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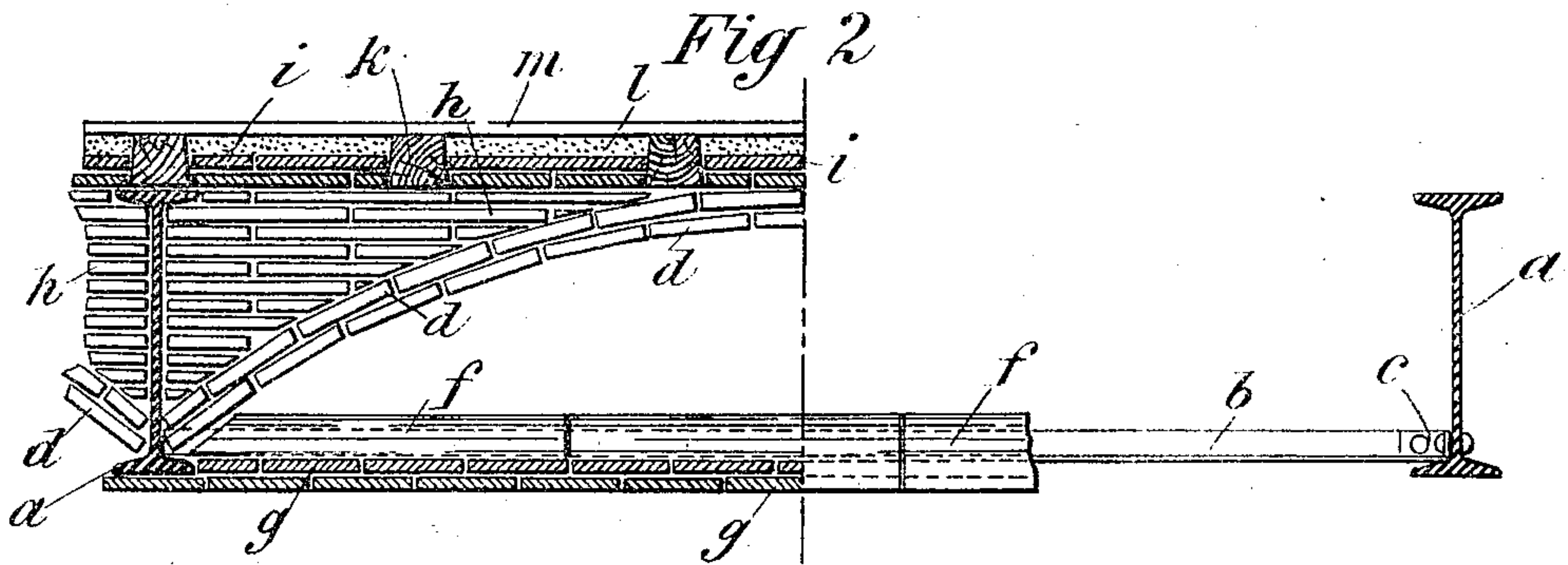
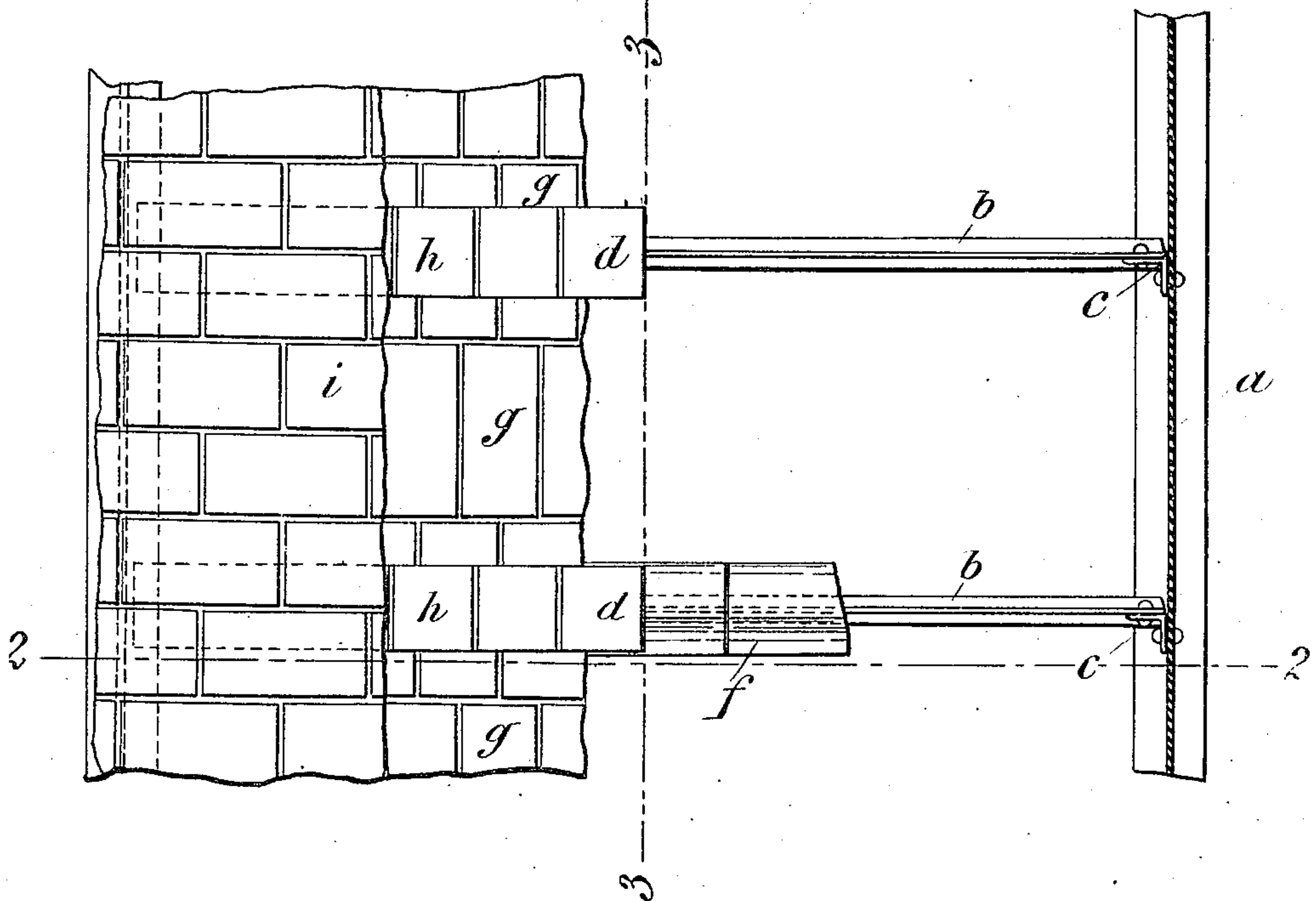
2 Sheets—Sheet 1.

R. GUASTAVINO.
COHESIVE CEILING-FLOOR.

No. 464,563.

Patented Dec. 8, 1891.

Fig 1.



Attest:

Chas. L. Horace
Witness

Inventor:

Rafael Guastavino

(No Model.)

2 Sheets—Sheet 2.

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Fig 3.

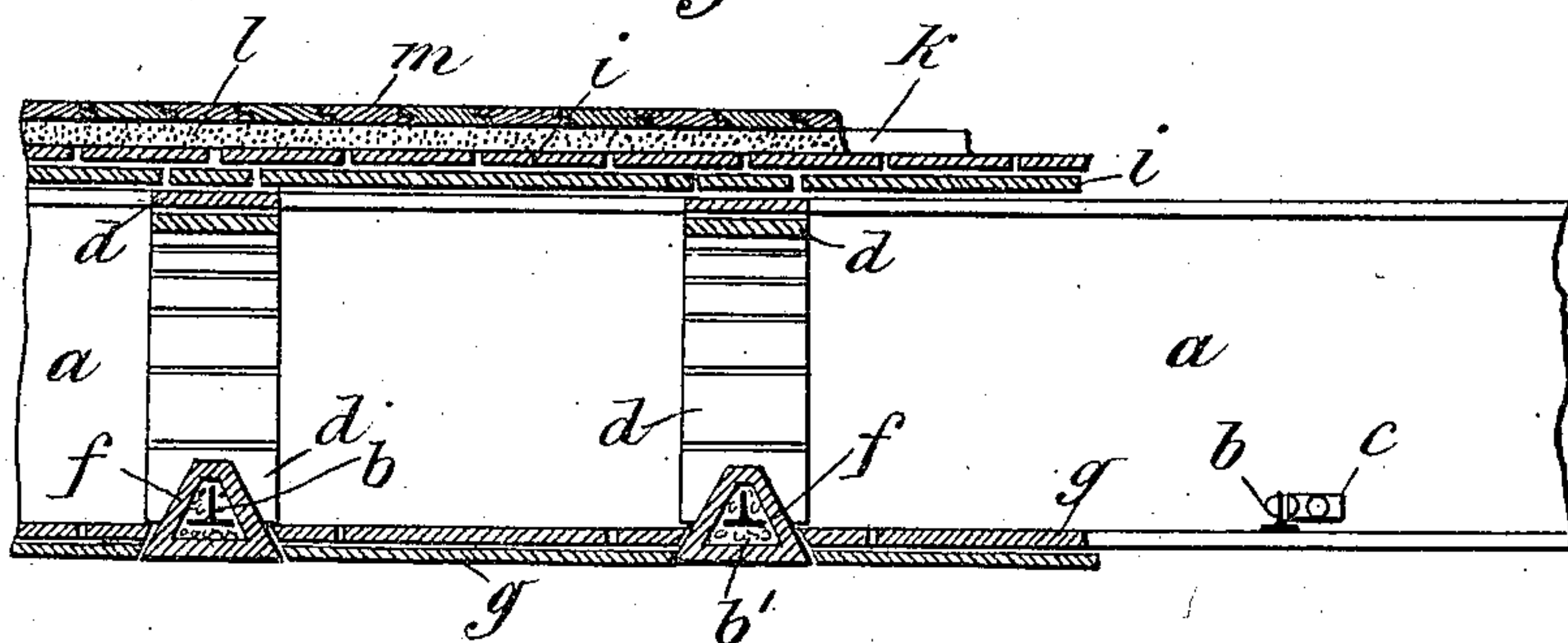


Fig 4.

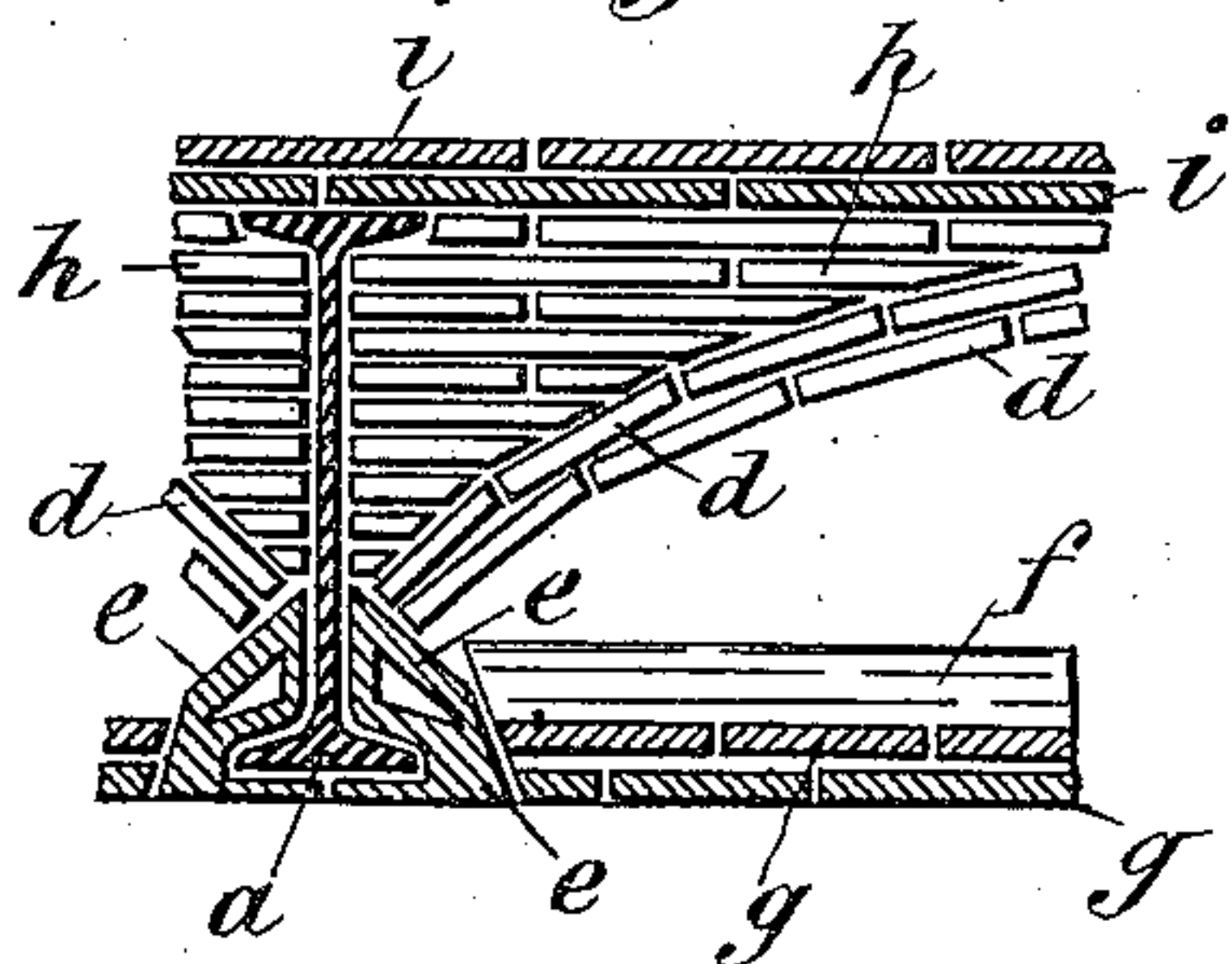
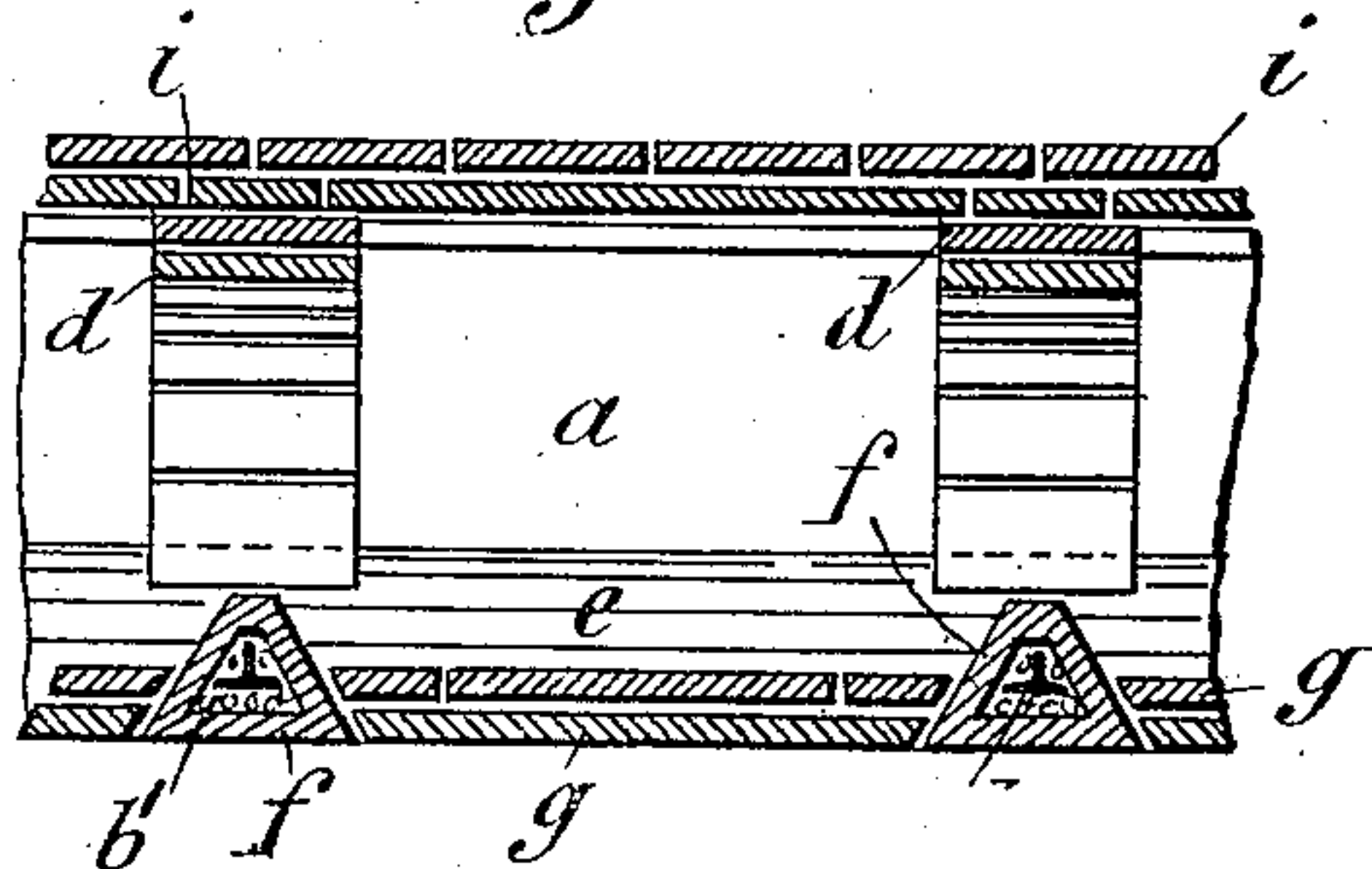


Fig 5.



Attest:

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Радугу на небе

UNITED STATES PATENT OFFICE.

RAFAEL GUASTAVINO, OF NEW YORK, N. Y.

COHESIVE CEILING-FLOOR.

SPECIFICATION forming part of Letters Patent No. 464,563, dated December 8, 1891.

Application filed March 11, 1891. Serial No. 384,567. (No model.)

To all whom it may concern:

Be it known that I, RAFAEL GUASTAVINO, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Cohesive Ceiling-Floors, of which the following is a specification.

My invention has reference to the construction of buildings, particularly fire-proof buildings, and the improvements which I seek to protect in this instance relate to the floors and ceilings of such buildings.

The invention is applicable to buildings of all descriptions, such as dwellings, factories, school-houses, warehouses, &c.

The object of my invention is to devise a cohesive ceiling-floor which shall possess great strength conjointly with lightness and which shall also be absolutely fire-proof and indestructible when subjected to the incidents of a fire, and the peculiar construction of which will give to the finished structure the quality of self-deafening, whereby noises originating in any one story of a building in which my invention is embodied are prevented from being communicated to the stories above or below.

In fire-proofing it is desirable to have the structure of as little weight as possible; but this condition must not be carried to the extent of sacrificing strength and stability. By my construction, in which I entirely dispense with the use of concrete or large bodies of cement and the like, I attain the condition of maximum strength with minimum weight, no similar fire-proof structure of which I have knowledge being of so little weight with the same degree of strength, the structure being also absolutely indestructible when subjected to a fire and its incidents; and in my construction I so combine the iron and clay together that the former will be entirely enveloped and protected by the latter, so that none of the iron will be exposed to view or to any unfavorable influences in any part of the structure, this being an important condition of my invention.

The floor and ceiling form one complete homogeneous organization, in which each part sustains and gives strength to the other. In

the finished structure, which provides spaces between the floor and ceiling, both floor and ceiling are exteriorly flat, intermediate arches of tiles working to sustain the weight of the floor. Said arches are maintained in place by their pressure being taken up by iron tie-rods extending between and fixed to iron beams of small section, on which the arches are supported, said tie-rods serving, also, to support the tiles forming the ceiling element of the organization. As before stated, this peculiar organization imparts to the structure the quality of deafening sounds, which explains the term "self-deafening" made use of herein by me.

The features of novelty for which I desire protection by Letters Patent are set out in the claims at the end hereof.

In the accompanying drawings, forming part of this specification and wherein like features are indicated by like letters of reference in the several views, Figure 1 at its left hand shows a plan view of a structure embodying my invention and at the right hand a plan, partly in section, of the iron-work employed therein. Fig. 2 is a sectional elevation on the line 2 2 of Fig. 1. Fig. 3 is a central sectional elevation on the line 3 3 of Fig. 1 midway between two of the main supporting-beams. Fig. 4 is a view similar to the left-hand part of Fig. 2, showing some additions to the construction illustrated in the latter view; and Fig. 5 is a detail section along the crown of the arch, embodying the features of Fig. 4.

Referring to the drawings, *a a* indicate iron beams of small section. (Shown here in the form of rolled I-beams.) These beams will generally extend between the side walls or end walls of the building. Where the distances between such walls are considerable the beams *a* may have intermediate supports between such walls in the form of iron posts or shafts constructed in a fire-proof manner. *b b* are iron tie-rods, likewise of small section, resting on the bottom flanges of the vertical I-beams *a* and bolted to bent plates or angle-irons *c*, which in turn are bolted to the vertical I-beams *a*. The tie-rods *b* extend between beams and are inclosed in boxes or jackets *f*, of clay material, preferably made

in short sections for convenience of manufacture and handling. These boxes or jackets cover the tie-rods substantially from end to end, as shown, and when they are placed over the tie-rods the intervening space is filled with cement *b'* in order to permanently secure the tie-rods and boxes or jackets together in their proper relative positions. The outer configuration of the cross-section of boxes or jackets *f* is substantially that of a triangle with its horizontal base depending beneath the bottom flanges of beam *a*. The inner surfaces of said box or jacket may be made to conform as nearly as practicable to the configuration of the tie-rod *b*. The boxes or jackets *f* when in position extend down below the under surface of the vertical beams *a*, as shown, so that the tiles of the ceiling *g* between the tie-rods *b* can be laid across, under, or beneath said beams *a*, thus completely concealing all iron by the clay, the exposed surface of the completed ceiling being flush with the lower surface of said clay boxes or jackets *f*, which cover the tie-rods, as seen in Fig. 3, for example.

The letters *d* indicate arches made of tiles, preferably two courses, laid in cement and breaking joints, as shown. These arches, there being a series of them, are built between and rest on the beams *a*, and, as indicated in Fig. 3, the tie-rods *b* are placed centrally beneath the arches *d*, so as to counteract as nearly as may be the outward thrust of the arches. Ribs *h*, made of tiles laid in cement, are built on top of the arches *d* to fill out the spaces between said arches and the contiguous parts of the beams *a*. The arches *d*, as well as the ribs *h*, are carried to the same elevation as the tops of the beams *a*, in order that the first course of the floor-tiles *i* may rest directly upon the top flanges of the beams *a*, the tops of ribs *h*, and the centers of the arches *d*. The tie-rods *b*, which tie the beams *a* together, serve, as stated, to make up the thrust exerted upon the beams by the arches *d*, and to further assist in this direction the arches springing from one side of a beam *a* should be placed as nearly as practicable in line with such arches as spring from the opposite side thereof, this arrangement permitting those arches springing from one side of the beam to counteract the lateral thrust exerted upon said beam by the arches springing from the opposite side of said beam.

The ceiling *g* is shown composed of two courses of tiles laid in cement and breaking joints. These tiles are joined together in panels, which extend between the flanges of the beams *a* and the sides of the boxes or jackets *f*, the sloping sides of said boxes or jackets forming supports for the outer edges of the panels, the tiles in contact with such boxes or jackets being sloped to conform to the shape of the boxes or jackets. It will be seen that the under surface of the boxes or jackets *f*, by the construction described, are in the same horizontal plane as the exposed

surface of the finishing course of tiles of the ceiling *g*, thus producing a flat ceiling in which none of the iron on the structure is exposed and which can be readily decorated or otherwise finished.

In the construction of Figs. 4 and 5 the arches *d* have abutments made of terra-cotta shoes *e*, which have sloping outer sides corresponding as nearly as may be to the inclinations of the ends of those tiles of the arches which are made to rest upon such shoes. The shoes *e* receive immediate support from the lower flanges of beams *a* and are made of such configuration as to adapt them to fit closely over said flanges, and thus transfer the thrust brought to bear upon them to as large a surface of the beams as possible. The clay boxes or jackets *f*, inclosing the tie-rods *b* and which extend between beams *a*, may be arranged to abut against the shoes *e*, covering the flanges of said beams when the shoes are made use of, and in such case the ends of said boxes or jackets may be made sloping to conform to the slope of the outer surface of the shoes *e*. The tile panels of the ceiling *g*, where they come in contact with the shoes *e*, will also be made with sloping edges to increase the support for the ceiling.

The structure will be cheaper when the shoes *e* are omitted therefrom, and they are not at all indispensable. Whether omitted or not the construction serves to completely inclose all the iron employed, so that the clay alone will be exposed to view, the iron being so enveloped by the clay that it will not be subjected to any unfavorable influences, such as moisture, flame, &c.

The clay elements of my cohesive ceiling-floor are joined together and as far as practicable to the iron of the structure by cement, thus uniting all of the material of the structure into a homogeneous mass or body, which will be fire-proof and of great strength, though comparatively of little weight. The weight of the loads resting on the floor of the structure will be transferred to the beams *a* through arches *d*, which are well adapted for supporting heavy loads, while the weight of the ceiling is taken up and transferred to the beams *a* principally by the tie-rods *b*, which at the same time serve to tie together the beams *a* and take up the thrust of said arches. The described combination of the iron of my structure with the clay or tiling thereof is such that each material re-enforces the other, rendering it possible to obtain by the employment of iron beams of little weight greater strength and stability than could be attained by structures of other forms employing heavy beams and girders representing great weight. The completed structure, as will be seen, presents a flat horizontal surface both on the floor side and on the ceiling side with concealed spaces under the floor and above the ceiling, which construction acts to effectually prevent sounds in one room from being heard in the rooms below or above. As the ceiling and floor are

practically finished in the construction, it is plain that my system has the merit, also, of much economy.

In Figs. 2 and 3 I have represented a series of wooden sleepers *k* arranged at the top of the structure, running parallel with the beams *a* and about two feet apart. These sleepers, which may have sloping sides, rest on the top flanges of the beams *a* and (between beams) on the ribs *h* and arches *d*, as shown. When the sleepers are made use of, the tiles *i* of the floor are laid between the same close to their sides, as indicated in Fig. 3, and said sleepers extend about one inch above the upper layer of the floor-tiling.

The sleepers *k* are made use of when it is desired to lay a wooden floor over the tile floor, and in doing this I place a layer of mineral wool *l*, of about one inch thickness, on top of the upper layer of the floor-tiling, and on top of this mineral wool the wooden floor *m*, about one inch thick, is laid and secured to the sleepers *k* by nailing or otherwise. This construction, with the mineral wool between the upper layer of tiling and the wooden floor, further serves to deaden sound, and thus has a tendency to increase the effectiveness of the structure in that respect.

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

1. In a cohesive ceiling-floor, the combination, with longitudinal beams supported between the walls of the building, of a thin independent floor built of flat tiles laid in cement and crossing over the upper flanges of said beams, and a thin independent ceiling, also built of flat tiles laid in cement and crossing under the lower flanges of said beams, thus providing spaces between beams under the floor and over the ceiling, substantially as set forth.

2. In a cohesive ceiling-floor, the combination, with longitudinal beams supported between the walls of the building and arches of tiles between beams, of a floor of tiles supported on the arches and the flanges of the beams, and a ceiling of tiles supported beneath the arches on said beams, whereby the ceiling and floor present flat outer surfaces and spaces over the ceiling and under the floor are provided, substantially as and for the purpose set forth.

3. In a cohesive ceiling-floor, the combination, with longitudinal beams supported between the walls of the building and a series of tile arches resting on the beams at suitable distances apart, of a thin independent floor built of flat tiles laid in cement and crossing over said arches and the upper flanges of the beams, and a thin independent ceiling, also built of flat tiles laid in cement and crossing under the lower flanges of said beams, whereby there are provided spaces between beams under the floor and over the ceiling, substantially as set forth.

4. In a ceiling-floor of the character herein

described, the combination, with longitudinal beams supported between the walls of the building and arches of tiles extending between and supported on said beams, of a floor of tiles laid in cement and supported on said arches and the upper flanges of the beams, a ceiling of tiles, likewise laid in cement and supported in proximity to the lower flanges of the beams, thus providing inclosed spaces between beams under the floor and over the ceiling, and tie-rods extending between the beams at or near their lower flanges and serving to tie the beams together and to stiffen the arches and to assist in supporting the ceiling, substantially as set forth.

5. In a ceiling-floor of the character herein described, the combination, with longitudinal beams supported between the walls of the building and tile arches extending between and supported on said beams, of a tile floor laid in cement and supported on the arches and the upper flanges of the beams, tie-rods between beams beneath the arches and serving to tie the beams together and stiffen the arches, and a tile ceiling laid in cement in panels or sections, with their edges supported by the tie-rods and the lower flanges of the beams, substantially as set forth.

6. In a ceiling-floor of the character herein described, the combination, with longitudinal beams supported between the walls of the building, tile arches extending between the beams and supported thereon, and tile ribs built on top of the arches and extending against the beams and as high as their upper flanges, of a tile floor laid in cement and supported on the said ribs and arches and the upper flanges of the beams, tie-rods between beams beneath the arches, and the tile ceiling laid in cement in panels or sections supported by said tie-rods and the lower flanges of the beams, substantially as set forth.

7. In a ceiling-floor of the character herein described, the combination, with longitudinal beams supported between the walls of the building and tile arches extending between the beams and resting thereon, of a tile floor supported on the arches and upper flanges of the beams, tie-rods extending between beams beneath the arches and serving to tie the beams together and stiffen the arches, clay boxes or jackets enveloping said tie-rods and depending below the under surfaces of the lower flanges of the beams, and a tile ceiling laid in cement in panels or sections supported by the lower flanges of the beams and by the enveloping boxes or jackets of the tie-rods, the construction providing spaces between beams under the floor and above the ceiling, substantially as set forth.

8. In a ceiling-floor of the character herein described, the combination, with longitudinal beams supported between the walls of the building and tile arches extending between the beams and resting thereon, of a tile floor supported on the arches and upper flanges of the beams, tie-rods extending between beams

beneath the arches and acting to tie the beams together and stiffen the arches, clay boxes or jackets enveloping said tie-rods and having sloping sides and depending below the under surfaces of the lower flanges of the aforesaid beams, and a tile ceiling laid in cement in panels or sections supported in part by said clay boxes or jackets, the outer surface of the ceiling being flush with the under surface of said boxes or jackets, and the tiles of the panels in contact with the boxes or jackets having sloping edges conforming to the slope of the sides of the boxes or jackets, substantially as set forth.

9. In a ceiling-floor of the character herein described, the combination, with longitudinal beams supported between the walls of the building, tile arches extending between the beams and resting thereon, and a tile floor supported on the arches and upper flanges of the beams, of tie-rods extending between beams beneath the arches and enveloped by clay boxes or jackets filled with cement to permanently secure the rods and enveloping clay together in proper relative position, and a tile ceiling laid in cement in panels or sections, supported in part by the lower flanges of the beams and in part by the clay covering of said tie-rods, substantially as set forth.

10. In a ceiling-floor of the character herein described, the combination, with longitudinal beams supported between the walls of the building and tile arches extending between and supported on said beams; of a tile floor supported on the arches and the upper flanges of the beams, tie-rods extending between the beams beneath the arches, terra-cotta shoes covering the lower flanges of the beams and extending below and covering the under surfaces of said flanges, and a tile ceiling laid in cement in panels or sections, supported by said tie-rods and shoes, the exposed surface of the ceiling being flush with the under surface of the terra-cotta shoes, substantially as set forth.

11. In a ceiling-floor of the character herein described, the combination, with longitudinal beams supported between the walls of the building and terra-cotta shoes enveloping the lower flanges of said beams and provided with surfaces sloping downward and outward from the beams, of tile arches extending between the beams and resting on the terra-cotta shoes, tie-rods extending between the beams at their lower flanges, a tile floor laid in cement and supported on said arches and the upper flanges of the beams, and a tile ceiling laid in cement in panels or sections,

supported by the tie-rods and terra-cotta shoes, the tiles of the panels in contact with the said terra-cotta shoes having sloping edges conforming to the slope of the surfaces of the shoes, substantially as set forth.

12. In a ceiling-floor of the character herein described, the combination, with longitudinal beams supported between the walls of the building and tile arches extending between the beams and supported thereon, of a tile floor laid in cement and supported on said arches and the upper flanges of the beam, tie-rods extending between beams beneath the arches and acting to tie the beams together and stiffen the arches, terra-cotta shoes covering the lower flanges of the beams and extending beneath and covering said flanges, clay boxes or jackets enveloping the said tie-rods and extending between the beams and abutting against the aforesaid shoes, and a tile ceiling laid in cement in panels or sections, supported by said shoes and boxes or jackets, the construction providing spaces between beams under the floor and above the ceiling, substantially as set forth.

13. In a cohesive ceiling-floor, the combination, with longitudinal beams supported between the walls of the building, arches of tiles between beams, a ceiling of tiles supported beneath the arches by said beams, and a floor of tiles supported on the arches and the upper flanges of the beams, of a series of sleepers resting on the upper flanges of the beams and tops of the arches and running parallel with the beams and a wooden floor laid above or over the tile floor and secured to said sleepers, substantially as set forth.

14. In a cohesive ceiling-floor, the combination, with longitudinal beams supported between the walls of the building, arches of tiles between beams, a ceiling of tiles supported beneath the arches by said beams, and a floor of tiles supported on the arches and the upper flanges of the beams, of a series of sleepers resting on the upper flanges of the beams and tops of the arches and running parallel with the beams, a layer of mineral wool placed on the upper layer of the tiles of the floor, and a wooden floor laid on the mineral wool and secured to the sleepers, substantially as set forth.

Signed at Boston, in the county of Suffolk and State of Massachusetts, this 3d day of March A. D. 1891.

RAFAEL GUASTAVINO.

Witnesses;

WILLIAM E. BLODGETT,
RAFAEL GUASTAVINO, Jr.