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(54)

COVERING EQUIPMENT OF A SPORTS FIELD, IN PARTICULAR A TENNIS COURSE

(57)

Disclosed herein is a covering structure of a sports field, in particular a tennis court, comprising a support frame, in particular a tennis court, comprising a support frame and a covering tarp applied to said frame, wherein

said support frame is comprised of a main fixed bearing arch (AP), which extends along a longitudinal axis of the sports field, and a plurality of lateral arches (AV) mounted according to a fan arrangement at the two sides of said main bearing arch (AP),

fan-shaped arches (AV) being pivotally mounted around axes (5) parallel to the longitudinal axis of said main arch (AP) and being constrained and controlled in rotation by means of retaining ropes (10) passing on the top of said main arch (AP), and wherein

the outermost arches of said fan-shaped lateral arches (AV) are designed to terminate close to the ground when the covering is deployed, and

holding means (8) are provided with which, when the covering is folded up, said outermost lateral arches engage at least one adjacent fan-shaped lateral arch (AV) so as to discharge the burdening load on the latter.

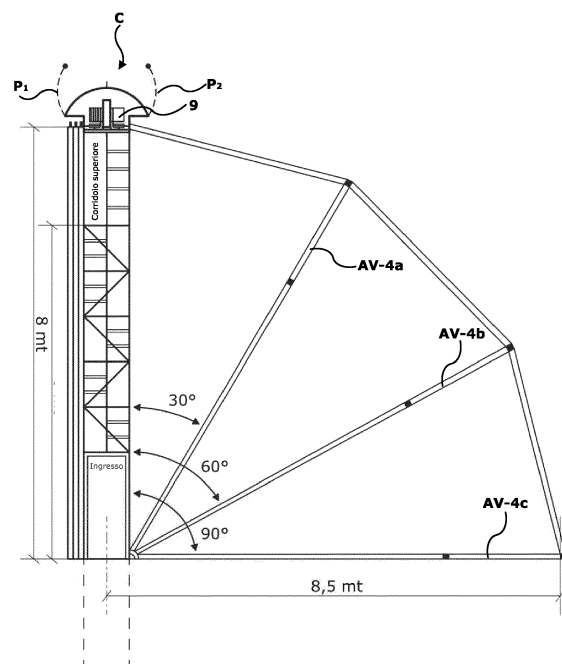


Fig. 4

Description

Field of the invention

[0001] The present invention relates to a variable attitude covering for a field for sport activities, in particular a tennis court.

Prior state of the art

[0002] The need to have facilities for sport activities is well known, in particular for tennis courts, which can be covered to perform activity even in case of bad weather. When they are not air-conditioned venues (for example a swimming pool), it is also preferable that the covering structures are temporary, in order to use them only when necessary (for example during the cold season, in case of adverse weather, etc.), and to be able to perform sport activities outdoor in all other conditions. From this point of view, tennis courts, basketball courts, futsal courts or other for amateur sport practice, are particular cases, as they have significant dimensions but not huge (not being normally equipped with tribunes) and they are therefore suitable - in theory - to the creation of temporary covering structures.

[0003] As known, a tennis court has significant dimensions, but in any case less than 40 meters of maximum extension: the part of the field for playing the "single" has dimensions of 8,23 m (width) and 23,77 m (length) to which, for the "double" two side corridors with dimensions of 1,37 m are added, bringing the overall dimensions of the court to 10,97 x 23,77 m. The tennis courts then require clear spaces for the movement of players, i.e. respectively about 4 m at the sides and 6,5 m at the head ends for international competitions, while for national competitions it is considered that about 3 m and 5,5 m, respectively, are sufficient.

[0004] This means that, considering a covering structure, an area of approximately 17 x 35 m should be considered.

[0005] Two types of solutions are currently widely used, both with some limitations or drawbacks.

[0006] A first solution envisages the use of so-called pressostatic covers; in other words, they are covers made from rubberized fabric of good strength and inflatable, therefore without rigid supporting structure, because they are supported by the atmospheric overpressure created in the internal environment. These covers are anchored to the contour of the court through air tightness means and then inflated by injecting pressurized air. They are also known as pressostatic balloons or inflatable covers. The pressostatic coverings are generally used for various sports fields, but they have several drawbacks: the overpressure inside the cover does not make it pleasant to stay inside them and obliges to condition and restore the air (both for hygienic reasons, and to compensate the inevitable losses) and it therefore involves a permanent energy consumption; moreover,

even if the assembly and disassembly operations are relatively rapid, a disassembled covering is quite bulky and, even if stored with adequate care, it is subject to wear due to the operations of folding/unfolding; finally, it is a structure that does not allow partial openings (for example in temperate climatic conditions or to use it only in case of rain during the hot season) and therefore has a determined and not flexible cycle of use. As mentioned, it also entails high usage costs due to the power consumption for supporting and heating (with low efficiency, due to the large volume of air that is continually lost to the outside) and related to the annual folding/unfolding activities.

[0007] A second solution envisages the use of a supporting structure, for example made of a metal framework (arched or having a geodesic structure) or in laminated wood, on which a covering made of rubberized fabric of good strength is laid and anchored. This structure does not suffer from the drawbacks of the pressostatic balloons, but can only be partially opened on the lateral sides, therefore it determines an unpleasant environment during the central hours in the hot season: it is actually unusable for a good part of the days during the year; in the case of laminated wood, it has a significantly higher cost for maintenance needs.

[0008] In theory, there are many other forms of covering structures, but none has been made so far applicable to sports fields, because of the significant size still requiring cumbersome and heavy structures. For example, covering which open/close according to a fan arrangement from the two sides of a central arched structure have been already proposed, but these are generally usable only when the area to be covered is rather narrow, both in the opening direction - because otherwise the height of the arch structure would be excessive - and in the transverse direction - because the pivoting arches tend to flex under the weight. A structure of this type is known for example from AT 505 762 or JP10-159394. In cases where it is necessary to cover an area with greater extension, the fan-shaped covering is used to create partially openable areas, as described for example in DE 7301392: the fan-shaped covering is provided at the two end regions, but the central part has a fixed structure of significant size, for example equal to that of the opening parts. This solution achieves a very small opening with respect to the extension of the covered area and provides that the supporting arches are arranged transversely to the greater length of that area.

Summary of the invention

[0009] The underlying problem of the invention is therefore to provide an improved covering structure, which does not suffer from the above-described drawbacks, by using a combined structure having metal frameworks and a waterproof tarp, which can be easily opened and closed and which provides a fixed covering part which is as narrow as possible.

[0010] These objects are achieved by the features mentioned in claim 1. The dependent claims describe preferred features of the invention.

[0011] In particular, according to a first aspect of the invention, a covering structure of a sports field is provided, in particular a tennis court, comprising a support frame and a tarp applied to said frame, wherein

said support frame is comprised of a main fixed bearing arch, which extends along the longitudinal axis of the sports field, and a plurality of lateral arches mounted according to a fan arrangement at the two sides of said main bearing arch,

said fan-shaped arches being pivotally mounted around axes parallel to the longitudinal axis of said main arch and being constrained and controlled in rotation by means of retaining ropes passing on the top of said main arch, and wherein

the outermost arches of said fan-shaped lateral arches are designed to terminate close to the ground when the covering is deployed, and

there are provided holding means with which, when the covering is folded up, said outermost lateral arches engage at least one adjacent fan-shaped lateral arch so as to discharge the load on the latter.

[0012] According to another aspect, the holding means are L-shaped terminals designed to lay on top of said adjacent fan-shaped lateral arch.

[0013] Advantageously, the outermost fan-shaped lateral arch has a spar whose height is lower than the height of the other fan-shaped lateral arches.

[0014] According to a further aspect, the fan-shaped lateral arches are made of a framework structure made of triangular-shaped vertical end struts, and a spar connecting said vertical end struts.

[0015] Preferably, three fan-shaped lateral arches on each side of the main bearing arch are provided, constrained so as to be positioned, when the tarp is deployed, at approximately 30°, 60° and at least 90°, respectively, relative to the vertical position of the bearing arch.

[0016] According to another aspect, the fan-shaped lateral arches are kept in position, in said deployed covering condition of the tarp, by a plurality of flexible holding rods, having a predetermined length, fixed to the lateral arches and the main bearing arch.

[0017] According to a further aspect, the retaining ropes are wound on the corresponding winch drums positioned at the top of the main bearing arch and run on corresponding return pulleys on at least one of said arches.

[0018] Further, at the top of the fan-shaped lateral arches, between the main bearing arch and the outermost lateral arch, guide pulleys are installed to let said retaining ropes slide.

[0019] Yet according to a further aspect, the covering tarp is anchored to the arches in such a way that, when said arches are withdrawn and kept in a closed position, it folds downwards forming loops between two lateral arches.

Brief description of the drawings

[0020] Further features and advantages of the invention will anyhow be more evident from the following detailed description of a preferred embodiment, given by mere way of non-limiting example and illustrated in the accompanying drawings, wherein:

Fig. 1 is a schematic elevational view of the sole main arch structure according to the invention, which extends along the length of a tennis court;

Fig. 2 is a schematic elevational view, in greater detail and interrupted, of one of the fan-shaped arches abutting the main arch in the structure according to the invention;

Fig. 3 is a schematic elevational front and partially sectional view, interrupted, of three fan-shaped arches, closed in a package-like arrangement, one against the other;

Fig. 4 is an elevational front view of the structure according to the invention;

Fig. 5 is an interrupted top plan view, showing the main bearing structure and three fan-shaped arches on one of the sides;

Fig. 6 is a view similar to that of Fig. 4 of an alternative embodiment of the invention;

Fig. 7A is an interrupted top plan view of a base portion of the arches;

Fig. 7B is an interrupted elevational side view of the same portion as Fig. 7A; and

Fig. 8 is a view similar to that of Fig. 6, having the covering partially opened.

Detailed description of some preferred embodiments

[0021] Fig. 1 shows a preferred embodiment of the covering structure according to the invention. First of all, it comprises a main supporting structure AP, which will be hereinafter referred to as the "bearing arch", and which extends according to the longitudinal centre axis of the tennis court, thus extending on a plane according to the largest size of the area to be covered.

[0022] This bearing arch AP is made up of a pair of pillars 1, positioned beyond the ends of a court - typically a tennis court (the position of the net R of which is shown) - and a wide longitudinal beam 2 the ends of which are anchored to the top of the pillars 1.

[0023] To ensure sufficient strength (especially considering the span in excess of 35 meters of the longitudinal beam 2) and, at the same time, to reduce the shielding of natural light, pillars and beam are preferably made of a metal framework, according to dimensioning and design choices within the reach of a skilled man in the field. Depending on the design choices, anchoring ropes can also be provided, acting at the top of the pillars 1.

[0024] Since this main bearing structure has a minimal transverse size and a negligible impact on the ground, it is preferably mounted fixed to the ground with suitable

foundations, for example a reinforced concrete base B (represented by dashes and dot lines in Fig. 2).

[0025] Due to this arrangement, the structure of the bearing arch AP is very resistant to the applied loads and, in particular, the beam 2 does not bend despite its considerable length (over 35 m). On the main supporting structure, accessories and auxiliary equipment are also located, such as air conditioning systems, heat blowers M and day/night lighting headlights L. Inside one, or both, of the posts it is provided a stair-type ladder, which allows access to the upper horizontal framework (and therefore to the relative service equipment installed thereon), as well as to the control panel for the various electrical systems and for the opening/closing of the covering (as will be seen below), with the relative electrical systems.

[0026] The horizontal framework 2 is preferably configured so as to be walkable by an operator also on the upper side, where electromechanical devices for controlling the covering are located (as will be seen below). In particular, on the top of the framework 2 a covering dome C is preferably provided to cover the electromechanical devices: it is divided into two openable semi-portions P1 and P2 which, hinged to the base, once opened also act as a barrier/parapet for making the access to the top safe for the operator. The total accessibility of the bearing structure allows the inspection/maintenance/repair of all the equipment.

[0027] According to the invention, fan-shaped arches AV are associated to this longitudinal bearing arch AP, arranged in equal numbers on one side and on the other of the longitudinal plane of the main arch AP.

[0028] Each of the fan-shaped arches has a similar structure to that of the bearing arch AP, but considerably slimmer and lighter. Each of the fan-shaped arches is arranged parallel to the bearing arch, hence along the longitudinal axis or, in other words, along the largest dimension of the area to be covered. As can be seen in the drawings, each one consists of two lateral posts 3 (in Fig. 2, it can be seen only one post on the left with respect to the drawing) of essentially triangular shape, with a lower vertex 3' and the base 3" at the top, and a spar 4 attached on the upper ends of said posts 3.

[0029] A first relevant feature of these fan-shaped arches AV is their relative lightness, which is achieved through a metallic tubular framework structure so as to have a very reduced thickness. For example, this framework structure may have the thickness of a single metal tube of the framework, i.e. about 40 mm.

[0030] In order to ensure that, in spite of this lightness, at least the spar 4 is sufficiently strong and rigid, i.e. resistant to bending under the load acting thereon, it has a significant height, in order to have, anyway, an adequate moment of inertia to the bending: accordingly, the height of the spar is preferably 80 to 120 cm.

[0031] Such a tubular metal framework structure is not the only possible embodiment for a fan-shaped arch AV meeting the requirements of lightness and rigidity required by the structure according to the invention. In fact,

other structures are conceivable, in particular with the use of metal sheets, replacing in whole or in part the tubular framework, or even with the use of composite material. Likewise, it is not necessary that all the spars have the same structure, but it may indeed be appropriate, as will be seen below, that at least one of the spars has a different structure.

[0032] The lateral arches are preferably three on each side - as can be seen in Figs. 3 and 4 - but they could be even more.

[0033] A second relevant feature of these fan-shaped arches AV is that the lower vertex 3' ends of each post 3 are hinged on a respective pin 5 with a horizontal axis, being parallel to the longitudinal centre axis of the structure. To allow a free fan-like rotation movement to each arch AV, the pins 5 of the various arches are arranged laterally and vertically offset, as shown in Figs. 3, 7A and 7B.

[0034] In this way, each arch AV can rotate on its end pins 5 and pass from a deployed position, wherein it assumes a supporting position (Fig. 4), to a withdrawn position, wherein it lies close to the main bearing arch (Fig. 3) so as to occupy as little space as possible above the court.

[0035] Fig. 3 shows how the fan-shaped arches AV are arranged on the right side (with respect to the drawing) of the bearing arch AP; it can be seen that, in the withdrawn attitude, the fan-shaped arches AV are arranged one against the other in a package-like arrangement, against the bearing arch AP, in such a way that the sky is visible above the tennis court.

[0036] Between the various arches AP and AV, in the upper part, it is laid an impermeable tarp 6, for example a rubberized tarp known per se. The tarp 6 is dimensioned so as to remain well stretched in the attitude by which the individual fan-shaped arches AV assume their deployed support position (Fig. 4), while it becomes loose when the fan-shaped arches are brought closer in a package-like arrangement between them, forming folds or loops between one arch and the other, as shown schematically with the dotted line in Fig. 3.

[0037] The individual arches are also constrained to the main bearing arch by means of control ropes or tie-rods 10, which can be operated upon command (as described below). In this way, each fan-shaped arch AV can be rotated in a fan pattern around its own pins 5 and brought from the package-like withdrawn condition, up to its specific deployed support position, simply driven by its own weight and leaving the constraining rope 10 to the desired extent. Vice versa, the ropes 10 are used to close the arches in a package-like arrangement, recovering them by traction.

[0038] Figures 3 and 5 also show

- an arrangement of drive pulleys 7, freely rotatably mounted at the top of two spars 4 (i.e. the spars 4a and 4b closest to the bearing arch AP) and suitable for sliding the control ropes 10; and

an L-shaped holding terminal 8, fixed to the top of the outermost spar 4c, having the function better described below.

[0039] In order to determine and stabilize the deployed end-of-stroke position, the first two fan-shaped arches AV-4a and AV-4b are provided with retaining ropes 11a and 11b, arranged parallel in a number suitable to the weight of the structure to attach each of the two spars 4a and 4b to the bearing beam of the main arch AP. The last (outermost) fan-shaped arch is instead intended to rest on the ground, so it does not require an end-of-stroke retaining rope.

[0040] Fig. 4 shows the covering structure according to the invention in its open, deployed position (for example when there is a need to protect the users from an adverse weather). It should be noted that the three fan-shaped arches AV are rotated respectively in a position of about 30° with respect to the vertical plane (arch of spar 4a), of about 60° (arch of spar 4b) and at 90°, i.e. practically horizontal resting on the ground (arch of spar 4c). With this arrangement, the waterproof tarp is stretched over the court at the desired height and down to the ground. For example, with an 8 m high bearing arch AP and a position of the rotation pins 5 at about 0,5 m from the centreline plane, it is possible to cover a regular tennis court (8,5 m on each side), having a height of the tarp falling into acceptable shapes for a tennis court.

[0041] The rotation of the fan-shaped arches is controlled by a winch drum 9 positioned at the top of the arch AP, i.e. above the respective spar 2, which controls the release or the recovery of the ropes 10. These ropes are fixed at one end to the drum of the winch and, at the other end, to the spar of the respective fan-shaped arch AV; the fixing can be carried out according to any manner within the reach of a skilled man.

[0042] Fig. 5 shows an exemplary arrangement, wherein a plurality of constraining ropes 10 are provided along the extension of the arches. With such an arrangement having multiple ropes 10, preferably a single winch drum 9 is used for a group of ropes - for example three on one side and three on the other - which is provided with a corresponding number of winding drums. In this way a simultaneous and perfectly parallel drag of the ropes 10 is obtained, by means of a very simple structure. This does not preclude that a system with a separate winch drum 9 for each rope can also be used, by realizing the synchronization of the driving motors, for example by electronic means.

[0043] Each rope 10 attached to the outermost arch 4c slides resting on a saddle of each of the guide pulleys 7 provided on the other arches.

[0044] Accordingly, when - starting from the covering closed position (see Fig. 3) - the winch drum 9 starts to leave the ropes 10, at least the outermost fan-shaped arch AV-4c descends by its own weight, rotating around its pin 5, towards the horizontal position of deployed cover (see Fig. 4).

[0045] During this descent, the fan-shaped arch AV-4b follows the arch AV-4c, in abutment on it, while the arch AV-4a may also not follow this descent, and follow it successively, for example by effect of a damped rotation on the pins 5. The fan-shaped arches AV then reach the respective rotation end of stroke due to the intervention of the flexible tie rods 11a, 11b.

[0046] The tie-rods 11a and 11b have the function of retaining the fan-shaped arches in their established position, as well as supporting the overlying tarp (avoiding bulging).

[0047] It should also be noted that the outermost fan-shaped arch AV has a spar 4c which has a much smaller height than the others (for example, only 40 cm). This is because this outermost arch is designed to end up on the ground (Fig. 4) and therefore it occupies a useful space of the covered area: to limit as much as possible the unused covered space, the spar of this arch must be as low as possible.

[0048] In this case, however, the arch may not have sufficient strength to support its own weight and that of the tarp, when it is in the withdrawn position of Fig. 3. Therefore, according to a preferred embodiment, the top portion of the arch AV-4c is provided with an L-shaped terminal 8 or in any case with holding means to the adjacent fan-shaped arch. This terminal 8 is designed to overlap the adjacent fan-shaped arch AV-4b during the closing operation of the covering, under the pulling operation of the ropes 10. In particular, when the outermost arch AV-4c approaches the second-last fan-shaped arch AV-4b, the holding means of the terminal 8 come to rest on the spar 4b - which has dimensions suitable to the load to be supported - discharging on it the load of the outermost arch.

[0049] In this way, the impact on the ground of the system according to the invention is greatly reduced, without compromising the support stability of the waterproof tarp 6.

[0050] Fig. 6 shows an alternative embodiment, usable in cases where a greater useful height above the court is required.

[0051] In this case, in order not to enlarge proportionally the whole bearing structure, which would entail higher costs and greater lateral bulk, it is possible to have higher pillars (for example 10 m) of the main bearing arch and then to mount the rotation pins of the arches at a certain height from the ground, for example at 2 m. The posts of the fan-shaped arches can remain of limited height, for example 8 m. As can be seen in Fig. 6, the outermost fan-shaped arch will still come to the ground, but leaving an open region at the two front and rear ends of the covering: it will be possible to close these regions with a structure fixed to the ground, such as a wall of masonry or a prefabricated panel P.

[0052] These regions are delimited, in their upper part, by a tubular strut of a significant size (for example 20x20) fixed at one end to the support pillar and to the other part to a solid base in the ground. In this way it is obtained

the dual function of increasing the stability of the supporting arch and of the support base of the arch AV-4c.

[0053] It is however understood that the invention is not limited to the particular embodiments illustrated above, which represent only non-limiting examples of its scope, but that numerous variants are possible, all within the reach of a skilled in the art, without thereby departing from the scope of the invention.

[0054] For example, it is not excluded that the main arch and, consequently, the fan-shaped arches, can take on a design different from a C shape, for example a more radiused arch.

Claims

1. Covering structure of a sports field, in particular a tennis court, comprising a support frame and a covering tarp applied to said frame, wherein said support frame is comprised of a main fixed bearing arch (AP), which extends along a longitudinal axis of the sports field, and a plurality of lateral arches (AV) fan-shaped mounted at the two lateral sides of said main bearing arch (AP),

said fan-shaped arches (AV) being pivotably mounted around axes (5) parallel to the longitudinal axis of said main arch (AP) and being constrained and controlled in rotation by means of retaining ropes (10) passing on the top of said main arch (AP), **characterized in that** the outermost arches of said fan-shaped lateral arches (AV) are arranged to lay close to the ground when the covering is deployed, and

holding means (8) are provided with which, when the covering is folded up, said outermost lateral arches engage at least one adjacent fan-shaped lateral arch (AV) so as to discharge the burdening load on the latter.

2. Covering structure of a sports field according to claim 1, wherein said holding means (8) are L-shaped terminals designed to lay on top of said adjacent fan-shaped lateral arch (AV).

3. Covering structure of a sports field according to claim 2 or 3, wherein said outermost fan-shaped lateral arch has a spar whose height is lower than the height of the other fan-shaped lateral arches.

4. Covering structure of a sports field according to any one of the preceding claims, wherein said fan-shaped lateral arches (AV) are composed of a framework structure made of triangular-shaped vertical end posts (3), and a spar (4) connecting said posts (3).

5. Covering structure of a sports field according to any one of the preceding claims, comprising three fan-

shaped lateral arches (AV) on each lateral side of the main bearing arch (AP), constrained so as to be positioned, when the tarp is deployed, at approximately 30°, 60° and at least 90°, respectively, relative to the vertical position of the bearing arch (AP).

6. Covering structure of a sports field according to claim 5, wherein said fan-shaped lateral arches (AV) are kept in position, in said deployed condition of the tarp, by a plurality of flexible tie rods (11a, 11b), having a predetermined length, fixed to said lateral arches and said main bearing arch (AP).

7. Covering structure of a sports field according to any one of the preceding claims, wherein said retaining ropes (10) are wound on corresponding winch drums (9) located at the top of said main bearing arch (AP) and run on corresponding pulleys on at least one of said arches.

8. Covering structure of a sports field according to any one of the preceding claims, wherein at the top of the fan-shaped lateral arches (AV), between the main bearing arch (AP) and the outermost lateral arch, guide pulleys (7) are installed to let said retaining ropes (10) slide.

9. Covering structure of a sports field according to any one of the preceding claims, wherein said covering tarp (6) is anchored to said arches in such a way that, when the arches are withdrawn and kept in a close position, the tarp folds downwards forming loops between each couple of lateral arches.

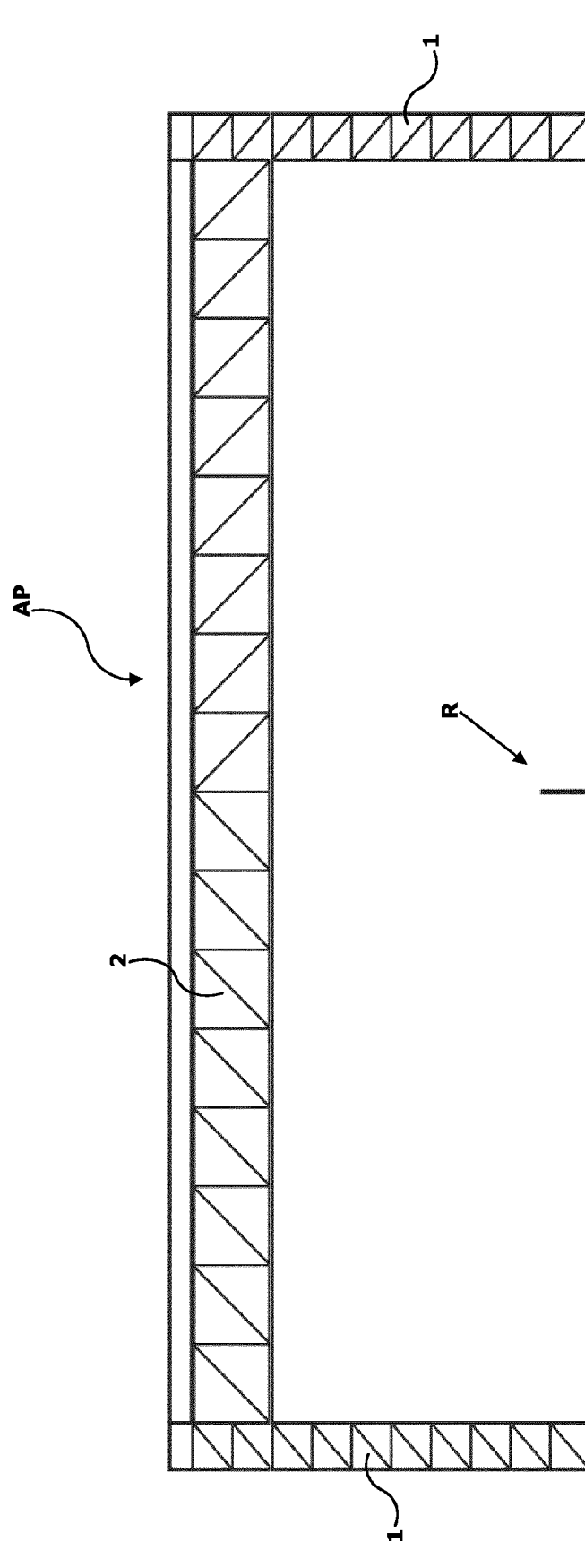


Fig. 1

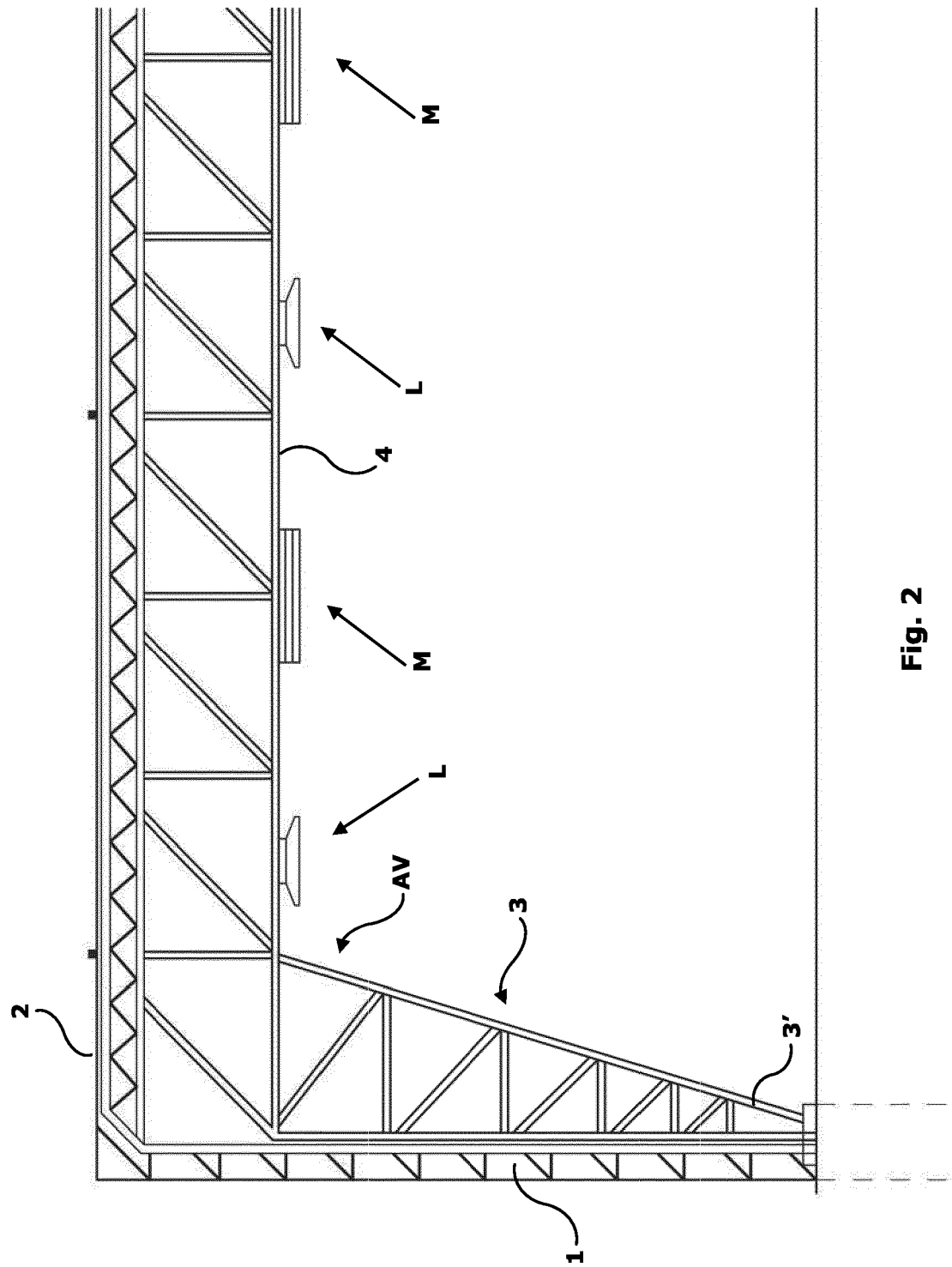


Fig. 2

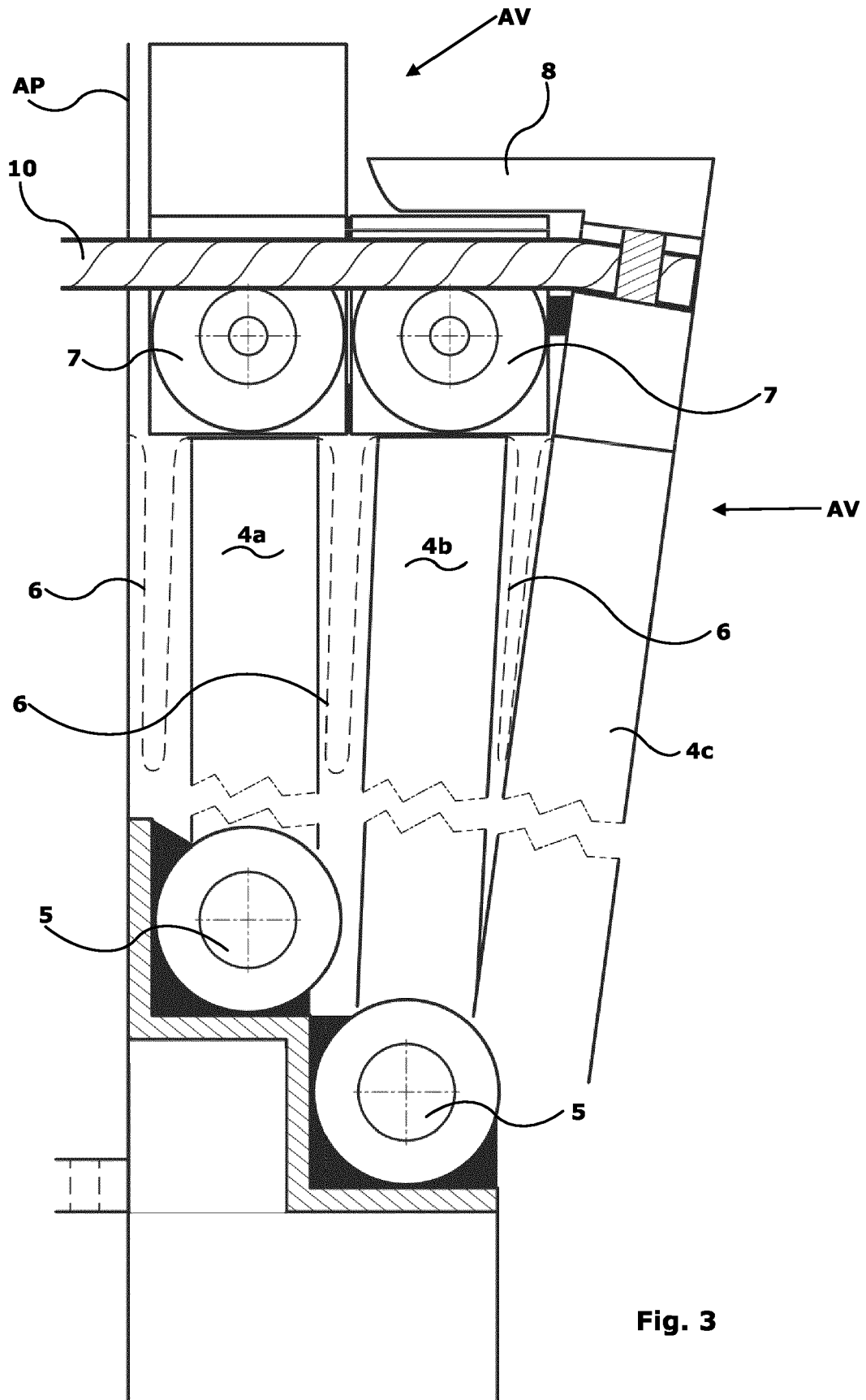


Fig. 3

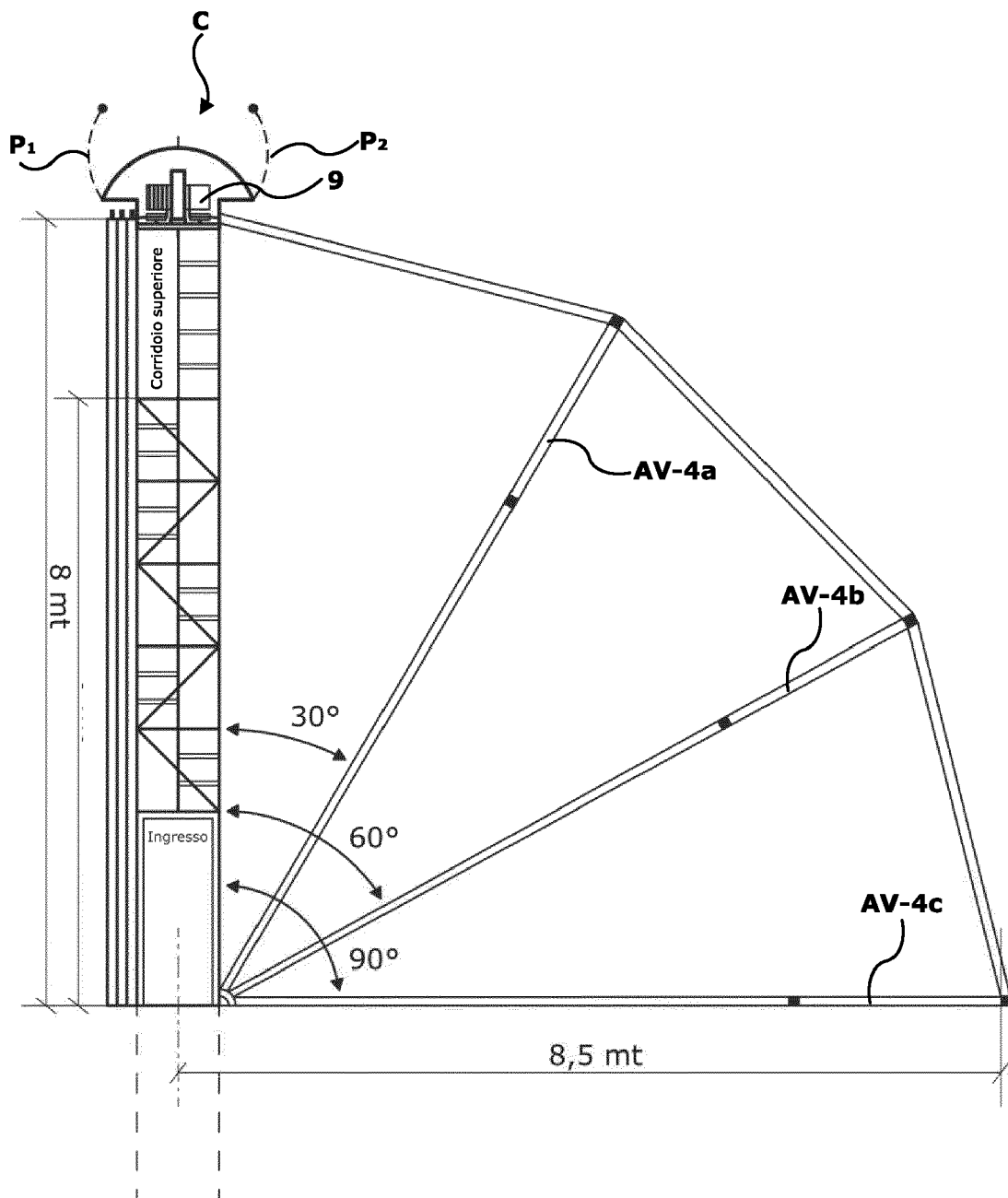
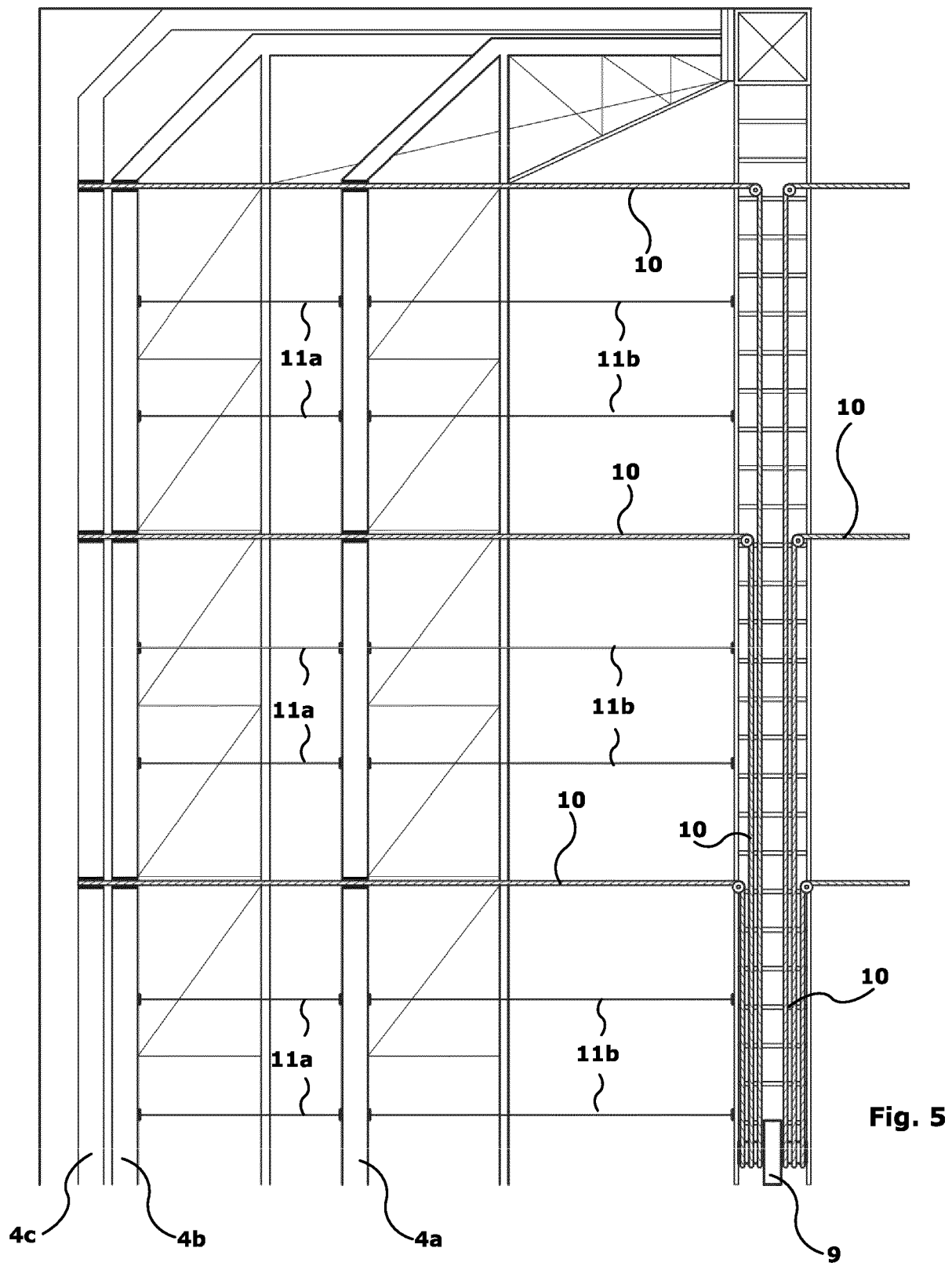


Fig. 4



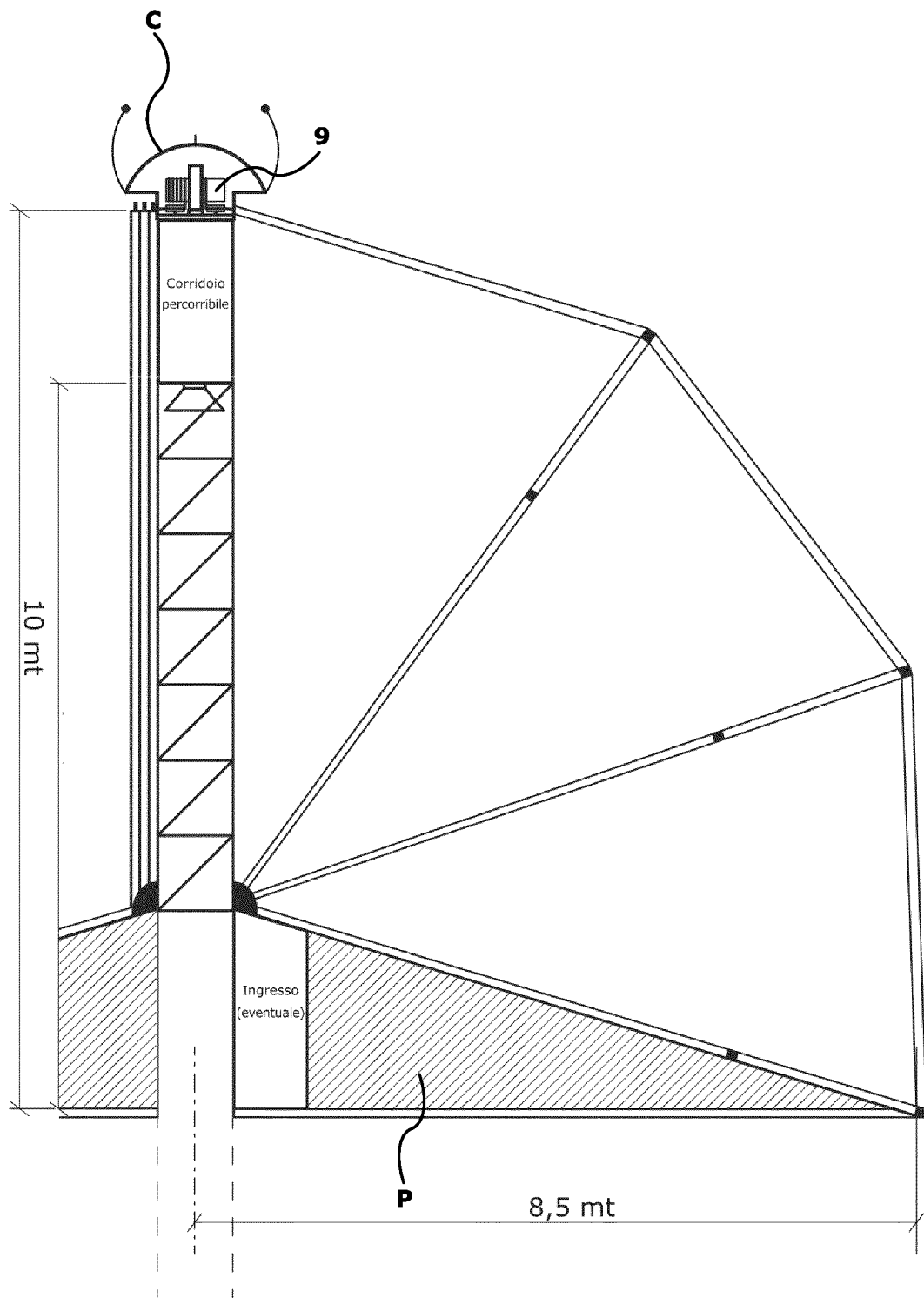
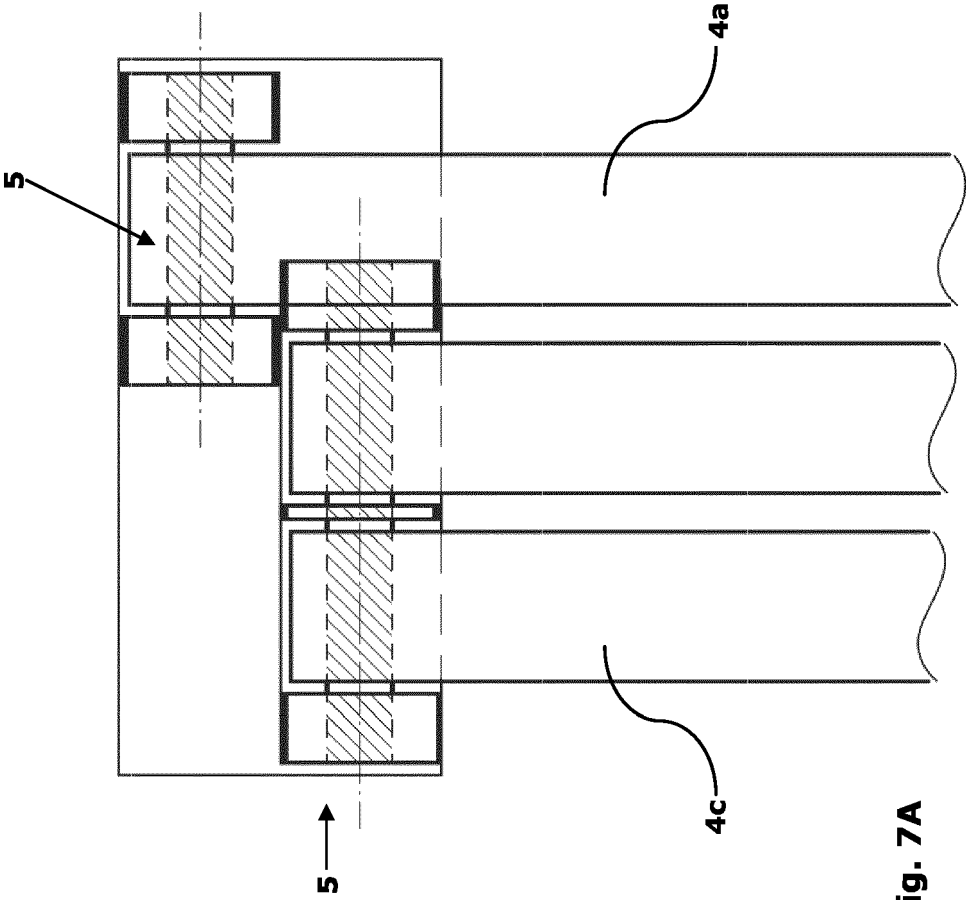
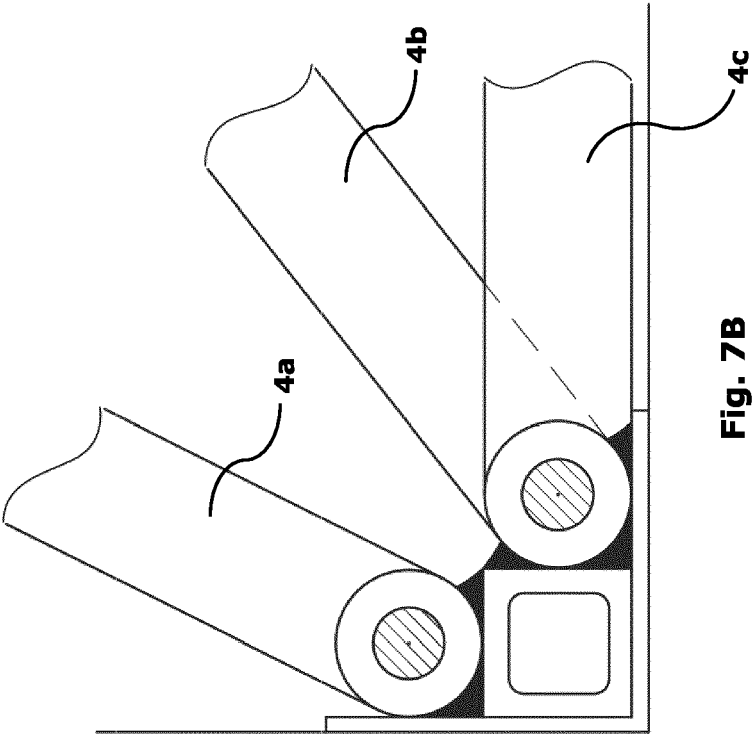


Fig. 6



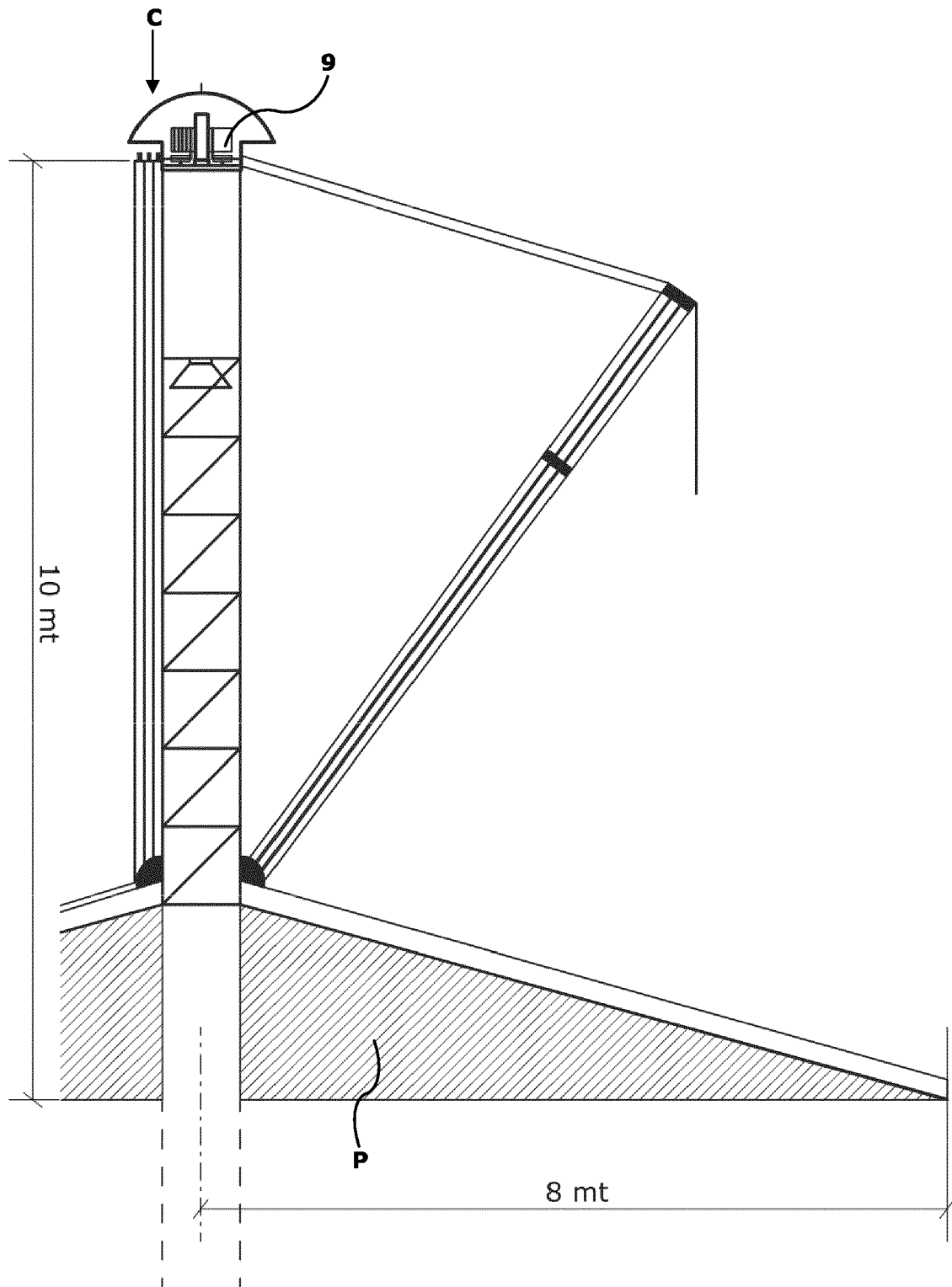


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 18 16 3627

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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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REFERENCES CITED IN THE DESCRIPTION

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