United States Patent

[11] 3,633,944

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Continuation-in-part of application Ser. No. 885,689, Dec. 17, 1969. This application Nov. 23, 1970, Ser. No. 91,884

[54] **TUBE COUPLING**
5 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** **285/81,** 285/93, 285/111, 285/340, 285/354
[51] **Int. Cl.** **F16l 17/02**
[50] **Field of Search** 285/340, 81, 111, 110, 93, 354, 386; 151/9, 28, 11

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ABSTRACT: A slip-in type tube coupling formed of a body having a central bore whose forward end is enlarged, a centrally apertured cap fastened upon the forward end of the body, a springy grab ring having an outer flat edge portion, clamped against the body forward end by the cap, and an inner frustoconical shaped gripping portion. A U-shaped resilient sealing ring with a corresponding frustoconically shaped base receives the gripping portion in face-to-face contact, with its outer leg sealing against the wall of the enlarged portion of the bore and its inner leg sealing against the tube.

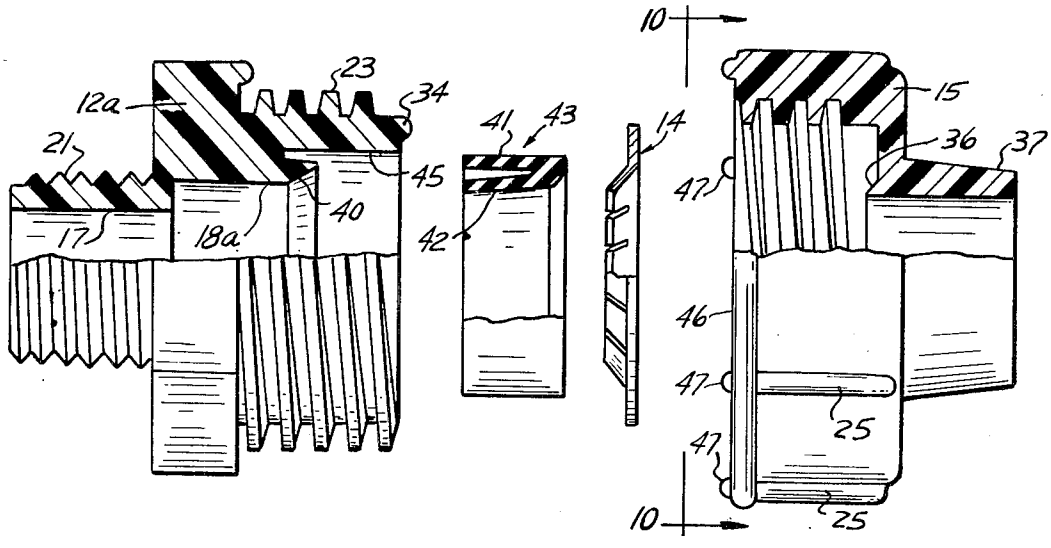


FIG. 1

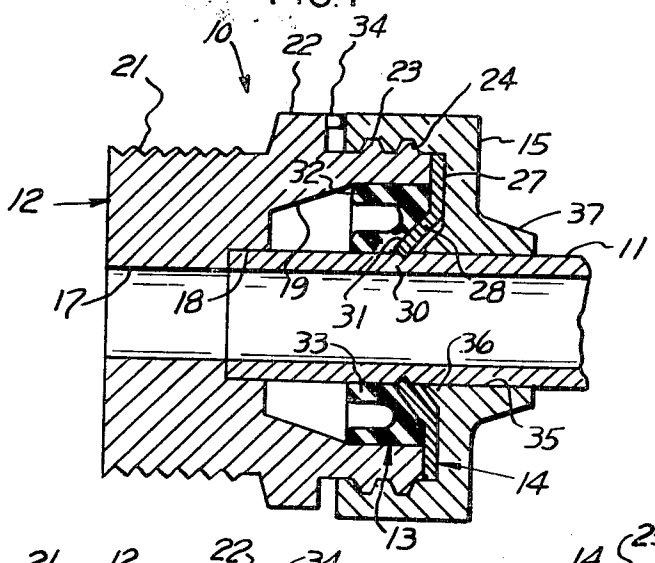
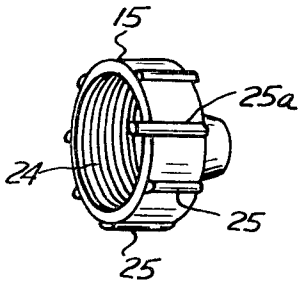


FIG. 2



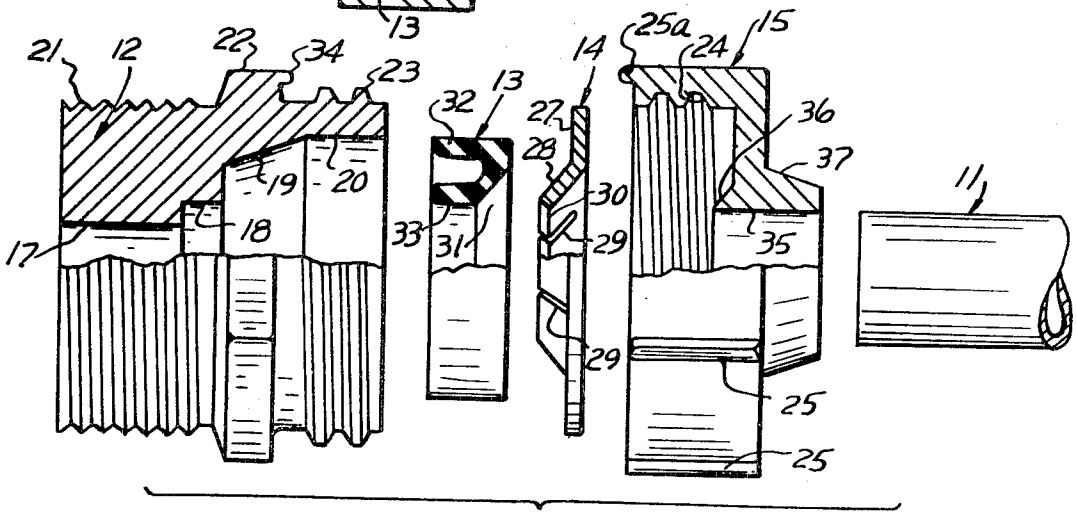


FIG. 3

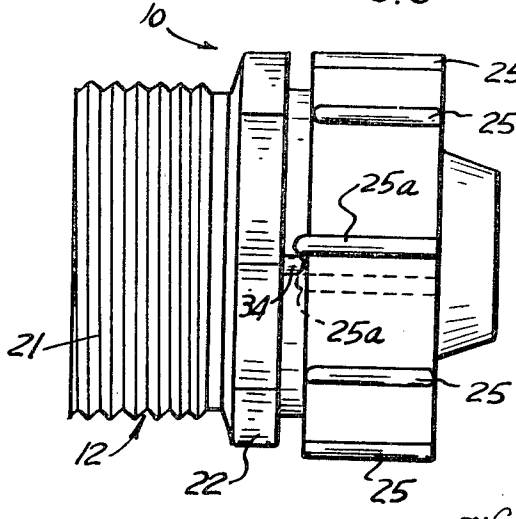


FIG. 4

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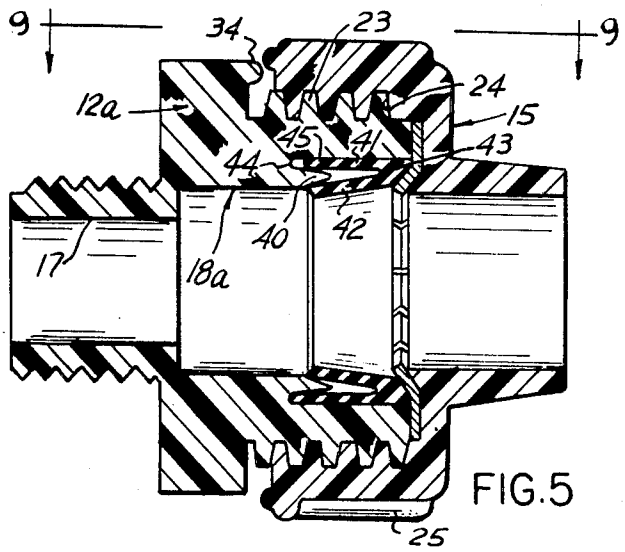


FIG.5

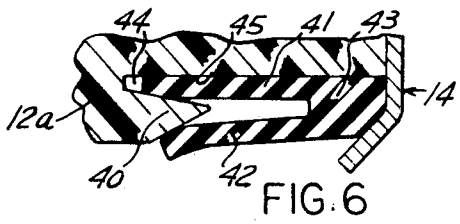


FIG.6

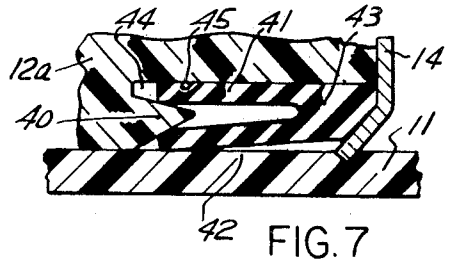
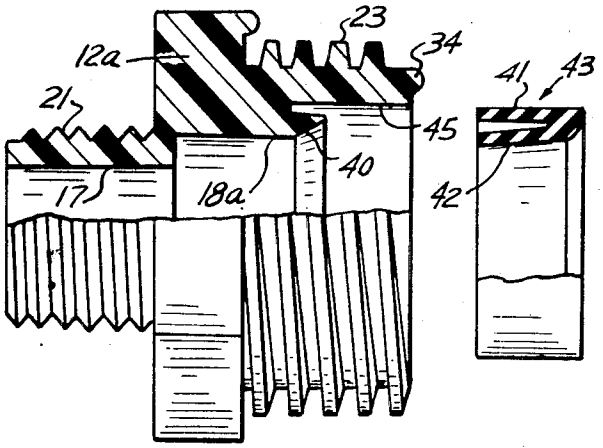


FIG.7



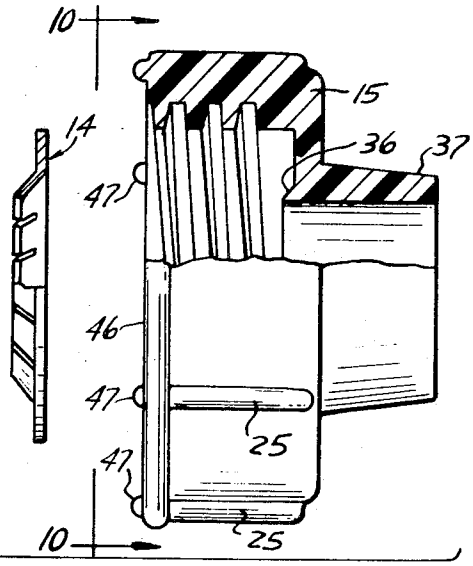


FIG.8

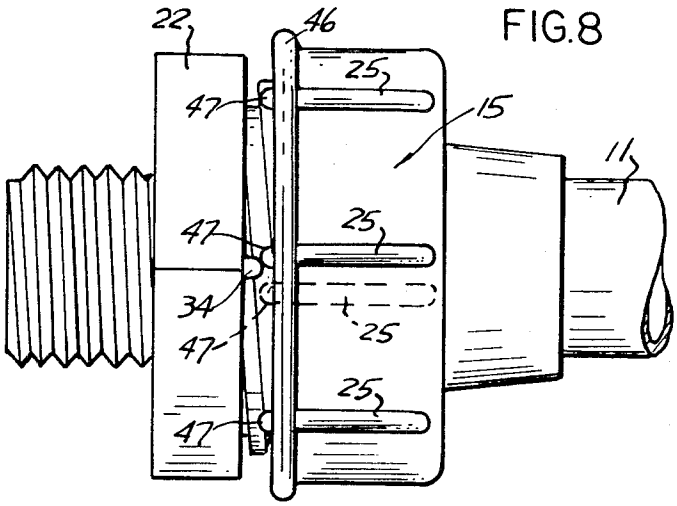


FIG.9

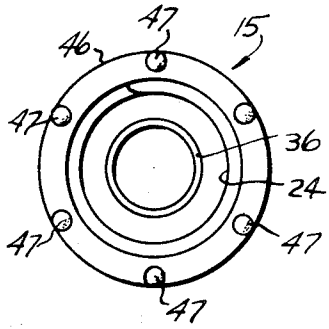


FIG.10

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TUBE COUPLING

PARENT APPLICATION

This application is a continuation-in-part of my earlier application Ser. No. 885,689 filed Dec. 17, 1969.

BACKGROUND OF INVENTION

The invention herein relates to slip-in type couplings for receiving and coupling a smooth, thin wall metal or plastic tube to some other type of fixture or pipe. Conventionally, this type of coupling has consisted of a centrally bored tube receiving body containing a frustoconical shaped springy grab ring whose inner, annular edge grips and bites into the outer wall of the tube.

Usually, such couplings have included an apertured cap, through which the tube is inserted to enter the body, with the cap functioning to hold the grab ring in position within the body as well as to apply an axial force for compressing suitable sealing rings against the outer wall of the tube for preventing fluid leakage through the coupling. In this type device, it was necessary to loosen the cap in order to expand or relax the sealing ring or rings for receiving the tube, after which the cap had to be tightened for compressing the sealing rings and causing the grab ring to grip the tube against withdrawal.

An example of this prior type of tube coupling is illustrated in U.S. Pat. No. 3,312,484 to Davenport, granted Apr. 4, 1967. In the coupling illustrated, for example, in said patent, it was necessary to tighten the cap sufficiently to tightly compress the sealing ring inwardly against the tube, after insertion of the tube, in order to prevent leakage of fluid through the coupling. In addition to forming a relatively inefficient or poor seal, generally unsuitable for high-pressure fluid flow, the inward compression of the sealing rings tended to buckle or bend inwardly the thin wall of the tube.

Thus, the invention herein relates to an improvement in slip-in tube couplings of the type illustrated by way of example in the foregoing patent.

SUMMARY OF INVENTION

The invention herein generally contemplates positioning a U-shaped sealing ring within an enlarged forward end portion of the coupling body bore, with the base of the ring being frustoconical in shape to mate with or correspond with the frustoconical shape of the grab ring which is received therein in face-to-face contact, with the outer leg of the sealing ring sealed against the wall defining the bore and the inner leg sealing against the tube received within the body bore. The end cap squeezes the grab ring against the end of the coupling body for frictionally holding it in place. Thus, the cap is not loosened at any time, even for insertion of the tube, but rather once assembled, prior to insertion of the tube, remains static and is removed only for purposes of disengaging the tube from the coupling body. Under high pressure force, the U-shaped sealing ring not only applies greater inward pressure to seal against the tube, but also forces the frustoconical shaped grab ring into tighter engagement with the tube to prevent withdrawal thereof as well as fluid leakage around the outside of the tube.

The invention herein also contemplates the addition of an annular lip on the interior of the cap to serve as a stop means for preventing the frustoconical grab ring from bending reversely upon an outward withdrawal movement of the tube, thereby preventing tube withdrawal except when the cap is removed. In addition, cooperating contacts are provided on the cap and coupling body to audibly signal at the point that the cap is properly tightened upon the body to thereby prevent overtightening of the cap.

These and other objects and advantages of this invention will become apparent upon reading the following description, of which the attached drawings form a part.

DESCRIPTION OF DRAWINGS

FIG. **1** illustrates a cross-sectional, elevational view of the tube coupling herein with the end of the tube positioned within the coupling.

FIG. **2** is a reduced scale, perspective view of the cap, per se.

FIG. **3** is an elevational view, partially in cross section, of the various parts making up the coupling in disassembled relationship.

FIG. **4** is a plan view of the assembled coupling.

FIG. **5** is a cross-sectional, elevational view of a modified coupling, and

FIGS. **6** and **7** are enlarged fragmentary views showing the sealing ring respectively before and after insertion of a tube.

FIG. **8** shows the coupling of FIG. **5** with the parts disassembled.

FIG. **9** is a plan view taken in the direction of arrows **9—9** of FIG. **5**.

FIG. **10** is an end view of the cap drawn to a reduced scale, taken in the direction of arrows **10—10** of FIG. **8**.

DETAILED DESCRIPTION

The tube coupling **10** is arranged to couple a thin wall, smooth surfaced, plastic or metal tube **11** to another tube or pipe or fitting (not shown). The coupling comprises four basic elements (see FIG. **3**), namely, a centrally bored body **12**, a U-shaped in cross section sealing ring **13**, a thin springy sheet metal grab ring **14**, and a cup-shaped cap **15**. Preferably, the body and cap are molded out of a suitable plastic material and the sealing ring is made of a rubber or synthetic rubberlike plastic material.

The body **12** is provided with a stepped bore having a rear bore portion **17**, which is approximately equal to the interior diameter of the tube **11**, an intermediate bore portion **18**, which forms a shoulder or stop for the tube end, an outwardly tapering bore portion **19**, and a forward, enlarged bore portion **20**.

The body **12** is generally cylindrical in shape with an outer rear threaded area **21** for threadedly coupling to a conventional fitting or pipe. The central portion of the body is formed as a wrench gripping portion **22** and the forward end of the body is formed as a forward threaded portion **23** for threaded engagement with threads **24** formed within the cap **15**.

The outer surface of the cap is formed with wrench gripping beads **25** for grasping and twisting the cap upon the body for assembly.

The grab ring **14** is formed with an outer, flat, annular flange **27** which is squeezed between the forward end of the body and the base of the cap for holding the grab ring in position. The center of the grab ring is bent into a rearwardly extending, frustoconical portion **28** having radially extending slits **29** for increased flexibility. Its inner, annular edge defines a sharp tube gripping edge **30**.

The forwardly facing surface of the base of the sealing ring is formed into a corresponding or mating frustoconical portion **31** which receives the grab ring frustoconical portion in face-to-face contact. The outer leg **32** of the sealing ring is arranged in face-to-face contact with the wall defining the enlarged bore portion **20** and the inner leg **33** is arranged to contact the tube **11** in face-to-face relationship.

The four basic parts making up the coupling are assembled together, as shown in FIG. **1**, with the cap **15** tightened upon the body for holding the grab ring in position.

To prevent overtightening of the cap, one of the beads **25***a* is enlarged to extend rearwardly a short distance and interfere with or bump against a short, forwardly extending projection **34** formed integral with the body portion **22** (see FIG. **4**), when the cap is almost, but not completely, tightened. A further twist on the cap causes the projection and bead extension to resiliently spring away from each other slightly, enough to cause them to pass from the dotted line position to the solid line position shown in FIG. **4**, where the cap is fully tightened.

As they pass each other, an audible click occurs which signals that the cap is fully tightened. This prevents stripping the threads of the cap and body, which are preferably formed of a slightly resilient plastic material.

In use, the tube **11** is slipped through the central aperture **35** in the cap **15**, through the grab ring **14** and seal **13**, until its end bottoms in the intermediate bore portion **18**. In this position, the annular grab ring gripping edge **30** grips against and bites into the tube to prevent withdrawal, which can be accomplished only by removing the cap **15** for disengaging the grab ring from the tube.

Once the tube is inserted in the coupling, fluid leaking into the enlarged bore portion of the body causes the legs of the seal to separate so that the outer leg presses even more tightly against the bore wall and the inner leg presses even more tightly against the tube, thereby increasing the sealing force in response to any increase in pressure of the fluid attempting to leak around the tube.

In addition, the base of the seal applies a pressure, in response to fluid, against the frustoconical portion of the grab ring, thereby increasing its force of gripping against the tube and increasing it in response to increased fluid pressure. As can be seen, the greater the pressure of the fluid, the greater the sealing and gripping of the tube against withdrawal.

In order to prevent accidental withdrawal of the tube **11**, such as due to an outwardly directed force applied to the tube, wherein tube withdrawal movement has a tendency to cause the grab ring frustoconical portion to bend reversely, a stop or antireversing annular lip **36** is formed around the opening **35** on the interior of the cap. The lip is normally spaced from the grab ring as shown in FIG. **1**. However, as the grab ring buckles or tends to bend reversely due to a pull on the tube, it contacts the lip **36** which stops it against any further buckling or reversing, thereby preventing withdrawal of the tube.

An outer, annular flange **37** surrounding the outer end of the cap opening **35** increases the support and positioning of the tube **11** within the coupling.

MODIFICATION—FIGS. 5–10

FIGS. **5–10** illustrate a modification wherein the inner bore **18*a*** of the body **12*a*** is forwardly elongated and terminates in a wedgelike, annular flange **40** which fits between the legs **41–42** of an elongated, resilient U-shaped seal ring **43**. The outer ring leg **41** fits into, but is spaced from the bottom of, a slightly tapered groove **44** formed between flange **40** and forward bore portion **45**.

As shown in FIG. **6**, the outer ring leg **41** is slightly squeezed within the groove **44**. The inner ring leg is curved or bent radially inwardly by the flange **40**. When tube **11** is inserted into the coupling, the inner ring leg **42** is squeezed or compressed between the flange **40** and the tube surface, as illustrated in FIG. **7**. Nevertheless, any leakage of pressurized fluid within the coupling tends to pass between the flange **40** and into the space between seal legs **41–42** causing them to more tightly seal against the tube **11** and the surface of bore portion **45**.

Also, the flange **40**, tends to center the seal within the bore and prevent it from shifting or buckling during assembly and during tube insertion.

The cap **15** is provided with annular flange bead **46** and a number of bumps or projections **47**, corresponding to each of the wrench beads **25**. When the cap is threaded upon the body, the first of the bumps to strike and pass over the body projection **34** (see dotted lines in FIG. **9**) causes an audible click which signals that the cap is sufficiently tightened. This prevents overtightening and possible damage to the parts.

Having fully described an operative embodiment of this invention, I now claim:

1. A tube coupling comprising a centrally bored body having a rear end and a forward end into which a tube may be received, with the forward end portion of the bore being of greater diameter than the rear end portion;

a cup-shaped cap removably fastened to the forward end portion of the body and having a centrally apertured base covering the body forward end;

a grab ring formed of thin springy sheet metal shaped as a flat outer flange, clamped between the cap base and body forward end, and with an integral, central frustoconical rearwardly extending portion whose inner free edge defines an annular tube gripping edge;

a U-shaped in cross section resilient sealing ring having an outer leg in face-to-face contact with the wall defining the bore forward end portion of said body, an inner leg normally arranged to surround and contact the tube in face-to-face contact, and a base having its forward face arranged in contact with the grab ring;

said body further including a forwardly extending annular flange formed homogeneously with said body and surrounding the forward edge of the smaller diameter rear end portion of the bore and extending a short distance into the greater diameter forward end portion of the bore, to thereby define an annular groove between the flange and the wall defining the greater diameter bore portion at the rear base thereof;

said flange being wedge-shaped in cross section and extending a short distance forwardly between the legs of the sealing ring to spread the free ends of said legs apart slightly, wherein the free end portion of the outer leg is fitted within said groove, and the free end portion of the inner leg is normally arranged between and slightly compressed by the flange and said tube;

whereby a tube may be slipped through the cap base aperture, grab ring and sealing ring to the bore rear end portion for being gripped by said grab ring gripping edge, and so that fluid pressure caused by leaking fluid entering the bore forward end portion forces the sealing ring tube legs apart into tighter contact with the tube and bore wall and tends to force the sealing ring base more tightly against the grab ring so that its frustoconical portion tends to more tightly grip the tube, with said body flange maintaining said sealing ring in concentric position and holding it against twisting and buckling, as well as backing the inner leg against the tube.

2. A tube coupling as defined in claim **1**, and said groove being deeper in the axial direction than the end portion of the outer leg which is fitted into said groove to form an annular space between the base of the groove and the free end of the outer leg.

3. A tube coupling as defined in claim **1**, and including the forward face of the base of the sealing ring being formed in a frustoconical shape corresponding to and receiving in face-to-face contact the frustoconical portion of the grab ring.

4. A tube coupling as defined in claim **1**, and said cap being threadedly connected to threads formed upon said body;

said cap having a short axially rearwardly directed projection formed upon its rear end near the periphery thereof and arranged in the path of a short axially forwardly directed projection formed on the body forward end for interference contact therewith when the cap is almost tightened upon the body, and said projections being forcibly movable relative to and past each other, for forcing one past the other to the final tightened position of the cap relative to the body, and thereby producing an audible sound as they pass each other, the first occurrence of such sound signalling that the final tightened position of the cap has been reached, to thereby prevent overtightening of the cap.

5. In a tube coupling having a centrally bored body having a forward end and a rear end for receiving a tube to be coupled therein and having means within the bore for gripping and securing the tube within the bore, and a cup-shaped cap having internal threads for receiving and threadedly engaging with corresponding threads formed upon the forward end portion of the body, with the cap being centrally apertured to receive a tube inserted into said bore, the improvement comprising:

a fixed axially forwardly extending, short projection formed homogeneously on the forward end of the body and a series of circumferentially spaced apart axially rearwardly extending projections formed homogeneously on the rear end of the cap, with the projections arranged in the same rotative path so one of said series strikes the fixed projection upon rotation of the cap to the point where the cap is almost at its final tightened location upon the body, and with the projections producing an audible sound as one is forced over and passes the other, the first occurrence of such sound providing an audible signal that the cap has reached the point of final tightened location upon the body.

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