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W. E. JENNINGS

3,153,299

APPARATUS FOR MAKING MODELS OF STRUCTURES

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Fig. 1

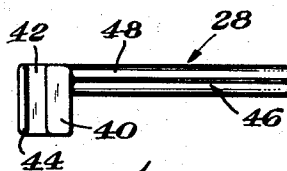
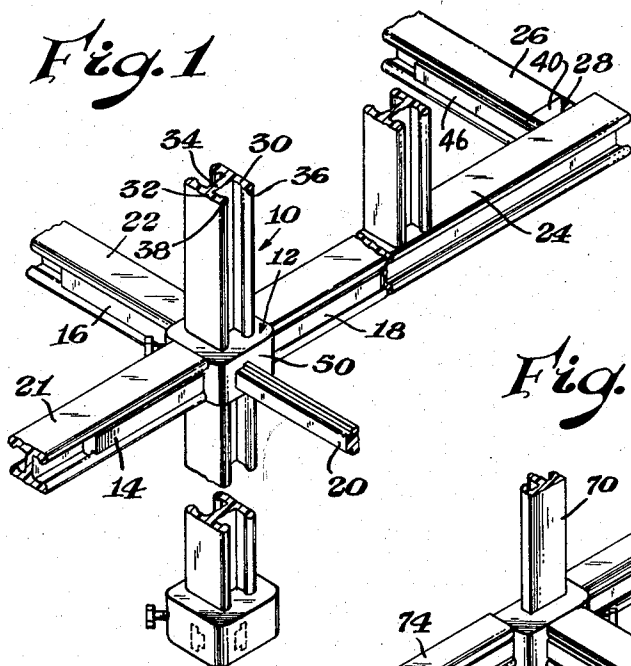


Fig. 5

Fig. 4

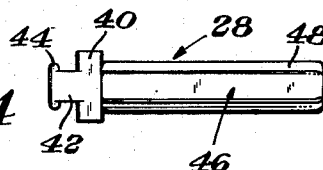


Fig. 6

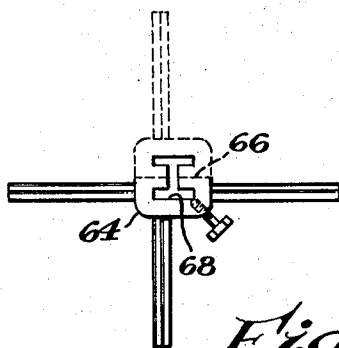
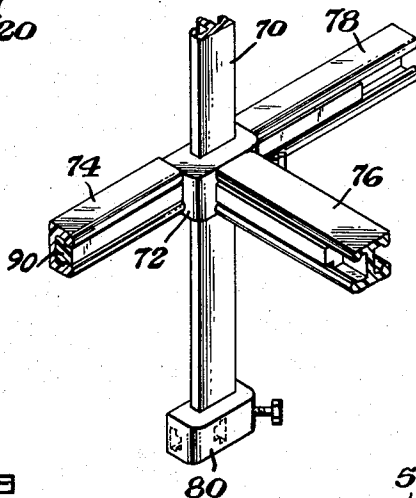


Fig. 7

Fig. 2

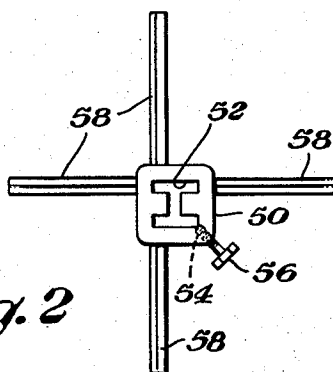


Fig. 3

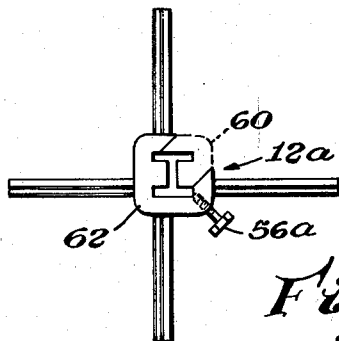


Fig. 8

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APPARATUS FOR MAKING MODELS OF STRUCTURES

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This invention relates to a system and apparatus for framing model layouts of buildings for engineering study, design, or other purposes.

The making of preliminary model layouts of industrial plants and other structures is accepted practice because of its obvious advantage in indicating design features of structures, providing a means for showing the layout of equipment within or upon the structure, and for familiarizing plant operating personnel with the proposed physical makeup of new structures before construction is begun, for example.

A number of systems are now in use for making such models, but all have limitations of one type or another, such as failure of the structural members to stay joined together when the members are subjected to torque, the structural members do not physically resemble beams, etc. which are used in framing actual structures. Another difficulty with some model making systems is that a considerable number of types of structural members must be used with such systems, enlarging the required inventory of parts to be stocked.

A major problem with some of the prior art model making systems has been the difficulty in joining members together in certain commonly used geometric configurations or in joining together members in other than a prescribed order.

While model making systems have been discussed in connection with industrial usage, similar systems are useful as educational or entertainment type toys.

Accordingly, a principal object of this invention is to provide an improved system for making models of architectural structures.

Another object of this invention is to provide an improved system for framing structures which utilizes only a few basic structural elements.

A further object of this invention is to provide a system for framing models of structures in which the elements are readily attachable and detachable one from another and are re-usable on the disassembly of the structure.

Still another object of this invention is to provide an improved, more economical system and apparatus for framing models of structures.

In accordance with this invention there is provided a system for making models of structures which utilizes a basic H beam of square sectional proportions having bulbs or enlargements on the inner side at the outer extremity of each of its four flanges which extend from the web part. A hub fitting having an H shaped aperture extending axially therethrough and having outwardly extending arms which are asymmetrically disposed and perpendicular with respect to the longitudinal axis of the hub is adapted to being fitted on and locked in place by means of a set screw, for example, along the basic beam.

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For beam connections in a horizontal plane at any point other than at a hub fitting, a somewhat T shaped fitting having an outwardly extending arm is provided.

The base section of the T is adapted to be snapped in place between two adjacent side by side flanges along the basic beam.

The arms of the hub and of the T shaped member are adapted to fit slidably between the web part and adjacent side-by-side pairs of outwardly extending flanges of the beam member whereby one or more beams may be connected at right angles to another beam element.

The invention, as well as additional objects and advantages thereof, will best be understood when the following detailed description is read in connection with the accompanying drawing, in which:

FIG. 1 is a fragmentary isometric view of model framing elements in accordance with this invention;

FIG. 2 is a plan view of a hub element in accordance with this invention;

FIG. 3 is a side elevational view of the hub element shown in FIG. 2;

FIG. 4 is a side elevational view of a T head type attaching element in accordance with this invention;

FIG. 5 is a plan view of the element shown in FIG. 4;

FIG. 6 is an isometric view showing a split hub coupled to a split beam and having two split beams and one regular beam elements coupled to the arms of the hub;

FIG. 7 shows, in plan, a hub element as cut away for use on a split beam, and

FIG. 8 shows, in plan, a cut away hub element which is adapted to be inserted around and coupled to a regular beam element.

Referring to FIGS. 2-5 as well as to FIG. 1, there is shown (in FIG. 1) an array of assembled elements comprising a vertically extending H beam, indicated generally by the numeral 10, over which is coupled a hub connector element, indicated generally by the numeral 12, having four outwardly extending arms 14, 16, 18, 20 which are disposed symmetrically with respect to an axis which is parallel to but offset from the central longitudinal axis of the hub part of the element 12. Beams 21, 22, 24 are coupled to the arms 14, 16, 18 respectively of the hub element 12.

A beam 26, of the same cross sectional configuration as the beams 10, 20, 22 and 24, is coupled to the beam 24 by means of a T headed coupling element 28. The coupling element 28 is best shown in FIGS. 4 and 5.

The beam members, exemplified by the member 10, for example, are basic elements of the framing system in accordance with this invention. The beams are elongated, straight elements having a generally H shaped cross sectional configuration which is as wide as it is high. The top and bottom flanges 30, 32 which extend from each side of the web part 34, of the beam each have a bulbous or thickened end part 36, 38 on their interior facing surface at or near to the outer end of the flanges 30 and 32. The increase in thickness of the flanges near their outer ends, though small, provide a means by which the T headed connector elements 28 may be snap-coupled to the beam 10. In order to achieve the desired snap-coupling between the T-headed connector 28 and the beams 10, the flanges of the beam on each side of the web section are preferably made thin and flexible enough

to permit bending of the flange in order that the T head of the connector element 28 may be inserted in place. It has been found that high impact types of thermoplastic resins are suitable materials from which the structural elements of this invention may be made.

Referring to FIGS. 4 and 5 as well as to FIG. 1, the T headed coupling element 28 comprises a plate 40 adapted to fit against the ends of side flanges of a beam. A T head element having a base 42 extending perpendicularly from the plate and which is dimensioned to fit between the bulbous ends 36, 38, for example, of the adjacent flanges of a beam (such as the beam 24 in FIG. 1) and a cross member 44 whose width is dimensioned to fit between the parts of the adjacent flanges which lie next to the web part of the beam to which the element 28 is coupled.

Extending perpendicularly from the other side of the plate 40 is an elongated arm 46 of T shaped transverse cross sectional configuration. The cross member 48 of the arm 46 is dimensioned in width and height to fit closely but slidably between adjacent pairs of beam flanges (such as flanges 30, 32 in FIG. 1) and closely but slidably between the web of the beam and the bulbous ends of the pairs of flanges. The arm 46 has a transverse cross sectional configuration which is the same as the arm 90 which extends from the hub 72 in FIG. 6. The arm 46 is perpendicular with respect to the T head (42 and 44) of the element 28, such as the beam 10 or 24 to which it is adapted to be coupled. The length of the arm 46 is approximately 3 times the width of the beam 10 or 24, for example, but this length is a matter of convenience rather than necessity. Obviously, the arm 46 should be long enough to extend into the end of the beam for a sufficient distance to rigidly couple together the arm and beam.

Referring to FIGS. 2 and 3, as well as to FIG. 1, the hub member 12 has a block-like body 50 which is as thick as the width of a beam 10 and approximately twice as long and wide as the width of a beam. A cutout 52 of H-shaped transverse cross sectional configuration extends axially through the thickness of the block-like body 50, the cutout being symmetrically located and being dimensioned to permit a beam 10 to pass slidably there-through in an axial direction.

The block-like body 50 is provided with a threaded bore 54 extending from a side surface to the cutout 52 whereby a set screw 56 may be tightened against a surface of a beam passing through the cutout 52 to prevent slippage between the beam and hub member.

Arm elements 58, like the arm element of the T headed coupling element, extend perpendicularly from each of the four sides of the block-like body 50, the longitudinal axis of the arms 58 lying in the same plane.

While arms 58 extending from opposite sides have a common longitudinal axis, the axes of the arms 58 do not pass through the center of the width or length of the block-like body 50. The arms 58 are offset from the center by a distance equal to the wall thickness of the web 34 of the beam 10.

The hub members 12 are capable of considerable modification, as shown in FIGS. 6, 7, and 8.

As seen in FIG. 8, a corner 60 of the block-like body 62 may be cut out to permit the hub member 12a to be slipped over a beam 10 intermediate of the ends of the beam. Upon tightening the set screw 56a the modified hub member is held securely on the beam.

FIG. 7 illustrates the situation where the block-like body 64 of the hub member is split in half along the dotted line 66 parallel with flange receiving part 68 of the cutout. This modification finds use where the model being constructed is too large to handle conveniently in one continuous structure. Splitting the beams 70 and hub members 72 along the junction, as shown in FIG. 6 illustrates the situation in which a hub modified as in

FIG. 7 is used to laterally join 3 beams (split beams 74, 78 and beam 76) to the split vertically disposed beam 70. The hub member 80, either modified or un-modified in the block-like base part, serves as a column or base member when the arms are removed.

While this invention provides a 3 piece model building system, thus achieving economy in the number of parts carried in inventory, the 3 parts, either modified or un-modified may be used in making models of the frames of most any building structure. The arm elements 14, 16, 18, 20, for example, are merely snapped off the hub member 12 when no beam is to be coupled to the hub. The detached arm elements, however, are useful in joining together beam sections in end-to-end relationship with one another.

By modifying hub members as illustrated in FIG. 8, already existing models of structures may be added to or altered without having to dis-assemble the structure to put in place intermediately disposed hubs.

As mentioned previously, the ability to "split" a large structural model into sections by means of the beam splitting technique shown in FIG. 6, means that sections of the structure may be re-assembled along the split-beam line without greatly changing the appearance of the model at the junction line between sections.

While the system of this invention finds great utility in the making of industrial models, the component parts used are simple to understand and economical to make and would serve equally well in use as an educational toy for building many types of structures.

The structural elements may be made of metal or many types of plastic materials, for example, but polystyrene has proved to be an economical, useful material of which all the parts may be made. Also, heating an arm element 14, for example, of polystyrene permits beams 10 to be joined together at angles other than 90°.

What is claimed is:

1. An apparatus system for use in making models of structural assemblies, comprising basic H beam members, said beam members having parallel flange parts joined by a web part, the flange parts having a bulbous part spaced from the web part extending along the length of the flange on the side thereof which faces the web part, all of the bulbous parts being equally spaced from the web part, a hub connector element, said hub connector element having a block-like body, said body having a cutout part extending therethrough, the cutout having the shape of the transverse cross-sectional configuration of the basic beams and being large enough to fit slidably over and surround said basic beams, said body also having beam coupling arm elements extending therefrom, said arm elements having a transverse cross-sectional configuration which is generally T-shaped, the cross member part of the T being sized to fit slidably between a pair of parallel flanges and the web and adjacent bulbous parts of a basic beam with the base of the T extending between the bulbous parts of said pair of parallel flanges, said hub connector element having means for securing it in a fixed relationship with respect to a basic beam member, and a T-headed coupler, said coupler including a flat body plate, said body plate having an elongated T-shaped coupling head extending perpendicularly therefrom with the cross member of the T-shaped head spaced from the body plate, said cross-member being dimensioned to fit closely between the space defined by the web and the parallel flanges and their bulbous parts on one side of a basic beam, the base of said T-shaped head being adapted to extend between adjacent bulbous parts of a basic beam, a beam coupling arm element of the type extending from the body of said hub connector element, said last mentioned coupling arm element being secured to and extending from a side of said body plate opposite from which the T head extends, the cross member part of the coupler arm element being perpendicular to the cross member of the T-shaped head.

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2. A system in accordance with claim 1, wherein said basic beam is equal in height and width.

3. A system in accordance with claim 1, wherein said bulbous parts are at the outer edges of said flanges.

4. A system in accordance with claim 1, wherein the body of said hub connector is as thick as the height of said basic beam.

5. A system in accordance with claim 1, wherein the flanges and web of said basic beam are capable of flexing without breaking.

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6. A system in accordance with claim 1, wherein said beams, said hub connector and said T-headed coupler are made of plastic.

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