United States Patent

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[54] PROTECTIVE GRILLE

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[30] **Foreign Application Priority Data**

Nov. 7, 1969 Canada 067029

[52] **U.S. Cl.** **160/199,** 160/206, 160/213, 160/229

[51] **Int. Cl.** **E05d 15/26**

[58] **Field of Search** 160/84, 199, 206, 213, 229

[56] **References Cited**

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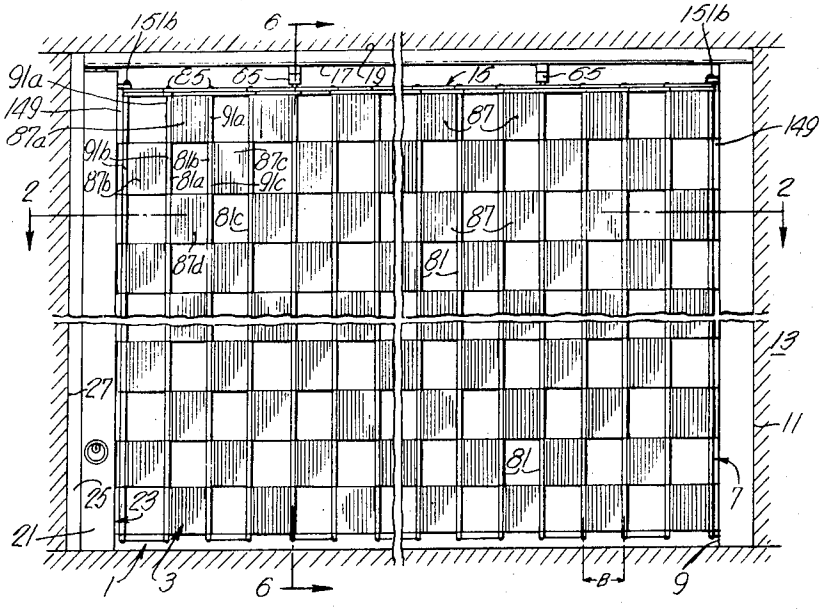
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[57] **ABSTRACT**

A folding closure having an open pattern curtain formed from a plurality of rods and panels interconnected together. The curtain is movable between open and closed positions supported by an extensible hinge. The hinge is constructed to permit the curtain to follow a curved track when in the open or folded position. Both the hinge and curtain are supported by frames in the opening to be closed, some of which have a reversible wall panel permitting the frame to be used at different locations to support the curtain either at its ends or intermediate its ends.

12 Claims, 14 Drawing Figures



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SHEET 1 OF 3

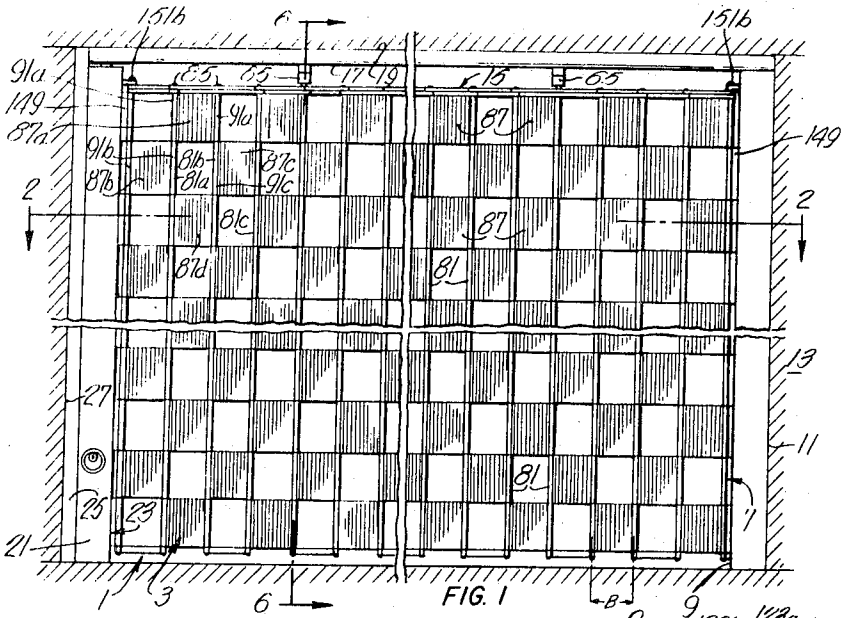


FIG. 1

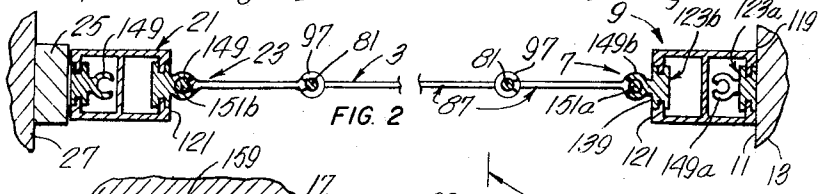


FIG. 2

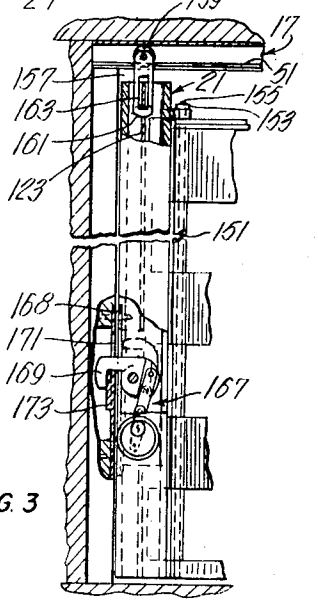


FIG. 3

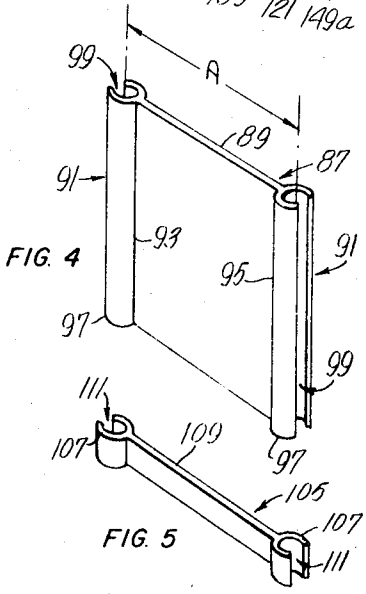


FIG. 4

FIG. 5

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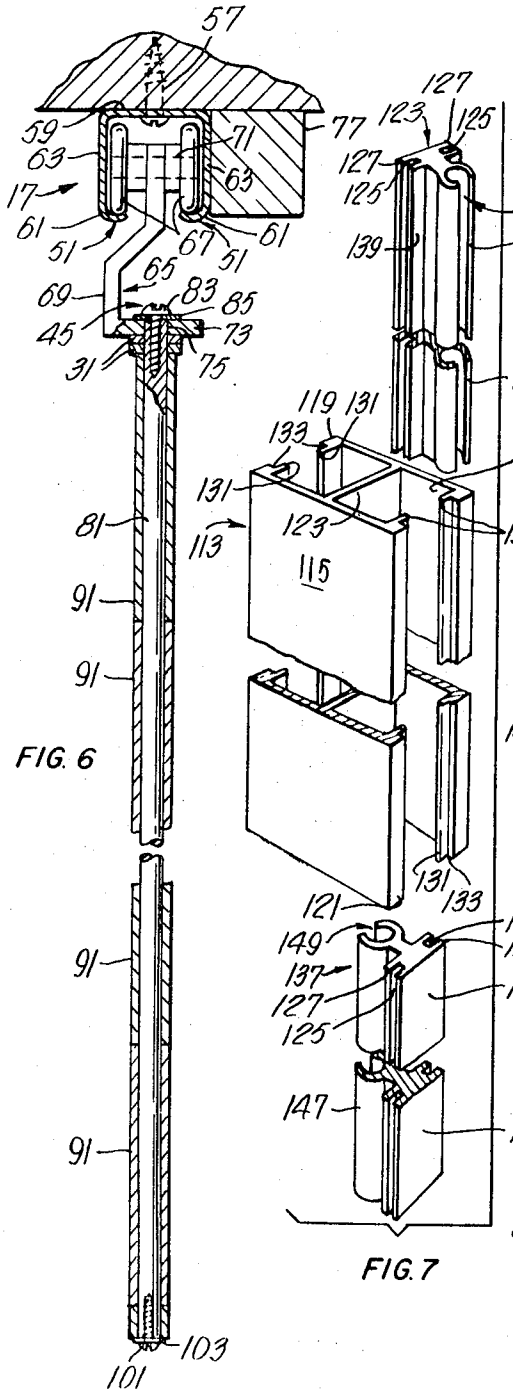
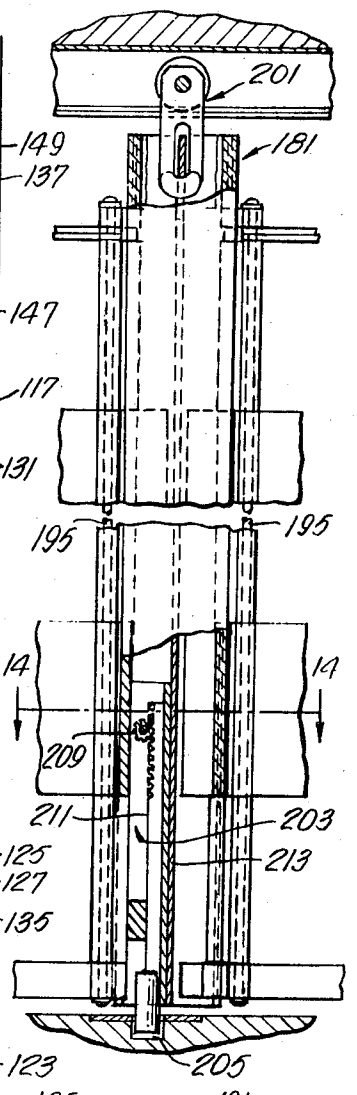


FIG. 6

FIG. 7

FIG. 13



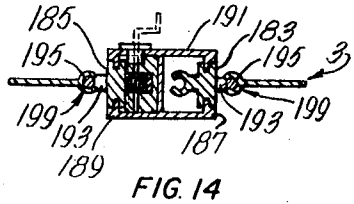


FIG. 14

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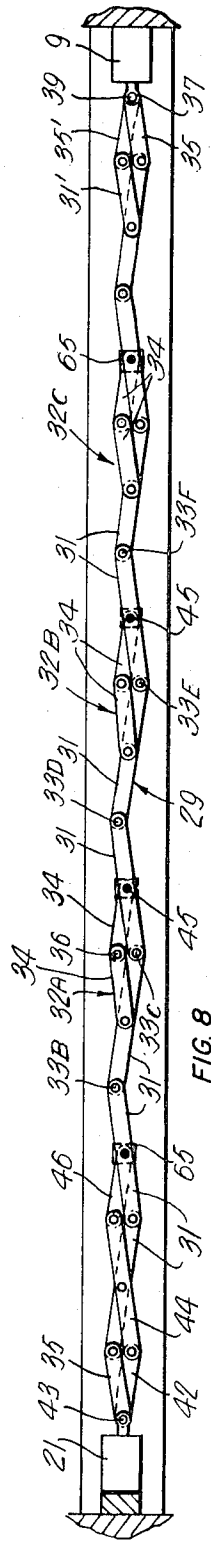


FIG. 8

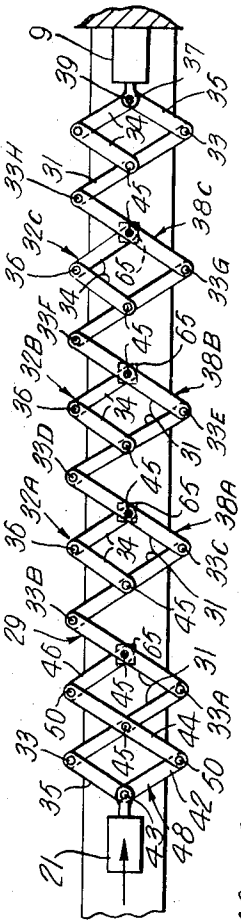


FIG. 9

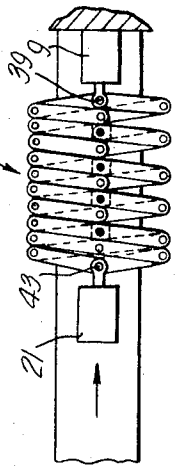


FIG. 10

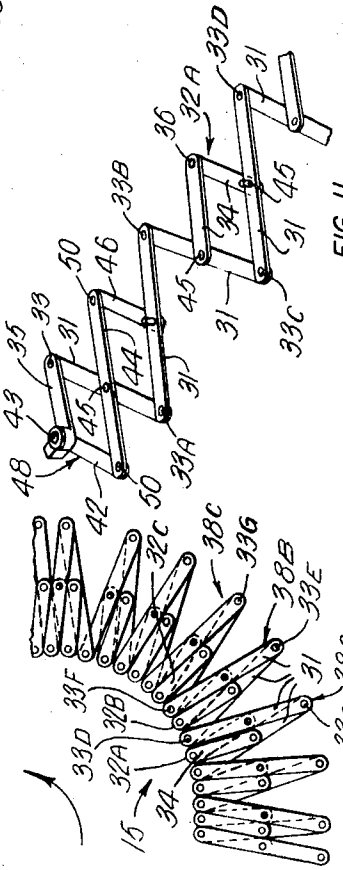


FIG. 11

FIG. 12

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PROTECTIVE GRILLE

BACKGROUND OF THE INVENTION

1. Field of Invention

This invention relates to an improved, foldable closure.

More particularly, the invention is directed to a foldable closure having an improved frame means for mounting the curtain of the closure, the curtain comprising structural elements arranged in an open pattern whereby the closure can be used as a protective grille.

2. Description of Prior Art

Foldable closures, particularly those having an open pattern whereby the closure can be used as a protective grille, are known. However, the known closures, in general, are constructed to extend in a straight plane in the open or closed position and cannot readily extend in a curved plane in an open or closed position. Further, known closures are relatively expensive in that in covering relatively long openings, additional curtain supports, of a type different from those used at the ends of the curtain, are required, thus increasing the cost.

SUMMARY OF INVENTION

Applicant's invention relates to an improved closure which can extend along curved openings in the open or closed position and is less expensive to manufacture and assemble, particularly in extra long lengths.

The improved closure of the invention can be manufactured more cheaply than known closures since certain of its parts are standardized and thus interchangeable, and the closure can be made in various lengths without requiring special parts for reinforcement or support while still providing adequate strength to serve as a barrier device. The improved folding closure comprises a foldable curtain having first and second opposed side edges. The curtain includes a plurality of support rods and a plurality of panels with rod-receiving means on opposed edges of each panel. The panels are mounted on the rods by the rod-receiving means to form an open pattern when the curtain is unfolded. The curtain is suspended from an extensible hinge. A first side edge of the curtain is connected to a first frame member, and the second side edge of the curtain is connected to a second frame member. The second frame member and the extensible hinge are movably suspended from a third frame member. The first and second frame members have a removable, reversible, wall panel with elements on one face only of the panel comprising a portion of the means for connecting an edge of the curtain to said first and second frame members.

The invention further relates to the construction of the frame members used in the closure. At least one of the frame members comprises a tubular member which is rectangular in cross-section. At least one of the walls of the tubular member includes a removable panel which can be reversibly mounted in the member. The panel has rod-receiving means projecting from one face, the other face being planar.

The invention also relates to means for locking the curtain in place when extended across an opening and also means for providing additional support for the curtain intermediate its ends.

The invention further relates to the structure of curtain using a combination of panels and spacer elements in combinations with support rods, to form an open pattern defining the body of the curtain.

The invention still further relates to an improved extensible hinge means for supporting the curtain, which hinge means is constructed to follow a straight or curved path when extended or retracted.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in detail, having reference to the accompanying drawings, wherein:

FIG. 1 illustrates the folding closure extending across an opening;

FIG. 2 is a cross-sectional view of the folding closure taken along line 2—2 of FIG. 1;

FIG. 3 is a partial cross-sectional view of a frame member connected to one side edge of the curtain of the folding closure, illustrating locking means carried by the frame member;

FIG. 4 illustrates one of the preferred forms of the panels used to form the curtain of the folding closure;

FIG. 5 illustrates an additional panel which can be used to form the curtain of the folding closure;

FIG. 6 is a cross-sectional view taken along line 6—6 of FIG. 1, showing, in detail, the means for movably supporting the curtain and hinge means from a frame member;

FIG. 7 is a detailed schematic view illustrating a frame member for the folding closure which has a reversible wall panel;

FIGS. 8, 9 and 10 illustrate the extensible hinge means supporting the curtain, showing the hinge means fully extended, partially extended and unextended, respectively;

FIG. 11 is a schematic view illustrating the extensible hinge means;

FIG. 12 is a plan view of an extensible hinge means used in a curved position;

FIG. 13, on the same sheet of drawings as FIG. 6, is a detailed view in partial cross-section showing an intermediate frame member for the curtain; and

FIG. 14, on the same sheet of drawings as FIG. 6, is a cross-sectional view taken along line 14—14 of FIG. 13 of the intermediate frame member.

DESCRIPTION OF PREFERRED EMBODIMENT

As shown in FIG. 1, the folding closure 1 includes a foldable curtain 3, having an open pattern when unfolded and mounted to unfold across an opening to provide a barrier across the opening. The curtain 3 is connected at one side edge 7 to a first frame member 9 mounted on or adjacent one edge 11 of a wall 13 defining the opening. A second frame member 21 is connected to the opposite side edge 23 of the curtain. The curtain 3 is supported from its top edge by an expandable hinge means 15, the hinge means 15 and second frame member 21 being movably suspended from a top frame member 17 attached to or adjacent the top edge 19 of the wall defining the opening. A fourth frame member 25 is mounted on or adjacent a second side edge 27 of the wall defining the opening.

The expandable hinge means 15 can be the well-known lazy-tong type. Preferably, however, the hinge means is constructed to permit it to travel along both a straight or curved path in the open or closed position. The regular lazy-tong type hinge, employing a continuous series of crossed interconnected links cannot follow a curved path when closed or retracted because of its construction. The hinge means 15, shown in FIGS. 8 to 12, can. The hinge means comprises a first chain 29 of links 31 pivotably connected together at their ends to each other by first pivot means 33A, 33B, etc. Each end of the chain 29 terminates in a short link 35, 35' pivotably connected by pivot means 33 to the free ends of the end links of the chain and having half the length of main links 31. The free end of one of the short links 35 is connected by a second pivot 39 to the first side frame member 9. The free end of the other short link 35' is connected by a third pivot 43 to the second frame member 21. The links 31, 35, 35' are made of strip material and are connected together with the first pivot means 33 extending transversely through apertures in the ends of the strips.

Additional pairs 32A, 32B, etc. of short links 34 are provided along the chain 29 of links 31, and attached thereto at predetermined locations to provide secondary hinges. Preferably, one secondary hinge, comprising two short links 34 pivotably attached together at one end by a pivot pin 36, is connected between each pair 38A, 38B, etc. of links 31 of the chain. The free end of each short link 34 is connected by a pivot pin 45 to the mid-point of each link 31 of a pair of links 38A, 38B, etc., as shown in FIG. 9. The pairs 32 of the short links provide secondary hinges assisting the first chain 29 of long links 31 to expand to an open position, as shown in FIG.

8, and to retract to a folded position, as shown in FIG. 10, in a uniform manner. The secondary hinges are essential to ensure uniform folding of the links 31 so that each link 31, in the folded position of the hinge means, extends in the reverse direction of the preceding link 31. The short links 34 are half the length of the long links 31.

The use of secondary hinges permits the hinge means 29 to follow a curved path when in the folded position, as shown in FIG. 12. Using only secondary hinges comprising pairs of short links at specific locations rather than a second continuous chain of long links crossing the links of the first chain, as is generally done in a lazy-tong type of hinge, permits the pivot connections 33C, 33E, 33G, etc. of each pair 38A, 38B, etc. of long links 31 joined by a secondary hinge to be spaced apart from one another, as shown in FIG. 12, in order that the hinge means 15 can follow a curved path when closed. This permits the closure to be used as a protective grille for curved windows or openings. The secondary hinges are located on one side or the other of the continuous chain 29 of links depending on whether the hinge means 15 is to curve left or right when in the folded position.

A short secondary chain 48 comprising a first short link 40, a long cross link 42 and a second short link 46, joined at the ends, can be used at the movable end or both ends of the hinge means 15 to further assist the curtain in beginning to fold or unfold properly. The links of the secondary chain 48, starting from pivot 43, run oppositely to the links of the main or first chain 29. The links of the short chain are pivotably connected together at their ends by pins 50 and link 44, where it crosses the first long link 31 at its center, is pivotably connected to it by pivot 45.

The hinge means 15 is movably supported from the top frame member 17. As shown in FIG. 6, the top frame member 17 has tracks 51. The top frame member can comprise a U-shaped, inverted channel section. Screws 57, passing through the base 59 of the channel section, connect it to the horizontal edge of the wall defining the opening. The ends 61 of the arms 63 of the channel section are bent inwardly to form the tracks 51. A hanger 65 is supported from the top frame member 17 by wheels 67 running on the tracks 51. The hanger 65 comprises a strip 69 loosely attached at one end to an axle 71 carrying the wheels 67. The lower end of the strip 69 has a horizontal arm 73 with an aperture 75 in the arm to permit connection of the hanger to the hinge means 15. The aperture 75 in the arm 73 of the strip is centrally located between the wheels 67. A plurality of hangers are connected to the hinge means 15 at the center of selected links 31, preferably by the pivot means 45. Preferably, one hanger 65 is connected to every second link 31 of the main chain of links at the link's center by pin 45 as shown in FIG. 9. This spacing ensures that the links of the hinge means will properly fold when they are retracted through the guidance of the hangers in the tracks 51. The hangers 65 could also be connected to every third link 31 of the main chain provided that the two links between the two links having hangers are connected together by a secondary hinge. If the hangers are arranged on every third link so that the two intermediate links are not joined by a secondary hinge, the hinge means may not fold properly when retracted.

The hangers 65 are free to run along the tracks 51, guiding and supporting the hinge means as it is expanded or compressed in opening or closing the closure means. A bar 77 can be located adjacent one arm 63 of the channel section and attached to the wall to provide support for the channel section.

The curtain 3 is carried by the hinge means 15. The curtain 3 includes a plurality of rods 81 suspended from the hinge means 15. One rod 81 is suspended from the chain 29 of the links, from each first pivot means 33 and also from the center of each link 31. The upper ends of the rods 81 pass through apertures in the links at these locations and, together with a screw 83 and washer 85, are loosely connected to the links to form the pivot means 33, and 45. The rod end also passes through the aperture 75 in the hanger 65 to connect the hinge means 15 to the horizontal frame 17 at selected locations, as shown in FIGS. 1 and 6. The rods 81 are preferably cylindrical although other rod shapes can be used.

The body of the curtain includes a plurality of panels 87 carried on the rods 81 to form an open pattern.

Each panel 87, as shown in FIG. 4, can comprise rectangular plates 89. Each plate has a pair of rod-receiving means 91 formed on two opposed side edges 93, 95 of the plate permitting the panels to be threaded on the rods 81 carried by the hinge means. The rod-receiving means 91 can comprise elongated, tubular sections 97 attached to the side edges of the plate. The plate and tubular sections 97 are integrally molded or extruded from thermoplastic material or can be extruded from metal material. Each tubular section 97 can have a slot 99 to facilitate molding of the panel 87. The distance "A" between the axis of the tubular sections 97 of each panel is equal to the distance "B" between the centers of adjacent rods 81.

The inside diameter of the tubular section 97 is slightly larger than the diameter of the rods 81 permitting the panels 87 to pivot about the rods as the closure is expanded or compressed.

The panels 87 and rods 81 are assembled into a curtain by passing the rods through the rod-receiving means on the panels with the panels arranged in a predetermined open pattern as shown in FIG. 1. By an "open pattern," it is meant an arrangement of panels with spaces adjacent the edges of each panel. One type of open pattern, as shown in FIG. 1, a first panel 87A is mounted on the first two rods 81A, 81B. A second panel 87B is mounted on rod 81A by one rod-receiving means 91B with its other rod-receiving means 91B free. A third panel 87C is mounted on second and third rods 81B, 81C at the same level as the second panel 87B. This pattern is repeated both vertically and horizontally to achieve a checkerboard effect. The rod-receiving means 91B of the second panel 87B is adjacent one of the rod-receiving means 91A of the first panel 87A and spaces and supports the first panel from a fourth panel 87D positioned on the first and second rods 81A, 81B. The rod-receiving means 91C of the third panel 87C also aids in spacing and supporting the first panel from the third panel. All the panels 87 are maintained in position on the rods 81 by means of screws 101, having enlarged heads 103, threaded into an aperture in the lower end of the rods, as shown in FIG. 6.

While one arrangement of rods and panels for the curtain has been shown, other arrangements employing additional elements comprising tubular spacers and/or narrow cross-pieces 105, as shown in FIG. 5, can be used as well. The cross-pieces 105 comprise relatively short tubular sections 107 attached to the ends of a narrow plate 109. Slots 111 can be provided in the tubular sections 107 to facilitate molding. The cross-pieces 105 can be used to close the open spaces formed adjacent the top and bottom edges of the curtain when using panels in a checkerboard pattern, as shown in FIG. 1, to provide additional support.

Tubular spacers (not shown) of varying length can be positioned between the rod-receiving means of adjacent panels to provide more open patterns on the curtain. Each tubular spacer is mounted on a rod between a tubular section on each of two panels to space the panels apart a greater distance to provide a more open pattern in the curtain. Panels of different length or different shape, such as diamond or circular shape as compared to rectangular, can also be used to form different patterned curtains. Various patterns can be formed using different combinations of panels of different length or shape, tubular spacers and cross-pieces.

The frame members 9 and 21 which support the end edges of the curtain 3 are constructed from identical structural members. Both frame members comprise a tubular body member 113 having side walls 115, 117 and end walls 119, 121. The side walls can be joined by a transverse rib 213 extending between the centers of the side walls. At least a portion of each end wall comprises a panel 123 which is removable from body member 113 and which can also be reversibly

connected to the body member. The panel **123**, as shown in FIGS. **2** and **7**, has a central groove **125** in each side edge **127**. Each groove cooperates with a flange **131** extending from an edge **133** of the end wall which edges define an opening closed by the panel when it is slidably inserted in place with the flanges **131** in the grooves **125**. One face **135** of the panel is planar and rod-receiving means **137** are attached to the other face **139** of the panel. The rod-receiving means **137** comprise tubular sections **147**, preferably having a slot **149**, attached along the length of the panel. The panels **123** can be mounted reversibly in the openings in the end walls **119**, **121** of the body member **113**. In one position, the tubular sections **149** face outwardly to receive a rod **151** used to connect a side edge of the curtain to the frame member. In the reverse position of the panel, the tubular sections **149** face inwardly between the side walls **115**, **117** of the body member **113** with the planar face **135** of the panel **123** lying flush with the end walls **119**, **121** of the body member **113**. The panels **123** are frictionally held in the body member **113**.

As shown in FIG. **2**, the first frame member **9** has one panel **123A** mounted with the tubular sections **149A** extending inwardly so as to present a planar end wall **119** to permit mounting of the first frame member **9** flush against the edge **11** of the wall **13** defining the opening. The opposite end wall **121** of the first frame member has the panel **123B** mounted in a reverse manner with the tubular sections **149B** on the outside of the frame member so as to receive a first pivot rod **151A** used to connect the member to the curtain. The first frame member **9** can be attached to the edge **11** of the wall of the opening by first fastening the panel **123A** to the wall and then slidably mounting the remainder of the panel member on the panel.

The second frame member **25** is assembled in a similar manner as the first frame member **9** with the tubular sections on one panel extending outwardly to receive a second pivot rod **151B** permitting connection of the curtain and the tubular sections on the other panel **123B** extending inwardly to provide a planar end wall for the second frame member.

The tubular sections **149** of the panels which face outwardly to support the end edges of the curtain can be spaced apart to permit mounting of a tubular section **97** of a panel **87** between each two adjacent sections **149**. The pivot rod **151** is then threaded through both tubular sections **149** of the panels and the free tubular sections **97** of the panels **87** to connect the curtain to the frame member. A nut **153**, threaded into a top threaded end **155** of the pivot rod **151**, retains the pivot rod **151** in place. The pivot rods **151** can also form the second and third pivot means **39**, **41** connecting the hinge means to the frames.

The second frame member **21** preferably is movably suspended from the tracks **51** of the top frame **17** by a hanger **157** having rollers **159** running on the tracks. A hook **161** at the bottom of the hanger passes through a slot **163** formed in the transverse rib **213** connecting the side walls. When the second frame member is assembled on the tracks, its length is such that it cannot be lifted off the hook **161** passing through the slot **163**.

The second frame member **21** can have a lock **167** mounted therein, as shown in FIG. **3**. In order to mount the lock, a portion of the transverse rib **213** and a portion of the panel **123** adjacent the edge of the wall is removed. The lock **167** is inserted in the space within the second frame member and maintained in position by an attached plate **168**, attached by screws to the end wall of the frame member. The latch **169** of the lock passes through a slot **171** to hook over a bar **173** in the frame member **25** so as to lock the closure when in an extended position.

The folding closure can be made in varying lengths. If it has an extended length, however, it is preferable to provide one or more intermediate frame members **181** to provide additional support for the curtain. The intermediate frame members **181**, shown in FIG. **13**, have the same type of construction as the frame members **9**, **25**, supporting the ends of the curtain. Both panels **183**, **185** on the end walls **187**, **189** of the body member **191** of the frame are slidably mounted to have the tubular sections **193** for receiving the pivot rods **195** facing outwardly to permit connection of the intermediate side edges **197**, **199** of the curtain **3**. The intermediate frame member **181** is suspended from the tracks **51** of the top frame member **17** by a hanger **201** similar to the hanger used to suspend the frame member **21**. The hinge means **15** is divided into two sections and connected to intermediate frame member by the pivot rods **195**, in the same manner as the ends of the hinge means are connected to the frame members **9**, **25**.

A locking mechanism **203** can be provided at the lower end of the intermediate frame member. The locking mechanism can comprise a gear and ratchet device mounted within the body member **191** of the intermediate frame member with the gear **209** mounted on a shaft supported by the side walls of the body member and the ratchet **211** slidably carried by the transverse rib **213**. Means, not shown, lock the gear in place with the ratchet raised and a key can be used to unlock the gear and then turn it to lower the ratchet so it extends below the end of the intermediate frame and rests in a well or depression **205** formed in the floor. The locking mechanism **203** prevents lateral movement of the curtain and extends to such a length as to prevent raising of the curtain to an extent which would permit entry underneath the bottom of the curtain.

I claim:

1. A folding closure comprising: a foldable curtain, having first and second opposed side edges, the curtain including a plurality of support rods and a plurality of panels, rod-receiving means on opposed sides of each panel, said panels being mounted on said rods by the rod-receiving means to form an open pattern when the curtain is unfolded, an extensible hinge, means suspending said curtain from said hinge, means connecting the first side edge of said curtain to a first frame member, means connecting the second side edge of the curtain to a second frame member, comprising a tubular body member having side walls and end walls, each end wall including a removable wall panel, cooperating means on said end wall and panel for slidably mounting the panel on said end wall to form a part thereof, one face of said panel being planar, the other face of said panel having tubular sections carried thereby, said tubular sections forming a portion of the means connecting the side edges of the curtains to the first and second frame members, and means movably suspending said second frame member and the extensible hinge from a third frame member.

2. A folding closure as claimed in claim **1**, wherein said panels forming part of the curtain comprise rectangular plates, and said rod-receiving means comprise tubular sections attached to two opposed side edges of the plate.

3. A folding closure as claimed in claim **2**, wherein said means for connecting said curtain to said frames include the tubular sections on the reversible wall panels, selected tubular sections on said panels forming part of the curtain, and a pivot rod threaded through said tubular sections on said reversible wall panels and on said curtain panels.

4. A folding closure as claimed in claim **2**, wherein said tubular sections on one plate, mounted on a first pair of adjacent rods, support the tubular sections of plates mounted on a second pair of adjacent rods, one of the rods of the first pair and one of the rods of the second pair being the same rod.

5. A folding closure as claimed in claim **1**, wherein said hinge comprises a chain of first links, means pivotably connecting the links together at their ends, secondary hinges, each comprising a pair of second links substantially half the length of the first links and joined together at one end by a pivot pin, the free end of each second link joined to the center of a first link whereby each pair of first links has a secondary hinge joined to it.

6. A folding closure comprising: a foldable curtain, having first and second opposed side edges, the curtain including a plurality of support rods and a plurality of panels, rod-receiving means on opposed sides of each panel, said panels being mounted on said rods by the rod-receiving means to form an

open pattern when the curtain is unfolded, an extensible hinge comprising a chain of first links, means pivotably connecting the links together at their ends, secondary hinges, each comprising a pair of second links substantially half the length of the first links and joined together at one end by a pivot pin, the free end of each second link joined to the center of a first link whereby each pair of first links has a secondary hinge joined to it, means suspending said curtain from said hinge, means connecting the first side edge of said curtain to a first frame member, means connecting the second side edge of the curtain to a second frame member, and means movably suspending said second frame member and the extensible hinge from a third frame member.

7. A folding closure as claimed in claim **6**, wherein a support rod extends from each pivotal connection between the first links, and a support rod extends from each first link where the free end of each second link is joined to the first link.

8. A folding closure as claimed in claim **6**, wherein all the pivot pins joining the second links of the secondary hinges are located on one side or the other of the chain of first links.

9. A folding closure as claimed in claim **6**, wherein the means for suspending the curtain includes a plurality of hangers, said third member having a track, means on the hangers movably mounting them in said track, there being one hanger connected to every second first link.

10. A folding closure comprising: a foldable curtain, having first and second opposed side edges, the curtain including a plurality of support rods and a plurality of panels, rod-receiving means on opposed sides of each panel, said panels being mounted on said rods by the rod-receiving means to form an open pattern when the curtain is unfolded, an extensible hinge, means suspending said curtain from said hinge, means connecting the first side edge of said curtain to a first frame member, means connecting the second side edge of the curtain to a second frame member, and means movably suspending said second frame member and the extensible hinge from a third frame member, including an intermediate frame member located between said first and second frame members, said intermediate frame member having end walls with a removable, reversible wall panel forming a section of each end wall, tubular sections on one face only of the wall panels, said panels mounted so said tubular sections face outwardly, said curtain being divided into two sections, means connecting one free edge of each curtain section to the tubular sections facing outwardly from the intermediate frame member, the opposed edges of each curtain section connected to the first and second frame members.

11. A folding closure as claimed in claim **10**, wherein the intermediate frame member includes a locking device, means mounting said locking device within said frame member, said locking device including a pin movable vertically downwardly from a raised, unlocked position to a locked position where the end of the pin rests in a depression formed in a floor.

12. A folding closure as claimed in claim **10**, wherein said hinge comprises a chain of first links, means pivotably connecting the links together at their ends, secondary hinges, each comprising a pair of second links substantially half the length of the first links and joined together at one end by a pivot pin, the free end of each second link joined to the center of a first link whereby each pair of first links has a secondary hinge joined to it.

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