United States Patent [19]

Griego

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[45] **July 10, 1973**

[54] **LOCKABLE HINGE**

[76] Inventor: **Steven J. Griego,** 635 Gene Avenue, N.W., Albuquerque, N. Mex. 87107

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[52] **U.S. Cl.** **16/144,** 16/137, 16/191
[51] **Int. Cl.** **E05d 11/10**
[58] **Field of Search** 16/137, 168, 169, 16/144; 287/108, 110

[56] **References Cited**

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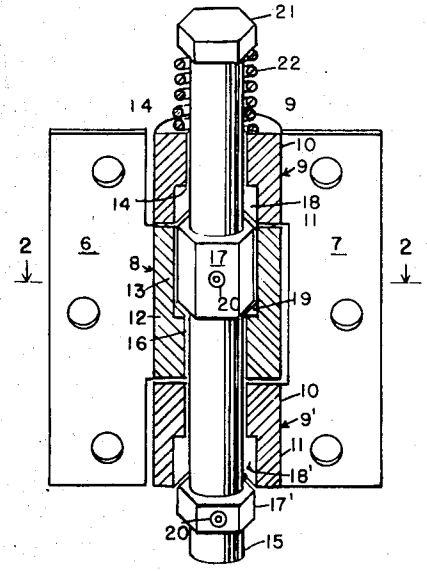
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Primary Examiner—James T. McCall
Assistant Examiner—Doris L. Troutman
Attorney—Henry Heyman

[57] **ABSTRACT**

A structural hinge having at least two leaves provided with registering barrels and an axially movable hinge pin inserted through said barrels, each of the barrels having an internal cylindrical journal portion and an internal polygonal socket portion, said hinge pin having corresponding cylindrical portions and polygonal in cross section plug portions, the socket portions in alternate barrels being of sufficient depth so that the plug portions of the hinge pin are completely nested in said alternate barrels when the hinge pin is in one extreme axial position and each plug portion engages adjacent socket positions when the hinge pin is in other axial positions whereby the hinge leaves are angularly movable with respect to each other, or are locked in a selected angular condition, respectively.

7 Claims, 7 Drawing Figures



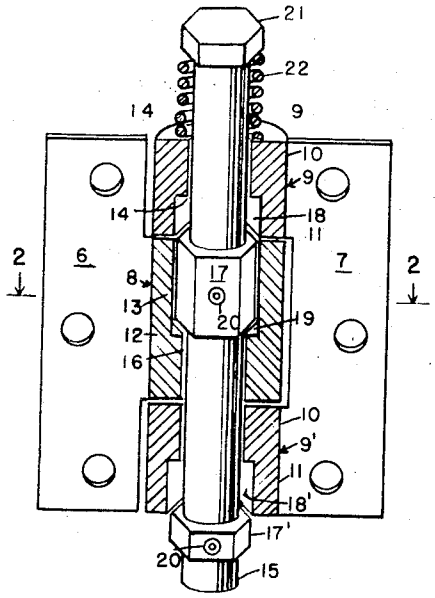


FIG. 1

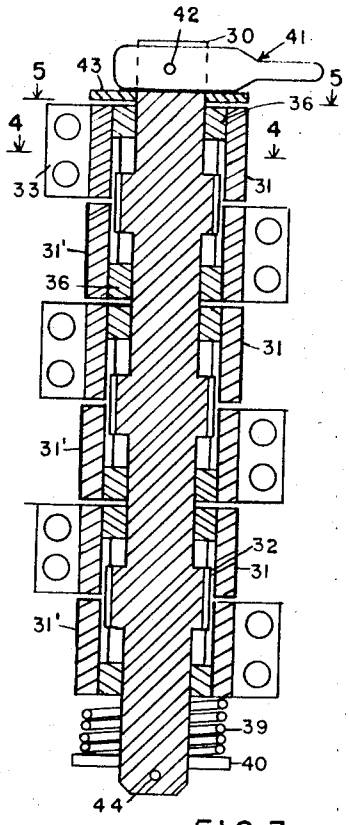


FIG. 3

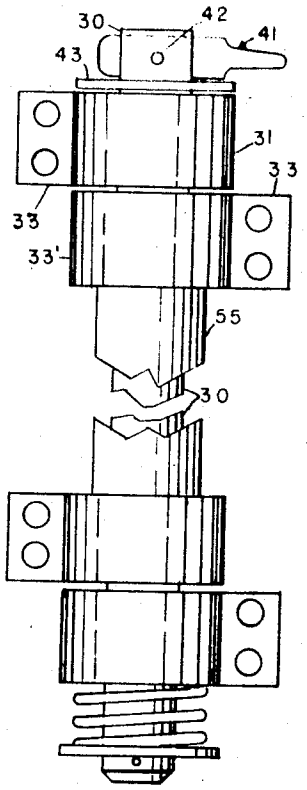


FIG. 7

FIG. 2

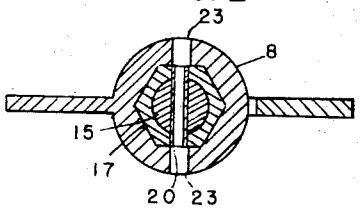
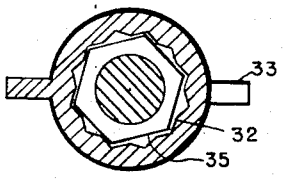


FIG. 4



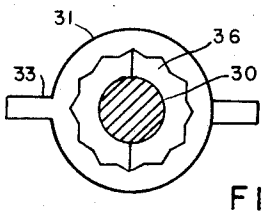


FIG. 5

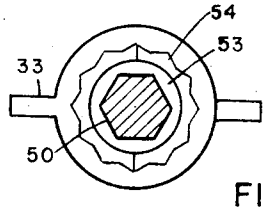


FIG. 6

LOCKABLE HINGE

This invention relates to a structural hinge member for use where structural members are to be supported and locked in selected angular positions with great strength and complete reliability. For example, step ladders, low scaffolds and the like have a user support portion and hinged legs. Because suitable locking hinges are unavailable, the hinged legs are extended to a fixed angular position and braced in that position by auxiliary mechanical linkages such as the hinged wishbone, sliding rods, chains, and the like.

The desirability of the need for a locking hinge has been recognized in the prior art. For example U.S. Pat. No. 2,966,697 to Mintz issued Jan. 3, 1961 shows one form of hinge lock for doors, car trunk lids and the like. The Mintz teaching is the provision of interlocking discs between two hinge barrels so that a latching action takes place upon moving the leaves to a predetermined angular relationship. Other prior art devices such as U.S. Pat. No. 1,683,814 to Block issued Sept. 11, 1928 address themselves to door stop mechanisms, that is, stop devices for insertion in selected positions to limit the angular movement of a door or the like. Still other hinge modifications such as shown in U.S. Pat. No. 2,843,873 to Slower issued July 22, 1958 provide spring actuated indent means for yieldably holding a closure device in a selected position.

In general the prior art devices are modifications of hinges utilizing the well known hinge leaf, trunnion journal and pivot pin.

Such devices are inherantly limited to applications requiring modest strength and in which the possibility of failure to insure a selected angular position can be tolerated.

The main objects of the present invention are to provide a hinge construction of novel configuration which effects great strength, selective angular locking, flexibility in application and fail safe operation.

Another object is to provide a hinge mechanism which is constituted by a single component with which the user can construct a hinge of any desired length and strength to suit any particular structural application.

The above objects, with other objects and advantages which will presently become apparent, reside in the details of the construction, arrangement and combination of the several parts and features as are more fully hereinafter described and claimed, reference being had to the accompanying drawings made a part hereof, and in which:

FIG. 1 is a side elevation partly in section of a butt hinge showing one form of the invention applied thereto.

FIG. 2 is a horizontal cross section taken on plane 2—2 of FIG. 1.

FIG. 3 is a diametric cross section in elevation of a preferred embodiment.

FIG. 4 is a horizontal cross section on plane 4—4 of FIG. 3.

FIG. 5 is a horizontal cross section on plane 5—5 of FIG. 3.

FIG. 6 is a horizontal cross section on plane 5—5 of FIG. 3 showing a modification thereof.

FIG. 7 is an external elevation of a modification of the FIG. 3 embodiment.

The invention in brief relates to a locking hinge in which the journal element or barrel comprises portions of the usual cylindrical hinge pin and interleaved hinge pin journals and in addition, the hinge pin includes portions which are polygonal in shape to cooperate with portions of the barrels which are internally provided with a corresponding polygonal socket, the length of the hinge pin polygonal portion, herein termed polygonal plug portions being not more than the length of the socket portion and means are provided to axially shift the hinge pin so that each plug portion is positioned entirely in a socket whereby the hinge leaves are free to rotate relative to each other, or each plug portion is positioned so its length is shared by adjacent sockets to lock the hinge leaves in a selected angular position.

Referring first to FIGS. 1 and 2, the hinge comprises two leaf members 6 and 7 having interengaged barrels 8, 9, and 9'. Each of barrels 9 and 9' is divided longitudinally into a cylindrical bearing hub 10 and socket portion 11. Barrel 8 comprises a hub portion 12 and socket portion 13.

The hub portion 10 of barrels 9 and 9' is provided on its inside surface with a journal 14 of a diameter to slidably support the external diameter of the cylindrical portions of hinge pin 15. The hub portion of barrel 8 likewise is provided with a journal 16 for accommodating hinge pin 15.

Socket 11 of leaf 7 is provided on its inner surface with teeth constituting a socket 18 of preselected length which equals, substantially one-half the length of polygonal plug member 17. Plugs 17 and 17' have a close sliding fit with socket 18 and 18', respectively.

Socket 19 in barrel 8 is similar in cross section to sockets 18 of barrels 9 but have a length at least equal and preferably slightly greater than the length of plugs 17.

The hinge pin 15 is an elongated cylindrical shaft providing along its length, spaced polygonal shaped plugs which can be either integral with the shaft or affixed in any well known manner. For ease and convenience in assembling the hinge of FIG. 1, I use anchor pins 20 of the rolled pin variety which are pressed into matching bores in the shaft and the respective plug.

The hinge of FIG. 1 is shown in the free swinging condition accomplished by pressing down hinge pin head 21 against the spring bias of spring 22. When a selected angular position of leaves 6 and 7 is obtained, the pressure against head 21 is released and plugs 17 and 17' will be translated upward into engagement with sockets 18 and 18'. Upper plug 17 now engages its length equally between upper sockets 18 and 19 and lower plug 17' engages socket 18' thus securing the angular position of the leaves 6 and 7 in a strong and fail-safe manner. Upper socket 18 is limited in length to one-half the axial length of plug 17 to provide a limit which accomplishes the proper division of the plug in adjacent sockets.

The hinge of FIG. 1 may be assembled by assembling spring 22 on hinge pin 15, inserting separate plug 17 in socket 19 of barrel 8. Aligning barrels 8 and 9 and inserting the hinge pin through the assembly. Locking pin 20 is inserted with a press fit in the provided registering apertures in the hinge pin and the plug 17 through access holes 23 in barrel 8 as shown in FIG. 2. As many pairs of barrels may be used as the hinge application requires, the only essential preliminary step being the insertion of a plug 17 in every barrel of type 8, and finally securing a plug 17' on the end portion of the shaft.

As stated previously one need for a rugged reliable locking hinge is in connection with folding step ladders,

folding scaffolds, and the like. The embodiment of FIG. 3 provides additional ruggedness and flexability in that any plurality of structural elements can be pivotally connected and are lockable in any desired configuration. For example, by providing a hinge of multiple leafs at each end of a scaffold plank, one pair of leafs at each end can provide the leg supports and another leaf at each end can provide upwardly directed supports for a safety rail.

The FIG. 3 hinge uses identical leaf and journal elements in all leaves thereby greatly simplifying the number of types of parts needed to make up a hinge of any given length or leaves. The hinge pin under some circumstances will more appropriately be considered an axle or shaft and the term hinge pin herein includes the more massive types. Any hinge assembly of the embodiment of FIG. 3 comprises hinge pin 30 and identical hinge barrels. When the hinge barrels include the hinge pin bushing they are identical except that one of each pair is reversed axially with respect to the other one of each pair. The barrels having the attitude of the top barrel are designated by numeral 31 and the reversed barrels are designated by numeral 31'. Each of the barrels is provided throughout its length with teeth 32 as shown in FIG. 4 thereby constituting initially an end to end socket. This form of construction enables the plug portions 35 on the hinge pin to be integral with the hinge pin for greater strength than is obtainable with shear pins between plug portions and the shaft. That is, the shaft with integral plug portions can thread as many aligned barrels as desired. The journals in the barrels for pivotal support of the hinge pin are provided during assembly by split annular bushings 36 which are provided with a polygonal parameter of shape conforming to the interior of the sockets and of a size to provide a squeeze or press fit in the sockets.

Barrels 31 and 31' are each provided with a leaf 33 which may be of any size and shape but in order to provide flexibility for jointure with elongated flat plates piano hinge fashion, or attachment to any plurality of structural elements, is preferably of the stub form shown.

In order to translate the hinge pin to unlock position, any known form of mechanism which provides axial reciprocation may be used such as cams, hydraulic cylinders, pneumatic devices, and the like. I show, for example, a cam mechanism 41 pivotally attached to the upper end of the hinge pin 30 by pivot pin 42. A thrust washer 43 is desirably placed between the cam 41 and the nearest barrel 31.

The hinge pin with associated plug portions 38 is normally in the position for locking each pair of adjacent sockets as established by spring 39 and thrust washer 40.

The sockets in barrels 31 and 31' may have as many teeth as selectivity of angular position requires but for purpose of illustration are shown as 12-point in the cross sectional FIG. 4. This enables commercially available 12-point sockets to be used with likewise available hexagonal steel rod. Such commercially available hexagonal rod can be reduced to cylindrical shape between plug portions by lathe machining or grinding.

The hinge of the embodiment of FIG. 3 may be assembled in various ways and for purpose of illustration one mode is explained. Washer 43 and cam 41 are assembled to hinge pin 30. Hinge pin 30 is threaded through a first barrel 31. While the cam and washer are spaced from the end of barrel 31, a split bushing 31 is positioned around the exposed part of hinge pin 30 and the barrel is pressed toward the cam end of pin 30 to force the bushing into the end of barrel 31 into the position shown in FIG. 5. Barrel 31 is threaded over the hinge pin 30 until it is adjacent barrel 31. A split bushing 36 is forced into the lower end of this barrel 31'. A second barrel 31 is threaded over the hinge pin and is assembled with a split bushing in the same manner as was done with first barrel 31. The entire hinge is thus assembled to any length desired and finally spring 39 and washer 40 are assembled and retained by pin 44.

It is contemplated that there are occasions when the hinge pin core of FIGS. 1 and 3 may desirably be of polygonal form such as hexagonal to provide a stronger engagement with separate plug portions. In order to provide for assembly of such a modification without the use of shear pins as when, for example, polygonal plugs are welded on a polygonal hinge pin core, bushing collars shown in FIG. 6 may be used. The collars 53 are assembled on the hinge pin core before the polygonal plug portions are welded or otherwise affixed to the pin core. Subsequently this alternative form of hinge pin can be assembled like the embodiment of FIG. 3 but using thinner split bushings 54.

There are occasions in which a hinge must be provided for wide devices such as various types of trap doors and the like. Such applications need a locking device which can be manipulated from one end but do not require continuous hinge segments. The embodiment of FIG. 7 is provided for this purpose. Two pairs of barrels 31 and 31' are used and are supported in spaced relationship by elongated cylinder 55. Otherwise the construction is similar to that of FIG. 3.

What is claimed is:

1. A hinge comprising at least two leaves, a barrel shaped housing affixed to one end of each leaf, said housings each having an internal polygonal socket portion and a hinge pin bearing portion, a hinge pin adapted to pass through said barrels when the same are in axial alignment, and supporting along the length thereof spaced polygonal plug portions of a size and shape to slidably mesh with the barrel socket portions, said socket portions having an axial length at least equal to the length of the plug portions whereby axial translation of the pivot pin in one direction uncouples the plug portions from the adjacent socket portions thereby releasing the leaves for relative angular movement and whereby axial translation of the hinge pin in the other direction to an extent wherein the plug portions are meshed with adjacent portions of adjacent sockets locks the leaves against relative angular movement.

2. The hinge of claim 1 in which the hinge pin comprises alternate cylindrical and polygonal plug portions and said housing hinge pin bearing portion is an extended socket portion, a split bearing bushing having an exterior polygonal configuration adapted to slidably fit in and being supported by the extended socket portion and having a central journal aperture to support the hinge pin cylindrical portion.

3. The hinge of claim 2 in which the hinge pin is provided with an enlarged end portion, a spring mounted under compression on the hinge pin between the enlarged end portion and the adjacent end of the adjacent barrel shaped housing whereby each hinge pin plug portion is maintained in mesh equally substantially with

adjacent barrel socket portions thereby securing the hinge leaves in locked angular relationship.

4. The hinge of claim **1** in which each housing hinge pin bearing portion is a cylindrical journal affixed to the respective socket portion, said hinge pin having a cylindrical cross section, each of said polygonal plugs and said hinge pin being provided with mating apertures adapted to receive anchoring element of elongated pin shape, said anchoring element having a cross section sized to provide a squeeze fit in said mating apertures and having a length substantially equal to but not exceeding the cross sectional dimension of the plug portion in the direction of the apertures.

5. The hinge of claim **1** in which a first barrel shaped housing is affixed to an independent leaf, said hinge pin having a polygonal cross section, said barrel shaped housing having its length divided into a polygonal socket portion and a cylindrical portion, a plug element having an external polygonal shape adapted to slidably engage the housing socket portion and having a central polygonal aperture adapted to slidably fit said hinge pin, said polygonal socket portion having a length at least equal to the length of the plug element, a second barrel shaped housing and leaf of identical construction with the first housing and leaf but juxtiposed adjacent the first housing in reversed relationship whereby the socket portions are adjacent, bearing elements having an interval polygonal aperture adapted to slidably fit the hinge pin and having an external cylindrical shape of diameter to slidably fit the housing cylindrical portion and means for translating in an axial direction the hinge pin between two preselected extremes, means for affixing each plug element to the hinge pin in a position whereby it is completely nested in the first barrel shaped housing socket when the hinge pin is translated to one extreme position, and shares its length equally with the socket portions of the first and second housing sockets when the pivot pin is in the other preselected extreme position.

6. The hinge of claim **5** in which a hinge pin reciprocating cam element is pivotally supported on the end of the pivot pin and is adapted to engage the adjacent end of the adjacent first barrel shaped housing whereby the hinge pin with its associated plug elements can be selectively positioned in either of said preselected extreme positions, spring means supported on the pivot pin between the other end of the hinge pin and the adjacent end of the adjacent second barrel shaped housing member whereby the hinge pin is biassed into the position in which the associated plug element shares its length substantially equally with the adjacent socket portions of the first and second housing and manual operation of the cam translates the plug elements out of engagement with alternate sockets.

7. The hinge of claim **3** in which the plug portions are integral with the hinge pin and in which the split bearing bushing is sized for a slidable squeeze fit in the socket portion of the leaf-barrel shaped housing assemblies, said bushings having a length relative to the axial length of the sockets portions such that when pressed in place flush with an edge of the socket, the axial length of the socket remaining is at least equal to the axial length of the plug portions, and stop means affixed to the hinge pin to limit the axial movement of the shaft in the direction of coercion of the spring to a position in which the plug portions are meshed equally, substantially with adjacent opposed sockets, and means affixed to the hinge pin for reciprocation to and holding the plug portions out of mesh with alternate leaf-barrel housing assemblies.

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