No. 754,574. PATENTED MAR. 15, 1904.

R. C. KYLE.

FIREPROOF FLOOR CONSTRUCTION.

APPLICATION FILED APR. 18, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

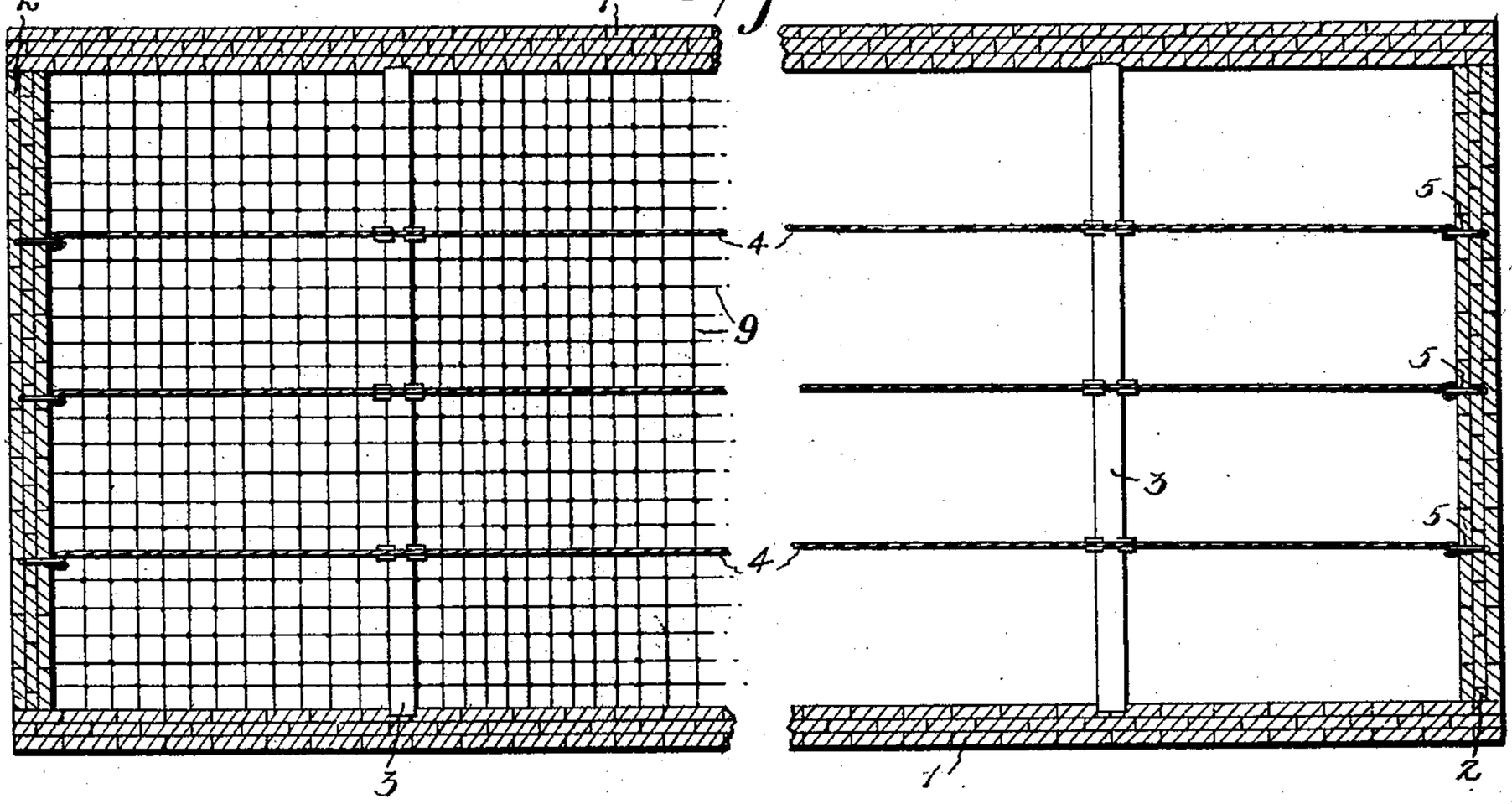


Fig. 2.

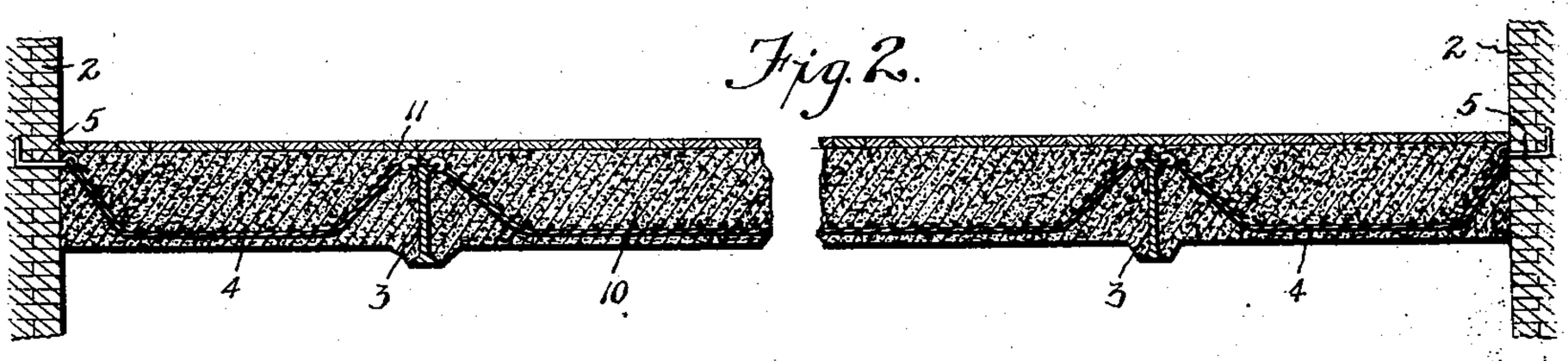
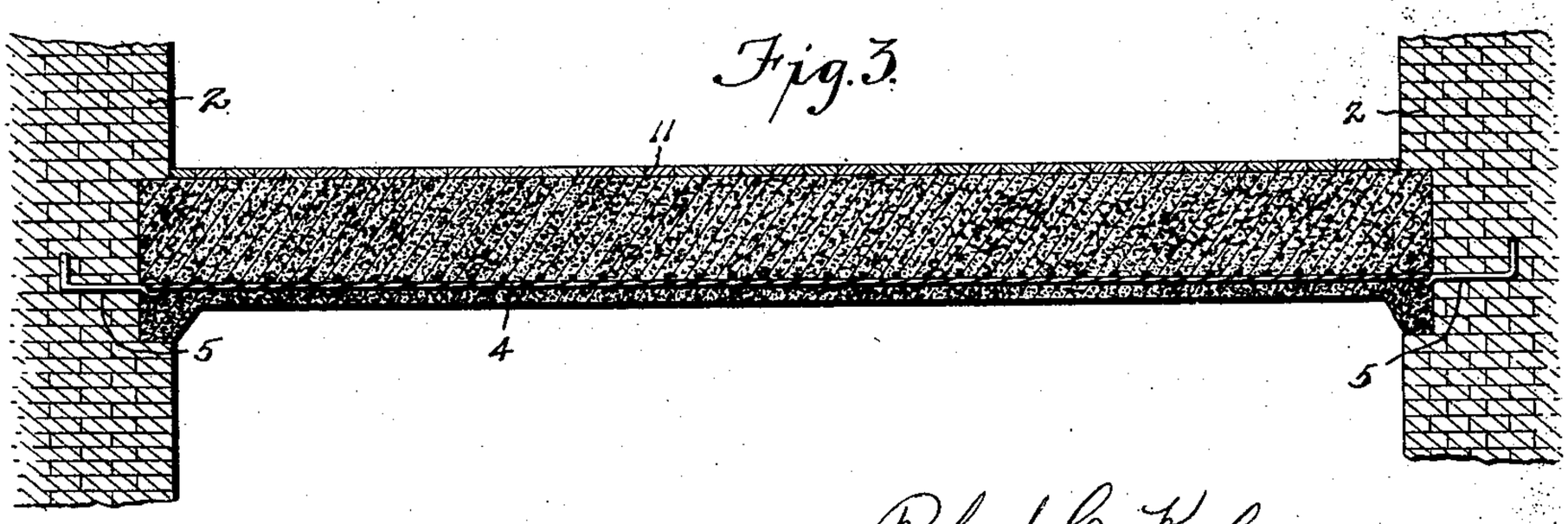


Fig. 3.



Witnesses
Ralph A. Shepard
H. C. Shepard.

Robert C. Kyle Inventor
By C. C. Shepherd.
Attorney

No. 754,574. PATENTED MAR. 15, 1904.

R. C. KYLE.

FIREPROOF FLOOR CONSTRUCTION.

APPLICATION FILED APR. 18, 1903.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 4.

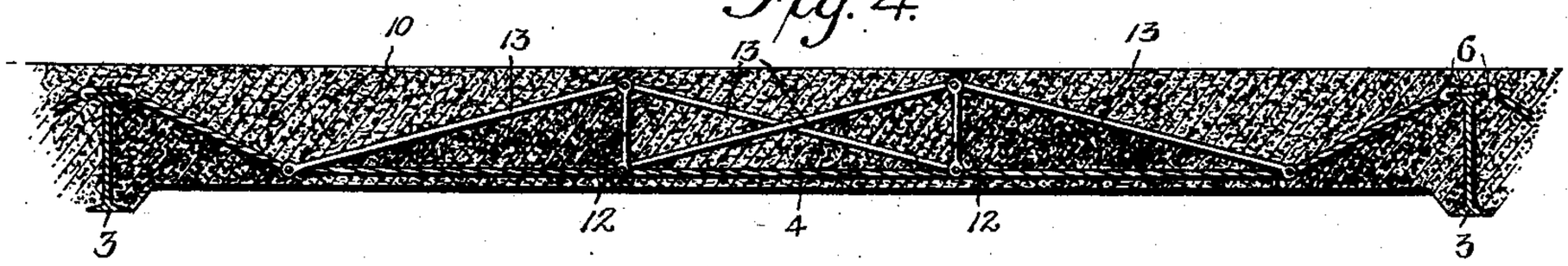


Fig. 5.

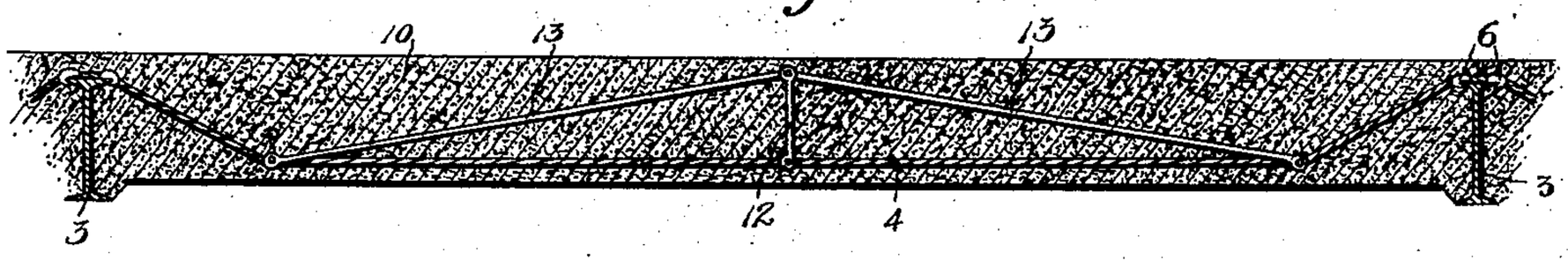


Fig. 6.

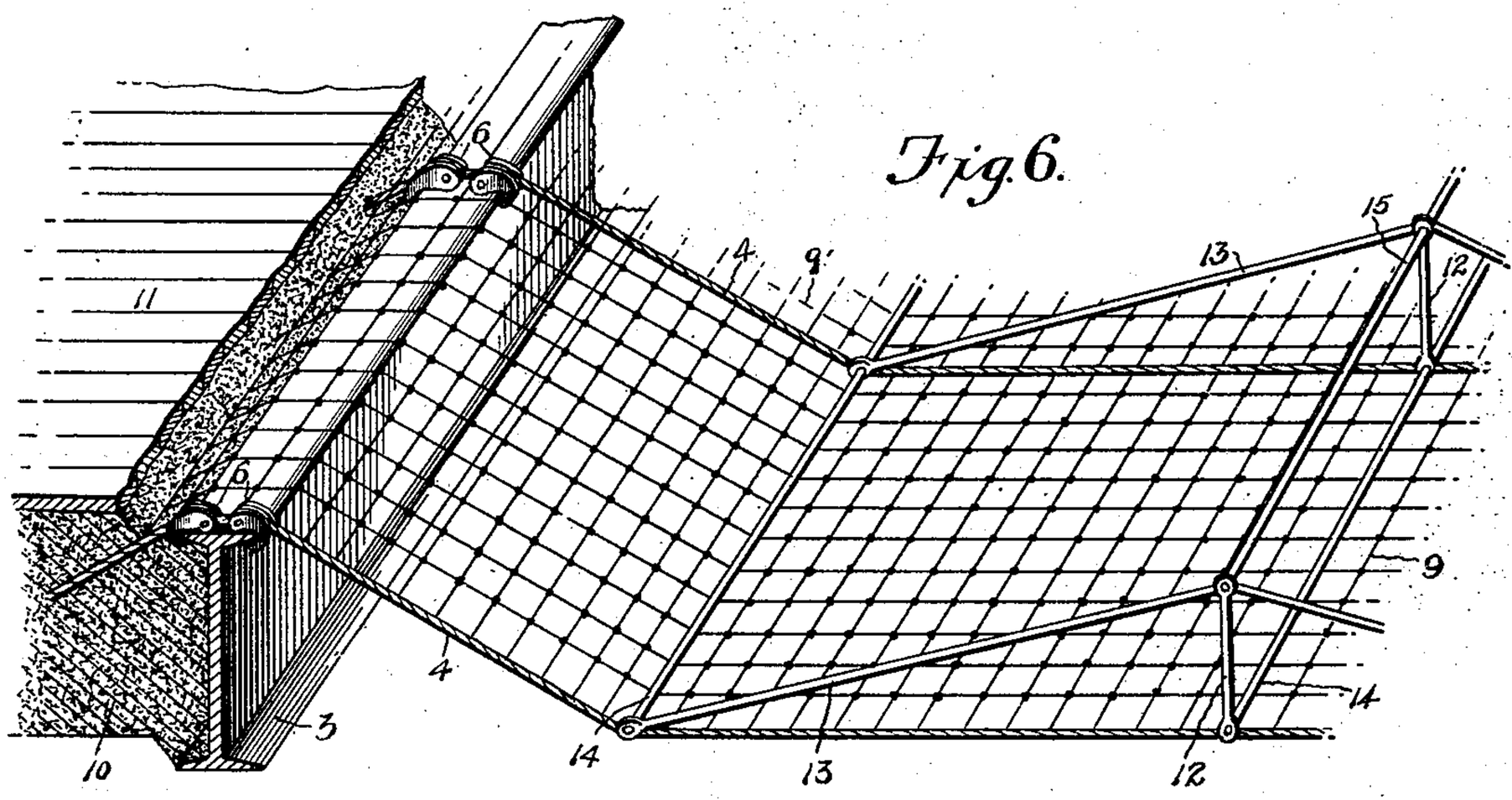


Fig. 7.

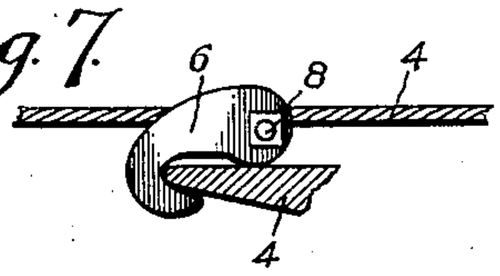
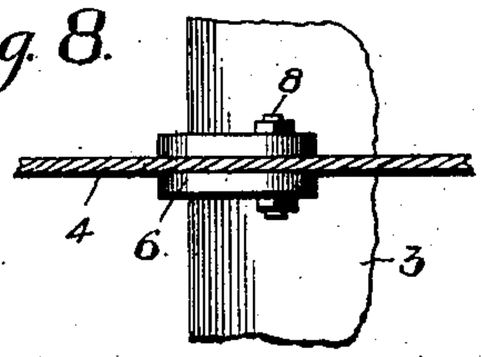


Fig. 8.



Witnesses
Ralph A. Shepard.
H. E. Shepard.

Robert C. Kyle Inventor

By O. C. Shepherd
Attorney

No. 754,574. Patented March 15, 1904.

UNITED STATES PATENT OFFICE.

ROBERT C. KYLE, OF COLUMBUS, OHIO, ASSIGNOR TO THE INTERNATIONAL FENCE & FIRE PROOFING COMPANY, OF COLUMBUS, OHIO, A CORPORATION OF OHIO.

FIREPROOF FLOOR CONSTRUCTION.

SPECIFICATION forming part of Letters Patent No. 754,574, dated March 15, 1904.

Application filed April 18, 1903. Serial No. 153,279. (No model.)

To all whom it may concern:

Be it known that I, ROBERT C. KYLE, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented a certain new and useful Improvement in Fireproof Floor Construction, of which the following is a specification.

This invention relates to building constructions, and while it is primarily designed to provide a flat arch construction for ceilings and floors it is also designed to afford a fireproof structure.

It is a further object of the invention to provide for the construction of comparatively long arches or spans without additional intermediate supports and in this connection to reduce to the minimum the cast-metal parts, so as to obviate as far as possible contraction and expansion in the supports for the body of concrete which constitutes the major part of the structure.

With these and other objects in view the present invention consists in the combination and arrangement of parts, as will be hereinafter more fully described, shown in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that changes in the form, proportion, size, and minor details may be made within the scope of the claims without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings, Figure 1 is a plan view showing the skeleton support of the present invention, the concrete body being omitted. Fig. 2 is a sectional view thereof, including the body of concrete and the flooring thereon. Fig. 3 is a similar view of a single span between opposite walls without an intermediate support. Fig. 4 is a sectional view taken between two I-beams and embodying a trussed form of support for the concrete body. Fig. 5 is a similar view showing a modification of the trussed support. Fig. 6 is a detail perspective view of the construction shown in Fig. 5, the concrete body being omitted. Fig. 7 is a detail side elevation of one of the I-beam-engaging hooks, and Fig. 8 is a plan view of Fig. 7.

Like characters of reference designate corresponding parts in each and every figure of the drawings.

As hereinbefore indicated, it is an important feature of the present invention to provide a support of minimum character for the body of concrete which constitutes the major part of the arch and also to reduce to the minimum the expansion and contraction of this supporting element. Practical experience has developed that I-beams and similar metallic supports for a floor composed of concrete expand and contract to such an extent as to crack and materially weaken the structure, and this is more noticeable in structures having metallic joists extending between metallic beams, as the endwise expansion and contraction of the joists tend to laterally displace the beams. To overcome these objections, I propose to form the skeleton support for the body of concrete of twisted-wire cables and wire-netting, either singly or in combination. The advantage of cables over cast-metal beams resides in the fact that there is practically no contraction and expansion of the cables and the tensile strength thereof is very much greater than that of the beams. Furthermore, the cables can be more conveniently handled in great lengths, and therefore may be employed as continuous ties from wall to wall, and the weight thereof is considerably less than that of rigid beams. Again, cables have practically no vibration, while rigid beams have considerable vibration, which is an objection in any building structure, and particularly in tall buildings and in long spans or arches.

For an adequate understanding of the present invention attention is first called to Figs. 1 and 2 of the drawings, wherein the reference character 1 designates opposite masonry walls of a building, and 2 designates the other opposite masonry walls. As is usual, suitable beams 3, preferably metallic I-beams, have their ends seated in recesses in opposite walls, in the present instance in the opposite walls 1, in

any well-known or preferred manner. Thus far the construction described is that now commonly in use, and in carrying out this invention twisted-wire cables 4 are strung across the I-beams 3 at substantially right angles thereto, with their ends anchored in the respective walls 2—as, for instance, by means of suitable hooks 5, embedded in said walls. No particular tension is placed upon the cables other than that required to properly dispose the same. It is preferred to run each cable over the top of each I-beam and to anchor the same thereto, a specific form of anchorage being best illustrated in Figs. 7 and 8 of the drawings, although indicated in several of the other figures. This specific form of anchorage consists of a longitudinally-bifurcated hook 6, the adjacent cable being received within the bifurcation, and an adjustable fastening, preferably a bolt 8, pierces the bifurcated portion of the hook—so as to clamp the members thereof upon the cable, the bill of the hook being engaged with one edge of the head or top flange of the adjacent I-beam. As plainly indicated in Fig. 6 of the drawings, it will be seen that these hooks are grouped in pairs, the members of which are reversely arranged—that is to say, their bills extend in opposite directions—so that one hook engages one side of the I-beam and the other hook engages the opposite side thereof, whereby the cable is anchored against endwise movement in either direction. From this description it will be understood that in addition to being anchored at opposite ends each cable is also intermediately anchored at a plurality of points, according to the number of floor-beams between the terminals of the cable. By reference more particularly to Fig. 2 of the drawings it will be seen that the cable extends downwardly at an abrupt incline from the top of each beam to a point near the bottom thereof, and for the greater portion of its length between adjacent I-beams it extends straight and substantially horizontal. While the distance between adjacent cables may be varied, it has been demonstrated that an interval of from six to eight feet is the best.

Over the cables is placed suitable netting 9, preferably of wire and having a comparatively large mesh, said netting lying flat upon the cables and running over the tops of the I-beams.

The cables and the netting are designed to form a skeleton support for the body of concrete 10, which extends from the bottoms to the tops of the I-beams, and the top of the concrete is faced with tile, boards, or other suitable material 11 to form a proper finish. It will here be noted that between each pair of I-beams the major portion of the cables and the netting lie close to the bottom of the body of concrete and in the same plane thereof, whereby the support is located in the best possible position for sustaining the body of concrete. This fact will be more fully understood from the fact that should the concrete split or crack from top to bottom the weight thereof has a tendency to depress the concrete along the edges of the crack, and thereby cause the separated portions of the concrete to spread apart at the bottoms thereof, and by locating the skeleton support as close as possible to the bottom of the concrete this tendency to separate is effectually obviated, and any cracking or splitting of the concrete does not tend to weaken the arch to any considerable extent.

As shown in Fig. 3 of the drawings, it will be seen that intermediate supports, such as I-beams, are not absolutely necessary; but this simplest form of construction can be used only in comparatively short spans or arches, although the length thereof may be somewhat greater than the ordinary interval between floor-beams.

In some instances, particularly in long arches or where the weight to be sustained is abnormal, it is necessary to strengthen the skeleton support, and this feature of the invention is carried out as indicated in Figs. 4, 5, and 6. For strengthening the skeleton support it is proposed to employ a trussed arrangement consisting of struts 12, rising from the cables, with inclined braces or tension-rods 13 leading from the outer ends of the struts to the respective cables. Furthermore, cross bars or rods 14 connect adjacent cables and are located at the lower ends of the tension-rods 13 and the struts 12, and other cross bars or rods 15 connect the outer ends of opposite struts, all of this trussed framework being embedded in the cement or concrete. Figs. 5 and 6 show the simplest form of this trussed feature, while Fig. 4 shows a slight modification, wherein adjacent braces or tension-rods are crossed, each of said rods extending from the outer end of one strut to the lower end of the next adjacent strut. This crossed arrangement of tension-rod is preferably located substantially midway between opposite supports or beams.

From the foregoing description it is apparent that the present invention obviates the employment of cast-metal joists between cast-metal beams and in lieu thereof employs twisted-wire cables extending continuously from one outer wall to the opposite wall, whereby the cables in addition to supporting the concrete body also form ties for the walls of the building. By the employment of cables vibration is reduced to the minimum. This is also true in the modified form employing the trussed rods, as the latter are supported solely upon the cables, and whatever slight vibration they may have is not imparted to the I-beams.

Having thus described the invention, what is claimed, and desired to be secured by Letters Patent, is—

1. In a fireproof floor construction, the com-

bination with spaced supports, of cables bridging the space between the supports and independently anchored to said supports, netting independent of the cables and resting upon the upper sides thereof, and a body of concrete inclosing the netting and cables between the supports.

2. In a fireproof floor construction, the combination with floor-beams, of cables running across the beams, netting also running across the beams and supported upon the upper sides of the cables between the beams, and a body of concrete in which the beams, cables and netting are embedded.

3. The combination with the walls of a building, of floor-beams supported upon opposite walls, cables running across the beams and anchored to the other opposite walls to form ties therefor, netting also running across the beams and supported upon the upper sides of the cables between the beams, and a body of concrete in which the beams, cables and netting are embedded, the cables and netting being sagged between the beams to lie adjacent to the bottom of the body of concrete and in substantially the same plane therewith.

4. The combination with the walls of a building, of floor-beams supported upon opposite walls, continuous cables crossing and supported by the beams and anchored to other opposite walls to form ties therefor, said cables extending in a continuous direction between each and every pair of beams, netting supported by the cables, and a body of cement in which the beams, cables and netting are embedded, the cables and netting being disposed adjacent to the bottom of the body of cement and in substantially the same plane therewith.

5. In a fireproof floor construction, the combination with supporting **I**-beams, of cables arranged between said **I**-beams, pairs of oppositely-disposed hooks connected with said cables and adapted to engage opposite sides of the heads of respective **I**-beams, netting arranged on said cables, and a body of concrete inclosing said netting and cables between said **I**-beams.

6. The combination with opposite supports, of cables secured thereto and extending between the same with their intermediate portions located in a plane below the points of connection between the cables and the supports, transverse rods connecting the depressed portions of the cables, truss-braces extending between the struts and the cables, and a body of concrete in which the cables, rods, struts and braces are embedded.

7. The combination with opposite supports, of cables extending between and running over the tops of the supports, pairs of hooks carried by the cables, the members of each pair of hooks being reversely arranged and engaging the opposite upper edges of the respective supports to anchor the cables thereto against movement in either direction, and a body of concrete in which the cables are embedded.

8. The combination with opposite supports, of cables extending between the supports, pairs of hooks carried by the cables, each hook being bifurcated and receiving the adjacent cable in the bifurcation thereof, and also provided with means to clamp the opposite side portions of the hook upon the cable, the members of each pair of hooks being reversely arranged with their bills engaging the opposite upper edges of the support, and a body of concrete in which the cables are embedded.

9. The combination with opposite supports, of cables extending between the supports, hooks upon the cables, each hook being bifurcated and receiving the adjacent cable in the bifurcation, and provided with means for clamping the opposite side portions of the hook upon the cable, each hook having its bill engaging the top of the adjacent support, and a body of concrete in which the cables are embedded.

10. The combination with opposite supports, of cables extending between the same, hooks upon the cables and engaging the supports, each hook being bifurcated and receiving the adjacent cable in the bifurcation, screw-threaded fastenings piercing the opposite sides of the hooks to clamp the same upon the cables, and a body of concrete in which the cables are embedded.

11. The combination with opposite supports, of cables extending between the same, hooks upon the cables and engaging the supports, each hook being bifurcated and receiving the adjacent cable in the bifurcation, fastenings carried by the hooks for clamping them upon the cables, transverse rods connecting the cables, struts rising from some of the rods at their points of crossing the cables, truss-braces extending between the struts and the cables, a wire-netting supported upon the cables and the rods, and a body of concrete in which the cables, rods, struts, braces and netting are embedded.

ROBERT C. KYLE.

In presence of—
A. L. PHELPS,
C. C. SHEPHERD.