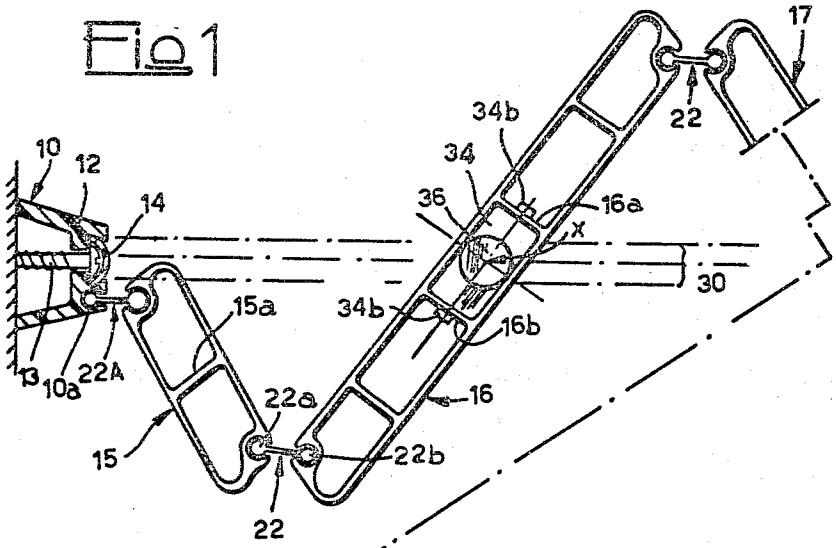
July 18, 1967 R. COLOMBO 3,331,427

FOLDING SLIDING DOORS

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Fig 1



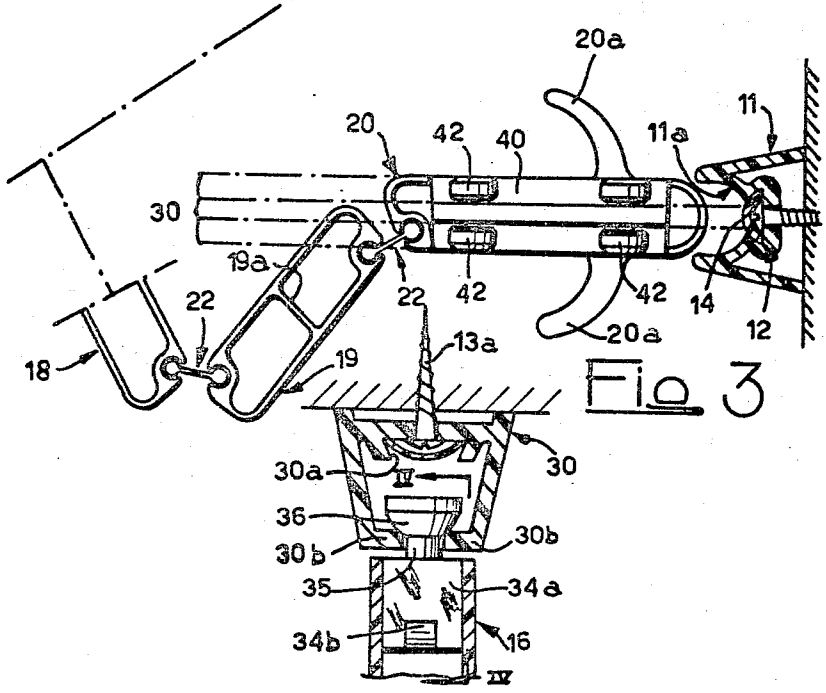


Fig 3

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Fig. 4

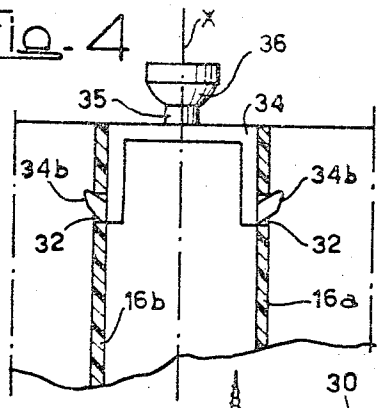


Fig 2

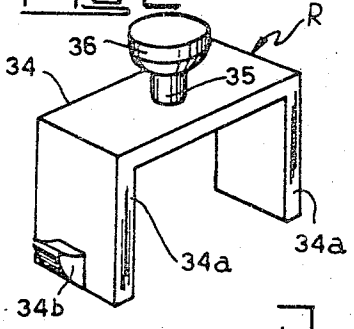


Fig 5

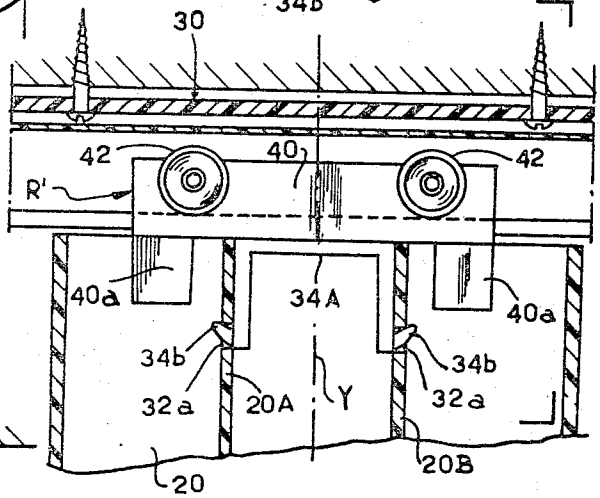


Fig 6

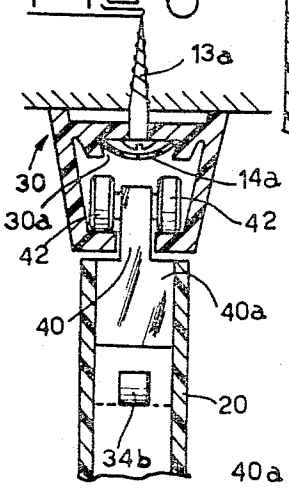
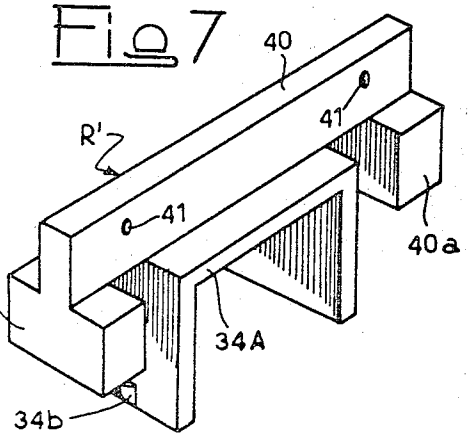


Fig 7



United States Patent Office 3,331,427 Patented July 18, 1967

3,331,427

FOLDING SLIDING DOORS

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Claims priority, application Italy, Aug. 3, 1964, 4,566/64
6 Claims. (Cl. 160—199)

ABSTRACT OF THE DISCLOSURE

A sliding door having a plurality of identical hollow plastic slats which are interconnected for accordion type folding. An overhead horizontal track wherein are slidably aligned extruded plastic runners which are centrally secured to each panel to guide and support the panel during folding and unfolding. A leading slat having handles and a wheel carrying runner secured thereto and having two sets of wheels rollable in the track and a compensating slat interconnecting the leading slat and the series of identical slats.

This invention relates to folding-sliding doors comprising an overhead horizontal track, a series of runners supported by the track, and a series of vertically extending slats depending from their respective runners in a mutually hinged zig-zag arrangement, wherein each of said slats is capable of pivoting about its longitudinal central axis whereby the series of slats can be folded up and unfolded like an accordion.

Moreover, a door of the just defined character usually comprises a leading slat or post constantly maintained by its runner in a co-planar relation to the track, and a compensating slat linking said series of slats to the leading slat, said compensating slat having a width substantially equal to the half-width of a slat in the series.

Folding up and unfolding of the door is usually accomplished by pushing and pulling, respectively, the leading slat, a pair of hand grips being provided to that end on the opposed faces of the latter at a suitable height from the floor. It is also known that an unexpected high degree of skill is required for successfully manoeuvring the door without causing jamming of the runners in the track. Jamming easily occurs in light-weight doors, because of the ease with which the slats are deflected from their straight-down depending condition by inexpert hands; heavy-weight slats reduce the probability of jamming, but require both very sturdy tracks and runners and considerable muscular efforts for operating the door. The probability of jamming can also be reduced by suspending the slats from their respective runners by means of universal joints; however, this and other known expedients (generally "borrowed" from the art of overhead monorail conveyors) are relatively costly and require a substantial space, the latter being another problem characterizing the folding-sliding doors. Actually, since folding up of a door involves a progressive closure to zero-value of the dihedral angle between each pair of slats in the series, it is obvious that the space available lengthwise of the track for each of the runners cannot exceed the thickness of its respective slat (except for the leading slat which is constantly co-planar with the track).

Accordingly, it is an object of this invention to provide, in a light-weight folding-sliding door of the hereinbefore-defined character, non-jamming runners requiring but a little space lengthwise of the track. Another object of this invention is to provide a light-weight folding-sliding door comprising said non-jamming runners structurally combined with slats of extruded plastics, such as rigid polyvinyl chloride, said runners consisting each of but a single

piece of moulded plastics fitted to one end of its associated slat without the use of screws, bolts or other fasteners. Still further objects and advantages of this invention will be evident from the following description and the accompanying drawings.

According to the invention, a folding-sliding door is provided comprising an overhead horizontal track, a series of runners supported by the track, and a series of vertically extending slats depending from their respective runners in a mutually hinged zig-zag arrangement, each of said slats being capable of pivoting about its longitudinal central axis whereby the series of slats can be folded up and unfolded like an accordion, characterized in that: (a) each of the slats in the series essentially consists of a flat hollow profile of extruded plastics including a pair of partitions interconnecting the opposite face walls of the profile at locations enclosing therebetween the longitudinal central axis of the latter; (b) each of the runners comprises a stirrup section encased in the upper end of the slat between said partitions, a cylindrical neck section protruding outwardly from the stirrup section in alignment with said longitudinal central axis, and an enlarged head section on said neck section comprising a spherical surface turned towards the stirrup section, said stirrup section comprising resiliently expandable branches having each an outwardly projecting tooth thereon snap-fitted into an aperture in its respective partition whereby the runner is anchored to the profile; and (c) the track comprises an inverted channel member having inturned opposed flanges jointly supporting therebetween the spherical surface on the head sections of the runners for sliding movement lengthwise of the track.

In the accompanying drawings:

FIGURE 1 is a part plan-view of an embodiment of the invention;

FIGURE 2 is a perspective view of a runner;

FIGURE 3 is a cross-sectional view on a vertical plane showing the suspension of one of the runner-equipped slats;

FIGURE 4 is a cross-sectional view on line 4—4 of FIGURE 3;

FIGURE 5 is a view similar to that of FIG. 4, referring to the upper end of the leading slat;

FIGURE 6 is a cross-sectional view on line 6—6 of FIGURE 5;

FIGURE 7 is a perspective view of the runner (deprived of its wheels) of the leading slat.

In the embodiment shown, the supporting (fixed) structure of the door comprises a pair of posts **10**, **11** bridged by a horizontal overhead track **30**, consisting each of an extruded profile of rigid polyvinyl chloride or other suitable synthetic resin composition. Each of the posts includes a dovetailed groove **12** and is fixed to its supporting wall by means of screws **13** screwed through the bottom of said grooves; the heads of the series of screws in each of the posts are concealed by means of a strip **14** of flexible plastics of an arcuate cross-sectional shape snap-inserted into its respective groove.

Similarly, the track **30** (FIGURES 3 and 6) includes a dovetailed groove **30***a* and is fixed to its suporting ceiling by means of screws **13***a* screwed through the bottom of the groove; the heads of the series of screws **13***a* are concealed by means of a strip **14***a*, identical to the strips **14**, snap-inserted into the groove **30***a*.

The movable structure of the door comprises a plurality of slats, indicated by **15**, **16**, **17**, **18**, **19**, and **20**, consisting each of a flat hollow extruded profile of rigid polyvinyl chloride or other suitable plastics. Said plurality of slats comprises a leading slat **20**, extruded integrally with a pair of wings **20***a*, **20***a*, on its opposite planar faces, providing handgrips for maneuvering the door. The

leading edge of the leading slat is rounded and engages in a channel **11***a* in the post **11** in the closed condition of the door. The flanks of the channel **11***a* resiliently grip the slat in said condition.

The "body" of the door is formed by a series of slats of which the slats **16**, **17** and **18** are the representatives in the drawing, said slats being identical to each other and being connected to the post **10** and to the leading slat **20** through the interposition of compensating slats **15**, **19**, respectively. All the slats are hinged to each other by means of strips **22** of flexible plastics, advantageously polypropylene, severed from a common stock, and a similar strip **22A** is used as hinge between the compensating slat **15** and its associated post **10**. Each of the two opposite longitudinal edges of each of said strips consists of a circular bead **22***a*, **22***b*, respectively, said beads being inserted as "tenons" in their respective "mortises" formed in the corresponding slats. Under this aspect, reference is made herein to the British patent specification 927,590 showing similar hinges and also to my co-pending application Ser. No. 474,905 filed in even date herewith, according to which the tenons are loosely rotatable in their mortises so that each of the hinges functions in part by the rotation of the tenons and in part by flexure of the web of the strip interconnecting the tenons. One of the tenons of the strip **22A** is inserted into its corresponding mortise **10***a* formed in the post **10** lengthwise of the dovetailed groove **12**.

Each of the slats **16**, **17**, **18** forming the body of the door has its opposite face walls interconnected by a plurality of partitions integrally extruded with the slat, comprising a pair of partitions **16***a*, **16***b* equally spaced at opposite sides of the longitudinal central axis X of the slat. The general purpose of the partitions is to reinforce and stiffen the slats; further reinforcing partitions are denoted by **15***a* and **19***a* in the case of the compensating slats **15** and **19**, respectively. However, the specific partitions **16***a*, **16***b* mentioned above have a particular function in this door, as will be evident hereinafter. It is to be noted, moreover, that also the leading slat **20** (FIG. 5) comprises a similarly specific pair of partitions **20A**, **20B**, equally spaced at the opposite sides of the longitudinal central axis Y of the slat. The space between said specific partitions (both in the slats **16** . . . **18** and in the leading slat **20**) is rectangular in cross-sectional shape.

For the sake of simplicity of the description, slat **16** will now be taken as representative of each of the slats **16** . . . **18** forming the body of the door. Said slat is suspended from the track **30** by means of a runner R which is separately shown in FIG. 2 and the arrangement of which is shown in FIGS. 1, 3 and 4.

The runner is integrally moulded from a high-impact, wear-resisting synthetic resin composition, such as nylon, for example, and comprises a stirrup section **34**, a cylindrical neck **35** and a hemispherical head **36**. More specifically, the stirrup section comprises a pair of resiliently expandable branches **34***a*, **34***a*, and its outer profile matches the rectangular space between the partitions **16***a*, **16***b* in the slat **16**, except for a tooth or hook **34***b* projecting laterally outwardly from each of the branches. Thus, by resiliently flexing the branches towards each other, the stirrup section can be slid into said space between the partitions to a depth defined by a pair of apertures **32**, **32**, formed in the partitions, into which the teeth **34***b* snappingly engage due to resilient expansion of the branches. In this manner the stirrup section is firmly locked in the upper end of the slat **16**. The neck **35** protrudes upwardly from the stirrup section in alignment with the axis X of the slat; the hemispherical surface on the head **36** of the runner is turned towards the stirrup section, i.e. downwardly, and its diameter does not exceed the thickness of the slat **16** (FIG. 3).

It will be also seen in FIG. 3 that the effective cross-sectional shape of the track **30** is that of an "inverted U" or "inverted channel" comprising a pair of inturned opposed flanges **30***b*, **30***b*; the latter have planar smooth upper surfaces and enclose therebetween a slot of a width slightly greater than the diameter of the neck **35** of the runner R (but substantially smaller than the diameter of the head **36**). Thus, the heads of all the runners associated with the body of the door can be slid into the track **30** thereby to pendularily support the slats **16** . . . **18** from the track. As a pull is exerted on the leading slat, the heads **36** of the runners slide lengthwise of the track on the flanges **30***b* and rotate at the same time through an angle corresponding to the rotational angle of the slats; in this manner the door unfolds (or folds up) smoothly and wear of the heads is practically negligible, particularly when (as is obvious to those skilled in the art) the edges of the flanges **30***b* have been preliminarily beveled. On the other hand, replacement of the runners R is relatively quick and easy; actually, it is sufficient to press inwardly the teeth **34***b* (even by fingertips) and withdraw the runner from the slat.

The runner R' of the leading slat (FIGS. 5, 6 and 7) is what is commonly known as "trolley," comprising two pairs of wheels **42** rolling on the upper planar surfaces of the flanges **30***b* of the track **30**. Thus, said flanges perform two different functions, viz. the function of slidably supporting the heads **36** on runners R and the function of rollably supporting the wheels **42** of the runner R'. The latter moreover comprises a stirrup section **34A** which is structurally identical to the stirrup section **34** of the runners R and is snap-encased between the partitions **20A**, **20B** of the leading slat, with its teeth **34***b* engaged in apertures **32***a* in said partitions and with its outline matching the cross-sectional shape of the space between the partitions. The stirrup section **34***a* is moulded integrally with an elongated wheel-carrying body **40**, consisting of a horizontal rectangular-prismatic bar co-planar with the leading slat **20**, and depends from a longitudinally intermediate portion of said body. The opposite ends of the body project beyond their respective partitions **20A**, **20B** and have each depending therefrom a block **40***a* integrally moulded with the body (of a high-impact wear-resisting plastics, such as nylon). The blocks **40***a* transversely fill the space between the opposite face walls (FIG. 6) of the leading slat **20** in the upper end of the latter and provide in this manner a pair of coupling dogs effective between the body **40** and slat around the axis Y to maintain these components in their co-planar relationship. A pair of transverse holes **41** is formed in the body **40** at locations adjacent the opposite ends of the latter, each of said holes having inserted therethrough a metal spindle rotatably supporting its respective pair of wheels **42**.

On assembly of the door, the body **40** is inserted lengthwise into the track **30** and is guided parallel to the latter by the pairs of wheels **42**, so that the leading slat is constantly co-planar with the track.

What I claim is:

1. Folding-sliding door comprising an overhead horizontal track, a series of runners supported by the track, and a series of vertically extending slats depending from their respective runners in a mutually hinged zig-zag arrangement, each of said slats being capable of pivoting about its longitudinal central axis whereby the series of slats can be folded up and unfolded like an accordion, characteried in that: (a) each of the slats in the series essentially comprising a flat hollow profile of extruded plastics including a pair of partitions spaced from the ends of the profile interconnecting the opposite face walls of the profile at locations enclosing therebetween the longitudinal central axis of the latter; (b) each of the runners comprises a stirrup section encased in the upper end of the slat between said partitions, a cylindrical neck section protruding outwardly from the stirrup section in alignment with said longitudinal central axis, and an enlarged head section on said neck section comprising a spherical surface turned towards the stirrup section, said stirrup

section comprising resiliently expandable branches having each an outwardly projecting tooth thereon disposed in a plane parallel to the face walls and adapted to be snap-fitted into an aperture in its respective partition whereby the runner is anchored to the profile; and (c) the track comprises an inverted channel member having inturned opposed flanges jointly supporting therebetween the spherical surface on the head sections of the runners for sliding movement lengthwise of the track.

2. Folding-sliding door as claimed in claim 1, characterized in that the stirrup-, neck- and head sections of each of said runners are integrally moulded of a high-impact, wear-resisting synthetic resin compositon.

3. Folding-sliding door as claimed in claim 1, characterized in that the profile of the stirrup section of each runner matches the cross-sectional profile of the space between said partitions.

4. Folding-sliding door as claimed in claim 1, moreover comprising a leading slat equipped with a four-wheeled trolley keeping the leading slat co-planar with the track, characterized in that: (a) the leading slat essentially consists of a flat hollow profile of extruded plastics including a pair of partitions interconnecting the opposite face walls of the profile at locations enclosing therebetween the longitudinal central axis of the latter; (b) said trolley comprises a stirrup section encased in the upper end of the leading slat between said partitions, an elongated wheel-carrying body integral with said stirrup section, and at least one coupling dog depending from said body into the upper end of the profile at a location beyond one of said partitions; said stirrup section comprising resiliently expandable branches having each an outwardly projecting tooth thereon snap-fitted into an aperture in its respective partition whereby the trolley is anchored to the profile; said wheel-carrying body being equipped with two pairs of wheels rollable in the track on the inturned opposed flanges of the latter.

5. Folding-sliding door as claimed in claim 4, characterized in that the stirrup-section and the body of the trolley are integrally moulded of a high-impact, wear-resisting synthetic resin composition.

6. Folding-sliding door as claimed in claim 4, characterized in that the profile of the stirrup section of the trolley matches the cross-sectional profile of the space between the partitions in the leading slat.

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