Feb. 1, 1966 B. AMMON 3,231,927

HINGE STRUCTURE

Filed June 14, 1963

FIG.1

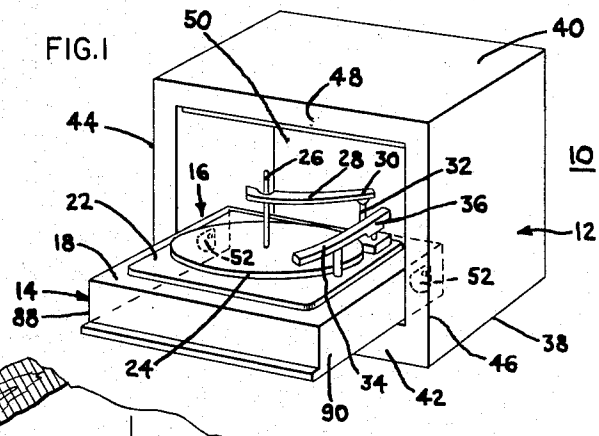


FIG.2

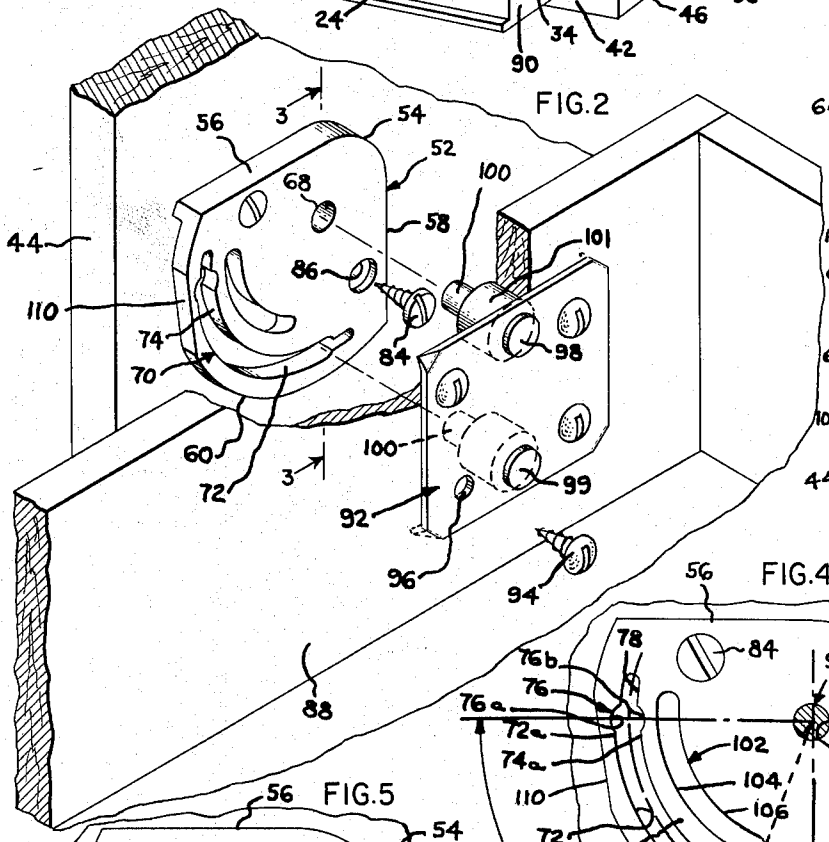


FIG.3

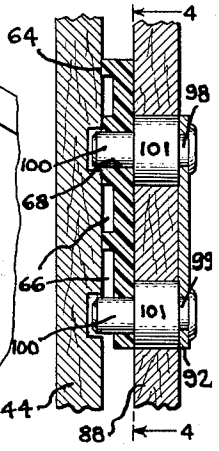


FIG.4

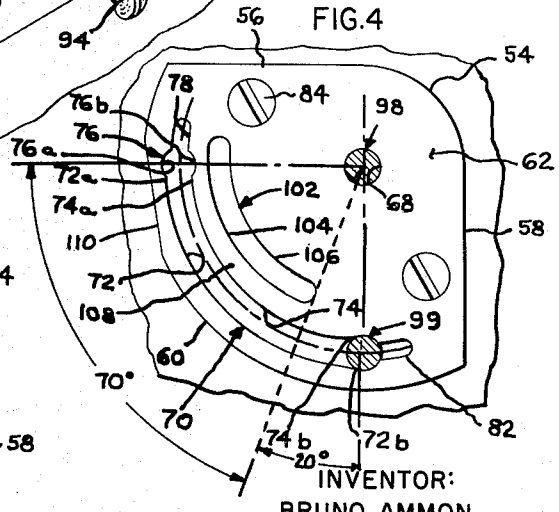
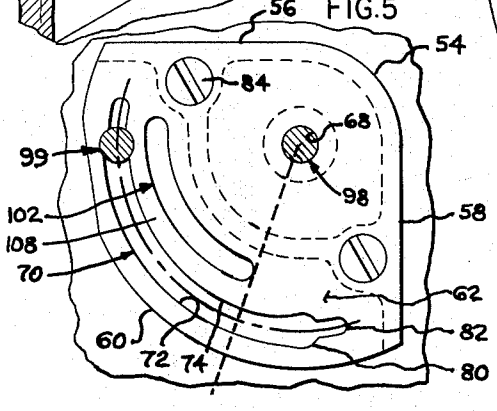


FIG.5



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HINGE STRUCTURE

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This invention relates to means for pivotally supporting one member with respect to another member, and in particular to a hinge structure for controlling pivotal movement of a door of a record playing apparatus relative to an associated supporting structure.

One form of record playing apparatus which has been put into widespread use is the type of record player wherein the turntable is mounted on the inner surface of a pivoted door. In one such type of player when it is not in use, the pivoted door is positioned in generally vertical disposition to help protect and enclose the turntable mechanism in a housing. When it is desired to use this particular record player, the door pivots from a vertical to a horizontal position, to thus suitably position the turntable for record playing purposes.

In prior art record playing devices of the nature referred to, considerable difficulty has been provided in effectively and economically controlling the pivotal movement of the turntable supporting doors when they are operated between their vertical and horizontal positions. In particular, it has been found that these record playing devices have failed to provide an efficient means for controlling the pivotal movement of the turntable door and/or have required the use of an uneconomical number or type of parts. Accordingly, an important object of my invention is to provide an improved pivotal structure for the door of a device such as a record playing apparatus.

Another object of my invention is to provide an improved hinge structure which includes a novel means for controlling the pivotal movement of one member relative to another.

An additional object of my invention is to provide an improved hinge structure wherein one member resiliently engages and coacts with another member to effectively control pivotal movement of one of the members with respect to the other.

A further object of my invention is to provide a hinge structure for pivotally supporting a turntable carrying door of a record playing apparatus, which hinge structure is low in cost and very economical to manufacture.

In carrying out my invention, in one form thereof, I apply it to a housing for a record player of the type wherein the turntable is mounted and supported on the surface of a pivoted door which faces inwardly when the door is closed. The door which supports the turntable is pivotally supported upon the housing by my improved hinge structure. This hinge structure includes a pair of hinge elements which are mounted in opposed relationship on oppositely facing inner walls of the housing, and two pairs of spaced apart and adjacent parallel pins which extend outwardly from each side of the door, respectively, for cooperation with the hinge elements. Each of the hinge elements is constructed from a resilient material and it includes a bearing slot for pivotally supporting one pin of each associated pair. Each hinge element also includes an elongated arcuate slot spaced radially from the bearing slot and having the same axis of curvature as the axis of the bearing slot. The other pin of each adjacent pair of pins extends through and is resiliently engaged by the arcuate slot of one of the hinges. With such an arrangement, one pin on each side of the door pivots within a bearing slot of an associated hinge element, and the other adjacent pin on each side of the door rides within its associated arcuate slot to effectively control the pivotal movement of the door with respect to the rest of the housing. Each hinge element also includes a relief means for gradually varying the resistance of the arcuate slot to movement of its associated pin. By means of resilient hinge elements and their co-operative arrangement with respect to two pairs of pins, a simplified, economical, and expeditious means has thus been provided for pivotally supporting and controlling the movement of the door of a record player with respect to the record player housing.

Further aspects of my invention will become apparent hereinafter, and the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which I regard as my invention. The invention, as to organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description when taken in conjunction with the accompanying drawing, in which:

FIG. 1 is a perspective view of a record player embodying one form of my invention;

FIG. 2 is a fragmentary exploded perspective view taken from FIG. 1, to show one of the hinge elements and its mode of cooperation with a pair of pins, in accordance with the teaching of my invention;

FIG. 3 is a sectional view taken generally along the line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken generally along the line 4—4 of FIG. 3, and showing the layout of the slots in the hinge elements, together with the relative pin positions, when the record player door is open; and

FIG. 5 is a view similar to FIG. 4, but showing the position of a pin in the arcuate slot of the hinge element when the record player door is closed.

Referring in detail to the drawing, and in particular to FIG. 1, there is shown a phonograph **10** comprising a housing **12**, and a platform-door **14** which is pivotally supported on housing **12**, and a record player **16** mounted on the inner side **18** of platform-door **14**. The record player **16** includes a frame **22** mounted on the inner side of door **14**, and a turntable **24** carried upon frame **22**. For centering records and positioning them in the desired relationship with turntable **24**, a spindle **26** is extended upwardly from turntable **24** in the usual manner.

The record player **16** shown is an automatic record changer type, and employs a record balancing arm **28**. The arm **28** is arranged in general parallel to the turntable **24**, and it is carried by attachment of its rear end **30** to a vertical post member **32**. Post member **32** is rotatably journalled and may be raised and lowered in the usual fashion. The balancing arm **28** is thus arranged on the record player **16** so that it may be raised and lowered, and is swingable sideways from its raised position for loading records on the spindle **26**. More particularly, for loading records on the spindle **26**, the balancing arm **28** may be raised and swung angularly from a position wherein its free end generally overlies the spindle **26** to a position wherein its free end is adjacent to but spaced laterally outwardly from the periphery of a record which is to be loaded. The balancing arm **28** may then be located in a detented position to allow clearance for a record to be loaded upon spindle **26**.

A tone arm **34** is located alongside of and above turntable **24**, and is provided with a pivotal support near its rear end **36**, in the well known manner. The arm **34** is pivotally supported so that vertical and horizontal movement is permitted and a pickup stylus or needle (not shown) located at the free end of the arm **34** can engage and reproduce sound signals from the groove of a phonograph record placed in playing position on the turntable **24**.

From viewing FIG. 1, and the above discussion, it will be understood that the record player **16**, together with its associated mechanism, is supported upon platform door **14** of the housing **12**. The housing **12** includes a rectangular or box shaped casing **38**, having top and bottom walls **40**, **42**, side walls **44**, **46**, open front wall **48**, and rear wall **50**. The platform-door **14** is pivotally supported on the inner surfaces of the vertical side walls **44**, **46** and is movable from an upright closed position (not shown) wherein it closes the open front wall **48**, to a horizontal open position (shown in FIG. 1) wherein records may be played on the turntable **24**.

Turning now to an important aspect of the present invention, which is the provision of a novel and improved means for pivotally supporting and controlling the movement of the platform-door **14** in the phonograph housing **12**, attention is directed to FIGS. 2 and 4. In accordance with the present invention, on the inner surface of each of the side walls **44** and **46** of housing **12**, there is secured a hinge element **52**. The hinge elements **52** are disposed near to but spaced rearwardly from the open front wall **48**. As further shown in FIG. 1, the hinge elements **52** are in opposed relationship. Each hinge element **52** is preferably molded from a polyamide resin or acetal resin material, but also may be formed from other thermoplastic materials. The periphery of element **52** includes a curved corner **54**, upper side **56** and rear side **58** which extend radially outwardly in divergent fashion from corner **54** (as shown in FIG. 2) and substantially arcuate diagonal surface **60** which connects the outermost (i.e. most divergent) sides **56** and **58** to each other. As further shown in FIG. 4, the inner face **62** of hinge element **52** is of smooth construction. The other or outer face **64** of hinge element **52** is recessed, as indicated by the dotted lines of FIG. 5, and the gaps **66** of FIG. 3, to provide the desired thickness of the hinge element at the slot **70**. Such an arrangement also effects an overall economy in the amount of molded material required for each hinge.

As further shown in FIGS. 2 and 4, there is formed in hinge element **52**, a bearing aperture **68** of cylindrical configuration, and an elongated arcuate slot **70**. The longitudinal axis of the arcuate slot **70** is an arc of a circle spaced radially from the axis of the bearing aperture **68**. It will be further noted from FIGS. 4 and 5 that the arcuate slot **70** extends through an angle of approximately 90 degrees. Between the ends of arcuate slot **70**, the curved surfaces **72** and **74** thereof are spaced apart in substantial uniformity, except for a portion of slot **70** near the bottom thereof (viewing FIGS. 4 and 5). More particularly, the radius of curvature of curved surface **72** of the slot **70** minus the radius of curvature of curved surface **74** is substantially uniform between the ends **72***a*, **72***b* and **74***a*, **74***b* of these surfaces, except for a portion of slot **70** near ends **72***b*, **74***b*. At the upper end of the arcuate slot **70** there is formed an enlarged upper seat **76**. Seat **76** includes two opposed cylindrical surfaces **76***a* and **76***b* which have their axis of curvature on the longitudinal axis of slot **70**. From the upper ends of surfaces **76***a* and **76***b*, there is formed an upper extension **78** of slot **70**. Extension **78** has its curved sides spaced closer together than curved surfaces **72** and **74**, and helps to encourage and facilitate resilient operation of the hinge element **52**, as shall be further set forth hereinafter.

The lower end of the arcuate lot **70** has its opposed surfaces curved toward the longitudinal axis of the slot, as shown in FIG. 5, to form a seat **80**. From seat **80** there is formed a lower extension **82** of slot **70**. Extension **82** has its curved sides spaced closer together than curved surfaces **72** and **74** to help encourage and facilitate resilient operation of the hinge element **52** in a manner similar to that set forth for extension **78**.

To enable the hinge elements **52** of the phonograph housing **12** to pivotally support and control the movement of the platform-door **14**, as shown by way of example in the exploded perspective view of FIG. 2, each of the hinge elements **52** is secured to the inner surface of one of the side walls **44**, **46** of housing **12**, by means of screws **84** which are extended through apertures **86** of each of the hinge elements **52**, and threaded into engagement with the walls **44**, **46**.

The platform-door **14**, which carries the turntable, has a pair of opposed side walls **88** and **90** (FIG. 1) which extend through the open front wall **48** of housing **12** and are in adjacent parallelism respectively to the inner surfaces of the housing walls **44** and **46**. On each of the walls **88** and **90** of the door **14** there is secured a bracket **92**. This bracket **92** is secured to an inner side of the walls **88** and **90** by screws **94** which extend through apertures **96**. As further shown in FIGS. 2 and 3, there are two pins **98** and **99** extended through and secured to each bracket **92**. Each of the pins **98** and **99** also includes a bushing portion **101** disposed in the wall **88** or **90**. The outer portion **100** of each pin **98**, **99** projects laterally outwardly from the wall **88** or **90** and has a cylindrical configuration.

The pins **98**, **99** are arranged on their brackets **92**, in parallel relationship, and are extended through walls **88**, **90**, as shown in FIG. 3. In addition, the axes of the pins for each bracket are spaced apart by a dimension substantially equivalent to the radius of curvature of the longitudinal axis of the arcuate slot **70**.

As illustrated in FIGS. 2 and 3, the smooth cylindrical outer portion **100** of pin **98** for each of the brackets extends into cooperative engagement with bearing aperture **68** of the associated hinge element **52**, to provide a pivotal support for each side of the platform door **14**. The outer portion **100** of the pin **99** extends into cooperative engagement with the arcuate slot **70**, to provide a means for controlling the pivotal movement of each side of door **14**.

Since the door **14** supports the turntable and its associated phonograph elements, the weight imposed upon the movable door **14** is considerable. It is, therefore, advantageous to provide a counterbalancing effect for controlling the movement of door **14** with respect to the relatively stationary hinge elements **52**. To enable the hinge elements **52** to achieve such an effect, as shown in FIGS. 2, 4 and 5, there is an arcuate slot **102** of shorter length than slot **70** which is arranged near the latter slot. More particularly, slot **102** is generally parallel to slot **70**, and extends through an angle of less than 90 degrees from the horizontal, as shown in FIG. 4. The slot **102** comprises a pair of spaced apart and parallel cylindrical surfaces **104**, **106** (FIG. 4) which are, in general, uniformly spaced apart, and are formed about an axis of rotation located a small increment higher than the axis of rotation of the arcuate slot **70** (viewing FIG. 4). Thus, as further shown in FIG. 4, the upper end portions of cylindrical surfaces **104**, **106** (which are located near seat **76**) are disposed closer to cylindrical wall **74***a* of the slot **70**, than the lower end portions of cylindrical surfaces **104**, **106** are spaced from wall **74**. This arrangement provides a wall or rib **108** of progressively variant thickness or radial depth, between arcuate slots **70** and **102**. Since the minimum thickness of rib **108** is near seat **76**, and the maximum thickness of rib **108** is near to the bottom of arcuate slot **70** and progressively variant therebetween, the rib **108** has a minimum resistance to flexion near seat **76**, a maximum resistance to flexion (with respect to rib **108**) near the bottom of slot **70**, and a substantially progressively increasing resistance to flexion between the top and bottom of the rib **108**.

Turning now to a detailed discussion of the mode of operation of the improved hinge arrangement of the present invention, attention is directed to FIGS. 1, 4 and 5. When the platform-door **14** of the phonograph **10** is

disposed in its closed position (not shown), it is generally vertical (viewing FIG. 1) and the record player **16** is completely enclosed in the phonograph housing **12**. With the door **14** in this position, outer portion **100** of each pin **99** is ensconced in seat **76** (FIG. 4) of its associated hinge element and held there or detented into that position by a relatively light frictional pressure exerted upon the cylindrical surface of outer portion **100** by cylindrical surfaces **76***a*, **76***b* of the seat **76** (FIG. 4). (See also FIG. 5.) The door **14** is thus detented into a closed position by engagement of hinge seats **76** with pins **99**.

When the operator begins to open the platform door **14** of the phonograph **10**, the outer cylindrical portion **100** of pins **98** thereupon rotates within its associated bearing slot **68**. As a pulling-out force is exerted upon the upper part of the door **14** (i.e. the outermost part, viewing FIG. 1) the cylindrical portion **100** of the pins **99** on each side of door **14** flexes the surfaces **72***a*, **74***a* outwardly and away from each other so that they gradually part in resilient fashion and allow the cylindrical portion **100** to approach bottom seat **80** of slot **70**. As the cylindrical portion **100** of each pin **99** is curving downwardly and to the right from the position wherein it is shown in FIG. 5 to the position wherein it is shown in FIG. 4, the surfaces **72**, **74** of each arcuate slot **70** resiliently flex, to allow these surfaces to impart the desired frictional resistance to the movement of the door **14**. Because of the gradually increasing thickness of the rib **108**, during movement of the door **14** from the closed to the open position (FIG. 1) a gradually increasing frictional resistance is exerted upon the pins **99** during movement thereof through an angle of approximately 70 degrees from the horizontal (indicated by the dotted radial line in FIG. 5). The walls **72**, **74** diverge slightly just before they reach the bottom seating surfaces **72***b*, **74***b*. The pins **99** are therefore provided with a gradually diminishing frictional resistance between the 70 degree position and their bottom seated position (FIG. 4), (i.e. through an angle of 20 degrees) to facilitate easy operation of the door near its bottom portion of travel.

When it is desired to close the door **14** from its open position, it is, of course, necessary to swing the pins **99** in a clockwise direction of rotation (viewing FIG. 4) from their lowermost position to a horizontal position (relative to their associated pins **98**). During this movement, a reverse operation occurs, and a relatively small frictional resistance is initially provided by the surfaces **72**, **74**. The surfaces **72**, **74** then provide a gradually increasing frictional resistance for pins **99** until they have reached a position spaced 20 degrees from their bottom position. For the remaining 70 degrees of movement the slot **70** provides a gradually diminishing frictional resistance until the pins **99** have been returned to seats **76**. The door **14** is then closed.

As further shown in FIG. 2, a cut **110** is provided in surface **60** of each hinge element **52**. Cut **110**, in the illustrated structure, lowers the initial frictional resistance of slot **70** near seat **76** even further, thereby assuring easy opening for door **14** when it is closed.

It will now, therefore, be understood that I have provided an improved hinge arrangement of novel structure which readily lends itself to use in a phonograph. It is also contemplated that my novel hinge structure may be effectively utilized in other devices for the purpose of pivotally supporting one member with respect to another and also controlling the pivotal movement of the one member. It will be further understood that my improved hinge arrangement involves a minimum expense, since it represents a very simplified construction.

While in accordance with the patent statutes, I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from my invention, and I, therefore, aim in the following claims to cover all such equivalent variations as fall within the true spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Means for pivotally supporting one member upon another member, said means comprising at least one hinge secured to one of the members and a pin secured to the other of said members, said hinge being constructed of resilient thermoplastic material and having an elongated arcuate slot formed therein, said pin extending through said slot, and means for enabling opposed arcuate walls of said slot to resiliently engage the pin and provide a progressively variant resilient flexion for controlling pivoting movement of the members relative to each other.

2. Means for pivotally supporting one member upon another member, said one member including a pair of spaced apart opposed walls, and said other member including a pair of walls disposed in proximate relationship respectively to the walls of said first mentioned member, a pair of hinges secured respectively to the walls of one of the members, and a pair of pins secured respectively to the walls of the other member, each said hinge being of unitary resilient thermoplastic construction and having an arcuate slot formed therein, each said pin extending through and slidable within an associated slot, and means for enabling opposed arcuate walls of each of the slots to resiliently engage an associated pin and provide a progressively variant resilient flexion for controlling the pivoting movement of the members relative to each other.

3. For pivotally supporting one member upon another member, a hinge means comprising at least one element of resilient thermoplastic material secured to one of said members and a pin secured to the other of said members, said one element having an elongated arcuate slot formed therein for receiving said pin, and means for enabling opposed arcuate walls of said slot to resiliently engage the pin and provide a progressively variant resilient flexion for controlling pivoting movement of at least one of the members relative to the other.

4. The arrangement of claim **3** wherein the element is of polyamide resin material.

5. In a record playing apparatus of the type wherein a pivoted door supports a turntable, an improved hinge structure for pivotally supporting the door in a stationary enclosure, said hinge structure comprising at least one hinge element secured to said enclosure, and a pair of spaced apart parallel pins secured to and extending outwardly from said door, said hinge element being of resilient thermoplastic material and including a cylindrical bearing aperture and an elongated arcuate slot concentric to said bearing aperture, one of said pins extending into and cooperating with said aperture thereby to provide a pivotal supporting means for said door on said stationary enclosure, the other said pins extending into and cooperating with said arcuate slot, said slot being dimensioned relative to said last mentioned pin so that the pin is slidable within the slot but is resiliently engaged by opposed walls of said slot to provide a progressively variant resilient flexion for controlling pivoting movement of the door in the stationary enclosure.

6. In a record playing apparatus of the type wherein a pivoted door supports a turntable, an improved hinge structure for pivotally supporting the door in a stationary enclosure, said hinge structure comprising at least one hinge element secured to said enclosure, and a pair of spaced apart parallel pins secured to and extending outwardly from said door, said hinge element being of resilient thermoplastic material and including a cylindrical bearing aperture and an elongated arcuate slot concentric to said bearing aperture, one of said pins extending into and cooperating with said aperture thereby to provide a pivotal supporting means for said door on said stationary enclosure, the other of said pins extending into and co-

operating with said arcuate slot, said slot being dimensioned relative to said last mentioned pin so that the pin is slidable within the slot but is resiliently engaged by opposed walls of said slot thereby to control pivoting movement of the door in the stationary enclosure, said arcuate slot including at least one wall portion of variable thickness to provide a substantially progressively variant resilient flexion of said wall portion with respect to its associated pin during at least part of the movement of said door.

7. In a record playing apparatus of the type wherein a pivoted door supports a turntable, an improved hinge structure for pivotally supporting the door in a stationary enclosure, said hinge structure comprising at least one hinge element secured to said enclosure, and a pair of spaced apart parallel pins secured to and extending outwardly from said door, said hinge element being of resilient thermoplastic material and including a cylindrical bearing aperture, said hinge element also including an elongated first arcuate slot concentric to said bearing aperture and a second arcuate slot in nonconcentric relation to said bearing aperture, one of said pins extending into and cooperating with said aperture thereby to provide a pivotal supporting means for said door on said stationary enclosure, the other of said pins extending into and cooperating with said first arcuate slot, said slot being dimensioned relative to said last mentioned pin so

that the pin is slidable within the slot but is resiliently engaged by opposed walls of said slot thereby to control pivoting movement of the door in the stationary enclosure, said arcuate slot including at least one wall portion of variable thickness to provide a substantially progressively variant resilient flexion of said wall portion with respect to its associated pin during at least part of the movement of said door, said second arcuate slot being arranged in proximity to the first mentioned arcuate slot to provide progressively variant flexion of said first mentioned slot in response to movement of the associated pin therein.

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