The system during the extension and retraction of the same sheets (4).
DESCRIPTION

The invention refers to greenhouses, i.e. those structures for the removable covering of rows of vegetable crops, with sheets or nets for the protection of these crops prevalently from weather conditions, of the type that comprise vertical supporting poles positioned along the rows of plants, aligned transverse to one another, close together or staggered, naturally having a height greater than the height of the crowns of the plants to be protected and that with their top are arranged in any manner such as to be connected to one another with longitudinal cables and with transverse cables, to form an aerial and fixed structure, of reticulate type, which can support longitudinally on each row, at least one protective sheet that forms on the same row, a flat or double pitched roof, which is supported by said cables so as to remain correctly in position and to withstand all important stresses, both vertical and transverse, to which the same roof can be subjected by weather conditions.

In the description below, purely for convenience and unless otherwise specified, the term "sheet" will be used to indicate any flexible covering structure for protecting the rows, either of a closed or reticulate type. The Italian patent application no. BO2015A000117 of 11 March 2015 by the same applicant, cited as prior art, describes a protection structure for covering vegetable crops positioned in parallel rows, which also comprises longitudinal eaves cables parallel and substantially equidistant from the longitudinal ridge cables of each pair of adjacent rows, positioned at a height lower than the height of the eaves cables, characterised by comprising means to allow the covering sheets to move transverse to their longitudinal extension, to pass from a position covering the rows, forming thereon a transverse double pitched roof, to a position uncovering the same rows, in which
each sheet is retracted transversely folded in a bellows-like manner through the action of transverse pulling cables between which the same sheets are positioned, which are effectively supported above and below by these pulling cables, to remain correctly arranged both when they are extended, to withstand the action of the wind and of bad weather, and during retraction and reduction of the overall transverse dimension, each sheet being secured to said transverse pulling cables with at least one longitudinal side thereof, with a reinforcing bar and related clamps interposed, while the other longitudinal side of each same sheet is anchored to a fixed eaves cable, at which the same sheet is retracted in a bellows-like and pitched manner when said transverse pulling cables carry out a retracting movement correlated to the width of the sheet. Said pairs of transverse pulling cables of the sheets run with the same sheets on the fixed ridge cables of the rows and run on guide means provided at said eaves cables, integral with which are rings or equivalent means, which project above these eaves cables and in which the pulling cable positioned above the sheet runs positioned below the sheet runs below the eaves cable or on guide means associated with this cable. The pairs of transverse pulling cables of the sheets are connected with the opposite ends to centralised guide and operating means, positioned on the opposite sides of the greenhouse, to allow them to be operated simultaneously with synchronised movements to the right or on the left, so that the various protective sheets can simultaneously pass from being extended covering the rows of plants, to being retracted folded in a bellows-like manner, laterally and between the same rows. In this solution, the pulling cables of the sheets must follow a zigzag path between the fixed ridge and eaves cables of the various rows of plants of the greenhouse, so that there are frictions that require considerable effort to be applied to operate the various pairs of pulling cables and it is complicated to pass the ridge cable over the pairs of pulling cables, with the sheet interposed and clamped between the same pulling cables while avoiding damage to the same sheet caused by rubbing against the ridge cable and against the same pulling cables.

The international patent application WO2003/073835 dated 12-9-2003 which is also cited as prior art document describes a protection system in which each
covering sheet has a fixed end cross-piece at the eaves of each fixed arch of each row, while the movable opposite cross-piece is secured to at least one transverse pulling cable that involves each arch, which passes below the sheet, which is guided on pulleys positioned on the opposite eaves sides of each arch and which with the ends is secured to cables that run longitudinally along the eaves areas, all so that by pulling and releasing these cables using winches, said transverse pulling cable can move forwards and backwards to open or close the covering sheet of each arch. Secured to the same movable cross-piece of the sheet is the end of at least one transverse cable that passes over the sheet, which passes through an arched guide secured to the fixed cross-piece for retraction of the same sheet, and this further transverse cable is also guided on a dedicated groove of the guide pulley of the other transverse cable below the sheet and is then secured to said pulling cables that run along the eaves, with the result that both when the sheet is extended and when it is retracted folded in a bellows-like manner on an eaves of the arch, the same sheet is always supported above and below respectively by said pair of transverse pulling cables.

This solution describes the selective operation of the sheets of each row, but also in this case the pulling cables interfere with the ridge cables of each protective arch of a row, resulting in the occurrence of friction and problems of wear of the system formed by the covering sheet and by the transverse pulling cables that are in condition that interferes with the same ridge cables.

The invention intends to overcome this dual technical problem of the prior art, i.e. the problem of the noteworthy effort currently required to operate the transverse pulling cables and the problem of wear of the same transverse cables and of the sheet, due to interference with the ridge cables, with a system for movement of the sheets as claimed in claim 1) and in the subsequent dependent claims, which makes use of the following inventive idea. The covering sheet extends transversely between the ridge cable of one row and the eaves cable of the adjacent row, so that each row is half covered by the sheet that is secured with a longitudinal side thereof to its ridge cable and half covered by the movable side of the sheet of the adjacent row, while
when the sheets are in the retracted position in which the rows are uncovered, each sheet is retracted folded in a bellows-like manner on the top part of each row. The movable longitudinal side of each sheet is provided with means that enable it to run at least on the fixed transverse cables of the system and the same longitudinal and movable side of the sheet is anchored to pulling cables above, parallel to the fixed transverse cables below and therefore also transverse to the sheets and these pulling cables are preferably positioned at a height slightly greater than the height of the fixed transverse and longitudinal cables of the system, so as not to interfere with them. Provided below the sheets are supplementary flexible cables, connected with the opposite ends to the longitudinal and movable sides of the consecutive sheets, to keep these sheets in a raised position at all times and to allow the complete transverse reduction of their overall dimensions, by retraction folded in a bellows-like manner above each row. All the cables of the system are arranged on their own trajectories that do not interfere with one another or with the sheets, so that these latter are positioned between the transverse cables and the upper pulling cables above and the supplementary cables below, so as to be able to substantially float between these same cables, thus preventing friction and wear of the whole system during the movements of extension and of retraction of the same sheets and so as to be able to implement these same movements with limited effort.

This solution solves both of the technical problems mentioned above, as the pulling cables, the supplementary cables and the sheet do not rub against one another and against the fixed and movable cables of the system, so that problems of wear are prevented and the pulling cables can be operated with minimum effort.

Further characteristics of the present system and the advantages deriving therefrom, both in operation of sheets with a flat arrangement and of sheets with a double pitched arrangement will be more apparent from the following description of some preferred embodiments thereof, illustrated purely by way of non-limiting example in the figures of the five accompanying drawings, wherein:

- Figs. 1 and 2 are schematic views of the present system, respectively according to a top plan view and according to a front view indicated by the
arrow K in Fig. 1;
- Figs. 3 and 4 illustrate a part of the system arranged for operation of the sheets with horizontal arrangement, in a cross section along the line A-A of Fig. 1 and shown respectively with the sheets extended and with the sheets retracted transversely folded in a bellows-like manner on the rows of plants;
- Figs. 5 and 6 illustrate, according to the same sectional view of Fig. 3, two different solutions for associating with the first row on the left of the system, on which the first sheet is retracted and to the longitudinal cable of which the fixed longitudinal side of this sheet is anchored, lower supplementary cables that correctly support the same sheet during retraction;
- Figs. 7 and 8 illustrate in a perspective view the details of two different solutions for providing the sheets, in the area of maximum extension of the arrow, with longitudinal openings for the free and rapid runoff of rain and hail and to vent the wind;
- Figs. 9 and 10 illustrate in a front elevation the system for horizontal sheets as in the preceding figures, but arranged to simultaneously operate sheets and nets and to be able to alternatively position a sheet or a net on the rows;
- Figs. 11 and 12 illustrate a part of the system arranged for operation of the sheets with a double pitched arrangement, in a cross section along the line A-A of Fig. 1 and shown respectively with the sheets extended and with the sheets retracted transversely folded in a bellows-like manner on the rows of plants.

In Figs. 1 and 2 the references F₁, Fₙ indicate the parallel rows of plants P, along which the poles 1 are installed, aligned transverse to one another, close together as in the example shown, or staggered, as stated in the prior art cited in the introduction of the present description and to which ample reference will be made. The references F, F' indicate rows of poles 1, positioned to serve the rows with the plants P and that complete the protection structure G of the protection system considered first here. The reference 2 indicates the longitudinal ridge cables that connect the tops of the poles 1 of each row F, F₁, Fₙ, F' to one another and the
reference 3 indicates the transverse cables that, again according to the prior art, connect the poles 1 of one row with the aligned poles 1 of the adjacent rows, all so as to produce a reticulate structure capable of supporting, above each row of poles 1 of each row F, F1, Fn, a respective sheet 4, 4', 4" with an extended arrangement that for the first system G is presumed to be horizontal or substantially horizontal, where each sheet is anchored with a longitudinal side 104, 104', 104" thereof to the longitudinal ridge cable 2 of the respective rows F, F1, Fn, and where the same sheet is preferably positioned below the transverse cables 3 and any other auxiliary cables not considered herein as not necessary for comprehension of the invention. The variant in which the sheets positioned above or both below and above the transverse cables 3, in this last case with a zigzag arrangement in which they are positioned alternately below and above these cables 3, also falls within the scope of the invention.

In Fig. 1 and in Fig. 4, the sheets 4, 4', 4" are illustrated in the position in which they are retracted transversely folded in a bellows-like manner above the respective rows F, F1, Fn with the opposite and movable longitudinal sides 204, 204', 204" in proximity of the fixed sides 104, 104', 104", while in the position of extension and closing the top of the protection structure G, as illustrated in Figs. 2 and 3, the same sheets will be opened with a movement from left to right (observing the figures) of the respective movable longitudinal sides 204, 204', 204", so that the sheet 4 extends transversely from F to F1 and covers the left half of the row F1, with the sheet 4' extending transversely from F1 to Fn to cover the right half of the row F1 and the left half of the row Fn and with the sheet 4" extending transversely from Fn to F' to cover the right half of the same row Fn.

As also illustrated in the details of Figs. 2 to 4, secured to the movable sides 204, 204', 204" of the sheets are rings 5 or other suitable means, such as pulleys or the like, which run on the sections of the transverse cables 3 of the system between adjacent rows and, as can be seen from comparing Figs. 3 and 5, the sections of the same movable sides 204, 204', 204" between the rings 5 of each sheet, are suitably reinforced by flexible elements, arched and such as to adopt in a plan view the shape
of consecutive waves T, T', T", in which the intermediate and highest projecting point 6, 6', 6" of each wave is connected, by means of clamps 70, to pulling cables 7 positioned transverse to the same sheets 4, 4', 4" and which, as shown in Fig. 2, are positioned at a height slightly greater than the height engaged by the longitudinal cables 2 and by the transverse cables 3 of the protection structure G, so that neither the same pulling cables 7 nor the sheets interfere negatively with the fixed cables 2, 3 and any other fixed cables of the system. When the sheets 4, 4', 4" are in the position retracted on the rows, after the pulling cables have translated simultaneously to the left (observing Figs. 1 and 4), said arched portions T, T', T" of the movable longitudinal sides 204, 204', 204" of the same sheets are arranged on the left of the rows F, F1, Fn, while when the sheets 4, 4', 4" are in the extended position on the rows and the pulling cables have been translated to the right (observing Figs. 2 and 3), said arched portions T, T', T" of the movable longitudinal sides 204, 204', 204" of the sheets 4, 4', 4" are arranged on the right of the rows F1, Fn, F', so as to be superimposed on the fixed sides 104, 104', 104" of the same sheets, to ensure the necessary protection to the rows of plants P below.

From Figs. 1 and 2 it can be seen that the pulling cables 7 are guided with the opposite ends for example on opposed pulleys 8, 8' supported by poles 9, 9' positioned on the longitudinal and external sides of the system G and, after being guided on these pulleys 8, 8', the same pulling cables 7 are guided on pulleys 10, 10', for example anchored to the ground, and are then secured with the opposite ends, by means of clamps, not shown, to a main cable 11 that in plan view is U-shaped, with sections 111, 111' parallel to one another and to the rows F, F1, Fn, F', guided on said lower pulleys 10, 10' and connected with the ends to motorised winches 12, 12' positioned on one end of the same protection structure G. The transverse section 211 of the main cable 11 is positioned transversely and in the top part of the other end of the protection structure G, the part without the winches 12, 12' and in which the same cable 11 is guided on aerial pulleys 13, 13'. The winches 12, 12' are operated by electric motors that rotate in two directions, synchronised with each other and arranged to alternately retract and feed sections of the cable 11.
of the same length, so that the rectilinear and opposed movement of the branches
111, 111' of the same cable 11 cause the necessary simultaneous translation to the
right or to the left of all the pulling cables 7. According to a constructional variant, not
illustrated as easily understood and implemented by those skilled in the art based on
the following description alone, the main cable 11 can be guided around the
protection structure G so as to form a closed loop and to be controlled with a single
winch, operated manually or with an electric motor, in two directions of rotation. It is
easily understood how, in place of the winches 12 and 12', the main cable can be
moved by an external moving system, such as a tractor or the like, where the means
shifts the main cable 11 on the side 12 or 12' after the cable has been released in the
opposite position. The sheets 4, 4', 4" are supported in an effective and well-
distributed manner, both during retraction and during extension, through the use of
groups of supplementary transverse cables 14, positioned below each said sheet 4,
4', 4", parallel to the transverse cables 3 and formed by flexible and optionally elastic
elements, anchored with the opposite ends to the movable sides 204, 204', 204"
and to their arched structure T, T', T" and which pass through rings or other suitable
guiding means 80 anchored to the longitudinal cables 2 of the poles 1 at which the
sheets are to be retracted. As illustrated schematically in the plan view of Fig. 1, the
groups of supplementary cables 14 are distributed equally and symmetrically along
the whole of the length of each sheet 4, 4', 4".

As on the left of the first sheet 4 of the row F there is no other sheet to which to
connect the other end of its supplementary cables 14, the various supplementary
cables 14 of this first sheet 4 preferably have a fan-like arrangement, as indicated
with 14' in Fig. 1 and in Fig. 5, to converge and join to a single cable 14" that is next
and parallel to a pulling cable 7 and to which this cable 14" is anchored with a clamp
90.

It is easily understandable that with this system it is easy to implement a
complete closing on the 4 sides. For this purpose, it is sufficient for the sheet to be
extended at the two ends also to cover the sides orthogonal to the rows of plants,
while on the sides parallel to the same rows it is possible to use exactly the same
system used for movement of the sheets above the same plants.

From Figs. 2, 3 and 5 it is evident how, when the pulling cables 7 are translated to the left (observing these figures), the movable side 204 of each sheet 4 is translated towards the fixed side 104 of the same sheet and how the sheet itself remains trapped between the transverse guiding cables 3 above and the lower supplementary transverse cables 14, which support and oblige it to remain in a raised position and therefore to retract completely folded in a bellows-like manner above the row, as illustrated in Figs. 1 and 4. From comparing Figs. 3 and 4, it can be easily understood how it is possible to ensure effective conditions for supporting the sheets by the supplementary transverse cables 14, exploiting any longitudinal elasticity of these same supplementary cables or of parts associated therewith.

To decrease the number of supplementary cables 14 that connect the sheets 4, 4', 4" of the system to one another, the aforesaid solution can be used for the supplementary cables serving the first sheet 4, so that each said cable 14 can be provided on the end serving the sheet to be retracted, with two or more fan-like branches, all in a manner that can be easily understood and implemented by those skilled in the art.

Fig. 6 illustrates a variant that can be used for the supplementary cables 14 serving the first sheet 4 of the system, as an alternative to the solution illustrated in Fig. 5. In the variant of Fig. 6, the supplementary cables 14 are secured with the opposite ends to the longitudinal cables 2 of the system and the movable side 204 of the sheet 4 is provided with supplementary rings 15' facing downwards and which run on the supplementary and fixed cables 14. When the pulling cable 7 is translated to the left (observing Fig. 6), the sheet 4 is held raised by the supplementary cables 14 and, also as a result of the presence of the guiding rings 15', the same sheet 4 is obliged to retract, folding in a bellows-like manner on the left section of the guides formed by the cables 7, 3 and 14.

This variant, even if it involves increased friction between the sheet and the supplementary cables 14, can be used to control all the sheets of the covering system.
To facilitate the free runoff of rain or hail from the sheets 4, 4', 4'' when these are in the extended position covering the rows, as illustrated in Figs. 2 and 3, the same sheets are provided longitudinally and in a position more or less equidistant from their longitudinal sides 104, 204, with small openings 16, as shown in Fig. 7, or, as shown in Fig. 8, these same sheets can each be formed by joining at least two adjacent sheets 40, 40', joined together by a longitudinal seam or by a section of large mesh net 116 that leads to the formation of said runoff openings 16, without compromising the mechanical strength of the composite sheets thus formed.

Figs. 9 and 10 illustrate the movement system described above for a protection structure G with sheets substantially horizontal, where a part of the same sheets is formed by the actual sheets 4, 4' and the other part is formed by nets 400, 400', so that by translating the pulling cables 7 to the left, as shown in the example in Fig. 9, the nets 400, 400' are extended and the sheets 4, 4' are retracted folded in a bellows-like manner, while by translating the same cables 7 to the right, as shown in Fig. 10, the sheets 4, 4' are extended and the nets 400, 400' are retracted folded in a bellows-like manner.

With reference to Figs. 11 and 12, there is now described the movement system for protection structures G' where the poles 1 are interconnected, as well as by the longitudinal and transverse cables 2 and 3, also by supplementary transverse cables that comprise a cable 3' parallel to and below the cable 3 and comprise at least one oblique V-shaped cable 103, secured with the ends to the poles 1 of the adjacent rows and secured with the intermediate top to the centreline of the lower transverse cable 3' and to an eaves cable 2', parallel to the longitudinal cables 2 of the system. In a protection structure G' of this kind, the sheets must be able to be retracted folded in a bellows-like manner on the rows of plants, as in the protection structure G considered previously, but when they are extended, the same sheets must form on the rows a protective roof with transverse double pitch, substantially resting on the oblique branches of each V-shaped cable 103. As illustrated in Figs. 11 and 12, each sheet 4, 4', 4'' is substantially provided on the centreline with a longitudinal spring 19, for example lower, which with the rings 20 runs on that oblique branch of the cable
103 that starts from the fixed side of the sheet, so that when the same sheet is extended as shown in Fig. 11, the rings 20 and the spring 19 are positioned at eaves cable 2', while the movable side 204 of the same sheet is at the top of the pole 1 of the row adjacent to the row to which the fixed side 104 of the sheet is constrained and is anchored to the pulling cable 7 by means of a clamp 70, in the same way as described above for the horizontal sheets. Also in this case, the supplementary transverse cables 14 are positioned below each sheet 4, are secured with the opposite ends to the movable sides 204 of the same sheets and pass through the rings 20 and guiding means 80 anchored to the longitudinal cables 2. Also in this case, when the sheets 4, 4', 4" are extended as illustrated in Fig. 11, the arched end portions T, T', T" of the same sheets, anchored to the pulling cables 7, are positioned above the fixed side of the adjacent sheet, to cover, substantially without interruption, the whole of the structure G'. Vice versa, when the pulling cables 7 are translated to the left (observing Fig. 16) as illustrated in Fig. 12, the movable side 204 of each sheet is moved towards the fixed side 104 and, as a result of the same supplementary transverse cables 14 and of the rings 20 and 80, each sheet 4, 4', 4" is obliged to remain in a raised position and to retract completely folded in a bellows-like manner on the row that supports the fixed longitudinal side 104 thereof.

Also in the solution illustrated in Figs. 11 and 12, the sheets 4 are provided with longitudinal and median openings 16, as shown in Figs. 7 and 8, to allow the free runoff of rain and hail when the same sheets are in the extended position and with these openings 16 are arranged at the eaves cables 2'.

The same arrangement as the solution with horizontal sheets and described with reference to Figs. 9 and 10 is also valid for the solution of Figs. 11 and 12, in the sense that half of each sheet can consist of an actual sheet and the other half of a net and that when the sheet is retracted the net is simultaneously extended, and vice versa.

From what has been described with reference to Figs. 3 to 6, 11 and 12, it is evident how all the cables of the system are arranged on their own trajectories and do not interfere with one another or with the sheets 4, so that these latter are
positioned between the transverse cables above and the upper pulling cables and the supplementary cables below, so as to be able to substantially float between these same cables, to prevent friction and wear of the whole system during the movements for extension and retraction of the same cables and to be able to implement these same movements with limited effort.

Finally, it is understood that the description refers to some preferred embodiments of the invention and that numerous variants, modifications and technical equivalences can be made to this latter, all without departing from the essence of the invention, as described, illustrated and as claimed below.

It will therefore appreciated that the system according to the invention is assuring the complete closure of the top and of the 4 peripheral sides of the plant in order to isolate the system from the outside and hence to increase its immunity to bacterial agents.

In the claims, the references indicated in brackets are simplified and for convenience refer to only one of the components of the system, and therefore must be considered purely indicative and not limiting to the scope of protection of the claims themselves.
CLAIMS

1. A system for the centralised transverse movement, with limited effort, of the covering sheets and/or nets of the protection structures (G, G') of plants (P) positioned in parallel rows (F1, Fn), which structures comprise vertical supporting poles (1) positioned along the rows (F1, Fn) of plants (P), aligned transverse to one another, close together or staggered, having a height greater than the height of the crowns of the plants (P) to be protected and that with their top are arranged in any manner such as to be connected to one another with longitudinal cables (2) and with transverse cables (3), to form a fixed reticulate structure such as to be able to support longitudinally on each row, at least one protective sheet (4), wherein each covering sheet (4) extends transversely between the ridge cable (2) of one row and the ridge cable (2) of the adjacent row, so that each row is half covered by the sheet that is secured with a longitudinal side (104) thereof to its ridge cable (2) and half covered by the movable side (204) of the sheet (4) of the adjacent row, while when the sheets are in the retracted position in which the rows (F) are uncovered, each sheet is retracted folded in a bellows-like manner on the top part of each row, characterised in that the movable longitudinal side (204) of each sheet (4) is provided with rings or other suitable means (5), to be able to run on the fixed transverse cables (3) of said structures (G, G') and in that the same longitudinal and movable side (204) of each sheet (4) is anchored to pulling cables (7), parallel to said fixed transverse cables (3) and therefore also transverse to the sheets (4) and these pulling cables (7) are positioned above and preferably at a height slightly greater than the height of said transverse fixed cables (3) and of the fixed longitudinal cables (2) of the structures (G, G') so as not to interfere with these fixed cables (2, 3), there being provided below the sheets (4) and arranged transversely, groups of supplementary and at least flexible cables (14), all or part of which can be fixed and/or movable together with and in the same direction as the pulling cables (7) and which have the function of maintaining the same sheets (4) in a raised position at all times, to produce the complete and correct transverse reduction of the overall dimension thereof, with retraction folded in a bellows-like manner above each row and to tie the same sheets
in the retracted position, all the cables of the system being arranged on their own trajectories that do not interfere with one another or with the sheets (4), so that these latter are positioned between the upper pulling cables (7) and the groups of supplementary cables (14) below, so as to substantially float between these same cables, to prevent friction and wear of the whole system during the movements of extension and of retraction of the same sheets (4) and so as to be able to implement these movements applying limited effort.

2. The system according to claim 1), wherein the supplementary cables (14) are movable and are anchored with the opposite ends to the movable sides (204) of the consecutive sheets (4) so as to move with these and to always remain in tension, while the supplementary cables (14) of the first sheet (4) are connected with one end to the movable side (204) of this sheet (4) by means of fan-like branches (14') and with the other end are connected directly to a pulling cable (7) by means of a clamp (90).

3. The system according to claim 1), wherein the supplementary cables (14) are anchored with the opposite ends to the movable sides (204) of the consecutive sheets (4) so as to move with these and to always remain in tension, while the supplementary cables of the first sheet (4) are secured with the opposite ends to the longitudinal cables (2) of the adjacent rows (F, F1) and the movable side (204) of the same first sheet (4) runs thereon with rings or other suitable means (15').

4. The system according to claims 1) and 2), wherein the supplementary cables (14) run below each respective longitudinal cable (2) with interposed guiding means (80) to facilitate running.

5. The system according to claim 1), wherein the supplementary cables (14) are connected to the movable sides (204) of the respective dedicated sheets (4) with fan-like branches (14') with which these supplementary cables act in a manner distributed along the length of the same sheets (4), even if the same supplementary cables (14) are in a limited quantity for each sheet (4).

6. The system according to claim 1), wherein said supplementary transverse cables (14), in order to adapt to the different needs to support the sheets (4) in the
extended position or in the retracted position folded in a bellows-like manner, are made in any way such as to have sufficient elasticity in longitudinal direction.

7. The system according to claim 1), wherein the sections of the movable sides (204) of the sheets (4) between transverse cables (3) are suitably reinforced by flexible elements, arched and such as to adopt in a plan view a shape with consecutive waves (T), in which at least the intermediate and highest projecting point (6) of each wave is connected to a pulling cable (7), all being provided so that when the sheets (4) are in the extended position on the rows (F), said wave-like portions (T) of the movable longitudinal sides (204) of the sheets (4) are arranged above the fixed sides (104) of adjacent sheets, to ensure continuous protection to the rows (F) of plants (P).

8. The system according to claim 1), wherein the sheets (4) are provided longitudinally and in a position more or less equidistant from their longitudinal sides, with small openings (16) for runoff of rain or hail and to vent the wind, or the same sheets (4) are each formed by joining at least two adjacent sheets (40, 40'), joined together by a longitudinal seam or by a section of large mesh net (116) that leads to the formation of said runoff openings (16), without compromising the mechanical strength of the composite sheets thus formed.

9. The system according to claim 1), characterised in that when the poles (1) of the rows (F) are interconnected, as well as by the longitudinal (2) and transverse (3) cables, also by supplementary transverse cables that comprise a cable (3'), for example parallel to and below said transverse cable (3) and that comprise a V-shaped cable (103), secured with the ends to the poles (1) of the adjacent rows (F) and secured with the intermediate top to the centreline of said lower transverse cable (3'), for example by means of a clamp (18), also useful for securing, in this same low area equidistant from the rows (F), an optional eaves cable (2'), parallel to the above longitudinal cables (2) of the protective structure (G') in which the sheets (4) must be able to be retracted folded in a bellows-like manner on the rows (F) of plants, but when they are extended, these same sheets must form on the rows (F) a protective roof with transverse double pitch, substantially resting on the oblique branches of
each V-shaped cable (103), each sheet (4) is substantially provided on the centreline with a longitudinal spring (19), for example lower, which with rings (20) runs on that oblique branch of said V-shaped cable (103) that starts from the fixed side (104) of the sheet, so that when the same sheet is extended, said rings (20) and said spring (19) are arranged at said eaves cable (2'), while the movable side of the same sheet is at the top of the pole (1) of the row adjacent to the row to which the fixed side (104) of the sheet is constrained and is connected to the pulling cable (7), it being provided that the supplementary transverse cables (14), positioned below each sheet (4), are secured with the opposite ends to the movable sides (204) of the consecutive sheets, passing under said spring (19), which is preferably provided with rings or other suitable guiding means (20) for these supplementary cables (14), which run below each respective longitudinal cable (2) with interposed a ring or other guiding means (80) to facilitate running.

The system according to one or more of the preceding claims, wherein the pulling cables (7) are guided with the opposite ends on opposed pulleys (8, 8') supported by poles (9, 9') positioned on the longitudinal and external sides of the system (G, G') and, after being guided on these pulleys (8, 8'), the same pulling cables (7) are guided on pulleys (10, 10'), for example anchored to the ground, and are then secured with the opposite ends to a main cable 11 that in plan view is U-shaped, with sections (111, 111') parallel to one another and to the rows (F), guided on said lower pulleys (10, 10') and connected with the ends to motorised winches (12, 12') positioned on one end of the same protection structure (G, G'), while the transverse section (211) of the same main cable (11) is positioned transversely and in the top part of the other end of the protection structure, the part without the winches (12, 12') and in which the same cable (11) is guided on aerial pulleys (13, 13'), said winches (12, 12') being synchronised with each other and arranged to alternately retract and feed sections of the main cable (11) of the same length, so that the rectilinear and opposed movement of the branches (111, 111') of this cable (11) cause the necessary simultaneous translation to the right or to the left of all the pulling cables (7) for the movement to open or close the sheets (4), or it being
provided that said main cable (11) is guided around the protection structure (G, G') so as to form a closed loop, to be operated by a single winch (12), operated manually or with an electric motor, in two directions of rotation.
INTERNATIONAL SEARCH REPORT

According to International Patent Classification (IPC) or to both national classification and IPC

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 practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
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<th>Relevant to claim No.</th>
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<td>wO 2012/175546 AI (MAGI F S A S DI CAPPI ANGELO &amp; C [IT]; CAPPI ANGELO [IT]; CAPPI ANDREA) 27 December 2012 (2012-12-27) the whole document</td>
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Further documents are listed in the continuation of Box C.

Date of the actual completion of the international search 15 February 2017

Date of mailing of the international search report 02/03/2017

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