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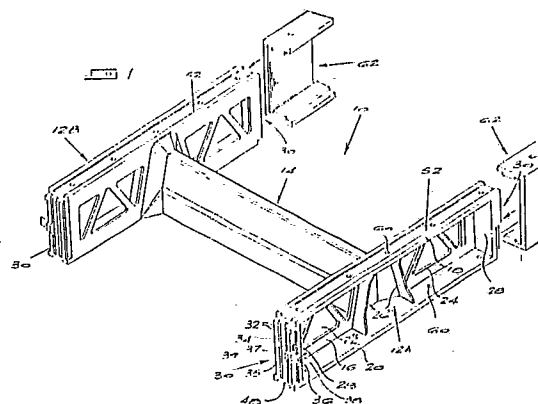
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54 **Ladders.**

57 An H-shaped modular ladder element (10) which has stringer sections (12A, 12B) which are parallel and spaced apart by a rung or step (14) spanning rigidly between the stringer sections. At their ends, the stringer sections have connection formations (30) by means of which they can be connected end-to-end with other similar modular ladder elements. In this way a ladder of the required length can be assembled. In a preferred form, the connections between elements are achieved by sliding interengagement of ribs and grooves (32, 34).



Description

LADDERS

BACKGROUND TO THE INVENTION

THIS invention relates to ladders.

One kind of known ladder is of fixed length and has no facility for increasing or decreasing that length. Other known ladders are of telescopic construction.

In both cases, the ladder is long, ungainly and difficult to transport. It is usually not possible to transport a conventional ladder in an ordinary passenger car unless roof racks are fitted.

The present invention seeks to provide a solution to this problem.

SUMMARY OF THE INVENTION

The invention provides a modular ladder element comprising :

- a) spaced, parallel stringer sections;
- b) at least one step spanning rigidly between the stringer sections;
- c) engagement means at the ends of the stringer sections which are engageable with corresponding engagement means at the ends of the stringer sections of like modular ladder elements upon relative movement between the modular ladder elements taking place in a direction transverse to the stringer sections, thereby to locate the stringer sections of the modular ladder elements end-to-end with one another; and
- d) means associated with the engagement means for releasably preventing disengagement of the engagement means from the engagement means of the stringer sections of the like modular ladder elements.

In a preferred version of the invention, the engagement means are in the form of slide formations which are slidably engageable with the slide formations of the stringer sections of the like modular elements upon relative movement between the modular ladder elements taking place in a direction transverse both to the stringer sections and to the step or steps.

Typically, the slide formations comprise alternating headed ribs and undercut grooves in which the headed ribs are slide fits.

The modular ladder element of the invention may also include stop means for limiting relative slide-ways movement between the slide formations of the modular ladder element and those of another like modular ladder element.

Still further according to the invention, the means for releasably preventing disengagement of the engagement means comprises resilient tongues and recesses in which such tongues make clip fits. Conveniently a hand-engageable tab is provided for each resilient tongue for the purposes of releasing the tongue from a recess in which it is clipped.

The invention extends to a one-piece moulded modular ladder element which comprises a pair of parallel stringer sections spaced apart from and

joined to one another by means of a single, central step spanning rigidly and transversely between the stringer sections, and engagement means at the ends stringer sections by means of which they can be connected releasably in end-to-end alignment with the stringer sections of other like modular ladder elements, thereby to form a ladder composed of like modular ladder elements.

The invention also extends to a ladder made up of modular ladder elements as specified above.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a perspective view of a modular ladder element of the invention;

Figure 2 shows how modular ladder elements can be mated end-to-end;

Figure 3 shows a partial perspective view of a ladder composed of modular ladder elements;

Figure 4 shows a partly sectioned front elevation of a modular ladder element;

Figure 5 shows a partially broken away cross-section at the line 5-5 in Figure 4;

Figure 6 shows a partly sectioned plan view of a modular ladder element, the section being at the line 6-6 in Figure 4;

Figure 7 shows, in schematic form, a step-ladder formed using modular elements of the invention;

Figure 8 shows, in a sectional plan view, how ladders can be mated telescopically; and

Figure 9 to 14 to illustrate the versatility of the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to Figure 1, a modular ladder element 10 according to the present invention has spaced, parallel stringer sections 12A and 12B and a single rung or step 14 which spans rigidly between the stringer sections. The step 14 is at right angles to the stringer sections, with the result that the element 10 has an H-shape when viewed in front elevation (see Figure 4). The element 10 is formed as a unitary plastics moulding.

Each stringer section 12A and 12B has a channel-shape in cross-section. Referring to the section 12A, the channel-shape is defined by a web 16 and spaced, parallel flanges 18 and 20. The web 16 is formed with triangular apertures 22 in the interests of material savings. The edges of the apertures 22 are ribbed towards the outside of the element 10 as indicated by the numeral 24. Angled webs 26 extend between the flanges 18 and 20 to rigidify the structure. Further rigidity is provided by transverse end flanges 28.

The stringer sections 12A and 12B are identical mirror images of to one another. Each flange 28 carries engagement means, in this case in the form of slide formations indicated generally with the

numeral 30. The slide formations 30 are identical mirror images of one another and are made up of alternating headed ribs 32 and undercut grooves 34. The ribs and grooves extend in a direction at right angles to the flanges 18 and 20.

In one set of slide formations 30 of each stringer section, one of the ribs carries a tongue which has an enlarged head 35 and a stem portion 37 which has inherent resilience because of its slenderness and which is defined by a slot 39. A tab 36 projects laterally from each tongue and is movable by hand in the direction of the arrow 38 (Figure 1) to flex the tongue in the same direction.

In the other set of slide formations 30 of each stringer section, there is a recess 40 (see the partially cut away portion of Figure 5) which is situated at the base of a groove 34 and which is complementary in shape to the head 35 of a tongue.

The single step 14 has generally a V-shape in cross-section, as will be apparent from the cross-section of Figure 5, and it has inclined, transverse, internal webs 54 providing reinforcement. The extreme ends of the step 14 are outwardly belled at 56 where they meet the stringer sections 12A and 12B, the belled portions providing added strength at the locations where the greatest bending moments and shear forces will take place in use of the element 10.

The step 14 is perfectly symmetrical about a central plane 58 (Figure 5). Treads 60 are inclined to the central plane at an acute angle. The treads 60 may be formed with grooves, or may be otherwise roughened, to increase the grip which the foot of a wearer will have on the step. The acute angle is chosen so that the treads 60 will be substantially horizontal when a ladder, such as that of Figure 3, is assembled and inclined against a wall at an appropriately stable angle, typically 20° to the vertical. Of course, when the ladder is vertical, the treads 60 are inclined to the horizontal.

The treads 60 meet, at chamfered corners 62, with flat portions 64 which are contained in planes normal to the planes of the webs 16 of the stringer sections.

In order to assemble a ladder from the modular ladder elements 10, the elements are brought together with their stringer sections adjacent one another as illustrated in Figure 2. The elements are then moved relatively to one another in a direction which is transverse both to the stringer sections 12A and 12B and to the step 14, as indicated by the arrows 50 in Figure 2. The headed ribs 34 of the stringer sections of one element 10 enter the undercut grooves 34 of the stringer sections of the other element 10 in a slide fit. Slideways movement in the direction of the arrows 50 is continued until such time as the ribs of one element abut a flange 48 of the other element, at which stage the elements are correctly mated with their stringer sections 12A and 12B properly aligned. The flange 48 thus serves as a stop to prevent slideways movement past the condition of correct alignment.

It will be appreciated that as the relative sliding movement of the ribs in the grooves takes place, the enlarged heads 35 of the tongues 35 of each stringer section are pressed inwardly, in the direction of the

arrow 38. When the condition of correct alignment of the stringer sections 12A and 12B is reached, the enlarged heads of the tongues clip, under the resilient action of the stem portions 37, into the recesses 40. This anchors the elements 10 relative to one another and prevents inadvertent slideways separation of the ribs and grooves in a direction opposite to the arrows 50.

A series of modular elements may be mated end-to-end in this way to form a ladder as seen partially in Figure 3. Of course, a major advantage of the illustrated modular elements is the fact that they can, when the ladder is taken apart, be conveyed compactly in, say, the boot of a passenger car. A person needing a ladder only has to acquire as many modular elements as necessary to create the required length of ladder. If, at a later stage, a longer ladder is required for a particular job, a few more elements may be acquired. When the ladder is not in use, it can be taken apart with ease and the modular elements can be stored compactly for re-use when required.

The tabs 36 are used to release the tongues 35 from the recesses 40, this being achieved merely by pressing the tabs manually in the direction 38. Once the tongues are clear of the recesses, the modular ladder elements 10 can be separated by a relative sliding movement in a direction opposite to the arrows 50.

It is intended to produce the modular elements with a wide range of accessories enabling the elements to be assembled to form ladders for a wide variety of applications. One such accessory is a footing (not illustrated) for each assembled stringer which has ribs and grooves similar to those of the stringer sections to enable them to be connected to the lower end of each stringer section of the bottom element 10 in the ladder. The footing has a surface adapted to grip well on the ground or other supporting surface on which the ladder rests in use.

Another accessory is a hinge attachable rib-and-groove fashion to the upper ends of the stringer sections of the top elements 10 of two different ladders, as shown schematically at 70 in Figure 7. The result would be a step-ladder having relatively inclined ladders 72 and 74. Straps 76, or centrally articulated tie members, span between the ladders 72 and 74 with their ends attached to the stringer sections.

It will be noted in Figure 1 that the flanges 18 and 20 have central, longitudinally extending depressions 52. Figure 8 shows schematically how two ladders 78 and 80 can be mated telescopically with one another to permit ready extension in the longitudinal direction. A bracket 82 is arranged to embrace side-by-side flanges of the stringer sections of the two ladders, with the depressions 52 combining with one another to form a rectangular cavity. The bracket 82 is fixed relative to one flange by means of a bolt 84 passing through aligned holes in the bracket and in the flange, and a nut 86. The flange holes are illustrated at 60 in Figure 1. This arrangement permits one flange to slide longitudinally relative to the other for extension purposes. Although Figure 8 only illustrates the situation on

one side of the ladder it will be appreciated that a similar arrangement is provided on the opposite side as well.

The depressions 52 are not useful solely for the above-described purpose of permitting a telescoping ladder. Various kinds of attachments can be attached slidably to the ladder. For instance, a support platform or container for tools, building materials and the like could be attached slidably to the ladder. In this case, brackets 62 such as those seen in Figure 1 could be engaged with the stringer sections in sliding fashion, the relevant platform, container or other attachment being carried by the brackets 62. Using appropriate bolts, studs or the like passing through aligned holes in the brackets 62 and the falgnes 18 and 20, the brackets could be anchored at chosen elevations on the ladder. When not anchored, the brackets 62 and whatever they are carrying are free to slide up and down the ladder. In addition, non-sliding fixtures such as safety hoops, support platforms or the like can be connected to the stringer sections at chosen elevations using the holes 60.

An important feature of the present embodiment resides in the fact that there is a single, central step 14. A single step is preferable in that the overall length of the modular element will be less than an equivalent modular element having more than one step and this in turn means that the modular element can be more easily packed and handled.

Furthermore, a single step enables the length of an assembled ladder to be increased in single step increments.

Figures 9 to 15 illustrate diagrammatically the versatility of the illustrated modular element. Figure 9 shows a typical assembled ladder while Figure 10 shows a typical extension ladder, the extension facility being provided in the manner described in relation to Figure 8, the sliding brackets 82 being omitted in the interests of clarity. Figure 11 depicts a trestle ladder in which a support platform is supported at an elevated position using the connection features described above in relation to Figure 8. Once again, the actual brackets which are connected to the ladders and which are used to support the platform are omitted. Figure 12 shows a stair ladder which enables a worker to work on a staircase. Naturally, this kind of application is only permitted by the modular nature of the elements 10 which allows the user to create assembled ladders to suit the inclination of the staircase. Figure 13 shows a step stool in which a support platform is provided. Finally, Figure 14 shows an assembled ladder in which safety hoops, as referred to previously, are provided in the interests of user safety. In each of Figures 12 to 14, the actual brackets and hinges used to achieve the various connections are omitted.

In a modified form of the invention, the slide formations 30 at the ends of the stringer sections could be so arranged that appropriate connections can be made to other modular ladder elements irrespective of which way round the elements are. Thus the step 14 is situated centrally along the lengths of the stringer sections so that the step

spacing in an assembled ladder remains constant irrespective of which way round the elements are placed relative to one another.

Claims

1. A modular ladder element (10) comprising spaced, parallel stringer sections (12A, 12B) and at least one step (14) spanning rigidly between the stringer sections (12A, 12B) characterised by engagement means (30) at the ends of the stringer sections (12A, 12B) which are engageable with corresponding engagement means at the ends of the stringer sections of like modular ladder elements upon relative movement between the modular ladder elements taking place in a direction transverse to the stringer sections, thereby to locate the stringer sections of the modular ladder elements end-to-end with one another, and means (35, 40) associated with the engagement means (30) for releasably preventing disengagement of the engagement means (30) from the engagement means of the stringer sections of the like modular ladder elements.

2. A modular ladder element (10) according to claim 1, the characterised in that the engagement means are in the form of slide formations (30) which are slidably engageable with the slide formations of the stringer sections of the like modular elements upon relative movement between the modular ladder elements taking place in a direction transverse both to the stringer sections (12A, 12B) and to the step (14) or steps.

3. A modular ladder element (10) according to claim 2 characterized in that the slide formations (30) comprise alternating headed ribs (32) and undercut grooves (34) in which the headed ribs (32) are slide fits.

4. A modular ladder element according to claim 2 or claim 3 characterized by stop means (48) for limiting relative sideways movement between the slide formations (30) of the modular ladder element (10) and those of another like modular ladder element.

5. A modular ladder element (10) according to any one of the preceding claims characterized in that the means for releasably preventing disengagement of the engagement means comprises resilient tongues (35) and recesses (40) in which such tongues (35) make clip fits.

6. A modular ladder element (10) according to claim 5 characterized in that a hand-engageable tab (36) is provided for each resilient tongue (35) for the purposes of releasing the tongue (45) from a recess (40) in which it is clipped.

7. A modular ladder element (10) according to any one of the preceding claims characterized in that it is H-shaped with a single step (14) spanning rigidly between the stringer sections (12A, 12B).

8. A modular ladder element (10) according

to claim 7 characterized in that it is formed as a one-piece plastics moulding.

9. A modular ladder element (10) according to claim 8 characterized in that the stringer sections (12A, 12B) have a channel-shaped cross-section.

10. A modular ladder element (10) according to claim 8 or claim 9 characterized in that the step (14) has a substantially V-shaped cross-section.

11. A modular ladder element (10) according to claim 10 characterized in that the step (14) has a roughened tread (60) which is inclined to the horizontal when the stringer sections (12A, 12B) are vertical.

12. A one-piece moulded modular ladder element (10) which is characterized in that it

comprises a pair of parallel stringer sections (12A, 12B) spaced apart from and joined to one another by means of a single, central step (14) spanning rigidly and transversely between the stringer sections (12A, 12B), and engagement means (30) at the ends of the stringer sections (12A, 12B) by means of which they can be connected releasably in end-to-end alignment with the stringer sections of other like modular ladder elements, thereby to form a ladder composed of like modular ladder elements.

13. A one-piece moulded modular ladder element (10) according to claim 12 characterized in that the stringer sections (12A, 12B) are identical mirror images of to one another.

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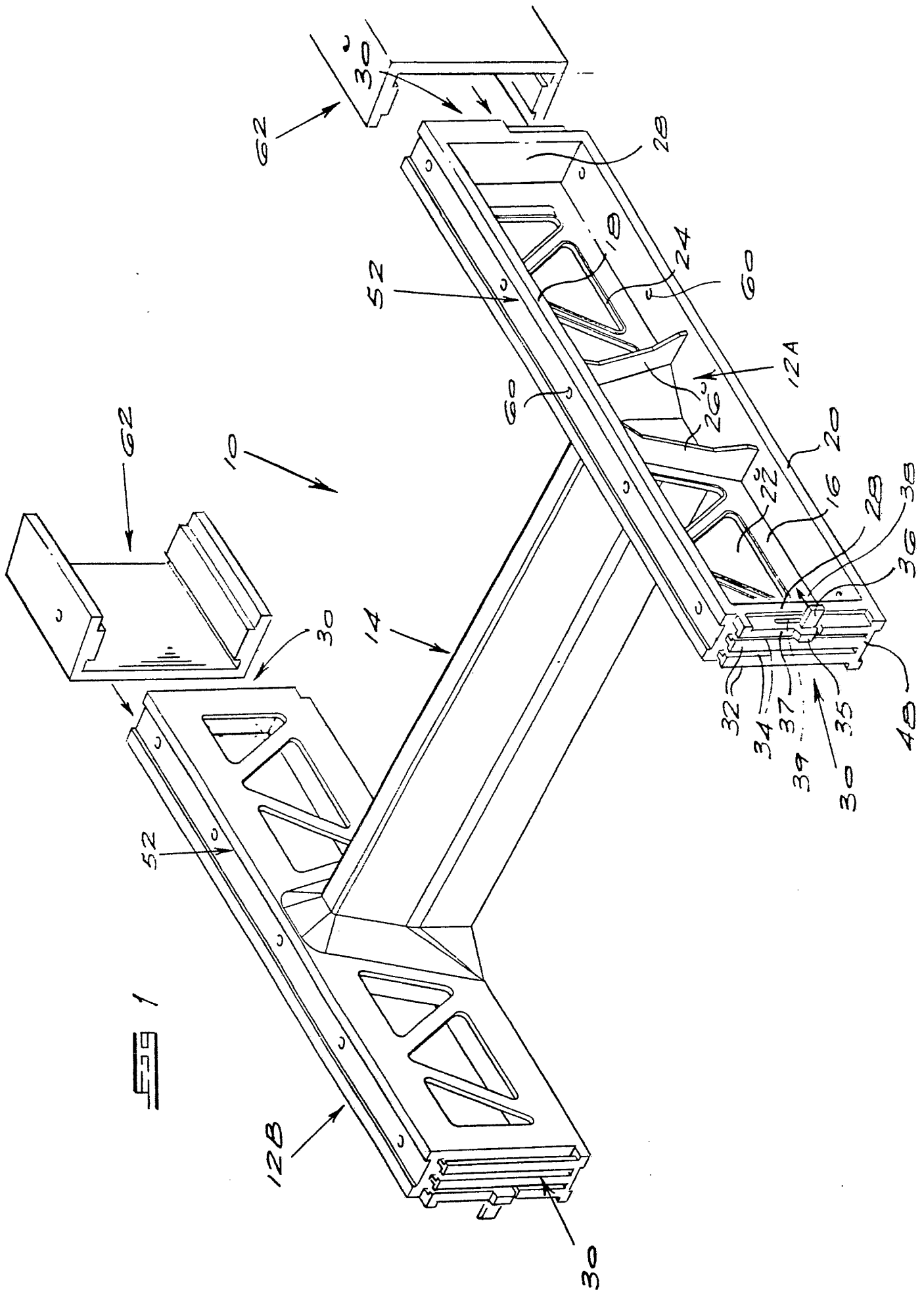
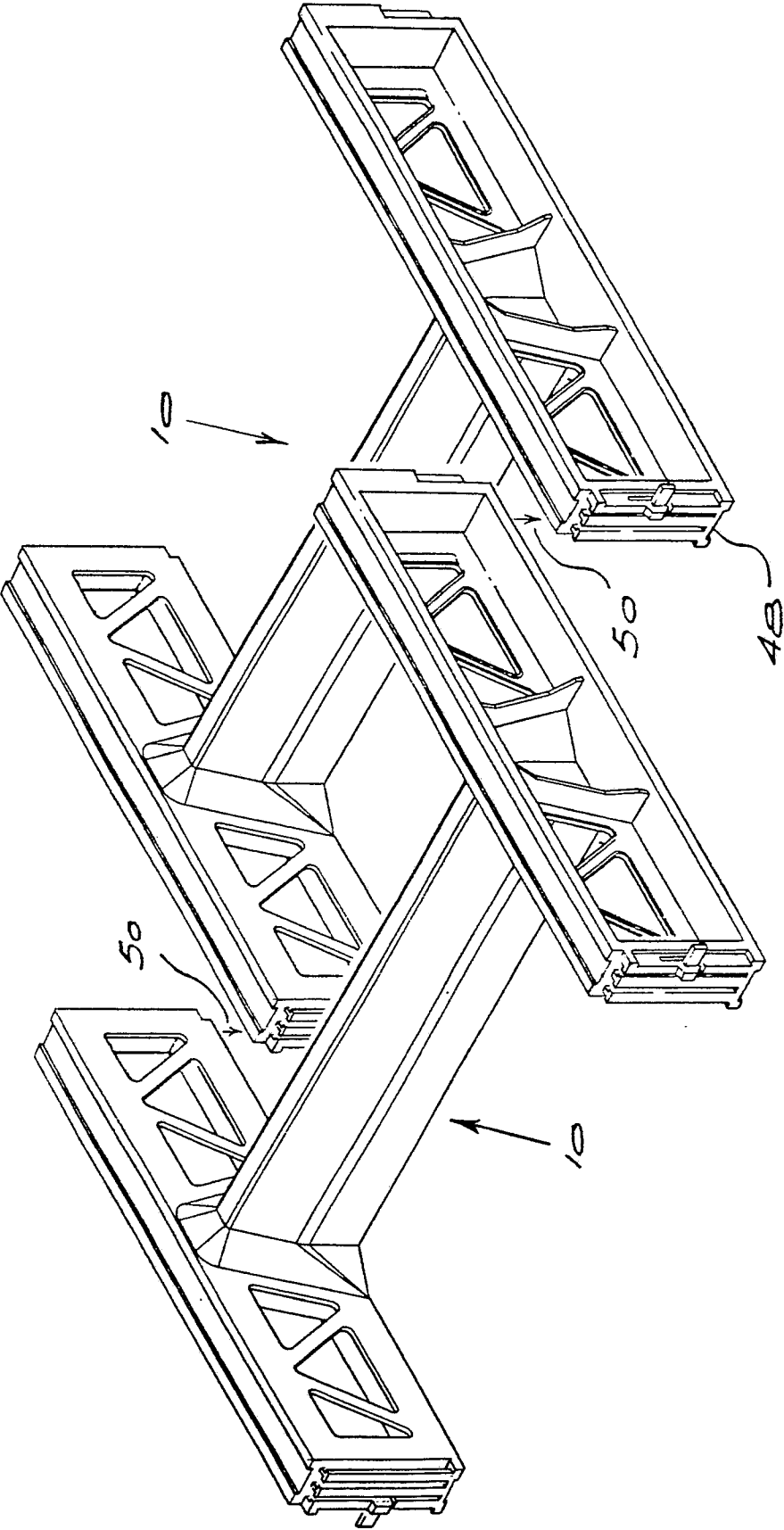
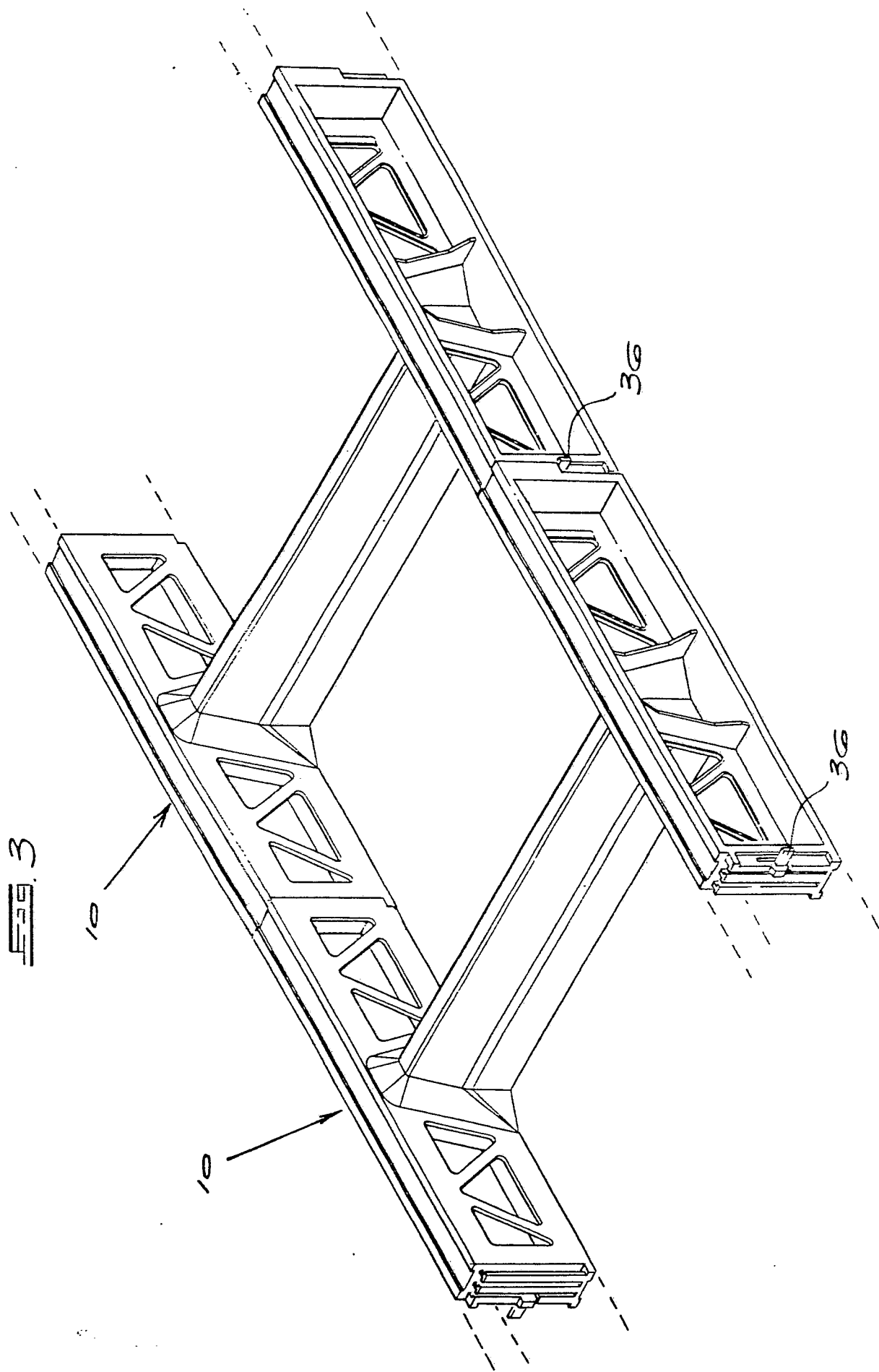
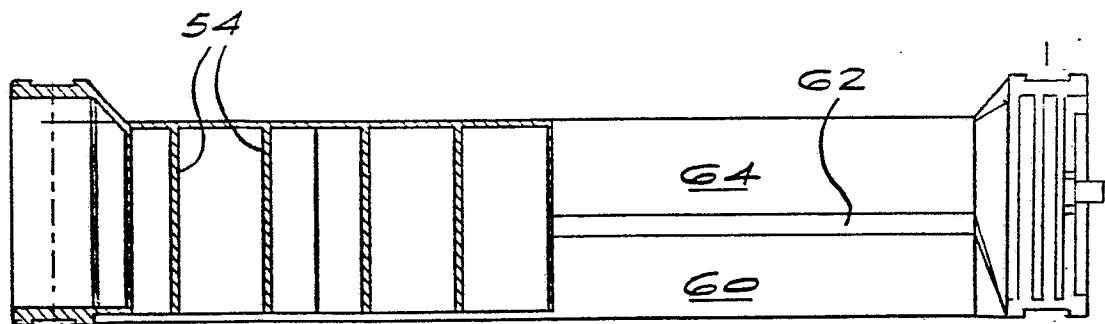
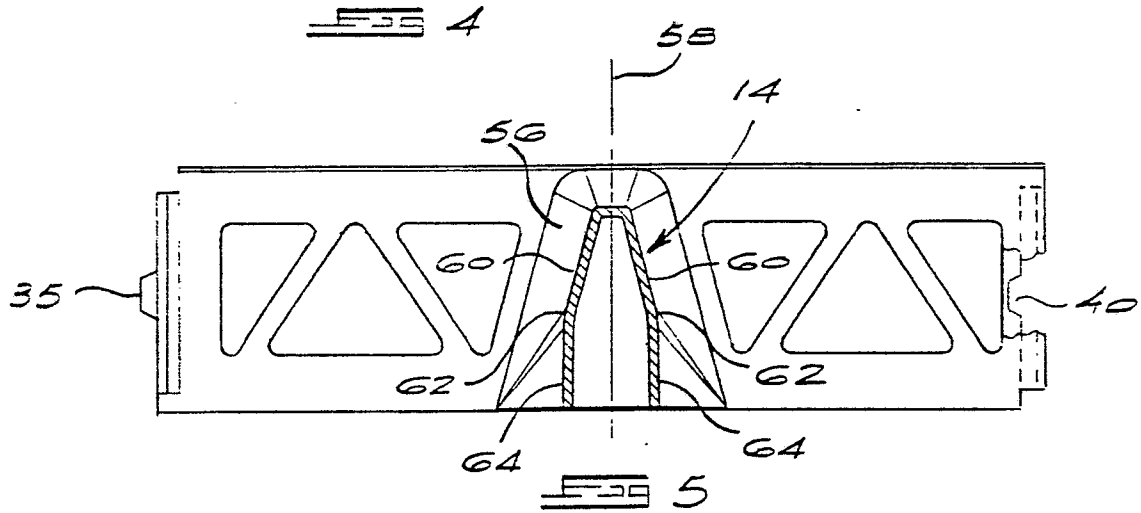
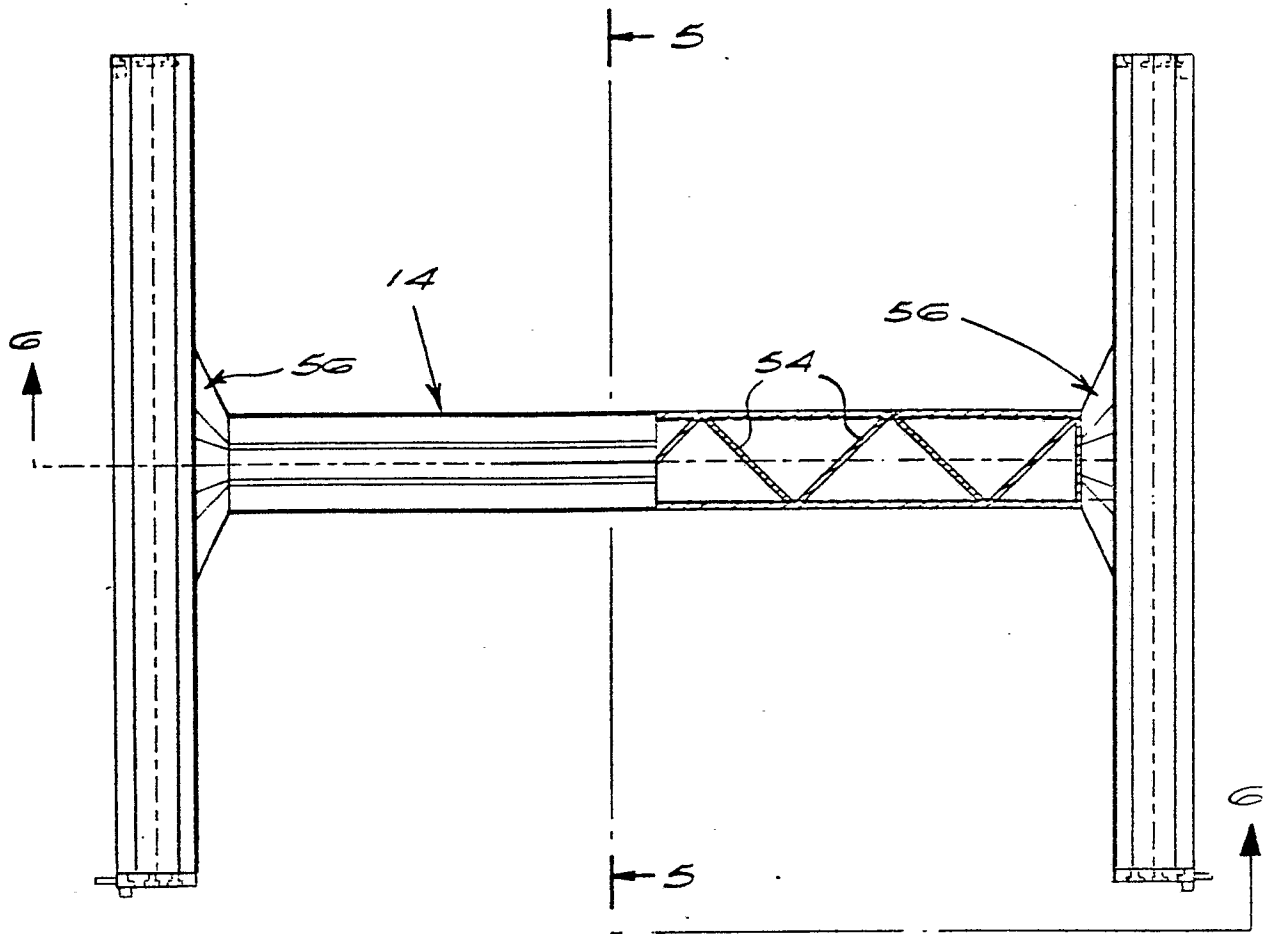
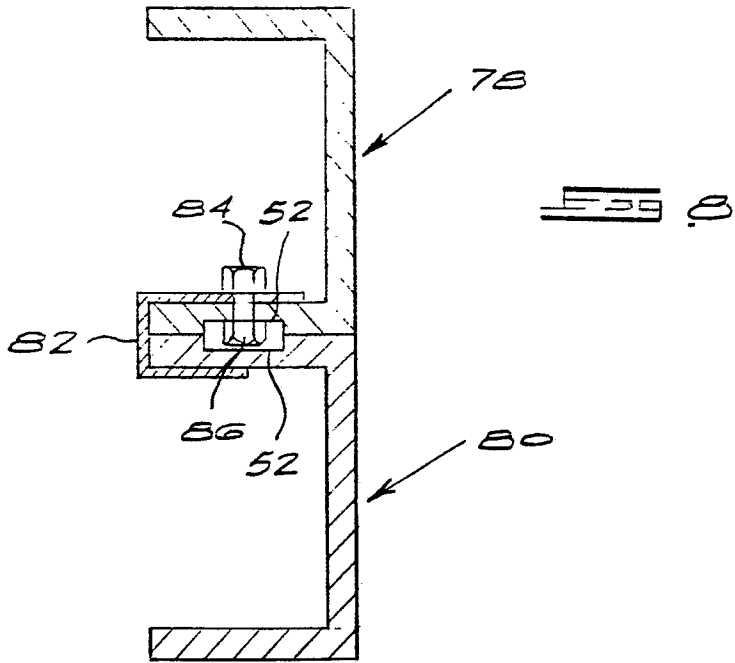
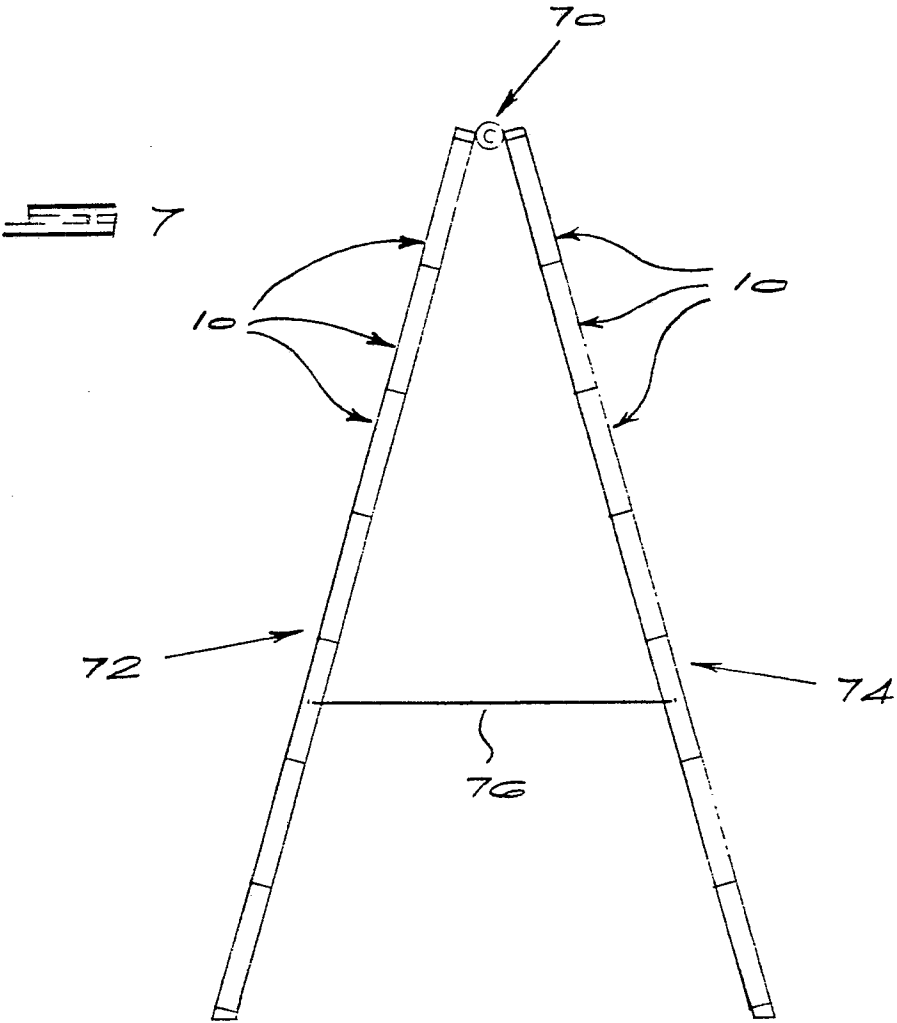


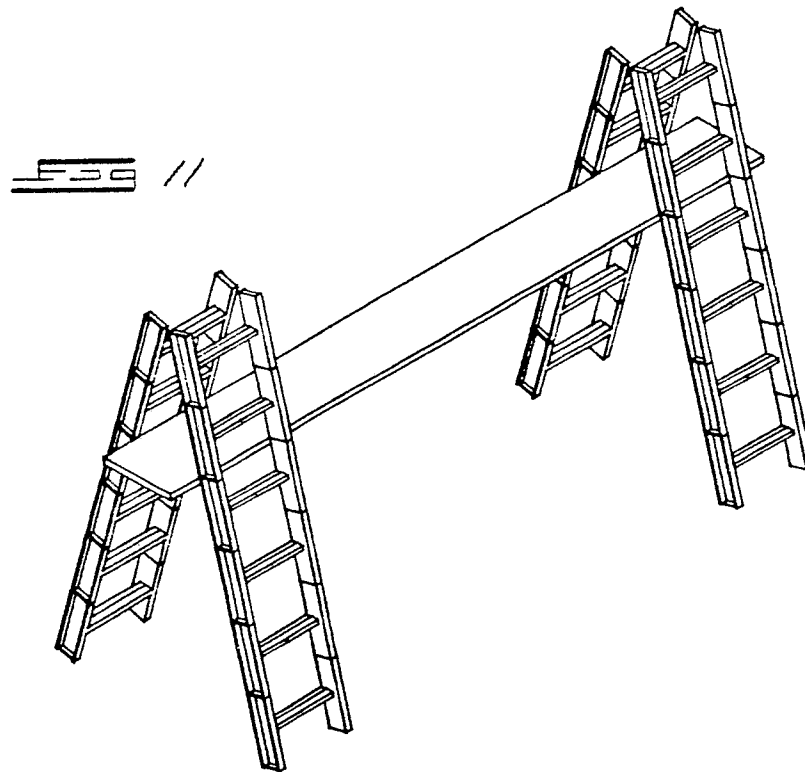
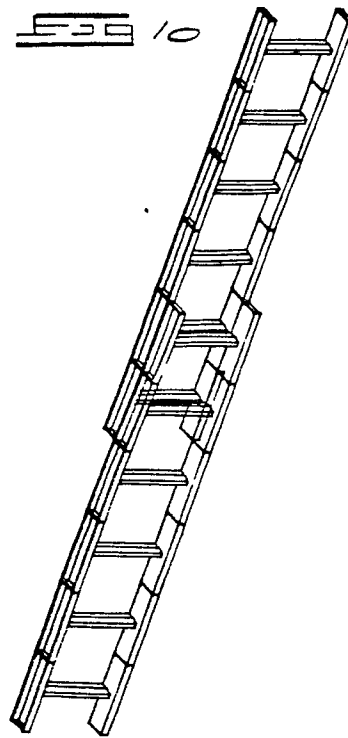
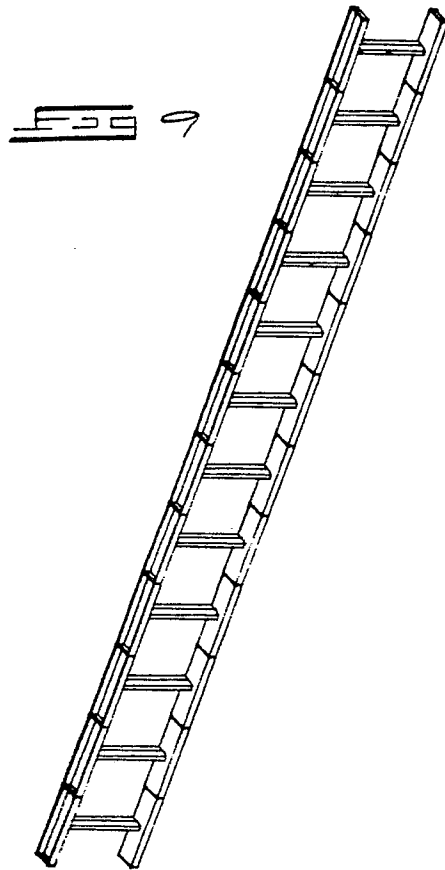
Fig 2



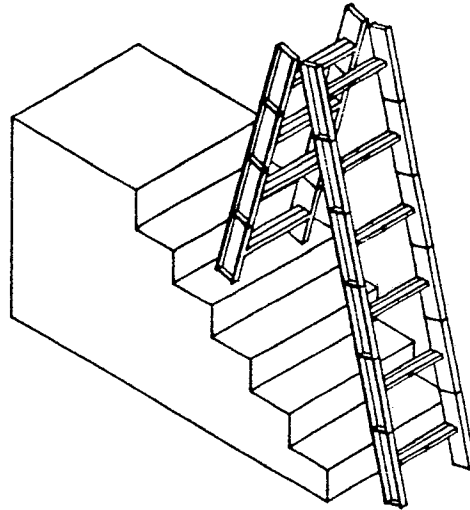


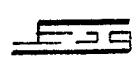


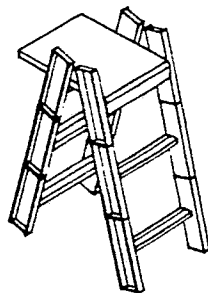


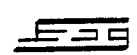


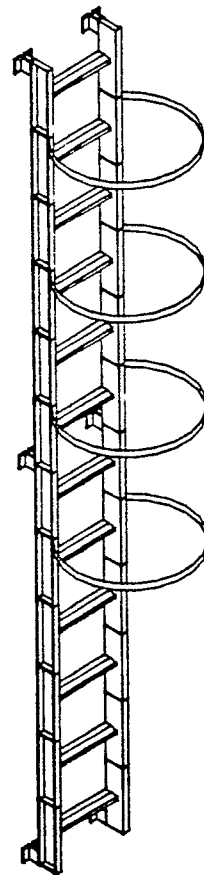
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X	GB-A-1 053 673 (RACOLE TRADING & MANUFACTURING) * Page 2, lines 93-130; page 3, lines 1-20,31-34; figures 7-19 *	1,7	E 06 C 1/10 E 06 C 7/08
Y	----	2-6,8-13	
Y	DE-A-2 547 637 (NAUMANN) * Page 11, last paragraph; page 13, paragraph 3; figures 1-3,7-9 *	2-4	
Y	----	5,6	
Y	DE-A-3 442 710 (HABER) * Page 14, paragraphs 1,3; figures 1-4 *	1,2,7	
A	----	8-13	
Y	US-A-2 788 167 (MORRISON) * Column 1, lines 15-24,56-72; column 2, lines 1-12; figures 1-3 *	1-4	
A	GB-A-1 508 436 (HICKMAN) * Page 5, lines 39-73; figures 7-9 *		TECHNICAL FIELDS SEARCHED (Int. Cl.4) E 06 C E 04 F F 16 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26-04-1989	Examiner HENDRICKX X.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document			