United States Patent

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[54] **LOCKING HINGES**
4 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **16/144**
[51] **Int. Cl.** **E05d 11/10**
[50] **Field of Search** 16/128, 139, 141, 144, 169, 176

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ABSTRACT: Locking hinges in which the hinge leaves or arms are locked in selected angular position against hinge action or relative rotational displacement by clamping structure utilizing the hinge pin to clamp the hinge leaves together as an incident to translation of the hinge pin along its axis.

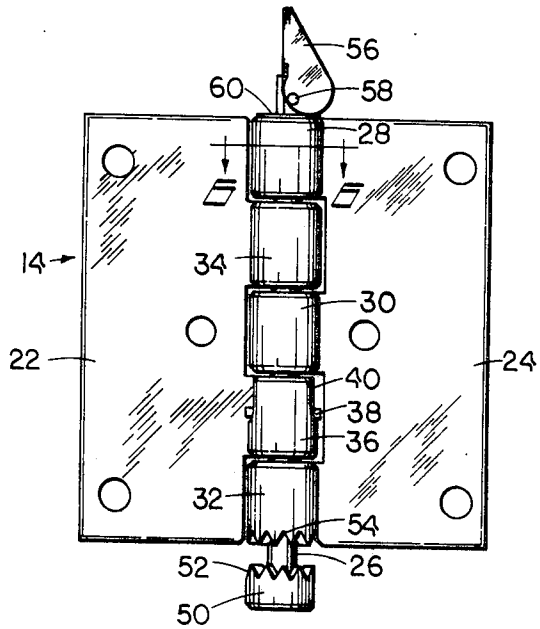


Fig 5

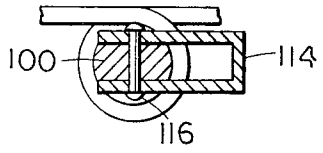
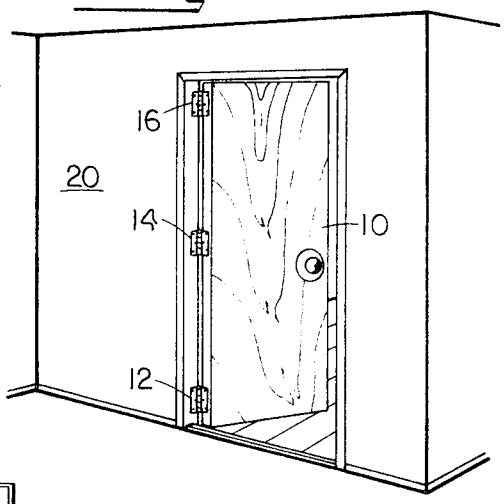


Fig 1



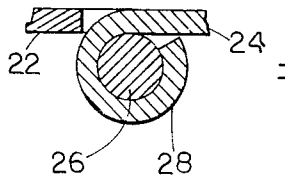


Fig 6

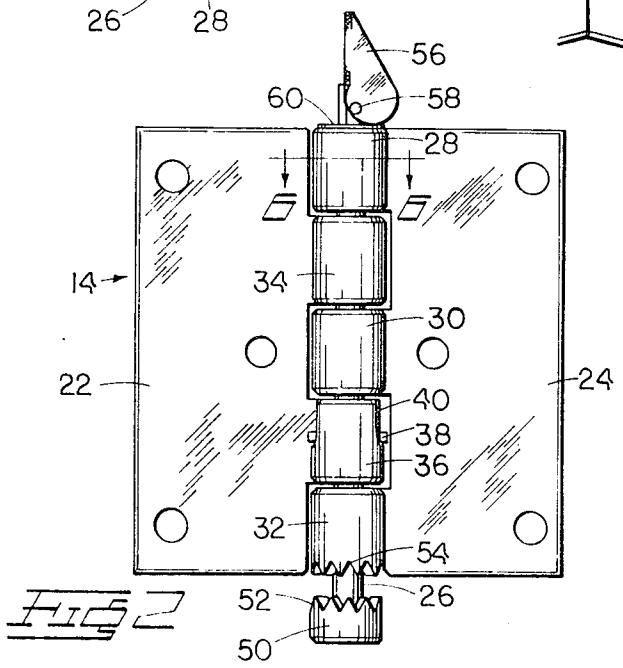


Fig 2

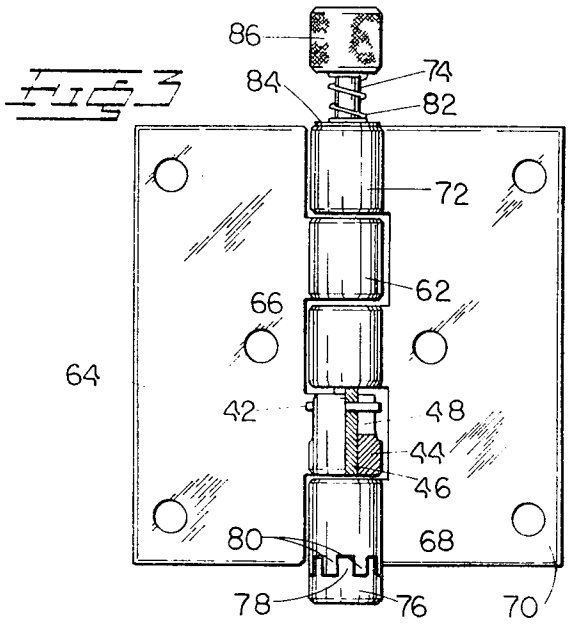


Fig 3

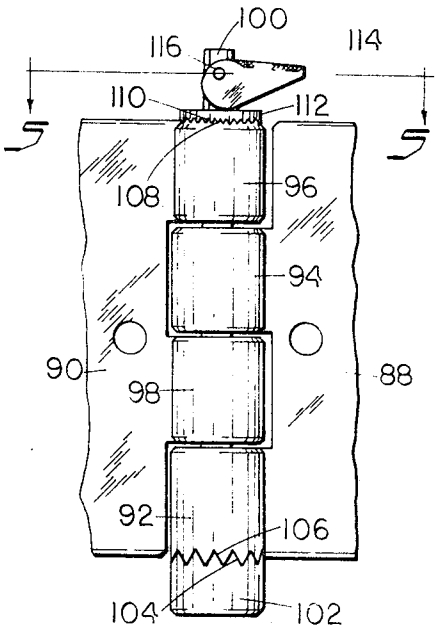


Fig 4

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LOCKING HINGES

This invention relates to improvements in hinges and it relates particularly to a hinge which incorporates a provision for locking the hinge arms or hinge leaves against pivotal motion around the hinge pin.

There are a variety of circumstances in which it is desirable to have one member hinged upon another so that the angular separation of the two can be varied and in which it is sometimes desirable to fix them at some selected angular degree of separation.

It is an object of the invention to provide a hinge which will perform those tasks and it is a related object to provide such a hinge which is not unduly expensive to produce, which provides the desired function well, and which is dependable and reliable in its operation. It is often undesirable or inconvenient, when two hinge members are to be fixed at some degree of angular separation, to employ an external stop either because such a stop would interfere or because of inconvenience in applying the stop to the hinge members or to the structures to which those members are attached. Accordingly, it is an object of the invention to provide a stop or hinge lock which can be made a permanent part of the hinge and which does not interfere with normal hinge action, if that is desired, or which acts primarily as a stop and can be made to serve as an ordinary hinge as circumstances require.

Hinges embodying the invention are useful in any application in which hinges are required and it is desired to lock against hinge action at selected times. One application for a locking hinge is to insure that a door mounted upon a hinge will remain ajar in some selected degree and one of the objects of the invention is to provide a hinge which is suitable for that purpose. In this connection, hinges incorporating the invention are not confined to use with doors or buildings and dwellings. The invention is equally applicable to use with container lids and hatch covers and cabinet doors and the like.

Other objects of the invention are to produce a locking hinge which can be produced from inexpensive tooling and as a modification of conventional hinges.

These and other objects and advantages of the invention which will hereinafter appear are realized in part by the provision of a locking hinge comprising a hinge pin; and by the provision of a pair of hinge leaves or arms, one having pivotal connection to the pin and the pin being movable along its central axis relative to both of the hinge leaves or arms; by the inclusion of means for preventing pivotal motion of the other leaf relative to the hinge pin; and by provision of means responsive to displacement of the pin along its central axis relative to said leaves to a locking position for impeding relative motion between the pin and said one leaf.

IN THE DRAWINGS:

FIG. 1 is an isometric view of a doorway formed in a wall and surrounded by a frame upon which a door is hung by hinges one of which embodies the invention and is adjusted to lock the door in a position ajar of its frame;

FIG. 2 is a view in front elevation of a locking hinge embodying the invention;

FIG. 3 is a view in front elevation of an alternative form of locking hinge embodying the invention, one portion of the structure being shown in cross section;

FIG. 4 is a view in front elevation of a fragment of another alternative form of locking hinge which embodies the invention;

FIG. 5 is a cross-sectional view taken on line 5—5 of FIG. 4; and

FIG. 6 is a cross-sectional view taken on line 6—6 of FIG. 2.

FIG. 1 of the drawing illustrates one application for the invention. In this figure a door 10 is hung by three hinges 12, 14, and 16 upon a door frame 18 which is mounted in a wall 20. Hinges 12 and 16 have conventional form but the hinge 14 is a locking hinge which embodies the present invention. The structural features by which the locking function is incorporated are so small and unobtrusive that the locking hinge looks not unlike the others. These structural elements that provide the locking function are sufficiently small and are located in a way so that there is no interference with hinge action. The door 10 may be opened and closed at will in any degree. No loss in conventional hinge function need attend incorporation of a hinge embodying the invention.

Hinge 14 is shown in larger scale in FIG. 2. It comprises a butt hinge formed by two leaves, a hinge pin, and means pivotally interconnecting the leaves and the pin. The leftmost leaf in FIG. 2 is designated by the reference numeral 22. The rightmost leaf in that figure is designated 24. The two leaves are held together by a hinge pin 26 which extends through extensions formed integrally at one edge of the two hinge leaves and wrapped around to form a generally cylindrical structure which is angularly displaceable about the pin, or at least about the pin axis, to provide the hinge action and is sometimes termed a "barrel." The extensions of the two hinge leaves are complementally formed so that the cylindrical structures formed by wrapping around the extensions of one leaf may be fitted between the cylindrical structures formed by wrapping around the extensions of the other leaf. These cylindrical structures are aligned so that the pin extends through them, passing alternately through a cylindrical structure of one leaf and then through a cylindrical structure of the other. In the embodiment of FIG. 2 the leaf 24 is provided with three such extensions or cylindrical structures which are designated 28, 30, and 32, respectively. The other leaf is provided with two of those extensions designated 34 and 36, respectively. They are seen to be in vertical alignment with the extensions 34 and 36 lying on opposite sides of the center extension 30 of the plate 24. That the extensions are wrapped around to form a cylindrical structure is illustrated in FIG. 6 where the structures 28 of leaf 24 is shown in cross section wrapped around the pivot pin 26.

Means are provided in the invention for preventing rotation or pivoting of one of the leaves relative to the hinge pin. That means may have a variety of forms in FIG. 2. It comprises a locking or stop pin 38 which extends through the barrel or cylindrical structure 36 and through the hinge pin 26 so that relative rotational movement of the two is precluded. However, while the pin extends through a hole of approximately the same diameter in the hinge pin 26, it extends through a slot in the cylindrical structure 36. The slot is only as wide as the pin but it extends vertically to the end that the pin 26 may be translated in the direction of its axis which is the central axis for hinge action. Summarizing, the hinge leaf 24 may be pivoted or rotatably displaced relative to the leaf 22 and to hinge pin 26 about the central axis of the pin. Pin 26 cannot be pivoted or rotationally displaced relative to the leaf 22. However, the pin 26 may be translated along its axis relative to the two plates because the pin 38 is free to slide up and down in the slot 40 of the cylindrical structure or barrel 36. The construction of the cylindrical structure 36 and its slot 40 and the construction of the pin 38 correspond to the structure illustrated in FIG. 3 where the pin 42 corresponds to pin 38 and cylindrical structure 44 corresponds to cylindrical structure 36. In FIG. 3 the pin 42 is seen to extend through an opening of corresponding size through the hinge pin 46 and to be lodged in a slot 48 which corresponds to the slot 40 of FIG. 2.

Means are incorporated in the invention for preventing pivotal motion of the other leaf relative to the pin and in the embodiment of FIG. 2 this means comprises a structural arrangement that prevents relative rotation or pivotal movement between the hinge leaf 24 and the hinge pin 26. One of these two members is made to carry a key and the other is formed with a slot. Relative rotation of the leaf and the hinge pin are prevented when the key is disposed in the slot. The hinge pin is translated along its axis to engage and disengage the key and the slot. In this embodiment the lower end of the hinge pin 26 is provided with a cap 50, the upper face of which is provided with a series of teeth 52 which in this embodiment are formed entirely around the cap 50. Means not shown prevent relative

rotation between the cap 50 and the hinge pin 26. The lower face of the cylindrical structure 32 of hinge leaf 24 is provided with corresponding teeth 54. The teeth 52 and 54 are complementally formed so that one set of teeth fits within the other in the manner of a key and slot and it matters not which is defined as the slot and which is defined as the key. Once the two sets of teeth are engaged with one another, relative rotation or pivotal movement of the hinge plate 24 relative to the hinge pin 26 is precluded and the angle between the two hinge leaves 22 and 24 is fixed. The teeth are arranged so that any tooth of the set 52 can fit within any two teeth of the set 54 so that the two hinge leaves 22 and 24 can be locked in any relative angular or pivotal position in which the sets of teeth will mesh with one another.

Means are provided for translating the hinge pin along its axis. In this embodiment that means comprises a cam and cam surface combination. In the embodiment of FIG. 2 a cam 56 is pinned by a pivot pin 58 to the upper end of the hinge pin 26. The face of the cam 56 bears against the upper face of a washer 60 through which the hinge pin extends and which lies against the upper face of the cylindrical structure 28. Rotation of the cam 56 about the pivot pin 58 forces the hinge pin upwardly along its axis until the set of teeth 52 is fully engaged in the set of teeth 54. The camming arrangement is similar to that illustrated in FIG. 5 and operation of cam 56 can be fully understood from the description of the embodiments of that figure. When the cam 56 is rotated back to the position shown, the hinge pin 26 is lowered either by the force of gravity or by pushing downwardly on the handle portion of the cam 56. If the handle is raised to the position shown and the hinge pin 26 is not lowered so that the teeth 52 clear the teeth 54, a camming action will occur between those sets of teeth when the hinge is actuated and the tooth set 52 will be forced downwardly to clear the tooth set 54.

Unlike the embodiment of FIG. 2 whose normal condition is either the locked condition or the unlocked condition, the hinge of FIG. 3 is normally locked because means are provided for urging the hinge pin to a locking position. In FIG. 3 the cylindrical structures 44 and 62 form part of the hinge leaf 64. The cylindrical structure 44 is disposed between the cylindrical structures 66 and 68 of leaf 70. The upper cylindrical structure of the leaf 70 is designated 72. The hinge pin 74 extends through all of those cylindrical structures and at its lower end the hinge pin is formed with a cap 76 whose upper face is formed with square teeth one of which is designated as 78 and is disposed between a pair of complementally formed square teeth 80 formed on the lower face of the cylindrical structure 68 of hinge leaf 70. The teeth of the cap 76 and of the cylindrical member 68 being engaged, relative rotation or hinge action between the hinge pin and the leaf 70 is precluded. The teeth of these members are held engaged by a spring 82 which bears at its lower end against a washer 84 overlying the upper face of the cylindrical structure 72. At its upper end the bias spring 82 bears against the lower face of a knurled knob 86 which is fixed to the hinge pin 74 whereby the hinge pin is urged upwardly. To disengage the teeth 78 and 80 whereby to permit rotation of leaf 70 relative to leaf 64 and the hinge pin, it is necessary only to depress the knob 86 against the bias of spring 82. As previously described rotation of the hinge pin 74 relative to the hinge leaf 64 is precluded by a stop pin 42 which extends through a vertical slot formed in the cylindrical structure 44 and through a hole which extends transversely through the hinge pin.

The embodiments of FIGS. 2 and 3 employ the pin and slot arrangement to provide the means by which one of the hinge leaves or arms is precluded from rotational or pivotal movement relative to the hinge pin. That means may comprise structures of alternate form one of which is illustrated in FIG. 5. In this embodiment the hinge is arranged so that the lowermost cylindrical structure forms part of one hinge leaf and so that the uppermost cylindrical structure forms a part of the other leaf. The two leaves are held together by a pivot pin which extends through those cylindrical structures. A key and slot arrangement is provided at both ends of the pivot pin and the key and slot are locked and unlocked by translating the hinge pin along its axis relative to the hinge leaves. In FIG. 4 the two hinge leaves are designated by the reference numerals 88 and 90, respectively. The lower cylindrical structure 92 and the third cylindrical structure 94 from the bottom in FIG. 4 from a part of the hinge leaf 88 in that they comprise extensions from one edge which are wrapped around to form a cylindrical structure by which the leaf is secured to the pin. The cylindrical structure at the top is designated by the reference numeral 96 and the cylindrical structure disposed between the structures 92 and 94 is designated 98. The two cylindrical structures 96 and 98 form a part of the leaf 90. The hinge pin 100 extends entirely through all four cylindrical structures. At its lower end the hinge pin is provided with a cap 102 whose upper face forms a set of teeth 104. This set of teeth is engageable with a complementally formed set of teeth 106 which are formed on the lower face of the cylindrical structure 92. The upper face of the upper cylindrical structure 96 is formed to provide a set of teeth 108 which is engageable with a complementally formed set of teeth 110 on the lower face of a heavy washer 112 which has a central opening, not shown in the drawings, through which the pivot pin 100 extends. As illustrated in FIG. 5, the upper end of the hinge pin 100 is flattened in diametric regions along a portion of its length to form parallel flats upon which the cam member 114 is mounted by pivot pin 116. The flats of the hinge pin extend to a point below the washer 112. The opening in the washer through which the hinge pin extends is not circular but is formed with flats complementing the flats of the pin whereby the washer 112 is free to move relative to the pin in its axial direction but is precluded from rotation relative to the hinge pin. When the cam lever is rotated to the position shown in FIG. 4 the cam bears against the upper face or camming surface of the washer 112 whereby the pin 100 is forced upwardly. The set of teeth 104 of cap 102 are forced into engagement with teeth 106 of cylindrical member 92. Also, the washer 112 is forced downwardly so that its set of teeth 110 engages the set of teeth 108 of the cylindrical member 96. The washer 112 and the cap 102 being fixed against rotation relative to the pivot pin and being fixed one to the leaf 90 and the other to the leaf 88, the leaves are precluded from hinge action or rotation relative to one another about the pivot pin when the cam occupies the position it is shown to have in FIG. 5.

While the several embodiments selected for illustration relate to butt hinges it will be apparent that the invention is applicable to other hinges. It will be apparent also that although the particular locking structures illustrated in these embodiments are advantageously employed and have preferred form, various modifications may be made in these forms and other forms are possible.

I claim:

1. A locking hinge comprising:

a hinge pin having a central axis;

a pair of hinge leaves, one having pivotal connection to said pin, and the pin being movable along its central axis relative to both hinge leaves and extending at both ends beyond said hinge leaves;

means for preventing pivotal motion of the other leaf relative to the pin;

locking means responsive to displacement of said pin along its central axis relative to said leaves to a locking position for impeding relative motion between said pin and said one leaf comprising a clamping element engageable with said one leaf and fixed to one end of said pin at a point beyond said hinge leaves and engageable with said one leaf as an incident to displacement of said pin; and

means for holding said pin displaced to locking position;

said locking means further comprising another clamping element carried on said pin at its other end and capable of being forced into engagement with one of said hinge leaves;

said means responsive to displacement of said pin comprising a complementary key and slot one carried by one of said pin and said one leaf and the other carried upon the other of said pin and said one leaf; and

in which said means holding the pin displaced comprises a cam carried by the pin and rotatable thereupon to bear against said other of said clamping elements.

2. A locking hinge comprising:

a hinge pin having a central axis;

a pair of hinge leaves, one having pivotal connection to said pin, and the pin being movable along its central axis relative to both hinge leaves and extending at both ends beyond said hinge leaves;

means for preventing pivotal motion of the other leaf relative to the pin;

locking means responsive to displacement of said pin along its central axis relative to said leaves to a locking position for impeding relative motion between said pin and said one leaf comprising a clamping element engageable with said one leaf and fixed to one end of said pin at a point beyond said hinge leaves and engageable with said one leaf as an incident to displacement of said pin; and

means for holding said pin displaced to locking position;

said locking means further comprising another clamping element carried on said pin at its other end and capable of being forced into engagement with one of said hinge leaves;

said means for holding said pin displaced comprising a cam and means for pivotally connecting the cam to the pin at a point such that said other clamping element is engaged and forced into clamping engagement with said one leaf as an incident to pivoting of the cam.

3. The invention defined in claim 3 in which said hinge leaves comprise complementally and alternately arranged wrap around extensions at one edge wrapped around said pin and in which said clamping elements are engageable with the outer edges of respectively associated ones of said wrap around extensions of said one leaf.

4. The invention defined in claim 3 in which said first mentioned clamping element and the wrap around extension with which it is associated, have their adjacent surfaces formed by complementally arranged teeth.

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