



"Closing device with a flexible screen"

The present invention relates to a closing device comprising a flexible screen, such as an awning, whose lateral edges are guided in guide channels, thus allowing the screen to be moved between a closed position and an open position.

In a first kind of closing devices of this type known up to now with flexible screen, the lower edge of the latter is provided with a weighting bar extending over the whole width of the screen to allow the closing of the latter essentially under the weight of this weighting bar and to maintain it in a taut condition.

The presence of such a weighting bar has various non-negligible disadvantages. Thus, as a result of its inertia, the speeds of opening and closing are limited and special precautions must be taken in order to brake the upward and downward motion of the screen a sufficient amount of time before the stoppage of the latter. Furthermore, the weight of such a weighting bar necessitates a relatively large amount of energy to bring the screen into its open position. Finally, reliable safety means must be provided in the screen's control circuit in order to prevent accidents when a person or any object is below the screen during its descent towards its closed position.

In another kind of known closing devices of the type mentioned above, one provide driving means which, by the intermediary of return-pulleys, pull on the lateral edges of the screen to bring the latter into its closed position. Although, in such a kind of closing device, it is not theoretically essential to provide a weighting and stiffening bar at the lower edge of the screen, from the practical point of view, however, such a stiffening and weighting bar is generally necessary to ensure the correct functioning of the closure.

One of the main purposes of the present invention is to provide a flexible screen closing device which no longer requires such a stiffening and weighting bar.

For this purpose, according to the invention, the

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lateral edges of the screen are substantially incompressible or rendered incompressible in their lengthwise direction, driving means being provided making it possible to apply a thrust force to these edges in the longitudinal direction of the latter in their guide channels in order to move the screen towards its closed position and possibly towards its open position.

Advantageously, the screen is provided, near or on the lateral edges mentioned above, with a series of members which are substantially rigid in the longitudinal direction of these edges, these members being able to bear against one another in the direction of these lateral edges, and preferably being able to be articulated with respect to each other such as to allow the rolling up or flexion of the screen in its open position.

According to a particular embodiment of the invention, the rigid members surround the lateral edges of the screen forming a protrusion with respect to the surface of the latter, this protrusion being held in the guide channels mentioned above and moving in the latter.

According to a preferred embodiment of the invention, the screen has, in the vicinity of at least one of its lateral edges and outside of the guide channels mentioned above, stiffening means making it possible to render the above-mentioned edges substantially incompressible in their lengthwise direction, these stiffening means advantageously being formed by a notched belt integral with the screen and extending along at least one of the lateral edges of the latter, the above-mentioned driving means cooperating with the said notched belt.

The invention concerns also a closing device with the above-mentioned advantages, but not necessarily requiring lateral edges which are compressible or rendered incompressible in the direction of their movement towards their closed position, in particular along their length.

This device is characterized by the fact that the screen is substantially stretched between these guide channels

at least in the closed position of it, means being provided in order to avoid, on the one hand, the compression of the lateral edges (2) of the screen (1) in their lengthwise direction at least during the movement towards the closed position and, on the other hand, the presence of a stiffening element near the free edge of the screen on the side of the closed position.

Other details and features of the invention will emerge from the following description, given by way of non-limitative example, of several particular embodiments of the closing device according to the invention with reference to the accompanying drawings.

Figure 1 is a diagrammatic view in front elevation of a closing device with a flexible screen according to a first embodiment of the invention, the screen being in the closed position.

Figure 2 is a view along the lines II-II of Figure 1.

Figure 3 is a view along the line III-III of Figure 1.

Figure 4 is, on a larger scale, a section along the line IV-IV of Figure 1.

Figure 5 is a section along the line V-V of Figure 4.

Figure 6 is a section similar to that of Figure 5, but on a larger scale, showing certain parts in more detail of Figure 5 in a rest position.

Figure 7 is a diagrammatic view rather similar to that of Figure 4, but on a larger scale and more diagrammatic, showing certain parts of Figure 4 in more detail.

Figure 8 is a view from one side of a detail of this first embodiment on a larger scale.

Figure 9 is a view similar to that of Figure 8, but from the opposite side of this same detail.

Figure 10 is, on a larger scale, a section similar to that of Figure 6 showing the position of the lateral edge of the screen in the spiral guide channel during the unrolling of the screen.

Figure 11 is similar to Figure 10, but shows the position of the lateral edge of the screen in the spiral guide channels during the rolling up.

5 Figure 12 is a cross-section, and on a larger scale, along the line XII-XII of Figure 1.

Figure 13 is a view similar to that of Figure 12 showing the disengagement of the lateral edge of the screen from the guide channels when a force is applied to the screen in the direction of the arrow F.

10 Figure 14 is a diagrammatic side view and a section of a closing device according to a second embodiment of the invention with the screen in a partially closed position.

Figure 15 is a diagrammatic front view along the line XV-XV of Figure 14.

15 Figure 16 is a diagrammatic sectional side view, with a partial break, of a third embodiment of the closing device according to the invention with the screen in the closed position.

20 Figure 17 is a similar section to that of Figure 12 of a fourth embodiment of the invention.

Figure 18 is a similar view to that of Figure 13 of this fourth embodiment.

25 Figure 19 is, on a larger scale, a longitudinal section with partial breaks, similar to that along the line XIX-XIX of Figure 1, but of a fifth embodiment of the invention.

Figure 20 is, on a larger scale, a section along the line XX-XX of Figure 19.

30 Figure 21 is, with partial breaks, a section along the line XXI-XXI of Figure 19.

Figure 22 is a similar view to that of Figure 19 of a sixth embodiment of the invention.

Figure 23 is, on an even larger scale, a section along the line XXIII-XXIII of Figure 22.

35 Figure 24 is a similar view to that of Figure 19 of a seventh embodiment of the invention.

Figure 25 is, on a larger scale, a section along the

line XXV-XXV of Figure 24.

Figure 26 is a similar section to that of Figure 25 during assembly.

Figure 27 is a similar view to that of Figure 22 of an eighth embodiment of the invention.

Figure 28 is, on a larger scale, a section along the line XXVIII-XXVIII of Figure 27.

Figure 29 is, on the same scale as Figure 28, a section along the line XXIX-XXIX of Figure 27.

Figure 30 is a diagrammatic view of a partial horizontal section of a closing device according to a ninth embodiment of the invention.

Figure 31 is a partial diagrammatic view in cross-section of this ninth embodiment.

Figure 32 is a partial diagrammatic front view along the line XXXII of figure 31.

Figure 33 is a diagrammatic side view, with partial breaks, of an additional variant of the details of the guide channel for the lateral edges of the screen.

Figure 34 is a front view along the line XXXIV-XXXIV of Figure 33.

Figure 35 is a view similar to that of Figure 33, but in a position for the re-engagement of a lateral edge of the screen in the guide channel.

In the various figures, similar reference numbers relate to similar or identical elements.

The closing device according to the invention and of which several particular embodiments are shown in the accompanying figures, comprises a flexible screen 1 whose lateral edges 2 are guided in guide channels 3 to allow the screen 1 to be moved between a closed position and an open position. These edges are preferably protruding with respect to the plane of the screen in order to allow them to be easily maintained in the guide channels.

The term "flexible screen" should be understood to mean, within the context of this invention, any flat element able to form a closure or a separation and able to roll around



an axis or to be folded, such as an awning, a strip of plastic material, etc., intended for closing a bay, forming a separating partition, covering a swimming pool or producing a canopy. In this respect it should be noted that, according to
5 the invention, a distinct preference is given to waterproof doors comprising thus a screen which is moved between two vertical guide channels.

In general, the closing device according to the invention is characterized by the fact that the lateral edges
10 2 of the screen 1 are substantially incompressible or rendered incompressible in their lengthwise direction, in order to make it possible to apply to these edges a thrust in their longitudinal direction inside the guide channels 3 without them being able to form puckers which are capable of jamming these
15 edges in these guide channels. Thus, drive means 4 are also provided making it possible to act on these edges 2 in their guide channels 3 in order to move the screen 1 into its closed position and if necessary into its open position.

According to the invention, the drive means 4 are
20 arranged in such a way as to make it possible to create a thrust force on the lateral edges 2 of the screen 1 in the longitudinal direction of the latter, thus causing the movement of the screen towards its closed position, as shown in Figure 1.

In the embodiment shown in Figure 1, the opening of
25 the screen 1 is caused by a spring 31 fixed between the free end of a belt 32 and a fixed point on the base 33. When the screen 1 is being closed, this belt 32 winds on a pulley 34 fixed to a drive shaft 20 which is driven by a motor reduction
30 unit 36, the latter being controlled from a control box 37. In this way, the spring 31 becomes stretched when the screen 1 is in its closed position, as shown in Figure 1. This allows thus the rolling up automatically of the screen towards its open position when it is unlocked from this closed position.

35 In this embodiment, the screen 1 is formed by an awning with three windows 38 made from a transparent plastic material and which is rolled up in its open position inside a

box having a square cross-section 39 and closed at its two ends by cheeks 40.

These two cheeks 40 have, in their internal surfaces which face one another, spiral guide channels 18, as shown in detail in Figures 4 and 5.

As shown in Figure 4, these spiral guide channels 18 extend in the prolongation of the straight guide channels 3.

In the first embodiment of the closing device according to the invention, shown in more detail in Figures 4 to 13, the screen 1 is provided, at its lateral edges 2, with a series of protruding members 5 which are at least rigid in the longitudinal direction of these lateral edges 2. These members 5 bear against one another in this longitudinal direction and are articulated with respect to one another, in such a way as to allow the rolling up of the screen 1 inside the box 39, when it is placed in its open position.

As shown in particular in Figures 8 to 13, these rigid members 5 surround the lateral edges 2 of the screen 1 forming a protrusion 6 on either side with respect to the plane of the latter and sliding with a certain friction in the guide channels 3 and 18, in order to prevent the screen from moving between the open position and the closed position under its own weight. An advantage of this is that no special braking means at the ends of travel of the screen are needed.

In this same embodiment, the lateral edges 2 of the screen 1 have a substantially continuous bead 7 around which the rigid members 5 are fixed.

Advantageously, this bead comprises a hollow pipe 8 able for example to contain a fluid or an electric current conductor.

In the embodiment shown in Figures 6 to 13, this pipe contains a gas, such as air 41, of any pneumatic safety system which is not shown. Such a pipe 8 is thus perfectly protected both by the rigid members 5 and by the guide channels 3 in which these members are moved.

In the first specific embodiment shown in Figures 6 to 13 in particular, the rigid members 5 are like protruding

sleeves 6 having in their wall a longitudinal slot 9 through which the screen 1 emerges from the sleeves, thus defining two flanges 10 and 11 extending on either side of the latter. The flange 10 has a length in the direction of the lateral edges 2 of the screen which is less than that of the other flange 11, such that a gap 12 is formed on one side of the screen 1 between two consecutive members 5, thus allowing the flexion of the edge 2 transversely in the plane of the screen on the above-mentioned side (see Figure 9). The other flanges 11 of these members 5 bear against one another end-to-end in the longitudinal direction of these lateral edges 2 of the screen 1 (see Figure 8).

More precisely, in this embodiment, the shortest flange 10 of the rigid member 5 has a length equal to half that of the other flange 11 and is located symmetrically with respect to the other flange 11, in such a way as to form, facing the latter and on either side of the shortest flange 10, a gap 12, having a length which is a quarter of that of the flange 11.

Figure 7 shows, in a diagrammatic way, the behaviour of these specific rigid members 5 during the rolling up of the screen. It can be seen that the rolled lateral edges can pucker freely in the gaps 12, thus facilitating their flexion.

The fact that the flange 10, located on the side of the centre of curvature of the spiral guide channel 19, is shorter than the opposite flange 11 of the rigid members 5, makes it possible, furthermore, to prevent the movement of these members 5 over the lateral edges 2 of the screen 1 during the rolling up of the latter into its open position. In fact, as shown clearly in Figure 7, two consecutive rigid members are articulated about the neutral axis of the lateral edges 2 whilst remaining in contact with each other at the place 11' located on this neutral axis.

As one can see in Figures 6, 10 and 11, the sleeves 6 have a rectangular cross-section and are fitted with a certain transverse play with respect to the screen 1 in the guide channels 18. Thus, a certain translation movement of the

edges 2 of the screen is possible in the plane of the flanges 40.

Furthermore, as a result of the rectangular shape of the cross-section of the protrusion 6 and of the corresponding
5 shape of the inside of the guide channels 18, the angular movement of the rigid members 5 inside these guide channels is very small and comprises at most 10° about the central axis 25 of the latter.

Moreover, the radial distance between the turns of
10 the guide channels 18 is such that, in the rolled up position, the superimposed layers of the rolled up screen do not touch each other, as shown clearly in Figures 4 to 7. Furthermore, it may be important to stretch the screen 1 between the flanges 4. An important advantage of this is that the windows 38 are
15 prevented from being scratched during the rolling up of the screen.

The spiral guide channels 18 delimit a substantially tubular channel 22, preferably of polygonal cross-section, with in its wall 23, on the side towards the screen 1, a
20 longitudinal slot 24 for the passage of the latter.

The central spiral axis 25 of this channel 22 is located in the plane of symmetry of the slot 24, whilst the screen extends in the plane 27.

Figure 10 shows the position of the rigid members 5
25 in the guide channels 18 during the unrolling of the screen towards its closed position. The centre of curvature, which is located on the axis 17, is in this case on the right hand side of Figure 10. Thus, the lateral edges 2 of the screen 1 are applied against the outer surface of the guide channels with
30 respect to this centre of curvature.

Conversely, during the rolling up of the screen 1, the rigid members 5 undergo a movement in the opposite direction, as shown in Figure 10. In this case, the lateral edges 2 of the screen 1 are therefore applied against the inner
35 surface of the guide channels 18, on the side near the previously mentioned centre of curvature.

These different arrangements of the rigid members 5

make it possible to prevent the latter from being moved over the lateral edges 2 of the screen 1 during its rolling up and unrolling.

As shown in Figures 4 and 5, when, in the open position, the screen is rolled up as a spiral, the driving means 4 comprise, in the vicinity of the cheeks 40, inside the box 39, a telescopic arm 19 working in conjunction with the upper end of the lateral edges of the screen 1.

This telescopic arm 19 is mounted transversely on a drive shaft 20 extending along the previously mentioned axis 17 and is fixed to a bar 21 parallel to this shaft 20. This bar works in conjunction with the end of the lateral edges 2 of the screen, which are engaged in the spiral guide channels 18 through a connecting part 35, on the one hand fixed to the transverse edge 41 of the screen 1 and, on the other hand, sliding in a longitudinal groove 42 of this bar 21.

More precisely, the telescopic arm 19 comprises two parallel U-shaped guide parts 43, fixed on either side of the shaft 20, in which are slid square cross-section tubes 43, of which one of the ends is rendered integral with the bar 21, which also consists of a square tube.

Thus, in order to move the screen 1 in the direction of the arrow 45, that is to say in order to bring the screen into its closed position, the shaft 20 is rotated in the direction of the arrow 46 by the motor 36 and the connecting part 35 pushes on the lateral edge 2 in its lengthwise direction, whilst the bar 44 undergoes a movement in the direction of the arrow 47. If necessary, the connecting part 35 can slide along the groove 42 of the bar 21 during the unrolling of the screen.

The opening of the screen can be caused either by the spring 31, as already described above, or by driving the shaft 20 in the direction opposite to the arrow 46.

Advantageously, as shown in more detail in Figures 12 and 13, the straight guide channels 3 comprise a U-shaped profile 48 made from a semi-elastic material, to allow that when a traction force is applied to the screen 1 in the

direction of the arrow F exceeding a certain limit, the lateral edges 2 of the screen can be disengaged from the guide channels 3. Such a force could for example result from the fact that a vehicle catches onto the screen 1 whilst the latter is still in its closed position.

By means of the access passage 49, which have each of the guide channels at the entrance of the box 39, when a lateral edge 2 is disengaged from its guide channel 3, as shown in Figure 13, during the movement of the screen in the direction opposite to the arrow 45, this edge automatically re-engages through this access passage 49 into its guide channel, at the entrance of the box 39 (see Figure 4).

Such technical measures were the subject of European Patent 272.733.

The base of the U-shaped profile 48 is held in a metal support 50 also having a U-shaped cross-section.

These supports 50 are advantageously mounted on elastic elements which are not shown. Such an assembly system was the subject of European Patent N° 92909384 of the same applicant.

Figures 14 and 15 show, very diagrammatically, a second embodiment of the closing device according to the invention.

In this embodiment the lateral edges 2 have the appearance of an articulated chain moving in the guide channels 3.

The straight guide channel 3 is interrupted before the entrance of the box 40 and, at this place of interruption, on either side of the lateral edge 2, driving means 4 are provided. These driving means comprise two pairs of toothed wheels 51 over which moves an endless belt 52 externally provided with teeth able to engage in the links of the articulated chain 15.

For the sake of clarity, in Figure 15 only the axes of rotation 55 of the toothed wheels 51 are represented.

Another difference of this second embodiment with respect to the first one is that, inside the box 39, the screen

is folded in zig-zag formation when it is brought into its open position.

Figure 16 is a simplified representation of a third embodiment of the closing device according to the invention.

5 In this embodiment, the screen 1 is brought into a horizontal open position, being guided along a ceiling 53 in guide channels 18, after having undergone a 90° deflection. Furthermore, the driving means 4 comprise an endless chain transmission 16 able to move along the horizontal section of
10 the guide channels 18 with a backward and forward motion, as indicated by the arrows 54. A connection piece 35 is provided between the upper end of the lateral edges 2 of the screen and the chain 16, thus making it possible to move the screen between its open position and its closed position during the
15 movement of the chain 16.

 In an interesting variant of this embodiment, the chain 16 can be fixed to the upper end of the lateral edges 2 and can also be guided in the guide channels 18 in such a way that can be pushed on this end, in the axis of these edges 2,
20 in order to bring the screen into its closed position.

 Figures 17 and 18 show a fourth embodiment of a closing device according to the invention which differs from the preceding embodiments as a result of the straight guide channels 3 and the rigid members 5.

25 In this fourth embodiment, the rigid members are formed by clips, preferably metallic, having the shape of a U in which the free ends of the flanges 10 and 11 form sections curved towards the exterior 10a and 11a which are, as shown in Figure 17, fitted into an internal hollow 56 formed near the
30 outer edge of the guide channels 3.

 Furthermore, these members 5 have, between these curved sections 10a and 11a and their protruding end 6, clamped around the bead 7 of the screen, a stamped part 57 serving as a support for the various members 5 against one another on the
35 lateral edges 2 of the screen, inside the guide channels 3.

 When a traction force, in the direction of the arrow F, is applied to the screen 1, the lateral edges 2 can

disengage from their guide channels 3 due to the fact that the curved sections 10a and 11a elastically bend towards the inside, as shown in Figure 18.

5 Figures 19, 20 and 21 relate to a particularly interesting fifth embodiment of the invention, which differs basically from the preceding embodiments by the fact that the rigid members 5, fixed to the lateral edges 2 of the screen 1, work in conjunction with one other by the intermediary of a ball-joint coupling 28.

10 In this particular embodiment this ball-joint coupling comprises a spherical seating 29 at one of the ends of the rigid member 5 and a pivot with a spherical head 30 at the opposite end of this rigid member 5. The head of the pivot 30 of a rigid member is articulated in the seating 29 of the
15 following adjacent rigid member, as shown clearly in Figure 21.

 Furthermore, as well the seating 29 as the pivot 30 are split in the lengthwise direction of the edges 2. Thus, by pressing the pivot 30 in its corresponding seating 29, the pivot is lightly compressed whilst the seating can undergo a
20 certain expansion, in order to ensure a reliable fixing of two successive rigid members with respect to one other, whilst allowing to articulate the latter in all directions. The nature of this compression and this expansion depends of course on the materials of which the member 5 is made.

25 When the lateral edges 2 of the screen 1 are provided with a bead 7, as is the case in the present embodiment, the rigid members 5 extend as well together with their pivot 30 as with their corresponding seating 29, around the bead 7, as shown clearly in Figure 20.

30 Figures 22 and 23 relate to a sixth embodiment of the closing device, according to the invention, which basically differs from the preceding embodiment by the fact that each rigid member 5 is provided with two rollers 26, thus making it possible to reduce considerably the friction of the lateral
35 edges 2 during their movement in the guide channels 3.

 Figures 24 to 26 relate to a seventh embodiment of the invention relatively simple with regard to the fixing of

the rigid members to the lateral edges 2 of the screen.

This embodiment basically differs from the preceding embodiments by the fact that no special finishing is provided on the lateral edges 2. For example, unlike the case in
5 practically all the preceding embodiments, a bead is not provided.

Moreover, in this embodiment, the rigid members 5 with ball-joint coupling 28 are formed from two flanges 10 and 11 articulated with each other at 59. As shown clearly in
10 Figures 25 and 26, these two flanges are fixed rigidly on either side of the lateral edges 2 of the screen. For this purpose, the surface of the flange 10 facing the flange 11 is provided with pins 14 which pierce the lateral edges 2 of the screen 1 to penetrate into and become fixed in corresponding
15 holes 60 provided in the facing surface of the flange 11.

These members 5 may, for example, be made from a plastic material which is relatively hard, but being elastic enough to allow the pins 14 to be fixed elastically into the holes 16. If necessary, the points 61 of the pins 14 may be
20 provided with a metal cap, which is not shown, to facilitate the piercing of the lateral edges of the screen 1.

Figures 27 to 29 relate to an eighth embodiment which differs from that in Figures 19 to 21 by the fact that the ball-joint coupling 28 comprises, between each rigid member 5,
25 a split ball 62 partially engaging in a corresponding seating 29 provided at the two opposite ends of each rigid member 5. These are seatings similar to those provided in the embodiment shown in Figures 19 to 21.

Figures 30 to 32 relate to a ninth embodiment of the
30 closing device according to the invention.

This embodiment basically differs from the preceding embodiments in that use is made of a screen 1, of which the lateral edges 2 are not necessarily incompressible in themselves in their longitudinal direction, but are rendered
35 incompressible indirectly by the presence of a stiffening zone 1' which extends in the vicinity of these lateral edges 2, outside of the guide channels 3.

This has, in particular, the advantage that special precautions do not have to be taken in the making of these lateral edges 2 and that one can, for example, make use of lateral edges formed by a simple bead or by a series of small rigid juxtaposed blocks articulated with respect to each other, as for example described and shown in European Patent 272.733.

Thus, in general, the phrase "lateral edge rendered incompressible" used in the present text denotes any type of lateral edge which, combined with a stiffening zone, located either outside the guide channels or inside the latter, makes it possible to prevent that, when a thrust is applied to this edge or to this stiffening zone 1' in the direction of closing the screen, this edge can deform and jam in these guide channels or create excessive friction forces which would jeopardize the correct functioning of entire closing device.

In more concrete terms, in this ninth embodiment, the above-mentioned stiffening zone 1' is formed by a notched belt fixed to the screen 1, whilst the driving means comprise a notched pulley 4 rotating about an axis 4' and engaging with the notched belt 1'. A pressure roller 4" is applied elastically against the screen 1 on the side opposite the latter with respect to the notched belt 1', in such a way as to ensure perfect engagement between the latter 1' and the pulley 4.

With regard to the lateral edge 2, the latter is formed by the small blocks of one of the parts of a known zip fastener which therefore has a certain compressibility in itself in its longitudinal direction, but which is rendered substantially incompressible, within the meaning given above.

As a variant of this ninth embodiment, it is possible to envisage replacing the small blocks of a zip fastener in the lateral edges for example with a notched belt which would therefore be simultaneously a part of the driving means and of the lateral edge 2 itself of the screen 1 moving in the guide channels 3.

Figures 33 to 35 relate to an improvement applied to the access passage 49 for the automatic reinsertion of a

lateral edge 2 of the screen 1 which has become disengaged from the lower section of the guide channels 3 (see Figure 4 on this matter).

5 It concerns an improvement which is particularly useful for the lateral edges of screens according to the embodiments shown in Figures 19 to 32.

10 Indeed, in certain cases, if in the access passage 49 the lateral edges 2 are not supported when the latter are pushed towards the closed position, that is to say in the direction of the arrow 45, as is the case in the embodiment shown in Figure 4, as a result of the friction of these edges in the guide channels, there is a risk that these edges will undergo a slight flexion at the position of the access passage 49 causing them to come out of the guide channels 3.

15 The improvement, according to the invention, consists in interposing, in the access passage 49, between the two separate fixed portions 3a and 3b of the guide channels extending in the prolongation of one another a mobile guidance connector 58, which is articulated at its upper edge, by the intermediary of hinges 64, with the portion 3a of the guide channels 3, in such a way as to be able to pivot between a first position, in which this connector 58 extends in the prolongation of the portions 3a and 3b of the guide channels, as shown in Figure 30, and a second position, in which its lower opening is directed outside of the guide channels 3, as shown in Figure 35.

A spring 65 makes it possible to retain the connector in or to return it to the said first position.

20 Thus, when, for any reason, the lateral edges 2 of the screen 1 are disengaged from the portion 3b of the guide channels during the movement of the screen towards its open position, as indicated by the arrow 66 in Figure 34, the connector 58 will automatically be brought into the said second position in order to thus allow the reinsertion of this edge 2 into portion 3a of the guide channel 3.

35 When the lower transverse edge of the screen and of these lateral edges 2 arrive at the position of the connector

58, or eventually above the latter, it automatically takes up its initial position again, as shown in Figure 33. In order to then bring the screen into its closed position, these lateral edges will be perfectly guided over the whole length of the guide channels, thus avoiding any risk of obstruction or disengagement of these edges at the position of the access passage 49.

10 In order to ensure perfect continuity in the guide channels and the connector 58, in its first position, the latter has advantageously an internal cross-section identical to that of the fixed portions 3a and 3b of the guide channels in order to form an entirely continuous guide channel.

15 It should also be noted that in Figures 33 and 34, the lateral edges 2 of the screen 1 have not been shown so that it can be assumed that the screen is in its open position. Conversely, in Figure 35, the representation of a lateral edge is restricted to the showing of rigid members 5 cooperating with each other by the intermediary of balls 62, as in the lateral edges of the embodiment shown in Figures 27 to 29.

20 An interesting variant of the closing device according to the invention consists in providing, by way of means which make it possible to prevent the compression of the lateral edges 2 of the screen 1 in their lengthwise direction at least during the movement of the latter towards its closed position, a driving mechanism comprising for example a cable and return pulleys applying traction on these lateral edges in order to cause the closing of the screen. In this variant, it is not necessarily that the lateral edges 2 are incompressible or rendered incompressible in their lengthwise direction.

30 Furthermore, in this variant, the screen is stretched between the guide channels 3, in which these edges move, at least when it is in its closed position.

35 This has the big advantage that, in this way, it is also possible to avoid the use of a stiffening element, for example in the form of a rigid bar, near the lower free edge of the screen 1. In this case, the screen should preferably be entirely flexible, without any transverse stiffening element.

It goes without saying that the invention is not limited to the various embodiments described above and shown in the accompanying figures, but that many other variants may still be envisaged without moving beyond the scope of the present invention.

Thus, the lateral edges 2 of the screen 1 could be rendered substantially incompressible in their lengthwise direction by providing, near these edges, a series of rigid plates fixed to the screen and located outside the guide channels or by fixing to the screen 1 a strip of reinforced fabric in the direction of the movement of the screen, thus preventing, in this zone and therefore also at the lateral edges, the screen from puckering, when a thrust force is applied, in the direction of closing the screen, either directly on the lateral edges or on this reinforced strip. In this case, the lateral edges may simply be formed by the bead 7, for example.

In still other cases, the lateral edges could be rendered substantially incompressible in their lengthwise direction by introducing in the latter a series of balls somewhat like the balls 62 of the embodiment shown in Figures 27 to 29. If necessary, these balls could be inserted in the hollow pipe 8, which would form a cover for these balls and which, in this case, would have a cross-section a little larger than that of the embodiments shown in the accompanying figures.

Another variant could consist in providing small rigid blocks, which would for example be moulded on the lateral edges of the screen, for example like the teeth of a zip fastener, between which there would be a flexible but incompressible seal.

Furthermore, it is not essential that the shaft 20 should extend over the entire length of the screen. In an extreme case, this shaft may be formed by two coaxial sections in the vicinity of the lateral edges of the screen for driving the telescopic arm 19. Also, if other driving means 4 are used, which do not necessitate such a shaft 20, as for example in the case in the embodiments shown in Figures 14 to 16, such a shaft

could be omitted.

Furthermore, in the absence of a drive shaft, the screen does not necessarily have to roll up but may, for example, move in any slanted, horizontal or vertical plane from
5 its closed position towards its open position.

If the screen moves between its open position and its closed position in the same plane, the lateral edges do not necessarily have to be flexible.

The invention is also not limited to screens which
10 move in a vertical plane, but also relates to screens moving horizontally, for example in order to cover swimming pools or silos.

In certain cases, the rolling up of the screen may be carried out from the lower edge, thus contrary to the
15 embodiments shown in the accompanying figures.

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CLAIMS

1. A closing device comprising a flexible screen, of which the lateral edges (2) are guided in guide channels (3) in order to be able to be moved between a closed position and an open position, characterized in that the said edges (2) are substantially incompressible or rendered incompressible in the direction of their movement towards the closed position, particularly in their lengthwise direction, driving means (4) being provided making it possible to apply a thrust force on these edges (2) in the longitudinal direction of the latter in their guide channels (3) in order to move the screen towards its closed position.

2. A device according to Claim 1, characterized in that the screen (1) is provided, at or in the vicinity of the above-mentioned lateral edges (2), with a series of substantially rigid members (5) along the longitudinal direction of these lateral edges (2), these members (5) being able to bear against one another, in the direction of these lateral edges (2) and preferably being able to be articulated with respect to each other in order to allow the screen (1) to be rolled up or flexed in its open position.

3. A device according to Claim 2, characterized in that the rigid members (5) surround at least partially the lateral edges (2) of the screen (1), forming a protrusion (6) with respect to the surface of the latter, this protrusion being held in the previously mentioned guide channels (3) and moving in the latter.

4. A device according to Claim 3, characterized in that the previously mentioned rigid members (5) comprise rollers (26) held in and rolling inside the previously mentioned guide channels.

5. A device according to Claim 3 or 4, characterized in that the lateral edges (2) of the screen (1) have a section (7) with the appearance of a substantially continuous bead around which are fixed the previously mentioned rigid members (5).

6. A device according to Claim 5, characterized in



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that the section (7) of the lateral edges (2) with the appearance of a bead comprises a hollow pipe (8) containing for example a fluid, an electrical current conductor or incompressible balls (62).

5 7. A device according to any one of Claims 4 to 6, characterized in that the rigid members (5) are like sleeves (6) having in their wall a longitudinal slot (9) through which the screen (1) extends, thus defining two flanges (10 and 11) extending on either side of the latter, one of these flanges
10 (10) having a length in the direction of the lateral edges (2) of the screen (1) less than that of the other flange (11), such that a gap (12) is formed on one side of the screen (1) between two consecutive members (5), thus allowing the flexion of the edge (2) transversely to the plane of the screen (1) on the
15 above mentioned side, the said other flanges (11) of the successive members (5) being able to bear end to end against one another in the longitudinal direction of the lateral edges (2) of the screen (1).

20 8. A device according to any one of Claims 2 to 7, characterized in that two successive rigid members (5) fixed to the lateral edges (2) of the screen (1) work in conjunction with each other by the intermediary of a ball-joint coupling (28).

25 9. A device according to Claim 8, characterized in that the ball-joint coupling (28) comprises a spherical seating (29) at one end of the rigid member (5) and a pivot with a spherical head (30) at the opposite end of this rigid member (5), the head of the pivot (30) of a rigid member (5) being articulated in the seating (29) of the following adjacent rigid
30 member (5).

 10. A device according to Claim 9, characterized in that the pivot (30) is split in the longitudinal direction of the lateral edges (2) in order to be able to be compressed elastically in the seating.

35 11. A device according to Claim 10, characterized in that the pivot (30) extends around the bead (7) provided at the lateral edges (2) of the screen.



12. A device according to any of Claims 3 to 11, characterized in that the section (6) of the previously mentioned rigid members (5) moving in the guide channels (3) has a substantially polygonal cross-section, the latter having
5 an internal cross-section corresponding to that of the said section (6).

13. A device according to any of Claims 3 to 12, characterized in that the previously mentioned lateral edges (2) of the screen (1) are fitted with a certain play in the
10 previously mentioned rigid members (5).

14. A device according to any of Claims 1 to 3, characterized in that the lateral edges (2) of the screen (1) are provided with a series of identical rigid small blocks (5) separated from each other by a seal (13) made of a flexible and
15 substantially incompressible material protruding with the small blocks with respect to the screen (1).

15. A device according to any of Claims 2 to 14, characterized in that the previously mentioned members (5) provided at the lateral edges (2) of the screen (1) have an
20 elastic section (10a, 11a) in a direction transverse to the plane of the screen (1) and sliding in the previously mentioned guide channels (3) so that, when a certain traction is applied to these members (5) in the plane of the screen (1), this section (10a, 11a) compresses elastically and allows the edges
25 (2) of the screen (1) to disengage from its guide channels (3).

16. A device according to any of Claims 8 to 15, characterized in that the rigid members (5) are formed by two flanges (10) and (11), articulated with each other, which can be fixed on either side of the lateral edges (2) of the screen
30 (1), preferably by pins (14) penetrating into the surface of the latter.

17. A device according to any of Claims 1 to 16, characterized in that the screen (1) has, in the vicinity of at least one of its lateral edges (2), and outside the
35 previously mentioned guide channels (3), stiffening means flexible in the direction of movement of the screen (1) making it possible to render the previously mentioned lateral edges



(2) substantially incompressible in their lengthwise direction.

18. A device according to Claim 17, characterized in that the previously mentioned stiffening means comprise a notched belt (1') integral with the screen (1) and extending
5 along at least one of the lateral edges (2) of the latter, previously mentioned driving means working in conjunction with the said notched belt.

19. A device according to Claim 18, characterized in that at least one of the lateral edges (2) moving in guide
10 channels is formed by a series of close small blocks articulated with respect to each other, substantially in the same way as in a zip fastener, the previously mentioned driving means (4) comprising teeth or protrusions that can penetrate between two consecutive small blocks in order to thus engage
15 with this lateral edge.

20. A device according to any of Claims 1 to 17, characterized in that the screen (1) has, at its lateral edges (2) or in the vicinity of the latter, an articulated chain (15) parallel to these edges (2), the previously mentioned driving
20 means (4) comprising teeth able to engage with this chain (15).

21. A device according to any of Claims 1 to 20, characterized in that the driving means (4) comprise a transmission (16) able to be moved along the guide channels (18) or in the latter, with a backward and forward motion and
25 working in conjunction with the lateral edges (2) of the screen (1), in order to make it possible to move the latter between its open position and its closed position.

22. A device according to any of claims 1 to 21, characterized in that, when the screen (1) in its open position
30 is rolled up around an axis (17), the guide channels (3) extend around this axis (17) in the form of a spiral (18) in a plane perpendicular to the latter, in order that, in the open position, the lateral edges (2) of the screen (1) are held in these spiral guide channels (18).

23. A device according to Claim 22, characterized in that the radial distance between the turns of the spiral guide
35 channels (18) is such that, in the rolled up position, the



superimposed layers of the screen do not touch each other.

24. A device according to Claims 22 or 23, characterized in that the rigid members (5) are fitted in the spiral guide channels (18) so that they can undergo an angular
5 movement of at most 10° about the central axis (25) of the latter during their movement along this axis.

25. A device according to Claim 23 or 24, characterized in that the driving means (4) comprise at least one telescopic arm (19) cooperating with the end of the lateral
10 edges (2) of the screen (1) on the side of the previously mentioned axis (17) and rotating about the latter.

26. A device according to Claim 25, characterized in that the telescopic arm (19) is mounted transversely on a drive shaft (20) extending along the previously mentioned axis (17)
15 and is fixed to a bar (21) parallel with this shaft (20), the latter cooperating with the lateral edges (2) of the screen (1) engaged in the spiral guide channels (18) preferably by the intermediary of a connecting part (35), on the one hand fixed to the screen (1) and, on the other hand, sliding with respect
20 to this bar (21).

27. A device according to any of Claims 1 to 26, characterized in that the guide channels comprise two separate fixed portions (3a) and (3b) extending in the prolongation of one another, a mobile guide connector (58) being interposed
25 between these two portions and being articulated by the edge of one of its openings with the portion (3a) located towards the open position of the screen, in order to be able to pivot between a first position, in which this connector (58) extends in the prolongation of these two portions (3a) and (3b) of the guide channels (3) and a second position, in which it is
30 orientated by its opposite opening outside the guide channels in order to allow the reinsertion (during the movement of the screen towards its open position) of the lateral edges (2) of the screen (1), which might have become disengaged from the other portion (3b) of the guide channels, means (65) being
35 provided on the one hand to hold in and bring the connector (58) into said first position when the lateral edges (2) of the



screen are moving in their guide channels and, on the other hand, to allow this connector to pivot towards said second position for the reinsertion of the edges (2) which might have become disengaged from their guide channels (3).

5 28. A device according to Claim 27, characterized in that the connector (58) has an internal cross-section identical to that of the fixed portions (3a) and (3b) of the guide channels, so that when the connector (58) is in the above-mentioned first position, it forms with these portions a
10 continuous guide channel.

 29. A closing device, in particular according to any of Claims 1 to 28, comprising a flexible screen (1), of which the lateral edges (2) are held and guided in guide channels (3) in such a way as to make it possible to move the screen (1)
15 between a closed position and an open position, characterized in that the screen is substantially stretched between these guide channels at least in the closed position of the latter, means being provided making it possible to avoid, on the one hand, the compression of the lateral edges (2) of the screen
20 (1) in their lengthwise direction at least during the movement towards the closed position and, on the other hand, the presence of a stiffening element in the proximity of the free edge of the screen towards the closed position.

 30. A device according to any of Claims 1 to 29,
25 characterized in that the lateral edges (2) of the screen (1) are held by friction in their guide channels, in such a way as to prevent the screen from being moved under its own weight between its open position and its closed position when the screen does not extend horizontally.

This Sheet Has Been Replaced



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REPLACED