April 21, 1959 McFERRELL HOLLANSWORTH 2,882,962

FOLDING DOORS

Filed Nov. 14, 1957 3 Sheets-Sheet 1

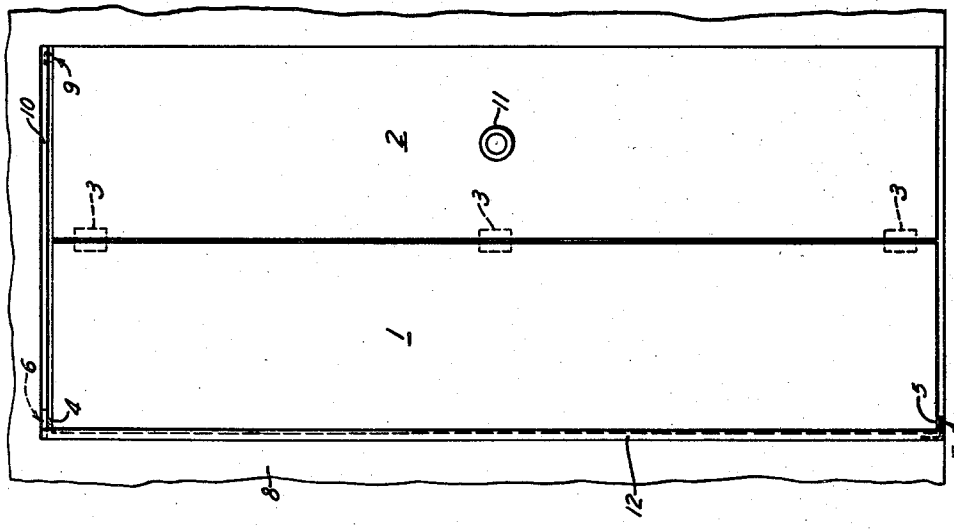


Fig. 1

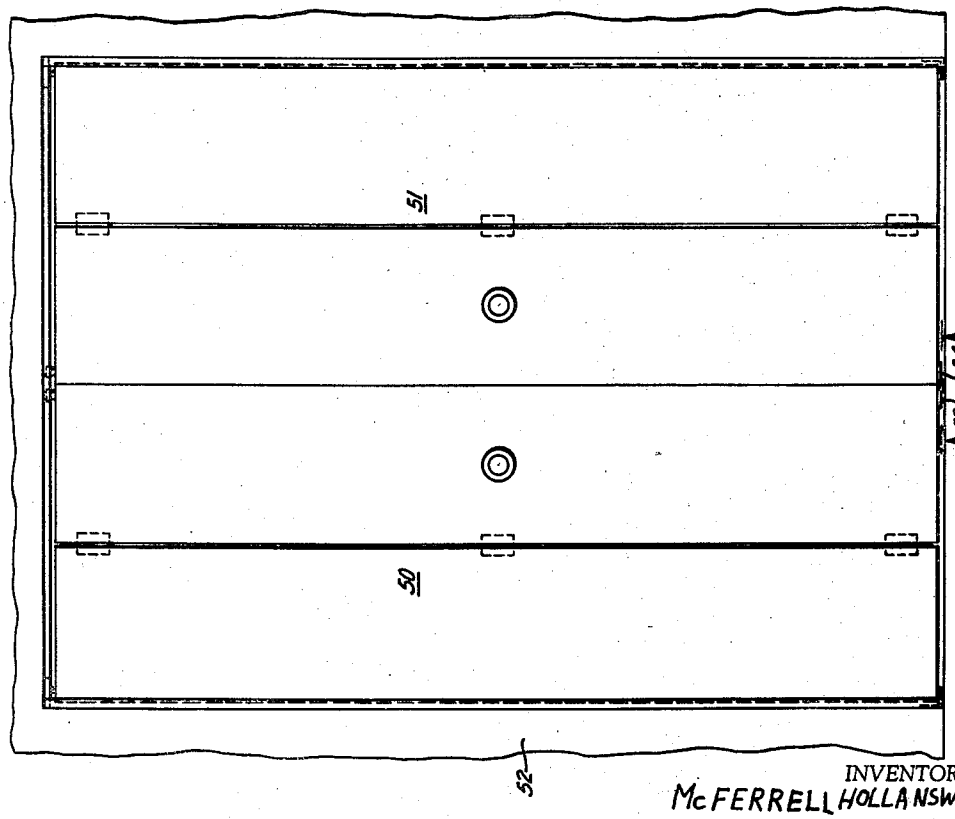


Fig. 2

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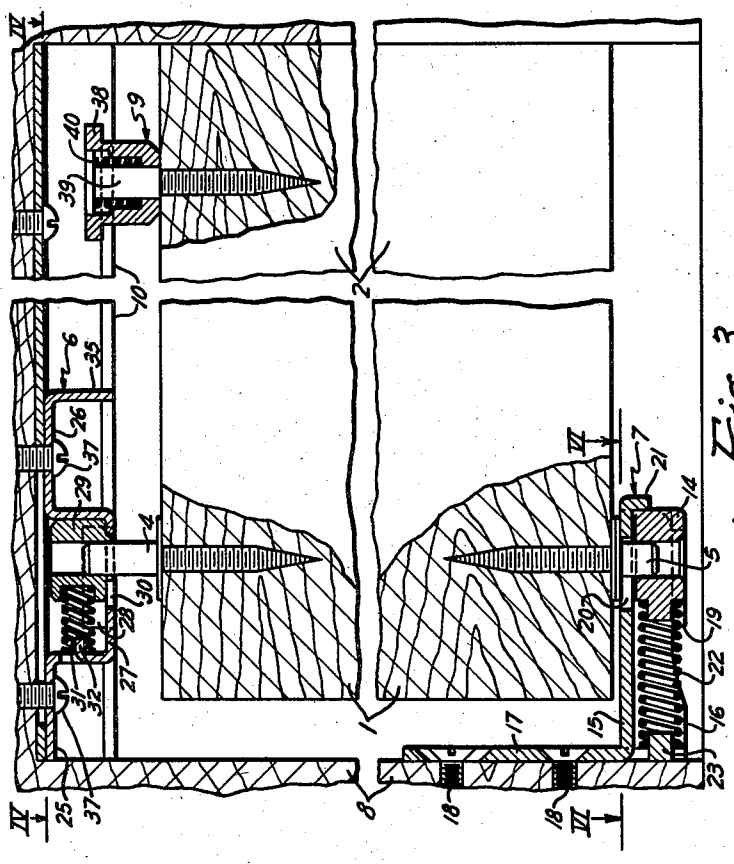


Fig. 3

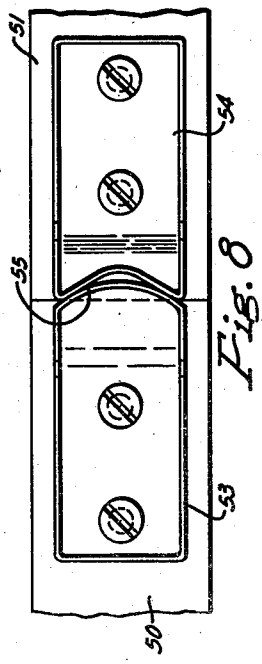


Fig. 8

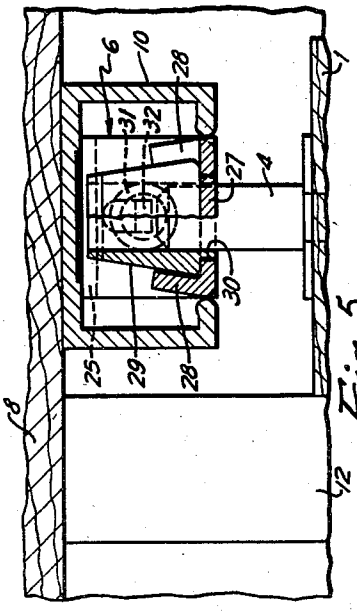


Fig. 5

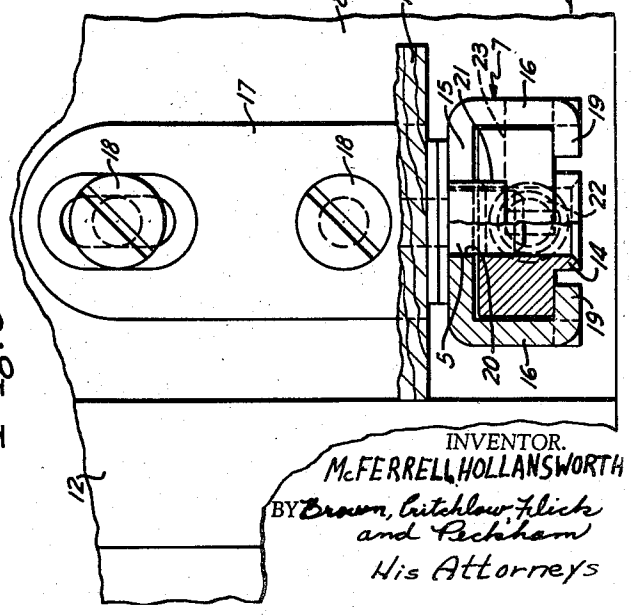


Fig. 7

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3 Sheets-Sheet 3

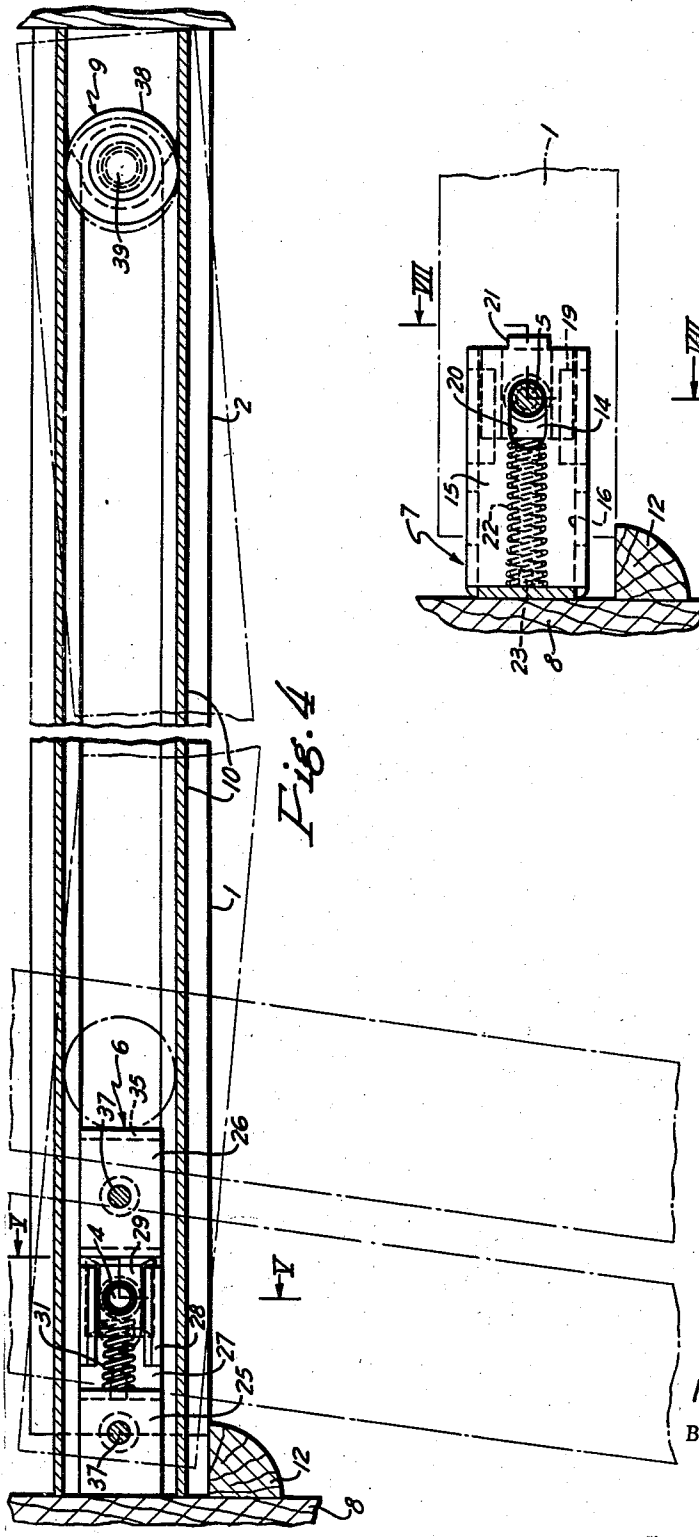


Fig. 4

Fig. 6

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FOLDING DOORS

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11 Claims. (Cl. 160—118)

This invention relates to folding doors, and more particularly to the manner of supporting such doors in doorways.

When a folding door is made from stiff panels that are hinged together on a vertical axis, it generally has been necessary in the past to space the free edge of the door from the door jamb, or from the adjoining door when two folding doors are hung in the same doorway. This is because the width of the door increases slightly when it first starts to open, due to a lining up of the diagonal dimensions of the panels as they are inclined relative to one another. To allow for this momentary increase in width, clearance has had to be left between the free edge of the closed door and the adjacent side of the doorway. Although it has been proposed to eliminate this clearance by mounting the jamb on springs that will allow it to be pushed back when the door starts to open, that idea is not satisfactory because a door frame is supposed to be rigid. Also, it cannot be used where a folding door is being installed in a conventional doorway.

It is among the objects of this invention to provide a folding door construction in which the jambs of the doorway are stationary, in which the free edge of a single door will engage a side of the doorway when the door is closed, in which double doors will engage each other when they are closed, and in which allowance is made for the temporary increase in width of such a door as it starts to open.

In accordance with this invention, a plurality of door panels are hinged together on a vertical axis, and they are disposed in a common vertical plane when the door is closed. At that time one edge of the door is spaced a short distance from the adjacent side of the doorway, while the opposite edge substantially engages the other side of the doorway or the edge of a second folding door in the same opening. Projecting from the top and bottom of the door near its first-mentioned edge are pivot pins, on which bearings are mounted. Means are mounted in the doorway for holding the bearings in such a way that they can move toward the adjacent side of the doorway, but springs urge them in the opposite direction. Movable along a track secured to the top of the doorway above the door is a guide member that is connected to the door near its free edge. As the door is opened, the guide member compels it to fold, whereupon its free edge presses against the adjoining door jamb and its opposite edge is forced toward the opposite side of the doorway, which is permitted by the spring-pressed bearings. As soon as the door is opened far enough to start to contract in width, the springs push the bearings back to their original positions.

The invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a front view of a closed folding door;

Fig. 2 is a similar view of a pair of folding doors in a single opening;

Fig. 3 is an enlarged fragmentary vertical section through the door construction of Fig. 1;

Fig. 4 is a horizontal section taken on the line IV—IV of Fig. 3;

Fig. 5 is a further enlarged cross section taken on the line V—V of Fig. 4;

Fig. 6 is a horizontal section taken on the line VI—VI of Fig. 3;

Fig. 7 is an enlarged cross section taken on the line VII—VII of Fig. 6; and

Fig. 8 is an enlarged fragmentary bottom view of the doors of Fig. 2, showing the members aligning them at the bottom.

Referring to Fig. 1 of the drawings, a door is shown formed from a plurality, preferably two, rigid panels 1 and 2. The panels are rather thick, in the neighborhood of an inch for example. Their adjacent edges are hinged together by any suitable form of hinges 3 secured to the back of the panels. There is only enough space, i.e. 1/32 inch, between the panels to prevent the hinges from binding. Screwed into the top and bottom of one panel near its outer edge are upwardly and downwardly extending pivot pins 4 and 5 that project into horizontal hinge brackets 6 and 7, respectively, secured to the door frame 8. The opposite or free edge of the door has an upwardly extending hanger or guide member 9 that is slidable back and forth in a horizontal track 10 secured to the top of the doorway along the top of the closed door. When the door is opened by pulling on a knob 11 or the like, or by pushing on its opposite side, the guide member will move along the track and compel the door to fold. While the door is closed, its free edge engages or nearly touches the adjoining side of the doorway. Its opposite or pivoted edge, however, is spaced a short distance from the adjacent door jamb for a purpose that will be explained presently. This space between the door and jamb may be concealed by a molding strip 12 secured to the side of the doorway in front of the door.

It is a feature of this invention that, as the door starts to fold and increase in width for a moment, its pivoted edge can move toward the adjacent side of the doorway to allow the temporary increase in width to take place. For this purpose the pivot pins on which the door turns are mounted in bearings that can move toward and away from the adjacent door jamb. Thus, the lower pivot pin 5 projects down into a bearing 14 that is slidably mounted in sheet metal bracket 7, as shown in Figs. 3, 6 and 7. The bracket has a top 15 with downwardly extending side flanges 16. Extending upward from the back of the top is an extension strip 17, through which extend screws 18 that fasten the bracket to the door jamb. At the opposite end of the bracket the bottoms of the side flanges are provided with inwardly projecting ribs 19, on which the bearing is slidable lengthwise of the bracket. Above the bearing the top of the bracket is provided with a slot 20, also extending lengthwise of the bracket and through which the pivot pin extends down into the bearing. The bearing is prevented from sliding out of the front end of the bracket by a down-turned lug 21 at that end. The bearing is normally held against this lug, with the pivot pin near the corresponding end of the slot, by means of a coil spring 22 compressed between the back of the bearing and a tongue 23 extending part way across the back of the bracket from one of its side flanges. The free end of the tongue is bent forward and projects into the coil spring a short distance to support that end of the spring. Consequently, although the slot permits the pivot pin and bearing to be moved toward the adjacent side of the doorway, the spring will urge them back toward their original position at the front end of the bracket.

The upper bracket 6 likewise is made of a strip of

sheet metal, but it has a different shape than the lower one. As shown in Figs. 3 and 4, it has two upper horizontal portions **25** and **26** connected by a depending U-shaped portion **27** that forms a recess between them. The opposite sides of the bottom wall of the recess is turned up to provide short ribs **28** that prevent the pin bearing **29**, which is disposed in the recess, from sliding out sideways. The bottom wall of the recess also has a slot **30** that extends lengthwise of the bracket. The upper pivot pin projects through this slot and into the upper bearing, which is urged away from the adjacent side of the doorway by a coil spring **31** compressed between the bearing and the back end of the recess, where the spring can encircle a lug **32** bent out of the bracket. By tapering the bearing upward as shown in Fig. 5, and inclining ribs **28** toward each other, the ribs will prevent the bearing from falling out of the bracket before it is installed. From the front end of horizontal portion **26** of the bracket there is a down-turned end portion **35** that serves as a stop for guide member **9**.

The upper bracket is secured in place by wood screws **37** that are screwed into the doorway above it. The bracket is mounted with its rear end engaging the door jamb, in which position the upper bearing will be the same distance as the lower bearing from the jamb. The bracket is concealed inside of track **10**, which is an inverted channel shaped member as shown in Fig. 5. The bracket screws **37** extend up through the top of the track and help hold it in place. The lower edges of the side flanges of the track are turned inward toward each other to form horizontal supports for the head of guide member **9** that is slidable lengthwise of the track. As shown in Fig. 4, this member includes a flanged cup **38** that is disposed in the track, and a headed screw **39** that is screwed into the top of the door near its free edge. The cup can move up and down around the screw to allow for variations in the elevation of the track. The screw is encircled by a coil spring **40** compressed between its head and the bottom of the cup. When the door is folded, this guide member will move along the track until it engages upper bracket stop **35**, which will stop the door with its panels substantially parallel but out of contact with each other so that they will not mar each other, as indicated in broken lines in Fig. 4. By having the distance from the axis of guide member **9** to the axis of hinges **3** slightly greater than the distance from the hinge axis to the axis of pivots **4** and **5**, the folded doors will be swung back toward the adjacent jamb, which improves the appearance of the open doorway.

When the door starts to open, in response to pulling on its knob or pushing on its opposite side, the pivot pins **4** and **5** will begin to turn in their bearings and the hinges **3** connecting the panels will start to fold. Since the closed door had its free edge substantially engaging one side of the doorway, initial pivoting of the door, which increases its overall width by lining up the diagonal dimensions of the panels, pushes the pivot pins toward the adjacent side of the doorway against the resistance of the coil springs. The position of the door at the moment of its greatest width is shown in inclined broken lines in Fig. 4. As the door continues to open, its width will decrease and the coil springs will push the bearings and pivots back toward the front ends of the slots in brackets **6** and **7**. From then on the door will merely pivot in the bearings as if the bearings were rigidly mounted. Of course, while the door is being opened guide member **9** is moving along the track. While the door is closing, the door will operate in the ordinary way until its free edge engages the adjoining side of the doorway. Further closing or straightening of the door will then cause the pivot pins and bearings to compress the springs, after which the springs will be allowed to expand again as the panels swing into a single vertical plane. The use of the springs and sliding pivots not only permits the free edge of the door to engage the side of the doorway, but it also holds the door straight when it is closed, due to the spring pressure against the aligned panels.

This door can be removed from the doorway by folding it and then lifting it enough to remove the lower pivot pin from its bearing. The door is then tilted to swing its bottom away from the lower bracket so that the door can be lowered enough to withdraw its upper pivot from the upper bracket. The door is then moved to the other end of the track to permit guide member **9** to be drawn down through the space between the side of the door and the ends of the track supports. Reversal of this procedure is the manner in which the door is installed in the first place. It is therefore easy to hang. The door frame does not have to be cut or mortised.

In the embodiment of the invention shown in Fig. 2, two folding doors **50** and **51** are shown in the same doorway **52**. Each door is constructed, mounted and operated in the same way as the one just described, except that the free edges of the doors meet each other at the center of the doorway. To assure perfect alignment of the doors with each other while they are closed, means can be provided for aligning their lower edges. This means preferably takes the form of two metal bars, one attached to the bottom of each door at its free edge as shown in Fig. 8. One bar **53** has an arcuate end pointing toward the other door. The other bar **54** has a tapered socket **55** that receives the first bar. The two bars thereby hold the bottoms of the doors in alignment, while the tops are held in line by the overhead track. By offsetting the engaging end portions of the two bars downward away from the doors, any possibility of the end of one bar catching on the lower corner of the adjacent door when the doors are closed is eliminated.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. The combination with a doorway, of a folding door construction comprising a plurality of panels hinged together on a vertical axis, the panels being disposed in a common vertical plane when the door is closed and one edge of the door being spaced a short distance from the adjacent side of the doorway, pivot pins projecting from the top and bottom of the door near said edge, bearings on the pins, means mounted in the doorway for holding the bearings for movement toward said adjacent side of the doorway, springs urging the bearings toward the opposite side of the doorway, a track secured to the top of the doorway above the door, and guide means movable along the track and connected to the door near its free edge for compelling the door to fold as it is opened.

2. The combination with a doorway, of a folding door construction comprising a pair of panels hinged together on a vertical axis, the panels being disposed in a common vertical plane when the door is closed and one edge of the door being spaced a short distance from the adjacent side of the doorway, pivot pins projecting from the top and bottom of the door near said edge, bearings on the pins, brackets mounted at the top and bottom of the doorway and provided with slots receiving said pins, said slots extending away from said adjacent side of the doorway, a bearing slidably mounted in each bracket and receiving the end of the adjoining pin, springs in the brackets urging the bearings toward the opposite side of the doorway, a track secured to the top of the doorway above the door, and guide means movable along the track and connected to the door near its free edge for compelling the door to fold as it is opened.

3. In the combination recited in claim 2, the upper bracket extending beyond the bearing therein toward the

opposite side of the doorway to form a stop adapted to be engaged by said guide means when the door is opened, whereby to keep the panels of the folded door from touching each other.

4. In the combination recited in claim 2, said track being an inverted channel with inturned flanges at its bottom, and the upper bracket being concealed within the track.

5. The combination with a doorway, of a folding door construction comprising a plurality of panels hinged together on a vertical axis, the panels being disposed in a common vertical plane when the door is closed and one edge of the door being spaced a short distance from the adjacent side of the doorway, pivot pins projecting from the top and bottom of the door near said edge, bearings on the pins, means mounted at the bottom of the doorway for holding the lower bearing for movement toward said adjacent side of the doorway, a spring urging the lower bearing toward the opposite side of the doorway, a sheet metal bracket mounted at the top of the doorway above said means and extending lengthwise of the door, the bracket having spaced horizontal portions connected by a depending U-shape portion to form an intermediate recess provided with side walls and having a slot in its bottom extending away from said adjacent side of the doorway and receiving the upper pin, a bearing slidably disposed in said recess and mounted on the upper pin, a spring compressed between said bearing and the end of the recess nearest said adjacent side of the doorway, a track secured to the top of the doorway above the door, and guide means movable along the track and connected to the door near its free edge for compelling the door to fold as it is opened.

6. The combination with a doorway, of a folding door construction comprising a plurality of panels hinged together on a vertical axis, the panels being disposed in a common vertical plane when the door is closed and one edge of the door being spaced a short distance from the adjacent side of the doorway, pivot pins projecting from the top and bottom of the door near said edge, bearings on the pins, means mounted at the top of the doorway for holding the upper bearing for movement toward said adjacent side of the doorway, a spring urging the upper bearing toward the opposite side of the doorway, a sheet metal bracket at the bottom of the doorway below said means and being provided with an inverted channel extending lengthwise of the door, the top of the channel having a slot in it extending lengthwise of the channel and receiving the lower pin, a bearing slidably disposed in said channel and mounted on the lower pin, a spring compressed between said bearing and the adjacent side of the doorway, a track secured to the top of the doorway above the door, and guide means movable along the track and connected to the door near its free edge for compelling the door to fold as it is opened.

7. The combination with a doorway, of a door construction comprising a pair of folding doors substantially

engaging each other at the center of the doorway when the doors are closed, each door being formed from a plurality of panels disposed in a common vertical plane with the outer edge of the door spaced a short distance from the adjacent side of the doorway, pivot pins projecting from the top and bottom of each door near said outer edge, bearings on the pins, means mounted at both sides of the doorway for supporting the bearings for movement toward the adjacent sides of the doorway, springs urging each pair of bearings toward the opposite side of the doorway, a track secured to the top of the doorway above the doors, means movable along the track and connected to the doors near their inner edges for compelling the doors to fold as they are moved away from each other, and interengageable means carried by the bottoms of the doors beneath their inner edges for holding the bottoms of the doors in line with each other while the doors are closed.

8. In the combination recited in claim 1, interengageable means carried by the bottoms of the doors at their inner edges for holding the bottoms of the doors in line with each other while the doors are closed.

9. In the combination recited in claim 7, said interengageable means including a socket member carried by one door beneath its inner edge, and a projecting member carried by the other door beneath its inner edge for projection into said socket member when the doors are closed, whereby to hold the bottoms of the doors in line with each other.

10. A folding door hinge bracket adapted to be mounted in a horizontal position, said bracket comprising a sheet metal strip having spaced horizontal end portions connected by a depending U-shape portion having a straight bottom wall provided with a longitudinal slot for receiving a door pivot pin, upwardly converging flanges integral with the opposite edges of said bottom wall, said end portions being provided with screw-receiving holes for fastening the bracket in place in a doorway, a pivot pin bearing between said flanges slidable along said bottom wall above said slot, the bearing having upwardly converging sides substantially engaging the flanges to connect the bearing to said strip, and a spring compressed between one end of the bearing and an adjacent part of said U-shape portion for urging the bearing toward the opposite end of the bracket.

11. A folding door hinge bracket according to claim 10, in which said strip has a portion extending downward from the outer end of its end portion at said opposite end of the bracket to form a stop for a folding door.

References Cited in the file of this patent

UNITED STATES PATENTS

1,230,345	Ursom	June 19, 1917
1,612,499	Etheredge	Dec. 28, 1926
1,768,267	Phillips	June 24, 1930
1,923,787	Larsen	Aug. 22, 1933