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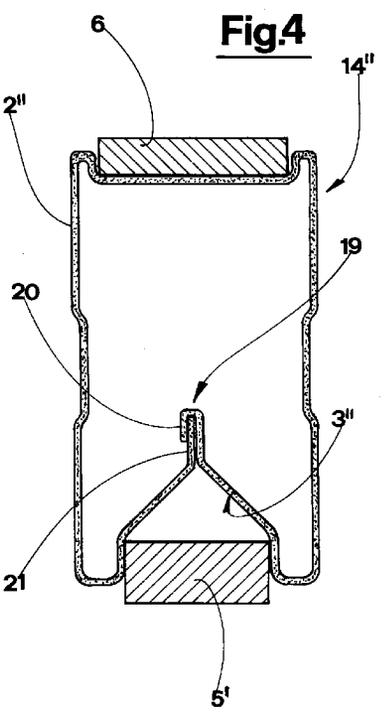
(54) Modular structure for metal shelving or the like

(57) A modular structure for metal shelving or the like, comprising a plurality of substantially vertical sides (10) located at a distance from one another and a plurality of stringers (14) designed to join together at least two of the sides (10). Each stringer (14) comprises a hollow support profile (2;2';2") provided with two longitudinal engagement zones, an upper one (4; 4'; 4") and a lower one (3; 3'; 3") and two solid auxiliary bars (5,6; 5',6) shaped so as to be able to be engaged, in a fixed manner, with the longitudinal engagement zones (3,4; 3',4'; 3",4") of the support profile (2; 2'; 2").

Fig.4



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Description

The present invention relates to modular metal structures which are used in the construction of lattice structures such as shelving for warehouses, raised floors or the like.

More particularly, the invention relates to modular metal structures comprising vertical sides connected together by horizontal stringers which support, at predetermined heights, a plurality of supporting elements such as, for example, shelves, flooring or the like. By means of suitable removable fastening systems arranged along the vertical sides and at the ends of the stringers, it is possible to provide, with great ease, structures which satisfy the various requirements in terms of both longitudinal and tranverse extension, and also freely arrange the supporting elements at the desired heights. Structures of this type are used not only for constructing small shelving for storing merchandise, or simple raised floors inside depositories or the like, but are also used in the construction of spacious self-supporting warehouses in which the lattice structure also supports the side walls and the overhead covering of the warehouse itself.

In order to reduce the cost of these metal structures, it is known to limit the number of basic elements which form them, designing them so that each of them may be used in the greatest possible number of constructions.

Similarly it is known to reduce the number of different basic materials used to produce the basic elements so as to obtain more efficient and hence economical production. In the art it is known of modular structures of this type, consisting of welded or bolted sides formed with two identical uprights made of profiled steel which are connected together by diagonal members and cross-pieces and to which the horizontal stringers are fastened. The cross-pieces and diagonal members are welded or bolted to the uprights so as to form the sides, while the stringers are joined to the uprights by means of suitably shaped brackets. This solution allows preassembly of the sides at the factory and facilitates subsequent assembly on-site of the remaining elements.

The distance which separates two sides defines, in the case of the shelving, the maximum width of the spaces for the merchandise. This width coincides with the length of the stringers used to connect the sides.

Viewing this shelving from the front it can be noted that the sectional height of the stringers is also important since said height may limit the possibility of vertical access to the spaces for the merchandise.

The stringers are greatly stressed since, in addition to connecting together the sides and also partially supporting the weights arranged on the support elements, they must also withstand the knocks to which they are subject as a result of the - often rough - handling of the forklift trucks used to move the merchandise.

So as not to limit the maximum degree of modularity which can be obtained with these structures, it is therefore known to provide a specific stringer for each application. Thus in practice, the load, the distance between the sides and the maximum sectional height define the shape used for the cross-section of the stringer.

It is known that the most economical shapes for the cross-sections of the stringers are those for which a maximum value of the modulus of resistance is obtained with the minimum use of material. Functional shapes of the section are therefore obtained by distributing the material of the section as far as possible from the neutral axis. The stringers constructed in accordance with the known art are obtained mainly by shaping and folding flat metal sheets so that the rigidity and the maximum length of the stringers are obtained by modifying, where possible, the geometry of the section without varying, however, the thickness used; in this way, as has already been seen, the costs of supplying and storing the material used for producing the elements of the structure are reduced.

For this reason, the section of the stringers is, in the technical sector concerned, mainly substantially rectangular and its dimensions vary in accordance with the variation in length of the stringer or the variation in the load to be supported. In this way, however, although the costs of supplying the material, which is qualitatively identical for all the various stringers, are minimized, the number of the sections and/or thicknesses of the profiles necessary for constructing any structure is therefore increased considerably.

This solution moreover has the drawback that it requires the use of extremely high stringers when the lengths and the stresses are such that said stringers must be particularly rigid.

A partial solution to this problem is provided by the use of improved sections in which the thickness of the material distributed at a distance from the neutral axis is increased by folding over the sheet metal onto itself several times so as to create a plurality of superimposed folds. In this way the long sides of the cross-section of the stringers have the basic thickness of the sheet metal, while the short sides, which are further removed from the neutral axis, have a multiple thickness compared to the basic thickness.

A variation in the rigidity of the stringers is thus obtained by increasing the number of folds without a substantial variation in the overall dimensions thereof. This solution also has the serious drawback, however, that it requires, for each application, the manufacture of suitable sections for the stringers and is therefore extremely costly since the manufacture of each of the sections of the profiles requires, for each geometrical shape of the section, a specially designed tool and a particular processing cycle.

All the stringers of the known type described above moreover have the disadvantage that when they are used for the construction of shelving, their upper edge is

subject to rapid wear. This is due to the abrasive action of the underside of the forks of the forklift trucks used to handle the merchandise, which rub against the stringers whenever the stored load is moved. Moreover, a similar abrasive action is also due to the merchandise itself (often arranged on pallets or the like) which are pushed from one side to the other of the shelf so as to make room for other merchandise.

A further disadvantage of the stringers provided in accordance with the known art consists in their limited transverse rigidity.

An object of the present invention is therefore that of eliminating the drawbacks of the known art mentioned above.

The invention, as characterized by the claims which follow, solves the problem of providing a modular structure for metal shelving which is extremely robust and stable and can be manufactured in an efficient and economical manner.

A further object of the present invention is that of enabling the construction of structures which have stringers with extremely compact and strong sections allowing the construction of spacious raised floors or spacious loading surfaces.

Moreover an object of the invention is that of reducing the costs of the modular structures by means of the use of stringers obtained using a single basic profile for all the lengths and the loads required.

A further object is that of allowing the use of extremely low-cost materials for constructing modular structures which are also very complex and robust.

A further object of the present invention is that of increasing the rigidity of the modular structure by increasing the transverse rigidity of its stringers.

Last but not least, an object is that of allowing the arrangement of the sides at a great distance from one another without thereby negatively affecting the overall rigidity of the structure.

From a constructional point of view, the modular structure for metal shelving or the like, forming the subject of the present invention, is characterized by the use of stringers obtained by engagement of a basic profile with two solid bars, i.e. an upper one and a lower one, arranged parallel to the longitudinal axis of the profile, within suitable longitudinal engagement zones, so as to adapt the strength thereof to the actual requirements in each case.

The solid bar arranged at the top of the basic profile is able to project upwards, from the shape of the latter, and may have a substantially rectangular section.

The solid bar arranged at the bottom of the basic profile may have a circular section and may consist of low-cost round iron bars used for the construction of reinforced-concrete structures.

Owing to this particular design it is thus possible to obtain an extremely low-cost modular structure which is able to perform in a reliable and compact manner the function of supporting even very high loads.

In particular, this solution limits the number of basic elements necessary for obtaining the maximum modularity of the modular structure and allows one to exploit fully the strength characteristics of very low-cost materials which can be easily found on the market.

Further advantages and features of the present invention will emerge more clearly from the detailed description which follows, with reference to the accompanying drawings, illustrating a purely exemplary and non-limiting embodiment thereof, in which:

Figure 1 shows a perspective view of a modular structure constructed in accordance with the present invention;
Figure 2 shows a cross-section through a stringer;
Figure 3 shows a cross-section through a variant of the stringer according to Figure 2;
Figure 4 shows a cross-section through a further variant of the stringer according to Figure 2;
Figure 5 shows a bottom view of the stringer according to Figure 2;
Figure 6 shows a top view of the stringer according to Figure 2;
Figure 7 shows a perspective view of the stringer according to Figure 2.

With reference to the Figures of the accompanying drawings, 1 denotes a modular structure for constructing the basic latticework which may be used for the construction both of shelving and of raised floors; these two latter elements differ in fact only with regard to the nature of the support elements used (not shown) and the vertical spacing between them; otherwise they consist of latticework structures which are entirely similar from the point of view of their technical design. For this reason the description which follows is applicable, except for few details, to both uses of the modular structure forming the subject of the present invention. The modular structure 1 comprises a plurality of vertical sides 10 connected together by horizontal stringers 14. The sides 10 have, along their height, a plurality of slits 11 arranged at a distance from each other.

The stringers 14 have, at their ends, brackets 12 provided with fastening tongues 13 designed to engage into the slits 11 for removable joining of the brackets 12 to the sides 10.

The stringers 14 each consist, as can be clearly seen in Fig. 7, of a support profile 2 provided with two longitudinal engagement zones, an upper one 4 and a lower one 3, inside which an upper auxiliary bar 6 and a lower auxiliary bar 5 are respectively inserted in a fixed manner.

The support profile 2 has laterally two sides 18 along which longitudinal ribs 15 are formed, said ribs having the function of strengthening the profile.

The longitudinal engagement zones 3,4 are formed in the zones of the support profile 2 furthest from the neutral axis of the support profile 2 so as to obtain the

maximum rigidity.

The support profile may also be formed by bringing together two or more support profiles 2 and connecting them firmly together. This constructional variant (not shown) allows the use of a single support profile 2 for the construction of stringers 14 with multiple heights or widths compared to the basic transverse dimensions of the support profile 2 itself. In this way it is possible to obtain a further increase in the rigidity of the stringers.

The cross-section of the profile 2 is preferably hollow, but the solution illustrated herein is also applicable in an entirely similar manner to profiles with a solid cross-section.

With particular reference to Figure 2, the upper engagement zone 4 has a cross-section shaped in the manner of a "U". This engagement zone 4 houses inside it the upper auxiliary bar shaped in the manner of a flat strip 6.

The depth d of the upper engagement zone 4 is chosen so as to be slightly less than the thickness S of the flat strip so that the flat strip projects, with respect to an upper edge 16 of the support profile 2, by the amount S-d. This feature is extremely important in the case of the construction of shelving since it eliminates the wear of the upper edge 16 due to the repeated movement of merchandise by means of forklift trucks, the forks of which repeatedly rub precisely against the upper edge.

Engagement of the flat strip 6 with the longitudinal engagement zone 4 may be performed by means of welding 7. The cross-section of the lower longitudinal engagement zone 3 is shaped substantially in the form of an upturned "V" and receives a lower auxiliary round-shaped bar 5.

The upturned V-shape is particularly suitable for receiving round bars 5 of varying diameters, chosen, in each case, depending on the stresses to which the stringer will be exposed during use. Fixing of the round bars is performed by means of continuous welding or spot-welding 7.

Both the auxiliary bars, i.e. the upper bar 6 and the lower bar 5, have a solid section for making full use of the modulus of resistance which can be obtained, while leaving the distance from the neutral axis unchanged. In this way, it is possible to reduce the height of the section so as to provide stringers which are extremely low and compact.

Moreover, as a result of the high modulus of resistance, the length of the stringers may be increased for the same height of the section.

In order to modify the strength of the stringer 14 it is therefore possible to modify simply the diameter of the round bar 5 to be fitted. In other words, all the stringers required for the various possible loads may be obtained by simply fitting smaller or larger bars 5 to the support profile 2.

The "V" shape of the longitudinal engagement zone 3, moreover, is also able to receive bars with a cross-section which is not circular, for example square, flat, rhomboid, hexagonal, etc. and is extremely suited for this purpose. In the case where no round bars are available it is possible to continue production of the stringers by simply fitting them with the bars which are available on the market at that particular moment.

In particular cases, i.e. when the stresses to be withstood are particularly high, it is possible to increase further the rigidity of the stringer by also increasing the thickness of the upper auxiliary bar 6.

If, however, the length of the stringer or the load is such that an even greater degree of rigidity is required, it is possible to envisage construction of a second support profile of greater height.

Since the auxiliary bars have a solid section and since they are arranged in zones of the support profile 2 furthest removed from its neutral axis, extremely compact and particularly rigid stringers are obtained.

Moreover, the flat strip 6, in addition to preventing wear of the upper edge 16, also increases considerably the transverse rigidity of the stringer.

From the point of view of the cost-efficiency of the construction envisaged here, it must be pointed out that the cost of purchasing the basic material used to produce the support profile (steel strip) is decidedly higher compared to the cost of the ready-formed flat strips or round bars. Moreover, it is possible to reduce further the purchase cost of round bars by using those normally used for the construction of reinforced-concrete structures, which, in addition to being extremely robust and easy to find, are also extremely cheap on account of their widespread use.

The U-shaped configuration of the upper longitudinal zone 4 has the advantage that it simplifies mounting of the flat strip 6 since the latter, once inserted inside this groove, does not require the use of special devices for fixing it during the subsequent welding operations. The same considerations also apply to the lower longitudinal zone shaped in the manner of an upturned "V" where a further advantage is that it is self-centering for round bars 5 of any diameter. Owing to the choice of these particular geometrical shapes it is therefore possible to automate assembly of the auxiliary bars with the support profile so as to limit further the costs for production and storage of the pre-finished stringers.

Figure 3 illustrates a constructional variant of the stringer 14'. In said variant the sections of the two, respectively upper and lower longitudinal zones 4', 3', which are similar to one another, are shaped so as to be able to each receive, both flat strips 6,5' and round bars 5, as required.

This substantially consists of a V-shaped section having located above it a U-shaped portion.

This type of profile 14', while being slightly more costly as regards its manufacture, has the advantage that it may be used with auxiliary bars having both a round and a rectangular section depending on the requirement or the availability of the material.

Figure 4 shows a further variant of the stringer 14".

Its lower longitudinal engagement zone 3" has a section which is slightly modified and shaped in the manner of an upturned "V", the two free ends of which terminate parallel with one another.

Moreover, the cross-section of the support profile 2" is closed by a curled portion 19 obtained by folding over onto one another two adjacent free edges 20, 21 of the profile 2". This improves the torsional rigidity of the stringer and also allows the use of the profile with only the upper bar, without fitting, therefore, any lower auxiliary bar.

The modular structure thus provided therefore achieves the objects indicated. With said structure it is possible to limit the number of basic elements necessary for obtaining the maximum modularity and moreover reduce the dimensions of the stringers, as well as limit the cost of manufacture since it involves the use of extremely cheap materials, assembly of which may be partially automated.

All the stringers necessary for constructing both smaller structures and larger structures may in fact be realized by combining with a single support profile low-cost auxiliary bars for obtaining the required rigidity.

With the present invention it is thus possible to construct modular structures for shelving, raised flooring or the like which are extremely robust and low-cost.

The invention thus conceived may be subject to numerous modifications and variants, all of which falling within the scope of the inventive idea. Moreover, all the details may be replaced by technically equivalent elements.

Claims

1. Modular structure for metal shelving or the like, comprising:

   - a plurality of substantially vertical sides (10) located at a distance from one another;
   - a plurality of stringers (14) designed to join together at least two of the said sides (10), characterized in that said stringers (14) each comprise:
   - a support profile (2;2';2") provided with one or more longitudinal engagement zones (3,4; 3',4'; 3", 4");
   - at least one auxiliary bar (5,6; 5',6) shaped so as to be able to be engaged, in a fixed manner, with one of the said longitudinal engagement zones (3,4; 3' ,4'; 3",4") of the support profile (2; 2'; 2").

2. Structure according to Claim 1, characterized in that said longitudinal engagement zones (3,4; 3',4'; 3",4") are formed in the zones of the support profile (2; 2'; 2") furthest removed from the neutral axis of the support profile (2; 2'; 2") itself.

3. Structure according to Claim 1, characterized in that each of said stringers (14) comprises two or more of the said support profiles (2; 2'; 2").

4. Structure according to Claim 1, characterized in that the cross-section of said support profile (2; 2'; 2") is hollow.

5. Structure according to Claim 1, characterized in that the cross-section of said auxiliary bar (5,6; 5',6) is solid.

6. Structure according to Claim 5, characterized in that the support profile (2; 2'; 2") has two longitudinal engagement zones, respectively an upper one (4; 4'; 4") designed to receive an upper auxiliary bar (6), and a lower one (3; 3'; 3") designed to receive a lower auxiliary bar (5; 5').

7. Structure according to Claim 6, characterized in that said upper auxiliary bar is a flat strip (6) with a substantially rectangular cross-section.

8. Structure according to Claim 7, characterized in that said upper longitudinal engagement zone (4; 4'; 4") comprises a cross-section substantially in the form of a "U", the depth (d) of which is slightly less than the thickness (S) of the flat strip (6) to be received, so that the upper edge of the flat strip projects slightly with respect to the support profile (2; 2'; 2").

9. Structure according to Claim 8, characterized in that said lower auxiliary bar is a round bar (5) with a substantially circular cross-section.

10. Structure according to Claim 9, characterized in that said lower longitudinal engagement zone (3; 3'; 3") comprises a cross-section substantially in the form of an upturned "V" so as to receive the round bar (5).

11. Structure according to Claim 9, characterized in that said longitudinal engagement zone (3' ,4'; 3") comprises a substantially V-shaped cross-section having located above it a larger U-shaped zone so as to be able to receive, equally well, both rods (5) and flat strips (6;5') or other polyhedric shapes.

12. Structure according to Claim 1, characterized in that fixed engagement of the auxiliary bar (5,6;5',6) with the longitudinal engagement zone (3,4; 3'4'; 3",4") of the support profile (2; 2'; 2") is performed by means of welding 7.

13. Structure according to Claim 9, characterized in that the round bar (5) is a round bar of the type used for reinforcing concrete.

14. Structure according to Claim 1, characterized in that the cross-section of the support profile (2") is closed.

15. Structure according to Claim 14, characterized in that closure of the section of the profile (2") is obtained by folding over one another two free edges (20,21) of the profile (2") so as to form a curled portion (19).

16. Structure according to Claim 9, characterized in that said lower auxiliary bar (5') has a polyhedric section.

Fig.4

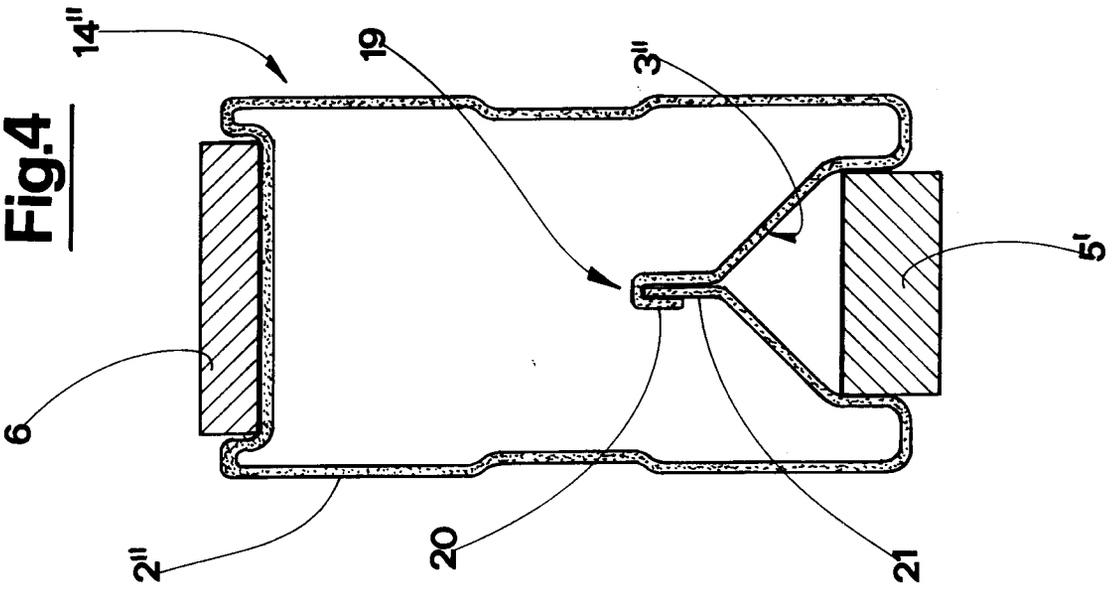


Fig.1

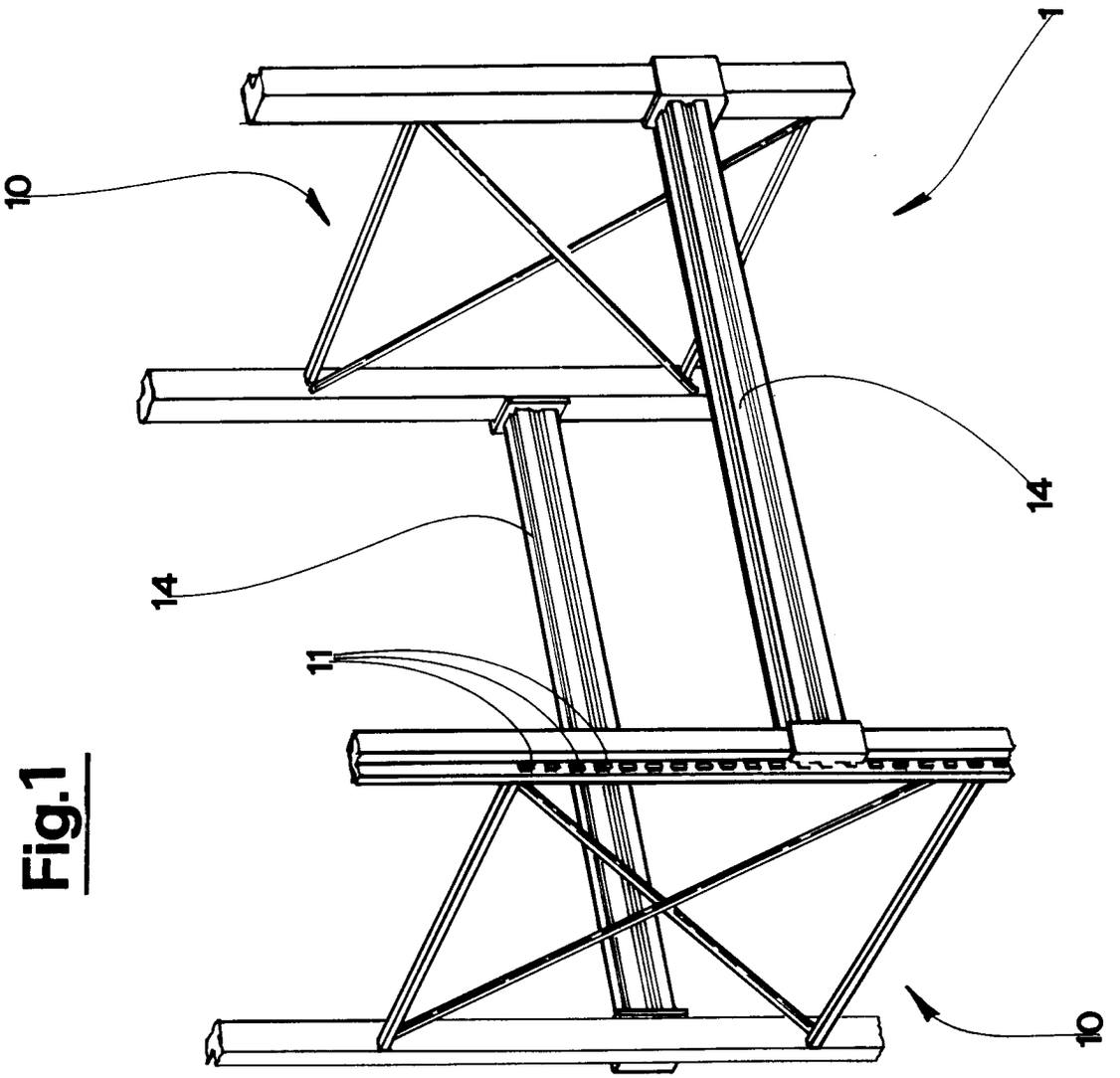


Fig.3

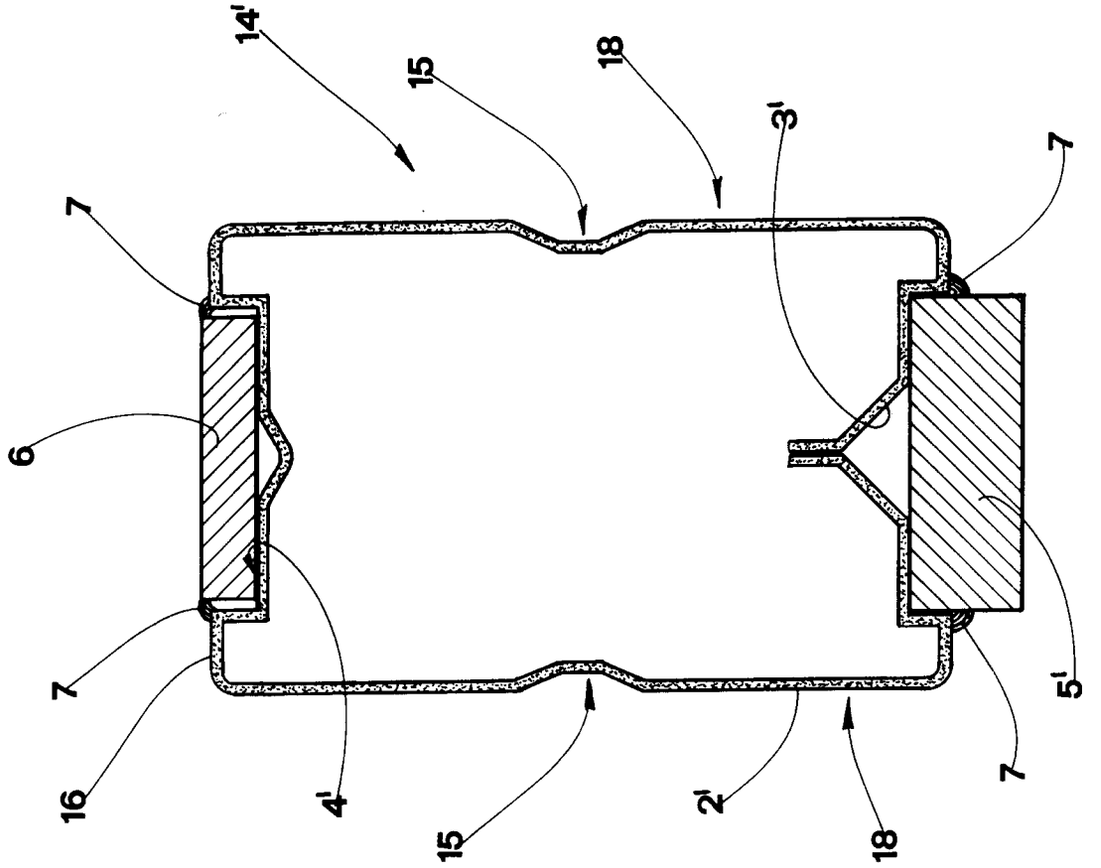


Fig.2

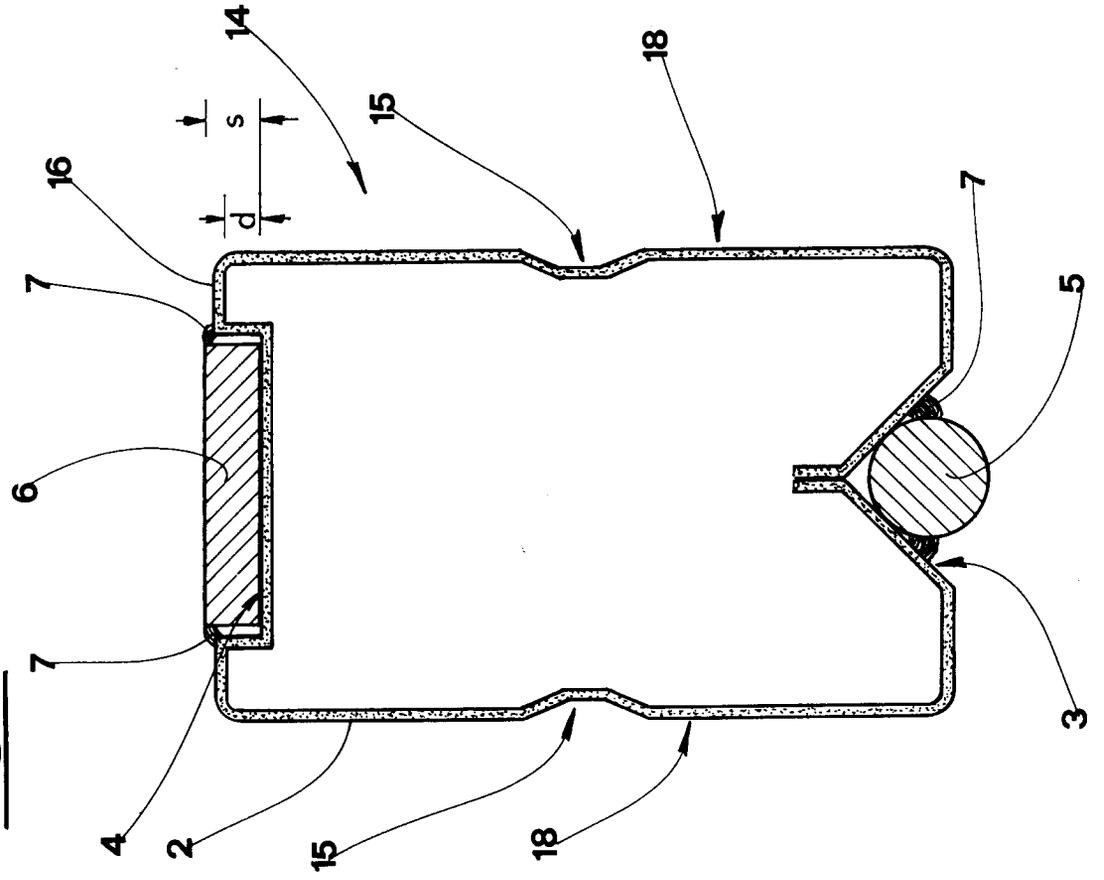


Fig.5

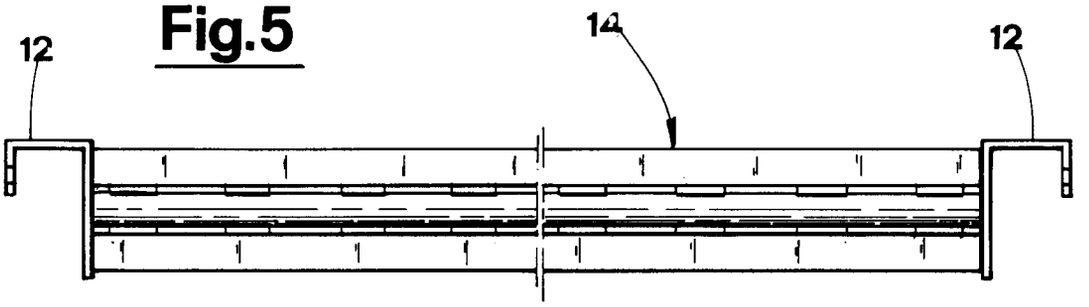


Fig.6

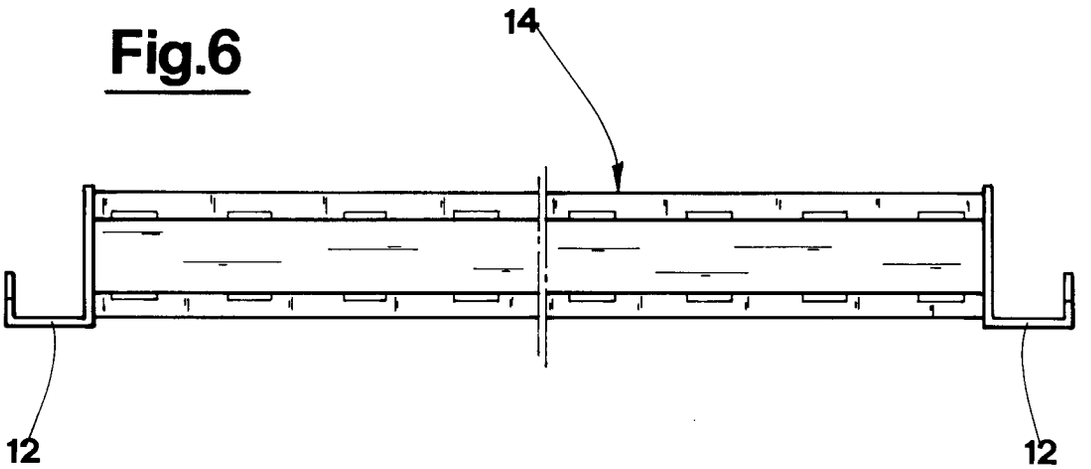
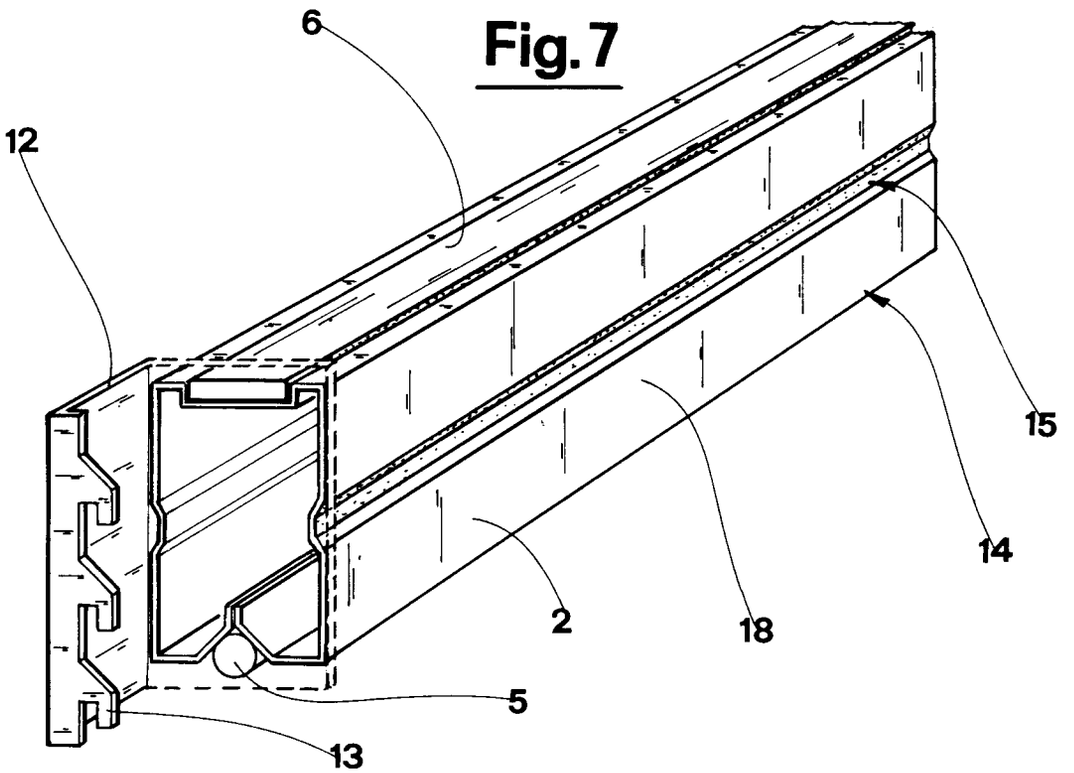


Fig.7



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EUROPEAN SEARCH REPORT

Application Number
EP 97 10 0303

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.6)
X	US 5 584 624 A (DEVOURSNEY) 17 December 1996	1,2,4,5	A47B47/02
	* abstract; figures 1,2,6 *		A47B96/14
A	* column 2, line 54 - line 60 *	7,14	E04F15/024

X	GB 818 459 A (NOAKES) 19 August 1959	1,2,4	
	* page 3, line 68 - line 106; figures 5-9 *		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A47B
E04F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 June 1997	Jones, C

CATEGORY OF CITED DOCUMENTS

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