

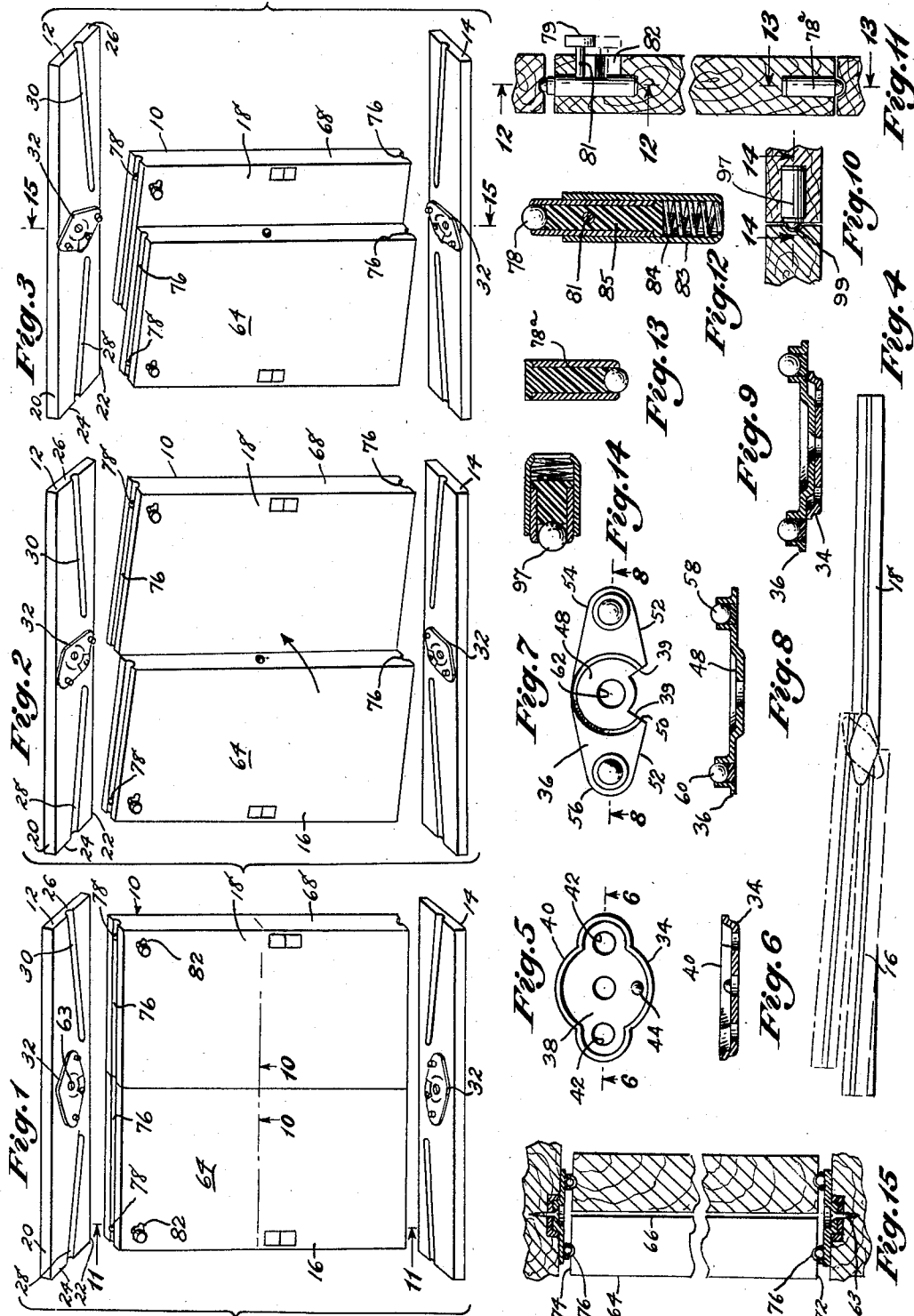
July 28, 1959

T. S. CHRIS
SLIDING DOORS

2,896,274

Filed May 20, 1957

3 Sheets-Sheet 1



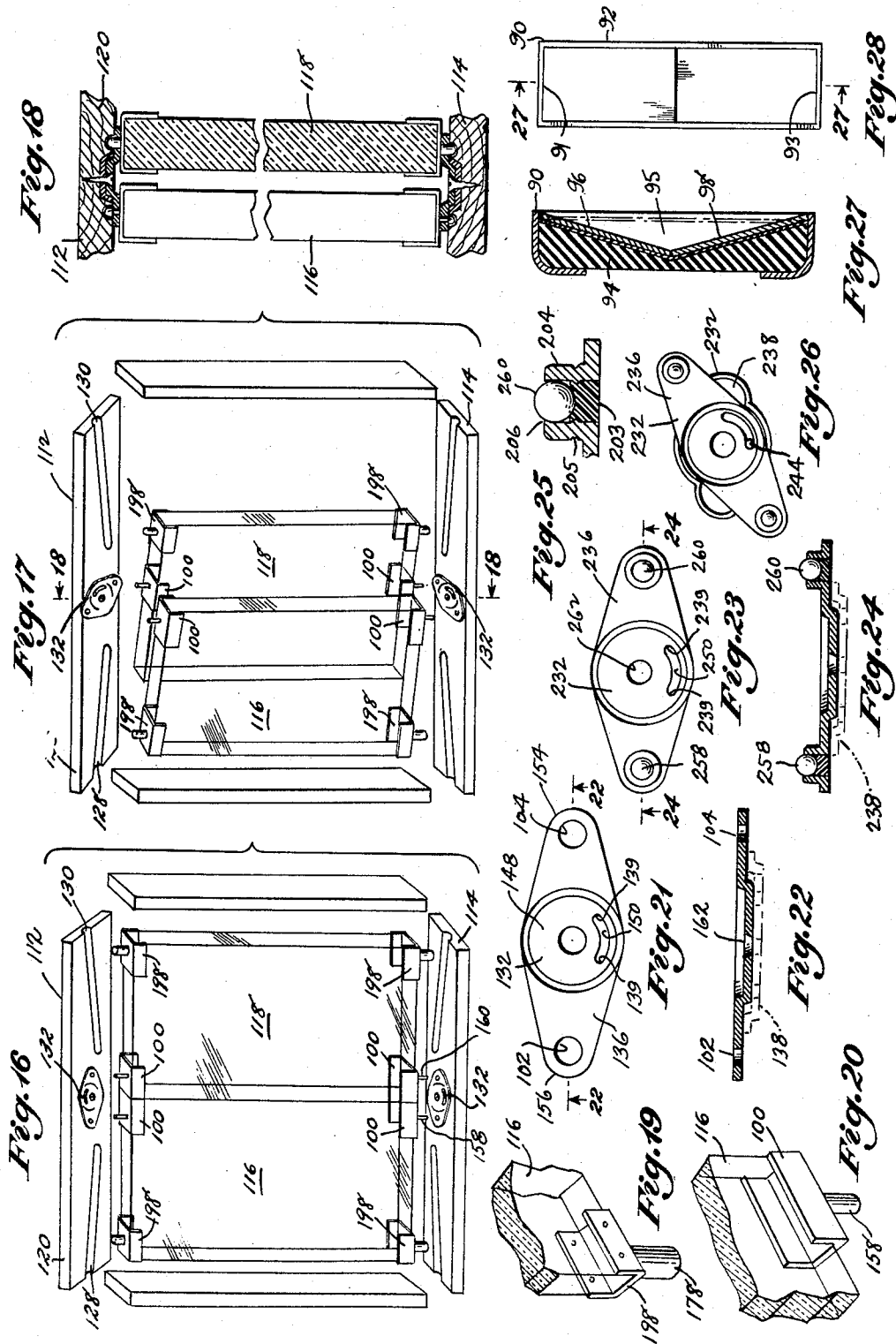
July 28, 1959

T. S. CHRIS
SLIDING DOORS

2,896,274

Filed May 20, 1957

3 Sheets-Sheet 2



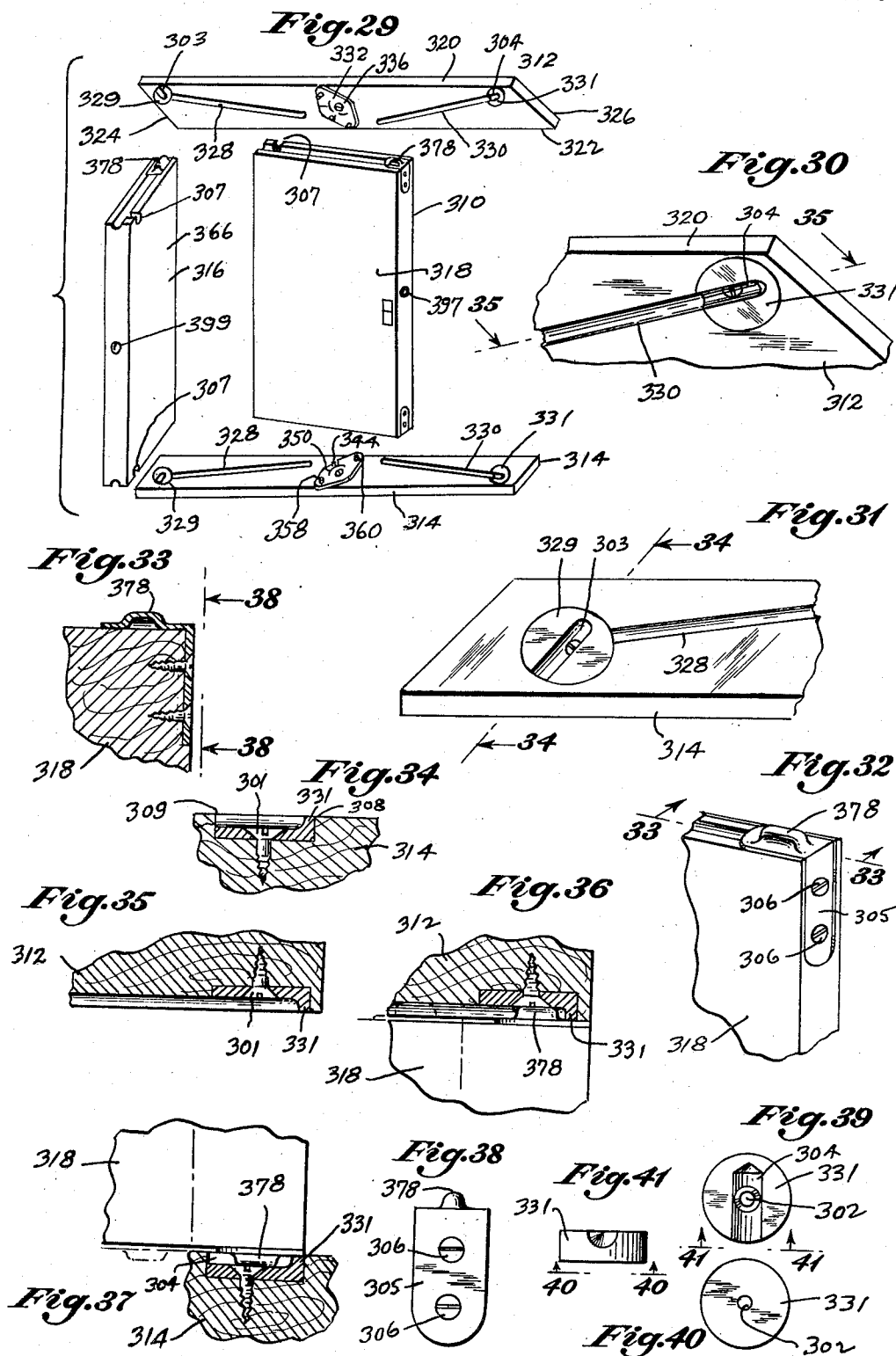
July 28, 1959

T. S. CHRIS
SLIDING DOORS

2,896,274

Filed May 20, 1957

3 Sheets-Sheet 3



1

2,896,274

SLIDING DOORS

Theodore S. Chris, New York, N.Y.

Application May 20, 1957, Serial No. 660,195

2 Claims. (Cl. 20—19)

This invention relates generally to the art of door closures, and more particularly to an improved form of sliding door in which a pair of doors are adapted to be slid in planes substantially at right angles to the axis of the opening to uncover either of two halves of the area of the opening.

This type of construction has application both in articles of furniture, as well as in the openings in walls dividing the several rooms of a building structure. In the past sliding doors have normally been arranged to move along parallel tracks so that they move in parallel spaced planes. This arrangement has suffered from a disadvantage in that when both doors are closed, a smooth surface is not presented to the viewer on either side of the opening, in that the door elements which completely fill the opening are not in abutted relationship.

It is therefore among the principal objects of the present invention to provide an improved form of sliding door construction in which the doors may be positioned in coplanar abutted relationship, when the same are in a closed position, and in which the doors may be shifted in position at their abutting edges to provide clearance so that one door may be slid to an open position on a plane parallel to and spaced from the plane of the other door.

Another object of the invention lies in the provision of improved pivoting means whereby the above-described motion is accomplished with a minimum of effort on the part of the user.

Another objection to ordinary sliding doors is that at least one door of a plurality of doors is always in a closed position. It is another object of the present invention to provide improved sliding door structure where not only do the doors slide from side to side across the opening but they may also swing about axes therein, thus, giving them an action comparable to regular hinge mounted doors.

A feature of the invention lies in the fact that the device may be adapted for use in conjunction with a wide variety of installations, the basic principles of the invention having application to many sizes and configurations of sliding doors.

Still another object of the invention lies in the provision of improved sliding door construction in which the movement of the component door elements from one position to another may be accomplished in an easy and an effortless manner by reducing sliding friction to a substantial minimum.

A further object of the invention lies in the provision of sliding door structure possessing the above advantages, in which the cost of fabrication may be of a reasonably low order, with consequent wide sale, distribution and use.

These objects and features, as well as other incidental ends and advantages, will become more clearly apparent during the course of the following disclosure, and be pointed out in the appended claims.

On the drawings, to which reference will be made in the specification, similar reference characters have been em-

2

ployed to designate corresponding parts throughout the several views.

Figure 1 is an exploded view in perspective showing a first embodiment of the invention.

5 Figure 2 is an exploded view in perspective of the first embodiment showing a first position or stage reached in the opening of one of the sliding door elements comprising the embodiment.

Figure 3 is another exploded view in perspective showing a second stage in the opening of the door element.

10 Figure 4 is a schematic plan view showing in full lines the door elements in a relatively closed position as indicated on Figure 1, and in dot-dash lines the alternate position of the door elements comparable to the showing in Figure 3.

Figure 5 is a plan view showing a base plate member comprising a part of the pivotal element which forms a part of the embodiment.

Figure 6 is a central sectional view of the base plate member as seen from the plane 6—6 on Figure 5.

Figure 7 is a plan view of the pivotal member which forms the second part of the pivotal element.

Figure 8 is a longitudinal central sectional view as seen from the plane 8—8 on Figure 7.

Figure 9 is a sectional view of the structure shown on Figures 6 and 8 in assembled condition.

Figure 10 is an enlarged fragmentary sectional view as seen from the plane 10—10 on Figure 1.

Figure 11 is an enlarged fragmentary vertical sectional view as seen from the plane 11—11 on Figure 1.

Figure 12 is an enlarged fragmentary vertical sectional view as seen from the plane 12—12 on Figure 11.

Figure 13 is an enlarged fragmentary vertical sectional view as seen from the plane 13—13 on Figure 11.

Figure 14 is an enlarged fragmentary sectional view as seen from the plane 14—14 on Figure 10.

Figure 15 is an enlarged fragmentary vertical sectional view as seen from the plane 15—15 on Figure 3.

Figure 16 is an exploded view in perspective corresponding in most respects to that seen on Figure 1, but showing a second embodiment of the invention.

Figure 17 is an exploded view in perspective of the second embodiment, but corresponding to Figure 2.

Figure 18 is a fragmentary sectional view of the second embodiment as seen from the plane 18—18 on Figure 17.

Figure 19 is a fragmentary view in perspective showing means employed for mounting the movable parts of the embodiment with respect to the relatively fixed parts thereof.

Figure 20 is a second view in perspective showing a second means employed for mounting the movable parts of the embodiment with respect to the relatively fixed parts thereof.

Figure 21 is a plan view of a part of the second embodiment corresponding to that seen on Figure 7.

Figure 22 is a vertical central sectional view as seen from the plane 22—22 on Figure 21.

Figure 23 is a plan view of a part showing a modification of the first embodiment corresponding to that seen in Figure 7.

Figure 24 is a sectional view as seen from the plane 24—24 on Figure 23.

Figure 25 is an enlarged fragmentary detail sectional view of the righthand end of Figure 24.

Figure 26 is a plan view of the assembly of the part shown in Figure 23 with the part shown in Figure 5.

Figure 27 is a vertical sectional view as seen from the plane 27—27 on Figure 28.

Figure 28 is a view in elevation showing a handle having finger engaging means employed to operate the first embodiment.

Figure 29 is an exploded view in perspective showing a third embodiment of the invention.

Figure 30 is an enlarged fragmentary perspective view of the upper frame element in the upper righthand corner of Figure 29.

Figure 31 is an enlarged fragmentary perspective view of the lower frame element in the lower righthand corner of Figure 29.

Figure 32 is an enlarged fragmentary perspective view of the upper righthand corner of the door element in Figure 29.

Figure 33 is a sectional view at plane 33—33 in Figure 32.

Figure 34 is a sectional view at plane 34—34 on Figure 31.

Figure 35 is a section at 35—35 on Figure 30.

Figure 36 is a section like Figure 35 with door element engaged in the rotatable socket element.

Figure 37 is a section like Figure 34 with the door element engaged in the rotatable socket element.

Figure 38 is an end elevational view of the upper projection of Figure 32.

Figures 39, 40 and 41 are plan, bottom plan and side elevation respectively of a rotatable socket element.

In accordance with the first embodiment of the invention, the device, generally indicated by reference character 10, comprises broadly: an upper frame element 12, a lower frame element 14, a first sliding door element 16, and a second sliding door element 18, inner guide means 32 and outer guide means 78.

The upper and lower frame elements 12 and 14 are substantially similar and symmetrical, and accordingly, a detailed description of the upper frame element 12 will serve equally well to describe the lower frame element 14.

The upper frame element 12 is shown as part of a door frame. Side jambs like those in Figure 16 may be used, and the frame may comprise a part of an article of furniture (not shown) or may be incorporated into the wall of a building structure, or installed in any other opening. It includes a forward edge 20, a rear edge 22, a left side edge 24, and a right side edge 26. Left and right hand grooves or channels 28 and 30, respectively, are formed in the undersurface of the frame element, that is to say, on the surface facing or abutting the door elements. As may be seen on Figures 1, 2 and 3, the channels are disposed in converged relationship toward the rearward edge 22 along directions parallel to the path of travel of the sliding door elements as the same are moved from closed to open position. Also disposed on the undersurface of the element 12 is the means 32 in the form of a pivotal element which is substantially centrally located between the grooves or channels 28 and 30.

Referring to Figures 5 to 9, inclusive, a pivotal element 32 includes a relatively fixed base plate member 34 upon which there is mounted a pivotal member 36 which is engageable with edge surfaces of the door elements. The base plate member 34 includes a planar portion 38 and a rim portion 40, the latter being up-turned to form a flange, as may be seen on Figures 6 and 9. Mounting holes 42 provide means for the engagement of screws (not shown) which maintain the base plate member 34 in substantially flush position with respect to the undersurface of the upper frame element 12. Extending from the exposed surface of the planar portion 38 is a pin 44 which is engageable with the edges 39 of the pivotal member 36 to limit the amount of rotational displacement of the pivotal member 36 with respect to the base plate member 34.

The pivotal member 36 includes a circular planar portion 48 having an arcuately shaped indentation 50 engageable with the pin 44 and has lever portions 52. These include a first end 54 and a second end 56 upon which substantially similar balls 58 and 60 are mounted

(see Figures 8 and 9). Disposed midway between the balls 58 and 60 is a central orifice 62 into which screw means 63 may extend. From a consideration of Figure 9, it is apparent that the pin 44 permits motion of the lever portions 52 from the position shown on Figure 1 to the position shown on Figure 3 in either a clockwise or counterclockwise direction, but otherwise arrests motion.

The door elements 16 and 18 are also substantially similar and generally symmetrical, and accordingly, a detailed description of the door element 16 will serve equally well to describe the element 18, thereby avoiding needless repetition.

The door element 16 may be formed from any suitable material, as for example, wood, plywood or metal, and includes a forward surface 64 a rear surface 66, as well as side surfaces 68. The lower surface 72 and upper surface 74 (Figure 15) are provided with elongated grooves 76 extending substantially the entire length thereof, and a projection 78 is disposed within each groove at points adjacent the outwardly disposed edges thereof, the projection being engageable within the grooves 28 or 30 to slide therein as the door elements are moved from open to closed position.

The projections 78 are in the form of spring pressed balls the upper ones of which are manually vertically shiftable by use of the button 79. The buttons 79 are attached to the outer ends of shanks 81 which coact with the L-shaped slots so that the projections 78 in the upper edge of the door elements may be lowered (and retained in a lowered position) while the doors are installed or removed from the frame, by partially rotating chambers 83 containing the springs 84. The ease of rotation of the balls is enhanced by the self lubricating cores 85 composed of nylon, sintered metal, or the like.

Referring to Figures 27 and 28, there may be observed a recessed finger engaging means 90, which may be employed in conjunction with the door elements 16 and 18. The means 90 presents a normally flat surface to the viewer of the outer surface of the door elements. The means includes an outer frame member 92, which is suitably recessed in a corresponding opening in the door element, and which encloses a sponge rubber or other resilient member 94, which in an unstressed position, maintains the inwardly movable members 96 and 98 in the position shown in Figure 27. Manual pressure exerted in a rearward direction, causes the members 96 and 98 to pivot about their outer horizontal edges 91 and 93, to permit the side surfaces 95 of the frame member to be engaged, thereby permitting the door elements to be slid with respect to each other.

To maintain the door elements in abutted relationship when the same are in a closed position, spring detent means of the type shown on Figures 10 and 14 may be employed. In this construction, the spring pressed ball 97 engages a corresponding recess 99 in the opposing door element, the same being disengaged upon inward pressure upon either of the door elements.

The operation of the device is substantially as outlined on Figures 1, 2 and 3 wherein on Figure 1 the door elements 16 and 18 are disposed in abutted relationship in the same plane completely closing the opening in which they are disposed. In Figure 2 pressure exerted upon the element 18 in the direction of the arrow serves to shift the abutted edge of the element 18 rearwardly of the abutted edge of the element 16, as the pressure is transmitted through the ball 58 to result in motion in an opposite direction of the ball 60. In this position the door panel element 18 may be moved to the left as seen on Figure 3 to result in opening a part of the space occupied by the door elements. During the sliding motion, the balls 58 slide within the grooves 76 disposed in the upper and lower surfaces of the door element 18, while aligning support is obtained by the engagement of the projection 78 within the grooves 30,

5

at both the upper and lower portions of the door element. The door is closed by reversing the operation, the element 18 first being slid to the right as seen on Figure 3 after which pressure is exerted upon the abutted edge of the door element 16 to return the panel elements 16 and 18 to their original coplanar position as shown on Figure 1. Where it is desired to open the door element 16, pressure is first exerted on the abutting edge of this door element rather than the panel 18, and in this case, the abutting edge of the door element 16 will be disposed rearward of the abutting edge of the door element 18, and then the door element 16 may be laterally shifted behind the element 18.

Turning now to the second embodiment of the invention, as shown on Figures 16 to 22, inclusive, parts corresponding to those of the first embodiment have been designated by similar reference characters, with the additional prefix "1."

The second embodiment of the invention differs from the first embodiment, principally in the use of door elements 116 and 118, which are formed from sheet glass or other transparent material. To avoid drilling or otherwise marring the surface of the elements 116 and 118, the same are supported by gripping clip members 198 and sliding clip members 100. The former support, projecting pins 178, while the latter support pins 158 and 160 corresponding to the pins 58 and 60 of the first embodiment. The pins 158 and 160 are adapted to engage the holes 102 and 104 in member 152.

In the modification illustrated in Figures 23 to 26 inclusive, here again, to avoid repetition certain of the parts corresponding to the prior described subject matter are given corresponding reference characters with the addition of the prefix "2." The use of the slot 250 instead of the indentation 50 increases the strength of the pivotal member 236. As seen in Figure 25 the lubricating and supporting plug 203 is held in place by the annular compressed distortion 205 of the housing 204, while the ball 260 is held by the spun-in rim 206.

Turning now to the third embodiment of the invention illustrated in Figures 29 to 40 inclusive, to avoid repetition, certain of the parts corresponding to prior described embodiments are given the same reference characters with the addition of the prefix "3."

The third embodiment differs from the others, principally in that the doors in addition to sliding laterally also pivot axially about their outer edges so that they open in a manner substantially the same as ordinary hinge mounted doors.

Disposed in the outer ends of the grooves or channels 328 and 330 are small turn-table elements 329 and 331. Four of these are required for each pair of doors. The turn-table elements are substantially identical and are shown in detail in Figures 39 to 41 inclusive. A cylindrical recess 308 is provided at the outer ends of grooves 328 and 330 and the turntable elements are rotatably mounted therein by the countersunk screws 301 which pass through central holes 302, and engage the respective upper and lower frame elements 312 and 314. The turntable elements have in the exposed surfaces thereof dead-end grooves 303 and 304.

The door elements 316 and 318 are provided with laterally elongated projections 378 which are of less length than the length of the dead-end grooves 303, 304.

The projections 378 are preferably integral with mounting brackets 305 therefor and the projections 378 may thus be suitably attached to the door elements by mortising the same and fastening with screws 306. Since the distance between the lower surface of the upper frame element 312 and the upper surface of the lower frame element 314 needs be only great enough to permit sliding movement of the doors, it is desirable when installing the doors that they be put into place and then the screws 306 are secured. The easiest position to do this, for

6

example for the door 318, would be in the position shown in Figure 29.

When it is desired to swing a door element to its most open position, for example the door element 316, it is moved all the way to the left at which point the projections 378 will move from the grooves 328 into the turn-table elements 329 which at that time have the dead-end grooves 303 thereof in alignment with the grooves 328. The rear or inner surface 366 and rear portions of the upper and lower edges of the door element are provided with notches 307 which are sufficient in size to clear the pins or balls 358. Thus, the door element 316 may be released of connection with the balls 358 and swung open about the screws 301 as centers to the position indicated in the lefthand portion of Figure 29.

When the door elements 316 and 318 are in their normal closed position the balls 358 and 368 may be in line with the screws 301, and the door elements may be in the same plane. Their juxtaposed inner edges may be interengaged by the spring pressed ball 397 and the recess 399. Pressing the righthand door element 318 rearward will rotate the means 332 counterclockwise as viewed from above so that the balls 358 may move to the right thereby enabling them to meet and pass the notches 307.

It will be noted that when the door 216 is swung about a vertical axis through the screws 301, the projections 378 engage against the rims 309, of the recesses 308, which prevents the door element from pulling out of its hinged arrangement at that position.

It may thus be seen that I have invented novel and highly useful improvements in sliding door construction in which there has been provided a simple and efficient means for mounting portions of the sliding door elements for pivotal motion permitting the door elements to clear each other to be slid to opened position, while also permitting the door elements when closed to occupy substantially a single plane. When desired the doors may also be opened in hinge fashion. The mounting of the door elements requires a limited amount of special hardware which is easily fabricated at low cost, and the entire device requires relatively few moving parts, thereby assuring a relatively long troublefree, useful life.

I wish it to be understood that I do not consider the invention limited to the exact details of structure shown and set forth in this specification, for obvious modifications will occur to those skilled in the art to which the present invention pertains.

I claim:

1. In a door construction including a frame, a door element and means to mount the door element upon the frame for slideable movement thereon and second means to mount the door element on said frame element for pivotal movement thereon, the improvement comprising: said door element including a projection thereon lying substantially on the plane of said door element and extending outwardly therefrom, said frame element having a first elongated groove in which said projection is slideably disposed, said frame element having a pivotally mounted turntable element thereon having a second dead-end groove therein adapted in a first rotational position to form an extension of said first groove, whereby the projection may move into said second groove whereby the turntable will form the pivotal axis of the door and in a second rotational position to maintain said projection against rectilinear movement therefrom.
2. In a door construction including a frame, a door element, first means to mount the door element on said frame for slideable movement thereon and second means to mount the door element on said frame for pivotal movement thereon, the improvement comprises: said frame including upper and lower frame elements each having a first elongated groove in which said projection is slideably disposed, each frame element having a pivotal-

ly mounted turntable element thereon having a second dead-end groove adapted in a first rotational position to form an extension of said first groove, whereby the projection may move into said second groove whereby the turntable will form the pivotal axis of the door and in a second rotational position to maintain said projection against rectilinear movement therefrom.

5

References Cited in the file of this patent

UNITED STATES PATENTS

2,386,510	Shafer	Oct. 9, 1945
2,686,941	Patten	Aug. 24, 1954
2,778,051	Menz	Jan. 22, 1957

FOREIGN PATENTS

1,123,185	France	June 4, 1956
-----------	--------	--------------