United States Patent

Collier

[15] **3,700,135**

[45] **Oct. 24, 1972**

[54] **HOLE PLUG**

[72] Inventor: **Frank J. Collier,** East Dundee, Ill.

[73] Assignee: **Illinois Tool Works Inc.,** Chicago, Ill.

[22] Filed: **Dec. 22, 1970**

[21] Appl. No.: **100,745**

[52] **U.S. Cl.** **220/25**

[51] **Int. Cl.** **B65d 45/00**

[58] **Field of Search** ..... 220/25, 57, 39, 40, 24 GT; 215/51; 292/202.87; 85/9

[56] **References Cited**

UNITED STATES PATENTS

1,247,391	11/1917	Gill	220/39 R
1,735,056	11/1929	Richey	220/40 R
2,816,681	12/1957	Taylor	220/39 R

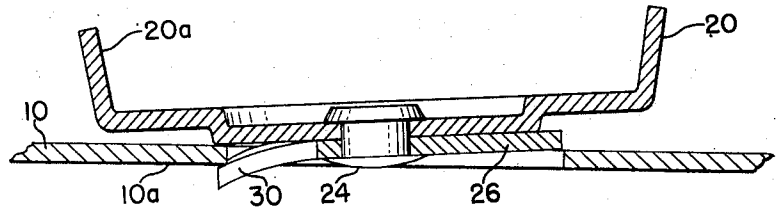
Primary Examiner—Richard A. Schacher

Attorney—Robert W. Beart, Michael Kovac, Jack R. Halvorsen and Thomas W. Buckman

[57] **ABSTRACT**

A plug assembly for closing preformed apertures in panels, or for closing holes resulting from removal of so-called knock-outs, and the like; and which includes a hole-closing shallow cup-like or dished formation with outward peripheral flange means and a spring disk fixed to the bottom of the cup-like formation by riveting, welding or the like and extending slightly outwardly beyond the cup-like formation for disposition in spaced relation to the flange means; and the spring disk being slit radially inwardly or provided with a cut-out portion with the adjacent portion being deflected downwardly to provide a leading ramp or cam surface so that insertion of the leading edge of the ramp through the panel aperture and wedging placement thereof under the blind face of the panel with subsequent rotation of the plug assembly in the direction of the leading edge of the ramp will effect progressive downward flexing of the trailing peripheral portions of the spring disk to underlie the blind face of the panel with the flange means engaging the accessible face of the panel and with the cup-like formation plugging the aperture in the panel.

8 Claims, 4 Drawing Figures



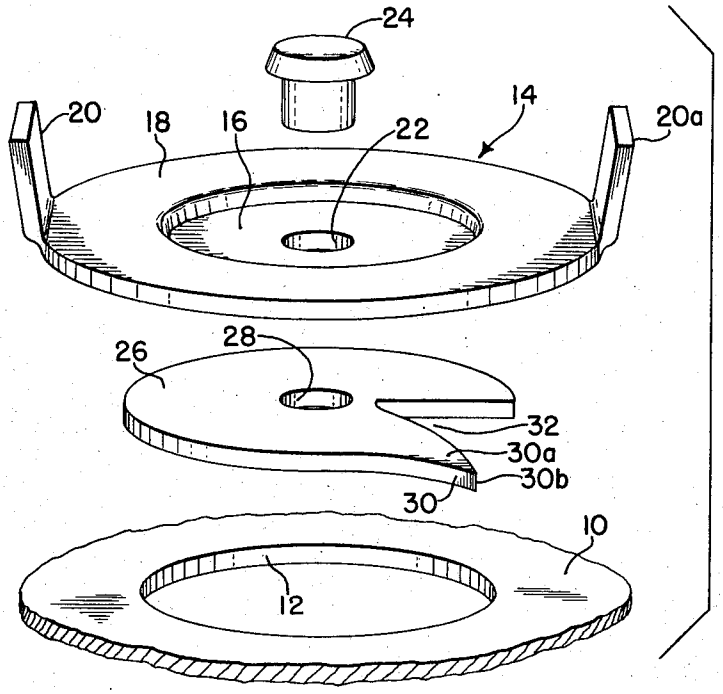


Fig. 1

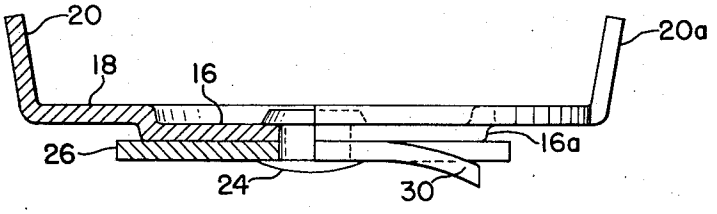


Fig. 2

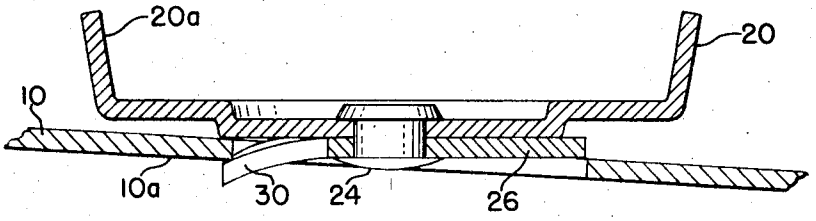


Fig. 3

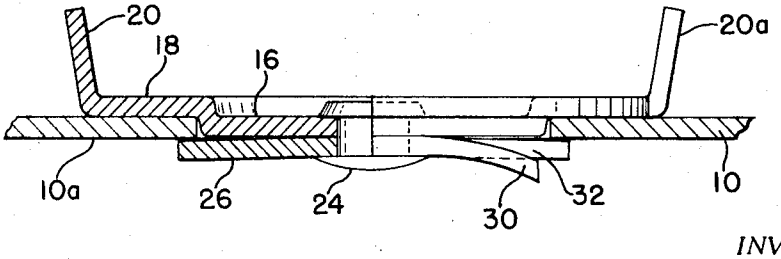


Fig. 4

INVENTOR.
Frank J. Collier
BY Thomas W. Buchanan
Robert W. Beart
His Att'ys

HOLE PLUG

The present invention is concerned with a plug assembly for closing apertures in panels and the like by canted partial insertion of a portion of the plug assembly into the aperture to engage the blind face of the panel and then rotation of the plug assembly to effect engagement of portions thereof with opposite faces of the panel and closing of the panel aperture by a cup-like formation within the aperture disposed between the panel face engaging portions.

Plugs for closing panel apertures or conduit ends have been provided with various types of assembly manipulations. In some instances, spaced interengageable lugs or cam surfaces have been provided around the panel or conduit aperture and on the plug so that rotation of the plug from an initial position will effect interlocking engagement between these lugs or cam surfaces for locating the plug in closing position. In some arrangements of this type, a lateral spring arm is provided for engaging the blind side of the panel lugs or cam surfaces. In other instances lateral spring arms carried by the closing plug may be engaged with the blind panel face by canting the assembly and overshifting the same along a diameter of the panel aperture until the opposite end of the spring arm drops through the aperture and then the assembly is shifting oppositely along the diameter so that both ends of the spring arms engage the blind face of the panel with the plug portion closing the panel aperture and held therein by the face engaging ends of the spring arms.

An object of the present invention is to provide a plug assembly for closing such panel aperture and the like by canted partial insertion thereof into the aperture and subsequent rotation thereof in a predetermined direction to locate the assembly in aperture closing position.

With the above in mind, another object of the invention is to provide a plug assembly with a body to engage the exposed panel face around the aperture therethrough and a spring disk with a leading ramp formation deflected away from the body for insertion through the panel aperture and beneath the blind face thereof causing relocation of the spring disk to engage the blind face of the panel around the aperture upon rotation of the plug assembly in the leading direction of the ramp formation.

A further object of the invention is to provide a plug assembly of the above type which cannot be removed from its seated closing position without mutilation thereof.

The above and other objects of the invention will in part be obvious and will be hereinafter pointed out in the detail description of the drawing in which the figures are as follows:

FIG. **1** is an exploded perspective of the plug assembly parts and a fragment of an apertured panel;

FIG. **2** is a side view of the assembled plug with the left quarter in section;

FIG. **3** is a full sectional view of the plug assembly turned 180° from the position of FIG. **2** with the lip or ramp in initial position relative the panel also shown in section; and

FIG. **4** is a side view of the plug assembly with the left quarter in section after 180° rotation in the direction of the lip or ramp from the position of FIG. **3** to show the fully closed and locked position relative to the panel, also in section.

In FIG. **1** the parts of the plug are shown prior to assembly for association with a panel **10** also shown as a fragment with a panel aperture **12** therethrough. The plug assembly includes an outer disk or body member **14** with a central drawn dished or cup-like formation **16** encircled by a horizontal flange portion **18**. The outer edge of the flange portion **18** is provided with upstanding peripherally spaced tabs **20**, **20***a* to serve as finger gripping elements to rotate the assembly as will be pointed out hereinafter. The dished portion **16** is provided with a central aperture **22** to receive therethrough a rivet **24** or the like for securing a spring disk **26** to the body member and the spring disk **26** is centrally apertured as at **28** for this purpose. However, it is to be understood that the parts may be secured together as a unit in any suitable manner as by welding or other fastening techniques. The spring disk is provided with an inclined lip or ramp **30** presenting an inclined camming or ramp surface **30***a*. This lip or ramp may be provided by radially slitting the disk or by cutting away some portion thereof as by the spiral cutout **32**, as shown, to form the pointed end **30***b* of the lip which is then deflected downwardly away from the plane of the disk and the body member.

The parts described above are secured together by the rivet connection **24** as a unit, that is, without relative rotation between the body member **14** and the disk **26**. The plug assembly can be made in various sizes but in most installations, as in the automotive industry, a particular type of installation, as in automobile bodies, will dictate a great many plugs for particular sizes of panel apertures and the like. Thus, for any particular diameter size of panel aperture and panel thickness, the depth of the dished portion **16**, that is, the extent of the peripheral wall **16***a* will be equal to or slightly less than the panel thickness and the diameter of the dished portion **16** will be selected to nicely fit within the panel aperture **12** so that the underface of the body flange portion **18** will engage the adjacent surface of the panel **10**. The underface of the body flange portion may have a sealant coating if desired. The diameter of the disk **26** is slightly larger than the diameter of the panel aperture **12** to underlie the blind face of the panel therearound but is selected so that the radial length of the lip or ramp **30** is such as to allow canted insertion thereof under the blind side of the panel to initiate re-location of the entire spring disk on the blind side of the panel as will be pointed out below.

For assembly of the plug to a panel for closing an aperture therethrough, reference is made to FIGS. **3** and **4**. For convenience in illustrating, the panel **10** is shown at an inclination in FIG. **3** and initial placement of the plug assembly will be canted relative thereto with the end **30***b* of the lip or ramp **30** disposed slightly beneath the blind face **10***a* of the panel and with the diametrically remote edge of the disk approximating the edge of the aperture and the dished portion about the lip overlying the exposed face of the panel as shown in FIG. **3**. The lugs **20**, **20***a* are then finger or tool engaged to rotate the unit assembly in the leading direction of the lip or ramp **30**, that is, in the direction in which the edge **30***b* points. According to the illustration, the plug assembly will be rotated in a counterclockwise direction, but by reversing the orientation of the ramp **30** relative to the disk **26**, rotation of the plug assembly in a clockwise direction would follow. As the

plug assembly is rotated and with pressure applied toward the ramp or lip **30** and later in the direction of the disappearing edge of the disk, the flexibility of the spring disk outwardly of the rivet connection **24** comes into operation. The inclined ramp surfaces **30***a* wedges or cams beneath the blind surface **10***a* of the panel around the aperture and causes progressive flexing of the trailing peripheral edge portions of the spring disk to become positioned on the blind side of the panel, as shown in FIG. **4**, when the peripheral portion of the disk at the slit or cut-out **32** will underlie the blind face of the panel. Where the depth of the dished portion **16** is slightly less than the thickness of the panel, as in FIG. **4**, the re-located spring disk will be slightly flexed, as illustrated, to resiliently engage the blind face **10***a* of the panel around the aperture therethrough. This will tend to maintain a closing seal as well as prevent rattling of the plug in the panel aperture. As will be appreciated, removal of the plug assembly from aperture closing position is impossible except with some form of mutilation thereof.

I claim:

1. A plug assembly for closing panel apertures and the like, and comprising a body member presenting a generally horizontally disposed peripheral flange portion dimensioned to overlie an exposed panel face around the aperture, and a spring disk secured to the underside of the body member and dimensioned to underlie the blind face of the panel around the aperture and spaced from the body member by a distance approximately the thickness of the panel; and said spring disk having a portion of the peripheral edge continuity thereof interrupted with a portion proximate to the interruption deflected away from the body member to provide a leading inclined ramp surface insertable through the panel aperture to engage beneath the blind face of the panel such that rotation of the plug assembly in the leading direction of the ramp surface will effect progressive flexing of the trailing peripheral edge portions of the spring disk away from the body member with ultimate positioning and engagement thereof against the blind face of the panel around the aperture to hold the body flange portion in engagement with the exposed panel face around the aperture wherein the body member includes a dished central portion within the flange portion to snugly fit within the panel aperture when closed by the plug assembly, the spring disk being secured to the underside of the dished portion in order to space the spring disc axially from the horizontal flange portion for snugly receiving the edge of the panel aperture.

2. A plug assembly as claimed in claim **1**, wherein the peripheral edge portion of the spring disk projects radially slightly beyond the peripheral edge of the dished central portion and has a diameter greater than the diameter of the panel aperture, to provide with the body flange portion a laterally open peripheral recess receiving the edge of the panel around the aperture when closed by the plug assembly.

3. A plug assembly as claimed in claim **2**, wherein the body flange portion is provided with upstanding spaced lugs at the periphery thereof to serve as finger grip members for rotating the plug assembly to aperture closing position.

4. A plug assembly as claimed in claim **1**, wherein the peripheral edge portion of the spring disk is interrupted by an inwardly extending cut-out with an adjacent portion of the disk reflected out of the plane thereof to provide the ramp surface with a leading edge for initial placement beneath the blind face of the panel in position for rotation.

5. A plug assembly as claimed in claim **4**, wherein the cut-out portion is along a spiral edge presenting a leading pointed end.

6. A plug assembly as claimed in claim **5**, wherein the dished portion is of a depth less than the panel thickness for maintaining the peripheral edge portion of the spring disk in stressed resilient engagement with the blind face of the panel around the aperture when the plug assembly is in aperture closing position.

7. A plug assembly as claimed in claim **6**, wherein the outer edge of the dished portion fits snugly with the panel aperture when the plug assembly is in aperture closing position.

8. A plug assembly as claimed in claim **7**, wherein the body flange portion is provided with peripherally spaced upstanding lug means for rotating the plug assembly to aperture closing position.

* * * * *