

1 QUICK-TURN PANEL FASTENER

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3 The present application is related to provisional patent application serial number
4 60/294,013 entitled "Quick-Turn Rubber Panel Fastener" filed on May 30, 2001, priority
5 from which is hereby claimed.

6 FIELD OF THE INVENTION

7 This invention relates to a fastener which enables two panels or boards to be
8 quickly attached or disengaged. More specifically, it relates to a fastener that provides a
9 clamp load through the axial compression and subsequent diametric expansion of a rubber
10 sleeve with actuation which is achieved by turning a center pin less than 360 degrees.

11 BACKGROUND OF THE INVENTION

12 There has long been a demand in the art for an effective quick-turn (less than 360
13 degrees) panel fastener. Quick-turn panel fasteners provide a fastening system to securely
14 join and detach two panels face-to-face quickly and easily. A clamping load is desirable
15 and often provided. There are many variations of fasteners that are designed to achieve
16 these general objectives, however each has specific limitations such as: cost, scope of
17 applications, absence of clamp load, etc. Also, some require that a second component be
18 placed on the support panel or that the parts be assembled when used.

19 The Southco® company offers a "fractional-turn fastener" that utilizes a rubber
20 sleeve, two cams, and a stud. However, this fastener has the significant drawback that
21 it must be assembled by the end user around the first panel on site when first used. This

1 fastener typically comes in two sets, one on either side of mating panels that attach the
2 panels together. Paneloc Company offers a vibration-resistant reusable BI-FIX™ quarter-
3 turn fastener that requires five components, with different components for different
4 applications. This fastener requires irregular shaped holes in both panels that cannot be
5 quickly drilled and can only be punched with a series of hits and different punches or a
6 special punch. The DZUS fasteners include a stud and a grommet that attach to the first
7 panel, and a spring with two rivets that attach to the second panel. There are several
8 variations of this fastener but each includes unassembled multiple components.

9 Thus, while there are many variations of quick-turn or quarter-turn fasteners
10 available that solve some of the problems in the art, each still has a number of drawbacks.
11 Therefore, there exists an unfulfilled need for an effective quick-turn fastener that can join
12 two panels quickly and easily without requiring the assembly of multiple parts or
13 complicated preparation of the panels.

14 SUMMARY OF THE INVENTION

15 In order to solve the problems of the prior art noted above, the present invention
16 has been devised which provides an assembled fastener that comprises a top side retainer,
17 a through-pin with an over-molded knob, a rubber sleeve, and an end cap. The retainer
18 includes a radially disposed upward-facing cam ramp that cooperates with a like cam
19 ramp affixed to the pin. The retainer base is fastened to a first panel preferably by clinch-
20 type attachment. The center clamp pin extends through the retainer and through aligned
21 circular holes in the two panels to be attached, extending through to the opposite side of

1 the second panel. A rubber sleeve is slidably fitted around the clamp pin and is retained
2 axially by an end cap which is attached to the end of the pin. When the pin is turned,
3 either manually or by a tool, the cam-action between the pin ramp and the retainer ramp
4 withdraws the pin axially upward from the retainer compressing the rubber sleeve between
5 the end cap and the base of the retainer. Due to this compression, the rubber sleeve
6 bulges outwardly and thereby its outer surface applies a clamp load against the backside
7 of the second panel. Thus, the two panels become clamped between the expanded area
8 of the rubber sleeve and the base of the retainer.

9 More specifically, the applicant has invented a clamp-type fastener for securing
10 together two panels or panels having aligned apertures. The fastener includes a retainer
11 having an axial bore and attachment means on a base of the retainer for rigidly fastening
12 the retainer to a first panel. The retainer further includes integral upward-facing cam
13 means which is concentric with the bore and disposed along a top surface of a cylindrical
14 wall extending upwardly from the base of the retainer. A pin having a head and a shaft
15 extends through the bore and beyond the base of the retainer. The pin is rotatable within
16 the retainer between released and clamped positions. Affixed to the pin is downward-
17 facing force bearing means in engagement with the retainer cam means whereby turning
18 the pin moves the shaft axially with respect to the retainer. A cylindrical elastomeric
19 sleeve is fitted loosely about a portion of the pin shaft which extends beyond the base of
20 the retainer. One end of the sleeve is in abutment with the retainer base and the other end
21 of the sleeve is axially retained by an end cap which is affixed to the distal end of the pin

1 so that when the pin is turned to the clamped position, the sleeve is compressed against
2 the base of the retainer and bulges outwardly. The cam means may further include a
3 plurality of radially extending grooves which cooperate with a protruding detent on the
4 force bearing means to provide a succession of stable, indexed positions at rest when the
5 detent occupies one of the grooves. The cam means and the force bearing means
6 preferably include like, helical cam surfaces. The pin preferably includes an over-molded
7 knob having lobes to make the pin easy to turn by hand. The force bearing means is
8 located along an end wall of the cylindrical cavity on the underside of the knob. A first
9 panel to which the retainer is attached is clamped to a second panel by placing the
10 elastomeric sleeve through a hole in the second panel and turning the knob/pin assembly
11 to the clamped position forcing the second panel against the first panel by the force of the
12 expanded elastomeric sleeve against a backside of the second panel.

13 It is therefore an object of the present invention to create a quick-turn fastener
14 which provides a clamp load and may be utilized to join two panels over a range of panel
15 thicknesses. It is another object of the invention to provide a quick-turn fastener that is
16 a fully preassembled part. It is a further object of the present invention to provide a
17 quick-turn fastener that is inexpensive and functions through a standard round hole in the
18 panels. It is yet a further object of the present invention to provide a quick-turn fastener
19 that may be operated from one side of the panels only and that is vibration resistant.
20 Other objects and advantages of the invention will be readily apparent to those of skill in
21 the art from the following drawings and description of the preferred embodiment.

1 BRIEF DESCRIPTION OF THE DRAWINGS

2 Figure 1 is a top right front partially sectioned isometric view of the present
3 invention fitted between two panels and in the released position.

4 Figure 2 is a top right front isometric assembly view of the same elements shown
5 in Figure 1.

6 Figure 3 is a bottom right side partial-cutaway isometric view of the knob and pin
7 assembly.

8 Figure 4 is a bottom cross-sectional view of the knob and pin assembly.

9 Figure 5 is a side-sectional view of the assembled components shown in Figure 1
10 with the fastener in its released position.

11 Figure 6 is the assembly shown in Figure 5 with the pin assembly rotated in the
12 direction of the arrow to place the fastener in the clamped position.

13 DESCRIPTION OF THE PREFERRED EMBODIMENT

14 Referring now to Figure 1, the fastener of the present invention **11** is shown
15 installed through two front and rear sheets or panels **12** and **14** respectively. The fastener
16 includes a retainer **15** affixed to the front panel by clinch attachment means **16**. An
17 elastomeric sleeve **17** and end cap **19** extend through the opposite side of the rear panel
18 **14**. Knob **13** includes manual grip enhancement lobes as well as a tool driving slot for
19 turning the fastener between clamped and released positions.

1 Referring now to Figure 2, an exploded view of the assembly shown in Figure 1
2 is depicted. The knob **13** is assembled, preferably by over-molding, to a center pin **24**
3 which extends axially through the retainer **15**. The retainer **15** includes a cylindrical cam
4 ramp **26** that has a helical cam surface **29** along its top surface which is interrupted by a
5 series of spaced radial grooves **22**. As described in more detail below, the grooves **22**
6 provide an indexing mechanism to hold the knob at different rotational positions. As
7 shown in Figures 5 and 6, the base of the retainer has a bore which closely receives pin
8 **24**, slidably and rotatably. The retainer further includes a flange **27** that abuts front panel
9 **12** when assembled. Clinch means **16** on the retainer beneath the flange permanently
10 affixes the retainer to the front panel. A rubber sleeve **17** is slidably fitted about pin **24**
11 and is axially retained by end cap **19** holding the sleeve snugly against the base of the
12 retainer **15**. The fastener requires only simple aligned holes **30** punched or otherwise
13 formed in the front and rear panels.

14 In operation, the fastener is first attached to the front panel **12** by clinch attachment of
15 the retainer **15** to the top of the front panel. The rear panel **14** is attached to the first panel by
16 passing the end of the fastener containing the elastomeric sleeve through a hole in the second
17 panel. As the panels are held in place, the knob **13** is then turned to the clamped position
18 which compresses the elastomeric sleeve **17** causing it to bulge outwardly against the backside

1 of the rear panel. This forceably clamps the two panels together as more clearly depicted in
2 Figure 6.

3 Referring now to Figures 3 and 4, greater detail of the knob/pin assembly is shown.
4 Referring to Figure 3, the knob **13** includes downward-facing cylindrical outer wall **38** and
5 inner sleeve **39** forming a cylindrical cavity therebetween which is provided with a helical cam
6 ramp **29** along an annular end wall. The end wall includes downward extending detent **25** that
7 provides the force bearing means against the retainer cam ramp to lift the pin upwardly from
8 the retainer as the knob is turned. This cavity closely receives the cylindrical cam ramp of the
9 retainer as more clearly shown in Figures 5 and 6. As seen in this figure, the cam ramp is two-
10 tiered to provide structures which closely mate with like surfaces on the retainer to provide a
11 closely-fitting rotatable attachment of parts. The outer tier of the cam ramp includes a stop
12 **28** on a side of detent **25** to prevent the knob from over-turning. Referring now to Figure 4,
13 a bottom view of the knob and pin assembly shows the relationship between the center pin **24**
14 and a two-tiered cam ramp **34** which lies along the end wall of the knob cavity between wall
15 **38** and sleeve **39**. The shape of the knob lobes **10** are also shown in this view.

16 Referring now to Figures 5 and 6, the fastener is shown in its released and clamped
17 positions, respectively. Referring to Figure 5, the knob **13** is shown in close mating
18 relationship with retainer cam ramp **26**. In this position, the cam ramps are in full mating
19 relationship along substantially their entire surfaces permitting the application of high force to

1 the knob/pin assembly in order to effect the clinch attachment of the retainer 15 to the front
2 panel 12. The elastomeric sleeve 17 projects through the backside of rear panel 14 and is
3 snugly captured between the base of the retainer 15 and end cap 19. The end cap is axially
4 secured to the pin 24 by a groove adjacent the end of the pin. The knob is preferably
5 composed of plastic and permanently affixed to the head of the pin by over-molding.

6 These same structures, similarly numbered, are depicted in Figure 6 however the knob
7 and pin assembly 13 has been rotated counterclockwise relative to the retainer. By the cam
8 action between the detent in the knob bearing against the helical cam ramp in the retainer, the
9 knob/pin assembly is lifted upward as the knob is turned from a released to a clamped position.
10 This forces the pin end cap upward, compressing the elastomeric sleeve 17 against the base of
11 the retainer 15 thus causing an outward bulging of the sleeve. As a result, the deformed sleeve
12 forceably presses against the backside of the rear panel around the circumference 39 of the hole
13 in the rear panel. As more clearly shown in Figure 2, the retainer cam ramp includes a series
14 of radial grooves which receive the knob detent establishing stable, indexed positions at
15 different points of rotation of the knob. This permits different degrees of clamping force to
16 be applied since the elastomeric sleeve will bulge more or less depending upon how much the
17 knob is turned and the pin is lifted upward.

18 Thus, the objects of the present invention have been achieved. The fastener disclosed
19 herein is a pre-assembled unit that is easy to use. Furthermore the fastener can be permanently

1 affixed to a panel so that there are no loose parts. It installs into two easily-formed, round
2 holes with no special tooling required to prepare the holes which are simply punched or drilled
3 quickly with standard tooling. Because the rubber is in compression while in use, the fastener
4 will always generate a clamp load. Furthermore, the amount of clamp load is adjustable by how
5 far the pin is turned to successive stable index points. It also has the following additional
6 advantages: it provides a clamp load in a variety of panel thicknesses; it is inexpensive; it can
7 be operated from one side only; and it is vibration resistant.

8 It should be understood that there may be other modifications and changes to the
9 present invention that will be obvious to those of skill in the art from the foregoing description,
10 however, the present invention should be limited only by the following claims and their legal
11 equivalents.

CLAIMS

What is claimed is:

1. A clamp-type fastener for securing together two panels having aligned apertures, comprising:

a retainer having an axial bore;

attachment means on a base of said retainer for attaching said retainer to a first panel;

upward-facing cam means integral with said retainer, said cam means being concentric with said bore and disposed along a top surface of the retainer;

a pin having a head and a shaft, the shaft of said pin extending axially through said bore and beyond the base of the retainer, said pin being rotatable within said retainer between clamped and released positions;

downward-facing force bearing means affixed to said head of said pin in engagement with said cam means whereby turning said pin moves said shaft axially with respect to said retainer;

an elastomeric sleeve fitted about a portion of said shaft which extends beyond the base of said retainer, a first end of said sleeve being in abutment with said base; and

an end cap secured to said pin adjacent a distal end thereof, said end cap being in abutment with a second end of said sleeve such that when said pin is turned to said clamped position, said sleeve is compressed by said end cap and the sides of said sleeve bulge outwardly.

2. The fastener of claim 1 wherein said cam means includes a helical cam

1 surface.

2 3. The fastener of claim 1 wherein said cam means includes at least one radially
3 extending groove in said helical cam surface and said force bearing means includes an axially
4 protruding detent whereby the pin is held in a rotationally stable position when said detent
5 occupies a groove.

6 4. The fastener of claim 2 wherein said force bearing means further includes a
7 second helical surface in mating relationship with said first cam helical surface.

8 5. The fastener of claim 1 wherein said elastomeric sleeve is composed of rubber.

9 6. The fastener of claim 1 wherein said end cap is rigidly secured to said pin.

10 7. The fastener of claim 1 wherein said panel attachment means is clinch-type
11 fastening means.

12 8. The fastener of claim 1 wherein the head of said pin further includes tool-
13 driving means.

14 9. The fastener of claim 1 further including a knob composed of plastic and
15 affixed to the head of said pin.

16 10. The fastener of claim 9 wherein said force bearing means is located along an
17 end wall of a cylindrical cavity on the underside of the knob.

18 11. The fastener of claim 10 wherein said retainer includes an upward extending
19 cylindrical wall adjacent said cam surface closely fitting within said cavity on the underside of
20 the knob.

21 12. The fastener of claim 3 wherein said force bearing means is a two-tiered cam

1 ramp including a stop on a side of said detent which engages said upward-facing cam means
2 to prevent the over-turning of said pin.

3 13. An assembly including the fastener of claim 1 further comprising:

4 a first panel affixed to said retainer by said attachment means;

5 a first circular aperture in said first panel greater in diameter than said
6 elastomeric sleeve;

7 a second panel in face-to-face abutment with a backside of said first
8 panel, said second panel having a second circular hole through which said sleeve extends, said
9 second hole being substantially the same size as said first hole and aligned with said first
10 circular aperture in said first panel; and

11 wherein said elastomeric sleeve is forceably compressed by
12 said end cap such that the outer surface of said sleeve applies a clamp force against a backside
13 of said second panel when said knob and said pin are turned to said clamped position.