Nov. 19, 1968 P. T. HAURY 3,411,560

SELF-SUPPORTING PLEATED SLAT CLOSURE

Filed March 29, 1966

FIG. 1

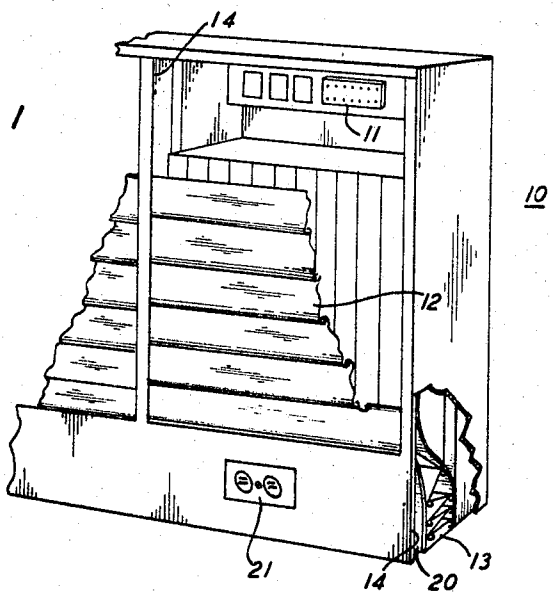


FIG. 2

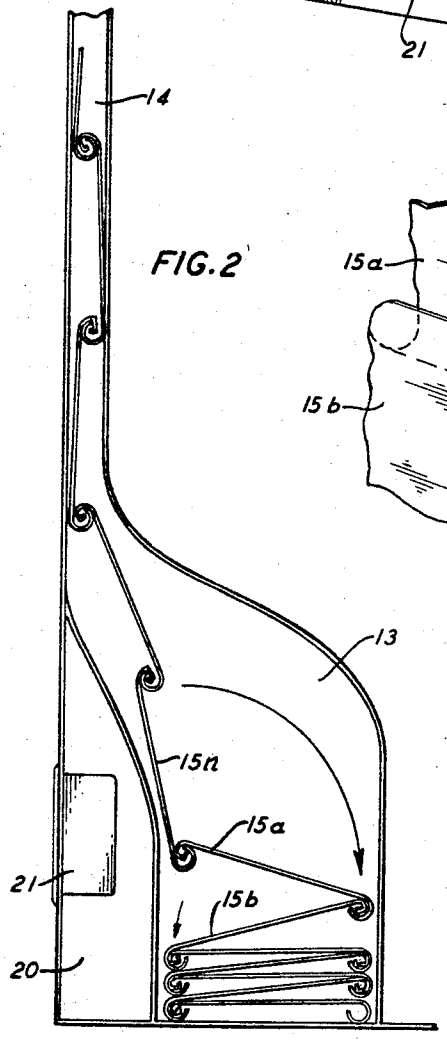
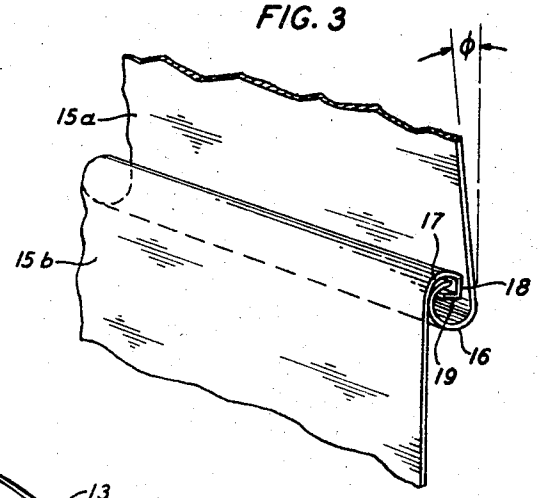


FIG. 3



INVENTOR
P. T. HAURY
BY C. E. Hirsch Jr.
ATTORNEY

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SELF-SUPPORTING PLEATED SLAT CLOSURE

Paul T. Haury, Berkeley Heights, N.J., assignor to Bell Telephone Laboratories Incorporated, New York, N.Y., a corporation of New York

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ABSTRACT OF THE DISCLOSURE

A pleated slat closure for apertured structures is formed of a number of individual slats longitudinally hinged to one another by specially formed edges. An angled edge on one slat engages a partially curled edge of another in a fashion such that positional stability is assured in a channeled guide without external support. Moreover, a pleating memory is developed so that the slats may be stored without additional attention.

This invention relates to pleated slat closures for apertured structures, or the like, and more particularly to the construction of an articulated aperture cover from a plurality of elongated slats interengaged by a unique, multipurpose, formed coupling. It has for its principal object the provision of positive positional stability and pleating memory in a sliding aperture cover.

Sliding aperture covers, composed of a number of parallel elongated slats, have been proposed for and used in the covering of apertures such as the doors of electrical equipment, racks or the like. In a preferred form, the sliding closure is arranged to provide a relatively solid cover in the extended position and to fold in a zig-zag fashion in the closed position. Thus, storage requirements are minimized, and the usual space difficulties present with solid, hinged door arrangements are avoided. Unfortunately, however, available articulated slat closures require additional means for holding the closure in a stable position when extended, and additional means for guiding the individual slats into proper alignment within the storage magazine during retraction. A variety of hangers, detents and locks have been provided for the former function, and formed rails and guides have been employed for the latter function.

In accordance with this invention, each of two important requirements, namely, positional stability and pleating memory, is achieved through the unique construction of hinge-like configurations provided at the edges of each slat by which each slat is coupled to the next adjacent slat. According to the invention, one longitudinal edge of each elongate slat member employed in the construction of an aperture closure is equipped with a smooth roll transversely disposed to create a tube-like formation in which the edge of the elongate member is positioned essentially normal to and at a selected distance from the body of the member. The other longitudinal edge is equipped with a smoothly rolled initial portion and a connected acutely angled portion. In a preferred form of the invention, the angled portion is formed by a pair of substantially plane longitudinal portions disposed to create a sharply angled juncture at a selected distance from the body of the member. Adjacent slats in the closure are preferably arranged with edge formations facing in opposite directions and oriented such that the sharply angled formation on the edge of one slat engages the edge of the smoothly curved formation on the adjacent slat.

With this construction and interconnection, adjacent slats are hinged to one another in a fashion such that alternate slats in the closure may be made to fold smoothly upon one another in the desired zig-zag arrangement. Folding is smooth and controlled in one direction by virtue of the tube-like bore within which the sharply angled edge formation of an adjacent slat is free to rotate. Folding is blocked in the other direction, beyond a threshold, through the engagement of the sharply angled formation with the edge of the tube-like formation. Consequently, folding is completely controlled, e.g., as the slats of a shutter or the like are urged into a magazine, so that auxiliary guide members or the like are not required.

Moreover, in accordance with a feature of the invention, a guide channel is provided, preferably at each edge of the closure, for containing the extended slat closure. The guide tracks are dimensioned to accommodate the longitudinally hinged slat members for easy, individual passage. In the extended configuration, however, the guide assures that the sharply angled formation on one longitudinal edge of each slat bears against the edge of the smoothly curved formation of the adjacent slat. By adjusting the "reach" of the sharply angled edge of each slat, i.e., the extent of its projection away from the body of the slat, adjacent coupled slats at rest in the extended position exhibit in nonparallel, slightly zig-zagged configuration. In the track, however, each slat is urged to assume a position essentially parallel to the next adjacent slats. As a result of the effective stop created by the short reach of the sharply angled edge of each slat, and the nonparallel rest position of adjacent slats, each slat is urged at one of its edges toward one side of the guide track and at its other edge toward the other side of the track. Sufficient friction is thus created between the guide and each hinge member to hold the extended cover in position at any point within the track. Yet, the cover may be smoothly moved within the guide against this slight frictional force.

Thus, in accordance with the invention, slats are formed with one edge smoothly rolled and the other edge partially rolled and partially folded into a pair of plane acutely angled portions. Adjacent slats are concentrically interconnected and located wtihin a channel guide which is selectively dimensioned to accommodate a pair of such interconnected slats in substantially parallel alignment. The slats are dimensioned so that when the slats are free of the channel guide, the smoothly rolled and the angularly folded edges permit rotation of interconnected slats from a folded position, in which the slats are substantially parallel to an unfolded position, in which the slats are prevented from attaining parallel alignments. Interconnected slats are thus stressed against the guide channel when drawn into that channel. However, the slats tend to spring back toward a folded position when drawn from the channel into a storage magazine. The stress against the channel is sufficient to support the interconnected slats in any position within the channel while the acutely angled edge configuration of the slats is such as to communicate longitudinal force between slats and thus permit the closure to be moved within the channel when desired.

The invention will be fully apprehended from the following detailed description of an illustrative embodiment thereof taken in connection with the appended drawings in which:

FIG. 1 illustrates, by way of a partially cutaway view, an equipment rack provided with a pleated slat closure constructed in accordance with the invention;

FIG. 2 illustrates, in a cross-section view, a pleated slat closure partially extended and partially stored in a magazine; and

FIG. 3 illustrates the unique longitudinal coupling of individual slats in accordance with the invention.

In the example of use shown in FIG. 1, an equipment rack **10**, of any desired size and construction, is employed to support electronic components **11**, or the like. The rack is equipped with a sliding articulated closure **12**, shown

in its partially extended position. By virtue of the cutaway illustration, the manner in which the closure is formed from a plurality of parallel slats, each with a formed edge, is apparent. A storage magazine **13** for the closure is visible at the lower front portion of the equipment rack. In this example of use, a channel **20** is provided between the front of rack **10** and magazine **13** to accommodate convenience outlets **21**, or the like. If this facility is not required, magazine **13** may abut the front of the cabinet.

The pleated closure is supported at its edges by generally U-shaped channels **14**, one of which is visible at the left of the rack and the other of which is partially visible in the cutaway view adjacent magazine **13**. In accordance with the invention, closure **12** may be withdrawn from magazine **13** to cover any portion of the aperture in rack **10**. As it is withdrawn from magazine **13**, it will remain firmly positioned at any location desired. As the closure is forced downward in order to open the rack aperture, the individual slats fold upon themselves in magazine **13**.

FIG. 2 illustrates by way of an end view the manner in which a pleated slat closure is formed of a number of connected individual slats and the manner in which the closure is supported within a magazine-terminated guide system in an equipment rack. Adjacent slats **15** are coupled to one another in a fashion such that a sharply angled longitudinal formation along one edge of one slat engages the smoothly curved formation along the edge of the other. Adjacent ones of the slats face in the opposite direction. Guide system **14**, which may be simply a pair of narrow channels of sufficient width to support the slats at both ends, is arranged to terminate, preferably at its lower extremity, in a magazine **13** of sufficient width to accommodate the transverse dimension of the slats. It will be recognized that the widths of the individual slats may be varied in accordance with the particular application, that adjacent slats need not be of the same width, and that the longitudinal dimension may be proportioned according to the requirements of the equipment. For most applications the slats may be constructed of metal, for example, of sheet aluminum with a thickness of from 0.015 to 0.020 inch, and may be textured or finished in any desired manner. Different surface finishes may be used on alternate slats to produce a shingled effect. Formed plastic slats may of course be used, although the radio frequency shielding effects of the metallic arrangement would be lost. It has been found that metallic slats may be formed by a rolling process whereas plastic slats would be extruded or molded.

The unique coupling between adjacent slats is shown in detail in FIG. 3. One edge of each slat, e.g., **15***a* in the figure, is formed with a smoothly curved, nearly circular edge formation **16** which creates an open-ended tube-like bore along the edge of the slat. Preferably, the curved edge formation exhibits a substantially constant radius of curvature. The edge of the elongate member is brought to a position approximately normal to the body of the member at a distance, approximately equal to the radius of curvature from the body of the member. The adjacent slat **15***b* has its edge formed as a smoothly curved arc **17**, preferably with the same radius of curvature exhibited by formation **16**, which extends the slat edge to a position approximately at right angles to the body of the slat, at which point the edge is terminated by an acutely angled formation, preferably by a pair of right angle faces **18** and **19**. Face **18** preferably extends approximately one half of the radial distance defined for the arc **17** of the slat edge. Although slats equipped throughout their length with the unique edge formations of the invention are preferred, it is of course feasible to employ sections only of the formations along the edges of the slats; i.e., the edge formations may be serrated.

With this construction, curved edge **16** of slat **15***a* may be longitudinally inserted with its outer edge grasped within the channel formed by arc **17** and faces **18** and **19** of slat **15***b*. Evidently, slat **15***a* in FIG. 3 may freely roll in a counterclockwise direction, about the edge of face **19** as a pivot, to fold back on the (left facing) surface of slat **15***b*. This folding action is evident in correspondingly numbered slats **15***a* and **15***b* in FIG. 2. On the other hand, with slat **15***b* held firm, slat **15***a* is estopped from rotating in the clockwise direction by virtue of the engagement of the edge of rolled member **16** with the inner surface of face **18**. Thus a "pleating memory" is inherently present, that is, as the closure is urged into magazine **13** (FIG. 2), each of its slats is free to fold in only one direction. Since adjacent slats are oppositely coupled, the desired zig-zag configuration for the folded closure is established.

Positive stability for the closure in any vertical position is assured by proportioning the reach of the two engaged formed edges such that slats **15***a* and **15***b* are held in slightly nonparalleled alignment in the rest, nonstressed position. Thus, as an attempt is made to move slat **15***a* in the clockwise direction, it reaches a firm stop against member **18** such that a slight angle ϕ, on the order of one or two degrees, is present. Consequently, by proportioning channel **14** to a width which accommodates a pair of slats measured from the outer edge of one joint to the outer edge of the next, the slight angling assured by the coupling arrangement provides a slight deformation of each slat, generally an S-shaped deformation across the breadth of the slat. That is to say, each elongate slat member preferably exhibits substantial longitudinal rigidity and slight transverse flexibility. This deformation, visible in the upper portion of FIG. 2, assures sufficient friction between the slats and the guide to hold the cover at whatever position it is placed. Spring-like action of this sort also aids the pleating memory to assure orderly stacking in the storage magazine.

The advantages of the arrangement described hereinabove will be evident to those skilled in the art. Adjacent slats face in opposite directions so that the cover **12** may be grasped for opening or closing at each joint. By virtue of the relatively tight fit at each joint, a metallic cover provides good radio frequency shielding for equipment in a rack or the like. Individual slats may be removed for repair or maintenance by withdrawing the slat in the longitudinal direction from the edge of the cabinet. The entire cover may be removed as a unit from the magazine without the necessity of releasing drawcords, hangers, or the like. And, finally, the tolerances on cover construction and track spacing are not overly critical; fabrication is relatively easy.

Other features will be evident to those familiar with the art. For example, slats may be fabricated with both edges formed with a smooth, open-ended roll, the formations extending from opposite sides of the body of the slat. Other slats may be fabricated with both edges formed with a partial roll terminating in an angled channel, also with the formations extending from opposite sides. With this construction, a closure may be assembled which exhibits a shingled appearance, without, however, relinquishing the many advantages of the invention. Other modifications and applications may similarly be made without departing from the spirit and scope of the invention.

What is claimed is:

1. An aperture enclosure which includes:

a pleated shutter composed of a plurality of individual substantially plane slats slideably supported within a pair of channeled guides; said individual slats being longitudinally hinged to one another via interengaged formed edges, one longitudinal edge of each of said slats being formed with a smooth, open-ended roll, and the other edge being formed on the same side thereof with a partial roll terminating in an acutely angled portion; said acutely angled portion being formed by a pair of longitudinal segments,

the first of which is substantially parallel to said plane portion of said slat and the second of which is substantially perpendicular to said plane portion of said slat; said open-ended roll and said acutely angled portion being respectively spaced at distances from the plane of the body of said slat such that a pair of coupled slats may be hinged to fold upon one another in one direction of rotation but restrained from reaching parallel body alignment in the other direction of rotation; the channel of each of said pair of channeled guides being selectively dimensioned to constrict each pair of said hinged slats within the channel in substantially parallel alignment so that, by virtue of the tensed engagement of said substantially parallel longitudinal segment with said edge associated with said smooth roll, each of said slats springs into angled alignment for pleated folding when withdrawn from said channel; and said channels being further selectively dimensioned at

one end thereof to form a magazine of sufficient width to accommodate the transverse dimension of said slats.

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DAVID J. WILLIAMOWSKY, *Primary Examiner.*

DENNIS L. TAYLOR, *Assistant Examiner.*