

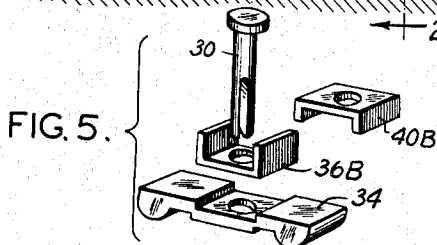
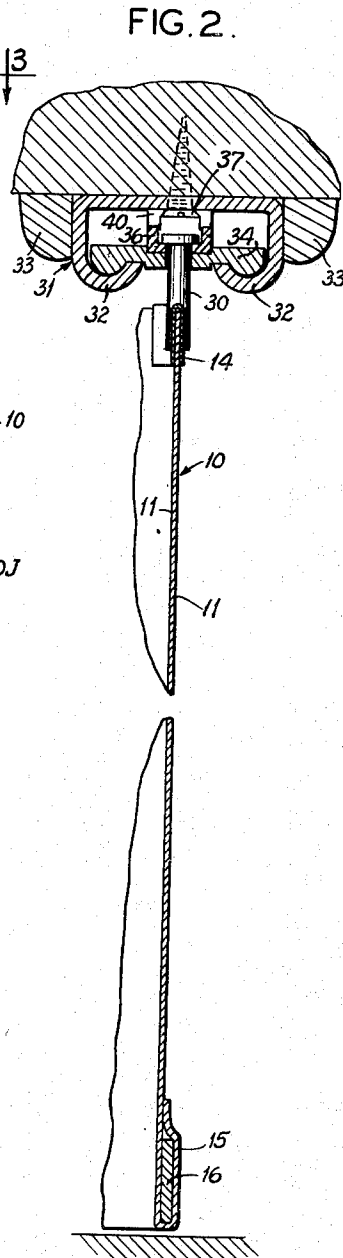
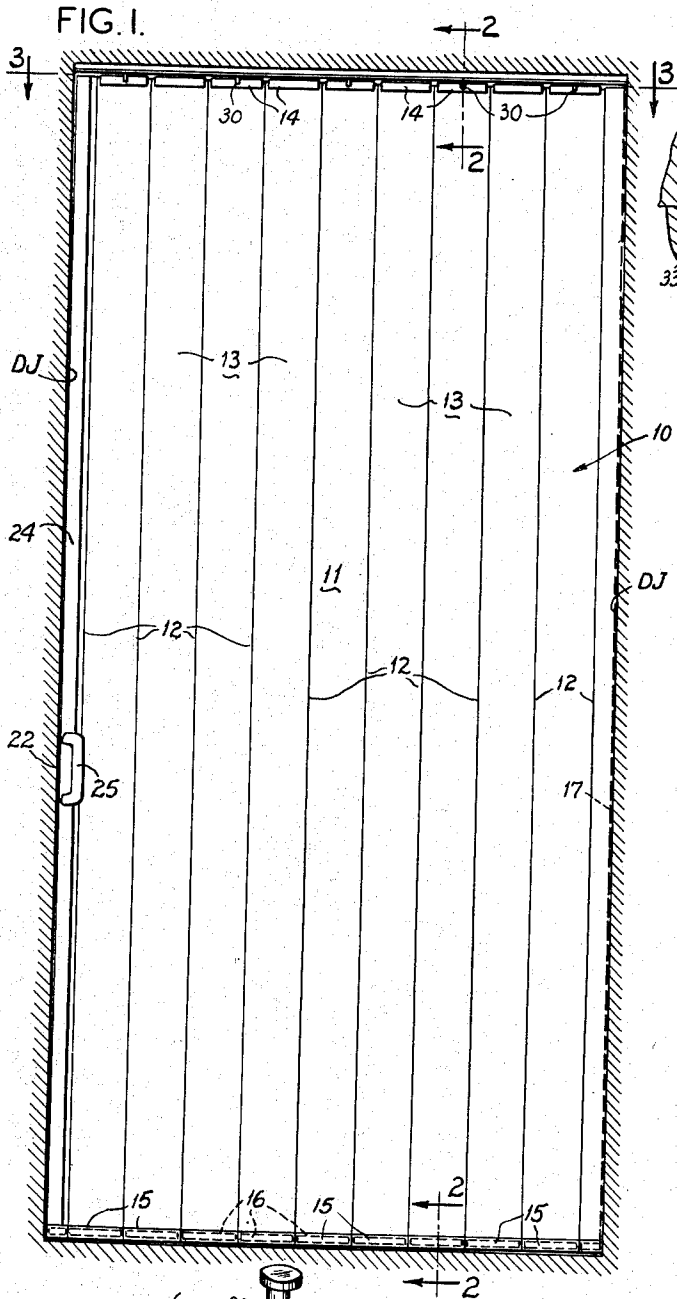
Aug. 24, 1954

T. L. JOHNSON
ACCORDION-TYPE DOOR

2,687,170

Filed Feb. 27, 1952

2 Sheets-Sheet 1



INVENTOR,
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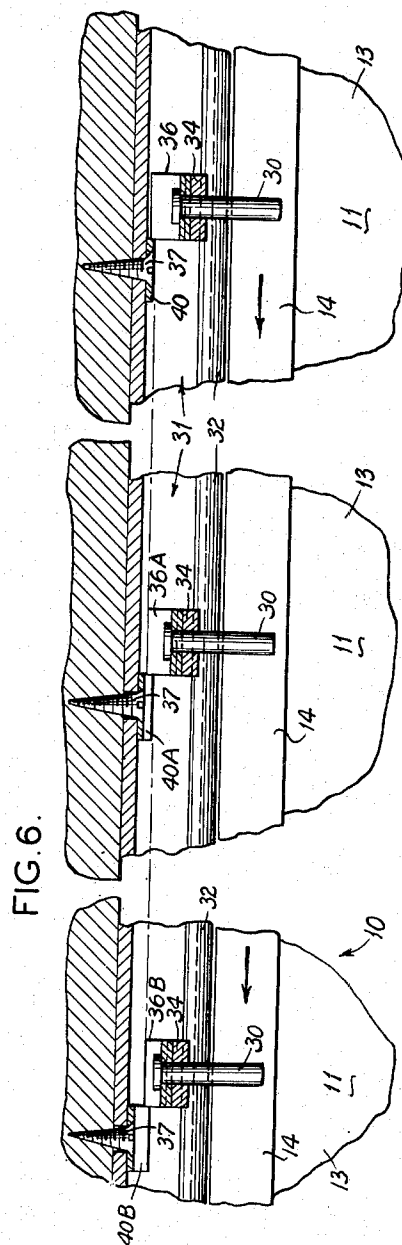
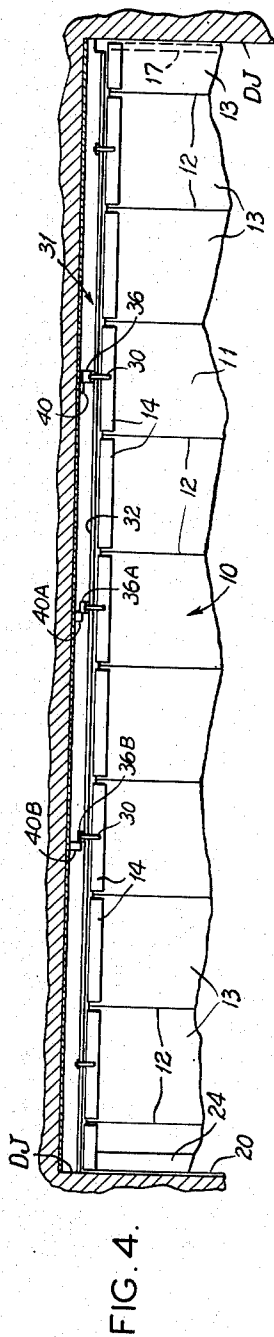
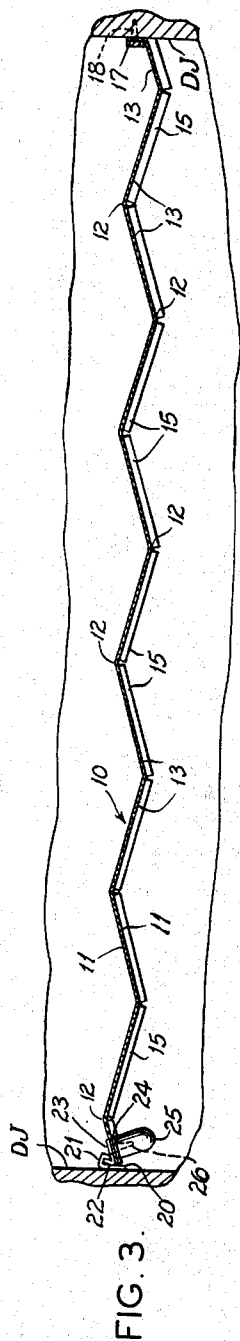
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UNITED STATES PATENT OFFICE

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ACCORDION-TYPE DOOR

Theodore L. Johnson, Kirkwood, Mo.

Application February 27, 1952, Serial No. 273,605

3 Claims. (Cl. 160-84)

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This invention relates to improvements in accordion-type doors, and more particularly to an improved light-weight, low-cost, easily manipulable accordion door assembly which, without limitation, is particularly adapted to embody a closure element of fabric.

This applicant is aware of numerous types of foldable doors heretofore employed as closures for openings of various sizes, such as single or double width door openings, and the usage in many cases of fabric curtains for a great variety of concealment and closure purposes. However most if not all of the folding doors of edge-connected accordion-type panels, have heretofore been characterized by complicated arrangements of linkage elements, in many cases of so-called "lazy tongs" type, introducing an objectionable weight to such closures, requiring a high production cost and sometimes involving the use of scarce materials, as well as requiring specialized skill in installation. Those closures of accordion-type heretofore available and predominantly of fabric construction, are characterized by uncertainties of operation, irregularities in folding, uneven disposition of panels when the fabric elements are extended for closure purposes, and in other ways have presented many objections in usage. It is accordingly a major and principal object of the present improvements to combine at a low cost and light weight, the advantages of a fabric closure of accordion type, while obviating the disadvantages thereof, and in so constructing the assembly that, while of much reduced weight, it presents the advantages of a foldable closure or partition in which the panels are of rigid construction.

A further object of the invention is realized in a light-weight, easily manipulable closure assembly of the type noted, resulting in a marked reduction in space requirement of the folded or closed accordion structure, thus materially enhancing the width and area of clear opening through a doorway or the like when the closure is in open or overfolded relation at one side of the portal.

Yet a further and highly valuable objective of the present improvements is realized in a novel provision for limiting the extent of opening, as well as the relative angularity, of each of a series of vertical panels in an accordion type closure thus conducing to better appearance, evenness of tension across the closure element, and by virtue of the same provisions, assuring even dimensions of the several panels or folds, and enabling stacking of the panels identically under all conditions.

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A still further object of the invention is realized in a closure element of the general type referred to, particularly one utilizing a fabric or other flexible closure, in that the individual panels of the door or partition are evenly tensioned, in a vertical direction, at all times and under all conditions.

An additional important object of the invention is realized in a closure formed of a treated fabric material so as to enhance the useful life of same, minimize cleaning requirements and serving to render the fabric flame- and mildew-resistant.

An added noteworthy object is realized in an improved light-weight, easily installed provision for anchorage of the opposite side margins of an accordion door or the like, with provisions for a detachable anchorage at one such margin so as to enhance the certainty and minimize the effort of fastening and unfastening the closure element as same is brought to and removed from its position of closure with respect to a door opening.

The foregoing and numerous other objects will more clearly appear from the following detailed description of a currently preferred embodiment of the invention, particularly when considered in connection with the accompanying drawing, in which:

Fig. 1 is a side or a face view of the closure and supporting elements of an assembly embodying the present improvements;

Fig. 2 is an enlarged transverse sectional view taken along line 2-2 of Fig. 1;

Fig. 3 is a somewhat enlarged horizontal sectional view through the upper end of the door structure, as particularly located by line 3-3 of Fig. 1;

Fig. 4 is an enlarged, partly diagrammatic view of the upper portion of the assembly, particularly showing the arrangement of stop elements;

Fig. 5 is an exploded view of one of the stop devices including an associated panel support, a journal and a track-riding element, and

Fig. 6 is a substantially enlarged vertical sectional view, partly broken away for clearness, to show the construction and arrangement of parts of the stop devices.

Referring now by characters of reference to the drawing, and first to the flexible closure portion of the accordion door assembly, this latter may if desired, but without limitation thereto, be formed of a single ply or thickness of a double coated fabric. This latter may consist of any suitable textile material whether of wool, cotton, linen or in fact any of the natural or synthetic

fibers. This door element proper, indicated generally at 10, is preferably provided with an impregnating coating 11 on each of its opposite sides. This coating which should be more truly referred to as an impregnant, may consist of a suitable vinyl resin or other plastic impregnant, preferably of a flame-resistant type and one which is not subject even in moist climates to the action of mildew or other fabric molds. The treated material 10-11 is to be prepared and offered to the trade in a variety of colors and grain textures.

The flexible element or accordion structure proper is, after treatment, pre-folded and pressed so as to provide, evenly horizontally spaced across the fabric, a series of fold lines or creases 12. These folds present hinge margins of a rather sharp character, so that there is little tendency of the fabric, when the accordion element 10 is stacked, to fold in any region other than along the several creases or pre-fold lines 12. From this fact there results a series of even-width vertical panels 13, it being understood that in the case of odd width door openings, one or both of the end panels may be formed of a somewhat greater or lesser width than the preferably uniform intermediate panels, merely for the purpose of adapting the closure to specifically dimensioned door or like openings.

So as to assure a freedom of the several panels from unwanted creases or wrinkling effects, each panel 13 is preferably provided with a pair of transverse reinforcing or stiffening elements. These include, at the top of each panel, an overfolded metal plate 14 between the folds of which is received the upper margin of the cloth panel with the plate crimped securely in gripping relation to the top of the panel. As will appear from the drawing (Figs. 1 and 4), each of the plates 14 is of a somewhat less horizontal dimension or length of plate, than the width of the panel. This arrangement, as will now appear obvious, is of advantage in that when the several vertical panels 14 are overfolded, as when the door is in open position, there will occur no interference between the nearest end margins of the reinforcing and supporting plates.

In the lower end region of each of the vertical panels is a metal weight pocket which is of substantially the same length or horizontal dimension, as the metal plate 14. The weight pocket indicated at 15 may be formed of an upturned lower margin of the panel and is stitched, or preferably cemented along its upper margin and at its ends, to contain therein a metal or other weight 16 which, when disposed in the closed pocket, is of such mass as to keep the individual panel taut at all times.

Along the vertical starting margin of the accordion closure 10, anchorage to the door jamb DJ is conveniently effected as by a thin, vertical, preferably metal anchor strip 17 secured by screws 18 to the jamb DJ in such position that the starting margin of the first panel 13 lies in the vertical midplane of the closure and also preferably midway of the depth of the door opening.

A generally similar form of anchorage is provided at the opposite vertical margin or closing edge of the accordion door, in the region of which there is provided, suitably attached to the opposite door jamb DJ, a stationary, preferably metal strip 20 which is extended to provide over a portion of the length of the strip, a hook structure 21. Coacting with the hook 21 is a companion hook portion 22 forming an extension of a hook plate 23 which coacts with a companion

plate 24 so as to receive, in clamped relation between the plates 23 and 24, the free vertical edge of the final fabric panel or an extension thereof.

For convenience of actuation in fastening and unfastening the door, there is provided a D-shaped handle 25, conveniently formed of an extruded plastic or other material, the horizontal legs of which contain, close to the plate 24, tapped metal inserts to receive screws or the like 26. These latter may serve the dual purposes of handle attachment and assembly of the plates 23 and 24 on opposite sides of the door fabric.

Proceeding now to describe the arrangement for mounting or hanging the accordion structure, a preferred form of primary support consists of a vertical pivot or swivel element in the form of a stem attached along a vertical median line to all or selected ones of the metal plates 14 at the top of the panel. Each such stem, indicated at 30, is provided over a lower portion, with a longitudinal kerf or split, preferably of a length such that the sides of the stem opposite the split, will engage the opposite sides of the adjacent metal plate 14 and are preferably welded thereto. It will be observed that the split stem will serve to maintain the plate 14 in securely clamped relation to the fabric panel. Located above and extending horizontally along the upper portion, for example along or within the head rail of a door opening, is a track structure, the track element proper of which, generally indicated at 31, consists of an inverted channel preferably of metal, and with its side flanges turned inwardly as shown to provide arcuate rail portions 32. For appearance or otherwise as desired, in case the track channel is not concealed above the door opening, it may be advisable to apply bed mold elements 33.

The track riding elements consist in the present disclosure of a series of narrow sliding blocks 34, each provided with a convex margin conforming to the inside curvature of the intumed marginal portions of the track, thus providing for smooth operating engagement between the blocks and the track as the accordion door is folded and unfolded in its movement between open and closed positions. Each of the track riding blocks 34 is provided with a depthwise central aperture through which extends the upper shank portion of the adjacent stem 30. The top part of the shank of each of the stems or swivel elements 30 is provided with a suitable head or other enlargement, usually of circular shape. It should here be noted as a preference that the dimensions of each of the sliding blocks are by preference such that, for purposes of assembly, each such block may be inserted into the track with the block at a right angle to its normal operating position, which latter is, with the block, normally located transversely of the track channel structure, as shown. Thus the assembly of the accordion structure to the track requires but a few minutes time, and no special tools or skill.

Numerous experiments with accordion-type doors, directed to the development of a light weight, low cost, simplified structure have led this designer to the objectives of providing for limitation of the extent of opening movement of each of a number of the panel sections of the accordion structure, thus assuring even folding at all times, and positively compelling even opening of the different panel portions when the door is closed, and an even angularity of the panels under all conditions. While such a result may be realized in some degree by the use of elaborate linkage systems such as the familiar

lazy tongs structure, reduction of weight and cost require that this purpose be attained with much less material and many fewer assembly operations than necessitated by such an elaborate linkage. For reasons stated, there is provided centrally of each of the sliding blocks 34 a short channel element, the horizontal length of which, (i. e., along the doorway) does not by preference exceed the width of the adjacent block 34. Each such U shaped piece indicated at 36, is provided with an opening 37 which receives the upper end of the shank of the adjacent stem 30, with the headed portion of the stem engaging the bottom of the U shaped channel member 36. It will be noted that each of the members 36 is recessed into the central portion of the adjacent block 34, so that member 36 is normally secured against rotation about a vertical axis. Thus the member 36 serves as a supporting journal for the stem 30, with which also thus coacts to some extent the apertured portion of the block 34. It will be noted that as the accordion door is opened from closed position, or closed from open position, there will necessarily occur a partial rotation or swiveling action of each of the stem elements 30, since the angularity of each of the panels thus equipped, will necessarily change as the door is extended or retracted.

The serial stop effect, resulting in a progressive check of the opening movement of the different sections of the accordion structure, is realized by a series of movable stops traveling with the different parts of the curtain, each such movable stop or abutment, coacting with a selected fixed stop or abutment, the latter being arranged along the upper portion of the doorway, and preferably within or at least in the region of the track. It will be observed that, first with reference to the movable abutments, these are shown as of graduated upward extent, three thereof being shown and indicated in order of decreasing height, one at 36, heretofore referred to, and a similar element 36A, spaced from which is a third such element 36B, being the shortest of the series.

Conveniently supported as shown, by the track mounting screws 37, is a series of spaced fixed stops or abutments indicated respectively as a shorter fixed stop 40, a somewhat further depending stop 40A, and a still further projecting fixed stop 40B.

In Fig. 6, there is indicated by arrow the direction of door-closing movement, or extension, of the accordion structure 10. The elements 40, 40A and 40B are, conveniently for production reasons, similar to the members 36, 36A and 36B except that those of the fixed series are relatively inverted. Thus in each stop device comprised of one movable and one fixed abutment, one of the longest and one of the shortest units will form a first stop, two such units of intermediate extent will form an intermediate stop, and so through the series wherein a final such stop device will again consist of a shortest and a longest abutment piece. It will appear from Fig. 6 that these stop elements are individually engageable in pair; for example, the lesser degree of extension of movable stop 36B, will prevent its abutting the fixed stops 40 or 40A, the selective action now being evident from this example.

If desired each of the vertical panels of the assembly may be provided with one of the supporting stems 30, a track riding element such as the sliding block 34, and an individual stop de-

vice as noted. However, experiments have shown that it is in most cases entirely adequate to provide direct support only for alternate panel supports. This is permitted by the extremely light weight of the foldable accordion curtain or door. Thus any present reference to the equipment of each of the panels with support and appurtenant stop means, should be taken as referring to each of a plurality of the panels without necessarily requiring such individual support for all thereof. It is of course desirable in order to provide a maximum width of clear door opening, that the accordion closure be foldable to a minimum thickness. This result is enhanced by minimizing the necessary number of the sliding blocks 34 and minimizing the cross dimension of each thereof, as well as the corresponding dimension of the movable stop elements such as 36, 36A and 36B.

The function of the several elements as described has been in part referred to in connection with structural description, but it may be noted that, assuming the accordion door to be in a fully opened position, i. e. with its panels in a substantially flat overfolded zig-zag relation, closing of the door is quickly and readily accomplished with virtually no effort, by gripping the handle 25 and by actuation thereof, extending the accordion structure fully to the opposite door jamb, with hooking engagement of the elements 22 and 21. During such movement the trailing portions of the door may remain relatively compacted until engagement of the co-acting movable and fixed abutments 6 and 40, at which time the trailing portion of the structure 10 will have assumed its final position with greatest angularity of its panels. Continuing door-closing movement next results in an abutting engagement between elements 36A and 40A, and similarly in succession, the movable stop 36B abuts the fixed stop 40B. At this time the free margin may be hooked in place, and all of the panels of the accordion structure are presented in an evenly angular, zig-zag relation. Being compelled thus to assume this uniform angularity upon repeated reopening of the door, the accordion structure will be again overfolded by stages, first the leading, then the intermediate and lastly the trailing portion thereof, until finally all of the panels will be brought into uniform, virtual parallelism, stacked against the starting jamb DJ of the door opening.

Although for convenience of description, having reference to expected more prevalent usage, the device has been described in reference to a closure for a door opening or like portal, it will be understood that many other fields of usage may be usefully served at a low cost by the present arrangement, and that the structure as described will serve fully to realize the several objects hereinabove expressed and implied.

Although the description has been directed to the structural particularization of a selected embodiment, the detail thereof should be understood solely in an instructive rather than in any limiting sense, many variants being possible within the fair scope of the claims hereunto appended.

I claim as my invention:

1. In an accordion type door assembly, a flexible closure portion characterized by vertical fold lines substantially evenly horizontally spaced so as to constitute vertical panels of substantially uniform width, the fold lines and panels being so arranged that the panels may be overfolded near one side of a door opening, a rigid support at the

top of certain ones of the panels, a vertical supporting stem centrally of each said rigid support and extended upwardly therefrom, an inverted, rigid channel track member disposed above the door opening for support and guidance of the panels as the door is open and closed, a plurality of slide blocks disposed internally of and guidedly supported by the track, a vertical bushing element for each of said stems, and carried by one of the sliding blocks, each of said sliding blocks and adjacent bushing elements having compatible abutting portions so as to prevent rotation of said bushing elements, each of said stems being provided with a head engaging an adjacent bushing element for swivel movement therein, said bushing elements projecting at differing distances in a direction depthwise of the track, and a series of stationary stops, said stops projecting at differing distances in a direction depthwise of the track, and located to be individually engageable by the projecting bushing elements, such that when the panels of the door are fully extended, as when the door is in fully closed position, the bushing elements will each individually coact with a selected one of the stops to fix the angular relation of adjacent panels of the door, together with means by which one of the endmost panels of the door may be secured to a door jamb, means by which the opposite end panel of the door may be releasably fastened to the opposite jamb of the door opening, and means by which the individual panels of the door are maintained under vertical tension at all times, irrespective of their folded or extended relations.

2. In an accordion type door assembly, a flexible closure portion formed of fabric and characterized by vertical fold lines substantially evenly horizontally spaced so as to constitute vertical panels of substantially uniform width, the fold lines and panels being so arranged that the panels may be brought to a superposed zig-zag relation when overfolded near one side of a door opening, a rigid support at the top of certain ones of the panels, a vertical supporting stem centrally of each said rigid support and extended upwardly therefrom, an inverted, rigid channel track member having inturned lower margins and disposed above the door opening for support and guidance of the panels as the door is open and closed, a plurality of slide blocks engaging said inturned margins, and disposed internally of and guidedly supported by the track, a U shaped vertical bushing element for each of said stems, and carried by one of the sliding blocks, the sliding blocks that carry the bushing elements being provided with a recessed portion into which the bushing elements seat so as to prevent rotation of said bushing elements, each of said stems being provided with a head engaging an adjacent bushing element for swivel movement therein, each of said bushing elements being of a fixed vertical length, said bushing elements projecting at differing distances in a direction depthwise of the track, and a series of stationary stops, each of said stops being of a fixed vertical length, said stops projecting at differing distances in a direc-

tion depthwise of the track, said stops being located to be individually engageable by the projecting bushing elements, such that when the panels of the door are fully extended, as when the door is in fully closed position, the bushing elements will each individually coact with a selected one of the stops, thus accurately fixing the angular relation of the adjacent supported panels of the door, together with means by which one of the endmost panels of the door may be secured to a door jamb, means by which the opposite end panel of the door may be releasably fastened to the opposite jamb of the door opening, and means by which the individual fabric panels of the door are maintained under vertical tension at all times, irrespective of their folded or extended relations.

3. In a foldable, accordion type door, a light weight fabric element constituting a closure, and prefolded along spaced vertical lines to establish vertical panels of substantially even width, a rigid supporting strip at the top of each of a plurality of said panels, the length of each such supporting strip being slightly less than the width of the panel served thereby, a vertical pivot element characterized by a diametral kerf receiving the rigid strip of the adjacent panel and secured thereto, a channel track arrangement horizontally above the panels of the door, a plurality of track-riding elements working along the channel as the door is opened and closed, each of the track-riding elements receiving in journalled relation, one of the pivot elements, each of the latter being provided with a head or enlargement, swivelly engaging the adjacent track-riding element, a series of fixed abutments supported in the region of the track, said fixed abutments projecting at differing distances in a direction toward the path of the door, a series of coacting movable abutments each associated with one of the track-riding elements, said movable abutments projecting at differing distances in a direction toward said fixed abutments, said fixed and movable abutments coacting to provide a plurality of stops for the panels of the closure, arranged along the path of movement thereof, the movable abutments being arranged in series in order of the extent of projection, the series of fixed abutments being arranged in relatively reversed order to that of said movable abutments so that each of the movable abutments will engage only one of the fixed abutments, whereby to fix the angularity of the panels and to fix the limit of opening movement of intermediate and end portions of the door.

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