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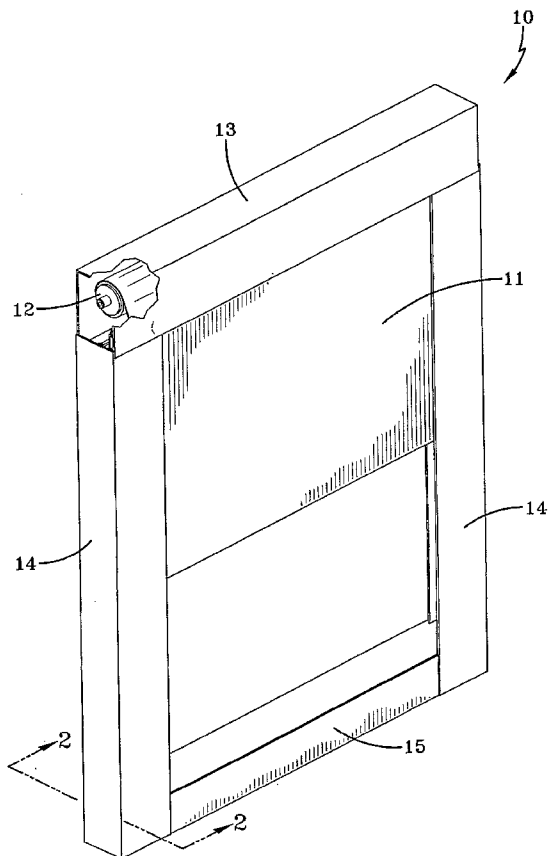
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(54) Title: ASSEMBLY TO LOCK A STORM CURTAIN ADJACENT TO AN OPENING IN A BUILDING



(57) Abstract: An apparatus for covering an opening in a structure may include spaced rails positioned at opposed sides of the opening. Each rail includes a channel and a curtain movable along the rails to cover and uncover the opening. A locking bar is attached to one end of the curtain. The locking bar has opposed end portions received in the channels, and a locking channel is positioned close to the ends of each rail to receive the bar. The locking channel is disposed at an angle relative to the channel and the bar is selectively received in the locking channel to lock the curtain in a position covering the opening. In some embodiments the locking bar includes a length that spans the distance between the side rails and is selectively locked in the sill along at least thirty percent of the length.

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ASSEMBLY TO LOCK A STORM CURTAIN ADJACENT TO AN OPENING IN A BUILDING

CROSS REFERENCE TO RELATED APPLICATION

5 This application claims the benefit of U.S. Provisional Application Serial Nos. 60/799,902 filed on May 12, 2006 and 60/816,830 filed on June 27, 2006.

TECHNICAL FIELD

10 This invention relates to a system of automatically locking a storm curtain in its down position so as to cover and protect an opening in a structure, such as a window. More particularly, this invention relates to such a system wherein the curtain is locked across a portion of the bottom sill or threshold.

BACKGROUND ART

15 In geographic areas which are prone to having high wind events, such as hurricanes and the like, the need exists for the protection of openings, such as windows and doors, in buildings. Otherwise, if the high winds or wind-borne debris breaches the integrity of the structure by destroying a window or door, severe damage to the structure can be expected.

20 In its most simple form, one type of known protection device which can be utilized is a sheet of plywood which can be attached to the structure so as to cover the openings thereof. However, this "boarding up" procedure is not only time consuming, when time is usually of the essence, but also can disfigure the exterior of the structure upon frequent installation and removal. In addition,
25 plywood has a limited life, particularly after becoming wet. Finally, storing and maintaining an inventory of plywood sheets can be problematic.

 As a result, a number of temporarily installable or permanently installed devices have been developed to be used as alternatives to plywood. For example, metallic shutters consisting of a plurality of hinged slats can be
30 provided adjacent to a window and can be rolled up by a hand crank or a motor when not in use. However, these devices are not only costly, but also they do not provide the necessary wind or water resistant seal, irrespective of whether they are mounted on the windward or leeward side of the building.

More recently, fabric-based systems have been developed which are much less costly than the metallic shutters or other devices, and which can provide a seal for the openings in the structure. In their simplest form, these systems include a sheet of fabric which is strong enough to withstand high winds and the forces of wind-borne debris without rupturing. These fabric sheets may be sealed on all four edges, thus providing a seal for the structure even if the glass of a window, for example, has been broken, or a door blown open.

In such systems, the fabric is oftentimes rolled up and stored in an upper housing and is payed out from the roll as the fabric curtain is pulled down between two side rails. When the fabric reaches the bottom sill of the structure, it is typically held in place by devices which engage the curtain along the side rails. However, at times these devices do not prove strong enough such that it would be desirable to provide a system which would lock the fabric curtain in place across a portion of the lateral extent of the sill — which is accomplished by the present invention.

SUMMARY OF THE INVENTION

It is thus an object of the present invention to provide a cover for a building opening that prevents penetration of debris and water during high wind events.

It is another object of the present invention to provide a cover, as above, that is easy to operate and lock.

These and other objects of the present invention, as well as the advantages thereof over existing opening coverings, which will become apparent from the description to follow, are accomplished by the improvements hereinafter described and claimed.

In general, an apparatus made in accordance with the present invention includes spaced rails positioned at opposed sides of an opening in a building. Each rail includes a channel and a curtain is movable along the rails to cover and uncover the opening. A locking bar is attached to one end of the curtain and has opposed end portions received in the channels. A locking channel is positioned proximate the ends of each rail to receive the locking bar and is disposed at an angle relative to the channel. The locking bar is

selectively received in the locking channel to lock the curtain in a position covering the opening.

In accordance with another aspect of the present invention, a storm curtain assembly includes a housing located at the top of an opening of a building and a bottom sill located at the bottom of the opening. A pair of spaced side rails extend from the housing to the sill and a curtain is movable to selectively cover and uncover the opening. A locking bar is secured to the bottom of the curtain and includes a length that spans the distance between the side rails and is selectively locked in the bottom sill along at least thirty percent of that length.

In accordance with yet another aspect of the present invention, a method of operating a storm curtain to cover an opening defined by a housing, a bottom sill and a pair of side rails includes the steps of, providing the curtain having a locking bar secured to the bottom of the curtain, moving the curtain downward to position the locking bar into the bottom sill, directing the locking bar into alignment with a locking channel in the bottom of the sill, and moving the curtain upward to position the locking bar securely with the locking channel.

In accordance with yet another aspect of the present invention, a storm curtain assembly is adapted to cover a building opening and includes a pair of spaced side rails, each of which includes a vertical channel. A curtain is carried by a roller and is movable to selectively cover and uncover the opening upon rotation of the roller. A locking bar is secured to an end of the curtain and includes opposed end portions received in the vertical channels. A locking channel is shaped to receive the locking bar and is biased to rotate relative to the curtain while in the vertical channel and is selectively received in the locking channel to lock the curtain in a closed position.

An exemplary building opening cover assembly incorporating the concepts of the present invention is shown by way of example in the accompanying drawings without attempting to show all the various forms and modifications in which the invention might be embodied, the invention being measured by the appended claims and not by the details of the specification.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a storm curtain assembly made in accordance with the present invention.

Fig. 2 is a somewhat schematic, sectional view taken substantially
5 along line 2-2 of Fig. 1 and showing the curtain being lowered and at a position just about to enter the lock area.

Fig. 2A is a view sequentially following Fig. 2 in the locking procedure.

Fig. 2B is a view sequentially following Fig. 2A in the locking
10 procedure.

Fig. 2C is a view sequentially following Fig. 2B and showing the curtain in the fully locked condition.

Fig. 2D is a view showing the initial movement of the curtain in the unlocking procedure.

Fig. 2E is a view sequentially following Fig. 2D in the unlocking
15 procedure.

Fig. 3 is a sectional view taken substantially along line 3-3 of Fig. 2.

Fig. 4 is a somewhat schematic, sectional view like Fig. 2 and showing another embodiment of a curtain assembly being lowered at a position
20 just about to enter the lock area.

Fig. 4A is a view sequentially following Fig. 4 in the locking procedure.

Fig. 4B is a view sequentially following Fig. 4A in the locking procedure.

Fig. 4C is a view sequentially following Fig. 4B and showing the curtain in the fully locked condition.

Fig. 4D is a view showing the initial movement of the curtain in the unlocking procedure.

Fig. 4E is a view sequentially following Fig. 4D in the unlocking
30 procedure.

Fig. 4F is a view sequentially following Fig. 4E in the unlocking procedure.

Fig. 5 is a somewhat schematic, sectional view like Figs. 2 and 4 and showing yet another embodiment of a curtain assembly being lowered at a position just about to enter the lock area.

5 Fig. 5A is a view sequentially following Fig. 5 in the locking procedure.

Fig. 5B is a view sequentially following Fig. 5A and showing the curtain in the fully locked condition.

Fig. 5C is a view showing the initial movement of the curtain in the unlocking procedure.

10 Fig. 5D is a view sequentially following Fig. 5C in the unlocking procedure.

Fig. 6 is an exploded perspective view of yet another embodiment of a locking bar.

Fig. 7 is a sectional view taken substantially along line 7-7 of Fig. 6.

15 Fig. 8 is a side elevational view of the locking bar of Fig. 6 prior to attachment to the curtain.

Fig. 9 is a front view of a curtain assembly including the locking bar of Fig. 6.

20 Fig. 10 is an exploded perspective view of the bottom sill, side rail and derailleur insert of this embodiment of the present invention.

Fig. 11 is an exploded perspective view of the derailleur insert of this embodiment of the present invention.

Fig. 12 is a perspective view of the locking channel of this embodiment of the present invention.

25 Fig. 13A is a somewhat schematic side view showing another embodiment of a curtain assembly being lowered at a position about to enter the lock area.

Fig. 13B is a view sequentially following Fig. 13A showing the pin resting on the derailleur.

30 Fig. 13C is a view sequentially following Fig. 13B showing the pin entering the locking channel.

Fig. 13D is a view sequentially following Fig. 13C showing the curtain in the fully locked position.

Fig. 13E is a view sequentially following Fig. 13D showing the initial movement of the curtain in the unlocking procedure.

Fig. 13F is a view sequentially following Fig. 13E showing the locking bar at the bottom of the sill.

5 Fig. 14 is an exploded side elevational view of an alternate locking bar.

Fig. 15 is a side elevational view of the locking bar of Fig. 14 assembled.

10 Fig. 16 is a side elevational view of an alternate roll including an opening for receiving the curtain.

Fig. 17 is a side view of the roll of Fig. 16 with a curtain crimped to the roll.

DISCLOSURE OF THE INVENTION

15 A storm curtain assembly made in accordance with the present invention is generally indicated by the numeral 10 and includes a fabric curtain 11 that has one end attached to a roll 12 which is stored in a housing 13. Curtain 11 is made of a material which is water resistant and which can withstand the forces of wind and airborne debris, as are often encountered in a
20 hurricane or the like. Exemplary of such fabric is disclosed in U.S. Patent Application Serial No. 11/190,114 filed on July 25, 2005, to which reference is made for whatever details are necessary to understand the present invention. Curtain 11 may be moved manually, or by a motor assembly, from the stored position on roll 12 to the extended position to cover and protect an opening in a
25 building, such as a window, door or the like. As such, curtain 11 moves along and between side rails 14 until a bottom sill 15 is reached.

The other end of curtain 11 carries a locking bar 20 which is part of a curtain locking system now to be described. Locking bar 20, as shown in the embodiment of Fig. 2, generally has elongate faces 21 and opposed edges 22.
30 As such, bar 20 is generally rectangular in the end view, and specifically as shown in end view, bar 20 preferably takes the shape of a parallelogram. Bar 20 extends across the entire lateral width of curtain 11 and may actually extend laterally outward of curtain 11 as shown in Fig. 3 as bar overhang portions 23.

Bar 20 is shown as being attached to curtain 11, as by gluing or the like, on only one face 21 or on one face 21 and one edge 22. As a result of this connection, and as a result of the resilient or flexible nature of the fabric of curtain 11, the bar 20 itself is biased and will be predisposed to rotate in the clockwise direction as viewed in Fig. 2. Such tendency is important to the locking of the bar by structure that will now be described.

A vertical channel 24 is formed along the length of each side rail 14 and extends from the area of housing 13 downwardly to the bottom of sill 15. Vertical channel 24 is sufficiently wide to allow locking bar 20 to be at an oblique angle, preventing binding or rattling when curtain 11 is moved up or down. A locking channel 26 is formed along the entire length of sill 15 and extends into side rails 14. Channel 26 is formed with a side wall 27 spaced from a side wall 28 by an end wall 29. Side wall 27 thus extends from lip 26 to end wall 29, and side wall 28 extends from end wall 29 to the bottom of sill 15 and side rail 14. As is evident from Fig. 2, channel 26 is disposed at an angle relative to channel 24.

A hook-like member, generally indicated by the numeral 30, extends from the wall of each side rail 14 and into each locking channel 26. Each hook member 30 includes a leg 31 positioned in channel 26 generally midway between, and paralleling, walls 27 and 28. A hook 32 is formed at the lower end of leg 31 and extends to a tip 33 which is positioned below vertical channel 24.

The manner in which locking bar 20 is utilized to lock curtain 11 across the entire sill 15 is best shown with reference to the sequential views 2A-2E. As shown in Fig. 2, as curtain 11 moves downwardly, bar 20 moves down channel 24, and as it moves past lip 25, pins 34, which extend laterally outward from each overhang portion 23 of bar 20, contact the tips 33 of hooks 32 (Fig. 2A). At this point, downward movement of curtain 11 is terminated and bar 20 pivots, from its own weight, clockwise to position pins 34 squarely in hooks 32 (Fig. 2B). Then, the manual or motorized movement of curtain 11 may be reversed, and the bar 20 is pulled up into locking channel 26 (Fig. 2C). Also, as shown, a shoulder 35 may be formed in channel side wall 28 to receive the edge of locking bar 20. Bar 20 is thus locked in channel 26 throughout the entire length of sill 15, and curtain 11 may be tensioned.

In order to remove bar 20 from channel 26 and unlock the curtain 11, the curtain is lowered from the Fig. 2C position. By so doing, the pins 34 are guided between leg 31 of hook member 30 and channel side wall 28, as shown in Fig. 2D. Continued downward movement directs bar 20 between a wedge 36
5 carried by each side rail 14 and the bottom of channel side wall 28, as shown in Fig. 2E. Curtain 11 may now be raised, and bar 20 will be guided by the bottom of hook 32 back into side rails 14 as curtain 11 is rolled onto roll 12. In other words, pin 34 contacts the bottom of hook 32 and prevents clockwise rotation of bar 20 back into channel 26. It is further contemplated that a bias member may
10 be positioned on side wall 28 to further prevent bar 20 from re-entering channel 26.

Another embodiment of the curtain locking system is shown in Fig. 4. In this embodiment, the locking bar 40 is generally C-shaped in end view, having curved portions 41 and 42 spaced by a generally flat portion 43. The
15 fabric curtain 11 is shown as being attached to portions 43 and 41 and the tip of portion 41. As such, like bar 20, bar 40 is itself biased and will tend to rotate in the clockwise direction as viewed in Fig. 4.

Locking bar 40, like bar 20, is capable of moving downwardly through the vertical channel 24 in each side rail 14 and into a locking channel 45 which
20 is similar to locking channel 26. Thus, channel 45 is formed with a side wall 46 spaced from a side wall 47 by an end wall 48. Side wall 46 thus extends from lip 44 to end wall 48, and side wall 47 extends from end wall 48 to a vertical wall 49 which extends to the bottom of sill 15 and side rail 14. Vertical wall 49 forms a pocket 50 in the bottom of side rail 14 and carries a spring member 51 that
25 extends upwardly, partially into the opening of locking channel 45.

The manner in which locking bar 40 may be utilized to lock curtain 11 across the entire sill 15 is best shown with reference to the sequential views of Figs. 4A-4F. Curtain 11 is lowered until bar 40 bottoms out in pocket 50 as shown in Fig. 4A. Then the movement of curtain 11 is reversed to raise the bar
30 40, at which time its tendency to rotate in the clockwise direction will overcome the bias of spring member 51 and allow bar 40 to enter locking channel 45 (Fig. 4B). Continued upward movement of curtain 11 fully seats bar 40 in channel 45, and bar 40 is thus locked in channel 45 along the entire length of sill 15.

In order to remove bar 40 from channel 45, the curtain 11 is lowered which causes spring member 51 to engage portion 41 of bar 40 as shown in Fig. 4D. This contact begins the rotation of bar 40 in a counterclockwise direction until it is fully rotated back to its original orientation as shown in Fig. 4E. Further
5 downward movement allows bar 40 to enter pocket 50 again (Fig. 4F). Downward movement of bar 40 out of channel 45 causes spring member 51 to double over, effectively increasing the bias strength. This time, when the curtain 11 is raised, because of the influence of the doubled over spring member 51, bar 40 will not be allowed to rotate clockwise. Bar portion 42 will contact lip 44,
10 resulting in bar 40 entering vertical channel 24 as curtain 11 is rolled up onto roll 12.

An additional embodiment of the curtain locking system is shown in Fig. 5. In this embodiment, the locking bar 60 is generally rectangular in profile with a pointed end. Thus, bar 60 includes opposed elongate faces 61
15 separated at one end by an edge 62 and at the other end by a pointed edge made up of intersecting beveled surfaces 63 and 64. Curtain 11 is attached to one face 61 and edge 62. As such, like the other embodiments, bar 60 biases itself and will tend to rotate in the clockwise direction as viewed in Fig. 5.

Locking bar 60 is also capable of moving downwardly through the
20 vertical channel 24 in each side rail 14. A lip 65 constitutes the entrance to a locking channel 66 which is similar to locking channel 45. Thus, channel 66 is formed with a side wall 67 spaced from a side wall 68 by an end wall 69. Side wall 67 extends from lip 65 to end wall 69, and side wall 68 extends from end wall 69 to a vertical wall 70 which extends to the bottom of the sill 15 and side
25 rail 14. Vertical wall 70 thus forms a pocket 71 in the bottom of side rail 14. A housing 72 is formed generally adjacent to the intersection of walls 68 and 70. Housing 72 carries an elastic biasing member, generally indicated by the numeral 73, which has a tongue 74 extending into the path of locking bar 60 between channel 66 and pocket 71.

30 The manner in which locking bar 60 may be utilized to lock curtain 11 across the entire sill 15 is best shown with reference to the sequential views of Figs. 5A-5D. As curtain 11 is lowered from the Fig. 5 to the Fig. 5A position, bar 60 engages and deflects tongue 74. At this point, the direction of the curtain is reversed, and the bias of tongue 74 coupled with the natural rotational tendency

of bar 60 causes the bar 60 to enter channel 66 (Fig. 5B). The guidance of bar 60 into channel 66 is also assisted by the engagement of beveled surface 63 with lip 65. With bar 60 fully seated in channel 66, bar 60 is locked along the entire length of sill 15.

5 To remove bar 60 from the locked position, curtain 11 is lowered to an extent that allows bar 60 to totally pass tongue 74 and at least partially into pocket 71 (Fig. 5C). Then the movement of curtain 11 is reversed with bar 60, as shown in Fig. 5D, deflecting tongue 74 in the opposite direction of the Fig. 5A deflection. As such, tongue 74 opposes the natural rotational tendency of bar
10 60 to assure that bar 60 will travel up vertical channel 24 rather than re-enter locking channel 66. As shown in Fig. 5D, such direction is also assisted by the potential engagement of beveled surface 64 with lip 65.

Yet another embodiment of the curtain locking system is described with reference to Fig. 6. In this embodiment, a locking bar generally indicated
15 by the numeral 80 includes a body 81 that is generally L-shaped in end view, and extends the length of the bottom sill 15 and into side rails 14. A channel 82 extends longitudinally along the top of body 81 and is adapted to receive a pin 83 therein. In one or more embodiments pin 83 may be a continuous metal pin extending from one longitudinal edge of body 81 to the other. In other
20 embodiments, a separate pin may be provided proximate to each lateral end. In either event, a portion of pin 83 extends from each end of channel 82 and is adapted to engage a derailleur generally indicated by the numeral 84 (see Fig. 9) as will be hereinafter described in more detail. In one or more embodiments pin 83 may be crimped into place within channel 82. In other words, pin 83 may
25 be positioned within channel 82 and then force may be applied to cause the c-shaped opening of channel 82 to partially collapse to permanently retain pin 83 within channel 82. In embodiments where pin 83 is retained by crimping, it may be preferable that locking bar be made of a metal such as aluminum or stainless steel. Other methods of retaining pin 83 to locking bar may be employed, for
30 example, set screws, adhesives, and threaded engagements.

Lock bar 80 further includes a grip portion 85 that extends perpendicularly from the bottom of body 81 and provides a surface that a user may grasp in order to manually operate the curtain 11. Further, grip portion 85 adds strength to locking bar 80 so that it can withstand high wind load

conditions. As is evident from Fig. 6, grip portion 85 does not extend all the way to the opposed ends of body 81. Rather, as shown in Fig. 9, grip portion 85 ends at a point just before side rails 14, with end portions 86 of body 81 extending into siderail 14.

5 Lock bar 80 further includes a clamp channel 87 that is adapted to receive and retain the bottom edge of curtain 11. One longitudinal side of clamp channel 87 is formed by body 81 and the other is formed by a projection 88 extending upwardly from grip portion 85. The inner surface of clamp channel 87 includes a plurality of ribs or barbs 89. As shown in Fig. 8, the grip portion 85
10 may be disposed initially at an obtuse angle relative to body 81. While in this configuration, the bottom end of fabric 11 may be inserted within clamp channel 87 and thereafter a force F may be applied to bring together opposing longitudinal sides of channel 87. In this manner, barbs 89 engage and retain curtain 11 within clamp channel 87. It should be appreciated that curtain 11
15 may or may not extend laterally beyond clamp channel 87 depending upon the window size and other factors.

Similar to bars 20, 40 and 60, body 81 of bar 80 is biased and will tend to rotate in the clockwise direction as viewed in Fig. 7. In other words, the equilibrium point of body 81 is an orientation other than vertical. This
20 achieved by both the weight distribution and the angle at which curtain 11 is received in channel 87 relative to body 81. If additional weight is desired for smooth operation or for additional biasing, an insert 90 may be secured within an insert groove 91 in body 81. In one or more embodiments, if lock bar 80 hangs at equilibrium, body 81 is disposed at angle of 20 degrees from vertical.
25 In these or other embodiments, the equilibrium angle is equivalent to the angle of the locking channel. Insert 90 may be made of any material of appreciable weight and may be adhered, mechanically fastened, or may be integral with body 81.

Vertical channel 24 is formed along the vertical length of each side
30 rail 14 and extends from the area of housing 13 downwardly to the bottom of sill 15. Vertical channels 24 are sufficiently wide to allow locking bar 80 to remain at an angle during upward and downward travel along side rails 14, thus preventing binding during travel. A locking channel 96 is formed along substantially the entire lateral length of sill 15 and extends into side rails 14.

Channel 96 is formed with a side wall 97 spaced from a side wall 98 by an end wall 99. Side wall 97 thus extends from a lip 95 to end wall 99, and side wall 98 extends from end wall 99 to a lip 100. As is evident from Fig. 13A, locking channel 96 is disposed at an angle relative to vertical channel 24. In one or
5 more embodiments locking channel is disposed at a twenty degree angle from vertical channel 24. Though the present embodiment discloses the locking channel 96 extending across the entire bottom sill 15, it should be appreciated that locking channel 96 can extend along as little as thirty percent of the bottom sill. It has been found that a locking channel 96 extending only thirty percent of
10 the width of sill 13 is sufficient to hold locking bar 80 in place and adequately distribute impact loads.

A derailleur insert 101 is positioned on opposed ends of the bottom sill 15. Each insert 101 includes an inwardly extending guide wall 102, a portion of which lies flush against a rear wall 103 of bottom sill 15 which extends
15 downwardly from lip 100. Guide wall 102 includes a generally vertical portion 104 that terminates at an angled portion 105. Angled portion 105 terminates at a lip 106, and a second vertical portion 107 extends downward from lip 106.

Derailleur 84 is secured to derailleur insert 101 by a fastener 109 in a manner that allows pivotal movement thereof. Derailleur 84 is generally prong
20 shaped and includes a first leg 110 and a second leg 111 that form a pin receiving channel 112 therebetween. Derailleur 84 further includes a wedge shaped leg 113 that extends downwardly on the opposed end from first and second legs 110 and 111.

As shown in Fig. 13A, because the majority of the weight of derailleur
25 84 is to the left of fastener 109, derailleur 84 is biased by gravity to rotate counter-clockwise. However, rotation is prevented because leg 113 rests against angled portion 105 and/or leg 111 rests against side wall 97. It should be appreciated that other means, such as torsion springs or the like, may be employed to bias derailleur 84.

30 The manner in which locking bar 80 is utilized to lock curtain 11 across sill 13 is best shown with reference to the sequential views 13A-F. As shown in Fig. 13A, as curtain 11 moves downwardly, bar 80 moves down channel 24, and as it moves past lip 95, pins 83 which extend laterally outward from bar 80 are directed into pin receiving channel 112 of derailleur 84 (Fig.

13B). At this point, because bar 80 is biased to rotate, the top edge of bar 80 will pivot toward lock channel 96. Downward movement of curtain 11 is terminated at a first resting position when pin 83 bottoms out in the pin receiving channel 112 (Fig 13B). At this point, because pin 83 rests on derailleur 84, the weight of the bar is removed from curtain 11. For motorized operation, the current draw of the operating motor may be monitored and the removal of the weight of bar 80 can be sensed. The change in current draw would indicate need to reverse the direction of curtain 11.

Upon reversal of the curtain direction (that is, upward), bar 80 is pulled upward into locking channel 96 (Fig. 13C). As it does so, pin 83 contacts second leg 111 of derailleur 84 and causes derailleur 84 to pivot clockwise. In this manner, pin 83 moves upwardly between second leg 111 and side wall 97. After passing second leg 111, derailleur 84 will pivot back to its original position with second leg 111 contacting side wall 97. Bar 80 continues upward until a locked position is achieved, with bar 80 contacting end wall 99 (Fig. 13D). At this point, additional tension may be applied to curtain 11 to remove any slack or wrinkles therefrom. Once in locked position, the storm curtain assembly is prepared for high wind conditions.

When a user wishes to unlock curtain 11, the curtain direction is again reversed (that is, lowered) and bar 80 is allowed to move downwardly. Because second leg 111 prevents reentry into channel 96, and further because of the bias of bar 80, pin 83 will now pass behind derailleur 84 (Fig. 13E). As bar 80 moves downward, pin 83 slides along angled portion 105 until it contacts leg 113 and forces derailleur 84 to again pivot clockwise. In this manner pin 83 passes between leg 113 and angled portion 105. After clearing the leg 113, the weight of derailleur 84 will again cause it to pivot clockwise into its resting position with second leg 111 resting against side wall 97. Bar 80 finally bottoms out at a second resting position when bar 80 contacts the bottom wall of sill 15 (Fig. 13F). At this point, the weight of the bar is again removed from curtain 11. During motorized operation, the current draw of the operating motor may be monitored and the removal of the weight of bar 80 can be sensed. The change in current draw would indicate need to reverse the direction of curtain 11.

Upon reversal of the curtain direction, bar 80 is pulled upward. The natural tendency of bar 80 to pivot forward is now prevented by leg 113 of

derailleur 84 which contacts pin 83 and prevents bar 80 from returning to the locking channel 96. As bar 80 continues to move upward, pin 83 slides along leg 113 and continues on to first leg 110. The weight of bar 80 against leg 110 causes derailleur 84 to pivot clockwise and leg 110 prevents pin 84 from
5 entering pin receiving channel 112. This prevents a repeated locking cycle and instead holds bar 80 in a generally upright position as it travels upwardly into side rails 14. In this manner, repeated and dependable locking and unlocking cycles may be achieved.

Referring now to Figs. 14 and 15, a locking bar 120 of an alternative
10 configuration is shown. Bar 120 extends substantially the entire length of sill 15 and is of a two piece design including a first portion 121 and a second portion 122. First portion 121 includes, in cross-section, a generally square body 123 having a hollow interior cavity 124. Interior cavity 124 may optionally receive an insert (not shown) which may be provided for additional weight, or to promote
15 added biasing. A pin 125 is coupled to first portion 121 at the top end of body 123. As above, a portion of pin 125 extends laterally outwardly from bar 120 on both sides and may be a single piece or separate pieces positioned proximate to each end. Pin 125 is received in a generally circular, open channel 126. When pin 125 is inserted into channel 126, a crimping force, for example, may
20 be applied to the channel to cause it to partially collapse, thereby retaining pin 125 therein.

Extending from the bottom end of body 123 is a J-shaped leg 127 that forms a curtain receiving channel 128. The interior surfaces of channel 128 include ribs or barbs that are adapted to engage curtain 11 when placed therein.
25 When a curtain 11 is placed in channel 128, a crimping force F may be applied to cause the channel 128 to collapse on curtain 11 to retain it therein.

The second portion 122 of bar 120 includes, in cross-section, a generally square body 130 with a hollow interior cavity 131. Optionally, an insert (not shown) may be positioned within cavity 131 to add additional weight or to
30 optimize the balance point of bar 120. A gripping leg 132, similar to grip portion 85, may extend from body 130 to provide a surface that a user may grasp to pull curtain 11 downward. Second portion 122 also includes a J-shaped leg 133 extending from body 130. As shown in Fig. 14, J-shaped leg, along with one wall of body 130, forms a receiving channel 134. One surface of channel 134

includes barbs or ribs 135 that are adapted to engage corresponding barbs or ribs 136 on the exterior of J-shaped leg 127. Once J-shaped leg 127 has been crimped to secure curtain 11 within channel 128, J-shaped leg 127 may be inserted into channel 134 where ribs 135 engage ribs 136 to thereafter couple
5 first portion 121 to second portion 122. In one or more embodiments, if lock bar 120 hangs at equilibrium body portion 123 is disposed at an angle α . In these or other embodiments, the angle α is about twenty degrees. It has been found that this angle allows for smooth vertical travel as well as dependable locking.

Referring now to Figs. 16 and 17, the other end of curtain 11 may
10 also be crimped to roll 12. Thus, roll 12 may include an upstanding leg 140 that extends from the cylindrical body 141 of roll 12 to form a curtain receiving channel 142. Curtain 11 may be inserted into channel 142, and a crimping force may be applied to leg 140 to collapse leg 140 into body 141. Thereafter, barbs or ribs 143 engage curtain 11 to prevent release.

15 In view of the foregoing, it should be evident that a curtain locking system made in accordance with any of the embodiments described herein substantially improves the art.

CLAIMS

What is claimed is:

- 1 1. Apparatus for covering an opening in a structure comprising spaced rails
2 positioned at opposed sides of the opening, each said rail including a channel, a
3 curtain movable along said rails to cover and uncover the opening, a locking bar
4 attached to one end of said curtain, said locking bar having opposed end
5 portions received in said rail channels, and a locking channel positioned
6 proximate the ends of each rail to receive said bar, said locking channel being
7 disposed at an angle relative to said rail channel, said bar being selectively
8 received in said locking channel to lock said curtain in a position covering the
9 opening.
- 1 2. The assembly of claim 1, wherein said angle is about twenty degrees.
- 1 3. The assembly of claim 1, wherein said locking channel is defined by a first
2 sidewall spaced from a second sidewall by an end wall.
- 1 4. The assembly of claim 1 further comprising a sill positioned at the bottom
2 of the opening, said locking channel being positioned in said sill.
- 1 5. The assembly of claim 4, wherein said locking channel extends at least
2 thirty percent of the lateral length of said sill.
- 1 6. The assembly of claim 4, wherein said locking channel extends
2 substantially the entire lateral length of said sill.
- 1 7. The assembly of claim 1, wherein said locking bar is biased to rotate
2 relative to said curtain while in said rail channel.
- 1 8. The assembly of claim 6, wherein said locking channel extends upwardly
2 and inwardly relative to said rail channel.

1 9. The assembly of claim 4, further comprising at least one derailleur
2 positioned in said sill and adapted to direct said locking bar into said locking
3 channel.

1 10. The assembly of claim 9, wherein said at least one derailleur is adapted to
2 direct said locking bar into said locking channel during movement of said locking
3 bar into said sill and to prevent said locking bar from entering said locking
4 channel during movement out of said locking bar.

1 11. The assembly of claim 9, said locking bar includes at least one pin
2 extending laterally from at least one lateral end of said locking bar and said at
3 least one derailleur is positioned at the lateral end of said sill, wherein said pin
4 engages said derailleur when said locking bar enters said sill.

1 12. The assembly of claim 11, wherein said derailleur is pivotally secured in
2 said sill and includes a first leg and a second leg defining a pin receiving
3 channel therebetween, said pin receiving channel facing said rail channel to
4 receive said pin as said locking bar travels into said sill.

1 13. The assembly of claim 1, wherein said locking bar includes a longitudinally
2 extending curtain channel having at least one rib therein, said curtain channel
3 retaining said curtain therein through the intermeshing of said rib with said
4 curtain.

1 14. The assembly of claim 1, wherein said locking bar includes a body portion
2 and a grip portion extending substantially perpendicular from said body portion.

1 15. The assembly of claim 14, wherein said body includes a recess adapted to
2 selectively receive an insert to provide additional weight to said locking bar.

1 16. The assembly of claim 7, wherein said locking bar includes a pair of
2 elongated faces and a pair of opposed edges, wherein said curtain is attached
3 to one of said faces.

1 17. A storm curtain assembly adapted to cover a building opening, the
2 assembly comprising, a housing located at the top of the opening, a bottom sill
3 located at the bottom of the opening, a pair of spaced side rails extending from
4 said housing to said sill, a curtain movable to selectively cover and uncover the
5 opening, and a locking bar secured to the bottom of said curtain, said locking
6 bar including a length that spans the distance between said side rails and is
7 selectively locked in said bottom sill along at least thirty percent of said length.

1 18. The storm curtain assembly according to claim 17, wherein each said side
2 rail includes a vertical channel, said locking bar including end portions that are
3 received therein to guide said locking bar during upward and downward
4 movement.

1 19. The storm curtain assembly according to claim 18, wherein said bottom sill
2 includes a locking channel that selectively receives said locking bar, such that
3 when said locking bar is positioned in said locking channel, upward movement
4 of said locking bar is prevented.

1 20. The storm curtain assembly according to claim 19 wherein said locking
2 channel extends upwardly and at an angle relative to said vertical channel.

1 21. The storm curtain assembly according to claim 20 wherein said locking
2 channel angle is twenty degrees or less.

1 22. The storm curtain assembly according to claim 19 wherein said locking
2 channel extends along at least thirty percent of said bottom sill.

1 23. The storm curtain assembly according to claim 19 wherein said locking
2 channel extends substantially the entire lateral length of said bottom sill.

1 24. The storm curtain assembly according to claim 19 further comprising a
2 derailer positioned at each opposed end of said bottom sill and adapted to
3 direct said locking bar into said locking channel during downward movement of
4 said locking bar.

1 25. The storm curtain assembly according to claim 24 wherein said derailleur
2 are adapted to prevent said locking bar from entering said locking channel
3 during upward movement of said locking bar.

1 26. The storm curtain assembly according to claim 24 wherein said locking bar
2 includes at least one pin that extends laterally from said locking bar to
3 selectively engage said derailleur.

1 27. The storm curtain assembly according to claim 17, wherein said curtain is
2 crimped to said locking bar.

1 28. The storm curtain assembly according to claim 17, further comprising a
2 roller in said housing, said curtain being crimped to said roller.

1 29. A method of operating a storm curtain to cover an opening in a building
2 bounded by a housing, a bottom sill and a pair of side rails, the method
3 comprising the steps of, providing a locking bar secured to the bottom of the
4 curtain, moving the curtain downward to position the locking bar into the bottom
5 sill, directing the locking bar into alignment with a locking channel in the bottom
6 of the sill, and moving the curtain upward to position the locking bar securely
7 within the locking channel.

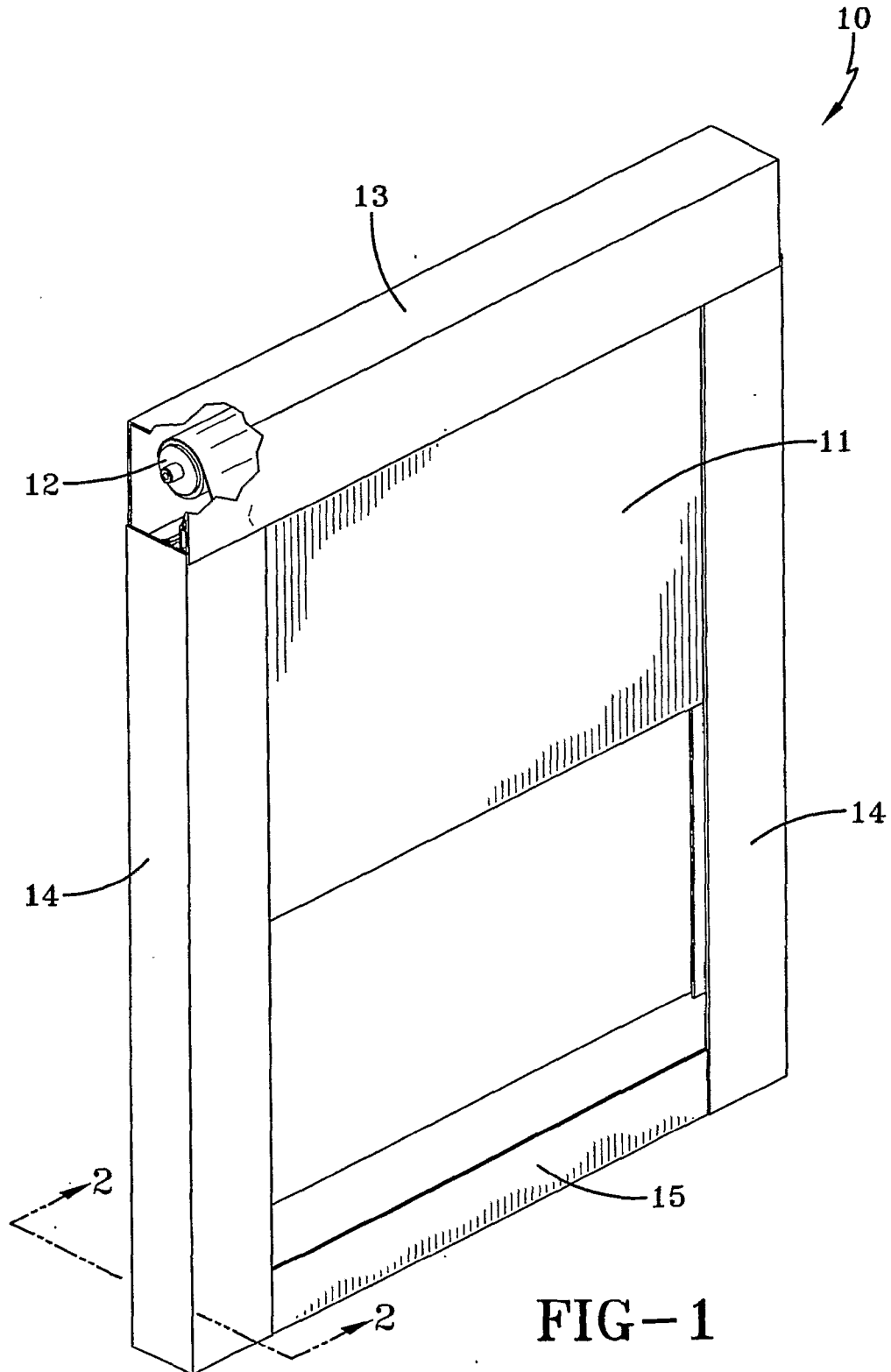
1 30. The method according to claim 29, further comprising the steps of:
2 moving the curtain downward to cause the locking bar to move out of the locking
3 channel, moving the curtain upward after the locking bar exits the locking
4 channel and contacts a bottom surface of the sill, preventing the locking bar
5 from re-entering the locking channel during upward movement past the locking
6 channel.

1 31. A storm curtain assembly adapted to cover a building opening, the
2 assembly comprising, a pair of spaced rails, each said rail including a rail
3 channel, a roller, a curtain carried by said roller, said curtain being movable to
4 selectively cover and uncover the opening upon rotation of said roller. a locking

5 bar secured to an end of said curtain and including opposed end portions
6 received in said rail channels, and a locking channel shaped to receive said
7 locking bar, wherein said locking bar is biased to rotate relative to said curtain
8 while in said rail channel and is selectively received in said locking channel to
9 lock said curtain in a closed position.

1 32. The assembly of claim 31 further comprising a housing positioned at the
2 top of the opening, and a bottom sill positioned at the bottom of the opening,
3 wherein said locking channel is positioned in said sill and said roller is
4 positioned in said housing.

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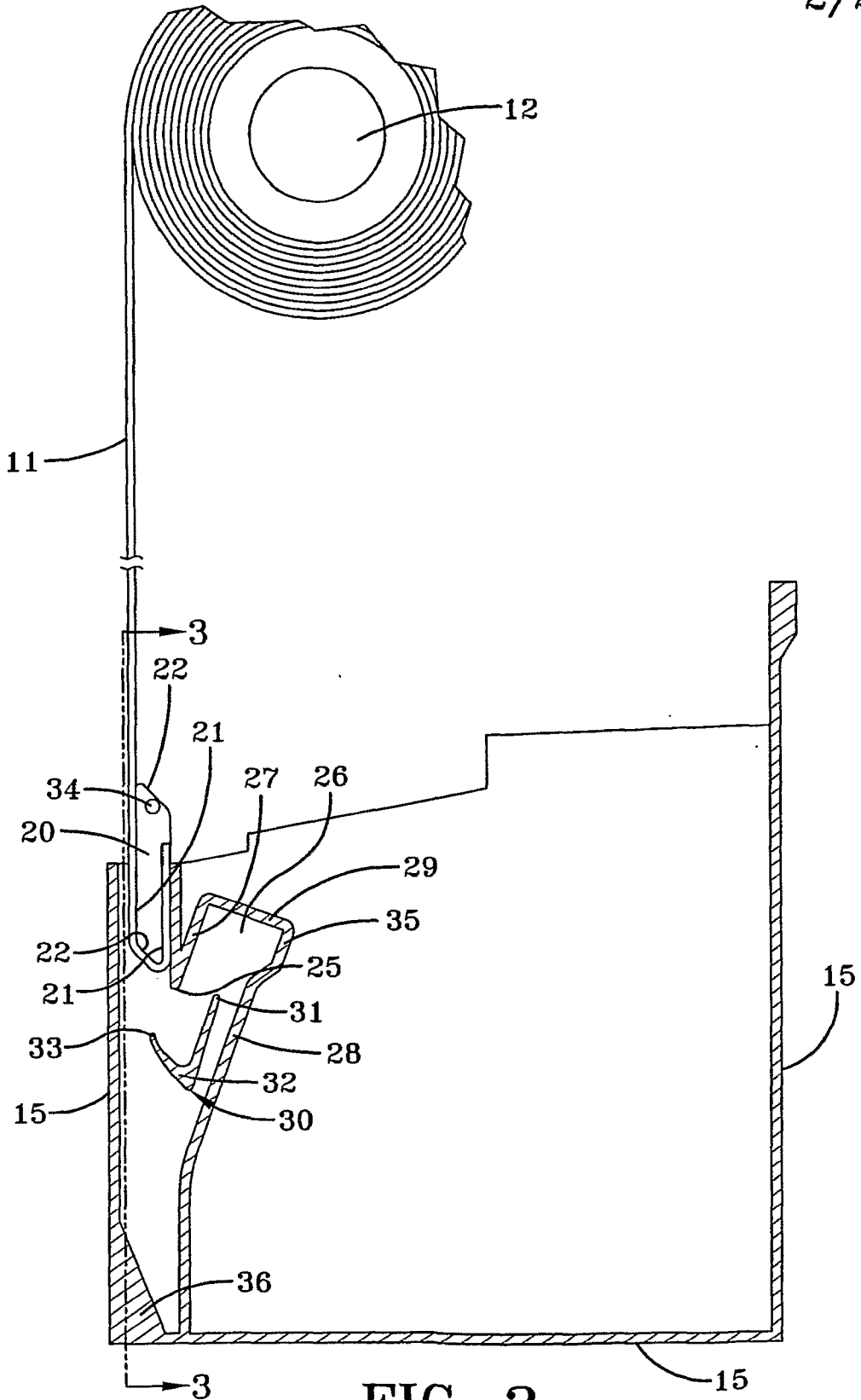


FIG-2

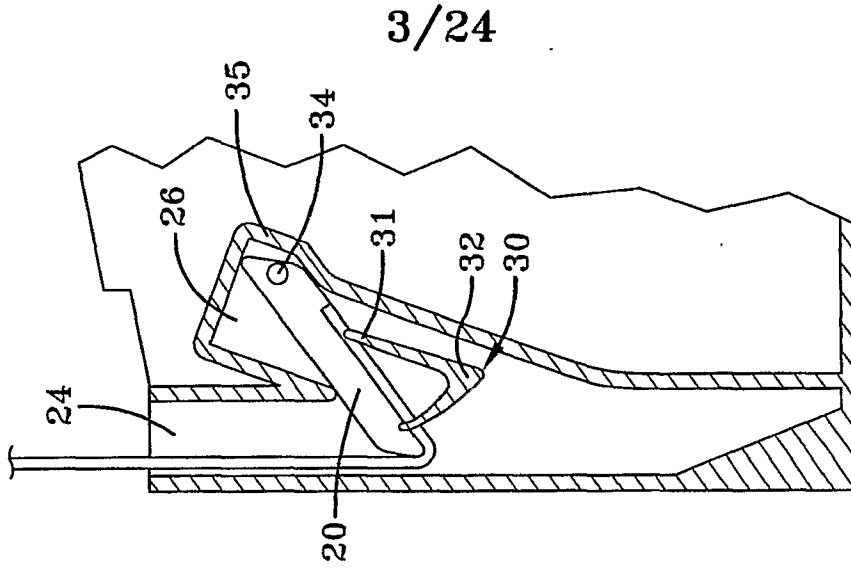


FIG-2C

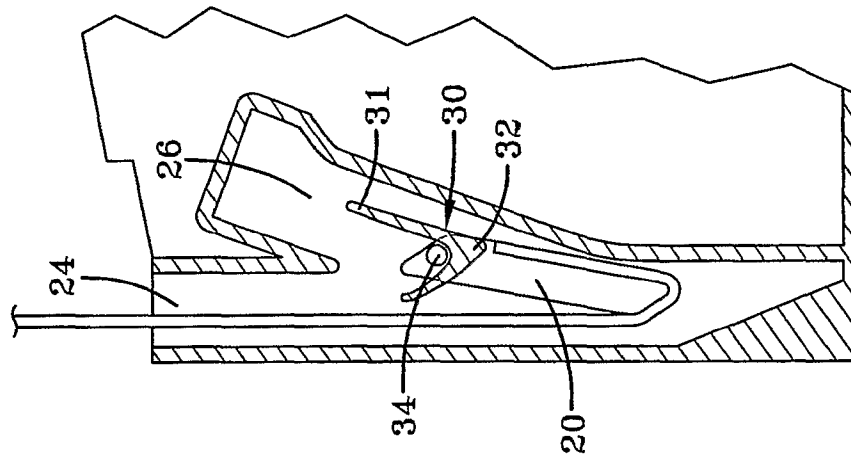


FIG-2B

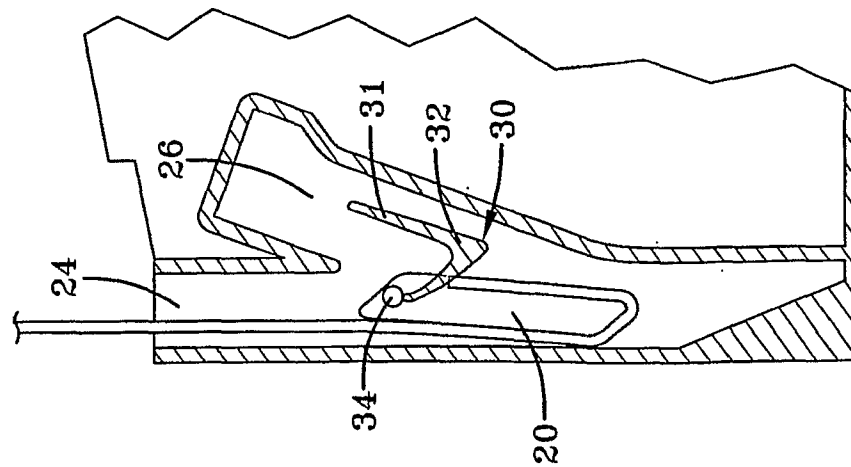


FIG-2A

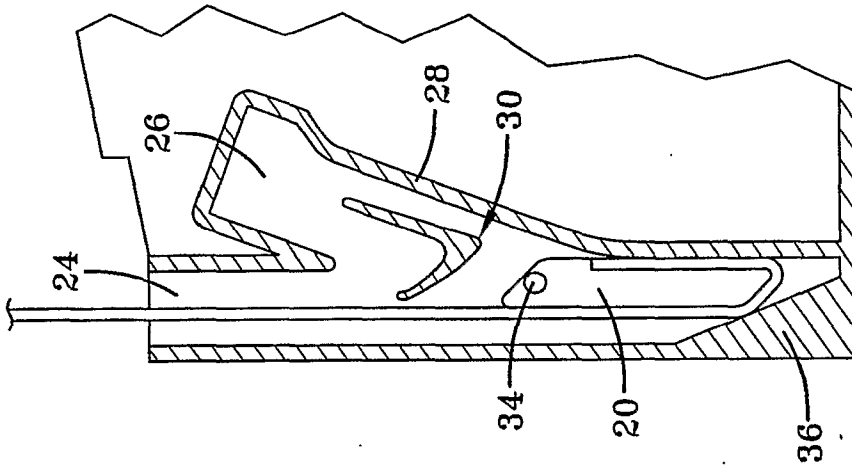


FIG-2E

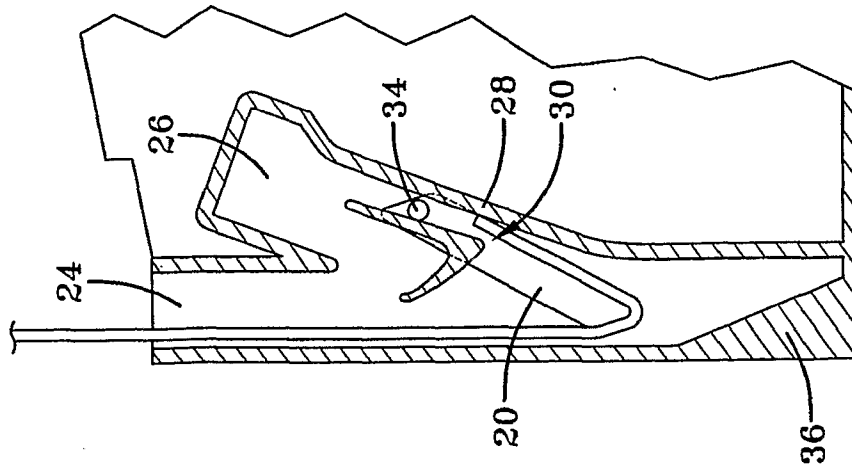


FIG-2D

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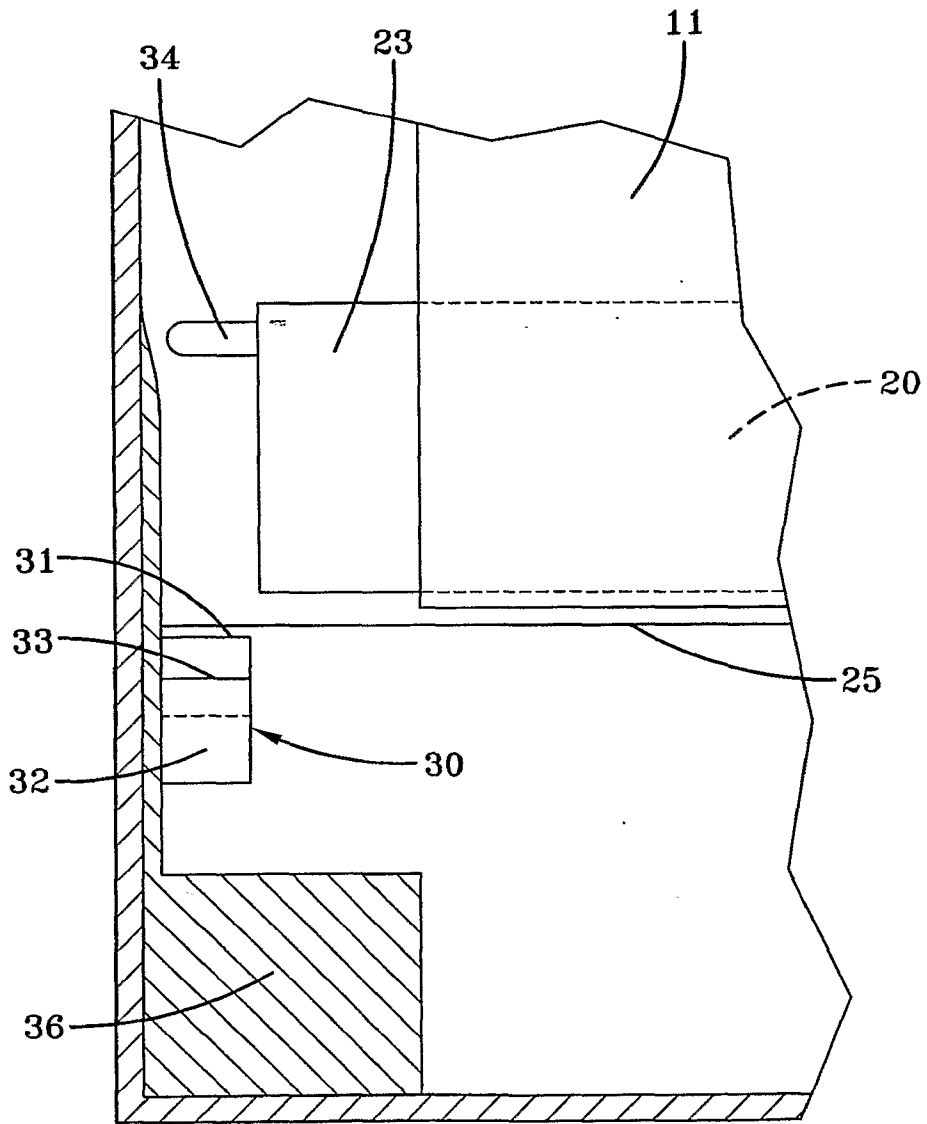


FIG-3

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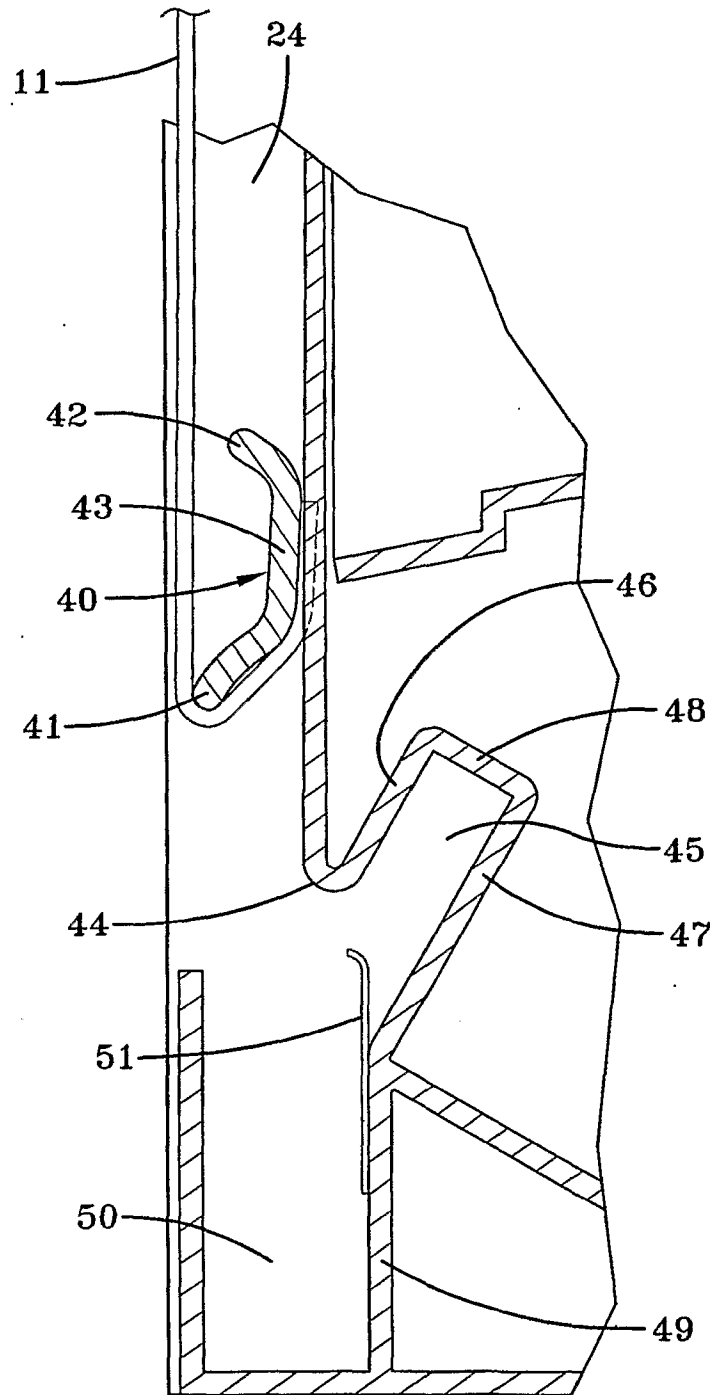


FIG-4

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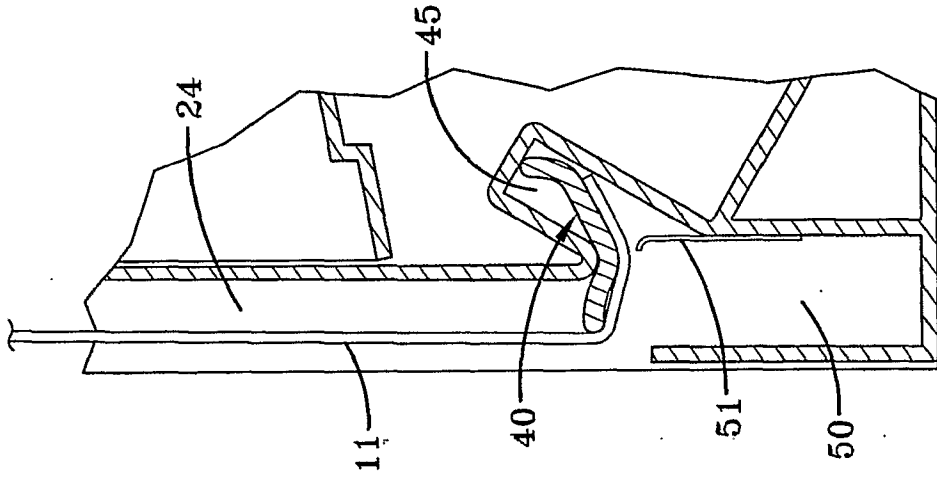


FIG-4C

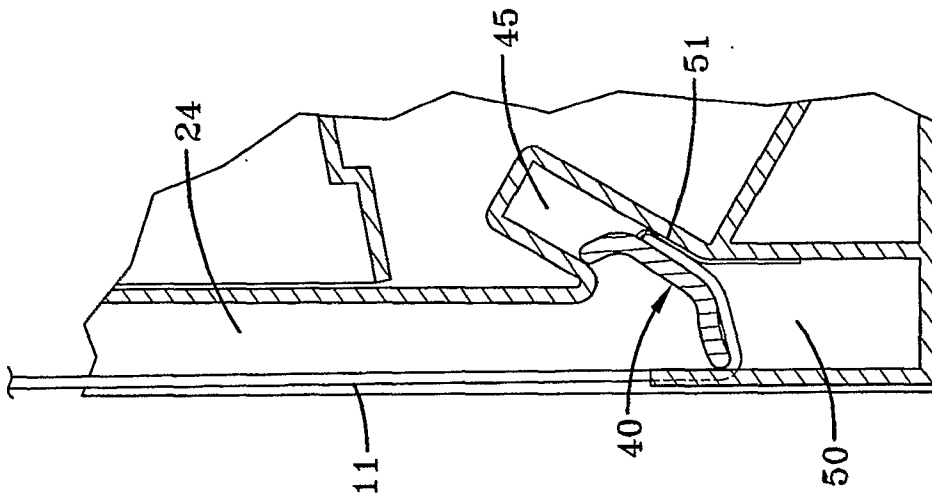


FIG-4B

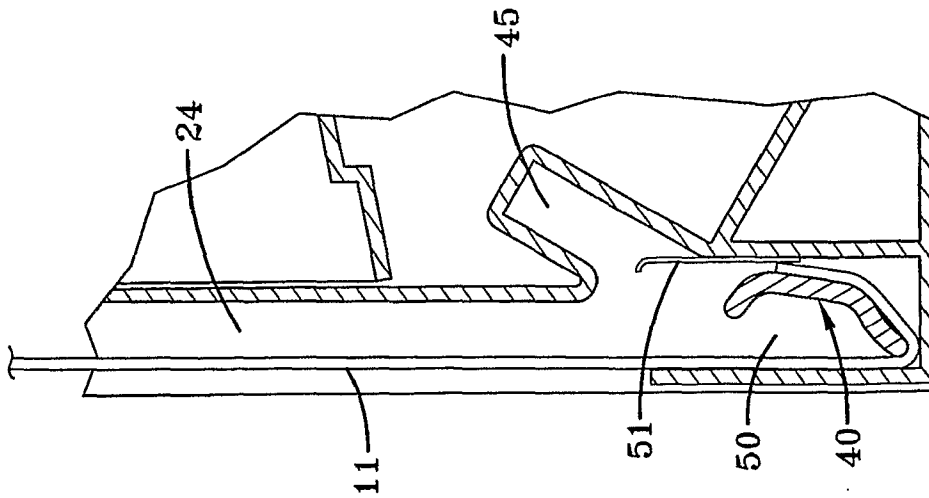


FIG-4A

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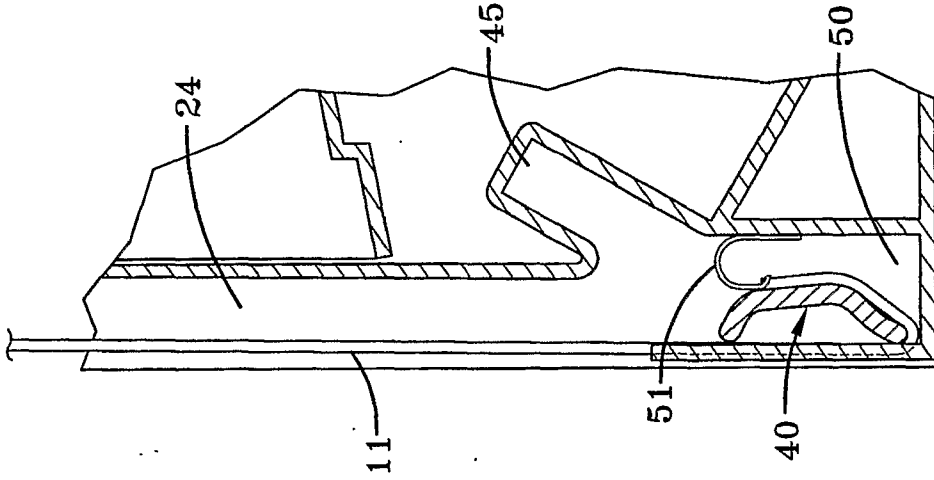


FIG-4F

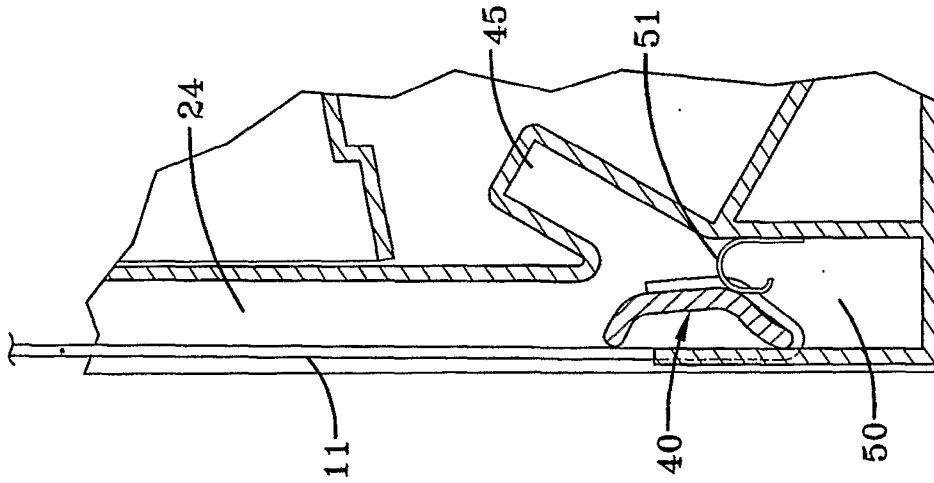


FIG-4E

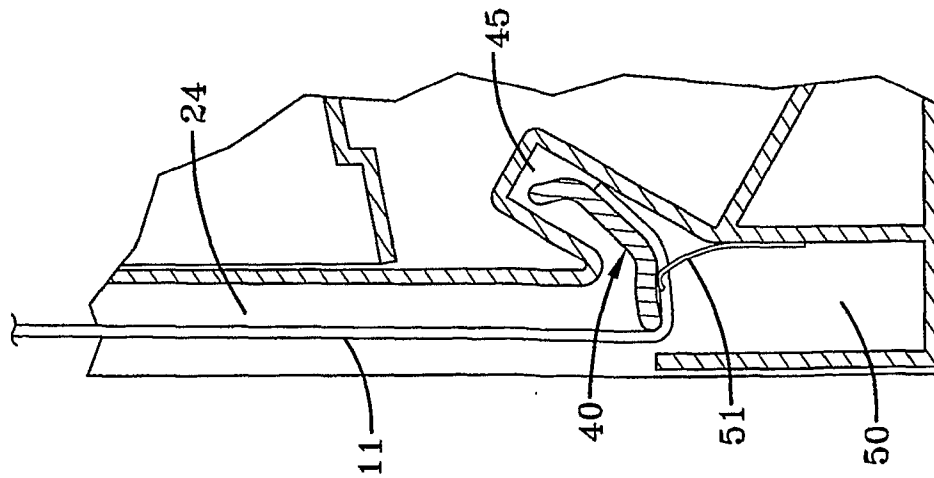


FIG-4D

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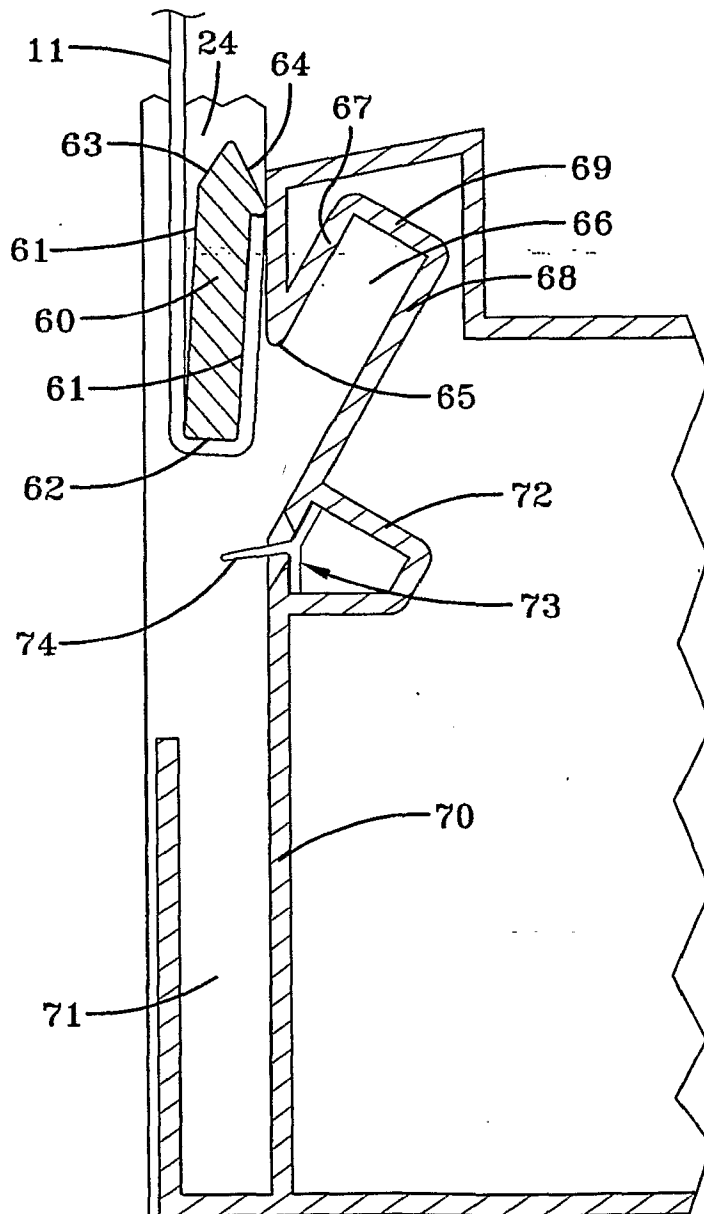


FIG-5

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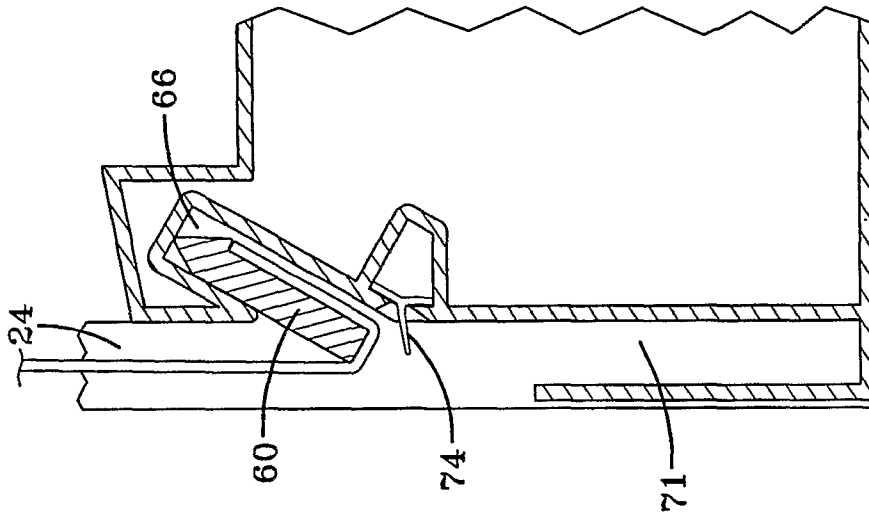


FIG-5B

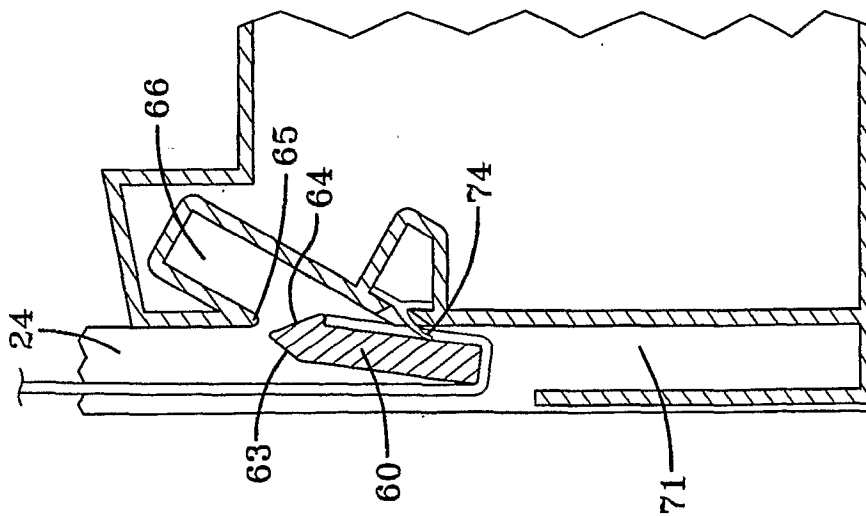


FIG-5A

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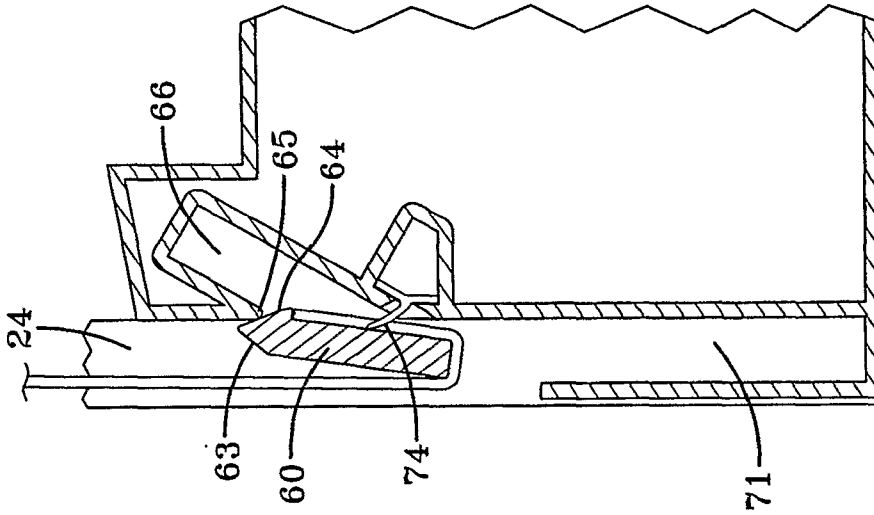


FIG-5D

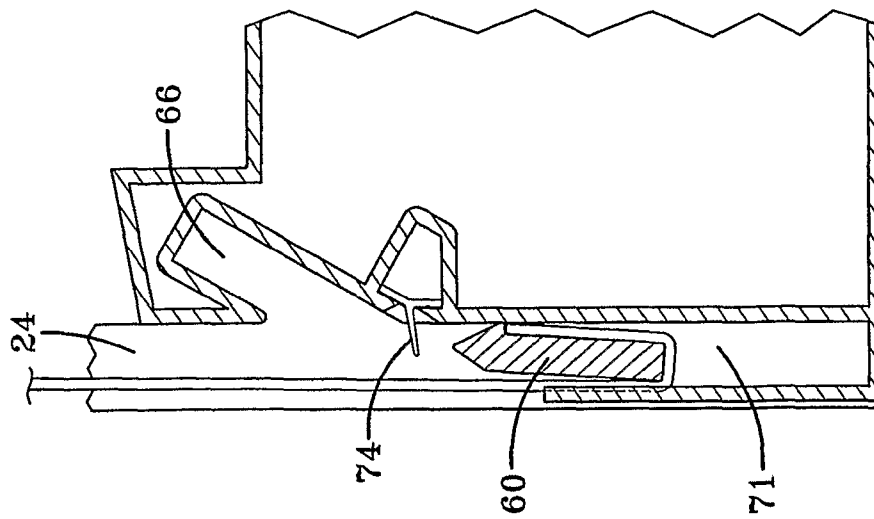
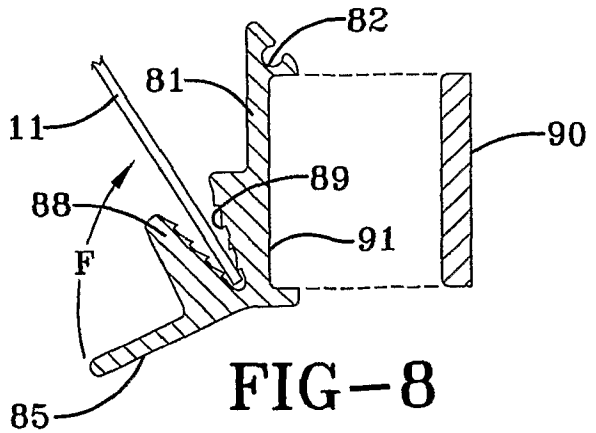
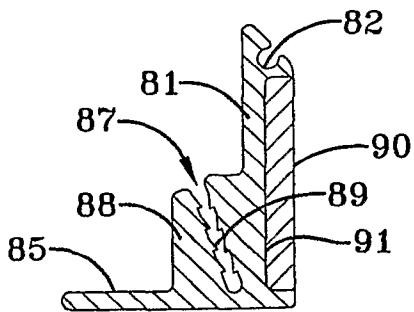
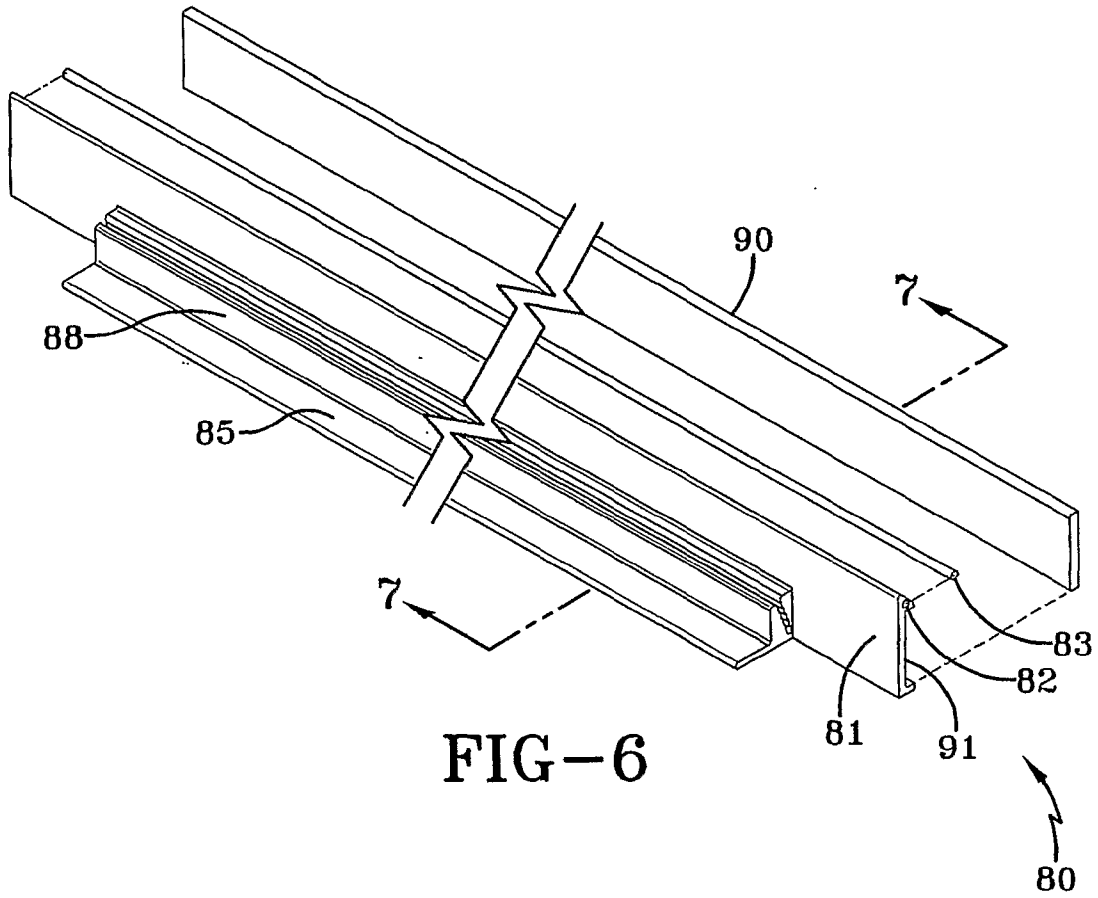


FIG-5C

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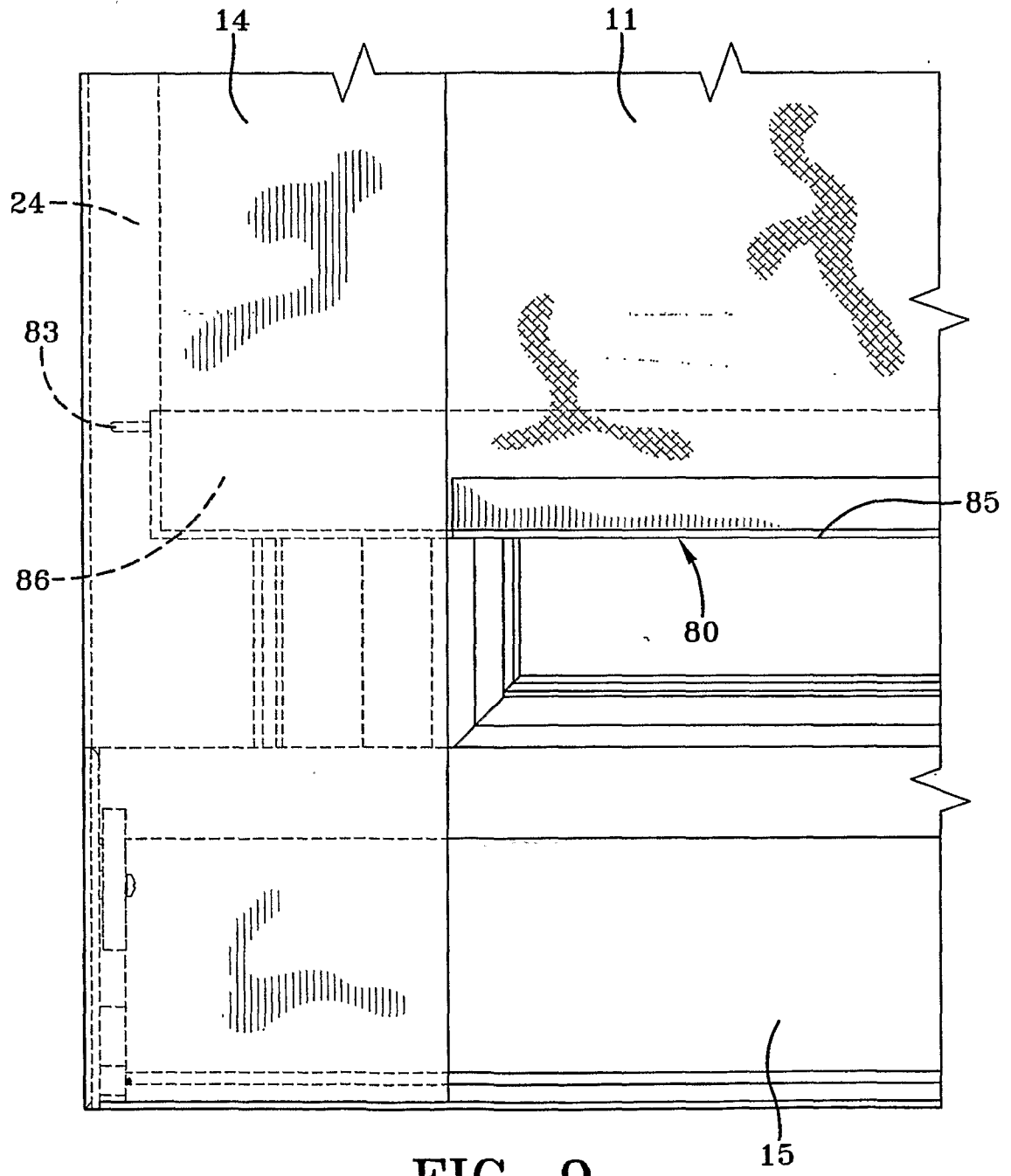


FIG-9

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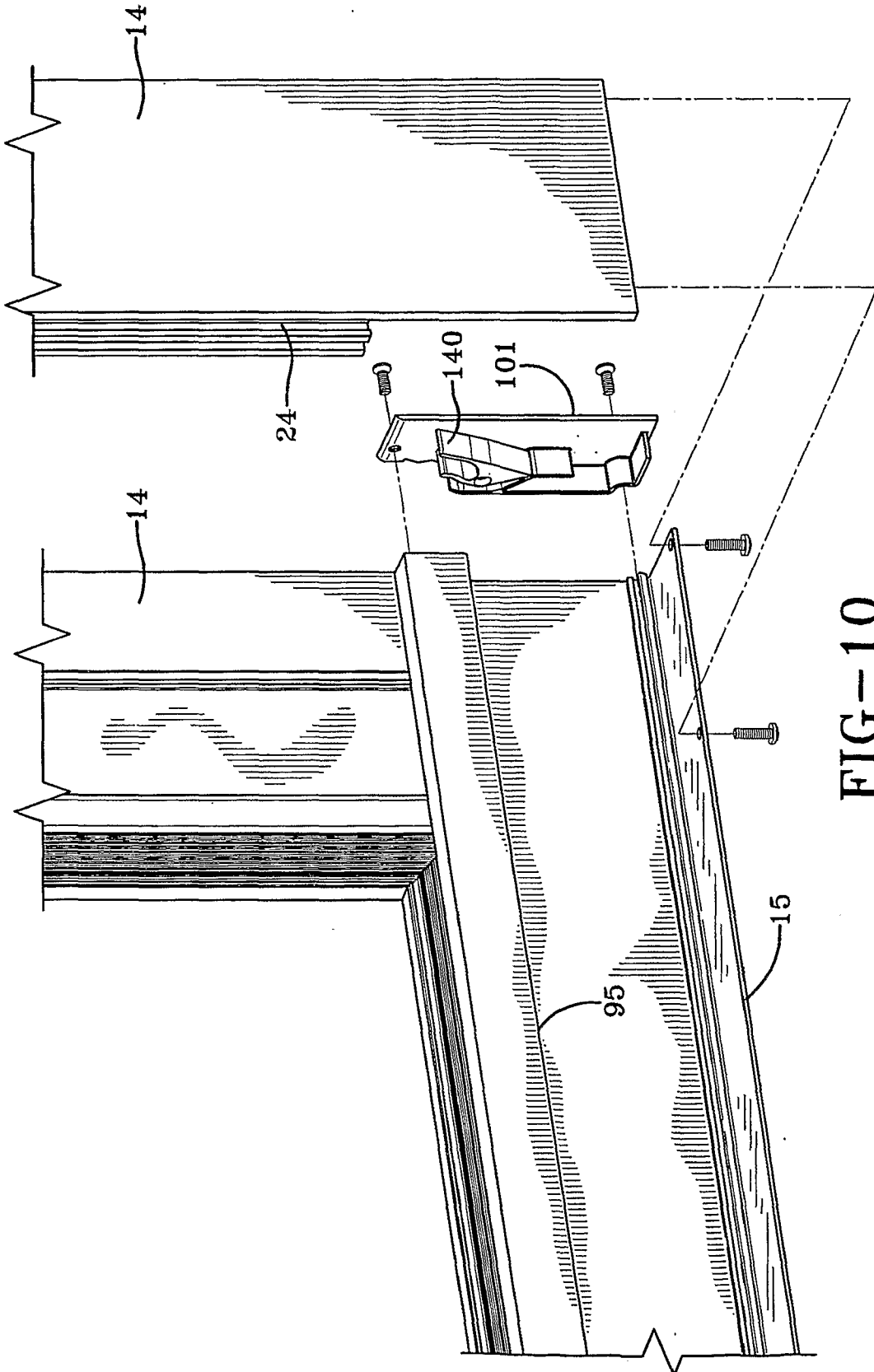


FIG-10

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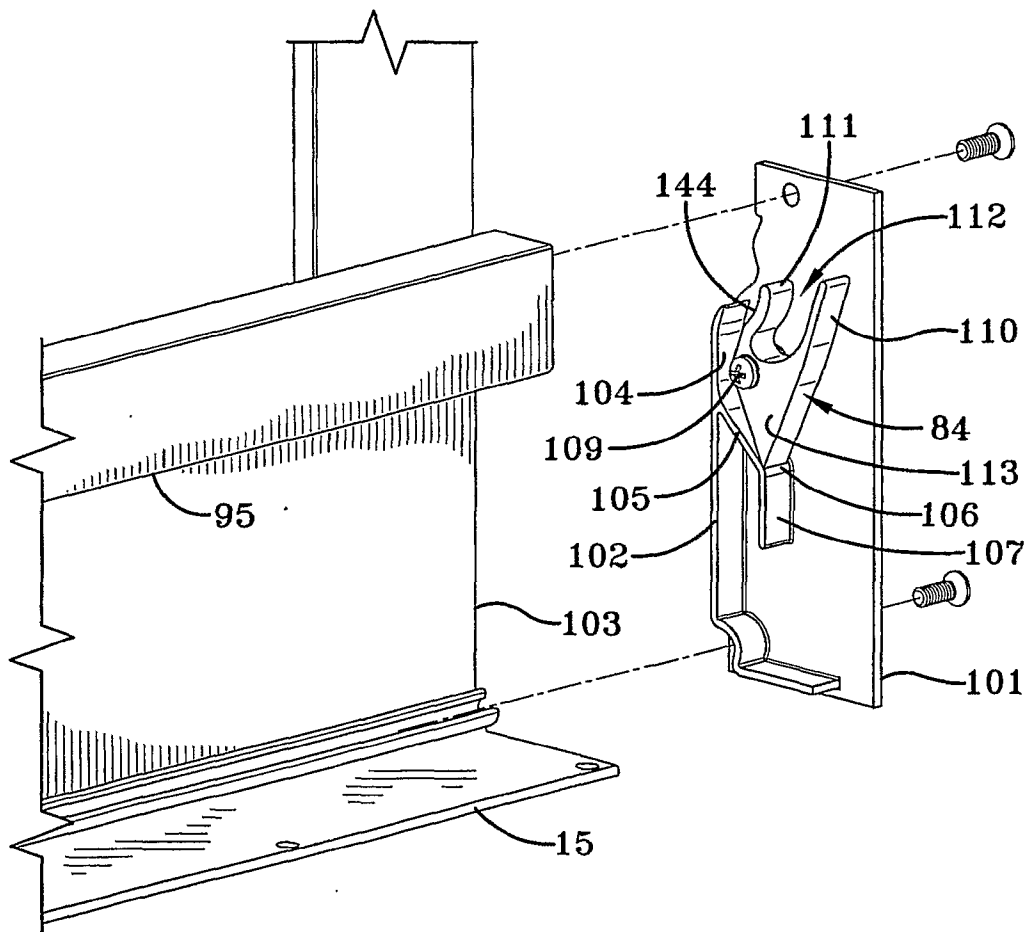
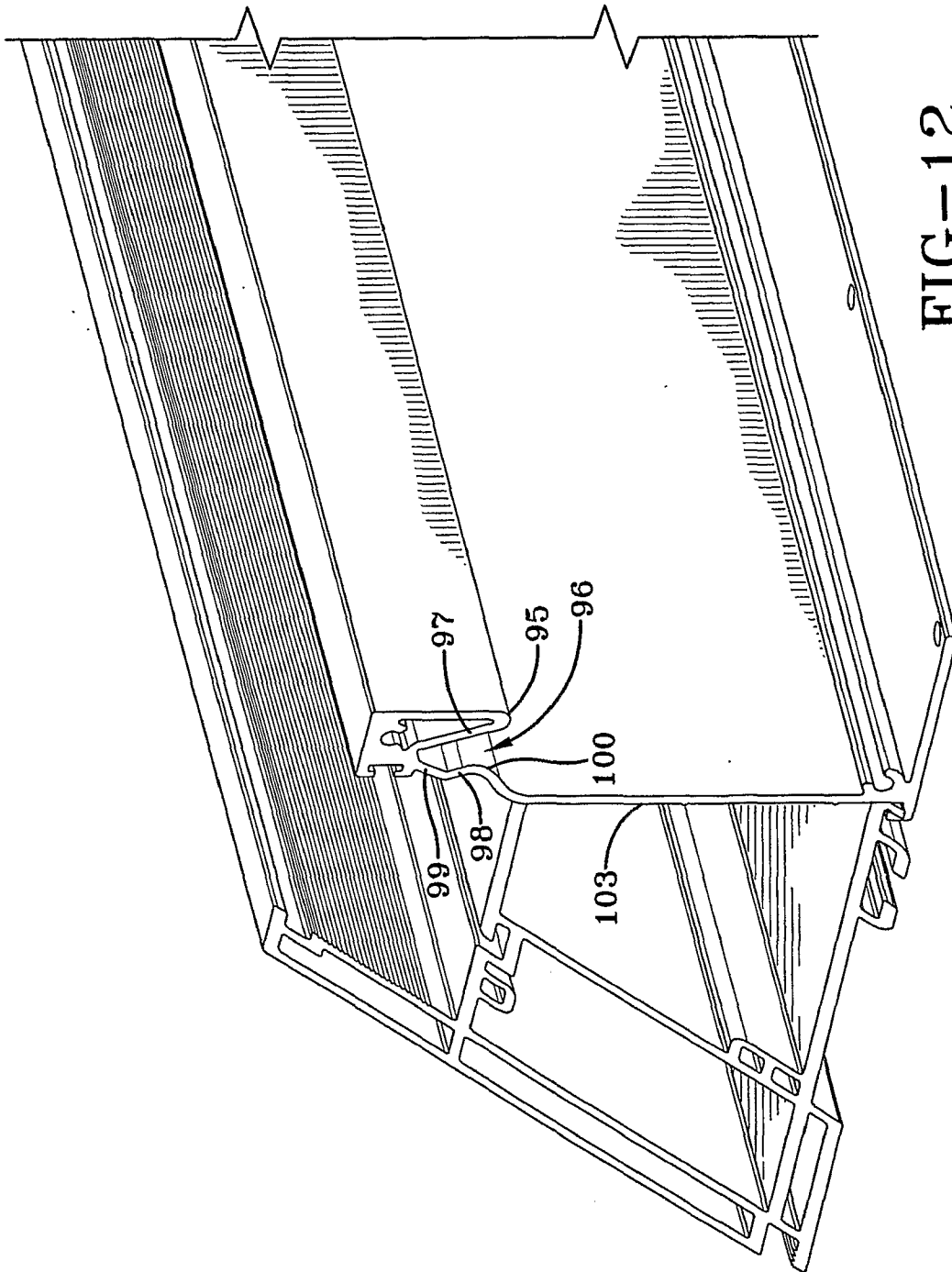


FIG-11



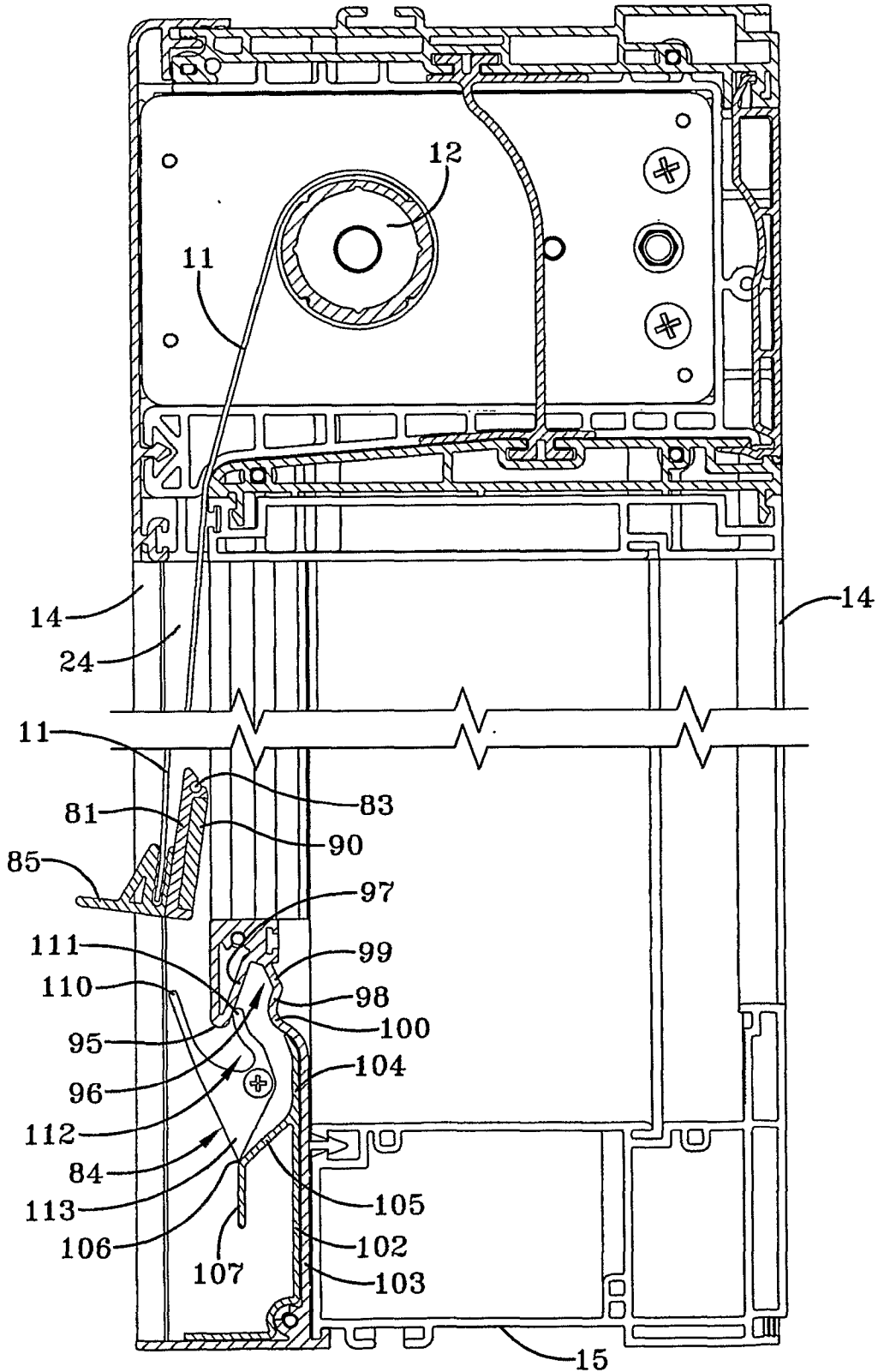


FIG-13A

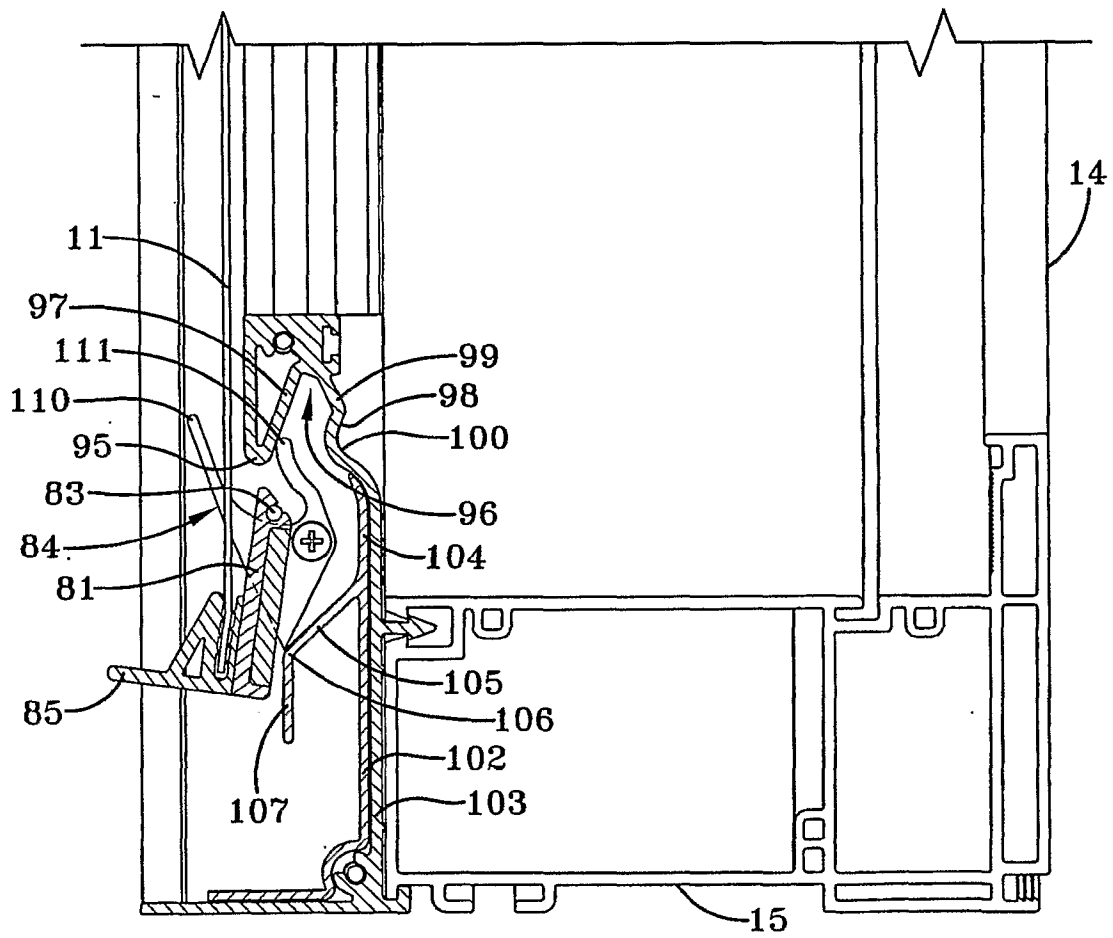
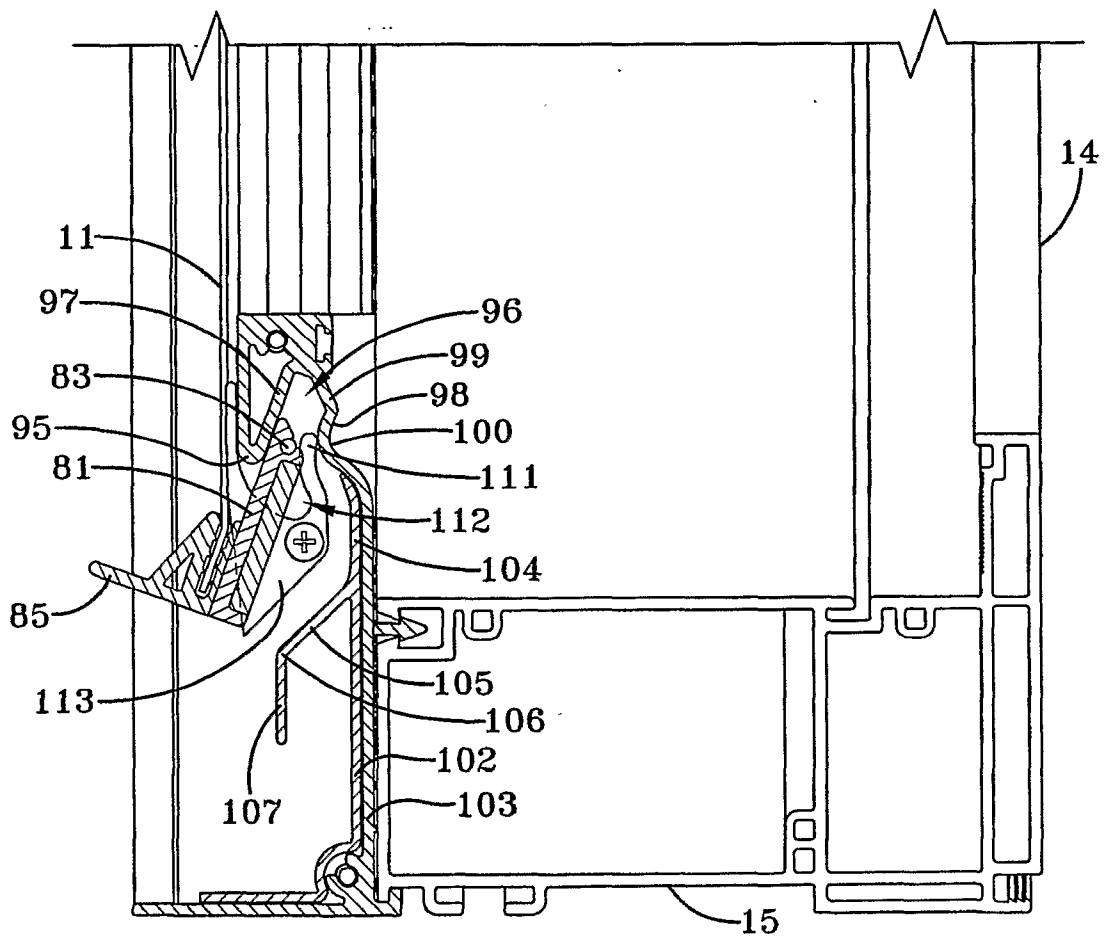


FIG-13B



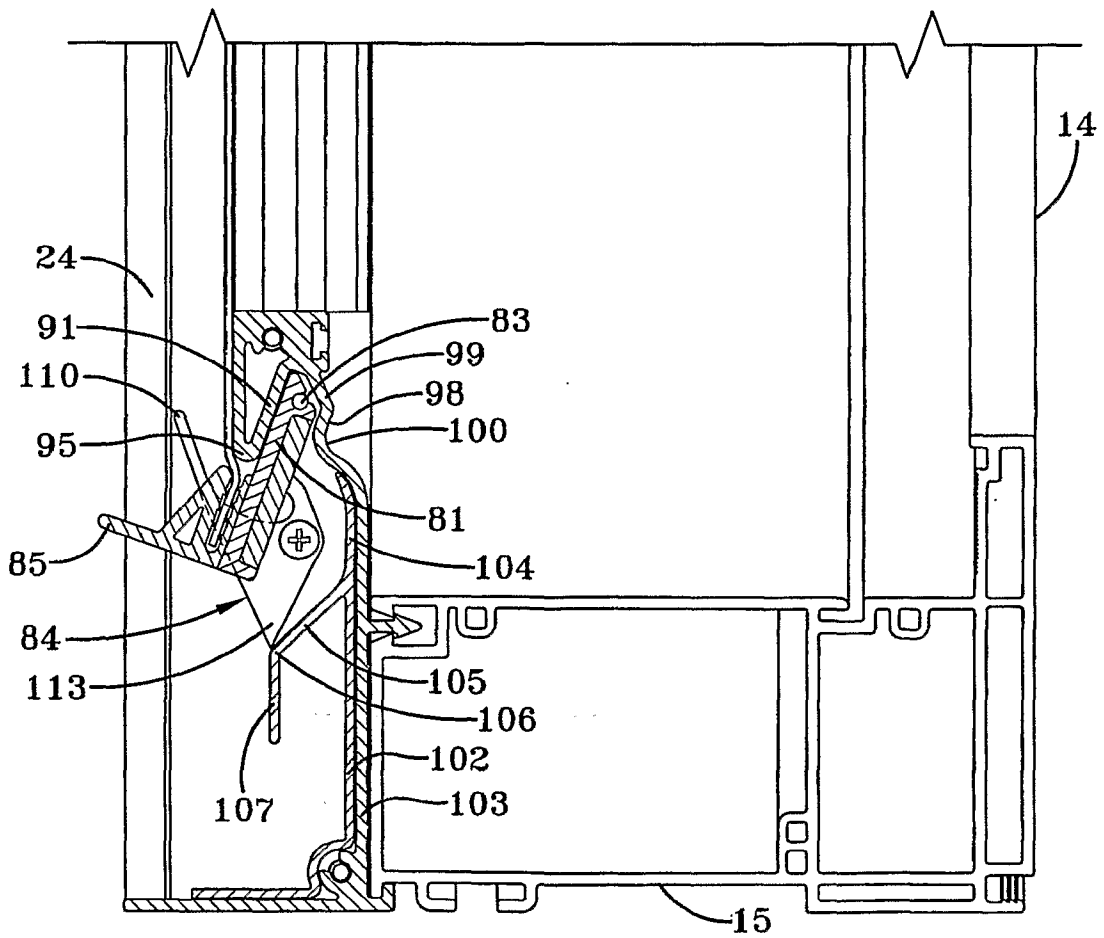


FIG-13D

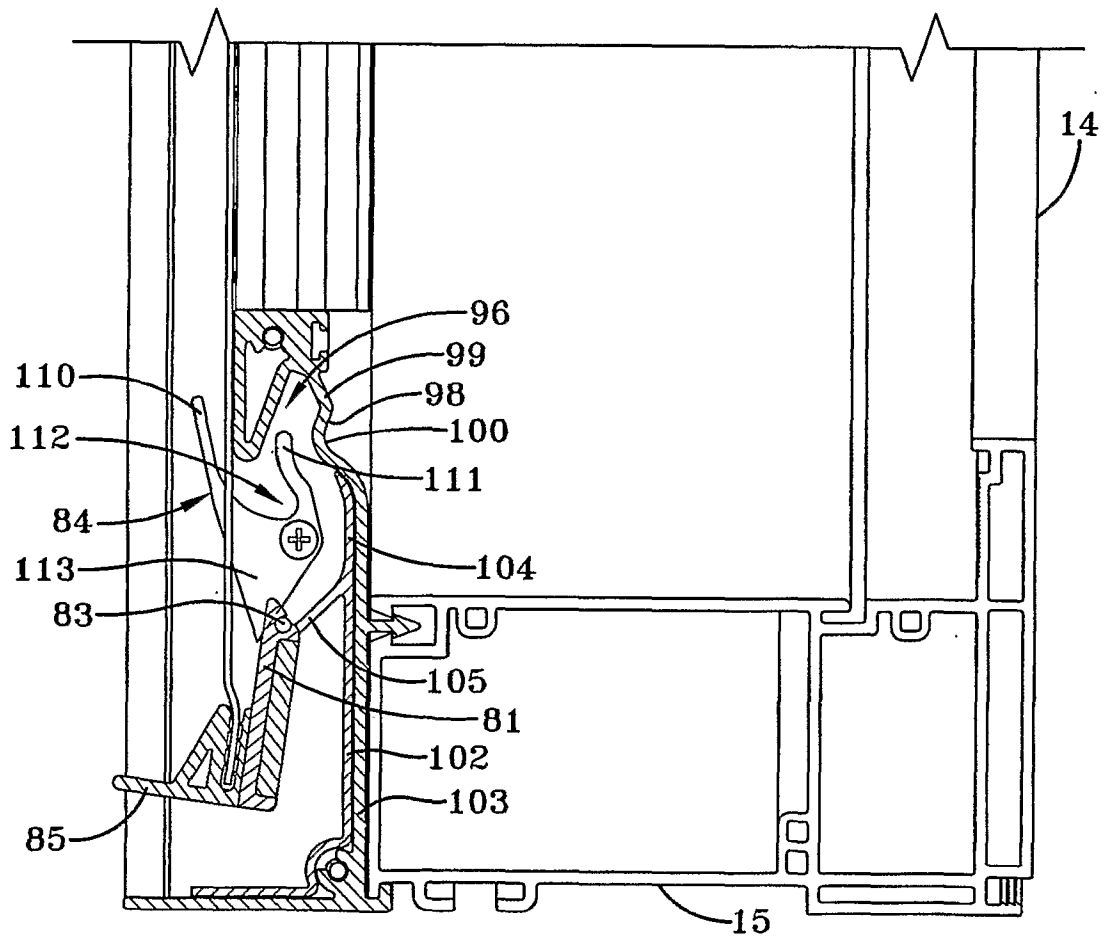


FIG-13E

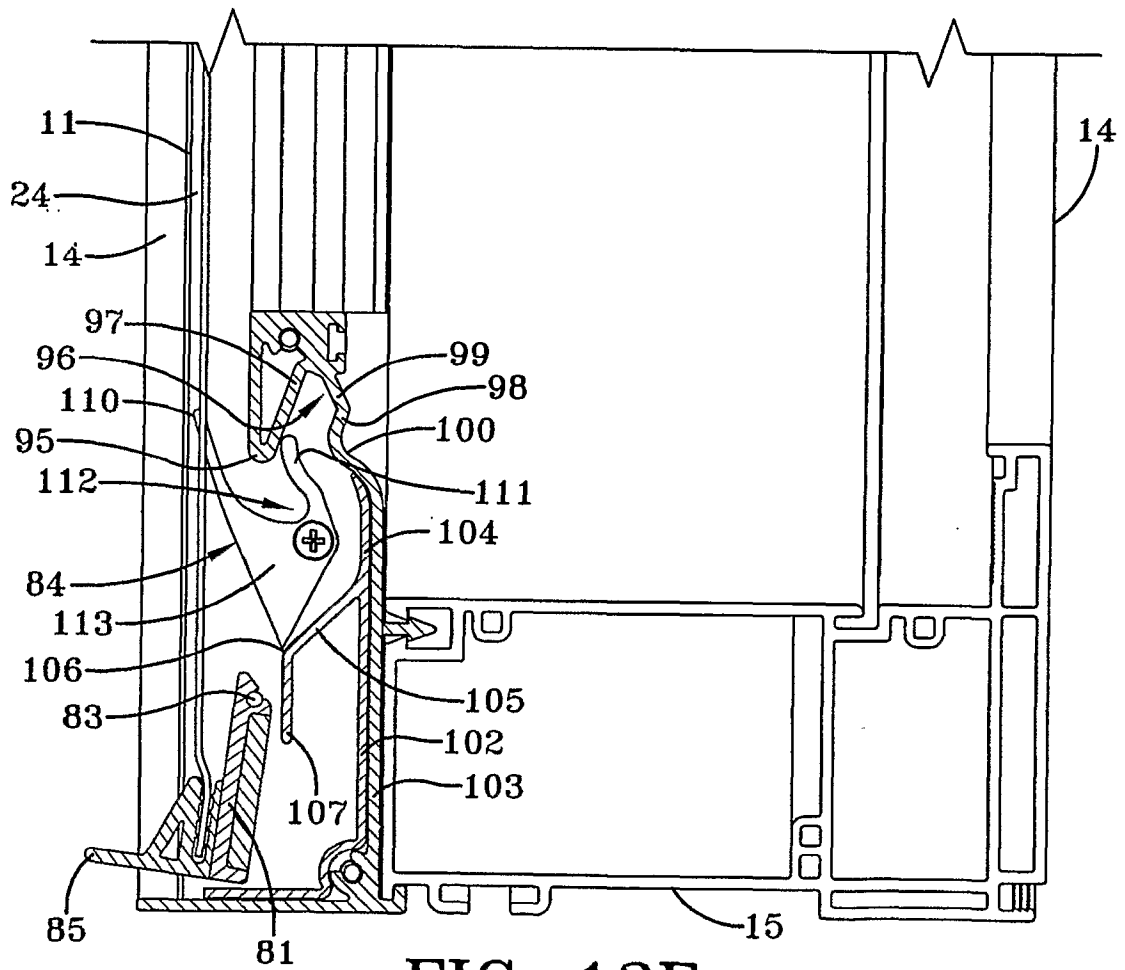
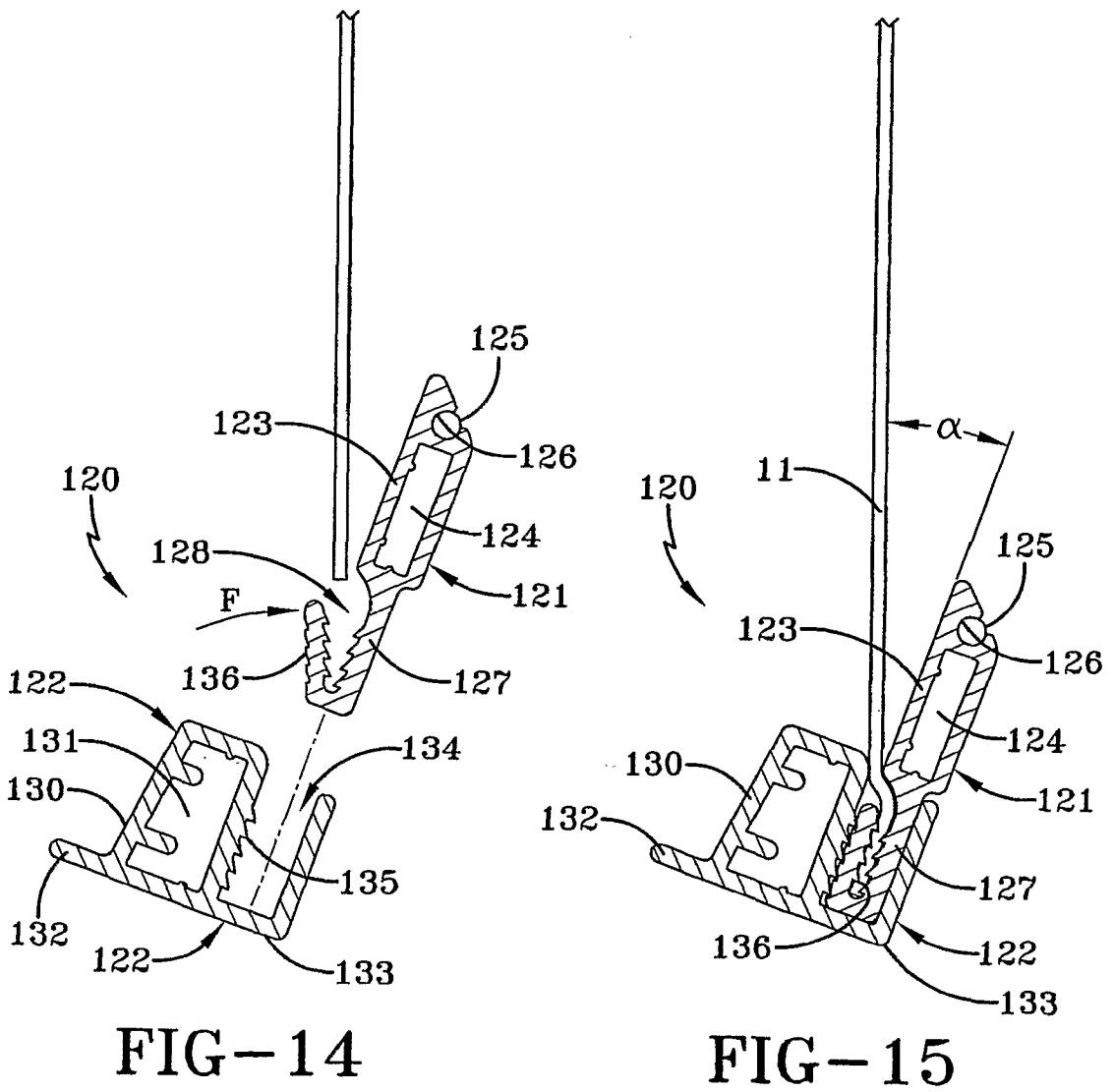


FIG-13F



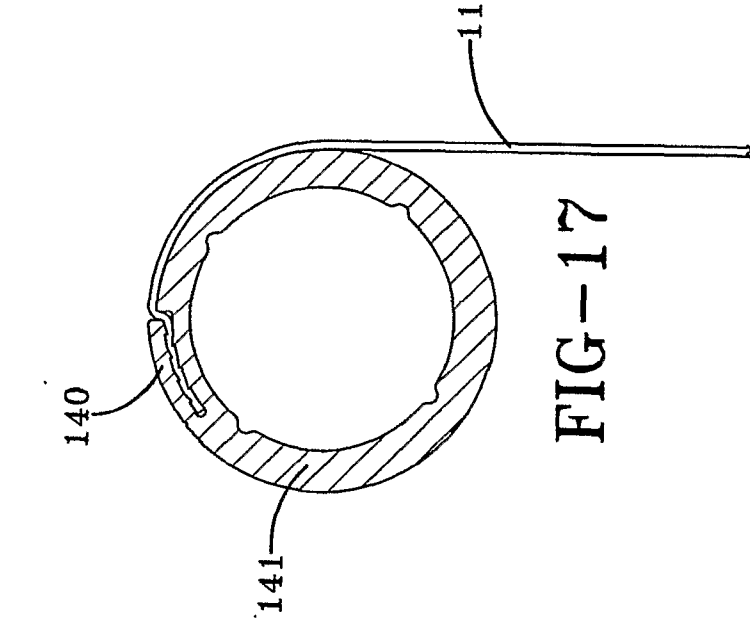


FIG-17

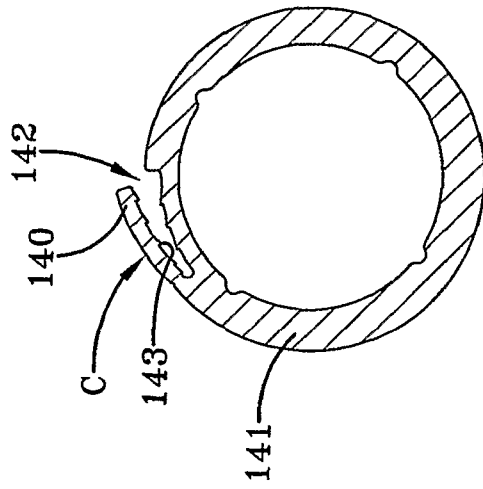


FIG-16