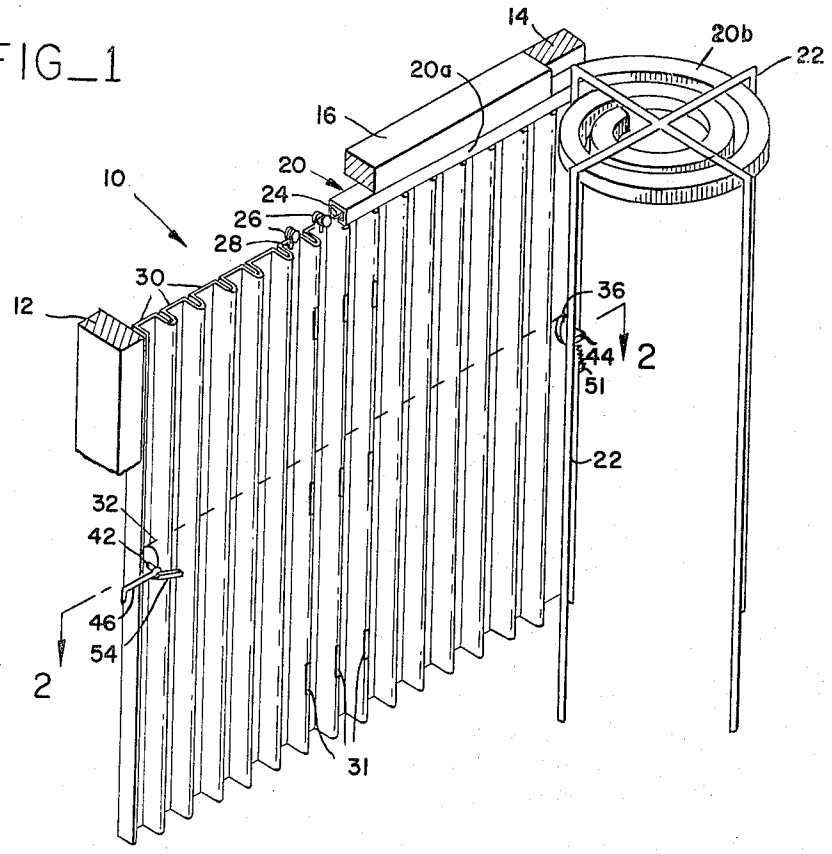
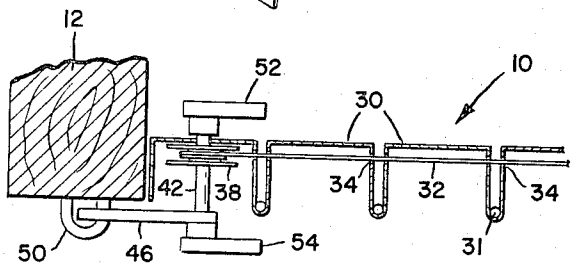
Dec. 12, 1967 T. T. MATSUMOTO 3,357,480

SLIDING DOOR STRUCTURE

Filed Sept. 27, 1965

FIG_1



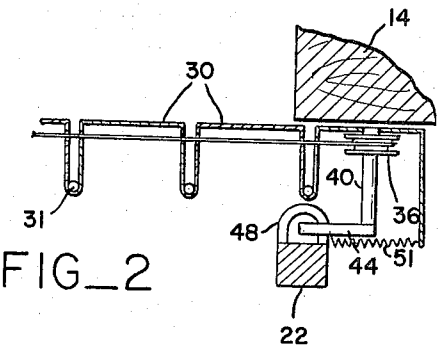




FIG_2

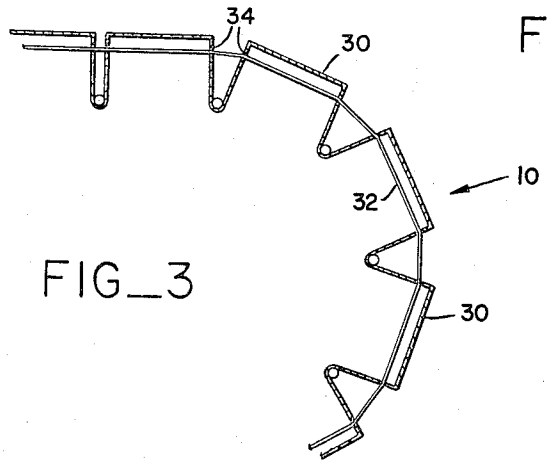



FIG_3

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# SLIDING DOOR STRUCTURE

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The present invention relates generally to door structures and more particularly to a sliding door structure arranged to control access through relatively large openings such as an entrance to a garage.

When access through a relatively large opening such as the entrance to a garage must be controlled, it becomes impractical to utilize a door consisting of a solid panel pivoted at one edge in a conventional manner for several reasons. In the first place, the requisite strength and weight of the structure become excessive and in the second place, the space requirement for swinging of the door becomes quite large. As a consequence, sliding of overhead doors have come into prevalent use for controlling access to relatively large openings such as the entrance to a garage. These also suffer from certain disadvantages. In the case of the rigid, sliding panel door, a large space must be available adjacent the door opening, and in the case of the overhead door, relatively complex counterbalancing structures are necessary to facilitate both raising and lowering of the relatively heavy structures.

Accordingly, it is a general object of the present invention to provide a novel sliding door structure which is simple and inexpensive yet, at the same time, is effective in its access control function.

More particularly, it is a feature of the invention to provide a sliding door structure including a plurality of pivotally-joined slats suspended for movement between rectilinearly aligned positions across an opening and a curled compact storage position adjacent the side of the opening.

Additionally, it is a feature to provide for suspension of the slats from an overhead track which substantially entirely supports the weight of the door slats and thus eliminates the need for any supporting or guide track at the lower end of the slats.

In order to enable the requisite movement of the door slats, the track includes a rectilinear section across the top of the door opening and a curvilinear section at one side thereof.

It is an additional feature of the invention to provide a particularly simple mechanism for holding the door slats against displacement from rectilinear alignment so as to accordingly preclude movement thereof along the curvilinear portion of the suspending track. Thus, in effect, a simple mechanism is provided for locking the door in its closed position as a substantially rigid structure.

It is a particularly significant feature of the invention to provide a sliding door structure designed so as to minimize over-all weight, yet to provide an effective rigid closure for the door opening.

These as well as other objects and features of the invention will become more apparent from a perusal of the following description of the structure illustrated in the accompanying drawing wherein:

FIG. 1 is a perspective view of a sliding door structure embodying the present invention, portions of the structure being broken away to show interior details thereof,

FIG. 2 is an enlarged fragmentary sectional view taken substantially along line 2—2 of FIG. 1 illustrating details of the door slats and portions of the operating mechanism associated therewith, and

FIG. 3 is an enlarged transverse sectional view generally similar to FIG. 2, but illustrating the slats when displaced out of the rectilinear alignment shown in FIG. 2.



With initial reference to FIG. 1, a sliding door structure indicated generally by the numeral **10** is disposed in a position of closure across a door opening defined by a generally rectangular frame including two side frame members **12**, **14** which rise substantially vertically from an underlying floor and a substantially horizontal top frame member **16** supported in bridging relationship thereover.

A track **20** for the sliding door includes a straight or rectilinear portion **20***a* which is attached in a substantially horizontal disposition to the top frame member **16** to extend substantially entirely from one side of the door frame to the other, and a curvilinear section **20***b* constituting an extension of the rectilinear track section as specifically illustrated in FIG. 1. Such curvilinear track section **20***b* is in the form of an inwardly curling spiral whose overall length is substantially equivalent to the length of the rectilinear track section **20***a*. Additional support for such curvilinear track section can be provided by an open box-like frame **22** as illustrated in FIG. 1 although other supporting structures can be utilized dependent upon the particular installation. In cross-section, the track **20** preferably constitutes a rectangular tube having a central longitudinal slot **24** in its lower face.

A plurality of roller pairs **26** are arranged for movement longitudinally of the track **20**, each roller pair being supported for rolling movement along the track on opposite sides of the central slot **24** which accommodate a suspension bracket **28** carried between the rollers and supported thereby at its upper end, and in turn, connected at its lower end to the upper extremity of a door slat **30** so as to suspend the latter in a substantially vertical disposition. The length of the suspended slat **30** is such that its lower extremity is immediately adjacent to the floor under the door opening. In transverse cross-section, as best illustrated in FIG. 2, each slat **30** preferably takes the form of a U-channel of generally rectangular outline. Such configuration allows the slats **30** to be made of light weight metal, but at the same time, meets the requirements for structural rigidity of the door. The free ends of the U-channels formed by adjacent slats **30** are hingedly connected as shown at **31**, preferably in three positions, at the top, bottom and an intermediate level, thus allowing the adjacent door slats to pivot away from the rectilinear aligned dispositions as shown in FIGS. 1 and 2 wherein the base of the U's are in co-planar relationship defining a smooth, front surface of the door, and the sides of the U's are in parallel, adjacent relationship. From such rectilinear alignment, the slats **30** can pivot relative to one another as the rollers **26** and the slats suspended therefrom are moved from the rectilinear track section **20***a* onto the spiral track section **20***b*, such open disposition being illustrated clearly in FIG. 3 whereat the sides of the U-channels depart from their parallel dispositions and are disposed at an acute angle.

The slats **30** can be held in their rectilinear dispositions as shown in FIG. 2 and precluded from displacement into the FIG. 3 disposition by a simple locking mechanism which takes the form of a cable **32** that passes through aligned openings **34** in the sides of the U-channel slats at positions adjacent the base of the U and thus relatively remote from the hinged juncture of the slats. The cable **32** is fixed at one end to a sheave **36** on the slat **30** nearest the spiral track section **20***b* on the right, and at its left end is fixed to a larger sheave **38** on the slat **30** at the remote side of the door opening.

The sheaves **36**, **38** are fixed to shafts **40**, **42** mounted for rotation in simple bearings and carry similar latches **44**, **46** arranged to enter conventional keepers **48**, **50** on adjacent frame members **12**, **22**. A spring **51** urges the latch **44** to an open unlocked position. A handle **52** is

secured to the outwardly projecting end of one shaft **42** and a similar handle **54** is secured to its inner end so that the sheave **38** can be turned by a person standing inside or outside the door. If the inner handle **54** is turned in a counter-clockwise direction as viewed in FIG. 1, the cable **32** is wound on the sheave **38** and effects clockwise rotation of the sheave **36** so both latches **44**, **46** enter the keepers **48**, **50**. Since the sheave **38** is larger, the cable **32** becomes taut to retain all of the slats in their rectilinearly aligned dispositions as shown in FIG. 2.

As the sheave **36** rotates to the locked position, the disposition of the spring **51** passes over center of the sheave thus to resiliently hold the sheave and the latch **44** in its closed position. If this same inner handle **54** is turned in a clockwise directon, the latches **44**, **46** are opened, the cable becomes slack and the slats **30** can then be moved onto the curvilinear track section **20***b*, the total amount of slack being sufficient to enable accommodation of the angular departure of the sides of adjoining U-channels as illustrated in FIG. 3.

It is to be particularly observed that as the cable **32** is tightened, the door slats **30** are urged against one another and thus become a substantially integrated, rigid structure which is held at its top in the track **20** and thereunder by the taut cable. Thus, the structure is held rigidly without the necessity for utilization of a lower track section in the floor.

It will be understood that many modifications and/or alternations can be made in the structure as specifically described without departing from the spirit of the invention. In particular, it is to be pointed out that the curvilinear track sections specifically described as a spiral configuration can have yet other configurations to meet particular space requirements, so long as such configurations include some curvilinear portion to preclude movement therearound when the cable is taut as described. Accordingly, the foregoing detailed description is to be construed purely as exemplary and not in a limiting sense and the actual scope of the invention is to be indicated only by reference to the appended claims.

What is claimed is:

**1.** A sliding door structure which comprises

a track extending along a substantially horizontal path extending rectilinearly above the door opening and curvilinearly adjacent one side of the opening,

a plurality of slats movably suspended in substantially vertical and adjacent positions from said track, and

means interconnecting said slats and means for tensioning said interconnecting means for releasably holding said slats against displacement from horizontal rectilinear alignment.

**2.** A sliding door structure according to claim **1** wherein the curvilinear portion of said track has a spiral configuration.

**3.** A sliding door structure according to claim **1** which comprises

means hingedly connecting adjacent slats permitting relative pivotal motion of adjacent slats about a substantially vertical axis.



**4.** A sliding door structure according to claim **1** wherein

each of said slats constitutes a U-channel member of generally rectangular outline, the free ends of the U-channels formed by adjacent slats being hingedly connected wherefore the sides of the U-channels can be pivoted between parallel adjacent dispositions and opened dispositions whereat the sides of adjacent U-channels form an acute angle.

**5.** A sliding door structure according to claim **4** wherein said slat interconnecting means includes

a cable operatively interconnected between the end slats of the door structure, and

said tensioning means urges sides of said U-channel slats into parallel relationship.

**6.** A sliding door structure according to claim **5** which comprises

means for securing each of said end slats against horizontal movement in any direction,

said means being operatively associated with said cable tensioning means so that said end slats are secured at the same time that tension is applied to said cable.

**7.** A sliding door structure adapted to close an opening formed within a door frame which comprises

a track extending along a substantially horizontal path extending rectilinearly above the door opening and curvilinearly adjacent one side of the opening,

a plurality of slats movably suspended in substantially vertical and adjacent positions from said track,

means hingedly connecting adjacent slats for pivotal motion about substantially a vertical axis,

a cable extending substantially horizontally across all of said slats, and

means at the end of said cable for applying tension to the same for releasably holding said slats against displacement from horizontal rectilinear alignment.

**8.** A sliding door structure according to claim **7** which comprises

latch means for releasably connecting opposite ends of said door structure to said frame in response to tensioning of said cable.


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