire it to be understood that I do not wish to limit myself

in this respect. The bolts *b*, by which the angle-irons are secured to the joists, may pass entirely through the latter, and thus bind the three members together.

5 The joists having been mounted with their angle-irons in position, I now apply to the bottom surface of each joist a gage-piece, preferably in the form of a longitudinal strip *d* of the triangular cross-section shown. These
10 strips may be conveniently obtained by the method illustrated in Fig. 5 where D represents an ordinary one-by-one piece of scantling, which is sawed lengthwise upon the diagonal line *D'*, so as to obtain two strips of
15 triangular cross-section with sharp edges. A false floor I (a portion of which is indicated upon the right-hand side of Fig. 1) is then supported upon the vertical posts J, or in any other convenient manner, with its upper sur-
20 face in contact with the sharp edges of the strips *d*, which strips, being of uniform size, form convenient guides for adjusting said false floor at the proper distance beneath the joists. Concrete or artificial stone in a plastic
25 condition is then poured in between the joists until it fills the spaces between them, preferably nearly to the top, and of course extends down below the angle-irons and bottom
30 surfaces of the joists, terminating flush with the sharp edges of the gage-strips *d*, as shown at E, the false floor I being of course removed after the concrete floor has become solid. The concrete thus envelops the entire bottom sur-
35 face of each joist and its angle-irons, so that the undersurface of the series of slabs is practically continuous, the feather edges of the strips *d* affording substantially no interrup-
40 tion to the concrete surface in the ceiling beneath, and being entirely inconspicuous.

40 When a floor of wood is to be laid on top of the joists, as is ordinarily the case, I allow the upper surfaces of said joists to project somewhat above the top of the concrete, so as to afford "nailing" for the floor to be laid
45 thereon; but it is of course not essential that the joists should so project above the surface of the concrete—as, for instance, where tiling is to be laid thereon—or in case the concrete
50 itself is to be used for the floor-surface it may be of a depth sufficient to cover the top of the joists as well as the under side thereof.

In Fig. 2 the only modification of the above method of construction consists of the method of attaching the angle-irons to the joists.
55 Instead of fastening the angle-irons B' directly in contact with the sides of the joists, washers G, preferably of metal, are interposed between the inner surface on the angle-iron and the adjacent surface of the joist A',
60 so as to leave an open space between said proximate surfaces, as shown clearly on the right-hand side of Fig. 2. The object of this method of construction is to permit the concrete E' to flow in behind the angle-irons and
65 lock itself fast upon them. This improvement, however, while offering a better hold for the concrete, does not necessarily affect

the other features of construction, nor do I limit its use to that connection, since, obviously, such improvements may be employed
70 with straight angle-irons, like those shown in my patent before referred to, for the same purpose as in the present case.

In Fig. 3 I have shown a form of floor in which upon one side of the joist the cam-
75 bered angle-iron B is attached in direct contact therewith, while upon the other side the cambered angle-iron B' is provided with an intermediate washer G.

I have before described the use of the sharp-
80 edged strips as a convenient method of obtaining gages for the adjustment of the false floor; but it must be understood that I do not limit my claim to the use of such strips for that purpose. Thus nails or pegs (if driven
85 carefully in to the proper depth) or non-continuous strips may be substituted for those which I have shown as the preferred form, it being only essential that the gage shall be of
90 such nature that when left embedded in the concrete it shall not afford a substantial interruption to the continuity or uniformity of the under surface thereof, and it will of course
95 be understood that the gage-strips may be so arranged as to permit of their removal as the spaces between the joists are successively filled with the plastic concrete or cement.

Among the prominent advantages and distinguishing features of the improved floor
100 above described are the following:

By the use of the cambered angle-irons I am enabled to apply this system of fire-proof
105 floor construction to ordinary house-floors, where it is desirable to employ wooden joists of the full length usual in such structures without supporting-girders visible in the
110 room below. The cambering gives such stiffness and strength to the timber as to permit the use of much smaller joists than are even used for wooden floors.

The angle-irons can readily be rolled in the form desired at any ordinary mill, whereas
115 iron girders such as are generally used in the construction of fire-proof floors can only be obtained from a few sources and are, comparatively, very costly.

Fire-proof floors constructed in the ordinary manner by means of brick arches be-
120 tween said girders are necessarily from fifteen to eighteen inches in depth or thickness; but by the use of the present improvements I find that nine inches is an amply sufficient
125 depth, and I thus not only economize greatly in material, but avoid a very considerable waste of space in the height of the building. Furthermore, by my method of construction
130 the under surface of the concrete is obtained in such a uniform condition that I am enabled to save the expense of lathing and of several coats of plaster upon the ceiling beneath, since, as before stated, it is entirely feasible
135 to apply the finish or white coat directly thereto. In fact, where the false floor I has been constructed of wood whose surface is

uniformly grained a pleasing decorative effect is thereby produced upon the under surface of the concrete, so that when the false floor is removed the ceiling may need no further finish.

In explaining my invention I have described the use of wooden joists, because as a general rule it is desirable to provide a suitable nailing-surface for the boards designed to furnish the tread of the floor; but it will be understood that in lieu of such wooden joists iron strips or long thin plates may be employed with equal advantages as a means of support for the cambered angle-irons. In fact, I have found from experience that any material which will serve as a temporary support or scaffolding for the angle-irons may be employed.

Having thus described my invention, I claim—

1. As an improvement in fire-proof floors, the combination of a series of wooden joists, a series of angle-irons secured longitudinally upon said joists, a continuous body of concrete applied between said joists, lending lateral support thereto and enveloping the bot-

toms of said joists and angle-irons, the under surface of such concrete being substantially continuous, and flooring above said joists, substantially as set forth. 30

2. As an improvement in fire-proof floors, the combination of a series of wooden joists, a series of cambered angle-irons secured longitudinally thereon, a continuous body of concrete supported between said joists upon said angle-irons, and flooring laid upon said joists, substantially as set forth. 35

3. As an improvement in fire-proof floors, the combination of a series of wooden joists, a series of cambered angle-irons secured longitudinally thereon, washers interposed between said angle-irons and said joists, a continuous body of concrete supported between said joists and upon said angle-irons and interlocking behind said angle-irons, and flooring laid upon said joists, substantially as set forth. 40 45

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Witnesses:

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