Aug. 11, 1959 R. E. FORD 2,898,987

DOOR CONSTRUCTION

Filed May 24, 1955 2 Sheets-Sheet 1

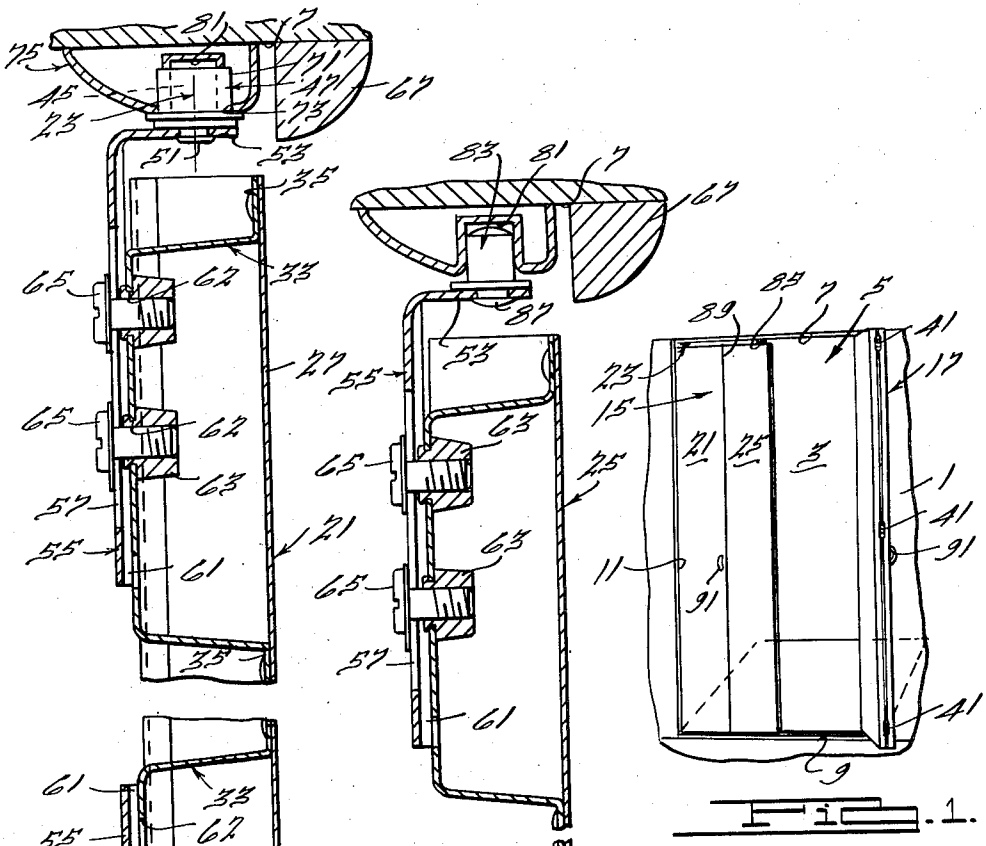


Fig. 1.

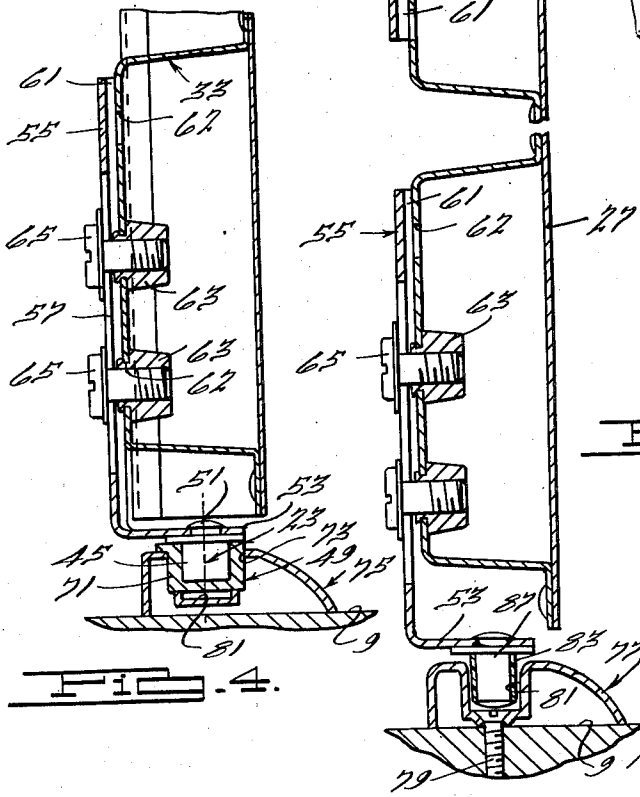


Fig. 4.

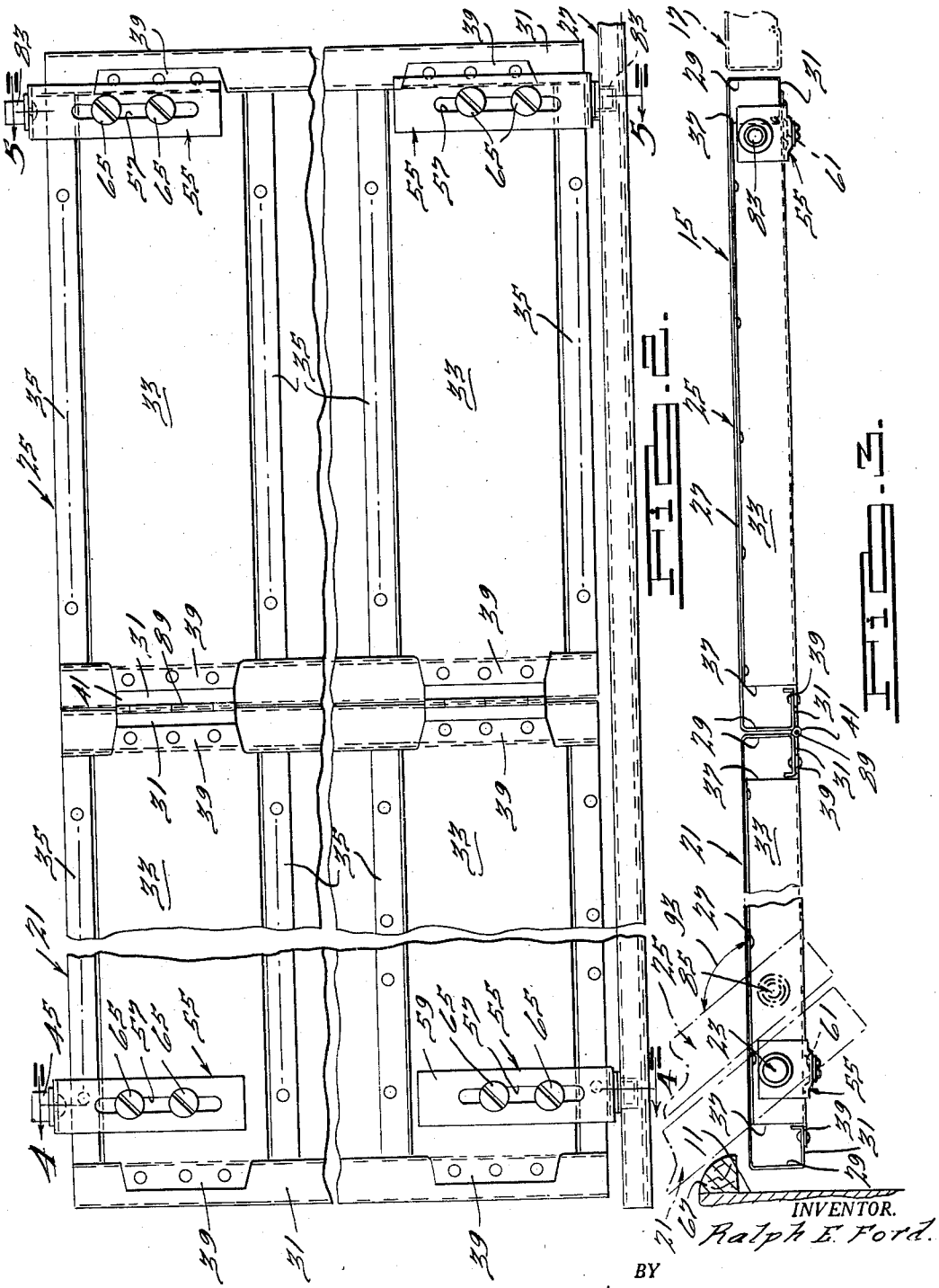
Fig. 5.

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United States Patent Office 2,898,987 Patented Aug. 11, 1959

2,898,987

DOOR CONSTRUCTION

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Application May 24, 1955, Serial No. 510,655

2 Claims. (Cl. 160—206)

This invention relates to door constructions and, in particular, to folding doors.

While the invention is not necessarily so limited, its original application has been to doors for closets in private residences. In recent years it has come to be the fashion to provide rather wide openings to closets, much wider than a conventional door. An ordinary hinged door could not be used for such closets since it would take up far too much space when swung open into the room containing the closet. As a consequence, builders turned to sliding doors or panels for the closet and at the present moment these are in widespread use in newly built homes.

Sliding doors, however, always occupy a considerable part of the opening that they are intended to close, even when they are moved to a retracted position. As a consequence, full advantage of the wide openings to modern closets cannot be taken since a good part of the opening is always closed by a sliding door.

It is the object of this invention to provide folding doors that are especially adapted to close wide openings in closets but which can be opened up to expose the complete closet opening. Of course, the invention can be used in other applications but it is of peculiar value in connection with closets since it performs the functions stated without projecting a significant amount into the room, even when fully opened.

Though my door construction could be made of other materials, I prefer for reasons of economy to make it of sheet metal. Its construction is such that it is very light in weight yet it is strong and pleasing in appearance. It is relatively simple and economical to manufacture and to install.

Speaking generally, my invention contemplates the use of a pair of folding door units which are hinged on opposite sides of the closet opening. Each door unit consists of a pair of panels which are hinged together. When the door units are closed the panels all lie in the same plane; but when the doors are open the panels in each unit are hinged together so that they are substantially parallel with each other and extend transversely to the wall or closet opening. The door units are mounted by means of my invention in such a way that they move freely and do not bind no matter how they are grasped, pushed, or pulled toward a closed or opened position.

My invention is illustrated in preferred forms in the accompanying drawings in which:

Figure 1 is a perspective view of my improved door construction and shows one door unit in closed position and the other in fully open position;

Fig. 2 is a front elevation, partly broken away, and with the upper track omitted, of the left-hand door unit of Fig. 1, it being noted that the left- and right-hand door units are identical;

Fig. 3 is a top elevation of the door construction shown in Fig. 2 and in dotted lines shows the doors swung to a fully opened position;

Fig. 4 is a cross section taken along the lines 4—4 of Fig. 2 with the top track added; and

Fig. 5 is a section taken along the line 5—5 of Fig. 2.

Referring first to the preferred embodiment of the invention as shown in Figs. 1–5, Fig. 1 shows diagrammatically a wall 1 of a room having a large closet 3 with an access opening 5 in the wall 1. The opening 5 is defined by top and bottom surfaces 7 and 9, respectively, and by left- and right-hand vertical surfaces 11, all of these being constructed in any desired way by the builder of the residence containing the closet 3. The opening 5 is closed by a door construction which includes left- and right-hand door units 15 and 17, respectively, which are identical in construction, except for being on opposite hands, so that a detailed description of only one of these units will suffice. The units are of such width that they meet when fully closed, preferably in the center of the opening 5, though there may be a slight clearance such as ⅛ inch or so between them. I contemplate especially that these door units extend from the floor to the ceiling of the room containing the closet so that the closet 3 is in effect provided with one side that can be entirely open from end to end and top to bottom.

Each of the door units 15 and 17 contain two panels, one of which is an outer panel 21 which is hinged along an axis 23 to the top and bottom surfaces 7 and 9 of the door opening. Hinged along the inside edge of the outer panel 21 is an inner panel 25. The panels 21 and 25 are preferably of the same width and, except for hardware to be hereinafter described, are identical with each other. While they can be made of plastic, plywood, or other materials, they preferably comprise a sheet 27 of mild steel that has been bent in a brake press along the vertical edges to form the inwardly turned J-corners 29 which present a vertically extending back surface 31. To stiffen the sheet metal 27 there are provided adjacent the top and the bottom of each panel a transverse hat section 33 having the side flanges 35 which are spot welded to the sheet metal 27, the ends of the hat section being cut out as shown at 37 to provide tabs 39 that fit on top of surfaces 31 so that they can be screwed, riveted, or spot welded, as shown, to the surfaces 31. The hat sections 33 in conjunction with the J-shaped corners 29 stiffen the panels 21 and 25 so that they do not "oilcan" or otherwise distort in an undesirable or unpleasing manner. It will be seen that the hat sections 33 at the top and the bottom are interchangeable, thus reducing the variety of parts needed to make up the entire door construction.

The panels 21 and 25 are hinged to each other by several hinge pieces 41 of a conventional type that can be purchased on the open market. Three such hinges located at the top, bottom, and central points on the panels are preferably used and they may be spot welded or otherwise secured to the surfaces 31 on adjacent corners 29 of the panels 21 and 25, thus being located at the rear of the panels whereby the front surfaces 43 thereof present a flush and pleasing appearance.

The panel 21 is hinged on axis 23 by means of pins 45 which pivot in sockets 47 and 49, respectively, fitted in channels at the top and the bottom of the closet door opening 5. Each pin 45 is secured by a screw or rivet 51 or the like to the foot 53 of an L-shaped bracket 55. Each bracket 55 has a vertical slot 57 formed in its major leg portion 59 and is embossed outwardly to provide a longitudinal recess 61. Each of the hat sections 33 has three holes 62 formed therein adjacent one end and these are preferably symmetrical with respect to the center line or midplane of the hat section, the top two holes being used for the bracket 55 at the top of the panel and the bottom two holes being used for the bracket 55 at the bottom of the panel. Secured in the holes in the hat sections are clinch nuts 63 of a type that is available on the open market which have sections that fit into the recess 61, the clinch nuts being non-rotatable but

having a threaded opening to receive screws **65** in slots **57** that will clamp the brackets **55** tightly against the top of the hat section to hold the pivot pins **45** in position. The slots **57** permit vertical adjustment of the brackets and thus of the pivot pins to accommodate substantial dimensional variations among different openings **5**. It might be noted that the brackets **55** enable the pivot pins **45** to be placed fairly close to the top and bottom surfaces of the door panel so that, as seen in Figs. 4 and 5, trim molding **67** secured to the surface **7** can be used to cover most, if not all, of the space between the top of the panel and the surface **7**.

The sockets **47** and **49** for the pivot pins **45** are preferably provided by bushings **71** that are pressed in drilled out openings **73** in the top and bottom tracks **75** and **77** which are secured by screws **79** to the top and bottom surfaces **7** and **9**. The tracks **75** and **77** are preferably identical and formed of extruded aluminum to the shape seen in Figs. 4 and 5 wherein the channel portions **81** constitute tracks defining a plane lying in the plane of the panels **21** and **25** when the door units are fully closed as shown at the left in Fig. 1. In other words, the channels **81** run parallel to the plane of the wall **1** and do not run off at an angle into the closet **3**. The channels **81** provide tracks for pins **83** that are located at the inside edges of the inside panels **25** along a movable vertical axis **85**. The pins **81** are preferably formed by mounting a piece of molded nylon tubing on studs **87** that are secured by screws, pins, or the like to the feet **53** of brackets **55**. It may be noted here that it is not absolutely necessary to have both the upper and the lower tracks **81**, and that one, preferably the top, will suffice to guide movement of the folding door panels **21** and **25**.

It is of the utmost importance that in the arrangement so far described the axis **23** be located closer to the axis **89** of hinges **41** than is the axis **85**. This is necessary in order to prevent jamming of the pins **83** in the tracks **81** when the door is closed by a push (as on handles **91**) on the outer panel **21** that is directed inwardly toward the center of the opening **5**. If the distances are the same or if the distance between hinges **41** and axis **85** is less than it is on the outer panel **21**, the doors will either not fully collapse or they will jam in the tracks when closed by pushing on the outer panel rather than by pulling on the inner panel. By making these distances unequal in the manner just indicated, the sliding panel **25** will always make an angle **93** with the track **81** that is greater than 90 degrees and will thus slide freely and without binding. At present, with the panels 1 inch thick and each 11¾ inches wide and a distance between the pin axis **23** and hinge axis **89** of 10 inches, I prefer to space the hinges **41** from the pins **83** (axis **85**) by a distance of 10¾ inches.

It will now be seen that the invention provides a simple door construction that may be economically manufactured and easily installed and which will operate smoothly. Furthermore, its construction is of such a nature as to occupy a minimum of space and make available the entire opening of the closet. In addition, by making the door so that it extends from the floor to the ceiling it is possible to eliminate some expensive wall construction

in building of the home, namely the overhang wall extending from the ceiling to the top of the door in conventional installations.

Modifications may be made in the specific structure illustrated without departing from the spirit and scope of the claims.

I claim:

1. In a door construction for a doorway having upper and lower horizontal surfaces and vertical side surfaces, a straight channel shaped track on one of said horizontal surfaces extending parallel to the plane of the doorway, a pivot socket mounted in said track adjacent one of said vertical surfaces, another pivot socket mounted on the other of said horizontal surfaces and acting with said first mentioned socket to define a vertical pivot axis in alignment with said track, a pair of door panels hinged together along a vertical axis so that they can be coplanar and parallel to said track in one position, one of said panels having pivot pins located in the midplane thereof and projecting into said sockets to pivotally mount said panels thereon, the other of said panels having a pin located in the midplane thereof and projecting into said track and movable along said track, said last mentioned pin being located farther from the hinge between said panels than said first mentioned pins whereby the exterior angle between the outside face of said other panel and said track is always greater than 90° during pivotal movement of the one panel.

2. In a folding door for a doorway having a frame with a vertical side, first and second panels having hinge means hinging them together so that they can be coplanar in one position and substantially parallel in a folded position, fixed pivot means for attachment in the doorway to said frame adjacent said vertical side and defining a vertical pivot axis, pivot means on said first panel cooperative with said first mentioned pivot means to pivotally connect said panels in said doorway so that they can be pivoted to fully open or fully closed positions, a straight horizontal track for attachment in said doorway to said frame and providing a runway parallel to the plane of the doorway and in alignment with said vertical pivot axis, guide means projecting from said second panel and riding in said track and movable along said runway as said panels are hinged together and apart, said guide means on said second panel being spaced farther from said hinge means between said panels than is the pivot means on said first panel.

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