

No. 611,908.

Patented Oct. 4, 1898.

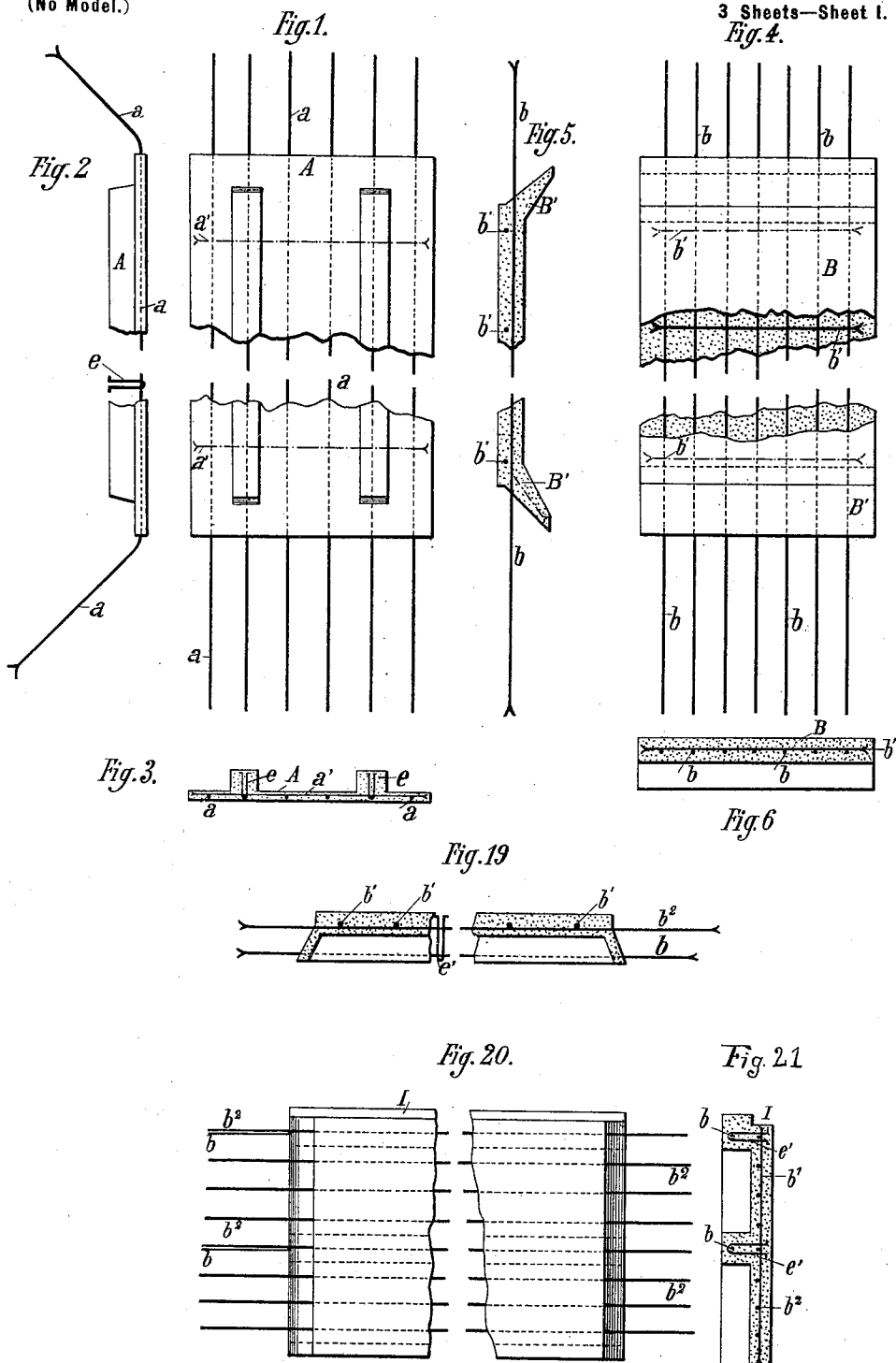
F. HENNEBIQUE.

SYSTEM OF FLOORING OF STRENGTHENED CONCRETE.

(Application filed Dec. 29, 1897.)

(No Model.)

3 Sheets—Sheet I.
Fig. 4.



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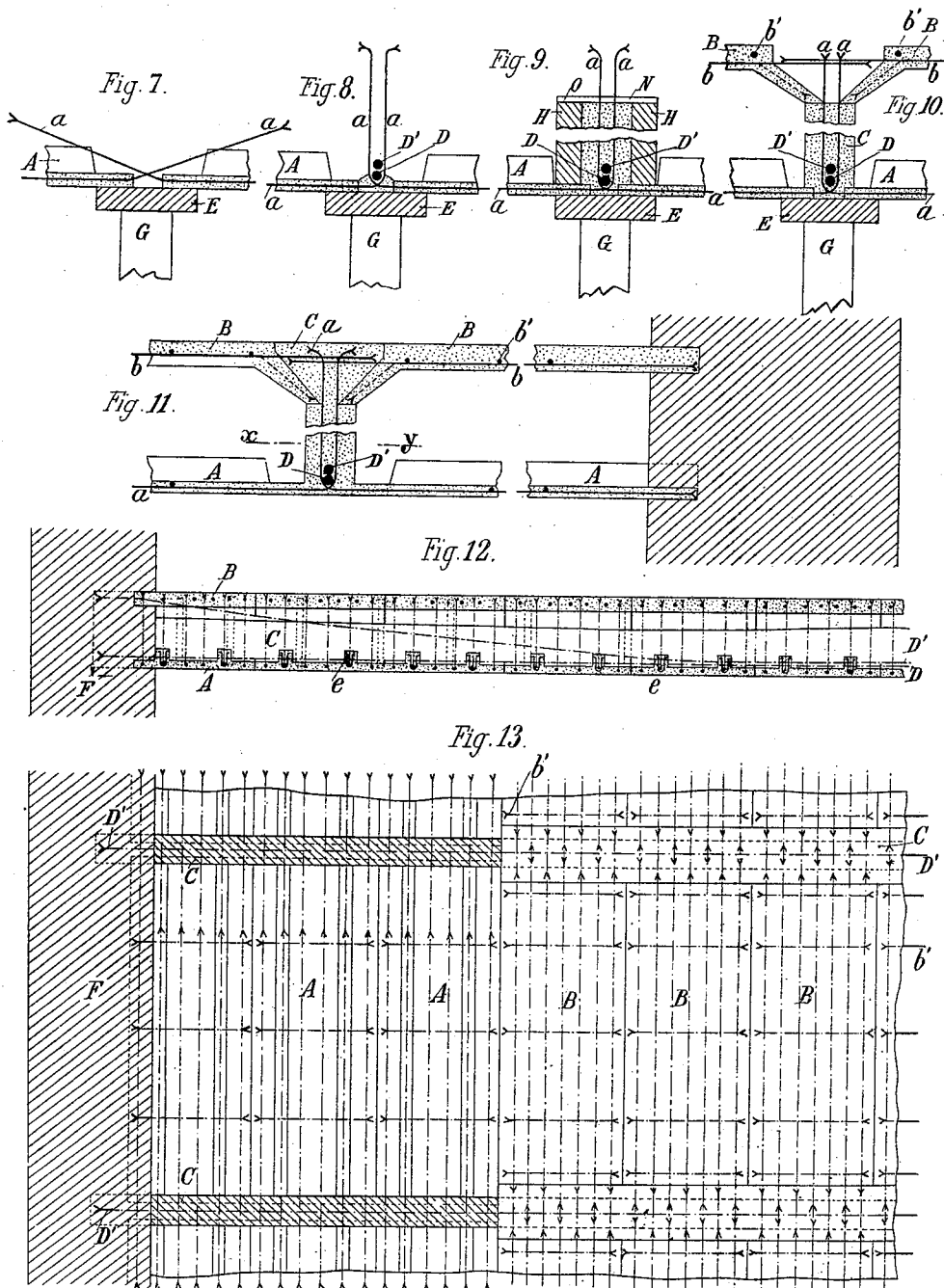
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3 Sheets—Sheet 2.



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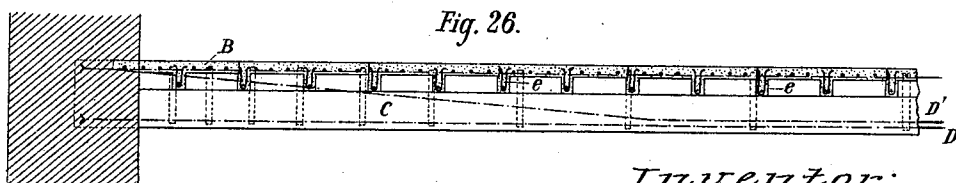
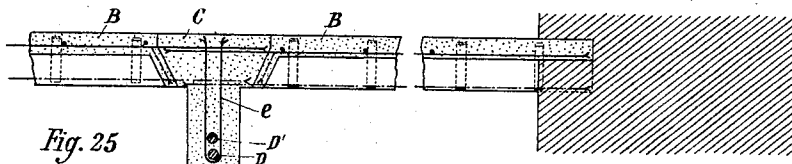
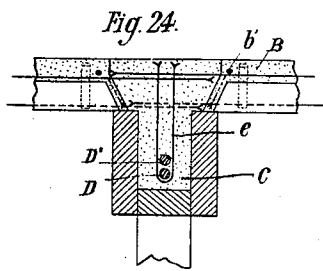
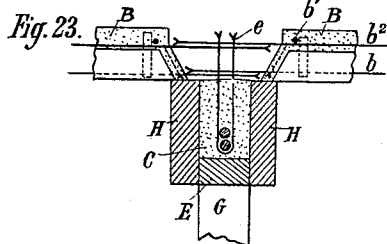
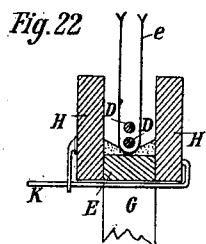
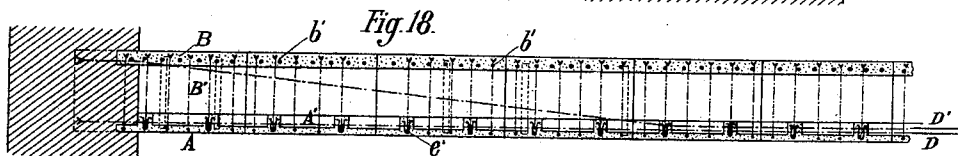
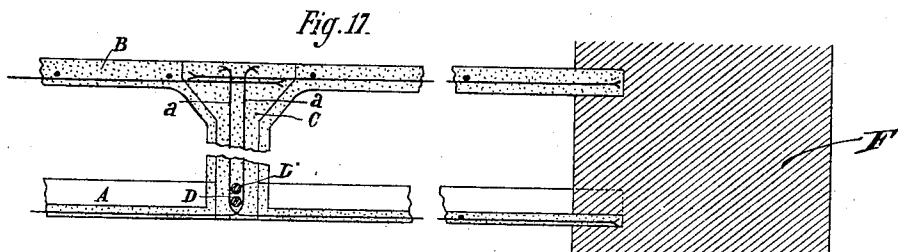
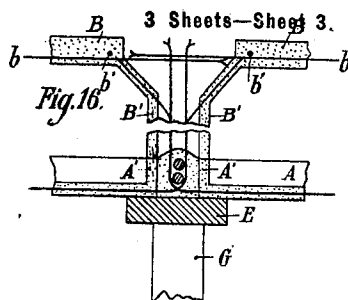
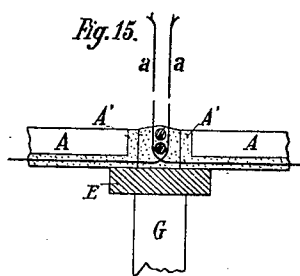
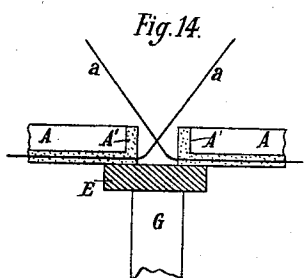
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UNITED STATES PATENT OFFICE.

FRANÇOIS HENNEBIQUE, OF PARIS, FRANCE.

SYSTEM OF FLOORING OF STRENGTHENED CONCRETE.

SPECIFICATION forming part of Letters Patent No. 611,908, dated October 4, 1898.

Application filed December 29, 1897. Serial No. 664,330. (No model.) Patented in France March 18, 1897, No. 265,135.

To all whom it may concern:

Be it known that I, FRANÇOIS HENNEBIQUE, a citizen of the French Republic, residing at Paris, France, have invented certain new and useful Improvements in Systems of Flooring of Strengthened Concrete, of which the following is a specification, this invention having been patented in France under date of March 18, 1897, No. 265,135.

Floors of strengthened concrete have hitherto been made by molding on the spot the flooring as a whole, either as regards the plane horizontal part forming the flooring proper and corresponding to the joists, lathwork, and ceiling-plastering or the beams forming the girders, which rest on the walls and the support-columns. For this object a false flooring is constructed on the surface to be covered, the various parts of which false flooring are arranged to serve as a mold, respectively, for the lathwork and ceiling-joists of strengthened cement or beton. It is only removed from the mold when the ceiling is completely finished.

In order to facilitate the construction and fixing of floorings of strengthened beton and to render such operations more rapid and economical, I make the major part of the floor (all the horizontal part—that is, the flooring proper and the ceiling) by means of light slabs, easily handled and conveyed, molded in advance by the ordinary processes for molding strengthened beton. The iron forming the strengthening part or core of these slabs projects to the desired extent on the same, and these projections are bedded in a suitable manner in the beton of the beams or joists, which are molded on the spot, and they thus form a connection between the slabs and the beams, the latter in turn fastening the slabs together and the whole forming a rigid monolith. Various types of the floorings constructed on these principles are shown in the accompanying drawings.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a plan view, Fig. 2 a side elevation, and Fig. 3 a section, of a lower slab. Figs. 4, 5, and 6 are respectively a plan view, a longitudinal section, and a transverse section, of an upper slab B. Figs. 7, 8, 9, and 10 are detail views illustrating the applica-

tion of the slabs. Fig. 11 is a longitudinal section showing the assembled parts. Fig. 12 is a sectional view of a completed flooring. Fig. 13 is a plan view thereof. Figs. 14, 15, and 16 are detail views showing a modified form of procedure. Fig. 17 is a sectional view of the completed connection. Fig. 18 is a sectional view of the completed flooring of this form. Figs. 19, 20, and 21 are respectively a longitudinal section, plan view, and transverse section, of a slab for simple ceiling construction. Figs. 22, 23, and 24 are detail views illustrating the mode of procedure in this form of flooring. Figs. 25 and 26 are sectional views of the completed floor.

The flooring (shown in detail in Figs. 1 to 13) is formed by a first series of lower slabs A, of strengthened beton, forming the ceiling, and a second series of upper slabs B, forming the flooring proper. The slabs or plates, which are molded beforehand, have a metallic core or strengthening part, the projections of which are bedded in the beton and suitably connected to the cores or strengthenings of the joists C, molded on the spot.

Figs. 1, 2, and 3 show a slab A respectively in plan view, side elevation, and transverse section. These slabs, molded according to the ordinary known process, contain a certain number of iron ribs *a*, which are incorporated longitudinally therein and the ends of which project. Each projection of these iron parts, which is turned up in order to be bedded in a joist or beam C, is in length approximately equal to the height of said joist.

Figs. 4, 5, and 6 represent an upper slab B respectively in plan view, longitudinal section, and transverse section. The core of these previously-molded slabs is formed of a certain number of transverse pieces of iron *b'*, completely buried in beton, and by a series of longitudinal ribs or pieces of iron *b*, the projecting ends of which penetrate horizontally into the beton of a joist C.

In order to form a flooring by means of the prepared slabs A and B, the procedure is as follows: Madriers E are arranged at intervals, carried by walls F and, if necessary, provisional supports G. These madriers are placed at points where the lower slabs abut, their distance from center to center being

thus slightly superior to the length of a slab A. The ends of the slabs are placed on the madrier E, as shown in Fig. 7, leaving between them the width of the base of the girder C. The projecting irons *a* are slightly turned up.

Fig. 8 represents the second stage of the operation, in which the interval between the slabs is filled with beton, forming thus the lower base of the girder C, while bars D and D', which form the tension-chord of the girders, are arranged between the iron bars *a*, which are turned quite upward. The projections of the bars *a* thus form stirrups, which in the girder C connect the chord of tension with the chord of compression. It is evident that the bars D and D' may also be carried by a series of independent stirrups, such as *e*, Fig. 22.

As shown in Fig. 9, planks H are placed longitudinally and edgewise and are held in position and at the desired distance apart by means of boards O and cramps K. (See Fig. 22.) They serve for molding the body of the joist or girder C, which they limit laterally. The interval between the planks H is filled with beton up to the level N. When the beton has set, the planks are withdrawn and the slabs B are placed, as shown in Fig. 10, on the girder-body C thus formed, which slabs are intercrossed by the ends of the iron bars *b*. The intervals between the ends of the slabs B are filled with beton, and the heads of the joists C are thus formed.

Fig. 11 shows the whole when completed in longitudinal section through the slabs A and B and in transverse section of a girder C. The whole A B C—that is to say, the entire flooring—forms, as may easily be seen, a perfectly rigid monolith. A floor is thus formed with interposed air-spaces, such as is shown on a reduced scale in transverse vertical section through the slabs in Fig. 12 and in plan view in Fig. 13. A portion of this plan view is a section on the line *xy* of Fig. 11 and shows the lower slabs A. The bars and rods of iron which form the framework or core are drawn in broken lines. It will be noted that the girders C are formed according to the method described in my previous application. They comprise in their lower part a tension-chord formed of a first horizontal bar D and a second horizontal bar D', Fig. 12, in its central part and raised at its two ends in order to cross the breaking strain.

In the upper slabs B it would be easy to incorporate, if desired, a mosaic pavement. The upper surface of the floor may be polished and lends itself also to various decorative effects. In order to allow of the flooring being still more quickly laid, I can dispense with the planks H by molding slabs A with

a raised edge A', Figs. 14 to 18, and prolonging the beak B' of the slabs B, so that the beak will rest directly onto the projecting surface A'. A simple examination of Figs. 14 to 17 shows the successive stages of the placing of the slabs A and B and the molding of the joists C.

Fig. 18 is a vertical section of the whole flooring.

Figs. 19 to 26 represent a flooring with simple ceiling constructed on the same principles. The slabs B may be formed as shown in detail in Figs. 19, 20, and 21. Each slab is provided on one of its longitudinal sides with a set-off or ridge I, on which the opposite side of the next slab is placed. The metallic core of each slab is formed of a series of longitudinal iron bars *b* and *b*², the projecting ends of which will be incorporated in the beton of the joists C. These iron rods are connected by stirrups of flat straight iron or round iron *e*, Fig. 21. In the flat part of the slab transverse iron bars *b'* are completely incased.

In order to fix the flooring in place, a mold formed of the madrier E and planks H is arranged for each joist C and held by clamps K. After some beton has been poured into the bottom of the mold bars D D', which form the tension-chords of the joists, are inserted or arranged, and the straight independent stirrup-pieces *e*, which connect them, are then placed in position.

Figs. 23, 24, and 25 illustrate sufficiently the successive stages which allow of the flooring being completed, the whole of which is shown in vertical section in Fig. 26.

It is needless to state that the slabs A and B and the joists C need not necessarily have the form which I have given them as an example in the accompanying drawings.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. A flooring of strengthened concrete or the like, comprising the joists and a plurality of slabs having projecting cores embedded in said joists, substantially as described.

2. A flooring comprising ceiling-slabs A provided with lateral projections A' serving as support for beaks B' formed on the flooring-slabs B of the joists the said projections A' and beaks B' being thus adapted to be utilized as lateral walls for molding the joists C substantially as hereinbefore described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

FRANÇOIS HENNEBIQUE.

Witnesses:

EMILE BEST, Jr.,
SUDÉ MORTIERTER.