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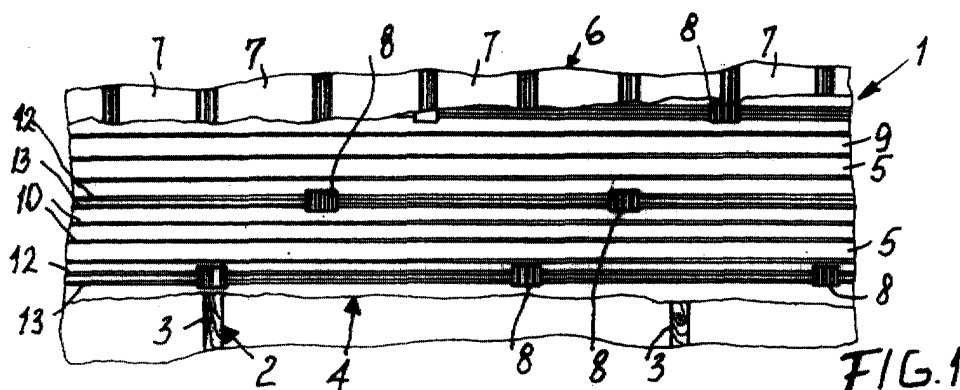
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(54) **A laying process for a metal cover and covering structure for implementing such a process**

(57) A flat covering structure (1) including a load-bearing purlin structure (2), a lower facing of staves (5) located side-by-side and aligned in a first direction on said load-bearing structure (2) and secured thereto in any suitable manner, the said staves (5) having a substantially flat mid-portion (9) and longitudinal edges (12, 13) that are bent with respect to the said mid-portion (9) and are designed to extend upwards, in use, an upper covering surface (6) of metal sheet elements (7) to be laid on the said staves (5) crossways with respect to the said first direction and to be anchored thereto thereby

delimiting with the said staves (5) a gap (33) arranged to receive a layer of thermally insulating material (44) and a plurality of removable locking blocks (8) arranged to anchor the said metal sheet elements (7) to the said staves (5). Each one of the said removable locking blocks (8) comprises blocking means (26, 27; 46) designed to connect the said side-by-side longitudinal edges (12, 13) belonging to two adjacent staves (5), as well as securing means (35, 36) designed to couple two adjacent metal sheet elements (7), thereby obtaining direct anchoring, in use, between the said staves (5) and the said metal sheet elements (7).



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## Description

**[0001]** The present invention refers to a laying process for a metal cover and covering structure required to implement the said process.

**[0002]** It is known that, at present, many buildings, whether for civil or industrial use, have a flat covering structure which generally consists of a support structure comprising a plurality of load-bearing beams, a first facing of steel sheet staves secured crossways to the load-bearing beams underneath, and a sequence of bent steel sheet sections for roofs located above the staves and secured thereto by means of suitable securing means.

**[0003]** Moreover, the lower facing of staves and the upper covering surface delimit a gap into which a layer of insulating material can be placed.

**[0004]** However, such a covering structure is in some respects inconvenient due to both the difficulty in laying it and its limited load resistance and limited protection against atmospheric agents.

**[0005]** So far as laying is concerned, construction of a covering structure as described above calls for use of specialised labour capable of ensuring that the different elements of the cover are correctly and safely secured. In fact, each stave must be adequately fixed to each of the beams underneath and, likewise, the covering steel sheets, in addition to being coupled together by overlapping tightly sealed joints, must also be connected to the lower facing in staves to obtain a compact and resistant structure.

**[0006]** Today, an often used technical solution for securing covering steel sheets to the staves underneath entails using securing means consisting of locking blocks having a base portion thereof designed for connection to the suitably shaped adjacent edges of two consecutive staves, e.g. by means of screws or expansion plugs, and an upper portion thereof snap-fitted to overlap the longitudinal edges of the adjacent covering steel sheets.

**[0007]** As can be evinced from what we have just said, the operations involved in constructing a flat covering are particularly delicate and complex and thus require a long time to accomplish and high labour costs.

**[0008]** Furthermore, the need to perforate the staves in order to secure the above mentioned locking blocks thereto, in addition to increasing time and execution difficulties, could jeopardise the integrity of the entire structure, since it increases the possibility of tightness and/or stability faults.

**[0009]** The main object of the present invention is to provide a process for obtaining flat covers suitable for eliminating or substantially reducing the inconveniences complained of above concerning current metal covering structures.

An important object of the present invention is that, with the above mentioned process, it is possible to simplify and considerably speed up the laying of a flat metal cov-

er.

**[0010]** Another object of the present invention is that, with the above mentioned process a flat cover can be obtained also by employing not particularly trained personnel thus enabling substantial savings in labour.

**[0011]** Yet another object of the present invention is that, with the above mentioned process, one can obtain a long-life covering structure, on which one can tread on and which is suitable for resisting particularly high positive loads due, for example, to build-up of snow or ice, and for resisting the force of atmospheric agents, while preventing entry of rainwater and efficiently contrasting wind energy.

**[0012]** A further object of the present invention is to provide a flat covering structure enabling easy laying even by non-specialised personnel.

**[0013]** Not the least important object of the present invention is that the said flat long-life covering structure, on which one can tread on, and which is suitable for resisting particularly high positive loads due, for example, to the build-up of snow or ice, and to resist the force of atmospheric agents, preventing entry of rainwater and efficiently contrasting wind energy.

**[0014]** According to a first aspect of the present invention, a flat covering structure is provided, which includes a load-bearing purlin structure, a lower facing of staves located side-by-side and aligned in a first direction on said load-bearing structure and secured thereto, an upper covering surface of metal sheet elements designed to be laid over the said lower facing of staves crossways with respect to the said first direction and to be anchored thereto and a plurality of removable locking blocks arranged to anchor the said metal sheet elements to the said lower facing of staves, the said covering structure being characterized in that each one of the said removable locking blocks comprises blocking means designed to engage with anchoring means connected to, or integral with, longitudinal edges of two adjacent staves, and securing means designed to couple two adjacent metal sheet elements.

**[0015]** Advantageously, the said blocking means comprises a pair of parallel slots that, in use, are open downwards, each housing a bent or loop provided close to and along the longitudinal edge of a respective stave.

**[0016]** According to another aspect of the present invention, there is provided a process for obtaining a flat covering structure including a load-bearing purlin structure, a lower facing of staves located side-by-side and aligned in a first direction on the said load-bearing structure and secured thereto in any suitable manner, the said staves having a substantially flat mid-portion and longitudinal edges that are bent with respect to the said mid-portion and are designed to extend upwards, in use, an upper covering surface consisting of metal sheet elements to be laid onto the said staves according to a transversal direction with respect to said first direction and to be anchored thereto, thereby delimiting therewith a gap arranged to house a layer of thermally insulating

material and a plurality of removable locking blocks suitable for directly anchoring the said metal sheet elements to the said staves, the said process being characterized in that it comprises:

- securing to the said load-bearing structure of a sequence of staves aligned in a first direction and with their longitudinal edges arranged side-by-side;
- snap-on fitting of a plurality of the said removable locking blocks on each pair of longitudinal edges positioned side-by-side and belonging to two adjoining staves, by exercising adequate downward pressure on each of the said movable locking blocks, the said locking blocks being located at a distance from each other and according to a pre-defined lay-out;
- laying above the said staves of a sequence of the said elements in metal sheet aligned according to a transverse directions with respect to the said first direction and located side-by-side, whereby their respective suitably shaped edges are arranged at one or more movable locking blocks to be snap-anchored therewith by exerting a suitable pressure from above.

**[0017]** Further aspects and advantages of the present invention can be better appear from the following detailed description of some presently preferred embodiments thereof given merely by way of non-limiting examples, with reference to the accompanying drawings, in which:

FIGURE 1 illustrates a top view of a portion of a flat covering structure according to the present invention;

FIGURE 2 shows a side elevation view on enlarged scale of a portion of the flat covering structure from viewpoint A in Figure 1;

FIGURE 3 is a cross-section view of the flat covering structure taken along the line III-III of Figure 2; FIGURE 4 illustrates a side elevation view of a locking block according to the invention;

FIGURE 5 shows a cross-section view of the locking block taken along the line V-V of Figure 4;

FIGURE 6 is a frontal elevation view of the locking block from viewpoint B in Figure 4;

FIGURE 7 shows a top view of the locking block of Figure 4;

FIGURE 8 shows a bottom view of the locking block of Figure 4;

FIGURE 9 is a side elevation view partly in cross-section on an enlarged scale of another embodiment of the lower anchoring portion of a locking block;

FIGURE 10 shows a front elevation view of a locking block according to another embodiment of the present invention;

FIGURE 11 is a view from below of the locking block

of Fig. 10;

FIGURE 12 a side elevation view of the locking block of Fig. 10;

FIGURES 10a and 12a are, respectively, a front view and an elevation view of a modification of a locking block shown in Figs. 10 and 12;

FIGURE 13 is a cross-section view taken along line XIII-XIII of Fig. 10;

FIGURE 14 shows sequential mounting phases of the locking block of Fig. 10 onto an grooved engaging support;

FIGURE 15 is a side elevation view of two grooved support elements for anchoring a locking block according to the present invention;

FIGURE 16 is a perspective view of a portion of a grooved support element of Fig. 15; and

FIGURE 17 is a perspective view of a portion of a grooved support element provided with a different securing system to staves underneath.

**[0018]** In the accompanying drawings, identical or similar parts or components are marked with the same reference numerals.

**[0019]** With reference first to the embodiment shown in Figures 1 to 9, a flat covering structure according to the present invention, is indicated with reference numeral 1 and comprises a purlin type load-bearing structure 2, preferably consisting of a plurality of load-bearing beams 3 parallel to each other and arranged at a pre-defined distance from each other, a lower facing 4 in staves 5 located side-by-side and transversely aligned with respect to the load-bearing beams 3 and secured to the latter in any suitable manner, an upper covering surface 6 consisting of metal sheet elements 7 overlapping the staves 5 according to a transverse direction and securable to the same, and a plurality of removable locking blocks 8 designed to directly anchor the metal sheet elements 7 to the staves 5 underneath.

As is better illustrated in Figure 2, the staves 5 have a mid-portion 9, which can be either flat or contain a plurality of longitudinal reinforcing ribs 10, delimited by two longitudinal edges 12 and 13 which are bent with respect to the said mid-portion 9, e.g. by rolling, pressing or in any other suitable manner, and designed to extend upward, in use, while allowing the mid-portion 9 to uniformly adhere to the load-bearing beams 3 positioned crossways with respect to the said mid-portion 9.

**[0020]** The longitudinal edges 12 and 13 located side-by side to each other and belonging to two adjacent staves 5 consist of a flank 14, preferably shaped in a complementary manner to enable the edges to uniformly abut against each other, the said flank being connected on one side to the mid-portion 9 by means of a rounded section 15 and, on the other side, to a leading end 16 by means of a bent connecting section 17 which is inclined in order to recede with respect to the stave 5 it belongs to.

**[0021]** Advantageously, the leading ends 16 of the

two longitudinal side-by-side edges 12 and 13 are of mirror geometry and delimit an open U-channel 18, pointing downward in use, which comprises a first section 19 that is substantially parallel to the respective flank 14 and having a longitudinal side in common with the bent connecting section 17 and terminating upward in a bent section 20 with a relatively wide radius of curvature and jutting to the outside of its respective stave 5, and a second section 21 extending from the bent section 20 downward and parallel to the first section 19 and having a free end 23 which is bent inwards, i.e. towards its respective U-channel 18.

**[0022]** The staves 5, as described above, are laid and anchored onto the load-bearing beams 3 and secured to them in any suitable manner, e.g. by screws or rivets (not shown in the Figures).

Subsequently, a row of locking blocks 8 at a pre-defined distance from each other is fitted at each pair of side-by-side longitudinal edges 12 and 13 belonging to two adjacent staves 5 (see Figure 1). The locking blocks 8 are thus distributed on the whole on a plurality of parallel rows advantageously aligned in a transverse direction along diagonal lines, thereby obtaining a uniformly distributed anchorage throughout the entire covering surface.

**[0023]** As illustrated in Figures 4 to 8 in particular, each locking block 8 comprises a lower portion 24 designed to be coupled, in use, to the side-by-side longitudinal edges 12 and 13 of two adjacent staves 5, and an upper portion 25 designed to snap-engage with two adjacent metal sheet elements 7, thereby securing the said elements to the staves 5 underneath.

**[0024]** In Figure 5, it can be seen that the lower portion 24 is provided with blocking means including a pair of parallel recesses or slots 26 and 27, open downward in use, and having a rounded bottom 28 with a radius of curvature preferably equal to that of the bent section 20 of the leading end 16 of the two longitudinal edges 12 and 13.

**[0025]** Each slot 26 and 27 has a substantially vertical throat delimited by a flat, vertical internal wall 29 and by an outer wall 30, shaped so that the throat widens at the bottom 31 of the locking block 8.

The internal walls 29 of both slots 26 and 27 are delimited at the lower end thereof by an abutting element 32 designed to be located, in use, between the leading ends 16 of two side-by-side longitudinal edges 12 and 13. The abutting element 32 forms, together with the internal walls 29, a respective jutting section 34 that extends substantially orthogonal with respect to the said walls and, preferably, in the same plane as the bottom 31 of the locking block 8, whereby narrowing the opening of the slots 26 and 27 and acting, in use, as an abutting surface for the free end 23 of the leading end 16 of the longitudinal edges 12 and 13, respectively, in work position.

**[0026]** The upper portion 25 of each locking block 8 instead delimits securing means comprising two projec-

tions or ridges, which are parallel and equal to each other, 35 and 36 and a respective groove 37 and 38 extending along the outer side of each projection in a substantially right-angled direction with respect to slots 26 and 27 of the lower portion 24.

**[0027]** Slots 37 and 38 delimit a respective throat which widens slightly by a pre-defined angle toward its respective ridge, e.g. an angle between 30° and 60°.

A radiused edge 39 is provided on the upper rim of the outer wall of each groove 37 and 38, whereas at the upper rim of the internal wall there is provided a substantially vertical abutting wall 40 that is followed by a wall section 41 inclined toward the respective projection 35 and 36, which section makes up part of the outer flank of its respective projection and terminates in an upper jointed abutment niche 42.

To install a locking block 8 as described above, first of all, as illustrated in Figure 2, the locking block 8 must be placed onto a pair of side-by-side longitudinal edges 12 and 13 with its abutting element 32 placed between their leading ends 16. Next, the said leading ends 16 are snap-fitted within their respective slots 26 and 27, by exerting adequate downward pressure until the bent section 20 rests against the bottom 28 of its respective slot and section 21 abuts against its respective internal wall 29 with its free end 23 insisting against the respective jutting section 34.

**[0028]** When locking blocks 8 have been fitted in quantities and according to a lay-out considered suitable for achieving safe reciprocal fastening of the staves 5, metal sheet elements 7 are laid next, aligning them according to a direction at right angles with respect to that of the staves 5.

**[0029]** Each metal sheet element 7 is suitably provided with non adjacent edges 43 and 45 shaped in a complementary manner thereby permitting the coupling of two adjacent metal sheet elements 7 to partly overlap edges 43 and 45 above the said projections 35 and 36 and allow snap-fitting into the grooves 37 and 38 of each locking block 8.

**[0030]** Advantageously, panels of insulating material 44 can be placed inside the gap 33 delimited by the metal sheet elements 7 and the staves 5 below, in order to thermally insulate the spaces enclosed at the top by the covering structure 1.

**[0031]** Modifications and variations are possible to the flat covering structure described above, within the protection scope as defined by the claims.

Thus, for example, the locking blocks 8 can have a lower portion 24 shaped as illustrated in Figure 9, where it can be seen that the blocking means comprise one groove 46, open downward, in use, and delimited by two internal walls 47 and 48 inclined along the same angle with respect to a vertical line and converging upwards. The same walls 47 and 48 are delimited at the bottom thereof by respective shoulders 49 and 50 designed to narrow the opening of the groove 46 and to delimit each an internal abutting surface 51 and 52 joined to its respective

internal wall 47 and 48.

Each shoulder 49 and 50 also has a lead-in face 53 and 54 identically inclined with respect to internal walls 47 and 48.

To enable fitting of locking blocks 8, as described above, on the side-by-side longitudinal edges 12 and 13 of adjacent staves 5 and to permit securing of the same in work position, the leading ends 16 of the longitudinal edges 12 and 13 must be suitably shaped. In this case, the leading ends 16 have a first section 55 bent in order to recede, which section is flat and substantially horizontal, and is connected on one side to its respective flank 14 and, on the other side, to an inclined section 56 forming with it an acute angle. Each inclined section 56 may terminate in an inwardly bent end 57 extending toward its respective first section 55.

The embodiment shown in Figures 10 to 14 and 10a and 12b a locking block 101 comprises securing means 102 located, in use, at the top thereof and designed to couple two adjacent metal sheets in order to form a metal covering. The locking block 100 also has a base where blocking means 103 are provided and arranged to be connected to an anchoring element 104 (Fig. 14). The latter generally comprises two longitudinal edges 104a and 104b which extend substantially parallel to one another. Each anchoring element 104 has a base (not shown in Fig. 14) designed to be secured to a covering underneath, e.g. made of staves 5, as will be further described below.

The blocking means 103 comprises two sides 105a and 105b opposite and extending substantially parallel to one another and provided with engaging means 106a and 106b, respectively, comprising one or more parallel slots or tenons that are arranged to engage, in use, with a respective ridge or a groove formed in an anchoring element 104.

The blocking means 103 also comprises two opposite guide plane surfaces 107a and 107b extending substantially parallel to one another. The distance between the guide surfaces 107a and 107b is advantageously smaller than that between the longitudinal edges 104a and 104b (Fig. 14), thereby making it possible to easily insert a locking block 101 between two longitudinal edges 104a and 104b.

Advantageously, the guide surfaces 107a and 107b are inclined through 45° with respect to the two sides 105a and 105b.

As shown in Fig. 14, a removable locking block 101 is first inserted between longitudinal edges 104a and 104b of an anchoring element 104 while keeping its guide surfaces 107a and 107b substantially parallel to the longitudinal edges 104a and 104b. Once the locking block 101 has been moved along the guide surfaces 107a and 107b to reach a desired position, the locking block is caused to rotate, e.g. in clockwise direction, whereby the engaging means 106a and 106b are brought into engagement with and underneath the longitudinal edges 104a and 104b, respectively.

As is better shown in Figures 15 to 17 illustrate an anchoring element 104 comprises two side walls 108 which extend substantially parallel to one another and at right angles with the laying plane of the staves 5. Each side wall is outwardly flanged at its lower resting end 109 and terminates with an upwardly bent section 110 followed by two further sections 111 and 112 bent at right angles with one another. Sections 112, 111, 110 and partly 109 are designed to be overlapped, in use, by a correspondingly shaped edge 115 of an adjacent staff 5.

Moreover, as shown in Fig. 15 the side walls 108 are kept spaced apart, in use, by means of a shaped base metal sheet 113 having an intermediate raised portion thereof extending substantially parallel to the main intermediate portion of the adjacent staves 5 and terminating with upwardly bent edges 114 arranged to engage with a respective section 110 of a side wall 108.

At top thereof side walls 108 have inwardly bent ends 108a and 108b, on which an engaging channel element 116 rests. The engaging element 116 is a channel-shaped metal sheet with its edges 106a and 106b bent so as to delimit each a lateral groove 117a, 117b, respectively, arranged to receive the upper bent edges 108a and 108b of the side walls 108. The engaging element 116 delimits inside thereof two opposite undercut guide shoulders 107a and 107b designed to become engaged with a removable locking block 101.

Figures 16 and 17 show two further ways in which the side walls 108 engage with the staves 5 and a shaped metal sheet 113. More particularly, Figure 16 shows an engagement element 104 with side walls 108 having lower resting flanged ends 109 onto which edges 114 of metal sheet 113 are bent over so as to extend parallel, in use, to adjacent staves 5 and the channel element 116 is a shaped portion integral with, and extending across, the side walls 108.

Figure 17 illustrates an engagement element 104 similar to that of Fig. 16 and having side walls 108 with lower resting ends 109a and 109b flanged inwardly and sandwiched between two metal sheets 118a and 118b extending parallel to adjacent staves 5.

## Claims

1. A flat covering structure (1) including a load-bearing purlin structure (2), a lower facing of staves (5) located side-by-side and aligned in a first direction on said load-bearing structure (2) and secured thereto, an upper covering surface (6) of metal sheet elements (7) designed to be laid over the said lower facing of staves (5) crossways with respect to the said first direction and to be anchored thereto and a plurality of removable locking blocks (8) arranged to anchor the said metal sheet elements (7) to the said lower facing of staves (5), the said covering structure (1) being characterized in that each one

of the said removable locking blocks (8) comprises blocking means (26, 27; 46; 103) designed to engage with anchoring means (12, 13; 104) connected to, or integral with, longitudinal edges of two adjacent staves (5), and securing means (35, 36; 102) designed to couple two adjacent metal sheet elements (7).

2. A covering structure according to claim 1, **characterized in that** the said blocking means includes a pair of parallel recesses or slots (26, 27), open downward in use, each designed to locate a bent or loop of said anchoring means (12, 13). 10
3. A covering structure according to claim 2, **characterized in that** the said recesses or slots (26, 27) are accessible from below through a neck narrower than the internal width of its respective slot (26, 27) and delimited by a pair of horizontal lateral shoulders (34), arranged to act as a retaining means. 15
4. A covering structure according to claim 2 or 3, **characterized in that** each recess or slot (26, 27) has an outer wall (30) broadening outward and an internal wall (29) terminating in an abutting edge (34) extending substantially at right angles to the said internal wall (29). 20
5. A covering structure according to any claim 2 to 4, **characterized in that** the said anchoring means comprises a bent or loop section (20) provided at and along both longitudinal edges (12, 13) of each stave (5) and complementary shaped with respect to said recess or slot (26, 27), thereby allowing snap-fitting of two side-by-side longitudinal edges (12, 13) belonging to two staves (5) adjacent to the said pair of recesses or slots (26, 27) of one and the same locking block (8). 25
6. A covering structure according to claim 5, **characterized in that** the said bent or loop section (20) is formed at the free ends of the said longitudinal edges (12, 13) of each stave (5) and includes an intermediate connecting section (17) inclined in order to recede with respect to a mid-portion (19) of the respective stave (5) and a leading section (16) connected to the said intermediate section (17) and bent outward to thus delimit a relatively deep U-shaped channel (18) opening downward, in use, and arranged to snap-fit into a respective slot (26, 27) of a respective locking block (8). 30
7. A covering structure according to claim 6, **characterized in that** the said leading section (16) terminates in an abutting inclined section (23) bent so as to recede toward the respective channel (18) thereby abutting, in use, against the said abutting edge (34) projecting from the internal wall (29) of its re-

spective slot (26, 27).

8. A covering structure according to any claim 3 to 7, **characterized in that** the said neck is delimited by a pair of internal walls (29), each inclined with respect to an adjacent horizontal shoulder (34). 5
9. A covering structure according to claims 8, **characterized in that** each shaped leading section (16) is provided at the free ends of said longitudinal edges (12, 13) of each stave (5) and comprises of a first section (20) that is bent inwardly and is joined to its respective longitudinal edge (12, 13) and is designed to abut against a respective horizontal shoulder (34) of its respective receiving slot (26, 27) and a second section (21) connected to the said first section (20) and inclined with respect to it thereby abutting against the respective internal wall (29). 10
10. A covering structure according to claim 8 or 9, **characterized in that** the said second section (21) terminates in a free angled end (23) facing its respective bent section (20). 15
11. A covering structure as claimed in claim 1, **characterized in that** the said securing means comprises one groove (46) open downward, in use, and delimited by two internal walls (47, 48) inclined along the same angle with respect to a vertical line and converging upwards, the said walls (47, 48) being formed at the bottom thereof with a respective shoulder (49, 50) acting as an abutting surfaces for a matching portion (55) of said anchoring means (12, 13). 20
12. A covering structure as claimed in any previous claim, **characterized in that** the said staves (5) have a substantially flat mid-portion (9) and longitudinal edges (12, 13) that are bent with respect to the said mid-portion (9) and extending upwards, in use. 25
13. A covering structure as claimed in any previous claim, **characterized in that** a gap (33) arranged to receive a layer of thermally insulating material (44) is delimited between said metal sheet elements (7) and said lower facing of staves (5). 30
14. A covering structure according to any previous claim, **characterized in that** the said securing means (35, 36; 102) are of the snap-fit type. 35
15. A covering structure as claimed in claim 1, **characterized in that** the said anchoring means (104) comprises a base (108) securable to said lower facing of staves (5), an undercut receiving seat having two longitudinal edges (104a, 104b) which extend substantially parallel to one another, and **in that** the

said blocking means (103) comprises two opposite and parallel sliding sides (105a, 105b, slidably engaging means (106a, 106b) at said sliding sides (105a, 105b) arranged to engage with the said undercut receiving seat in said base (108).

16. A covering structure as claimed in claim 15, **characterized in that** the said slidably engaging means (106a, 106b) comprises at least one pair of parallel slots or tenons designed to engage, in use, with a respective longitudinal edge (104a, 104b).

17. A covering structure as claimed in claim 15 or 16, **characterized in that** the said blocking means (103) comprises two opposite guide plane surfaces (107a, 107b) extending substantially parallel to one another and spaced apart by a distance smaller than that between the said longitudinal edged (104a, 104b) for the said locking block (101) being inserted between two longitudinal edges (104a and 104b).

18. A covering structure as claimed in claim 17, **characterized in that** the said guide surfaces (107a, 107b) are inclined through 45° with respect to the said sliding sides (105a, 105b).

19. A covering structure as claimed in any previous claim 15 to 18, **characterized in that** the said anchoring means (104) comprises two sides walls (108) extending substantially parallel to one another and at right angles with the said lower facing of the said staves (5), each side wall (108) being outwardly flanged at the lower resting end (109) thereof and terminating with an upwardly bent section (110) followed by two further sections (111, 112) bent at right angles with one another and in at least partly overlapping relationship, in use, with a correspondingly shaped edge (115) of an adjacent stave (5).

20. A covering structure as claimed in claim 19, **characterized in that** the said side walls (108) are kept spaced apart, in use, by a shaped base metal sheet (113) having an intermediate raised portion thereof extending substantially parallel to an intermediate portion of the said adjacent staves (5) and terminating with upwardly bent edges (114) arranged to engage with a respective section (110) of a sidewall (108).

21. A covering structure as claimed in claim 20, **characterized in that** at top thereof the said side walls (108) have inwardly bent ends (108a, 108b), on which an engaging channel element (116) rests.

22. A covering structure as claimed in claim 21, **characterized in that** the said engaging element (116) is a channel-shaped metal sheet with its edges

(106a, 106b) bent thereby delimiting each a lateral groove (117a, 117b), respectively, arranged to receive the said upper bent edges (108a, 108b) of the said side walls (108).

23. A covering structure as claimed in claim 22, **characterized in that** the said engaging element (116) delimits inside thereof two opposite undercut guide shoulders (107a, 107b) designed to engage with a removable locking block (101).

24. A covering structure as claimed in any claim 15 to 18, **characterized in that** the said anchoring means (104) comprises two sides walls (108) extending substantially parallel to one another and arranged to engage with the said staves (5), a lower shaped metal sheet (113), the said side walls (108) having lower resting flanged ends (109) onto which edges (114) of said metal sheet (113) are bent over so as to extend parallel, in use, to adjacent staves (5) and an upper channel element (116) integral with, and extending across, the side walls (108).

25. A covering structure as claimed in any claim 15 to 18, **characterized in that** the said anchoring means (104) comprises side walls (108) with lower resting ends (109) flanged inwardly and sandwiched between two metal sheets (118a, 118b) extending parallel to adjacent staves (5).

26. A process for obtaining a flat covering structure including a load-bearing purlin structure, a lower facing of staves located side-by-side and aligned in a first direction on the said load-bearing structure and secured thereto in any suitable manner, the said staves having a substantially flat mid-portion and bent longitudinal edges designed to extend upwards, in use, an upper covering surface consisting of metal sheet elements to be laid onto the said staves according to a transversal direction with respect to said first direction and to be anchored thereto, thereby delimiting therewith a gap arranged to house a layer of thermally insulating material and a plurality of removable locking blocks suitable for directly anchoring the said metal sheet elements to the said staves, the said process being **characterized in that** it comprises:

- securing to the said load-bearing structure of a sequence of staves aligned in a first direction and with their longitudinal edges arranged side-by-side;
- snap-on fitting of a plurality of the said removable locking blocks on each pair of longitudinal edges positioned side-by-side and belonging to two adjoining staves, by exercising adequate downward pressure on each of the said movable locking blocks, the said locking blocks being

located at a distance from each other and according to a pre-defined lay-out;

- laying above the said staves of a sequence of the said elements in metal sheet aligned according to a transverse directions with respect to the said first direction and located side-by-side, whereby their respective suitably shaped edges are arranged at one or more movable locking blocks to be snap-anchored therewith by exerting a suitable pressure from above.

27. A process according to claim 26, **characterized in that**, after the said staves have been placed on and secured to the said load-bearing structure and before laying the said metal sheet elements over the said staves, a layer of thermally insulating material is placed on the said staves.

28. A process according to claim 26 or 27, **characterized in that** the said steel sheet elements are laid over the said staves connected to each other by the said movable locking blocks whereby their respective suitably shaped longitudinal edges are correctly arranged over a predetermined sequence of the said pre-laid movable locking blocks, and **in that** downward pressure is applied onto the said longitudinal edges on the said movable locking blocks thereby snap-anchoring the said longitudinal edges to the said movable locking blocks, the said longitudinal edges partly overlapping, in use, to prevent water from penetrating therein.

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