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(71) Applicant: **Euroedile S.r.l.**
31040 Postioma di Paese (TV) (IT)

(72) Inventor: **Parisotto, Nereo**
31040 Postioma di Paese (TV) (IT)

(74) Representative: **Zanoli, Enrico et al**
Zanoli & Giavarini S.r.l.
Via Melchiorre Gioia, 64
20125 Milano (IT)

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(54) **A scaffolding module for arranging a scaffolding structure and a method for the assembly/disassembly of said structure**

(57) The present invention relates to a scaffolding module to be used for the realization of a scaffolding structure for construction works such as buildings, infrastructures or monuments.

The scaffolding module, according to the invention comprises a plurality of support frames (4), between which a walkable surface (5) is created, each of said frames comprising at least one pair of upper coupling ends (6) and a corresponding couple of lower coupling

ends (7).

The scaffolding module, according to the invention comprises centring means positioned on such upper and/or lower coupling ends in order to facilitate the coupling of said module respectively with the lower or the upper coupling ends of an additional module.

The invention also relates to a method for the assembly/disassembly of a scaffolding structure composed of a plurality of scaffolding modules.

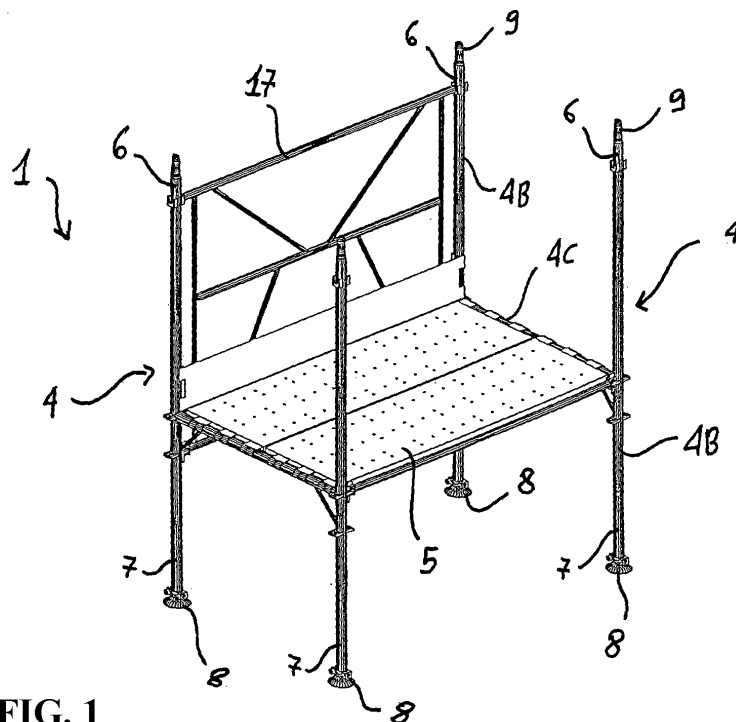


FIG. 1

Description

[0001] The present invention relates to a scaffolding module to be used for the realization of a scaffolding structure for construction works such as buildings, infrastructures or monuments. The invention also relates to a method for the assembly/disassembly of a scaffolding structure composed of a plurality of scaffolding modules.

[0002] In the construction of buildings, the use of scaffolding structures that serve primarily to provide construction workers with support is commonly known. The various existing types include structures with portal-type frames and others with H-type frames. Both types of structure require specific procedures for assembly and disassembly.

[0003] For portal frame structures, the respective assembly procedure specifies the set-up of a plurality of bases fixed or removable and the subsequent positioning of portal frames, each one on a pair of the corresponding bases. The frames are then joined together through the use of diagonal connection bars and rails. A set of anchors for the structure and a set of walkable surface boards that make up the first layer of scaffolding are then prepared. The next phase consists in the outfitting and tightening - always working at ground level - of the so-called "lifelines" that enable the workers to climb in safety onto the scaffolding platform in order to perform the assembly of the elements destined to support the second platform or other alternative elements according to the pre-established construction drawing. In order to lift the elements to be assembled portal frame, rails, etc to the desired height, operators have traditionally used electric lifts or cable-pulley systems wherever possible, when scaffolding of modest height was required, for example.

[0004] The disassembly of this type of scaffolding consists in dismantling from the structure's highest level with the use of a "lifeline". The material is lowered to the ground using the above-mentioned lifting or manual systems. After reaching the structure's lowest level and making sure that they are no longer necessary, the anchors are removed and the material is put away.

[0005] As regards H-frame scaffolding structures, the assembly process occurs essentially as above. In particular, after first setting up a certain number of bases, raised tubes are installed if necessary and the H-frames are positioned and connected to the internal rails. Subsequently and in the following order, the anchors are set up, the railings of the scaffolding's first level are installed, and the boards that form the walkable surface are positioned. In order to reach the first level formed in this way, the operators usually use a trapdoor with a ladder and then attach themselves to safety systems. After taking steps to ensure their own safety, they continue the assembly process by repeating the above operations for each successive layer required.

[0006] In this case as well, lifting systems similar to those described above are used to carry the elements to be assembled to the desired height, and the disassembly

process is entirely similar to the one described above for portal frame scaffolding structures.

[0007] As becomes evident from the above, these currently-used scaffolding structures pose various problems, the first of which is the time it takes to assemble and then disassemble the structure. Both types of structure are in fact assembled and then disassembled "piece by piece". This obviously takes a very long time, which obviously increases the operating costs. The use of lifting systems or cable-pulley systems does not contribute to reducing the assembly times because the pieces must still be moved one at a time. Installation times and operating costs also increase considerably whenever there are other obstructions, when the above-mentioned lifting systems cannot be used, for example.

[0008] At the same time, current assembly/disassembly processes are also clearly disadvantageous in terms of worker safety. Even if lifelines or similar safety measures are used, the number of workers dedicated to the assembly of the structures is too high and, as is commonly known, this keeps the risk of falling or other accidents in the workplace high.

[0009] These considerations clearly indicate the need for alternative technical solutions that enable the drawbacks cited above to be overcome in terms of both the structural design and the method used to assemble and subsequently disassemble the scaffolding structure.

[0010] Thus, the main aim of the invention is to provide a scaffolding module for the assembly/disassembly of a scaffolding structure that overcomes the above problems.

[0011] Within said technical aim, one object of the invention is to provide a scaffolding module that reduces the operating costs and times required for the assembly/disassembly of the scaffolding structure.

[0012] Another object of the invention is to provide a scaffolding module that permits the use of a scaffolding structure assembly/disassembly method that requires fewer workers while at the same time ensuring the proper safety of such workers.

[0013] Another object of the invention is to provide a scaffolding module that enables a scaffolding structure assembly/disassembly method to be used such that the scaffolding structure can be erected quickly even when obstructions are encountered.

[0014] Another, not necessarily last object of the invention is to provide a modular scaffolding structure that is reliable and easy to construct at competitive costs.

[0015] The above aim and objects are achieved by a scaffolding module according to the following Claim 1.

[0016] Additional aspects of the present invention relates to a scaffolding structure assembly/disassembly method according to the following Claims 8 and 9.

[0017] The scaffolding module according to the invention can be advantageously combined with another equivalent module to form a substantially modular scaffolding structure.

[0018] The arrangement of appropriate centring

means facilitates this combination, significantly reducing the human action required, which can in any case be undertaken in safe conditions, as described below.

[0019] The module according to the invention also enables a scaffolding structure to be assembled/disassembled using an extremely rapid and safe method that also affords significant savings in terms of operating times and costs.

[0020] Further advantages of the invention will be presented in more detail in the description of the preferred but not exclusive embodiments of the scaffolding module given purely as a non-limiting example in the final drawings, wherein:

- Figures 1 and 2 are perspective views from different angles of a scaffolding module according to the invention;
- Figure 3 shows a first and second module according to the invention, and particularly the phase for coupling said first module over said second module;
- Figure 4 shows a scaffolding structure realized by coupling the two modules shown in Figure 3;
- Figure 5 shows the coupling of an additional module to the structure shown in Figure 4;
- Figure 6 shows a scaffolding structure made by coupling three modules equivalent to those illustrated in Figures 1 and 2;
- Figures 7 and 7B show a possible embodiment of centring means for a scaffolding module according to the invention;
- Figure 8 is an exploded view of the coupling of the lower end of one module with the upper end of a second module;
- Figure 9 is a cross-sectional view of a detail of the coupling between the lower end of a first module and the upper end of a second module;
- Figure 10 is a view of a possible embodiment of a plurality of modules connected horizontally according to this invention;
- Figure 11 is a view of the coupling of one of the modules illustrated in Figure 10 to a scaffolding structure obtained by coupling another two of the modules shown in Figure 10;
- Figure 12 is a view of a modular structure obtained by coupling the modules shown in Figure 10;
- Figure 13 is a view of another plurality of modules according to the invention;
- Figure 14 is a view of two modular groups, each of which is obtained by coupling the modules shown in Figure 13;
- Figure 15 shows a structure obtained by coupling the modular group shown Figure 14 with another module as shown in Figure 13;
- Figure 16 shows another modular structure that includes a plurality of modules according to the invention;
- Figure 17 shows a scaffolding structure during its disassembly that includes a plurality of modules ac-

ording to the invention.

[0021] With reference to the above-mentioned figures, the scaffolding module 1, 1B, 1C according to the invention is advantageously employed in the realization of scaffolding structures 2 for construction yards.

[0022] The module 1, 1B, 1C according to the invention essentially comprises a plurality of support frames 4, between which at least one walkable surface 5 extends in the longitudinal direction.

[0023] Each support frame 4 also includes a pair of upper coupling ends 6 and a corresponding pair of lower coupling ends 7. The distance between a lower coupling end 7 and an upper coupling end 6 gives the scaffolding module 1 its vertical definition.

[0024] In this regard, Figures 1 and 2 show from different points of view a module 1 that can be considered as an "elementary" module for the purposes of this invention.

[0025] Said module includes two support frames 4 each of which has an essentially "H" shape consisting of two vertical members 4B and a cross member 4C.

[0026] Each vertical member 4B defines a lower coupling end 7 and a corresponding upper coupling end 6.

[0027] The cross member 4C supports one end of the walkable platform 5, which can be created using the boards commonly employed in scaffolding construction.

[0028] The above-described embodiment of the support frames 4 must be considered merely as a preferred, but not exclusive embodiment.

[0029] One alternative to these support frames 4, in fact, might take the form of a portal in which the lower portion of the vertical members 4B is markedly larger than the upper portion forming the upper coupling ends 6

[0030] The module 1 according to the invention includes centring means positioned on the upper coupling ends 6 and/or lower coupling ends 7 to facilitate the coupling of the module 1 respectively with the lower 7 or upper 6 coupling ends of another module. According to the invention, the upper coupling ends 6 of the module 1 are in fact destined to be coupled to the lower coupling ends 7 of another module in order to create a modular scaffolding structure 2, see Figure 4, which in its most basic form comprises two levels, i.e. two walkable surfaces 5, 5' created by placing the two modules 1, 1B one above the other.

[0031] As shown in Figure 3, according to the invention, a first module 1 lends itself to being advantageously lifted over a second module 1B and then lowered so that its two lower coupling ends 7 are coupled to the corresponding upper coupling ends 6' of the second module 1B.

[0032] When the two modules 1, 1B are juxtaposed, the presence of the centring means is extremely advantageous because it guides the coupling of the modules 1, 1B, thereby reducing the need for human action to a minimum.

[0033] The coupling by means of the overlapping of

the modules 1, 1B enables a scaffolding structure 2 with two walkable surfaces 5, 5' to be obtained, as shown in Figure 4.

[0034] With reference to Figure 5, according to need, the scaffolding structure 2 may constitute the required scaffolding structure, or it may also simply be a "modular group" consisting of two modules that can be further extended by coupling another module 1C according to the invention. In this second case, the coupling of another module 1C gives rise to the scaffolding structure 3 shown in Figure 6, with three walkable surfaces 5, 5B, 5C.

[0035] In line with the above description, the third module 1C is coupled to the "modular group" formed by the two previously-coupled modules in such a way that the lower coupling ends 7C of the third module 1C engage with the upper coupling ends 6 of the first module 1 placed over the second module 1B.

[0036] It should be noted that each of the stacked modules 1, 1B, 1C includes one or more safety railings 17 that are installed between the members 4B of the module frames 4 before a module is coupled to other modules. In particular, these safety railings 17 serve to make the corresponding walkable surface 5, 5B, 5C safe after the structure 2 has been assembled. At the same time, the safety railings 17 also contribute to stiffening the module and make it easier to lift during the assembly of the structure 2. The safety railings 17 can also be positioned between two sides of two vertical members 4B in the longitudinal direction, in which the module 1, 1B, 1C extends, or they can serve as frontal safety barriers (not shown) supported transversally between two vertical members 4B of the same frame 4.

[0037] Figures 7 and 7B show perspective views of a preferred embodiment of the centring means for positioning on the lower coupling ends 7 of the first module 1 according to the invention.

[0038] As shown, the distinctive feature of these centring means lies in that they provide a stable support surface 80 for the scaffolding module 1 during its set-up or before it is lifted and coupled on top of another module 1B.

[0039] At the same time, this stable support surface is also extremely useful during the disassembly of the structure. In fact, as explained below, dismantling involves a modular disassembly of the structure. After a module has been detached from the structure, it can simply be placed on the ground using these support surfaces.

[0040] More in detail, the centring means in the solution illustrated consist of centring bowls 8 with truncated cone surfaces 23 with hollow collars 24 in line with the lesser cross-section of the truncated cone surface 23.

[0041] The collar 24 is coupled to one of the lower coupling ends 7 of the module 1 and fastened thereto by means of locking means 23, such as bolts with nuts.

[0042] Thus, the rim of the bowl 20 corresponding to the larger cross-section of the truncated cone surface 23 provides the stable support surface 80 for the module 1.

[0043] In other words, after coupling to a lower coupling end of the module 1, the centring bowl 20 thus

formed becomes a support foot for the module itself.

[0044] As regards the above, Figure 8 provides an exploded view that best illustrates the type of coupling between the lower coupling end 7 of a first module 1 according to the invention and the upper coupling end 6B of a second module 1B according to the invention. As may be observed, the second module 1B advantageously includes insertion-type coupling means preferably positioned at the upper coupling ends 6B. These coupling means consist of a tapered tube 9 that is inserted inside the upper coupling end of the module 1 so that its tapered end 9B protrudes from the same. The tapered tube 9 is locked to a corresponding end by means of second locking means 13, such as bolts with nuts, for example, or any other functionally equivalent means that enable the coupling to be maintained in a fixed operative position in relation to the upper coupling end 6B in which it has been inserted.

[0045] As shown in the exploded view above, in terms of ease of installation, the presence of these centring means e.g. the centring bowl 8 in the example provided decidedly facilitates the coupling of the ends of the two modules 1, 1B. More in detail, the internally hollow truncated cone shape of the centring bowls 8 guides the movement of the lower coupling ends 7 of the first module 1 as they are lowered onto the upper coupling ends 6B of the second module 1B.

[0046] Figure 9 provides a cross-sectional view with a detailed look into the structure of the coupling between the two modules coupled together from above 1, 1B as previously described.

[0047] In order to solidly lock the coupling into position once it has been coupled to the other module, the first module 1 is fitted with locking means that lock the coupled ends together in a removable way. As shown in Figure 9, the locking means 33 can advantageously consist of a bolt that transversally passes through the coupling, or rather, the tapered part 9B of the tube 9 and the module lower coupling end 6B, and is locked by a nut on the other end. Other functionally equivalent systems can obviously be used for the same purpose.

[0048] The scaffolding module 1 according to the invention features connecting means that can be connected to the lifting equipment on site. These connecting means are preferably positioned on the upper coupling ends 6 in order to ensure more stable movement and especially the more stable lifting of the module as better described below.

[0049] The invention also relates to a method for the assembly/disassembly of a scaffolding structure 2 that includes a plurality of scaffolding modules 1, 1B, 1C as indicated above.

[0050] In particular, the method according to the invention is characterized by the coupling/uncoupling of a first module 1 to/from a second module 1B in such way that the lower coupling ends 7 of the first module 1 are coupled/uncoupled to/from the corresponding upper coupling ends 6' of the second module 1B. In particular, such

coupling/uncoupling is performed with the use of lifting equipment.

[0051] In other words, with the use of this method, the scaffolding structure 2 is composed through the coupling of modules and then dismantled through modular disassembly. This solution is completely different from the traditional methods based on the assembly and subsequent disassembly of the structure piece by piece.

[0052] The method according to the invention is extremely advantageous because the modules can all be prepared at ground level and only then coupled together with the use of lifting equipment. As a result, the workers can work substantially from the ground and use the lifting equipment to carry the material, e.g. the scaffolding modules coupled on the ground to the desired height. In this regard, the lifting equipment may include mechanical lifting arms with much higher lifting load capacities than the traditional electric lifts or cable-pulleys systems.

[0053] Considering the assembly of a scaffolding structure 2 in greater detail, the method according to the invention envisions a preliminary phase with a plurality of scaffolding modules 1, 1B, 1C, which according to the invention might be those shown in Figure 10 for example. The modules shown in this figure consist in five support frames 4 along which a walkable surface 5 extends. With the use of lifting equipment, a first module 1 is coupled to a second module 1B in order to form the twin-module structure 2B shown in Figure 11. During the coupling of the first module 1 to the second module 1B, only one worker is required on the walkable surface 5 of the second module to lock the coupling ends being coupled into position. The presence of the centring means associated with the first module 1 and/or the second module 1B is extremely useful in making said coupling.

[0054] The twin-module structure 2B shown in Figure 11 can be further developed by repeating the method according to the invention, or in other words, by joining to the same yet another module 1C. This permits the triple-module structure 2C shown in Figure 12 to be obtained, which as can be seen is composed of three walkable surfaces 5, 5B, 5C, each one of which provided with a coupled module. Note that when a worker climbs to the second walkable surface 5 by means of a trapdoor-ladder system, for example, he can move in conditions of safety because the first module 1 is already equipped with safety railings 17. In other words, the solution being presented does not require additional time to prepare lifelines or similar safety measures, for example.

[0055] As mentioned above, a structure derived from the coupling of two or three modules can also be seen as a "modular group" that can be coupled to an equivalent or different modular group. In other words, the modularity that forms the basis of the method according to the invention is also applied to modular groups, considering "modular group" to mean the aggregate of one or more modules according to the invention. Figure 14, for example, illustrates two such modular groups 2B, 2A, each formed by the insertion from above of two equivalent modules

such as the modules 1, 1B, 1C, 1D shown in Figure 13, or in other words, modules composed of eight support frames 4 and one walkable surface 5. The two modular groups 2B, 2A shown in Figure 14 can be coupled together or as an alternative, each one can be coupled to another single module 1 of the type shown in Figure 13 in order to obtain the structure 2D shown in Figure 15, for example. At the same time, the latter might also be coupled to another equivalent structure or further developed through the coupling of other modules that might or might not be equivalent to the others already used.

[0056] In this regard, it must be understood that the modules provided for the realization of the modular structure can be equivalent or different. The term "equivalent" module is used to indicate a plurality of modules that are substantially equal but sometimes slightly different in terms of the number of sides in the support frame, the number of walkable surfaces, and the respective longitudinal, transversal and vertical dimensions.

[0057] The structure shown in Figure 16, for example, is obtained by starting from the preparation of three modules, two of which can be considered equivalent, while the third differs from the other two in terms of longitudinal development. In greater detail, this structure is made by coupling one of the modules shown in figure 10 to one of the modular groups shown in Figure 14.

[0058] It is clear from the above that this modular coupling permits the development of scaffolding structures according to the construction drawing required. In particular, the structure can be entirely obtained through the coupling of single modules that are more or less equivalent or through the coupling of one or more sets of modules in single "modular groups" and then coupling such larger modular groups together.

[0059] Figure 17 provides a schematic representation of scaffolding structure 2 during its disassembly. In particular, the structure is disassembled in modular fashion, in other words through decomposition into modules. In this regard, it must be noted that in order to uncouple a first module from a second module, the method envisions a preliminary phase that consists in the removal of the locking means that solidly fasten the upper coupling ends of a module coupled to the corresponding lower coupling ends of another module.

[0060] The modular structure can be advantageously disassembled using the same lifting equipment but with different criteria than those used during the structure's assembly. In other words, it is important to understand how the modular structure can be dismantled into different modules from those originally used for the structure's assembly. In terms of practicality, for example, this possibility consists in the fact that the dismantling of a structure can provide modules or "modular groups" that can be used to assemble another structure. After detachment from the structure, the modules can be easily placed on the ground thanks to the centring means that offer the stable support surface indicated above.

[0061] As also mentioned above, the coupling/uncou-

pling of the scaffolding modules is obtained with the use of lifting equipment, one form of embodiment of which is shown in the figures above, and more precisely, in Figures 11 and 15 for example, in which lifting is preferably performed by connecting the upper coupling ends 6 of the module 1 - which must be connected to the connecting means provided at the ends themselves. In greater detail, the ends must be preferably connected to a web truss 15 that is raised by a mechanical lifting arm 16 such as that of a crane or any other functionally equivalent lifting machine. The ends are connected to the web truss 15 by means of connection elements 18 such as cables or chains, for example. According to one preferred solution, the truss 15 has been selected in such way as to extend sufficiently in both the transversal and longitudinal directions (always assessed in respect to the direction of the longitudinal development of the walkable surfaces of the modules) and to permit the connection elements 18 to be maintained substantially in vertical position during the lifting of the module. Through this operative condition, the swaying of the scaffolding module is significantly reduced for greater safety and easier coupling with another module.

[0062] According to one preferred embodiment of the method according to the invention, the lifting equipment is connected to a number of upper coupling ends 6 corresponding to twice the number of frames whenever said number of frames is less than three, see Figures 3 and 4, for example. Whenever instead the number of frames is higher than 3, see Figures 4, 5, 6, 8, the number of upper coupling ends connected to the lifting equipment corresponding to twice the number of frames from which a fixed value equal to four is subtracted.

[0063] The technical solutions adopted for the scaffolding module and for the assembly/disassembly method permit the complete achievement of the aims and objects posed. In particular, the scaffolding module according to the invention permits the assembly and subsequent disassembly of modular scaffolding structures that run in at least two modular directions. Using the assembly/disassembly method permitted by the scaffolding modules reduces assembly times and costs by 50% compared to traditional methods, while the time saved during disassembly amounts to as much as 80%.

Claims

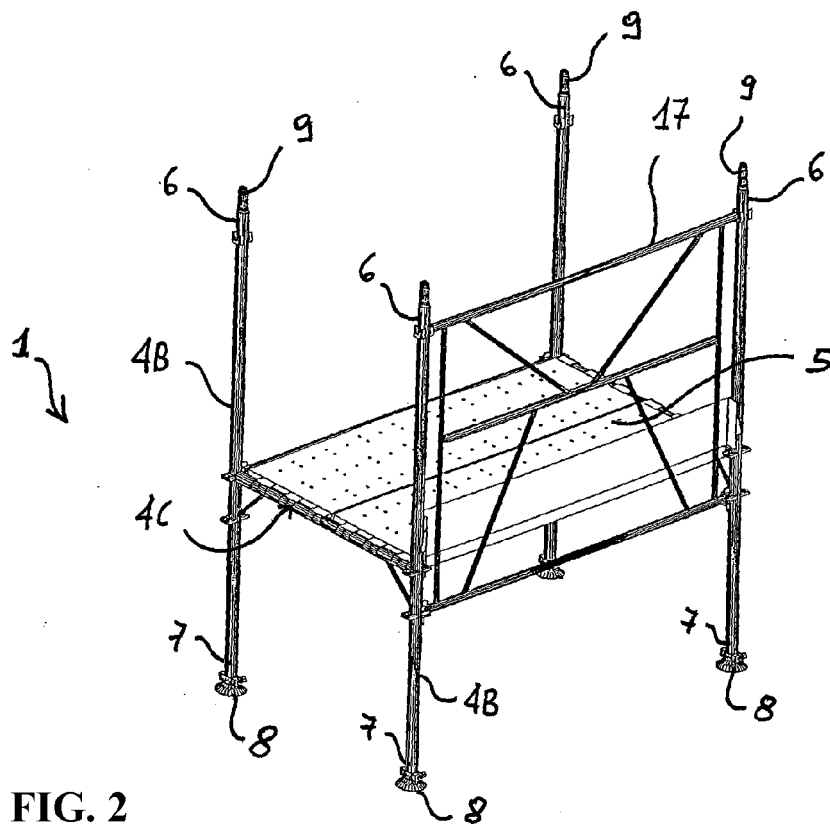
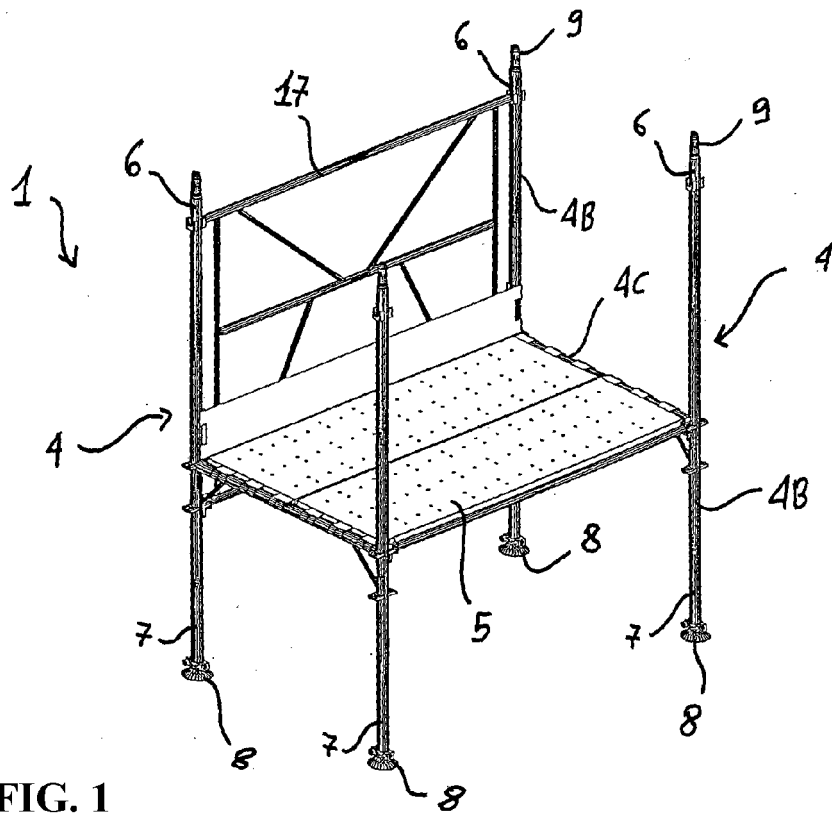
1. A scaffolding module (1,1A) for the realization of a scaffolding structure (2), said module (1, 1A) comprising a plurality of support frames (4), between which a walkable surface (5) is created, each of said frames (4) comprising at least one pair of upper coupling ends (6) and a corresponding couple of lower coupling ends (7) **characterized in that** said module (1,1A) also includes centring means positioned on such upper (6) and/or lower (7) coupling ends in order to facilitate the coupling of said module respec-

tively with the lower (7') or the upper coupling ends (6') of an additional module.

2. A module (1) according to Claim 1, **characterized by** the inclusion of one or more safety railings (17) positioned between a pair of mutually adjacent frames (4).
3. A module (1,1A) according to Claim 1 or 2, **characterized in that** each frame (4) is substantially configured in H-shape comprising two vertical members (4B) and one cross member (4C), each vertical member (4B) defining one said lower coupling end (6) and one corresponding said upper coupling end (7).
4. A module (1, 1A) according to one or more Claims 1 to 3, **characterized in that** said centring means define a stable support surface (80) for such first module (1) prior to the coupling of the same with said additional module.
5. A module (1, 1A) according to one or more Claims 1 to 4 **characterized by** the inclusion of insertion-type coupling means for the coupling of said upper (6) and/or lower (7) coupling ends of such module respectively to the lower (7') or upper (6') coupling ends of such additional module.
6. A module (1, 1A) according to one or more Claims 1 to 5, **characterized by** the inclusion of locking means (33) for the removable locking of each lower (6) or each upper (7) coupling end of such first module (1) after the module has been coupled to a corresponding upper (7') or lower (6') coupling end of such additional module (1A).
7. A module (1, 1A) according to one or more Claims 1 to 6, **characterized in that** it comprises connecting means positioned on said upper coupling ends (7) for the lifting of such module (1,1A).
8. A method for the assembly/disassembly of a scaffolding structure (2, 2A, 2B) including a plurality of scaffolding modules (1,1A,1B) **characterized in that** it comprises the coupling/uncoupling with the use of lifting equipment (8) of one first module (1) to/from a second module (1A) in such way that the lower coupling ends (7) of such first module (1) are coupled/uncoupled to/from the corresponding upper coupling ends of said second module (1A).
9. A method for the assembly/disassembly of a scaffolding structure (2, 2A, 2B) that includes a plurality of scaffolding modules (1, 1A, 1B) according to one or more of the Claims from 1 to 7, **characterized in that** it comprises the coupling/uncoupling with the use of lifting equipment (8) of a first module (1) to/from a second module (1A) in such way that the lower

coupling ends (7) of said first module (1) are coupled/
uncoupled to/from the corresponding upper coupling
ends of such second module (1A).

10. A method for the assembly of a scaffolding structure (2, 2A, 2B) according to Claim 9, **characterized in that** it comprises a preliminary phase that consists in the preparation of a plurality of scaffolding modules (1, 1B, 1C, 1D) each one equipped with a plurality of support frames (4) among which at least one walkable surface (5) is developed, each of said frames (4) creating at least one pair of upper coupling ends (6) and a corresponding lower coupling end (7) for connection. 5 10 15
11. A method according to Claim 10, **characterized in that** it comprises the following phases: 20
- the coupling together of a first modular group (1, 1B) from said plurality of modules (1, 1B, 1C, 1D) in order to create the first modular group (2A);
 - the coupling together of a second modular group (1C, 1D) from said plurality of modules (1, 1B, 1C, 1D) in order to create the second modular group (2B);
 - the coupling together of the first modular group (2A) to said second modular group (2B); 25
12. A method according to Claim 10 or 11, **characterized in that** each module (1, 1A, 1B) has one or more safety railings (17) between one pair of mutually adjacent support frames (4); said one or more safety railings (17) being positioned prior to the lifting of the module itself. 30 35
13. A method according to Claim 10 or 11, **characterized by** the locking - using removable locking means (18) - of such lower coupling ends (7) of said first module (1) to one upper coupling end (6) of such second module (1B) coupled to it after the coupling of such first module (1) to said second module (1B). 40
14. A method according to one or more Claims from 10 to 12, **characterized by** the lifting of said first module (1) through the connection of said lifting equipment to connecting means (8) positioned near such upper coupling ends (6) of said first module (1). 45
15. A method according to one or more Claims from 10 to 13, **characterized by** the lifting of said first module (1) with the use of lifting equipment that includes a Pratt/Warren truss moved by a lifting arm (8), said truss (15) being connected to said plurality of upper coupling ends (6) by means of connection elements (45). 50 55



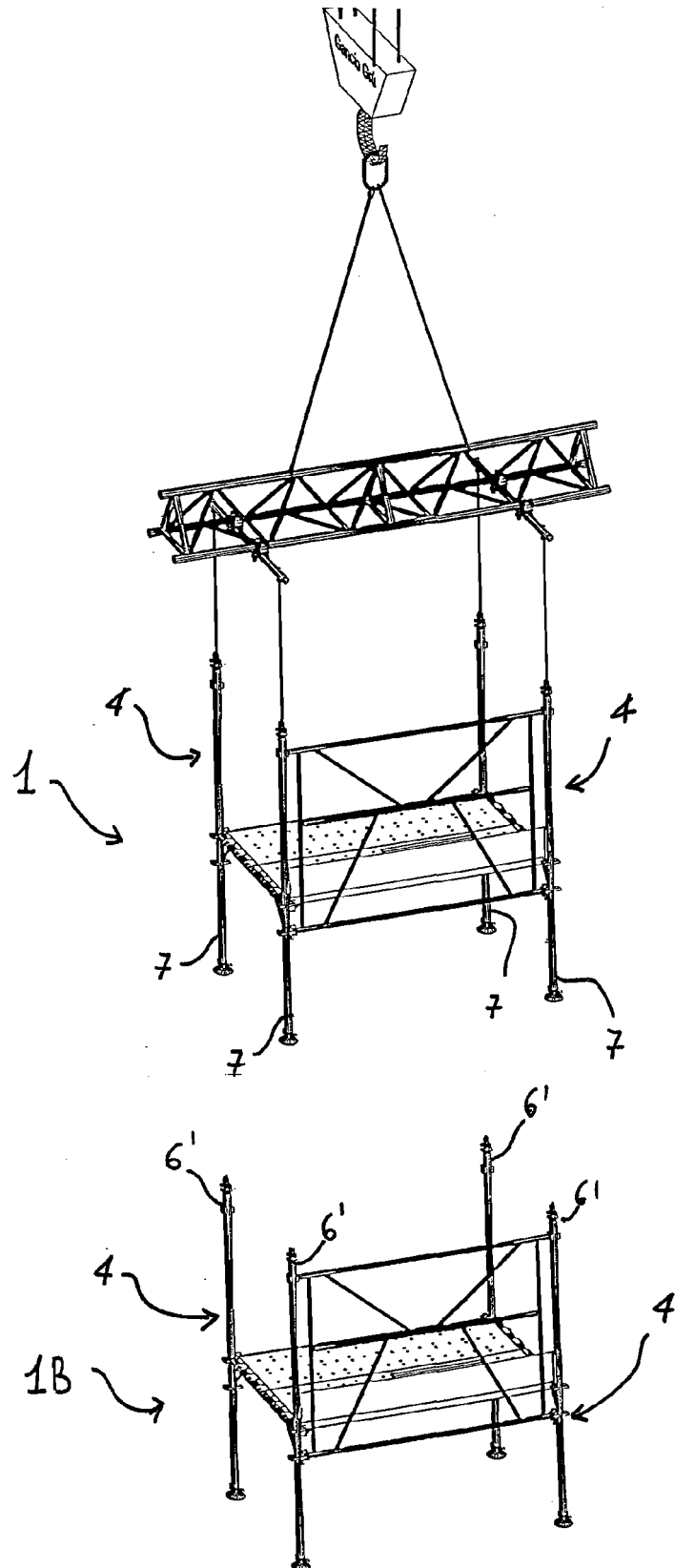


FIG. 3

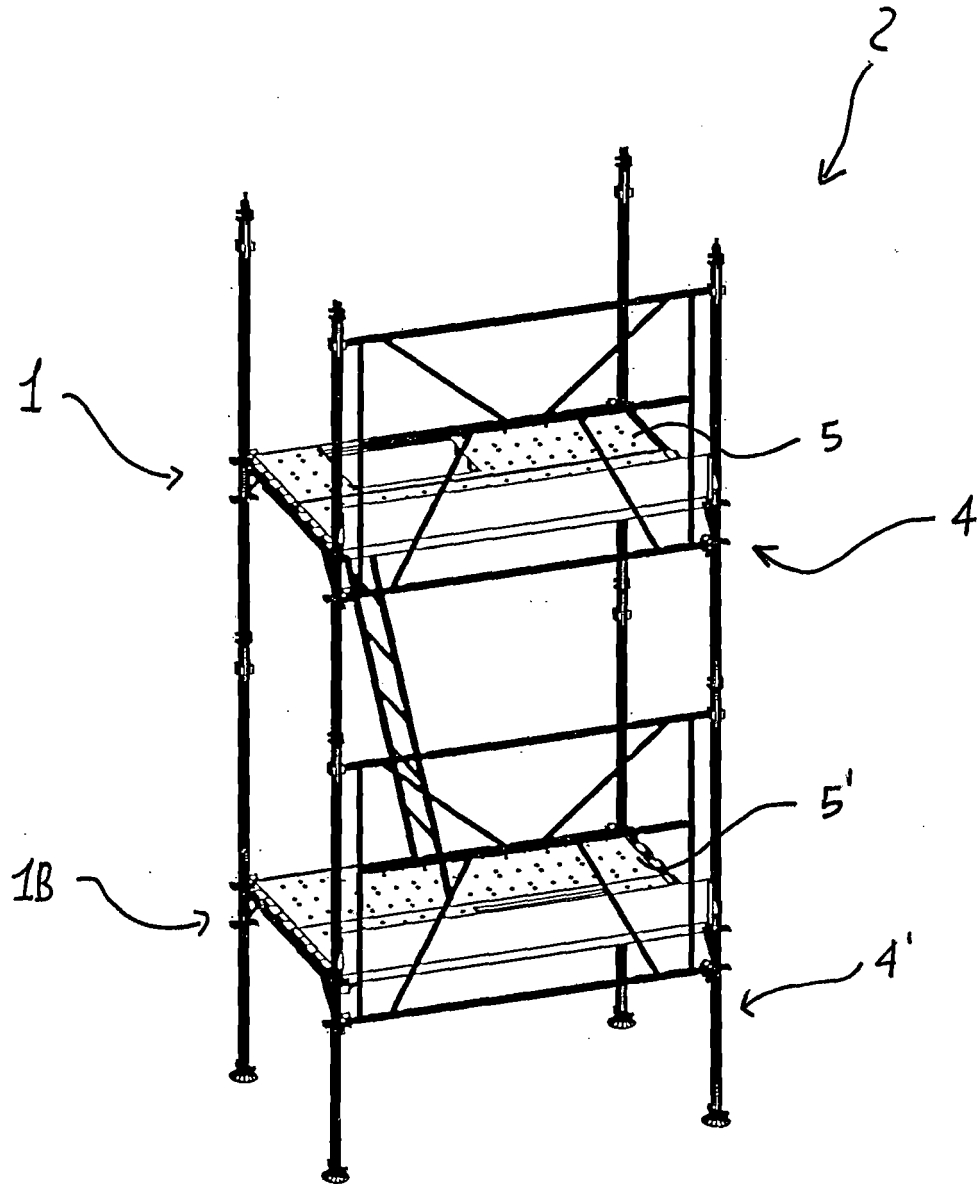


FIG. 4

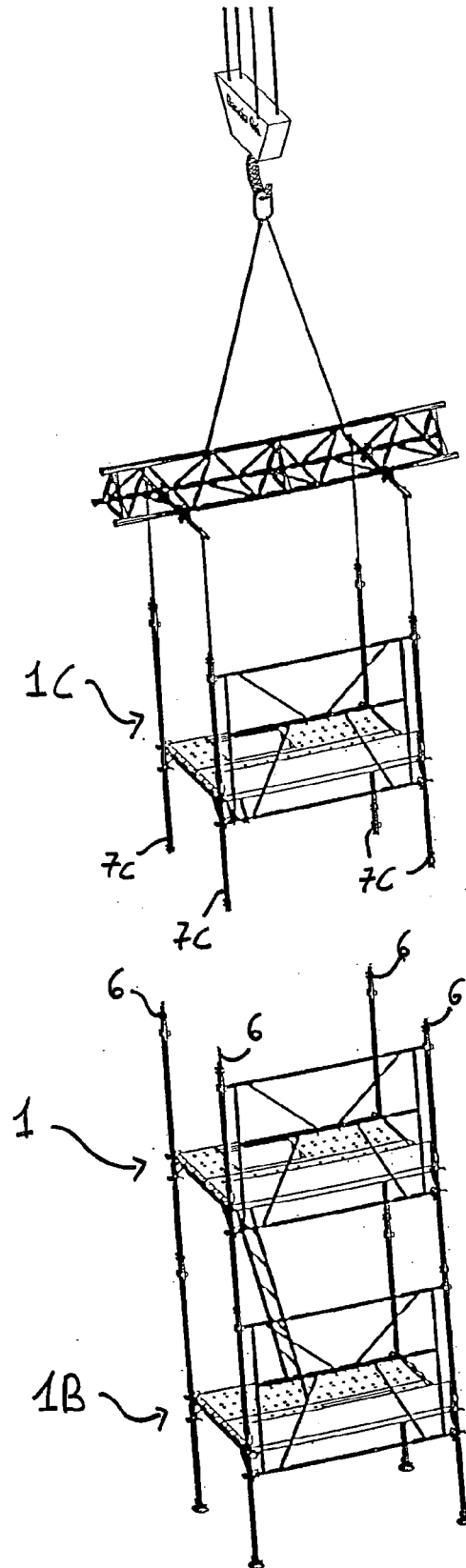


FIG. 5

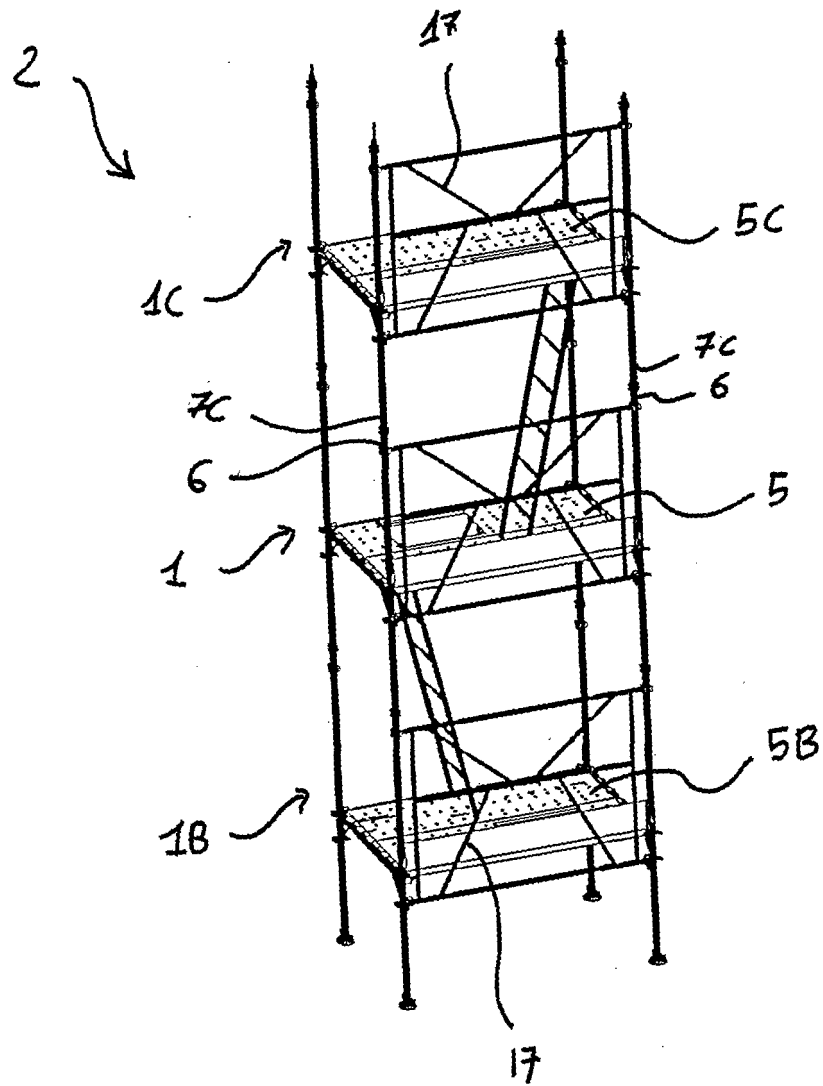


FIG. 6

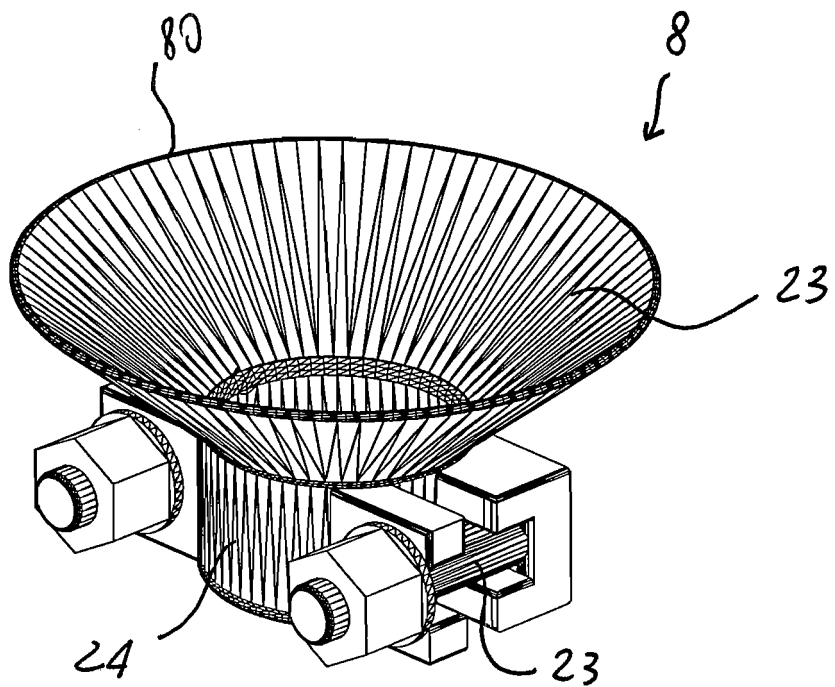


FIG. 7

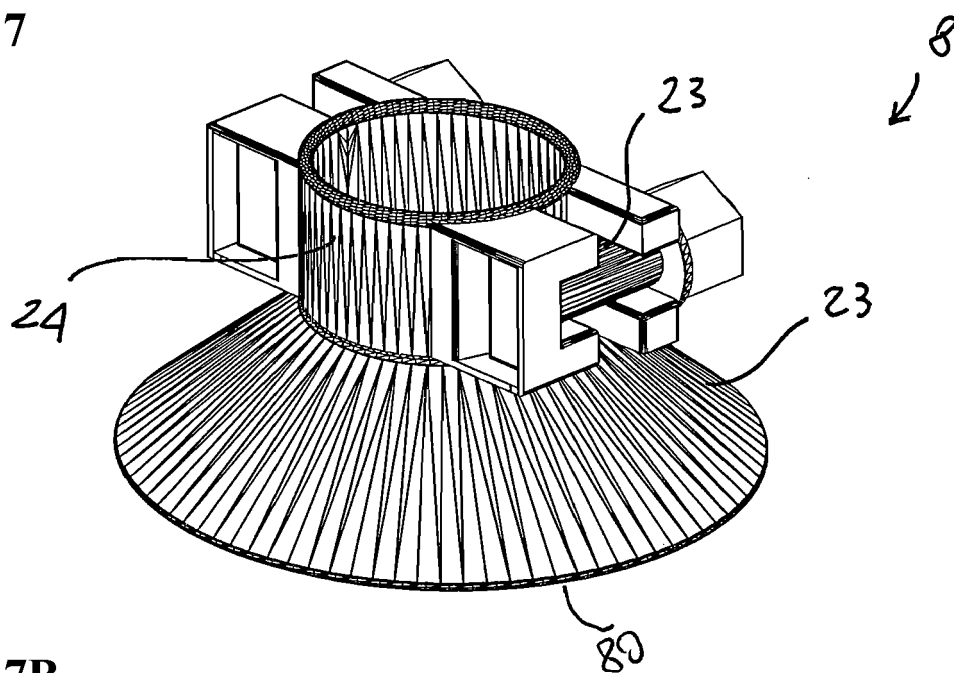


FIG. 7B

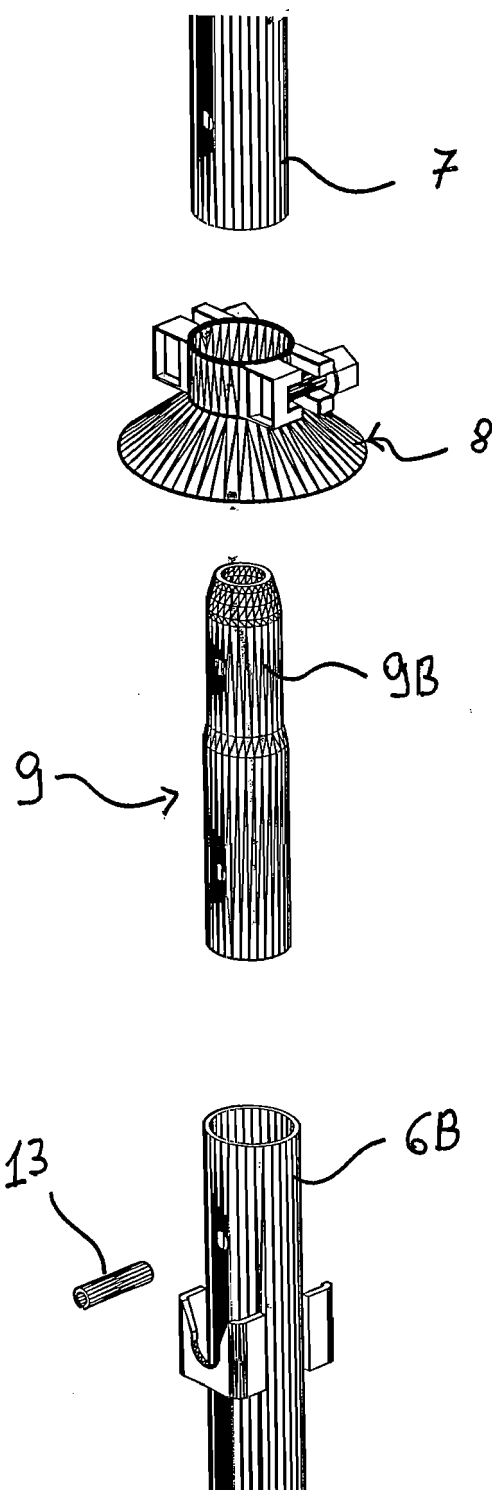


FIG. 8

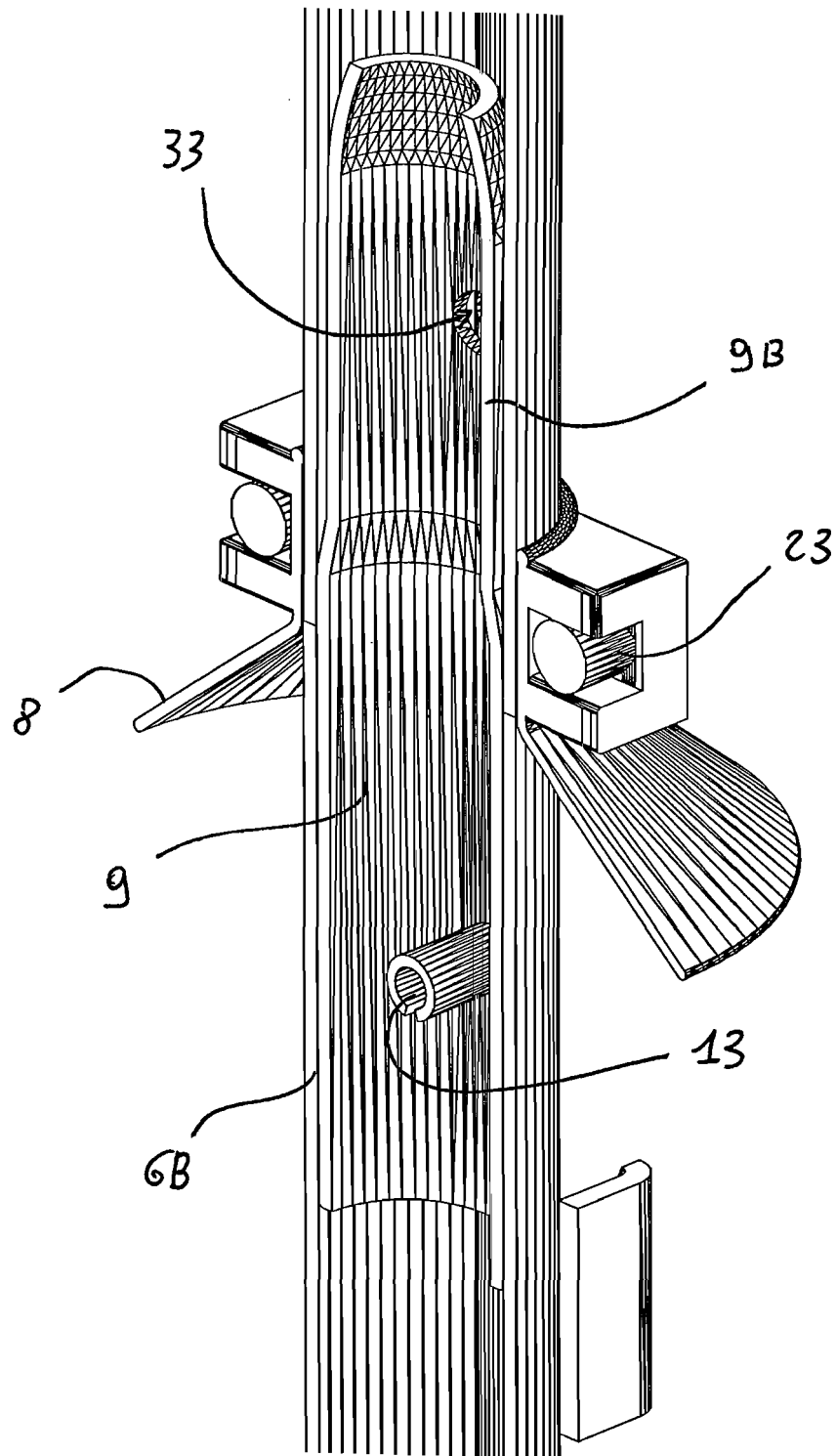


FIG. 9

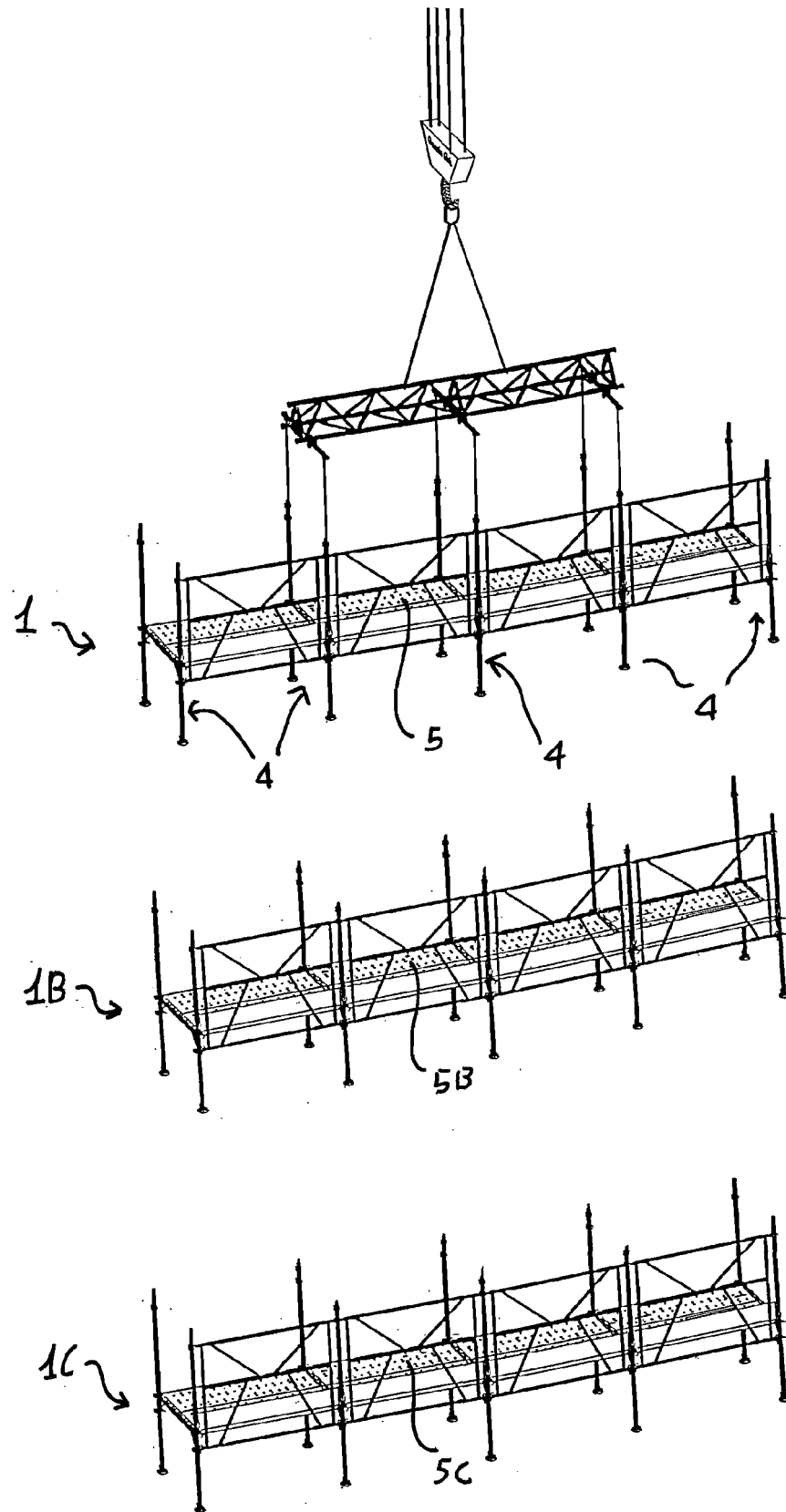


FIG. 10

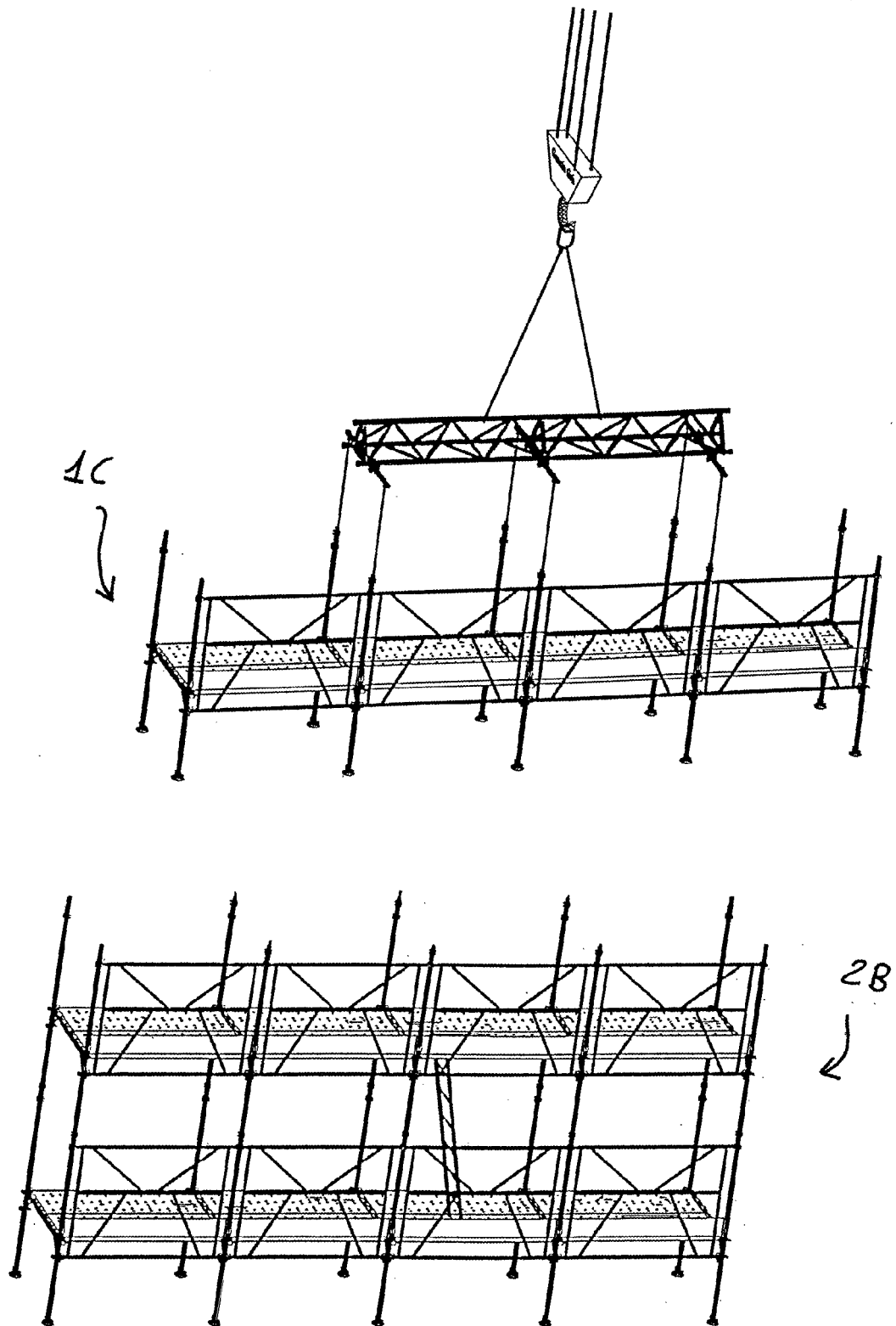


FIG. 11

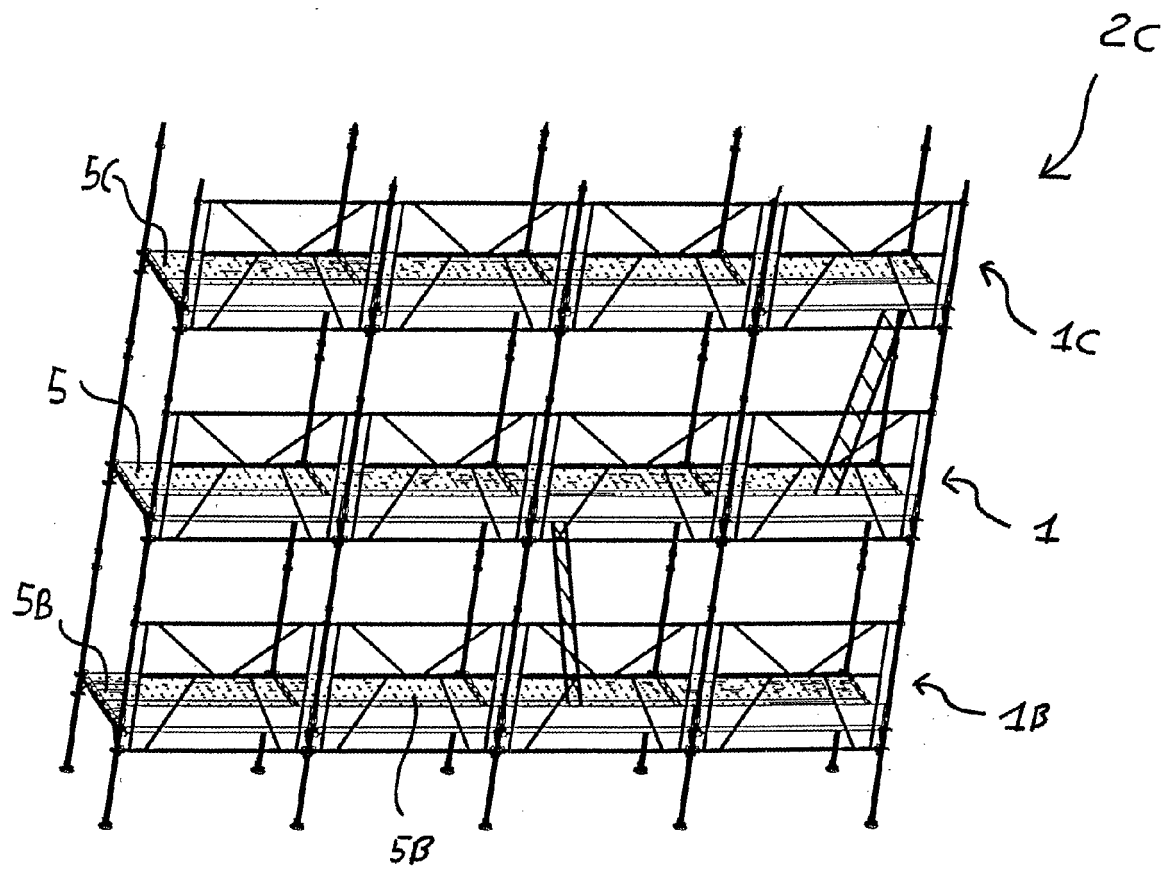


FIG. 12

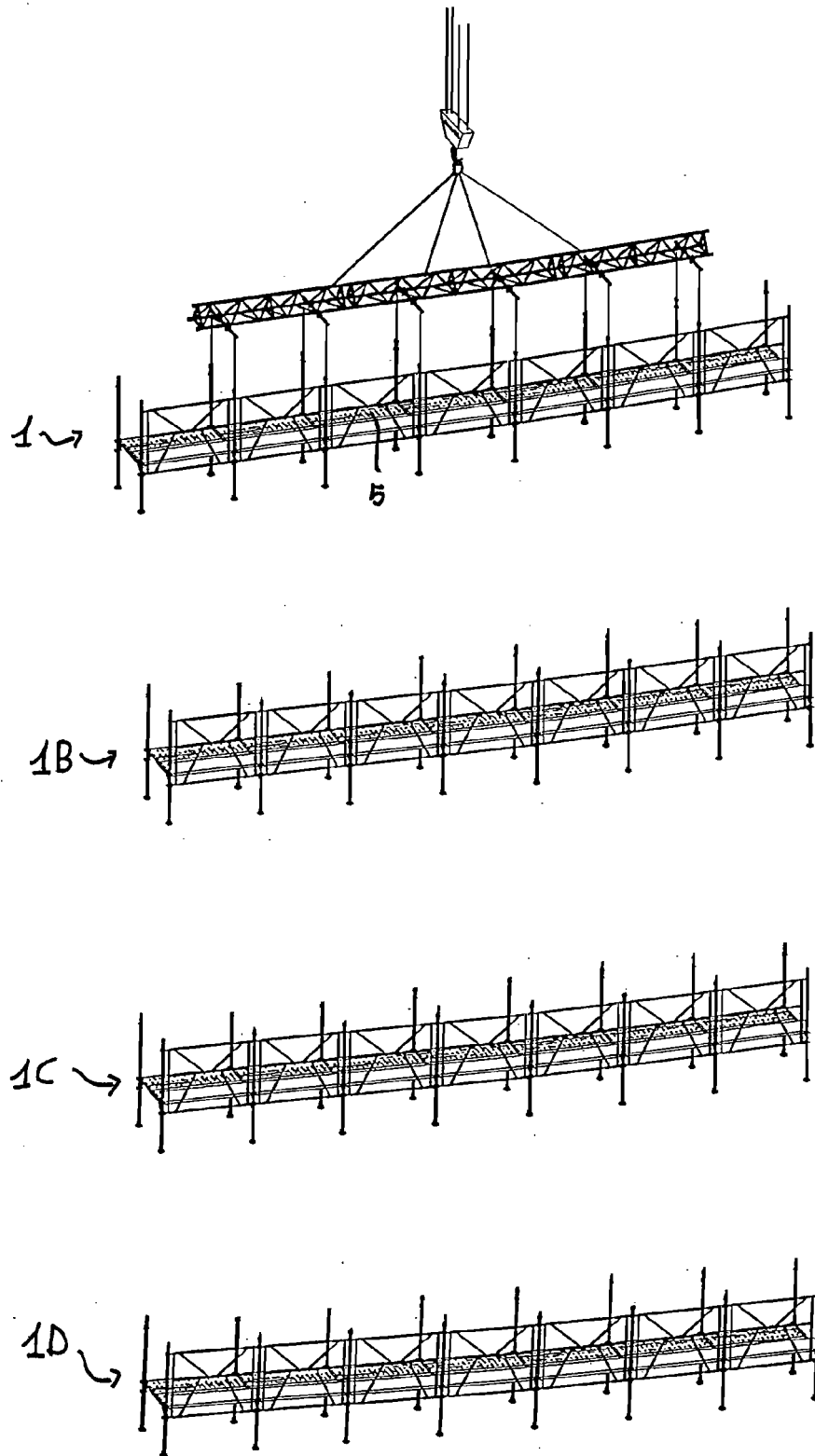


FIG. 13

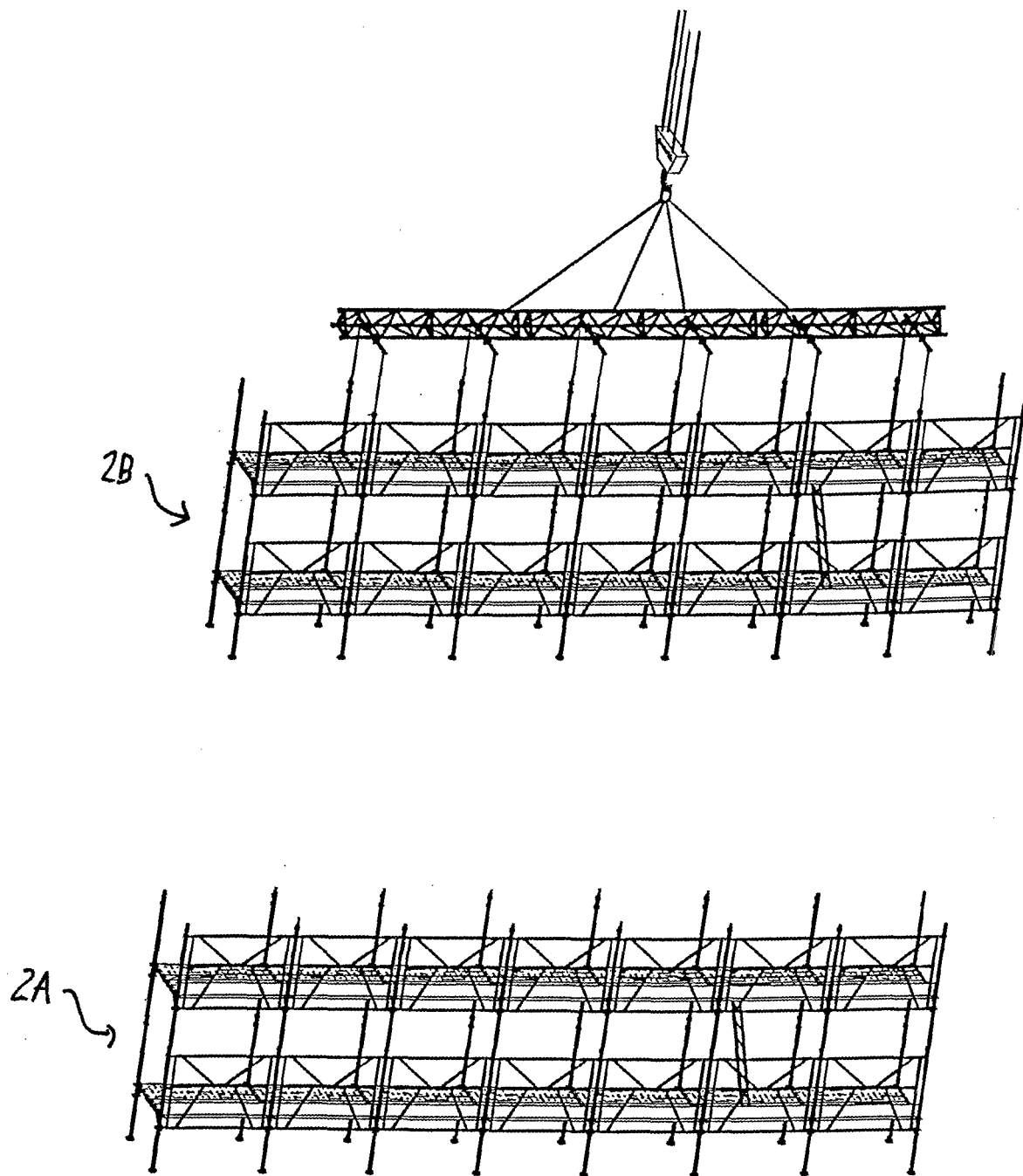


FIG. 14

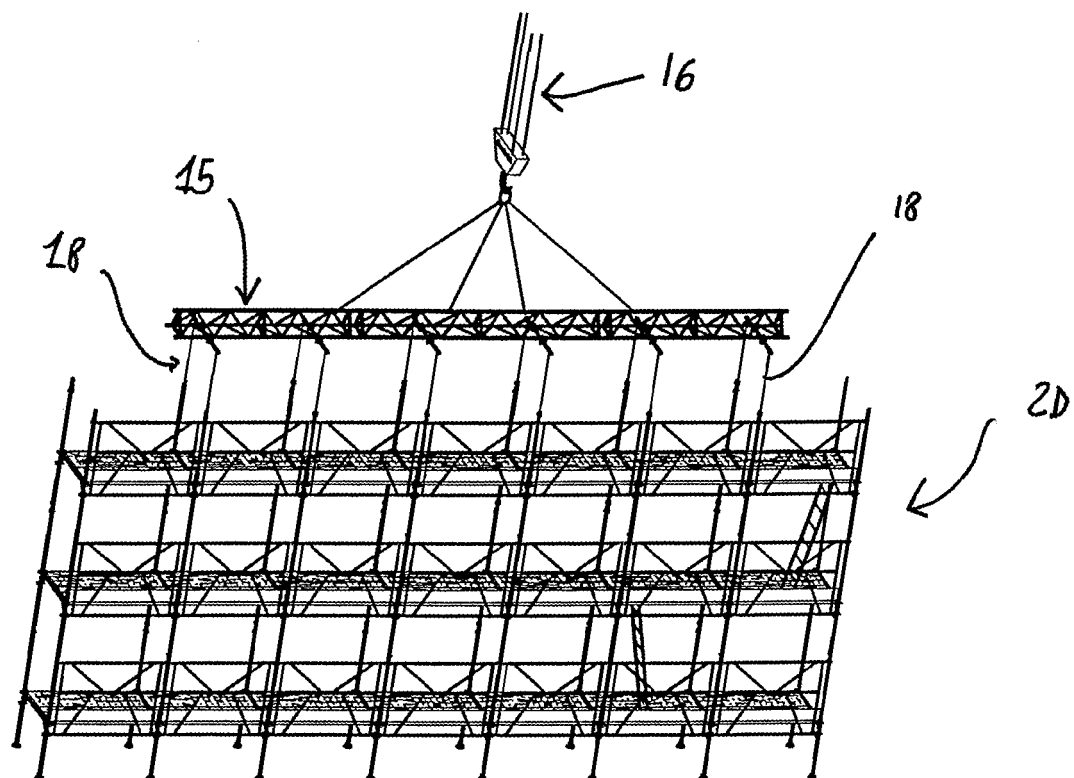


FIG. 15

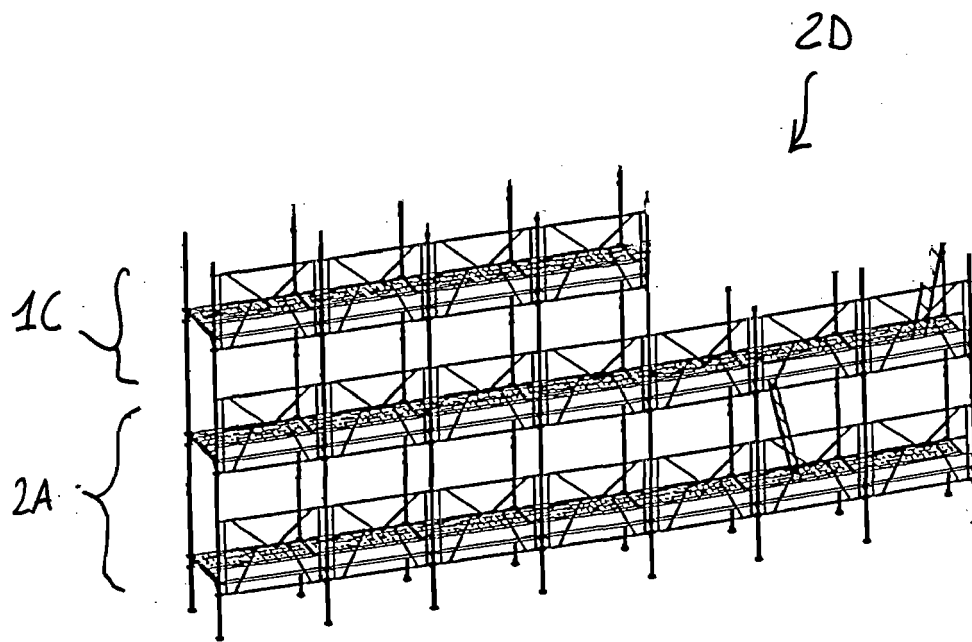


FIG. 16

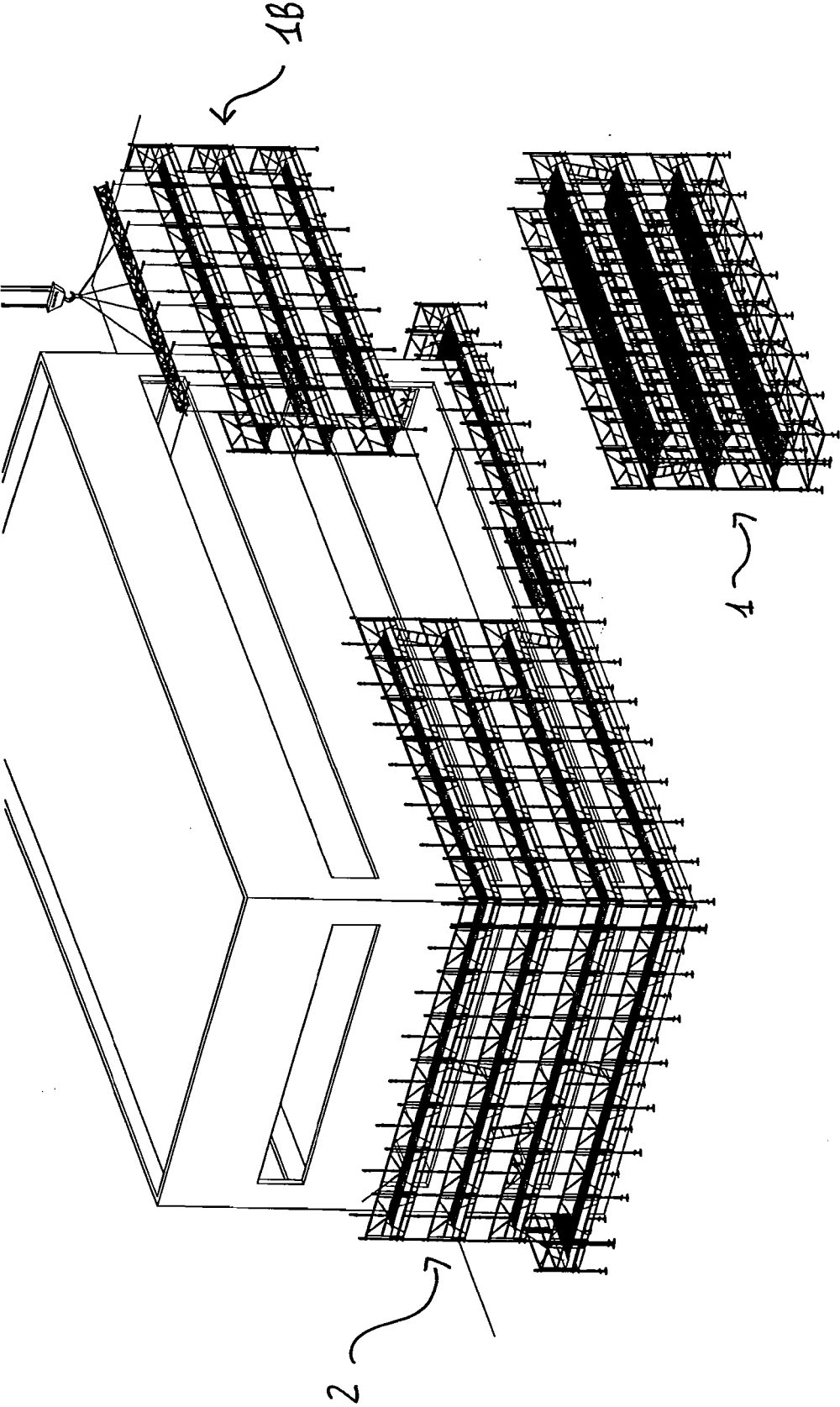


FIG. 17