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TUBE TWISTER ENGAGING FILL TUBE

Abstract

A surgical implant fill system can include a fill tube and a tube twister. A flange of the fill tube can be keyed to the tube twister so that the fill tube does not rotate independently from the tube twister when the flange is engaged with the tube twister. A release mechanism secures the flanged end to the tube twister. Visual and tactile indications can be provided on the tube twister to show the direction of the dispensing end of the fill tube.

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Background/Summary

[0001] This application is a continuation of U.S. patent application. Ser. No. 17/680,011 filed Feb. 24, 2022, which claims the benefit of U.S. Provisional Application Ser. No. 63/153,159, filed on Feb. 24, 2021, each of which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Technical Field

[0002] The present invention generally relates to surgical instruments. More particularly, the present invention relates to instruments and methods for filling a surgical implant.

2. Background Information

[0003] Fill tubes are used to fill implants for surgical procedures such as spinal fusion procedures. In the case of diverted fill tubes, there is a need for the surgeon to rotate the fill tube.

SUMMARY

[0004] The present invention is directed toward tools and methods of filling surgical implants, such as, for example, implants used for spinal surgical procedures.

[0005] A surgical implant fill system can include a fill tube and a tube twister. A flange of the fill tube can be keyed to the tube twister so that the fill tube does not rotate independently from the tube twister when the flange is engaged with the tube twister. A release mechanism secures the flanged end to the tube twister. Visual and tactile indications can be provided on the tube twister to show the direction of the dispensing end of the fill tube.

[0006] The fill tube can include an elongated hollow body having a distal dispensing end and an opposing proximal end, and a flange disposed at the proximal end that extends outward in a plane perpendicular to a longitudinal axis of the elongated hollow body. The tube twister can include a hub, including a recess defined therein, and a release lever provided to the hub. The release lever is movable between an open and a closed position with respect to the recess. The flange of the fill tube and the recess in the tube twister can be respectively sized and shaped such that the fill tube is keyed to the tube twister when the flange is disposed in the recess and the release lever is in the closed position.

[0007] A spring can be disposed in the tube twister such that the spring biases the release lever to the closed position. The flange can define a flat side and an opposing curved side. The tube twister can include tactile and/or visual indicators of the fill direction of the distal dispensing end of the fill tube. A dowel can be disposed in the tube twister such that the dowel guides the release lever as the release lever moves between the open and closed positions.

[0008] A surgical instrument can include a base, an inserter tube extending distally from the base, a handle extending radially from the base, a fill tube disposed longitudinally through the inserter tube, and a tube twister engaged with the proximal end of the fill tube. The flange and recess are respectively sized and shaped such that the fill tube is keyed to the tube twister when the flange is disposed in the recess and the release lever is in the closed position.

[0009] A method of operating a fill tube for filling a surgical implant can include keying a flanged end of a fill tube to a tube twister so that the fill tube cannot rotate axially relative to the tube twister. A release lever can be engaged with the flanged end so that the flanged end cannot be unkeyed when the release lever is in a closed position. The release lever can be biased to maintain the closed position. The tube twister can be rotated about a longitudinal axis of the fill tube to rotate a direction of a dispensing end of the fill tube. The direction of the dispensing end of the fill tube can be indicated visually and/or tactilely on the tube twister.

[0010] The release lever can be moved to an open position. Then the fill tube can be inserted through the tube twister in a distal direction while the release lever is in the open position until the flange engages a recess in the tube twister. The release lever can then be moved to the closed position. The movement of the release lever to the closed position can be automatically performed via a spring disposed in the tube twister.

[0011] The detailed technology and preferred embodiments implemented for the subject invention

are described in the following paragraphs accompanying the appended drawings for people skilled in this field to well appreciate the features of the claimed invention. It is understood that the features mentioned hereinbefore and those to be commented on hereinafter may be used not only in the specified combinations, but also in other combinations or in isolation, without departing from the scope of the present invention.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is a perspective view of an implant filling instrument in accordance with embodiments of the present invention.

[0013] FIG. **2** is a perspective view of a proximal end of a fill tube in accordance with embodiments of the present invention.

[0014] FIG. **3** is a perspective view of a distal end of a fill tube in accordance with embodiments of the present invention.

[0015] FIG. **4** is a perspective view of a fill tube twister in accordance with embodiments of the present invention.

[0016] FIG. **5** is a bottom view of a fill tube twister in accordance with embodiments of the present invention.

[0017] FIG. **6** is a side cross-sectional view of a fill tube twister in accordance with embodiments of the present invention.

[0018] FIG. **7** is an exploded assembly perspective view of a fill tube twister in accordance with embodiments of the present invention.

[0019] FIG. **8** is a perspective view of a fill tube twister in accordance with embodiments of the present invention.

[0020] FIG. **9** is a perspective view of the fill tube twister of FIG. **8** engaging the proximal end of a fill tube in accordance with embodiments of the present invention.

[0021] FIG. **10** is a perspective view of the fill tube twister of FIG. **8** disengaged from the proximal end of a fill tube in accordance with embodiments of the present invention.

[0022] While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular example embodiments described. On the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION

[0023] In the following descriptions, the present invention will be explained with reference to example embodiments thereof. However, these embodiments are not intended to limit the present invention to any specific example, embodiment, environment, applications or particular implementations described in these embodiments. Therefore, description of these embodiments is only for purpose of illustration rather than to limit the present invention.

[0024] It should be appreciated that dimensional relationships among individual elements in the attached drawings are illustrated only for ease of understanding, but not to limit the actual scale.

[0025] The tube twister and the instrument system described herein allows a surgeon to rotate a diverted fill tube without first disengaging or partially withdrawing the fill tube. This allows the diverted fill tube to be rotated within a mesh implant during filling (bone stock discharged out of the fill tube) without first removing the fill tube from the compressed bone pack within the implant.

[0026] Referring to FIG. **1**, an implant filling instrument **100** is shown. The instrument includes a base **102**, an inserter tube **104** extending distally from the base **102**, a handle **106** extending radially

from the base **102**, a fill end **108** disposed proximally of the base **102**, a fill tube **110** disposed longitudinally through the inserter tube **104** from the fill end **108**, and a tube twister **112** engaged with a proximal end of the fill tube **110**.

[0027] As shown in FIGS. **1-3**, the fill tube **110** is a diverter fill tube. An angled opening **114** is defined at a distal end of the elongated hollow body **111** of the fill tube **110**. A flange **116** is formed at the proximal end of the elongated hollow body **111** of the fill tube **110**. The flange **116** is eccentrically-shaped. In the depicted embodiment, the flange **116** extends in a plane perpendicular to the longitudinal axis of the fill tube's elongated hollow body, and defines a flat lateral side **118** and an opposing curved lateral side **120**. In an end view along the longitudinal axis of the elongated hollow body **111** the flange **116** generally resembles a capital letter D.

[0028] Referring now to FIGS. **4-7**, the tube twister **112** comprises a hub **122** that has a central aperture **124** defined therethrough in alignment with the longitudinal axis of the fill tube's **110** elongated hollow body. A lateral channel **126** is defined radially inward from a sidewall of the hub **122** to pass across the aperture **124**. An engagement lever **128** (also referred to as a locking tab) is disposed in the channel such that the lever can translate radially inward and outward of the sidewall of the hub **122** in a plane perpendicular to the longitudinal axis of the fill tube's **110** elongated hollow body. A bias member, such as a spring **130**, is disposed between a portion of the hub **122** and lever **128** to bias the lever **128** into a closed or engaged position as will be discussed below. A dowel **132** can be disposed in the hub **122** to support and guide the translating movement of the engagement lever **128** through its full travel.

[0029] The lever **128** defines an aperture **134** through its body such that the fill tube can pass entirely through the aperture, including the flange **116**, as the fill tube **110** is inserted into the instrument **100** in the distal direction. A recess **138** is defined distally into a proximal-facing surface in the channel **126** of the hub **122**. The recess **138** is sized and shaped to match the perimeter shape of the flange such that the fill tube **110** cannot rotate about its longitudinal axis when the flange **116** is seated in the recess **138**. Thus, the fill tube **110** is keyed to the hub **122**. The flange **116** is seated in the recess **138** when the fill tube **110** is fully disposed distally into the instrument **100**. The outer circumferential surface **140** of the hub **122** can be textured or ribbed to provide enhanced grip by the surgeon.

[0030] Referring now to FIGS. **8-10**, use or operation of the tube twister **112** will now be described. When the surgeon desires to rotate the orientation of the distal end of the fill tube **110**, the tube twister **112** is rotated by grasping and rotating the hub **122**. The distal end of the fill tube correspondingly rotates.

[0031] The tube twister **112** is shown in FIG. **8** prior to engaging the proximal end of the fill tube **110**. The lever is biased into the closed or latched state until pressure is applied to the axially-exposed side **136** of the lever **128** by a finger or thumb of the operator (surgeon or other surgical personnel).

[0032] Moving now to FIG. **9**, the lever **128** is being held in the release position by the operator (operator's thumb not shown) with sufficient force to overcome the force of the spring **130**. The fill tube **110** is inserted into the instrument distal end first through the aperture **134** in the lever **128** and the center aperture **124** of the hub **122** until the flange **116** is seated in the recess **138** of the hub **122**. Then the operator's force on the lever **128** is removed and the spring **130** causes the lever **128** to slide into the closed or latched position as shown in FIG. **10**. It can be seen in FIG. **10** that the fill tube **110** cannot move proximally with respect to the tube twister **112** while the lever **128** is in the closed or latched position.

[0033] The surgeon can rotate the tube twister **112** to rotate the fill direction of the angled opening **114** of the fill tube **110**.

[0034] Because the flange shape is keyed to the hub **122**, the fill tube **110** is always seated in the same rotational position with respect to the hub **122**. This allows rotational reference tactile marker **142** and/or visual marker **144** to be provided to indicate to the surgeon, both visually and tactilely,

the fill direction of the angled opening **114**.
[0035] The fill tube **110** can be removed from the tube twister **112** by reversing the steps described above.
[0036] The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is, therefore, desired that the present embodiment be considered in all respects as illustrative and not restrictive. Those skilled in the art may recognize other equivalents to the specific embodiment described herein which equivalents are intended to be encompassed by the claims attached hereto.

Claims

1. A surgical implant fill system, comprising: a fill tube, comprising: an elongated hollow body having an distal dispensing end and an opposing proximal end; and a flange disposed at the proximal end that extends outward in a plane perpendicular to a longitudinal axis of the elongated hollow body; and a tube twister, comprising: a hub, including a recess defined therein; and a release lever provided to the hub, the release lever movable between an open and a closed position with respect to the recess, wherein the flange and recess are respectively sized and shaped such that the fill tube is keyed to the tube twister when the flange is disposed in the recess and the release lever is in the closed position.
2. A surgical instrument, comprising: a base; an inserter tube extending distally from the base; a handle extending radially from the base, a fill tube disposed longitudinally through the inserter tube, the fill tube, comprising: an elongated hollow body having a distal dispensing end and an opposing proximal end; and a flange disposed at the proximal end that extends outward in a plane perpendicular to a longitudinal axis of the elongated hollow body; and a tube twister engaged with the proximal end of the fill tube, the tube twister comprising: a hub, including a recess defined therein; and a release lever provided to the hub, the release lever movable between an open and a closed position with respect to the recess, wherein the flange and recess are respectively sized and shaped such that the fill tube is keyed to the tube twister when the flange is disposed in the recess and the release lever is in the closed position.
3. The surgical implant fill system of claim 1, further comprising a spring disposed in the tube twister such that the spring biases the release lever to the closed position.
4. The surgical implant fill system of claim 1, wherein the flange defines a flat side and an opposing curved side.
5. The surgical implant fill system of claim 1, wherein the tube twister includes a visual indicator of the fill direction of the distal dispensing end of the fill tube.
6. The surgical implant fill system of claim 1, wherein the tube twister includes a tactile indicator of the fill direction of the distal dispensing end of the fill tube.
7. The surgical implant fill system of claim 1, further comprising a dowel disposed in the tube twister such that the dowel guides the release lever as the release lever moves between the open and closed positions.
8. The surgical implant fill system of claim 2, further comprising a spring disposed in the tube twister such that the spring biases the release lever to the closed position.
9. The surgical implant fill system of claim 2, wherein the flange defines a flat side and an opposing curved side.
10. The surgical implant fill system of claim 2, wherein the tube twister includes a visual indicator of the fill direction of the distal dispensing end of the fill tube.
11. The surgical implant fill system of claim 2, wherein the tube twister includes a tactile indicator of the fill direction of the distal dispensing end of the fill tube.
12. The surgical implant fill system of claim 2, further comprising a dowel disposed in the tube

twister such that the dowel guides the release lever as the release lever moves between the open and closed positions.