US006439086B1

(12) **United States Patent**
Bahr

(10) **Patent No.: US 6,439,086 B1**
(45) **Date of Patent: Aug. 27, 2002**

(54) **TORQUE LIMITING DEVICE**

(76) Inventor: **Randall A. Bahr**, 4550-3 Saint Augustine Rd., Jacksonville, FL (US) 32207

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 542 days.

(21) Appl. No.: **08/931,932**

(22) Filed: **Sep. 17, 1997**

Related U.S. Application Data

(60) Provisional application No. 60/026,228, filed on Sep. 17, 1996.

(51) **Int. Cl.**[7] **B25B 23/14**

(52) **U.S. Cl.** **81/467**; 81/473; 81/477; 81/480

(58) **Field of Search** 81/467, 473, 476, 81/477, 478, 480, 58, 58.4, 58.5

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,332,972 A * 10/1943 Johnson 81/480
2,400,205 A * 5/1946 Livermont 81/477
2,972,271 A * 2/1961 Gill 81/480
3,425,314 A * 2/1969 Ohlson ..... 81/447 X

* cited by examiner

Primary Examiner—D. S. Meislin
(74) *Attorney, Agent, or Firm*—Nixon & Vanderhye P.C.

(57) **ABSTRACT**

A torque limited applicator is useful for a wide variety of purposes where a mechanical device, such as a fastener, is to be driven but a maximum level of torque not exceeded. The applicator is reusable, and preferably easily constructed from integral pieces of plastic. A torque applying element with internal cam followers and a fastener drive structure with a drive element and a cam element may either be removably positioned with respect to each other, or a retaining ring and deformable pin may attach them together. A plug may be provided to reduce the possibility of tampering, provide a tamper evident seal, and to prevent foreign material from entering the area of cooperation between the cam element and cam followers, as well as providing an area for indicia indicating the maximum level of preset torque. Color coding for different torque levels for the applicators may be provided.

17 Claims, 4 Drawing Sheets

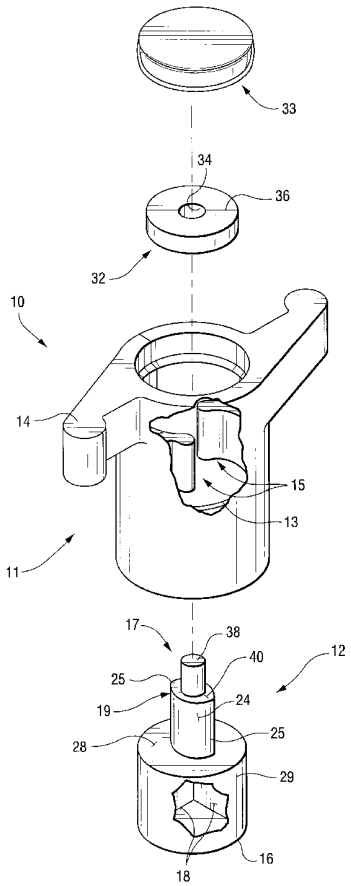
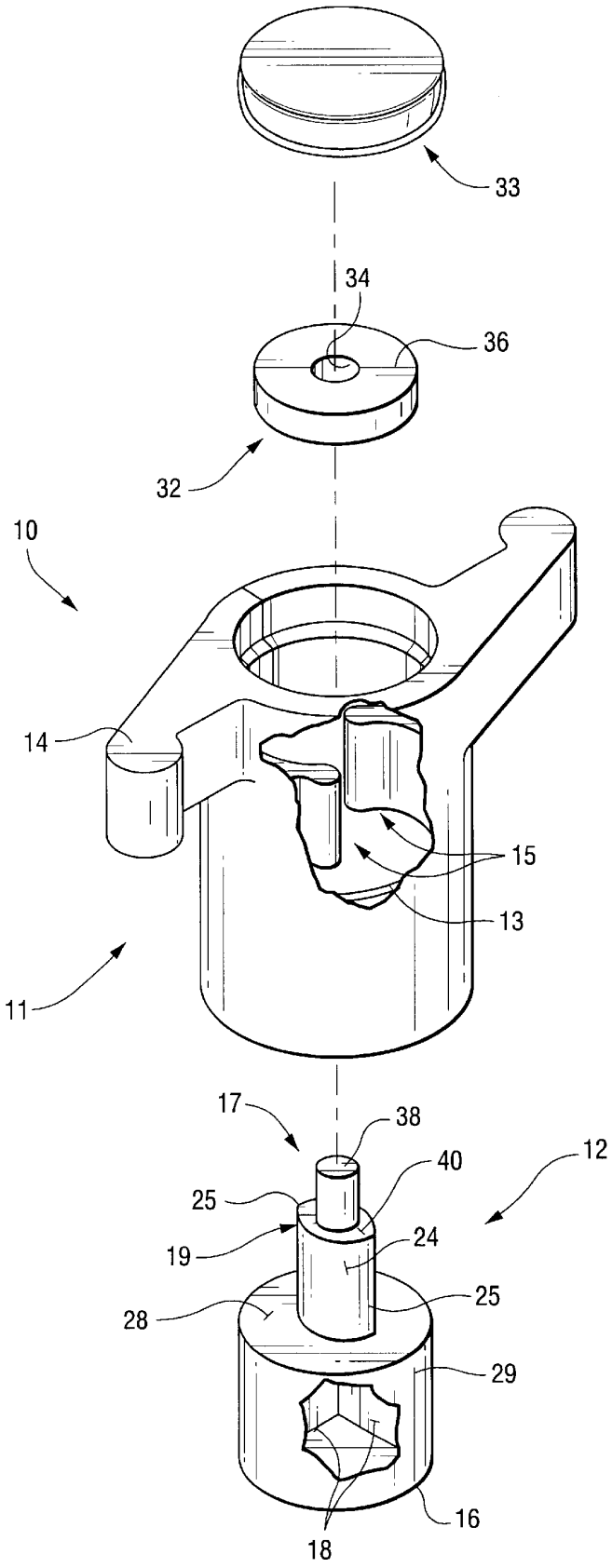


Fig. 1



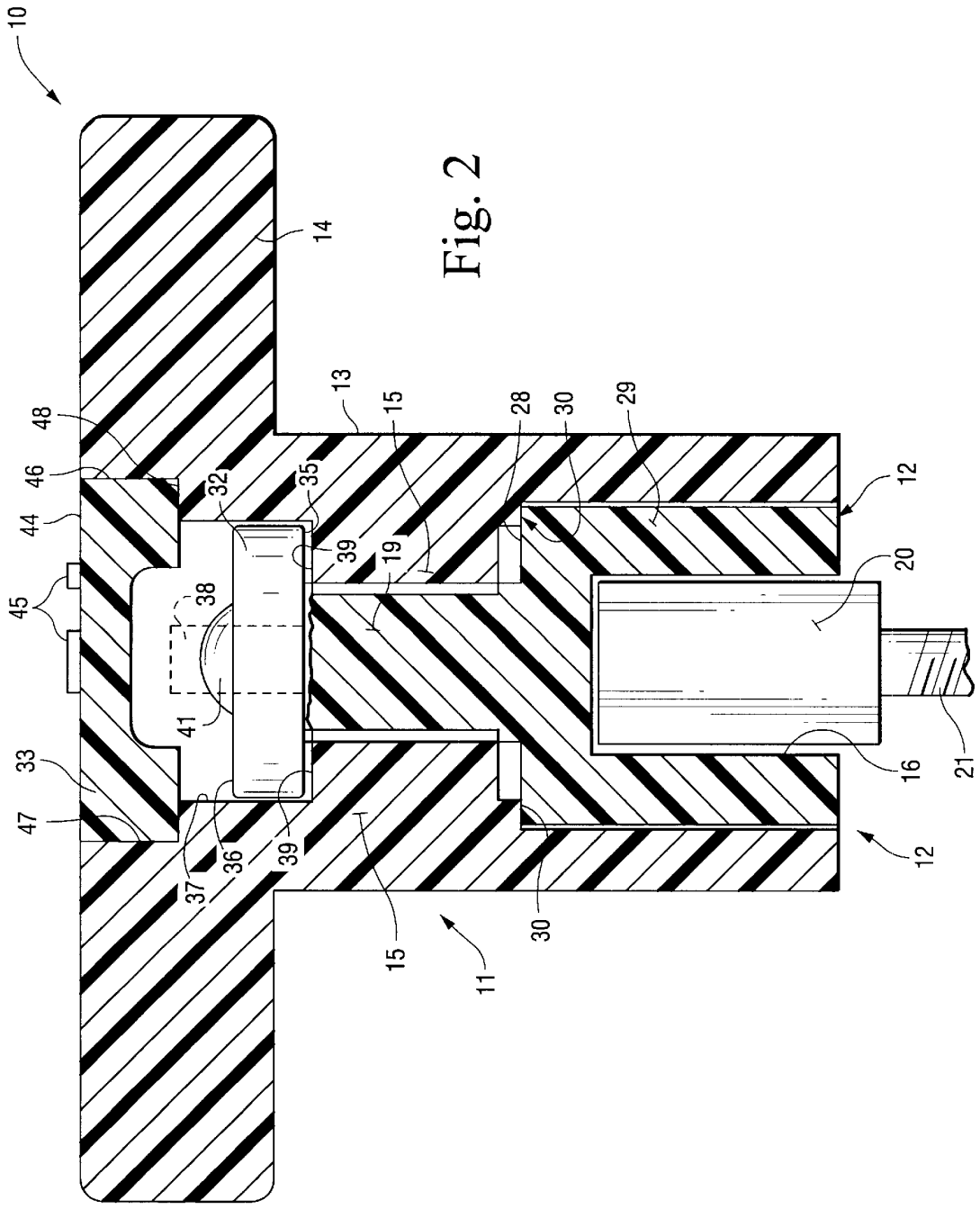

10
14
13
15
28
30
29
48
46
44
45
32
35
39
19
38
41
12
20
16
21
33
47
37
36
39
15
11
30
12

Fig. 2

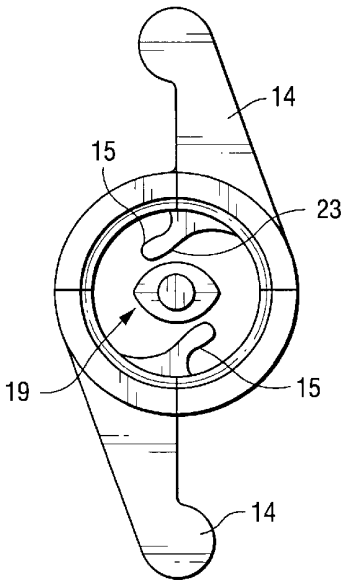


Fig. 3

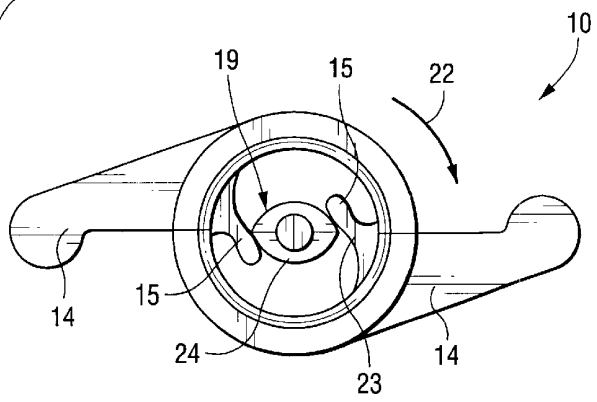


Fig. 4

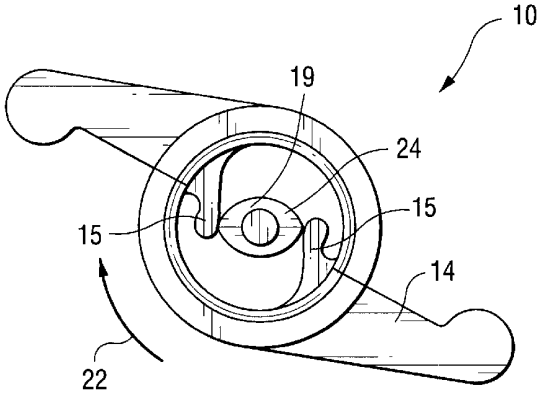


Fig. 5

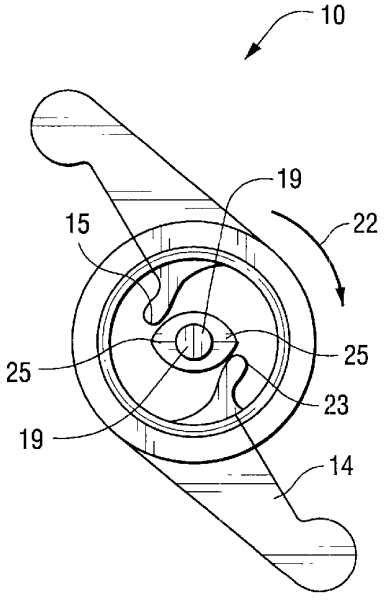


Fig. 6

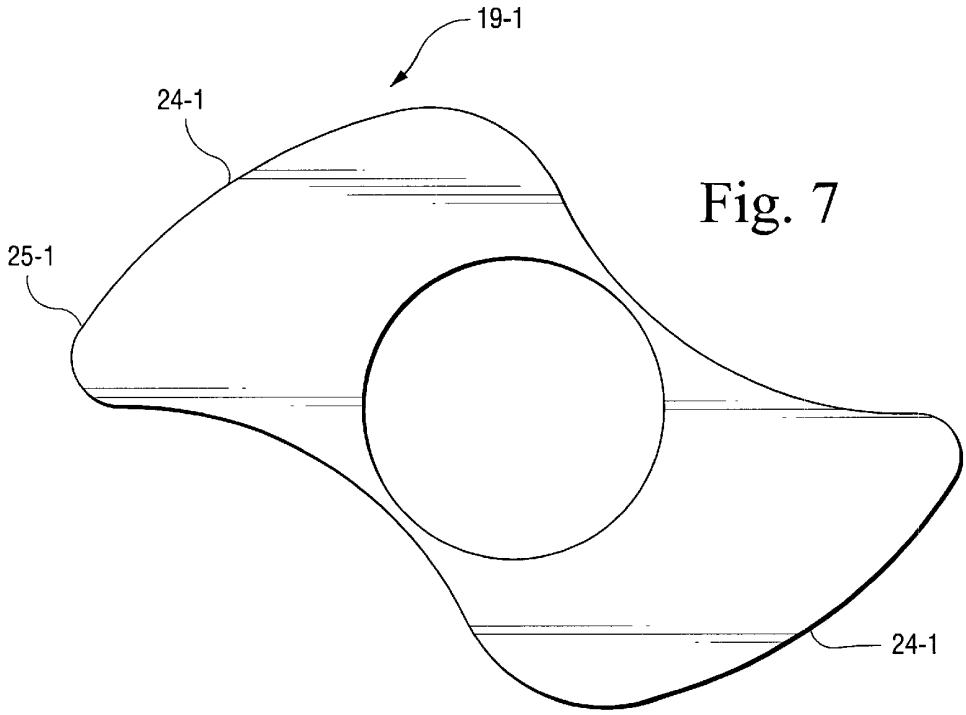
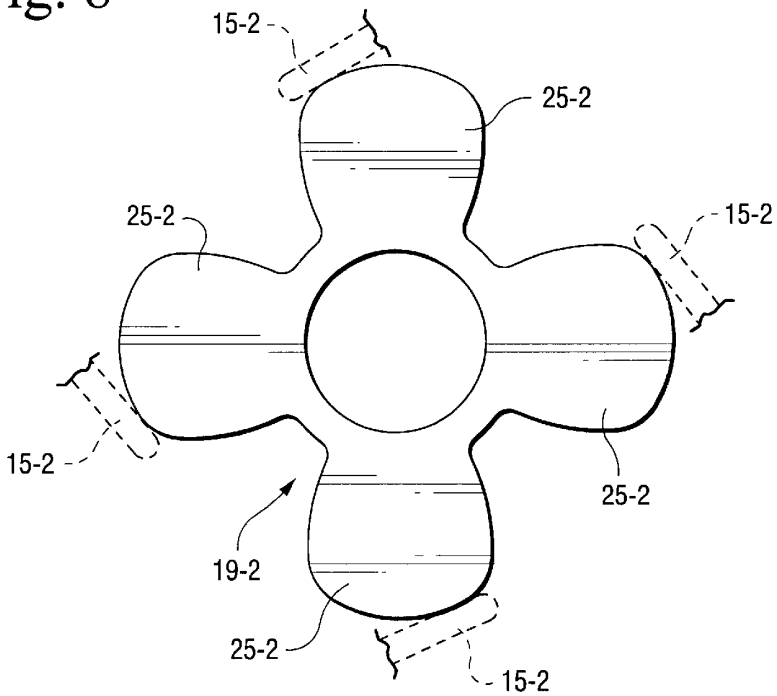


Fig. 7

Fig. 8



TORQUE LIMITING DEVICE

CROSS REFERENCE TO RELATED APPLICATION

This application is based upon and claims priority of provisional application No. 60/026,228 filed Sep. 17, 1996.

BACKGROUND AND SUMMARY OF THE INVENTION

In many industries such as medical, electronic assembly, tool, and fixturing industries, there are circumstances when a limited amount of torque should be applied to mechanical devices, such as fasteners. As one example when using bone penetrating pins especially for attachment of halos or like mechanical appliances, it is necessary to limit the amount of torque applied to the fastener (such as described generally in U.S. Pat. No. 4,838,264, the disclosure of which is hereby incorporated by reference herein). It is desirable to be able to provide such torque limited applicators at low cost, and in some industries—such as the medical industry—low enough cost so that they are disposable. Sometimes single use breakaway types of torque limited applicators are used, but in some situations it is desirable to be able to have a reusable torque limited applicator, e.g. one that can at least be used with a plurality of fasteners, the number of fasteners being suitable to at least perform a particular procedure.

The torque limited applicator according to the present invention is simple and easy to construct, having a minimum number of components, wide diversity in component configurations that allows great flexibility depending upon the particular industry and particular mechanical devices (such as fasteners) to be utilized therewith, and being constructable of a wide variety of materials. Typically the torque limited applicator includes at least a torque applying element and a fastener drive structure, one of the components having cam followers and the other a cam element which cooperates with each other so that the torque applying element drives the fastener drive structure until a predetermined torque is reached, at which point there is relative rotational movement between the cam followers and the cam element. The cam element can have any number of "lobes" and any suitable configuration, and two or more cam followers may be provided. Both components may be formed of an integral piece of plastic, e.g. by injection molding, or by milling, turning, or other machining.

In most circumstances it would be desirable to have the torque applying element and the fastener drive structure connected together so that they do not separate during normal use. This may be provided by using a retaining ring which cooperates with a deformable pin of the fastener drive structure. Also a plug may be utilized to prevent tampering with the internal components, to provide a tamper evident seal, and to prevent the entry of foreign material into the operative area between the cam element and cam followers, as well as to provide an area for the placement of indicia (such as the amount of torque that such an applicator may apply). The plug and retainer ring also can each be an integral piece of plastic.

According to one aspect of the present invention a torque limited applicator is provided comprising the following components: A torque applying element having a tubular body and a handle, the tubular body comprising at least two internal cam followers. A fastener drive structure having first and second ends, and comprising a drive element adjacent the first end, and a cam element adjacent the second end. And, the cam followers and the cam element engaging and cooperating with each other so that upon application of a force to the handle up to a predetermined maximum torque the cam followers engage the cam element to transmit rotational force from the handle to the drive element, and upon the predetermined maximum torque being exceeded the cam followers being deformed and moved past the cam element so that a torque greater than the predetermined maximum cannot be applied to the drive element by the torque applying element.

The cam element may comprise a cylindrical element having a cross-section in the shape of a pointed end ellipse, or may have a wide variety of other dual or multi-lobed configurations.

In one embodiment the tubular body of the torque applicator has an interior surface; and wherein the cam followers comprise at least two oppositely disposed first and second arms of bendable material and each having a contoured surface free end extending outwardly from the interior surface and engaging the cam element; and wherein there is sufficient clearance within the tubular body of the torque applying element between the cam element and the contoured surface free ends so that the free ends may move between the cam element and the tubular body interior along substantially 360E.

The torque applying element and fastener drive structure may each be one integral piece of plastic, and a retaining ring may be provided for connecting the torque applying element and fastener drive structure together so that they are connected during normal use. That is the torque limited applicator cam followers may each comprise a top surface, and further comprise a retaining ring having a central opening therein, the retaining ring having a bottom surface in engagement with the top surface; and the fastener drive structure may include a pin integral therewith and extending upwardly therefrom, the pin having cross-sectional dimensions less than the cross-sectional dimensions of the ring opening, and having a length greater than the thickness of the ring so that a portion of the pin extends above the ring, the portion of the pin above the ring deformed into contact with the top surface of the ring to hold the ring in place.

There also may be bearing surfaces between the torque applying element and the fastener drive structure to facilitate relative rotation therebetween.

The torque limited applicator may also comprise a plug that plugs the torque applying element tubular body at the handle. The plug may have indicia thereon, visible from the exterior of the torque applying element, indicating the predetermined maximum torque that can be applied by the torque applying element. The plug and the retaining ring may also each be one integral piece of plastic, and all of the components can be made of the same plastic, although they can be made of different plastics too (e.g. such as the torque applying element of acetal and the fastener drive structure of polytetrafluoroethylene). Suitable plastics that may be used for the components include acetal (e.g. DELRIN7 500 from DuPont), PBT, PET, polytetrafluoroethylene, polyamide, polycarbonate, polysulfone, PEEK, PEKEKK, and polyetherimide.

At least three torque limited applicators may be utilized, each of the applicators having a different maximum torque and of a different color. All of the components can be of a different color from one torque level to the next, or just the plugs within any given torque level may be of the same color.

The invention also relates to a method of securing a fastener in place, which fastener should be subjected to only

TORQUE LIMITING DEVICE

CROSS REFERENCE TO RELATED APPLICATION

This application is based upon and claims priority of provisional application No. 60/026,228 filed Sep. 17, 1996.

BACKGROUND AND SUMMARY OF THE INVENTION

In many industries such as medical, electronic assembly, tool, and fixturing industries, there are circumstances when a limited amount of torque should be applied to mechanical devices, such as fasteners. As one example when using bone penetrating pins especially for attachment of halos or like mechanical appliances, it is necessary to limit the amount of torque applied to the fastener (such as described generally in U.S. Pat. No. 4,838,264, the disclosure of which is hereby incorporated by reference herein). It is desirable to be able to provide such torque limited applicators at low cost, and in some industries—such as the medical industry—low enough cost so that they are disposable. Sometimes single use breakaway types of torque limited applicators are used, but in some situations it is desirable to be able to have a reusable torque limited applicator, e.g. one that can at least be used with a plurality of fasteners, the number of fasteners being suitable to at least perform a particular procedure.

The torque limited applicator according to the present invention is simple and easy to construct, having a minimum number of components, wide diversity in component configurations that allows great flexibility depending upon the particular industry and particular mechanical devices (such as fasteners) to be utilized therewith, and being constructable of a wide variety of materials. Typically the torque limited applicator includes at least a torque applying element and a fastener drive structure, one of the components having cam followers and the other a cam element which cooperates with each other so that the torque applying element drives the fastener drive structure until a predetermined torque is reached, at which point there is relative rotational movement between the cam followers and the cam element. The cam element can have any number of "lobes" and any suitable configuration, and two or more cam followers may be provided. Both components may be formed of an integral piece of plastic, e.g. by injection molding, or by milling, turning, or other machining.

In most circumstances it would be desirable to have the torque applying element and the fastener drive structure connected together so that they do not separate during normal use. This may be provided by using a retaining ring which cooperates with a deformable pin of the fastener drive structure. Also a plug may be utilized to prevent tampering with the internal components, to provide a tamper evident seal, and to prevent the entry of foreign material into the operative area between the cam element and cam followers, as well as to provide an area for the placement of indicia (such as the amount of torque that such an applicator may apply). The plug and retainer ring also can each be an integral piece of plastic.

According to one aspect of the present invention a torque limited applicator is provided comprising the following components: A torque applying element having a tubular body and a handle, the tubular body comprising at least two internal cam followers. A fastener drive structure having first and second ends, and comprising a drive element adjacent the first end, and a cam element adjacent the second end. And, the cam followers and the cam element engaging and cooperating with each other so that upon application of a force to the handle up to a predetermined maximum torque the cam followers engage the cam element to transmit rotational force from the handle to the drive element, and upon the predetermined maximum torque being exceeded the cam followers being deformed and moved past the cam element so that a torque greater than the predetermined maximum cannot be applied to the drive element by the torque applying element.

The cam element may comprise a cylindrical element having a cross-section in the shape of a pointed end ellipse, or may have a wide variety of other dual or multi-lobed configurations.

In one embodiment the tubular body of the torque applicator has an interior surface; and wherein the cam followers comprise at least two oppositely disposed first and second arms of bendable material and each having a contoured surface free end extending outwardly from the interior surface and engaging the cam element; and wherein there is sufficient clearance within the tubular body of the torque applying element between the cam element and the contoured surface free ends so that the free ends may move between the cam element and the tubular body interior along substantially 360E.

The torque applying element and fastener drive structure may each be one integral piece of plastic, and a retaining ring may be provided for connecting the torque applying element and fastener drive structure together so that they are connected during normal use. That is the torque limited applicator cam followers may each comprise a top surface, and further comprise a retaining ring having a central opening therein, the retaining ring having a bottom surface in engagement with the top surface; and the fastener drive structure may include a pin integral therewith and extending upwardly therefrom, the pin having cross-sectional dimensions less than the cross-sectional dimensions of the ring opening, and having a length greater than the thickness of the ring so that a portion of the pin extends above the ring, the portion of the pin above the ring deformed into contact with the top surface of the ring to hold the ring in place.

There also may be bearing surfaces between the torque applying element and the fastener drive structure to facilitate relative rotation therebetween.

The torque limited applicator may also comprise a plug that plugs the torque applying element tubular body at the handle. The plug may have indicia thereon, visible from the exterior of the torque applying element, indicating the predetermined maximum torque that can be applied by the torque applying element. The plug and the retaining ring may also each be one integral piece of plastic, and all of the components can be made of the same plastic, although they can be made of different plastics too (e.g. such as the torque applying element of acetal and the fastener drive structure of polytetrafluoroethylene). Suitable plastics that may be used for the components include acetal (e.g. DELRIN7 500 from DuPont), PBT, PET, polytetrafluoroethylene, polyamide, polycarbonate, polysulfone, PEEK, PEKEKK, and polyetherimide.

At least three torque limited applicators may be utilized, each of the applicators having a different maximum torque and of a different color. All of the components can be of a different color from one torque level to the next, or just the plugs within any given torque level may be of the same color.

The invention also relates to a method of securing a fastener in place, which fastener should be subjected to only

friction coating may be provided at the area of cooperation between the elements **28**, **30** or one or both of those,surfaces may be made of inherently low friction material such as polytetrafluoroethylene. Other bearing surfaces (such as the circumferential periphery of the body **29** and the corresponding internal tubular cavity of the body **13**) may also be provided, but are typically unnecessary. The engagement between the surfaces **28**, **30** also prevents movement of the element **11** too far downwardly with respect to the element **12**, and properly vertically aligns the cam followers **15** and cam element **19**, as seen in FIG. **2**.

While the elements **11**, **12** are the only elements absolutely required to perform the torque limiting function of the applicator **10** according to the invention, preferably other elements are also provided. Particularly, it is desirable to provide a retaining ring **32** and a plug **33**, both of which are visible in FIGS. **1** and **2**, but have been removed from FIGS. **3** through **5** for clarity of illustration.

The retaining ring **32** is a structure that prevents the element **12** from slipping out of the element **11**, so that the elements **11**, **12**—while relative rotation between them is allowed—can be easily transported together and moved from fastener head **20** to fastener head **20**. The retaining ring **32** has an internal central bore **34** (see FIG. **1**), a bottom surface **35** (see FIG. **2**), and a top surface **36** (FIGS. **1** and **2**). It has an outside diameter just slightly less than the internal diameter of the tubular bore **37** at the handle part **14** of the element **11** (see FIG. **2**), and the internal bore **34** cooperates with the cylindrical pin **38** extending upwardly from the cam element **19** (see FIG. **1**). The pin **38** has a length such that it extends past the top surface **36** of the ring **32** (see the dotted line configuration in FIG. **2**) when the ring bottom surface **35** engages the top surface **39** of the lobes **15** and/or the top surface **40** of the cam **19**. The retaining ring **32** is held in place by deforming the pin **38** to form the head **41** as illustrated in FIG. **2**, the head **41** preventing the ring **32** from moving upwardly through the bore **37**, and the cam follower **15** surfaces **39** preventing the ring **32** from moving downwardly out the bottom of the tubular element **11**.

The plug **33**, when utilized, is provided to perform a number of functions. It reduces the possibility of tampering with the internal operative components (**15**, **19**) or access for easy removal of the ring **32**, as well as providing a tamper evident seal. Also it prevents foreign material from entering the volume adjacent the cam followers **15** and cam element **19**, which foreign material could interfere with operation or change the maximum torque level. Also on the top surface **44** of the plug **33** is a suitable area for providing indicia, such as the name or logo of the applicator **10** manufacturer and/or a maximum torque level for that particular applicator **10**, the indicia being seen schematically at **45** in FIG. **2**. While the plug **33** may be mounted with the rest of the components of the applicator **10** in any desired manner, in the embodiment illustrated in FIGS. **1** and **2**, the circumferential periphery **46** of the plug **33** makes an interference fit with the internal periphery **47** of the tubular bore of the element **11**, and an annular shoulder **48** of the handle **14** precludes downward movement of the plug **33** in the element **11** past the level of the shoulder **48**. If desired an ultrasonic weld, adhesive, screw thread engagement, or other fastening mechanism may be used instead of or in addition to the interference fit between the surfaces **46**, **47**.

Preferably all of the individual components **11**, **12**, **32**, and **33** of the applicator **10** according to the invention are each made of an integral piece of plastic. For example they may be injection molded in integral form, or they may be machined (e.g. milling, turning, stereo-lithography, etc.) from a block of plastic. A wide variety of different types of plastic may be utilized. Three of the most desirable plastics are acetal (e.g. DELRIN7 500, from DuPont), polyamide, and polytetrafluoroethylene. All of the elements **11**, **12**, **32**, **33** may be made of the same plastic to make applicator **10** easy to recycle, or they may be made of different plastics depending upon the relative properties of the plastics. For example the element **11** may be made of acetal or polyamide (nylon) while element **12** (including cam element **19**) is made from polytetrafluoroethylene. Other plastics that may be suitable are PBT, PET, polycarbonate, polysulfone, PEEK, PEKEKK, and polyetherimide. Physical characteristics that will control the functionality of the applicator **10**, and the suitable plastic, include elongation, flexural strength, and flexural modulus.

A wide variety of different applicators **10** may be manufactured, each having a different maximum torque that can be applied thereby. For most purposes the minimum torque to be applied by the applicator **10** would be on the order of about one inch ounce, while at the maximum end the torque could be essentially as high as a human hand or fingers could exert on the handle **14**. For a handle **14** having a cross-dimension (from one end of one portion of the handle **14** to the other end of the other portion of the handle **14**) of 1.5 inches, the maximum torque level for a device **10** would be on the order of 40–50 inch pounds. Different torque levels of the applicators **10** may be indicated by different colors either of the element **11** (or even all of the components **11**, **12**, **32**, **33**), or just the color of the plug **33** itself. Typically there would be at least three different applicators **10** having different colors (e.g. blue, red, yellow, orange, white, black, etc.) depending upon the maximum torque that could be applied therewith. This color coding would allow the user to immediately know if he or she were using the correct applicator **10** for a particular situation, and would facilitate the utilization of the applicator **10** in general.

When the element **12** is made of plastic, formation of the head **41** may be accomplished utilizing a heated tool with a small concave radius.

That heated tool could then deform the portion of the pin **38** extending above the ring **32** to form the head **41** as illustrated in FIG. **2**. Note that while the retainer **32** holds the elements **11**, **12** together, it does not interfere with the relative rotation between them, which rotation is provided by the bearing surfaces **28**, **30**, but resisted by the torque limiting elements **15**, **19**.

Depending upon the particular materials of construction and the particular geometric design of the elements **15**, **19**, as the elements **15**, **19** move with respect to each other to return to the rest position after the maximum torque has been exceeded (see FIG. **6**) there may be an audible snapping sound, and/or a clearly noticeable tactile sensation.

In a typical manner of construction and use of the applicator **10** according to the invention, the element **12** is slipped into the open bottom of the element **11** so that the bearing surfaces **28**, **30** engage. The retaining ring **32** is then passed through the bore **37** so that the pin **38** moves through the bore **34** in the ring **32**. Then using a heated tool the pin **38** is engaged and the head **41** formed, holding the elements **11**, **12** together so that they will not separate in the axial dimension. Then the appropriate plug **33**, having indicia **45** indicating the maximum torque for the elements **15**, **19**, is pushed into the bore **47** so that an interference fit between the surfaces **47**, **48** takes place.

The applicator **10** is then used to fasten a plurality of fasteners **21**. For example assuming that the fastener **21** is a

bone penetrating pin, the drive element **16** is moved into operative association with the fastener head **20** of the first fastener **21** (see FIG. **2**), and the handle **14** is grasped by the operator and turned from the rest position of FIG. **3** in the direction **22**, so that there is a force transmitting engagement between the surfaces **23**, **24**. Continued rotation of the handle **14** thus effects rotation of the drive element **16**, resulting in rotation of the fastener head **20**. Once the fastener **21** penetrates the bone sufficiently so that further torque should not be applied, the maximum torque level of the applicator **10** is reached, FIG. **5** illustrating the relative positions between the components **15**, **19** at full stress (when the maximum torque is achieved). Then, as seen in FIG. **6**, the elements **15** become sufficiently deformed so that they move past the "lobes" **25** of the cam element **19**, an audible and tactile sensation being provided so that the user knows that the maximum torque has been reached, and so that the elements **15**, **19** return to a rest position as seen in FIG. **6**. Then the user simply removes the applicator **10** from the head **20**, and moves the drive element **16** into association with another head **20** of another fastener **21**, the process being repeated until all appropriate fasteners **21** have been installed.

The applicator **10** according to the present invention can be produced inexpensively enough so that it is disposable after the installation of one set of fasteners **21**. However it may be made of more secure materials so that it is essentially a permanent structure, being continuously reusable. Also it can be made of materials that are sterilizable, so that when subjected to steam and EtO or gamma radiation the physical properties do not change sufficiently enough so that the device **10** could not be reused (e.g. for another patient or environment).

It will thus been seen that according to the present invention a simple, effective, reusable yet low cost torque limited applicator is provided, as well as a method of utilization thereof. While the invention has been herein shown and described in what is presently conceived to be the most practical and preferred embodiment thereof it will be apparent to those of ordinary skill in the art that many modifications may be made thereof within the scope of the invention, which scope is to be accorded the broadest interpretation of the appended claims so as to encompass all equivalent structures and devices and procedures.

What is claimed is:

1. A torque limited applicator comprising:

a torque applying element having a tubular body and a handle, said tubular body comprising at least two internal deformable cam followers;

a fastener drive structure having first and second ends, and comprising a drive element adjacent said first end, and a cam element adjacent said second end; and

said cam followers and said cam element engaging and cooperating with each other so that upon application of a force to said handle up to a predetermined maximum torque said cam followers engage said cam element to transmit rotational force from said handle to said drive element, and upon said predetermined maximum torque being exceeded said cam followers are deformed and moved past said cam element so that a torque greater than said predetermined maximum cannot be applied to said drive element by said torque applying element.

2. A torque limited applicator as recited in claim **1** wherein said cam element comprises a cylindrical element having a cross-section in the shape of a pointed end ellipse.

3. A torque limited applicator as recited in claim **2** wherein said tubular body of said torque applicator has an interior surface; and wherein said cam followers comprise at least two oppositely disposed first and second arms of bendable material and each having a contoured surface free end extending outwardly from said interior surface and engaging said cam element; and wherein there is sufficient clearance within said tubular body of said torque applying element between said cam element and said contoured surface free ends so that said free ends may move between said cam element and said tubular body interior along substantially 360°.

4. A torque limited applicator as recited in claim **3** wherein said torque applying element and fastener drive structure are each one integral piece of plastic.

5. A torque limited applicator as recited in claim **4** further comprising a retaining ring for connecting said torque applying element and fastener drive structure together so that they are connected during normal use.

6. A torque limited applicator as recited in claim **5** further comprising a plug that plugs said torque applying element tubular body at said handle.

7. A torque limited applicator as recited in claim **6** wherein said plug has indicia thereon, visible from the exterior of said torque applying element, indicating the predetermined maximum torque that can be applied by said torque applying element.

8. A torque limited applicator as recited in claim **6** wherein said plug and said retaining ring are also each one integral piece of plastic.

9. A torque limited applicator as recited in claim **8** wherein said torque applying element, fastener drive element, plug, and retaining ring are all of the same plastic.

10. A torque limited applicator as recited in claim **9** wherein said plastic is acetal, polyamide, or polytetrafluoroethylene.

11. A torque limited applicator as recited in claim **1** wherein said cam element has at least two lobes.

12. A torque limited applicator as recited in claim **1** wherein said torque applying element is an integral piece of acetal, and said fastener drive structure is an integral piece of polytetrafluoroethylene.

13. A torque limited applicator as recited in claim **1** wherein said cam followers each have a top surface; and further comprising a retaining ring having a central opening therein, said retaining ring having a bottom surface in engagement with said top surface; and wherein said fastener drive structure includes a pin integral therewith and extending upwardly therefrom, said pin having cross-sectional dimensions less than the cross-sectional dimensions of said ring opening, and having a length greater than the thickness of said ring so that a portion of said pin extends above said ring; said portion of said pin above said ring deformed into contact with the top surface of said ring to hold said ring in place.

14. A torque limited applicator as recited in claim **1** further comprising bearing surfaces between said torque applying element and said fastener drive structure to facilitate relative rotation therebetween.

15. A method of securing a fastener in place, which fastener should be subjected to only a predetermined amount of torque, comprising the steps of:

(a) selecting an appropriate torque level limited applicator comprising a torque applying element having a tubular body and a handle, said tubular body comprising at least two internal deformable cam followers;

a fastener drive structure having first and second ends, and comprising a drive element adjacent said first end, and a cam element adjacent said second end; and

said cam followers and said cam element engaging and cooperating with each other so that upon application of a force to said handle up to a predetermined maximum torque said cam followers engage said cam element to transmit rotational force from said handle to said drive element, and upon said predetermined maximum torque being exceeded said cam followers are deformed and moved past said cam element so that a torque greater than said predetermined maximum cannot be applied to said drive element by said torque applying element;

(b) bringing the drive element associated with the torque limited applicator into operative contact with a fastener;

(c) rotating the torque applying element to drive the fastener drive structure until the desired torque level has been reached as indicated by a tactile or audible indication once the cam followers have moved past the cam element;

(d) removing the torque limited applicator from the fastener; and

(e) repeating steps (a) through (d) for a second fastener using the same torque limited applicator.

16. A method as recited in claim **15** wherein at least three torque limited applicators are provided, each of said applicators having a different maximum torque, and of a different color; and wherein step (a) is practiced by selecting the appropriate color of torque limiting applicator corresponding to the maximum torque required.

17. A torque limited applicator comprising:

a torque applying element having a body, a handle, and either at least two deformable cam followers or a cam element;

a fastener drive structure having a drive element and either a cam element or deformable cam followers; and

one of said torque applying element and said fastener drive structure including deformable cam followers and the other including a cam element, said cam followers and cam element engaging and cooperating with each other so that upon application of a force to said handle up to a predetermined maximum torque said cam followers and said cam element cooperate to apply a rotational force from said handle to said drive element, and upon said predetermined maximum torque being exceeded said cam followers are deformed and relative movement between said cam element and said cam followers takes place so that a torque greater than said predetermined maximum cannot be applied to said drive element by said torque applying element.

* * * * *