United States Patent [19]

Smith

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[45] **June 4, 1974**

[54] **HINGES FOR USE ON FOLDING DOORS AND THE LIKE**

[76] Inventor: **Lester L. Smith,** 5151 Mission Hills Dr., Tucson, Ariz. 85718

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[21] Appl. No.: **335,231**

[52] **U.S. Cl.** **16/135,** 160/118, 16/159

[51] **Int. Cl.** **E05d 5/02**

[58] **Field of Search** 16/159, 137, 151, 135; 160/118, 199, 206, 183

[56] **References Cited**

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Primary Examiner—Bobby R. Gay
Assistant Examiner—Doris L. Troutman
Attorney, Agent, or Firm—Keith K. Nicolls

[57] **ABSTRACT**

A hinge adapted to low cost production and suited to use in connecting planar panels of folding doors and the like together for swinging movements relative to one another and to and from coplanar relationship, said hinges having plug-type mounting portions insertable into, and securable in precisely located openings that may be jig-bored or prefabricated in the panels prior to installation, thereby to minimize both product and installation cost and to effect proper positioning and alignment of the hinge axes. The hinge is also reversible and interchangeable for use at both top and bottom positions on the door panels, thus to limit inventory of parts and reduce possibilities of errors in assembly or placement.

14 Claims, 10 Drawing Figures

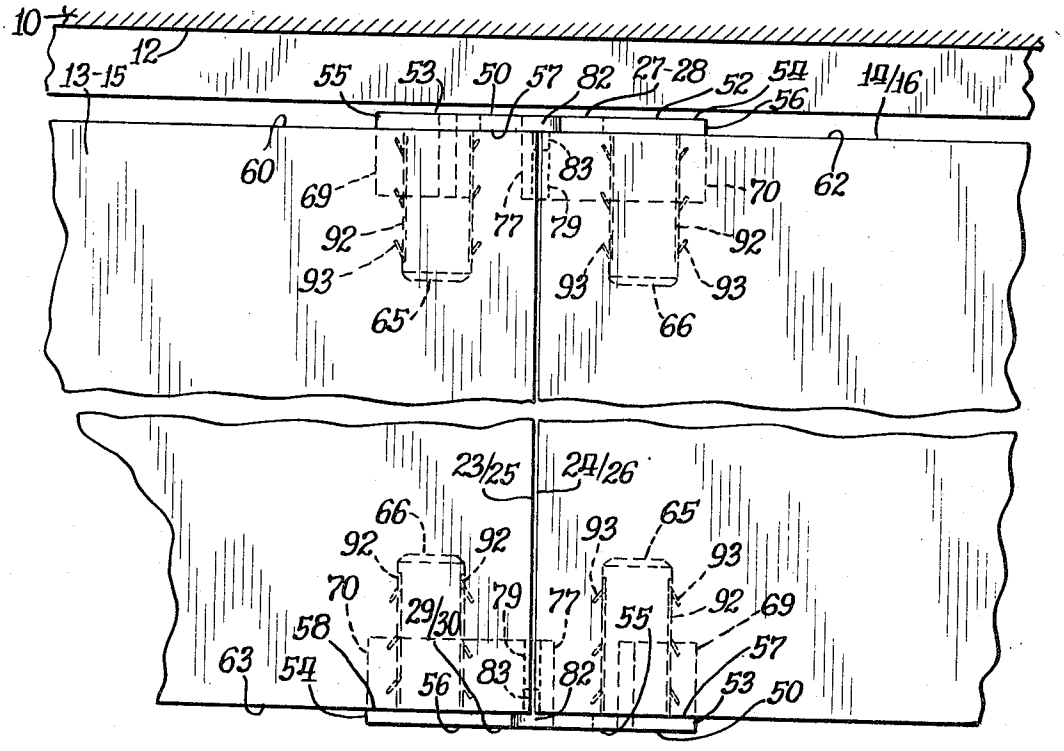
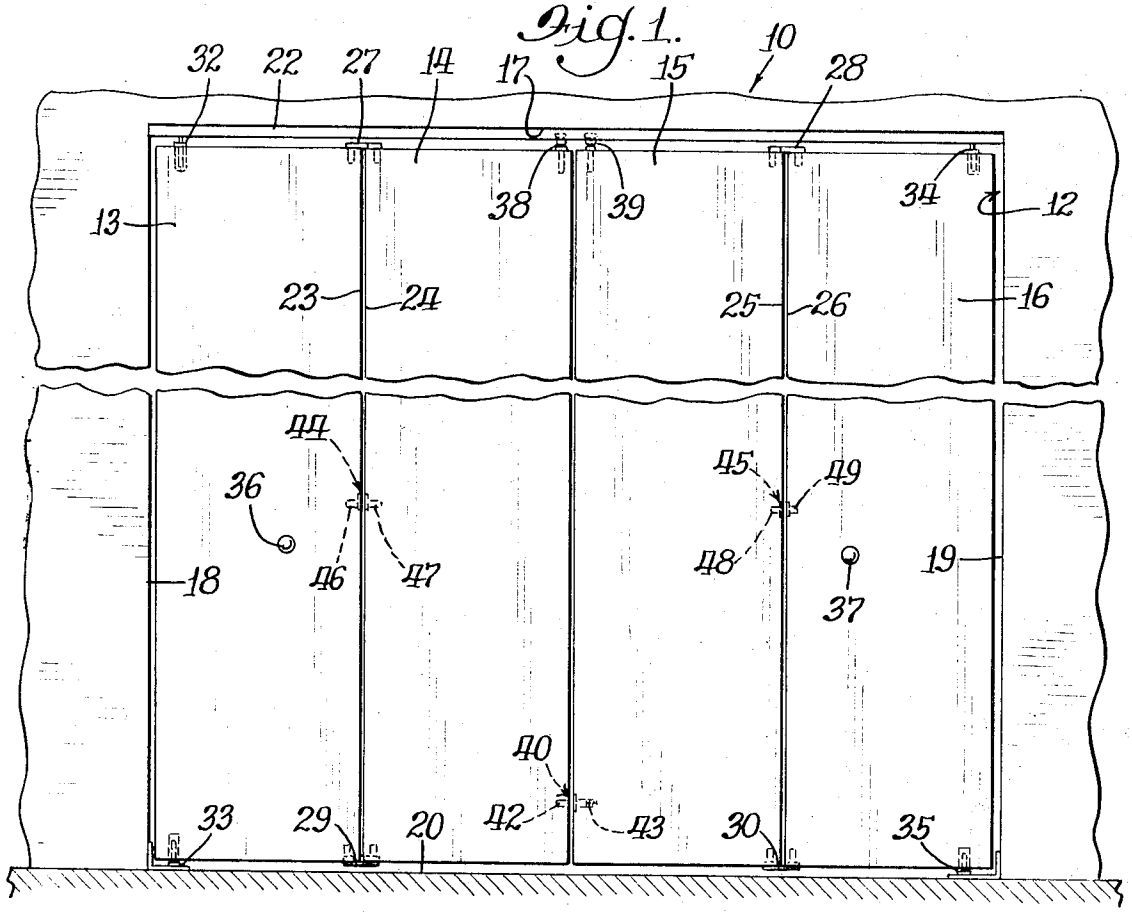


Fig. 1.


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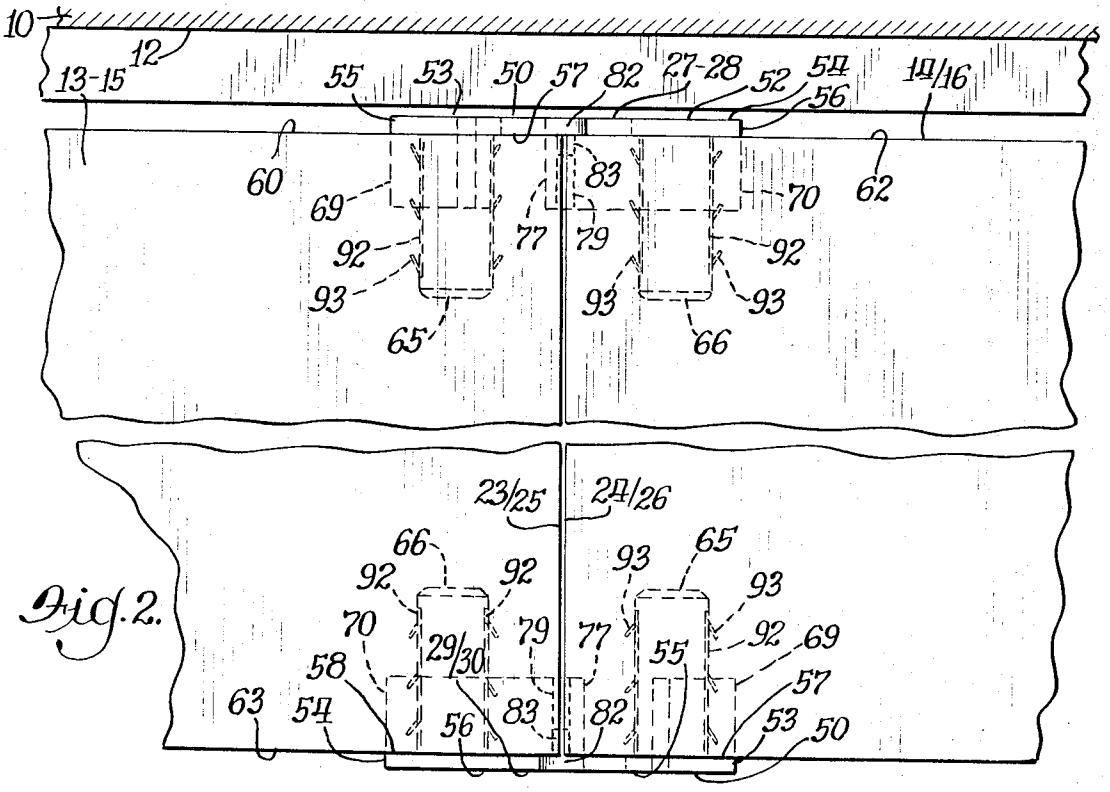

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Fig. 2.

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Fig. 3.

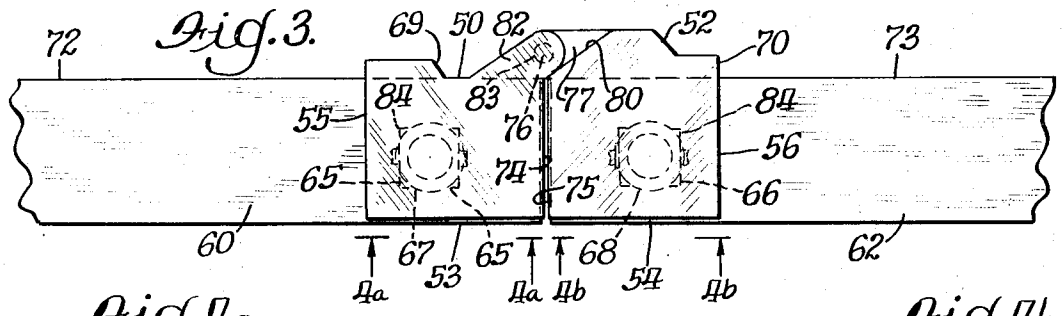


Fig. 4a

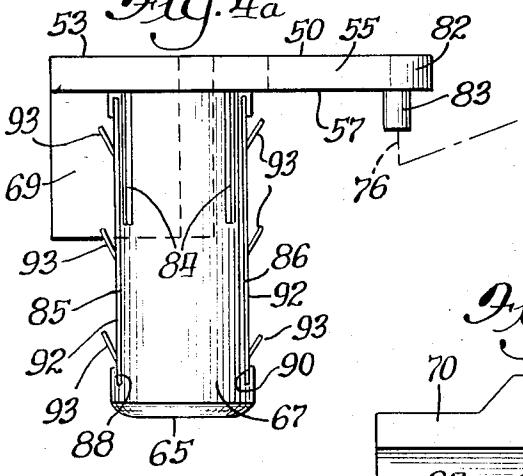


Fig. 4b.

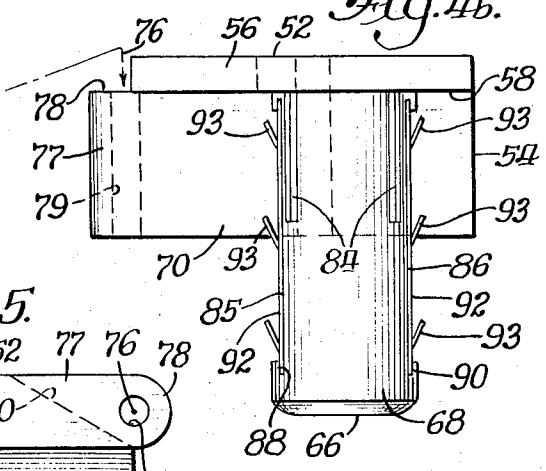


Fig. 5.

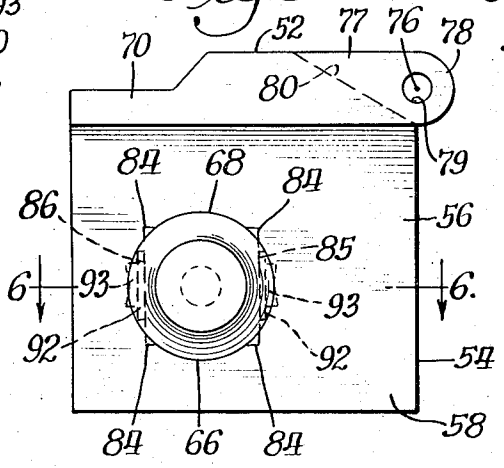


Fig. 7.

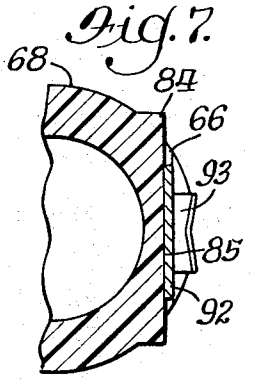


Fig. 6.

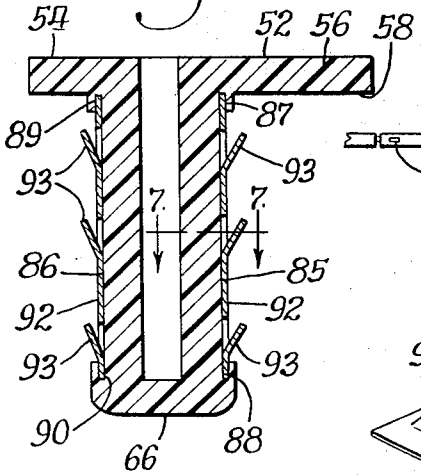


Fig. 8.

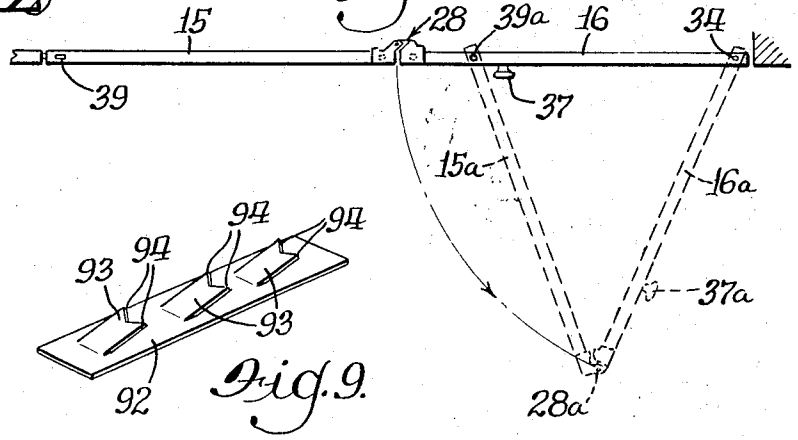


Fig. 9.

HINGES FOR USE ON FOLDING DOORS AND THE LIKE

BACKGROUND OF INVENTION

Traditionally, the installation and alignment of door hinges and the hanging of hinge supported doors has required both time and skill. The current trend toward the use of lightweight folding or bifold doors to afford better access and to limit the space requirements for the swinging of the doors, as well as the desire for avoidance of the high material and labor costs associated with large and heavy wood doors, have brought on corresponding desires with respect to promotions of economies and the adaptations of supporting hardware, including hinges, for use with the folding door panels and their materials, structures and manners of fabrication.

As with other doors, the hinges for folding doors must be securely mounted and accurately placed. The hinges should desirably be inconspicuous for most door structures and should not cause appreciable gaps between the door panels when the door panels are in their closed positions. Also, the hinges and their placement whould be compatible with the mounting and operatings of other hardware items used on the doors.

Usually the hinges are flush mounted on the back faces of the door panels, or may be edge mounted using butterfly or butt hinges. If butt hinges are used, costly countersinking is required to avoid an unsightly gap between the adjacent panels of such doors in the closed position. When the panels are fabricated of plastic material, as many are being made, countersinking is practically impossible unless done when the panels are made. Even then, additional fastening elements or means are required for securing the hinges to the panels. This affords added problems in respect to both mounting and possible loosening during use. In any event, such countersinking and face mounting operations are time consuming and expensive.

As a result of the foregoing and other considerations, it has become a basic concept of this invention that hinges with ample strength and ruggedness for use on folding doors and the like can be made and mounted to provide only relatively thin exposed portions at very inconspicuous positions on the top and bottom edges of the door panels adjoined thereby. In addition, and in accordance with this invention, the hinges may be fabricated with precisely located and rugged mounting parts and locating surfaces for securement to panels which are either fabricated or jig-bored to receive the mounting and locating parts of the hinges.

One of the objects of this invention is to provide a hinge adapted to mounting at the top and bottom ends of planar panels to folding doors to connect those panels for relative swinging movements to and from coplanar relationship about an axis spaced from the panel planes and which is approximately coincident with the planes of the adjacent edges of the connected panels, each said hinge including a pair of unitary and integral parts connectible to one another for swinging movements and each of which incorporates mounting and locating elements.

Another object of the invention is to provide a hinge structure adapted to precise mounting relative to edge and face surfaces of a planar door panel by virtue of having as parts thereof a plug-type mounting element to be pressfitted into a precisely located opening in the

door panel, means for limiting the movement of the plug-type mounting element into the panel opening, and an additional means for engagement with a face surface of the panel to further establish the hinge part position relative to the panel.

This invention further has within its purview the provision of hinges adapted to quick and easy mounting in, and relative to openings and surfaces in the planar panels of folding doors, which openings are established precisely during fabrication of the panels or bored with aid of a suitable jig or guide, and which surfaces are established when the door panels are fabricated.

Also within the comprehension of this invention is the provision of hinges mountable quickly and easily at inconspicuous positions on the planar panels of folding doors without the aid of additional fasteners, such as screws or bolts, so that the door panels are freely swingable from and toward positions in which the panels are closely spaced at adjacent edges and in substantially flush and coplanar relationship to one another.

As another object, this invention comprehends a hinge having parts, each of which parts is mounted and secured in position by a plug-type mounting element which fits into an opening in a door panel, and which plug-type mounting elements are each provided with retaining tangs shaped and constructed to move into the opening in the door panel with relative ease when the plug-type element is installed therein, but which bite into the surface of the opening to retain the plug-type element in the opening after installation.

It is also within the purview of this invention to provide hinges suited to use on folding doors and the like, and the principal parts of which can be made by molding from tough and wear resistant plastic material, such as nylon.

This invention has for another object the provision of hinges made of separate parts which are each securable to an end surface of a panel of a folding door adjacent one edge of the panel, and which parts are connectable for swinging movements about an axis spaced from the panels connected thereby, as well as reversible for use at either the top or bottom end surfaces of the panels.

IN THE DRAWINGS:

FIG. 1 is a fragmentary front plan view of a wall segment having a door opening in which is hung a double bifold door and which is illustrative of an adaptation of the hinges of this invention;

FIG. 2 is a fragmentary and broken view, drawn to a larger scale than FIG. 1, and showing an adjacent pair of panels of a bifold door which are connected for relatively swinging movements about an axis provided by an aligned pair of the hinges of this invention;

FIG. 3 is a top plan view of one of the hinges depicted in FIG. 2, the connected door panels being fragmentarily shown;

FIGS. 4*a* and 4*b* are front elevational views of two coacting parts of a hinge of the type illustrated herein and embodying a preferred form of this invention;

FIG. 5 is a bottom view of the hinge part shown in FIG. 4*b*;

FIG. 6 is a sectional view taken substantially as shown by a line 6—6 and the accompanying arrows in FIG. 5;

FIG. 7 is a fragmentary sectional view taken substantially as indicated by a line 7—7 and accompanying arrows in FIG. 6;

FIG. 8 is a fragmentary top view of the portion of the structure illustrated in FIG. 1, with the folding positions of door panels illustrated in dotted lines; and

FIG. 9 is a perspective view of one type of retainer part adapted to use with the illustrated and preferred hinges.

In the exemplary embodiment of this invention which is shown in the accompanying drawings for illustrative purposes, a wall 10 has therein a door opening 12 which may be, for example, the entrance to a closet. Depending upon the width of the closet door opening and the widths of the panels used, either one or two pairs of planar panels 13, 14, 15 and 16 may be used to provide a closure for the door opening. Another feature of consideration is that narrow panels require less space for their swinging movements. It is, of course, a feature of bifold door structures that they provide access to the door opening space, and yet, when hung as shown herein, require much less space for single movements than a conventional swinging door.

This invention being mainly concerned with a particular type of hinges adapted to the connection of adjoined panels of a bifold door for swinging movements relative to one another, the general structure, movements and operations of other door parts will be considered only to the extent necessary for a general understanding of the door and its operation, with particulars directed mainly to the hinges, their structure, installation and operation.

Structurally, the door opening is encompassed by a lintel 17 at the top, jambs 18 and 19 at its opposite vertical sides, and a sill 20 at the bottom. Extending across the top of the door opening 10, below the lintel 17, is a guide track 22 which is usually made of metal having a section providing a support and guiding movements of one edge of one panel (14 or 15) of each bifold door linearly back and forth across the top of the door opening. The panels (13 and 14, and 15 and 16) of each bifold door have adjacent edges 23 and 24, and 25 and 26 connected together for relative swinging movements, each about an axis, by for relative swinging movements, each about an axis, by top hinges 27 and 28 and bottom hinges 29 and 30 respectively; the top and bottom hinges of the connected panels of each bifold door being axially aligned. Spaced somewhat inwardly from the outer edge which is adjacent the door jamb (18 and 19) each outer panel (13 and 16) is supported for swinging movements about a fixed axis by aligned upper and lower pivots, 32 and 33 for panel 13, and 35 and 36 for panel 16; the upper pivots being secured in fixed positions relative to the lintel, and the lower pivots being secured in fixed positions relative to the sill.

With this arrangement of pivots, hinges and slides, the panels are in flush and generally coplanar relationship to one another to effect closure of the door opening. Knobs or handles 36 and 37 are provided on the exteriors of the mid-regions of the pivoted panels 13 and 16, by which the doors are swung between their closed and opened positions. Between such positions, the hinges between adjoined panels swing through the position depicted at 28*a* in FIG. 8, and the panels of each bifold door pass through the positions shown in dotted lines at 15*a* and 16*a*. When the doors are wide open, practically the entire door opening 12 is clear; it being understood that during the swinging movements of the door panels, the outer edges of the doors are guided in a linear path along the door opening by guides 38 and 39 moving in or on the track 22.

Preferably, bifold doors of the type shown in FIG. 1 are provided, at their outer and adjoining edges, with an aligner 40 having parts 42 and 43 attached at the free or exposed edge regions of panels 14 and 15 and movable into aligned relationship for engagement for bringing, and holding the panels of the door in proper position at and near the lower end portion of the door. In addition, and for holding the panels of each bifold door in coplanar relationship to one another, so that the air pressure within a confined spaced, when one bifold door of a pair is closed before the other, will not cause opening movement of the other, novel latches 44 and 45 may be utilized. These latches are attached to each bifold door panel at the mid-region of the hinge axis at which the panels are connected, and may comprise aligned and releasably connected detent elements 46 and 47 for the panels 13 and 14 and releasably connected detent elements 48 and 49 for the panels 15 and 16. In this instance, it is contemplated that the releasably connected detent elements are offset, in each instance, from the hinge axis in a direction such that they are brought together in coupling relationship when the panels of a bifold door are in coplanar relationship, and are pulled apart when the panels of the bifold door are swung into angular relationship, so as to separate the adjoined edges of the door panels.

Having particular reference to the hinge structures, as depicted in FIGS. 2, 3, 4*a*, 4and 5, each hinge has two unitary or integral elements 50 and 52, both of which are adapted to be produced of thermoplastic material, such as nylon, molded under pressure in a suitable die. Furthermore, the hinges used at the top and bottom positions on each bifold door are alike, except that the elements are reversed from side to side and inverted between the positions. Thus, a description of the structure of one hinge will suffice for all. A hinge being thus made, need only be positioned relative to a door for use, as will be more fully described.

In the form illustrated, the hinge elements 50 and 52, in addition to being unitary, have bodies 53 and 54 respectively adapted to production by molding. The hinge bodies have mounting plate portions 55 and 56 at one end, the inner surfaces of which, as used, serve as mounting surfaces 57 and 58, which, when the hinge element is mounted, engage a top end surface, such as 60, 62 or a bottom end surface, such as 63 or 64 of the door panel on which the element is mounted. The hinge element bodies 53 and 54 also include plug-type mounting portions 65 and 66 which project from the mid-regions of the mounting surfaces 57 and 58 on the mounting portions 55 and 56.

The plug-type mounting portions 65 and 66 have generally cylindrical surface portions 67 and 68 respectively which, when installed on a door panel fit snugly in openings in the edges of the adjacent panels which are to be connected by the hinge, which openings are selectively and precisely placed in the panels thereby to serve in properly locating the hinge elements on the panels. In addition, the hinge elements 50 and 52, in this preferred hinge structure, have flanges 69 and 70 which are integral with the mounting plate portions 55 and 56 and project in substantially right angular rela-

tion to the mounting surfaces 57 and 58 in spaced and parallel relation to the plug-type mounting portions 65 and 66 respectively. When the hinges are mounted with their plug-type mounting portions in their respective panel openings, the flanges engage external planar surfaces of the panels and serve additionally to locate and orient each hinge element with its respective door panel. Although there are other reasons in respect to the hinge structure disclosed, it is preferred that the flanges 69 and 70 are disposed to engage the rear or inner surfaces of the door panels, as shown in FIGS. 1, 2 and 3, so that visible hinge structure is as inconspicuous as possible.

In order that the panels of each bifold door may swing outwardly, as shown in FIG. 8, and effect separation of edges 74 and 75 which abut when the door panels are in a coplanar and closed position, the axis 76 of each of the panel connecting hinges is displaced somewhat to the rear of the back panel surfaces 72 and 73, as shown in FIG. 3. Additionally, the hing axis 76 is aligned substantially with the edges 74 and 75, so that those edges swing in practical radial relationship relative thereto.

For the accomplishment of this hinge axis placement, and to obtain the required hinge support for the connected panels in the disclosed structure, the flange 70 on the hinge element 52 has an end projection 77 extending beyond the edge 75, and which, at its top, is at a level below the top of the mounting plate portion 56, and serves as a support or bearing suface 78. A bearing bore 79 which establishes the hinge axis for the hinge element 52 extends into the end projection 76 on the flange, through the bearing surface 78 thereof at a position substantially aligned with edge 75 and rearward of the door panel engaging surface of the flange 70. Since the level of the bearing surface 78 is below the top of the mounting plate portion 56, a shoulder 80 extends across the flange and between the top of the flange end projection 77 and the top of the mounting plate portion 56.

On the hinge element 50, a projecting arm 82 is provided on the mounting plate element 55 which extends rearwardly therefrom and also beyond the line of the edge 74. This arm 82 on the hinge assembly 50 has a thickness such that when resting against the bearing surface 78 on the hinge element 52 in the hinge assembly, the mounting surfaces 57 and 58 of the two hinge elements of the assembled pair are substantially coplanar. Although other types of hinge pins, such as metal, may be used, the disclosed embodiment has a hinge pin 83 integrally molded thereon and projecting from the arm 82 for rotational engagement in the bearing bore 79 to adjoin the hinge elements for relative swinging movements. It may be observed that the arm 82 has a rounded end surface permitting it to turn in the space adjacent the shoulder 80 on the hinge element 52, and also that the back surface of the arm 82 is angularly disposed to provide for ample swinging movement between the hinge elements.

For mounting and securing the hinge elements 50 and 52 on door panels, it is an expectation that the plug-type mounting portions 65 and 66 will be press fitted into generally circular openings in the panels. The mounting openings will snugly fit the cylindrical surface portions 67 and 68 of the mounting portions. In order to provide a deterrent to rotation of the mounting portions in their respective openings, outwardly projecting splines 84 of generally triangular section extend longitudinally of the cylindrical surface portions which splines break the cylindrical surface contours and depress themselves into the surrounding material when installed.

While other structural arrangements are obviously available, the plug-type mounting portions shown are provided at their mid-regions with elongated flat surfaces 85 and 86 in opposed relationship. At the opposite ends of the flat surface 85, notches 87 and 88 are provided, while at the opposite ends of the flat surface 86, notches 89 and 90 are provided; such notches being in opposed relationship and opening toward the flat surface, as well as being open at opposite sides. These notches, or equivalent means, are used to fasten metal spring elements 92, of the type shown in FIG. 9 in operating position. Each such spring element has a generally flat back surface which mounts against the flat surfaces 85 and 86 of the mounting portions. Each spring element has punched therefrom a plurality of tangs 93 in a row and extending in angular relationship to the back surface of the strip. Each tang is notched to present sharp points 94 at its projecting end. When mounted on the plug-type mounting portions of the hinge elements, the tangs 93 57 and 58 of the mounting plate portions. When each plug-type mounting portion is pressed into a mounting opening of a door panel, the tangs flex inwardly to afford ease of mounting, and when once set, the sharp tang end points bite into the door panel material to prevent extraction of the hinge element from the door panel.

From the foregoing description, and by reference to the drawings, it may be readily understood that the hinge of this invention has many advantages, particularly for a type of relatively lightweight doors, such as bifold closet doors and the like. Being made in standard sizes for selected door panel thicknesses, the panels may be fabricated or drilled by inexpensive operations to receive the hinges without further cutting, fitting, or drilling at the time of instllation. During installation, or even when the door panels are fabricated, the hinge elements can be quickly and easily installed. Being reversible for use at either end of a door, the inventory of hinge parts is minimized. Since the structures of the main parts adapt them to production of relatively small quantities of pressure moldable plastic material, the hinges can be produced at low cost. It is a further feature that the hinge of this invention both locates and orients itself at the time of installation.

I claim:

1. A hinge of a type suited for use in connecting planar panels of folding doors for relative swinging movements about a hinge axis spaced outwardly of the planar panel surfaces and in substantial alignment with adjacent side edges of the panels connected by the hinges, said connected panels also being relatively swingeable about said hinge axis from and toward coplanar positions in which said adjacent side edges thereof are in substantial abutment with one another, said hinge comprising a pair of hinge elements which each include means through which the elements are connected for relative swinging movements about the aforesaid hinge axis, said hinge elements having mounting plate portions which, when the elements are connected, have reference surfaces in coplanar relationship to one another, each said mounting plate portion having a plug-type mounting portion thereon and projecting in per-

pendicular relationship from the mid-region of said reference surface, and each said mounting plate portion also having a reference and locating flange thereon which extends in right angular relationship to the reference surface from one margin of the mounting plate portion in spaced and parallel relationship to said plug-type mounting portion.

2. A hinge as defined in claim **1** and wherein said means through which the elements are connected for relative swinging movement are disposed on the same side of the mounting plate portions as said mounting and locating flanges.

3. A hinge as defined in claim **1,** and further characterized by means on said plug-type mounting portions for resisting the removal thereof from closely fitting door panel openings into which they are inserted.

4. A hinge as defined in claim **1,** and wherein said means through which the elements of each pair of hinges are connected for relatively swinging movements comprise a portion projecting from one of the hinge elements of the pair and having a support surface substantially flush with the reference surface thereof, said flange of the other hinge element having another support surface thereon and substantially flush with the reference surface thereof, said portions of the pair of hinge elements being disposed to overlap when the hinge elements are assembled, and means connecting said projecting and flange portions of the hinge elements for relatively swinging movements when the support surfaces thereof are in contact.

5. A hinge as defined in claim **4,** and wherein said means connecting said projecting and flange portions of the hinge elements comprises an integral hinge pin on the projecting portion of one of the hinge elements which fits rotationally into a bearing opening in the flange portion of the other hinge element of the pair.

6. A hinge suited for use for connecting planar panels of folding doors and the like for relative swinging movements and adapted to mounting against top and bottom end edge surfaces of said panels, said hinges comprising a pair of hinge elements, said hinge elements having mounting plate portions which have thereon mounting surfaces that are in substantially coplanar relationship when the hinge elements are assembled and which have thereon mounting surfaces for engagement with the end surfaces of adjacent door panels connected by the hinge, said mounting plate portions each having thereon a plug-type mounting portion projecting in perpendicular relationship from the mounting surface for the location and securement of the hinge element relative to a door panel, projections on said mounting plate portions and extending to positions spaced outwardly of the hinge from adjacent end edges of the hinge elements when assembled, said projections having thereon surfaces which are engageable in overlapping relationship as door panel supporting surfaces when the hinge elements are assembled, and means connecting said projections for rotationally swinging movements.

7. A hinge as defined in claim **6,** and wherein said mounting plate portions have thereon means for effecting orientation of the respective hinge elements with surfaces of the door panels upon which they are mounted.

8. A hinge as defined in claim **6,** and wherein each of said plug-type mounting portions has an external non-circular perpendicular surface configuration.

9. A hinge as defined in claim **6,** and wherein said adjacent end edges of the hinge elements are in adjacent and closely spaced relationship when the hinge elements are relatively disposed to provide substantially coplanar relationship of panels connected thereby, and said means connecting said projections for rotationally swinging movements being displaced laterally from the panels thus connected.

10. A hinge for connecting planar panels of folding doors and the like for swinging movements relative to one another and adapted to mounting at precisely located positions near adjacent side edges of said panels, said hinges comprising a pair of hinge elements, each of said hinge elements including a unitary and integral molded body having a mounting plate portion, one surface of which mounting plate portion serves as a mounting surface engageable with one surface of a door panel, said body for further having a plug-type mounting portion projecting in substantially perpendicular relationship from the mid-region of the mounting surface on the mounting plate portion, said mounting plate portions of the two elements of a pair having projections thereon at different levels and for engagement in overlapping relationship as relative supporting surfaces when the pair of elements is assembled, and means providing a hinge pin connection between said side projections of the elements of the pair to join the elements for swinging movements about an axis displaced from said mounting plate and plug-type mounting portions.

11. A hinge as defined in claim **10,** and wherein said plug-type mounting portions have non-circular peripheral contours to prevent rotation thereof when pressed into an opening in a door panel.

12. A hinge as defined in claim **10,** and further characterized by means on opposed side surfaces of the plug-type mounting portions and having integral tangs projecting angularly therefrom in a direction outwardly from the plug-type mounting portions and toward the mounting surfaces to resist removal of the hinge elements from panels after the plug-type mounting portions are pressed into openings in the door panels.

13. A hinge as defined in claim **10,** and further characterized by means on each of the hinge elements for determining the position of that element peripherally of the plug-type mounting element with respect to the panel on which it is mounted.

14. A hinge as defined in claim **10,** and further characterized by a flange on the mounting plate portion of each hinge element and extending in angular relationship to said mounting surface and spaced from the plug-type mounting portion for engagement with an external surface of the panel other than said one surface upon which it is mounted and angularly disposed relative thereto.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,813,730 Dated June 4, 1974

Inventor(s) Lester L. Smith

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 24, "whould" should be --should--

Col. 1, line 54, after "panels" the word "to" should be --of--

Col. 2, line 10, after "with" insert "the"

Col. 4, line 33, after "4" insert "b"

Col. 5, line 20, "hing" should be --hinge--

Col. 6, line 25, after "93" insert "project outwardly therefrom and toward the mounting surfaces"

Col. 8, line 6, "perpendicular" should be --peripheral--

Col. 8, line 24, after "body" delete "for" claim 10, line 9).

Col. 8, line 28, after "having" insert "side"

Signed and sealed this 5th day of November 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.