United States Patent

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[45] Patented **Jan. 11, 1972**

[54] **HINGE CONSTRUCTION**
5 Claims, 10 Drawing Figs.

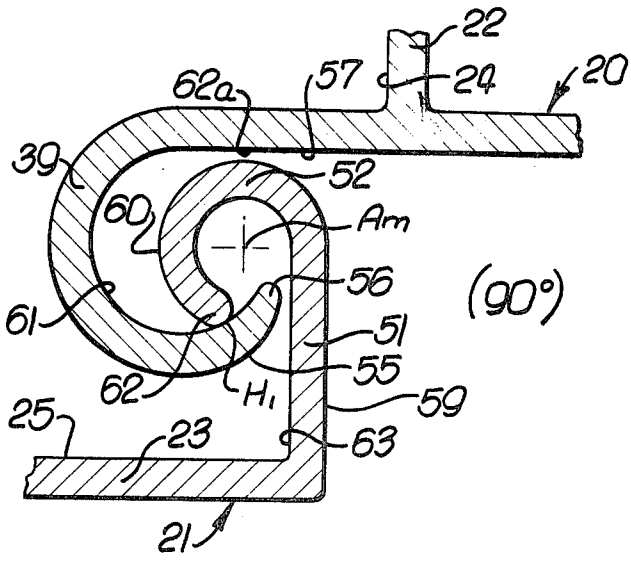
[52] **U.S. Cl.** **16/178**
[51] **Int. Cl.** **E05d 1/04**
[50] **Field of Search** 16/178, 128, 179; 49/397

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ABSTRACT: A hinge construction for use, by way of example, in a fenestration construction for pivotally supporting a closure member along an edge of a window opening and allowing the closure member to be pivoted through 180° without interference with adjacent structure. The hinge construction comprises two mating or interfitted extruded hinge members having a cross-sectional shape whereby the members may be assembled by relative longitudinal slidable engagement and thereafter cannot be disassembled throughout pivotal movement of one of the hinge members with respect to the other.



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FIG. 1.

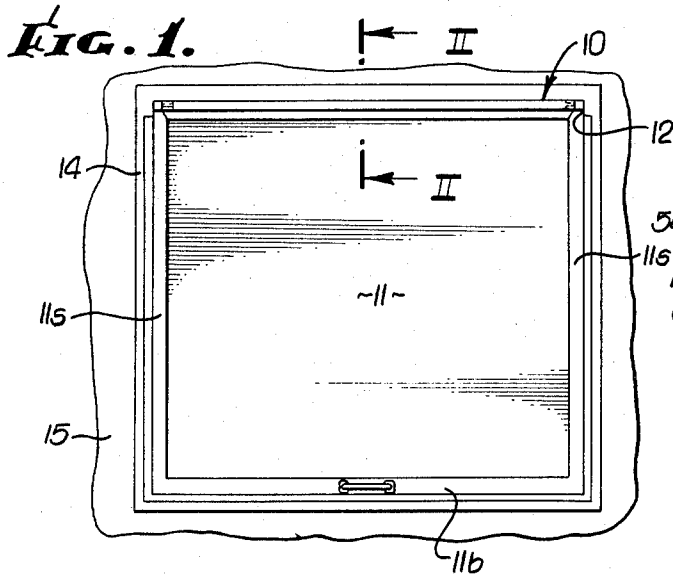


FIG. 2.

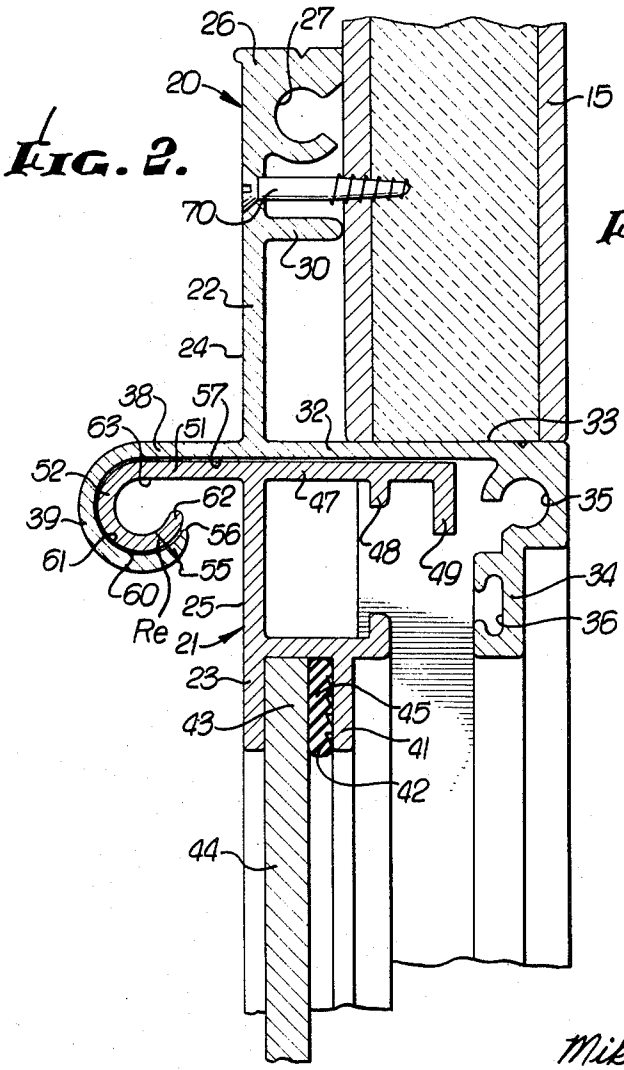


FIG. 4a.

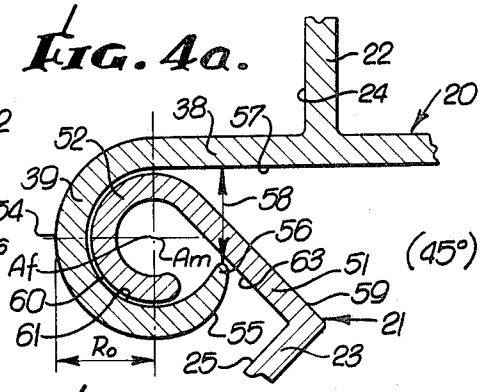


FIG. 4b.

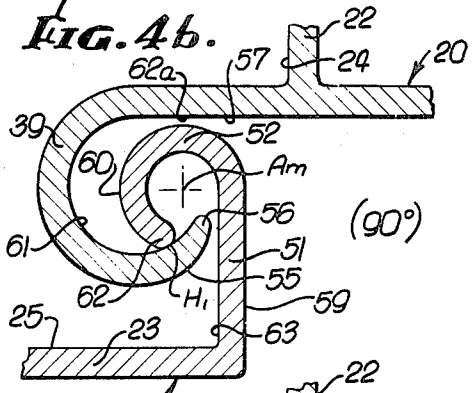


FIG. 4c.

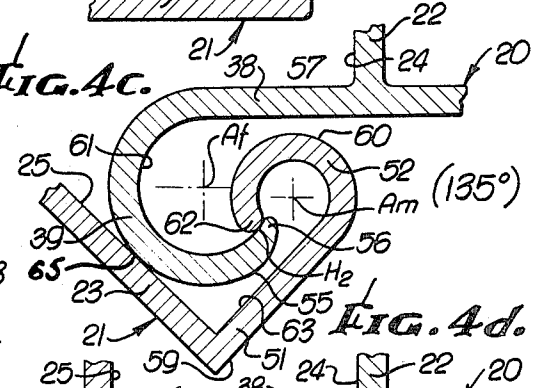
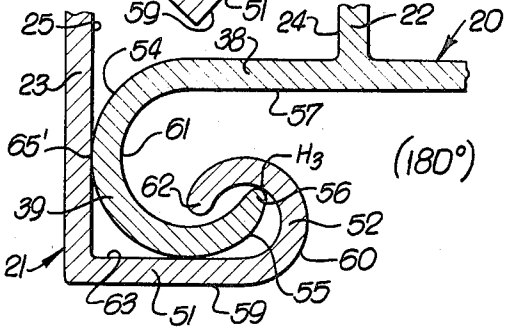


FIG. 4d.



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FIG. 3.

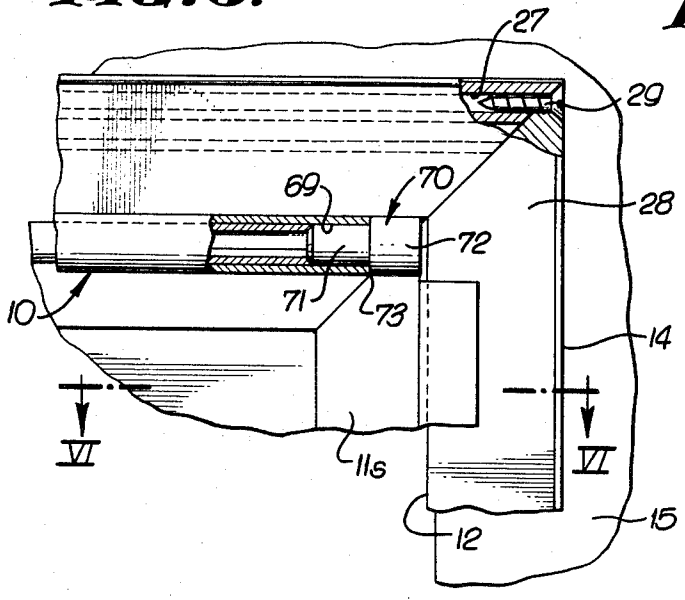


FIG. 7.

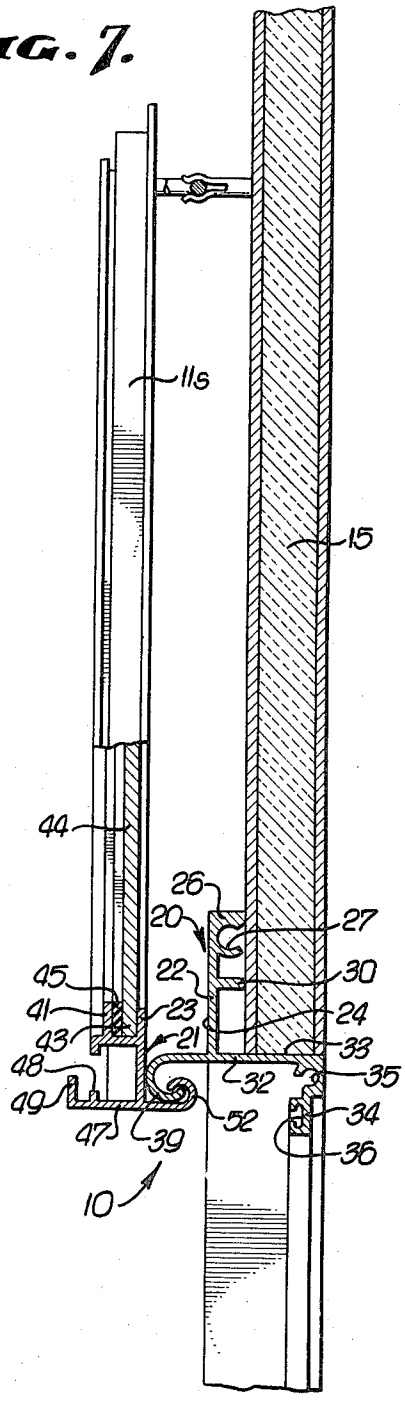


FIG. 5.

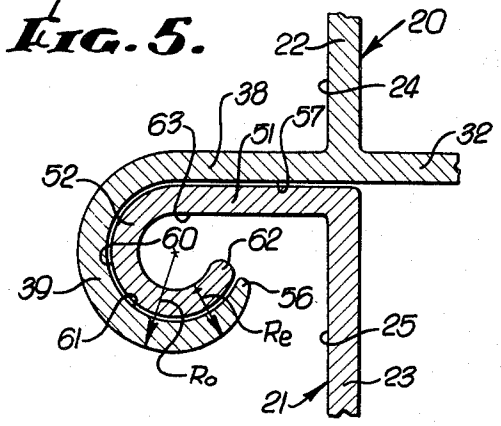
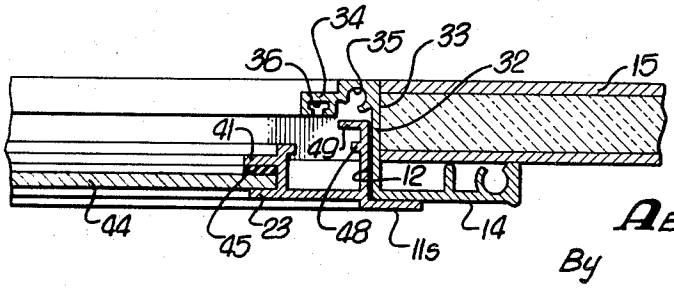


FIG. 6.



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HINGE CONSTRUCTION

Hinges of various types and designs are usable in innumerable applications. One type of hinge is desired to be of considerable longitudinal extent for connecting two long members. One use for such long hinges is to secure doors or windows in a fenestrated building construction, particularly metal mobile trailer-type homes or similar types of constructions. Other uses are many, such as pivotally securing doors on metal shower enclosures, bookcases, or the like. In the prior art, a most common and well-known hinge used in the above-described applications is the so-called "piano hinge." As is well known, such hinge comprises a plurality of longitudinally spaced circular segments secured along one edge of a butt plate, two butt plates being joined by alternately disposing the circular segments and passing an elongated pivot pin through aligned openings of the segments. There are many disadvantages to piano hinges, one of these being the difficulty in assembly of such hinges, particularly after the butt plates are secured to the members to be pivoted, creating a problem in aligning the circular segments so that the elongated pivot pin may be passed therethrough. Piano hinges are also expensive to manufacture, because of the detailed forming operations which are required and because of the tolerances which must be held in the formation of the circular segments to enable the slidable receiving of the elongated pivot pin while allowing relatively easy pivoting movement of the circular segments with respect to the pivot pin. Piano hinges are also expensive to use because of the requirement of a plurality of manually placed screws with which the butt plates are secured to the members to be pivotally connected.

Other prior proposed long hinges have included a pair of interfitted longitudinal extruded hinge portions which permitted hinge movement through substantially less than 180°, usually about 135°. Such prior proposed hinges included several disadvantages, one of which was the relatively rough or irregular hinge movement of a closure panel equipped with such a hinge about its hinging axis. In addition, such prior proposed hinges were subject to damage and breakage when an attached closure panel was raised because of the tendency to lift the panel higher than or beyond 135° to facilitate access to the opening or compartment closed by the panel, such lifting at the opposite bottom rail of the panel imposing a large leverage force on the relatively thin material section of the hinge portions. A length of chain or a bar attached to the adjacent wall was required to limit raising of the panel to prevent damage.

Generally speaking, the present invention contemplates a novel hinge construction in which a pair of extruded mating hinge members are provided with nested longitudinal edge portions of arcuate cross sections, for example, having a common axis of rotation in one position, the common axis being spaced from the plane of a closure panel covering or closing an opening in a wall, the arcuate cross sections being so shaped that as the inner nested arcuate portion moves relative to the other arcuate portion, the axis thereof is displaced with respect to the location of the common axis so that the hinge members may be moved through an angle of at least 180° without disassembly of the hinge members. In fully open position, at least 180°, the adjacent wall provided a convenient surface for a stop means so that undue stressing of hinge portions is obviated. The construction of hinge members are readily produced by extruding aluminum alloy or other metal alloy material in long lengths which may then be cut to selected length for a closure panel of specific size, readily assembled, and then easily attached to the closure panel and opening frame.

Accordingly, it is one object of the present invention to provide a hinge construction which overcomes the above-described disadvantages of prior art hinge constructions.

An object of the present invention is to provide a hinge construction wherein extruded longitudinally extending hinge members may be interfitted, mated or interengaged so as to provide a hinge construction of two members without the use of a separate pivot pin.

Another object of the present invention is to provide a hinge construction comprising two longitudinally extending hinge members which are rotatable with respect to one another through an angle of 180° but cannot be disengaged after assembly.

A further object of the present invention is to provide a hinge construction of the above-described type in which the two hinge members may be easily assembled by longitudinally sliding one of the members within the other and can be easily disassembled by reversing the above step and in which the plates of the hinge members may be easily secured to closure and frame members to be pivotally interconnected.

A further object of the invention is to disclose a novel hinge construction wherein nested hinge sections are so constructed and arranged as to provide a smooth uniform swinging movement of the closure panel about its hinge axis and wherein progressive changing location of the hinge axis is accomplished in a smooth manner.

It is still a further object of the present invention to provide a hinge construction of the above-described type which is adapted for fenestrated constructions for pivotally supporting a closure member for a wall opening or the like.

Other objects and advantages of the present invention will be readily apparent from the following description of the drawings in which an exemplary embodiment of the invention is shown.

In the drawings:

FIG. 1 is a fragmentary front elevational view of a window opening provided with a closure panel having a hinge construction embodying the present invention.

FIG. 2 is an enlarged fragmentary vertical sectional view taken in the plane indicated by line II—II of FIG. 1.

FIG. 3 is an enlarged fragmentary sectional view of a corner of the closure panel and window frame opening, partly in section, to illustrate the connection of the hinge construction to the closure panel and frame.

FIGS. 4*a*, *b*, *c*, *d* are fragmentary sectional views taken in a plane similar to FIG. 2 and progressively illustrating the relationship of the hinge members as the closure panel is swung through 180°to an open position.

FIG. 5 is an enlarged fragmentary sectional view taken in the same plane as FIG. 2.

FIG. 6 is a fragmentary sectional view taken in the plane indicated by line VI—VI of FIG. 3.

FIG. 7 is an enlarged fragmentary sectional view taken in the same plane as FIG. 2.

Referring first to FIG. 1 of the drawings a hinge construction embodying the present invention is generally indicated at **10**. The hinge construction **10** provides a pivotal mounting for a closure panel **11** which closes or covers an opening **12** defined by a window frame structure **14** installed in a wall **15** in suitable well-known manner. In this exemplary embodiment of hinge construction **10** it will be understood that the hinge construction is designed particularly for use with metal wall framing and construction of a mobile home such as a vehicle trailer and that the novel features of the hinge construction have utility in numerous hinge applications where a continuous hinge is desirable.

Hinge construction **10** (FIG. 2) may comprise an upper hinge member **20** and a lower mating or companion hinge member **21**. Both hinge members **20** and **21** may be made of suitable metal, such as aluminum alloy, and extruded through dies of selected configuration depending upon the manner of attachment or installation to the frame member and closure panel for which the hinge construction is intended. Extruded lengths of each hinge member may be cut to a preselected length suitable for the closure panel on which the hinge construction is to be used. The hinge members **20** and **21** preferably include longitudinal hinge plate portions **22** and **23**, respectively, provided with front faces **24** and **25**, respectively, lying in approximately the same plane when in assembly and in fully nested closed position as more fully described hereafter.

Plate portion **22** may be of selected width and has integrally formed therewith along its top edge **26** an internal recess **27** of generally part-circular cross-sectional configuration for attachment of hinge member **20** to a vertical window frame member **28** as by a metal screw **29** in well-known manner. Plate portion **22** may include a longitudinally extending back rib **30** for positioning the hinge member **20** in parallel relation to the exterior surface of wall **15**.

Plate **22** may be integrally formed with a rearwardly horizontally and longitudinally extending portion **32** providing a top horizontal surface **33** for seating against the bottom edge of wall **15** to further facilitate positioning of the hinge member **20** with respect to the framed opening. The rearwardly extending horizontal portion **32** also includes a depending longitudinally section **34** provided with a part-circular attachment recess **35** and a forwardly facing generally T-shaped recess **36** for reception of a gasket or a sealing means.

Extending forwardly from plate portion **22** and in the same plane as rearwardly extending horizontal portion **32** may be a longitudinally horizontally extending flange portion **38** terminating and integrally merging with a downwardly and rearwardly curved part cylindrical or arcuate in cross section edge section **39** forming part of the hinge means as more fully described hereafter.

Hinge member **21** includes, in addition to said plate portion **23**, a rearwardly extending generally vertically oriented T-section portion **41** defining with the lower portion of the plate portion **23** a downwardly facing channel **42** within which may be received the edge portion **43** of a closure panel **44** of suitable closure material. In this example, panel **44** is sealed and retained by a resilient longitudinally extending resilient gasket member **45** of suitable configuration and construction whereby resiliency of gasket member **45** snugly and tightly maintains the panel **44** in assembly. It will be understood that the panel **11** includes panel side frame members **11***s* and a bottom frame member **11***b* provided with a suitable handle, the frame members being of suitable configuration and interconnected in suitable well-known manner.

Plate portion **21** also includes a rearwardly extending horizontal portion **47** provided with depending spaced reinforcing ribs **48** and **49**. The rearwardly extending portion **47** extends along horizontal portion **32** of the upper plate portion **22**.

Extending forwardly from the plate portion **23** and in the same plane as rearwardly extending portion **47** is a longitudinally horizontally extending flange portion **51** terminating and merging in a longitudinal edge section **52** of arcuate configuration nested within arcuate section **39** as particularly described hereafter.

Hinge construction **10** is primarily concerned with the hinging arrangement of the surfaces of longitudinal flange portions **38** and **51** and their nested arcuate edge sections **39** and **52** together with their relation to front surface **25** of the lower hinge member **21**. It will be understood, of course, that the remaining configuration of the plate portions **22**, **23** and rearwardly extending portions may be modified and may be of different configuration depending upon the type of installation for the hinge construction.

The forwardly or outwardly extending hinging means of the hinge construction **10**, in detail, includes the arcuate section **39** having an outer longitudinally extending part-cylindrical surface **54** having a radius R_o and which subtends an angle of approximately 210° as measured from point of tangency with the outer surface of flange portion **38**. At approximately 210° outer surface **54** merges smoothly with a curved surface **55** on edge extremity **56** of arcuate section **39**, the curved surface **55** having a radius R_e having its center on the radian of 210° and within the sectional configuration of the inner arcuate section **52**. Edge extremity **56** subtends an angle of approximately 240°. Edge extremity **56** defines with inner or bottom surface **57** of flange portion **38** a longitudinally extending space or opening **58**.

The lower hinge member **21** is assembled with the upper hinge member **20** by aligning inner arcuate section **52** with outer arcuate section **39** and then longitudinally sliding arcuate section **52** into nested arrangement with arcuate section **39** for the entire length of the hinge members. The flange portion **51** with its upper or outer surface **59** and arcuate section **52** with its outer arcuate surface **60** slidably fits within inner arcuate surface **61** of arcuate section **39**. Arcuate section **52** subtends an angle of slightly less than 270° as measured from the flange portion **51** and, as best seen in FIG. **2**, edge extremity **62** of arcuate section **52** extends upwardly above the edge extremity **56** of outer arcuate section **39** and is spaced a selected distance from inner surface **63** of the flange portion **51**.

The relationship of arcuate sections **52**, **39**, flange portions **51**, **38**, and plate portion **23** maintains the hinge members **20**, **21** in assembly during opening and closing of the closure panel **11**. The radius R_o of outer arcuate surface **54** is approximately equal to the distance between the rearwardmost surface of the inner arcuate section edge extremity **62** and the front surface **25** of plate portion **23** of the swingable hinge member **21**. This relationship permits the hinge member **21** to be swung through an angle of at least 180° without disengagement of the nested arcuate sections **39**, **52** as now described in detail.

As best seen in FIG. **2** in normal closed relationship of hinge members **20** and **21** and therefore of closure panel **11**, the arcuate hinge sections **39** and **52** are in fully nested relationship and the axis of each arcuate section and hinge or pivotal axis is coincident or common. When the closure panel is being swung to open position, inner arcuate section **52** rotates about this common axis through an angle of approximately 45° (FIG. **4***a*) at which position the bottom surface **63** of the horizontal flange portion **51** moves into proximity with and may bear against the edge extremity **56** of outer arcuate section **39**. Mating arcuate surfaces **60** and **61** control this initial swinging movement of hinge member **21**.

As hinge member **21** continues to turn, axis A_m of moving arcuate section **52** is displaced out of its common or coincidence relationship with axis A_f of fixed arcuate section **39** and edge extremity **62** of arcuate section **52** may bear against and move along the inner surface **61** of arcuate section **39** and such contact becomes hinge axis **H**. This relationship is shown in FIG. **4***b* wherein at a 90° position it appears that the slightly tapered edge extremity **56** of outer arcuate section **39** has been introduced slightly into the opening defined by edge extremity **62** and flange portion **51**. Horizontal movement between hinge members is thus restricted and disassembly is not permitted.

It should also be noted that at a 90° position of hinge member **21**, arcuate sections **52** and **39** cannot become disengaged because the distance between the outer surface of edge extremity **62** and a point **62***a* on surface **57** substantially vertically opposite thereto is approximately equal to the diameter of outer arcuate surface **60** and is greater than the space between the edge extremity **56** and flange portion **38** as indicated by **58**.

Further rotation of hinge member **21** is indicated in FIG. **4***c*, this position being approximately 135° from original fully nested position. As indicated, edge extremity **62** of the inner arcuate section **52** has been moved toward the edge extremity **56** of outer arcuate section **39** and a major portion of arcuate section **52** has passed through space **58**. However, disengagement is prevented because at this position front face **25** of plate portion **23** has moved into vertical sliding engagement with outer surface **54** of outer arcuate section **39** as indicated at **65**. Since radius R_o is approximately equal to the space between the extremity **62** and front face **25**, it will be apparent that such sliding contact engagement as at **65** between front face **25** and outer arcuate surface **54** will limit movement of the inner arcuate section **52** rearwardly or further through space **58** so that the hinge member **21** cannot become disengaged.

In FIG. 4*d* is shown hinge member turned approximately 180° and wherein the line of sliding contact between front face **25** and outer arcuate surface **54** has been moved to a position indicated at **65'**. In addition, the line of contact between edge extremity **62** and inner arcuate section **52** has now been lost and a line of contact between edge extremity **56** and inner surface **66** of the inner arcuate section **52** is at **67**. In the 180° position it should be noted that plate portion **24** lies forwardly of and parallel to plate portion **22**.

In the explanation of the turning movement of the hinge member **21** about the several axes involved which shift because of contact of certain surfaces, in brief summary it may be noted that in fully closed nested position of the flange portions and arcuate sections as shown in FIG. **2** the axes A_f, A_m and hinge axis H (that is the axis about which actual turning occurs) coincide. As hinge member **21** moves through approximately 45° (FIG. 4*a*), the member is still turning about the common axis as determined by A_f, a_m and H, and controlled by the arcuate surfaces **60, 61**. However, as the hinge member continues to turn as indicated in FIG. 4*b*, it will be noted that the moving axis A_m has been displaced rearwardly, axes A_f and A_m no longer serve as a turning axis and instead the turning axis occurs at H_1 which is a line of contact made by edge extremity **62** against the inner surface **61** of outer arcuate section **39**. As hinge member **21** continues to turn into the position shown in FIG. 4*c* the hinge axis now indicated at H_2 moves rearwardly and upwardly on inner surface **61** of the edge extremity **56**. In FIG. 4*d* it will be apparent that the hinge axis H_3 has further shifted and now is provided by the linear contact of the surface of edge extremity **56** against inner arcuate surface **66** of the inner arcuate section **52**. It will thus be apparent that between 135° and 180° there is a transfer of the linear contact forming the hinging axis H from the interior arcuate surface **61** of the outer arcuate section **39** to the inner arcuate surface **66** of inner arcuate section **52**. During such transfer it will be apparent that disengagement of the hinge members **20, 21** cannot occur because of the limiting contact of the surface **57** of flange portion **38** and front face **25** of plate portion **23**. It will also be apparent that hinge member **21** is capable of turning beyond 180° if desired until edge extremity **62** interlocks with the edge extremity **56**.

The hinge members **20** and **21** are readily assembled by longitudinal insertion of the inner arcuate section **52** into the outer arcuate section **39** until the two hinge members are moved relatively longitudinally into a selected position. To facilitate mounting the hinge members relative to the adjacent ends of the panel side frame members such as **11***s*, inner arcuate section **52** may be cut to a shorter length than that of outer arcuate section **39** so as to provide at each end of the hinge assembly a longitudinal recess **69**. Each recess **69** may receive a reduced shank **71** of a headed pin **70** which extends approximately to the end edge of inner arcuate section **52**. A head **72** of pin **70** may abut as at **73** the outer edge of outer arcuate section **39**. The head **72** has an outer cylindrical surface of approximately the same radius as that of the outer surface **54** of arcuate section **39** so that a continuous cylindrical effect is provided for the width of the panel closure.

When the hinge construction **10** is used horizontally to swingably mount a closure panel at its top horizontal edge, as shown, the flange portion **38** also serves as a water deflector and drip means which prevents rainwater from flowing directly downwardly over the closure panel. When hinge **10** is used vertically to swingably mount a door or like panel, pin **70** may be fixed against longitudinal movement and shank **71** as by a transverse pin extending through outer arcuate section **39** so that relative longitudinal movement between the hinge members will not occur.

It will be understood that other means may be employed for maintaining the hinge members in longitudinal relation, as for example, a transverse slot may be cut in flange portion **51** to receive and engage a suitable rivet or pin driven through an aligned port in the arcuate section **39**.

The fixed hinge member **20** may be secured to wall **15** by suitable screwbolts **70** installed in selected longitudinal spaced relation in plate portion **22**. It will be apparent from a consideration of FIG. 4*d* that when the closure panel is in fully open position, the space between the wall **15** and the closure panel is relatively small, and generally speaking, a handle provided at the bottom rail of the closure panel will abut wall **15** so as to provide a stop against further swinging movement of the closure panel. In the event a handle is not provided on the closure panel, a suitable bumper stop may be provided on the panel or wall. Additionally the small space between the closure panel in raised position and the wall permits the use of short-retaining hooks in the event it is desired to hold the closure panel in fully open position. Friction-type latches may also be used.

It will be understood by those skilled in the art that the hinge portions provided by the flange and arcuate edge sections may be made of slightly different configuration. The arcuate or return sections **52** and **39** are preferably made of virtually uniform material cross section, but it will be understood that certain portions of said cross section may be thickened or reduced depending upon the requirements for the hinge construction as long as the several relationships between the surfaces of the return sections, flange portions and plate portions are maintained. In the exemplary embodiment described above which employs part-cylindrical edge sections, the hinging movement is smooth and uniform because of the curved surfaces and the smooth transfer of the hinge axis from one location to another as the closure panel is swung thereabout.

It will be understood that various modifications and changes may be made in the configuration of the hinge member described above which may come within the spirit of this invention and all such changes and modifications coming within the scope of the appended claims are embraced thereby.

I claim:

1. In a hinge construction, the combination of:
   - a pair of longitudinally extending mating hinge members including
   - plate portions having front faces;
   - hinge portions extending from said plate portions and having longitudinal edge arcuate sections in nested concentric relation in one position of said hinge members;
   - one of said hinge members being normally fixed and the other hinge member being swingable with respect thereto about progressively changing hinge axes during movement of the swingable hinge member;
   - said arcuate section of the fixed hinge member terminating in an edge extremity spaced from the opposed surface of its flange portion a distance less than the external diameter of the arcuate section of said swingable hinge member;
   - said arcuate section of the swingable hinge member having an edge extremity spaced from the front face of its plate portion a distance approximately that of the radius of the external surface of the fixed arcuate section whereby contact of said external surface of said fixed arcuate section maintains interengagement of the arcuate sections to maintain assembly of said hinge members while said swingable hinge member is turned through an angle of at least 180°.

2. In a hinge construction as stated in claim **1** wherein said arcuate sections include external and internal part-cylindrical surfaces whereby said hinge axis during part of said turning of said swingable member is coincident with the axes of said part-cylindrical surfaces.

3. In a hinge construction as stated in claim **1** wherein said edge extremity of said arcuate section of said fixed swingable member is tapered in cross section.

4. In a hinge construction as stated in claim **1** wherein said arcuate section of said swingable member subtends an angle of approximately 270° as measured from its point of tangency with its flange portion; and

wherein said outer arcuate edge section of said fixed member subtends an angle of approximately 240° as measured from its point of tangency of its flange portion.

5. In a hinge construction as stated in claim 1 wherein said hinge members are movable longitudinally relative to each other for assembly of said nested arcuate edge sections; and

means for holding said hinge members against relative longitudinal movement.

* * * * *