J. S. HAGAN.

CONCRETE FLOOR.

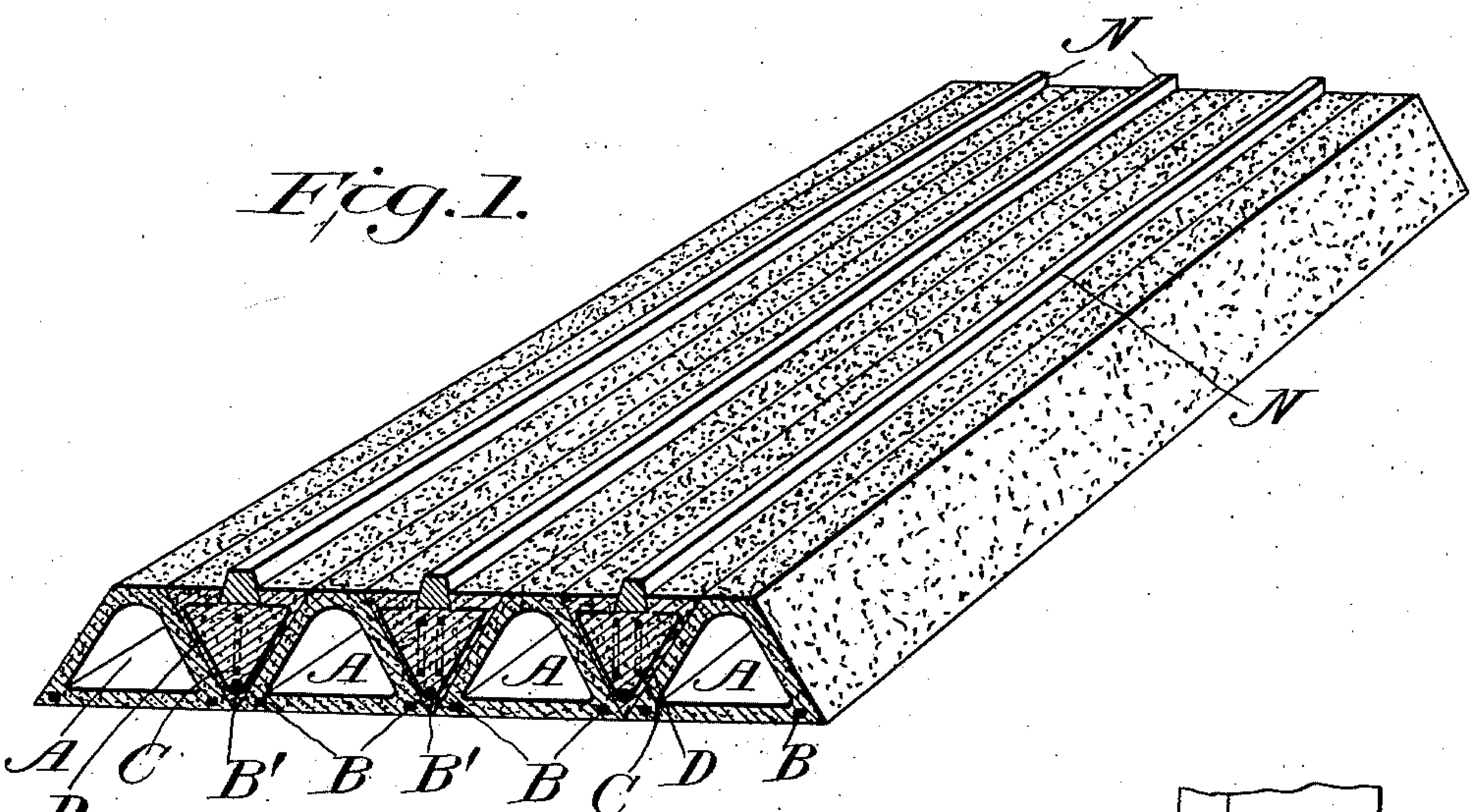
APPLICATION FILED JULY 16, 1908.

985,165.

Patented Feb. 28, 1911.

3 SHEETS—SHEET 1.

Fig. 1.



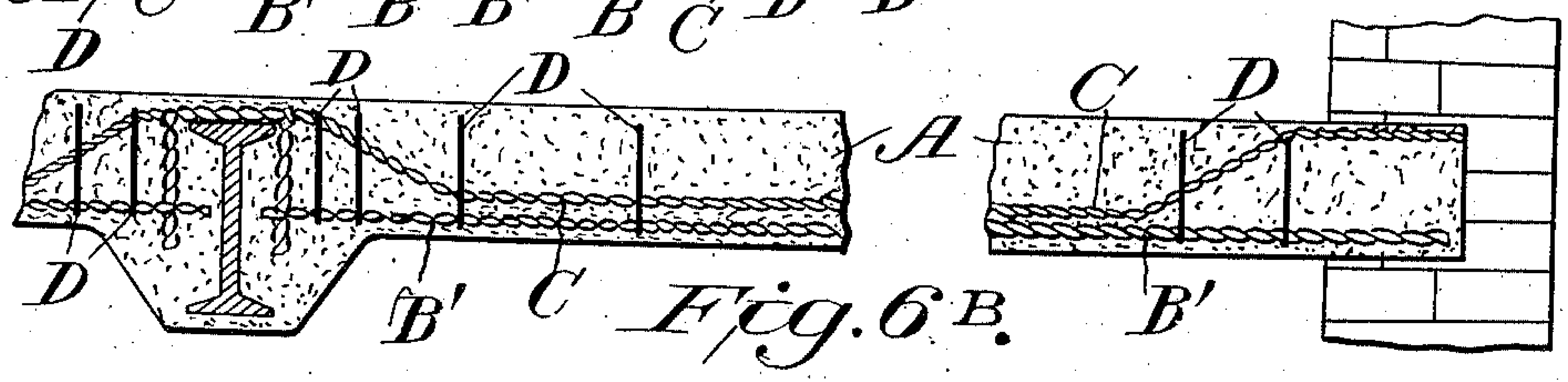
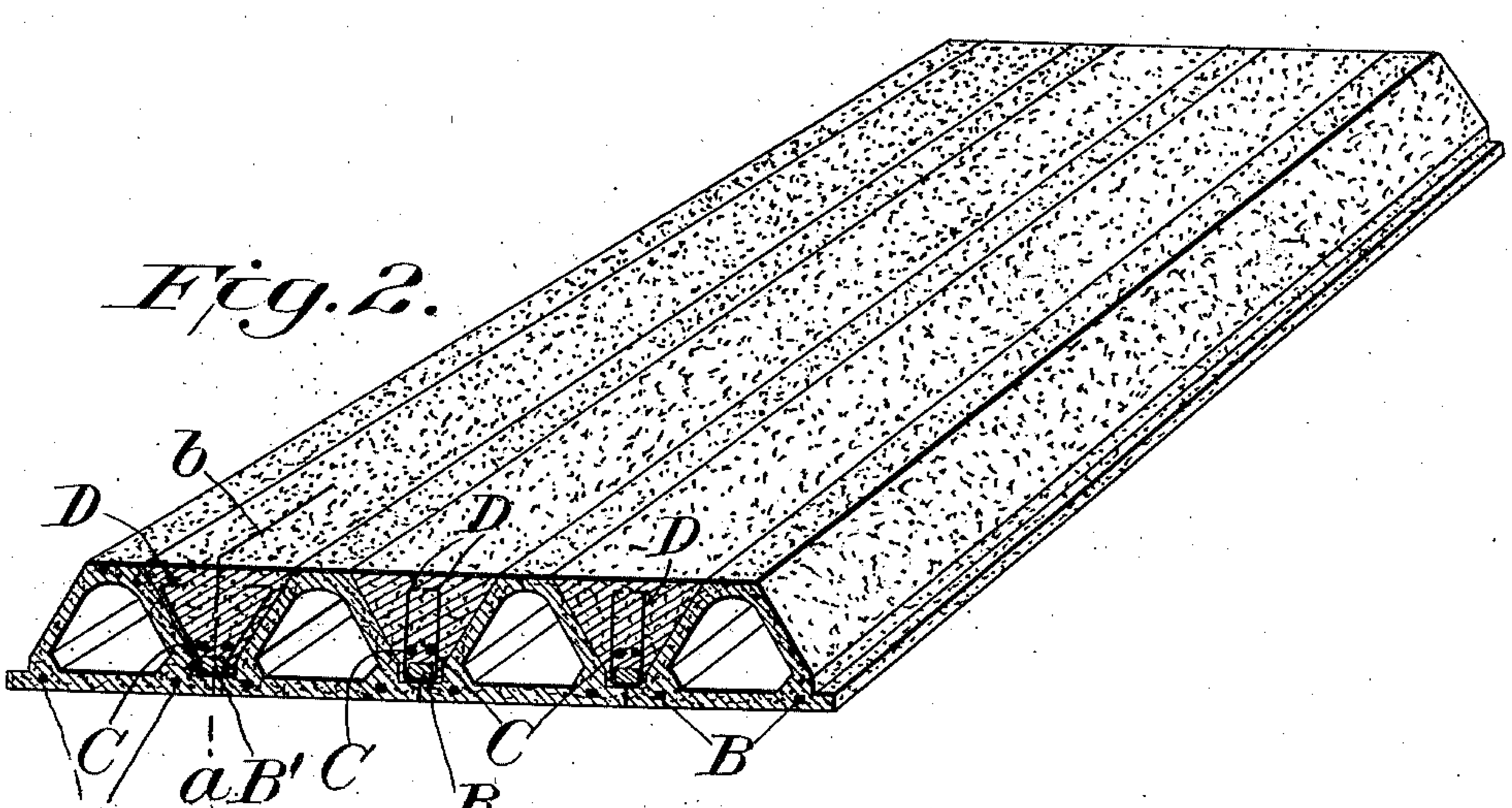


Fig. 6 B.

Fig. 2.



Inventor

Joseph S. Hagan

Witnesses

C. H. Walker.

R. C. Halsizer

By Byrnes Townsend & Brickenstein

Attorneys

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3 SHEETS—SHEET 2.

Fig. 3.

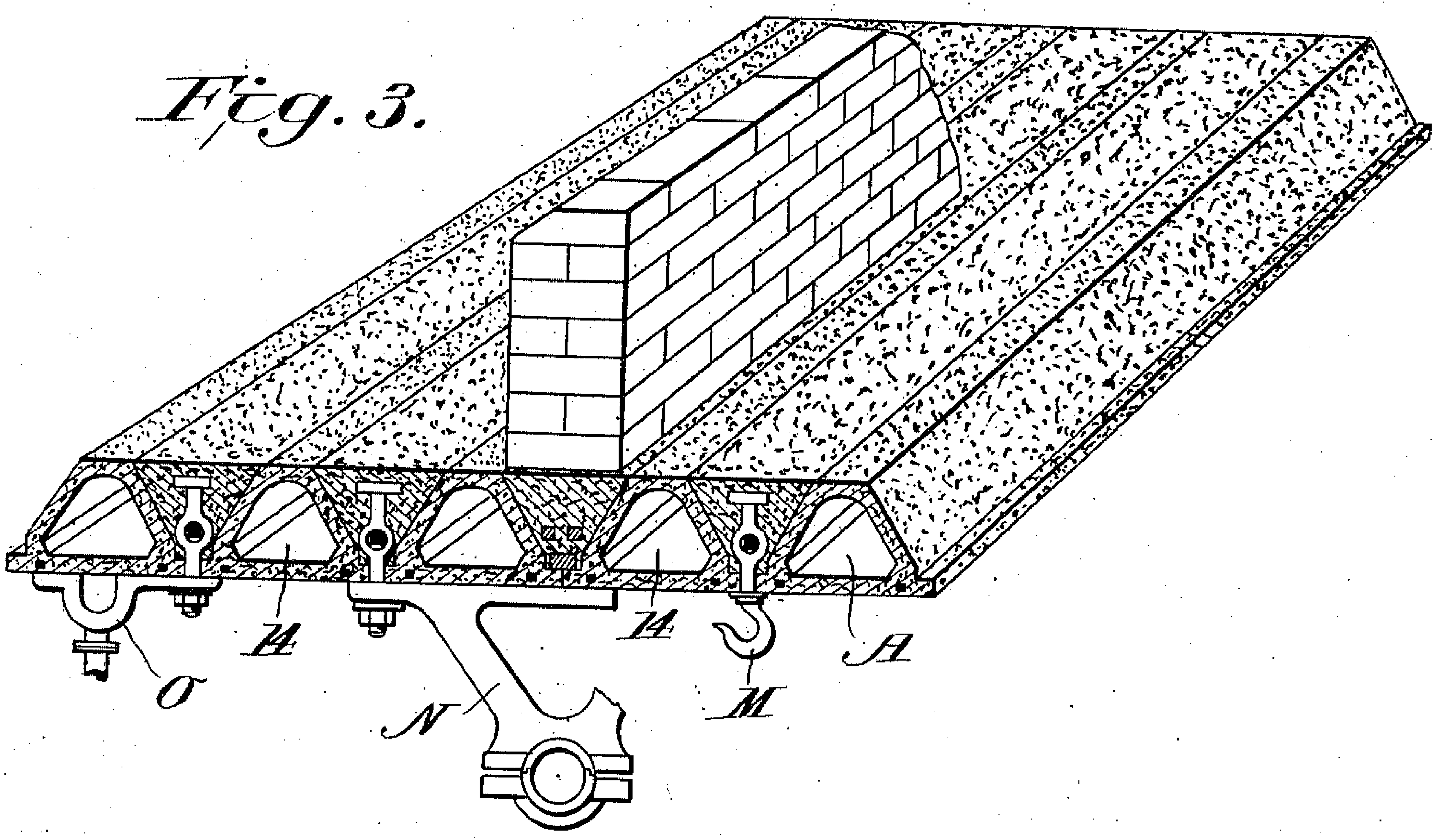



Fig. 4.

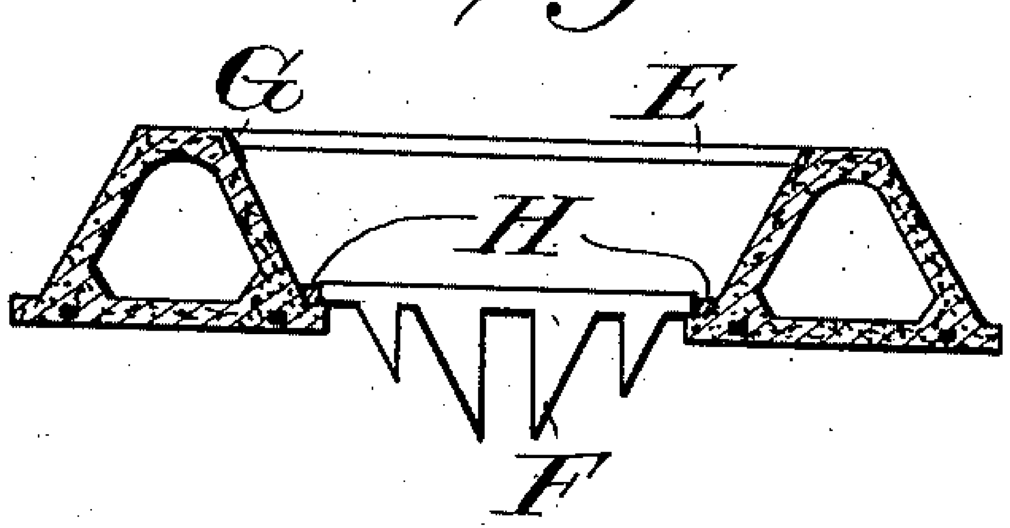



Fig. 5.

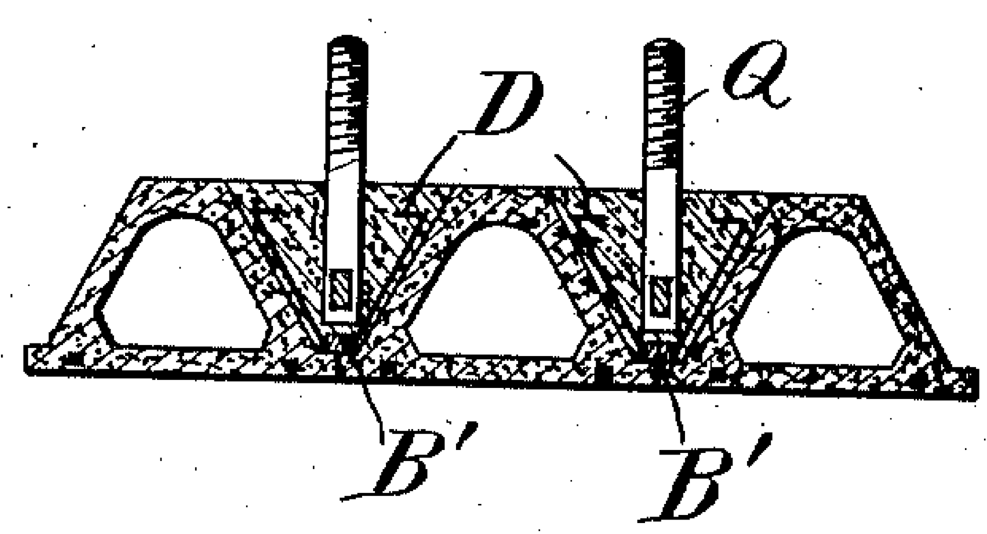
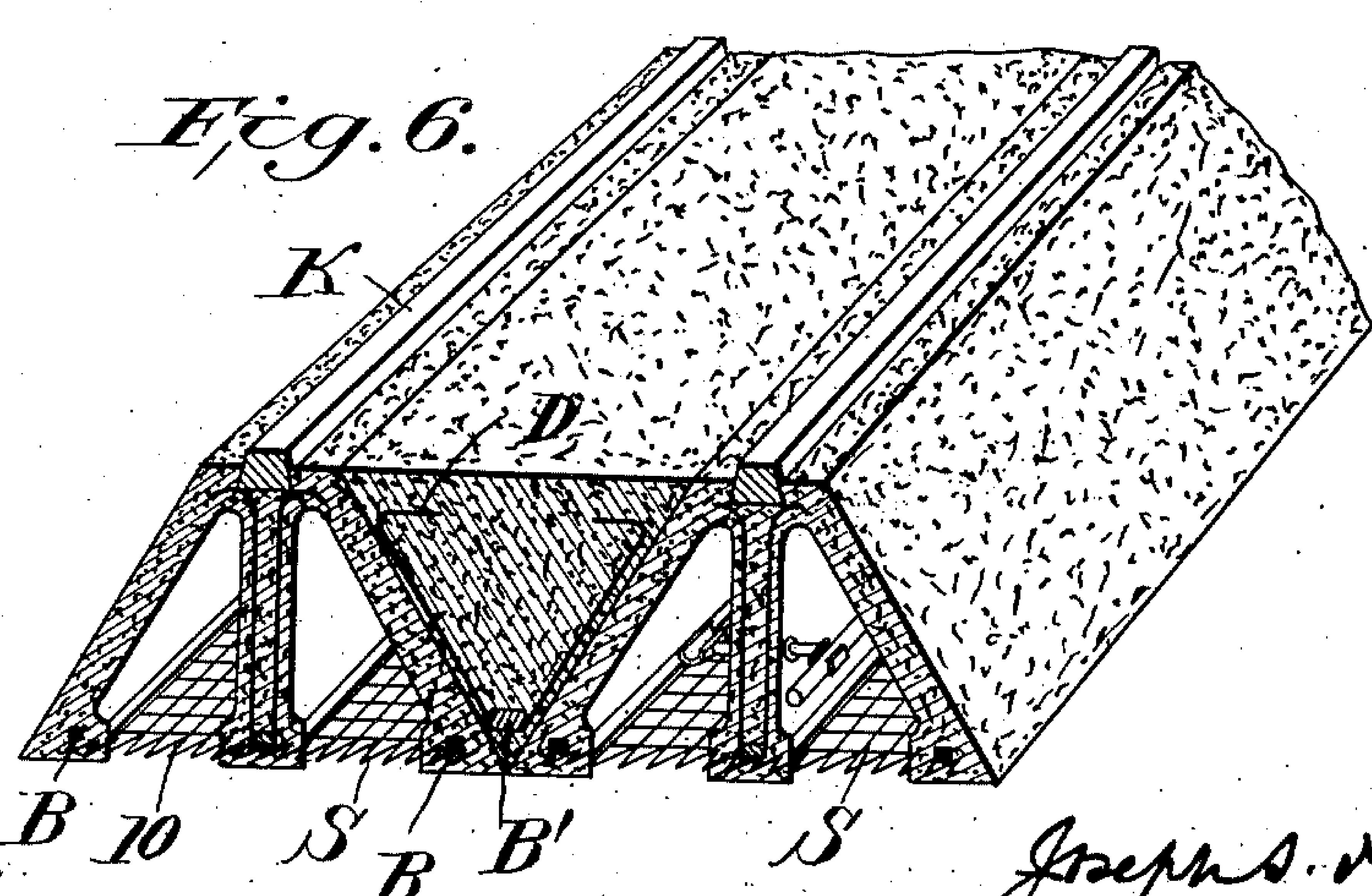



Fig. 6.




Witnesses

C. H. Walker.

R. I. Hulsizer

Inventor

Joseph S. Hagan

By Byrnes Townsend & Brickenstein

Attorneys

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3 SHEETS—SHEET 3.

Fig. 7.

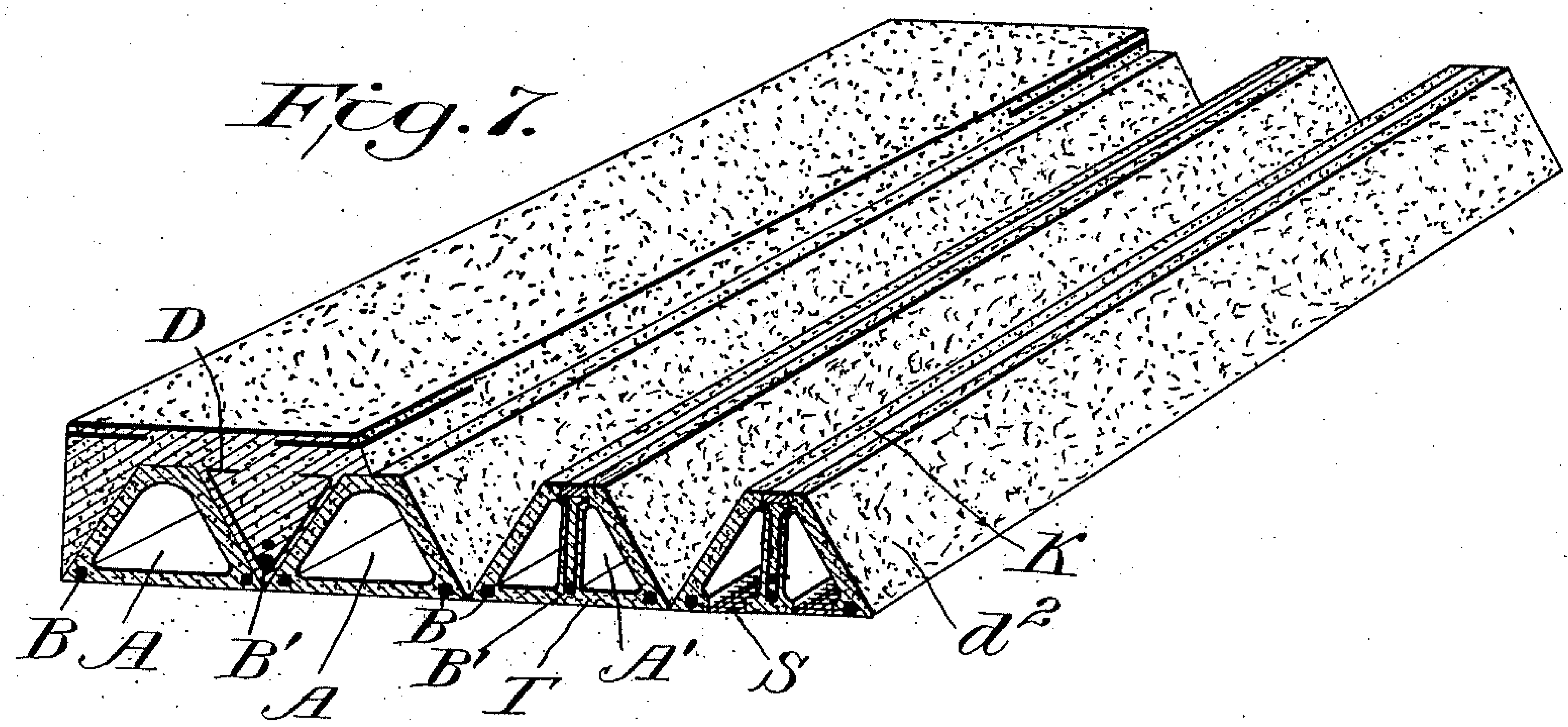



Fig. 8.

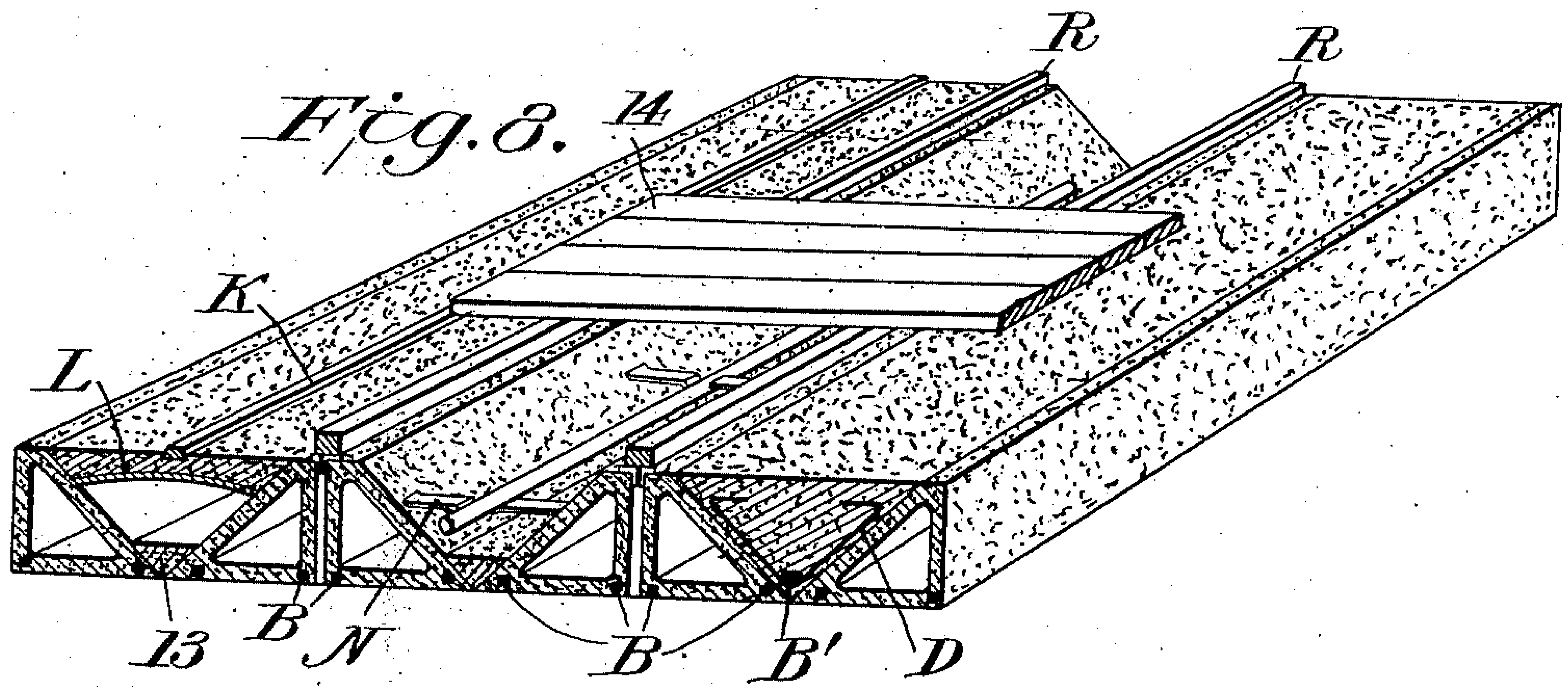
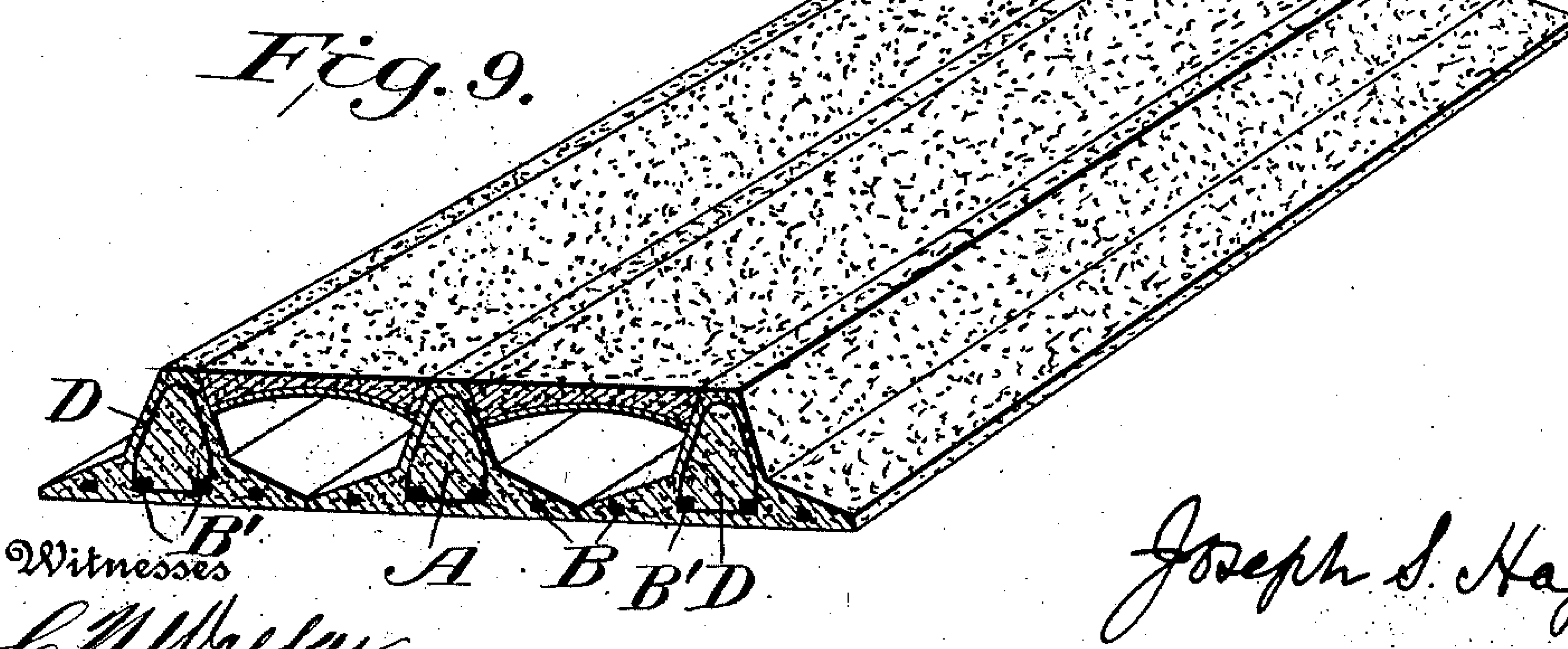



Fig. 9.




Witnesses

C. W. Waltar.

R. I. Hulsizer

Inventor

Joseph S. Hagan

By Byrnes Townsend & Brickenstein

Attorneys

# UNITED STATES PATENT OFFICE.

JOSEPH S. HAGAN, OF BUENOS AYRES, ARGENTINA.

CONCRETE FLOOR.

985,165. Specification of Letters Patent. Patented Feb. 28, 1911.

Application filed July 16, 1908. Serial No. 443,924.

*To all whom it may concern:*

Be it known that I, JOSEPH S. HAGAN, a citizen of the United States of America, residing at Esmeralda 552, Buenos Ayres, Argentina, have invented new and useful Improvements in Concrete Floors, of which the following is a specification.

Concrete floor construction as at present designed is either monolithic by the use of expensive wooden forms with columns, etc., to support them until the concrete has attained sufficient strength to support its own dead and certain superimposed weights, and solid or hollow reinforced strips or slabs made at some point distant from the building for which they are designed.

To obviate the expensive forms necessary in monolithic construction and, at the same time, secure a homogeneous mass, is the object of the present invention.

Heretofore, in unit floor construction, it has been practically impossible to make a true bond between one unit and another, and no means has been afforded to allow of those niceties of steel allotment to the concrete for taking up tensile and shearing strains which monolithic work so admirably affords. It is obvious that if forms can be done away with while at the same time attaining a theoretically monolithic mass in which steel may be inserted at will, that much has been done toward cheapening this most excellent building material, and when, further, that method is a unit system that may be made away from the building in erection, and which floor may have any percentage of steel distributed at will throughout it, and any percentage of hollow space (within certain limits that each individual floor load may necessitate), then that invention should be a notable advancement in cheapening and perfecting a now well established industry. Many and varying conditions affect the strength of floors of this material. The quality of the cement; the coarseness and, especially, the density of the sand; the quality and hardness of the rock, etc. In monolithic work these can be carefully gaged. Stone can be graded the coarsest to the finest and the sand so accurately apportioned to fill the voids that very dense concrete results with greater perfection in the work and a higher modulus of rupture. In unit systems as at present used, these accurate adjustments of steel to tensile and shearing stresses (as well as the proper apportionment of concrete with the maximum of economy and of strength) cannot be attained. The invention herewith described, will, I believe, go far to overcome these difficulties.

One other grave defect in present unit systems is that no true bond can be made between the individual pieces that constitute the floor, from the reason that a sufficient volume of cementing material is not provided for between them. It will be noted that in the present system the heavier volume is cemented to the lighter, the advantage of which is apparent. Again, in most unit systems, as at present designed, mortar only is used; that is to say the mixtures of which the floors are made invariably of cement and sand in the proportions of 1:3, 1:4, 1:5, etc.

It is a fact established that the greater volume of stone that can be enveloped in cement motors of 1:2 1:3 or even 1:4 (maximum density of mass always being kept in mind), the stronger and more homogeneous the resulting slab or stone is. To illustrate, a motor slab of 1 cement to 3 of sand will not have as high a modulus of elasticity nor of rupture as a mixture of 1 cement 2½ sand and 4 well graded trap rock or granite. Apart from the great saving of cement, a mechanical bond exists in true concrete, the irregularities of the broken stone interlocking with the high frictional surfaces of the sand beween them in a manner that is entirely impossible with cement and sand alone. Monolithic concrete affords all these advantages but its cost for small jobs is almost prohibitive. To combine unit adaptability with monolithic advantages has been given much attention and will be found liberally embodied in the present invention.

The invention may be described as being a keystone shaped concrete beam which may be either hollow or solid at the will of the manufacturer. It may be in varying lengths and is destined to span areas from wall to wall or joist to joist in floor and roof construction. Its object principally is to afford a substitute for brick and steel arches, and to cheapen floor construction of the monolithic concrete type while sacrificing none of its fireproof and little of its homogeneous nature.

In the accompanying drawings: Figure 1 is a perspective view of a floor embodying my invention, the end being shown in section; Fig. 2 is a perspective view of a modified form of such floor; Fig. 3 is a perspective view of the floor, showing means for supporting shafting, etc.; Fig. 4 is a view partly in section illustrating the means of inserting slabs of glass into the floor structure; Fig. 5 is a sectional view illustrating the manner of securing bolts into the floor; Fig. 6 is a perspective view illustrating the manner in which a floor having hollow beams may be adapted for ventilating purposes; Fig. $6^B$ is a vertical longitudinal section on the line $a$—$b$ of Fig. 2; Fig. 7, 8 and 9 are perspective views of modified forms of the floor embodying my invention.

Referring to Fig. 1 of the drawing, A designates the basic shape of the beam, which shape however may be modified as circumstances demand, such modification being shown in some of the other figures. B designates light tension bars of steel or iron which are molded in the beam to take up tensile stresses engendered in handling, transporting, placing, etc. As shown the beams A are located edge to edge, and the intervening V-shaped groove is filled with concrete, having at its lower portion the main reinforcing bar B′ which may be of any desired shape or form, its weight and disposition depending entirely upon the weight of the floor and the movement to which it may be subjected. Additional tension bars C arranged as shown in Fig. $6^B$ serve the purpose of taking up shearing strains and some of the tensile strains. Located at intervals along the main reinforcing bar and passing underneath it are steel stirrups D which are designed both for reinforcing against shear and to prevent bursting strains in the sides of the hollow beams. These stirrups D may be of various shapes as shown in Figs. 1, 2, 7 and 8. It will be apparent from the drawing and explanation so far given that this unit system of beams enables the designer to apportion and allot steel as the circumstances demand and also that the hollow beams when placed side by side constitute perfect forms for the filling in of true concrete of whatever composition the engineer may select. The shape assures a perfect covering throughout the extension of the beam and thus a perfect bond is secured. The bearing surface of the weakest member, the hollow beam, is reduced to a minimum and the sides reinforced against collapse by the steel stirrups D.

In Fig. 2 the beams are shown as provided at each of their lower edges with laterally extending flanges, thereby providing a larger recess for the insertion of the reinforcing bars B′, C.

Referring to Fig. 3, the floor illustrated is of substantially the same construction as that shown in Fig. 2, but is provided with various means embedded in the floor for supporting hooks M or brackets N, O, for shafting, piping, etc.

Fig. 4 illustrates the manner of inserting a slab of wire glass E between two of the beams, a light-distributing prism F being arranged at the lower portion of the V-shaped opening between the beams. It is obvious that if heavy armored glass can be used as shown to support the loading stresses, that the light distributers F are protected from dirt and danger of breakage and are located at the most advantageous position in the floor. In case of fire the reinforced glass E may be depended upon (within certain temperatures) to prevent the spread of flames to the floor above. G and H afford beveled joints that may be calked and cemented to make them water-tight. The intervening space between the glasses E and F will act as a non-conductor of heat and cold.

Fig. 5 illustrates a means by which bolts Q may be inserted in the floor for the purpose of securing machinery, newels and banisters.

Fig. 6 illustrates the manner in which these beams may be used for ventilation. In this form of construction a central longitudinally extending web 10 is provided, the lower portion of the beam being left open except for a covering of expanded metal or metal mesh S of any description which may be molded into the beam as shown. Pipes 11 may be located within the hollow portions of the beam and serve to convey away the hot air or gases arising from the room beneath.

Fig. $6^B$ illustrates the method of suspending the tension members upon I-beams and also the manner of suspending the tension bars in the stirrups as well as the arrangement of the tension and shear bars and stirrups with reference to each other.

As shown in Fig. 7 two of the beams are provided with a central longitudinal bar or rib which assures a sufficient quantity of concrete to contain the reinforcing bars B′. As shown one of these bars A′ has a concrete base T, while another $A^2$ is shown as provided with an expanded metal bottom S. On the upper surface nailing strips K of wood are inserted, to which strips the floor can be directly nailed.

In Fig. 8 the beam, while still retaining its general keystone shape is divided in the middle vertically and the two resulting units when placed back to back reform the original but with a double ribbed center. It will be noted that these units are placed horizontally side by side, leaving channels between them which may be partially or wholly filled with concrete and steel. Nailing strips J, K, may be secured into the concrete filling as shown, the floor boards 14 being nailed directly to these strips. Templets L may be inserted in the upper surface of the V-shaped groove between the beams, and may be covered with concrete as shown, while the lower portion of the V-shaped groove may be provided with a triangular shaped filling of concrete 13. One of the channels between the beams may be used for piping U supported on bars V, as shown.

In Fig. 9 is illustrated a solid beam with its lower edge extended in flanges to afford a larger percentage of hollow space, together with a greater mass of concrete in which to embed the reinforcing bars. Templets L may also be used in this form and covered with concrete.

I claim:

1. A hollow concrete beam, keystone-shaped in cross-section, and having a central flat-sided longitudinally extending web, and tension reinforcing members embedded in the concrete of the web.

2. A hollow concrete beam, keystone-shaped in cross-section, and having a central longitudinally extending web, and a metal mesh bottom having its edge embedded in the sides of the beam.

3. A compound hollow concrete beam, keystone-shaped in cross-section, said beam being formed of two juxtaposed hollow sections substantially triangular in cross-section, with tension members embedded in the concrete of the adjacent sides.

4. A floor composed of two sets of elements, viz: (1) parallel reinforced concrete beams of keystone shape in cross section, comparatively narrow at the top and having their lower edges adjacent to each other so that V-shaped grooves are formed between the beams; and (2) complementary masses of concrete filling the grooves between and bonded to the beams, such masses themselves forming substantial weight-supporting elements and having reinforcing bars embedded in their lower portions.

5. A floor composed of two sets of elements, viz: (1) parallel reinforced hollow concrete beams of keystone shape in cross section, comparatively narrow at the top and having their lower edges adjacent to each other so that V-shaped grooves are formed between the beams; and (2) complementary masses of concrete filling the grooves between and bonded to the beams, such masses themselves forming substantial weight-supporting elements and having reinforcing bars embedded in their lower portions.

6. A floor composed of two sets of elements, viz: (1) parallel reinforced hollow concrete beams of keystone shape in cross section, comparatively narrow at the top and having their lower edges adjacent to each other so that V-shaped grooves are formed between the beams; and (2) complementary masses of concrete filling the grooves between and bonded to the beams, such masses themselves forming substantial weight-supporting elements and having reinforcing bars and additional reinforcing tension bars embedded in their lower portions.

7. A floor composed of two sets of elements, viz: (1) parallel reinforced hollow concrete beams of keystone shape in cross section, comparatively narrow at the top and having their lower edges adjacent to each other so that V-shaped grooves are formed between the beams; and (2) complementary masses of concrete filling the grooves between and bonded to the beams, such masses themselves forming substantial weight-supporting elements and having reinforcing bars embedded in their lower portions, and stirrup-shaped bars for resisting shearing and bursting strains arranged at intervals along the reinforcing bars.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOSEPH S. HAGAN.

Witnesses:

ENARVAL,
GEO. R. HERRON.