(No Model.) 2 Sheets—Sheet 1.

R. GUASTAVINO.

CONSTRUCTION OF FIRE PROOF BUILDINGS.

No. 336,048. Patented Feb. 9, 1886.

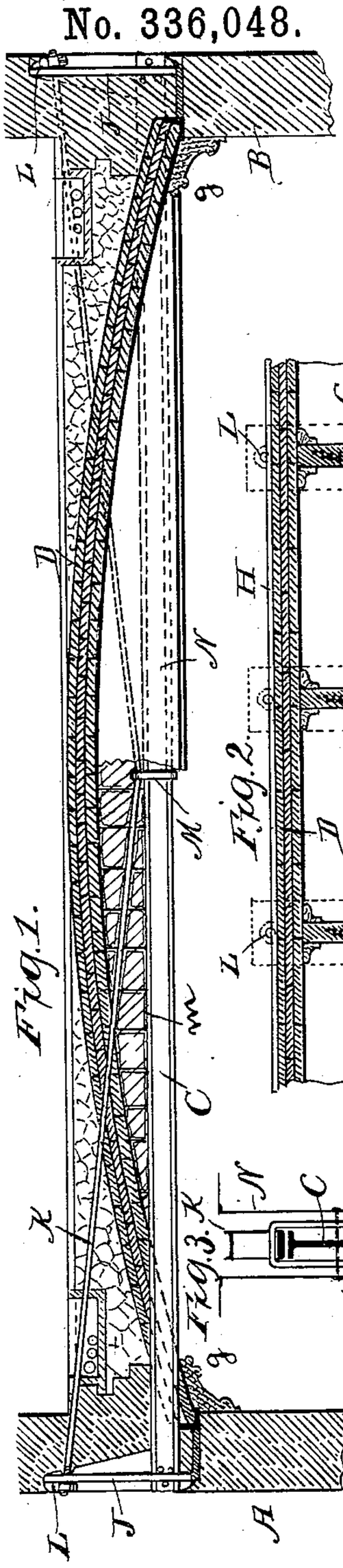

Fig. 1.

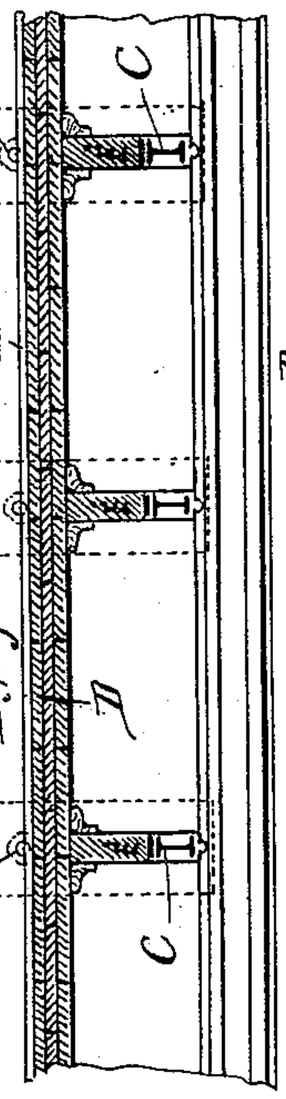

Fig. 2.

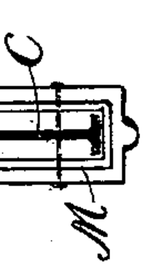

Fig. 3.

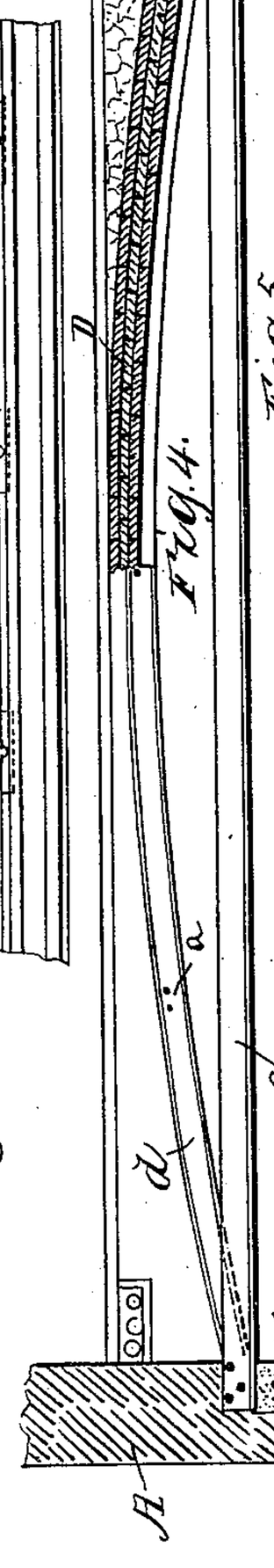

Fig. 4.

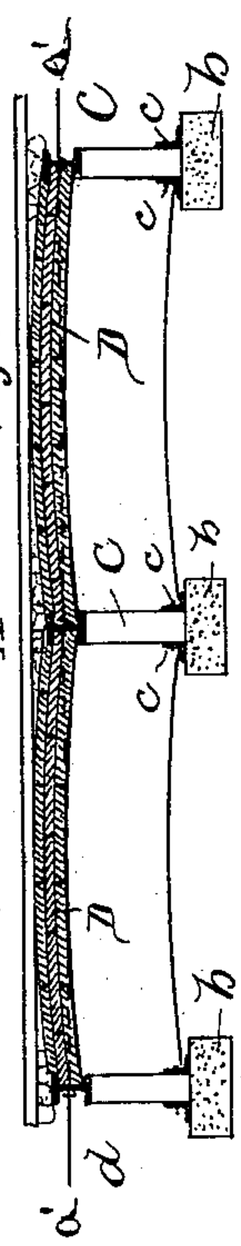

Fig. 5.

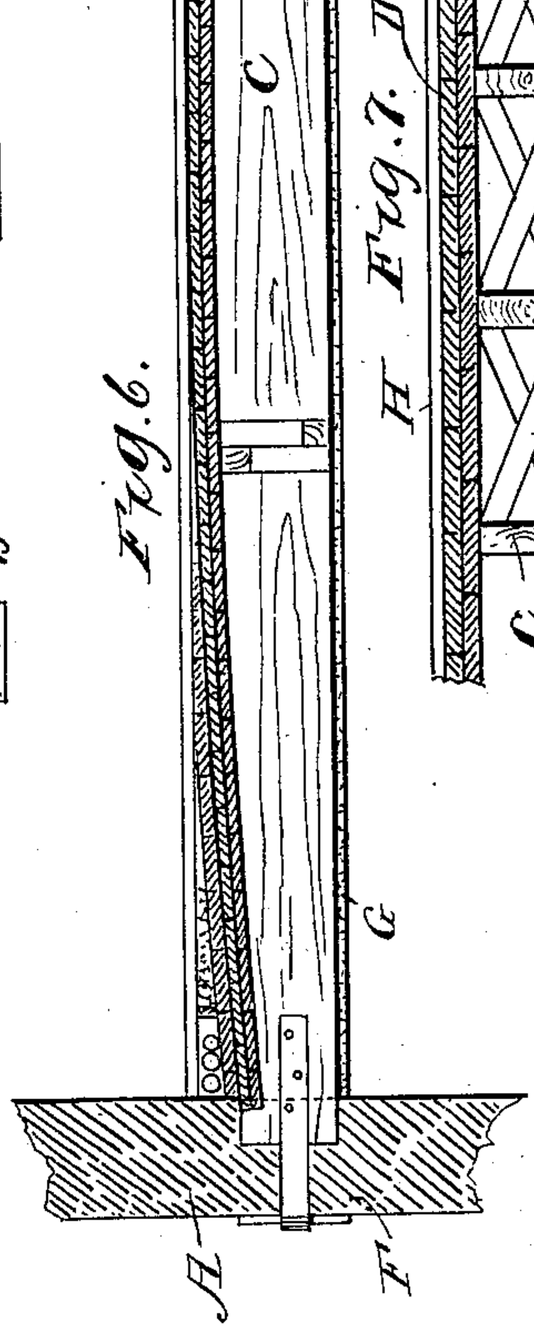

Fig. 6.

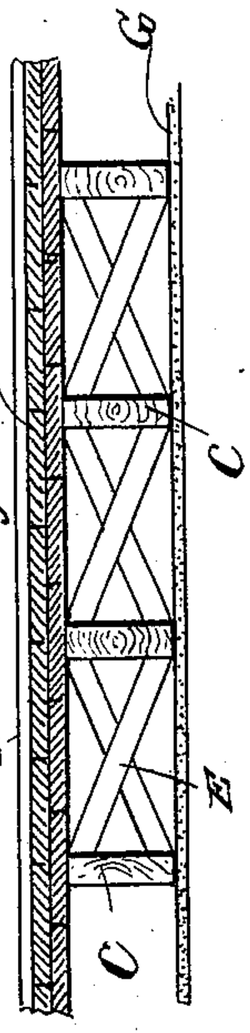

Fig. 7.

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(No Model.) 2 Sheets—Sheet 2.

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CONSTRUCTION OF FIRE PROOF BUILDINGS.

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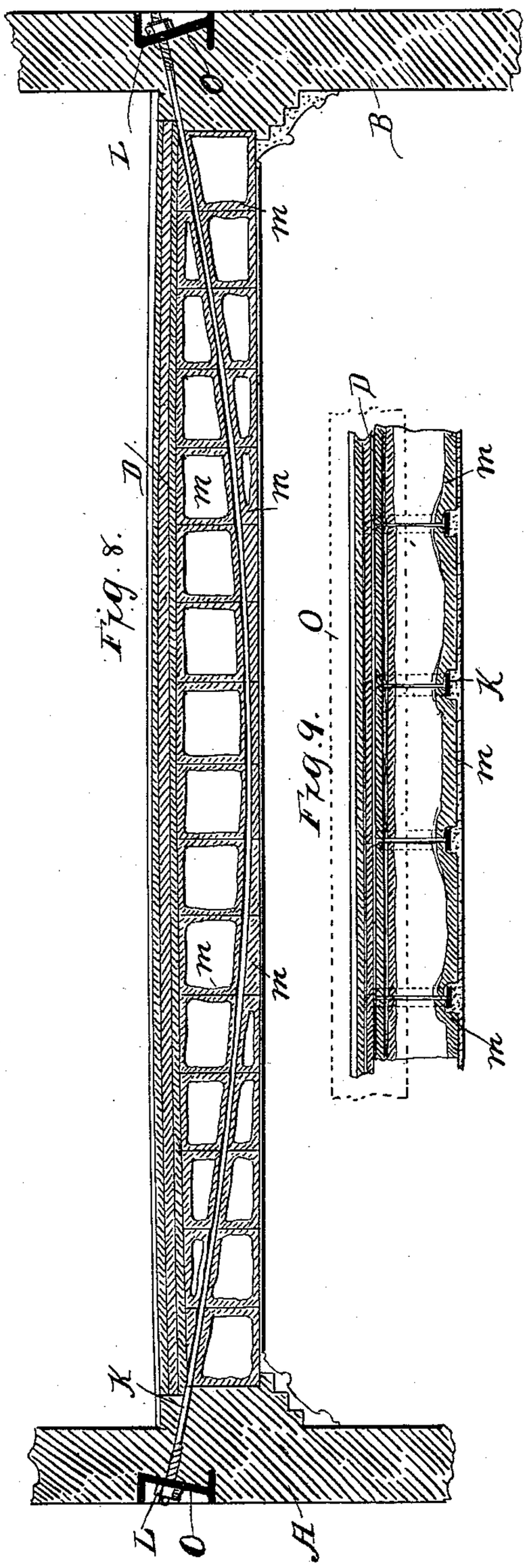

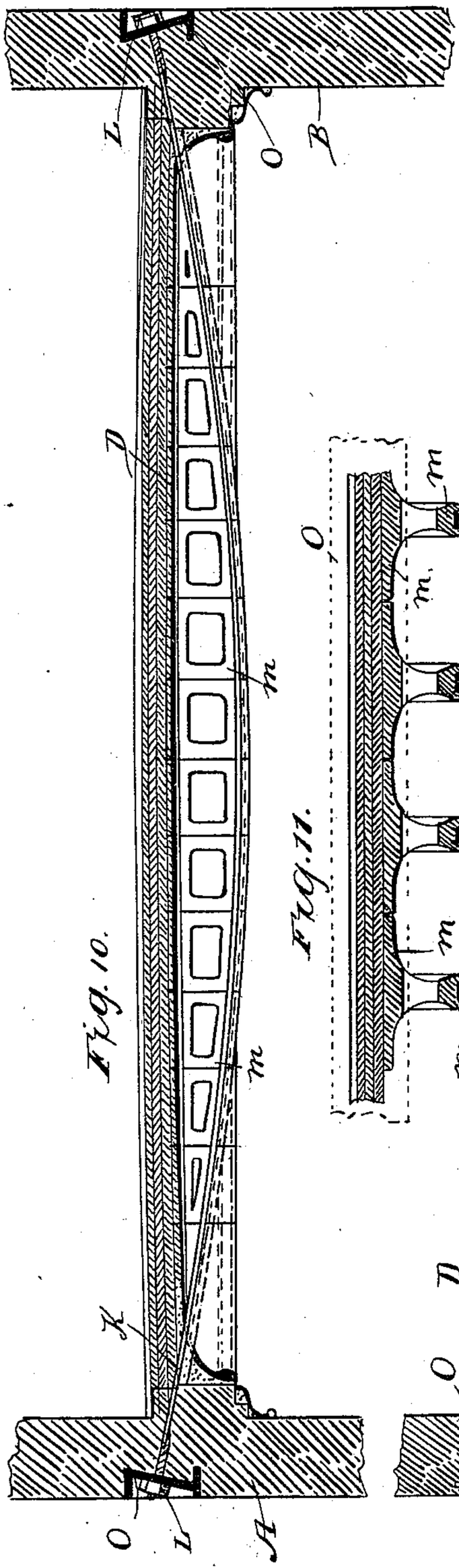

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UNITED STATES PATENT OFFICE.

RAFAEL GUASTAVINO, OF NEW YORK, N. Y., ASSIGNOR TO FRANCESCA RAMIREZ GUASTAVINO AND BERNARD S. LEVY, BOTH OF SAME PLACE.

CONSTRUCTION OF FIRE-PROOF BUILDINGS.

SPECIFICATION forming part of Letters Patent No. 336,043, dated February 9, 1886.

Application filed September 16, 1885. Serial No. 177,277. (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 the Construction of Fire-Proof Buildings, of which the following is a specification.

My invention relates to the construction of buildings, and particularly to such as are to be fire-proof; and the improvements which I seek to protect in this instance have reference to the roofs, floors, and ceilings of such buildings.

My improvements are applicable to buildings of all descriptions—such as private dwellings, factories, theaters, school-houses, warehouses, &c.

The object of the invention is to devise a more economical and substantial system for constructing ceilings, floors, and roofs than any now employed. The character of the structures of this nature now in use, in which wooden or iron beams are employed, is not such as to meet the requirements of the service, especially when economy, solidity, and incombustibility are aimed at. Ordinarily, structures such as mentioned are composed of wooden or iron beams on which rests a double wooden floor; or when fire-proof qualities are specially desired small vaults of ordinary brick or hollow brick are employed between the beams. Such constructions are familiar to architects and builders, and need not be explained in detail here. In the common forms of those structures the resistance of the ceiling depends entirely on the ability of the beams to resist deflection, since the wooden floors and small brick vaults serve merely as bridges between beam and beam, and in no degree increase the resisting power of the beams. On the contrary, the floor or vault contributes its weight to augment that weight which alone the beams are intended to support. With my system, which I employ in various embodiments, all of which, however, having a common object, the iron and brick, which principally compose the floor, ceiling, or roof, are so arranged with reference to each other and with reference to the entire structure as to utilize their best qualities upon scientific principles, the iron resisting by tension and not by flexion, and consequently all the fibers of its section work in the highest coefficiency, and the vault of brick tiles, resisting by compression and being supported upon itself, thus contributing in an efficient manner to the resisting quality of the floor. The economy that results from this construction is very great, because the materials entering into the structure are employed in a manner for which their respective inherent qualities best fit them, thus enabling the use of less material of a given kind for the effecting of a predetermined degree of resistance.

The features of novelty for which I desire protection in this instance are pointed out in the claims at the end of this description.

In the accompanying drawings, which form a part of this specification, and in which like features are indicated by like letters, Figure 1 is a transverse section of a construction designed for dwellings and factories where great strength is required. Fig. 2 is a central longitudinal section of Fig. 1. Fig. 3 is a detail showing the manner of inclosing the beams and tie-rods of Fig. 1 in galvanized-iron boxes. Fig. 4 is a transverse section of another embodiment of my invention, showing iron beams composed of two angle-irons secured to a double T-beam. Fig. 5 is a central longitudinal section of Fig. 4, and it also represents a longitudinal section of a ceiling composed of a series of short arches or risers extending transverse of the ceiling without the long arch or riser. Fig. 6 is a transverse section of a ceiling for the cheaper class of dwellings, the beams C being of iron, but may be of wood. Fig. 7 is a central longitudinal section of Fig. 6. Fig. 8 is a transverse section of a flat hanging ceiling. Fig. 9 is a central longitudinal section of Fig. 8, showing in dotted lines one of the long plates to which the tie-rods are secured. Fig. 10 is a transverse section of a ceiling similar to that shown in Fig. 8, but constructed to provide greater height of ceiling. Fig. 11 is a central longitudinal section of Fig. 10; and Fig. 12 is a detail of a modified method of connecting the tie-rods to the walls and of adjusting their tension.

For building the vaults according to the plan herein explained ordinary brick are not

well adapted. I use brick tiles of about three-fourths (¾) of an inch thick by four (4) to six (6) inches wide, and from eight (8) to twelve (12) inches long. Such tiles are built up into two or more rings or layers for each vault, and are set in cement or plaster-of-paris. When two or more rings or layers of tiles of this description are united together face to face in such manner as to break joints, a structure is produced having a surface without solution of continuity, and resembling a large stone three or more inches thick, and which may be flat or curved, and when curved, in one or two oppositely-directed arches or risers. Vaults built on this principle possess the requisite elasticity, and resist pressure both by compression, the same as brick, and by cohesion, the same as stone or cast-iron.

The structure shown in Figs. 1 and 2 is intended for factory-buildings and dwellings where great strength is required. In this construction, Figs. 1 and 2, the iron beams C are double T-beams, and they are anchored by plates J, located in the side walls, A B, as shown. The shape of the plates J is shown by dotted lines in Fig. 2. H is the floor, and D is the vault, composed of two or more layers of brick tiles arranged so as to break joints, which vault has its bearings in the side walls, as shown. *g* indicates mere ornamentation, which may be varied according to taste. The letter K indicates tie-rods, which may be placed from two to four feet apart, the same as the beams. Their ends project through the anchor-plates J, and have nuts L thereon for adjusting the tension of the rods. M indicates rings which connect the tie-rods to the T-beams C, and *m* indicates pieces of common terra-cotta located between the under surface of the vault D and the T-beams C, the said terra-cotta pieces being provided with openings for the passage of the tie-rods K, as shown.

In Fig. 3 are shown certain features of the construction of Figs. 1 and 2, and their relation to the galvanized-iron box or envelope N, which is of the shape shown in this view, and designed to surround and be secured to the beam C, as shown at the right of Fig. 1.

The structure shown in Figs. 4 and 5 is designed especially for cheap factory-buildings. The side walls, A B, are provided with suitable tablets, *b*, at proper intervals, upon which rest the iron beams C of the structure. The beams in this instance are composed of two angle-irons, *c*, secured to a double T-beam, *d*, as shown. The letters *a' a'*, Fig. 5, indicate small tie-rods, which extend between beam and beam at the points designated by *a*, Fig. 4. In these views (Figs. 4 and 5) H represents the floor, as in the other views, and D is the vault, constructed similar to the vault of Fig. 1, (with two or more layers of brick tiles.) Beneath the floor H, near the side walls, is provided a box for the gas, ventilating, and other piping, the rest of the vacant space being filled with concrete, as shown. These features are also shown in other views of the drawings.

It will be observed that in the construction just described, Fig. 4, the vault D is composed of arches or risers extending transversely as well as longitudinally of the ceiling. By this form of vault much greater strength is attained than where the vault is composed merely of a single transverse arch or riser.

I also contemplate constructing ceilings, roofs, and floors according to the plans herein set forth, in which the vault shall be composed of a series of short arches or risers, either transverse or longitudinal of the structure. To illustrate this feature of the case Fig. 5 may be deemed a transverse sectional view.

The structure shown in Figs. 6 and 7 of the drawings is intended for the cheaper class of dwelling-houses. In these views A B are the side walls; C, the beams, which may be of iron or wood; D, the vault, which is composed of two or more layers of brick tiles of the charter herein mentioned, and E the trusses between the beams C. F are the anchor-plates for the beams C, and they extend through the side walls, as shown. The heavy black line at the bottom of the beam C (represented by G) is intended to indicate wire-netting, upon which the plaster is placed. In this structure, as well as in those shown in the other views of the drawings, the thickness of the vaults D and the dimensions of the sections of the beams and tie-rods depend on the distance between the side walls.

In the structure shown in Figs. 6 and 7 the compression is principally in the vault D, which fact relieves the beams C of almost all strain by flexion, and renders the beams substantially free for resisting the tension strain, which is their special office in the construction in question.

In Figs. 8 and 9 I show a flat hanging ceiling designed for dwelling-houses, stores, and factory-buildings. In this embodiment of my invention those portions which are subjected to compressing strain—to wit, the vault and terra-cotta pieces—are composed of cheap material, which, although cheap, is especially adapted for the purpose in view. In all fire-proof buildings the use of terra-cotta is essential, and by its employment according to my plan I not only utilize its fire-proof qualities, but attain cheapness in those parts of the structure into which it enters, and at the same time derive the largest results in compressing-resistance. In this form of structure, Fig. 8, I use tie-rods of iron, the material best adapted for resisting tension strain. In these views, Figs. 8 and 9, A B are the side walls, which may be provided with offsets for bearings for the floor, vault, &c, as shown. D is the vault of two or more layers of tiles, and H is the floor. In this ceiling there are no beams, the tension being in tie-rods K, which are passed through openings in the terra-cotta pieces *m*, which latter are to be substantially of the shape shown, and are located beneath the vault D, as illustrated. The letter O indicates metal plates in the side walls, A B. These

plates extend continuously from end to end of the walls and have the tie-rods K attached thereto. The longitudinal face of the plate O is indicated by dotted lines in Fig. 9. The tie-rods are held in plates O, and adjusted by nuts L, as in Fig. 1.

In Figs. 10 and 11 is shown a hanging ceiling similar to that illustrated in Fig. 8, except that the terra-cotta pieces *m* are of a different shape, as will be noticed by comparing the respective longitudinal sections 9 and 11. This difference in the shape of the terra-cotta pieces *m* gives greater height to ceilings embodying the construction of Fig. 11 than can be attained by the construction of Fig. 9.

In Fig. 12 I show a modification of the manner of securing the tie-rods K to the side walls, and of adjusting the rods when in position. In this view the plates O are upon the interior surface of the side walls, which will be the plan adopted when for any reason it is not convenient to get at the exterior surface of the walls. The turn-buckle L′ answers the same purpose as the nuts L in the other views, for adjusting the tie-rods after they have been placed in position.

In addition to the tie-rod K, which, as shown in Fig. 12, extends beneath the arch from wall to wall, I may in practice use a straight tie-rod extending between wall and wall above the arch from O to O.

It may be stated, generally, that the resistance of my ceilings depends upon the ability of the beams or tie-rods to resist tension and upon the resistance of the vaults or terra-cotta pieces against compression. When these structures are employed as roofs, the concrete between the floor H and vault D will be replaced by Portland cement and the whole covered with tin or any other desirable covering for roofs.

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

1. In the construction of the ceilings, roofs, and floors of dwelling-houses and other buildings, a vault composed of two or more layers or rings of brick tiles set in cement or plaster-of-paris which operates to resist pressure by compression and cohesion, substantially as set forth.

2. A ceiling, roof, or floor embodying a vault composed of two or more layers or rings of brick tiles arranged to break joints, and set in cement or plaster-of-paris, substantially as set forth.

3. In a ceiling, roof, or floor, a vault composed of two or more layers or rings of brick tiles set in cement or plaster-of-paris, in combination with beams between wall and wall, the said vault arranged to resist pressure by compression and the beams to resist by tension, substantially as set forth.

4. In a ceiling, roof, or floor, a vault composed of two or more layers or rings of brick tiles set in cement or plaster-of-paris, in combination with tie-rods between wall and wall, the said vault arranged to resist pressure by compression and the tie-rods to resist by tension, substantially as set forth.

5. In a ceiling, roof, or floor, a vault composed of two or more layers or rings of brick tiles set in cement or plaster-of-paris, in combination with tie-rods between wall and wall, and pieces of terra-cotta arranged beneath the vault, substantially as and for the purpose set forth.

6. In a ceiling, roof, or floor, a vault composed of two or more layers or rings of brick tiles set in cement or plaster-of-paris, in combination with beams and tie-rods between wall and wall, and pieces of terra-cotta beneath the vault, substantially as set forth.

7. In a ceiling, roof, or floor, a vault composed of two or more layers or rings of brick tiles set in cement or plaster-of-paris, in combination with beams between wall and wall, and concrete or Portland cement between the top of the vault and the covering for the latter, substantially as set forth.

8. In a ceiling, roof, or floor, a vault composed of two or more layers of brick tiles set in cement or plaster-of-paris, and constructed with arches or risers in two opposed directions, substantially as set forth.

9. In a ceiling, roof, or floor, a vault composed of brick tiles, in combination with beams C, tie-rods K, anchor-plates J, and rings M, substantially as set forth.

10. In a ceiling, roof, or floor, a vault composed of brick tiles, in combination with beams C, tie-rods K, anchor-plates J, terra-cotta pieces *m*, and rings M, substantially as set forth.

11. In a ceiling, roof, or floor, a vault of brick tiles, in combination with tension-beams C and the enveloping-boxes N, substantially as set forth.

Signed at New York, in the county of New York and State of New York, this 15th day of September, A. D. 1885.

RAFAEL GUASTAVINO.

Witnesses:
F. MIRANDA,
J. E. M. BOWEN.