

[54] SNAP-IN VIAL RETAINERS

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220/4 E, 60 R, 82 R

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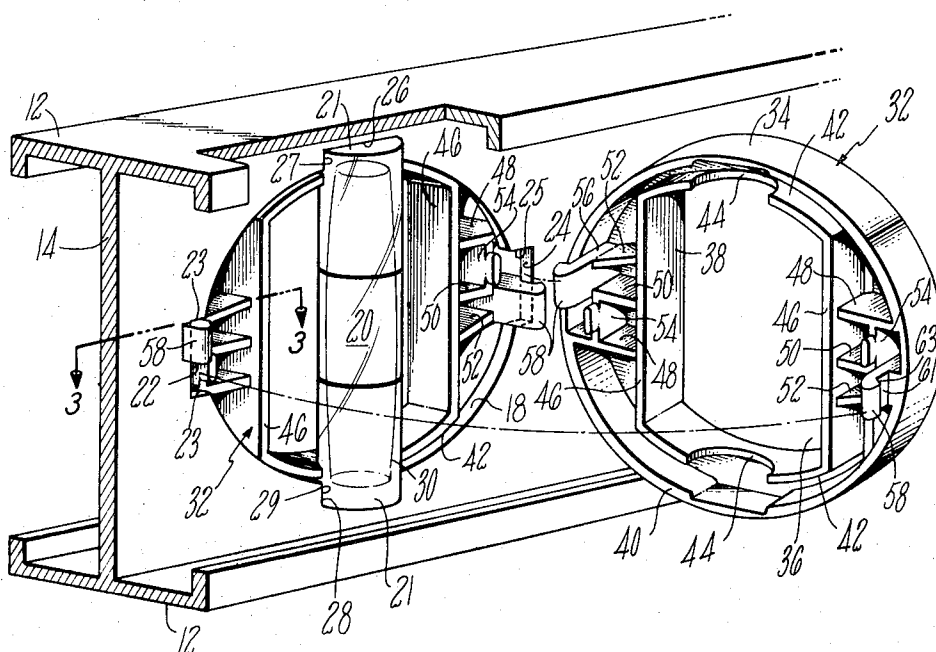
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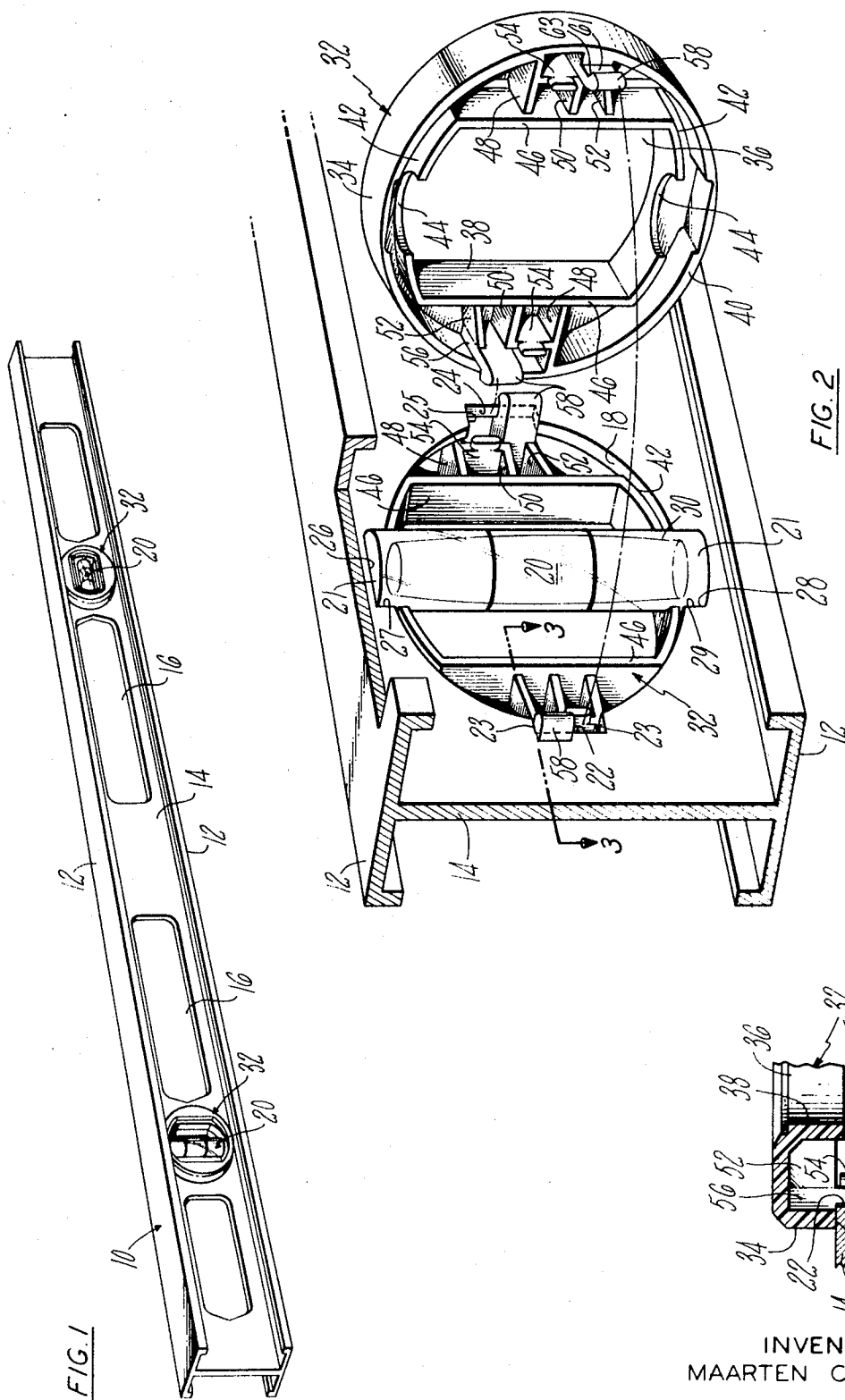
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ABSTRACT

A level having a cylindrical vial having a barrel-shaped bubble cavity is positioned in a circular aperture in the web of a level frame with its axis coincident with the central plane of the web and is retained therein by a pair of identical retainer caps snap-fitted onto the frame web. The retainer caps are each provided with a pair of hooks which engage the edge of a pair of notches of the aperture, and each of the retainer caps provides a reinforcing wall engaging the hooks of the other retainer cap to reinforce the hooks and lock them against inadvertent disassembly.

7 Claims, 3 Drawing Figures





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SNAP-IN VIAL RETAINERS

This invention relates to levels used by carpenters, masons and other mechanics and is particularly concerned with improved vial retainers for such levels.

A primary object of the invention is to provide an improved vial retainer assembly to accommodate the easy and accurate assembly of a vial in the level frame by an individual having no special skills and without the need for subsequent adjustment of the vial after assembly.

Another object of this invention is to provide a level of a novel construction which is adapted for the precision field replacement of a vial. Included in this object is the provision of a vial retainer assembly which will withstand abuse without inadvertent disassembly.

A further object of this invention is the provision of an improved vial retainer assembly which includes a pair of snap-on members for retaining the vial in its assembled position on the frame.

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.

In the drawing:

FIG. 1 is a perspective view of a level embodying the present invention;

FIG. 2 is an enlarged partially exploded view, in part broken away, illustrating the invention in further detail; and

FIG. 3 is a section view taken along the line 3—3 of FIG. 2.

Referring now to the drawings, in which like numerals refer to like parts throughout the several views, the level is provided with a frame 10 which is shown as having an I-beam configuration with two parallel working flanges 12 connected by a central web 14. The frame 10 is preferably made of metal so as to be warp free, and where lightness is desired, the metal employed may be one of the available alloys of aluminum, magnesium or the like.

The web 14 is preferably cut away as at 16 to reduce its weight and to provide a hand grip for the level. The web is also provided with a plurality (shown as being two in number) of longitudinally spaced circular apertures 18 to accommodate one or more level vials 20.

As best shown in FIG. 2, each aperture 18 is provided with diametrically opposed pairs of notches 22, 24 and 26, 28 to selectively receive the ends 21 of a vial 20 at a preselected angle relative to the parallel working flanges 12. The vials 20 are shown in FIG. 1 as being disposed parallel to and perpendicular to the working flanges 12, respectively, although any other desired angle may be selected.

An important feature of this invention is that the notches 22, 24, 26, 28 are precision formed relative to the flanges 12 of the frame and that the outer ends 21 of vial 20 be precision formed to the same dimension as the notches. When so constructed, vial 20 may be precisely and accurately aligned with the working flanges 12 of the frame when the vial is assembled in the frame with its longitudinal axis coincident with the plane of the web of the frame.

Preferably, and as illustrated, the vial 20 has a cylindrical outer surface and the cavity 30 within the vial is barrel-shaped and has a longitudinal axis coincident

with the axis of the cylindrical outer surface of the vial 20. With such a construction, the rotative disposition of the vial 20 relative to the frame will not affect the accuracy of the bubble cavity 30 relative to the working flanges 12. Also, the side walls 23, 25, 27, 29 of the notches 22, 24, 26, 28, respectively, are parallel to each other so that axial movement of the vial within the notches does not affect the accuracy of mounting.

According to another aspect of this invention, there is provided a novel mounting means for retaining the vial 20 mounted on the web 14. As best shown in FIGS. 2 and 3, these retaining means comprise a pair of identical retainer caps 32 having a peripheral wall 34 which is constructed to bottom on the rim of aperture 18. Retainer cap 32 is provided with a central window 36 defined by a frame 38 which projects beyond the surface 40 of the peripheral wall 34, the amount of such projection of the frame being slightly less than 50% of the thickness of the web 14. The end walls 42 of the frame 38 are of generally circular configuration and are dimensioned so as to enter aperture 18. As shown, the end walls 42 are provided with semicircular recesses 44 to receive and engage the ends of the vial 20 to hold the vial in alignment with the web 14 when the retainer caps 32 are mounted in place on the frame 10.

Bridging each side wall 46 of the frame 38 and the peripheral wall 34 are a plurality of spaced ribs 48, 50, 52 which serve to mutually reinforce the frame 38 and the peripheral wall 34. The ribs 48 and 50 are connected at a point intermediate their ends by a web 54. A second web 56 bridges the ribs 50, 52 and extends beyond the edge 40 of the peripheral wall 34 to provide a projecting hook 58. The pairs of webs 54 and 56 are respectively disposed 180° apart on each retainer cap 32.

To assemble the vial 20 in place, one of the identical retainer caps 32 is snapped into assembled position in aperture 18 from one side of the web 14 with the window frame 38 projecting into the aperture 18 with edge 40 bottomed on the web 14 of the frame and the diametrically opposed hooks 58 securing the cap to the web 14 by engagement of the end wall of, say, notches 22, 24. Vial 20 may then be cradled in the semicircular recesses 44 with its ends precisely positioned relative to the web 14 of the level frame by the precision formed side walls 27, 29 of slots 26, 28 which are aligned with recesses 44. The second retainer cap 32 may then be similarly snapped into place to complete the assembly of the vial 20.

When assembled, all of the hooks 58 of the two retainer caps 32 are disposed between an end wall of notch 22 or notch 24 and a web 54 of the other retainer cap.

The distance between the edge of the notch 22 and the web 54 is less than the thickness of the enlarged end of hook 58. To enable the enlarged end of hook 58 to enter the cavity between the backing web 54 and the end of a mounting notch, the end of the hook is tapered to serve as an entering wedge and bias the web 54 to the right as viewed in FIG. 3. When the end of the hook is in its fully assembled position as shown in FIG. 3, the web 54 engages the hook to serve as a backing wall reinforcing the hook so that each hook is firmly locked in place and the retainer caps are maintained in use despite shocks imposed thereon in use.

In order to ensure that each retainer cap 32 is held tightly against the side of the web 14, the bottom sur-

face of the groove 61 of the hook has a lesser dimension than the thickness of the web 14, and the outer surface 63 of the groove 61 is tapered toward the bottom of the groove so that the edge 40 of the peripheral wall 34 will bottom against the web 14 due to the engagement between the tapered wall 63 of the groove with the edge of the aperture 18 thereby accommodating any manufacturing variations and tolerances.

In the preferred embodiment, the retainer caps are formed of a molded plastic material such as a polycarbonate, and the grooves 44 have a radius slightly greater than the ends 21 of vial 20 and encompass slightly less than a semicircle so that their bottoms engage the ends 21 of vial 20 to center the vial in a position where its longitudinal axis coincides with the central plane of the web 14 of the level frame so that the notches 26, 28 position the vial in precisely aligned relationship relative to the working flanges 12 of the level frame.

Should it be desired to replace a vial or to change its mounting aspect with respect to the working flanges 12, this may be accomplished by simultaneously applying a biasing force to both retainer caps 32 in the same direction perpendicular to the axis of the vials so that the adjacent backing walls or webs 54 of both retainer caps 32 are moved a sufficient distance from the adjacent end of the associated notch to allow the adjacent hook portions 58 of the two retainer caps to pass freely therebetween so that the two retainer caps may be removed.

With the retaining caps 32 removed, a vial may be replaced in the manner described above.

If desired, and as shown in FIG. 3, the retainer caps 32 may be provided with recesses 60 for receiving a transparent pane to shield the vial 20.

From the foregoing it will be readily apparent that this invention provides a level having a snap fitted vial retainer assembly which provides for precision assembly of the vial in the level frame by an individual having no special skills and without requiring any adjustment of the vial relative to the frame after assembly. It is further apparent that the invention provides a design which accommodates the precision field replacement or adjustment of a vial relative to the frame while at the same time utilizing a retainer ring construction which is not susceptible to inadvertent disassembly during

use.

As will be apparent to persons skilled in the art, various modifications, adaptations and variations of the foregoing specific disclosure can be made without departing from the teachings of the present invention.

I claim:

1. A level comprising a frame provided with parallel working surfaces and a web interconnecting said surfaces, said web having aperture means providing two pair of oppositely directed notches, an elongated vial having its ends precision fitted in one pair of said notches for mounting said vial at a fixed preselected relationship to the working surfaces with the longitudinal axis thereof coincident with the central plane of said web, and a pair of retainers overlying said aperture means on both sides of said web, both of said retainers engaging said vial to maintain its longitudinal axis coincident with the central plane of the web of the frame, each of said retainers providing hooks projecting through said aperture means and engageable with the second pair of said notches with a snap fit.

2. The device of claim 1 wherein said retainers are identical.

3. The device of claim 2 wherein each of said retainers provides backing walls respectively engageable with the hooks of the other retainer to lock the hooks into engagement with an edge of said aperture means.

4. The device of claim 3 wherein said hooks are provided with enlarged wedge-shaped ends to deflect said backing walls away from the edges of said aperture means to enable the hooks to enter the space therebetween during assembly.

5. The device of claim 1 wherein the vial has a cylindrical outer surface and has a barrel-shaped cavity, the axis of which is coincident with the axis of the cylindrical surface thereof.

6. The device of claim 6 wherein the side walls of each notch of said one pair are parallel to each other.

7. The device of claim 1 wherein said hooks are provided with a necked portion having a bottom wall of less dimension than the thickness of said web, said necked portion being defined at its outer end by a tapered wall engageable with said web to assure a tight fit and accommodate manufacturing variations and tolerances.

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