United States Patent [19]

Lowe

[11] **3,782,035**

[45] **Jan. 1, 1974**

[54] **COLLAPSIBLE REVOLVING DOOR HAVING PAIRS OF PIVOT DETENTS AT THE TOP AND BOTTOM OF EACH LEAF**

[76] Inventor: **Dennis Lowe**, 58 Pitfield Rd., Agincourt, Ontario, Canada

[22] Filed: **Oct. 26, 1972**

[21] Appl. No.: **300,971**

[52] **U.S. Cl.** **49/44**
[51] **Int. Cl.** **E05d 15/02**
[58] **Field of Search** 49/42–44

[56] **References Cited**

UNITED STATES PATENTS

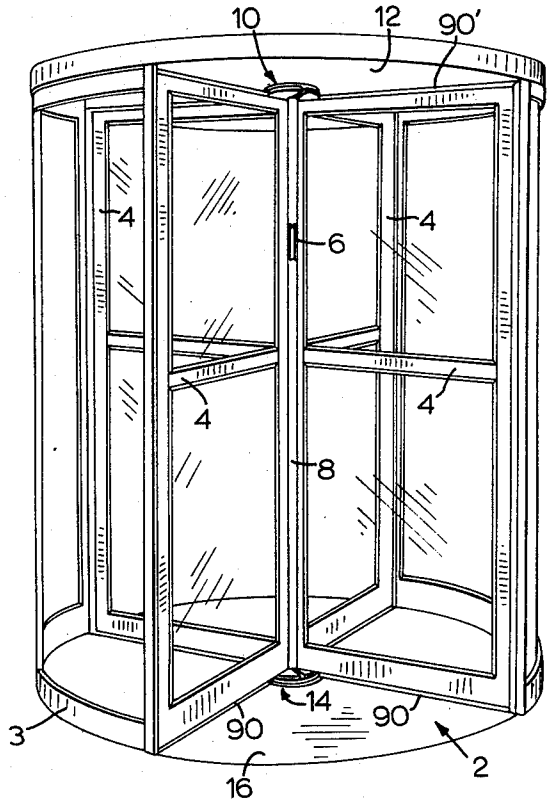
2,114,405	4/1938	Shields	49/44
3,495,251	2/1970	Lowe	49/44

Primary Examiner—J. Karl Bell
Attorney—David M. Rogers et al.

[57] **ABSTRACT**

A collapsible revolving door with upper and lower mechanisms which enable the folding of the revolving door leaves upon the application of a predetermined abnormal pressure thereto. A mechanism includes a retaining plate concentrically mounted on the end of the central vertical door shaft; horizontal bearing plates mounted on the horizontal edge of each door leaf adjacent to the central shaft; and a pair of detents connecting each bearing plate to its associated retaining plate, one detent on either side of the door leaf axis. Upon application of an abnormal force, the upper and lower detents on one side of the door leaf yield allowing the door leaf to pivot about the detents on the other side of the leaf enabling folding.

9 Claims, 15 Drawing Figures



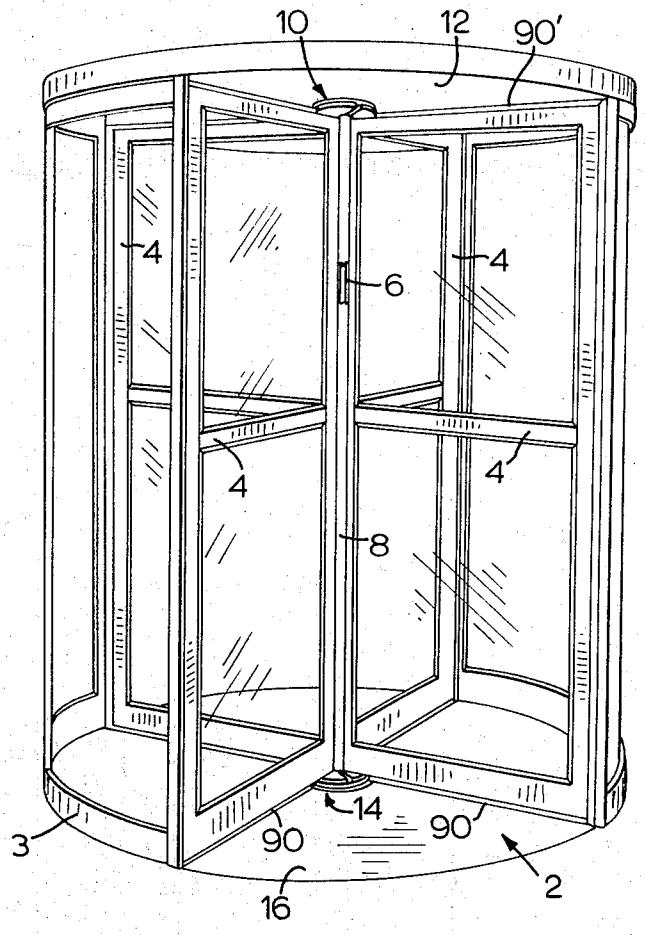


FIG. 1

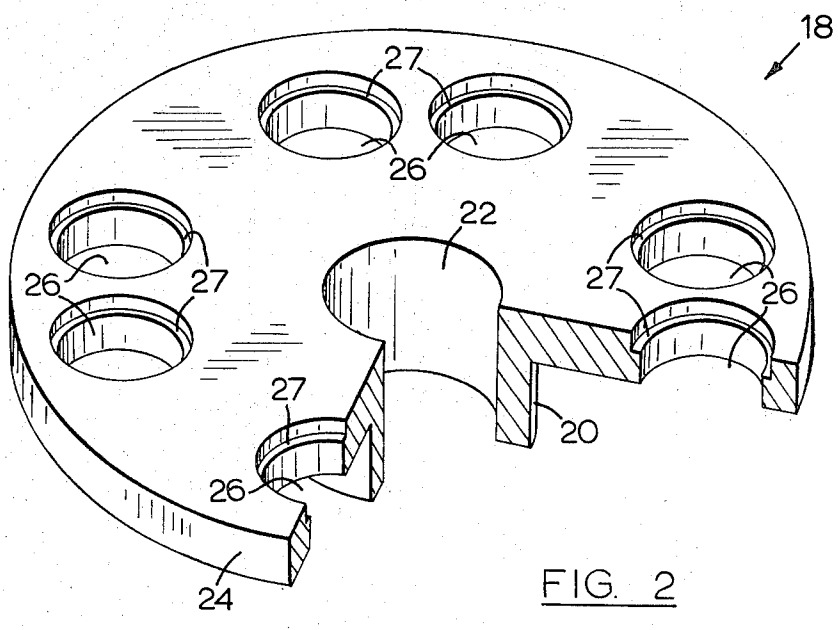


FIG. 2

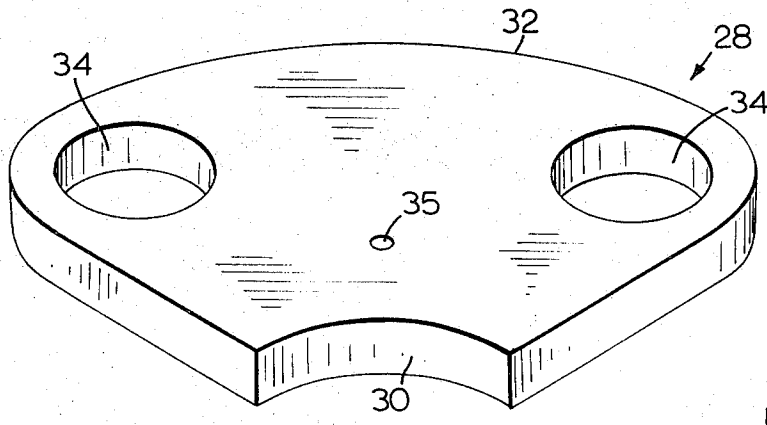


FIG. 3

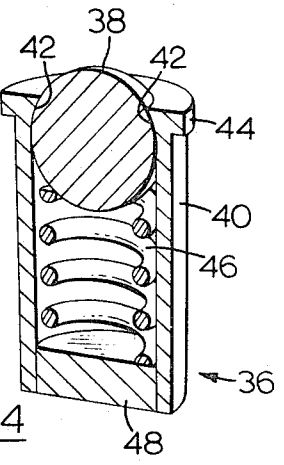


FIG. 4

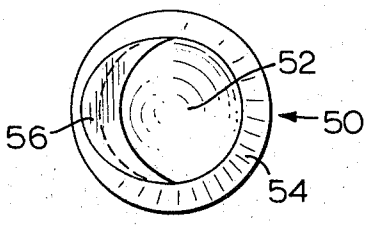


FIG. 5

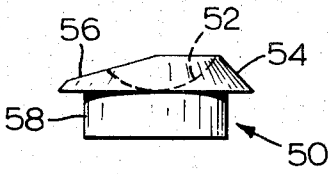


FIG. 7

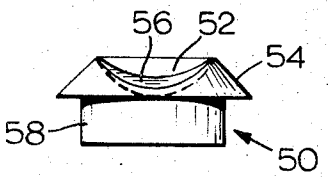


FIG. 6

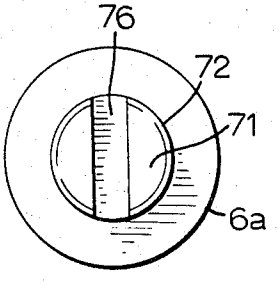


FIG. 8B

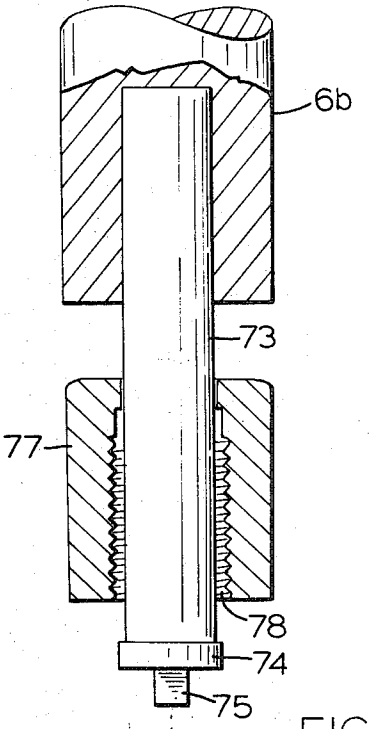
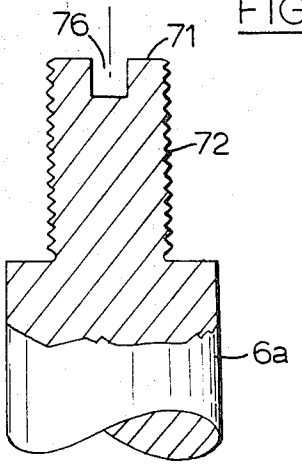


FIG. 8A



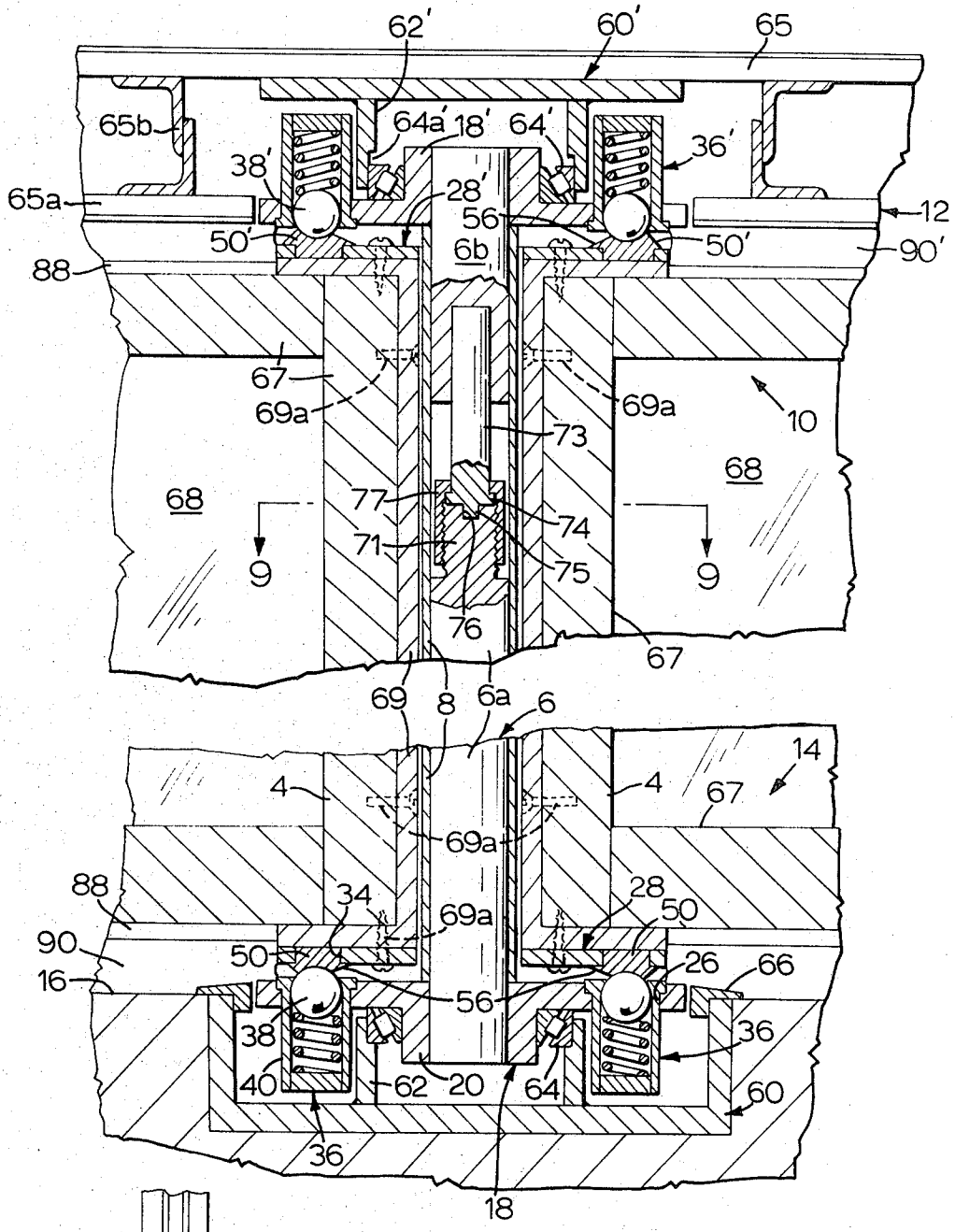

62'
60'
65
65b
64a'
18'
64'
36'
38'
28'
65a
56
12
50'
6b
50'
90'
88
67
69a
69a
73
10
68
68
77
74
71
75
9
9
76
67
69
8
6a
6
14
4
4
67
69a
88
34
69a
28
50
90
50
26
66
16
56
38
36
40
62
20
64
60
36
18

FIG. 8

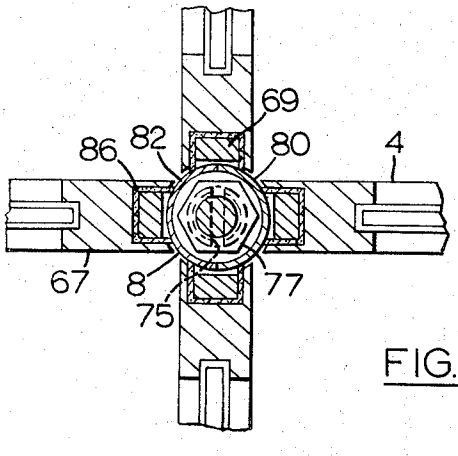

69
86
82
80
4
67
8
77
75

FIG. 9

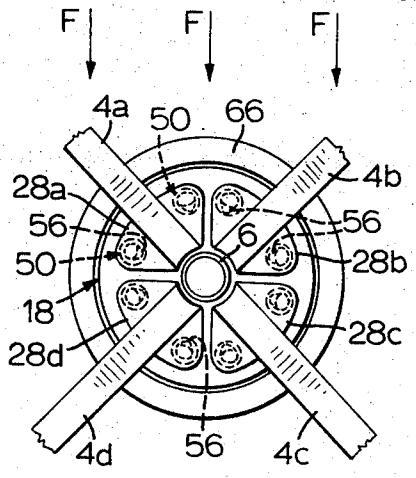


FIG. 10

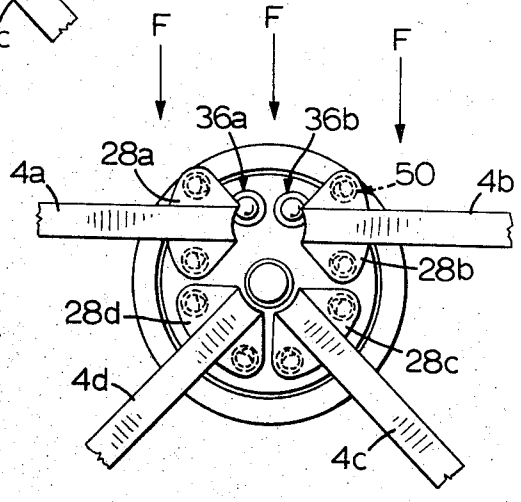


FIG. 11

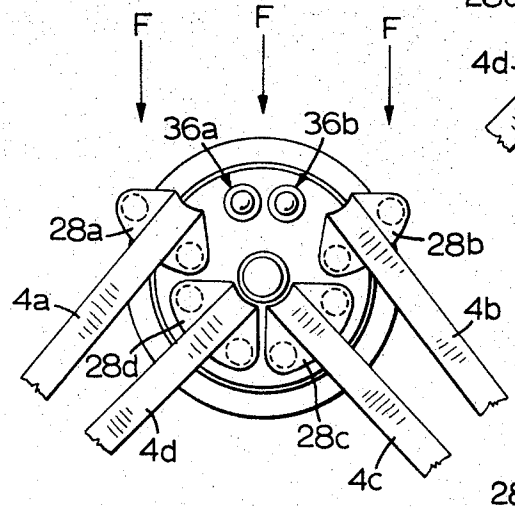


FIG. 12

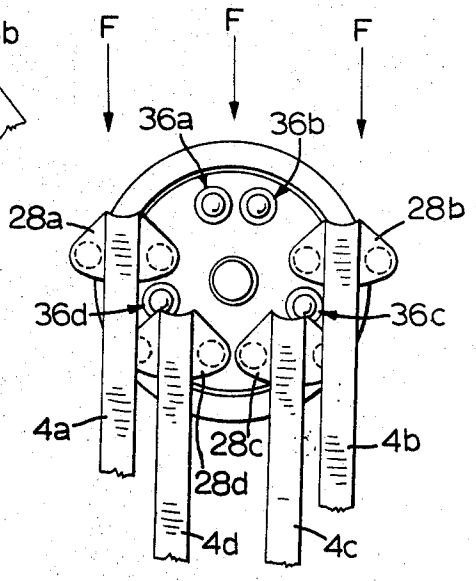


FIG. 13

COLLAPSIBLE REVOLVING DOOR HAVING PAIRS OF PIVOT DETENTS AT THE TOP AND BOTTOM OF EACH LEAF

The invention relates to a revolving door of the type having a central vertical rotating shaft and door leaves normally rotating with and extending from the central shaft along radial door axes. More specifically, the invention relates to a revolving door in which the leaves are adapted to fold under abnormal pressure so as to create an open passage through the doorway. Revolving doors of this type are often referred to as collapsible revolving doors.

Many different types of collapsible revolving doors have been built in the past which incorporate mechanisms to retain the door leaves normally in their extended position and to guide the leaves to their collapsed position. These mechanisms are usually quite complicated and are exposed to view creating an unsightly appearance for the door. In U.S. Pat. No. 2,495,251 which issued Feb. 10, 1970 to Dennis Lowe there is disclosed a collapsible revolving door in which the mechanism is concealed, but this mechanism is relatively expensive to manufacture.

It is therefore an object of the present invention to provide a simple inexpensive collapsing mechanism which is also substantially entirely concealed. In a typical embodiment the mechanism includes circular retaining plates concentrically mounted, one at the top and one at the bottom of the central vertical shaft of the door. These retaining plates extend radially outwardly beyond the inner corners of the door leaves. Horizontal bearing plates are mounted on the top and bottom edges of each of the door leaves adjacent to the central shaft and between said door leaf edges and their associated retaining plates.

Between each bearing plate and its associated retaining plate a pair of detents is connected. The detents are located on opposite sides of the plane of the door leaf and adjacent to the central vertical shaft. When an abnormal pressure is exerted on a door leaf, the top and bottom detents on one side of the leaf yield and release allowing the door leaf to pivot about the top and bottom detents on the other side of the leaf, thus enabling folding.

Further objects and advantages of the invention will appear from the following disclosure, taken together with the accompanying drawings in which:

FIG. 1 is a perspective view of a typical revolving door according to the invention,

FIG. 2 is a perspective view of a retaining plate for the FIG. 1 door;

FIG. 3 is a perspective view of a bearing plate for the FIG. 1 door;

FIG. 4 is an oblique sectional view of a detent for the FIG. 1 door;

FIGS. 5 to 7 are the top, front and left side views respectively of a ball socket for the FIG. 1 door;

FIG. 8 is a sectional view of the door of FIG. 1;

FIG. 8A is a partly sectional view of shaft portions of the FIG. 1 door;

FIG. 8B is a top view of a post of FIG. 8A;

FIG. 9 is a sectional view along line 9—9 of FIG. 8;

FIGS. 10 to 13 show diagrammatically the movement of the door leaves and bearing plates during folding of the leaves.

Reference is first made to FIG. 1 which shows in perspective a typical revolving door 2 according to the present invention, revolving in a shell 3. The door 2 includes four leaves 4 mounted to rotate with a central vertical shaft 6 normally hidden from view by a weather barrier 8. The tops of the leaves 4 and the central shaft 6 are connected to an upper collapsing mechanism 10 partially recessed in the ceiling 12, while the bottoms of the leaves 4 and central shaft 6 are similarly connected by a lower collapsing mechanism 14 partially recessed in the floor 16. The mechanisms 10, 14 maintain the door leaves in a radially extended position as shown while permitting rotation of the leaves and central shaft about the central vertical axis of the door, and the mechanisms 10, 14 also control the collapse of the leaves, as will be described.

The upper and lower collapsing mechanisms 10, 14 are normally identical, although minor differences (to be described) may be incorporated if desired. Primed reference numerals in the drawings will be used to indicate parts in the upper collapsing mechanism 10 corresponding to those in the lower collapsing mechanism 14.

Reference is next made to FIGS. 2 to 7 which show the components of a preferred embodiment of the lower collapsing mechanism 14. FIG. 2 shows a typical retaining plate 18 for the collapsing mechanism 14. The retaining plate 18 includes a central sleeve 20, a central aperture 22 for the central vertical shaft 6, and an outer disc portion 24 typically cast integrally with the sleeve 20.

The disc portion 24 includes eight holes 26, two for each door leaf 4. The two holes 26 associated with each door leaf 4 are located on opposite sides of the plane of their respective door leaf in such a manner that the door leaf 4 is permitted to collapse, as will be described. Each of the holes 26 includes a circumferential ledge 27 which seats one of the detents (ball holders to be described) forming part of the mechanism for maintaining the door leaves in a radially extended position.

Reference is next made to FIG. 3 which shows a typical bearing plate 28 for the collapsing mechanism 14. One bearing plate 28 is mounted on the bottom edge of each door leaf 4 at a position adjacent to the central vertical shaft 6 (as shown in FIG. 8 and in FIGS. 10 to 13). Thus there are four bearing plates for the lower portion of the door. (Similarly there are four bearing plates 28' for the upper collapsing mechanism, one mounted on the upper edge of each door leaf in a position adjacent the central shaft 6, as shown in FIG. 8.)

Each bearing plate 28 includes (see FIG. 3) a central arcuate edge 30 and an outside arcuate edge 32. When the four bearing plates are in position at the upper or lower portion of the door the arcuate edges 30 form a hole to accommodate the central vertical shaft 6.

Two bearing plate holes 34 are drilled part way into the bearing plate 28 on opposite sides of the door leaf plane, in positions which match a pair of retaining plate holes 26 when the bearing plate is placed over the retaining plate. The two holes 34 accommodate detent members to be described. The bearing plate 28 also includes a screw hole 35 to accommodate a screw for fastening the bearing plate to a door leaf, as will be described.

Reference is next made to FIG. 4 which shows a preferred embodiment of a detent, namely a ball socket 36 which fits into the holes 26 in the retaining plate 18.

Socket 36 includes a spherical ball 38 retained inside a tubular housing 40. The upper end of the tubular housing 40 includes a rounded inner edge 42 which retains the ball 38 (typically stainless steel 1 inch in diameter) in a position projecting from the socket. The upper end of housing 40 also includes an outer shoulder 44 which seats on the ledge 27 when a ball socket 36 is mounted in a retaining plate hole 26, to prevent the socket 36 from being pushed through hole 26 when pressure is applied to ball 38.

A heavy coil spring 46 inside the tubular housing 40 urges the ball outwardly to its extended position. A plug 48 is inserted into the bottom of tubular housing 40 to hold coil spring 46 in place. The plug 48 may be secured in any desired manner (e.g. welded) or it may be threaded into the end of the tubular housing 40 to allow adjustment of the compression of coil spring 46 and replacement of the parts.

Reference is next made to FIGS. 5, 6 and 7, which show at 50 in orthographic projection a detent (a ball socket) which fits into the holes 34 in the bearing plates 28. The ball socket 50 includes a shallow recess 52, of spherical curvature, which accommodates the detent ball 38. The recess 52 is bounded by and set into a generally conical shoulder 54. A flat surface 56 is produced on one side of the conical shoulder 54 to form a run-out from recess 52 so that the spherical ball 38 may be removed horizontally from recess 52 in one direction (namely over the run-out 56) with very little force. However, a very substantial force is required to remove the ball from the recess in any other horizontal direction. This characteristic is due to the fact that the detent ball 38 is only required to be depressed slightly to move it in the direction of the run-out 56 (since shoulder 54 is quite low at run-out 56) while a much higher depression is required to move the ball 38 in any other direction.

The detent or ball socket 50 also includes a cylindrical base 58 which fits into one of the bearing plate holes 34 to hold the ball socket in position.

It will be appreciated that instead of providing a separate and discrete ball socket 50, the recess 52 and the run-out 56 could be cut into the bearing plate 28 in place of each hole 34. However, by casting the ball sockets 50, which is a very simple operation, a less expensive assembly results and the ball sockets are easily replaceable.

Reference is next made to FIG. 8 which shows how the central vertical shaft 6, the upper and lower collapsing mechanisms 10, 14, and their associated parts are mounted on the floor and ceiling and connected to door leaves 4. The lower portion of the door will first be described. As discussed previously, the lower portion is identical to the upper portion of the door.

The lower collapsing mechanism 14 is supported in a cylindrical housing 60. Housing 60 is located in a well in the floor 16 and includes a cylindrical sleeve 62 therein which supports a thrust bearing 64. Thrust bearing 64 in turn supports and aligns the bottom of the door by supporting the retaining plate 18. The retaining plate 18 is secured by welding or by a pin, not shown, to the lower end of the central shaft 6 with the central sleeve 20 facing away from the door leaves 4.

A similar support arrangement is used, as shown, at the top of the door, but the upper support housing 60' is fixed to heavy structural members 65 in the ceiling 12. The portion of the ceiling 12 normally visible to viewers is indicated in FIG. 8 at 65*a* and is typically made of plywood held to structural members 65 by supports 65*b*, employing adhesive or screws (not shown).

Referring again to the bottom of the door, eight ball holders 36 are mounted in the eight retaining plate holes 26 so that the detent balls 38 face the door leaves 4. A sealing ring 66 is set in the floor 16 to prevent dirt from falling through the space between the support housing 60 and the retaining plate 18. No sealing ring is needed at the top of the door.

The bearing plates 28 are mounted on the door leaves 4 as follows. Each door leaf comprises conventional frame members 67, welded or screwed together, which encircle and retain the glass 68 of the leaf. A U-shaped stainless steel member 69 extends for a short distance along the bottom and top of each door leaf and also extends along the inner vertical edge of the door leaf, and is secured to the leaf by a number of screws 69*a* spaced along the length of member 69. The bearing plates 28 are welded to the rspective members 69 so that there is a bearing plate 28 or 28' oriented horizontally at the bottom and top inner corner of each door leaf, as shown. The screws 69*a* help to secure the bearing plates to their respective U-shaped members 69. This arrangement provides a secure connection between the bearing plates and the door leaves.

The ball sockets 50 are press-fitted or otherwise secured in the bearing plate holes 34 so that the run-outs 56 are in a direction parallel to the door leaf axis and facing the central shaft 6, as shown. Thus it can be seen that the ball holders 36 and the ball sockets 50 connect the bearing plates 28 (and hence the door leaves) with the retaining plate 18 (and hence the central shaft 6). In fact, this is the only connection between the door leaves 4 and the central shaft 6. Also, the weight of each door leaf 4 is transmitted through the bearing plates 28, the ball sockets 50, and the ball holders 36 to the retaining plate 18 and finally to the thrust bearing 64. Thus, the door leaves 4 are directly supported for rotation with the central shaft and held in a radially extended position by the operation of the ball holders 36 and ball sockets 50. It is these two elements which also enable the door leaves 4 to be folded as will be described.

The central shaft 6 extends vertically from the retaining plate 18 and is formed in two sections, namely a lower section 6*a* and an upper section 6*b* (see also FIG. 8A). A reduced diameter post 71 projects upwardly from the top of the lower shaft portion 6*a*, the post 71 having an exterior thread 72. Another reduced diameter post 73 is secured to and projects downwardly from the upper shaft portion 6*b*. The post 73 carries a slightly enlarged end plate 74 from which a flattened locating piece 75 projects downwardly (see also FIG. 9). The locating piece 75 is adapted to fit into a locating slot 76 (FIG. 8B) in the top of the post 71. A nut 77 is slidably mounted on the post 73 so that it can slide up and down over the plate 74. The nut 77 carries an interior thread 78 so that it can be screwed onto the threaded post 71.

The shaft 6 is installed by placing the lower portion 6*a*, with its retaining plate 18 and ball holders, in position in the bearing 64, and by placing the upper portion 6*b*, with its retaining plate 18' and ball holders, in the upper bearing 64'. (The ball holders 36' are retained in their retaining plate 18' by friction at this time.) The upper and lower shaft portions may each be tilted

slightly in a shallow V-configuration at this time, to allow installation of both portions. The locating piece **75** is then slid into the slot **76.** Once the piece **75** is located in the slot **76,** the shaft portions **6***a*, **6***b* are straight with respect to each other. The upper bearing **64'** can move slightly upwardly at this time because its socket **64***a'* is longer than the bearing **64'**.

Next, the nut **77** is pulled down over the post **71** and partly, but not fully, tightened. After this has been done, each door leaf **4** is installed in the book folded position shown (and later described) in FIG. **13.** This is accomplished by setting the run-outs **56** of the ball sockets **50** at one side of the top and bottom of each leaf against the detent balls **38** and then pushing the leaves radially inwardly towards central shaft **6.**

With the leaves installed in the book folded position, the nut **77** is tightened all the way, moving the lower and upper retaining plates **18, 18'** slightly together and "compressing" the leaves **4** between them (actually the springs **46** are compressed as the retaining plates **18, 18'** move towards each other).

After the shaft and leaves are installed, the weather barrier **8** is placed around the shaft **6.** The weather barrier **8** (see FIG. **9**) is typically formed as two aluminum extruded halves **80, 82** which are fastened to the central shaft by any desired means, e.g. by screws. (When the leaves are book folded, half of the central shaft is accessible to attach half of weather barrier **8,** and then the leaves may be book folded the other way to attach the other half of weather barrier **8.**)

The inner edges of the leaves may be provided with weather stripping **86,** secured between member **69** and the door leaf frame **67,** to seal the space between the inner edges of the door leaves **4** and the central shaft **6.** No identations are needed in the weather barrier **8** to allow for folding of the leaves, because the leaves swing substantially out when they are folded, as will now be described.

Reference is next made to FIGS. **10** to **13** which show the operation of the door by illustrating various positions assumed by the leaves **4** and the bearing plates **28** as folding progresses. In FIGS. **10** to **13,** the four door leaves **4,** four bearing plates **28,** and four pairs of ball holders **36** are distinguished one from the other by the suffixes *a*, *b*, *c*, and *d*.

Referring to FIG. **10,** assume that an abnormal force F is being applied to the door in the direction of the arrows. This abnormal force may occur when people are streaming toward the door in a panic situation, or when it is desired to fold the door leaves for special purposes.

When the force F contacts the two leading door leaves **4***a*, **4***b* the pressure on these leaves is transmitted through the bearing plates **28***a*, **28***b* and the ball sockets **50** to the ball holders **36** which are supporting the door leaves **4** and holding them in position. (As discussed the detent mechanism for each door leaf is constituted by springs **46** pressing the balls **38** vertically into the ball sockets **50.**)

The force F tends to cause the door leaf to rotate and move the bearing plates and ball sockets horizontally. This horizontal motion is converted into a vertical force and motion by the action of the ball socket spherical recess **52** on the detent ball **38.** The ball **38** is forced to move vertically downwardly into the detent housing **40.**

As was discussed, the run-outs **56** on the ball sockets **50** are aligned in a direction parallel to the door leaves **4** and facing the central shaft **6.** Also, a relatively low force is required to move a detent ball **38** situated in the spherical recess **52** horizontally in the direction of the run-out **56,** and a very high force is required to move a detent ball **38** in the opposite direction.

Consider first the detent on the side of door leaf **4***a* nearest the force F. Bearing plate **28***a* tends to rotate counter-clockwise. This motion causes the right hand (as drawn) ball socket **50** of plate **28***a* to move horizontally away from central shaft **6.** Only a relatively small force and depression of the detent ball **38** of the right hand ball socket **50** is required to release it from the ball socket allowing the bearing plate to continue rotating counter-clockwise.

Consider next the detent on the side of door leaf **4***a* farthest from force F. The rotating tendency of bearing plate **28***a* tends to cause the left hand ball socket **50** to move horizontally toward central shaft **6.** Since runout **56** is also in the direction of shaft **6,** a very high force and large depression of ball **38** is required to release ball **38** from the ball socket **50,** and such a force is not normally available.

The result is that as force F is applied to the door leaves **4,** the detent balls on the sides of the door leaves **4** nearest force F are released from their sockets before the detent balls release on the opposite sides of the door leaves. Once one of a pair of detents is released, the horizontal force at the other detent is reduced so that it cannot be released (unless the nut **77** is loosened, which would be done when the leaves are to be removed from the door). The same result occurs at both the upper and lower collapsing mechanisms. With the upper and lower detents on the side of the door leaf away from force F remaining in contact with their ball sockets, such detents form pivot points about which the door leaf **4** continues to rotate as force F continues to be applied.

In FIG. **11,** door leaves **4***a*, **4***b* have been pivoted about the detents farthest away from force F while the detents closest to force F have been released. FIG. **12** shows door leaves **4***a*, **4***b* pivoted to the point where the edges of the door leaves farthest away from central shaft **6** have come into contact with door leaves **4***c*, **4***d*. At this point force F is transmitted through door leaves **4***a*, **4***b* to door leaves **4***c*, **4***d*.

In a similar manner to above the detents of door leaves **4***c*, **4***d* closest to force F are released and door leaves **4***c*, **4***d* are pivoted until the four leaves eventually assume the position shown in FIG. **13,** in which the door is "book folded".

In order to return the door leaves to their uncollapsed position, the leaves are simply pivoted in the reverse direction by a force in a direction opposite to force F. As the detent balls **38** contact the run-outs **56** of the ball sockets **50,** the balls **38** are depressed and travel up the run-outs **56** until the balls seat in the spherical recesses **52.** The run-outs **56** and the recesses **52** provide a distinctive "feel" for an operator as balls **38** seat in order to reduce the likelihood that the leaves will be moved too far (i.e. "overshoot").

The upper and lower edges of each door leaf **4** are provided with channels **88** which hold conventional sealing strips **90.** The sealing strips **90'** in the upper leaf channels extend up to sweep the surface **65***a* of the ceiling **12,** and the ring **66'** while the sealing strips **90** in the lower leaf channels sweep the floor **16** and the ring **66.**

It will be noted that the outer arcuate edges of the bearing plates **28** extend radially outwardly beyond the ball holders **36,** thereby protecting the ball holders against entry of dirt, and also hiding them, thus improving the appearance of the door.

It will be seen that when the leaves are book folded as shown in FIG. **13,** the outer door leaves **4***a*, **4***b* have moved over the bearing plates **28***c*, **28***d* of the inner leaves **4***c*, **4***d*. To allow this, the sealing strips **90, 90'** are of quite flexible material so that they can be pushed aside by the bearing plates when the leaves are book folded.

It will be appreciated that various modifications may be made in the structure described. For example, four door leaves have been shown since this number is conventional, but this number may be reduced to three, with the number of detents positioned in the retaining plates also reduced to six instead of eight.

If desired, the ball holders **36** and ball sockets **50** can be repositioned from the locations shown in the drawings, e.g. by being moved radially outwardly and farther apart (by increasing the size of retaining plate **18** and bearing plate **28**). It should be noted, however, that when the door leaves pivot about one upper and lower set of detents, the outer edges of the door leaves swing out radially from the central vertical door axis. If the centre to centre distance between each of a pair of detents is too great, the outer edges of the door leaves may interfere with the shell **3** (FIG. **1**) which encircles the door. Therefore, a typical centre to centre distance between a pair of detents would be approximately 2¾ inches. A typical diameter of the pitch circle on a retaining plate **18** around which the detents are located would be approximately 6 inches. Although interference between the outer edges of the door leaves and the encircling shell is a typical application will not occur until the centre to centre distance between detents exceeds approximately 10 inches, nevertheless, it is desirable to keep the folding mechanism small to improve the appearance of the door. Thus, the interference problem will not normally arise in practice.

The detents will normally be positioned equidistant from and on opposite sides of the plane of their associated door leaf, on a line taken at right angles to the plane of the door leaf. (The term "plane" of a door leaf as used in this description and in the appended claims means the vertical plane taken through the centre of the door leaf midway between the faces of the door leaf.) The detents associated with a door leaf could if desired be positioned unequal distances from the plane of their door leaf, or on a line not at right angles to the door leaf, but the path of travel of the leaves when folded would then differ depending which way they are folded. This is usually undesirable, and therefore any departure from the detent positioning described will normally be either zero or small.

It will further be appreciated that other detent mechanisms may be used if desired, in place of (and in the location of) ball holders **36** and ball sockets **50,** to retain the door leaves in an extended position and to permit them to collapse upon application of a force greater than a predetermined force. However, the detent mechanism illustrated and described is believed to be the best embodiment in view of its effectiveness and simplicity.

Further, the ball holders **36** and the ball sockets **50** can be interchanged in position so that the ball holders **36** are mounted on the bearing plates **28** and the ball sockets **50** are mounted on the retaining plates **18.** This embodiment would function in the same manner as the preferred embodiment but the elongated ball holder housings **40** would then have to be buried in the leaves, which is less desirable than the arrangement shown. Alternatively, if desired, the ball sockets **50** can be formed integrally with the bearing plates **28** (or with the retaining plates **18**).

The upper portion of the door need not be made as strongly as the lower portion of the door since the upper portion does not support the weight of the door as does the lower portion. In addition, although the bearings **64** are shown as supporting the door shaft through the retaining plate **18,** the bearings **64** could if desired support and locate the shaft **6** directly and not through retaining plate **18.** However, in the arrangement shown, the retaining plate serves dual duty, not only retaining the ball holders **50** but also providing a flange for the thrust bearings **64,** thus reducing cost.

Finally, if desired the central shaft **6** can be eliminated and the lower and upper retaining plates **18, 18'** can simply be rotatably secured to the floor and ceiling respectively for rotation about the central vertical axis formerly occupied by the shaft **6.** The remainder of the mechanism will be unchanged, except that the weather seals at the inner edges of the leaves will be extended to block air flow through the centre of the door. Any desired means can be provided to adjust the vertical position of the upper or lower retaining plate, to adjust the force with which the leaves are clamped between the retaining plates.

What I claim is:

1. In a collapsible revolving door having a central vertical axis and a plurality of door leaves, an improved mechanism for normally holding said leaves in radially extended positions for rotation in unison about said axis with the inner edges of said leaves facing said axis, and for allowing collapsing of said leaves, said mechanism comprising:

a. upper and lower retaining plates concentric with said axis,

b. means mounting said upper retaining plate at the top of said door and said lower retaining plate at the bottom of said door for rotation of said upper and lower retaining plates about said axis,

c. a plurality of bearing plates, one secured to the top and one to the bottom of each leaf adjacent the inner edges of said leaves, each bearing plate projecting laterally to each side of the plane of its associated leaf, said bearing plates at the tops of said leaves facing and being spaced just below said upper retaining plate and said bearing plates at the bottom of said leaves facing and being spaced just above said lower retaining plate,

d. two detents coupled between each bearing plate, and the retaining plate associated with such bearing plate, said detents for each bearing plate being located substantially equidistant from the plane of the door leaf associated with such bearing plate and on a horizontal line substantially at right angles to such plane,

e. said detents each including pivot means supporting their associated leaf in normally fixed relation to said retaining plates and being separable upon application of a predetermined force applied thereto in a first direction directed substantially radially

away from said central axis through such pivot means and requiring a substantially higher force in any direction other than said first direction for separation, so that when a door leaf is pushed with a force sufficient to generate at the detents at one side of the leaf a force in said first direction which exceeds said predetermined force, said pivot means at the top and bottom of said one side of such leaf will separate allowing such leaf to pivot and fold about the pivot means at the top and bottom of the other side of such leaf.

2. Apparatus according to claim 1 wherein each said detent comprises a ball housing, a ball retained in and movable in said housing, and biased to a position projecting from said housing, and a ball socket containing a shallow depression therein to seat said ball when said leaves are in their normal radially extended position, said socket including a run-out extending from said depression substantially radially towards said central axis when said leaves are in their normal radially extended position.

3. Apparatus according to claim 2 wherein said ball housings are located in said retaining plates and said sockets are located in said bearing plates.

4. Apparatus according to claim 1 wherein said door has a central rotatable vertical shaft aligned with said axis, said upper and lower retaining plates being concentric with said shaft and secured to said shaft adjacent the top and bottom of said shaft respectively.

5. Apparatus according to claim 2 wherein said ball housings are located in said retaining plates and said sockets are located in said bearing plates.

6. Apparatus according to claim 5 wherein said sockets are each discrete members removable from their bearing plates.

7. Apparatus according to claim 4 including a pair of main housings for said shaft, one at the bottom and one at the top of said shaft, and retaining plates being located in said main housings and said ball housings extending into said main housings.

8. Apparatus according to claim 7 wherein the centres of said detents are spaced about 2¾ inches apart.

9. Apparatus according to claim 4 wherein said shaft includes upper and lower shaft portions, said upper retaining plate being secured to said upper shaft portion and said lower retaining plate being secured to said lower shaft portion, and means coupled to said upper and lower shaft portions for drawing said upper and lower shaft portions together, to secure said leaves between said retaining plates.

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