Dec. 26, 1967 K. LAUTENSCHLÄGER, JR 3,359,593

CONCEALED CABINET HINGE

Filed Sept. 30, 1964 4 Sheets-Sheet 1

Fig. 1

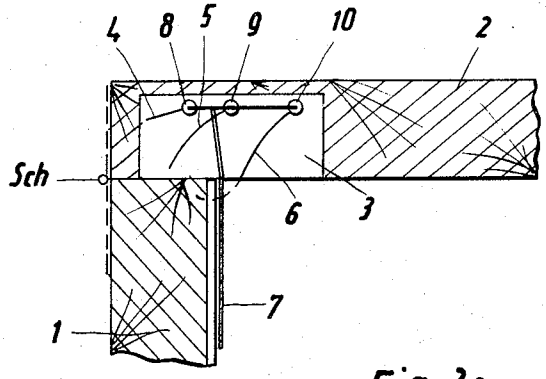


Fig. 2a

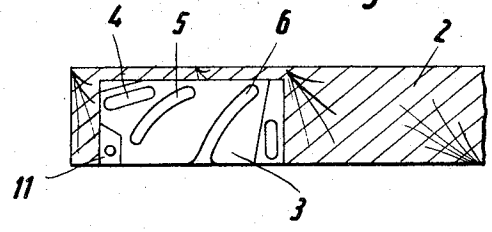


Fig. 2b

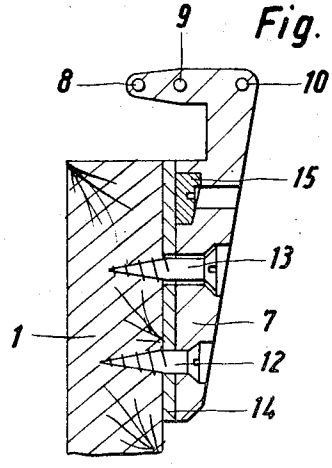
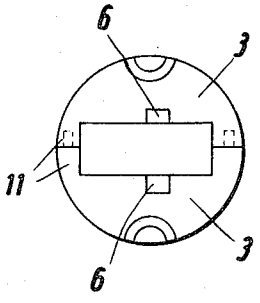


Fig. 3



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Fig. 4

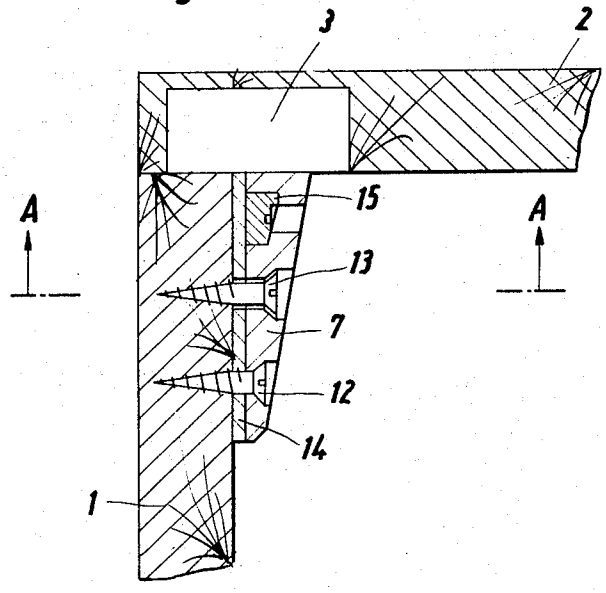


Fig. 5

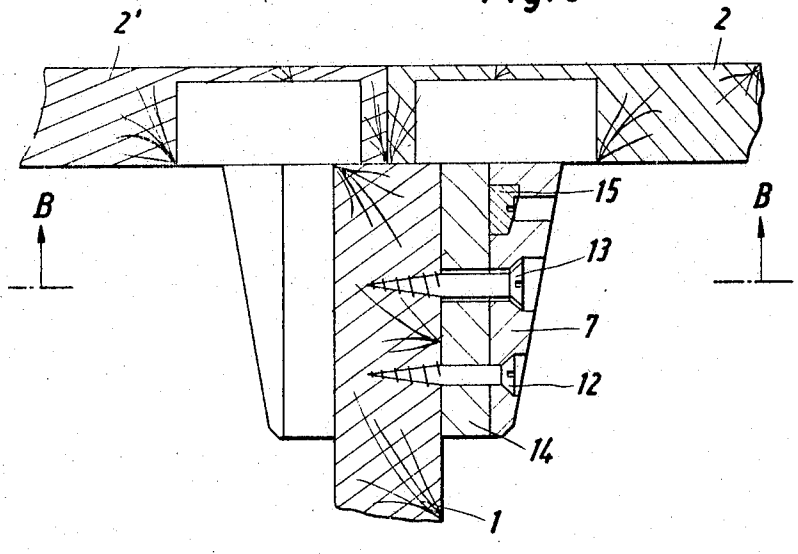


Fig. 6

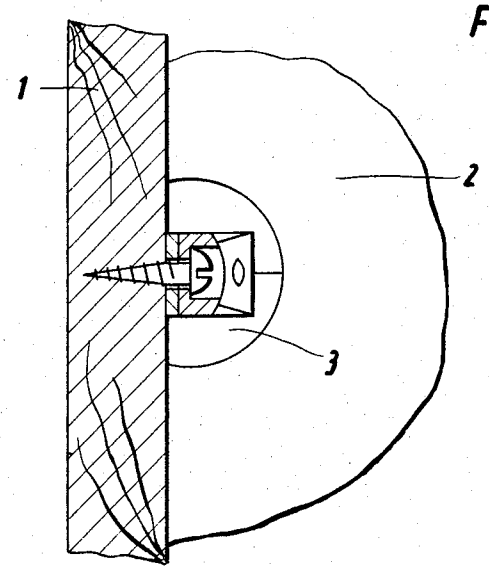
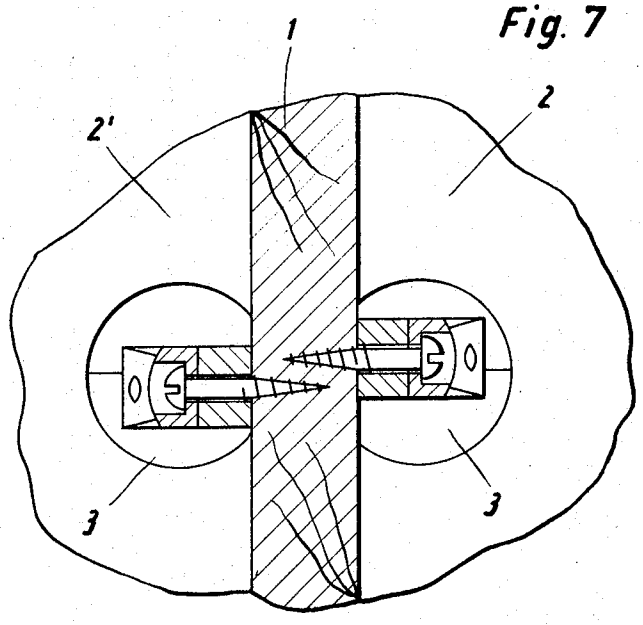


Fig. 7



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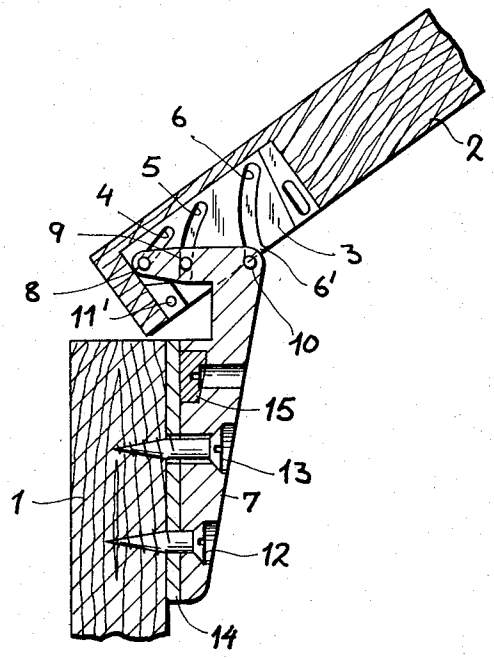


Fig 8

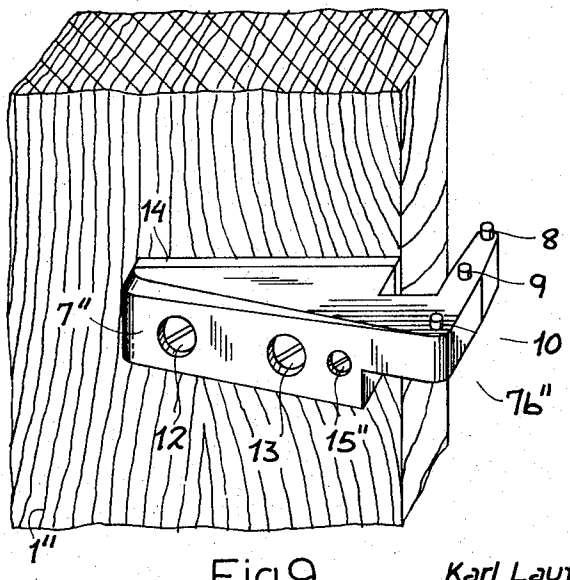


Fig 9

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CONCEALED CABINET HINGE

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Filed Sept. 30, 1964, Ser. No. 400,659
14 Claims. (Cl. 16—164)

ABSTRACT OF THE DISCLOSURE

A cabinet hinge for securing a door to a cabinet for swinging movement about an axis parallel to respective edges of the door and frame, the hinge having a guide head mounted upon the door and having three grooves, a support mounted on the cabinet and having three slide bodies respectively received in the grooves for sliding movement therein, one of the guide grooves opening at one end thereof for receiving a respective body and guiding the door upon door-closing movement thereof at least during the portion of the movement at which the door enters the frame but withdrawn from this groove in an open position of the door.

The present invention relates to hinges for articulatingly joining a pair of generally planar members and, more particularly, to concealed cabinet hinges which cannot be seen by an observer in a closed condition of a cabinet door.

There have been many proposals relating to hinge constructions for cabinet use wherein the pintle arrangement is recessed so as not to be apparent to a viewer. In such hinges, a clearance must be maintained between the door member and the wall member upon which it is mounted to permit the opening of the door. In more conventional pintle hinges (e.g. of the butterfly type), the fixed hinge axis is disposed externally of the cabinet so that the clearance is unnecessary. Hinges of this latter type, however, have the significant disadvantage that they are unsightly and frequently destroy the aesthetic lines of the cabinetry in which they are included. To eliminate the disadvantages of these earlier systems it has been proposed to provide an internal or concealed hinge which is recessed in the interior of the door and/or wall and which provides a floating or shiftable imaginary axis about which the door swings, such a hinge being described in French Patent 1,303,764. In this system, a support element mounted along a wall has a cantilevered arm provided with a pair of pins received within respective slots of another hinge element recessed in the door adjacent the adjoining edges of the members. These spaced-apart slots co-operate with the pins to enable the small end face of the door to swing through a substantial angle without necessitating the mounting of the hinge structure on the exterior of the cabinet. In the conventional shiftable-axis hinge just described, the length of the grooves and their orientations are determined by the desired movement of the axis which enables the door to clear the wall or any other structure in the region thereof. There is, however, an important limitation upon the orientation and dimensions of the grooves in that one of the pins can be viewed as defining the movable axis of the door while the other pin serves to guide the axis along a desired path. Thus the angular sweep of the door is directly related to the degree of movement permitted by the two slots. This, in turn, is limited by the thickness of the door since, although one of the slots can extend generally parallel to the plane of the door and thus be as long as may be desirable, the other slot must extend linearly or curvilinearly obliquely of the plane of the door. In practice, these limitations are countered by

disposing the two slots and pins so close to one another as to permit a large angular displacement of the door with respect to the wall. This expedient is, however, highly disadvantageous in that the hinges must support the weight of the door and are unable to do so adequately when the pins are disposed close to one another. The result is a sagging of the door which is especially pronounced when the pins are coplanar therewith, generally in the closed condition of the door. In this case, the torque applied by the weight of the door acts in the plane of the pins rather than transversely to this plane and has maximum effectiveness. The sagging of the door is not only unaesthetic but also makes it extremely difficult to close the door properly in view of the misalignment of the door and the cabinet opening. For this reason, hinges of the latter type, although theoretically a significant development over the prior art in connection with cabinet hinges and the like, have not found widespread acceptance in practice.

It is, accordingly, the principal object of the present invention, to provide an improved shiftable-axis hinge wherein the disadvantages of conventional hinges, as described above, are obviated.

Still another object of this invention is to provide a concealed cabinet hinge enabling the opening of a cabinet door with wide compass and preventing misalignment of the door and cabinet opening during closing of the cabinet.

These objects and others which will become apparent hereinafter are attained, in accordance wtih the present invention, by the provision of a hinge of the shiftable-axis type described earlier but provided with an additional pin-and-groove arrangement offset from the usual first and second pairs of formations and slidably engageable upon closing of the door to bring the latter into alignment with the door opening and supporting the door at a distance further from the axis than the first and second formations can be disposed if they are to enable the opening of the door through a wide angle. Thus, a hinge, according to the present invention, includes a head element mounted upon one of the generally planar members proximally to an edge thereof adjoining another planar member carrying the support element of the hinge, said elements being provided with spaced-apart first and second pairs of slidably mating and constantly interengaging formations (e.g. pins and grooves as previously indicated) and defining a shiftable articulation axis, and at least one additional pair of slidably engageable formations which are operable upon the relative swinging of the members from a "closed" position to an "open" position but mating upon the reverse swinging movement of the members to support the door just prior to its movement into its closed position.

It will be evident that the third or additional pair of formations can include a pin similar to those employed in the first and second pairs of formations, the pin being receivable in a groove or channel, spaced from the channels of the first and second pairs proximal to the articulation axis. The channel of the additional pair of formations is open in the direction of the shank of the hinge so that the respective pin can be withdrawn from the channel during opening of the door and reinserted into the channel during closing, the configuration of the channel being chosen in conjunction with the pair of the axes of the door in an empirical manner to prevent straining the pins.

According to a more specific feature of this invention, the head of the hinge is bipartite and formed with symmetrical channels, while sandwiching the cantilevered transverse arm of a hinge shank between them, this being provided with three sets of pins successively spaced from the adjoining members and respectively engageable in the first, second and additional channels and projecting from opposite sides of the transverse arm. It will be im-

mediately evident that the construction described above obviates the most significant disadvantage of conventional shiftable axes and concealed cabinet hinges in that the third pair of formations supports the door at a distance from the pin proximal to the edges and forms a relatively long load arm of the imaginary lever fulcrumed to the last-mentioned pin and whose other lever arm can be considered the distance from this pin to the center of gravity of the door. Misalignment is prevented during the closing of the door while the swinging movement is not inhibited by the requirement that the guide grooves or channels be disposed relatively distally from the fulcrum of the load lever.

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a diagrammatic plan view of a cabinet hinge according to the present invention shown in simplified form to facilitate the understanding of the principles of the invention;

FIG. 2*a* is a cross-sectional view through a door showing one half of the bipartite head portion of a hinge;

FIG. 2*b* is a longitudinal cross-section through a support element adapted to co-operate with head element of FIG. 2*a*;

FIG. 3 is an elevational view of the assembled head, with the hinge shank removed;

FIG. 4 is a view similar to FIG. 3 of the complete hinge in a closed position of the door;

FIG. 5 is a view similar to FIG. 4 showing how a pair of hinges can be mounted upon a wall, according to the invention;

FIG. 6 is a cross-sectional view taken along the line VI—VI of FIG. 4;

FIG. 7 is a cross-sectional view taken along the line VII—VII of FIG. 5;

FIG. 8 is a horizontal cross-sectional view through an assembled cabinet hinge, according to the present invention with the door shown in an intermediate angular position; and

FIG. 9 is a vertical elevational view of a modified support element of the hinge.

In the diagrammatic arrangement of FIG. 1, the cabinet wall **1'** is articulated to a door **2'** by a hinge consisting essentially of a head element **3'** and a support element **7'**. In the closed condition of the hinge (FIG. 1), mating first and second pairs of formations **4'**, **8'**, and **5'**, **9'** slidably engage one another constantly, i.e. in all operative angular positions of the door **2'** with respect to the wall **1'**. Since the female formations **4'**, **5'** of head **3'** are proximal to one another, when the door **2'** is swung into an open position, considerable strain might be placed upon the pair of formations as a consequence of the weight of the door, this strain being most pronounced when the door is on the verge of closure. It is, therefore, the principal feature of the present invention to provide an additional pair of formations **6'**, **10'**, which co-operate only when the door **2'** is swung into its closed position and slidably interengage to support the door at a greater distance from the hypothetical axis, to insure correct alignment of the door with the cabinet opening. As the door **2'** is swung in the counterclockwise sense, for example, about the shiftable axis represented by pin **9'**, pin **10'** of the additional pair of formations will withdraw from the channel **6'** and describe the path represented in dot-dash lines relatives to the door **2'**. Thus the additional pair of formations cannot inhibit the opening of the door but insures reduced sagging at least as the door is closed. The lengths, locations and configurations of the channels **4'** and **5'** are selected empirically in such manner that the movable axis shifts so that the edge of the door, which in its closed position practically abuts the edge of the wall, clears the latter in all operative angular positions of the door. The selection of these parameters with respect to

channels **4'** and **5'** determines the configuration of the further channel **6'** as will be evident from FIG. 1.

Referring now to FIGS. 2*a*, 2*b*, 3 and 8, it will be seen that, in practice, the head element **3** is provided upon the door **2** while the support element **7** is mounted upon the cabinet wall **1** although the system permits reversal in the sense that member **1'** can be the door while member **2'** constitutes a stationary wall within the scope of the present invention. The head **3** is bipartite (FIG. 3) and is recessed in the door **2** (FIG. 2*a*) and can be held therein by screws **3***f* (one shown in FIG. 3) engageable with suitable recesses **3***c* at the flanged periphery **3***d* of the head (FIG. 4). The support element **7** comprises a shank **7***a* upon which a tranverse arm **7***b* is cantilevered to form the projecting portion of the support element which is received within the space **3***e* defined by the head portions **3***a*, **3***b*. From FIG. 2*b*, it will be apparent that the arm **7***b* extends in a plane perpendicular to the axis of articulation and the wall members **1**, **2**, but is generally parallel to the door. The pairs of pins **8**, **9** and **10** projecting from opposit sides of arm **7***b* are receivable respectively in the closed channels **4**, **5** of the mirror-symmetrical halves **3***a*, **3***b* and the open channels **6**. The halves of the head **3** are aligned by pins **11'** which extend into slots **11''** as seen in FIGS. 2*a* and 3*b*. The pins **11'** are provided in a flange **11** (see FIG. 8) whose surface **11''** forms an abutment for the arm **7***b* preventing opening of the door **2** beyond the predetermined angular limit, e.g. about 180°, so that the pins **8**, **9** are not required to constitute the stop means and are thus free from strain when the door is opened too widely. As the door is swung open (FIG. 8), pins **10** are withdrawn from the channels **6** at their mouths **6'** which open at the side of the door upon which the hinge is disposed. While only a single pair of additional formations **6**, **10** have been illustrated in the embodiment described, it will be evident that further pairs of such formations can be used and spaced along the arm **7***b* for successive interengagement during door closure. In general, however, only one additional pair of formations is required.

The shank **7***b* of the supporting elements can be affixed to the wall **1** by the usual wood screws **12** and **13** received within countersunk bores **12***a*, **13***a*, a shim or spacer element **14** of selectively varying thicknesses being disposed between the support element **7** and the wall **1** to position the hinge and at the end face of the door **2** to the desired location. As will be evident from FIG. 3, the abutment plane between the halves **3***a*, **3***b* of the head **3** is symmetrically located with respect to the space **3***e*. It should be understood, however, that this abutment surface can be shifted to one side or the other to render the head as symmetrical as required. In the system of FIGS. 4 and 6, for example, the assembled hinge is shown with a symmetrical head. In the system of FIGS. 5 and 7, however, a pair of hinges are required for two doors **2**, **2''**, at approximately the same level. In order to avoid splitting of the wood of the wall when the hinges are mounted thereon, one of the shanks **7** can be disposed above the other (FIG. 7) although it is desirable that for the sake of prefabrication and mass protection the spaces **3***e* in the heads **3** be offset from one another as also seen in FIG. 7. In this case, the head portions **3***a'*, **3***b'* of each head **3** are of different dimensions and the space **3***e* is displaced from the median plane of each head. Under these circumstances, it is merely necessary to rotate the generally cylindrical head within one of the doors through an angle of 180° prior to tightness to accommodate the heads **3** to the offset support elements **7**. In a modified system, the heads are symmetrically shaped but co-operate with assymetrical support elements such as that shown at **7''** in FIG. 9 wherein the transverse arm **7***b''* is offset from the median plane. Under these circumstances, the screws **12** and **13** of the support elements of two hinges can be offset from one another on opposite sides of the wall **1''** while their head portions are symmetrically

oriented and are similarly positioned in the respective doors **2**, **2''**.

As will also be evident from FIG. 5, the spacers **14'** can be of any thickness necessary to accommodate the hinge to walls **1''** of different thicknesses. Since very fine adjustment is frequently required for an aesthetic mounting of the doors so that the end face of door **2** is properly aligned with the outer surface of wall **1**, an adjusting means is provided for shifting the support element **7** parallel to its arm **7***b*. The adjusting means illustrated in FIGS. 3–5 comprises, according to the invention, a frustocylindrical stud **15** having a slot **15***a* into which a screw driver can be inserted and a ramp **15***b* co-operating with the surface of the cylindrical frustocylinder receiving the stud **15**. Since both the receiving chamber and the stud have a similar configuration, an angular offsetting of the stud with respect to its bore cams the support element **7** away from the wall **1**. The stud **15** can be loosely set into the bore from the left (FIG. 2*b*) prior to mounting of the hinge and is held in its bore by the fastening screws **12** and **13**. The angle of ramp **15***b* is so selected that the sliding friction thereof is sufficient to prevent reverse rotation of the stud. The adjusting means **15'** of FIG. 9 is a set screw threadedly received in the support element **7''** whose thread functions as a ramp in the same manner as characteristic of stud **15**. The latter can be a complete frustum in which case a rotation of approximately 300–320° is possible to permit adjustment of the support element within a range of approximately 2 mm. The ramp can, however, also extend over an angle of about 180° so that a rotation of about 150° is possible with a proportionately smaller degree of adjustment. The adjusting means permit two doors **2''** to be mounted in such close proximity (FIG. 5) that only a hairline crevice can be seen between them. In the latter case, with the end faces of two doors in close proximity, the channel **4**, **5** must be so arranged that interference of one door with the other does not occur.

According to a more specific feature of the present invention, the head portions of the hinge are injection-molded from synthetic material although it is also conceivable that they be die-cast from a suitable metal (zinc or aluminum). In general, the support element will be die-cast from such metal and provided with hardened (steel) pins **8–10** which are set into the die-cast arm and project from the opposite sides thereof. It is also possible, however, to die-cast the entire support element including the pins or to injection-mold it from synthetic resin. It is preferred, however, that the pins be composed of steel. An integral construction of the transverse arm and shank portion of the support element is also desirable.

The invention described and illustrated is believed to admit of many modifications within the ability of persons skilled in the art, all such modifications being considered within the spirit and scope of the appended claims.

I claim:

1. In a cabinet hinge for securing a door to a cabinet for swinging movement about an axis parallel to respective edges of the door and a frame receiving the door in a closed position thereof and formed by the cabinet, said hinge comprising a guide head mounted upon said door proximal to said edge thereof, a support mounted on said cabinet proximal to said edge thereof and having a shank engaging said head, said head having a surface lying in a plane perpendicular to the swinging axis of the door and to said edges formed with a pair of guide grooves spaced from said edges, and said shank having a pair of slide bodies projecting transversely to said surface and respectively received in said grooves for sliding displacement therein, the improvement wherein

(a) said surface is formed with a further guide groove opening at one end thereof in the direction of said shank and spaced from said edges further than the first-mentioned grooves; and

(b) a further slide body projecting from said shank transversely of said surface and received in said further groove for guiding said door upon door-closing movement thereof at least during the portion of said movement at which said door enters said frame but withdrawn from said further groove in an open position of the door.

2. A hinge for articulatingly joining a pair of generally planar members along adjoining edges thereof, said hinge comprising a head element mounted upon one of said members proximal to said edge thereof; and a support element mounted upon the other of said members proximal to said edge thereof and received within said head element, said elements being provided with spaced-apart first and second pairs of slidably mating and constantly interengaging formations offset from said edge of said one of said members and defining a shiftable articulation axis enabling relative swinging movement of said members between a first position wherein said members extend generally transversely to one another and a second position angularly offset from said first position about said axis wherein said members include a relatively large obtuse angle, and at least one additional pair of slidably engageable formations spaced from said edges by a distance greater than that separating said first and second pairs from said edges and separable upon relative swinging of said members from said first to said second position and mating upon swinging of said members from said second to said first position as said members approach said first position, one of said members being a swingable door and the other of said members being a stationary wall, said head element being mounted upon said door and said support element being mounted upon said wall, all of said formations upon a respective element being substantially coplanar, said first, second and additional pairs of formations each including at least one respective channel formed in said head element and a guide pin slidably and rotatably guided in the respective channel and mounted on said projecting portion, said projecting portion extending generally transversely to said wall and said pins of said first, second and additional pairs being successively spaced along said projecting portion from said edge of said wall and lying in a common plane parallel thereto.

3. A hinge for articulatingly joining a pair of generally planar members along adjoining edges thereof, said hinge comprising a head element mounted upon one of said members proximal to said edge thereof; and a support element mounted upon the other of said members proximal to said edge thereof and received within said head element, said elements being provided with spaced-apart first and second pairs of slidably mating and constantly interengaging formations offset from said edge of said one of said members and defining a shiftable articulation axis enabling relative swinging movement of said members between a first position wherein said members extend generally transversely to one another and a second position angularly offset from said first position about said axis where said members include a relatively large obtuse angle, and at least one additional pair of slidably engageable formations spaced from said edges by a distance greater than that separating said first and second pairs from said edges and separable upon relative swinging of said members from said first to said second position and mating upon swinging of said members from said second to said first position as said members approach said first position, one of said members being a swingable door and the other of said members being a stationary wall, all of said formations upon a respective element being substantially coplanar, said support element being provided with an elongated shank affixed at one end to said wall and a projecting portion cantilevered on said shank and extending into said head element, said head element comprising a pair of head portions separable from one another and defining a space between them into

which said projecting portion extends, said head portions being in abutting relationship along a plane perpendicular to said door and parallel to said shank portion.

4. A hinge as defined in claim **3** wherein said first, second and additional pairs of formations each include at least one respective channel formed in said head element and a guide pin slidably and rotatably guided in the respective channel and mounted on said projecting portion, said projecting portion extending generally transversely to said wall and said pins of said first, second and additional pairs being successively spaced along said projecting portion from said edge of said wall.

5. A hinge as defined in claim **4** wherein the channel of said additional pair of formations is open at one end thereof along a side of said door upon which said support element is disposed for receiving said pin of said additional pair of formations and disengaging therefrom upon swinging of said door in opposite directions about said axis.

6. A hinge as defined in claim **4** wherein said head portions are provided with mirror-symmetrical channels corresponding to the channels of said first, second and additional pairs of formations and said projecting portion is provided with respective pins extending into each of the first, second and additional channels of both said head portions.

7. A hinge as defined in claim **6** wherein said head portions are injection-molded from a synthetic resin.

8. A hinge as defined in claim **4** wherein at least one of said elements is provided with abutment means in addition to said first, second and additional pairs of formations and engageable with the other of said elements for preventing the relative swinging of said members from said first position to said second position beyond a predetermined angle about said axis.

9. A hinge as defined in claim **4**, further comprising adjusting means on said shank portion for varying the distance of said projecting portion thereof from the edge of said wall.

10. A hinge as defined in claim **9** wherein said adjusting means includes spacing means of varying thicknesses selectively interposable between said shank portion and said wall.

11. A hinge as defined in claim **9** wherein said adjusting means includes a rotatable stud received in said shank element and formed with a ramp adapted to cam said shank element away from said wall upon rotation of said stud.

12. A hinge as defined in claim **11** wherein said stud is threadedly mounted in said shank portion and said ramp is formed by the screw thread connecting said stud to said shank portion.

13. A hinge as defined in claim **4** wherein said shank portion is generally planar and said projecting portion is integral with said shank portion but offset transversely with respect to the plane thereof for enabling the mounting of a pair of support elements on opposite sides of said wall.

14. A hinge as defined in claim **4** wherein all of said pins lie in a common plane perpendicular to said wall.

References Cited

UNITED STATES PATENTS

3,083,403	4/1963	Van Noord	16—166

FOREIGN PATENTS

78,738	7/1952	Denmark.
1,303,764	8/1962	France.

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