A method for unwinding/winding a laminar sheet (2) arranged so as to cover an area (a) and forming part of a winding structure (1), which comprises a supporting structure (3) associated with the area and including a cylinder (9) for supporting said laminar sheet that identifies a first longitudinal axis of rotation, drive means (11) for rotating the cylinder around the first longitudinal axis and elastic means (12) cooperating mechanically with the drive means (11) during the unwinding/winding of the laminar sheet. The unwinding of the laminar sheet from the cylinder is due to the effect of the rotation of the cylinder induced by the drive means, while the winding of the laminar sheet onto the cylinder is due to the effect of the recovery of the mechanical energy stored by the elastic means during the unwinding of the laminar sheet.
METHOD FOR UNWINDING/ WINDING A LAMINAR SHEET AND WINDING STRUCTURE FOR COVERING AREAS SUITABLE FOR IMPLEMENTING SAID METHOD.

DESCRIPTION
The present invention relates to a method for unwinding/winding a laminar sheet to cover an area, and a winding structure particularly suitable for covering areas that implements said method.

It is common knowledge that, to create an area under cover in squares, gardens, parks and so on, or to increase the available area under cover in hotels, restaurants, bars or other such public spaces, or any other building, particular winding structures for laminar sheets are installed in the areas immediately adjacent thereto, so that users or visitors can be protected from bad weather, though they are still in the open air.

A particular type of winding structure currently available on the market generically comprises a laminar sheet of the aforementioned type for covering a given area, made of a material of suitable strength for such an application, which is usually a plastic fabric.

The winding structure also comprises a supporting structure associated with the area to cover, the structural design of which may vary depending on the design decisions and environmental constraints of the installation.

In any case, the supporting structure includes one or more supporting elements that are associated with a supporting surface existing in the area, such as the ground, paving or a wall of a building.

Each supporting element is complete with first transmission means, such as sheaves or pulleys, for instance, connected to the laminar sheet by tensioning means, generally consisting of:

The supporting structure also includes a cylinder for supporting the laminar sheet, which identifies a longitudinal axis of rotation and is associated with the supporting surface by fixing means of various types.

The winding structure thus includes drive means for rotating the cylinder around said longitudinal axis, and elastic means that cooperate mechanically with the drive means to unwind or wind the sheet around the cylinder.

To be more specific, in the winding structures of known type, the drive means
are installed in the vicinity of one end of the cylinder, always projecting therefrom.

A ring-shaped seat is also provided in said terminal area of the cylinder, wherein the tensioning means are wound when the sheet is in the closed position, i.e. rewound around the cylinder.

One end of the tensioning means is associated with the cylinder, while the opposite end is attached to the laminar sheet by fixing means of the type known to a person skilled in the art.

Elastic means, e.g. a pair of spiral springs, are provided in line with the end of the cylinder opposite the end where the drive means are installed.

These elastic means are connected to second transmission means placed between the drive means and the first transmission means, and are substantially of the same type as the latter.

The tensioning means slide on the second transmission means during the unwinding and winding of the laminar sheet and, in practical terms, they occupy a position above the cylinder and the laminar sheet when it is unwound.

The laminar sheet consists of two sheets of equal thickness and length, each having a shape, as seen from above, essentially in the form of an isosceles triangle or trapeze.

The two sheets are attached to one another by joining means in line with the edge of the laminar sheet connected to the cylinder, whereon they are wound in opposite directions.

During the unwinding of the laminar sheet, the drive means turn the cylinder around its longitudinal axis, releasing the tensioning means and thus enabling the two sheets to spread out and cover the area, moving in the same plane but in opposite directions.

During this stage, the passage of the tensioning means of the second transmission means compresses the elastic means, which consequently keep the laminar sheet taut as it is unwinding, thus affording effective protection against the elements, such as the sun or driving rain, or wind up to a certain force, and so on.

In the winding stage, the drive means turn the cylinder in the opposite direction around its longitudinal axis, rewinding the tensioning means in line with the aforesaid ring-shaped seat and withdrawing the two sheets from either side of
the cylinder. During the stage, meanwhile, the elastic means are released and thus move back into their resting position. Thus, in the winding structures of known state of the art, the elastic means exert a tensile force on the laminar sheet, while the drive means simply wind and unwind the laminar sheet. The winding structures generally, and preferably, also include means for monitoring the weather conditions, such as anemometer, connected electrically to a central data processing unit to which the drive means are also connected. This enables the laminar sheet to be rewound automatically in the event of critical or particularly severe weather conditions, that would be capable of severely or irreparably damaging the winding structures should they remain open.

However, winding structures of the type briefly described above and belonging to the known state of the art present several acknowledged drawbacks. A first drawback is represented by the fact that the structural shape of the winding structures of known type is somewhat articulated and considerably complicates the assembly operations involved for the installer covering the area.

A second drawback stems from the fact that the mechanical components used to construct the winding structures of known type, e.g. the drive means, the elastic means, the tensioning means and the transmission means, remain exposed to the weather. With time, this gives rise to rusting of these components because, in the majority of cases, they are made of metal such as steel, even if they have undergone surface heat treatments or chemical treatments. Another far from negligible drawback of the winding structures of the known state of the art derives from the fact that the laminar sheet remains rather slack and its level of tension is far from optimal.

As a consequence, the laminar sheet is capable of effectively withstanding weather, such as driving rain or strong wind, only within certain limits, so it has to be closed even when the weather conditions are not particularly severe. In this respect, the above-mentioned anemometers are currently set to operate at rather low critical wind speed values, so the central data processing unit triggers the rewinding of the laminar sheet onto the cylinder already when the
wind speed reaches 40 km/h.
This naturally causes inevitable discomfort, both to the owner of the public
space, for instance, and to the people occupying the area covered by the
winding structure.

A further drawback lies in the fact that the laminar sheet risks being damaged
and the winding structure as a whole suffers from structural instability even in
the case of sub-critical weather conditions, just because of the somewhat slack
arrangement of the laminar sheet when it is spread out to cover the underlying
area.

Yet another drawback of the winding structures of the known state of the art is
related to their appearance, which is spoiled by the fact that their components,
and especially the elastic means and transmission means, remain in view.
The present invention aims to overcome the above-mentioned drawbacks of
the known state of the art.

In particular, the main object of the invention is to provide a winding structure
of more straightforward design with respect to structures similar of known type.
A second object of the invention is to make it quicker and easier to install the
winding structure than is the case of the winding structures of known type.
Another object is to achieve a greater tautness of the laminar sheet, when it is
opened to cover the underlying area, than is achievable with equivalent
winding structures of known type.
A further object of the invention is to improve the stability of the winding
structure as a whole, with respect to the known technique, in relation to
weather conditions similar to those making it necessary to rewind the laminar
sheet onto the cylinder.
A last but not least objective of the invention is to improve the aesthetic impact
of the winding structure with respect to comparable structures of known type.

The aforementioned objects are achieved by means of—
unwinding/winding a laminar sheet to provide a cover over an area and forming
part of a winding structure that, in accordance with the content of the first
claim, comprises:
- a supporting structure for placing in said area, which includes a cylinder
  that supports said laminar sheet and identifies a first longitudinal axis of
  rotation;
- drive means for rotating said cylinder around said first longitudinal axis;
- elastic means cooperating mechanically with said drive means during the unwinding/winding of said laminar sheet,
the method being characterized in that the unwinding of said laminar sheet from said cylinder takes place due to the effect of the rotation of said cylinder induced by said drive means, and the winding of said laminar sheet onto said cylinder takes place due to the recovery of the mechanical energy stored by said elastic means during said unwinding of said laminar sheet.

The present invention also relates to a winding structure for covering areas that, in accordance with the corresponding main claim, comprises:

- a laminar sheet for placing so as to provide a cover over said area;
- a supporting structure for placing in said area, which includes the following components:
  - at least one supporting element for associating with a supporting surface provided in said area, complete with transmission means connected by tensioning means to said laminar sheet;
  - a cylinder that supports said laminar sheet and identifies a first longitudinal axis of rotation, designed to be attached by fixing means to said supporting surface;
  - drive means for rotating said cylinder around said first longitudinal axis;
- elastic means cooperating mechanically with said drive means during the unwinding/winding of said laminar sheet,
characterized in that said elastic means are contained inside one of said component parts of said supporting structure and are associated with rotating means operatively connected to said drive means, for loading/releasing said elastic means during the unwinding/winding of said laminar sheet.

The winding structure of the invention advantageously has a less articulated structural design, as regards the components remaining visible from the outside at least, with respect to the currently known state of the art.

The operator can thus install the winding structure described herein more quickly and easily than similar structures of known type.

Equally advantageously, the design of the winding structure of the invention enables the adoption of a more efficient laminar sheet unwinding system than the equivalent one of the known state of the art.

In fact, in the case of the invention, it is the drive means that keep the laminar sheet taut when open, instead of the elastic means as in known winding
structures, thus achieving a better tensioning of the laminar sheet than with the known state of the art.

The winding structure of the invention can thus be reasonably defined as a genuine tensegrity system, in the sense generally attributed to said term, unlike the winding structures of the known state of the art wherein the laminar sheet remains somewhat slack when open.

Equally advantageously, this enables the winding structure of the invention to withstand weather conditions nearing the critical parameters at which the rewinding of the laminar sheet is programmed, more effectively and safely than equivalent structures of known type.

By comparison with the latter, in the event of relatively severe weather conditions, the invention carries fewer risks of damage to the laminar sheet, which is more taut, and the transmission of more moderate tensile strains to the winding structure, which becomes structurally more stable.

Moreover, the greater tautness of the laminar sheet achieved by the invention advantageously enables higher critical values to be set for the parameters used to measure the weather conditions at which the cylinder has to be rewound, by comparison with the known state of the art.

In the case of the invention, for instance, the value of the wind speed that prompts the rewinding of the laminar sheet is set at 60 km/h, instead of the 40 km/h typical of similar structures of known type.

Another advantage of the invention is associated with the appearance of the winding structure, which is far more attractive and better than that of the known state of the art.

This is thanks to the fact that, by comparison with known winding structures, fewer transmission means are visible on the outside of the structure, and the elastic means are provided inside one of the components of the supporting structure, thereby achieving an uncluttered aspect, virtually without any mechanical parts in view.

The open laminar sheet also contributes towards the achievement of this aesthetic impact because it is more taut than with the known state of the art and enables for particularly stylish architectural shapes to be obtained.

The aforesaid objects and advantages, as well as any others stemming from the further development of the present invention, are better explained in the following description of a preferred embodiment of the winding structure of the
invention, and of a preferred application of the method it enables, given as an example with reference to the following drawings, wherein:

- fig. 1 shows an axonometric view of the winding structure of the invention installed and in the open arrangement;
- fig. 2 shows an axonometric view of the structure in fig. 1 installed and in the closed arrangement;
- fig. 3 shows an exploded axonometric view of an enlarged detail of part of the structure of fig. 1;
- figs. 4 and 5 show an axonometric view, in two distinct working conditions, of a second enlarged detail of the structure of fig. 1;
- fig. 6 shows a cross-section of an enlarged detail from figures 4 and 5;
- fig. 7 shows a partial cross-section of a side view of a third detail of the structure in fig. 1;
- fig. 8 shows an exploded axonometric view of a detail from fig. 7;
- fig. 9 shows an axonometric view of another detail from fig. 7.

The winding structure of the invention is illustrated in figures 1 and 2, where it is globally indicated by the numeral 1, respectively in the situation of intended use and in the situation of non-use, installed in an area A to cover.

As illustrated, the winding structure 1 comprises:

- a laminar sheet 2 arranged so as to cover the area A;
- a supporting structure, globally identified by the numeral 3, which is associated with the area A and includes the following components:
  - two supporting elements 4, 5, associated with a supporting surface S in the area A, which - in this specific case - is the flooring of an area adjacent to a public room, such as a restaurant; each of the supporting elements 4, 5 is complete with its own transmission means, globally numbered as 6, 7, connected by tensioning means, generally indicated by the numeral 8, to the laminar sheet 2;
  - a cylinder 9, which supports the laminar sheet 2 and identifies a first longitudinal axis of rotation Z, attached to the supporting surface S by fixing means globally numbered as 10;
- drive means, globally indicated by the numeral 11, for rotating the cylinder 9 around the first longitudinal axis Z;
- elastic means, visible only from fig. 3 onwards, where they are globally indicated by the numeral 12, cooperating mechanically with the drive
means 11 during the unwinding/winding of the laminar sheet 2.

According to the invention, the elastic means 12 are contained inside one of the component parts of the supporting structure 3 and are associated with means of rotation, globally indicated by the numeral 13, operatively connected to the drive means 11, that are used to load/release the elastic means 12 during the unwinding/winding of the laminar sheet 2.

In this particular case, the elastic means 12 are contained inside the cylinder 9 and the drive means 11 are installed in the supporting elements 4, 5, while the cylinder 9 constitutes the means of rotation 13.

In other embodiments of the invention, not included in the attached drawings for the sake of simplicity, the elastic means may be contained inside the supporting element and the drive means may be associated with the cylinder, e.g. by keying them or otherwise connecting them to its outer wall.

Such structural solutions, wherein the means of rotation are in the form of the transmission means instead of the cylinder and a single motor overcomes the resistance of the elastic means associated with one or more supporting elements, are suitable for winding structures of more limited size than the structure 1, which is designed to cover medium to large areas.

 Preferentially, but not necessarily, the winding structure 1 comprises a central data processing unit 14 of known type available to the user, that is electrically connected to the drive means 11 and used to automatically control the unwinding/winding of the laminar sheet 2.

Figures 1 and 2 also show that the winding structure 1 comprises means for monitoring the weather conditions, globally numbered as 15 and consisting, for instance, of an anemometer, electrically connected to the central unit 14.

Moving on to describe the various elements of the winding structure 1 in more detail, the laminar sheet 2 is a sheet of plastic material, preferably but not necessarily polvamide, also known.JivJjiejuxuiimer-CiaLname-of-nvlon-that-is waterproof and particularly water-resistant and suitable for silkscreen printing with symbols, patterns, wording and the like for decorative or advertising purposes.

The laminar sheet 2 is attached to the cylinder 9 by connection means, generally indicated by the numeral 16, situated on one edge 2a of the laminar sheet 2.

According to a structural solution known to a person skilled in the art, the
laminar sheet 2 is composed of two sheets 21, 22, of substantially the same size, joined together near the edge 2a by joining means, globally indicated by the numeral 17, and wound in opposite directions onto the cylinder 9. The joining means 17 consist, in the example described herein, of a seam of stitches 18 extending the full width L of the laminar sheet 2, but slightly less than the length of the cylinder 9, but in other embodiments these joining means may naturally be of any other type.

The connection means 16 comprise a shaped cavity 19 open on one side 19', in the side wall 9a of the cylinder 9, to allow for the insertion of a cylindrical core 20 contained inside a fold 23 stitched in the vicinity of the edge 2a along the full width L of the laminar sheet 2. The profile 19' of the shaped cavity 19 is in the form of an incomplete circle comprising at least 180° of its circumference so as to substantially define a "C" shape.

The cylindrical core 20 is made of plastic and, at one end 20a, it has an internally threaded hole 24, wherein a screw 25 engages to exert a tensile force on the laminar sheet 2.

As for the supporting elements 4, 5, each of these contains an electric motor of the type used for operating roller blinds, complete with a limit switch associated with the drive means 11.

From now on, unless specified otherwise, reference is only made to the supporting element 4 for the sake of simplicity, but the considerations also apply equally to the other supporting element 5 of the supporting structure 3. As shown in figures 4 and 5, the supporting element 4 consists of a tubular element 26, which identifies a second longitudinal axis of rotation Y and is attached by supporting means globally indicated by the numeral 29 to a first upright 28 coming to bear on the supporting surface S.

The supporting element may consist of a container situated inside the supporting surface, e.g. a concrete pit sunk in the ground, which contains a low-voltage (e.g. 24V) electric motor associated with the transmission means by suitable drive gearing, easily identifiable by a person skilled in the art. The supporting means 29 comprise a shaped bracket 30 and a pair of shaped arms 31, 32, arranged above said shaped bracket 30, and projecting from the outer wall 28a of the first upright 28.
The tubular element 26 has its base 26a resting on the shaped bracket 30 and, near the top 26b it is connected laterally to the shaped arms 31, 32 by restraining means, jointly numbered as 33. The transmission means 6, associated with the supporting element 4, are situated above the top 26b of the tubular element 26, in the same way as the transmission means 7 are associated with the supporting element 5 on the corresponding tubular element 56 on the other side of the winding structure. In this case, the transmission means 6 comprise a plastic pulley 34, coaxial to the tubular element 26, which has a continuous, spiral shaped groove 35 on the outer surface 34a, in which the tensioning means 8 are contained during the winding of the laminar sheet 2.

The above-mentioned restraining means 33 consist of screw means 37 inserted in two through slots 38, 39, each obtained on one of the arms 31, 32, and two threaded holes 401, 402 communicating respectively with the through slots 38, 39 and obtained in a metal ring 40, illustrated in the enlargement in fig. 6, coupled coaxially and externally to the tubular element 26.

The screw means 37 have a screw head 37a projecting from the side 31a, 32a of the arms 31, 32, while the threaded holes 401, 402 are diametrically opposite one another.

There may be other winding structure solutions that are not illustrated in the figures attached hereto, wherein the screw means are inserted in only one of the through slots obtained in one of the arms, and thus in only one of the threaded holes in the ring.

The through slot 38, 39 has an elongated shape with a slightly arched profile so as to enable the angular adjustment of the tubular element 26 with respect to the first upright 28.

As illustrated in fig. 5, this design solution enables the tubular element 26, and the drive means 11 contained therein, to be tilted with respect to the first upright 28 at an angle a, which may range from 0° to 15°, between the longitudinal axis Y' of the former and the longitudinal axis Y of the latter, in order to keep the longitudinal axis Y' of the tubular element 26 substantially at right angles to the supporting surface S and the tensioning means 8, thereby facilitating the proper winding of the pulley 34 in the continuous groove 35 during the unwinding of the laminar sheet 2.

The first upright 28 is also complete with a pair of shaped wings 41, 42,
projecting from the outer wall 28a of the first upright 28 on the side opposite the shaped arms 31, 32.

Tensioning means, globally indicated by the numeral 43 and of known type, e.g. metal cables, are fixed to said shaped wings 41, 42 and permanently attached to the ground, or any other surface, being designed to contrast the force exerted by the tensioning means 8 during the winding of the laminar sheet 2.

As for said tensioning means 8, these consist of metal cables 6 typical of such constructions, having one end 36a attached to the side rim 34b of the pulley 34 and the opposite end 36b attached to the laminar sheet 2.

As for the previously-mentioned fixing means 10, fig. 7 shows that these comprise a pair of second uprights 44, 45, which come to bear on the supporting surface S, having at their free end 44a, 45a a female thread, not illustrated, whereon one of the threaded pins 46, 47 projecting coaxially from the ends 9b, 9c of the cylinder 9 engages.

Each of the threaded pins 46, 47 is fixed to one of the second uprights 44, 45 by means of a locking nut, only one of which is illustrated, indicated by the numeral 57.

According to the preferred embodiment of the invention described herein, the following are installed inside the cylinder 9:

- a shaft 48 coaxial to the cylinder 9 that extends along the first longitudinal axis Z, complete with the threaded pin 46;
- an internal spacer cylinder 49, coming between the cylinder 9 and the shaft 48;
- a cylindrical bumper 50, slidingly located inside the cylinder 9 and attached to the free inner end 48a of the shaft 48.

The next fig. 8 shows that the elastic means 12 consist of a spiral spring 51 coupled externally to the internal cylindrical 49, having one end 51b connected to a shaped plate 53 projecting from the shaft 48.

The cylindrical bumper 50 is precisely coupled to the cylinder 9, in relation to which it has a slightly smaller diameter.

Given these design features, the spiral spring 51 is able to slide inside the cylinder 9.
The internal cylinder 49 and the cylindrical bumper 50 are made of plastic, but of different types: the first is made of polyvinyl chloride (PVC), while the second is made of polyamide or nylon, which assures a smooth surface finish, particularly indicated for slidingly coupled surfaces.

As shown in fig. 9, the winding structure 1 comprises means, globally indicated by the numeral 54, for loading the elastic means 12, associated with the cylinder 9.

To be more precise, the loading means 54, of known type, are part of a bearing block 55, with a first part 55a coupled to the second upright 44, and a second part 55b, with a threaded through hole 59 wherein the threaded pin 46 engages.

Preferentially, the first part 55a and the second part 55b of the bearing block 55 are connected together by hinged means, globally indicated by the numeral 60, suitable for making the shaft 48, and consequently also the cylinder 9, occupy a horizontal or tilted position, depending on installation needs.

Other variants of the invention, not illustrated here, may involve one bearing block on each of the second uprights, one of which is complete with loading means.

The above-described method for unwinding/winding the laminar sheet 2 with the winding structure 1 is also protected by the patent.

According to the invention, the unwinding of the laminar sheet 2 from the cylinder 9 is achieved by the rotation of the cylinder 9 induced by the drive means 11, and the winding of the laminar sheet 2 onto the cylinder 9 is due to the release of the mechanical energy stored by the elastic means 12 during the unwinding of said laminar sheet 2.

The cylinder 9 turns around the first longitudinal axis Z in one direction during the unwinding of the laminar sheet 2 and in the opposite direction during the winding-of-the-Jaminar-sheet-2L.

The elastic means 12 are progressively loaded and released respectively during the unwinding and winding of the laminar sheet 2.

According to the preferred embodiment of the method of the invention described herein, the elastic means 12 are loaded/released due to the direct effect of the rotation of the cylinder 9, with which they are associated, around the first to longitudinal axis Z.

During unwinding, the elastic means 12 are loaded as they slide in one
direction along the longitudinal axis Z inside the cylinder 9, entraining the cylindrical bumper 50 attached to one of their ends.

During the opposite phase, i.e. rewinding, the elastic means 12 slide inside the cylinder 9 in the opposite direction, extending progressively to their full length and thus returning to their resting condition.

In other variants of the method of the invention, not accompanied by reference drawings, the elastic means are loaded/release due to the effect of the rotation of transmission means, to which the elastic means are connected, around a second longitudinal axis identified by a supporting element forming part of the supporting structure, to which the transmission means are connected.

The laminar sheet 2 is unwound from or wound onto the cylinder 9 by means of the unwinding or winding of two sheets 21, 22 of substantially the same size, that together form the laminar sheet 2, in opposite directions along the same, substantially horizontal plane, and at right angles to the first longitudinal axis Z defined by the cylinder 9.

The rewinding of the laminar sheet 2 is obtained automatically when the parameter used to measure the weather conditions reaches or exceeds a previously-established critical value.

Said critical value is no less than 60 km/h when the parameter considered is the wind speed.

The unwinding or winding of the laminar sheet 2 is enabled by the user by means of the central data processing unit 14, whose functions also include controlling the operating conditions of the drive means 11.

If one of the electric motors contained in the supporting elements 4, 5 is out of commission for any reason, the central processing unit 14 also stops the other, preventing any further maneuvers of the laminar sheet 2.

The method of the invention also comprises a procedure for loading the elastic means 12, used during the installation of the winding structure 1 with the laminar sheet 2 unwound and positioned so as to cover the area A.

Said operation consists in the operator making the shaft 48 rotate by means of the loading means 54 connected to the pin 46 so as to compress the elastic means 12, coaxially associated with the shaft 48, and thereby reduce them to
their minimum length, keeping them in said position until the laminar sheet 2 has been spread out.

Preferably, but not necessarily, the method forming the object of the patent claim comprises a procedure for horizontally positioning the cylinder 9 that is completed before or after the operation for loading the elastic means 12. This consists in rotating the second part 55b of the bearing block 55, associated with the cylinder 9, through a suitable angle in relation to the first part 55a, associated with the second upright 44, by taking action on the hinged means 60.

On the strength of the above explanation, it is consequently clear that the method for unwinding/winding a laminar sheet, and the winding structure for covering areas that implements said method achieve the objects and offer the advantages as previously stated.

In addition to the advantages already highlighted in the description, the winding structure of the invention enables a better runoff of rainwater in that the particular tautness of the laminar sheet prevents the formation of pockets or the hazardous accumulation of water, which is often seen in the winding structures of known type.

Changes may be made to the winding structure of the invention in the development stage, consisting, for instance, in a supporting structure having a different composition from the one previously described.

Moreover, in other embodiments of the invention, the drive means and elastic means may be of a different nature from those previously described, without this having any bearing on the advantages offered by the present patent.

In addition, the means for fixing the cylinder to the supporting surface differ from those described and illustrated in the attached drawings, while still using systems that are a part of the normal technical know-how of a person skilled in the art, and consequently come within the field of application of the present invention.

Provision may also be made for the installation of a reserve battery, or uninterruptible power supply that, in the event of a mains power failure, enables the automatic and immediate rewinding of the sheet around the
cylinder, thereby closing the winding structure.
In such an events, a manual action by the operator will be necessary to restore
the winding structure to normal operation.
This is all on the understanding that the winding structure of the invention may
be applied to a different type of supporting surface from the one to which
reference is made, simply as an example, in the description and drawings of
the invention provided herein.
Moreover, the winding structure of the invention may be used not only for
covering areas, but also as a partition for separating areas.
Where the technical characteristics indicated in the claims are followed by
reference signs, these have been included merely for the purpose of facilitating
the reading of the claims, so said reference signs shall have no restrictive
effect on the scope of the protection for each element they identify for the
purpose of providing an example.
All the variants described and mentioned, but not illustrated in the attached
drawings, nonetheless come within the context of the inventive concept
expressed by the claims that follow, and shall consequently be considered as
covered by the present patent.
CLAIMS

1) Method for unwinding/winding a laminar sheet (2) for spreading so as to cover an area (A) and forming part of a winding structure (1) that comprises:

- a supporting structure (3), for installing in said area (A), that includes a cylinder (9) for supporting said laminar sheet (2) and identifying a first longitudinal axis of rotation (Z);
- drive means (11) for rotating said cylinder (9) around said first longitudinal axis (Z);
- elastic means (12) cooperating mechanically with said drive means (11) during the unwinding/winding of said laminar sheet (2), characterized in that the unwinding of said laminar sheet (2) from said cylinder (9) occurs due to the effect of the rotation of said cylinder (9) induced by said drive means (11), and the rewinding of said laminar sheet (2) onto said cylinder (9) is due to the effect of the recovery of the mechanical energy stored by said elastic means (12) during said unwinding of said laminar sheet (2).

2) Method according to claim 1), characterized in that said cylinder (9) rotates around said first longitudinal axis (Z) in one direction during said unwinding of said laminar sheet (2) and in the opposite direction during the winding of said laminar sheet (2).

3) Method according to claim 1), characterized in that said elastic means (12) are progressively loaded and released, respectively, during said unwinding and winding of said laminar sheet (2).

4) Method according to claim 3), characterized in that said elastic means (12) are loaded/released due directly to the effect of the rotation of said cylinder (9), with which they are associated, around said first longitudinal axis (Z).

5) Method according to claim 1), characterized in that said elastic means (12) slide in one direction along said first longitudinal axis (Z) inside said cylinder (9), thereby becoming loaded, during the unwinding of said laminar sheet (2), and slide in the opposite direction, thereby becoming extended during the winding of said laminar sheet (2).

6) Method according to claim 3), characterized in that said elastic means are loaded/released due to the effect of the rotation of transmission means, to which said elastic means are connected, around a second
longitudinal axis identified by a supporting element forming part of said supporting structure and to which said transmission means are connected.

7) Method according to claim 1), characterized in that the unwinding/winding of said laminar sheet from/onto said cylinder involves the unwinding/winding of two sheets of substantially the same size, forming together said laminar sheet, in opposite directions lying on the same plane.

8) Method according to claim 7), characterized in that said longitudinal plane is substantially horizontal.

9) Method according to claim 1), characterized in that the rewinding of said laminar sheet (2) is done automatically when the parameter used to measure the weather conditions reaches or exceeds a pre-set critical value.

10) Method according to claim 9), characterized in that said critical value is at least 60 km/h when said parameter is the wind speed.

11) Method according to claim 1), characterized in that said unwinding/winding of said laminar sheet (2) is enabled by the user by means of a central data processing unit (14).

12) Method according to claim 1), characterized in that it comprises a procedure for preloading said elastic means (12), conducted during the installation of said structure (1) while said laminar sheet (2) is unwound.

13) Method according to claim 12), characterized in that it comprises a procedure for the horizontal positioning of said cylinder (9) that is completed before/after said procedure for preloading said elastic means (12).

14) Winding structure (1) for covering areas (A) comprising:
   - a laminar sheet (2) for arranging so as to cover said area (A);
   - a supporting structure (3), for installing in said area (A) and including the following-components:
     • at least one supporting element (4, 5) for associating with a supporting surface (S) in said area (A), complete with transmission means (6, 7) connected by tensioning means (8) to said laminar sheet (2);
     • a cylinder (9), that supports said laminar sheet (2) and identifies a first longitudinal axis of rotation (Z), for associating by means of fixing means (10) with said supporting surface (S);
   - drive means (11) for inducing the rotation of said cylinder (9) around said
first longitudinal axis (Z);
- elastic means (12) cooperating mechanically with said drive means (11) during the unwinding/winding of said laminar sheet (2), characterized in that said elastic means (12) are contained inside one of said components comprising said supporting structure (3) and are associated with means of rotation (13), operatively connected to said drive means (11), suitable for loading/releasing said elastic means (12) during said unwinding/winding of said laminar sheet (2).

15) Structure (1) according to claim 14, characterized in that said elastic means (12) are contained inside said cylinder (9) and said drive means (11) are installed inside said supporting element (4, 5).

16) Structure (1) according to claim 15, characterized in that said means of rotation (13) consist of said cylinder (9).

17) Structure according to claim 14, characterized in that said elastic means are contained inside said supporting element and said drive means are associated with said cylinder.

18) Structure according to claim 15, characterized in that said means of rotation consist of said transmission means.

19) Structure (1) according to claim 14, characterized in that said laminar sheet (2) is a sheet made of plastic material.

20) Structure (1) according to claim 14, characterized in that said laminar sheet (2) is attached to said cylinder (9) by connection means (16) provided in line with one edge (2a) of said laminar sheet (2).

21) Structure (1) according to claim 14, characterized in that said laminar sheet (2) consists of two sheets (21, 22) of substantially the same size, joined together in the vicinity of said edge (2a) by joining means (17).

22) Structure (1) according to claim 21, characterized in that said sheets (21, 22) are wrapped onto said cylinder (3) in opposite directions.

23) Structure (1) according to claim 21, characterized in that said joining means (17) consist of a seam of stitches (18) extending over the full length (L) of said laminar sheet (2).

24) Structure (1) according to claim 20, characterized in that said connection means (16) comprise a shaped cavity (19) that is open on one side (19'), in the side wall (9a) of said cylinder (9), to allow for the insertion of a cylindrical core (20) contained inside a fold (23) created in the vicinity of said
edge (2a) along the full width (L) of said laminar sheet (2).

25) Structure (1) according to claim 24), characterized in that said profile (19') of said shaped cavity (19) is in the form of an incomplete circle whose circumference extends around at least 180°.

26) Structure (1) according to claim 24), characterized in that said cylindrical core (20) has an internally threaded hole (24) at one end (20a) at least, whereon a screw (25) engages thereby pulling said laminar sheet taut (2).

27) Structure (1) according to claim 24), characterized in that said cylindrical core (20) is made of plastic.

28) Structure (1) according to claim 14), characterized in that said supporting element (4, 5) consists of a tubular element (26, 56) that identifies a second longitudinal axis of rotation (Y) and is associated by means of supporting means (29) with a first upright (28) coming to bear on said supporting surface (S).

29) Structure (1) according to claim 28), characterized in that said supporting means (29) include a shaped bracket (30) and a pair of shaped arms (31, 32), situated above said shaped bracket (30), projecting from the outer wall (28a) of said first upright (28).

30) Structure (1) according to claim 29), characterized in that the bottom (26a) of said tubular element (26, 56) rests on said shaped bracket (30) while, near the top (26b), it is connected laterally by restraining means (33) to said shaped arms (31, 32).

31) Structure (1) according to claim 30), characterized in that said restraining means (33) consist of screw means (37) inserted in at least one slot (38, 39) obtained in at least one of said arms (31, 32), and a threaded hole (401, 402), communicating with said slot (38, 39) and obtained on a ring (40) coupled coaxially and externally to said tubular element (26, 56).

32) Structure (1) according to claim 31), characterized in that said screw means (37) are complete with a screw head (37a) projecting from the lateral surface (31a, 32a) of one of said arms (31, 32).

33) Structure (1) according to claim 31), characterized in that said slot (38, 39) has an elongated shape with a slightly arched profile so as to enable the angular adjustment of said tubular element (26, 56) with respect to said first upright (28).
34) Structure (1) according to claim 30), **characterized in that** said transmission means (6, 7) are situated above said top (26b) of said tubular element (26, 56).

35) Structure (1) according to claim 26), **characterized in that** said transmission means (6, 7) comprise a pulley (34), coaxial to said tubular element (26, 56), with a spiral-shaped continuous groove (35) on its outer surface (34a) wherein said tensioning means (8) are contained during said winding of said laminar sheet (2).

36) Structure (1) according to claim 35), **characterized in that** said tensioning means (8) consist of metal cables (36), having one end (36a) attached to said edge (34b) of said pulley (34) and the opposite end (36b) attached to said laminar sheet (2).

37) Structure (1) according to claim 29), **characterized in that** said first upright (28) is complete with a pair of shaped wings (41, 42), projecting from said outer wall (28a) of said first upright (28) on the side opposite the shaped arms (31, 32), to which ties (43) are attached to contrast the force exerted by said tensioning means (8) during said winding of said laminar sheet (2).

38) Structure (1) according to claim 14), **characterized in that** it includes a central data processing unit (14) at the user's disposal, electrically connected to said drive means (11), suitable for automatically controlling the unwinding/winding of said laminar sheet (2).

39) Structure according to claim 38), **characterized in that** it includes means for monitoring (15) the weather conditions, electrically connected to said central data processing unit (14).

40) Structure according to claim 14), **characterized in that** said supporting element consists of a container placed inside said supporting surface:

41) Structure (1) according to claim 14), **characterized in that** said means (10) for fixing said cylinder (9) to said supporting surface (S) comprise at least a second upright (44, 45) that comes to bear on said supporting surface (S) and, at its free end (44a, 45a), has a female thread whereon a threaded pin (46, 47) projecting coaxially from the end (9b, 9c) of said cylinder (9) engages.

42) Structure (1) according to claim 41), **characterized in that** said
cylinder (9) contains:
- a shaft (48) coaxial to said cylinder (9) and developing along said first longitudinal axis (Z), complete with said threaded pin (46);
- an internal spacer cylinder (49), coming between said cylinder (9) and said shaft (48);
- a cylindrical bumper (50), slidingly arranged inside said cylinder (9) and fixed to the free inside end (48a) of said shaft (48).

43) Structure (1) according to claim 42), **characterized in that** said elastic means (12) consist of a spiral spring (51) coupled externally to said internal cylinder (49), with one end (51a) attached by locking means (52) to said cylindrical bumper (50), and the opposite end (51b) connected to a shaped plate (53) projecting from said shaft (48).

44) Structure (1) according to claim 42), **characterized in that** said cylindrical bumper (50) is precisely coupled to said cylinder (9).

45) Structure (1) according to claim 42), **characterized in that** said cylindrical bumper (50) is made of plastic.

46) Structure (1) according to claim 42), **characterized in that** said internal cylinder (49) is made of plastic.

47) Structure (1) according to claim 42), **characterized in that** it comprises means for loading (54) said elastic means (12), associated with said cylinder (9).

48) Structure (1) according to claim 47), **characterized in that** said loading means (54) form part of a bearing block (55), with a first part (55a) coupled to said second upright (44, 45) and a second part (55b) with an internally threaded through hole (59) wherein said threaded pin engages (46).

49) Structure (1) according to claim 48), **characterized in that** said first (55a) and second parts (55b) of said bearing block (55) are connected together-by-hinged-means-(60-)-suitable-for-enabling-the-horizontal-positioning-of-said-cylinder (9).
A. CLASSIFICATION OF SUBJECT MATTER
INV. E04F10/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
E04F E06B E04B E04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[ ] Further documents are listed in the continuation of Box C

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Date of the actual completion of the international search
25 September 2006

Date of mailing of the international search report
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Severens, Gert

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