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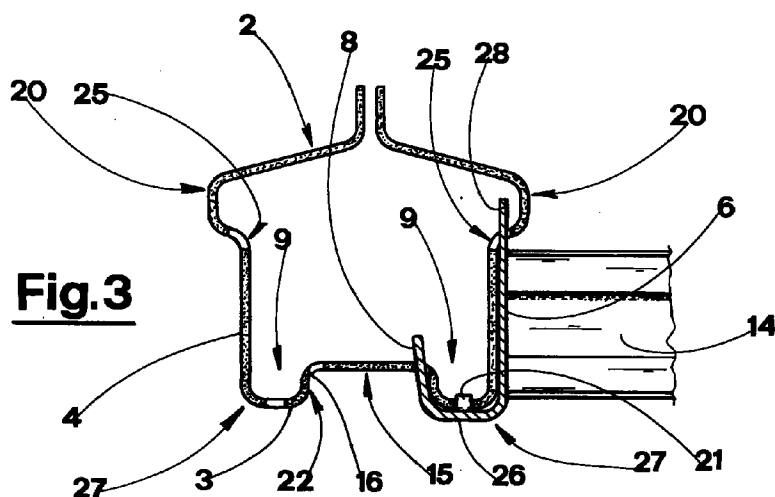
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### (54) Modular structure for metal shelving or the like

(57) Modular structure for metal shelving or the like, comprising: a plurality of vertical uprights (2) each with a front wall (3) and at least one side wall (4) and having along its height a plurality of first slots (5) spaced with respect to one another and arranged aligned along said front wall (3); a plurality of brackets (6) with a bearing surface (7) counter-shaped with respect to a portion of the external surface of the uprights (2) and having at least one first engaging tongue (8) designed to be inserted into first slots (5) of the front wall (3) for remov-

ably coupling the bracket (6) onto the upright (2). The uprights (2) also comprise a plurality of second slots (25) which are formed inside a lateral projection (20) of the upright (2) and accessible at the front, being aligned and spaced vertically with respect to one another, and into which at least one second engaging tongue (28) is inserted, said tongue being associated with the bracket (6) and being arranged laterally at a distance from the said first engaging tongue (8).



**Fig. 3**

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## Description

The present invention relates to modular metal structures which are used in the construction of lattice-work 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, floors 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 transverse 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 latticework structure also directly supports the side walls and the overhead covering of the warehouse itself.

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 horizontal stringers are fastened. The cross-pieces and diagonal members are firmly connected to the uprights so as to form the sides to which the stringers are fastened by means of brackets suitably counter-shaped with respect to the portion of the upright.

This solution allows preassembly of the sides at the factory and facilitates subsequent assembly of the remaining elements on-site.

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

The rigidity of the finished structure therefore greatly depends on the rigidity of each its components and in particular on that of the stringers and the connection used for fastening them to the uprights.

Having to use stringers which are particularly long, for example in order to increase the transverse dimensions of the support surfaces, the technical problem which is posed is therefore that providing a connection between the ends of the stringers and the sides, which is extremely rigid and strong and able to withstand also the severest stresses due, for example, to the weight of the merchandise deposited on the support elements or the knocks resulting from the - often rough - handling of the forklift trucks used to move this merchandise. In particular this connection must not weaken the uprights or

excessively increase the cost of constructing the entire structure.

In the art it is known to fix the brackets to the upright by means of a row of engaging tongues which are arranged vertically along the bracket and are inserted into corresponding rectangular slots formed in the uprights.

The cross-section of these brackets of the known type is substantially L-shaped so as to rest against the upright on two of its sides.

It is known to improve the rigidity of the connection using brackets with a U-shaped cross-section which embrace the upright on three sides. This solution, while improving the transverse rigidity of the brackets, does not solve, however, the drawback which L-shaped brackets also have, of being easily deformed plastically owing to the stresses on the cross-pieces. These deformations obviously make the structure less secure and stable and hinder the subsequent maintenance operations which might require disassembly of the stringers.

In order to overcome this problem it is known to use uprights which have a continuous longitudinal groove formed on the front wall of the latter, inside which a locking tongue is inserted, said tongue projecting from the internal surface of the bracket. In this way it is possible to limit the mutual rotation of the bracket with respect to the upright, caused by the stresses on the stringer.

With the adoption of this configuration it is possible to limit the problem of deformation of the bracket, but it is not possible, however, to increase beyond a certain level the load which can be applied. The maximum load depends, in fact, also on the number of tongues and their cross-section; if the maximum permissible load values are in fact exceeded, nicks occur on both the tongues and the slots of the uprights with serious consequences for the stability and hence the safety.

Increases in the load which can be applied are therefore obtained by enlarging the thickness of the metal sheets or increasing the number of tongues which are inserted into the uprights.

The first solution has the drawback that it is costly, while implementation of the second solution requires elongation of the brackets in order to make space for the additional tongues. This latter solution, however, limits the minimum distance at which two stringers may be arranged above one another (equal at least to the height of the bracket). Moreover, the connection of the stringers to the brackets, the dimensions of which are too dissimilar from one another (height of the profile of the stringer with respect to height of the bracket) creates problems of local stability and therefore requires special measures in order to strengthen the bracket so as to distribute uniformly the load of the stringers over the entire vertical surface of the brackets.

Finally the handling of long stringers, which have long brackets welded perpendicularly at their ends, is more difficult and increases the probability of bending the brackets prior to assembly on account of accidental

knocks due to lack of attention by the personnel responsible for assembly or the personnel responsible for transportation. Even if the bracket is bent only slightly, it may happen that distribution of the load on the tongues no longer occurs in a uniform manner, as envisaged by the designer, but that only some of said tongues rest correctly on the edge of the slots in the upright. In this way the load on each of the tongues which have not been deformed is increased, while the deformed tongues do not contribute to transmission of the forces. It is obvious that this condition, besides favouring the deformation of the tongues in use, notably reduces the safety of the structure.

The solution which envisages lengthening of the brackets also has the disadvantage that it is excessively complex in relation to the advantages which can be obtained.

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 or the like which is extremely strong and stable and can be manufactured in a practical and economical manner.

A further object of the present invention is that of enabling the construction of structures in which the connection of the stringers to the uprights uses brackets which are extremely compact and resistant, 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 using uprights having a cross-section which is extremely simple to manufacture.

A further object of the present invention is that of increasing the rigidity of the modular structure.

Last but not least, an object is that of allowing the arrangement of the sides at a great distance from one another by using long stringers, without thereby negatively influencing 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 the engagement of brackets with a J-shaped or U-shaped cross-section and having two rows of tongues which are arranged alongside one another and are inserted into as many rows of slots formed in the uprights. Additional coupling systems are arranged between the brackets and the uprights and are designed to strengthen the mutual connection so as to avoid the relative rotation of the bracket and the upright owing to the stresses transmitted to the bracket.

As a result of this particular construction it is possible to obtain a modular structure which is extremely simple and economical and which performs in a safe and very compact manner the function of supporting loads even of considerable weight.

Further advantages and characteristic 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 front view of the upright with which one bracket is associated;

Figure 3 shows the section III-III through the upright and the bracket shown in Figure 2;

Figure 4 shows a plan view of a stringer with two brackets;

Figure 5 shows a back view of a stringer according to Figure 4;

Figure 6 shows a side view of the stringer according to Figure 4.

With reference to the Figures of the accompanying drawings, 1 denotes a modular structure which can be used for constructing the basic latticework which may be used for the construction of shelving, raised floors or other similar constructions.

The modular structure 1 comprises a plurality of vertical sides 10 connected together by horizontal stringers 14.

Each of the sides 10 consists essentially of a pair of uprights 2 connected together by diagonal members 11 and cross-pieces 12.

The upright 2 has, as can be clearly seen in Figure 3, a symmetrical cross-section comprising a front wall 3 and a side wall 4 which is substantially flat and from which a projection 20 extends, said projection being developed parallel to a longitudinal axis A of the upright 2 and being arranged at the rear with respect to the front wall 3.

The front wall 3 of the upright 2 has a substantially U-shaped central groove 15 which comprises, in particular, a bottom wall 30 and two short side walls 22 which form between them two internal corners 16. The central groove 15 is flanked by two square-shaped projections 27 also having a substantially U-shaped profile.

In the vicinity of each of the two internal corners 16 there are formed two rows of first slots 5 which are distributed, uniformly spaced with respect to one another, along the entire height of the upright 2.

Similar second slots 25 are formed inside the lateral projection 20.

Both the first slots and the second slots are accessible frontally, namely from the front of the upright 2.

The front wall 3 has moreover two parallel rows of incisions 29 which are spaced uniformly with respect to one another and arranged symmetrically and parallel with respect to the longitudinal axis A of the upright 2.

The modular structure 1 comprises moreover brackets 6 (see Figures 4, 5 and 6) with a cross-section

in the form of a square-shaped "J" and formed by two facing walls, respectively a short wall 23 and a long wall 24 which are joined together by a central connecting wall 26. Each bracket 6 has first engaging tongues 8 formed along a first free edge 18 of the short side 23 and second engaging tongues 28 formed along a second free edge 19 of the long side 24. Both the first and the second tongues 8, 28 are shaped substantially in the manner of a hook directed downwards, as can be clearly seen from Figure 6, and are identical to one another.

The two facing walls 23, 24 are slightly splayed with respect to one another at an acute angle  $\alpha$  (see Figure 4). This configuration, in addition to facilitating assembly, making it extremely simple and quick to perform, also ensures perfect contact between an internal bearing surface 7 of the bracket 6 and a portion of the external surface of the upright 2.

The bracket 6 has moreover on its inside two projecting elements 21 obtained by means of incision and local deformation of the bracket 6.

Assembly of the brackets 6 on the uprights 2 is obtained by inserting the bracket 6 frontally into one of the square-shaped projections 27 until the first and the second engaging tongues 8, 28 are completely inserted inside the corresponding first and second slots 5, 25.

The spacing suitably chosen between the incisions 29 ensures that, once the bracket has been mounted, the projecting elements 21 are also perfectly inserted inside these incisions 29. The operator, however, does not have to perform any additional operation in order to centre these incisions 29 since centering thereof is automatic owing to the greater length of the tongues with respect to the height of the projecting elements. The tongues are inserted in fact first into the respective slots and from this point on independently guide the next phase involving insertion of the projecting elements 21 into the incisions 29.

Mounting of the bracket 6 on the upright 2 is illustrated in Figure 3. It can be noted in particular that the bearing surface 7 of the bracket 6 is perfectly counter-shaped with respect to a portion of the external surface of the upright 2.

The vertical section of the projecting elements 21 is rounded, in the form of a "wave" (i.e. without sharp edges), so as to greatly simplify any subsequent disassembly of the brackets 6.

The presence of the second engaging tongues 28 allows the height of the bracket 6 to be limited considerably since they transmit part of the loads generated by the forces applied to the stringers 14. Moreover, since the bracket embraces the upright on as many as three sides, and two of these are firmly locked to the upright by the first and second tongues inserted into the respective first and second slots, the joint is extremely reliable, strong and able to limit considerably also the possibility of relative rotation of the bracket and the upright.

This connection is made even more stable by the presence of the projecting opposition elements which are inserted, when the bracket is mounted, into the corresponding incisions arranged along the front wall of the upright 2.

This joint requires a minimum amount of lateral play which does not exceed that indispensable for ensuring mounting of the brackets. An excessive amount of play, in fact, could neutralise the locking function of the bracing system 9, or at least limit the efficiency thereof, since in this case the deformation suffered by the bracket before the lateral edge of the projecting element rests against the lateral edge of the incision could become plastic, i.e. irreversible. Correct functioning of the bracing system 9 is therefore obtained only if any deformation necessary to make it operative, at its full efficiency (which is achieved when at least most of the lateral edge of the projecting element rests on the edge of the incision), is limited to a slight deformation which is elastic, i.e. reversible.

As can be clearly seen in Figure 1, the brackets 6 are mounted at the two free ends of stringers 14. The height of the profile of these stringers is only slightly less than the height of the brackets 6 so that assembly is performed by means of direct welding of the brackets to the stringers and does not require the need for inserting therein any reinforcing element or the like. This is an important advantage since it facilitates the work of the designers without creating additional costs.

The J-shaped configuration of the brackets, illustrated here, is obviously not the only one possible, it also being possible, for example, to envisage adopting U-shaped brackets (not shown) or the like which are equally able to exploit the advantages offered by the presence of the second row of engaging tongues. However, brackets with two facing sides arranged at a distance from one another, enable better results to be obtained since they embrace the upright on at least three of its sides.

Obviously it is also possible to use suitably shaped brackets with more than two rows of tongues. The addition of other rows of tongues would allow the height of the brackets to be reduced further, but would involve, on the other hand, a penalizing increase in the manufacturing costs. For this reason the optimum number of rows of tongues is that indicated here, i.e. two.

The upright 2 and the brackets 6 thus shaped are extremely simple and economical to produce, do not require any special apparatus for their manufacture and are also able to withstand well the knocks to which the components of the modular structure 1 are subject during the transportation or assembly phases. Moreover frontal accessibility of the slots allows assembly of the cross-pieces in the conventional manner or by inserting the brackets onto the upright, engaging them from the front by means of a simple translatory movement of the stringers, without requiring any further auxiliary rotational movement or the like. The time required for

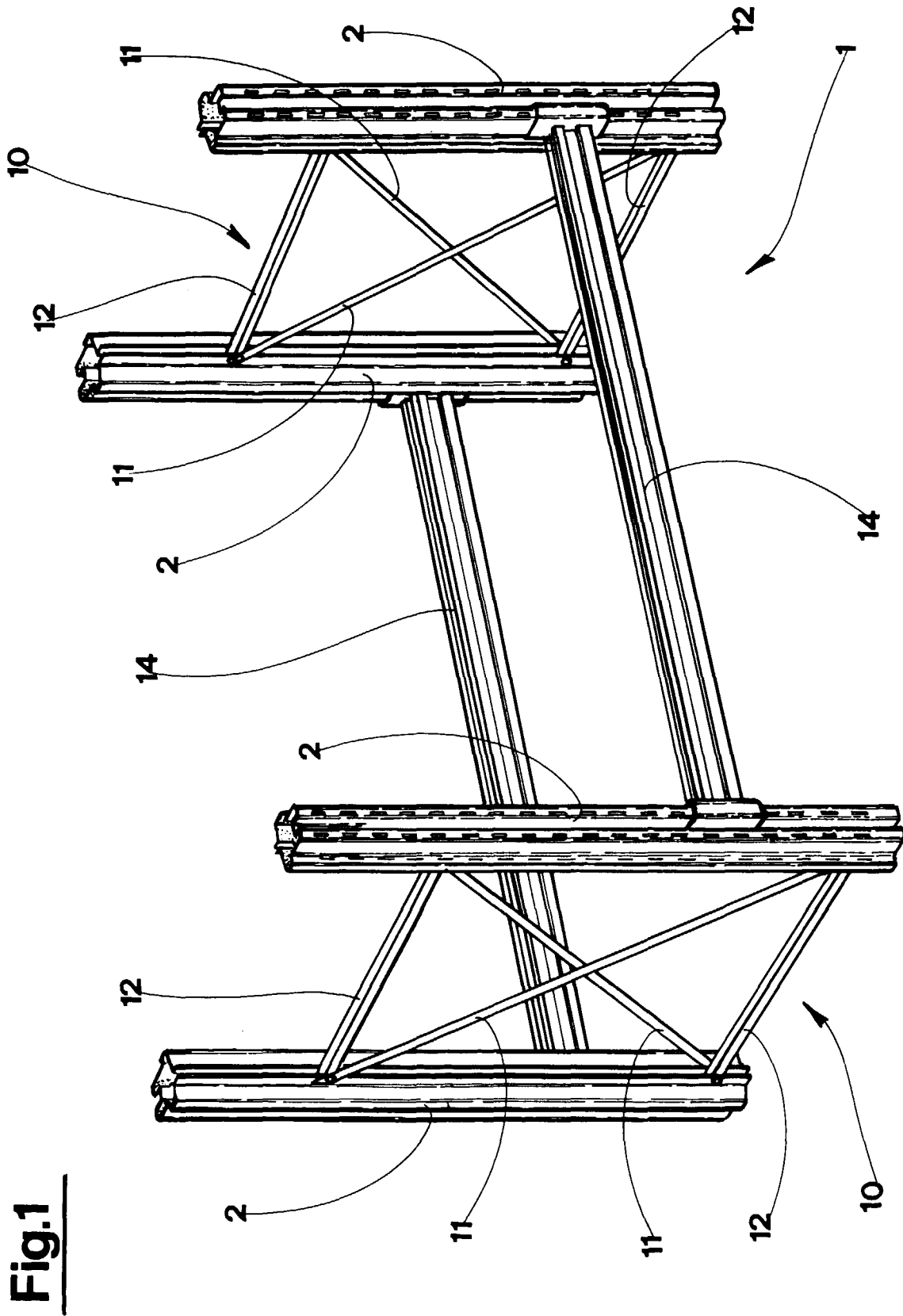
assembly of the structure constructed in accordance with the present invention is less than that required for assembling the modular structures of the known type since the side walls of the bracket, which are slightly splayed with respect to each other (at an angle  $\alpha$ ), facilitate insertion of the bracket onto the upright.

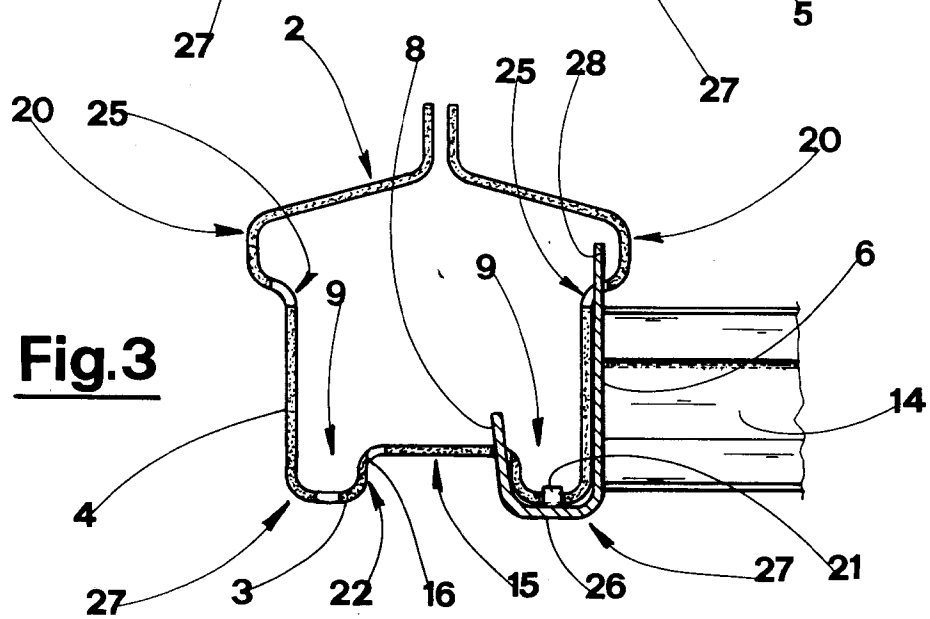
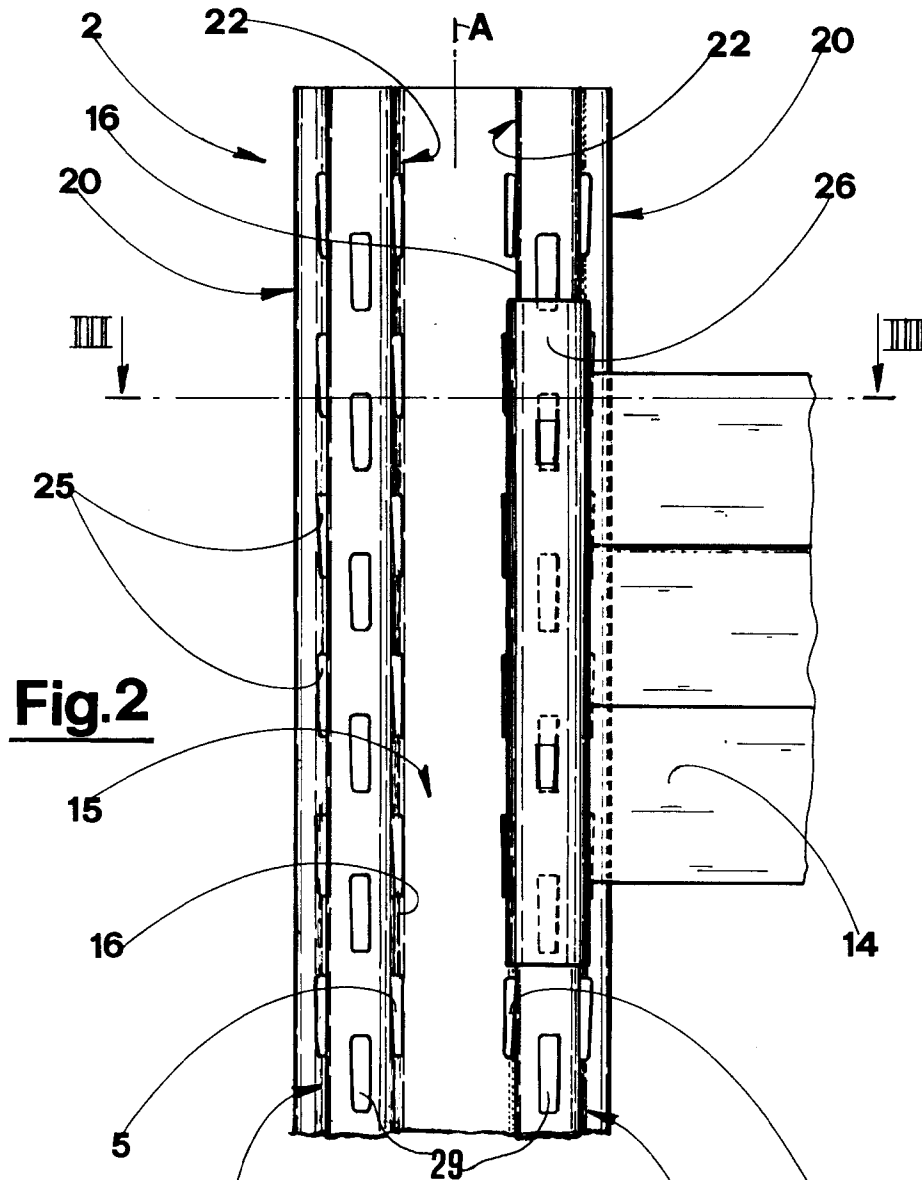
With the structure thus provided it is therefore possible to achieve the preset objects in an extremely simple and economical manner.

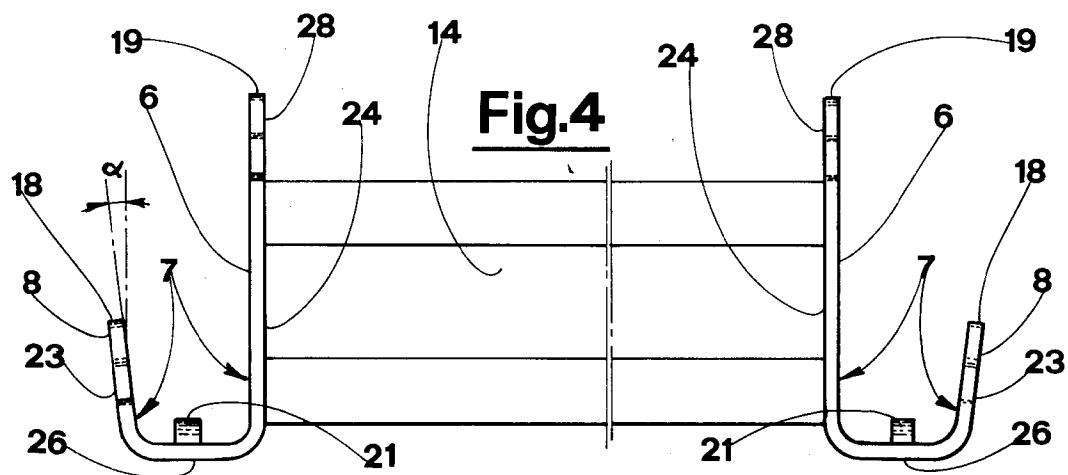
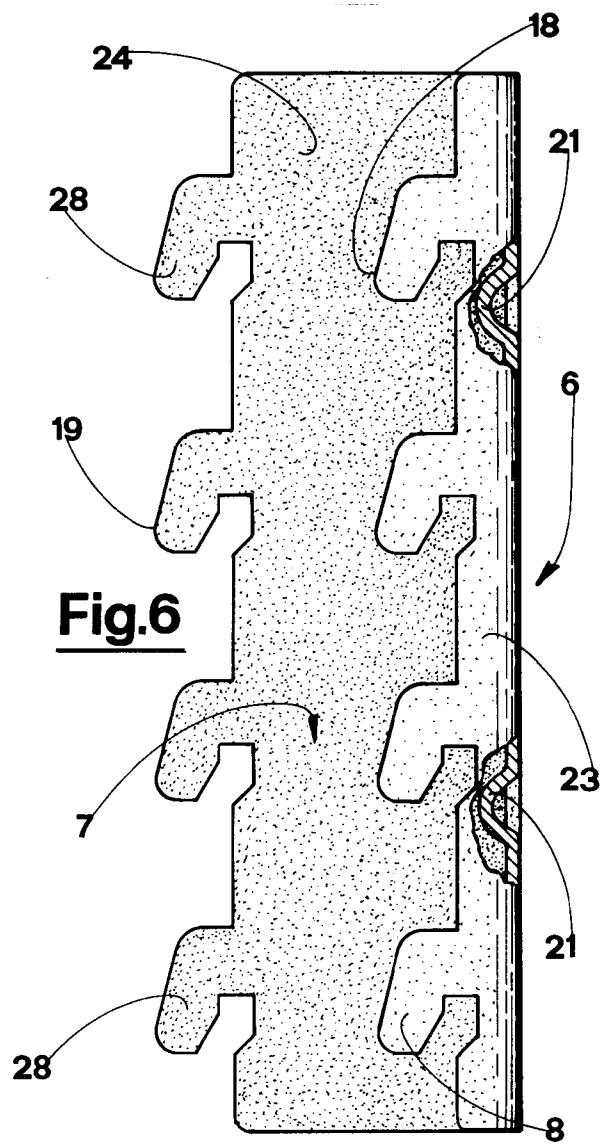
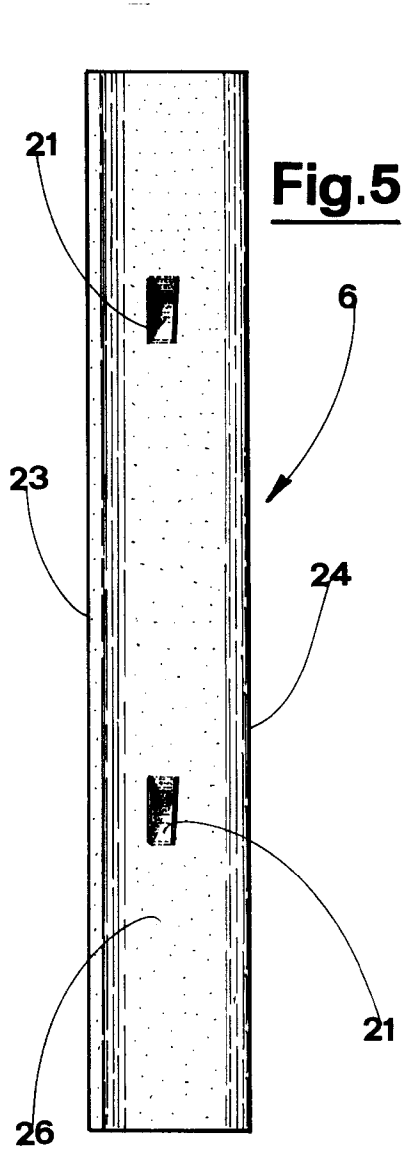
Obviously, numerous other modifications of the constructional details - of a practical and applicational nature - may be applied to the invention, without thereby departing from the protective scope of the inventive idea claimed below.

### Claims

1. Modular structure for metal shelving or the like, comprising:
  - at least one substantially vertical upright (2) with a front wall (3) and at least one side wall (4) and having along its height a plurality of first slots (5) spaced with respect to one another and arranged aligned along said front wall (3);
  - at least one bracket (6) with a bearing surface (7) counter-shaped with respect to a portion of the external surface of the upright (2) and having at least one engaging tongue (8) designed to be inserted into the said first slots (5) of the front wall (3) for removably coupling the bracket (6) onto the upright (2), characterized in that said upright (2) also comprises a plurality of second slots (25) which are accessible at the front, being aligned and spaced vertically with respect to one another, and into which at least one second engaging tongue (28) is inserted, said tongue being associated with the said bracket (6) and being arranged laterally at a distance from the said first engaging tongue (8).
2. Modular structure according to Claim 1, characterized in that said second slots (25) are formed inside a lateral projection (20) formed on the side wall (4) of the upright (2).
3. Modular structure according to Claim 2, characterized in that said lateral projection (20) is arranged at the rear, in a direction for coupling of bracket (6) onto the upright (2), with respect to the front wall (3) of the upright (2).
4. Modular structure according to Claim 3, characterized in that the front wall (3) of the upright (2) comprises a U-shaped recess on the bottom of which the said first slots (5) are arranged.
5. Modular structure according to Claim 3, characterized in that the cross-section of the bracket (6) is formed in the manner of a square-shaped "J" so as to embrace the upright (2) along three sides.
6. Modular structure according to Claim 5, characterized in that two facing sides (23, 24) of the bracket (6) form an acute angle ( $\alpha$ ) between them.
7. Modular structure according to Claim 1, characterized in that the said first and second slots (5, 25) are arranged parallel and aligned with respect to one another.
8. Modular structure according to Claim 1, characterized in that it also comprises bracing means (9) associated with the upright (2) and the bracket (6) in order to avoid relative rotation of the bracket (6) and the upright (2) due to the stresses on the bracket (6).
9. Modular structure according to Claim 8, characterized in that said bracing means (9) comprise a plurality of incisions (29) arranged along the front wall (3) of the upright (2) and designed to interact with at least one corresponding projecting opposition element (21) of the bracket (6), said opposition element (21) being inserted into the incisions (29) without lateral play.
10. Modular structure according to Claim 9, characterized in that the incisions (29) have a rectangular shape.
11. Modular structure according to Claim 9, characterized in that the height of the projecting opposition elements (21) is less than the length of the tongues (8, 28).
12. Modular structure according to Claim 9, characterized in that the vertical section of the projecting opposition elements (21) is rounded in the manner of a "wave".









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# EUROPEAN SEARCH REPORT

Application Number  
EP 97 10 3297

| 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 3 465 895 A (MILLER)                                                       | 1-3,7                                            | A47B57/40                                    |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | * claim 1; figures 1-4 *                                                      | 4,5,8-11                                         | E04F15/024                                   |
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| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | FR 2 237 517 A (A. & R. WIEDEMAR A.G.)                                        | 8-11                                             |                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | * page 2, last paragraph; figures 1,2 *                                       |                                                  |                                              |
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| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US 4 928 834 A (NEIMAN)                                                       | 8,12                                             |                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | * abstract; figures 6,7 *                                                     |                                                  |                                              |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                               |                                                  |                                              |
| Place of search<br>THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                               | Date of completion of the search<br>30 July 1997 | Examiner<br>Jones, C                         |
| <p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone<br/> Y : particularly relevant if combined with another document of the same category<br/> A : technological background<br/> O : non-written disclosure<br/> P : intermediate document</p> <p>T : theory or principle underlying the invention<br/> E : earlier patent document, but published on, or after the filing date<br/> D : document cited in the application<br/> L : document cited for other reasons<br/> .....<br/> &amp; : member of the same patent family, corresponding document</p> |                                                                               |                                                  |                                              |

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