

1 HYBRID PANEL FASTENER WITH SNAP-ON CAP

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3 The present application is related to provisional patent application serial
4 number 60/284,902 entitled "Hybrid Panel Fastener With Snap-On Cap" filed on April
5 20, 2001, priority from which is hereby claimed.

6 FIELD OF THE INVENTION

7 The present invention relates to panel fasteners affixed to circuit boards and, in
8 particular, to panel fasteners of the type having a molded cap composed of a material
9 such as ABS Plastic. More specifically, it relates to panel fasteners of the type
10 disclosed in U.S. patent application serial number 09/739,689 entitled "Snap-In Panel
11 Fastener" which is herein incorporated by reference as though fully set forth.

12 BACKGROUND OF THE INVENTION

13 There are cases in which panel fasteners of the hybrid type, that is fasteners in
14 which the screw portion has a molded-on plastic cap for ease of manual operation, are
15 required to be soldered to a printed circuit board. A problem arises, however, due to
16 the soldering temperature required to affix the retainer portion of the panel fastener to
17 the PCB because the soldering heat has an adverse effect on the materials used in the
18 plastic portion of the panel fastener. This problem not only arises with regard to
19 soldering to PCBs but may also arise in other situations where attachment of the
20 retainer to a base panel requires elevated temperatures. There is therefore a need in
21 the art to provide a hybrid-type panel fastener that may be soldered or applied to a
22 base panel by heating without adversely affecting its plastic portion.

1 SUMMARY OF THE INVENTION

2 In order to meet this need in the art, the present invention has been devised in
3 which the two main components of the panel fastener, the screw cap portion and the
4 metal retainer portion, are assembled together after the retainer is soldered to the PCB
5 and the retainer has cooled. The screw cap assembly is later attached to the soldered
6 retainer by the snap action of its resilient parts. Since the screw cap is away from the
7 heat during soldering the retainer, it cannot be adversely affected. Accordingly, the
8 present invention provides a unique snap-together method provided by its structure
9 which permits a low insertion force that can be accomplished by hand as well as
10 automatic equipment so that the fastener can easily be installed onto a retainer after it
11 has been soldered to a circuit board without damage to the PCB. Since the high force
12 of assembly required by prior art hybrid-type panel fasteners would severely damage
13 the PCB and also require expensive installation equipment and tooling, the low
14 assembly force of the screw cap assembly to the retainer of the invention avoids these
15 problems.

16 More specifically, the applicants have invented a two-piece panel fastener
17 comprising a generally barrel-shaped metal retainer which holds a screw. The retainer
18 has a chamfered top flange along its top edge, a circumferential bulge area along its
19 outer surface approximately in the middle of its length, and a base at the bottom. Two
20 circumferential valley regions of reduced diameter are located along the outer surface
21 of the retainer. The first valley region is located between the chamfered top flange and
22 the bulge area and the second is located between the bulge area and the base. The

1 screw includes a threaded shaft and a plastic cap which has longitudinally-extending
2 resilient fingers as means to engage the outer surface of the retainer to captivate the
3 screw. The screw is captively held at either of two stable positions of retraction or
4 extension where the fingers occupy either of the valley regions. The retainer is
5 preferably rigidly affixed to a circuit board by soldering a base flange at the bottom of
6 the retainer to the top surface of the panel. The shank extends axially downward from
7 the flange and lies within a hole in the PCB during soldering. The threaded portion of
8 the screw extends beyond the shank of the retainer when the screw is in the extended
9 position.

10 The method of assembling the captive panel fastener to a printed circuit board
11 comprises the steps of placing an axially-extending shank of a captive fastener retainer
12 through a mounting hole in a printed circuit board, soldering the retainer to the printed
13 circuit board, cooling the retainer, and then affixing a retractable screw assembly
14 including a plastic screw cap to the retainer by snap attachment of the screw cap to an
15 outside surface of the retainer.

16 In another embodiment, the panel fastener comprises a generally cylindrical
17 retainer having a base flange at the bottom. An inward-facing flange is located at the
18 top of a through-hole in the retainer, and includes a lead-in ramp at the top and a steep
19 angle on an underside. The screw has a threaded shaft and a plastic cap rigidly affixed
20 to its head. A deformable ring is located around the shaft of the screw at the top of a
21 threaded region and has a relaxed diameter greater than the inside diameter of the
22 retainer through-hole flange such that the ring engages an underside of the flange

1 when the screw is retracted thereby captivating the screw.

2 The applicants have therefore devised a unique two-piece hybrid panel fastener
3 with a structure and method of attachment which permits it to be used in solder-on
4 applications to PCBs without damage to either the fastener or the PCB. Other objects
5 and advantages of the present invention will become apparent to those of skill in the
6 art from the following drawings and description of the preferred embodiment.

7 BRIEF DESCRIPTION OF THE DRAWINGS

8 Figure 1 is a side assembly view of the present invention showing the
9 installation sequence of the present invention.

10 Figure 2 is a side and part sectional view of the retainer portion of the present
11 invention.

12 Figures 3a and 3b are side and part sectional views showing the screw cap
13 assembly in its retracted and fully-extended positions.

14 Figures 4a and 4b depict two side sectional views showing the extended and
15 retracted positions of an alternate embodiment of the snap-on hybrid-type panel
16 fastener of the present invention.

17 DESCRIPTION OF THE PREFERRED EMBODIMENT

18 Referring now to Figure 1, the sequence of assembly of the main components
19 of the present invention is shown. A preform or solder paste **3** is first applied to the
20 PCB beneath the flange **15** at the base of the barrel-shaped retainer **4**. With shank **11**
21 inserted through a hole **2** in the PCB, base flange **15** rests against the top surface of
22 the PCB during wave or hot air soldering, providing vertical alignment and increased

1 PCB contact surface area. After wave or hot air soldering is complete, the retainer
2 becomes permanently attached to the PCB 5. Later, after the PCB and retainer have
3 cooled, the screw cap assembly 6 is attached to the retainer by inserting the threaded
4 end into the top of the retainer and pushing it downward. As the screw cap is pushed
5 downward, the plastic fingers 7 on the screw cap deflect outwardly and snap over
6 chamfered top flange 13.

7 Referring to Figure 2, the retainer portion of the present invention is shown. It
8 includes significant novel features which allow its use according to the above-
9 described installation into PCBs. A shank 11 at the bottom of the retainer 4 extends
10 from flange 15 and provides for insertion into a clearance hole in the PCB which
11 locates the retainer. A chamfered top flange 13 along the top edge of the retainer is
12 included to provide the inwardly-biased elastic fingers on the screw cap with an angled
13 lead-in surface 14. A backside surface 12 restricts disassembly of the cap in the
14 direction of retraction. The greatest diameter of the bulge may further include a flat
15 portion 16, i.e. a cylindrical surface along the longitudinal axis of the retainer.

16 Referring now to Figures 3a and 3b, the present invention is shown in both its
17 retracted position and in its extended position, respectively. A bulge area 20 along the
18 sides of the retainer between its top and bottom ends bears against the fingers of the
19 screw cap 6 to bias the cap into the valley regions at either of the extended or
20 retracted positions. Additionally, the bulge area of the retainer may include a flat
21 portion as described with regard to Figure 2 so that the screw cap may achieve an
22 unbiased position mid-way between the extended and retracted positions. In Figure

1 3a, the tips of the fingers 7 on cap 6 occupy valley 19 at the top of the retainer just
2 below the chamfered top flange 13 which holds the cap in the retracted position. As
3 shown in Figure 3b, when the screw cap 6 is pushed down farther, a valley at the base
4 of the retainer 18 just above the flange 15 captures inwardly-biased resilient fingers 7
5 to hold the screw assembly in an extended position where the end of the screw extends
6 beyond the shank of the retainer. It should be understood that the sides of the retainer
7 may have as many valleys as desired in order to provide alternate stable longitudinal
8 positions of the screw cap with respect to the retainer.

9 Referring now to Figures 4a and 4b, an alternate embodiment of the present
10 invention with different means of screw captivation is shown in retracted and extended
11 positions. In this embodiment, the screw portion of the fastener is held captive in the
12 retainer by an inwardly-facing flange 23 which provides a reduced diameter at the top
13 of the through-hole in the retainer. The through-hole provides a close clearance for
14 the screw threads. The flange 23 dimensionally restricts a flexible rubber ring 21
15 which is either assembled or manufactured over the last thread on the screw cap
16 assembly as shown. As in the first embodiment, the screw cap is inserted into the
17 retainer after the retainer is permanently attached to the PCB, however in this case
18 there is no outer chamfered top flange to provide the snap-together function to
19 captivate the screw in the retracted position. In this second embodiment, the screw
20 cap assembly snaps into the retainer as the rubber ring 21 deforms and passes by the
21 inward-facing flange 23 at the top of the through-hole. The shape of the rubber ring in
22 cooperation with a lead-in ramp at the top of the flange 23 provides for a low insertion

1 force while a steep angle on the underside of the flange requires a high removal force
2 and thus captivates the screw.

3 From the foregoing description of the invention it will be apparent that the
4 objects of the invention have been achieved. Other modifications may be made which
5 will be obvious to one of skill in the art from the description of the preferred
6 embodiment, however the scope of the applicant's invention should be limited only by
7 the following claims and their legal equivalents.

CLAIMS

1. A two-piece panel fastener, comprising:

a generally barrel-shaped retainer including a top flange along a top edge of its outer surface, an axial through-bore, and a base at a bottom thereof;

a circumferential bulge area along the outer surface of the retainer in approximately the middle of the retainer along its length;

two circumferential valley regions of reduced diameter along the outer surface of the retainer, a first valley region located between said top flange and said bulge area, and a second valley region located between the bulge area and the base;

and

a screw located within said through-bore and having a threaded shaft and a plastic cap rigidly affixed to a head of the screw, said cap including resiliently deformable means engaging the outer surface of said retainer to captivate said screw within said retainer.

2. The panel fastener of claim 1 further including a base flange at the bottom of the retainer.

3. The panel fastener of claim 2 further including a shank extending axially downward from said base flange.

4. The panel fastener of claim 1 wherein said retainer is metal.

5. The panel fastener of claim 1 wherein said resiliently deformable means engaging the outer surface of said retainer are longitudinally-extending fingers which are inwardly-biased.

1 6. The panel fastener of claim 5 wherein said screw is captively held
2 within said retainer at two biased positions where said fingers occupy said valley
3 regions.

4 7. The panel fastener of claim 6 wherein said two stable positions are a
5 position of retraction and a position of extension, the threaded portion of said screw
6 extending beyond the shank of said retainer when said screw is in said position of
7 extension.

8 8. The panel fastener of claim 7 further including a circuit board to which
9 said retainer is rigidly affixed.

10 9. The assembly of parts of claim 8 wherein said retainer is affixed to said
11 circuit board by soldering.

12 10. The panel fastener of claim 7 further including a longitudinally-
13 extending cylindrical surface area of said retainer located on said bulge area.

14 11. The panel fastener of claim 1 wherein said top flange is chamfered.

15 12. The panel fastener of claim 1 wherein said screw is composed of
16 plastic.

17 13. The method of assembling a captive panel fastener to a printed circuit
18 board, comprising the steps of:

19 placing an axially-extending shank of a captive fastener retainer through
20 a mounting hole in a printed circuit board;

21 soldering the retainer to the printed circuit board;

22 cooling said retainer; and

1 affixing a retractable screw assembly including a plastic screw cap to
2 said retainer by snap attachment of the screw cap to an outside surface of the retainer.

3 14. A panel fastener, comprising:

4 a generally barrel-shaped retainer having a base at the bottom thereof;
5 an inward-facing flange located at the top of a through-hole in the
6 retainer, said flange including a lead-in ramp at the top of the flange and a steep angle
7 on an underside of the flange;

8 a circumferential bulge area along the outer surface of the retainer
9 located in the middle of the retainer along its length;

10 a circumferential valley region of reduced diameter along the outer
11 surface of the retainer located below the bulge area; and

12 a screw having a threaded shaft and a plastic cap rigidly affixed to the
13 screw, said screw lying within said through-bore and including a deformable ring
14 located at the top of a threaded region of said shaft, the relaxed outer diameter of said
15 deformable ring being greater than the inside diameter of said retainer through-hole
16 flange whereby said ring engages an underside of said flange when said screw is
17 retracted thereby captivating said screw within said retainer.