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(54) **Scaffolding**

(57) A scaffolding structure (10) having a two dimensional inner grid (12) interconnected with a two dimensional outer grid (14). Additional bamboo members (25, 27) are secured on the outer grid (14) such that the interstices defined by the load bearing members (24, 26) and the bamboo members of the outer grid (14) are smaller than the interstices defined by the load bearing members (20, 22) of the inner grid (12). An anchoring device (50b) to anchor the scaffolding structure (10) to the building (15) includes an arm (52b) and an anchoring member (50c). The anchoring member (50c) has a first leg in the form of a bar or rod which is alignable such that the first leg extends parallel to the longitudinal axis of the arm with the remote end of the first leg extending beyond the arm (52b). The scaffolding structure further comprises platforms (102b) which have an access opening (127) for access to a lower region of the scaffold (10), and a ladder (120) disposed for access by a worker through the access opening (127).

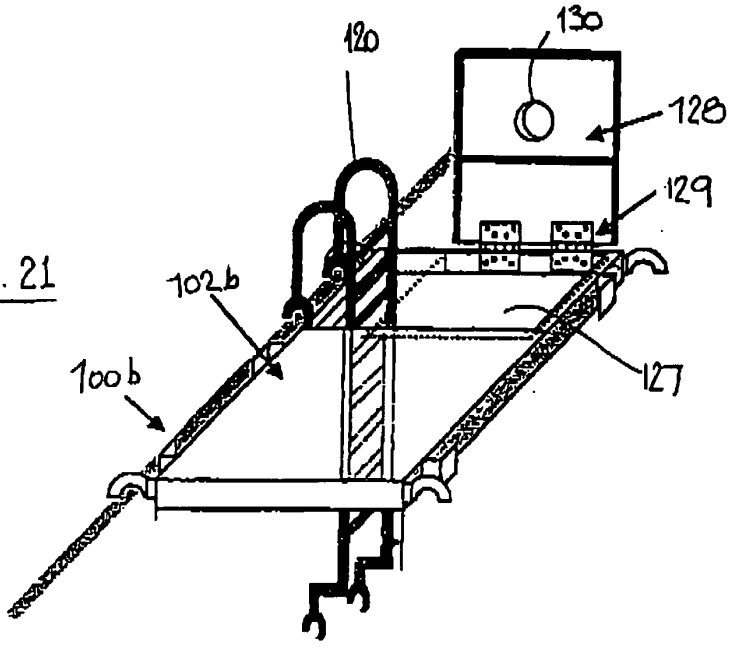

FIG. 21

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Description

Field of the Invention

[0001] The present invention relates to scaffolding. More particularly, the invention relates to safety aspects of scaffolding.

Background to the Invention

[0002] In western countries the use of timber in scaffolding structures was prevalent in the early part of the twentieth century. Due to the high number of industrial accidents and fires arising from timber scaffolding, timber scaffolding has generally been replaced worldwide by steel tubular scaffolding.

[0003] However, in Asia, bamboo has been traditionally used for scaffolding. Bamboo scaffolding is still in use in China and Hong Kong. As a scaffolding material, bamboo has a number of advantages. Bamboo is economical and can be simply constructed without special tools. Bamboo scaffolding can also be constructed within a short period of time in a limited working space. The most significant advantage of bamboo scaffolding is its very strong bending strength and elasticity when freshly cut. However, the strength of bamboo decreases as time goes by because it gradually dehydrates over time. When the water content has reduced below 10% the bamboo becomes dry and cracks will appear. The maximum lifespan ofbamboo scaffolding members is thus relatively short, only about 12 to 18 months. Thus bamboo is considered somewhat unreliable.

[0004] In view of the limitations of bamboo, it is gradually being superseded in Hong Kong by steel scaffolding members. Steel scaffolding members still possess disadvantages none the least of which is cost. The weight of steel scaffolding structures may also be problematic in some situations. Because of the cost and strength characteristics of steel, the distances between the structural members is generally very wide to reduce material by taking advantage of steel strength. These distances are often inconvenient for workers climbing on the scaffolding and pose safety problems.

[0005] Australian Patent Specification No. 45247/85 discloses a convention scaffolding structure with an additional guard panel spaced outwardly from the scaffolding structure. This guard panel adds substantial additional weight to the structure and requires special brackets to secure the guard panel to the scaffolding structure.

[0006] It is therefore an objective to overcome or ameliorate at least one of the aforementioned disadvantages or to provide the public with a useful choice.

Summary of the Invention

[0007] In accordance with a first aspect of the present invention there is provided a scaffolding structure for a building being erected, the scaffolding structure being in the form of a substantially two dimensional inner grid interconnected with a substantially two dimensional outer grid, each of the grids being comprised of load bearing members having relatively constant strength over time under expected loading conditions of the scaffolding structure characterised in that additional bamboo members are secured on the outer grid such that the interstices defined by the load bearing members and the bamboo members of the outer grid are smaller than the interstices defined by the load bearing members of the inner grid.

[0008] Preferably the load bearing members are elongate structural members intersecting in a regular pattern to form the grids. The elongate members may be coupled by right angle metal couplers at all or some of the intersections in the grid. In a most preferred form of the invention the load bearing members are steel members, preferably of tubular cross section. In an alternative aspect of the invention, the load bearing members may comprise fibre reinforced plastic tubes. The grids are preferably constructed of load bearing members arranged at 90° to each other although other configurations are possible. Each grid may therefore have upright load bearing standards and substantially horizontal load bearing ledgers. Desirably, at least some of the load bearing ledgers in the inner grid correspond to a respective load bearing ledger in the outer grid provided at the same height.

[0009] The additional bamboo members are preferably secured between the load bearing members in the outer grid. In a most preferred form of the invention, the scaffolding structure is erected such that each of the distances between any two adjacent bamboo members and between any bamboo member and an adjacent load bearing member, are substantially equal. Preferably the bamboo members include upright standards and horizontal ledgers with intersections between any bamboo members and other members being effected by nylon ties.

[0010] Additionally, bamboo transoms may provide the interconnection between the inner grid and the outer grid.

[0011] The invention may further comprise one or more platforms on the structure, the or each platform disposed between two corresponding load bearing ledgers from the inner and outer grid which are of the same level, wherein the platform is of elongate configuration and includes a planar supporting surface and attachment means coupling the platform to the two load bearing ledgers.

[0012] Preferably, the attachment means comprise hook portions. These hook portions may extend transversely out either side of the platform. Preferably there is a minimum of four hook portions, each extending from a respective corner of the platform.

[0013] The invention may further include an anchoring device anchoring the scaffolding structure to the building being erected, the anchoring device having an arm coupled to the scaffolding structure, one end of the arm being provided with an anchoring means anchored to the building, the anchoring device also including a tether secured

thereto which is capable of load bearing, the tether being attached to the scaffolding structure.

[0014] The arm is provided with appropriate couplers to couple the anchoring means to the scaffolding structure. Where the scaffolding structure comprises an interconnected inner grid and outer grid, preferably the arm is coupled to both the inner grid and the outer grid. Furthermore, the load bearing tether is also suitably secured to the outer grid at a point on the outer grid below the attachment point of the arm and the outer grid so that the load bearing tether extends taut in a diagonal configuration.

[0015] Preferably, the load bearing tether is flexible and as such may comprise wire, cable or chain. In use, the coupling on the load bearing tether is preferably secured to the outer grid of the scaffolding structure to provide backup in case of bracket failure.

[0016] The anchoring means may comprise a plate which is suitably welded to the arm. Preferably the anchor plate extends in a plane transverse to the longitudinal direction of the arm and the plate is bolted to the building. The anchoring means may include an eyelet by which one end of the tether can be secured to the anchoring means.

[0017] The scaffolding structure of the present invention may be supported from the building being erected. This building suitably includes at least one concrete slab with one or more structural beams supported from and extending outwardly from the concrete slab in a cantilevered fashion. The scaffolding structure is then supported on the one or more structural beams.

[0018] The spacing between adjacent cantilevered structural beams will depend upon the particular application but a preferred spacing would be about 3 metres. The above method may be used in conjunction with supporting brackets mounted on support columns of the building. The above method is especially appropriate where the column spacing of the building is more than 3 metres apart and the slab depth is insufficient to mount the brackets across the depth of the slab. Accordingly, the supporting brackets may be mounted to the support columns with an appropriate number of structural beams spaced between neighbouring supporting brackets mounted on respective building columns.

[0019] In a preferred form of the invention the structural beams comprise I-beams. However other types of structural beams are considered within the scope of the present invention including box-section beams.

[0020] In accordance with a further aspect of the invention, there is provided an anchoring device for anchoring a scaffolding structure to a building being erected, the anchoring device including: an arm for coupling to the scaffolding structure, the arm having a longitudinal axis; and an anchoring member to anchor the device and the scaffolding structure to the building, the anchoring member being coupled to the arm and having a first leg in the form of a bar or rod, the anchoring member being alignable such that the first leg extends substantially parallel to the longitudinal axis of the arm with the remote end of the first leg extending beyond the arm.

[0021] In accordance with another aspect of the invention, there is provided a scaffolding structure for a building being erected, the scaffolding structure being in the form of a substantially two dimensional inner grid interconnected with a substantially two dimensional outer grid, each of the grids being comprised of load bearing members in the form of elongate structural members including substantially horizontal ledgers and upright standards intersecting to form the grids, the structure being erected such that at least some of the load bearing ledgers in the inner grid correspond to respective load bearing ledgers in the outer grid provided at the same height, the scaffolding structure further comprising one or more platforms, the or each platform disposed between two corresponding load bearing ledgers from the inner and outer grid which are of the same level, wherein an access opening is provided in the platform for access to a lower region of the scaffolding structure, the scaffolding structure further comprising a ladder mounted on the scaffolding structure and disposed for access by a worker through the access opening.

[0022] The invention consists in the foregoing and also envisages constructions of which the following gives examples only.

Brief Description of the Drawings

[0023] In order that the invention may be more fully understood, one embodiment will now be described with reference to the drawings in which:-

Figure 1 is a partial schematic perspective view of a scaffolding structure according to a first preferred embodiment of the invention;

Figure 2 is a diagrammatic view of an inner grid of the scaffolding structure illustrated in Figure 1;

Figure 3 is a diagrammatic view of an outer grid of the scaffolding structure of Figure 1;

Figure 4 is a side view of the scaffolding structure of Figure 1;

Figure 5 is a diagrammatic front elevation view of a base detail of the scaffolding structure of Figure 1;

Figure 6a is a diagrammatic front elevation view of the scaffolding of Figure 1, illustrating the main structural components only;

Figure 6b is a diagrammatic perspective view of a slightly modified arrangement of the supporting brackets for the scaffolding structure;

Figure 7 is a front view of an alternative support detail for the scaffolding structure of Figure 1;

Figure 8 is a side view of the alternative support detail illustrated in Figure 7;

Figure 9 is a diagrammatic side view of an anchoring method for the scaffolding illustrated in Figure 1;

Figure 10a is a perspective view of an anchoring device used to implement the anchoring method il-

lustrated in Figure 9;
Figure 10b is a side view of an alternative form of an anchoring device;
Figure 11 is a diagrammatic view of appropriate bracing for the scaffolding structure illustrated in Figure 1;
Figure 12 illustrates a typical detail of the outer grid of the scaffolding structure of Figure 1, with the outline of an intended opening in the outer grid;
Figure 13 illustrates the outer grid detail illustrated in Figure 12 with an opening cut therein with appropriate bracing to strengthen the outer grid;
Figure 14 is a side view of a catch fan for use with the scaffolding structure illustrated in Figure 1;
Figure 15a is a side view of a supporting bracket and a protective layer for use with the scaffolding structure illustrated in Figure 1;
Figure 15b is a side view of an alternative form of supporting bracket;
Figure 16 is a perspective view of a detail of the scaffolding of Figure 1 showing a workers' platform installed;
Figure 17 is a detail of the scaffolding structure of Figure 1 with a staircase installed;
Figure 18 is a schematic perspective view of the scaffolding structure with an alternative form of workers' platform installed;
Figure 19 is a plan view of a corner detail for the alternative form of the workers' platform;
Figure 20 is a side view of a toeboard for use in the workers' platforms illustrated in Figures 18 and 19;
Figure 21 is a schematic perspective view of a particular form of workers' platform illustrating an access opening and a ladder; and
Figure 22 is a side and front view of the ladder illustrated in Figure 21.

Preferred Embodiment(s) of the Invention

[0024] The scaffolding structure 10 illustrated in Figure 1 is a three dimensional structure. The scaffolding structure 10 includes an inner two dimensional grid 12 illustrated in Figure 2 and an outer two dimensional grid 14 illustrated in Figure 3. As shown in Figure 4, the inner grid 12 is disposed adjacent the wall of the building 15 being constructed. The spacing of the inner grid 12 from the wall of the building 15 is generally about 200 mm. The outer grid 14 is disposed outwardly of the scaffolding structure 10 relative to the building 15. The outer grid 14 and the inner grid 12 are spaced approximately 600 to 700 mm apart. They are joined together by bamboo transoms 18 as shown in Figure 4 and Figure 1.

[0025] Referring to Figure 2, the inner grid is comprised of upright standards 20 and horizontal ledgers 22. Each of the standards and ledgers are elongate steel tubular members. At each intersection of a ledger and standard, the tubular members are joined by metal couplers (not shown). The metal couplers are protected by covers to prevent contamination, particularly from concrete.

[0026] As can be seen in Figure 2, each of the upright standards 20 are spaced 1.5 metres apart whereas the horizontal ledgers 22 are spaced 2.25 metres apart. This rectangular window created by the intersecting tubular members defines an interstice in the grid through which workers on the scaffolding structure can access the various parts of the building 15 as required. Due to the inherent strength of the steel ledgers 22 and standards 20, the interstices are comparatively large enabling easy access to the building 15 for the workers on the scaffolding structure 10.

[0027] On the other hand, the outside grid illustrated in Figure 3 comprises bamboo ledgers 25 and bamboo standards 27 in combination with steel standards 24 and steel ledgers 26. The bamboo ledgers and standards are illustrated by the thin lines in Figure 3 whereas the steel ledgers 26 and standards 24 are illustrated by the thick vertical and horizontal lines of Figure 3. The steel ledgers 26 and standards 24 provide the structural strength for the outer grid 14 whereas the bamboo ledgers 25 and standards 27 provide guard rails for the safety of the workman on the scaffolding structure 10. The bamboo ledgers 25 and standards 27 thus increase the safety for workers on the scaffolding structure 10 without unnecessarily increasing the cost or weight of the structure.

[0028] The steel standards 24 in the outer grid 14 are spaced at intervals of 3 metres (in contrast to the 1.5 metre spacing of the inner grid 12). The steel ledgers 26 are arranged at a vertical spacing of 2.25 metres. This corresponds to the spacing of the horizontal ledgers 22 so that the levels of the ledgers 26 in the outer grid correspond to the levels of the ledgers 22 in the inner grid. This is appropriate because the bamboo transoms 18 extend between the ledger 22 of the inner grid and the ledgers 26 of the outer grid as can be seen in Figure 4. Further, as shown in Figure 1, the spacing of the bamboo transoms horizontally in the scaffolding structure 10 in line with the ledgers 26, 22 corresponds to the spacing of the bamboo standards 27 in the outer grid.

[0029] Reverting to Figure 3, the bamboo standards 27 are arranged at spacings of 0.75 metres which allows for three at equal spacing from and between adjacent steel standards 24. Similarly, the bamboo ledgers 25 are arranged at equal spacing of 0.75 metres from and between adjacent steel ledgers 26. Given that the steel ledgers are spaced 2.25 metres, apart this enables two bamboo ledgers 25 at equal spacing therebetween. Generally speaking, the intersecting steel elongate members are joined by metal couplers. The intersecting bamboo members are joined by nylon tie.

[0030] Figure 4 also illustrates the arrangement of netting 24 on the outer layer of the scaffolding structure. This prevents materials or tools dropping outside the scaffolding structure. The netting 24 should be securely attached to the scaffolding structure by nylon ties or metal wire as illustrated.

[0031] Figure 6a shows diagrammatically only, the main structural components of the scaffolding structure

10. Each of the steel standards 20, 24 is about 6 metres long. Each level of the scaffolding structure 10 is referred to as a "zone" and is 24 metres in height as indicated in Figure 6a. Thus each zone is made up of 4 x 6 metre lengths of the steel standards 20, 24. The region between adjacent steel standards 20, 24 in each zone is referred to as a "bay". In the present case the height of each bay is defined by the vertical distance between support brackets 30. In the present case, with the support brackets disposed at vertical intervals corresponding to the length of four steel standards 20, 24, the height of each bay is thus 24 metres. However, the vertical spacing of the brackets will naturally depend upon the weight of the scaffold and the expected loading.

[0032] The configuration of the support bracket 30 is illustrated schematically in Figure 15a. The steel standards 20, 24 of the scaffolding structure 10 fit into suitable recesses (not shown) on one arm of the bracket. The support bracket 30 is constructed from angle iron configured in the shape of a right angle isosceles triangle having side lengths of 900 mm. The angle iron might be 80x80x8 angle grade 43 depending on the particular application. One side of the support bracket 30 is secured to the wall of the concrete building, preferably at an upright support column of the building 15. An array of supporting brackets 30 thus provides support for the scaffolding structure 10 at the base thereof and at intervening levels of the scaffolding structure.

[0033] In order to erect the scaffolding structure, a temporary bamboo structure may be first erected. Once the first layer of steel brackets 30 has been installed, the temporary bamboo structure may be transformed to be components of the scaffolding structure.

[0034] Figure 15b illustrates an alternative form of support bracket 30b. It can be seen from Figure 6a that the appropriate vertical spacing for the brackets is 24m. However, by using the higher strength brackets illustrated in Figure 15b together with closer spacing of the anchoring devices (see Figures 9, 10a and 10b), the bracket spacing can be increased to 30 m as shown in Figure 6b. Figure 6b also illustrates that a bracket 30b of one level should be offset by an appropriate amount (80mm) in relation to the bracket 30b on an adjacent upper or lower level. This enables the steel standards to be overlapped (preferably by about 3m) and clamped together in the manner illustrated. The clamps 30c are arranged at a spacing of about 750mm.

[0035] In some instances, the building columns may be located too far apart for effective securement of adjacent supporting brackets 30. In this case, an alternative supporting arrangement for the scaffolding structure will be required as illustrated in Figure 7. Figure 7 illustrates adjacent columns 40 of the building 15 with a slab 42 extending therebetween. Two supporting brackets 30 are bolted by bolts 46 to respective columns 40 as illustrated. However, these supporting brackets 30 exceed the maximum permissible spacing therebetween for properly supporting the scaffolding structure 10. Therefore, cantilevered I-beams 44 are bolted to the slab to extend outwardly beyond the slab 42 as illustrated in Figure 8. The inner grid 12 and the outer grid 14 are supported on the I-beam 44 as illustrated in Figure 8, provided that the outer grid 14 is a minimum of 200 mm from the cantilevered end of the I-beam 44 and a minimum of 200 mm from the end of the slab. The I-beams 44 are temporary and may be removed once the scaffolding has been disassembled.

[0036] Figure 9 illustrates one method of anchoring the scaffolding structure 10 to the building 15. The anchoring is achieved by way of an anchoring device 50 as shown in Figure 9. The anchoring device 50 is illustrated more clearly in Figure 10a. The anchoring device 50 comprises a relatively short arm of metal tube of approximately 1 metre in length having an outside diameter of 48.6 mm. At one end of the metal tube 52 is provided an anchoring plate 54 adapted to be bolted to the concrete building 15 as shown in Figure 9. The metal tube 52 is secured to the upright standards of the inner grid 12 and the outer grid 14 by way of metal right-angle couplers (see Figure 9). The anchoring plate 54 also provides an eyelet 56 for attachment of a steel cable 58. The other end of the steel cable 58 of R6 steel wire is provided with a coupling 59 for securement to a member of the outer grid 14 as shown in Figure 9. By attaching the coupling 59 to the outer grid 14, the scaffolding structure 10 will be effectively tethered to the building 15.

[0037] The anchoring method illustrated in Figure 9 serves to anchor both the inner grid 12 and the outer grid 14 to the building given that only bamboo transoms 18 are provided between the two grids. The anchoring method may serve as a backup in case of any failure of the brackets 30.

[0038] Figure 10b illustrates an alternative anchoring device 50b. The anchoring device 50b includes a short arm 52b of about 1m in length. At one end of the arm, a through-aperture 50d is provided into which an anchoring member 50c in the form of an L-shaped rod is received. The anchoring member 50c has a first leg having a free end which, in the configuration shown in the drawing, extends past the end of the arm. The free end of the first leg is threaded to enable the anchoring member to be secured into the structure of the building being erected. The small footprint of the first leg onto the building enables the first leg to be secured almost anywhere, thereby allowing greater flexibility in locating the anchoring device. The anchoring member 50c may be cast into position or alternatively secured to the concrete structure of the building 15 after the concrete has set. The threaded end may extend into the concrete about 750mm. The anchoring member 50c also includes a second leg which is received in the through- aperture 50d. The second leg also has a threaded free end. This threaded free end receives a nut (not shown) to retain the second leg within the aperture. However, the length of the second leg is such that the arm 52b can slide along the second leg, hence increasing the flexibility in locating the first leg at

an appropriate location on the building 15. As mentioned above, frequent use of the anchoring devices reduces the demand for support brackets. Desirably, the vertical spacing should not exceed 2.25m and the horizontal spacing should not exceed 3m. From a comparison of Figures 6a and 6b, it can be seen that the vertical spacing between brackets can be increased from 24m to 30m. This is achieved with frequent use of the anchoring devices 50b and the modified form of brackets 30b.

[0039] Figure 11 illustrates appropriate bracing 60 for the scaffolding structure 10. The outside grid 14 of the scaffolding structure 10 is illustrated diagrammatically by the spaced upright steel standards 24. As illustrated, for every 15 metre width ie 5 bays, diagonal cross bracing is typically arranged at an angle of 45- 60° plus or minus 5°.

[0040] Figure 12 illustrates a detail of the outer grid 14 with the dotted line 70 illustrating the location of an intended opening to be formed in the outer grid 14. An opening 70 such as that illustrated might be required to load materials onto the site. Figure 13 illustrates the detail of the outside grid 14 with the opening cut 70. The bamboo and steel members have been cut as illustrated. To reinforce the grid 14, additional bracing members 72 are installed. These extend diagonally as shown. Additionally, warning signs are installed to notify workers on the scaffolding structure of potential danger.

[0041] An additional feature of the scaffolding structure 10 is the provision of a catch fan as illustrated in Figure 14. The catch fan 80 comprises a catchment surface 82 extending upwardly and outwardly from the scaffolding structure 10. The catchment surface 82 is defined by spaced metal tubes 84 extending upwardly and outwardly from the outer grid 14 with a canvas-like fire resistant material extending over the metal support tubes 84. The upper and outer end of the metal support tubes 84 are supported by further metal tubes 86. Each metal tube 86 is joined to the end of one of the metal tubes 84 and extends from that end upwardly and inwardly towards the outer grid 14, Generally, the catchment surface 82 is arranged at an angle of 45° from the horizontal but is adjustable with adjustment of the further metal tubes 86. The catchment surface 82 is provided to catch materials falling off the building 15 or scaffolding structure 10 for easy collection of debris and removal. Catch fans 80 are generally provided at each ten storey interval. However, individual contractors may install the catch fans 80 to suit the requirements of a particular building site.

[0042] As shown in Figure 15, for the protection of workers on the scaffolding structure 10, protective layers 90 are disposed at regular intervals, preferably immediately above the supporting brackets ie every ten storeys. The projective layers 90 provide access for workers as well as protect the workers from falling. Additionally, the protective layers 90 protect the workers from falling debris. Each protective layer 90 comprises a layer of horizontally arranged bamboo members 92 extending between adjacent transoms 18. The spacing of the bamboo members should not exceed 200mm. The bamboo members 92 can be above or below the transoms 18. These bamboo members provide a buffer effect in case heavy objects fall from above. Above the horizontal bamboo members 92, zinc sheet 94 is laid down. The zinc sheet may be formed with upturned edges 94a of about 100mm in height. A bamboo ledger (not shown) fastened on top of the zinc sheet prevents the sheet from blowing away.

[0043] Optionally, metal workers' platforms, referred to as "cat walks" may be installed in addition to the protective layers 90 or in place of the protective layers 90. An appropriate catwalk 100 is illustrated in Figure 16. The catwalk 100 is of generally elongate planar form defined by an elongate rectangular metal frame 101 with a metal sheet 102 providing an elongate rectangular supporting surface. The catwalk 100 is supported by a horizontal steel ledger 26 of the outer grid 14 on one side and a horizontal steel ledger 22 of corresponding height of the inner grid 12, on the other side. Hook portions 107 extend transversely from the sides of the metal frame 101 to hook over the associated horizontal steel ledgers 22, 26. It will be appreciated that the horizontal steel ledgers 22, 26 on the inner and outer layer ought to be provided at the same height in order to ensure that the catwalk resting thereon is level. For this reason, during construction a piece of catwalk may be put into position on the outer layer 14 prior to the erection of the inner layer 12.

[0044] Figure 18 illustrates a slightly modified form of the catwalk. The catwalk illustrated includes toeboards 100b on each longitudinal side. The specific form of the toeboards 100b is illustrated in Figure 20. The toeboards are in the form of generally rectangular panels, the bottom corners being removed to enable the toeboards to be held within a pair of opposed brackets. The form of the brackets 100c is illustrated most clearly in Figure 19. The metal brackets 100c are an L-shape in plan with a height corresponding to the height of the platform 102. Each longitudinal side of the platform is provided with a pair of opposed brackets 100c. The toeboard is held between the opposed brackets 100c. Accordingly, the length between the opposed brackets TL corresponds to the distance between the upright edges of the cut-out corners of the toeboard. The overall length of the toeboard corresponds to the length of the platform 102.

[0045] Figure 19 also illustrates the form of a special corner platform with brackets 100c on adjacent sides.

[0046] An additional feature of the scaffolding structure 10 is the provision of metal staircases as illustrated in Figure 17. The metal staircases comprise a pair of spaced stiles 110 with appropriately spaced stair treads 112 extending therebetween. The ends of the elongate stiles 110 are provided with hook or loop portions 114 for attachment to appropriate structural members of the scaffolding structure 10.

[0047] It will be appreciated that the form of the metal staircases illustrated in Figure 17 can only be installed at the corner of the scaffolding structure otherwise the platform will be blocked. Figures 21 and 22 illustrate an

alternative form of the ladder 120 which can be installed at intermediate locations along the platforms. A particular type of platform 125 has been developed for use in connection with the alternative form of the ladder 120. The platform 125 incorporates an access opening 127 of sufficient size to position the ladder therein and enable a worker to pass therethrough. An access hatch 128 is hingedly connected to the platform 125 by means of hinges 129. The access hatch covers a portion of the opening 127, leaving a space sufficient for the ladder 120 to pass therethrough. A hand-hole 130 in the access hatch enables a worker to open the hatch 128 from above.

[0048] The specific form of the ladder is illustrated in Figure 22. The ladder 120 has stiles 132 and rungs 133. The rungs 133 are of rectangular cross-section. At the top of the ladder 120, the stiles are shaped in a U-shape, with the respective ends being formed in a C-bracket 135 to conform to the contour of the steel ledger on which they are supported. Likewise, the lower ends of the stiles 132 are formed with respective C-brackets 137. Additionally, the lower ends of the stiles are formed with a step since the upper and lower C-brackets 135, 137 must necessarily align.

Additional Statements of Invention

[0049]

1. A scaffolding structure for a building being erected, the scaffolding structure being in the form of a substantially two dimensional inner grid interconnected with a substantially two dimensional outer grid, each of the grids being comprised of load bearing members having relatively constant strength over time under expected loading conditions of the scaffolding structure, characterised in that additional bamboo members are secured on the outer grid such that the interstices defined by the load bearing members and the bamboo members of the outer grid are smaller than the interstices defined by the load bearing members of the inner grid.

2. The scaffolding structure as in statement 1 wherein the load bearing members are steel members of tubular cross section.

3. The scaffolding structure as in statement 1 wherein the load bearing members comprise fibre reinforced plastic tubes.

4. The scaffolding structure as in any one of statements 1 to 3 wherein the bamboo members include upright standards and substantially horizontal ledgers with the intersection between any two bamboo members or a bamboo member and another member being effected by nylon ties.

5. The scaffolding structure as in any one of statements 1 to 4 wherein bamboo transoms provide the interconnection between the inner grid and the outer grid.

6. The scaffolding structure as in any one of statements 1 to 5 wherein each of the distances between any two adjacent bamboo members and between any bamboo member and an adjacent load bearing member are substantially equal.

7. The scaffolding structure as in statement 1 wherein the load bearing members are elongate structural members including substantially horizontal ledgers and upright standards intersecting in a regular pattern to form the inner and outer grids.

8. The scaffolding structure as in statement 7 wherein the structure is erected such that at least some of the load bearing ledgers in the inner grid correspond to respective load bearing ledgers in the outer grid provided at the same height.

9. The scaffolding structure as in statement 8 further including one or more platforms, the or each platform disposed between two corresponding load bearing ledgers from the inner and the outer grid which are of the same level, wherein the platform includes a planar supporting surface and attachment means coupling the platform to the two load bearing ledgers.

10. The scaffolding structure as in statement 9 wherein the attachment means comprise hook portions.

11. The scaffolding structure as in statement 9 or statement 10 wherein the platform is elongate and the attachment means extend transversely out either side of the platform.

12. The scaffolding structure as in any one of statements 9 to 11 wherein there are four hook portions, each extending from a respective corner of the platform.

13. The scaffolding structure as in any one of statements 1 to 12 further including an anchoring device anchoring the scaffolding structure to the building being erected, the anchoring device having an arm coupled to the scaffolding structure, one end of the arm being provided with an anchoring means anchored to the building, the anchoring device also including a tether secured thereto which is capable of load bearing, the tether being attached to the scaffolding structure.

14. The scaffolding structure as in statement 13 wherein the arm is coupled to both the inner grid and the outer grid.

15. The scaffolding structure as in statement 14 wherein the tether is secured to the outer grid of the scaffolding structure.

16. The scaffolding structure as in statement 15 wherein the tether is secured to the outer grid at a point below the coupling of the arm and the outer grid such that the tether extends taut in a diagonal configuration.

17. The scaffolding structure as in any one of statements 13 to 16 wherein the tether comprises a flexible cable.

18. The scaffolding structure as in any one of statements 13 to 17 wherein the tether is secured to the anchoring device at or adjacent to the anchoring means.

19. The scaffolding structure as in any one of statements 13 to 18 wherein the anchoring means comprises a plate which is welded to the arm, the plate extending in a plane transverse to the longitudinal direction of the arm with the plate being bolted to the building.

20. The scaffolding structure as in any one of statements 1 to 19 wherein the building being erected includes at least one concrete slab with one or more temporary structural beams supported by and extending outwardly from the concrete slab in a cantilevered fashion, the scaffolding structure being supported on the one or more structural beams.

21. The scaffolding structure as in statement 20 wherein the spacing between any two adjacent cantilevered structural beams is about 3 metres.

22. The scaffolding structure as in either statement 20 or statement 21 wherein one or more of such cantilevered structural beams are spaced between two neighbouring supporting brackets mounted on respective neighbouring support columns of the building.

23. The scaffolding structure as in any one of statements 20 to 22 wherein the structural beams comprise I-beams.

24. The scaffolding structure as in any one of statements 1 to 23 further including an anchoring device anchoring the scaffolding structure to the building being erected, the anchoring device including:

an arm coupled to the scaffolding structure, the arm having a longitudinal axis; and an anchoring member anchoring the device and the scaffolding structure to the building, the anchoring member being coupled to the arm and having a first leg in the form of a rod or bar which extends beyond the arm, the rod or bar being anchored into the building.

25. The scaffolding structure as in statement 24 wherein the arm is movable relative to the anchoring member in a direction transverse to the longitudinal axis.

26. The scaffolding structure as in statement 24 or statement 25 wherein the anchoring member is L-shaped and incorporates the first leg, a second leg of the L-shape being coupled to the arm.

27. The scaffolding structure as in statement 26 wherein the second leg of the L-shaped member is received in an aperture in the arm, the arm being slidable along the second leg, with a stop provided to limit movement along the arm.

28. The scaffolding structure as in any one of statements 24 to 27 further including a tether secured thereto which is capable of load bearing, the tether being attachable to the scaffolding structure.

29. The scaffolding structure as in any one of statements 9 to 12 wherein an access opening is provided in the planar supporting surface for access to a lower region of the scaffolding structure, the scaffolding structure further comprising a ladder mounted on the scaffolding structure and disposed for access by a worker through the access opening.

30. The scaffolding structure as in statement 29 further including an access hatch movable between a closed position to at least partially close the access opening and an open position which provides sufficient space for a worker to use the ladder.

31. The scaffolding structure as in statement 30 wherein the access hatch is such to leave a space in the access opening when in the closed position, the ladder extending through the space.

32. The scaffolding structure wherein the ladder includes rungs and stiles, the stiles at the upper end being formed in a U-shape, the remote ends of the U-shape having respective couplers which are complementary to the shape of the ledgers, the stiles at the bottom end also having respective couplers complementary to the shape of the ledgers.

33. A method of constructing a scaffolding structure for a building being erected, the method including:

erecting the structure in the form of a substantially two dimensional inner grid interconnected

with a substantially two dimensional outer grid, each of the grids being comprised of load bearing members having relatively constant strength over time under expected loading conditions of the scaffolding structure; and
securing additional bamboo members on the outer grid such that the interstices defined by the load bearing members and the bamboo members of the outer grid are smaller than the interstices defined by the load bearing members of the inner grid.

34. The method as in statement 33 wherein the load bearing members are steel members of tubular cross section.

35. The method as in statement 33 wherein the load bearing members comprise fibre reinforced plastic tubes.

36. The method as in any one of statement 33 to 35 wherein the bamboo members include upright standards and substantially horizontal ledgers with the intersection between any two bamboo members or a bamboo member and another member being effected by nylon ties.

37. The method as in any one of statements 33 to 36 wherein bamboo transoms provide the interconnection between the inner grid and the outer grid.

38. The method as in any one of statements 33 to 37 wherein the structure is erected such that each of the distances between any two adjacent bamboo members and between any bamboo member and an adjacent load bearing member, are substantially equal.

39. The method as in statement 33 wherein the load bearing members are elongate structural members including substantially horizontal ledgers and upright bearers intersecting in a regular pattern to form the inner and outer grids.

40. The method as in statement 39 wherein the structure is erected such that at least some of the load bearing ledgers in the inner grid correspond to respective load bearing ledgers in the outer grid provided at the same height.

41. The method as in statement 40 further including erecting one or more platforms on the structure, the or each platform disposed between two corresponding load bearing ledgers from the inner and outer grid which are of the same level, wherein the platform is of elongate configuration and includes a planar supporting surface and attachment means coupling the platform to the two load bearing ledgers.

42. The method as in statement 41 wherein the attachment means comprise hook portions.

43. The method as in statement 41 or statement 42 wherein the attachment means extend transversely out either side of the platform.

44. The method as in any one of statements 41 to 43 wherein there are four hook portions, each extending from a respective corner of the platform.

45. The method as in any one of statements 33 to 44 further including anchoring the scaffolding structure to the building being erected, the method employing an anchoring device having an arm, one end of which is provided with an anchoring means, the anchoring device also including a tether secured thereto which is capable of load bearing, the method further including:

anchoring the anchoring means to the building;
coupling the arm to the scaffolding structure; and
attaching the tether to the scaffolding structure.

46. The method as in statement 45 wherein the arm is coupled to both the inner grid and the outer grid.

47. The method as in statement 46 wherein the tether is secured to the outer grid of the scaffolding structure.

48. The method as in statement 47 wherein the tether is secured to the outer grid at a point below the coupling of the arm and the outer grid such that the tether extends taut in a diagonal configuration.

49. The method as in any one of statements 45 to 48 wherein the tether comprises a flexible cable.

50. The method as in any one of statements 45 to 49 wherein the tether is secured to the anchoring device at or adjacent to the anchoring means.

51. The method as in any one of statements 45 to 50 wherein the anchoring means comprises a plate which is welded to the arm, the plate extending in a plane transverse to the longitudinal direction of the arm with the plate being bolted to the building.

52. The method as in any one of statements 33 to 51 wherein the building being erected includes at least one concrete slab, the method including:

extending and supporting one or more structural beams outwardly from the concrete slab in a cantilevered fashion; and
supporting the scaffolding structure on the one or more structural beams.

53. The method as in statement 52 wherein the spacing between any two adjacent cantilevered structural beams is about 3 metres.

54. The method as in either statement 52 or 53, as dependent on any one of claims 45 to 51 wherein one or more cantilevered structural beams are spaced between two neighbouring anchoring devices.

55. The method as in any one of statements 52 to 54 wherein the structural beams comprise I-beams.

56. An anchoring device for anchoring a scaffolding structure to a building being erected, the anchoring device including:

an arm for coupling to the scaffolding structure, the arm having a longitudinal axis; and
an anchoring member to anchor the device and the scaffolding structure to the building, the anchoring member being coupled to the arm and having a first leg in the form of a bar or rod, the anchoring member being alignable such that the first leg extends substantially parallel to the longitudinal axis of the arm with the remote end of the first leg extending beyond the arm.

57. The anchoring device as in statement 56 wherein the arm is movable relative to the anchoring member in a direction transverse to the longitudinal axis.

58. The anchoring device as in statement 56 or 57 wherein the anchoring member is L-shaped and incorporates the first leg, a second leg of the L-shape being coupled to the arm.

59. The anchoring device as in statement 58 wherein the L-shaped anchoring member is pivotable about the coupling relative to the arm.

60. The anchoring device as in statement 58 or statement 59 wherein the second leg of the L-shaped member is received in an aperture in the arm, the arm being slidable along the second leg, with a stop provided to limit movement along the second arm.

61. The anchoring device as in statement 60 wherein the second leg is threaded at a remote end thereof and receives a nut.

62. The anchoring device as in statement 61 wherein the remote end of the first leg is threaded.

63. The anchoring device as in any one of statements 56 to 62 further including a tether secured thereto which is capable of load bearing, the tether being attachable to the scaffolding structure.

64. The anchoring device as in any one of statements 56 to 63 including one or more couplers to couple the arm to scaffolding structure.

Claims

1. A scaffolding structure for a building being erected, the scaffolding structure being in the form of a substantially two dimensional inner grid interconnected with a substantially two dimensional outer grid, each of the grids being comprised of load bearing members in the form of elongate structural members including substantially horizontal ledgers and upright standards intersecting to form the grids, the structure being erected such that at least some of the load bearing ledgers in the inner grid correspond to respective load bearing ledgers in the outer grid provided at the same height, the scaffolding structure further comprising one or more platforms, the or each platform disposed between two corresponding load bearing ledgers from the inner and outer grid which are of the same level, wherein an access opening is provided in the platform for access to a lower region of the scaffolding structure, the scaffolding structure further comprising a ladder mounted on the scaffolding structure and disposed for access by a worker through the access opening.

2. The scaffolding structure as claimed in claim 1 further including an access hatch movable between a closed position to at least partially close the access opening and an open position which provides sufficient space for a worker to use the ladder.

3. The scaffolding structure as claimed in claim 2 wherein the access hatch is such to leave a space in the access opening when in the closed position, the ladder extending through the space.

4. The scaffolding structure as claimed in any one of claims 1 to 3 wherein the ladder includes rungs and stiles, the stiles at the upper end being formed in a U-shape, the remote ends of the U-shape having respective couplers which are complementary to the shape of the ledgers, the stiles at the bottom end also having respective couplers complementary to the shape of the ledgers.

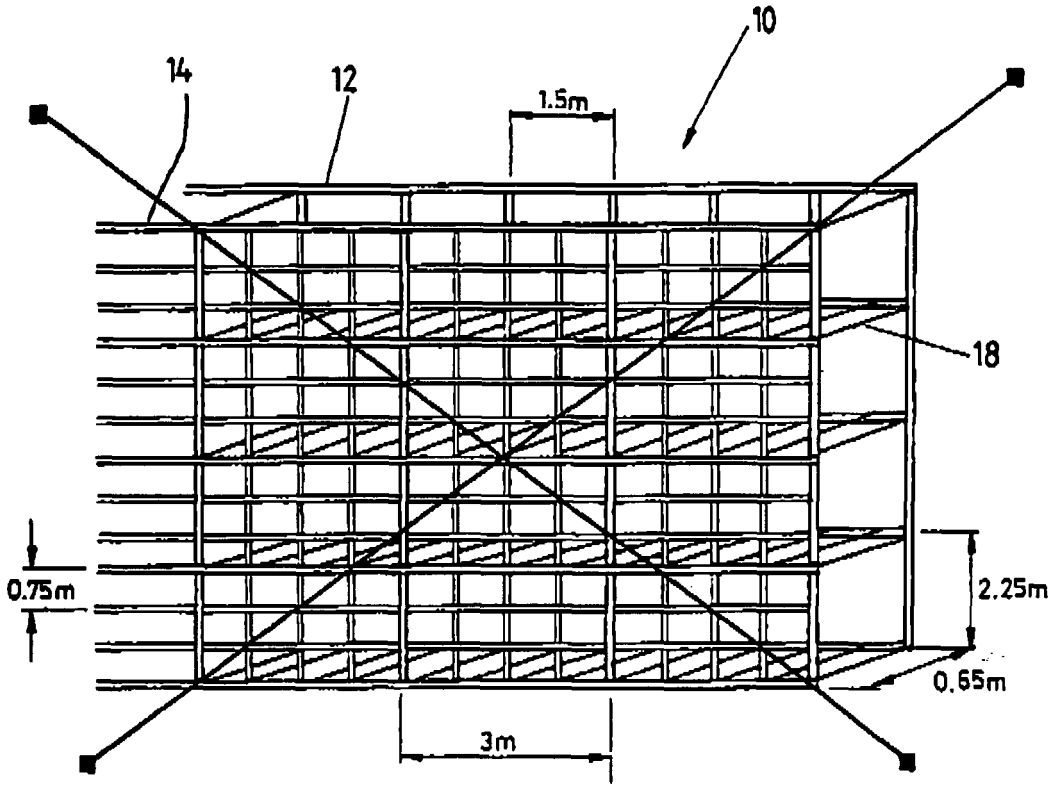

FIG. 1

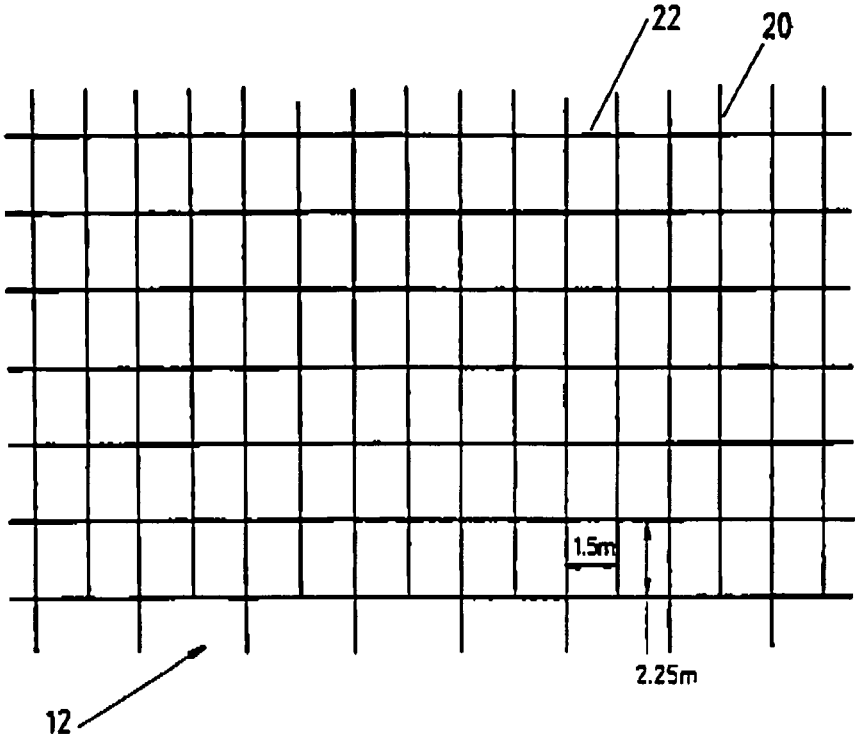

FIG. 2

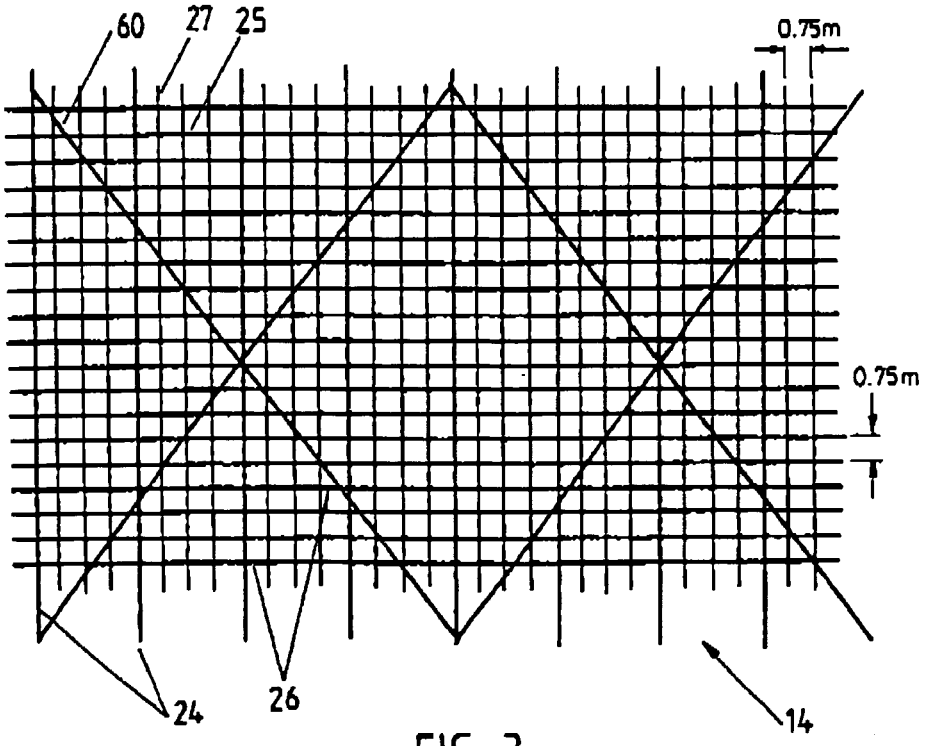

FIG. 3

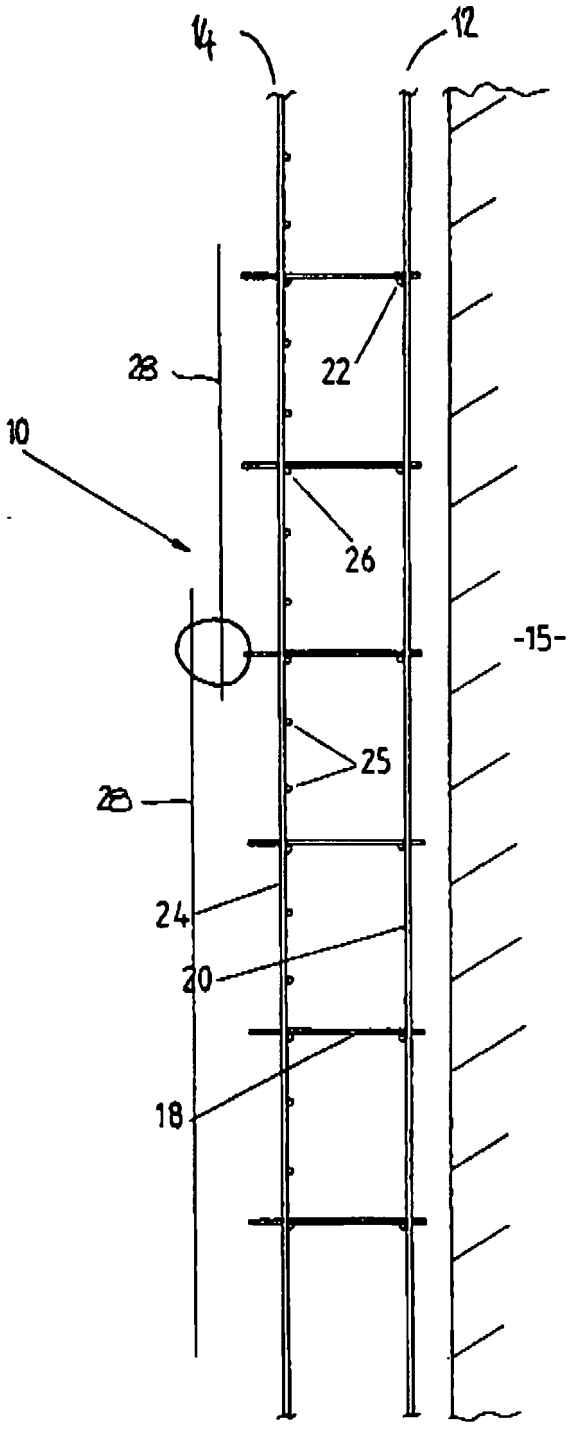

FIG. 4

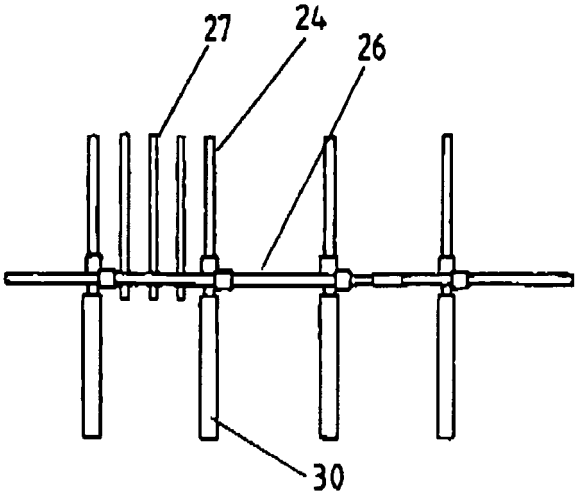

FIG. 5

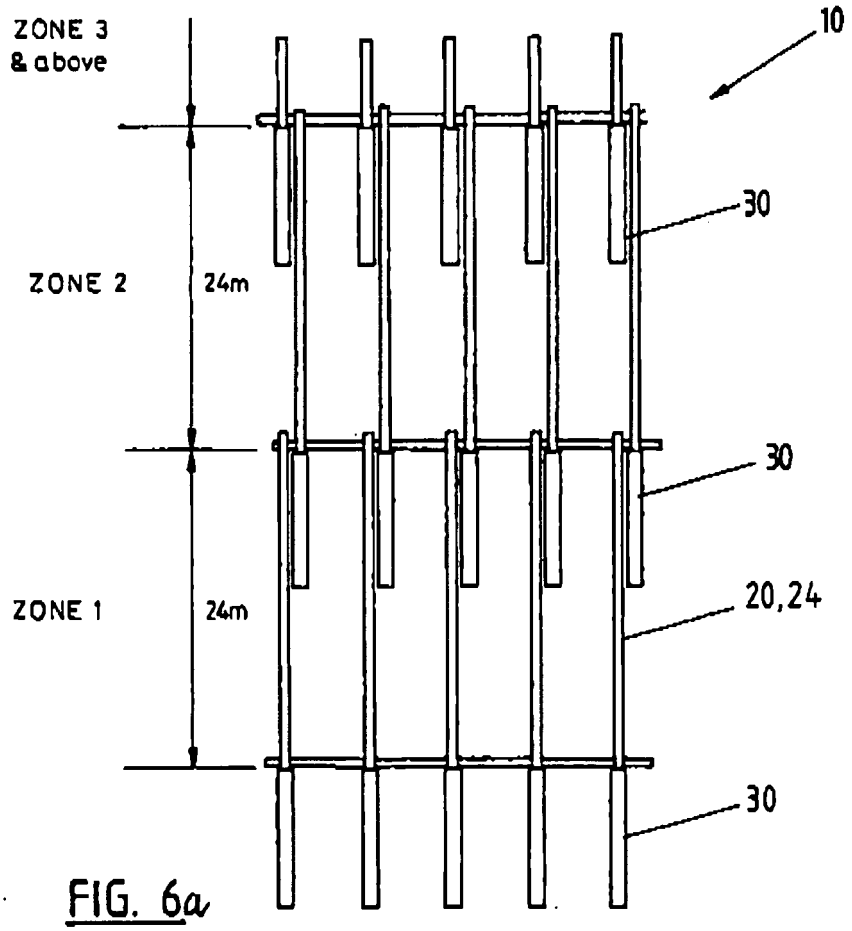

FIG. 6a

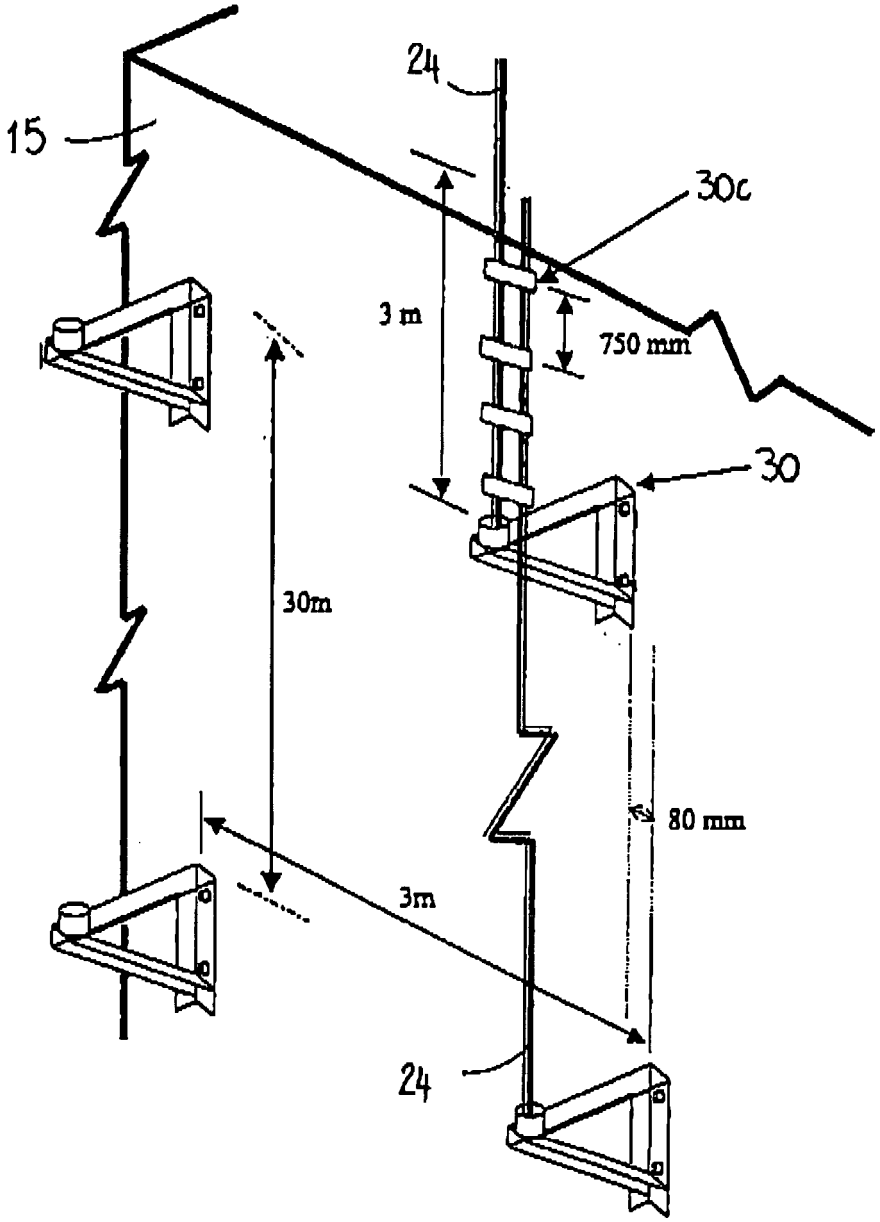

FIG 6b

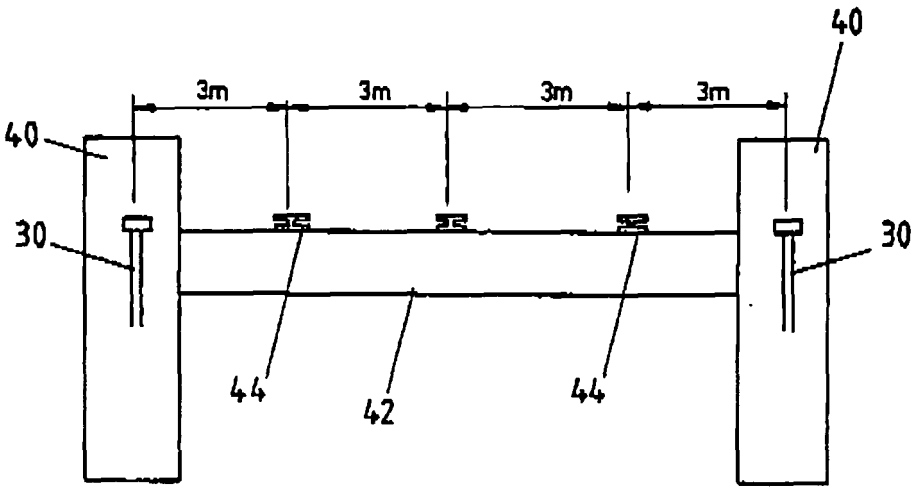

FIG. 7

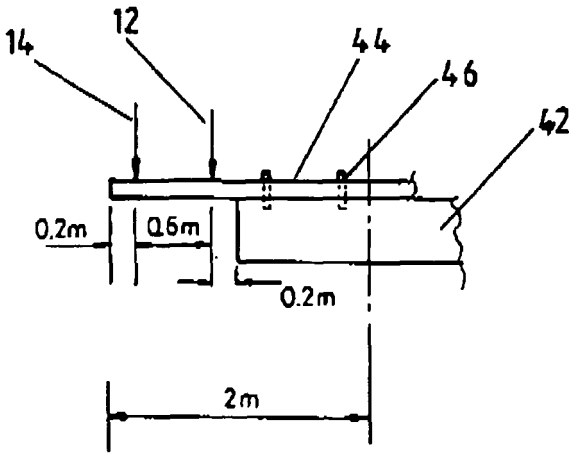

FIG. 8

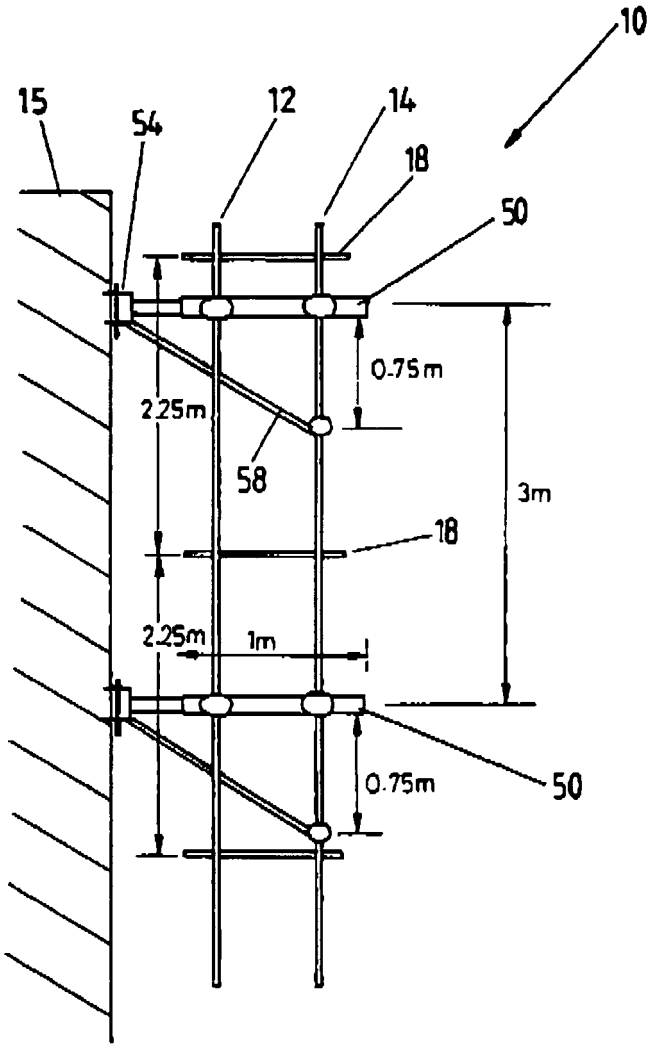

FIG. 9

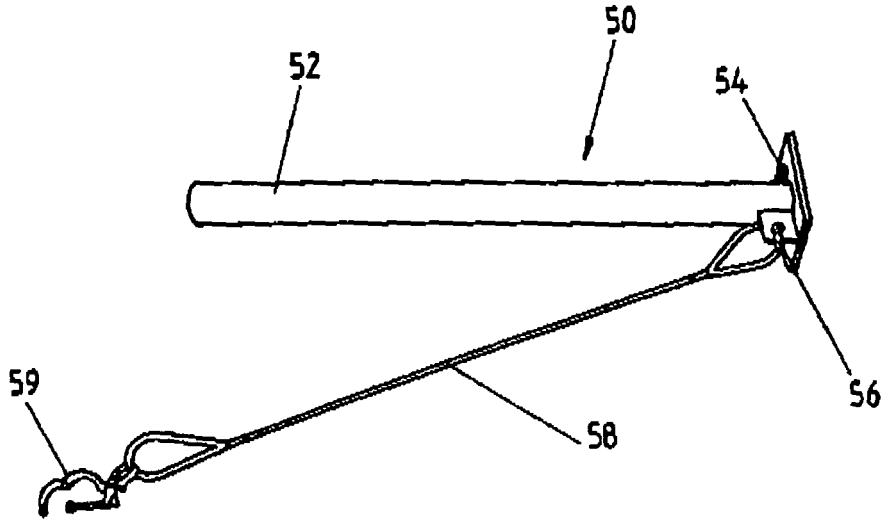

FIG. 10a

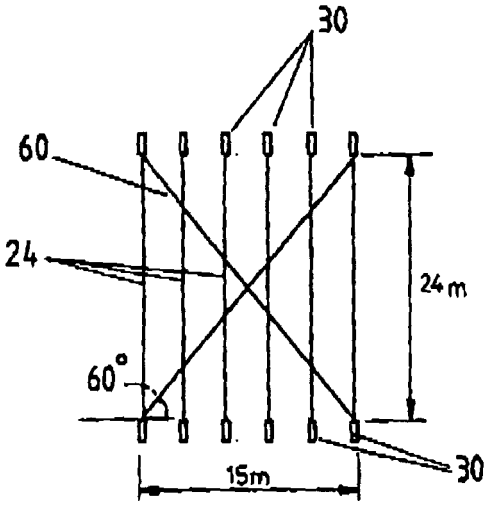

FIG. 11

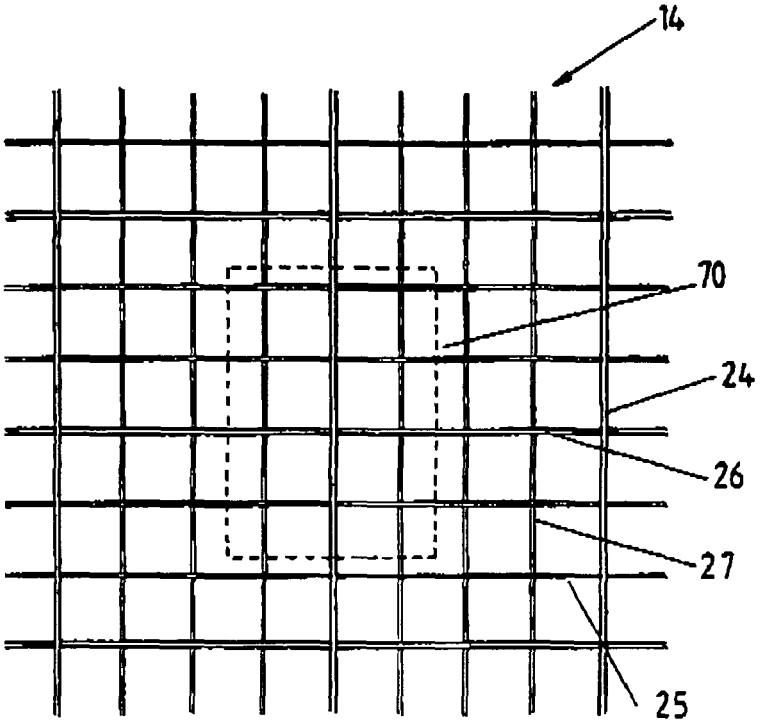

FIG. 12

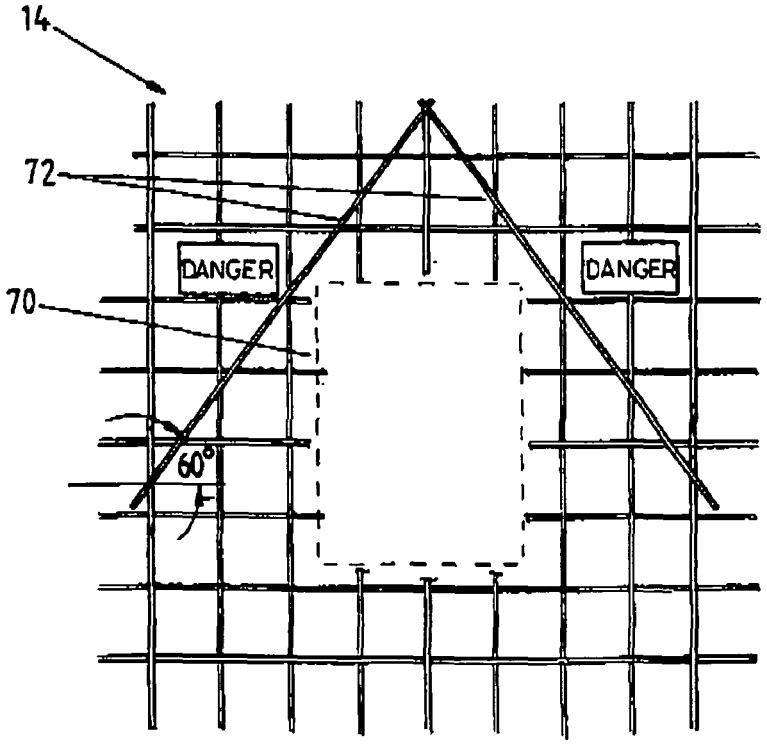

FIG. 13

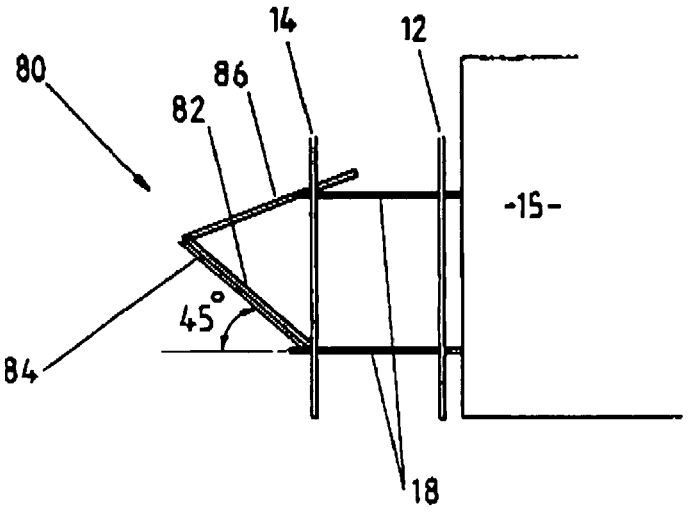

FIG. 14

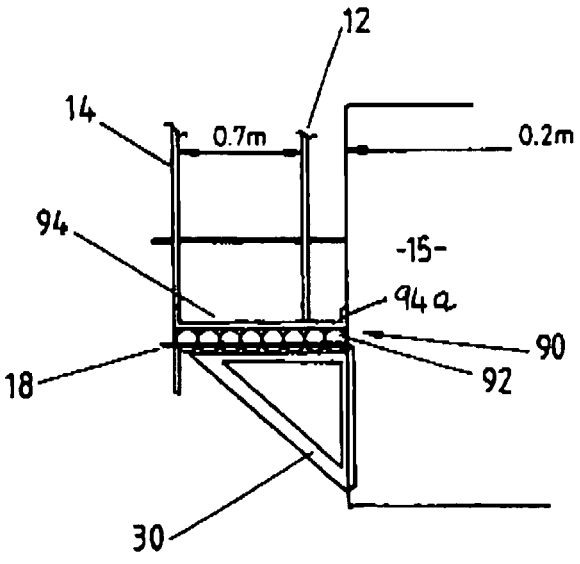

FIG. 15a

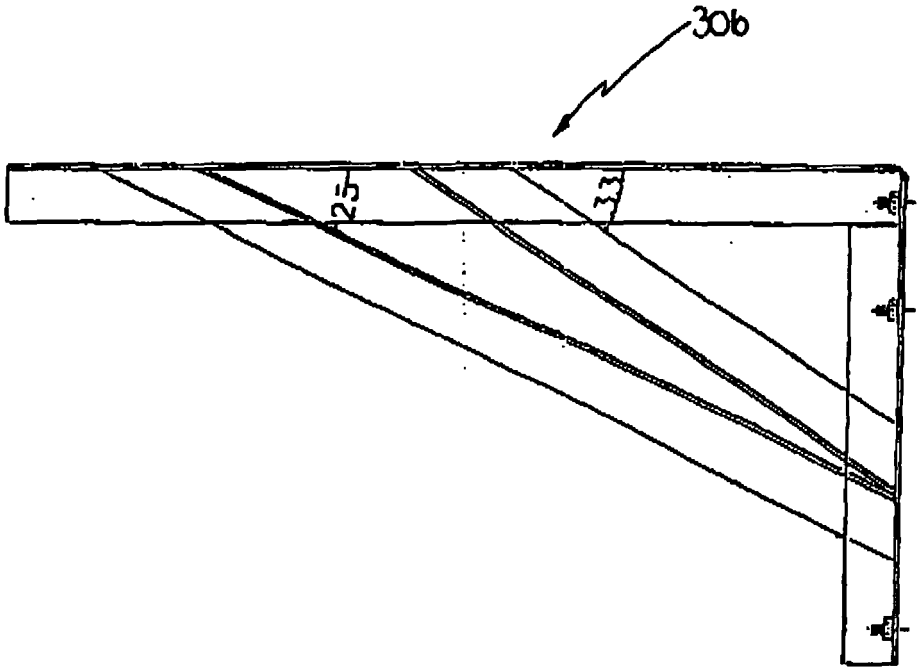

FIG 15b

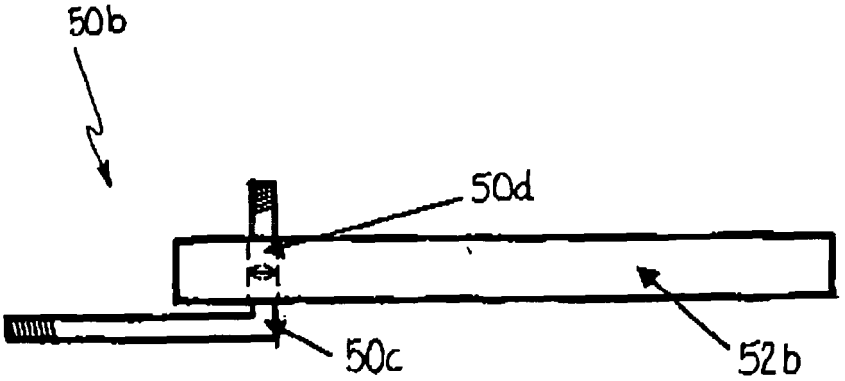

FIG 10b

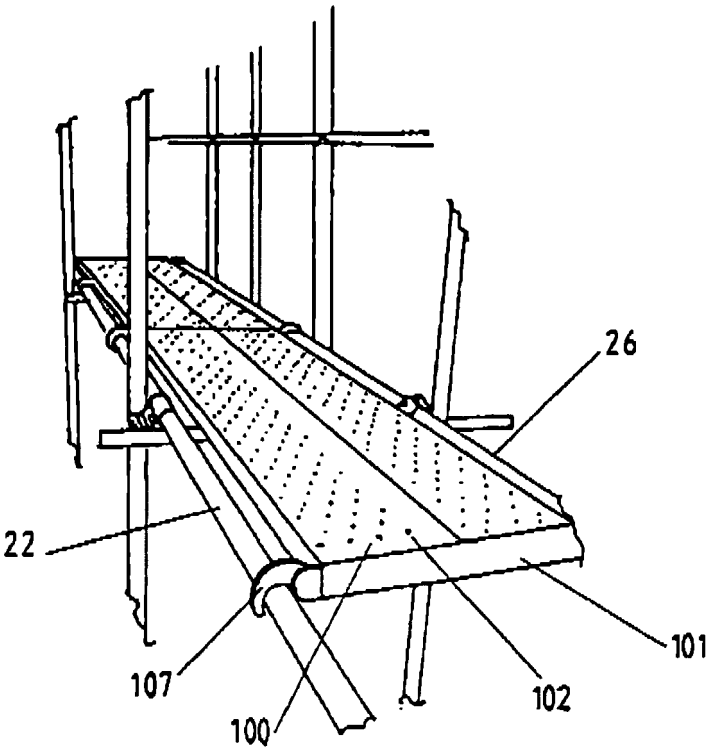

FIG. 16

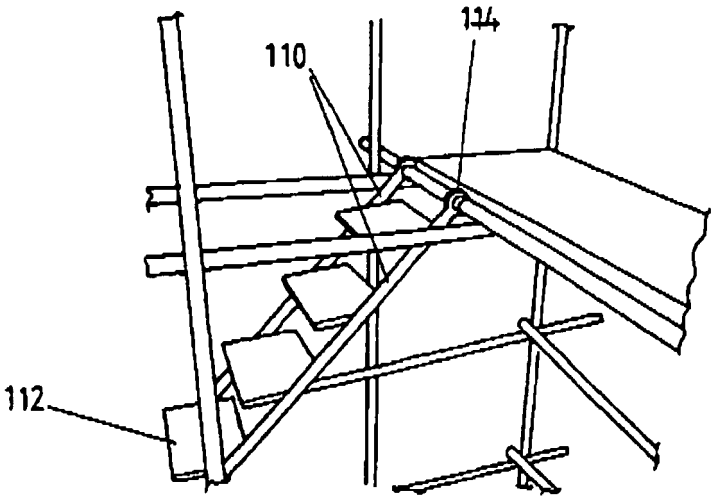

FIG. 17

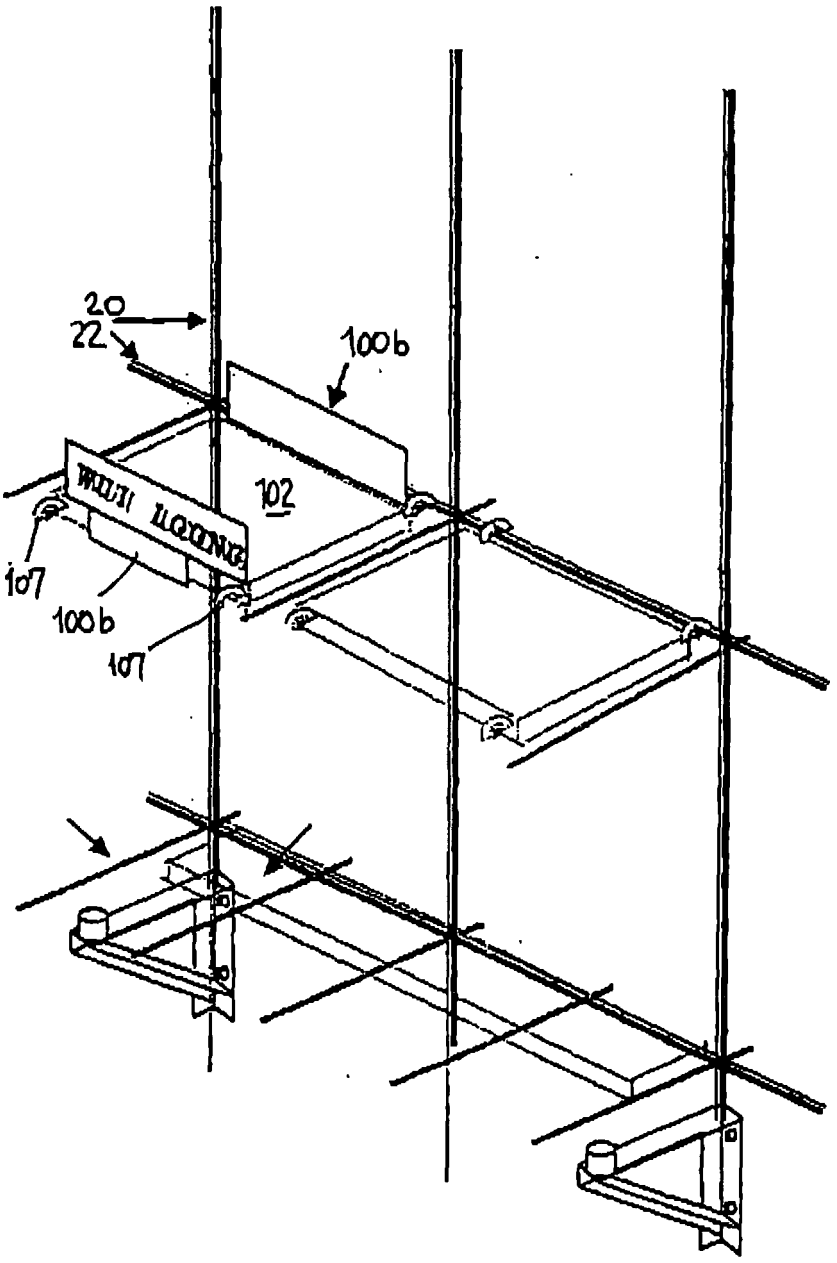

FIG. 18

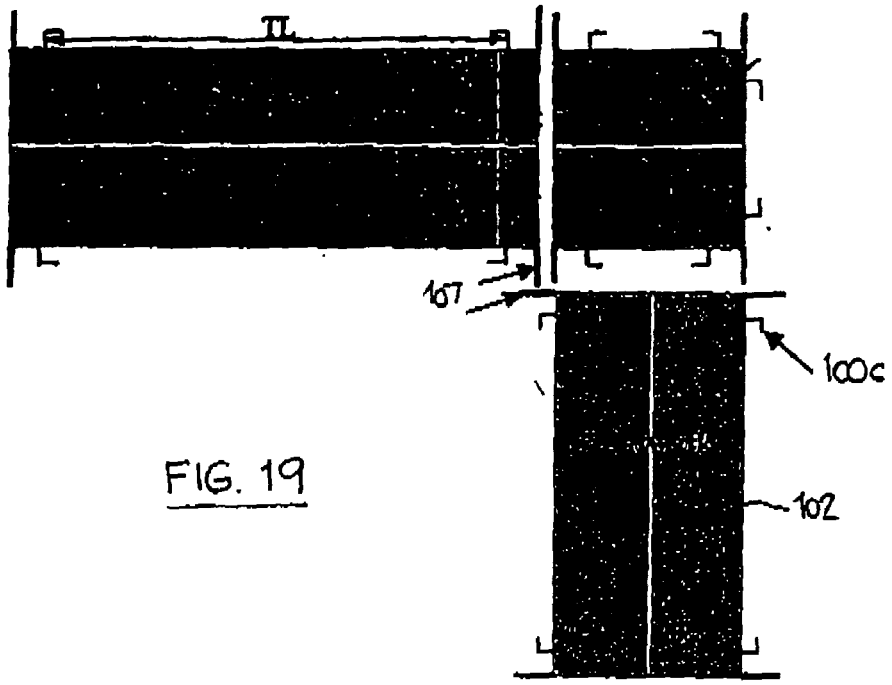

FIG. 19

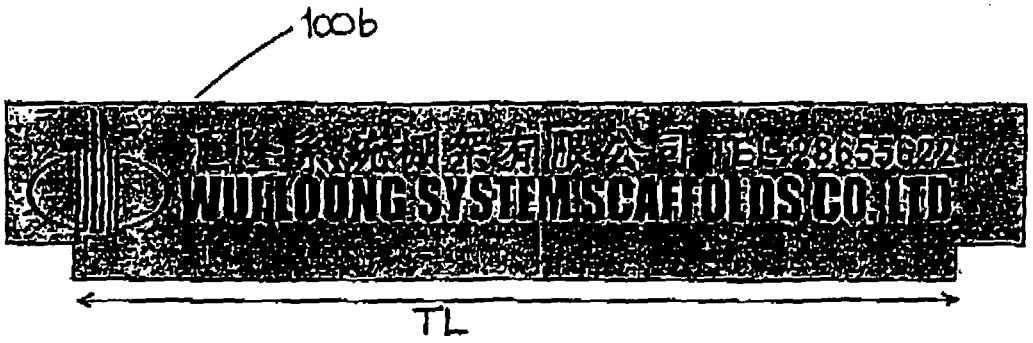

FIG. 20

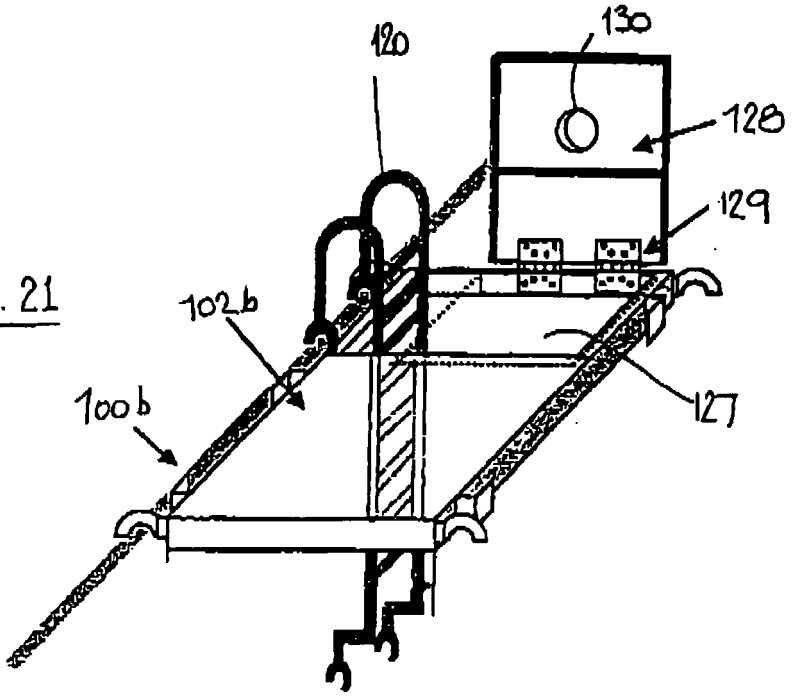

FIG. 21

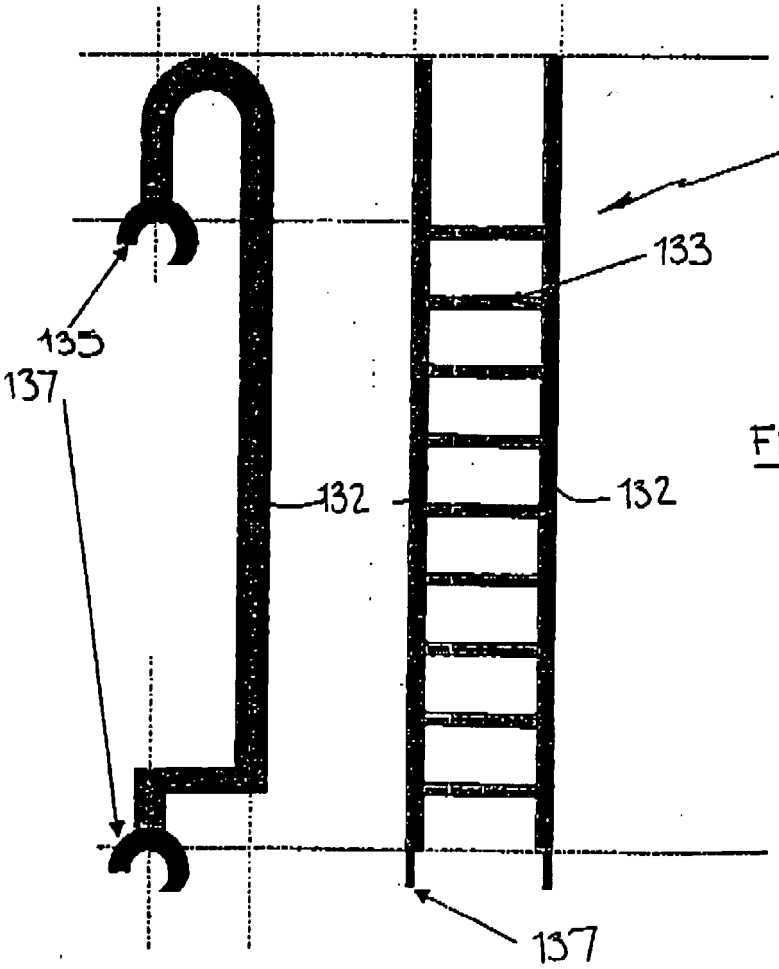

FIG. 22

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 01 6534

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 870 124 A (HOWARD IVY J) 11 March 1975 (1975-03-11) * column 2, line 27 - column 3, line 4 * -----	1	INV. E04G5/10 E04G1/15
X	FR 2 199 786 A (THOMAS LTD MARTIN [GB]) 12 April 1974 (1974-04-12) * page 2, line 35 - page 3, line 3; figure 2 * * page 3, line 34 - page 4, line 8 * -----	1,2	
A	FR 1 355 507 A (NOUAL) 20 March 1964 (1964-03-20) * page 1, right-hand column; figure 1 * -----	4	

TECHNICAL FIELDS SEARCHED (IPC)

E04G

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	4 October 2007	Saretta, Guido

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
L : document cited for other reasons

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3

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 01 6534

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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