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(54) **Roller shutter for windows and doors**

(57) A roller shutter comprising a plurality of main slats (1) of solid surface and width A, that pivot around a longitudinal axis, each main slat (1) comprising a solid outer surface and a solid inner surface, a lower portion (3) of which has a spiral-shaped lower longitudinal hook receiving groove (13) with center C2, and an upper portion (4) which has a spiral-shaped upper longitudinal hook receiving groove (12) with center C1; a plurality of perforated secondary slats (2) that pivot longitudinally, each perforated secondary slat (2) comprising a central flat portion with holes (5) that allow air and light to flow through, and upper and lower hook-shaped end portions that engage in the longitudinal hook receiving grooves (12,13) of the adjacent main slats (1) when the roller shutter is assembled; a plurality of guide pins (7) engaged to the ends of the main slats (1) that allow said main slats (1) to pivot longitudinally around a rotation center C3 and guide the roller shutter along the lateral guide channels (8) when it is raised or lowered; and a lower slat (9) longer than the main and perforated secondary slats, the ends of which fit into the side channels (9) and therefore does not pivot, which, when the shutter is being let down and comes to rest on the base of the window or door provides a solid foundation that allows the main and secondary slats (1,2) to move into the up or down position.

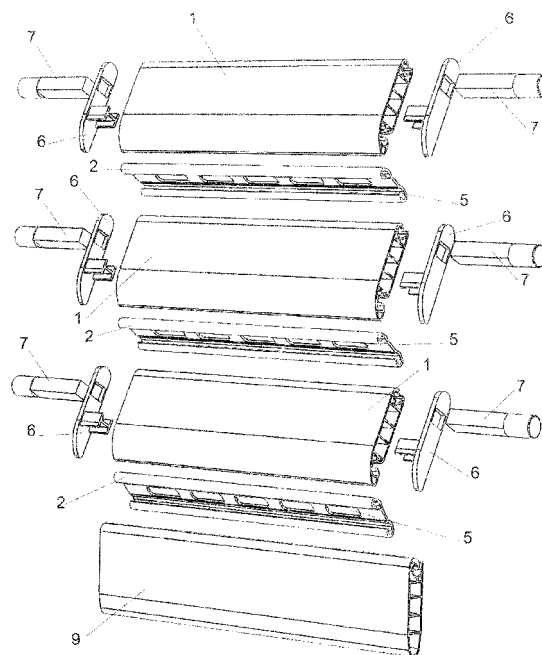


FIG.1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a roller shutter for windows and doors that allows air to flow through with or without passage of light. Therefore, it intends to substantially improved the capabilities of existing roller shutters without adding significant cost.

BACKGROUND OF THE ART

[0002] PVC extruded roller shutters are the cheapest and most widely used on the market today. However, these existing roller shutters as well as the similar aluminum roll formed shutters have an important limitation. They are either slightly open letting air and light through, or closed in which case no air or light can pass. If a user wants to enjoy the evening air, the shutter must remain partially open in which case the air will be able to flow through the holes, but so will the morning light. If the user does not want to be awakened by the morning sun rays the shutter must be completely closed in which case there will be no evening air flow either. Also, to avoid the passing sun rays to be even stronger, holes are very narrow and therefore will only allow the passage of a minimal amount of air. Therefore, a need exists for an improved roller shutter that can let more air through with or without light passage.

[0003] Patent US 6,874,560 refers to a security metal roller shutter of the type used, for example, to close the front of a store. These security shutters are made of steel and are designed in such a way that, when closed, they can be pulled open, but if somebody tries to push them open from the bottom, the shutter will jam against the sides of the guide channels and block. The construction includes a moving pivoting connecting slat between every main slat holding them together. This pivoting connecting slat may look similar to the one used in the present invention but actually works in a very different manner. The slat of the present invention is wider and contains holes to let air through. This slat is narrow, solid and has no holes because it is meant to carry out a different function. The slats of the present invention have pins which function as an axis allowing them to pivot within the limits imposed by the guide channels. This shutter is designed to work in the opposite manner so that, if pushed from underneath, the moving pivoting connecting slat which has no axis, pivots toward one of the sides of the guide channels and jams the shutter. It is important to point out that the shutter in the present invention is meant to be made of PVC, not metal.

[0004] Patent Application USSN 2010/012,279 refers to a roller shutter, which has metal pivoting slats that are either extruded or roll formed. It is meant to be used to close securely the front of stores, for example, but adding to existing models a better protection against rain. When in the open position, air comes through and, when closed,

air can still pass in smaller quantities while providing better protection against bad weather. Although functions seem similar, the way it works differs significantly from the present invention. The pivoting movement of the slats is achieved by arms that connect the slats between them, not by an axle pin as in the newly invented shutter. The design of the shutter disclosed in the cited document will not work for PVC shutters; it has to be made of metal. The newly invented shutters of the present invention are held together by the perforated secondary slats which are threaded into the longitudinal hook receiving grooves in the main slats and, hence, leave no open spaces between slats. The shutter of the present invention is a single continuous flexible sheet, similarly to the conventional PVC shutters widely used today, which does not allow sliding a hand through it. In the metal shutter of the cited document, when open, there are free spaces between slats.

[0005] Patent Application DE 10 2006 005 750 refers to a newly designed slat which is meant to be built into a standard aluminum shutter in at least one or more units per shutter. The basic roller shutter of which the new slat is to be a part, is the standard roller shutter made of roll formed aluminum slats of the type that, when open, let air and light pass through the holes and, when closed, hide the part which contains the holes in the hollow part of the upper slat and so on. This newly developed slat that is designed to let more light and air through, of which at least one can be intercalated in the standard shutter functions as a lid. When the intercalated lid formed element is opened, it flaps up letting light and air through the resulting open gap. Although at first glance, from the side, the opening lid looks very much like the main slat of the shutter of the present invention, it actually works in quite a different manner. From the side, the lid of the mentioned document shows hooks that look like the longitudinal hook receiving grooves of the shutter of the present invention but, in fact, they are only hooks added to the ends of the lid which, in combination with side arms, lift the lid. The lid of the Patent Application DE 10 2006 005 750 document does not comprise axle pins which allow slats of the shutter of the present invention to pivot but, instead, it uses side arms which flap the lid up and down producing a wide open space which lets air and light through.

[0006] In summary, conventional prior art PVC or aluminum roller shutters use slats that are all identical and insert in each other. When slightly open a part of the slat containing narrow holes is exposed, allowing air and light to flow through. When closed, the upper part of the slat containing the holes is inserted within the lower hollow part of the next slat, and so on. In this position no air or light is able to flow through. The prior art slats are long enough to fit into the guide channels attached to the walls of the building, slide up and down within them and are unable to pivot.

SUMMARY OF THE INVENTION

[0007] The improved roller shutter of the present invention herein disclosed allows the slats to pivot. Except for one lower slat that is longer and works conventionally, the rest of the slats are cut shorter so that they do not reach the guide channels. At each end of the slat, protruding guide pins are attached. It is these guide pins that slide up and down within the lateral guide channels and allow the slats to pivot. The main slats are held together by perforated secondary slats, which pivot inversely to the main slats and tilt them.

[0008] The slats of the present invention are of new design and are intercalated with perforated secondary slats. These perforated secondary slats have hook shaped sides which are threaded into the longitudinal hook receiving grooves in the upper and lower rear parts of the main slats, thereby holding them together. They are kept in place, unable to slide out laterally, by the main slat side lids, and the side lids are kept in place by the guide pins. The perforated secondary slats pivot inversely to the main slats to which they are alternately attached, in such a manner that when the shutter is in the down position, these perforated secondary slats are positioned at an angle facing downwards, while the main slats create a shade over them. In this position, air flows through freely while only a slight light reflection might be seen from the inside. No direct sun rays are able to pass. Consequently, since light passage does not need to be restricted, the holes are made much bigger, allowing a larger air volume to flow through.

[0009] In a first embodiment of the invention, the roller shutter has two positions: down-position, in which air flows through but no light; and up-position in which air and light flow freely through the holes. In the down position the perforated secondary slat looks down. Air flows, light does not pass. In the up position though, the perforated secondary slat is upright permitting air to flow through and light to pass. This embodiment never closes completely. Air always flows through. When pulled up it winds into a roll slightly larger in diameter than existing models. It is recommended for users, who want air passage at night without light rays shining through in the morning, but want a closed shutter during daytime for sunshade, security or privacy reasons while having air flowing through and light seeping through, so as to have some light in the room.

[0010] In a second embodiment of the invention, the roller shutter also has two positions: down-position in which air flows through but no light; and up-position in which no air or light can go through. Thus, when the shutter is in the down position, perforated secondary slats are looking down letting air flow, but no light. However, differently from the other embodiment, when it is slightly pulled up, it closes completely. No air or light are able to pass. When pulled up from the up/closed position it winds up into a roll somewhat larger in diameter than existing models. It is recommended for users who want air pas-

sage at night without light rays shining through in the morning, air tight when closed for better insulation, and will roll the whole shutter up during daytime.

[0011] The disclosed roller shutters fit in existing guide channels, so that old shutters can easily be replaced by these new ones without requiring changing said guide channels. Not only does the pin fit in the existing guide channels, also the slats of the present invention swing forward when pivoting so that they use less than one centimeter of back space. New wider deeper vertical guide channels were designed containing the pin and hiding the ends of the shutter slats behind a front rim that avoids the passage of any light ray that could seep through the edges, also achieving greater strength and security against burglary. As far as cost is concerned, if mass produced, the new shutters should only be slightly more expensive than conventional PVC roller shutters. The new shutters are also made of PVC and, while the prior art models only use one standard slat, the new shutters use the extruded main slat, the extruded perforated secondary slat, the extruded bottom slat slightly different in shape and length, and the injected end lids which act as a retainer for the perforated secondary slats so they don't slide out, as well as the injected guide pins. The end lids are held in place by the guide pins.

[0012] Another advantage of our PVC Roller Shutter is the rain protection feature. When it rains in windy weather conventional Roller Shutters will let water through the holes. In our Roller Shutters, when in the down position in which air flows through without light, holes are looking downward and therefore there is no water leakage. Water hits against the slats and then slides down along the exterior of the shutter.

[0013] Lastly, it is important to point out that there are other prior art roller shutters that also pivot, but those are more complex and much more expensive. Those are made of wood, aluminum or steel and require more complex mechanisms to function. The shutters of the present invention require no complex mechanisms; they fall into place by their own weight.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] In the enclosed drawings:

Fig. 1 shows an exploded perspective view of the newly invented roller shutter;

Fig. 2a shows a front perspective view of a first embodiment of the invention in the down position in which air flows through, but no light;

Fig. 2b shows a front perspective view of a first embodiment of the invention in the up position in which air and light flow through;

Fig. 3 shows a rear perspective view of the main slat in a first embodiment of the invention;

Fig. 4a. shows a rear perspective view of a bottom main slat in a first embodiment of the invention;

Fig. 4b shows a detailed side view of the bottom main slat in a first embodiment of the invention;

Fig. 4c shows a detailed enlarged side view of the upper part of the bottom main slat in a first embodiment of the invention;

Fig. 5 shows a perspective view of the side lid that is engaged to the ends of each main slat in a first embodiment of the invention;

Fig. 6a shows a side view of the engagement between main and secondary slats in a first embodiment of the invention in a position that allows air flow, but no light;

Fig. 6b shows a side view of the engagement between main and secondary slats in a first embodiment of the invention in a position that allows air and light to flow through;

Fig. 7a shows a detailed side view of a main slat in a first embodiment of the invention;

Fig. 7b shows a detailed enlarged side view of the upper portion of a main slat in a first embodiment of the invention;

Fig. 7c shows a detailed enlarged side view of the lower portion of a main slat in a first embodiment of the invention;

Fig. 8a shows a rear perspective view of a second embodiment of the invention in the down position in which air flows through, but no light;

Fig. 8b shows a rear perspective view of a second embodiment of the invention in the up closed position in which no air and no light flow through;

Fig. 9 shows a rear perspective view of the main slat in a second embodiment of the invention;

Fig. 10a shows a rear perspective view of a bottom main slat in a second embodiment of the invention;

Fig. 10b shows a detailed side view of the bottom main slat in a second embodiment of the invention;

Fig. 10c shows a detailed enlarged side view of the upper part of the bottom main slat in a second embodiment of the invention;

Fig. 11 shows a perspective view of the side lid that is engaged to the ends of each main slat in the sec-

ond embodiment of the invention;

Fig. 12a shows a side view of the engagement between main and secondary slats in the second embodiment of the invention, in the down position which allows air to flow through, but no light;

Fig. 12b shows a side view of the engagement between main and secondary slats in the second embodiment of the invention in the up closed position in which no air and no light flow through;

Fig. 13a shows a detailed side view of a main slat in the second embodiment of the invention;

Fig. 13b shows a detailed enlarged side view of the upper portion of a main slat in the second embodiment of the invention;

Fig. 13c shows a detailed enlarged side view of the lower portion of a main slat in the second embodiment of the invention;

Fig. 14a shows a perspective view of the perforated secondary slat in both embodiments of the invention

Fig. 14b shows a detailed enlarged side view of a perforated secondary slat in both embodiments of the invention;

Fig. 15 shows a perspective view of the guide pin in both embodiments of the invention;

Fig. 16 shows a perspective view of the newly developed guide channel in both embodiments of the invention; and

Fig. 17 shows a view from above of a guide pin inserted in the guide channel in both embodiments of the invention.

DETAILED DESCRIPTION

[0015] In accordance with the invention, a roller shutter is provided comprising a plurality of main slats of solid surface and width A that pivots around a longitudinal axis, each main slat comprising a solid outer surface and a solid inner surface, a lower portion which has a spiral-shaped lower longitudinal hook receiving groove with center C2, and an upper portion which has a spiral-shaped upper longitudinal hook receiving groove with center C1; a plurality of perforated secondary slats that pivot longitudinally, each perforated secondary slat comprising a central flat portion with holes that allow air and light to flow through, and upper and lower hook-shaped end portions that engage in the longitudinal hook receiving grooves of the adjacent main slats when the roller shutter is assembled; a plurality of guide pins engaged

to the end of the main slats that allow said main slats to pivot longitudinally around a rotation center C3 and guide the roller shutter along the side channels when the shutter is raised or lowered; and a lower slat, longer than the main and secondary slats, of which the ends fit directly into the side channels, therefore unable to pivot, which, when the shutter is being lowered and comes to rest on the base of the window or door, provides a solid foundation that allows the main and secondary slats to move into the up or down position.

[0016] In a first embodiment each main slat of width A comprises a distance between the lower longitudinal hook receiving groove center C2 and the upper longitudinal hook receiving groove center C1 that is in a range of $3.1xA$ to $4.1xA$; and a distance between the lower longitudinal hook receiving groove center C2 and the rotation center of the main slat C3 that is in a range of $2.58xA$ to $2.68xA$; said distance ratios between centers C1, C2, and C3 are such that when the roller shutter is in the down position no direct light is able to flow through because the lower portion of each main slat rests lower than the upper portion of each adjacent lower main slat so that as a result the perforated secondary slat is positioned at an angle looking downwards allowing air to flow through the holes while only a minor light reflection may possibly be seen from the inside, and when the roller shutter is in the up position direct light flows through because the lower portion of each main slat rests higher than the upper portion of each adjacent lower main slat, thereby allowing the perforated secondary slat to be in an upright position.

[0017] An additional aspect of the first embodiment of the invention, consists in that the upper portion of each main slat of width A comprises a spiral-shaped longitudinal hook receiving groove with a retention lobe having a radius in a range of $0.03xA$ to $0.13xA$, the inner radius of the longitudinal hook receiving groove surface being in a range of $0.27xA$ to $0.37xA$, the radius becoming smaller near to the upper retention lobe to measure $0.07xA$ to $0.17xA$; an inner surface with a radius in a range of $0.59xA$ to $0.69xA$; an outer surface having a first radius in a range of $0.48xA$ to $0.58xA$, and a second radius near the retention lobe in a range of $0.16xA$ to $0.26xA$, the change in curvature occurring on a plane forming an angle of 60° to 70° with respect to a vertical plane; the end of the curvature of the outer surface occurring on a plane forming 25° to 35° with respect to a vertical plane. The lower portion of each main slat of width A comprises a spiral-shaped longitudinal hook receiving groove with a retention lobe having a radius in a range of $0.03xA$ to $0.13xA$, the inner radius of the longitudinal hook receiving groove being in a range of $0.26xA$ to $0.36xA$ an inner surface above the longitudinal hook receiving groove with a radius in a range of $0.26xA$ to $0.36xA$; and an inner surface below the longitudinal hook receiving groove with a radius in a range of $0.22xA$ to $0.32xA$; the end of the curvature of the inner surface below the longitudinal hook occurring on a plane forming 98° to 108° with respect to a vertical plane.

[0018] In another aspect of the first embodiment of the invention the lower slat of width A comprises a height in a range of $3.9xA$ and $4.9xA$; a spiral-shaped longitudinal hook receiving groove having a depth in a range of $0.58A$ and $0.68A$, the spiral-shaped longitudinal hook receiving groove having a retention lobe with a radius in a range of $0.03xA$ to $0.13xA$, the inner radius of the spiral-shaped longitudinal hook receiving groove being in a range of $0.27xA$ to $0.37xA$; and an outer curved surface with a radius in a range of $0.33xA$ to $0.43xA$.

[0019] In a second embodiment each main slat of width A comprises a distance between the lower longitudinal hook receiving groove center C2 and the upper longitudinal hook receiving groove center C1 that is in a range of $2.5xA$ to $2.9xA$; and a distance between the lower longitudinal hook receiving groove center C2 and the rotation center of the main slat C3 that is in a range of $1.64xA$ to $1.74xA$; said distance ratios between centers C1, C2, and C3 are such that when the roller shutter is in the down position no direct light goes through because the lower portion of each main slat rests lower than the upper portion of each adjacent main slat, and as a result the perforated secondary slat is positioned at an angle looking downwards allowing air to flow through the holes while only a minor light reflection may possibly be seen from the inside, and when the roller shutter is in the up position neither light nor air can go through because the lower portion of each main slat rests on the upper portion of each adjacent lower main slat thereby leaving the secondary perforated slat hidden in the back and blocking the holes.

[0020] An additional aspect of the second embodiment of the invention consists in that the upper portion of each main slat of width A comprises a spiral-shaped longitudinal hook receiving groove with a retention lobe having a radius in a range of $0.03xA$ to $0.13xA$, the inner radius of the longitudinal hook receiving groove surface being in a range of $0.27xA$ to $0.37xA$, the radius becoming smaller near to the upper retention lobe to measure $0.26xA$ to $0.36xA$; an outer surface having a first radius in a range of $0.48xA$ to $0.58xA$, and a second radius near the retention lobe in a range of $0.27xA$ to $0.37xA$, the change in curvature occurring on a plane forming an angle of 74° to 84° with respect to a vertical plane, and the end of the curvature of the outer surface occurring on a plane forming 26° to 36° with respect to a vertical plane. The lower portion of each main slat of width A comprises a spiral-shaped longitudinal hook receiving groove with a retention lobe having a radius in a range of $0.03xA$ to $0.13xA$, the inner radius of the longitudinal hook receiving groove being in a range of $0.26xA$ to $0.36xA$; an inner surface above the longitudinal hook receiving groove with a radius in a range of $0.26xA$ to $0.36xA$; and an inner surface below the longitudinal hook receiving groove with a radius in a range of $0.48xA$ to $0.58xA$.

[0021] In another aspect of the second embodiment of the invention the lower slat of width A comprises a height in a range of $3.9xA$ and $4.9xA$; a spiral-shaped longitudinal

dinal hook receiving groove having a depth in a range of 0.58A and 0.68A, the spiral-shaped longitudinal hook receiving groove having a retention lobe with a radius in a range of 0.03xA to 0.13xA, the inner radius of the spiral-shaped longitudinal hook receiving groove being in a range of 0.27xA to 0.37xA; and an outer curved surface with a first radius in a range of 0.33xA to 0.43xA and a second radius near to the retention lobe in a range of 0.57xA to 0.67xA, the change in curvature occurring on a plane forming an angle of 27° to 37° with respect to a vertical plane.

[0022] In another aspect of both embodiments of the invention, each perforated secondary slat that engages between two main slats of width A comprises a first central flat part with a plurality of holes; two slanted flat parts extending from the limits of said first central flat part, each of said slanted flat parts forming an angle of between 14° to 24° with respect to said first central flat part; and two circular parts extending from each of said slanted flat parts, each of said circular parts having a development in the range of 237° to 247°; wherein the distance between the center of the upper circular portion C4 and the center of the lower circular portion C5 is in the range of 1.3xA to 2.3xA; the distance between the upper and lower ends of each secondary slat is in the range of 1.8xA to 2.8xA; and the surface width of each perforated secondary slat is in a range of 0.07xA to 0.17xA.

[0023] In another aspect of both embodiments of the invention, two lids comprising engagement tabs are fit under pressure to the ends of each main slat after two adjacent perforated secondary slats have been engaged into the longitudinal hook receiving grooves of each main slat so as to prevent the lateral movement of the perforated secondary slats.

[0024] In another aspect of both embodiments of the invention, each lid comprises a rectangular hole to receive the rectangular part of a guide pin that is inserted under pressure and fits tightly therein, the round part of the guide pin protruding out of the main slats and being slightly wider in diameter than the rectangular part of said pin and lid hole.

[0025] In another aspect of both embodiments of the invention, a guide channel is mounted on the window or door on which the shutter is installed the guide pins being inserted within the guide channel to guide the shutter when it is lowered or raised, the guide channel also comprising a front rim which hides the ends of the shutter slats and hinders the passage of any light ray that might seep through the edges.

[0026] In another aspect of both embodiments of the invention, in each main slat, the width A is in a range of 5mm to 50mm and preferably is equal to 13mm.

Figure 1 shows an exploded view of the shutter of the present invention. The shutter comprises main slats 1 of solid surface and perforated secondary slats 2 having holes 5 to allow air and light to flow through. The ends of the main slats 1 are covered

by lids 6, each one secured in place by the guide pin 7 which protrudes out of the lid and runs inside the guide channels placed on the sides of the windows or doors on which the shutter is mounted. Also, the shutter comprises a lower slat 9 which is longer than the main slats 1 and longer than the secondary slats 2 and has no lids 6 on its ends as the slat 9 itself inserts in the window guide channels.

Figures 2a to 7c show a first embodiment of the present invention in which, when the roller shutter is in the down position air flows through but no light, while when the roller shutter is in the up position both air and light are able to flow through.

Figure 2a shows a first embodiment of the shutter in the down position. It shows that, in the down position, no direct light is able to flow through because the lower portion 3 of each main slat 1 rests lower than the upper portion 4 of each lower adjacent main slat 1. As a result the perforated secondary slat 2 is positioned at an angle looking downwards allowing air to flow through the holes 5 while only a minor light reflection may possibly be seen from the inside.

Figure 2b shows a first embodiment of the shutter in the up position. It shows that, in the up position, the lower portion 3 of each main slat 1 rests higher than the upper portion 4 of each lower adjacent main slat 1. As a result the perforated secondary slat 2 is in an upright position allowing both air and light to flow through the holes 5.

Figure 3 shows a main slat 1 in a first embodiment. The main slat 1 comprises an outer surface 10 and an inner surface 11. The upper edge comprises an upper longitudinal hook receiving groove 12 which receives the lower end of the perforated secondary slat 2. In the lower portion of the inner surface 11 a longitudinal hook receiving groove 13 is located which receives the upper end of the perforated secondary slat 2.

Figure 4a shows a lower slat 9 in the first embodiment. Each shutter has a single tower slat 9 which is longer than the main and secondary slats, the ends of which fit into the guide channels and therefore does not pivot. This lower slat 9 comprises only one upper longitudinal hook receiving groove 21 placed on the upper edge of the slat which receives the lower end of a perforated secondary slat 2 (not shown).

Figure 4b shows a cross section of the lower slat in the first embodiment. Each lower slat 9 has a width "A" measuring in a range of 5mm to 50mm and preferably equal to 13mm. The height of each lower slat 9 is in a range of 3.9xA and 4.9xA and preferably of 4.4xA.

Figure 4c shows in detail a cross section of the upper portion of a lower slat 9 in the first embodiment. The longitudinal hook receiving groove 21 comprises a retention lobe 20 with a radius in a range of $0.03x_A$ to $0.13x_A$ and preferably equal to $0.08x_A$. The inner surface 30 of the longitudinal hook receiving groove 21 has an outer radius in a range of $0.27x_A$ to $0.37x_A$ and preferably equal to $0.32x_A$ and ends with a straight segment that forms an angle in a range of 21° to 31° and preferably of 26° with respect to a vertical plane. The outer surface 31 of the longitudinal hook receiving groove 21 has an outer radius in a range of $0.33x_A$ to $0.43x_A$ and preferably equal to $0.38x_A$. The longitudinal hook receiving groove's depth is in a range of $0.58x_A$ to $0.68x_A$ and preferably equal to $0.63x_A$.

Figure 5 shows a lid 17 which engages on each end of each main slat 1 in the first embodiment. It comprises a rectangular hole 18 and an engagement tab 19. Each lid 17 is held in place by the lid engagement tab and the guide pin, the rectangular part of which is inserted in the rectangular hole of the lid 18 before the rectangular part of said guide pin is again inserted in the corresponding rectangular cavity in the main slat; the insertion of the guide pin into said cavity is done under pressure and fits tightly. The round part of the guide pin which protrudes out of the main slats and is slightly wider in diameter than the rectangular part of said pin and the lid hole, holds the lid firmly in place. Each one of the guide pins which protrude out of the main slats not only allow for the pivoting movement of the main slats 1 but also guide the shutter along the guide channels. The function of each lid is to avoid the lateral displacement of the secondary perforated slat relative to the main slats.

Figure 6a shows a side view of the engagement between main and secondary slats in the first embodiment of the invention in a position that allows air flow but no light. In this position, the main slats 1 form an angle in the range of 22° to 32° , preferably of 27° with respect to a vertical plane, and the perforated secondary slats 2 form an angle in a range of 52° to 62° and preferably of 57° with respect to a vertical plane and, therefore, the main slats 1 form an angle in a range of 79 to 89° and preferably of 84° with respect to the perforated secondary slats 2. The lower portion 3 of each main slat 1 rests slightly lower than the upper portion 4 of the adjacent lower main slat thereby positioning the perforated secondary slat at an angle looking downward so that air flows but no light.

Figure 6b shows a side view of the engagement between main and secondary slats in the first embodiment of the invention in a position that allows air and light through. Here, the main slats 1 form an angle

in the range of 11° to 21° , preferably of 16° with respect to a vertical plane and the perforated secondary slats 2 form an angle in a range of 22° and 32° , preferably of 27° with respect to a vertical plane. As a consequence of the reduction of the angles with respect to the vertical plane and the increase of the angle formed among the main and perforated secondary slats, which in this case is in a range of 38° to 48° , preferably of 43° , the shutter flattens thereby placing the perforated secondary slats 2 in an upright position, exposed to the sun, and allowing not only air but also light to flow through its holes. The relative positioning between the main slats 1 and the perforated secondary slats 2 is such that the perforated secondary slats 2 are always slanted outwards, so that when the shutter slides into the down position, from the bottom upwards the perforated secondary slats automatically tilt further out thereby causing the assembly to fall into the right position.

Figure 7a shows a cross section of the main slat 1. Each main slat 1 has a width "A", in a range from 5mm to 50mm and preferably 13mm. The rotation center C1 of the upper longitudinal hook receiving groove 12 is separated from the rotation center C2 of the lower longitudinal hook receiving groove 13 by a distance in the range of $3.1x_A$ to $4.1x_A$ and preferably by a distance of $3.6x_A$. Also, the distance between the rotation center C1 of the upper longitudinal hook receiving groove 12 and the rotation center C3 of the main slat 1 is in a range of $0.92x_A$ to $1.02x_A$ and preferably $0.97x_A$. The distance between the rotation center C2 of the lower longitudinal hook receiving groove 13 and the rotation center C3 of the main slat is in a range of $2.58x_A$ to $2.68x_A$ and preferably is $2.63x_A$.

Figure 7b shows a cross section of the upper portion 4 of a main slat in detail. The upper longitudinal hook receiving groove 12 comprises an upper retention lobe 22 having a radius in a range of $0.03x_A$ to $0.13x_A$ and preferably equal to $0.08x_A$. The upper longitudinal hook receiving groove 12 has a surface 23 of a radius in a range of $0.27x_A$ to $0.37x_A$ and preferably measures $0.32x_A$, the radius becomes smaller near to the upper retention lobe 22 to measure $0.07x_A$ to $0.17x_A$ and preferably measures $0.12x_A$. The inner surface of the main slat has an upper portion with a radius in a range of $0.59x_A$ to $0.69x_A$ and preferably equal to $0.64x_A$. The outer surface 24 of the main slat has an upper portion with a radius in a range of $0.48x_A$ to $0.58x_A$ and preferably equal to $0.53x_A$, and becomes smaller near the retention lobe 22 to measure $0.16x_A$ to $0.26x_A$ and preferably equal to $0.21x_A$. The change in curvature of the outer surface 24 of the upper longitudinal hook receiving groove 12 occurs on a plane forming an angle of 60° to 70° and preferably of 65° with respect to a vertical

plane. The end of the curvature of the outer surface 24 of the upper longitudinal hook receiving groove 12 occurs on a plane forming 25° to 35° and preferably 30° with respect to a vertical plane.

Figure 7c shows a cross section of the lower portion 3 of a main slat 1 in detail. The lower longitudinal hook receiving groove 13 comprises a detention lobe 25 having a radius in a range of $0.03xA$ to $0.13xA$ and preferably equal to $0.08xA$. The inner surface 26 of the lower longitudinal hook receiving groove 13 has an entrance radius in a range of $0.26xA$ to $0.36xA$ and preferably equal to $0.31xA$. The outer surface 27 above the entrance of the lower longitudinal hook receiving groove 13 has a radius in a range of $0.26xA$ to $0.36xA$ and preferably equal to $0.31xA$; and the outer surface 28 below the entrance to the lower longitudinal hook receiving groove 13 has a radius in a range of $0.22xA$ to $0.32xA$ and preferably equal to $0.27xA$. The end of the curvature of the outer surface 28 of the lower longitudinal hook receiving groove 13 occurs on a plane forming an angle in a range of 98° to 108° and preferably 103° with respect to a vertical plane.

Figures 8a to 13c show a second embodiment of the present invention in which, when the roller shutter is in the down position it allows air but no light to go through; but, when the shutter is in the up position neither air nor light goes through.

Figure 8a shows a second embodiment of the shutter in the down position. In this position all the shutter's weight rests on the supporting base. The shutter comprises main slats 1 showing solid surface and perforated secondary slats 2 showing a perforated surface. This assembly allows the lower portion 3 of each main slat 1 to rest slightly lower than the upper portion 4 of the lower adjacent main slat 1. This positions the perforated secondary slat at an angle looking downwards, and therefore air flows through the holes but no light. The ends of the main slats 1 are covered by lids 6, as well as guide pins which protrude out of the slat through the lids, and run inside the lateral guide channels 8 placed on the sides of the window or door on which the shutter is mounted. The lower slat 9 is longer than the main slats 1 and the perforated secondary slats 2, has no lids 6 on its ends, and inserts in the lateral guide channels 8.

Figure 8b shows a second embodiment of the shutter in the up position in which no air and no light go through because the lower portion 3 of each main slat 1 rests on the upper portion 4 of each adjacent lower main slat 1, thereby leaving the secondary slat hidden in the back and blocking the holes.

Figure 9 shows a main slat 1 in the second embodiment, comprising an outer surface 10 and an inner surface 11. The upper edge comprises an upper longitudinal hook receiving groove 12 which receives the lower end of the perforated secondary slat 2. The lower portion of the inner surface 11 of each main slat 1 comprises a longitudinal hook receiving groove 13 which receives the upper end of the perforated secondary slat 2.

Figure 10a shows a lower slat 9 in the second embodiment. Each shutter has a single lower slat 9 which is longer than the main and secondary slats, the ends of which fit into the guide channels and therefore does not pivot. This lower slat 9 comprises only one upper longitudinal hook receiving groove 21 placed on the upper edge of the slat which receives the lower end of the perforated secondary slat 2.

Figure 10b shows a cross section of the lower slat 9 in the second embodiment. Each lower slat has a width "A" measuring in a range of 5mm to 50mm and preferably equal to 13mm. The height of each lower slat 9 is in a range of $3.9xA$ and $4.9xA$ and preferably of $4.4xA$.

Figure 10c shows in detail a cross section of the upper portion of a lower slat in the second embodiment. The longitudinal hook receiving groove 21 comprises a retention lobe 20 with a radius in a range of $0.03xA$ to $0.13xA$ and preferably equal to $0.08xA$. The inner surface 30 of the longitudinal hook receiving groove 21 is a circular segment that has a radius in a range of $0.27xA$ to $0.37xA$ and preferably equal to $0.32xA$ and ends with a straight segment that forms an angle in a range of 21° to 31° and preferably of 26° with respect to a vertical plane. The outer surface 31 of the longitudinal hook receiving groove 21 has a first radius in a range of $0.33xA$ to $0.43xA$ and preferably equal to $0.38xA$ and a second radius near to the retention lobe in a range of $0.57xA$ to $0.67xA$ and preferably equal to $0.62xA$. The change in curvature occurs on a plane forming an angle of 27° to 37° and preferably of 32° with respect to a vertical plane. The longitudinal hook receiving groove's depth is in a range of $0.58xA$ to $0.68xA$ and preferably equal to $0.63xA$.

Figure 11 shows a lid 15 which engages on the end of each main slat 1 in the second embodiment. It comprises a rectangular hole 18 and an engagement tab 19. Each lid 17 is held in place by the lid tabs and the guide pin, the rectangular part of which is inserted in the rectangular hole of the lid 18 before the rectangular part of said guide pin is again inserted in the corresponding rectangular cavity in the main slat; the insertion of the guide pin into said cavity is

done under pressure and fits tightly, and the round part of the guide pin which protrudes out is slightly wider in diameter than the rectangular part of said pin and the lid hole, therefore holding the lid firmly in place. Each one of the guide pins which protrude out of the main slats not only allow for the pivoting movement of the main slats 1 but also guide the shutter along the guide channels. The function of each lid is to avoid the lateral displacement of the perforated secondary slat 2 relative to the main slats.

Figure 12a shows a side view of the shutter in the second embodiment in the down position. In this position, the main slats 1 form an angle in a range of 22° to 32° and preferably 27° with respect to a vertical plane, and the perforated secondary slats 2 form an angle in a range of 130° to 140° and preferably of 135° with respect to a vertical plane and, therefore, the main slats 1 form an angle in a range of 103° to 113° and preferably of 108° with respect to the secondary slats 2. This assembly allows the lower portion 3 of each main slat 1 to rest below the upper portion 4 of the adjacent main slat

Figure 12b shows a side view of the shutter in the second embodiment in the up position. Here, the main slats 1 form an angle in a range of 8° to 18° and preferably 13° with respect to a vertical plane, and the perforated secondary slats 2 form an angle in a range of 159° to 169° and preferably 164° with respect to a vertical plane. As a result of this reduction in the angles with respect to the vertical plane and due to the change in the angle between the main and secondary slats which increases in this position to a range of 144° to 154° and preferably to 149° , the shutter flattens, the lower portion 3 of the main slat 1 leans against the upper portion 4 of the lower adjacent main slat, hiding the perforated secondary slat and blocking the holes.

Figure 13a shows a cross section of the main slat 1 in the second embodiment. Each main slat 1 has a width "A", measuring 5mm to 50mm and preferably measuring 13mm. The rotation center C1 of the upper longitudinal hook receiving groove 12 is separated from the rotation center C2 of the lower longitudinal hook receiving groove 13 by a distance in a range of $2.5 \times A$ to $2.9 \times A$ and preferably $2.7 \times A$. Also, the distance between the rotation center C1 of the upper longitudinal hook receiving groove 12 and the rotation center C3 of the main slat 1 is in the range of $1.005 \times A$ to $1.015 \times A$ and preferably $1.01 \times A$. The distance between the rotation center C2 of the lower longitudinal hook receiving groove 13 and the rotation center C3 of the main slat is in a range of $1.64 \times A$ and $1.74 \times A$ and preferably is equal to $1.69 \times A$.

Figure 13b shows a detailed cross section of the up-

per portion 4 of a main slat in the second embodiment. The upper longitudinal hook receiving groove 12 comprises an upper retention lobe 22 having a radius in the range of $0.03 \times A$ to $0.13 \times A$ and preferably of $0.08 \times A$. The radius becomes smaller near to the upper retention lobe to measure $0.26 \times A$ to $0.36 \times A$ and preferably of $0.31 \times A$. The surface 23 of the upper longitudinal hook receiving groove 12 has an inner radius in a range of $0.26 \times A$ to $0.36 \times A$ and preferably of $0.32 \times A$. The outer upper surface 24 of the upper longitudinal hook receiving groove 12 is curve and has a first radius in a range of $0.48 \times A$ to $0.58 \times A$ and preferably of $0.53 \times A$ and decreases near the retention lobe 22 to a second radius in a range of $0.27 \times A$ to $0.37 \times A$ and preferably $0.32 \times A$. The change in curvature occurs on a plane forming an angle of 74° to 84° and preferably of 79° with respect to a vertical plane, and the end of the curvature of the outer surface occurs on a plane forming 26° to 36° and preferably of 31° with respect to a vertical plane.

Figure 13c shows a detailed cross section of the lower portion 3 of a main slat 1 in the second embodiment. The lower longitudinal hook receiving groove 13 comprises a retention lobe 25 having a radius in a range of $0.03 \times A$ to $0.13 \times A$ and preferably equal to $0.08 \times A$. The inner surface 26 of the lower longitudinal hook receiving groove 13 has a radius in a range of $0.26 \times A$ to $0.36 \times A$ and preferably of $0.31 \times A$. The inner surface 27 above the lower longitudinal hook receiving groove 13 has an equivalent radius in a range of $0.26 \times A$ to $0.36 \times A$ and preferably equal to $0.31 \times A$; and the inner surface 28 below the lower longitudinal hook receiving groove 13 has a radius in a range of $0.48 \times A$ to $0.58 \times A$ and preferably equal to $0.53 \times A$,

Figure 14a shows a perforated secondary slat 2 in both embodiments of the invention, comprising an upper edge 14 and a lower edge 25. The perforated secondary slats 2 are the same in the first and the second embodiments. Both edges have a hook-like shape and are designed to engage inside the upper and lower longitudinal hook receiving grooves 12, 13 respectively of the main slat 1. Also, each perforated secondary slat 2 comprises plurality of holes 5 which extend along the whole length of the perforated secondary slat 2. These holes 5 are located in the flat central part 16 of the perforated secondary slat 2.

Figure 14b shows a cross section view of the perforated secondary slat 2. The distance between the upper rotation center C4 and the lower rotation center C5 of each secondary slat 2 is in the range of $1.3 \times A$ to $2.3 \times A$ and preferably equal to $1.8 \times A$; and the distance between the upper and lower ends of

each secondary slat is in the range of $1.8 \times a$ to $2.8 \times A$ and preferably equal to $2.3 \times A$. The surface width of each secondary slat 2 is in a range of $0.07 \times A$ to $0.17 \times A$ and preferably equal to $0.12 \times A$. The cross section of each perforated secondary slat 2 comprises a central flat part 29 which contains the holes two slanted flat parts 30 extending from the limits of said first central flat part, each of said slanted flat parts forming an angle of between 14° to 24° and preferably equal to 19° with respect to a vertical plane, and two circular parts extending from each of said slanted flat parts, each of said circular parts having a development in the range of 237° to 247° and preferably of 242° . The curvature radius of each hook 31 is in a range of $0.20 \times A$ to $0.30 \times A$ and preferably equal to $0.25 \times A$.

Figure 15 shows a guide pin 7 in both embodiments of the invention. Each guide pin is inserted in the end of the main slats through the rectangular hole in the lid 6 (see figure 1). The guide pins 7 guide the shutter within the lateral guide channels when the shutter is raised or lowered. Each guide pin 7 comprises a cylindrical head 33, which protrudes out of the ends of the main slats, and inserts inside the lateral guide channels; and a rectangular body 34, which inserts and engages in the ends of the main slats 1 also holding the lids in place (see figure 1).

Figure 16 shows a newly developed guide channel 8 which is mounted on the window or door on which the shutter is installed, and guides the shutter when it is lowered or raised. In addition of comprising the channel 36 in which the guide pins 7 are inserted it also comprises a front rim 35 which hides the ends of the shutter slats, and hinders the passage of any light ray that could seep through the edges while also achieving greater strength and security against burglary.

Figure 17 shows a view from above of the guide pin 7 inserted in the guide channel 8. It also shows the front rim which hides the ends of the slats.

[0027] Although the invention has been shown and described with reference to certain embodiment examples, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the invention as defined by the accompanied claims.

Claims

1. A roller shutter comprising:

- a plurality of main slats of solid surface and width A that pivots around a longitudinal axis,

each main slat comprising a solid outer surface and a solid inner surface, a lower portion which has a spiral-shaped lower longitudinal hook receiving groove with center C2, and an upper portion which has a spiral-shaped upper longitudinal hook receiving groove with center C1;

- a plurality of perforated secondary slats that pivot longitudinally, each perforated secondary slat comprising a central flat portion with holes that allow air and slight to flow through, and upper and lower hook-shaped end portions that engage in the longitudinal hook receiving grooves of the adjacent main slats when the roller shutter is assembled;

- a plurality of guide pins engaged to the end of the main slats that allow said main slats to pivot longitudinally around a rotation center C3 and guide the roller shutter along the side channels when the shutter is raised or lowered; and

- a lower slat, longer than the main and secondary slats, of which the ends fit directly into the side channels, therefore unable to pivot, which, when the shutter is being lowered and comes to rest on the base of the window or door, provides a solid foundation that allows the main and secondary slats to move into the up or down position.

2. A roller shutter as set forth in claim 1, wherein each main slat of width A comprises:

- a distance between the lower longitudinal hook receiving groove center C2 and the upper longitudinal hook receiving groove center C1 that is in a range of $3.1 \times A$ to $4.1 \times A$; and

- a distance between the lower longitudinal hook receiving groove center C2 and the rotation center of the main slat C3 that is in a range of $2.58 \times A$ to $2.68 \times A$;

- said distance ratios between centers C1, C2, and C3 are such that when the roller shutter is in the down position no direct light is able to flow through because the lower portion of each main slat rests lower than the upper portion of each adjacent lower main slat so that as a result the perforated secondary slat is positioned at an angle looking downwards allowing air to flow through the holes while only a minor light reflection may possibly be seen from the inside, and when the roller shutter is in the up position direct light flows through because the lower portion of each main slat rests higher than the upper portion of each adjacent lower main slat, thereby allowing the perforated secondary slat to be in an upright position.

3. A roller shutter as set forth in claim 2, wherein the upper portion of each main slat of width A comprises:

- a spiral-shaped longitudinal hook receiving groove with a retention lobe having a radius in a range of $0.03 \times A$ to $0.13 \times A$, the inner radius of the longitudinal hook receiving groove surface being in a range of $0.27 \times A$ to $0.37 \times A$, the radius becoming smaller near to the upper retention lobe to measure $0.07 \times A$ to $0.17 \times A$; 5
 - an inner surface with a radius in a range of $0.59 \times A$ to $0.69 \times A$; 10
 - an outer surface having a first radius in a range of $0.48 \times A$ to $0.58 \times A$, and a second radius near the retention lobe in a range of $0.16 \times A$ to $0.26 \times A$, the change in curvature occurring on a plane forming an angle of 60° to 70° with respect to a vertical plane; the end of the curvature of the outer surface occurring on a plane forming 25° to 35° with respect to a vertical plane. 15
4. A roller shutter as set forth in claim 2, wherein the lower portion of each main slat of width A comprises: 20
- a spiral-shaped longitudinal hook receiving groove with a retention lobe having a radius in a range of $0.03 \times A$ to $0.13 \times A$, the inner radius of the longitudinal hook receiving groove being in a range of $0.26 \times A$ to $0.36 \times A$; 25
 - an inner surface above the longitudinal hook receiving groove with a radius in a range of $0.26 \times A$ to $0.36 \times A$; and
 - an inner surface below the longitudinal hook receiving groove with a radius in a range of $0.22 \times A$ to $0.32 \times A$; the end of the curvature of the inner surface below the longitudinal hook occurring on a plane forming 98° to 108° with respect to a vertical plane. 30 35
5. A roller shutter as set forth in claim 1 or 2, wherein the lower slat of width A comprises: 40
- a height in a range of $3.9 \times A$ and $4.9 \times A$;
 - a spiral-shaped longitudinal hook receiving groove halving a depth in a range of $0.58A$ and $0.68A$, the spiral-shaped longitudinal hook receiving groove having a retention lobe with a radius in a range of $0.03 \times A$ to $0.13 \times A$, the inner radius of the spiral-shaped longitudinal hook receiving groove being in a range of $0.27 \times A$ to $0.37 \times A$; and 45
 - an outer curved surface with a radius in a range of $0.33 \times A$ to $0.43 \times A$. 50
6. A roller shutter as set forth in claim 1, wherein each main slat of width A comprises: 55
- a distance between the lower longitudinal hook receiving groove center C2 and the upper longitudinal hook receiving groove center C1 that is in a range of $2.5 \times A$ to $2.9 \times A$; and
- a distance between the lower longitudinal hook receiving groove center C2 and the rotation center of the main slat C3 that is in a range of $1.64 \times A$ to $1.74 \times A$;
 - said distance ratios between centers C1, C2, and C3 are such that when the roller shutter is in the down position no direct light goes through because the lower portion of each main slat rests lower than the upper portion of each adjacent main slat, and as a result the perforated secondary slat is positioned at an angle looking downwards allowing air to flow through the holes while only a minor light reflection may possibly be seen from the inside, and when the roller shutter is in the up position neither light nor air can go through because the lower portion of each main slat rests on the upper portion of each adjacent lower main slat thereby leaving the secondary perforated slat hidden in the back and blocking the holes.
7. A roller shutter as set forth in claim 6, wherein the upper portion of each main slat of width A comprises: 60
- a spiral-shaped longitudinal hook receiving groove with a retention lobe having a radius in a range of $0.03 \times A$ to $0.13 \times A$, the inner radius of the longitudinal hook receiving groove surface being in a range of $0.27 \times A$ to $0.37 \times A$, the radius becoming smaller near to the upper retention lobe to measure $0.26 \times A$ to $0.36 \times A$;
 - an outer surface having a first radius in a range of $0.48 \times A$ to $0.58 \times A$, and a second radius near the retention lobe in a range of $0.27 \times A$ to $0.37 \times A$, the change in curvature occurring on a plane forming an angle of 74° to 84° with respect to a vertical plane, and the end of the curvature of the outer surface occurring on a plane forming 26° to 36° with respect to a vertical plane.
8. A roller shutter as set forth in claim 6, wherein the lower portion of each main slat of width A comprises: 65
- a spiral-shaped longitudinal hook receiving groove with a retention lobe having a radius in a range of $0.03 \times A$ to $0.13 \times A$, the inner radius of the longitudinal hook receiving groove being in a range of $0.26 \times A$ to $0.36 \times A$;
 - an inner surface above the longitudinal hook receiving groove with a radius in a range of $0.26 \times A$ to $0.36 \times A$; and
 - an inner surface below the longitudinal hook receiving groove with a radius in a range of $0.48 \times A$ to $0.58 \times A$.
9. A roller shutter as set forth in claim 1 or 6, wherein the lower slat of width A comprises: 70

- a height in a range of $3.9 \times A$ and $4.9 \times A$;
 - a spiral-shaped longitudinal hook receiving groove having a depth in a range of $0.58A$ and $0.68A$, the spiral-shaped longitudinal hook receiving groove having a retention lobe with a radius in a range of $0.03 \times A$ to $0.13 \times A$, the inner radius of the spiral-shaped longitudinal hook receiving groove being in a range of $0.27 \times A$ to $0.37 \times A$; and
 - an outer curved surface with a first radius in a range of $0.33 \times A$ to $0.43 \times A$ and a second radius near to the retention lobe in a range of $0.57 \times A$ to $0.67 \times A$, the change in curvature occurring on a plane forming an angle of 27° to 37° with respect to a vertical plane.
10. A roller shutter as set forth in claim 1, wherein each perforated secondary slat that engages between two main slats of width A comprises:
- a first central flat part with a plurality of bores;
 - two slanted flat parts extending from the limits of said first central flat part, each of said slanted flat parts forming an angle of between 14° to 24° with respect to said first central flat part; and
 - two circular parts extending from each of said slanted flat parts, each of said circular parts having a development in the range of 237° to 247° ;
 - wherein the distance between the center of the upper circular portion $C4$ and the center of the lower circular portion $C5$ is in the range of $1.3 \times A$ to $2.3 \times A$;
 - the distance between the upper and lower ends of each secondary slat is in the range of $1.8 \times A$ to $2.8 \times A$; and
 - the surface width of each perforated secondary slat is in a range of $0.07 \times A$ to $0.17 \times A$.
11. A roller shutter as set forth in claim 1, wherein two lids comprising engagement tabs are fit under pressure to the ends of each main slat after two adjacent perforated secondary slats have been engaged into the longitudinal hook receiving grooves of each main slat so as to prevent the lateral movement of the perforated secondary slats.
12. A roller shutter as set forth in claim 11, wherein each lid comprises a rectangular hole to receive the rectangular part of a guide pin that is inserted under pressure and fits tightly therein, the round part of the guide pin protruding out of the main slats and being slightly wider in diameter than the rectangular part of said pin and lid hole.
13. A roller shutter as set forth in claim 12, wherein a guide channel is mounted on the window or door on which the shutter is installed the guide pins being inserted within the guide channel to guide the shutter

when it is lowered or raised, the guide channel also comprising a front rim which hides the ends of the shutter slats and hinders the passage of any light ray that might seep through the edges.

14. A roller shutter as set forth in any of claims 1-10, wherein in each main slat, the width A is in a range of 5mm to 50mm and preferably is equal to 13mm

Amended claims in accordance with Rule 137(2) EPC.

1. A roller shutter **characterized by** comprising:

- a plurality of main slats (1) of solid surface and width A that pivots around a longitudinal axis, each main slat comprising a solid outer surface (10) and a solid inner surface (11), a lower portion (3) which has a spiral-shaped lower longitudinal hook receiving groove (13) with center $C2$, and an upper portion (4) which has a spiral-shaped upper longitudinal hook receiving groove (12) with center $C1$;
- a plurality of perforated secondary slats (2) that pivot longitudinally, each perforated secondary slat comprising a central flat portion (16) with holes (5) that allow air and light to flow through, and upper and lower hook-shaped end portions (14, 15) that engage in the longitudinal hook receiving grooves (12, 13) of the adjacent main slats (1) when the roller shutter is assembled;
- a plurality of guide pins (7) engaged to the end of the main slats (1) that allow said main slats (1) to pivot longitudinally around a rotation center $C3$ and guide the roller shutter along side channels when the shutter is raised or lowered; and
- a lower slat (9), longer than the main and secondary slats (1,2), of which the ends fit directly into the side channels, therefore unable to pivot, which, when the shutter is being lowered and comes to rest on the base of the window or door, provides a solid foundation that allows the main and secondary slats (2) to move into the up or down position.

2. A roller shutter as set forth in claim 1, **characterized in that** each main slat of width A comprises:

- a distance between the lower longitudinal hook receiving groove (13) center $C2$ and the upper longitudinal hook receiving groove (12) center $C1$ that is in a range of $3.1 \times A$ to $4.1 \times A$; and
- a distance between the lower longitudinal hook receiving groove (13) center $C2$ and the rotation center of the main slat $C3$ that is in a range of $2.58 \times A$ to $2.68 \times A$;

- said distance ratios between centers C1, C2, and C3 are such that when the roller shutter is in the down position no direct light is able to flow through because the lower portion (3) of each main slat (1) rests lower than the upper portion (4) of each adjacent lower main slat so that as a result the perforated secondary slat (2) is positioned at an angle looking downwards allowing air to flow through the holes (5) while only a minor light reflection may possibly be seen from the inside, and when the roller shutter is in the up position direct light flows through because the lower portion (3) of each main slat (1) rests higher than the upper portion (4) of each adjacent lower main slat (1), thereby allowing the perforated secondary slat (2) to be in an upright position.

3. A roller shutter as set forth in claim 2, characterized in that the upper portion (4) of each main slat (1) of width A comprises:

- a spiral-shaped longitudinal hook receiving groove (12) with a retention lobe (22) having a radius in a range of $0.03xA$ to $0.13xA$, the inner radius of the longitudinal hook receiving groove surface (23) being in a range of $0.27xA$ to $0.37xA$, the radius becoming smaller near to the upper retention lobe (22) to measure $0.07xA$ to $0.17xA$;
- an inner surface (11) with a radius in a range of $0.59xA$ to $0.69xA$;
- an outer surface (10) having a first radius in a range of $0.48xA$ to $0.58xA$, and a second radius near the retention lobe (22) in a range of $0.16xA$ to $0.26xA$, the change in curvature occurring on a plane forming an angle of 60° to 70° with respect to a vertical plane; the end of the curvature of the outer surface (10) occurring on a plane forming 25° to 35° with respect to a vertical plane.

4. A roller shutter as set forth in claim 2, characterized in that the lower portion (3) of each main slat (1) of width A comprises:

- a spiral-shaped longitudinal hook receiving groove (13) with a retention lobe (22) having a radius in a range of $0.03xA$ to $0.13xA$, the inner radius of the longitudinal hook receiving groove (13) being in a range of $0.26xA$ to $0.36xA$;
- an inner surface (11) above the longitudinal hook receiving groove (13) with a radius in a range of $0.26xA$ to $0.36xA$; and
- an inner surface (11) below the longitudinal hook receiving groove (13) with a radius in a range of $0.22xA$ to $0.32xA$; the end of the curvature of the inner surface (11) below the longi-

tudinal hook occurring on a plane forming 98° to 108° with respect to a vertical plane.

5. A roller shutter as set forth in claim 1 or 2, characterized in that the lower slat (9) of width A comprises:

- a height in a range of $3.9xA$ and $4.9xA$;
- a spiral-shaped longitudinal hook receiving groove (21) having a depth in a range of $0.58A$ and $0.68A$, the spiral-shaped longitudinal hook receiving groove (21) having a retention lobe (20) with a radius in a range of $0.03xA$ to $0.13xA$, the inner radius of the spiral-shaped longitudinal hook receiving groove being in a range of $0.27xA$ to $0.37xA$; and
- an outer curved surface (31) with a radius in a range of $0.33xA$ to $0.43xA$.

6. A roller shutter as set forth in claim 1, characterized in that each main slat of width A comprises:

- a distance between the lower longitudinal hook receiving groove (13) center C2 and the upper longitudinal hook receiving groove (12) center C1 that is in a range of $2.5xA$ to $2.9xA$; and
- a distance between the lower longitudinal hook receiving groove (13) center C2 and the rotation center of the main slat C3 that is in a range of $1.64xA$ to $1.74xA$;
- said distance ratios between centers C1, C2, and C3 are such that when the roller shutter is in the down position no direct light goes through because the lower portion (3) of each main slat (1) rests lower than the upper portion (4) of each adjacent main slat (1), and as a result the perforated secondary slat is positioned at an angle looking downwards allowing air to flow through the holes (5) while only a minor light reflection may possibly be seen from the inside, and when the roller shutter is in the up position neither light nor air can go through because the lower portion (3) of each main slat (1) rests on the upper portion (4) of each adjacent lower main slat (1) thereby leaving the secondary perforated slat (2) hidden in the back and blocking the holes (5).

7. A roller shutter as set forth in claim 6, characterized in that the upper portion (4) of each main slat (1) of width A comprises:

- a spiral-shaped longitudinal hook receiving groove (12) with a retention lobe (22) having a radius in a range of $0.03xA$ to $0.13xA$, the inner radius of the longitudinal hook receiving groove surface (23) being in a range of $0.27xA$ to $0.37xA$, the radius becoming smaller near to the upper retention lobe (22) to measure $0.26xA$ to

0.36xA;

- an outer surface having a first radius in a range of 0.48xA to 0.58xA, and a second radius near the retention lobe (22) in a range of 0.27xA to 0.37xA, the change in curvature occurring on a plane forming an angle of 74° to 84° with respect to a vertical plane, and the end of the curvature of the outer surface occurring on a plane forming 26° to 36° with respect to a vertical plane.

8. A roller shutter as set forth in claim 6, **characterized in that** the lower portion (3) of each main slat (1) of width A comprises:

- a spiral-shaped longitudinal hook receiving groove with a retention lobe (22) having a radius in a range of 0.03xA to 0.13xA, the inner radius of the longitudinal hook receiving groove being in a range of 0.26xA to 0.36xA;
- an inner surface above the longitudinal hook receiving groove with a radius in a range of 0.26xA to 0.36xA; and
- an inner surface below the longitudinal hook receiving groove with a radius in a range of 0.48xA to 0.58xA.

9. A roller shutter as set forth in claim 1 or 6, **characterized in that** the lower slat (9) of width A comprises:

- a height in a range of 3.9xA and 4.9xA;
- a spiral-shaped longitudinal hook receiving groove (21) having a depth in a range of 0.58A and 0.68A, the spiral-shaped longitudinal hook receiving groove (21) having a retention lobe (20) with a radius in a range of 0.03xA to 0.13xA, the inner radius of the spiral-shaped longitudinal hook receiving groove (21) being in a range of 0.27xA to 0.37xA; and
- an outer curved surface (31) with a first radius in a range of 0.33xA to 0.43xA and a second radius near the retention lobe (20) in a range of 0.57xA to 0.67xA, the change in curvature occurring on a plane forming an angle of 27° to 37° with respect to a vertical plane.

10. A roller shutter as set forth in claim 1, **characterized in that** each perforated secondary slat (2) that engages between two main slats (1) of width A comprises:

- a first central flat part (16) with a plurality of holes (5);
- two slanted flat parts (30) extending from the limits of said first central flat part (16), each of said slanted flat parts (30) forming an angle of between 14° to 24° with respect to said first central flat part (15); and

- two circular parts (14, 15) extending from each of said slanted flat parts (30), each of said circular parts (14, 15) having a development in the range of 237° to 247°;
- wherein the distance between the center of the upper circular portion C4 and the center of the lower circular portion C5 is in the range of 1.3xA to 2.3xA;
- the distance between the upper and lower ends of each secondary slat is in the range of 1.8xA to 2.8xA; and
- the surface width of each perforated secondary slat (2) is in a range of 0.07xA to 0.17xA.

11. A roller shutter as set forth in claim 1, **characterized in that** two lids comprising engagement tabs are fit under pressure to the ends of each main slat (1) after two adjacent perforated secondary slats (2) have been engaged into the longitudinal hook receiving grooves of each main slat (1) so as to prevent the lateral movement of the perforated secondary slats (2).

12. A roller shutter as set forth in claim 11, **characterized in that** each lid (6) comprises a rectangular hole to receive the rectangular part (34) of a guide pin (7) that is inserted under pressure and fits tightly therein, the round part (33) of the guide pin (7) protruding out of the main slats (1) and being slightly wider in diameter than the rectangular part (34) of said pin and lid hole.

13. A roller shutter as set forth in claim 12, **characterized in that** a guide channel (36) is mounted on the window or door on which the shutter is installed the guide pins (7) being inserted within the guide channel (36) to guide the shutter when it is lowered or raised, the guide channel (36) also comprising a front rim (35) which hides the ends of the shutter slats and hinders the passage of any light ray that might seep through the edges.

14. A roller shutter as set forth in any of claims 1-10, **characterized in that** in each main slat (1), the width A is in a range of 5mm to 50mm and preferably is equal to 13mm.

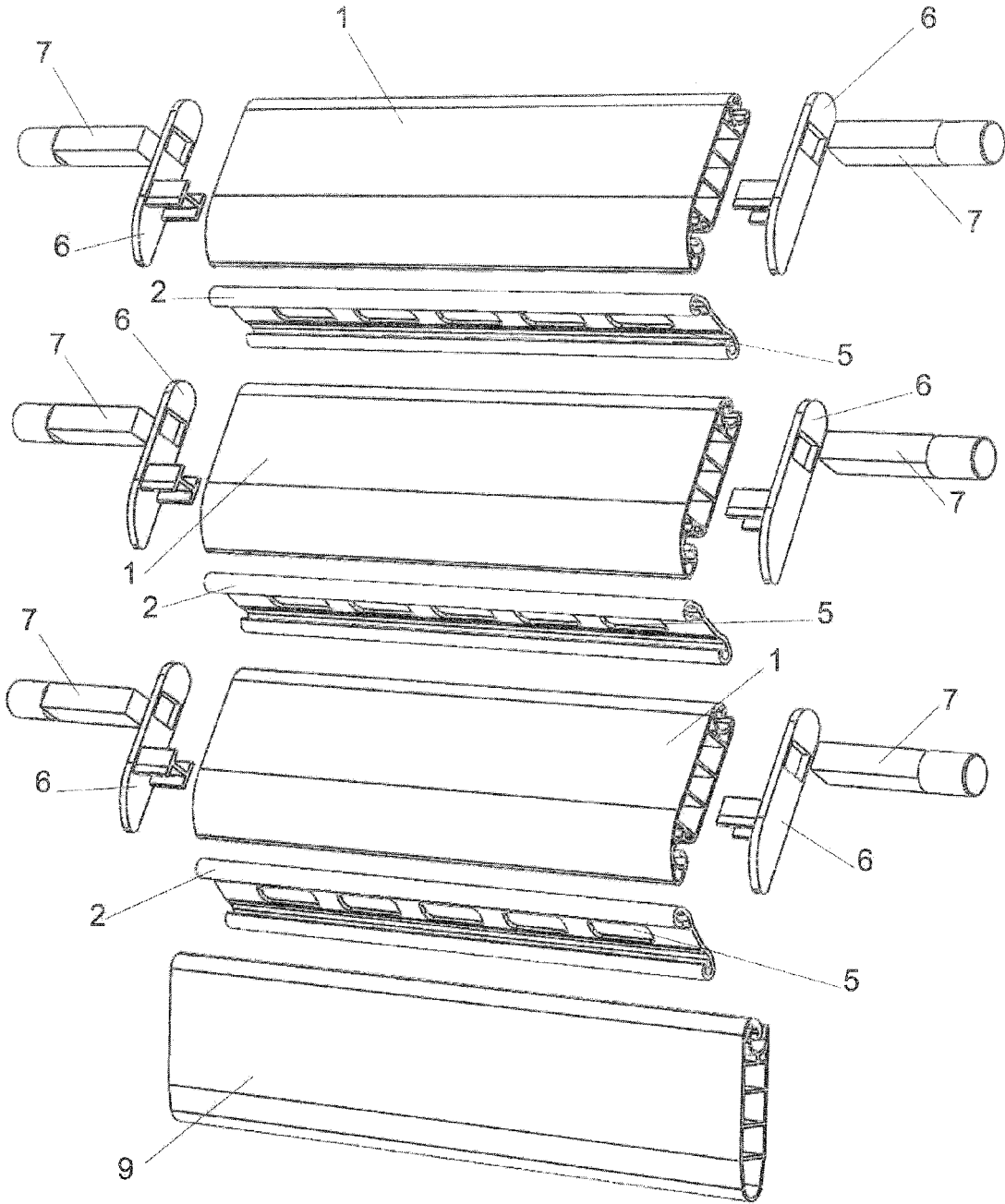


FIG.1

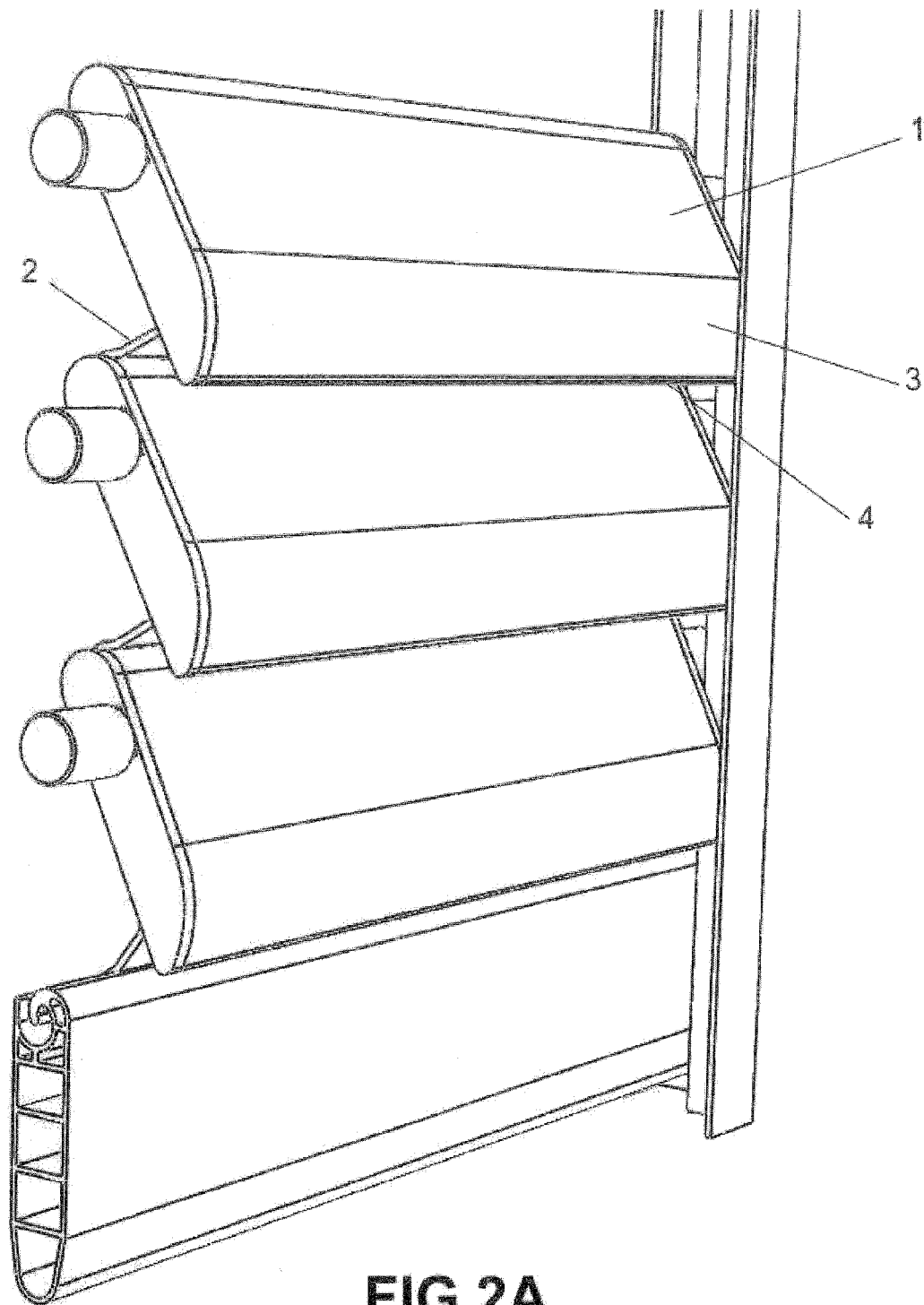


FIG.2A

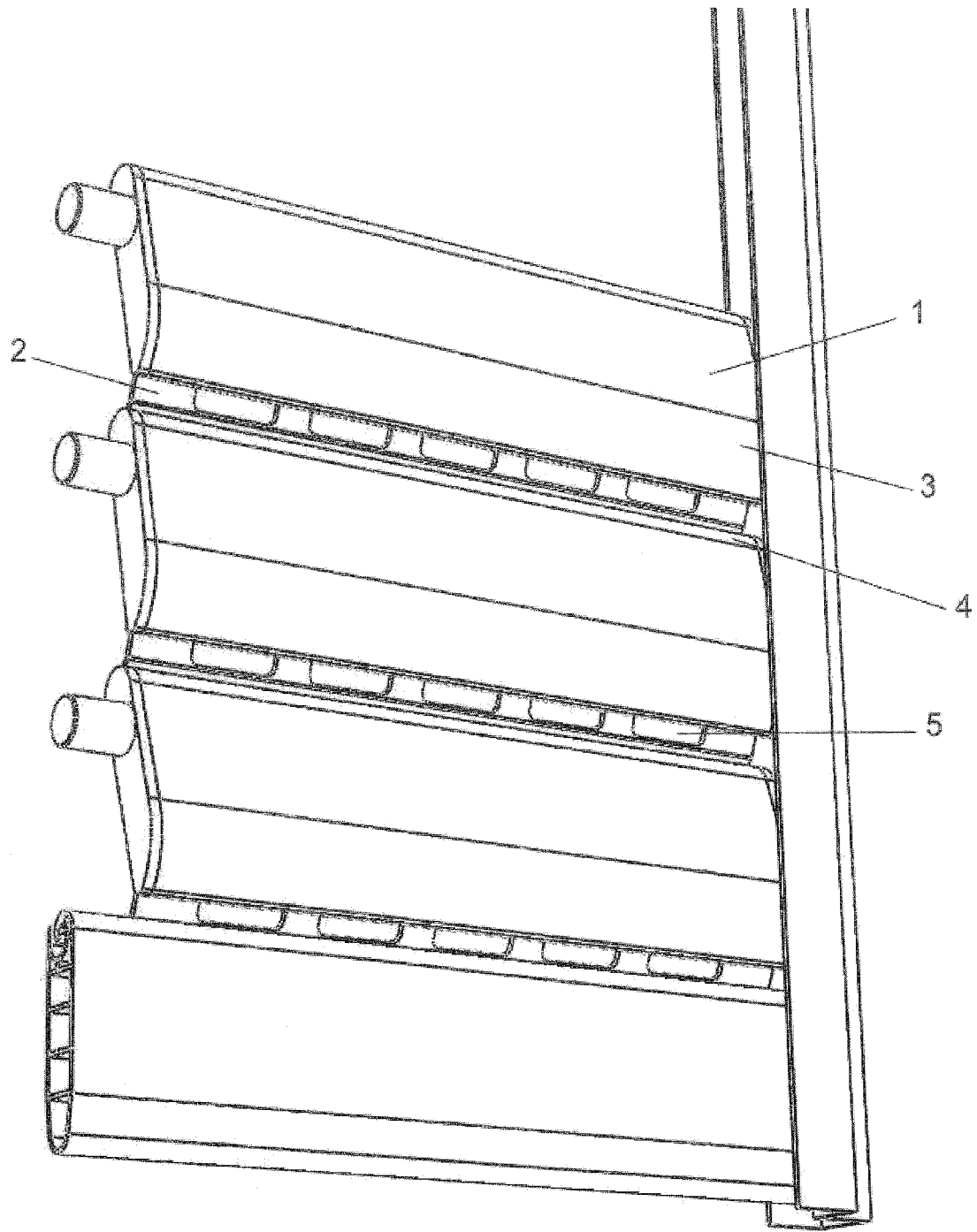
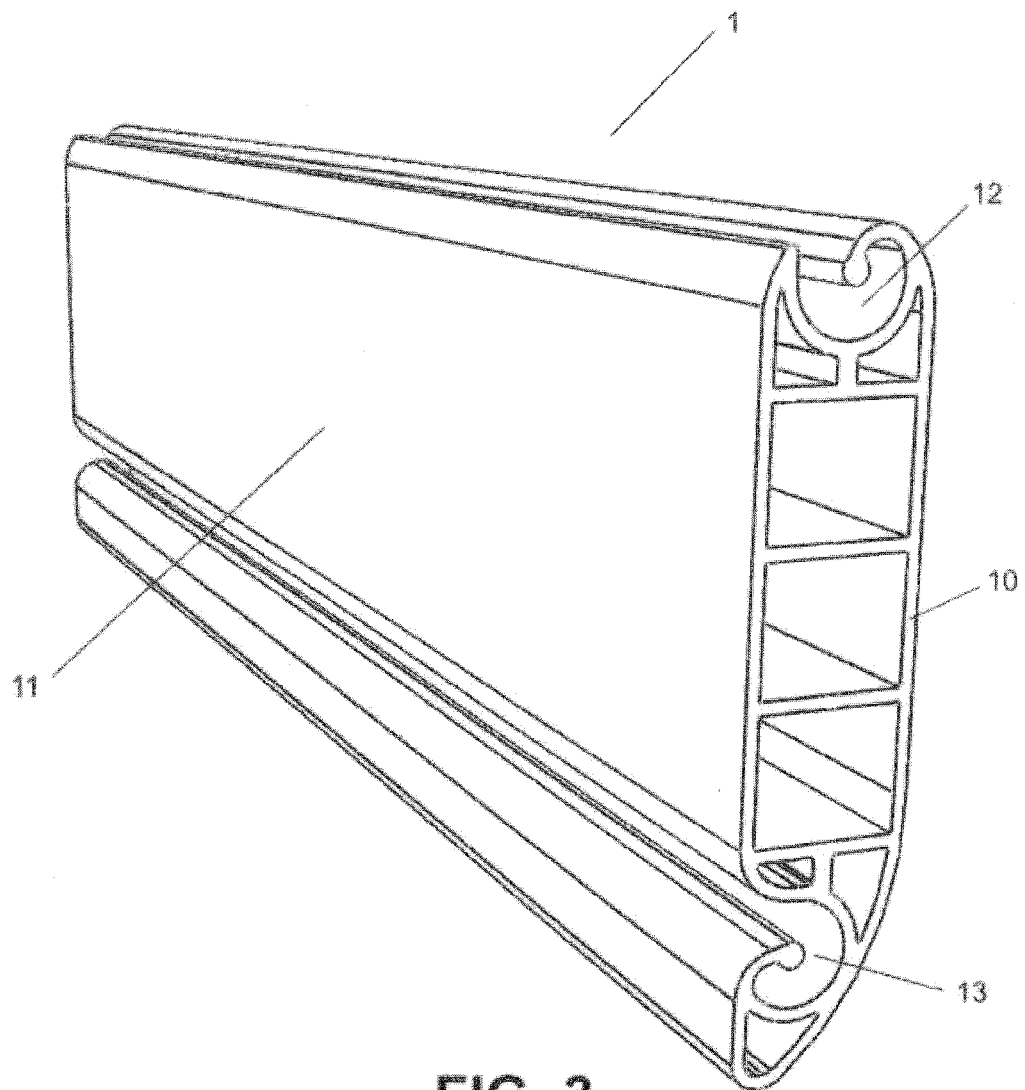


FIG.2B



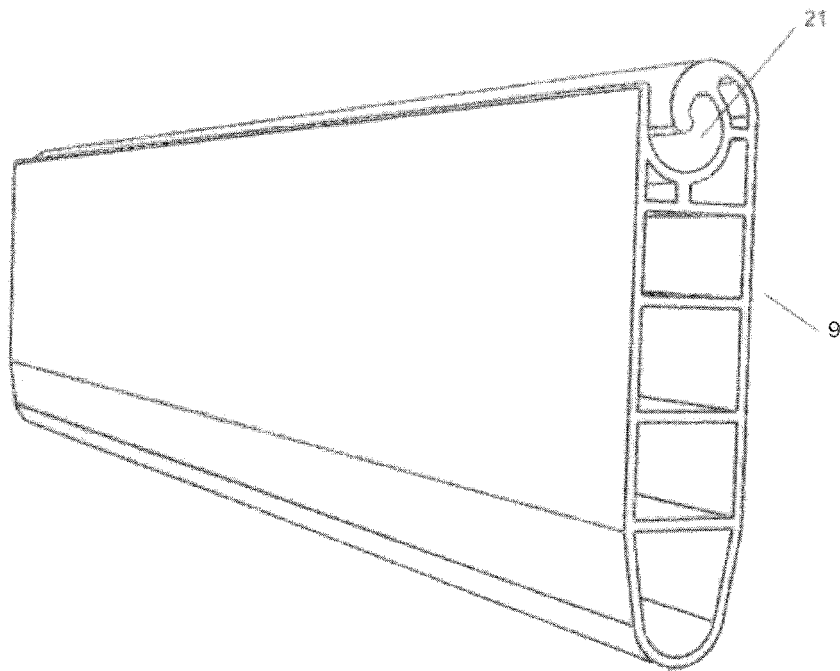


FIG. 4A

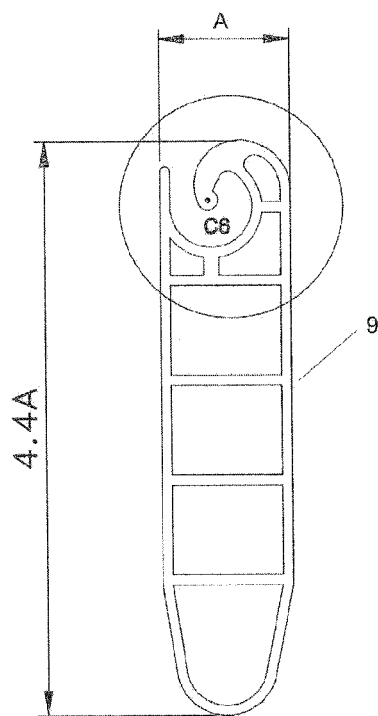


FIG. 4B

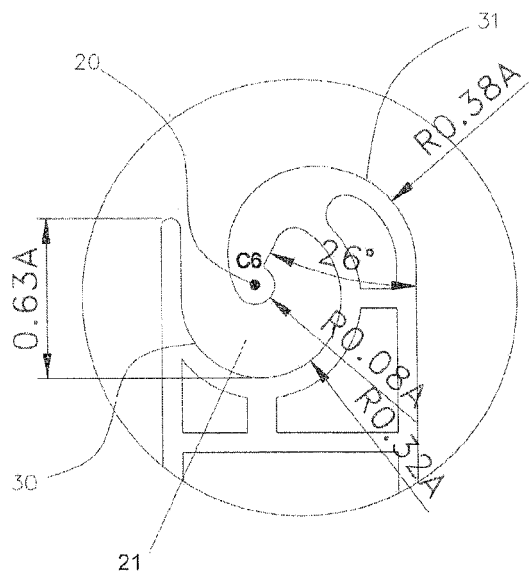


FIG. 4C

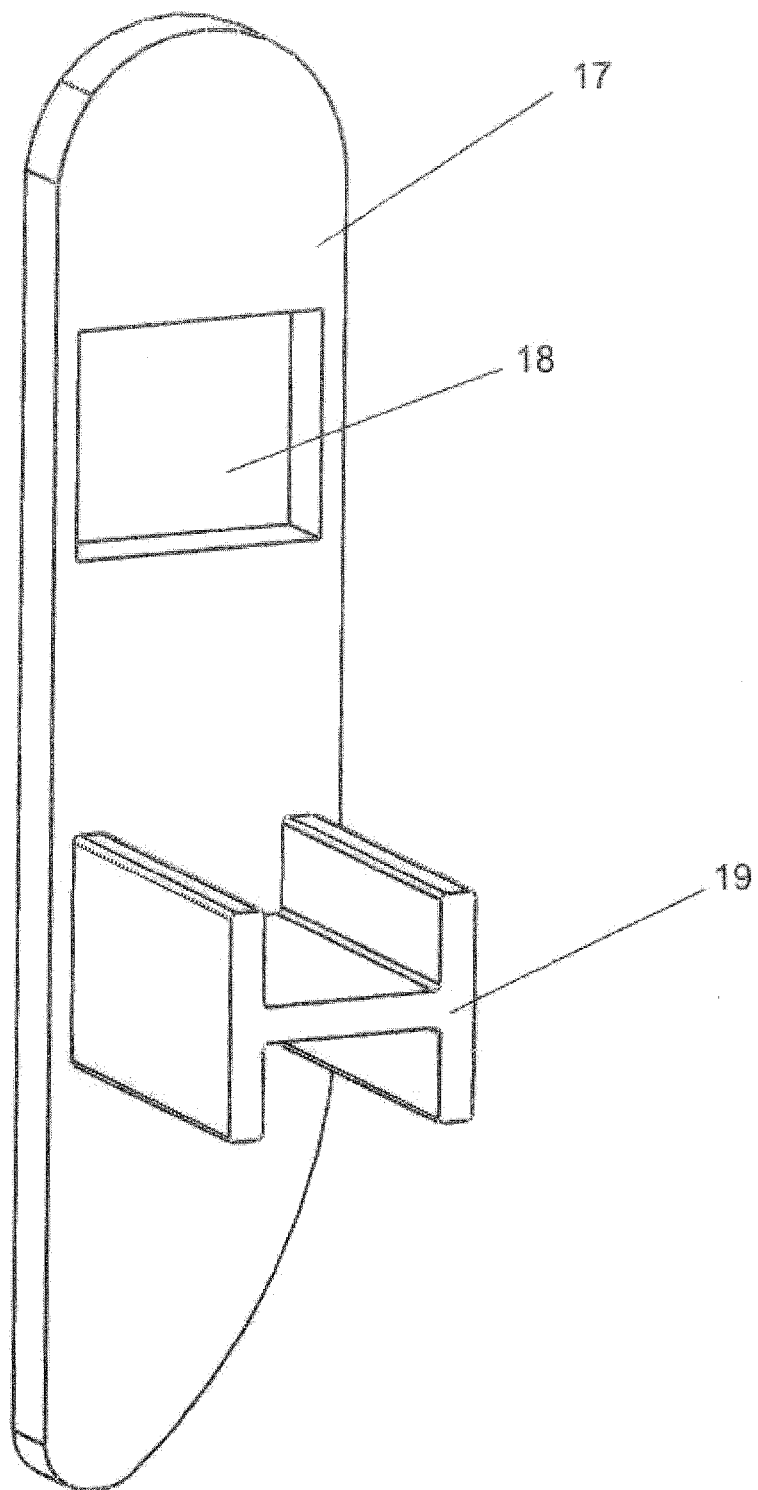


FIG.5

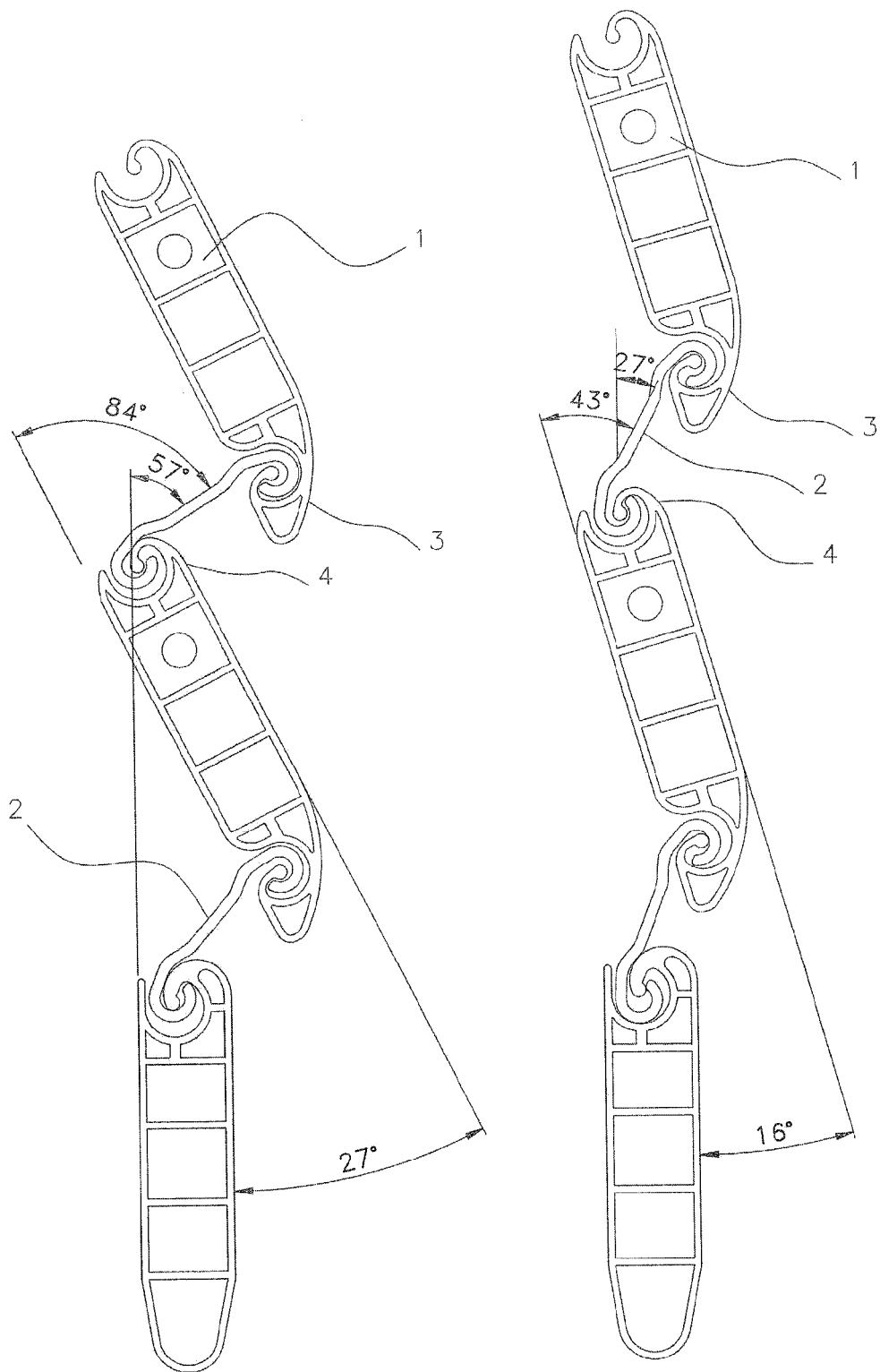


FIG. 6A

FIG. 6B

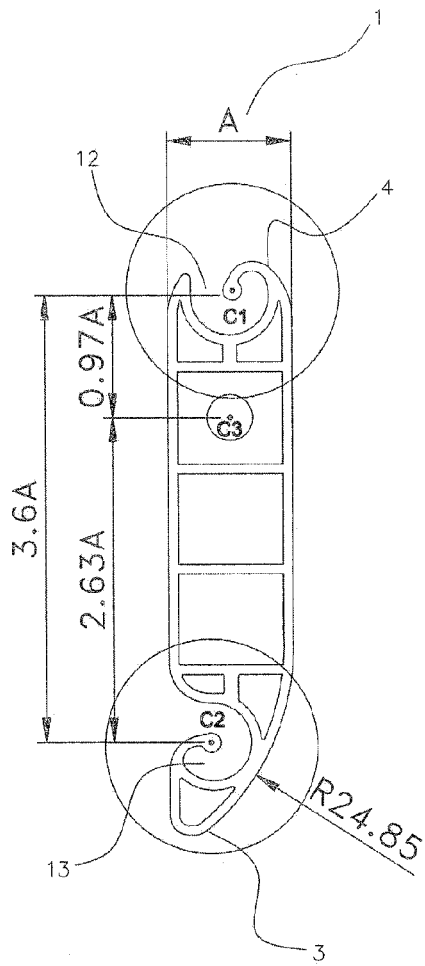


FIG. 7A

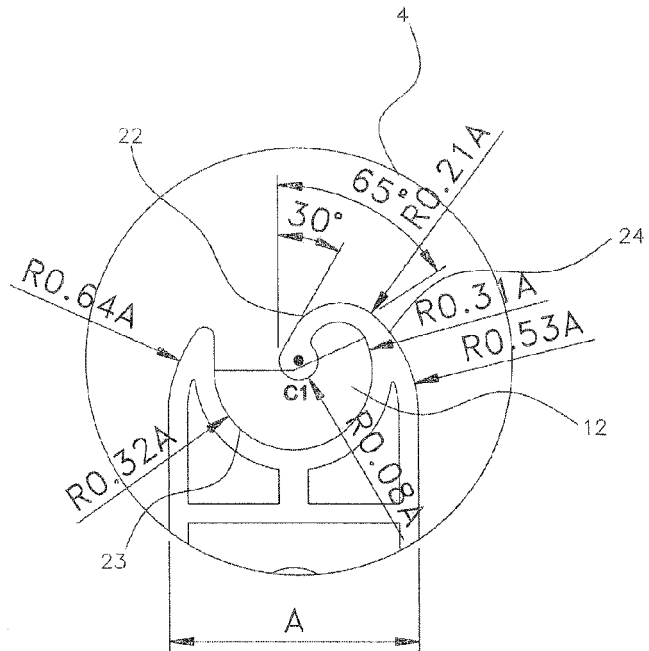


FIG. 7B

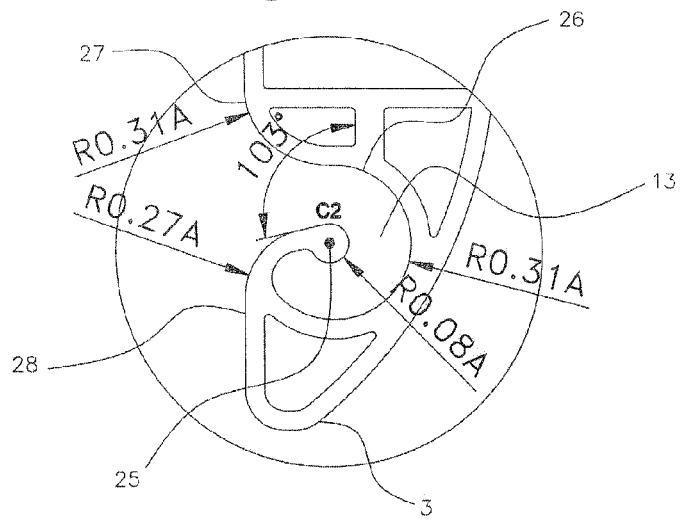


FIG. 7C

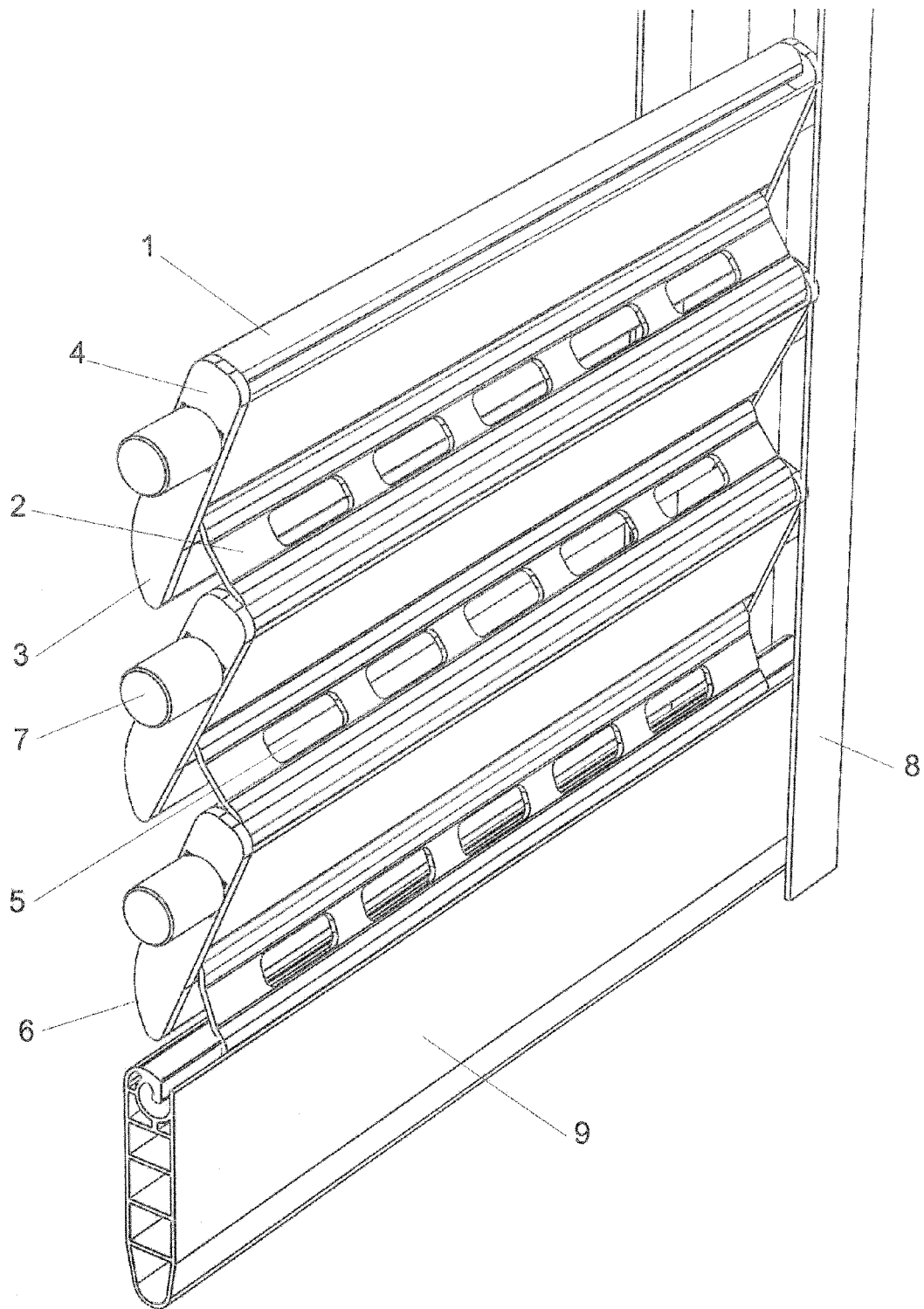


FIG.8A

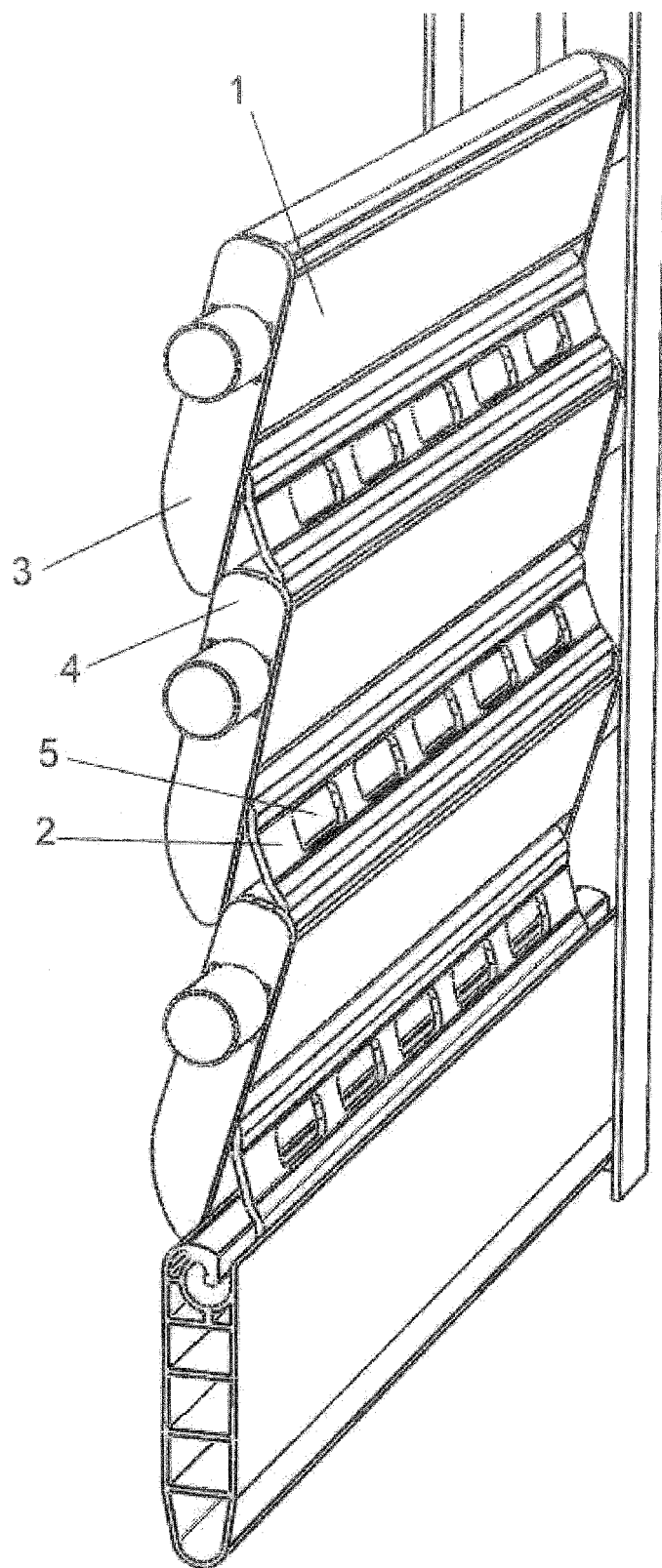


FIG.8B

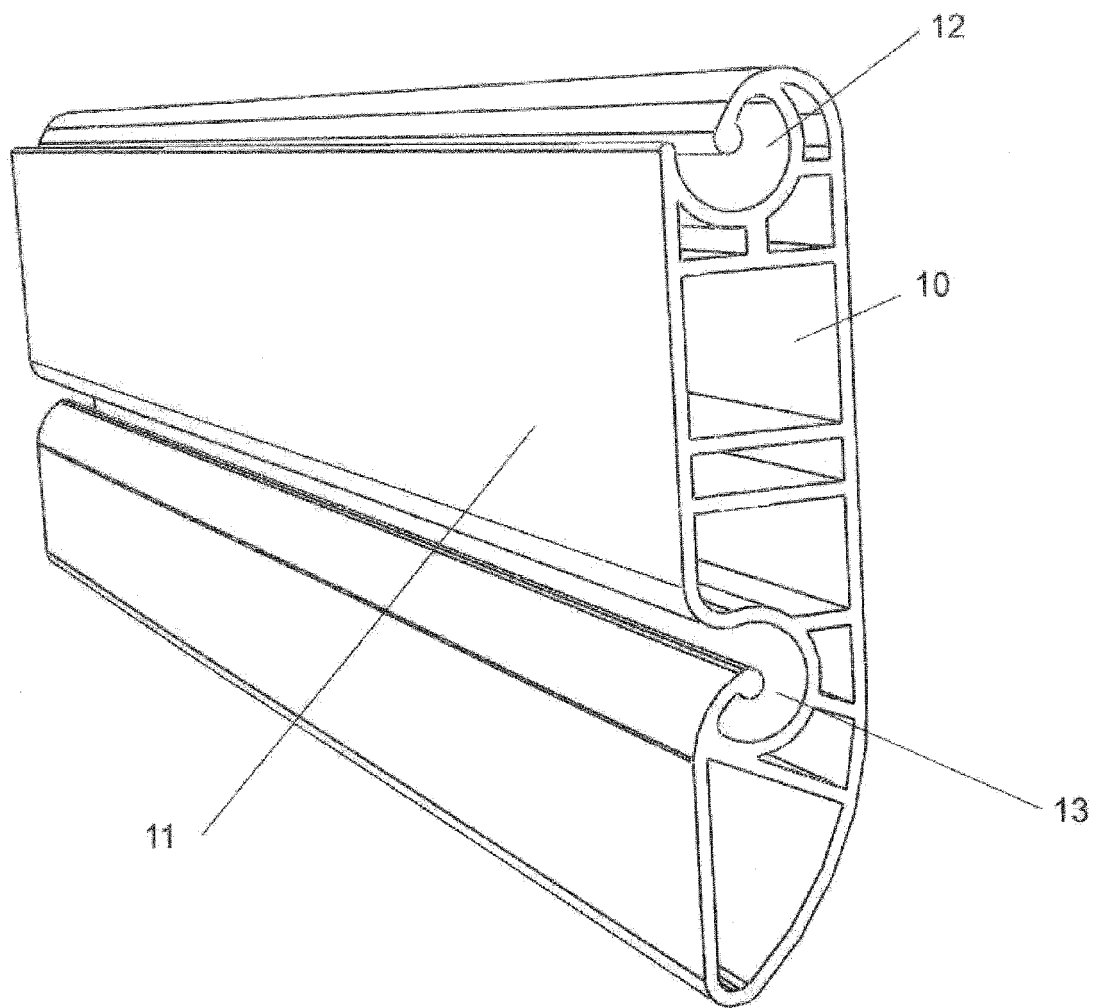


FIG.9

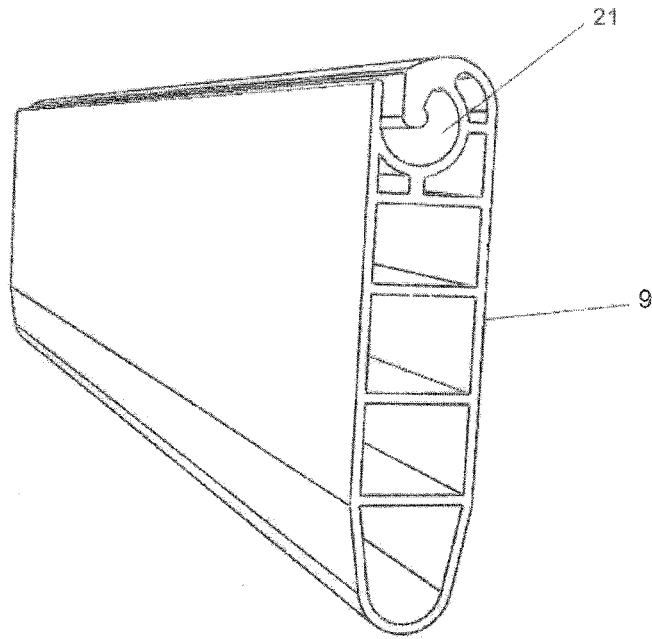


FIG. 10A

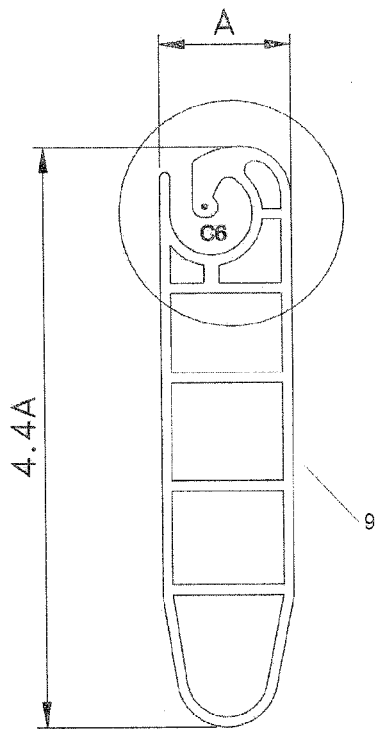


FIG. 10B

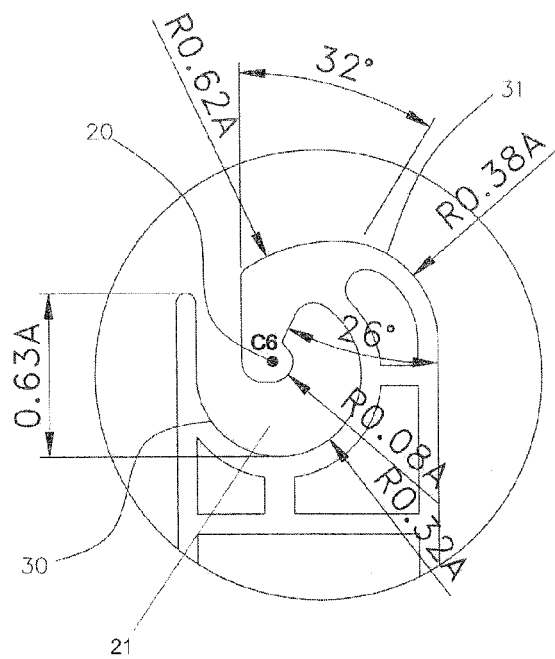


FIG. 10C

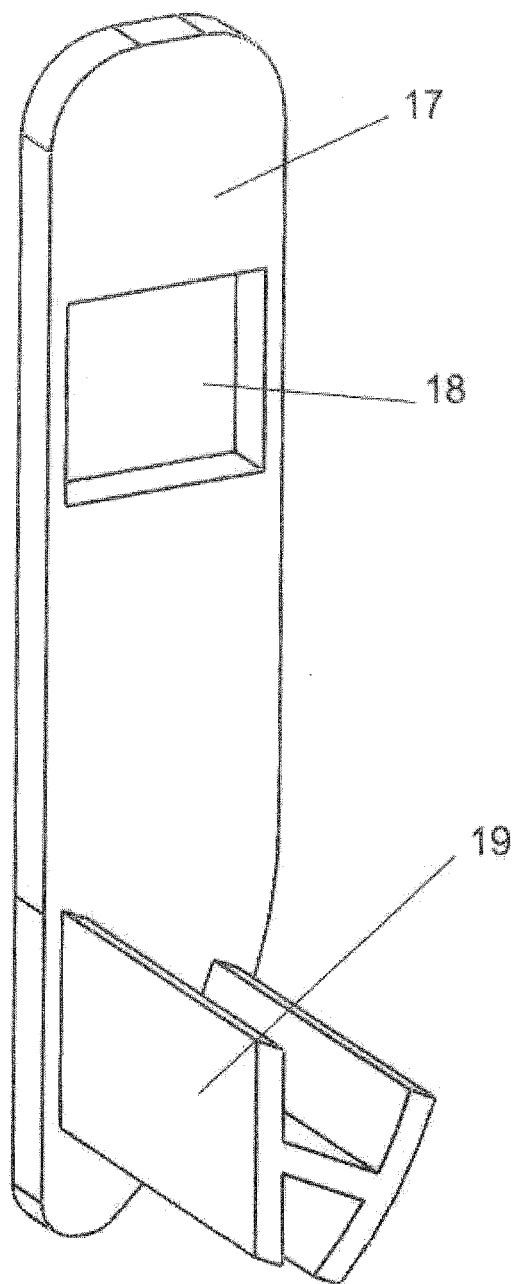


FIG.11

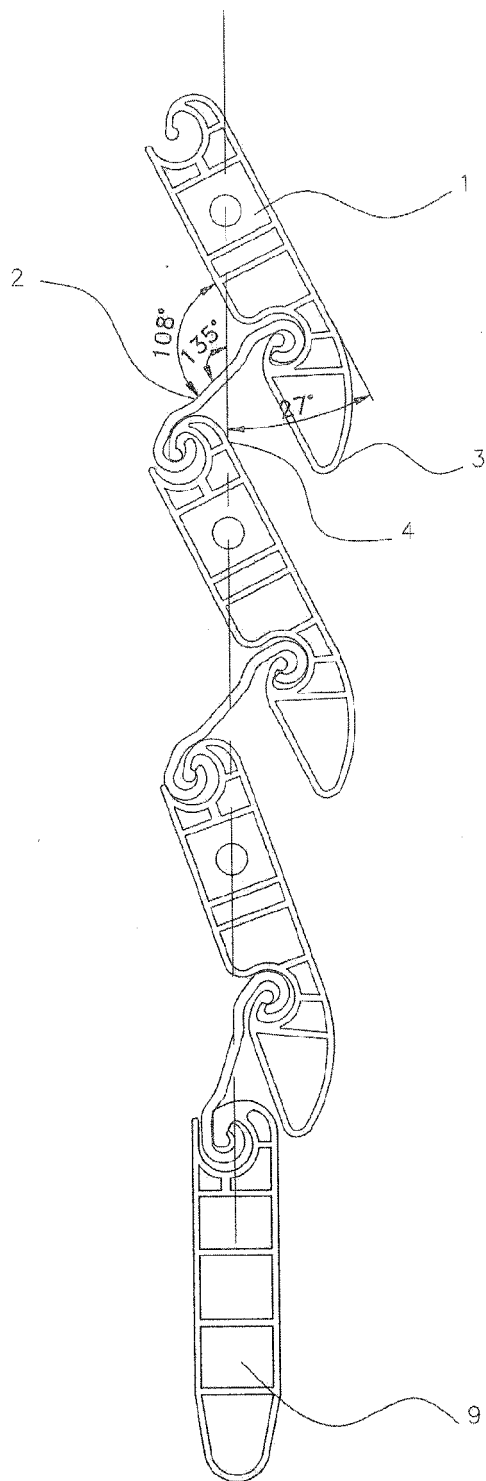


FIG. 12A

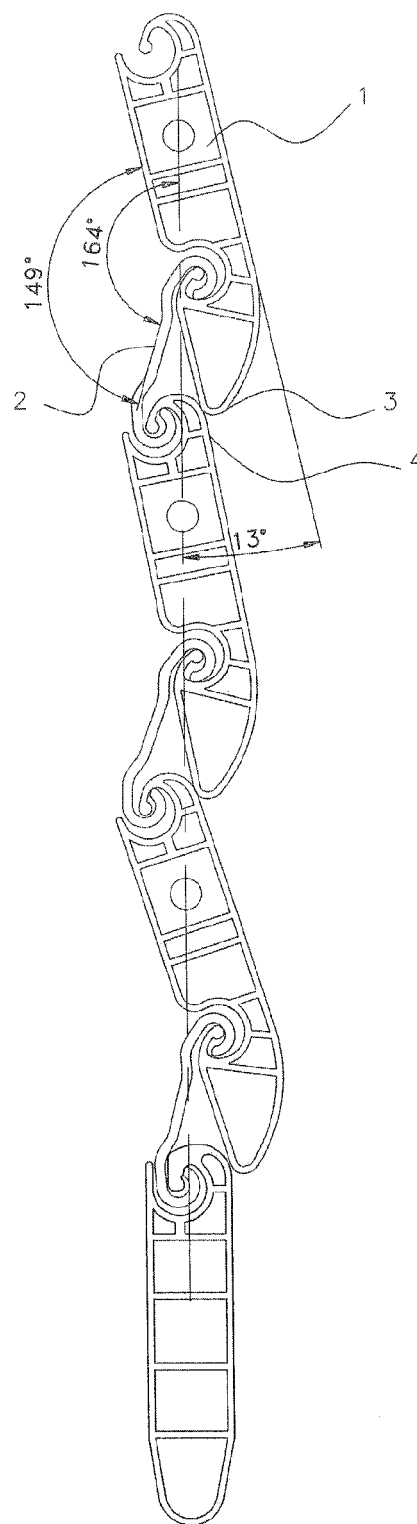


FIG. 12B

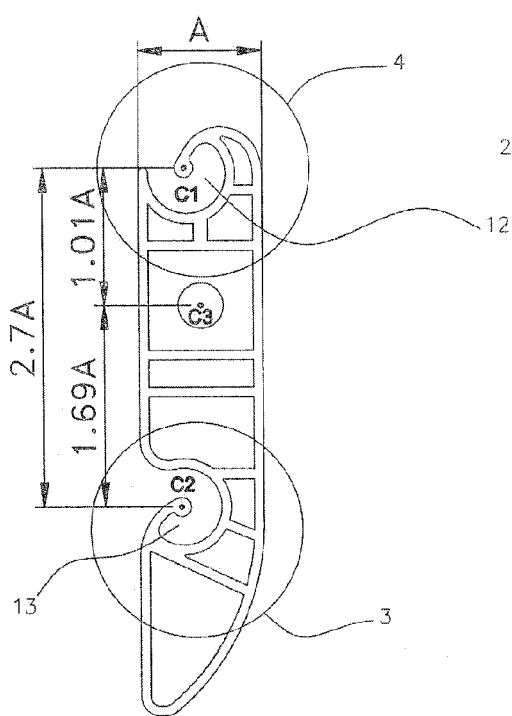


FIG. 13A

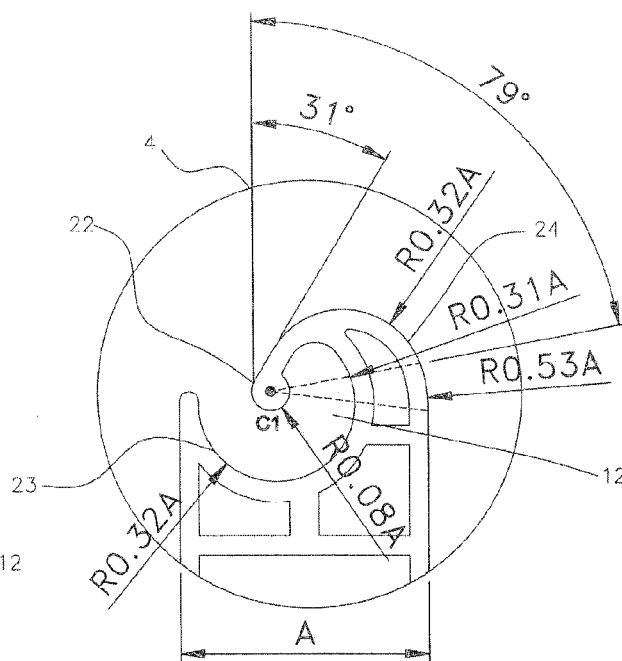


FIG. 13B

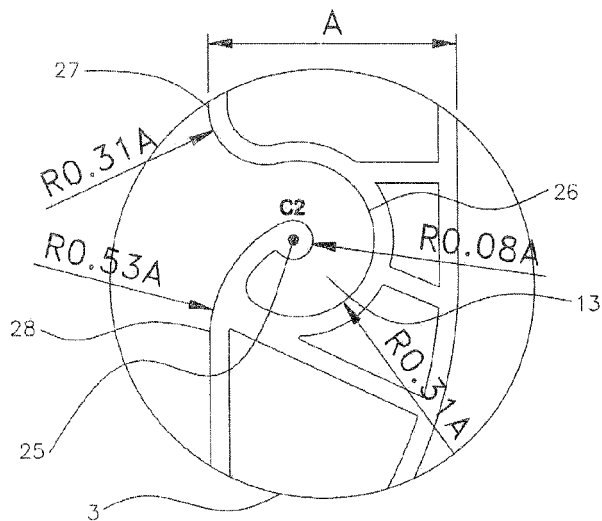


FIG. 13C

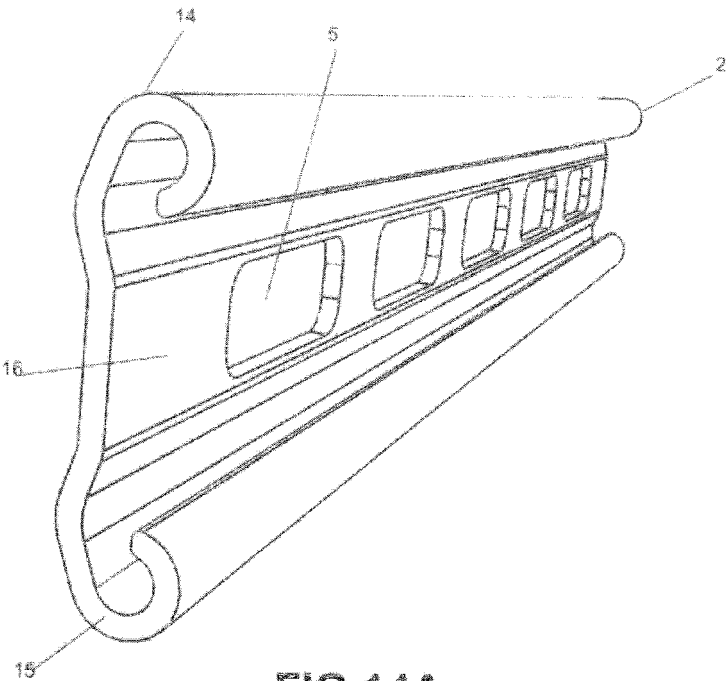


FIG. 14A

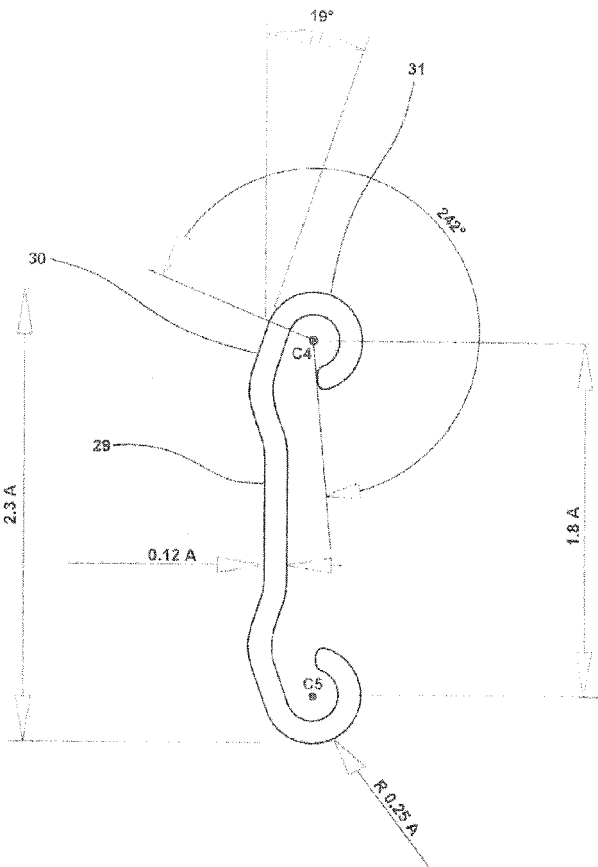


FIG. 14B

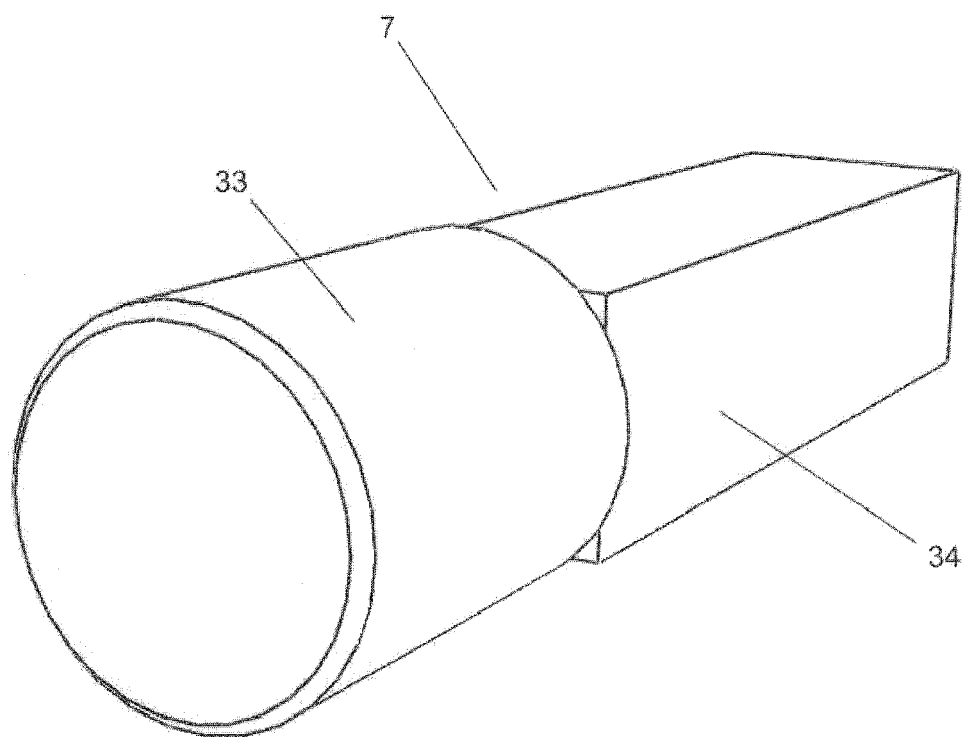


FIG.15

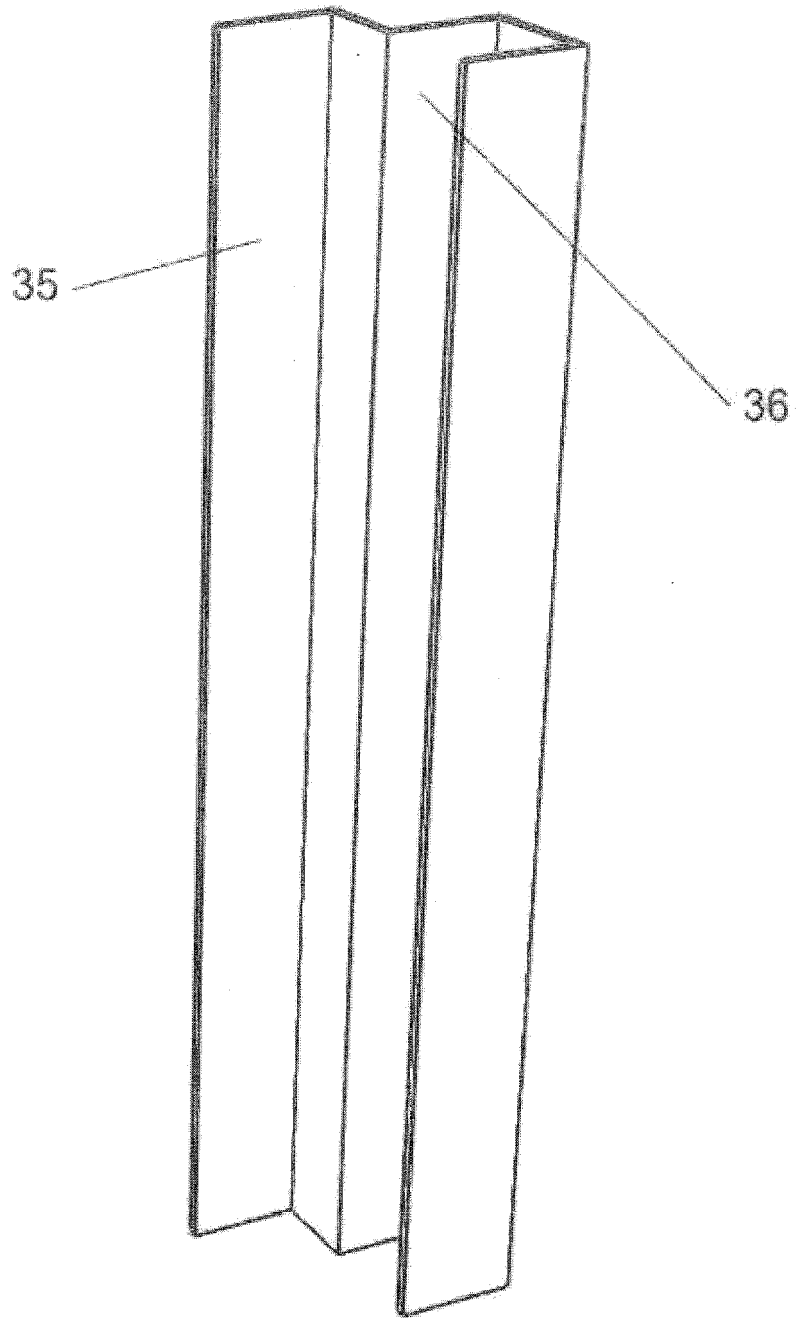


FIG.16

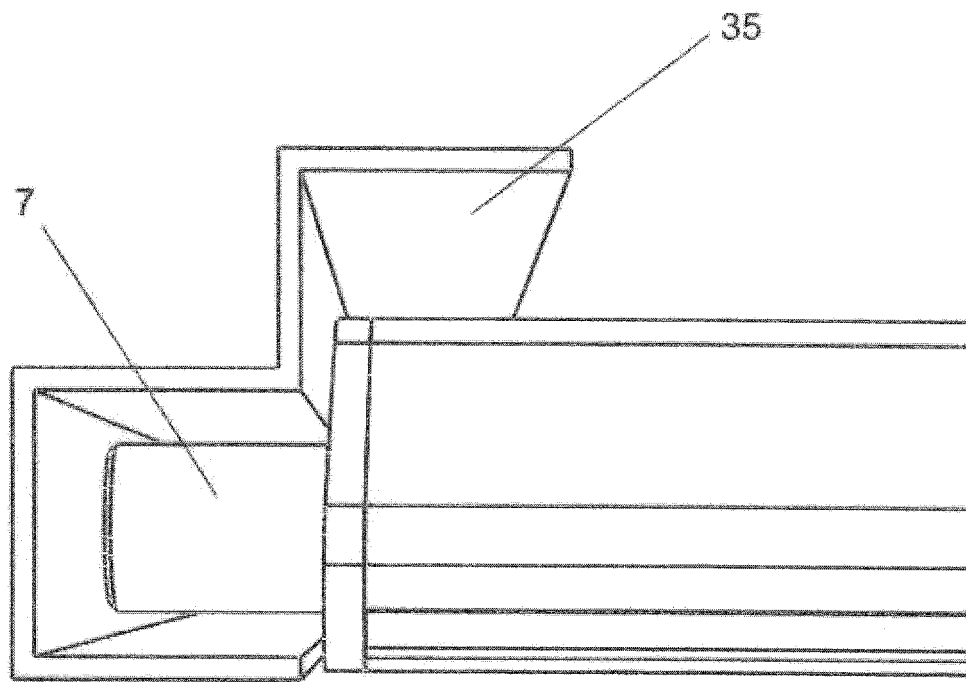


FIG.17



EUROPEAN SEARCH REPORT

Application Number
EP 11 15 3811

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	WO 95/11365 A1 (GIOVANETTI QUINTO [IT]) 27 April 1995 (1995-04-27) * abstract; figures 1-9 * -----	1-14	INV. E06B9/165
A	US 4 690 193 A (MORRISON DONALD L [US] ET AL) 1 September 1987 (1987-09-01) * the whole document * -----	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			E06B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 8 April 2011	Examiner Koulo, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

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ON EUROPEAN PATENT APPLICATION NO.**

EP 11 15 3811

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08-04-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		EP 0674743 A1	04-10-1995
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- DE 102006005750 [0005]