R. H. ROBINSON.

COMPOSITE BUILDING FRAME STRUCTURE.

APPLICATION FILED FEB. 17, 1909.

973,815.

Patented Oct. 25, 1910.

Fig. 1.

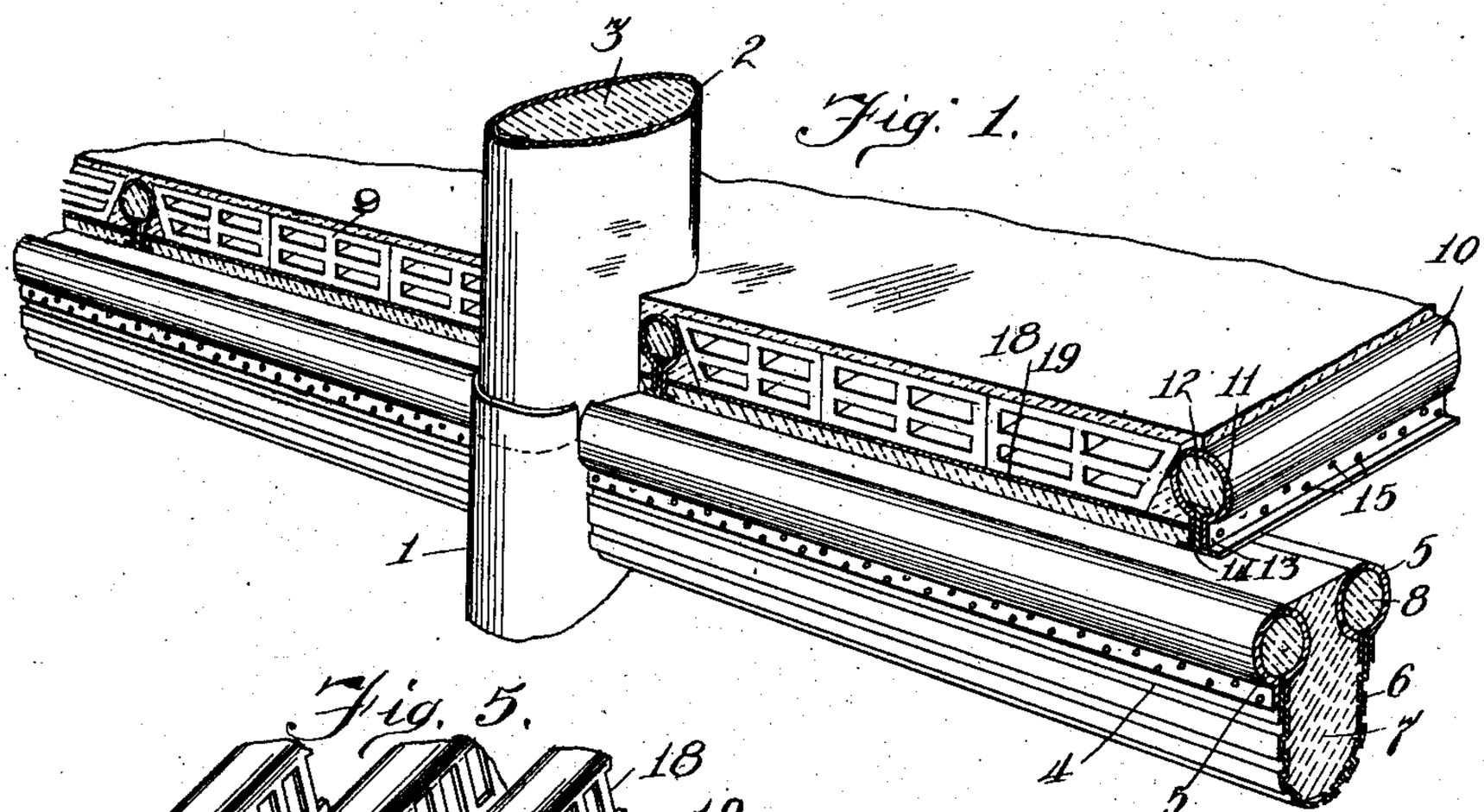

Fig. 5.

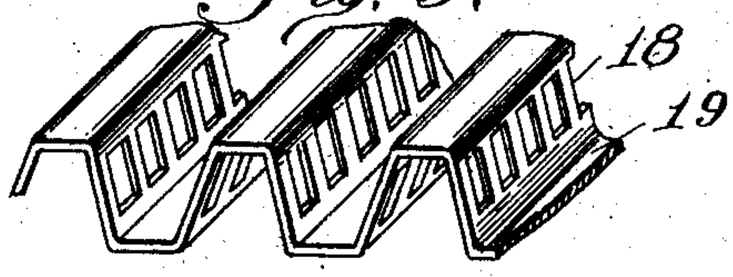

Fig. 2.

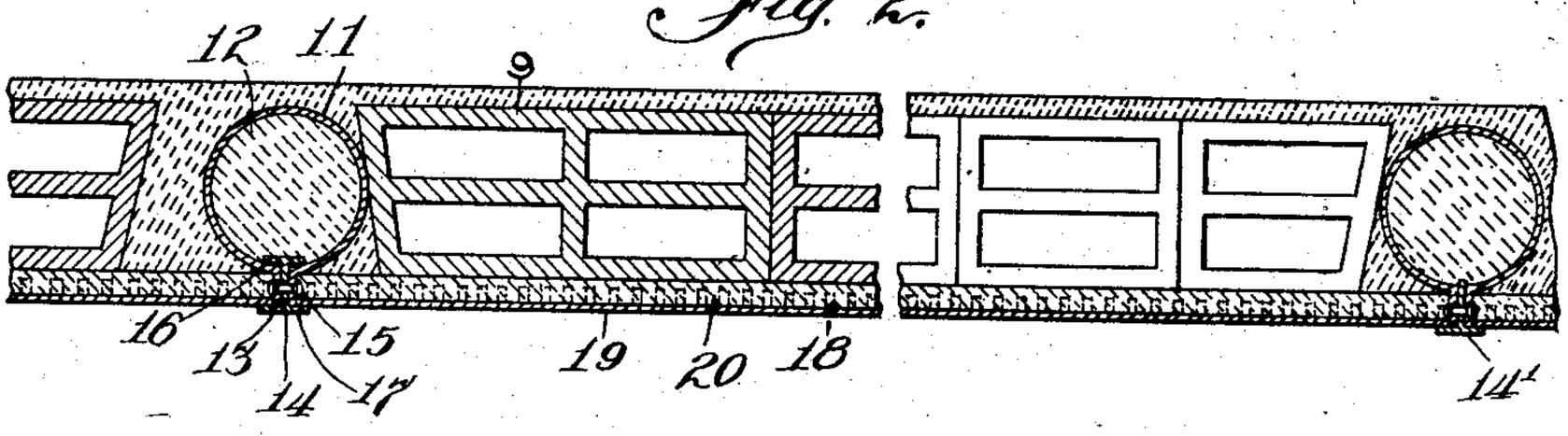

Fig. 3.

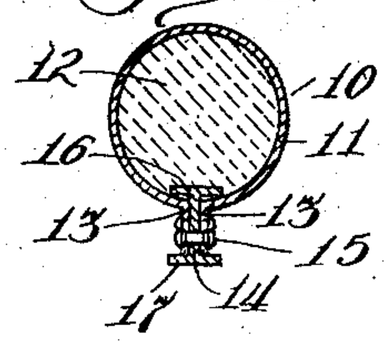

Fig. 4

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COMPOSITE BUILDING-FRAME STRUCTURE.

973,815. Specification of Letters Patent. **Patented Oct. 25, 1910.**

Original application filed January 2, 1908, Serial No. 409,053. Divided and this application filed February 17, 1909. Serial No. 478,490.

To all whom it may concern:

Be it known that I, ROY HENRY ROBINSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Composite Building-Frame Structures, of which the following is a specification.

This specification is a division of an application filed by me January 2, 1908, Serial No. 409,053.

This invention relates to improvements in composite building frame structures, and refers more particularly to a construction of that character wherein the beams or joists are formed of concrete and metal so combined as to obtain the objects of the invention.

Among the salient objects of the invention are to provide a composite beam or joist so constructed that the metallic member constitutes a form or retainer to determine the conformation of the cement and also a metal reinforcement; to provide a construction of the above character in which the metallic reinforcing members are provided along their tension sides with web-like extensions which serve both as strengthening members for the joists and as supporting members for the arches or blocks which together with the joists form the floor construction; to provide in a construction of the above character novel means for reinforcing these web-like extensions; to provide an extremely light but nevertheless strong joist member which is further characterized by its very low cost and suitability for its intended use; and in general to provide an improved construction of the character referred to.

To the above ends the invention consists in the matters hereinafter described, and more particularly pointed out in the appended claims.

In the drawings—Figure 1 is a perspective view showing a fragmentary portion of a pillar, fragmentary portions of two adjoining main stringers or beams, and portions of a floor construction superposed upon the beams and embodying my improved joists; Fig. 2 is an enlarged cross sectional detail of the flooring shown in Fig. 1; Figs. 3 and 4 are cross sectional details of various forms of tubular joists embodying my invention; Fig. 5 is a perspective view of a fragmentary portion of one form of skeletonized metal which may be used to form a permanent centering or under layer of the floor construction.

Referring to the drawings, 1 designates an upright pillar or post consisting of an outer tubular shell 2 and the filling of concrete 3. The post is, however, preferably made in lengths or sections equal to the distance between the stories of the building; the upper section being arranged to telescope a short distance within the lower section, as shown in Fig. 1. To each of these pillars, at opposite sides thereof, is connected a main stringer or beam 4, which in the present instance consists of a pair of tubular stiffening members 5, between which is supported a trough-like container 6 adapted to receive a filling of concrete 7. Each of the stiffening members 5 is also provided with a filling of concrete 8. Inasmuch, however, as the construction of the pillars 1 and the main beams or girders 4 form no part of the present invention, these members need not be described in detail.

Upon the major stringers or girders 4 is supported a formless floor construction consisting essentially of a plurality of skeleton-like tiles or blocks 9 supported between the tubular joists or transversely extending beams 10. The construction of these joists 10 forms the important feature of the present invention. Each of these members consists essentially of a tubular hollow metal container 11 provided with a filling of concrete or other cementitious material 12. This hollow tubular member 11 not only serves as a container to determine the formation of the concrete but also acts as a metal reinforcement for the joists as a whole. Preferably this tubular member 11 is filled in with the concrete before the joist is placed in position although this may not be necessary in all cases.

As a novel feature of the present invention the tubular member 11 of the joist 10 is provided along one or both sides coincident with its vertical axis with web-like reinforcements or flanges 13. In the most efficient form which I have devised I insert a small I-beam reinforcement 14 between the flanges 13 of the tubular member 11, and unite said I-beam and said flanges by a plurality of trough-rivets 15. The upper head 16 of the I-beam extends within the base of the tubular member, as shown in

the drawing, and thus serves to more effectually confine the I-beam in position and at the same time increase the strength of the construction as a whole. The lower head of the I-beam 14 forms a pair of horizontally extending flanges 17, which serve to support the arches or blocks 9 of the floor or ceiling. Preferably these flange-like reinforcements just described extend along the tension side of the joist.

Where considerable strength is required, but not so much as to demand the I-beam reinforcement 14, I may substitute a reinforcement of inverted T-shape in cross section, as indicated at 14′ at the right-hand end of Fig. 2. In some instances I form arch-supporting flanges as continuations of the lateral edges of the sheet metal container 11, as shown at 17′ in Fig. 4, and in this manner dispense with the insert of rolled or fabricated structural metal. Such a modification is shown in Fig. 4.

Before laying the tiles or blocks 9, a metal reinforcement 18, which is preferably in the form of a corrugated and skeletonized or expanded sheet, (see Fig. 5) is laid across from the flange 17 of one joist to the flange of the next, as indicated at 19 in Fig. 2, and this metal reinforcement is covered and embedded into a relatively thin layer of concrete or cement 20, which is allowed to set and harden before the tiles are placed in position. This forms a preliminary support or floor which entirely dispenses with the usual "centering" or temporary scaffolding commonly used for building such tile or composite floor arches upon. Subsequently a bed of concrete is provided upon which the tiles are laid, and the tiles are thereafter covered with a layer of concrete or cement, all as indicated in Fig. 2.

It is here to be noted that the tubular sheet metal member 11 may be of any desired cross sectional form, and that the web-like reinforcement and supporting flanges may be either integral with the tubular container, or may be otherwise secured to the latter, for example, as is shown in the various modifications.

The composite beam of the present invention is characterized by great economy in cost of manufacture, great strength and reliability under the duties to which a structural beam is ordinarily subjected, and convenient in the matter of manufacture, in testing of defects and in assembling into a structural frame. By reason of the fact that the steel jacket member is tubular and of such construction that it serves as a container which will hold the concrete while plastic, it obviously is very convenient of construction and may be filled with great uniformity, since the concrete may, if desired, be filled in under pressure. The jacketing, inasmuch as it is circumferentially continuous, forms a constrictor element which encircles the concrete, thus greatly augmenting the compressive strength of the latter. Moreover, in addition to thus serving as a constrictor element it obviously joins the reinforcing tension metallic member to the beam in such manner as to form a practically unitary beam, and inasmuch as this tension member is located remote from the compression side of the beam, it is obvious that its tension strength is availed of in the most effective manner. When the beams are constructed at a factory equipped for that purpose it is obvious that they may be readily subjected to a definite flexure test, and any imperfections of construction will readily be disclosed, thus insuring that the builder be supplied with beams of perfect reliability. There are many other advantages inherent in the construction.

While I have herein shown and described a preferred and practical embodiment of my invention, yet it will be understood that the details of construction may be more or less modified without departing from the spirit of the invention.

I claim as my invention:

1. A composite beam, comprising an inner monolithic beam member, an outer circumferentially-continuous metallic jacket united with, and substantially covering, the superficial area of said inner member so as to combine and mutually enhance the strength of both, and a continuous metal reinforcement extending along one side of the jacket member and forming a structural unit with the latter.

2. A pre-formed beam, comprising an inner monolithic compression member, a metal tension member extending throughout the length of said compression member along the tension side of the latter, and a metal constrictor jacket embracing the compression member and structurally uniting the tension and compression members throughout the length of the beam.

3. A composite beam member, comprising a hollow tubular member provided at its lower side with a depending web-like reinforcement having laterally outstanding flanges, and a filling of cementitious material within said tubular member.

4. A composite beam structure, comprising a hollow tubular member provided along its side with an outstanding web-like reinforcement, and a filling of cementitious material within said tubular member.

5. A composite beam structure, comprising a tubular sheet metal member provided along its tension side with a pair of depending web-like reinforcements, a second reinforcing member inserted between said web-like members and secured to the latter, and laterally out-turned flanges upon the lower side of said inserted member.

6. A composite beam structure, comprising a tubular sheet metal member provided along one side with a pair of outstanding web-like reinforcements, a second reinforcing member of substantially I-beam shape in cross section extending between said web-like reinforcements and united to the latter, and a laterally out-turned flange upon said second reinforcing member, and a filling of concrete within said tubular member.

7. A composite beam, comprising an inner monolithic beam member, a circumferentially-continuous metallic jacket coherently united with the superficial area of the inner member, so as to combine and mutually enhance the strength of both, a continuous metal reinforcement extending along the tension side of the jacket member and forming a structural unit with the latter, and a covering of concrete enveloping and united with all of the before mentioned elements.

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Witnesses:
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