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(54) **FIRE PROTECTION CLOSURE SYSTEM OF THE FIRE CURTAIN TYPE EQUIPPED WITH A MANTLE WITH INSULATING CHAMBER**

(57) The present invention relates to a dry fire protection closure system of the fire curtain type (1) characterized in that the chamber (12) of the mantle (4) is enclosed by the fireproof surfaces (5) which form it, which are kept stably spaced and tensioned, even under the thrust of the hot air which tends to inflect them in case of fire, under the weight of a tensioner roller (9) inserted inside the chamber generated by the diverter rollers (6, 7). The tensioner roller is equipped with side hubs (10) and bearings (11, 18), which, sliding on a pair of side guides (3), ensure an easy and quick closing in case of a fire emergency. The fire protection mantle (4) is preferably made with a single fireproof surface (5) folded into two, so as to roll up the tensioner roller (9), and sewn on the opposite free ends thereof, so as to be insertable into the spinner (14) of a motorized roller (8). The fire protection closure system (1) thus made may be used, usually open, as a fire protection closure system (1) adapted, in case of a fire emergency, to quickly block compartments, sealingly resistant to smoke and fire, as well as, usually closed, as a valid and alternative closing means for delimiting commercial and industrial areas.

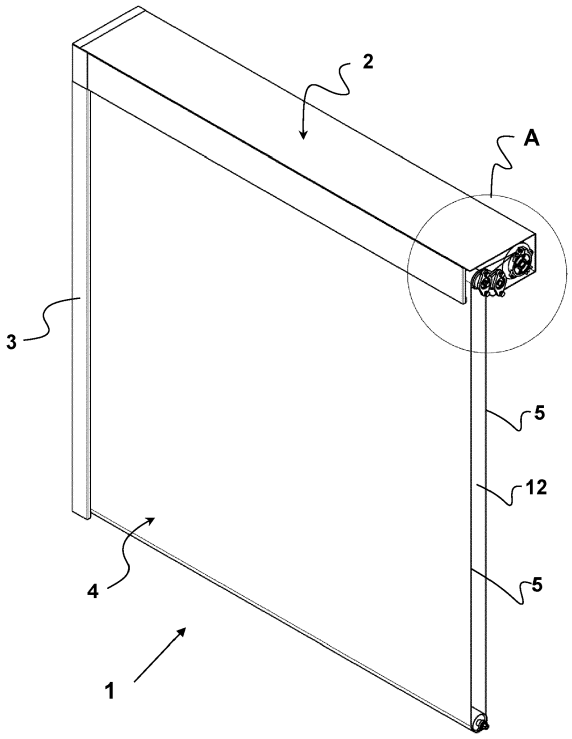

Fig.3

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Description

[0001] The present invention relates to a fire protection closure system of the fire curtain type equipped with a mantle with insulating chamber for commercial and industrial applications.

[0002] The present fire protection closure system is totally innovative and inventive, since it was created as an original technical solution to solve the issues which have not been resolved so far by the background art.

[0003] The above is understandable to a person skilled in the art if it is noticed that, first of all, nowadays, fire protection closure systems of the fire curtain type must comply with the product standard UNI EN 16034 "Pedestrian doorsets, industrial, commercial, garage doors and openable windows - Product standard, performance characteristics - Fire resisting and/or smoke control characteristics" of October 23, 2014, having said standard now passed the transitional period ending last November 1, 2019, date from which it is possible to mark as CE all the fire closure systems and elements which were already previously compliant with harmonized standards, including, *inter alia*, the other regulatory requirements to be necessarily applied for the correct design and production thereof also in compliance with safety standards.

[0004] In fact, said standard, independently of the material, identifies the safety and performance requirements applicable to all products suitably used for making the mantle and the other necessary components, both as a function of the predisposition thereof at resisting contact with fire and/or at controlling smoke as a sealed barrier, so as to be appropriately used on the escape routes themselves in case of a fire for separating well-delimited areas in EIW compartments (fire endurance "E", heat insulation "I", radiation resistance "W"), since they may be efficiently used due to the predisposition thereof at resisting fire and at controlling and delimiting heat with an hermetic seal and at insulating even from toxic fumes and vapors usually present in the event of a fire.

[0005] Therefore, the CE mark for said systems is now possible, provided that tests are carried out at a certified lab, relating to:

- smoke, heat and fire resistance, according to UNI EN 1634-1:2018 which regulates "Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware - Part 1: Fire resistance test for door and shutter assemblies and openable windows";
- mechanical, electrical and performance safety, according to the product standard UNI EN 13241:2016, governing "Industrial, commercial, garage doors and gates - Product standard, performance characteristics".

[0006] By applying said European standards, therefore, a harmonized procedure at Community level has finally been defined, which eliminates all the constraints previously imposed by the individual member nations, which, in the past, had bureaucratized the marketing and free movement in EU countries of protection closure systems adapted to resist smoke, heat and fire, since they were subject to national ministerial approvals.

[0007] Meanwhile, on the world market, and in particular in the USA and in the UK, products similar to curtains and/or technical closures have been created, which, using materials particularly resistant to the direct action of fire and the relative heat, as well as made following particular precautions for the correct insulation and seal of fumes during the fire, are now widely appreciated for creating barriers to the propagation of smoke (and partly also of heat and fire) in case of a fire. They are installed along the escape routes and are often particularly effective, where the high concentration of people, during the start of a fire, may obviously constitute an undesired increase in evacuation times.

[0008] Smoke curtains, therefore, are preferred today, since they constitute the first line of defense in case of the start of a fire, and are usually connected to automatic smoke and heat detection systems, which activate the quick closing thereof immediately after the activation of an alarm device of both the light and sound type, warning about the danger of the start of the closing step.

[0009] Smoke curtains are usually applied along the ceiling or inserted in the false ceilings of attics and descend automatically in quick mode if they have been alerted in time about the fire itself by the smoke detection devices, leaving a clear passage of about two meters.

[0010] Fire curtains are also applied along the ceiling or inserted in false ceilings and descend automatically in quick mode if they have been alerted in time about the fire itself by the heat detection devices, until they completely close the passage, creating the insulation of the compartment during the fire.

[0011] The latter are generally installed in public places with a high concentration of people, such as airports, shopping malls, shops, museums, railway stations, libraries, multi-cinema halls, high-flow escalators and moving walkways, congress buildings, sports halls and other highly crowded environments.

[0012] Known fire curtains are usually equipped, at the bottom, with a terminal device adapted to adhere to the floor, so as to achieve a seal against fumes also on the ground, as well as in the lintel and along the guides of the curtain itself; known fire curtains are also further equipped with U-shaped side guides, rolling up on a motorized hollow tube, controlled by a control panel operated by the system for detecting the smoke and heat of the fire start.

[0013] The main disadvantage of known smoke and fire curtains and systems (apart from said limits in the certifications due to said legislative issues), nowadays, consists of the fact that they are built with a sheet, which, although provided with such fireproof properties as to obtain a good flame resistance performance (E), has a minimized capacity in insulation (I) and radiation imped-

ance (W) performance, unless additional applications of water blades are made with sprinkler systems.

[0014] A further disadvantage of the background art is inherent in the fact that, in the case of a mantle formed by a double sheet with an internal chamber, the cavity created does not remain stable during the attack of the fire, since the pressure generated by the heating of the air produces a sail effect on the double-sheet mantle itself, creating, due to the thrust, an undesired contact between the two sheets (and, therefore, the elimination of the volume of the cavity itself), inexorably compromising the insulation. In this regard, it should be noted that the standard performance in case of a fire required from protection closure systems adapted to create efficient compartments is equal to EI60 or EI90 or EI120.

[0015] In a few cases, some manufacturers have used a double curtain which rolls up on separate rollers to double said limited insulation and radiation performances, without however solving the further disadvantage of the simultaneous doubling of costs for the end user.

[0016] A further disadvantage of said fire curtains is that, for how they are made nowadays, they are not capable of forming technical closures delimiting a commercial area, preventing the access thereto by the public, since the sheet is extremely flexible and may be easily passed with a simple manual pressure.

[0017] It is, therefore, the object of the present system to solve said issues and disadvantages of the background art, by designing and implementing an innovative dry fire protection closure system of the fire curtain type equipped with a mantle with insulating chamber for commercial and industrial applications, which is provided with better integrity, insulation, radiation and smoke endurance performance, minimized costs and which may also fulfill, in case of normal operation and not in case of a fire emergency, the task of delimiting a commercial area in the same way as a technical closure.

[0018] It is another object of the present system to use materials and components which, with the same construction and operational features, have a minimized cost, an environmental impact index which is possibly also minimized with component elements possibly recyclable over time.

[0019] Such objects are achieved by making a fire protection closure system of the fire curtain type equipped with a mantle with insulating chamber for commercial and industrial applications, as claimed following the present description and described below.

[0020] Said objects and the consequent advantages, as well as the features of the finding according to the present invention, will become more apparent from the following detailed description of a preferred solution, given by way of explanation, but not by way of limitation, with reference to the accompanying drawings, in which:

Figure 1 shows a three-dimensional view of a graphical diagram from the inside showing a preferred, but not limitative, representation of a fire protection closure system of the fire curtain type 1 equipped with a mantle 4 with insulating chamber for commercial and industrial applications according to the present invention, from which the fundamental parts forming the same may be deduced, namely a box 2, a pair of side guides 3 and the mantle 4 provided with an insulating chamber or cavity;

Figure 2 shows a three-dimensional view of a graphical diagram showing, from the outside, said fire protection closure system 1 referred to in Figure 1;

Figure 3 shows the same graphical diagram referred to in Figure 2, of which the side closure of the box 2 and an entire side guide 3 are not shown, to allow better deducing the fireproof surfaces 5 forming the mantle 4 with insulating chamber 12 and the detail A of the box 2;

Figure 4 shows a three-dimensional view of a graphical diagram showing an enlargement of the detail A referred to in Figure 3, from which detail the characterizing method is better deduced of unrolling the fireproof surfaces 5 forming the mantle 4 on a pair of diverter rollers 6 -7, said fireproof surfaces 5 forming the mantle 4 with insulating chamber 12, being unrolled and rerolled by means of a motorized roller 8 installed in the box 2;

Figure 5 shows a triad of views, of which a first axonometric front view from the inside of said fire protection closure system 1, together with the other two views, respectively, a first side view, showing the cross section A-A thereof, and a second top view, showing the cross section B-B thereof, from which sections A-A and B-B it is possible to deduce, respectively, the details B, C and D of the closure system 1, being the latter details separately shown in the following Figures with enlarged dimensions, so as to allow better deducing the configuration of the component elements of said system 1;

Figure 6 shows a cross section and a two-dimensional view of a graphical diagram showing an enlargement of the detail D referred to in Figure 5, from which detail the characterizing conformation of the side guide 3 and of the sliding methods of the tensioner roller 9 of the fireproof surfaces 5 rolled up thereon as a "U" may be better deduced, said roller 9 being slidable along the guides 3, being a hub 10 provided with a radial sliding bearing 11 and with an axial thrust bearing 18 axially keyed at both the ends thereof;

Figure 7 shows a longitudinal section and a two-dimensional view of a graphical diagram showing an enlargement of the detail C referred to in Figure 5, from which detail the characterizing conformation of the side guide 3 and of the sliding methods of the tensioner roller 9 of the fireproof surfaces 5 rolled up thereon as a "U" may be better deduced, the latter, in turn, being slidable inside the guides 3, being a hub 10 provided with a radial sliding bearing 11 and with an axial thrust bearing 18 axially keyed at both

the ends thereof, as in the previous Figure 6;

Figure 8 shows a two-dimensional section of a graphical diagram showing an enlargement of the detail B of Figure 5, from which detail the characterizing unrolling method of the fireproof surfaces 5 on the pair of diverter rollers 6-7 forming the chamber 12 of the mantle 4 under the weight of the tensioner roller 9 may be better deduced, said fireproof surfaces 5, thus unrolling, forming the chamber 12 of the mantle 4, the latter unrolling and rerolling by means of said motorized roller 8, in turn, formed by a shaft provided with an internal gearmotor, as already shown in three dimensions in Figure 4;

Figure 9 shows a three-dimensional graphical diagram similar to the one shown in Figure 3, now however with a view from the outside, of which the side closure of the box 2 and an entire side guide 3 are not shown, to allow better deducing the fireproof surfaces 5 forming the mantle 4 with chamber 12 and the details E and F, respectively of the box 2 and of the tensioner roller 9 along the guides 3, being a hub 10 provided with a radial sliding bearing 11 and with an axial thrust bearing 18 axially keyed at both the ends thereof;

Figure 10 shows a sectional and three-dimensional view of the graphical diagram showing the detail E of Figure 9, from which detail the characterizing unrolling method of the fireproof surfaces 5 on the pair of diverter rollers 6-7 during the opening of the mantle 4 with chamber 12 may be better deduced, the latter, in turn, unrolling and rerolling by means of said motorized roller 8, as already shown in three dimensions in Figure 4 and in two dimensions in Figure 8;

Figure 11 shows a graphical diagram showing an enlargement of the detail F referred to in Figure 9, from which detail the characterizing sliding method, as a "U", of the fireproof surfaces 5 around the tensioner roller 9 may be better deduced, the latter, in turn, being slidable inside the guides 3 (now not shown), being a hub 10 provided with a radial sliding bearing 11 and with an axial thrust bearing 18 axially keyed at both the ends thereof;

Figure 12 shows a graphical diagram showing the inventive core of the present fire protection closure system 1, i.e., the innovative, original and operational method for rolling up the fireproof surfaces 5 forming the mantle 4, both around the motorized roller 8, and as a "U" 13 around the tensioner roller 9, said unrolling of the fireproof surfaces 5 forming the mantle 4 with chamber 12 being made by means of said diverter rollers 6-7, under the tensioning of the tensioner roller 9, on which said fireproof surfaces 5 are rolled up as a "U" 13;

Figure 13 shows another graphical diagram showing said inventive core of Figure 12, where not all of said rollers 6-9, respectively, the diverter 6-7, motorized 8 and tensioner rollers 9 are shown, so as to allow better deducing the unrolling and rolling up methods of the fireproof surfaces 5 forming the mantle 4 with insulating chamber 12;

Figure 14 shows a graphical diagram showing the enlarged rectangular detail G shown in Figure 13, from which the rolling up conformation of the mantle 4 on the motorized roller 8 may be better deduced, said mantle being formed by said fireproof surfaces 5, the ends thereof being sewn and rigidly constrained in the spinner 14 present inside the motorized roller 8 itself;

Figure 15 shows a three-dimensional view of a graphical diagram showing a mantle 4 for small-medium size closure systems 1, preferably formed by a single fireproof surface 5, so as to allow deducing both the folding methods of the fireproof surface 5 itself around the axis of the tensioner roller 9 (marked with a broken line-dot axis), as well as the sewing methods of the opposite free ends 17 along a transverse sewing line 15 (dashed) given only by way of explanation, but not by way of limitation;

Figure 16 shows a front view of a graphical diagram showing a mantle 4 for medium-large size closure systems 1, preferably formed by at least one pair of fireproof surfaces 5, so as to allow deducing both the folding methods of the fireproof surfaces 5 themselves around the axis of the tensioner roller 9 (marked with a broken line-dot axis), as well as the sewing methods of the opposite free ends along a sewing line 16 (dashed) given only by way of explanation, but not by way of limitation.

[0021] From said sixteen Figures attached hereto showing a preferred but not limitative solution of the dry fire protection closure system of the fire curtain type 1 equipped with a mantle 4 with insulating chamber 12 for commercial and industrial applications, it is possible to deduce how it was conceived and designed so as to prevent the propagation of smoke, heat and fire, being provided with both efficient flame endurance and resistance features (E), as well as with optimized insulation (I) and radiation impedance performance (W), in accordance with UNI EN 16034, being capable, at the same time, to fulfill the object of infallibly delimiting fireproof compartments in commercial areas, as much as technical fireproof closures (such as roller shutters, extendable gates, sliding doors or fire doors and other similar systems).

[0022] As it is possible to deduce from Figures 1, 2, 3, 5, 9, 12 and 13, as well as from the details referred to in Figures 4, 6, 7, 8, 10, 11 and 14, the present fire protection closure system of the fire curtain type 1 equipped with a mantle 4 with insulating chamber 12 for commercial and industrial applications is completely new and inventive as it is formed by:

- a mantle 4 (Figures 1-5, 8-10 and 12-14) preferably comprising a single surface 5 provided with fireproof properties (similar to the materials used for the clothing of firefighters or blast furnace operators) which

rolls up the tensioner roller 9 as a "U" 13 and with the opposite ends thereof sewn together so as to be adapted to be inserted inside a spinner 14 obtained on the rolling axis of the motorized roller 8 installed inside the box 2;

- a motorized roller 8 (Figures 4, 8 and 10), comprising a hollow steel tube provided with a spinner 14 for hooking the mantle 4. Said roller 8 houses a tubular gearmotor, having variable torque, preferably powered with a potential difference of twenty-four volts, so as to also work with direct current supplied by batteries of the same voltage; as well as an approved parachute brake, installed on the opposite side of the motorized roller 8 itself, so as to safely protect from the risk of crushing, in the unexpected case of breakage of a single component of the gearmotor;
- a pair of shafts or diverter rollers 6-7 at the opening of the mantle 4 with insulating chamber 12 (Figures 4, 8, 10 and 12), comprising hollow tubes, equipped with side hubs and flanged bearings; they allow the mantle 4 to tension vertically under the tension of the tensioner roller 9 on which it is rolled up as a "U" 13; the fireproof surfaces 5, thus rolled up and tensioned downwards by said tensioner roller 9, which keeps them rigidly open and spaced by means of said diverter rollers 6-7 at the top, thus forming an insulating chamber 12 of the mantle 4, the latter slidable along the side containment guides 3;
- a lower shaft or tensioner roller 9 (Figures 6, 7, 11 and 12), comprising a hollow tube, equipped with side hubs 10 and sliding bearings 11 and thrust bearings 18, said tensioner roller 9 being rolled up in the fireproof surfaces 5 configured as a "U" 13 (as it may be deduced from the further Figures 12, 13, 14) rolled up on the tensioner roller 9 itself; the latter was designed to tension the fireproof surfaces 5 forming the mantle 4 with insulating chamber 12, preventing the escape thereof from the side guides 3;
- a pair of side guides 3 (Figures 1-3, 5-9), made of sheet steel, the latter suitably shaped so as to form a rigid support for the vertical sliding of the bearings and for containing the fireproof surfaces 5 forming the mantle 4 with insulating chamber 12; said pair of guides 3 is provided, at the internal faces thereof, with a heat-expanding gasket, which ensures an efficient endurance performance (E), preventing, during the fire, the passage of gas and toxic vapors from one compartment to another, as well as the passage of fire tongues of the flames possibly present during the fire on one of the fireproof surfaces (inside or outside the mantle 4 with insulating chamber 12);
- an upper box 2 (Figures 1-5 and 8-10), equipped with a pair of side support shelves and a crankcase for closing the fire curtain equipped with the mantle 4 with insulating chamber 12. Said box 2 may also be equipped with heat extractors (not shown in the attached Figures), so as to prevent the overheating of the air in the cavity enclosed between the two sheets 5 forming the mantle 4 with insulating chamber 12; in the lower part of said box 2 there are the same gaskets present in the guides 3, which, being in contact with the fireproof surfaces 5, contribute to increase the flame and burning smoke endurance performance (E); another gasket similar to the aforesaid ones is present below the mantle 4, at the area of contact of the tensioner roller 9 with the floor, so as to ensure the perfect lower sealing of the present fire protection closure system 1 and, therefore, the perfect endurance (E) and insulation (I) of the mantle 4 itself to flames and smoke in case of fire;
- a motorized roller 8 internally provided with a tubular gearmotor (Figures 4, 8 and 10) preferably operating at the voltage of twenty-four volts and controlled by a control panel (not shown) interfaced to the fire protection system and equipped with two separate entrances, one for the smoke signaling and one for the fire signaling;
- an automatic command and control panel of the fire protection closure system 1 (not shown in the attached Figures), provided with backup batteries controlled by a visible charge indicator; in the event that the fire curtain is in the open condition (being usually open in non-emergency conditions) and the control panel detects a start of a fire with simultaneous lack of electricity, the panel is adapted to provide in any case the automatic closing of the fire curtain 1, however blocking the latter at a distance from the lower edge thereof to the floor of about two meters; subsequently, upon receiving a fire signal in the event of a fire emergency (heat of the fumes above a given temperature), it is also adapted to provide the total closure of the mantle 4 with insulating chamber 12 itself, ensuring the sealing thereof on the floor, thus suitably compartmentalizing the room in which the present fire protection closure system 1 is installed; in both said cases, the movement of the mantle 4 with insulating chamber 12, first in partial closing and then in total closing, is presignaled by means of an acoustic and luminous alarm; in case of normal operation without fire emergency conditions, the panel may control the "dead man" or automatic fire protection closure system 1 in a completely similar manner to roller shutters, allowing the use of the fire curtain 1 also as a simple locking means for blocking the access of customers or unauthorized personnel to the premises;
- an optical barrier of the push/pull type (not shown in the attached Figures), preferably powered by twenty-four volt electric batteries, inserted inside the sliding guides 3, adapted to prevent the risk of crushing along the lower edge of the mantle 4 with insulating chamber 12 and stop the descent of the mantle 4 itself in the presence of people passing in the immediate vicinity thereof.

[0023] The fire protection closure system 1 thus formed

is characterized in that it completely innovates the sector of fire curtains equipped with a mantle 4 with insulating chamber 12, being made with an inventive conformation and rolling up method of said set of elements (4, 5, 6, 7, 8, 9, 12, 13, 14) forming it (Figures 12, 13 and 14), the latter being adapted to make the operation thereof completely automatic and reliable in case of a fire, while, at the same time, ensuring high peculiarities and unmatched performance in case of a fire.

[0024] Said mantle 4, for small and medium compartmentalization surfaces, is preferably formed (Figure 15) by a single fireproof surface 5, folded over, so as to roll up said tensioner roller 9 at the bottom, and sewn along a transverse line 15, at the otherwise free ends of the opposite flaps 17, so as to be insertable and rigidly constrainable into the spinner 14 of the motorized roller 8.

[0025] On the other hand, said mantle 4, for medium and large compartmentalization surfaces, is preferably formed (Figure 16) by at least one pair of fireproof surfaces 5, sewn together along a longitudinal line 16 along the entire height of the mantle 4, thus forming a single fireproof surface 5, adapted to be then folded over, so as to roll up said tensioner roller 9 at the bottom, and sewn along a transverse line 15, at the otherwise free ends of the opposite flaps 17, so as to be insertable and rigidly constrainable into the spinner 14 of the motorized roller 8.

[0026] Said fireproof surfaces 5 forming the mantle 4 may be made with a single or with a plurality of materials nowadays existing on the market and provided with different fireproof features, exploiting several of the mutual coupling methods thereof, even with overlapping sandwich layers.

[0027] As it may be possible, therefore, to deduce from what is described above and shown below, the present fire protection closure system 1 is new and inventive, since it was conceived and designed to solve said issues of the background art, so as to achieve at very low costs for the end user a fire protection system adapted to prevent the propagation of smoke, heat and fire, also ensuring an optimal heat insulation performance of the compartment protected thereby, as well as an optimal radiation impedance performance of the fire protection closure system itself when subject, on one of the sides of the mantle 4 thereof with insulating chamber 12, to the heat of the fire flames, so efficiently compartmentalized thereby.

[0028] The present fire protection closure system 1, in case of operation without fire emergency conditions, may, at the same time, in addition to efficiently fulfilling, as already said, the object of infallibly delimiting fireproof compartments in commercial and industrial areas, also be used excellently as a technical closure system, equally to known technical closures, such as roller shutters, extendable gates and sliding doors, thus increasing the competitiveness thereof on the national and European market.

[0029] The present fire protection closure system 1 fully meets the principles of innovation and industrialization, being possible to make it with already available materials and machinery; it also fully meets the requirements for innovative projects which may be financed under the HORIZON 2020 framework.

[0030] The construction simplicity and flexibility of use thereof allows the application thereof in several commercial and industrial fields, being possible to use it as a technical closure or as a smoke and fire closure.

[0031] The present fire protection closure system 1 has the additional advantage of not producing a significant environmental impact at all, being formed by easily recyclable metal components (with the only exceptions of the sheet and the electrical parts).

[0032] A further advantage stands in the fact that the present fire protection closure system 1 may be industrially manufactured in a very wide range of applications, geometries and size, such as to satisfy the most varied market needs.

[0033] Further benefits, not less important than the previous ones, obviously derive from the minimized costs for the end user of the present fire protection closure system, said costs being low also with regard to the expenses required for the transport and installation thereof.

[0034] The present fire protection closure system of the fire curtain type equipped with a mantle provided with insulating chamber for commercial and industrial applications according to the present invention, therefore, represents an efficient and undoubted inventive idea and a new opportunity for the development of the current economy and for the efficient compartmentalized closure of rooms in commercial and industrial premises.

[0035] It is also evident that the embodiment described above, given by way of explanation and not by way of limitation, may be subject to numerous revisions, adaptations, additions, variations and substitutions of elements with other functionally equivalent ones, without however departing from the scope of protection of the following claims.

KEY

[0036]

1. MOTORIZED FIRE PROTECTION SYSTEM OF THE FIRE CURTAIN TYPE EQUIPPED WITH A MANTLE WITH INSULATING CHAMBER
2. BOX
3. SIDE GUIDES OF THE TENSIONER ROLLER 9 OF THE MANTLE 4
4. MANTLE FORMED BY FIREPROOF SURFACES 5
5. FIREPROOF SURFACES ROLLED UP AS A "U" 13 AT THE BOTTOM, ON A TENSIONER ROLLER 9, AND FORMING THE MANTLE 4 WITH THE CHAMBER 12, CLOSING UP AT THE TOP OF THE BOX 2, ROLLING UP ON THE MOTORIZED ROLLER 8

6. FIRST DIVERTER ROLLER WHEN OPENING THE MANTLE 4
7. SECOND DIVERTER ROLLER WHEN OPENING THE MANTLE 4
8. MOTORIZED ROLLER ON WHICH THE MANTLE 4 ROLLS UP
9. TENSIONER ROLLER OF THE MANTLE 4 EQUIPPED WITH SIDE HUBS 10 AND BEARINGS 11
10. HUBS ON THE SIDE ENDS OF THE TENSIONER ROLLER 9
11. RADIAL SLIDING BEARINGS
12. CHAMBER OF THE MANTLE 4 DELIMITED BY A PAIR OF FIREPROOF SURFACES 5 SPACED FROM ONE ANOTHER
13. "U" CONFORMATION OF THE FIREPROOF SURFACES 5 ON THE TENSIONER ROLLER 9
14. SPINNER INSIDE THE MOTORIZED ROLLER 8 FOR THE RIGID CONSTRAINT OF THE ENDS OF THE FIREPROOF SURFACES 5, FORMING THE MANTLE 4 WITH A CHAMBER 12
15. TRANSVERSAL SEWING LINE AT THE TOP OF THE FIREPROOF SURFACE 5 ROLLED UP AS A "U" ON THE TENSIONER ROLLER 9
16. LONGITUDINAL SEWING LINE OF A PAIR OF FIREPROOF SURFACES 5 FOR MEDIUM-LARGE MANTLES 4
17. ENDS TO BE SEWN OF THE FIREPROOF SURFACES 5
18. AXIAL THRUST BEARINGS

A. THREE-DIMENSIONAL DETAIL OF THE BOX OF FIGURE 3
B. CROSS SECTION AND TWO-DIMENSIONAL VIEW OF A DETAIL OF THE BOX OF FIGURE 5
C. CROSS SECTION AND TWO-DIMENSIONAL SECTION OF A DETAIL OF THE TENSIONER ROLLER 9 OF THE MANTLE 4 SLIDABLE ALONG THE SIDE GUIDES 3 REFERRED TO IN FIGURE 5
D. LONGITUDINAL AND TWO-DIMENSIONAL VIEW OF A DETAIL OF THE TENSIONER ROLLER 9 OF THE MANTLE 4 SLIDABLE ALONG THE SIDE GUIDES 3 REFERRED TO IN FIGURE 5
E. THREE-DIMENSIONAL DETAIL OF THE BOX 2 OF FIGURE 9
F. THREE-DIMENSIONAL DETAIL OF THE TENSIONER ROLLER 9 OF THE MANTLE 4 SLIDABLE ALONG THE SIDE GUIDES 3 REFERRED TO IN FIGURE 9
G. CROSS SECTION AND TWO-DIMENSIONAL SECTION OF A DETAIL OF THE MANTLE 4 INSIDE THE BOX 2

Claims

1. A fire protection closure system (1) of the fire curtain type for commercial and industrial applications, essentially constituted by a box (2), a pair of side guides (3), a motorized roller (8) on which a mantle (4) rolls up during the opening step and unrolls during the closing step, the mantle comprising surfaces (5) provided with fireproof properties, which may be folded over and shaped so as to create an internal insulating air chamber (12), said closure system (1) being **characterized in that** said internal insulating chamber (12) of the mantle (4) is generable at the start of the closing step, during the unrolling of the mantle (4), by means of a pair of diverter rollers (6-7) and a mobile tensioner roller (9), with said pair of rollers (6-7) rigidly constrained inside the box (2) and adapted to achieve the maximum design spacing of the fireproof surfaces (5) of the mantle (4) itself, and said tensioner roller (9) being free to slide along the guides (3) and with the weight thereof being adapted to unroll, when lowering the mantle (4), the fireproof surfaces (5) in which it is rolled, keeping them well tensioned and thus spaced, said rollers (6, 7 and 9) thereby generating a mantle (4) having an insulating chamber or cavity (12) which is permanently efficient, especially in the event of a fire emergency, in compartmentalizing two adjacent rooms.

2. A fire protection closure system (1) according to the preceding claim, **characterized in that** said tensioner roller (9) is equipped, on each of the side ends thereof, with a hub (10) and with a radial sliding bearing (11) and with an axial thrust bearing (18), the latter bearings being adapted to guide the tensioner roller (9) itself along the side guides (3) during the closing and opening steps of the mantle (4).

3. A fire protection closure system (1), according to at least one of the preceding claims, **characterized in that** said mantle (4) is made with a single fireproof surface (5) sewn over and provided with an end adapted to be inserted into a spinner (14) obtained in the motorized roller (8).

4. A fire protection closure system (1), according to at least one of the preceding claims, **characterized in that** it is provided with a command and control panel of the automatic type, powered by backup batteries and interfaced with the fire protection closure system (1), as well as with an optical safety barrier; said fire protection closure system (1) thus formed being adapted to compartmentalize well delimited spaces, in an "automatic" or "dead-man" manner, with a dual function, i.e., operating as a closure system (1), usually open and automatically closable in case of a fire emergency, while, at the same time, ensuring better fire resistance, sealing and insulation against flames and fumes, and radiation impedance, as well as operating as a simple closure system (1), usually closed for all the various needs to delimit well-identified commercial and industrial areas, and easily

opened if necessary.

5. A fire protection closure system (1), according to claim 3, **characterized in that** a single motorized shaft (8), formed by a hollow steel tube provided with said spinner (14), is capable of rolling up the mantle (4), by virtue of the fact that inside the hollow tube a tubular gearmotor is housed, having a variable torque, powered with a potential difference of twenty-four volts, so as to also work with direct current supplied by batteries of the same voltage; as well as an approved parachute brake, installed on the opposite side of the shaft (8) itself, so as to safely protect from the risk of the mantle (4) falling, in the unexpected case of breakage of a single component of the gearmotor.

6. A fire protection closure system (1), according to at least one of the preceding claims, **characterized in that** the diverter rollers (6-7), adapted to ensure the opening of the fireproof surfaces (5) forming the internal insulating chamber (12) of the mantle (4), are made with hollow tubes, also equipped with side hubs and flanged bearings; said diverter rollers (6-7), together with said tensioner roller (9), allowing the fireproof surfaces (5), which roll up said tensioner roller (9) as a "U" (13), to remain well tensioned vertically and at a predetermined distance, with respect to the thrust of the hot air generated during the fire, which, otherwise, would tend to inflect the fireproof surface itself.

7. A fire protection closure system (1), according to claim 2, **characterized in that** said tensioner roller (9), thus provided with said hubs (10) and bearings (11, 18), is adapted to easily slide along the side guides (3), both during the closing and during the opening step, so as to be adapted to tension the fireproof surfaces (5) forming the insulating chamber (12) of the mantle (4), ensuring, by means of a plurality of silicone gaskets, the perfect sealing and fireproof insulation thereof, as well as avoiding an undesired release of the side guides (3) of the fireproof surfaces (5) themselves, especially in case of a fire emergency.

8. A fire protection closure system (1), according to claim 3, **characterized in that** said mantle (4), for small and medium compartmentalization surfaces, is formed by a single fireproof surface (5), folded over, so as to roll up said tensioner roller (9) at the bottom, and sewn along at least one transverse line (15), at the otherwise free ends of the opposite flaps (17), so as to be insertable and rigidly constrainable into the spinner (14) of the motorized roller (8).

9. A fire protection closure system (1), according to claim 3, **characterized in that** said mantle (4), for medium and large compartmentalization surfaces, is formed by at least one pair of fireproof surfaces (5), sewn together along at least one longitudinal line (16) for the whole height of the mantle (4), thus forming a single fireproof surface (5), further adapted to be foldable over, so as to roll up said tensioner roller (9) at the bottom, and sewn along at least one transverse line (15), at the otherwise free ends of the opposite flaps (17), so as to be insertable and rigidly constrainable into the spinner (14) of the motorized roller (8).

10. A fire protection closure system (1), according to at least one of the preceding claims, **characterized in that** said fireproof surfaces (5) forming the mantle (4) may be made with a single or with a plurality of materials nowadays existing on the market and provided with different fireproof features, exploiting several of the mutual coupling methods thereof, even with overlapping sandwich layers.

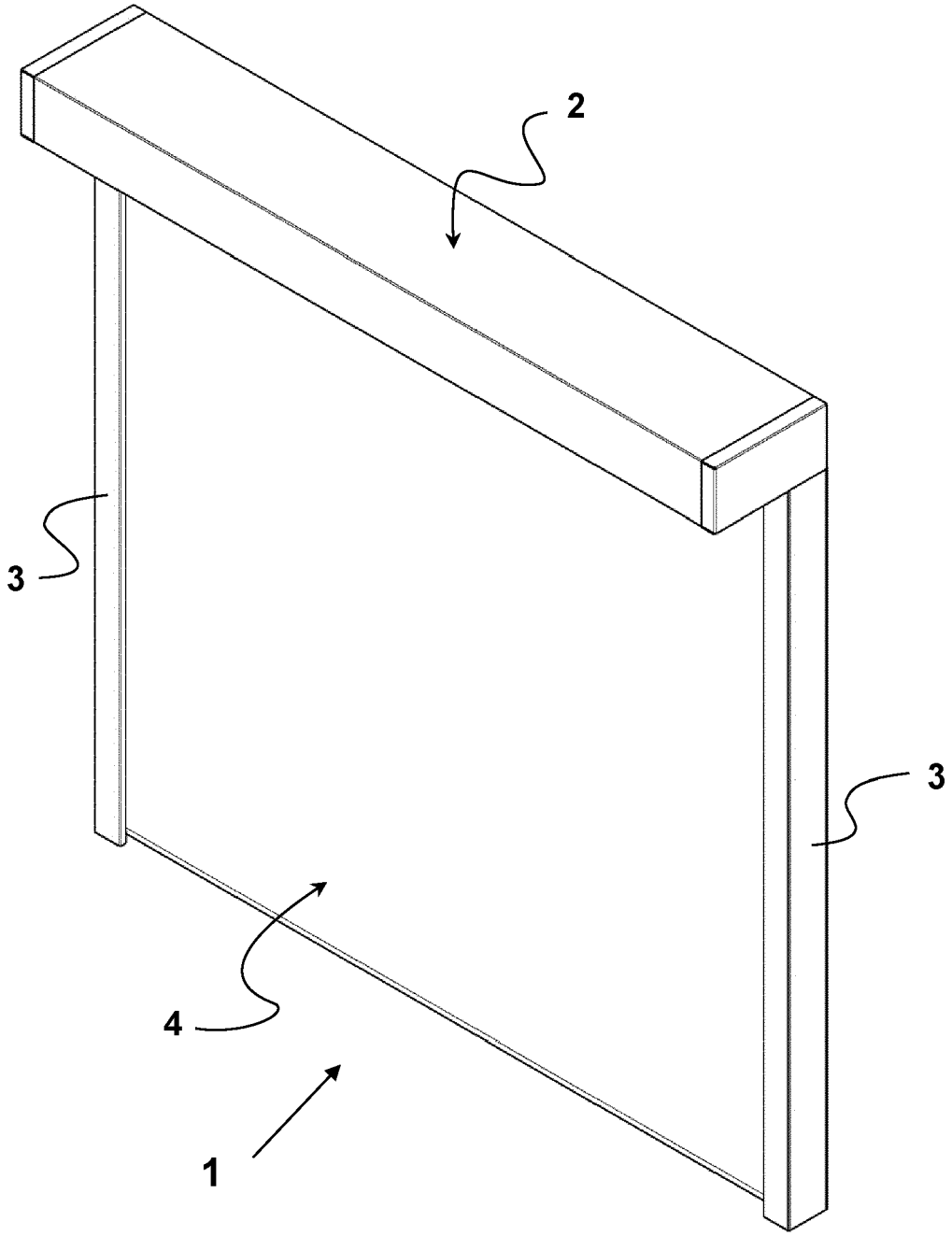

Fig.1

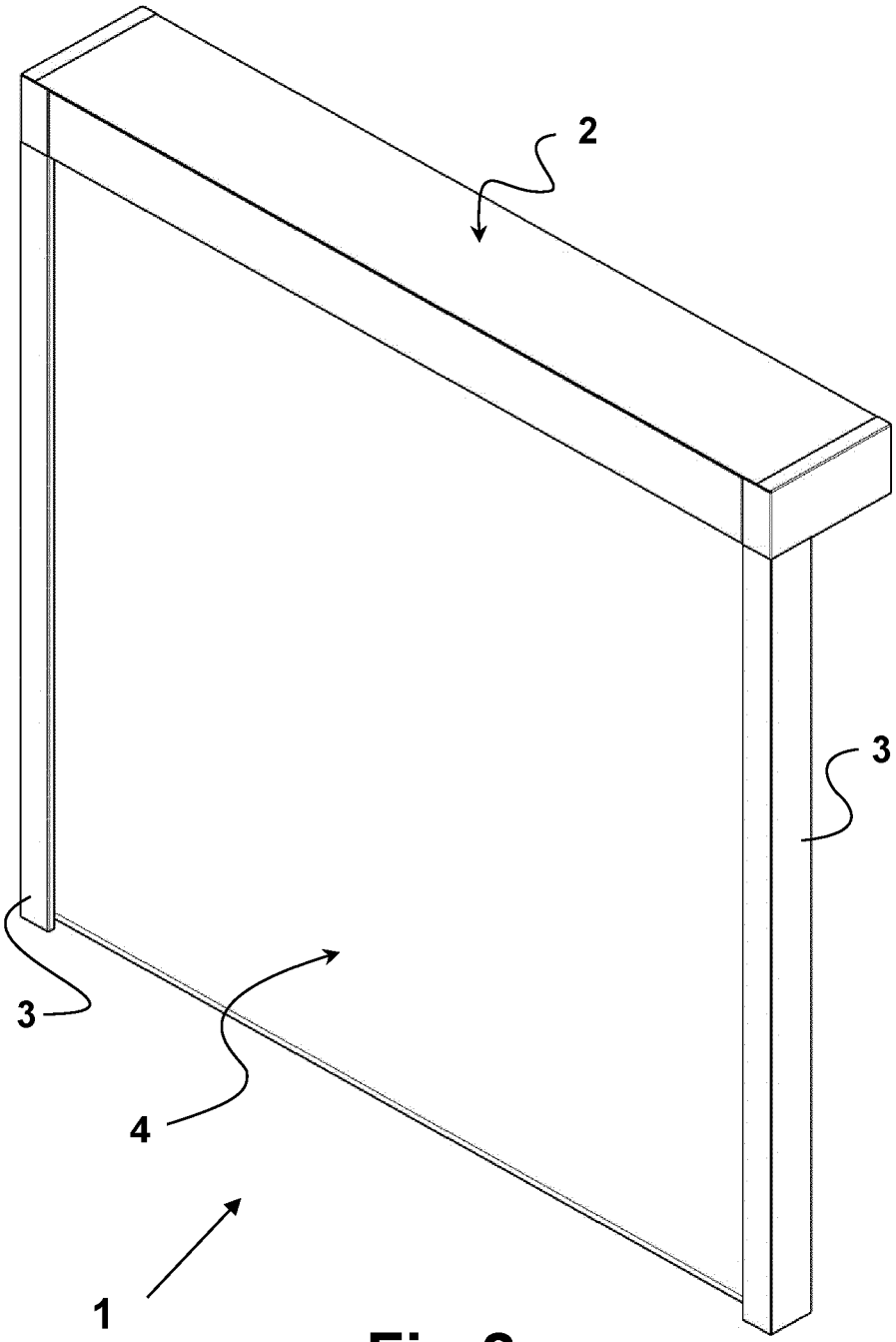

Fig.2

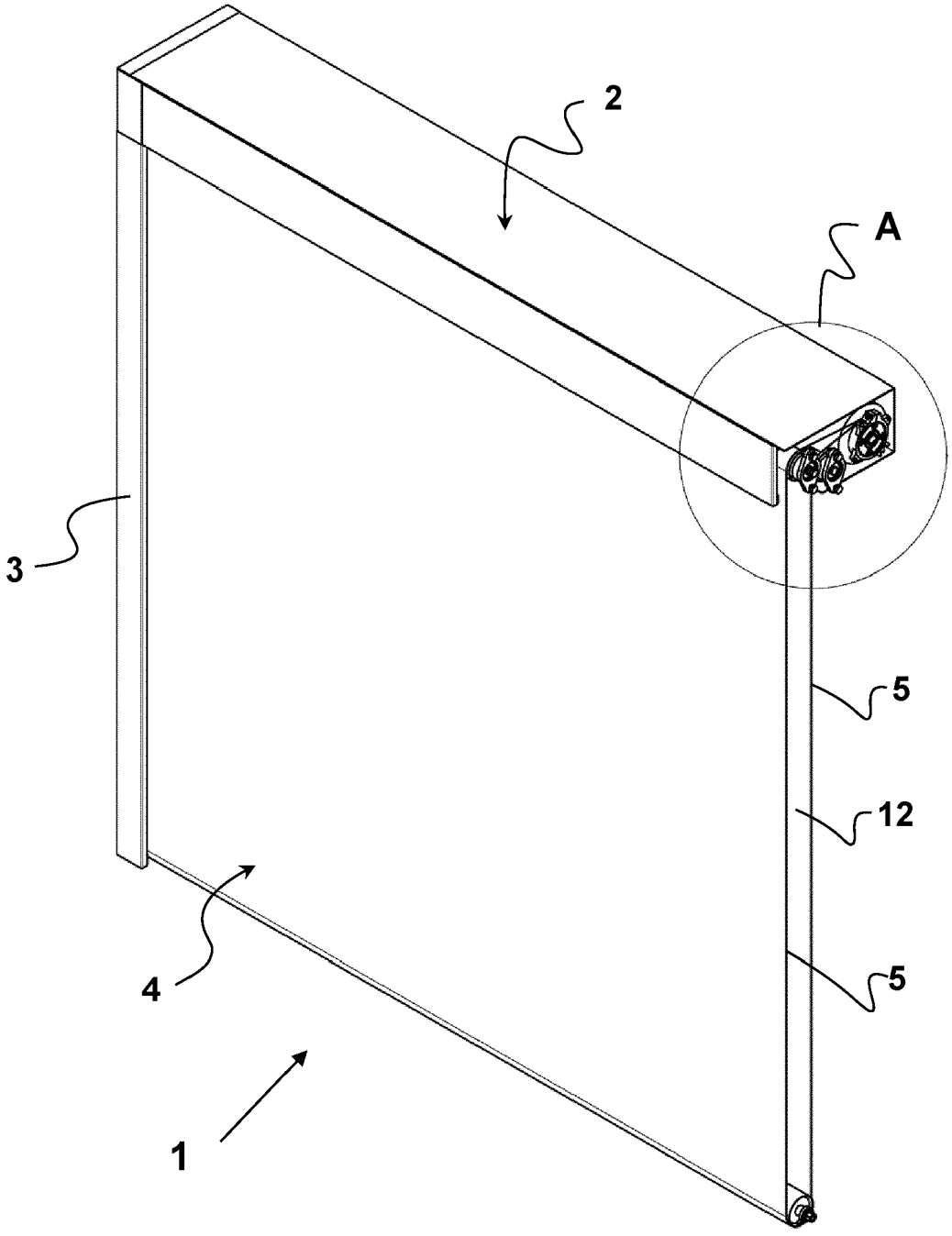

Fig.3

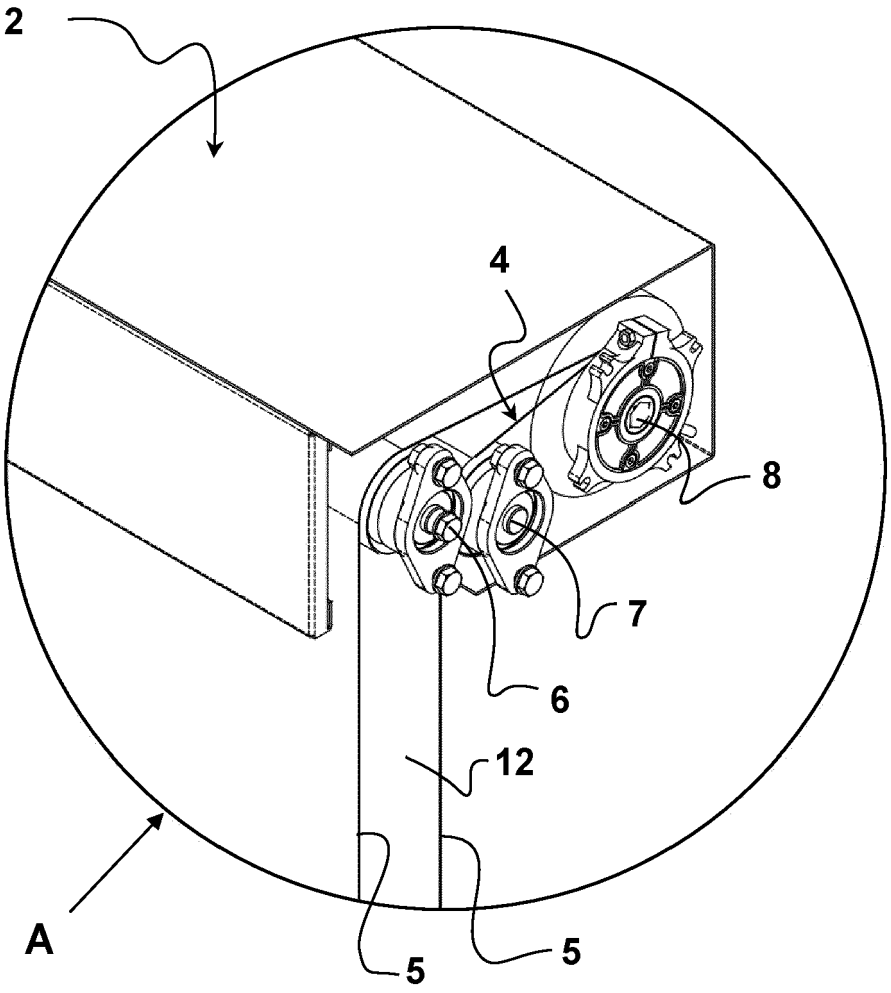

Fig.4

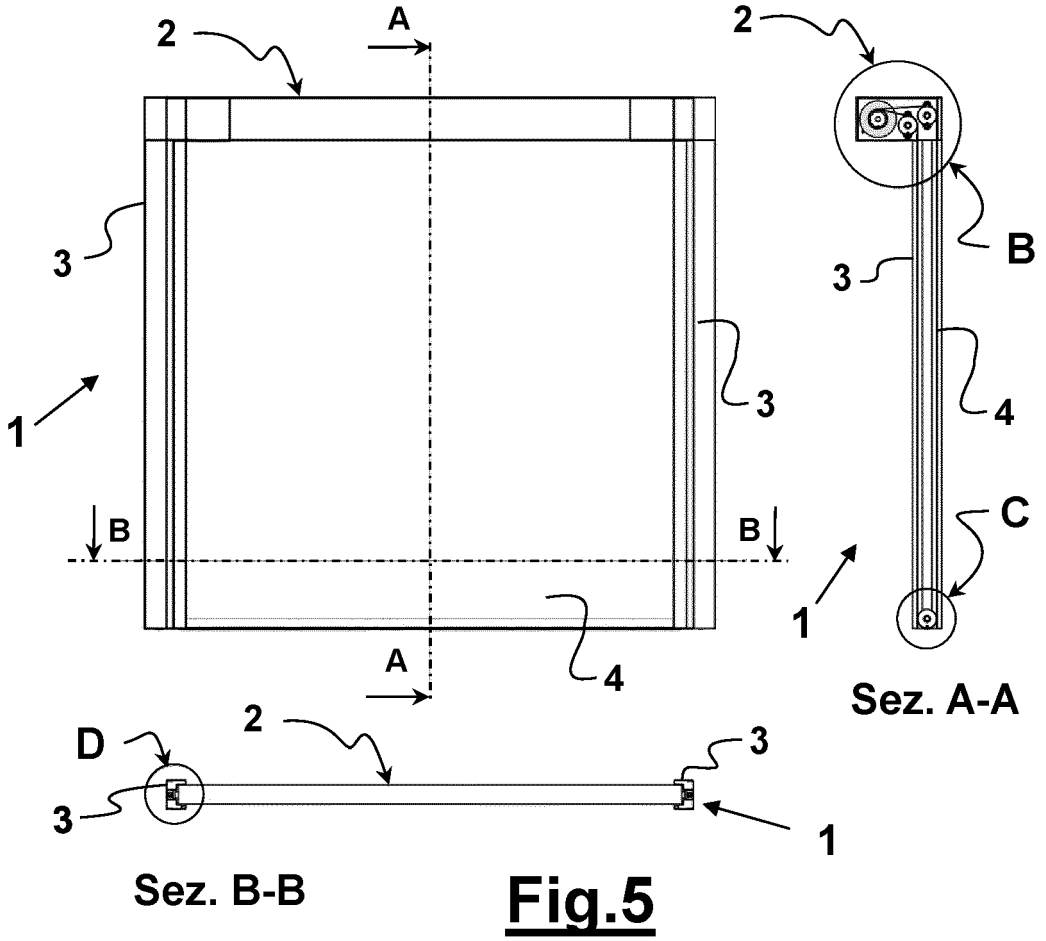

Fig.5

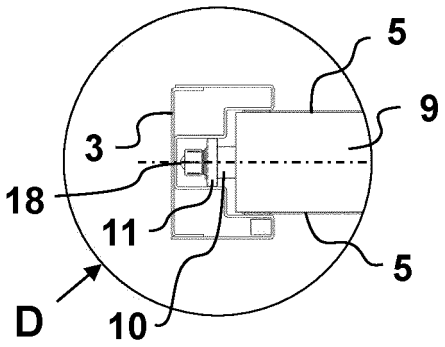

Fig.6

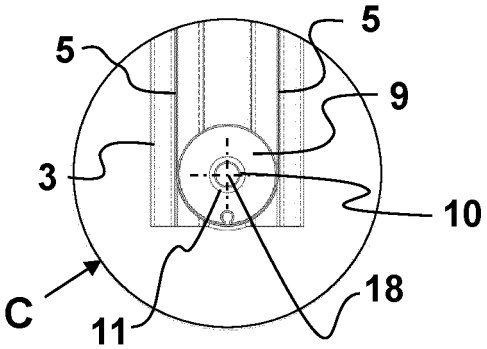

Fig.7

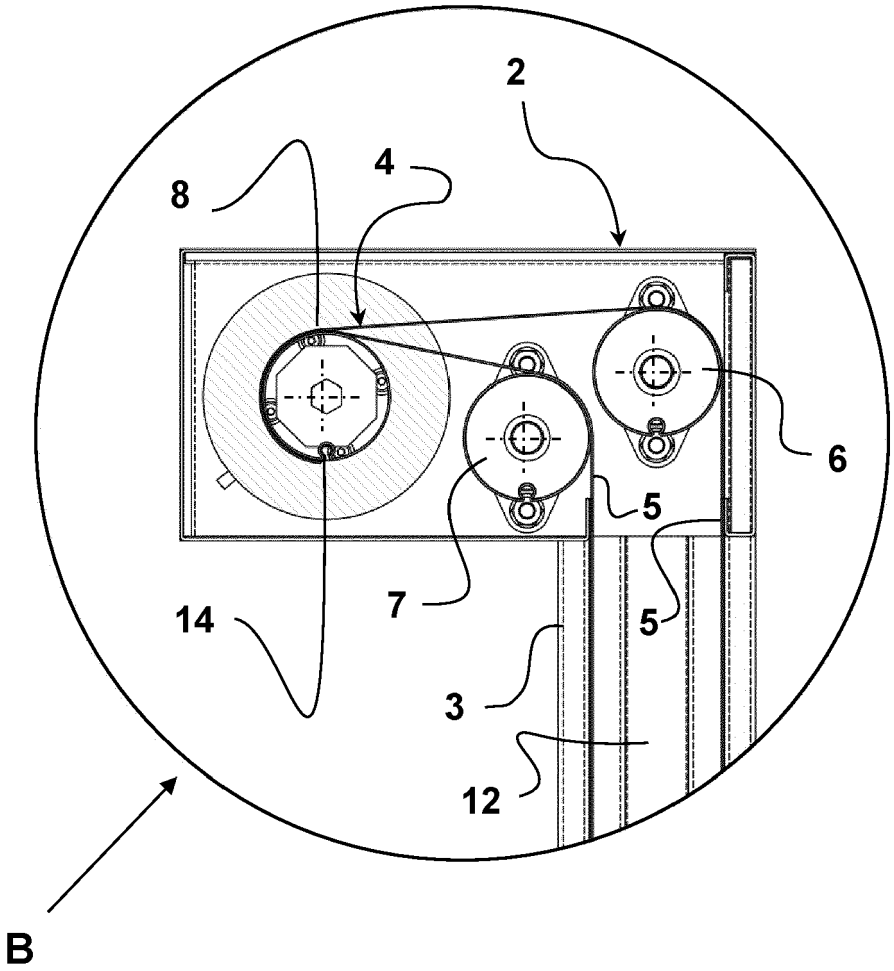

Fig.8

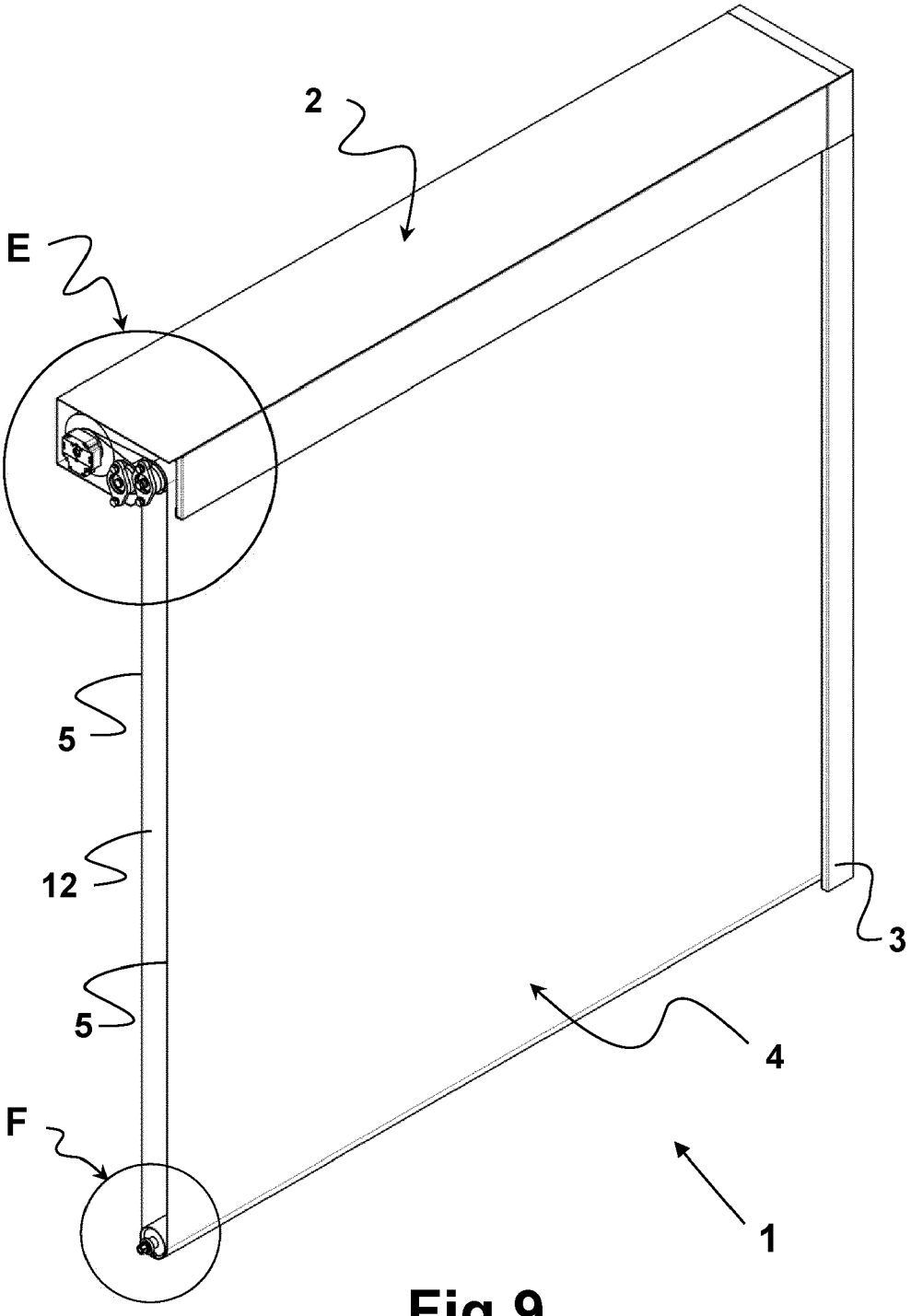

Fig.9

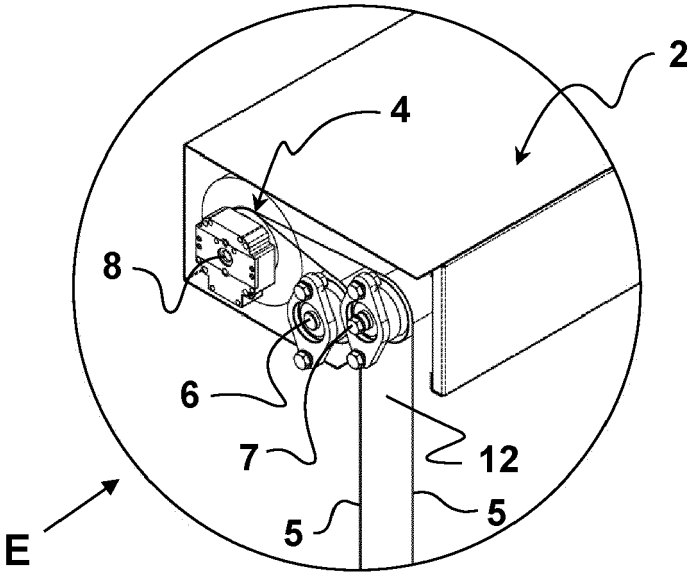

Fig.10

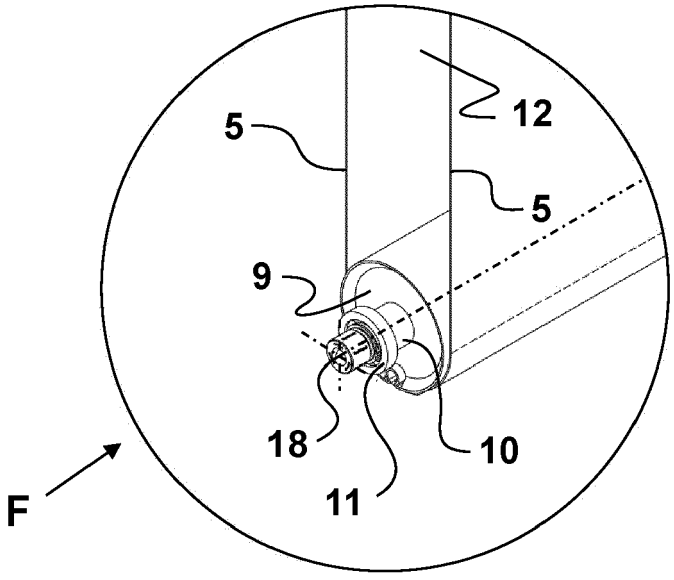

Fig.11

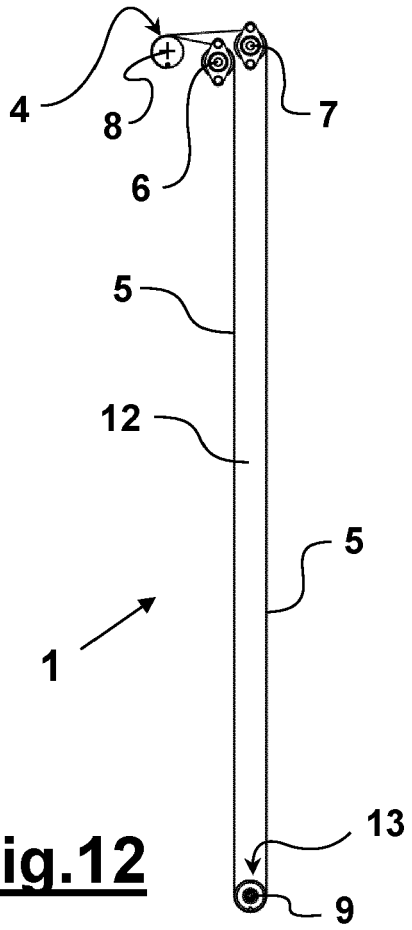

Fig.12

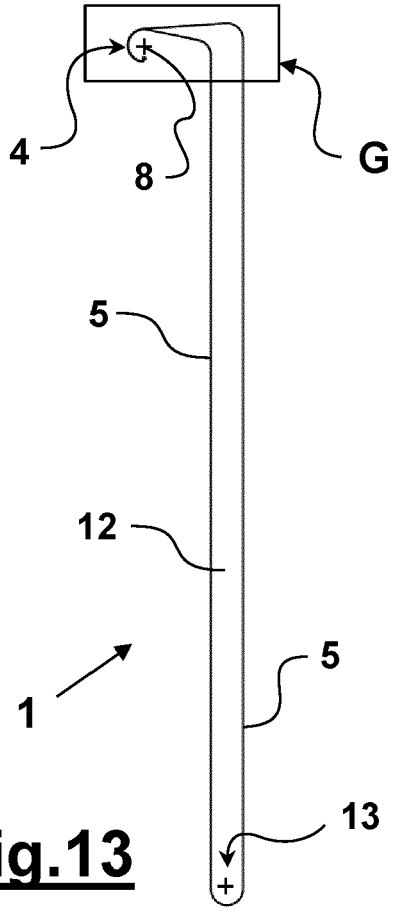

Fig.13

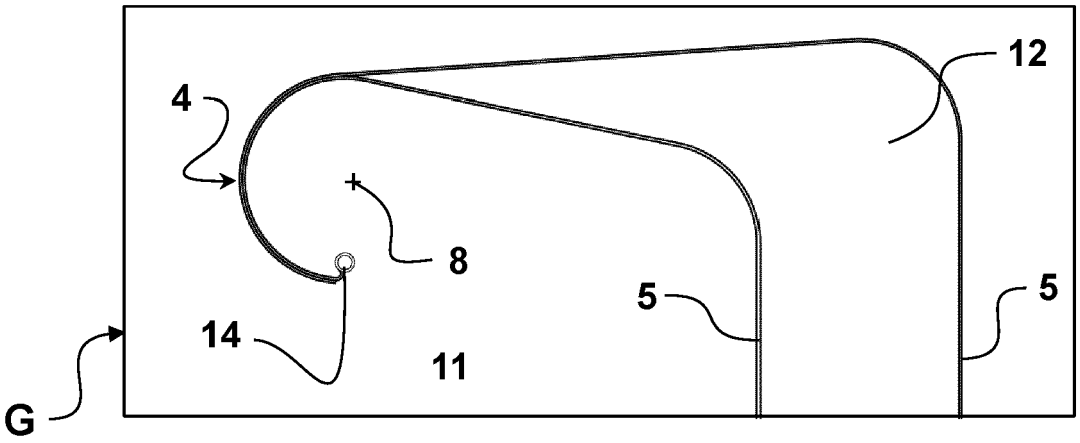

Fig.14

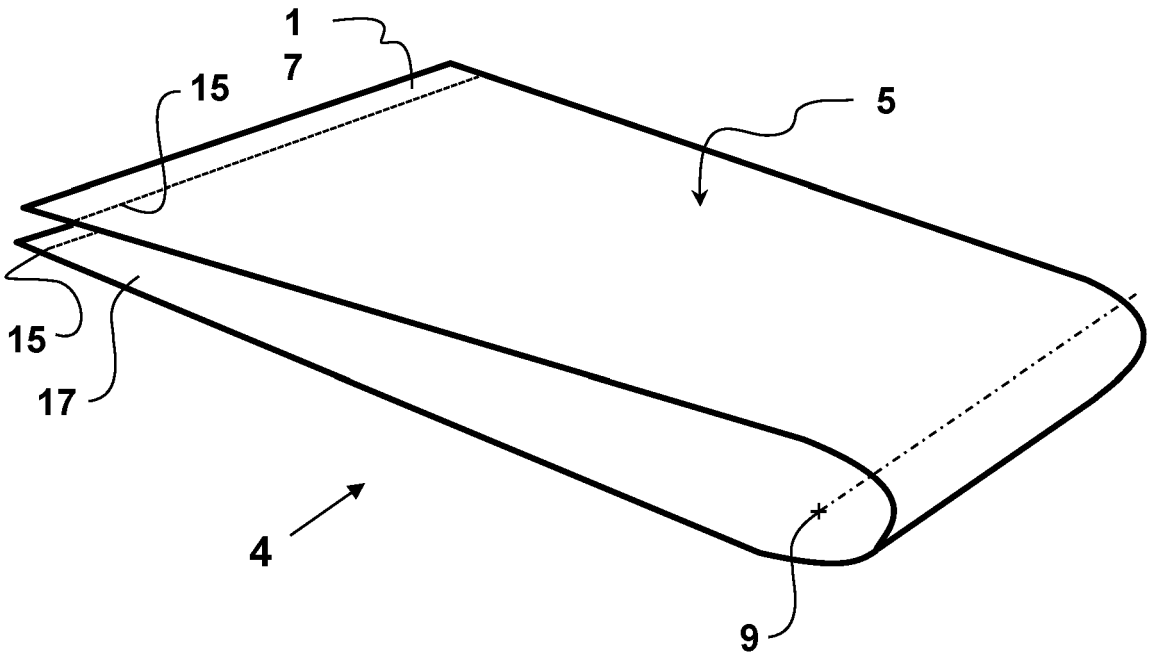

Fig.15

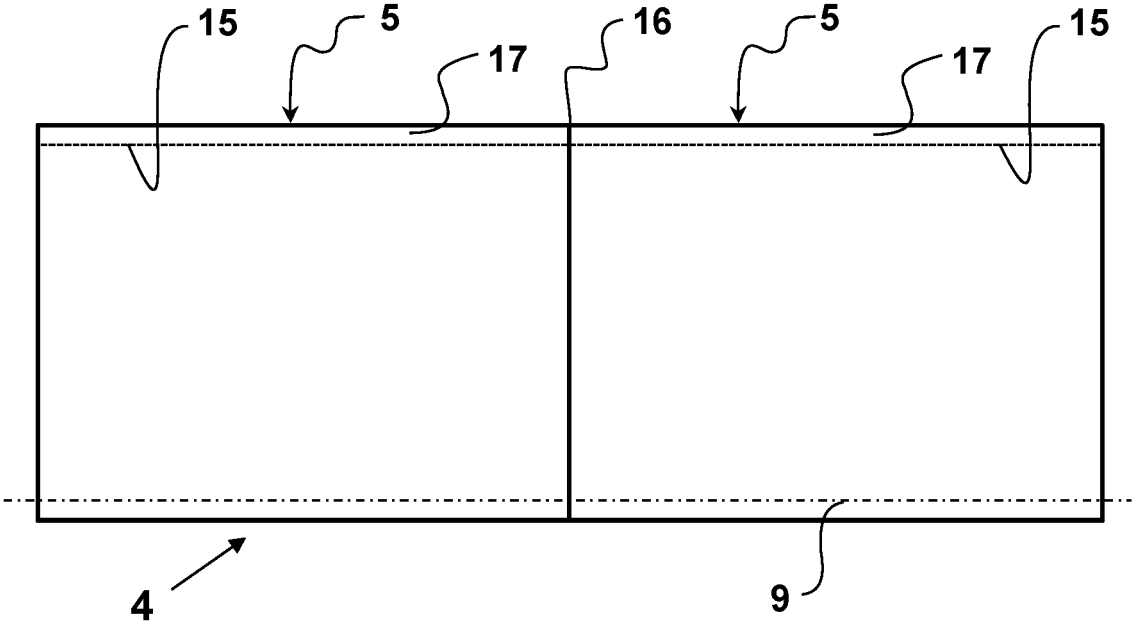

Fig.16

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EUROPEAN SEARCH REPORT

Application Number
EP 19 21 9468

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	FR 2 586 355 A1 (FECHOZ STE NLE EQUIP SCENIQUES [FR]) 27 February 1987 (1987-02-27) * figures 1, 2 * -----	1	INV. E06B5/16 E06B9/06 A62C2/10 E06B9/11 E06B9/17 E06B9/64
A	WO 2017/172362 A1 (HH TECH INC [US]) 5 October 2017 (2017-10-05) * figures 1-3 * -----	1	
A	WO 96/04453 A1 (KLEIN ARNO [DE]) 15 February 1996 (1996-02-15) * figure 4 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)
E06B A62C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	30 January 2020	Crespo Vallejo, D

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30-01-2020

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