No. 732,482. PATENTED JUNE 30, 1903.

W. N. WIGHT.

FIREPROOF FLOOR.

APPLICATION FILED JULY 9, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

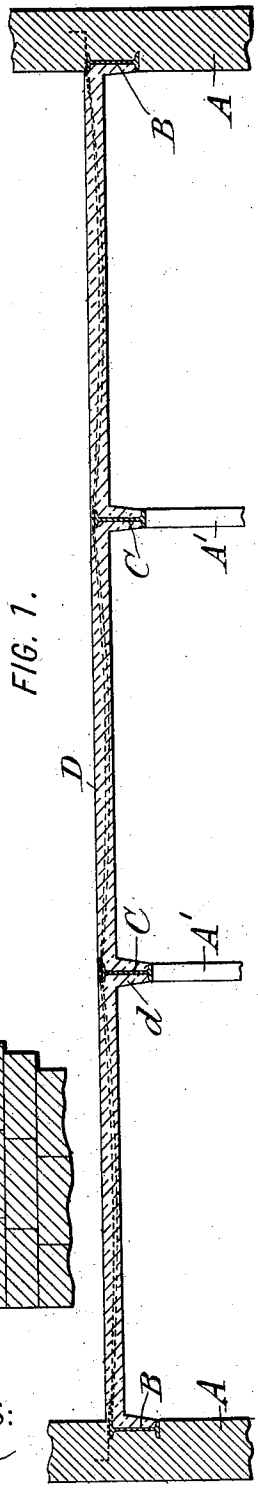


FIG. 1.

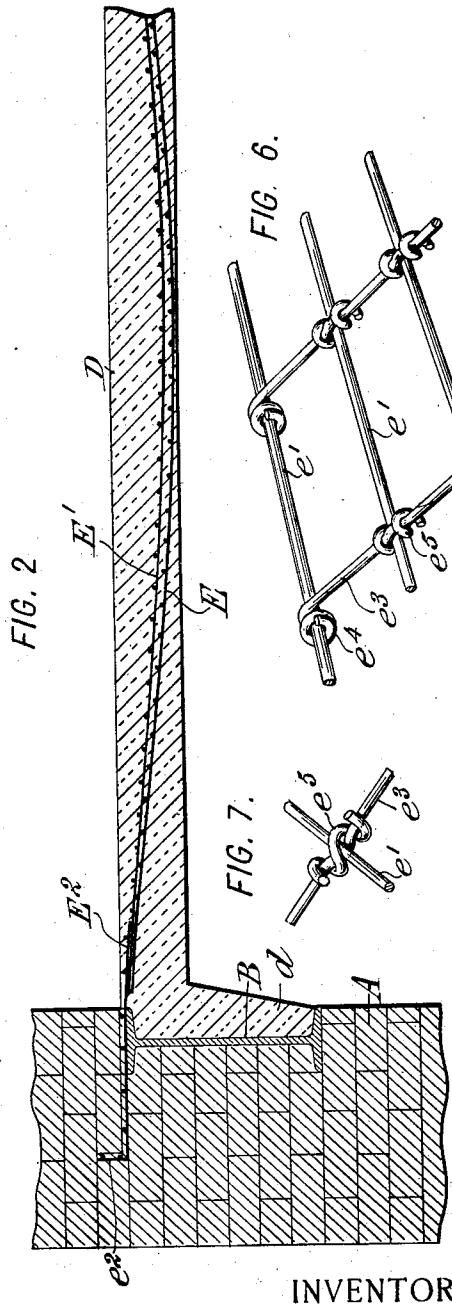


FIG. 2.

FIG. 6.

FIG. 7.

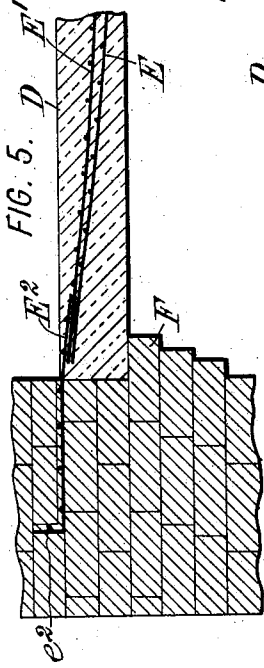


FIG. 5.

WITNESSES:

René Pruine

Fred Whitte

INVENTOR:

William N. Wight,

By Attorneys,

Arthur C. Fraser & Co.

No. 732,482. PATENTED JUNE 30, 1903.

W. N. WIGHT.

FIREPROOF FLOOR.

APPLICATION FILED JULY 9, 1902.

NO MODEL. 3 SHEETS—SHEET 2.

FIG. 4.

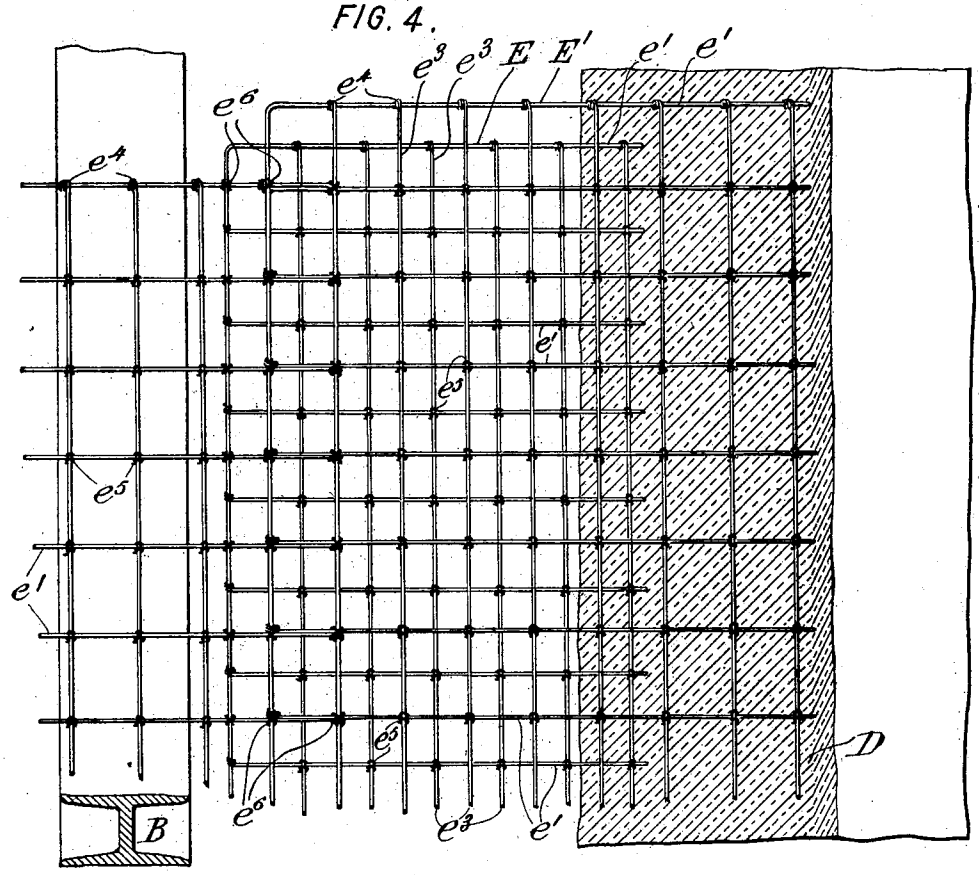
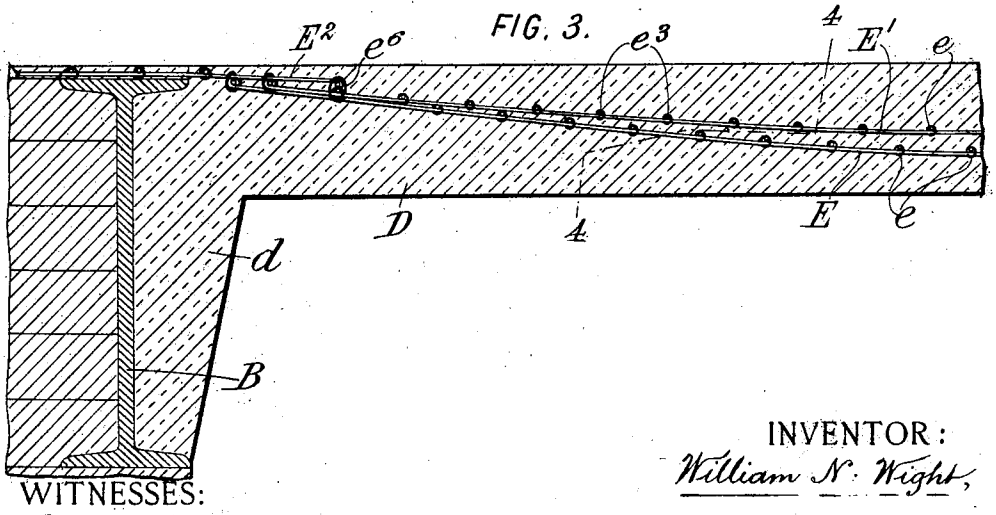


FIG. 3.



WITNESSES:

Rene Bruine.

Fred Whitty

INVENTOR:

William N. Wight,

By Attorneys,

Dickerson & Brown & Co.

No. 732,482. PATENTED JUNE 30, 1903.

W. N. WIGHT.

FIREPROOF FLOOR.

APPLICATION FILED JULY 9, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

FIG. 8.

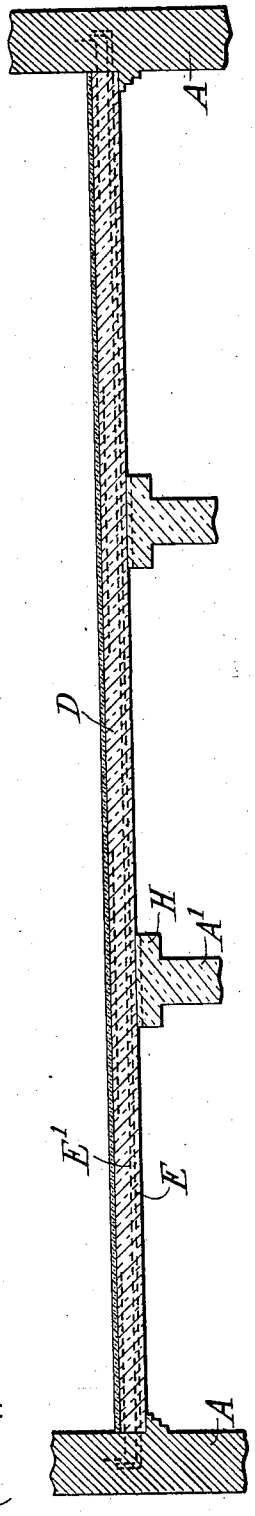
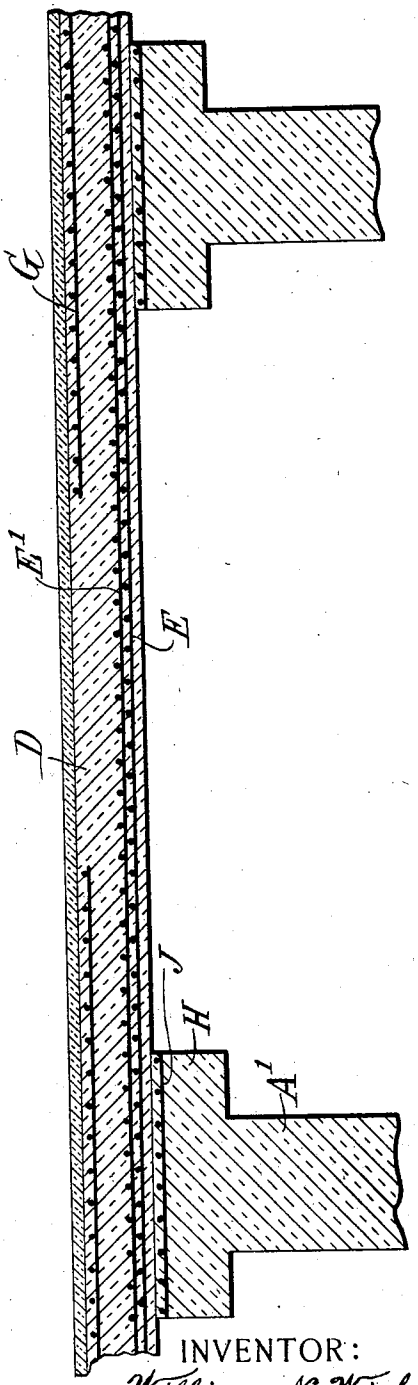


FIG. 9.



WITNESSES:

Fred White

Rem Bruine

INVENTOR:

William N. Wight,

By Attorneys,

Dustin & Gwinn & Co

No. 732,482. Patented June 30, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM N. WIGHT, OF NEW YORK, N. Y.

FIREPROOF FLOOR.

SPECIFICATION forming part of Letters Patent No. 732,482, dated June 30, 1903.

Application filed July 9, 1902. Serial No. 114,868. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM N. WIGHT, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Fireproof Structures, of which the following is a specification.

My invention provides an improved fireproof floor composed of a combination of concrete with embedded metal fabric so arranged that the former takes the compressive and the latter the tensile stresses which occur between the supporting I-beams.

It provides also an arrangement of the strands in the wire fabric employed whereby great tensile strength may be obtained in any fireproof structure and whereby a great span between I-beams and a shallow floor are made possible without sacrificing the strength of the structure.

It provides also a floor having various other points of advantage which are set forth in the following specification.

In the accompanying drawings, showing embodiments of my invention, Figure 1 shows a cross-section of a complete floor built according to my system. Fig. 2 is an enlarged portion of Fig. 1. Figs. 3 and 4 are a cross-section and a plan, partly in section, on 4 4, Fig. 3, showing in detail the arrangement of the wire fabric employed. Fig. 5 is a cross-section of a modification, and Figs. 6 and 7 are details of the fabric viewed from opposite sides. Figs. 8 and 9 are cross-sections of another form of the invention, the latter showing a single bay on an enlarged scale.

In the construction of my improved floor the usual supporting-framework of I-beams and walls is provided. The centering or false work on which the floor is to be molded is arranged in any usual way. Wire fabric of a construction peculiarly suited to the purpose is then hung over the beams and allowed to droop in a catenary between them. Preferably the wire fabric is made in sheets of considerable length and is strung continuously from one wall to the other, as shown in Fig. 1. Preferably, also, it is fastened at the wall end to a short strip of similar fabric embedded in the wall and projecting slightly therefrom. Concrete is then molded about the wire fabric in such shape as to be supported on the lower flanges of the I-beams and to slightly cover the lowest point of the wire fabric. The upper floor-surface is made just high enough to effectually cover the wire fabric where it passes over the upper flanges of the I-beams.

Referring to the drawings, A represents the walls of the building.

A′ represents partitions.

B represents I-beams partly embedded in the wall and forming practically a part thereof.

C represents intermediate I-beams supported only at intervals in the usual way.

D is the concrete body of the flooring, forming substantially a plate or beam between the I-beams and having where deep I-beams are used, as shown, depending end portions *d*, supported at the lower flanges of the I-beams.

The concrete structure described has so little tensile strength that for considerable spans it would require to be made very deep unless reinforced by material having considerable tensile strength and arranged in such a way as to utilize its tensile strength effectually. This reinforcing material I provide as a wire fabric, which in the form of my floor illustrated is disposed in two sheets E E′ and is attached at its ends to short strips of similar fabric E^2, embedded in the wall and preferably having its end e^2 bent into one of the vertical joints of the wall. In order that the tensile stress shall be communicated directly from the load to the I-beam through the wire fabric without being communicated to the concrete and without any yielding by the wire fabric, it is necessary that the wires which extend from I-beam to I-beam shall be without small bends, curves, or projections—that is to say, in a sheet of the fabric when laid flat the wires which are to extend between the I-beams should be perfectly straight. When hung over the I-beams, as shown, they assume the position of a catenary, which is the theoretically perfect curve for the transmission of an average load to the beams; but the catenary is of such slight curvature that for the purpose of preventing injury to the

concrete when the fabric is strained in tension the catenary is equivalent to a straight line.

In structures of the class to which my invention relates much depends upon the material and construction and arrangement of the reinforce. My invention provides a structure in which numerous advantages are secured by reason of the particular construction of reinforce used independently of the specific arrangement of the concrete and of the reinforcing fabric as a whole. The fabric which I propose to use is made of two sets of wires, which for the sake of distinction I call "longitudinal" and "transverse," respectively. These wires are arranged at right angles to each other, and an additional member, constituting a binder, is used to tie them together at their crossing-points, so as in use to maintain the proper spacing thereof and to transmit to one set the strains on the other set. In order that the tensile stress shall be communicated directly from the load to the support through the wire fabric without any yielding by the wire fabric, the wires, at least between their crossing-points, (at which points there is no possibility of stretching,) are straight, (or in catenary curves,) with the advantages above described. Preferably single wires are used, and each set is located wholly on one side or the other, as shown. Such a fabric may be made in continuous long sheets, making possible a larger monolithic area as compared with the short sheets of reinforcing fabric previously used. The fiber stresses are direct and not distorted, as with the twisted wires sometimes used. The joints at the crossing-points are superior to welded joints, since they have not been subjected to the attendant heating and chilling which destroy the superior quality of the drawn steel ordinarily used. Therefore there is no injury at any point of the fabric in the making thereof. No patching or splicing is necessary. When cut, there is no waste, and a new selvage may be easily and quickly formed by bending back the straight single ends cut. It is specially advantageous when used double or triple, as hereinafter explained in detail, has a perfect selvage, and is of equal strength at all points, showing economy in material.

My improved structure is quite distinct from those built according to the well-known Monier system, in which stout rigid bars are separately erected in place and sometimes cross each other and are tied together by fine wires of just sufficient strength to hold them in place until the concrete can be molded around them, but not to take any of the strains to which the finished structure is to be subjected. The fabric in my structure is formed before use in continuous sheets, which facilitates the building of the structure, and the wires thereof being slender and flexible, as distinguished from the stout rigid rods or bars of the Monier system, and being therefore at more frequent intervals, provide a reinforce of great tensile strength and at the same time reduce to a minimum the weakening of the concrete along the lines of the wires and the distortion of the metal under heat and facilitate manipulation of the fabric in use. The fabric in my structure is further distinguished from the Monier reinforcement in having binders not merely of sufficient strength to hold together the heavy reinforcing members proper, but of approximately the same strength as the main wires of the fabric, because in the finished structure, as well as in the forming of the same, they serve to transmit the strains on one set of wires to the wires of the other set, thus distributing each strain over the entire fabric and making all the wires act in conjunction. The heavy binders also form a well-balanced fabric—that is to say, one in which the several elements are well proportioned to each other, so that neither one will give or yield much sooner than the others. They likewise by their stiffness hold the longitudinal wires with a strong frictional grip, so as to prevent the latter slipping through the joint, and they maintain the angle of the two main wires, so as to prevent accidental skewing thereof, a fault frequently observed in other fabrics when used in small sections. They likewise strengthen the fabric to stand the rough usage which it necessarily receives in handling and setting in place if the work is to be done with a fair degree of expedition. An example of such a fabric is shown from opposite sides in Figs. 6 and 7, in which e' represents the longitudinal strands running transversely between the I-beams and preferably from wall to wall, as shown in Fig. 1, and which transmit the main tensile strains to the supporting-framework. For the purpose of spacing these main wires and incidentally taking the secondary stresses which occur in the direction parallel to the I-beams are used wires e^3. At the side wire e' of each separate strip wires e^3 are fastened by being wound around the wire e', as at e^4. At intermediate points the wires e' and e^3 are connected by bending the latter over the former and binding them together—as, for example, by a short wire e^5, wound spirally around the wire e^3 and crossing at its middle point the wire e', as shown best in Fig. 7. With such a fabric the joints along the wall are very easily made, the strands being all locked in connection.

Along the line of the wire fabric the cohesion of the concrete is slightly weakened, and this weakening will depend in a great measure upon the size of the meshes in the wire fabric used. An increase in the number of wires in a given space therefore strengthens the fabric and weakens the concrete if a single fabric be used. I have avoided this difficulty by arranging the metal fabric in two lines, so far separated that the weakness of the concrete along one line will not add to the weakness along the other. At the same time

I have practically increased the number and reduced the size of the meshes by arranging the wires in staggered order. I thereby get as great tensile strength—that is, strength of the metal—as if a single fabric were used with double the number of wires, and as great a compressive strength—that is, strength of the concrete—as if but one sheet of fabric with the large mesh were used. Figs. 3 and 4 show this most clearly, the lower sheet of fabric being indicated at E and the upper sheet at E′, and both the wires e' and e^3 being staggered so as to produce, in effect, a fabric having four meshes in place of the single mesh which exists in each fabric.

The wire fabric is stretched in a continuous sheet across the entire series of beams and from wall to wall, as explained, and thereby tends to convey the stresses not merely to the I-beams immediately adjacent to the load, but to some extent beyond such I-beams and eventually to the side walls of the house. It is necessary, therefore, that it be firmly fastened at its ends, and the arrangement of the ends is shown in detail in Figs. 3 and 4. The short strip of fabric E^2 after being embedded in the wall, as explained above, bears on the top of the I-beam which is within the wall and projects slightly beyond it. The sheets of fabric E′ and E are then attached at their ends by means of short binding-wires e^6. The attachment is most conveniently formed by arranging one of the strips E E′ with its wires substantially coincident with those of the short strip E^2. The wires of the other long strip will of course be staggered with respect to the short strip.

While I have described with great particularity of detail one embodiment of my invention, it will be understood that the same is capable of considerable modification by those skilled in the art without departure from the spirit of my invention. For example, Fig. 5 shows the arrangement which may be adopted where the I-beam in the wall is omitted. In this case the concrete structure D is supported at the end adjacent to the wall on the corbel F. The short strip of fabric E^2 and the two long strips E′ and E are arranged as in the other figures. The I-beams and the depending portion d of the concrete may be arranged as shown in the other figures or in any other suitable manner.

In Figs. 8 and 9 the principle of the invention is shown in application to what is called a "blanket-floor," which is entirely above the supports. This type is used generally for very heavy floors. In these figures I show also the application of the invention to caps on the tops of the supports. The sheets of wire fabric E E′ are preferably embedded in the walls A in Fig. 1 and extend continuously from wall to wall over the supports and through the lower portion of the concrete D. The fabric, however, does not need to be drooped between the supports, since the supports do not extend up into the concrete. As in previous constructions, the straight wires of the fabric extend in a direction between the supports—that is, transversly thereto—and the cross-wires for spacing the straight wires extend parallel to the supports; also, as in the other constructions described, the two sheets of fabric are separated, and the wires thereof are staggered, as indicated in Fig. 9. A feature of improvement which may be used wherever the upper portion of the concrete is above the support and which is especially adapted to blanket-floors is the use of a wire fabric, such as G, to take the tensile stress existing immediately above the supports in the upper layers of concrete. The concrete in such cases forms, in effect, a continuous plate or beam extending over the support, and is therefore strained in tension in its upper layers above the support and in its lower layers between the supports. The arrangement of wire fabric shown therefore provides the most economical arrangement of netting for resisting the stresses. This feature of the invention is applicable also to caps H, of concrete, which may be formed on the partitions or for main supports A′. The upper layers of the caps H are reinforced by a sheet J of fabric. Preferably the sheets G and J are made of the same fabric as the sheets E and E′.

My invention includes also the use of the wire fabric specified in floors in which a plate of concrete extends across only the lower part of a bay between two I-beams, the fabric for this purpose being extended over the I-beams and substantially vertically downward to the necessary level for embedding in the concrete plate. My invention includes also the use of such a fabric embedded in strengthening ribs, beams, or columns, the straight wire running in such case in the direction of the length of the rib, beam, or column.

What I claim, and desire to secure by Letters Patent, are in a floor the following-defined novel features, all substantially as described:

1. In a floor, the combination of supports, concrete molded between said supports, and wire fabric suspended between said supports and embedded in said concrete, said fabric being composed of straight wires in the direction transverse to said supports and cross-wires at right angles to said straight wires spacing the same and bound thereto at the crossing-points.

2. In a floor, the combination of supports, concrete molded between said supports, and wire fabric suspended between said supports and embedded in said concrete, said fabric being composed of straight wires in the direction transverse to said supports, cross-wires at right angles to said straight wires spacing the same, and binding-wires e^5 binding together the straight wires and the cross-wires at their crossing-points.

3. In a floor, the combination of supports, concrete molded between said supports, and

wire fabric suspended between said supports in the form of a catenary and embedded in said concrete, said fabric being composed of straight wires in the direction transverse to said supports and cross-wires spacing said straight wires and bent around the same at the crossing-points, and binding-wires binding together the straight wires and the cross-wires at the crossing-points.

4. In a floor, the combination with a wall and a support, of concrete molded between said wall and said support, and a wire fabric composed of two parts one of which is embedded in said wall and projects slightly therefrom and the other of which is embedded in said concrete, and connected to said first part and comprises straight wires in the direction transverse to the support, and cross-wires spacing said straight wires and bound thereto at the crossing-points.

5. In a floor, the combination with a wall and a support, of concrete molded between said wall and said support, and a wire fabric embedded in said concrete and embedded at one end in said wall, said fabric being composed of straight wires in the direction between said supports, and cross-wires spacing said straight wires.

6. In a floor, the combination of supports, concrete molded between said supports, and sheets of wire fabric embedded in said concrete, said sheets being separated and the wires thereof being staggered.

7. In a floor, the combination of supports, concrete molded between said supports, and sheets of wire fabric embedded in said concrete, said sheets being separated and the wires thereof being staggered, and said fabric being composed of straight wires in the direction transverse to said supports and cross-wires spacing said straight wires.

8. In a floor, the combination with a wall and a support, of concrete molded between said wall and said support, and a sheet of wire fabric embedded in said wall and projecting therefrom, and separated sheets of wire fabric embedded in said concrete with their wires staggered, said separated sheets being connected to said projecting sheet.

9. In a floor, the combination of supports, concrete caps H forming the upper parts of said supports, concrete molded between and over said supports, and wire fabric embedded in said concrete above said supports and in the upper portions of said caps.

10. In a floor, the combination of supports, concrete molded between and over said supports, separated sheets of wire fabric embedded in the lower part of said concrete, and short interrupted sections of wire fabric embedded in the upper part of said concrete above said supports.

11. In a floor, the combination of supports, concrete molded between and above said supports, wire fabric extending between said supports and embedded in said concrete, and wire fabric embedded in the upper part of said concrete at points above said supports.

12. In a floor, the combination of supports, concrete molded between and above said supports, wire fabric extending between said supports and embedded in said concrete, and wire fabric embedded in the upper part of said concrete at points above said supports, said fabric being composed of straight wires in a direction transverse to said supports, and cross-wires for spacing said straight wires.

13. In a floor, the combination of supports, concrete caps H forming the upper parts of said supports, wire fabric embedded in the upper parts of said caps, and a floor-plate carried by said supports.

14. In a floor, the combination of supports, concrete molded between said supports, and wire fabric suspended between and extending continuously over more than two of said supports and embedded in said concrete, said fabric being composed of straight wires in the direction transverse to said supports and cross-wires at right angles to said straight wires spacing the same and bound thereto at the crossing-points.

15. A fireproof structure comprising in combination a concrete body and a wire fabric embedded therein, said fabric being formed in continuous sheets to facilitate the building of the structure and being composed of continuous longitudinal and transverse wires crossing each other at right angles, said wires being slender and flexible (as distinguished from stout rigid bars or rods) and at frequent intervals, so as to obtain a reinforce of great tensile strength and at the same time reduce to a minimum the weakening of the concrete along the lines of the wires and the distortion of the metal under heat and to facilitate the manipulation of the fabric in use, and an additional member constituting a binder of strength approximating that of the wires, binding together said longitudinal and transverse wires at their crossing-points, adapted to maintain the spacing thereof, said wires being straight between their crossing-points.

16. A fireproof stucture comprising in combination a concrete body and a wire fabric embedded therein, said fabric being formed in continuous sheets to facilitate the building of the structure and being composed of continuous longitudinal wires and continuous single transverse wires crossing said longitudinal wires at right angles and located wholly on one side thereof, said wires being slender and flexible (as distinguished from stout rigid bars or rods) and at frequent intervals, so as to obtain a reinforce of great tensile strength and at the same time reduce to a minimum the weakening of the concrete along the lines of the wires and the distortion of the metal under heat and to facilitate the manipulation of the fabric in use, and an additional member constituting a binder of strength approximating that of the wires,

binding together said longitudinal and transverse wires at their crossing-points, adapted to maintain the spacing thereof and to transmit to one set the strain on the other set, said wires being straight between their crossing-points.

17. A fireproof structure comprising in combination a concrete body and a wire fabric embedded therein, said fabric being composed of straight wires in one direction, cross-wires spacing said straight wires and bent around the same at the crossing-points, and additional members constituting binders binding together the straight wires and the cross-wires at the crossing-points.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM N. WIGHT.

Witnesses:
FRED WHITE,
ARTHUR C. FRASER.