Oct. 25, 1966 P. KOLLSMAN 3,280,507

FLUSH CLOSING SLIDING DOOR ASSEMBLY

Filed April 21, 1964

2 Sheets-Sheet 1

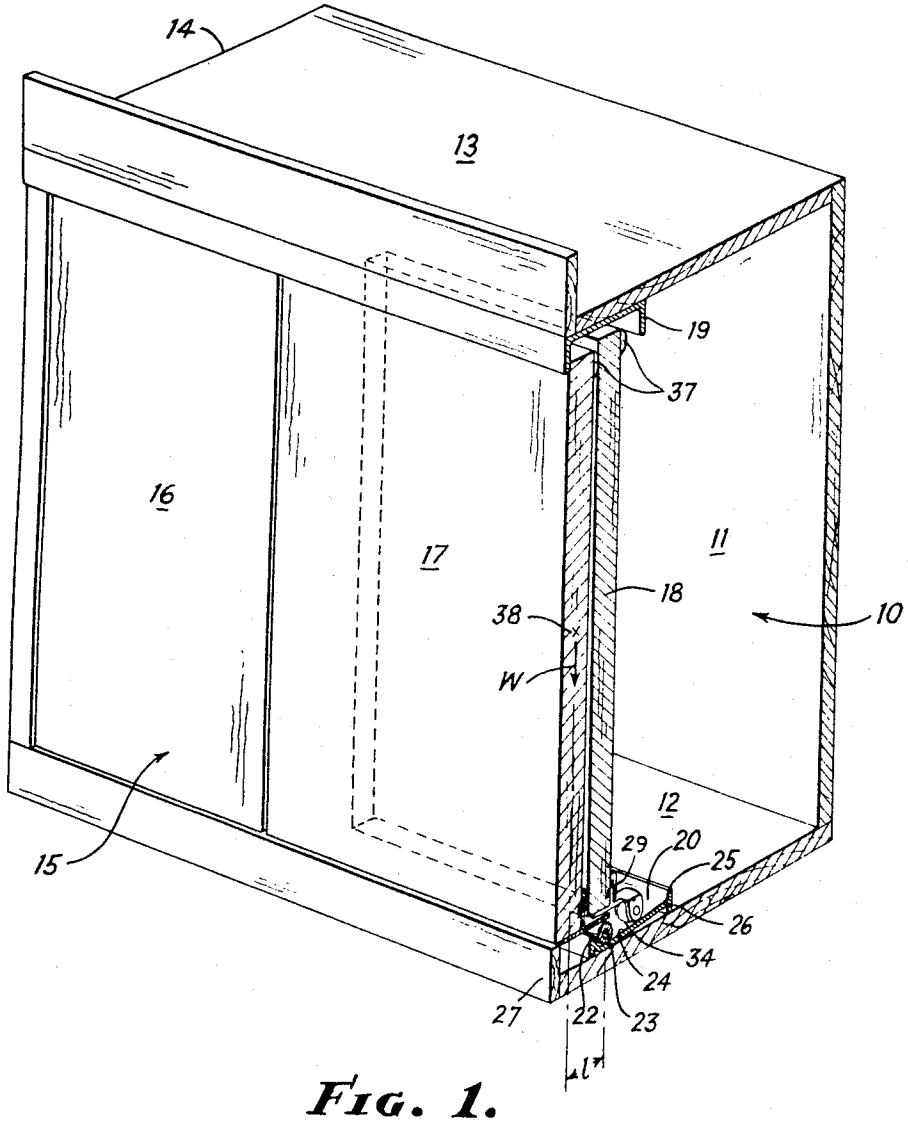


FIG. 1.

INVENTOR.
Paul Kollsman
BY
Howard B. Russell
his ATTORNEY

Oct. 25, 1966 P. KOLLSMAN 3,280,507

FLUSH CLOSING SLIDING DOOR ASSEMBLY

Filed April 21, 1964 2 Sheets-Sheet 2

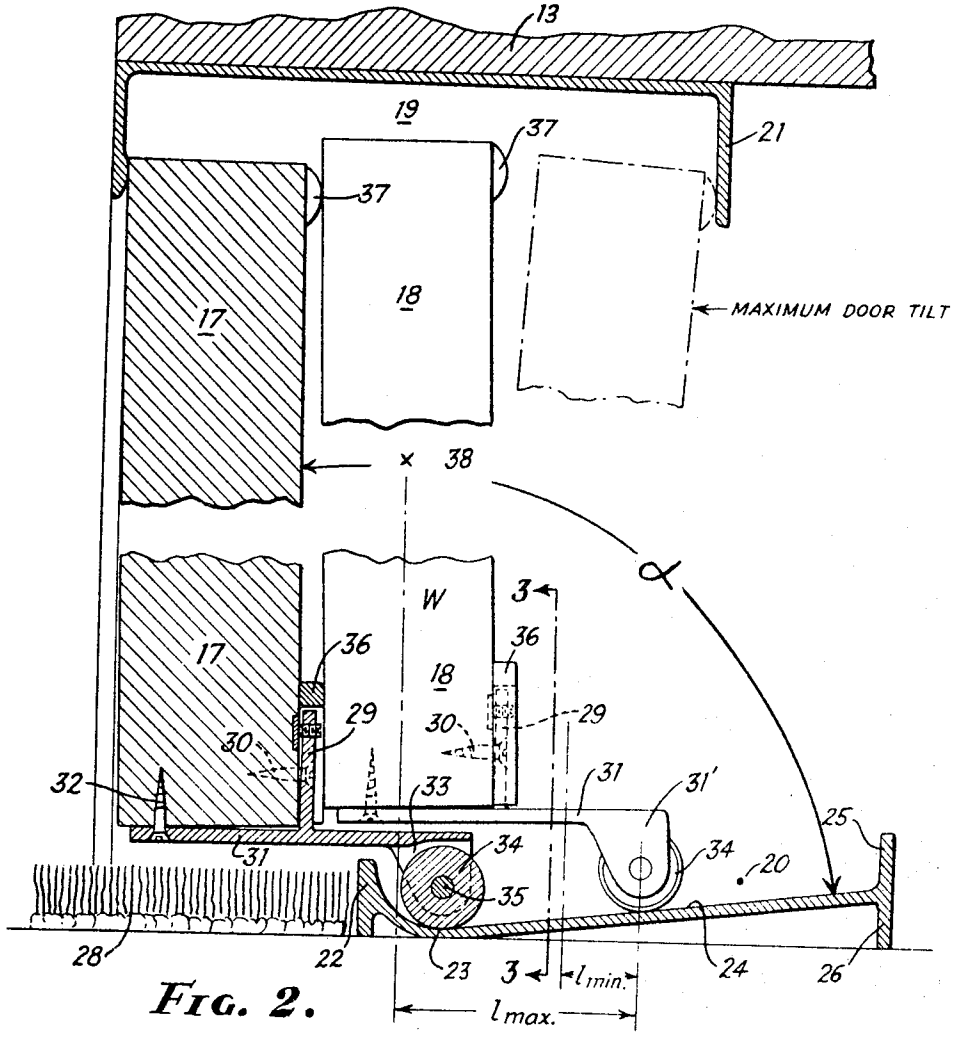


FIG. 2.

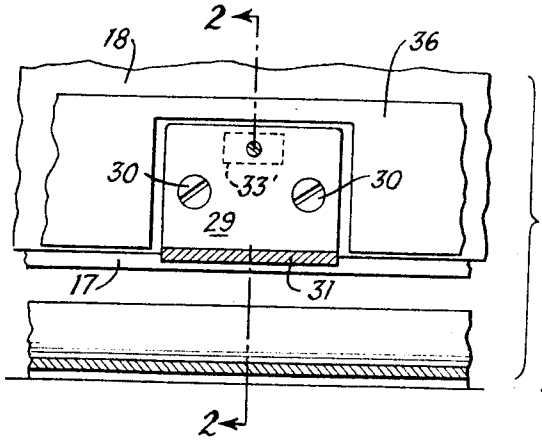


FIG. 3.

INVENTOR.
Paul Kollsman
BY Howard E. Russell
his ATTORNEY

United States Patent Office 3,280,507 Patented Oct. 25, 1966

3,280,507
FLUSH CLOSING SLIDING DOOR ASSEMBLY

Paul Kollsman, 100 E. 50th St., New York, N.Y.

Filed Apr. 21, 1964, Ser. No. 361,334
4 Claims. (Cl. 49—130)

This application is a continuation-in-part of my earlier application Serial No. 172,206, filed February 9, 1962, and now abandoned.

This invention relates to improvements in sliding doors of the type in which two or more individually movable door panels assume a flush position when closed, thus presenting the pleasing appearance of a multi-paneled flat wall or surface.

It is known to mount flush closing sliding cabinet doors at a slant in such a manner that the top portion of the door is considerably in advance of, or overhangs, the bottom portion of the door. The door panels rest in a lower track or guideway on a supporting surface which is perpendicular to the inclined plane of the door panels, and the upper track is likewise shaped to comprise an upper surface perpendicular to the plane of the door panels. The door panels, however, do not engage the upper surface, but rest by reason of their slanted disposition against the front surface or lip of the upper track.

In the known arrangement one panel may be rearwardly displaced and pushed behind the other in order to open the cabinet. The cabinet is closed by sliding the displaced door panel into a position to the side of, and clear of, the other panel, whereupon the closed panel gravitates forward and assumes a flush position with the other door panel.

The known arrangement is not suited for passage or closet doors as a very substantial slant of the door panels is required to insure proper flush closing. A slant of the order of twenty degrees is not admissible in closet doors of a height of the order of seven feet or more, as the overhang of the top door portion over the bottom portion becomes excessive, unsightly and reduces the closet floor space.

The present invention is based on the consideration that a dependably adequate forward bias of the tops of flush closing door panels can be achieved by an almost imperceptible forward tilt of the panels of the order of a few degrees, such as one to four degrees, which is far from sufficient for urging the door bottoms forward, under the influence of gravity, on a supporting surface perpendicular to the inclined plane of the door panels.

The invention offers particular advantages if employed in conjunction with the sliding door assembly disclosed in the copending application of Saudek and Radanyi, Serial No. 353,701, filed March 23, 1964.

According to the invention, a forward bias of the door panel tops is accomplished by a rearward offset of the point of support on which the door weight rests on the slanted bottom track. In this arrangement the door panels may even be vertical. The angle between the upper surface of the bottom track and the rear surface of the door panels is also made less than a right angle, angles of the order of 78 and 85 degrees being sufficient to impart to the door bottoms a forward bias which is many times as great as the bias effective on the door tops due to the rearward offset of the supporting means.

Regardless of the form of bottom support or construction, the top construction of the assembly becomes very simple, as springs, etc. are eliminated.

These and various other objects, features and advantages of this invention will appear more fully from the detailed description which follows accompanied by drawings showing, for the purpose of illustration, a preferred embodiment of the invention. The invention also resides

in certain new and original features of construction and combination of elements hereinafter set forth and claimed.

Although the characteristic features of this invention which are believed to be novel will be particularly pointed out in the claims appended hereto, the invention itself, its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part of it in which:

FIG. 1 is a perspective illustration of a vertical flush panel door assembly embodying the invention;

FIG. 2 is an elevational end view, partially in section, illustrating details of the assembly of FIG. 1; and

FIG. 3 is an elevational front view of a door supporting element.

In the following description and in the claims various details will be identified by specific names for convenience. The names, however, are intended to be generic in their application. Corresponding reference characters refer to corresponding parts in the several figures of the drawings.

The drawings accompanying, and forming part of, this specification discloses certain specific details of construction for the purpose of explanation of broader aspects of the invention, but it is understood that structural details may be modified in various respects without departure from the principles of the invention and that the invention may be incorporated in other structural forms than shown.

A closet or cabinet space **10** is shown in FIG. 1 as being formed by a rear wall **11**, a bottom wall **12**, a top wall **13** and an end wall **14**, the opposite end wall being broken away to show interior details. The door aperture **15** is provided with a sliding door assembly comprising door panels **16**, **17** and **18**, door panel **18** being shown behind panel **17** and placed in this position to open the right hand broken away portion of the door aperture **15**. The door panels may be of equal or unequal width and, as will be seen from the further description, are interchangeable, so that each panel may be moved into any of the three positions. Hence, viewed from the front, the panels may close the door aperture in a flush abutting arrangement in the order, from left to right, **16, 17, 18; 17, 18, 16; 18, 16, 17; 17, 16, 18; 16, 18, 17** and **18, 17, 16.**

The sliding panels **16**, **17** and **18** are guided in a top track **19** and a bottom track or sill **20**. These tracks are formed in channel structures made from extruded or machined metal, or of extruded or molded plastic and require only cutting length to fit a particular installation.

The top track **19** is formed in a U channel structure **21** secured to the top wall **13** and wide enough to accommodate two door panels one behind the other with adequate play to prevent jamming.

The bottom track **20** is formed in a channel structure comprising a front lip **22**, a trough **23**, an upwardly slanted portion **24** and a rear lip **25** which may be formed as an upward extension of a rear support **26**.

The bottom channel structure may be concealed by a structural element **27**, for example trim (FIG. 1) or by carpeting **28** (FIG. 2).

The door panels are vertical and are fitted with an outrigger type of support or spaced supports so as to maintain the center of gravity of the door forward of the point of support.

The illustrated preferred embodiment of the invention employs two spaced bracket-shaped supports, one at, or near, each end of the door. The illustrated form of supporting bracket comprises an escutcheon-type rear plate **29** through which fastening screws **30** pass into the back of the door panel. A bottom portion **31** is secured to the door at **32** and terminates in a bracket or fork **31'** in which

a roller 34 is pivotally mounted on an axis 35. The roller may consist of metal or a low friction plastic, such as tetrafluoroethylene polymer plastic, known in the trade as "Teflon." The roller 34 is so contoured that in addition to rolling freely in a forward and back direction it can slide laterally on the track 20. A set screw 33 extending through the rear plate 29 and bearing against a pressure plate 33' on the rear door surface permits slight raising and lowering of the door while screws 30 are backed off. After the adjustment the screws 30 are tightened.

A spacer strip 36 attached to the rear of the door panel provides a low friction rubbing strip between two door panels in the position one behind the other and spaces the front surface of the rear panel from the rear surface of the front panel. The spacer strip is cut out for the plates 29. A similar but narrower spacer strip 37 is provided at the top.

The center of gravity of the door is indicated at 38. The weight W of the door may be considered as being concentrated at that point which lies forward of the point of support, the point of contact of the roller 34 on the track 20 by a distance 1. This distance is a maximum 1_{max} when the door panel is upright, as shown in solid lines in FIG. 2, and may become a minimum 1_{min} when the panel is tilted back, as shown in broken lines. The latter position may occur temporarily while the door panel is being pushed back in order to slide it behind another panel. Under these conditions a moment acts on the door equal to $W \times 1_{max}$ or $W \times 1_{min}$, as the case may be, sufficient to cause the door to tilt forward against the front lip of the upper track 19 as soon as the force pushing the panel back is relieved. Thus the conventional relatively complicated spring assemblies previously employed for moving the door top forward can be dispensed with, yet the door panels in closed position are vertical or, if desired, may deviate from the true vertical position by a very small angle of the order of one degree.

An inclined bottom track is employed for moving the door bottoms into a forward position under the influence of gravity.

The portion 24 of the sill or bottom track on which the door supporting element, such as the rollers 34, move is slanted, imparting to the door panels a tendency to move downwardly towards the trough portion 23 and hence forward either against the front lip 22 or into contact with the door panel in front, as the case may be.

It is now evident that each door panel may be slid to the right or left, in which case the rollers 34 slide on the track 20 laterally, or may be moved behind another door panel by merely pushing the door panel back, in which case the rollers 34 move up on the inclined track portion 24. After the backward pressing force is relieved, the panel moves to the front. More particularly, the panel bottom does so due to the inclination of the bottom track and the panel top moves forward due to the panel weight lying forward of the point of support. If the several door panels are in side by side position they form a flush closure of the door aperture.

What is claimed is:

1. A flush closing assembly of substantially vertical sliding doors for a structural door opening, the assembly comprising, in combination, a plurality of sliding doors; a pair of rearwardly extending supporting brackets mounted at the bottom of each door, each said bracket comprising an anti-friction element rearwardly spaced from the door panel and resting on the supporting surface hereinafter recited; a common door supporting bottom sill on which said doors are movable from side to side as well as at right angles thereto, said sill having a door supporting upper surface engaged by said anti-friction element, said surface being of a depth sufficient to accommodate two doors in a position one behind the other and having a downward slant in a forward direction throughout the extent of engagement with the anti-friction elements within the range of movement of the doors from side to side to impart to the doors under the influence of gravity a bias to move forward within said range of movement; means at the sill for limiting said forward movement; and guide means for engaging the top portion of the doors at the top of the opening, said guide means being forward of the points of engagement of said anti-friction elements with said upper surface to maintain the doors normally in a substantially vertical position in which each door has a gravity induced tendency to bear against said guide means in a forward position for the said range of movement of the door on said upper surface, the vertical thickness of the bracket being so related to the slope of said supporting surface that the brackets of a door in back of another door clear the brackets of the door in front.

2. A flush closing sliding door assembly for a structural door opening, the assembly comprising, in combination, plurality of slidng door, a common door supporting member on which said doors are movable with freedom to move from side to side as well as at right angles thereto, said member having a door supporting upper surface of depth sufficient to accommodate two doors one beind the other, said supporting surface being substantially flat and having a downward slant in a direction of passage through the door, the slanted surface extending throughout the extent of lateral movement of doors from side to side and imparting to the doors under the influence of gravity a bias to move forward in all positions within said extent; means for limiting such forward movement; a pair of brackets attached to the lower portions of each of the doors, each bracket extending rearwardly of the door and including a roller resting on said slanted upper surface, said roller being rearward of the doors so as to place the center of gravity of door and bracket forward of all points of engagement with said slanted upper surface, the vertical thickness of the bracket being so related to the slope of said supporting surface that the brackets of a door in back of another door clear the brackets of the door in front; and guide means for engaging the top portion of the doors, said guide means comprising a stop extending across at least a major portion of the door opening forward of the point of engagement of said brackets with said slanted surface.

3. A flush closing sliding door assembly for a structural door opening, the assembly comprising, in combination, a plurality of sliding doors; a common door supporting bottom still relatively to which the door bottoms are movable with freedom to move from side to side and at right angles thereto, said sill having and upper bearing surface of a depth sufficient to accommodate two doors in a position one behind the other, said bearing surface being substanitally flat and having a downward slant in a forward direction throughout the range of movement of the doors from side to side; two rearwardly extending brackets mounted to the bottoms of each of the doors; a bearing element on each of said bracket, said bearing element resting on said bearing surface with freedom to move from side to side, as well as up and down the slant of said bearing surface, the point of engagement of each bearing element with the bearing surface being rearward of the door so as to impart to the door under the influence of gravity a tendency to tip forward at the top and at the same time slide forward at the bottom under the influence of gravity towards the lowest portion of the bearing surface; means for restricting the forward movement of the door bottoms with respect to the bearing surface; and stop means for engaging the top portions of the doors in a position in which the doors are substantially upright.

4. A flush closing sliding door assembly for a structural door opening, the assembly comprising, in combination, a plurality of sliding doors; a common door supporting bottom sill relaatively to which the door bottoms are movable with freedom to move from side to side and at right angles thereto, said sill having an upper bearing surface of a depth sufficient to accommodate

two doors in a position one behind the other, said bearing surface being substantially flat and having a downward slant in a forward direction throughout the range of movement of the doors from side to side; two rearwardly extending brackets mounted to the bottoms of each of the doors; a bearing element on each of said brackets, said bearing element resting on said bearing surface with freedom to move from side to side, as well as up and down the slant of said bearing surface, the point of engagement of each bearing element with the bearing surface being rearward of the door so as to impart to the door under the influence of gravity a tendency to tip forward at the top even in a position in which the door is vertical, and at the same time slide forward at the bottom under the influence of gravity towards the lowest portion of the bearing surface, the slant angle of the

bearing surface measured with respect to the plane represented by the rear surface of the door being not greater than 85 degrees, considering the door in closed position; means for restricting the forward movement of the door bottoms with respect to the bearing surface; and stop means for engaging the top portions of the doors in a position in which the door are substantially vertical.

References Cited by the Examiner

UNITED STATES PATENTS

2,644,205	7/1953	Karp	20—19
2,899,252	8/1959	Rolfe	20—19

HARRISON R. MOSELEY, *Primary Examiner.*

K. DOWNEY, *Assistant Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,280,507 October 25, 1966

Paul Kollsman

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 16, for "bination, plurality of slidng door," read -- bination, a plurality of sliding doors, --; line 24, after "of", second occurrence, insert -- the --; line 46, for "still" read -- sill --; line 48, for "and" read -- an --; line 72, for "relaatively" read -- relatively --; column 6, line 7, for "door" read -- doors --.

Signed and sealed this 12th day of September 1967.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents