Aug. 4, 1936. A. RAFTER 2,049,926

STUD AND RAFTER

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Fig. 1

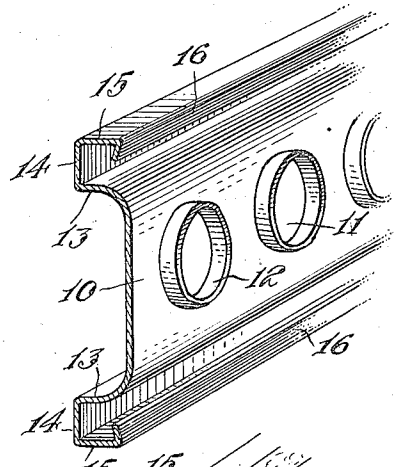


Fig. 3

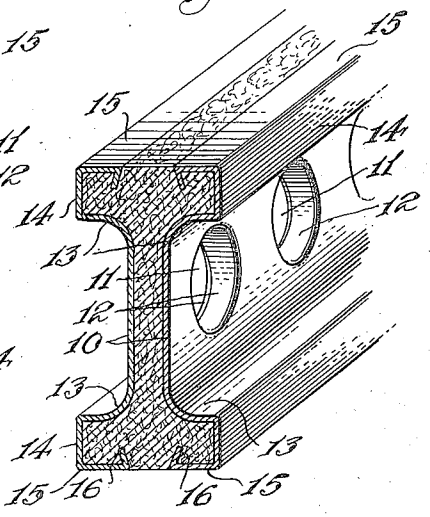


Fig. 2

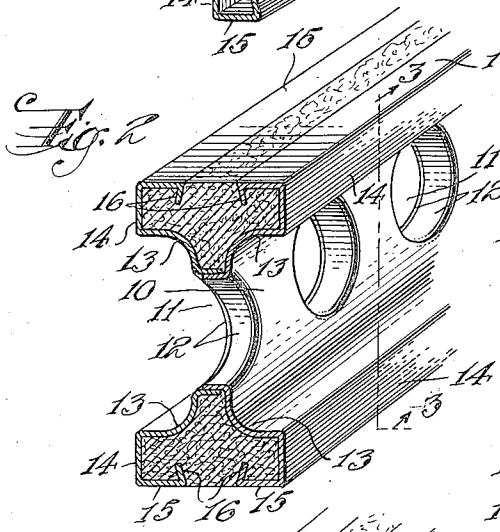


Fig. 10

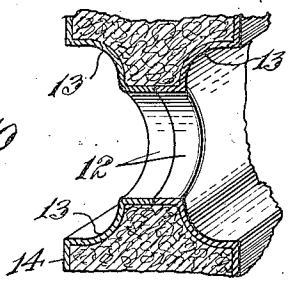
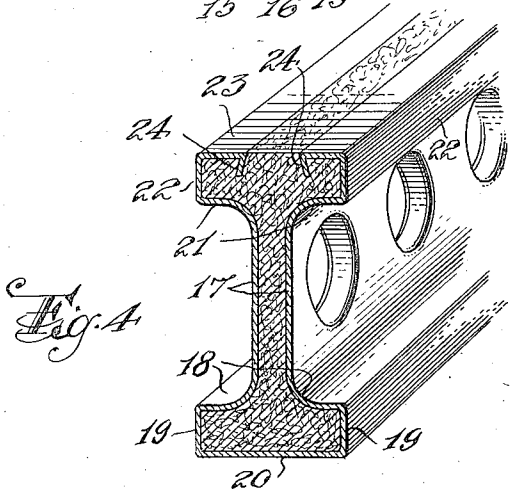


Fig. 4



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Fig. 5

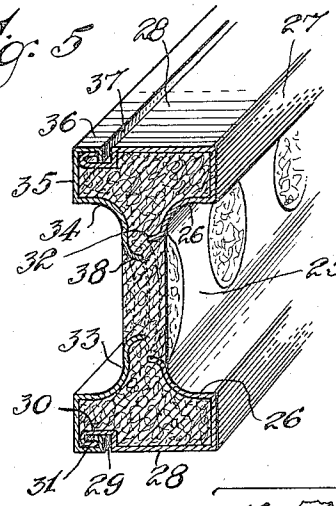


Fig. 6

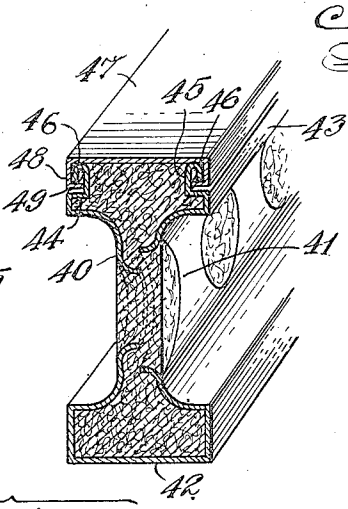


Fig. 7

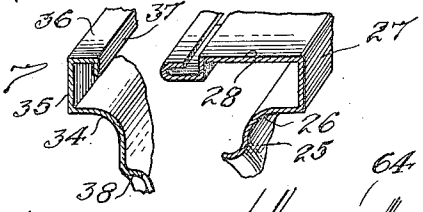


Fig. 8

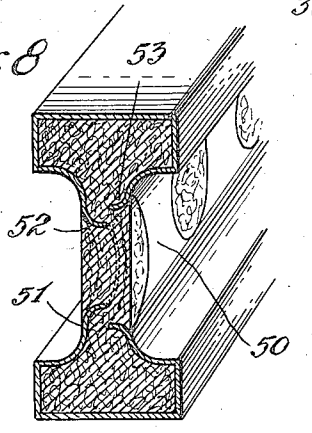
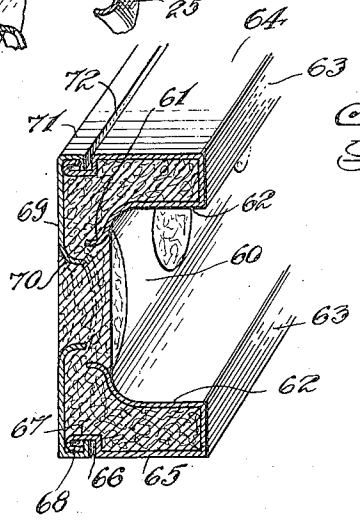


Fig. 9



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Patented Aug. 4, 1936 2,049,926

UNITED STATES PATENT OFFICE

2,049,926

STUD AND RAFTER

Albert Rafter, Glen Ridge, N. J., assignor to Rafter Machine Company, Belleville, N. J., a partnership composed of Albert Rafter and John C. Rafter, Jr.

Application October 22, 1935, Serial No. 46,079

9 Claims. (Cl. 72—60)

This invention relates to improvements in studs and rafters and the like for use in building construction, and more particularly to such studs and rafters which comprise a combination of metallic members in a cementitious material.

In building construction, it has heretofore been the practice to use studs, rafters and beams made of steel because of its great strength and fire resisting qualities. However, insofar as fire resistance is concerned the steel beam is not as effective as is generally believed, for steel is a good conductor of heat, and in the presence of intense heat, the strength of the steel member is considerably decreased which results in many instances in a complete collapse of a building due to buckling, bending and other failures of the steel members.

There also has been used in the construction of small buildings, rafters and studs comprising a cementitious material inserted into a steel casing formed from sheet metal of such thickness as to enable nails and screws to be driven therethrough. Such studs and rafters have been found desirable in that they are light and can be sawed through in the same manner as wood and offer an advantageous substitute for wood in the construction of buildings. However, cementitious studs and rafters as heretofore used have been found objectionable in that when stress is applied to the member, the metal begins to distort before the cementitious material, causing the latter to bow outwardly and subsequently to crumble, thereby greatly depreciating the value of the cementitious building member. Also, it has been necessary to insert the cementitious material into the metal casing in a wet condition and the metal casing prevents complete drying of the cementitious material, which causes deterioration after a period of time.

It is an object of this invention to provide a building member such as a stud or rafter, made of metal and cementitious material, which enables complete drying of the cementitious material and which can be used in substantially the same manner as a wooden rafter or stud, that is, nails can be driven into the member and it can be sawed freely in any direction.

A further object is the provision of a building member comprising cementitious material encased in a metal casing, the latter being formed and arranged in a manner to enable quick drying of the cementitious material and to provide anchoring means which prevents independent distortion of the metal parts and the cementitious material, thereby eliminating the possibilities of crumbling of the cementitious material when stresses are applied to the member.

These and other advantageous objects, which will later appear, are accomplished by the simple and practical construction and arrangement of parts hereinafter described and exhibited in the accompanying drawings, forming part hereof, and in which:

Fig. 1 is a perspective view partly in section of the metal member used in constructing a stud or rafter in accordance with my invention,

Fig. 2 is a perspective view in section of a stud or rafter embodying my invention,

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2,

Fig. 4 is a modified form of the invention in which the metal casing for the building member is made in one piece,

Fig. 5 is a perspective view in section of a further modification of the invention,

Fig. 6 is a perspective view showing a further modification,

Fig. 7 is a perspective view in section showing fragments of the metal member used in the form shown in Fig. 5,

Fig. 8 shows a modified form of casing which is made from a single blank,

Fig. 9 is a perspective view in section of a further modification, and

Fig. 10 is a perspective view in section of a further modification.

Referring to Figs. 1 and 2, the building stud or rafter is shown to comprise a pair of metal members, each of which has a web 10 having a plurality of spaced apertures 11 surrounded by cylindrical inwardly directed flanges 12 integral with said webs. As shown in Fig. 1, the web 10 is directed outwardly at each edge to provide ledges 13 which have portions 14 substantially parallel with the web 10, said portions 14 being provided with inwardly directed flanges 15 at right angles thereto, which in turn have inwardly directed flanges 16 at an acute angle thereto.

Each stud or rafter comprises two metal members as shown in Fig. 1, and the two members are joined together by telescoping the cylindrical flanges 12 of one member into the cylindrical flanges of the other member as shown in Fig. 2 to provide a substantially I beam construction as shown in Fig. 3. After the members have been joined together to form the I beam construction, cementitious material is poured between the members, and due to the spacing of the flanges 15 of adjacent members, a large area is available for allowing the cementitious material to quickly

dry. Heretofore in beams of this type, there was only available the areas at the ends of the beam or stud which was an insufficient area to cause complete drying of the cementitious material.

It will be seen that the cementitious material is permanently anchored to the metal members so that the material moves therewith. When a force is applied on the flanges **15** the flanges will bend downwardly and due to the anchoring of the cementitious material by the cylindrical flanges **12**, the cementitious material will move with the metal members to thereby eliminate the possibility of crumbling as heretofore has been the case in building members of this type.

In Fig. 4 there is shown a stud or rafter in which the metal casing is formed into an I shape from a single blank of metal; the casing is shown to comprise spaced webs **17** which are outwardly directed at the bottom edges thereof to provide ledges **18** having downwardly directed flanges **19**, which are integral with the bottom member **20**. The upper edges of the web **17** are outwardly directed at **21** and then upwardly directed at **22**, the latter parts having inwardly directed flanges **23**, provided with downwardly and inwardly directed flanges **24**.

The structure shown in Fig. 4 is substantially the same as that described in Figs. 1, 2 and 3, with the exception that the metal casing is made from a single blank of metal instead of two parts as shown in Figs. 1, 2 and 3.

In Fig. 5 is shown a modified form of the invention in which the casing is made of two parts. One member of the casing comprises a web **25** which is outwardly directed at each edge thereof to provide ledges **26** which in turn have flanges **27** parallel to the web **25**, said flanges being integral with right-angularly directed portions **28**, each of which has an inwardly directed flange **29**, which in turn has a right angularly directed portion **30** bent back upon itself at **31**. The web **25** is provided with a plurality of spaced apertures, each of which is surrounded by an inwardly directed cylindrical flange **32** integral with the web **25**. Cementitious material is poured into the above described member after which it is covered by a member having a web **33** and outwardly directed portions **34** at each end thereof, which portions are integral with portions **35** parallel to the web, the latter portions having inwardly directed flanges **36** which in turn are provided with downwardly directed flanges **37** engaging the edge of the portions **31**, thereby securely locking the cover member to the member carrying the cementitious material.

The cover member is provided with a plurality of spaced apertures along the center line thereof, each of which is surrounded by an inwardly directed cylindrical flange **38** integral with the web **33**. The flanges **38** are of less diameter than the flanges **32** so that the cementitious material is packed between them. In the completed beam, the cementitious material is allowed to remain in the apertures, if desired, however, should it be necessary for the purpose of passing wires or other instrumentalities through the beam, the cementitious material can be readily knocked out of the aperture without affecting the strength of the beam.

In Fig. 7 there is shown in detail the manner in which parts of the metal casing are formed to enable them to be locked together.

In Fig. 6 there is shown a further modification in which a casing is formed from a single blank of material to provide a web having side walls **40**, **41**, which are provided with a plurality of spaced apertures surrounded by cylindrical, inwardly directed flanges integral with the webs as described in connection with Fig. 5. The bottom **42** of the casing is integral with the webs and the upper part of the casing is open with the side walls **43** thereof bent inwardly at **44** and then upwardly at **45** and then turned back upon itself at **46**. There is positioned on the casing a cover **47** having sides **48** and inturned flanges **49** which engage portions **46**.

In Fig. 8 is shown a beam in which the casing is formed from a single blank of metal bent into an I shape in cross section, and having webs **50** and **51** provided with a plurality of spaced apertures, surrounded by cylindrical inwardly directed flanges **52** and **53**, which flanges are spaced from each other as explained in connection with Fig. 5. The spacing of the cylindrical flanges from each other allows a considerable area to enable rapid and complete drying of the cementitious material in the casing.

In Fig. 9 is shown a further modification in which a web **60** is provided with a plurality of spaced apertures surrounded by cylindrical, inwardly directed flanges **61** integral with the web **60**, said web having its upper and lower edges turned outwardly to provide ledges **62** which are integral with side walls **63** parallel to the web **60**, said side walls being attached to upper walls **64** and bottom walls **65**, each of which has inturned flanges **66** provided with right angular portions **67** which are bent back upon itself at **68**. Cementitious material is poured into the casing thus formed and there is thereby provided a beam of C shape in cross section.

There is then attached to the casing a side cover having a web **69** provided with a plurality of spaced apertures, each of which is surrounded by an inwardly directed cylindrical flange **70** integral with the web **69**, said web having at each edge thereof an inturned flange **71** provided with a downturned portion **72** engaging the portion **68** to secure the cover to the casing.

From the above description it will be seen that there has been provided a building member of cementitious type which can be used as a beam, stud or rafter, which building member has a metal casing so constructed as to enable the rapid drying of cementitious material and preventing relative movement between the cementitious material and the metal parts when forces are applied to the building member. By providing a plurality of spaced apertures along the longitudinal center lines of the webs, and surrounding said apertures with cylindrical flanges integral with the web, the weight of the beam is decreased, at the same time materially increasing the strength thereof by providing more metal at points where it is most needed.

While I have described with reference to Figures 1 to 4 inclusive the cylindrical flanges **12** as telescoping one within the other to hold the parallel members **10** together, a satisfactory beam of greater width may be obtained by making the cylindrical flanges **12** of the web **10** of the same diameter so that they will abut each other as shown in Fig. 10 instead of telescoping. In such a case when the flanges abut each other they can be permanently secured together by means of welding or the like.

While I have described the metal casing as being filled with a cementitious material, an effective beam can also be made by filling the casing

with compressed paper, wall board, wood or the like.

The foregoing disclosure is to be regarded as descriptive and illustrative only, and not as restrictive or limitative of the invention, of which obviously an embodiment may be constructed including many modifications, without departing from the general scope herein indicated and denoted in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a structural member for building construction, a metal casing having a pair of spaced walls provided with a plurality of spaced apertures, inwardly directed cylindrical flanges surrounding said apertures and integral with said walls, the flanges on one wall being positioned within the flanges on the other wall, and cementitious material packed in the casing and surrounding said flanges.

2. In a structural member for building construction, a metal casing of substantially I shape cross section, the web of said I shaped casing comprising a pair of spaced walls having a plurality of spaced apertures along the longitudinal center line thereof, inwardly directed cylindrical flanges integral with said walls and surrounding said apertures, the flanges on one wall telescoping in the flanges of the other wall, and cementitious material packed in the casing and around said flanges.

3. In a structural member for building construction, a metal casing of substantially I shape cross section, said casing being formed from a pair of spaced metal plates having a plurality of spaced apertures along the longitudinal center line thereof, inwardly directed cylindrical flanges surrounding said apertures and integral with said plates, the flanges on one plate being telescopically fitted within the flanges of the other plate to join the plates together, the longitudinal edges of the plates having inwardly directed flanges spaced from each other, and cementitious material packed between said plates and around the cylindrical flanges.

4. In a structural member for building construction, a casing formed from a single sheet of metal bent back upon itself to form a pair of spaced parallel plates having a plurality of spaced apertures along the longitudinal center line thereof, inwardly directed cylindrical flanges surrounding said apertures and integral with said plates, the cylindrical flanges on one of said plates being positioned within and spaced from the cylindrical flanges on the other plate, and cementitious material packed in the casing around said flanges and in said apertures.

5. In a structural member for building construction, a metal casing of substantially I shape cross section having a web formed from a pair of spaced plates provided with a plurality of spaced apertures along the longitudinal center line thereof, inwardly directed cylindrical flanges surrounding said apertures and integral with said plates, the cylindrical flanges on one plate lying within and spaced from the cylindrical flanges on the other plate, and cementitious material packed in the casing and in said apertures and surrounding said cylindrical flanges.

6. In a structural member for building construction, a metal casing having a pair of spaced metal plates provided with a plurality of spaced apertures along the longitudinal center line thereof, inwardly directed cylindrical flanges surrounding said apertures and integral with said plates, the flanges on one plate being telescopically fitted within and attached to the flanges of the other plate to join the plates together, and cementitious material packed within said plates.

7. In a structural member for building construction, a metal casing having a pair of spaced walls provided with a plurality of spaced apertures, inwardly directed cylindrical flanges surrounding said apertures and integral with said walls, the flanges on one wall engaging the flanges on the other wall, and cementitious material packed in the casing and surrounding said flanges.

8. In a structural member for building construction, a metal casing having a pair of spaced walls provided with a plurality of spaced apertures, inwardly directed cylindrical flanges surrounding said apertures and integral with said walls, the flanges on one wall being positioned within the flanges on the other wall, the longitudinal edges of said walls being provided with inwardly directed flanges at right angles thereto, said last mentioned flanges being provided with means for interlocking said walls, and cementitious material packed between said walls and around the cylindrical flanges.

9. In a structural member for building construction, a metal casing of substantially I shape cross section, said casing being formed from a pair of spaced metal plates having a plurality of spaced apertures along the longitudinal center line thereof, inwardly directed cylindrical flanges surrounding said apertures and integral with said plates, the flanges on one plate being telescopically fitted within the flanges of the other plate to join the plates together, the longitudinal edges of the plates having inwardly directed flanges spaced from each other, and cementitious material packed between said plates and around the cylindrical flanges, said inwardly directed flanges having portions thereof extending into said cementitious material.

ALBERT RAFTER.