

Sept. 17, 1968

F. J. McCABE

3,401,734

ARTICULATED BARRIER

Filed July 5, 1966

3 Sheets-Sheet 1

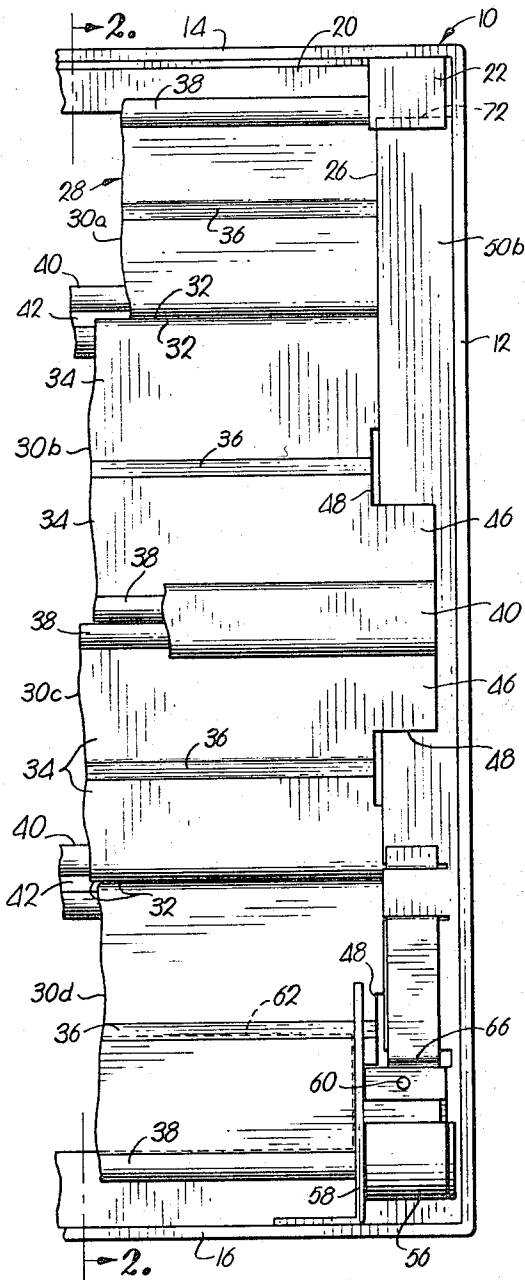


Fig. 1.

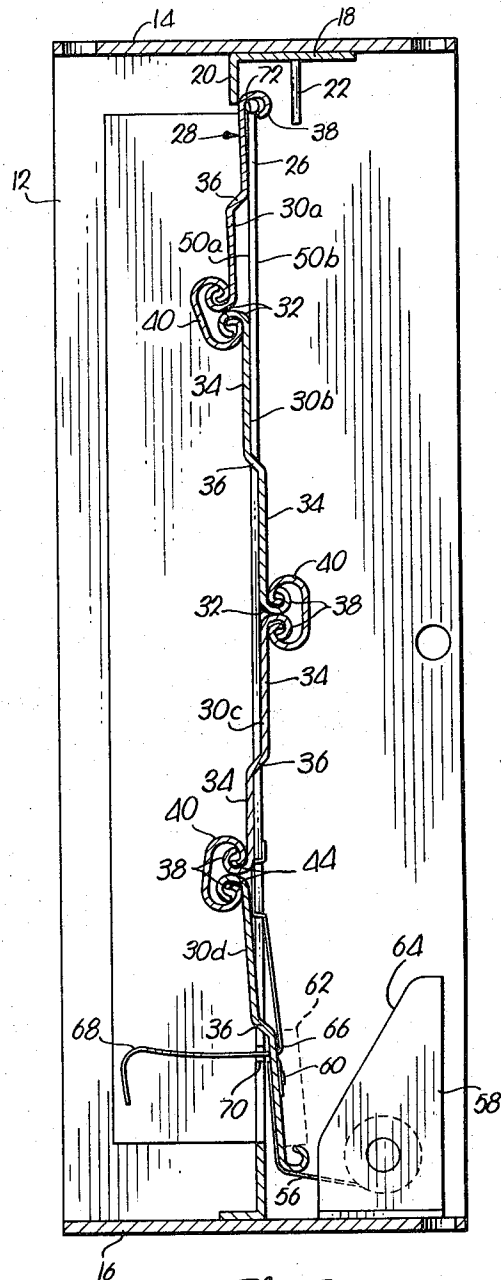


Fig. 2.

INVENTOR
Francis J. McCabe

BY

Novy, Schmidt, Johnson & Novy
ATTORNEYS.

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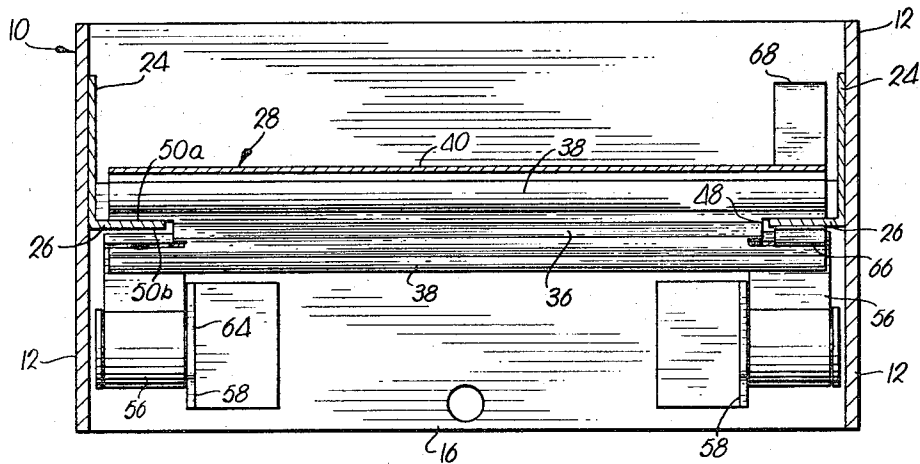


Fig. 3.

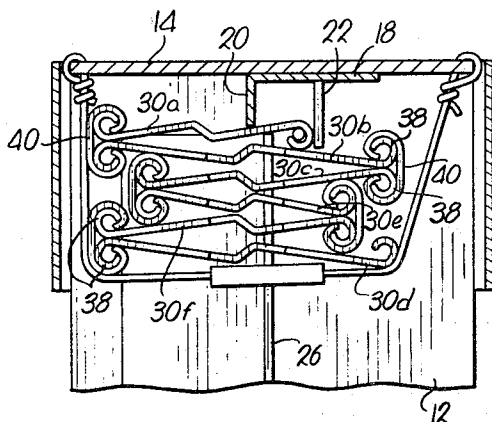


Fig. 5.

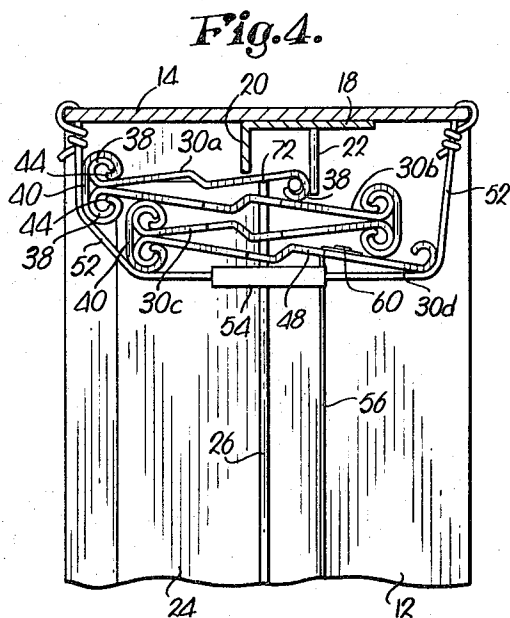


Fig. 4.

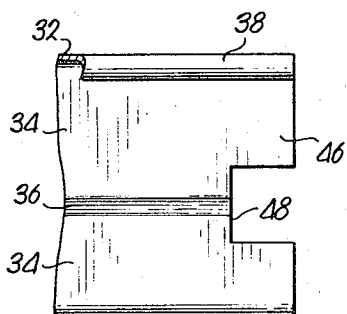


Fig. 6.

INVENTOR
Francis J. McCabe

BY
Hovey, Schmidt, Johnson & Hovey
ATTORNEYS.

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F. J. McCABE

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3 Sheets-Sheet 3

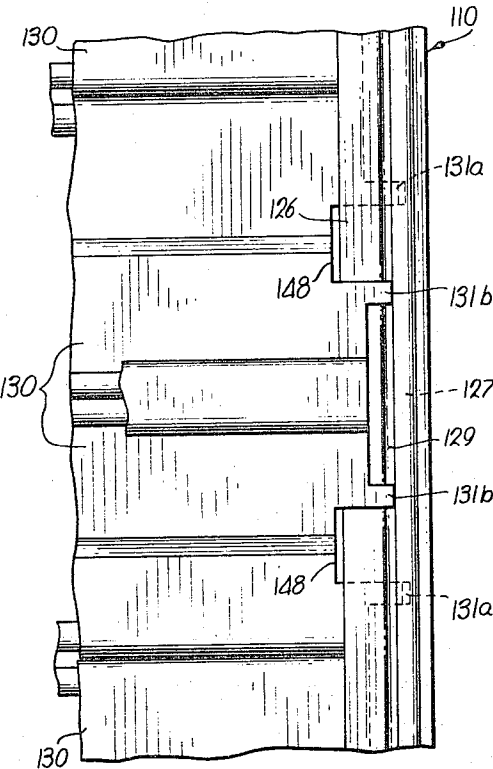


Fig. 8.

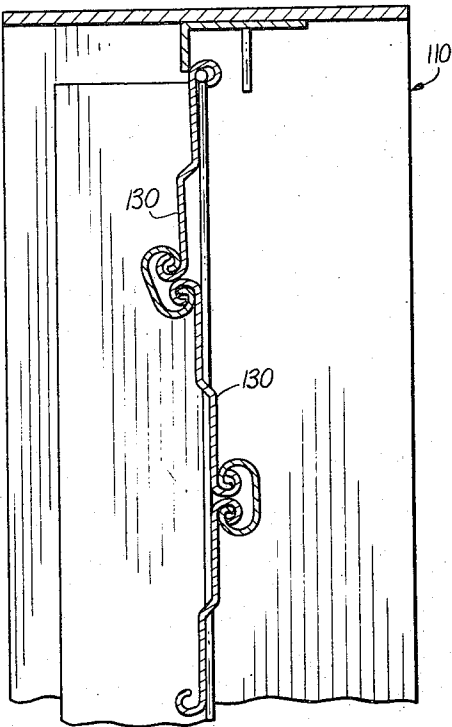


Fig. 7.

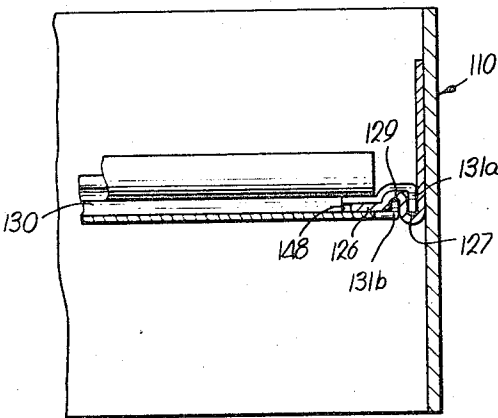


Fig. 9.

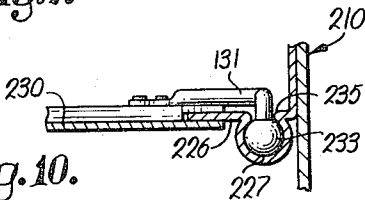


Fig. 10.

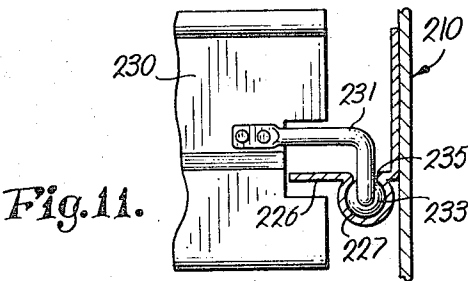


Fig. 11.

INVENTOR
Francis J. McCabe

BY

Hovey, Schmidt, Johnson & Hovey
ATTORNEYS.

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3,401,734

ARTICULATED BARRIER

Francis J. McCabe, Penn's Park, Pa., assignor to Ruskin Manufacturing Company, Grandview, Mo., a corporation of Missouri

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ABSTRACT OF THE DISCLOSURE

A folding blade type barrier including a rectangular frame having a pair of inwardly extending flanges which cooperate with slots in the blade ends to provide a track for movement of the blades from an open to the closed position. The blades have a longitudinally extending offset intermediate the edges of the blade so that a portion of each blade is disposed on each side of the flanges when the blade assembly is opened. The blades may be of three different widths, and are arranged in a series with a blade of intermediate width between blades of the other two different blade widths whereby the hinge joints are staggered when folded to minimize the folded space of the blade assembly.

This invention relates to improvements in barriers of the folding blade type, and more particularly to a barrier having novel sealing and space saving characteristics. Flanges on the barrier frame cooperate with slots in the blade ends to present a novel blade guide or track and to effectively seal the barrier against fluid passage there-through. Three different blade widths arranged in a novel series conserve space required for the folded blade assembly.

Barriers of this type are useful as fire dampers which are commonly utilized in forced air or ventilation ducts and which communicate with a section or room of a building through a fire wall. Where fire walls are required by building codes, air ducts are often permitted if a suitable damper is employed which will close the duct in response to the occurrence of fire on either side of the wall.

The folding blade type fire damper is an advantageous approach to damper construction since the closure, when folded, occupies less space than closures of the rotary door type. However, when it is desired to mount the damper entirely within the confines of the duct, the space consumed by the folded closure is still significant from the standpoint of the reduction in the cross-sectional area of the duct available for air flow. Additionally, a problem is presented in the design of an articulated closure which will provide an effective smoke seal.

It is, therefore, the primary object of this invention to provide a barrier of the folding blade type having an articulated closure which occupies a minimum of space when folded.

As a corollary to the above object, it is an important aim of this invention to provide such a closure wherein the various blades thereof are interconnected by hinge means which extend out of the major planes of the blades themselves, and wherein the blades are dimensioned and configured such that the hinge means are disposed in a staggered configuration when the closure is folded to thereby reduce the space occupied.

Another important object is to provide a novel blade configuration which enables the blades to cooperate with a pair of side guides for the closure in a manner to provide an effective smoke seal when the closure is unfolded.

An additional object is to provide a positive lock which releasably maintains the closure in its unfolded position upon movement thereto in response to a fire condition.

A yet further object of the invention is the provision of interlocking components on the blades and the frame

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respectively for enhancing rigidity of the unit when the blades are in the unfolded position, thus positively sealing the passage against flames, smoke, water or the like.

In the drawings:

FIGURE 1 is a fragmentary, elevational view showing one side of a fire damper with the closure unfolded;

FIG. 2 is a vertical sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a horizontal sectional view of the damper looking downwardly with reference to FIGS. 1 and 2;

FIG. 4 is a fragmentary illustration similar to the view of FIG. 2 but showing the closure in its folded position;

FIG. 5 is a view similar to FIG. 4 illustrating a larger version of the damper in which a closure having a greater number of blades is employed;

FIG. 6 is a fragmentary detail of one of the blades;

FIG. 7 is a fragmentary, sectional view similar to FIG. 2 but illustrating a modified damper having blades of uniform width;

FIG. 8 is a fragmentary, front elevational view of another modified damper, portions of the blades appearing in broken lines to illustrate integral locking lugs on the blades;

FIG. 9 is a fragmentary, horizontal, cross-sectional view of the damper of FIG. 8;

FIG. 10 is a fragmentary, horizontal, cross-sectional view of yet another damper illustrating locking means on a blade and on the frame, the blade being shown in a closed position; and

FIG. 11 is a view similar to FIG. 10 with the blade shown in an open position.

The numeral 10 broadly designates a rectangular frame comprising a pair of spaced, upright plates 12 interconnected by a top plate 14 and a baseplate 16. An angle member 18 is rigidly secured to the underside of top plate 14 and presents a depending flange 20 which extends across the plate between upright 12. A pair of retainers 22 are disposed at respective upper corners of frame 10 and each comprise a downturned tab formed from angle member 18.

A pair of upright angle members 24 are rigidly secured to the inner surfaces of respective uprights 12 and present a pair of opposed, inwardly projecting guides 26 (see particularly FIG. 3). Guides 26 support an articulated closure 28 and provide a track therefor during opening and closing of the closure 28. The closure illustrated in FIGS. 1-4 includes four elongated blades 30a, 30b, 30c and 30d each having a pair of opposed, longitudinal edges 32. Thus, it will be appreciated that the blades are disposed in edge-to-edge relationship when the closure is unfolded as illustrated in FIG. 1 and 2.

Each blade 30a, 30b, 30c or 30d comprises a pair of flat, longitudinally extending portions 34 joined by an integral offset 36. Each portion 34 is provided with an elongated, transversely hook-shaped element 38 integral with its longitudinal edge 32, each pair of adjacent elements 38 being received by a hinge barrel or link 40. Each barrel 40 is of elongated, tubular configuration and is provided with a longitudinally extending opening 42 defined by a pair of elongated, inwardly projecting lips 44. Thus, elements 38 provide pintles which are rotatable in respective barrels 40, the lips 44 being received by respective elements 38 to interlock the same and prevent withdrawal of the blades from barrels 40, while permitting rotating action during the folding and unfolding of the closure as illustrated by a comparison of FIGS. 2 and 4.

Each blade has a pair of opposed extremities 46 and, as is especially clear in FIG. 6, each extremity 46 of blades 30b, 30c, and 30d is cut away as at 48 to present a slot which is centered with respect to offset 36 and extends into portions 34. Slots 48 receive respective guides

26 with the flat portions 34 of each blade 30b, 30c and 30d disposed on opposite sides of the guides. Blade 30a is of the same general configuration as the remaining blades of the series, except that blade 30a is not provided with slots 48. Thus, portions 34 of blade 30a are both disposed on one side of guides 26 when the closure is unfolded (FIGS. 1 and 2).

Each guide 26 is a relatively thin member and presents a pair of opposed, longitudinally extending faces 50a and 50b. It will be appreciated, particularly in FIG. 2, that the offsets 36 in blades 30b and 30c not only cause portions 34 of these two blades to remain on opposite sides of guides 26 when the closure is unfolded, but also dispose portions 34 such that the latter bear flatly against faces 50a and 50b to provide an effective smoke seal.

Referring to FIG. 4, closure 28 is held in its folded position by a pair of wires 52 interconnected by a fusible link 54 which melts when the ambient temperature reaches a dangerous level indicative of the occurrence of a fire. When the link melts, the blades are shifted to the unfolded position by a pair of springs 56 rotatably carried by a pair of upright ears 58 on baseplate 16. The ends of springs 56 are rigidly connected to respective lower corners of blade 30d by rivets 60 or any other suitable fastening means. Alternatively, when the damper is oriented as illustrated, closure 28 may be permitted to unfold by gravity, positive action being assured by the addition of a bar weight 62 illustrated in phantom lines in FIGS. 1 and 2. Link 54 is replaced when it is desired to reset the damper once the hazardous condition is corrected.

Each ear 58 is provided with an inclined cam surface 64 which serves to direct the descending closure to the final disposition illustrated in FIG. 2. When the closure reaches the fully unfolded position, a spring catch 66, mounted on the right-hand guide 26, positively locks the closure to prevent raising thereof until it is desired to reset the damper after correction of the hazardous condition. Note that, if force is applied to the closure which tends to raise the same, the edge of the lower portion 34 of blade 30d defining the lower margin of the right-hand slot 48 therein will engage catch 66. In order to facilitate release of the catch from either side of the damper, an extension 68 projects through a slit 70 in the adjacent guide 26 to the opposite side of the closure.

Referring to FIG. 5, an enlarged version of the damper is shown wherein closure 28 is provided with two additional blades 30e and 30f disposed between blades 30c and 30d. Other than the addition of blades 30e and 30f, the structure as shown in FIG. 5 is identical to the four blade closure illustrated in FIGS. 1-4.

Referring to FIG. 4, it may be seen that the four blades 30a-30d have three different widths. Blades 30b and 30d are equal width and have the greatest transverse dimension. Blade 30a is narrowest, and blade 30c is of intermediate width. The effect of this dimensional relationship among the four blades is to cause the two left-hand hinge barrels 40 to assume a staggered configuration when closure 28 is folded. In this manner, these two adjacent barrels 40 do not engage each other but are out of vertical alignment, thereby permitting the barrels to vertically overlap and reduce the space occupied by the folded closure.

The saving in space gained by the staggered arrangement of the hinge barrels 40 is especially evidenced by the illustration of FIG. 5 where the larger, six-blade closure is shown. Blades of three different widths are also utilized in the FIG. 5 version; blades 30b and 30d are of equal and greatest width, blades 30a and 30e are narrowest and are also equal in width, and blades 30c and 30f are of equal, intermediate width. Thus, depending on the required size of closure 28, any number of blades of the three relative widths illustrated may be utilized to form a closure of desired size. In order to preserve the staggered relationship of hinge barrels 40 when the closure is folded, every other blade in succes-

sion after the initial hinge barrel 40 of the blade series will be of intermediate width, as evidenced by blades 30c and 30f shown in FIG. 5. Additionally, for closure such as illustrated in FIG. 5 wherein a large number of blades are required, the interconnecting blades between the end blades 30a and 30d will be arranged in a given sequence until the desired closure size is obtained, i.e., long, intermediate, short, intermediate, long, etc.

In operation, the melting of fusible link 54 permits closure 28 to fall to its unfolded position by gravity, or to shift to such position under the action of springs 56, depending upon the orientation of the damper and the means selected for closing thereof as discussed hereinabove. As the closure advances from its folded to its unfolded position, elements 38 rotate in respective hinge barrels 40 but are maintained therein by the interlocking action of lips 44 and the hooks formed by elements 38. The elements 38 of each blade are disposed on opposite sides of the blade, thereby facilitating this rotative action.

Since the elements 38 of each blade are on opposite sides and thus project away from the guides 26 when the closure is in its unfolded position, offsets 36 permit the interconnecting blades between end blades 30a and 30d to shift to a final position, as best illustrated in FIG. 2, where the flat portions 34 of each interconnecting blade are flush with faces 50a and 50b respectively of the guides. As the closure unfolds, the upper element 38 of upper end blade 30a shifts from the position illustrated in FIGS. 4 or 5 to the position illustrated in FIGS. 1 and 2, and hooks over the upper margins 72 of respective guides 26. Note that flange 20 is in sufficiently closely spaced relationship to margins 72 to force the upper element 38 of blade 30a to interlock with margins 72, thereby precluding the possibility of blade 30a escaping from the guides under the momentum of the unfolding closure.

A modified form of barrier is illustrated in FIGS. 7, 8 and 9. This form of the invention is similar to that hereinabove described except for blade width and the provision of structure for stabilizing the closure when the latter is in the flow blocking position. To this end, the elongated guide 126 of frame 110 is of generally S-shape in transverse cross-sectional configuration to provide longitudinally extending grooves 127 and 129 respectively on opposite sides of guide 126 as is best shown in FIG. 9. Each blade 130 has an outwardly extending hook member 131a and 131b on respective opposite sides of its corresponding slot 148. Thus, when each blade is in the unfolded or blocking position, the hook member 131a thereof engages in groove 127 of guide 126 and member 131b engages in groove 129 of the guide. This stabilizes the closure to make an extremely tight seal and one that will not yield under extreme force against the blades such as might be exerted by strong air drafts, water under pressure or the like.

The hooks 131a and 131b will be withdrawn from the grooves to swing out of the way on either side of guide 126 when the blades are folded. It will be understood that the opposite ends of blades 130 may be constructed similar to the ends illustrated, to cooperate with a guide (not shown) identical to guide 126.

FIGURE 7 illustrates that blades 130 may be of equal width, top to bottom, if desired. Ordinarily, however, the advantageous features which may be achieved by use of an arrangement of blades of unequal width will be employed to conserve space.

The modification illustrated in FIGS. 10 and 11 is similar to the structure shown in FIGS. 8 and 9 with the exception that each blade 230 has only a single stabilizing member 231 at each end of the blade. The members 231 are in the form of arms secured to the respective blades, said arms terminating in generally spherical terminals 233 which are received in complementally-shaped grooves 227 in the elongated guides 226 on each side of frame 210.

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It may be seen that the open neck 235 of the groove 227 permits the arms 231 to swing with respect to guides 226 when blades 230 move between the open and closed positions. Terminal 233 is free to pivot in the groove, as well as to move longitudinally thereof as its corresponding blade moves, yet the blade is stabilized in the frame to resist forces directed against its face.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a barrier:

a frame; and

an articulated closure mounted in said frame for movement between an unfolded, flow blocking position and a folded position permitting passage of fluid through the barrier, and including a series of elongated blades hingedly interconnected along longitudinal blade edges,

said frame being provided with an elongated guide for said closure,

each of said interconnected blades having a pair of flat, longitudinally extending portions presenting respective edges thereof, a longitudinally extending offset intermediate the edges of the blade and interconnecting said portions to dispose the latter out of alignment with each other, and a slot in said offset extending into said portions,

said slots receiving said guide with said portions of each interconnecting blade being disposed on opposite sides of the guide.

2. The invention of claim 1,

said frame being provided with a pair of spaced, elongated guides for said closure,

each of said interconnecting blades having a slot in each respective end extremity of the blade,

said slots receiving respective guides with said portions of each interconnecting blade being disposed on opposite sides of the guides.

3. The invention of claim 2,

said guides being disposed in parallelism and each comprising a relatively thin member presenting a pair of opposed, flat faces,

said portions of each interconnecting blade engaging respective faces of each guide and bearing flatly thereagainst when the closure is in its unfolded position.

4. In a barrier:

a frame;

an articulated closure mounted in said frame between an unfolded, flow blocking position and a folded position permitting passage of fluid through the barrier and including a series of elongated blades,

hinge means interconnected said blades,

said hinge means including a hook on each of the adjacent, longitudinal edges of said interconnected blades, said hooks being bent away from the respective major planes of the corresponding blades,

there being a pair of said blades defining respective

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ends of said series and the remaining interconnecting blades being of three different predetermined widths, each alternate interconnecting blade of said series of interconnecting blades being of intermediate width, whereby said hinge means interconnecting successive pairs of blades are disposed in offset relationship when the blades are in said folded position to minimize the space occupied by said folded closure.

5. The invention of claim 4, said interconnecting blades being of three predetermined widths,

a blade of least width and a blade of greatest width being joined together by a blade of intermediate width.

6. The invention of claim 5,

each of said interconnecting blades having a pair of flat, longitudinally extending portions presenting respective edges thereof, and a longitudinally extending offset intermediate the edges of the blade and interconnecting said portions to dispose the latter out of alignment with each other, whereby to further reduce the space occupied by the closure when the latter is in its folded position.

7. In a barrier:

a frame; and

a closure mounted in the frame for movement between a flow blocking position and a position permitting passage of fluid through the barrier, and including one or more elongated blades, each blade having a pair of opposed extremities and including a pair of flat, longitudinally extending portions presenting respective edges thereof, a longitudinally extending offset intermediate the edges of the blade and interconnecting said portions to dispose the latter out of alignment with each other, and a slot in each respective end extremity of the blade,

said frame being provided with an elongated, spaced apart flange adjacent each end of the blade, each flange extending into a corresponding proximal slot of each blade with the portions of each blade being disposed on opposite sides of the flanges.

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DAVID J. WILLIAMOWSKY, *Primary Examiner*.

DENNIS L. TAYLOR, *Examiner*.