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(54) Prefabricated modular structure for the construction of industrial and/or civil buildings

(57) A prefabricated modular structure for the construction of industrial and/or civil buildings comprises a plurality of parallel rows (3) of mutually aligned supporting pillars (4), a plurality of corresponding rows (5) of roofing beams (6) which are mutually aligned and connect the pillars (4) in pairs, and a plurality of finishing elements (7) which are arranged side by side and substantially transversely to the longitudinal extension of the beams (6), so that their respective ends rest on two contiguous rows (5) of the beams (6).

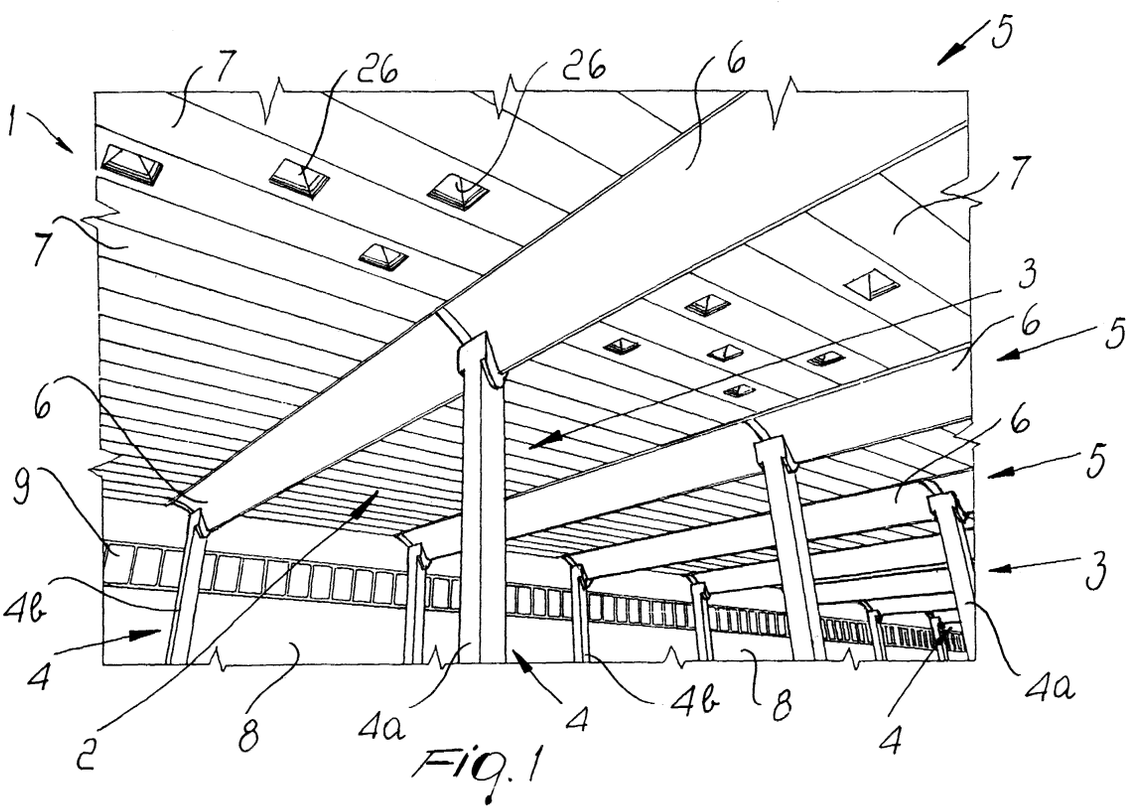

Fig. 1

EP 1 136 633 A1

Description

[0001] The present invention relates to a prefabricated modular structure for the construction of industrial and/or civil buildings, such as buildings used for production, agriculture, commerce or for social and/or recreational uses.

[0002] Buildings are known in which the roofing is provided by means of self-supporting reinforced-concrete prefabricated elements, or roofing beams, which are supported by the supporting framework of the building and in turn can support an upper roofing on their exterior.

[0003] Said framework is substantially constituted by a frame of supporting pillars which are joined peripherally by closure walls and are connected one another by primary supporting beams which support the roofing elements.

[0004] Conventional roofing elements generally have a longitudinal central channel for water collection being delimited by two lateral wings which diverge outwardly.

[0005] The lateral wings can have pairs of longitudinal ridges on which corrugated roofing panels, made for example of fiber-reinforced cement, are fixed, delimiting a cavity for air circulation and for the insertion of insulating material.

[0006] These roofing elements can be arranged side by side or be spaced one another with a specific center distance; the free space between two successive elements can be covered by way of secondary upper roofing means which are constituted, for example, by skylights, curved slabs or sheds.

[0007] These conventional buildings are not free from drawbacks, including the fact that their construction requires the presence of several components (at least four), of which some have merely structural functions and others have merely a covering function; they are substantially constituted by the pillars, by the supporting beams, by the roofing elements and by the panels and/or any secondary upper covering means (skylights, slabs or the like), each of which has to be designed, manufactured, transported and installed; accordingly, the costs for production and for labor use are high, transportation is awkward and onerous, and consumption of the materials used is considerable.

[0008] The aim of the present invention is to eliminate the above-noted drawbacks of conventional buildings by providing a prefabricated modular structure for the construction of industrial and/or civil buildings which allows to simplify the construction of buildings and the provision of their roofings, to reduce production and installation costs, to limit the use of labor, to contain the waste of material and to facilitate operations for transporting and assembling the elements that constitute said buildings.

[0009] Another advantage of the present invention is that it allows to build structures having characteristics in terms of space occupation, load-bearing capacity, protection, thermal insulation, lighting and systems which can be adapted and are suitable to meet the different requirements of the individual situation.

[0010] Within the scope of this aim, an object of the present invention is to provide a structure which is simple, relatively easy to provide in practice, safe in use, effective in operation and relatively low in cost.

[0011] This aim and this and other objects are achieved by the present prefabricated modular structure for the construction of industrial and/or civil buildings, characterized in that it comprises a plurality of parallel rows of mutually aligned supporting pillars, a plurality of corresponding rows of roofing beams being mutually aligned and connect said pillars in pairs, and a plurality of finishing elements which are arranged side by side and substantially transversely to the longitudinal extension of said beams, so that their respective ends rest on two contiguous rows of said beams.

[0012] Further characteristics and advantages of the present invention will become better apparent from the detailed description of a preferred but not exclusive embodiment of a prefabricated modular structure for the construction of industrial and/or civil buildings, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a perspective view of the inside of a portion of a building constructed with a prefabricated modular structure according to the invention;

Figure 2 is an exploded top perspective view of a supporting pillar, of two roofing beams and of two finishing elements of the structure according to the invention;

Figure 3 is an exploded bottom perspective view of the supporting pillar and of the two roofing beams of Figure 2;

Figure 4 is an exploded top perspective view of a terminal supporting pillar and of the corresponding roofing beam of the structure according to the invention.

[0013] With reference to the figures, 1 generally designates a building constructed with a prefabricated modular structure 2 for the construction of industrial and/or civil buildings, according to the invention.

[0014] The structure 2 comprises multiple mutually parallel rows 3 of supporting pillars 4 being mutually aligned so as to constitute a frame for supporting a plurality of corresponding rows 5 of roofing beams 6 which are mutually aligned and connect the pillars 4 in pairs, and a plurality of elements 7 for finishing the roofing of the building 1, whose respective ends rest on two contiguous rows 5 of beams 6; the finishing elements are arranged mutually side by side and substantially transversely to the longitudinal extension of said beams 6.

[0015] Advantageously, the rows of pillars 4 and of beams 6 run parallel to the width of the building 1; the finishing elements 7 are instead arranged parallel to the length of the building 1 and are perpendicular to the lon-

gitudinal axis of the beams 6.

[0016] Intermediate pillars 4a and terminal pillars 4b can be distinguished along each row 3 of pillars 4 and respectively support two concurrent beams and a terminal beam of the respective row 5.

[0017] The terminal pillars 4b are joined peripherally by walls 8 for closing the building 1, in which windows 9 are formed.

[0018] Each roofing beam 6 falls within the category of structural members having a low-thickness main cross-section, whose maximum width depends essentially on dimensional requirements during transport, although in the case of on-site manufacture this limitation can be removed, while its maximum longitudinal dimension is essentially linked to structural load-bearing factors.

[0019] Each beam 6 is constituted by two symmetrical elongated wings 10 which are arranged substantially in a V-shaped configuration with the vertex pointing downward and have, in an upward region, respective lips 11 for supporting the edges of the elements 7.

[0020] Each wing 10 is curved outward with its convexity directed towards the inside of the V; this shape is rendered more efficient by means of thicker portions at the vertex and/or upper apices of said V-shaped configuration.

[0021] Conveniently, the two wings 10 of each beam 6 are mutually connected by a flat dividing portion 12 which is arranged horizontally at a presettable level with respect to the vertex of the V-shaped configuration; the flat portion 12 and the upper portions of the wings 10 form a longitudinal upper channel 13 which is shaped like an isosceles trapezoid and is open upward in order to collect and convey precipitation.

[0022] A longitudinal duct 14 is formed between the flat portion 12 and the lower portions of the wings 10, which are mutually joined at the vertex of the V-shaped configuration; channels for the systems of the building 1 can be inserted in said duct and are thus kept protected and out of sight.

[0023] The flat portion 12, having a structural function, can be provided with openings which allow inspection and, as an alternative, can be supported by optionally perforated partitions which are inserted between the wings 10 or supported by tension elements or profiled elements made of steel; the flat portion 12 can further be constituted by removable metal plates.

[0024] The upper walls of the two wings 10 can have circular skylights for daytime or artificial lighting.

[0025] The beams 6 are structural and functional components, since they are part of the load-bearing structure of the building 1 and at the same time help to form its upper roofing.

[0026] Each pillar 4 has a shaped head 15 for stably supporting an end 16 of at least one beam 6 which is constituted by an upper partition 17 for the abutment of the end 16, which is substantially vertical and perpendicular to the beam 6, and by a lower portion 18, which is thicker than the partition 17 so as to form a step 19 for supporting the end 16.

[0027] The head 15 stably supports the beam 6 and prevents its rotation about its longitudinal axis.

[0028] The step 19 is formed in the corresponding pillar 4 and is substantially V-shaped, so that it is possible to insert and rest therein the vertex of the corresponding V-shaped configuration formed by the wings 10 of the beam 6 supported by said pillar.

[0029] The partition 17 protrudes upward from the step 19 with a shape which substantially duplicates the transverse cross-section of the beam 6 proximate to the end 16.

[0030] At least two seats 20 are formed on the top of the partition 17, proximate to the apices of the V-shaped configuration that it forms, and are coupled respectively to the extensions 21 of the lips 11 that protrude from the end 16.

[0031] Advantageously, the lower portion 18 is enlarged and protrudes with respect to the pillar 4, so as to extend the supporting region of the end 16.

[0032] In the intermediate pillars 4a (Figures 2 and 3), the partition 17 is in a substantially central position with respect to the thickness of the lower portion 18 and forms two steps 19 which are mutually opposite and separate and in which the respective ends 16 of two concurrent beams 6 of a same row 5 rest.

[0033] In the terminal pillars 4b (Figure 4), the partition 17 is in a substantially lateral position with respect to the thickness of the lower portion 18 and forms a step 19 for supporting the end 16 of the beam 6 at the end of the corresponding row 5.

[0034] The partition 17 has, at its top, a flat surface 22 on which the precipitation collected by the channels 13 is gathered and at which the top end of a drainage hole 23 opens; said hole is formed vertically through the pillar 4 in order to drain precipitation.

[0035] The pillars 4 substantially act as a support and can internally accommodate axially aligned channels having a small diameter for water conveyance.

[0036] The shape of the pillars is linked particularly to the function of coupling the beams, which is provided by the support of the lower vertex of said beams and by the locking of their rotation both during the assembly of the finishing elements and in the border condition in which the beams that form the outer perimeter of the building support the elements only on one side.

[0037] The elements 7 for finishing the upper roofing of the building 1 are plate-like and are constituted by a rectangular slab 24 with a flat internal face having, in an upward region and proximate to its sides, two longitudinal stiffening ridges 25.

[0038] The slabs 24 can be provided with skylights 26 of the circular, dome or shed type, or the like, in two possible directions so as to allow an orientation which is always favorable to the north; a solution in which the slabs 24 are alternated with continuous skylights is also possible.

[0039] The upper roofing can be provided by means of a continuous covering or with an independent structure, so as to constitute a ventilation cavity, while heat insulation can be localized at one of the several elements whose layered succession constitutes the protective structure of the building as a whole.

[0040] In one possible embodiment, the ends of the two series of elements 7 resting on the lips 11 of a beam 6 form an opening above the channel 13 which is open outward in order to collect precipitation.

[0041] The pillars 4, the roofing beams 6 and the finishing elements 7 are prefabricated using prestressed or non-prestressed reinforced concrete, and are manufactured, transported and assembled using technologies which are typical of the field of prefabrication.

[0042] In practice it has been found that the described invention achieves the intended aim and objects, and in particular that it allows to simplify the construction of buildings and of their roofings by reducing the number of components required for their construction.

[0043] Only three components (pillars, roofing beams and finishing elements) are in fact essential, and they can be considered both as structural components and as covering components; each component can be equipped to perform all the functions required for the completion of a building.

[0044] The structure according to the invention further allows to provide buildings having an extensive floor plan with minimal use of components, each of which is potentially capable of meeting any system-related requirements: the production, labor and materials costs are accordingly reduced and the transport and assembly operations are simplified.

[0045] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0046] All the details may further be replaced with other technically equivalent ones.

[0047] In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the scope of the protection of the appended claims.

[0048] The disclosures in Italian Patent Application No. MO2000A000051 from which this application claims priority are incorporated herein by reference.

[0049] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A prefabricated modular structure for the construction of industrial and/or civil buildings, **characterized in that** it comprises a plurality of parallel rows (3) of mutually aligned supporting pillars (4), a plurality of corresponding rows (5) of roofing beams (6) which are mutually aligned and connect said pillars (4) in pairs, and a plurality of finishing elements (7) which are arranged side by side and substantially transversely to the longitudinal extension of said beams (6), so that their respective ends rest on two contiguous rows (5) of said beams (6).

2. The structure according to claim 1, **characterized in that** each one of said roofing beams (6) is constituted by two elongated symmetrical wings (10) which are arranged substantially in a V-shaped configuration with the vertex directed downward and have, in an upward region, respective lips (11) for supporting the ends of said finishing elements (7).

3. The structure according to one or more of the preceding claims, **characterized in that** each one of said wings (10) is curved outward, with its convexity directed towards the inside of said V-shaped configuration.

4. The structure according to one or more of the preceding claims, **characterized in that** the wings (10) of each beam (6) are mutually connected by at least one substantially horizontal flat dividing portion (12) which is arranged at a presettable level with respect to the vertex of said V-shaped configuration, said flat portion (12) and the upper portions of said wings (10) forming a longitudinal upper channel (13) which is open upward for collecting and conveying precipitation.

5. The structure according to one or more of the preceding claims, **characterized in that** said flat dividing portion (12) comprises at least one inspection opening.

6. The structure according to one or more of the preceding claims, **characterized in that** said flat portion (12) is supported by partitions inserted between the wings (10).

7. The structure according to one or more of the preceding claims, **characterized in that** said flat portion (12) is supported by tension elements or profiled elements made of steel.

8. The structure according to one or more of the preceding claims, **characterized in that** each one of said wings (10) comprises, in an upward region, circular skylights or the like.

9. The structure according to one or more of the preceding claims, **characterized in that** each one of said pillars (4) has a shaped head (15) for stably

supporting an end (16) of at least one of said beams (6).

10. The structure according to one or more of the preceding claims, **characterized in that** said shaped head (15) comprises an upper partition (17) for the abutment of said end (16) of the beam (6) and a lower portion (18) which is thicker than said partition (17), so as to form a step (19) for supporting said end (16), and is adapted to stably support the beam (6) and to prevent its rotation about its own longitudinal axis.

11. The structure according to one or more of the preceding claims, **characterized in that** said step (19) is formed in the corresponding pillar (4) and is substantially V-shaped for the insertion and resting therein of the vertex formed by the wings (10) of the beam (6), and in that said upper partition (17) protrudes upward starting from said step (19) with a shape which substantially duplicates the transverse cross-section of the beam (6).

12. The structure according to one or more of the preceding claims, **characterized in that** said lower portion (18) is thicker than the corresponding pillar (4).

13. The structure according to one or more of the preceding claims, **characterized in that** said upper partition (17) is in a substantially central position with respect to the thickness of said lower portion (18) and is adapted to form a pair of mutually opposite steps (19) for supporting the respective ends of two concurrent beams (6).

14. The structure according to one or more of the preceding claims,
characterized in that said upper partition (17) is in a substantially lateral position with respect to the thickness of said lower portion (18) and is adapted to form said step (19) for supporting the end (16) of the terminal beams (6) of said rows (5) of beams.

15. The structure according to one or more of the preceding claims, **characterized in that** said upper partition (17) has, at its top, a flat surface (22) where the precipitation collected by said upper channel (13) gathers and at which the top end of a vertical drainage hole (23) opens, said hole (23) being formed through said pillar (4) in order to drain precipitation.

16. The structure according to one or more of the preceding claims, **characterized in that** the ends of the finishing elements (7) resting on the lips (11) of each one of said beams (6) form an opening above said upper channel (13) which is open outward.

17. The structure according to one or more of the preceding claims, **characterized in that** said finishing elements (7) are plate-like.

18. The structure according to one or more of the preceding claims, **characterized in that** said finishing elements (7) comprise longitudinal stiffening ridges (25).

19. The structure according to one or more of the preceding claims, **characterized in that** said finishing elements (7) comprise skylights (26) of the circular, dome, shed type or the like.

20. The structure according to one or more of the preceding claims, **characterized in that** said supporting pillars (4), said roofing beams (6) and said finishing elements (7) are made of reinforced concrete.

21. The structure according to one or more of the preceding claims, **characterized in that** said roofing beams (6) and said finishing elements (7) are made of prestressed reinforced concrete.

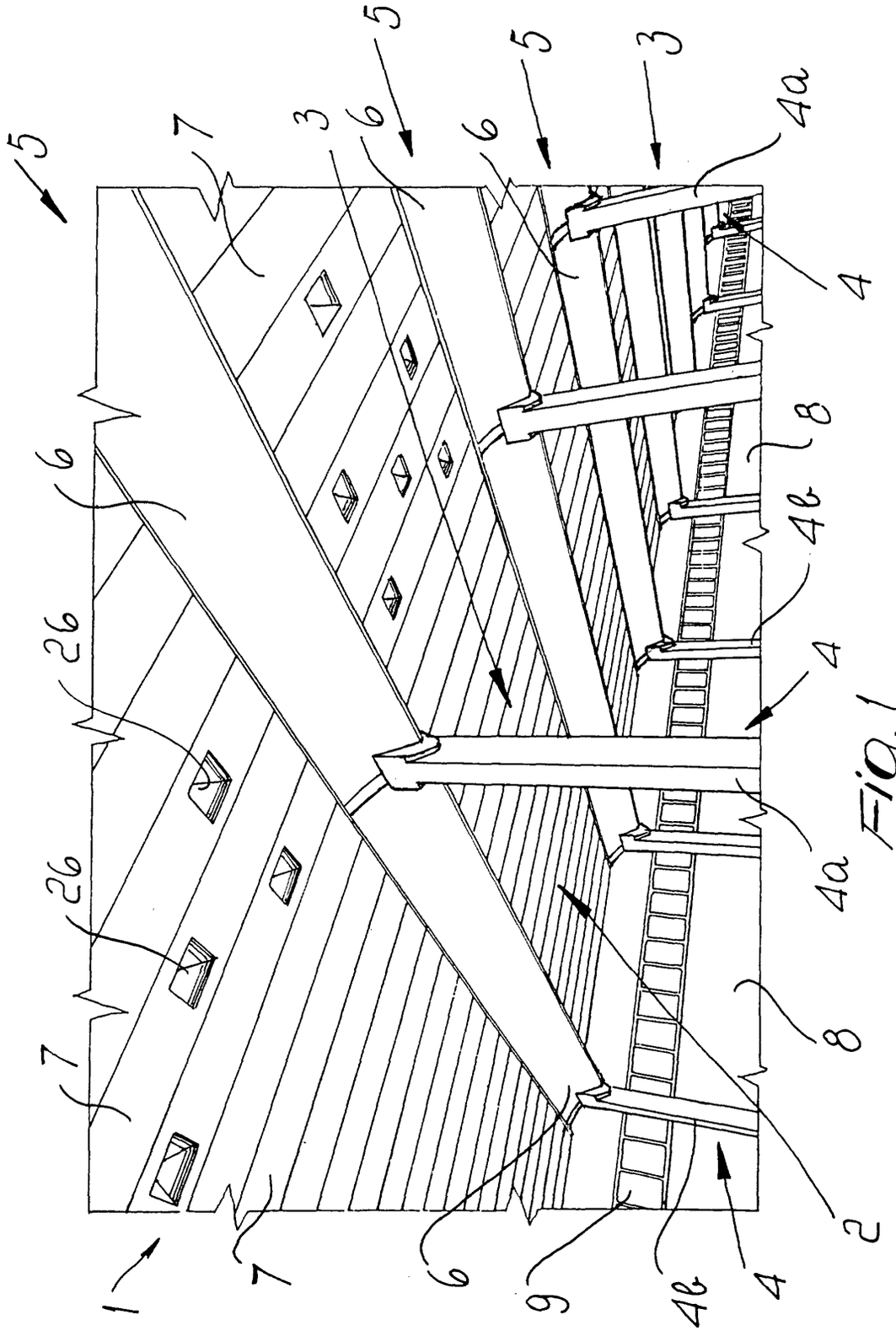

Fig. 1

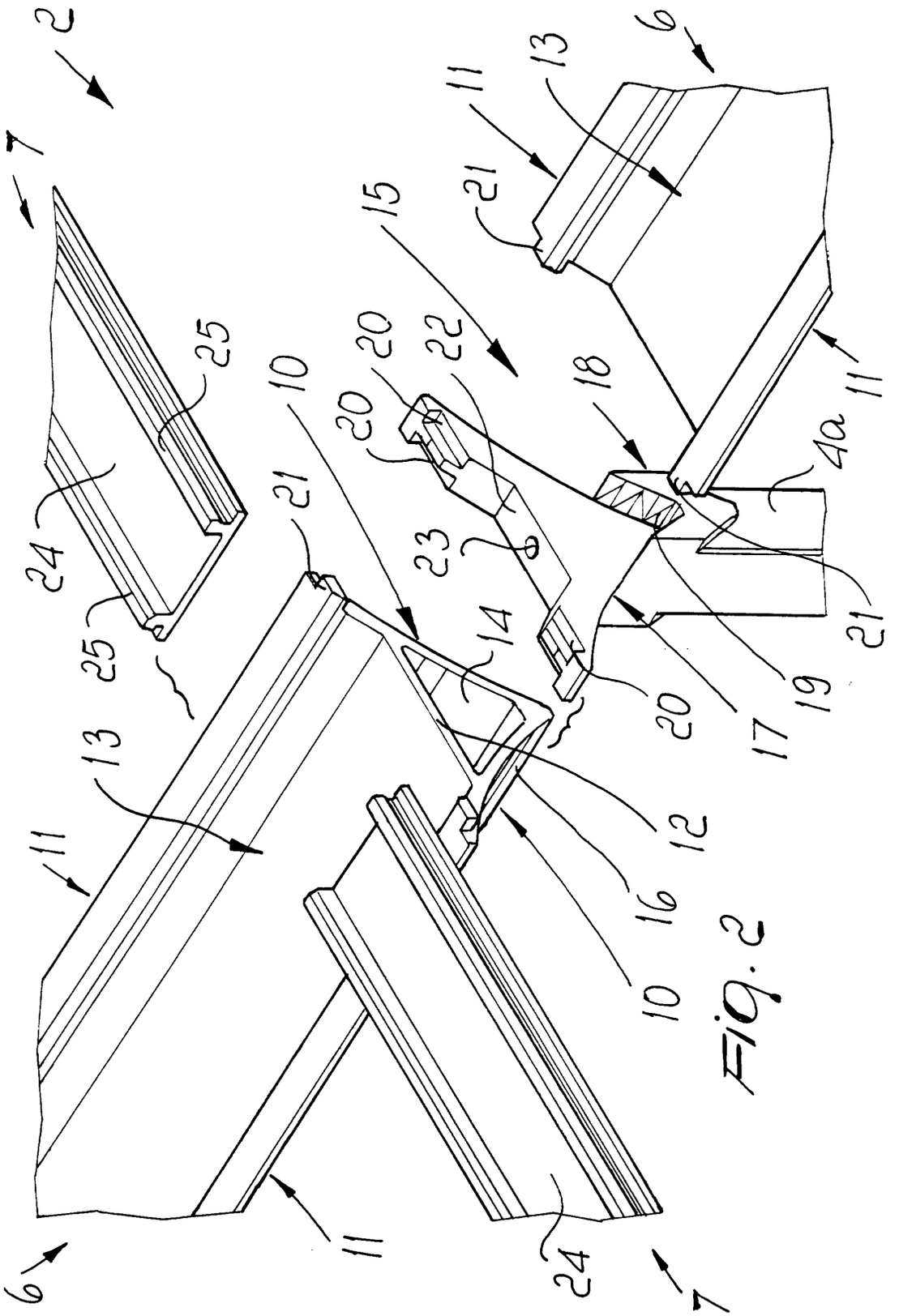

Fig. 2

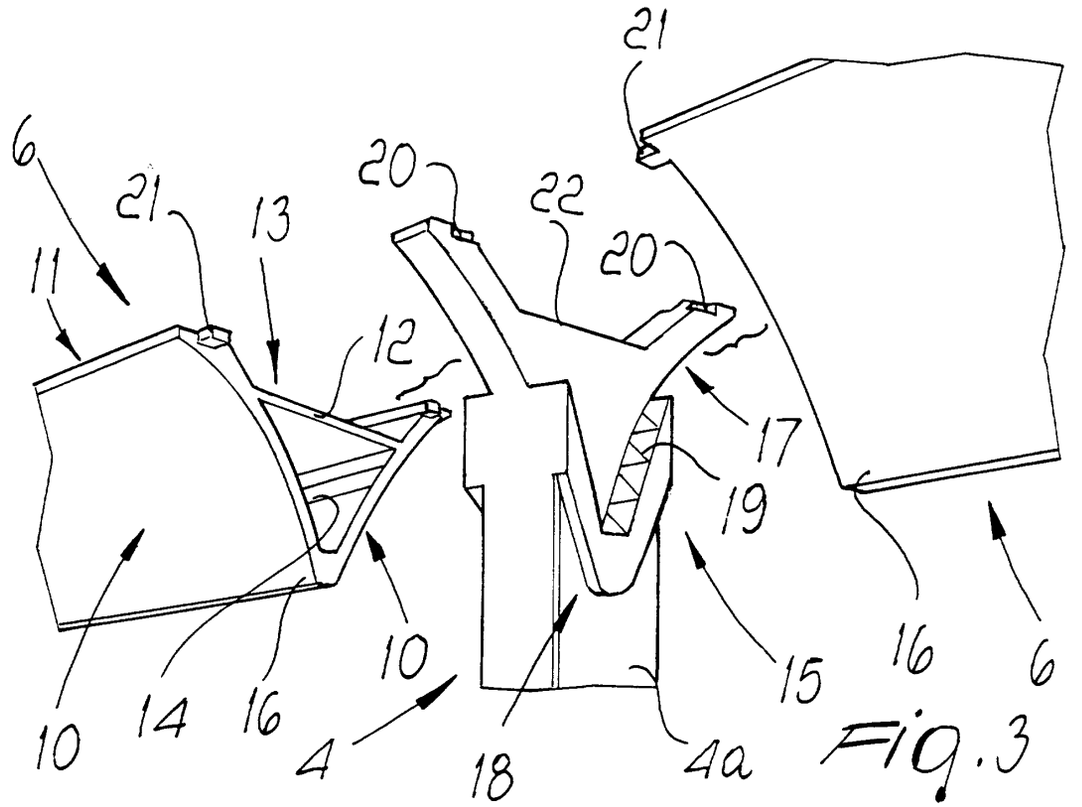
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Fig. 3

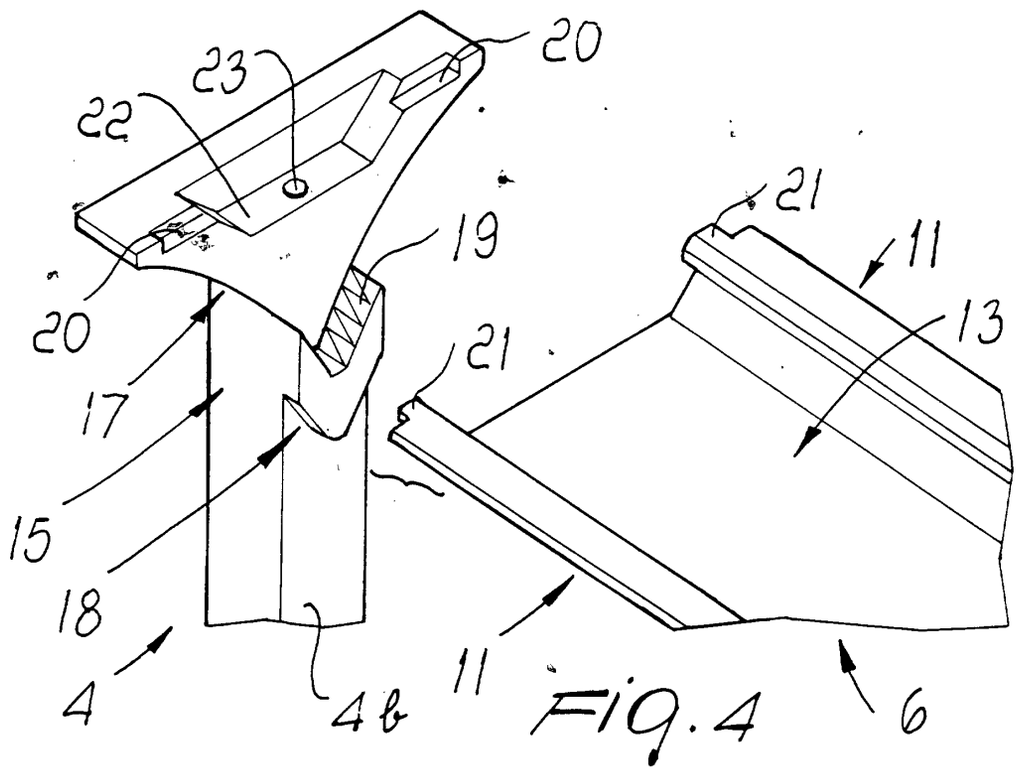
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Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 01 10 5445

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.7)
X Y A	FR 1 022 385 A (ATELIERS PROUVÉ ET AL.) 5 March 1953 (1953-03-05) * the whole document * ---	1-5, 19-21 8 6-17	E04B7/10 E04B7/12 E04B7/04 E04D13/04
X Y A	EP 0 250 020 A (DLC S.R.L.) 23 December 1987 (1987-12-23) * column 2, line 40 - column 3, line 20; figures * ---	1-3,9, 16-21 10,12, 13,15 4-8,11, 14	
X A	EP 0 521 431 A (ITALCASE PREFABBRICATI) 7 January 1993 (1993-01-07) * column 3, line 11 - column 6, line 21; figures * ---	1-4, 16-21 5-15	
Y A	FR 529 542 A (VILLEMIN) 29 November 1921 (1921-11-29) * the whole document * ---	10,12, 13,15 1-3,6,9, 11,14, 19,20	TECHNICAL FIELDS SEARCHED (Int.Cl.7) E04B E04D
Y A	DE 23 36 603 A (MENOSSO) 6 February 1975 (1975-02-06) * figure 6 * ---	8 1	
A	FR 1 289 240 A (JOUBERT) 16 August 1962 (1962-08-16) * column 1, line 26 - line 40; figures * ---	1,2,20, 21	
A	EP 0 727 537 A (COCCO ET AL.) 21 August 1996 (1996-08-21) * abstract; figures * ---	1-21	
A	FR 1 435 718 A (ALMEIDA ARAÚJO) 27 June 1966 (1966-06-27) * the whole document * -----	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 July 2001	Righetti, R

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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12-07-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 1022385 A	05-03-1953	NONE	
EP 250020 A	23-12-1987	IT 1204860 B AT 54980 T DE 3763911 D	10-03-1989 15-08-1990 30-08-1990
EP 521431 A	07-01-1993	IT 1250609 B	21-04-1995
FR 529542 A	29-11-1921	NONE	
DE 2336603 A	06-02-1975	NONE	
FR 1289240 A	16-08-1962	NONE	
EP 727537 A	21-08-1996	IT VI950027 A	16-08-1996
FR 1435718 A	27-06-1966	NONE	

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