A fastening tool has a centrally disposed rod with a shaped tip at a first end thereof and an enlarged second end effective to transfer force from an external source to the tool. A collar circumscribes the centrally disposed rod. A first end of the collar is adjacent to the shaped tip and an opposing second end of the collar terminates in an outwardly extending flange. A compressible spring is disposed between the enlarged second end of the centrally disposed rod and the outwardly extending flange of the collar. This tool provides simplified installation of swage-type hardware into a stack of two or more panels by providing both a clamping force and a swaging operation in a single stroke.
TOOL FOR INSTALLING SWAGE-TYPE HARDWARE

CROSS REFERENCE TO RELATED APPLICATION

[0001] N.A.

U.S. GOVERNMENT RIGHTS

[0002] N.A.

BACKGROUND

[0003] 1. Field

This invention relates to a fastening tool. More particularly, clamping and swaging operations are integrated in a single tool.

[0004] 2. Description of the Related Art

When hardware is to be attached to panels, such as printed wiring boards or sheet metal panels, using swage-type hardware, such as standoff, it is necessary to clamp the hardware and panels tightly together during the swaging operation to eliminate looseness that could cause misalignment. Conventionally, separate clamping tools are used which are costly and must be aligned very precisely to be effective and to avoid damage to the parts being assembled.

[0005] Swaging is an assembly process to secure work pieces using hardware that is usually installed through a hole in a panel. A portion of the hardware extends through the hole and is deformed so that it cannot be withdrawn back through the hole. There are many types of swage-type hardware and tools available on the market. There are also many types of clamps and clamping devices available.

[0006] There remains, however, a need for a tool that integrates the clamping and swaging operations into a single tool. Such a tool would reduce to cost, complexity and risk of damage to parts that exist with conventional separate swage tools and clamps.

BRIEF SUMMARY OF THE DISCLOSURE

[0009] Disclosed herein is a tool that provides simplified installation of swage-type hardware into a stack of two or more panels. More particularly, a single tool provides both a clamping force and a swaging operation in a single stroke.

[0010] In accordance with a first embodiment, there is provided a fastening tool that has a centrally disposed rod with a shaped tip at a first end thereof and an enlarged second end effective to transfer force from an external source to the tool. A collar circumscribes the centrally disposed rod. A first end of the collar is adjacent to the shaped tip and an opposing second end of the collar terminates in an outwardly extending flange. A compressible spring is disposed between the enlarged second end of the centrally disposed rod and the outwardly extending flange of the collar.

[0011] In accordance with a second embodiment, the fastening tool of the first embodiment is used in combination with fastening hardware. This hardware has a body portion with a first outside diameter and a deformable shank with a second outside diameter where the first diameter is greater than the second diameter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is perspective view of a tool for installing swage-type hardware as disclosed herein.

[0013] FIG. 2 is a cross-sectional representation of swage-type hardware for use with the tool of FIG. 1.

[0014] FIG. 3 is a cross-sectional view of the tool of FIG. 1 and hardware of FIG. 2 during a preliminary installation step.

[0015] FIG. 4 is a cross-sectional view of the tool of FIG. 1 and hardware of FIG. 2 during an intermediate installation step.

[0016] FIG. 5 is a cross-sectional view of the tool of FIG. 1 and hardware of FIG. 2 during a concluding installation step.

[0017] FIG. 6A is a cross-sectional view and FIG. 6B is a perspective view of the hardware of FIG. 2 following installation.

[0018] FIG. 7 is a cross-sectional view of an alternative swage-type hardware that includes splines.

[0019] Like reference numbers and designations in the various drawings indicated like elements.

DETAILED DESCRIPTION

[0020] FIG. 1 is a perspective view of a fastening tool 10. The fastening tool 10 includes a centrally disposed rod 12, a collar 14 circumscribing the centrally disposed rod 10 and a compressible spring 16. A pin 18 extends through slots 20 formed in the collar and through a hole (22 in FIG. 3) in the centrally disposed rod 12.

[0021] With reference to FIG. 3, the centrally disposed rod 12 has a shaped tip 24 at a first end thereof. As will be disclosed hereinbelow, the shaped tip 24 is specially shaped to provide a desired type of swage feature. Two conventional swage features are the elliptical swage which is formed by the shaped tip 24 having an elliptical shape and the roll swage that is formed by a rounded groove that evenly displaces the hardware shank (26 in FIG. 2) outwardly. An opposing second end 28 has a larger diameter than the remainder of the rod to prevent the compressible spring 16 from extending over this second end 28 during operation of the tool. Hole 22 extends though the body of the centrally disposed rod 12 perpendicular to the direction of motion 30 of the rod during operation of the tool. As best seen in FIG. 1, the pin 18 and slot 20 are positioned such that spring 16 is in the partially-compressed state when the tool is at rest. As best seen in FIG. 3, the force 30 applied to the second end 28 has the first action of applying clamping force to the work pieces 39 and 44 before overcoming the partially-compressed spring 16. Increased force 30 on the second end 28 has the effect of moving the shaped tip 24 in the axial direction with the collar 14 until the shaped tip 24 creates the swage in the fastener shank 26 by displacing the shank material outwardly thereby fastening the work pieces. The rod is typically formed from conventional swage tool material, such as tool steel.

[0022] With reference to FIG. 1, the collar 14 is tubular and coaxially positioned over the centrally disposed rod 12 to circumscribe the shaped tip 24. The collar is free to slide axially along the direction of motion 30 of the centrally disposed rod. At an end of the collar 14 that is opposite the shaped tip 24, is an outwardly extending flange 32 to prevent the compressible spring 16 from extending over the collar during operation of the tool 10. Typically, the collar is formed from tool steel.

[0023] The compressible spring 16 is disposed between the second end 28 of the centrally disposed rod 12 and the outwardly extending flange 32 of the collar 14. The spring 16 is compressed during the swaging step and then expands back to its original configuration subsequent to swaging to remove the shaped tip 24 from the swaged hardware. A typical pre-
load force value for the compressible spring is from 0 to several hundred pounds, depending on fastener size and material.

[0024] FIG. 2 illustrates exemplary swage hardware 34. The swage hardware includes a body portion 36 and deformable shank 26. The deformable shank 26 has an outside diameter, D1, that is less than the diameter of a through hole formed in work piece and a bore 37 effective to receive the shaped tip and be outwardly deformed therefrom. A shoulder 38 at the interface of the body portion 36 and deformable shank 26 functions as both a work piece holder and a stop for the collar. The shoulder 38 has an outside diameter, D2, that is larger than the diameter formed in the through hole of the work piece. Typically, the swage hardware is formed from a ductile material such as copper, brass or steel.

[0025] FIGS. 3-5 illustrate operation of the fastening tool 10 where the swage hardware 34 is a standoff being installed into a first panel 39 and a second panel 40, such as a printed circuit board (39) and a bracket (40). During a preliminary installment set, FIG. 3, panels 39, 40 are provided with through holes 42, 44. Through holes, 42, 44 have a diameter larger than the outside diameter, D1, of the deformable shank 26, but smaller than the outside diameter, D2, of the shoulder 38 enabling the panels to fit over the shank 26 but not over the shoulder 38.

[0026] Alternatively, one or both of the through holes 42, 44 have a diameter slightly less, such as 0.005 inch less, than the outside diameter, D1, of the deformable shank 26 so that when inserted, there is a press fit that prevents the swage hardware from rotating during installation or during a subsequent manufacturing step, such as when a screw is tightened into the bore 37. Another alternative is to include splines 48 projecting from exterior surfaces of the shank 26 as shown in cross-sectional representation in FIG. 7. The splines are sized to engage the walls of at least one through hole 42, 44.

[0027] FIG. 4 illustrates an intermediate installation step. A force is applied to the second end 28 of the centrally disposed rod 10. This force is on the order of several hundred pounds and is typically applied by a machine press. This force causes the centrally disposed rod 10 to move in the direction of motion 30. The collar moves in the direction of motion 30 until the shank 26 is fully formed by the shaped tip 24.

[0028] FIG. 5 illustrates a concluding installation step. When collar 14 is stopped by shoulder 38, the first panel 39 and the second panel 40 are firmly and accurately clamped between the collar 14 and shoulder 38. The slot 20 enables the centrally disposed rod 10 to continue moving in the direction of motion 30 so that the shaped tip 24 deforms the spline 26 over the top of through hole 44. When the force is removed, the compressible spring 14 expands withdrawing the shaped tip 24 from swage hardware 34. The fastening tool 10 is then removed.

[0029] As shown in FIGS. 6A and 6B, on removal of the fastening tool, the outside diameter, D1', of the shank 26 is larger than the diameter of the through holes 42, 44 in first panel 39 and second panel 40, thereby securing the two panels 39, 40 to the swage hardware 34.

[0030] One or more embodiments of the present invention have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the invention. For example, the shaped tip 24 may be such as to create other types of swage features such as elliptical deformation of the shank 26. Additionally, the shank 26 may include splines 48 to prevent rotation of the hardware 34 in the panels 39 and 40. Accordingly, other embodiments are within the scope of the following claims.

What is claimed is:
1. A fastening tool, comprising:
a centrally disposed rod having a shaped tip at a first end thereof and an enlarged second end effective to transfer force from an external source to said tool;
a collar circumscribing the centrally disposed rod, a first end of the collar being adjacent to the shaped tip and an opposing second end of the collar terminating in an outwardly extending flange; and
a compressible spring disposed between the enlarged second end of the centrally disposed rod and the outwardly extending flange of the collar.

2. The fastening tool of claim 1 wherein the collar has a first slot and a second slot extending through the collar on opposing sides thereof, the first slot and the second slot aligned with a through hole in the centrally disposed rod.

3. The fastening tool of claim 2 wherein a pin extends through the through hole and through both the first slot and the second slot.

4. The fastening tool of claim 3 wherein the pin has a diameter that is less than a length of at least one of the first slot and the second slot when the length is measured in a direction parallel to a direction of motion of the centrally disposed rod.

5. The fastening tool of claim 4 wherein the length and position of at least one of the first slot and the second slot defines a distance of travel of the centrally disposed rod.

6. A combination fastening tool and hardware for fastening, comprising:
the fastening tool having a centrally disposed rod having a shaped tip at a first end thereof and an enlarged second end effective to transfer force from an external source to said tool; a collar circumscribing the centrally disposed rod, a first end of the collar being adjacent to the shaped tip and an opposing second end of the collar terminating in an outwardly extending flange; and a compressible spring disposed between the enlarged second end of the centrally disposed rod and the outwardly extending flange of the collar; and
the hardware having a body portion having a first outside diameter and a deformable shank having a second outside diameter wherein the first diameter is greater than the second diameter.

7. The combination of claim 6 wherein an interface between the body portion and deformable shank of the hardware forms a shoulder.

8. The combination of claim 7 wherein an inside diameter of the collar is less than the first outside diameter but greater than the second outside diameter.

9. The combination of claim 8 wherein the deformable shank includes a bore effective to receive the shaped tip and be outwardly deformed therefrom.

10. The combination of claim 9 wherein the collar has a first slot and a second slot extending through the collar on opposing sides thereof, the first slot and the second slot aligned with a through hole in the centrally disposed rod and a pin extends through the through hole and through both the first slot and the second slot.

11. The combination of claim 10 wherein the length and position of at least one of the first slot and the second slot defines a distance of travel of the centrally disposed rod when the collar contacts the shoulder.
12. The combination of claim 11 further including a plurality of work pieces wherein each one of said plurality of work pieces includes a through hole having a diameter that is less than the first outside diameter and greater than the second outside diameter.

13. The combination of claim 11 further including a plurality of work pieces wherein one or more of said plurality of work pieces includes a through hole having a diameter equal to or less than the first outside diameter but greater than the second outside diameter.

14. The combination of claim 9 wherein the deformable shank has splines extending outwardly therefrom.