

SECURITY BAR ASSEMBLYTechnical Field

The present invention relates to an extendable security bar assembly for a window or door opening in a building.

Background Art

There is a requirement for security bars to be used in front of windows and doors and particularly in front of store fronts and the like. Such security bars are needed to deter break-in attempts into a building. There are various types of security bars and shutters available some of the shutters are designed for weather protection such as hurricanes as well as security. Many of these shutters and security bars when raised up are rotated on a drum or alternatively fold into a large cage member positioned above the opening. One example of a hurricane shutter is that disclosed in U.S. Patent 5,469,905. This patent shows a series of blades which accordion upwards into a cage or frame. The main purpose of the shutter is to provide strength against wind, but as a side effect the shutter provides security to prevent intruders from breaking in.

- 2 -

The hurricane shutter has heavy blades for weather protection. There is a requirement for a lighter security system for helping to prevent break-ins. The system has a plurality of spaced apart horizontal bars with connecting links. One example of such a system is that disclosed in U.S. Patent 2,095,690 which shows a series of horizontal bars with connecting linkage members. The bars roll up on a drum. A similar system is shown in U.S. Patent 3,739,832.

10 If the opening is wide, then the security bars generally have links joining the bars together to prevent the bars being bent to force an opening between bars. However, if the opening is not wide, for example, a small household window, then it is not needed to have links joining the bars together provided they are rigidly held
15 at each end.

When connecting links are not required between bars, one does not have the necessity of folding bars and connecting links but can store the bars in a stored configuration or a container adjacent the opening and
20 arrange to feed each bar to join opposing connecting links of drive chains on opposing faces of the opening so they are positioned and spaced apart for the full opening or a portion of the opening as required.

- 3 -

Disclosure of Invention

One aim of the present invention is to provide an improved extendable security bar assembly which is convenient, aesthetic and less costly than existing
5 devices, one that is used primarily for security.

It is another aim of the present invention to provide a security bar assembly having a plurality of bars extending between two channels, the two channels positioned on opposite faces of the opening, the bars
10 slidable within the channels and having ends of the bars retained in the channels over the opening, at least one bar of the plurality of bars has a connection at each end within each of the two channels to a transporting mechanism in each channel co-ordinated to slide the at
15 least one bar between the two channels, drive means are included for the transporting mechanism to slide the plurality of bars across the opening, and a storage area substantially adjacent the opening, associated with the channels to receive and retain the bars when they are not
20 in place over the opening.

It is a further aim of the present invention to provide a security bar assembly having bars that move up and down in side channels and when either raised or lowered, the bars and connecting links fold into a folded
25 configuration above or below the opening. The bars may

- 4 -

be moved up and down manually or may be motorized and can lock in any position to prevent accidental lowering. In the case of a motorized arrangement, safety provisions stop movement of the bars if an object becomes caught in the opening. Thus the mechanism or the object is not damaged. It is a further aim to provide guides at the top of the opening or at the bottom of the opening which permits the security bars and the connecting links to fold in an accordion fashion into a space which is smaller than those presently available. The assembly has a frame comprising the two side channels. In one embodiment the frame also includes either a bottom plate which fits at the base of the opening or in the case of the folded configuration occurring below the opening, a top plate. In the case when the folded configuration of bars and connecting links is at the top, the lowest bar is locked adjacent the bottom plate when the security bars are closed to prevent forcing the security bars open.

It is a further aim to provide an emergency escape mechanism so that the security bar assembly can easily be removed from the inside of a building without having to raise or lower the security bars.

The present invention provides a security bar assembly for an opening comprising a plurality of bars extending between two channels, the two channels

- 5 -

positioned on opposite faces of the opening, the bars
slidable within the channels and having ends of the bars
retained in the channels over the opening, at least one
bar of the plurality of bars having a connection at each
5 end within each of the two channels to a transporting
mechanism in each channel co-ordinated to slide the at
least one bar and retain the bars a predetermined
distance apart, a drive means for the transporting
mechanism, and a storage area substantially adjacent the
10 opening associated with the channels to retain the bars
when they are not in place over the opening.

In one embodiment a plurality of connector links
join adjacent bars together and the storage area has
guides to receive and guide the bars into a folded
15 configuration with alternate bars on opposite sides.

In another embodiment the two channels have bar
drive chains with adjoining chain links guided within the
two channels, each of the bars having a connection at
each end to engage in chain links in the drive chains,
20 the engaged links spaced apart a predetermined number of
chain links in each of the drive chains, and retaining
bars a predetermined distance apart.

In a further one embodiment the present invention
provides a method of sliding and folding a plurality of
25 horizontal security bars, joined by connector links,

- 6 -

across an opening into a storage area, the bars extending between two channels on either side of the opening, comprising the steps of: sliding the plurality of bars in the channels to push a first bar out of the channels into
5 the storage area; guiding the first bar to one side of the storage area, sliding the plurality of bars to push an adjacent bar to the first bar out of the channels into the storage area; guiding the adjacent bar to the other side of the storage area, and continuing sliding the
10 plurality of bars so further bars are guided to one side followed by the other side of the storage area to form a folded configuration.

In yet a further embodiment there is provided a method of forming a security bar assembly in an opening
15 including a plurality of security bars, the bars having retained ends extending between two channels on opposing faces of the opening and slidable therein, comprising the steps of moving drive chains in guides within the two channels, the drive chains having adjoining chain links;
20 feeding opposing retained ends of a first bar to engage in first chain links of the drive chains so the first bar slides across the opening; feeding a second bar to engage in second chain links spaced a predetermined number of chain links from the first chain links, and continuing
25 moving the drive chains and engaging further bars in further chain links spaced the predetermined number of

- 7 -

chain links apart until the security bar assembly covers the opening.

In a still further embodiment there is provided a method of forming a security bar assembly in an opening including a plurality of security bars having retained ends engaged in chain links of drive chains guided in two channels on opposite faces of the opening and slidable therein, comprising the steps of moving the drive chains in guides within the two channels until a first bar having ends engaged in first chain links of the drive chains slides across the opening; continuing moving the drive chains in the guides until a second bar having ends engaged in second chain links of the drive chains slides across the opening, and further moving the drive chains with further bars engaged in further chain links until the security bar assembly covers the opening.

Brief Description of Drawings

In drawings which illustrate embodiments of the present invention:

20 Figure 1 is a front view showing a security bar assembly in the secure position according to one embodiment of the present invention;

- 8 -

Figure 2 is a partial sectional view showing a channel for the security bar assembly of Figure 1;

Figures 3A to 3F are sectional end views showing the security bar assembly with the bars and connecting links
5 moving into a folded configuration above the opening;

Figure 4 is a sectional end view showing another embodiment of guides for retaining the security bars in a folded configuration above the opening;

Figures 5A to 5F are sectional end views showing the
10 security bar assembly with the bars and connecting links moving into a folded configuration below the opening;

Figure 6 is a sectional end view showing another embodiment of guides for retaining the security bars in the folded configuration below the opening;

15 Figure 7 is a partial front view showing one embodiment of guides with horizontal bars retained in the folded configuration;

Figure 8 is a partial sectional view taken at line
8-8 of Figure 7 showing ends of bars with retaining ends
20 in the guide slot of the guides;

- 9 -

Figure 9 is a sectional view through a channel showing a threaded shaft with the nut attachment thereon for raising the security bar assembly;

Figure 10 is a sectional view through a channel
5 similar to that shown in Figure 9 with the threaded shaft raised to disengage the drive mechanism;

Figure 11 is a partial front view showing a locking mechanism at the top of a channel to prevent the security bar assembly from being raised when in the lowered
10 position;

Figure 12 is a top view showing the security bar assembly of Figure 1 with quick release connections between the channels and the building wall;

Figure 13 is a partial elevational view of a
15 mounting plate on the back of a channel showing elongated slots with wider top portions for engaging screws or bolts on the surface of a building, and showing the horizontal bars and connecting links;

Figure 14 is an exploded elevational view showing a
20 modular constructed horizontal bars and connecting links.

- 10 -

Figure 15 is a front elevational view showing another embodiment of a portion of a security bar assembly with a drive chain in a side channel,

Figure 16 is a side sectional view of the embodiment
5 shown in Figure 15 showing a side channel and container for holding bars with connecting links in a stored configuration above an opening,

Figure 17 is a side sectional view similar to Figure 16 showing a side channel and container for holding bars
10 with links in a stored configuration below an opening,

Figure 18 is a detailed front view showing a drive chain and sprocket for engaging ends of bars,

Figure 19 is a detailed sectional top view showing a drive chain in a channel guide connected to a bar across
15 an opening,

Figure 20 is a perspective view of a further embodiment of the security bar assembly showing bars connecting to side channels with an upper container to store the raised bars above the opening,

20 Figure 21 is a detailed front elevational view of the embodiment shown in Figure 20 showing the ends of

- 11 -

bars joined to chain links and stored in a container above the opening,

Figure 22 is a detailed sectional top view showing the escapement mechanism for ensuring bars from an upper container engaging with chain links a predetermined number apart on a drive chain,

Figure 23 is an end view showing a container above an opening with bars and an escapement mechanism for feeding the bars into opposing chain links of drive chains on both sides of an opening,

Figure 24 is a front elevational view showing another embodiment of a security bar assembly with flexible connection spacers between adjacent bars,

Figure 25 is a side view showing a bar drive chain and a storage drive chain with bars spaced apart according to a further embodiment of the invention,

Figure 26 is a side view similar to Figure 25 showing two bars nestled together on the storage drive chain,

Figure 27 is a perspective view showing two bars with elongated anchors overlapping and the bars nestled together,

- 12 -

Figure 28 is a schematic perspective view showing the intermittent drive mechanism for the storage drive chain according to an embodiment of the invention,

Figure 29 is a partial front elevational view showing yet a further embodiment of the present invention wherein the bars are angled across the opening,

Figure 30 is a detailed sectional front view showing a drive chain which is not endless and stores the spare chain links between rods above the opening.

10 Best Modes for Carrying Out the Invention

A security bar assembly 10 is shown in Figure 1 with a plurality of horizontal bars 12 spaced apart by connector links 14, which are interspaced between adjacent bars with connector links 14 for two adjacent bars 12 being interspaced between connector links 14 joined to bars above and below the two adjacent bars. Details of the connector links 14 will be described hereafter.

The ends of each bar 12 are inserted into channels 16 located vertically at the sides of an opening 17 which the security bar assembly 10 covers. The bottom horizontal bar 12Z has threaded attachments 18 at each

- 13 -

end which in turn are connected to threaded shafts 20 in each channel 16.

The channels 16 are joined at the base to a bottom plate 22 extending below the opening 17. The bottom
5 plate 22 as well as joining the channels 16 together may provide a bottom support for the bottom bar 12Z. In some applications, the bottom plate 22 is omitted and the lower edge of the opening forms the bottom support.

At the top of the two channels 16 is a space 24 to
10 contain the bars 12 and connecting links 14 when in the raised folded configuration. First bevel gears 26 at the top of the threaded shafts 20 engage second bevel gears 27 on a connecting shaft 28 having a drive mechanism 30 containing a motor and gears for raising and lowering the
15 assembly 10. The first bevel gears 26 are above the second bevel gears 27 so they can disengage when the threaded shafts 20 are raised as will be described hereafter.

Figure 2 shows a retaining head 32 on the end of a
20 horizontal bar 12 in the channel 16 which has inward sloping lips 34 to prevent the bar 12 from being pulled out of the channel. The bottom bar 12Z of the assembly may not have retaining heads 32 as this is connected to threaded attachments 18 on the threaded shafts 20. Any
25 attempt to force the bars 12 to come out of the channel

- 14 -

16 results in the lips 34 being pushed inward to grip the bar 12 tightly.

The connector links 14 as shown in Figure 1 have a fixed attachment 38 at the top end wherein they are
5 rigidly fixed to each bar 12 and a pivoted connection 40 at the bottom end connecting to an adjacent lower bar 12.

Figures 3A to 3F illustrate the bars 12 and connector links 14 folding into a space 24 above the opening. Figure 3A illustrates the security bar assembly
10 in the fully lowered position with the top bar 12A located at the top of the channel 16. The assembly is raised by rotating the threaded shafts 20 so that the nut attachments 18 rise upwards and the bottom bar 12Z, pushes the assembly of bars 12 and connector links 14
15 upwards. The arrangement shown in Figures 3A to 3F is for the security bar assembly 10 to be mounted on a flat surface and therefore has a flat internal guide 44 and an outside curved guide 46 which extends up from the two sides of the channel 16. As the top bar 12A moves
20 upwards as shown in Figure 3B, it folds over towards the curved guide 46 of the space 24. A detent 48 is shown on the flat guide 44 just above the channel 16 to ensure
that the top bar 12A does fold towards the curved guide 46. Figure 3C shows the second bar 12B being pushed
25 straight upwards to rest against the flat guide 44. Figure 3D shows the third bar 12C being pushed over

- 15 -

towards curved guide 46 and Figure 3E shows the fourth bar 12D being pushed up against the flat guide 44. Figure 3F shows the fifth bar 12E being pushed towards the curved guide 46. As the bottom bar 12Z forces the
5 assembly upwards, alternate bars are directed to the curved guide 46 followed by the flat guide 44 to provide a folded configuration.

Figure 4 illustrates another embodiment of a space
24 for the folded configuration having two curved guides
10 46. This arrangement would not be suitable for mounting flush against a wall but may be built integrally into a building. The folded configuration will apply in the same manner as that shown in Figures 3A to 3F.

In another embodiment of the security bar assembly,
15 as shown in Figures 5A to 5F, provision is made for the plurality of bars 12 and connector links 14 to be lowered into a folded configuration below the opening. At least one of the ends of connector links 14 have a pivoted connection to a bar 12, both ends may have pivoted
20 connections.

Figure 5A illustrates the bottom bar 12Z entering the folding space 24, it reaches the bottom of the space 24 in Figure 5B and in Figure 5C the next bar 12Y commences to fold away from the flat guide 44 towards the
25 curved guide 46. Figure 5D shows the connector link 14

- 16 -

between the bars 12Z and 12Y flat on the bottom of the folding space. Figures 5E and 5F show the bars 12 and connector links forming into the folded configuration as the bars 12 are lowered.

5 Figure 6 shows another embodiment of a folding space 24 below the opening with two curved guides 46 similar to the arrangement shown in Figure 4 for a folded configuration above the opening.

Figures 7 and 8 illustrate the mechanism on the
10 guides 44,46 to ensure that the bars 12 follow a folding configuration as illustrated in Figures 3A to 3F and do not jam up when either the bar assembly 10 is raised or lowered in the channels 16. Figure 7 illustrates a partial front view of the curved guide 46 having a
15 vertical groove 50 along each of the channels 16. The retaining head 32 at the end of each bar 12 has an engagement portion 52 as illustrated in Figure 8 at one side which engages in the groove 50 commencing on the curved guide 46 at the position where the top bar 12A
20 contacts the curved guide 46 as shown in Figure 3C. The groove 50 commences at the approximate position where the top bar 12A first touches the curved guide 46. The engagement portion 52 on the end of the retaining head 32 as shown in Figures 7 and 8 prevents the bars 12 from
25 twisting away from a horizontal position and prevents jamming during the raising and lowering of the bars 12.

- 17 -

Because the connector links 14 have a fixed end 38 attached to the bars 12, the engagement portion 52 is positioned opposite the projecting connector link 14 so that it is guided into the groove 50. When further bars 5 12 are raised and the connecting link 14 becomes substantially horizontal, the engagement portion 52 on the next retaining head 32 is guided into the groove 50. Thus the engagement portions 52 on both sides are guided into appropriate grooves 50 in the curved guide 46 and 10 the flat guide 44. When unfolding, the engagement portion 52 on the lowest bar 12 pulls out of the groove 50 and the next bar 12 takes its place.

Figures 9 and 10 illustrate the threaded nut attachment 18 on the threaded shaft 20 attached to the 15 bottom bar 12Z. As can be seen the bottom bar 12Z is attached to the underside of the nut 18 so that in the lowest position the bottom bar 12Z is flush with the bottom plate 22. The threaded shaft 20 has a bottom shoulder 60 with a smaller diameter lower portion 62 20 extending downwards through a hole 64 in the bottom plate 22. At the top of the threaded shaft 20 is top shoulder 66 which joins to an upper portion 68 having a smaller diameter that passes through a hole 70 in a plate 72 at the top of the channel 16. At the top of the upper 25 portion 68 is a bevel gear 26 which meshes with a second bevel gear 27 on the connecting shaft 28. A spring 74 is positioned around the upper shaft portion 68 between the

- 18 -

top shoulder 66 and the plate 72. When the bottom bar 12Z reaches the bottom and rests against bottom plate 22 or hits an obstruction and cannot move further down, then at least one of the two threaded shafts 20 rises upwards as illustrated in Figure 10 and this in turn disengages at least one of the bevel gears 26 and 27 so that at least one of the shafts 20 no longer rotates. A limit switch 76 is shown which cuts off the power to the motor when one of the threaded shafts 20 is raised and the bevel gears 26 and 27 disengage in order to stop rotation of both shafts 20. Thus the mechanism prevents the bars being lowered if there is an obstruction in the opening or alternatively when the bottom bar 12Z reaches the bottom of the opening 17. Whereas this arrangement illustrates the bars being raised to a folded configuration above the opening, the same mechanism may be reversed and used when the folded configuration is below the opening.

Utilizing the mechanism shown in Figures 9 and 10 there is provided a collar 80 adjacent the top of the threaded shafts in the channel 16 below the guides 44 and 46 as shown in Figure 11. When the lowest threaded attachment 18 can no longer move downwards, the threaded shaft 20 is raised upwards and the collar 80 pivots a lever arm 82 which has lower engagement end 84 that passes through an opening 86 in the channel 16. This engagement end 84 is positioned to stop an adjacent

- 19 -

horizontal bar 12 from being raised. Thus the locking mechanism acts as a further security if for instance the bottom bar 12Z was broken or the connector links 14 severed then it would still not be possible to push the remaining bars 12 upwards because the engagement end 84 stops the next bar 12 from moving up, and the connector links 14 support the other bars 12 in their spaced relationship. This mechanism works in the same way when the folded configuration is below the opening, except the threaded shafts 20 move down when the highest threaded attachment 18 can no longer move up.

In another configuration as shown in Figures 12 and 13, provision is made for quick release of the complete frame containing the security bar assembly from the side of a building. Figure 12 illustrates mounting plates 90 attached to the wall surface 92 adjacent the opening. The plates 90 are located between the channels 16 and the wall surface 92 of a building. The mounting plate 90 is attached to the wall surface 92 by a number of wall screws 93 or other types of attachments and has a series of studs 94 which extend out with enlarged heads 96. As shown in Figure 13, a series of elongated slots 98 with wider top portions 100 are provided in one side of the channels 16, and the slots 98 fit over the studs 94. A wedge 102 is positioned under each channel supported by a fixed member 104. The wedge holds the channels 16 at a height such that the enlarged heads 96 of the studs 94

- 20 -

are level with the slots 98 below the wider top portions. When the wedge is removed, and this is done by a quick release lever mechanism (not shown) the channels 16 drop down and the complete security bar assembly may be moved clear of the wall surface with the enlarged heads 96 of the studs 94 passing through the wider top portions 100 of the slots 98. In another configuration, a hinge 106 is provided at one side of the assembly. The hinge 106 permits the assembly 10 to be swung open. This quick release mechanism for the security bar assembly 10 is for a fire escape or an emergency escape from a building particularly if there is power failure and one is not able to raise the bars 12.

In operation the bars 12 are kept in horizontal positions at all times. When there are in the folded configuration, it is essential that they retain their horizontal position to prevent tipping or falling to one side which causes the mechanism to jam. The engagement portion 52 on the retaining head 32 of bar 12 aids in preventing tipping from occurring. When the bars are lowered, the bevel gears 26,27 disengage, because the two threaded shafts 20 have lifted, and at the same time the locking mechanism as shown in Figure 11 is engaged to lock one of the top bars 12. To raise the bars, the gears 26,27 are reversed and as they engage each other, the threaded shafts 20 lower, so the collar 80 allows the lever arm 82 to pivot downwards disengaging the

- 21 -

engagement end 84 from openings 86 in the channels 16 and the bars 12 move upwards into the storage area 24 to form the folded configuration as illustrated in Figures 3A to 3F. The reverse operation occurs when the folded
5 configuration is below the opening.

The rotation of the two threaded shafts 20 is shown in Figure 1 by means of a connecting shaft 28 and bevel gears 26,27 driven by a motor 30 or by a crank handle 31 for manual operation. In another embodiment there may be
10 two synchronized motors each driving a threaded shaft 20. In a still further embodiment there may be a manual mechanism for rotating the threaded shafts 20, such a manual mechanism is synchronized so that both threaded shafts 20 rotate together to keep the bars substantially
15 horizontal. The raising and lowering of the bar assembly is achieved by rotating the threaded shafts 20. When the threaded attachment 18 can no longer move downwards because it is at the bottom or if there is an obstruction preventing the bottom bar 12Z from moving down, then at
20 least one of the threaded shafts 20 rises up disengaging the bevel gears 26,27, and tripping the limit switch 70 so the motor 30 is turned off. When the threaded shafts 20 rise up, the top locking mechanism as shown in Figure
12 is activated so that the upper bars 12 cannot be moved
25 until after the locking mechanism is disengaged.

- 22 -

The horizontal bars 12 themselves together with the connector links 14 may be made in modular units as shown in Figure 14 with the bars 12 formed of internal rods 110 and sleeves 112 which are used to space connector links 14 apart. The rods 110 have a retaining head 32 at one end and a removable retaining head 32A at the other end with tongues 114 that engage with slots 116 in the adjacent sleeve 112. The connector links 14 are shown having one fixed connection 38 at one end of a bar 12 and having a pivoted connection 40 at the other end. In another embodiment the connector links 14 may have two pivoted ends. By having modular units of different sizes and lengths, security bar assemblies may be made up to cover any specific size opening and be foldable into a storage area 24 positioned above the opening.

In another embodiment, the security bar assembly 10 as shown in Figure 15 has a plurality of bars 12 spaced apart by connecting links 14 which are interspaced between adjacent bars 12. The ends of each bar 12 are inserted into channels 16 which have a drive chain 120 which moves on a first sprocket 122 and a second sprocket 124.

Figure 16 shows a section of a security bar assembly 10 positioned in front of an opening 17 in a wall surface 92. A storage area such as a container 126 is shown above the opening 17 and folded security bars 12 with

- 23 -

connecting links 14 are shown in the container 126.
Figure 17 shows a similar sectional view of a security
bar assembly to that shown in Figure 16, the difference
being that the container 126 is positioned below the
5 opening 17.

Details of the drive chain 120 are shown in Figure
18 rotating about the second sprocket 124 which has an
axis of rotation projecting from the wall substantially
perpendicular to the bars 12. Each bar 12 has at either
10 end a projection 32 which passes through a side slot 128
in the side of the channel 16 as shown in Figure 19. The
projection 32 has a disk member 130 to retain the end of
the bar 12 within the channel 16 and has an end piece 132
that extends to engage in an aperture of a chain link 134
15 of the drive chain 120. A chain guide 136 in a lower
channel member 138 shown in Figure 18 acts to direct the
drive chain 120 away from the sprocket 124 so that the
end piece 132 of each of the bars 12 does not interfere
with the teeth of the sprocket 124. The channels 16 are
20 held to the wall beside the opening 17 by bolts 140 and a
snap-on cover 142, shown in Figure 19, extends over the
channel 16. As the channel 16 is preferably placed on
the inside of the building, the cover 142 can only be
reached from the inside.

25 Whereas Figures 18 and 19 show the drive chains 120
with sprocket axes substantially at right angles to the



- 24 -

bars 12, in another embodiment the sprocket axes may be substantially parallel to the bars 12. In this case a chain link plate (not shown) extends from the side of a chain link 134 to engage an end of the bar 12.

- 5 Whereas Figure 15 shows connecting links 14 between bars 12, Figure 20 is a perspective view showing a security bar assembly with bars 12 and no connecting links joining the bars 12 together. This is possible because each bar is individually held in a chain link.
- 10 The connector links 14 are not essential because the opening is not too wide and the bars 12 cannot easily be pried apart. Figures 21, 22 and 23 illustrate one embodiment of a mechanism for the shutter assembly shown in Figure 20. The drive chain 120 as shown in Figure 21
- 15 rotates on the first sprocket 122 which is an eight tooth drive sprocket having one tooth missing. Every time the first sprocket 122 rotates and the missing tooth is open, the end piece 132 of the projection 32 from each bar 12 engages in a connection aperture in the chain link 134
- 20 and is then conveyed across the opening as the drive chain 120 moves around the sprocket 122. The missing tooth on the sprocket 122 is shown more clearly in Figure 22 with the end piece 132 engaging in the chain link 134
- 25 of the drive chain 120. The first sprocket 122 rotates on axle 144 which in turn is driven by a driven bevel gear 146. A drive shaft 28 shown in Figure 1 extends across the opening between the two drive chains 120.

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- 25 -

While not shown, the drive shaft 28 is driven by a gear motor that can rotate in either direction to slide the bars 12 across the opening. On either end of the drive shaft is a drive bevel gear 150 that engages the driven bevel gear 146 on the axle 144 to drive the first sprocket 122. Thus, rotation of the drive shaft 28 rotates both first sprockets 122 on either side of the opening in the channels 16 and moves the chains 120 at exactly the same speed so that the bars 12 remain substantially evenly spaced apart when they are engaged in individual chain links of the drive chain 120.

An escapement wheel 152 is attached to the drive bevel gear 150 and has a notch 154 to engage the projection 32 of a bar 12. Initially the bars 12 are stored in a stored configuration which in the embodiment shown is a container 126 above the opening and positioned above the cross shaft 28. Guides 156 direct the bars 12 into a slot 158 where they individually fall. As the escapement wheel 152 rotates the projection 32 of the first bar 12 is engaged by the notch 154 which moves the bar 12 down until the end piece 132 of the bars 12 engages in the connection aperture of the chain link 134 that is positioned on the sprocket 122 at the location where the tooth is missing. This applies for both sprockets 122 for both drive chains 120 on either side of the opening. As the drive chains 120 move downward, the projections 32 of the bars 12 fit into the slots 128 of



- 26 -

the channels 16. The escapement wheel 152 continues to rotate until it picks up a second bar 12 and lowers that in the slots 128 of the channels 16, at the same time each end piece 132 of the bars 12 fits into a connection
5 aperture of a chain link at the missing tooth position on the sprocket 122. This continues until all of the bars 12 are spaced apart across the opening 17. For an eight tooth sprocket 122, the end piece 132 will engage in every eighth chain link. In one embodiment an eight
10 tooth drive sprocket with one tooth missing provides 4" (10.16 cm) spacing for the bars. In a further embodiment the speed of the drive chain represents 2" (5.08 cm) per second both up and down.

When raising the bars, the drive chain moves in the
15 opposite direction as does the escapement wheel 152. The notch 154 in the escapement wheel 152 picks up the projections 32 of each bar 12 and disengages the end piece 132 from the drive chain 120. The bar 12 is raised and pushed into the container 126 pushing other bars
20 upwards. The container 126 is preferably lined with soft material to reduce the noise of the bars 12. As the bars 12 move upwards they spread out to take up the space of the container 126.

Whereas the mechanism shown in Figures 21, 22 and 23
25 illustrates the container 126 being on top of the opening, in another embodiment the container 126 may be

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- 27 -

positioned below the opening. The same mechanism as is illustrated would be used for feeding individual horizontal bars 12 to engage with the chain 120. However, there is a spring mechanism (not shown) provided to push each horizontal bar 12 up to ensure that each of the projections 32 engages in the notch 154 of the escapement wheel 152.

In further embodiments, the security bar assembly may have the bars 12 substantially vertical, with the channels 16 and drive chains 120 at top and bottom. In this configuration, the engagement of the bars 12 in the drive chains 120 does not rely on gravity.

When connecting links 14 join the bars together, the escapement wheel is not essential providing the first bar 12 is always retained in a chain link 134 of the drive chain 120. The sprocket with one tooth missing only allows the end piece 132 of a bar 12 to engage where that sprocket tooth is missing. With the mechanism shown in Figure 18, a chain guide 136 directs the drive chain 120 out from the lower sprocket 124 so that the sprocket teeth do not interfere with the end piece 132 of the bar 12 engaging in a chain link 134 of the drive chain 120. In this mechanism other spacing arrangements are provided. In one embodiment plugs 160 such as that shown in Figure 18, are positioned in each of the so-called connection apertures or spaces in the chain links 134,



- 28 -

thus avoiding the necessity of an escapement mechanism. The plugs 160 are preferably made of plastic and move with the chain links 134, thus preventing the end pieces 132 of the bars 12 engaging in a chain link 134. By
5 placing the plugs 160 in every chain link except in chain links which are engaged by end pieces 132 of bars 12, the bars 12 are spaced apart the predetermined distance.

Another embodiment to maintain the predetermined distance apart is shown in Figure 24. In this
10 embodiment, the storage area, which is shown as a container 126 to retain the bars 12 is positioned below the opening under the second sprocket 124.

The sprocket 124 is a truncated sprocket, that is to say, a sprocket with the tips of the teeth 124A removed.
15 By having truncated teeth, the end pieces 132 of the bars 12 do not interfere with the truncated teeth 124A.

Whereas a truncated sprocket is shown for this embodiment, a sprocket with a missing tooth as shown in Figure 21 may be used or, alternatively, chain guides
20 136, as shown in Figure 18 may be used to move the chain away from the sprocket.

Flexible connection spacers 170 are shown attached to the projections 32 at each end of all the bars 12.

The spacers determine the predetermined distance between

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- 29 -

the bars 12 when they are across the opening, but fold so the bars are adjacent each other. One configuration of folding is shown in Figure 24 when the bars are moved across the opening into the container 126 so they are
5 able to nestle up to each other. When the first bar 12, which is never disengaged from the drive chains 120, moves up, the spacers 170 pull the adjacent bar behind it to engage in chain links of the drive chains 120.

In Figures 25, 26 and 27, another embodiment is
10 shown which has a second set of drive chains referred to as storage drive chains 180. These storage drive chains 180 are positioned in line with the bar drive chains 120 either adjacent the first sprocket 122 positioned above the opening or positioned adjacent the second sprocket
15 124 below the opening. In the embodiments shown, the sprockets are all truncated sprockets as shown in Figure 24, so the sprocket teeth do not interfere with the connections between the drive chains and the bars 12. The bars 12 have projections 32 at each end to fit in
20 side slots 128 of the channels 16 as shown in Figure 19. Disk members 130 on the ends of the projections 32 have elongated anchors 182 which have four protrusions 184 in line to engage in apertures of adjacent chain links. As
shown in Figure 27, the anchors 182 have a width less
25 than half the width of the space between link plates in the chain link, and the anchors are arranged to overlap



- 30 -

so that adjacent bars 12 have anchors offset so that the bars can be retained together when in the container 126.

In Figure 25 the bars 12 are shown spaced apart with a first bar having the anchor 182 spanning between the
5 bar drive chain 120 and the storage drive chain 180.
When the bars 12 are moved into storage, the bar drive chain 120 moves the anchor 182 so that it engages with the storage drive chain 180, this chain is driven
intermittently and it moves just sufficient for the top
10 anchor 182 to clear the bar drive chain 120. Then, as shown in Figure 26 the next bar 12 is moved up and the anchor 182 of the lower bar overlaps the anchor 182 of the first bar so the two bars 12 nestle together. Thus, when the bars are stored they are all nestled together on
15 the storage drive chain 180.

To lower or raise the bars 12, depending upon whether the storage drive chain 180 is positioned above or below the opening, the storage drive chain 180 moves intermittently feeding the bars so the anchors 182 engage
20 into the continuously moving bar drive chain 120. The intermittent movement of the storage drive chain 180 is arranged to ensure that the space between bars, i.e., the number of chain links, is always the same across the opening.

- 31 -

Figure 28 is a schematic perspective view of the drive mechanism for the bar drive chain 120 and the storage drive chain shown in Figures 25 and 26. An intermediate gear 190 meshes with a continuous drive gear 192 to drive the first or second sprockets 122, 124 of the bar drive chain. An intermittent drive gear segment 194 is formed integral with the intermediate gear 190 and drives an intermittent drive gear 196 which drives the storage drive chain 180. An intermittent lock wheel 198 is keyed to the intermediate gear 190 and has a cutout 200 which is positioned above the intermittent drive gear segment 194. A locking dog 202 is attached to the intermittent drive gear 196 and only permits the intermittent drive gear 196 to rotate when the intermittent drive gear segment 194 meshes with the intermittent drive gear 196. At all other times the intermittent gear locking dog 202 cannot rotate as it is prevented by the periphery of the locking wheel 198.

The drive mechanism as described may be a gear drive motor to rotate the drive shaft 28. In a preferred embodiment a brake is included with the motor so the bars 12 cannot be shifted when the power is off. In another embodiment a manual rotating crank arm (not shown) may be provided so that if there is power failure the bars 12 can be either lowered or raised manually simply by rotating the drive shaft 28.

- 32 -

Furthermore, for emergencies, a clutch or release pin may be included between the gear drive motor and the drive shaft 28 to disengage the gear motor from the drive shaft 28. This allows the bars 12 to be pushed up or
5 down as the drive chains move freely. The drive chains 120 rotate on the sprockets 122, 124 and when each horizontal bar comes to the ends of the drive chains 12 it disengages from the drive chain 120 and either falls onto the floor or, alternatively, is guided into a
10 container depending upon the particular embodiment provided, thus providing an escape opening for an emergency. The security bar assembly is preferably placed on the inside of a building as intruders are not easily able to get at the operating mechanism.

15 Figure 29 shows a security bar assembly wherein the ends of the bars 12 are connected together with a pivotal sliding bar attachment 210 that can have a single pin assembly for connecting to a chain link 134 as shown in Figure 18, or may have multiple connections similar to
20 that shown in Figures 25 and 26. This permits the bars 12 to be zig-zagged across the opening.

Whereas the drive chains 120 shown in the other
Figures have been shown rotating about first sprocket 122 second sprocket 124 in Figure 30 there is shown a drive
25 chain 120A which is not endless. A single drive sprocket 122A is positioned at the top of the channel 16 and the

- 33 -

drive chain 120A has the end pieces 132 of the bar permanently attached to chain links 134 spaced a predetermined number of links apart. The sprocket 122A is a truncated sprocket so the teeth do not interfere
5 with the end pieces 132 of the bars 12. When the bars 12 are moved up into the storage area 126 the intermediate chain links of the drive chain 120A fold up as shown in Figure 30, so the bars 12 are stored as close together as possible. The sprocket 122A pulls the drive chain 120A
10 down feeding the bars 12 across the opening and provided the spacing between the bars 12.

Various changes may be made to the embodiments shown herein without departing from the scope of the present invention which is limited only by the following
15 claims.

- 34 -



WE CLAIM:

1. A security bar assembly for an opening comprising:

5 a plurality of bars extending between two channels, the two channels positioned on opposite faces of the opening, the bars slidable within the channels and having ends of the bars retained in the channels over the opening;

10 at least one bar of the plurality of bars having a connection at each end within each of the two channels to a transporting mechanism in each channel co-ordinated to slide the at least one bar between the two channels;

15 drive means for the transporting mechanism to slide the plurality of bars across the opening, and

storage area substantially adjacent the opening, associated with the channels to receive and retain the bars when they are not in place over the opening.

- 20 2. A security bar assembly for an opening, comprising:

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- 35 -

a plurality of horizontal bars extending between two channels, the two channels positioned one on each side of the opening, the bars being slidable vertically within the channels and having
5 ends of the bars retained in the channels;

a plurality of connector links joining adjacent bars spaced apart along the bars, each of the connector links having at least one end pivotally connected to one of the horizontal bars;

10 at least one bar of the plurality of horizontal bars having a connection at each end within each of the two channels to a raising and lowering mechanism in each channel coordinated to raise and lower the at least one bar and keep the at least one bar
15 substantially horizontal;

drive means for the raising and lowering mechanism, and

storage area substantially adjacent the opening associated with the channels to receive and guide
20 the horizontal bars into a folded configuration with alternate bars on opposite sides, and retain the horizontal bars in the folded configuration.

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- 36 -

3. The security bar assembly according to claim 2 wherein one end of each of the connector links closest to the storage area is pivotally connected to one of the bars and the other end of each of the connector links furthest from the storage area has a fixed connection to an adjacent bar.

4. The security bar assembly according to claim 2 wherein the raising and lowering mechanism comprises a threaded connection attached to each end of a bar of the plurality of horizontal bars substantially furthest from the storage area, the threaded connection engaging vertical threaded shafts in each of the channels.

5. The security bar assembly according to claim 3 including an engaging portion extending from ends of the bars retained in the channels in a direction opposite the fixed connection of the connector link, the engaging portion engaging into a retaining means provided in the storage area to ensure each of the bars moves into the folded configuration when the bars enter the storage area, and moves back into the channels when the bars leave the storage area.

6. The security bar assembly according to claim 2 wherein the combination of horizontal bars and connector links are constructed in modular units.

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- 37 -

7. The security bar assembly according to claim 4 wherein each of the threaded shafts has provision to move vertically towards the storage area.
8. The security bar assembly according to claim 7 including a locking mechanism positioned to lock one or more horizontal bars in the security bar assembly when the threaded shafts have moved vertically.
9. A security bar assembly for an opening comprising:
- 10 a plurality of bars extending between two channels, the two channels positioned on opposite faces of the opening, the bars slidable within the channels and having ends of the bars retained in the channels over the opening;
- 15 bar drive chains, having adjoining chain links, guided within the two channels;
- each of the bars having a connection at each end to engage in chain links in the drive chains, the engaged chain links spaced apart a predetermined number of chain links in each of the drive chains, and retaining the bars a predetermined distance apart;
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- 38 -

a drive means for moving the drive chains at substantially the same speed to slide the bars in the channels over the opening, and

5 a storage area substantially adjacent the opening associated with the channels to receive and retain the bars when they are not in place over the opening.

10. The security bar assembly according to claim 9 wherein the drive means for moving the drive chains
10 is at least one sprocket to engage each of the drive chains.

11. The security bar assembly according to claim 10 wherein the sprocket has truncated teeth.

12. The security bar assembly according to claim 9
15 wherein the drive chains are guided in the two channels.

13. The security bar assembly according to claim 9 wherein the drive chains fit in slots formed in the channels with chain links having connection
20 apertures towards the opening of the channels for engaging the ends of the bars.

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- 39 -

14. The security bar assembly according to claim 10 wherein the at least one sprocket has an axis substantially perpendicular to the bars.
15. The security bar assembly according to claim 10 wherein the at least one sprocket has an axis substantially parallel to the bars, and wherein the connection apertures in the chain links comprises modified chain side link plates with engagement grooves for the ends of the bars.
- 10 16. The security bar assembly according to claim 10 wherein the at least one sprocket has at least one tooth missing, and the connection at each end of each of the bars engages in one of the connection apertures of the chain links at the location on the at least one sprocket where the tooth is missing.
- 15
17. The security bar assembly according to claim 10 including an escapement mechanism to feed the ends of each of the bars to engage in one of the chain links of each of the drive chains, the engaged chain links in each of the drive chains being spaced apart predetermined distances to provide desired spacing between the bars.
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18. The security bar assembly according to claim 9 wherein the connection at each end of the bars to

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engage the chain links prevents the bars from rotating.

19. The security bar assembly according to claim 9 wherein the ends of adjacent bars have flexible connection spacers between two adjacent bars; the connection spacers having similar lengths to retain the bars at the predetermined distance apart when in position over the opening.
20. The security bar assembly according to claim 19 wherein the storage area for the bars is positioned substantially adjacent the opening to receive the bars and the flexible connection spacers pull adjacent bars so the connection at each end engages in the engaged chain links on opposing drive chains as the bars slide in the channels.
21. The security bar assembly according to claim 9 including storage drive chains positioned adjacent and in line with the bar drive chains;

the connection at each end of the bars comprising an elongated anchor to fit in at least two apertures of adjacent chain links and having sufficient length to span between the storage drive chains and the bar drive chains;

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THIS SHEET HAS BEEN
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- 41 -

the elongated anchors on adjacent bars retaining the adjacent bars close together in the storage area, and

5 an intermittent drive for the storage drive chains to feed the bars spaced the predetermined distance apart to the bar drive chains and collect the bars from the bar drive chains and retain the bars closely together.

22. The security bar assembly according to claim 21
10 wherein the elongated anchors on adjacent bars overlap when the bars are retained closely together in the storage area.

23. The security bar assembly according to claim 14
15 wherein the drive chains move about a first sprocket nearest the storage area, each of the chains have an offset guide adjacent the first sprocket to guide the drive chains away from the first sprocket to enable the ends of each of the bars to engage in the connection apertures of the opposing engaged chain
20 links.

24. The security bar assembly according to claim 23 including chain link inserts positioned in the connection apertures of the chain links not engaging an end of a bar.





- 42 -

25. The security bar assembly according to claim 9 including a release mechanism to disconnect the drive means for moving the drive chains, thus permitting the drive chains to move freely by pushing on the bars to provide an emergency exit opening.

26. The security bar assembly according to claim 9 wherein each of the bar drive chains is driven by a single sprocket adjacent a face of the opening, each of the drive chains having bars attached to chain links in opposing drive chains, the drive chains and bars being retained in the storage area positioned substantially adjacent the opening when the bars are not in place over the opening.

27. The security bar assembly according to claim 9 wherein the bars are arranged in a zig-zag configuration across the opening with the ends of adjacent bars being pivotally joined at the connection at each end.

28. The security bar assembly according to any of claims 1, 2 or 9 wherein the storage area is a container positioned above the opening.

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- 43 -

29. The security bar assembly according to any of claims 1, 2 or 9 wherein the storage area is a container positioned below the opening.
30. The security bar assembly according to any of claims 1, 2 or 9 including disengaging means to disengage the drive means if an obstacle prevents the horizontal bars from moving.
31. The security bar assembly according to any of claims 1, 2 or 9 including a locking mechanism to prevent the bars being moved manually when in position over the opening.
32. The security bar assembly according to any of claims 1, 2 or 9 wherein each of the two channels have lips tapered inwards to prevent the ends of the bars being pulled out of the channels.
33. The security bar assembly according to any of claims 1, 2 or 9 wherein the ends of the bars have retaining heads to retain the ends of each of the bars in the two channels.
34. The security bar assembly according to any of claims 1, 2 or 9 including a quick release to release the assembly and uncover the opening, the quick release comprising a plurality of elongated

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- 44 -

slots with wider top apertures associated with at least one channel, the slots engaging attachment means from a wall surface on at least one side of the opening, and including a movable wedge member associated with the at least one channel for permitting the at least one channel to drop such that the security bar assembly may be disengaged from the wall surface with the attachment means passing through the wider top apertures of the elongated slots.

35. A method of sliding and folding a plurality of horizontal security bars, joined by connector links across an opening into a storage area positioned to receive the bars, the bars extending between two channels on either side of the opening, comprising the steps of:

sliding the plurality of bars in the channels to push a first bar out of the channels into the storage area;

20 guiding the first bar to one side of the storage area;

sliding the plurality of bars to push an adjacent bar to the first bar out of the channels into the storage area;

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- 45 -

guiding the adjacent bar to the other side of the storage area, and

continuing sliding the plurality of bars so further bars are guided to one side followed by the other side of the storage area to form a folded configuration.

36. The method of sliding and folding a plurality of horizontal security bars according to claim 35 wherein the sliding occurs by rotating threaded shafts in the channels, the threaded shafts having threaded connections which are connected to one of the bars that is not pushed out of the channels into the storage area.

37. A method of forming a security bar assembly in an opening including a plurality of security bars, the bars having retained ends extending between two channels on opposing faces of the opening and slidable therein, comprising the steps of:

moving drive chains in guides within the two channels, the drive chains having adjoining chain links;

This Sheet Has Been Replaced





- 46 -

feeding opposing retained ends of a first bar to engage in first chain links of the drive chains so the first bar slides across the opening;

5 feeding a second bar to engage in second chain links spaced a predetermined number of chain links from the first chain links, and

10 continuing moving the drive chains and engaging further bars in further chain links spaced the predetermined number of chain links apart until the security bar assembly covers the opening.

38. A method of forming a security bar assembly in an opening including a plurality of security bars having retained ends engaged in chain links of drive chains guided in two channels on opposing faces of the opening and slidable therein, comprising the steps of:

20 moving the drive chains in guides within the two channels until a first bar having ends engaged in first chain links of the drive chains slides across the opening;

continuing moving the drive chains in the guides until a second bar having ends engaged in

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- 47 -

second chain links of the drive chains slides across the opening, and

further moving the drive chains with further bars engaged in further chain links until the security bar assembly covers the opening.

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