

Oct. 8, 1957

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2,809,074

STRUCTURAL BEAM WITH FIRE EXTINGUISHER

Filed May 5, 1953

2 Sheets-Sheet 1

Fig. 1.

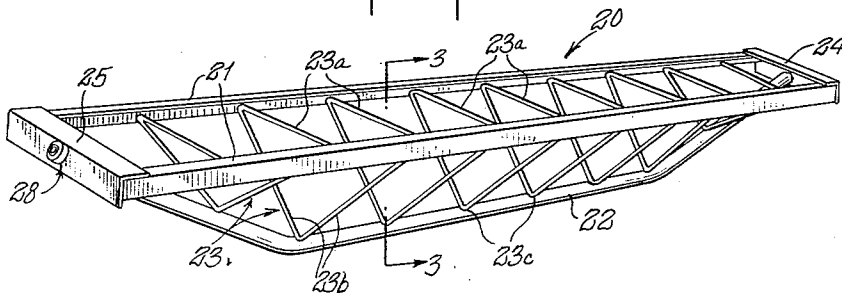


Fig. 2.

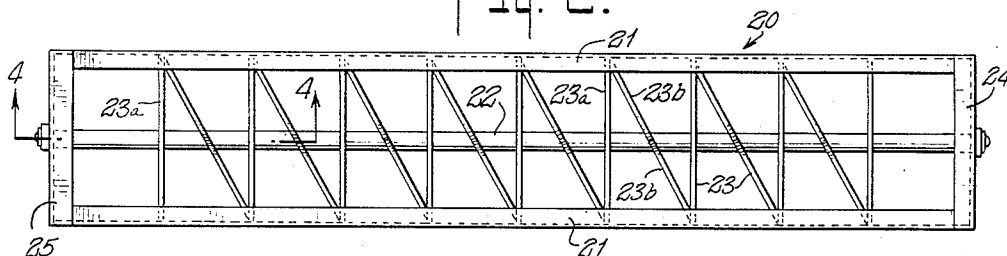


Fig. 4.

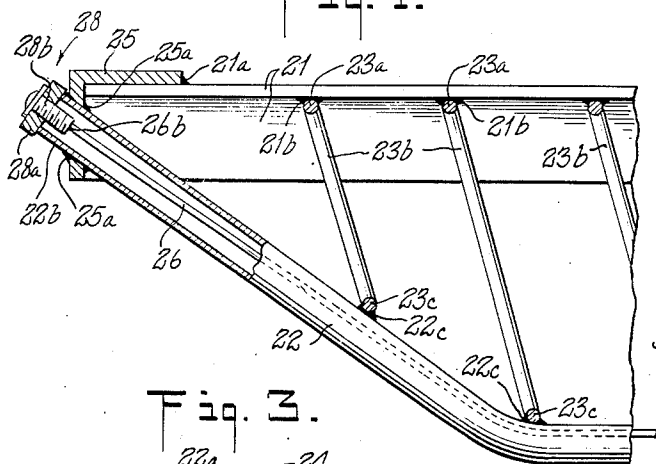


Fig. 3.

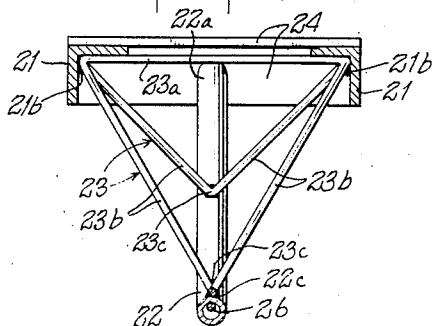
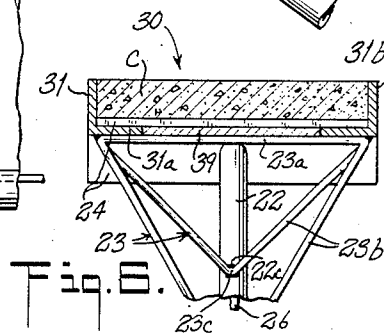
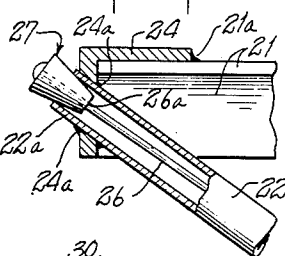


Fig. 5.



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2 Sheets-Sheet 2

Fig. 7.

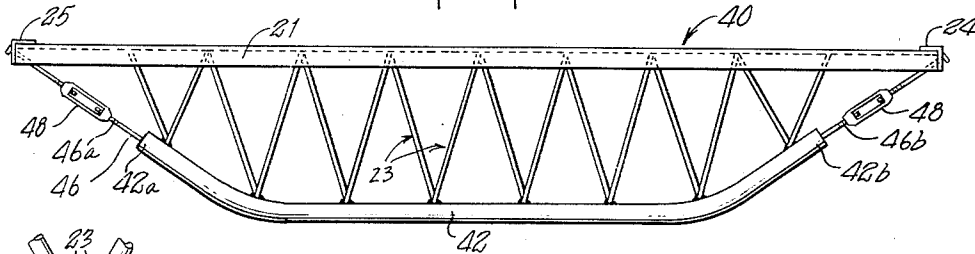


Fig. 8.

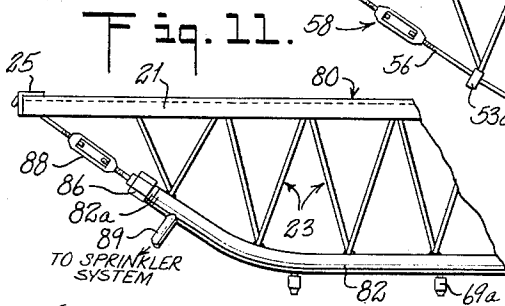
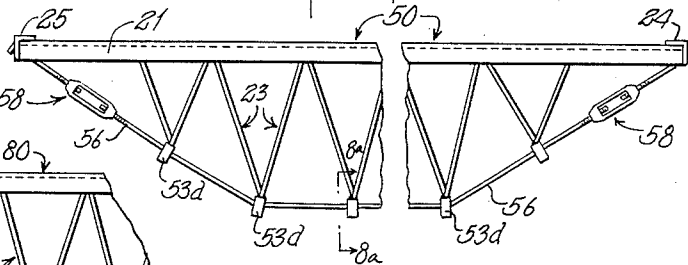


Fig. 9.

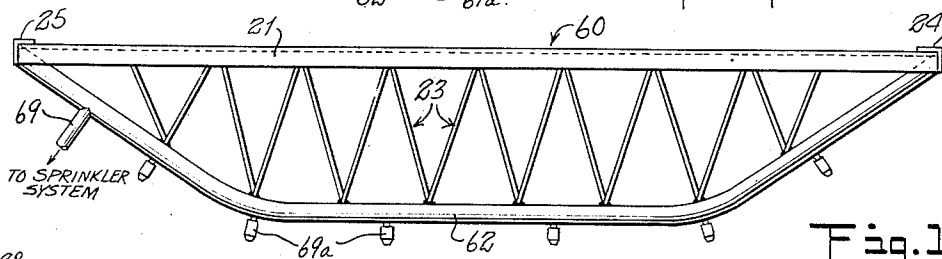


Fig. 10.

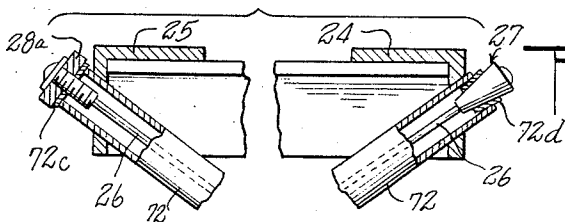
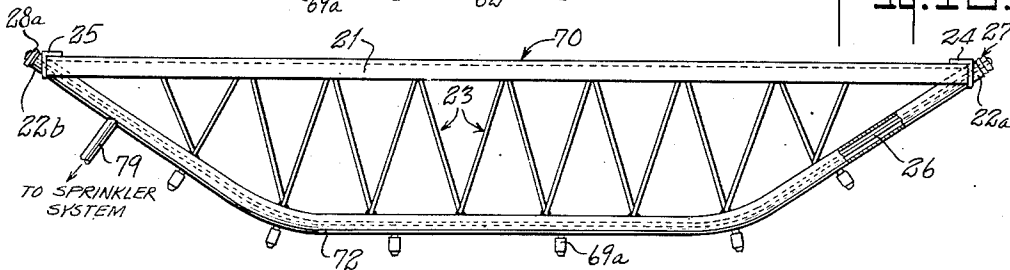


Fig. 10a.

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1

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STRUCTURAL BEAM WITH FIRE EXTINGUISHER

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2 Claims. (Cl. 299—106)

This invention relates to structural units for use in temporary work and permanent constructions and more particularly is directed to joists, beams, girders, trusses and combinations thereof with a floor or ceiling portion forming improved building structural and other service units of light weight, yet having relatively large load carrying capacities.

Among the objects of the invention is to generally improve constructions of the character described which shall comprise few and simple parts that are readily assembled to provide a relatively light weight yet heavy load carrying capacity, which shall to a great extent be capable of being furnished prefabricated or readily assembled in situ, which shall be cheap to manufacture, which shall provide prestressed metallic and composite concrete reinforced structural units capable of being fabricated in quantity production, which structural units may have portions subjected to loading stress serving also as part of a conduit sprinkler fire protection system, and which shall be practical and economical to a high degree in use.

Other objects of the invention will in part be obvious and in part hereinafter pointed out.

The invention, accordingly, consists of features of construction, combinations of elements and arrangements of parts which will be exemplified in the constructions hereinafter described and of which the scope of the application will be indicated in the claims following.

Fig. 1 is a perspective view of an improved metallic floor or roof joist or truss formed with a horizontal load carrying top frame member of angle bar sections downwardly and inwardly disposed and bowed bottom pipe member fitted with prestressing means extending through the latter assembled with interconnecting bracing strut formations to embody the invention.

Fig. 2 is a top plan view of the improved metallic joist shown in Fig. 1.

Fig. 3 is an enlarged cross-sectional view taken on line 3—3 in Fig. 1 showing in detail the disposition of the bracing strut formation with respect to the horizontally extending spaced apart top frame members, and cross angle bar, and the bent bottom pipe member.

Fig. 4 is an enlarged fragmentary view partly broken away to expose an end prestressed take-up tensioning construction as seen from line 4—4 in Fig. 2.

Fig. 5 is an enlarged fragmentary view partly broken away showing the other or anchored end of the prestressing tensioning construction.

Fig. 6 is an enlarged fragmentary cross-sectional view similar to Fig. 3, but showing in detail the disposition of the bracing strut formation in a modified construction of the invention with respect to the horizontally extending spaced apart top frame member arranged in upwardly and inwardly extending position forming an improved composite reinforced concrete prestressed structural unit.

Fig. 7 is a side elevational view of another modified form of a floor or roof joist or truss constructed to embody the invention, which construction is like that shown

2

in Figs. 1 and 2 but has bottom pipe member made shorter and the opposite ends of the tensioning rod provided with turn buckles for prestressing.

Fig. 8 is a further modification of the prestressing feature of the invention in which the bracing strut is provided with cradles or holders in which to seat the tensioning rod.

Fig. 8a is a fragmentary cross-sectional view showing details of the structure taken on line 8—8a in Fig. 8.

Fig. 9 is a side elevational view of another feature of the invention, the construction being like that shown in Figs. 1 and 2, but in which the pipe bottom member is sealed tight and serves as a part of a sprinkler system.

Fig. 10 is a side elevational view of a truss like that shown in Fig. 9 except that the prestressing rod is included.

Fig. 10a is an enlarged fragmentary side elevational view showing the details of the leak-proof type ends under the take-up tensioning nut and the plug anchor, and

Fig. 11 is a fragmentary side elevational view of a truss constructed to embody the invention like that shown in Fig. 7 except that the bottom bent pipe member serves as part of the sprinkler system.

Referring in detail to the drawing, 20 denotes an improved floor or roof joist or truss constructed, as here shown, fabricated of metal, such as, for example, steel, aluminum or other suitable metal or alloy constructed to embody the invention, which as seen in Figs. 1 to 5, may comprise a pair of spaced apart horizontally extending top load carrying portion or frame members 21, a bent bottom pipe member 22 having a down-bulged or bowed mid-section disposed in central relation, that is, in a plane midway between and at right angles to said spaced frame members 21. Bracing member or framing strut 23 is provided to interconnect said load carrying members 21 with the pipe member 22, all secured together in assembly by cross-stretcher bars 24 and 25 terminating opposite ends of said pair of truss frame top members 21.

The improved construction of truss 20 may also be provided with suitable tensioning means through a flexible wire, rope, cable, chain or combination thereof, and, as here shown, a bendable rod 26 is extended through pipe member 22 being anchored at one end 26a at cross-stretcher bar 24 and suitable means for adjusting the tension of rod 26 at the pipe member other end 26b at cross-stretcher bar 25 is provided, as is clear from Figs. 1, 2, 4 and 5.

For simplicity and economy, said top members 21, as shown in Figs. 1 to 6, may be made of suitable down-turned angle bar section stock inwardly facing interconnectingly fitted and welded at 21a to down-turned end cross-stretcher bars 24 and 25 which also may be made of suitable angle section bars disposed to face inwardly.

Opposite ends 22a and 22b of bottom pipe member 22 may be fabricated to project through and terminate beyond end cross-stretcher bars 24 and 25, respectively, said pipe ends 22a and 22b being secured in projected position by welded portions 24a and 25a, respectively, to stretcher bars 24 and 25, respectively, as seen in Figs. 1 to 6.

Framing strut 23 may be constructed of suitable metallic bar or rod material helical-like or zig-zag wound having, as seen in Figs. 1 to 5, a horizontal section 23a of each successive portion thereof spaced a uniform pitch distance apart constructed and arranged to extend in a transverse direction with respect to top frame members 21 substantially at right angles thereto, said framing strut 23 also having angularly extending sections 23b from end portions of section 23a disposed to form down-pointing apices 23c, said horizontal strut sections 23a being secured to top frame members 21 so that the

ends of said angularly disposed sections 23b extend in a straddling relation with respect to the frame members 21, as is clear from Figs. 1, 2, 3 and 5.

Portions of the framing strut 23 between the opposite ends of said horizontal strut section 23a and angularly disposed sections 23b each may be fitted into the reentrant angular shapes of top frame members 21 and welded in position at 21b and said apices 23c each welded at 22c to pipe member 22. Thus, truss 20 forms a rigidly assembled structure from frame members 21, pipe member 22 and cross-stretcher bars 24 and 25, and helical-like framing strut 23 all welded together as above described and as is clear from Figs. 1 to 5.

The improved construction may, through tensioning of rod 26, serve to effectuate a prestress for truss 20 so that the latter is capable of carrying an increased load greater than would otherwise be possible. To that end, said tensioning rod 26 which is incorporated to extend the length within pipe member 22 may have rod end 26a suitably anchored to pipe end 22a at cross-stretcher bar 24 and, as shown in Fig. 5, by a wedging stop 27, and the other rod end 26b adjustably seated against pipe end 22b at cross-stretcher bar 25 by suitable take-up means 28, such as, for example, nut 28a and screw stud 28b fixed to rod end 26b, which on turning of nut 28a provides prestressing forces to truss 20 through pipe member 22.

The utility of truss 20 above described will now be apparent. After providing the pair of said top members 21, bottom pipe member 22 bent into a desired shape to conform to the contour of bracing strut 23 formed in helical-like shape or zig-zag fashion and cross-stretcher bars 24 and 25, truss 20 may be assembled into a rigid metallic structure with welds 21a, 21b and 21c, as described above, for use either as a temporary or permanent building structural unit.

For prestressing tension rod 26 may be provided by threading thereof through pipe member 22, and if said rod 26 is not sufficiently flexible to readily conform to the bent shape of pipe member 22, said rod 26 can be threaded through pipe member 22 before the latter is bent or bowed and then bending both into the desired shape.

The end 26a of rod 26 projecting beyond pipe end 22a and cross-stretcher bar 24 which is securely fitted with wedging anchor stop 27, as shown in Fig. 5, and which has the other end 26b of rod 26 projecting beyond the opposite pipe end 22b and cross-stretcher bar 25 fitted with screw stud 28b of take-up tensioning means 28, can now be adjusted for the desired prestressing effect on truss 20 by simply turning the nut 28a against pipe end 22b. As above stated, truss 20 can then be made to carry more load than a similar truss is capable of without the tension rod 26 cooperating with pipe member 22 and rod 26 adjusted for said desired prestressing effect. Said prestressing effect which is provided before the normal stresses due to the load is applied, therefore, permits a greater or heavier load capacity for improved truss 20.

It appears that the ordinary effect of tension in the truss 20 does not become immediately effective after said prestressing is applied to the rod 26 and pipe member 22. The latter is then under compression and is thus conditioned to compensate for the tensional effect created in the top frame members 21 which normally would have a tendency to straighten out bent bottom pipe member 22 as, for example, would be the case with a conventional bow action for projecting an arrow.

Thus, before the usual tension stress in said pipe member 22 can become effective, the compression created therein by said prestressing must be overcome, that is, reversal of stresses, by a sufficient load which, when increased by additional loads, has said pipe member 22 and rod 26 subjected in cooperation to tension whereby increasing the normal capacity of the prestressed truss 20

for greater loads with less deflection than would be otherwise possible.

With the above described forms of the present invention in which the ordinary and usual stresses are partially reversed, a joist, beam, girder or truss prestressed in the improved construction and arrangement shown are conditioned to safely carry greater loads per pound of metal used than those now being used for similar purposes due fundamentally to the better and novel utilization of the well understood principle in structural practice that considerably larger loads can be carried on trusses, joists, beams or girders made of metal when subjected to tension stresses than under compression whereby it appears partial conversion of compression stress takes place making same available for tensional effectiveness to carry increased loads.

In Fig. 6, modified forms of the invention are shown as applied to the construction and arrangement of an assembly of parts similar to that shown in Fig. 3, namely, pipe bottom member 22, tension rod 26, end cross-stretcher bars (only one 24 being shown), framing strut 23 with horizontal sections 23a and angular sections 23b, and welds 24a and 22c, except that the pair of spaced apart top frame members 31 are positioned to have inwardly facing angular portions 31a fitted against and welded to the down-facing sides of said cross-stretcher bars to provide upstanding flange portion 31b that may serve, when desired, as sittings for concrete, wood or the like in roofing or ceiling constructions.

To provide an improved composite reinforced concrete and framed truss 30, an expanded metal or similar plate 39 is fitted to lie horizontally between upstanding flange portion 31b and a concrete flooring or roofing, denoted as C in Fig. 6, poured thereon, said truss 30 incorporating reinforced concrete C either with or without prestress means, as provided, rod 26 or the like, passing through pipe 22, it is clear may form an improved reinforced structural unit 30 which can readily be fabricated or formed in situ.

For light loads or inexpensive constructions, it is contemplated in practicing the invention to use trusses 20 or 30 like that described above and shown in Figs. 1 to 6 with the prestressing means omitted, that is, without rod 26, thereby depending entirely on bottom pipe member 22, bracing strut 23 and top frame members 21 to carry a required load.

Another modification of the invention is shown in Fig. 7 in which truss 40 may be constructed with top members 21, end cross-stretched bars 24 and 25 and framing strut 23 like truss 20 shown in Figs. 1 to 5 with the exception that truss 40 has bottom pipe member 42 shortened so that the ends 42a and 42b thereof terminate at a spaced distance from cross stretcher bars 24 and 25, and opposite ends 46a and 46b of rod 46 which extends through pipe member 42 and said rod ends 46a and 46b connect to cross members 24 and 25, respectively, which terminate the ends of frame members 21 by means of suitable turn buckles 43 wherethrough truss 40 may be prestressed.

In Figs. 8 and 8a, a further modification of the prestressing feature of the invention is shown. Here truss 50 may have a suitable top load carrying framing member, such as, top members 21, end cross members 24 and 25 and bracing strut 23 formed with apices 23c, but instead of a bottom pipe member, each apex 23c may be provided or formed with a suitable cradle or holder 53d, as for example, the inverted U-shaped portion welded in position at 53c. A cable or rod 56 may be provided with a suitable adjustable tensioning means 58, such as, turn buckles that are anchored to cross members 24 and 25 for prestressing truss 50. Each of the above modified forms of trusses 30, 40 and 50 may be prestressed like truss 20 described above and can be made to safely carry a greater load than would otherwise be possible and requiring a minimum of structural material.

5

Another feature of the invention, for example, is shown in three forms as applied to the modifications above shown in Figs. 1 to 7 and described above. This feature provides additional utility of a load bearing portion of the truss structure under stress, namely, the pipe member which is constructed and arranged to also form part of a conduit sprinkler fire protection system.

To that end, as shown in Fig. 9, truss 60 may be provided like truss 20 or 30 to have top frame members 21 or 31, end cross members 24 and 25 and bracing strut 23, but the prestressing tensioning rod may be entirely omitted and pipe member 62 made to have the opposite ends 62a and 62b sealed tight and a communicating nipple or other suitable tap connection 69 provided as part of a sprinkler system. Suitable spaced sprinkler heads 69a as required may be tapped into pipe member 62 in the well understood manner.

Similarly, as shown in Fig. 10, truss 70 may be made like truss 20 or 30 including rod 26 utilized for prestressing, but ends 22a and 22b of pipe member 22 sealed leak-proof tight by providing gaskets 72c and 72d under nut 28a and plug anchor 27, respectively, and pipe member 22 provided with a communication nipple or other suitable tap connection 79 for joining with a sprinkler system.

In Fig. 11 is shown another form construction of truss 80 like that shown in Fig. 7, but also modified to serve as part of a sprinkler system. As here shown, truss 80 has bottom pipe member 82 shortened so that the ends 82a and 82b thereof terminate at a spaced distance from cross members 24 and 25, respectively, which terminate the ends of frame members 21. The tensioning rod of the form shown in Fig. 7 is replaced by having caps 86 provided for tightly closing pipe ends 82a and 82b to make same leak-proof.

Suitable turn-buckles 88 connect said pipe caps 86 to cross members 24 and 25 whereby truss 80 may be prestressed.

Pipe member 82 may be provided with a communication nipple or other suitable tap connection 89 for joining with a sprinkler system.

Thus, it is clear that trusses 60, 70 and 80, provided with pipe members 62, 72 and 82, respectively, which are under load stresses, serve not only as load carrying portions but also as a conduit part of a sprinkler fire protection system having suitably spaced apart sprinkler heads 69a of any well understood building installation.

Whereas bracing member or framing strut 23 is shown as an integral unit preshaped or bent to form sections 23a and 23b it is to be understood that the same may be made in convenient sectional form and welded into the assembled structure.

It will thus be seen that there is provided structural unit constructions in which the several objects of the in-

6

vention are achieved and which is well adapted to meet the conditions of practical use.

As various other possible embodiments of the invention might be made of the above invention, and as various changes in the embodiments above set forth might be made, it is to be understood that all matters herein set forth or shown in the accompanying drawings and described in the specification is to be interpreted as illustrative and not in a limiting sense.

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

1. A metallic structural unit comprising a plurality of longitudinally extending, spaced, substantially parallel frame members, a pair of cross-bars disposed transversely of and secured to said frame members at the opposite ends thereof, said frame members and cross-bars forming an elongated, substantially flat, load-carrying portion, a pipe extending longitudinally of said unit between said cross-bars, the ends of said pipe being secured to said cross-bars, the intermediate portion of said pipe being bowed away from said load-carrying portion and in spaced relation thereto, a bracing strut positioned between and secured to said frame members and said pipe and extending substantially from end-to-end of said unit, said bracing strut comprising a continuous length of wire bent to a substantially triangular helix-like formation, the apices of said strut being secured to the respective frame members and said pipe, a tensioned rod extending longitudinally through said pipe, the ends of said rod being adjustably secured to the respective ends of said pipe, said tensioned rod maintaining said pipe in a compressed state.

2. The metallic structural unit defined in claim 1 in which said pipe ends are sealed, a communicating connection extending from said pipe member for joining with a fire extinguishing system, and a fire extinguisher spray nozzle tapped into said pipe to serve as an outlet for said system.

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