June 2, 1964 J. S. PARSONS 3,135,013

HINGE WITH PIN RETAINING MEANS

Filed March 10, 1961

FIG. 1

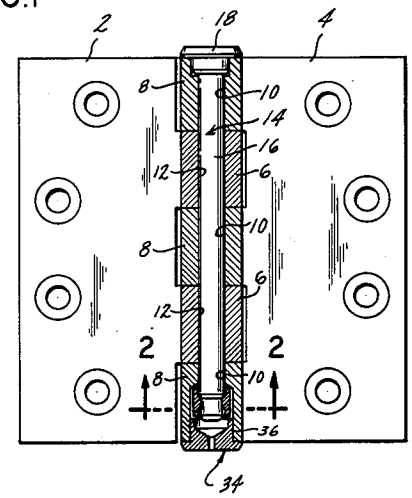


FIG. 2

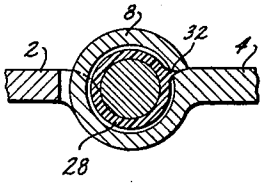


FIG. 3

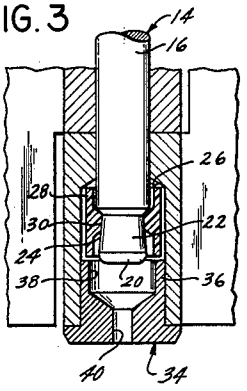


FIG. 4

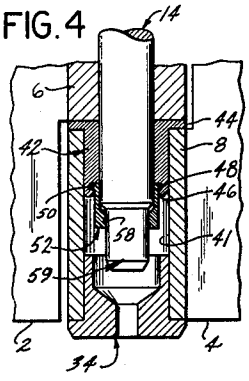


FIG. 6

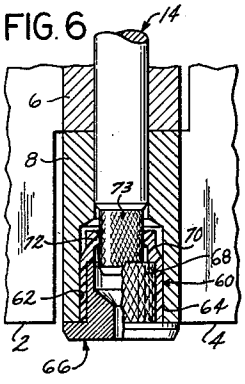


FIG. 7

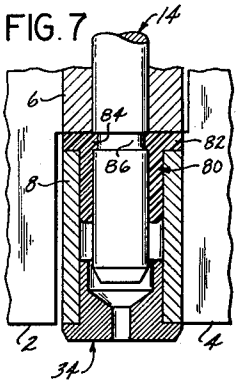
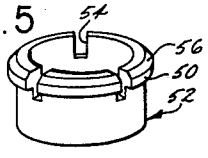


FIG. 5



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HINGE WITH PIN RETAINING MEANS

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The present invention relates to hinges of the type having a pair of leaves with interfitting knuckles and a pin extending therethrough to provide a pivotal connection. More particularly, the present invention is directed to a novel assembly wherein undesired movement of the hinge pin is limited during normal operation of the hinge.

It is an aim of the present invention to provide a hinge assembly having means for firmly engaging the hinge pin to limit undesired movement thereof which is readily and economically fabricated and simple and durable in construction.

Another aim is to provide a hinge assembly having pin retaining means which readily accommodates variations in size and contour of the hinge pin resulting from manufacturing tolerances.

A further aim is to provide a hinge assembly having means for retaining the pin against undesired movement in combination with a bearing member.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application which will be indicated in the appended claims.

In the drawings:

FIG. 1 is a front view of a hinge constructed in accordance with the invention having the leaves in open position and the knuckle portions thereof in section;

FIG. 2 is an enlarged fragmentary sectional view along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged fragmentary section of the lower barrel portion of the hinge in FIG. 1;

FIG. 4 is a fragmentary section of the lower barrel portion of a hinge employing an alternative embodiment of the invention;

FIG. 5 is an enlarged perspective view of the collar in FIG. 4;

FIG. 6 is a fragmentary section of the lower barrel portion of a hinge employing another alternative embodiment of the invention; and

FIG. 7 is a fragmentary section of the lower barrel portion of a hinge embodying a further alternative embodiment of the invention.

Referring first to the embodiment of the hinge illustrated in FIGS. 1–3 of the drawings, the hinge has two leaves 2, 4 of sheet metal which are provided with interfitting knuckles 6, 8 having aligned bores 10, 12 extending therethrough. Seated in the bores of the knuckles is the elongated shank 16 of a hinge pin 14 and the head 18 of the pin fits tightly against the edge of the uppermost knuckle 8. The shank 16 has a frusto-conical end portion 22 which defines a circumferential groove or recess 24 of tapering and lesser diameter than the diameter of the body of the shank 16. The base 20 of the frusto-conical end portion 22 is rounded to provide a reduced diameter tip of increasing diameter which guides the pin and acts as a camming surface.

The lowermost knuckle 8 is provided with a counterbore 26 extending inwardly of the hinge pin recess 24. An annular collar 28 of resiliently deformable plastic material is disposed within the counterbore 26 and is provided with an internal rib 30 which extends inwardly of the recess 24 in the hinge pin and into binding engagement with the inwardly tapering surface 22 to lock the pin in the knuckle. The internal rib 30 provides an aperture of lesser diameter than that of the pin shank 14 and the maximum diameter of the tip end portion 22 in its normal or disengaged condition and is preferably dimensioned to apply substantial contractive pressure upon the surface 22. The external diameter of the collar 28 is smaller than the diameter of the counterbore 26 to provide radial spacing therebetween.

In this manner, the inclined surfaces of the portions 20 and 22 during insertion and withdrawal of the pin 14 will act as camming surfaces and radially expand the collar 28 in the counterbore 26 at least adjacent to the rib 30. During assembly, the resilient nature of the plastic material will cause the collar 28 to contract into engagement in the recess 24 of the pin after the maximum diameter portion of the pin end has moved beyond the rib 30. The gentle inward tapering of the portion 22 will provide binding engagement between rib 30 and pin 14 despite minor variations in length and contour of the pin due to manufacturing tolerances and will further result in the contractive pressures of the collar tending to draw the pin downwardly. Generally, the plastic material of the rib 30 will flow or creep into any of the normal, minor aberrations in the surface of the portion 22 so as to provide mechanical interlocking, and this mechanical interlocking may be enhanced by intentionally roughening or knurling the surface of the metal.

As shown in FIG. 2, the annular collar 28 may be provided with an axially extending key portion 32 which fits into a recess or irregularity in the counterbore 26 of the knuckle, such as that provided during the roll-forming of the knuckle, thereby preventing rotational movement of the collar. Due to the tight engagement between the collar rib 30 and the surface of portion 22, rotational movement of the pin is thereby limited.

The collar 28 is maintained within the counterbore 26 by the hinge tip 34, the stem portion 36 of which is firmly secured into the counterbore 26. As more clearly shown in FIG. 3, the tip 34 has an enlarged aperture 38 in the stem portion into which the end of the hinge pin 14 may project and a smaller coaxial aperture 40 communicates with the exterior of the tip so as to permit insertion of a nail or the like. In this manner, sufficient force may be applied through a nail to the bottom of the hinge pin 14 so as to result in expansion of the collar 28 and disengagement of the hinge pin therefrom.

Referring now to the embodiment illustrated in FIGS. 4–5, a somewhat different arrangement is illustrated. Because of the substantial force that must be applied to drive the hinge pin into and radially deform the annular collar, axial pressure is applied to the hinge tip and there is a tendency to loosen the hinge tip which is generally secured by driving it into the counterbore.

In the structure of this embodiment, the bore 41 of the lowermost knuckle is provided with a bushing 42 having a radial flange 44 disposed between the lowermost and adjacent knuckles of the hinge. The inner end portion of the bushing 42 has a bevelled edge 46 and an annular recess 48 in its inner surface. Seated in the recess 48 is the outwardly extending radial flange portion 50 at one end of the annular collar 52. As best shown in FIG. 5, the collar 52 is provided with spaced axial slots 54 which extend through the flange portion 50 and into its body so as to permit ready compression of this portion of the collar in conjunction with the camming surfaces provided by the bevelled edge 46 of the bushing and the bevelled edge 56 of the flange portion 50 itself. In this manner, the flange portion 50 can be readily inserted and locked into the recess 48 of the bushing 42. When sealed, the pin 14 prevents the flange portion 50 from collapsing inwardly and holds the flange portion in locking engage-

ment within the recess 48. The lower portion of the collar 52 is provided with an internal rib 58 defining an aperture of reduced diameter which firmly engages the tip portion 59 of the hinge pin 14. Although the tip portion 59 is of uniform reduced diameter, locking of the pin is provided by the contractive pressures of the collar 52 upon the surface of the tip portion 59 and creep of the plastic material into minor aberrations in the surface of the pin. If so desired, the surface may be roughened or knurled to increase mechanical interlocking. The annular collar 52 is of lesser external diameter than the bore 41 of the knuckle to provide radial spacing therebetween and permit expansion of the collar 52 during insertion and withdrawal of the pin. In this embodiment, it can be seen that the axial forces upon the collar 52 occurring during insertion of the pin are resisted by the bushing 42 so as to prevent disengagement of the hinge tip 34.

Referring now to the embodiment of FIG. 6, an elongated annular collar 60 is provided which extends substantially throughout the entire axial length of the counterbore 62 in the lower knuckle. As illustrated, the lower or outer portion 64 of the collar 60 has an outer diameter approximating the diameter of the counterbore 62, and the hinge tip 66 has a stem portion 68 which is driven into the outer portion 64 of the collar 60 so as to wedge and compress the plastic material of the collar portion 64 firmly between the stem portion 68 and the knuckle. As illustrated in the drawing, the stem portion 68 is preferably knurled so as to permit some radial flow of the plastic material of the collar outer portion 64 into the knurling and prevent excessive compression and axial flow of the plastic.

The upper or inner portion 70 of the annular collar 60 tapers inwardly to an outer diameter less than the diameter of the counterbore 62 so as to provide radial spacing therebetween, and is provided with an internal rib 72 which engages the tip portion 73 of the hinge pin 14. During insertion and withdrawal of the pin 14, the inner portion of the collar 60 expands radially outwardly and the axial pressures exerted by the pin 14 upon the collar 60 are resisted, and in part directed radially, by the wedging of the collar portion 64 between the stem portion 68 and knuckle.

Referring to the embodiment illustrated in FIG. 7, the annular collar 80 has a radial flange 82 at one end disposed between the knuckles 6, 8. An internal rib 84 is formed on the collar 80 in registry with the flange 82 and defines an aperture of reduced diameter which is less than the diameter of the major portion of the pin in its normal or disengaged condition. The rib 84 engages in the circumferential groove 86 of the hinge pin 14 and applies contractive force to the pin. The axially extending portion of the collar 80 provides a bushing for the pin and the radial flange 82 serves as a thrust bearing between the knuckles. Upon insertion or withdrawal of the hinge pin 14, the portion of the collar defined by the rib 84 and the flange 82 is expanded radially outwardly between the knuckles 6, 8.

Of the various plastics that may be employed for the collar in the various embodiments disclosed and described, nylon, "Delrin," and linear polyethylene have proven particularly suitable because of their high tensile strength and wear resistance. These materials are also characterized by a low coefficient of friction so as to enable their use as combined bearings and pin retainers.

In each of the several embodiments illustrated in the drawings, it can be seen that the annular collar of resiliently deformable plastic material provides an internal

aperture of normally lesser diameter than the hinge pin so as to engage the pin and limit movement thereof. The collar in each instance is expansible radially outwardly at least adjacent the pin-engaging rib portion so as to permit insertion and withdrawal of the pin. As previously pointed out, although the holding power may be effected solely by the contractive forces of the collar upon the pin or by the inherent creep of the plastic material into any irregularities in the surface of the pin, it is preferable to provide a recessed portion in the pin for engagement with the collar and/or intentional surface roughening upon the pin so as to provide mechanical interlocking.

Thus, it can be seen that the present invention provides a simple and rugged hinge assembly wherein undesired movement of the pin is limited and the pin can be held from rising during normal operation of the hinge and/or held from rotation where this feature is desired.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above described will become readily apparent without departure from the spirit and scope of the invention, the scope of which is defined in the appended claims.

I claim:

1. A hinge comprising a pair of hinge leaves having interfitting knuckles with an aligned bore extending therethrough, a hinge pin seated in said bore to provide a pivotal connection between said hinge leaves, the lowermost of said knuckles having a counterbore in the end thereof, a hinge tip secured within said counterbore, said hinge tip and said counterbore defining an annular cavity in said lowermost knuckle, an elongated annular collar of resiliently deformable plastic material of high tensile strength loosely received in said annular cavity, said collar being spaced from the wall of said counterbore to provide an annular recess, the upper end of said collar having an inner diameter greater than the diameter of the pin so as to freely receive the pin therein and an internal rib positioned below said upper end of the collar of normally lesser diameter than that of the pin, said collar being radially movable in the cavity so as to be automatically aligned by the pin as it passes therethrough, said collar being expandable radially outwardly to permit insertion and withdrawal of said pin and engaging said pin to apply a contractile force to limit the movement thereof.

2. A hinge in accordance with claim 1 wherein said collar has a radial projection on its outer periphery engaged with said hinge knuckle to prevent the rotation of the collar and the hinge pin.

3. A hinge in accordance with claim 2 wherein the end of the hinge pin engaged with the rib of said collar is provided with a gentle taper diverging toward the end of the pin.

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