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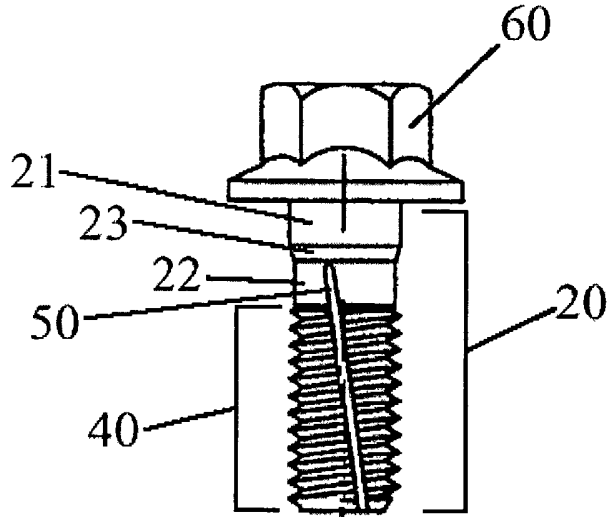
(54) Title: FLUID CONNECTOR



(57) Abstract: The present invention relates to a fluid connector, comprising a shaft having at least one solid shaft element and a plurality of connector surfaces, wherein the plurality of connector surfaces includes a surface with a plurality of threads and a plurality of grooves.

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FLUID CONNECTOR

FIELD OF THE INVENTION

This invention relates to connectors for fluid distribution systems, and particularly to fluid connectors used to distribute fluids under pressure.

BACKGROUND OF THE INVENTION

Fluid connectors are known in the art and are referred to as "flow bolts" or "flow bolt assemblies." Such devices in the prior art are typically fabricated with external threads and an internal cavity through which fluid flows. Examples of such flow bolts are shown in U.S. Patent No. 5,011,192 to Campo, entitled "Bolt Retaining Hydraulic End Fitting Assembly." However, such flow bolts are weaker connectors because they are made with an internal cavity.

The present invention is directed to overcoming this and other disadvantages inherent in prior-art systems.

SUMMARY OF THE INVENTION

The scope of the present invention is defined solely by the appended claims, and is not affected to any degree by the statements within this summary. Briefly stated, a fluid connector, comprising a shaft having at least one solid shaft element and a plurality of connector surfaces, wherein the plurality of connector surfaces includes a surface with a plurality of threads and a plurality of grooves.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 depicts a preferred embodiment of a fluid connector.

Figure 2 depicts the bottom view of the preferred embodiment of a fluid connector.

Figure 3 depicts an alternative embodiment of a fluid connector.

Figure 4 depicts a view of the outside of a second embodiment of a fluid connector.

Figure 5 depicts a third embodiment of a fluid connector.

Figure 6 depicts a fourth embodiment of a fluid connector.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTs

Turning now to the drawings, FIG. 1, 2, and 3 show a fluid connector 10 constituting a preferred embodiment of the present invention. The fluid connector 10 is

composed of a metal, preferably aluminum. According to one aspect of the present invention, the metal is copper. According to another aspect of the present invention, the metal is iron.

Those skilled in the art will appreciate that the metal is an alloy. According to one aspect of the present invention, the metal includes ferrous and non-ferrous materials. According to another aspect of the present invention, the metal is a steel. Those skilled in the art will appreciate that steel is in a plurality of formulations, such as stainless steel. According to one embodiment of the present invention the steel is a low carbon steel. In another embodiment of the present invention, the steel is a medium carbon steel. According to yet another embodiment of the present invention, the steel is a high carbon steel.

Those with skill in the art will also appreciate that the metal is a super alloy. According to one aspect of the present invention, the super alloy is bronze; according to another aspect of the present invention, the super alloy is a high nickel material. According to yet another aspect of the present invention, the fluid connector 10 is composed of martensitic material. According to still another aspect of the present invention, the fluid connector 10 is composed of austenitic material. According to another aspect of the present invention, the metal is a ferritic material.

The fluid connector 10 includes a shaft 20. The shaft 20 is composed of at least one of a plurality of shaft elements. According to one aspect of the present invention, the shaft element is cylindrical in shape. According to another aspect of the present invention, the shaft element is conical in shape. According to yet another aspect of the present invention, the shaft element is solid. According to still another aspect of the present invention, the shaft element is hollow.

FIG. 1 depicts the preferred embodiment of the present invention composed of a plurality of shaft elements. The shaft 20 includes an upper cylindrical shaft element 21, a lower cylindrical shaft element 22, and a conical shaft element 23. In the preferred embodiment, the upper cylindrical shaft element 21 is joined to the lower cylindrical shaft element 22 via the conical shaft element 23.

The fluid connector 10 of the present invention is provided with a plurality of connector surfaces. According to one aspect of the present invention, the connector surface is an unthreaded surface 30. According to another aspect of the present invention, the connector surface is a surface composed of a plurality of threads 40. According to yet another aspect of the present invention, the connector surface is a

surface composed of at least one groove 50. According to yet another aspect of the present invention, the connector surface is a surface composed of a plurality of threads 40 and at least one groove 50.

FIG. 1 depicts the preferred embodiment of the present invention composed of a plurality of connector surfaces. FIG. 2 depicts a bottom view of the preferred embodiment of the present invention. As illustrated in FIG. 1, the shaft 20 provides a suitable location for at least one of the plurality of connector surfaces. The lower cylindrical shaft element 22 of the preferred embodiment includes a plurality of threads 40 and a plurality of grooves 50. The upper cylindrical shaft element 21 and the conical shaft element 23 of the preferred embodiment provide an unthreaded surface 30. FIG. 2 depicts a bottom view of the shaft 20.

The connector surfaces of the present invention perform a plurality of functions. In the preferred embodiment, the surface composed of a plurality of threads 40 functions to couple the fluid connector 10 to another structure. This function is accomplished through the interaction of the plurality of threads 40 and the cooperating threads of another structure (not shown).

In the preferred embodiment, the surface composed of at least one groove 50 functions to channel fluid from one end of the shaft 20 to the other. In the preferred embodiment, this function is accomplished through channeling fluid through at least one groove 50. In the preferred embodiment of the present invention, the groove 50 functions to channel fluid.

The present invention is fabricated through a plurality of processes. According to one aspect of the present invention, the fluid connector 10 is machined. According to another aspect of the present invention, the fluid connector 10 is hot formed or forged. According to yet another aspect of the present invention, the fluid connector 10 is fabricated through casting. The preferred embodiment of the present invention is cold formed (also known as "cold head").

The process of cold forming the preferred embodiment begins with a metal wire or metal rod which is drawn to size. After being drawn to size, the wire or rod is upset by being run through a series of dies or extrusions. After the wire or rod is run through a series of dies or extrusions, the wire or rod has been changed to a semi-formed state. In the semi-formed state, the metal is rolled so that a surface with at least one groove 50 is formed. In the preferred embodiment, a plurality of grooves 50 are rolled into the shaft 20 so that they form a spiral. Those skilled in the art will appreciate that a plurality

of grooves 50 can be fabricated so that they are straight and do not form a spiral and, furthermore, that a plurality of grooves can be fabricated to form a spiral of any degree.

While the preferred embodiment depicted in FIG. 1 illustrates a groove 50 fabricated through rolling, those skilled in the art will appreciate that a groove may be fabricated in other ways, and the groove of the present invention is not limited to a groove fabricated through rolling. As used herein, a groove is any structure which allows for fluid flow on a connector surface.

After a plurality of grooves 50 has been impressed into the surface, a surface with a plurality of threads 40 is formed through a similar rolling process. In the preferred embodiment, threads are rolled to half the depth of the plurality of grooves 50. However, those skilled in the art will appreciate that the groove and the threads can be made through machining or drilling with a different ratio of relative depths. Furthermore, those skilled in the art will appreciate that the present invention can be threaded and then rolled with a groove.

The presently preferred embodiment includes a torque transferring structure 60. As used herein, a torque transferring structure is any structure which allows a torque to be transferred to the present invention. The torque transferring structure 60 of the preferred embodiment cooperates with the surface with threads 40 to tighten or loosen the connection between the present invention and another structure. In the preferred embodiment of the present invention, the torque transferring structure 60 is a polygonal cap. Alternatively, the torque transferring structure 60 is a recessed area 61, such as will fit a screw driver.

Those skilled in the art will appreciate that torque is transferred via a plurality of structures and that any such structure can be used without departing from the spirit of the present invention. Any structure which allows a torque to be transferred to the present invention is a torque transferring structure within the scope of the present invention.

FIG. 3 depicts the hollow shaft element of an alternative embodiment of the present invention. In the alternative embodiment of FIG. 3, a surface with a plurality of threads 40 defines an inner section 24 which accommodates a threaded rod 25. Within the surface with a plurality of threads 40, a groove 50 is provided through which fluid flows. As depicted in FIG. 3, the alternative embodiment is preferably provided with a torque transferring structure 60, which is in the form of a roughened gripping surface 62. However, as noted above, those skilled in the art will appreciate that torque may be

transferred through other structures, such as a recessed area 61, as depicted in FIG. 4. FIG. 4 depicts the outer surface 26 of the hollow shaft element of the alternative embodiment of the present invention with an alternative torque transferring structure 60.

FIG. 5 depicts a second alternative embodiment of the present invention. As illustrated in FIG. 5, a surface with a plurality of threads 40 defines an inner section 24 which accommodates a threaded rod. Within the surface with a plurality of threads 40, a groove is provided through which fluid flows. In the alternative embodiment depicted in FIG. 5, an opening 27 is provided which accommodates a fluid conveying structure, such as a nozzle (not shown). Those skilled in the art will appreciate that the opening 27 may be defined in the outer surface 26. As illustrated in FIG. 5, the inner section 24 accommodates a threaded rod.

FIG. 6 depicts a third alternative embodiment of the present invention configured as a coupler 11. The coupler 11 depicted in FIG. 6 is composed of an outer surface 26 and a surface with a plurality of threads 40 which defines an inner section 24. The inner section 24 accommodates at least one threaded rod 25, preferably two threaded rods. Within the threaded surface 40, a groove 50 is provided through which fluid flows. As depicted in FIG. 6, the coupler 11 is preferably provided with a torque transferring structure 60.

While this invention has been particularly shown and described with references to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

WHAT IS CLAIMED IS:

1. A fluid connector, comprising:
   a) a shaft having at least one solid shaft element and a plurality of connector surfaces, wherein the plurality of connector surfaces includes a surface with a plurality of threads and a plurality of grooves.
2. A fluid connector according to claim 1, wherein at least one groove is formed in the shape of a spiral.
3. A fluid connector according to claim 1, wherein the plurality of connector surfaces includes a surface with at least four grooves.
4. A fluid connector according to claim 1, wherein the shaft is fabricated through cold forming.
5. A fluid connector according to claim 1, wherein the shaft is composed of solid shaft elements.
6. A fluid connector according to claim 1, wherein the shaft includes at least one hollow shaft element.
7. A fluid connector according to claim 1, further comprising a torque transferring structure, wherein the torque transferring structure allows a torque to be transferred to the shaft.
8. A fluid connector, comprising:
   a) a hollow shaft having an outer surface and a surface with a plurality of threads and a plurality of grooves defining an inner section, wherein the inner section accommodates a rod.
9. A fluid connector according to claim 8, wherein at least one groove is formed in the shape of a spiral.
10. A fluid connector according to claim 8, wherein the plurality of connector surfaces includes a surface with at least four grooves.
11. A fluid connector according to claim 8, further comprising a torque transferring structure, wherein the torque transferring structure allows a torque to be transferred to the shaft.
12. A fluid connector, comprising:
   a) a shaft having a plurality of solid shaft elements and a plurality of connector surfaces, wherein the plurality of connector surfaces includes a surface with a plurality of threads and a plurality of grooves; and

b) a torque transferring structure, wherein the torque transferring structure allows a torque to be transferred to the shaft.

13. A fluid connector according to claim 12, wherein at least one groove is formed in the shape of a spiral.

14. A fluid connector according to claim 12, wherein the plurality of connector surfaces includes a surface with at least four grooves.

15. A fluid connector according to claim 12, wherein the shaft is fabricated through cold forming.

16. A fluid connector according to claim 12, wherein the shaft is composed of solid shaft elements.

17. A fluid connector according to claim 12, wherein the shaft includes at least one hollow shaft element.

18. A fluid connector according to claim 12, wherein the plurality of connector surfaces includes a surface with at least four grooves in the shape of a spiral.

19. A fluid connector according to claim 12, wherein the plurality of connector surfaces includes a surface with at least two grooves in the shape of a spiral.

20. A fluid connector according to claim 12, wherein the torque transferring structure is a polygonal cap.

FIG. 1

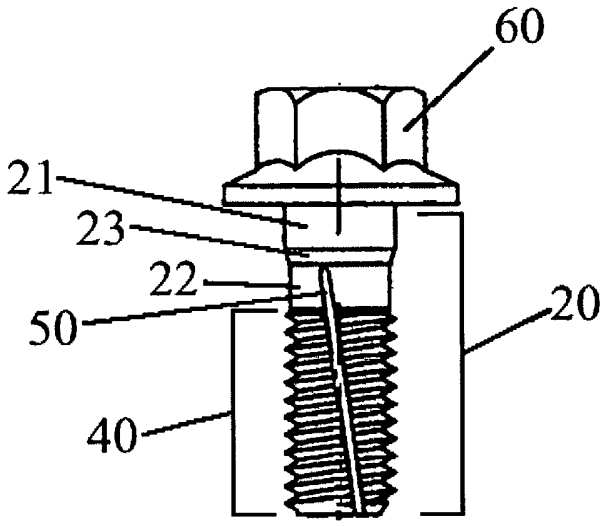

FIG. 2

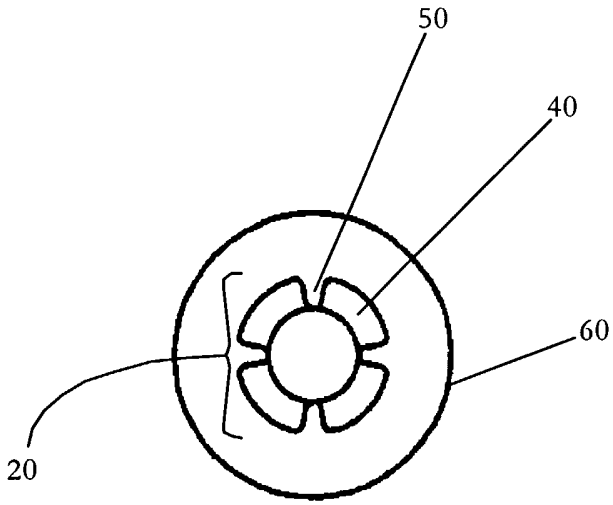

FIG. 3

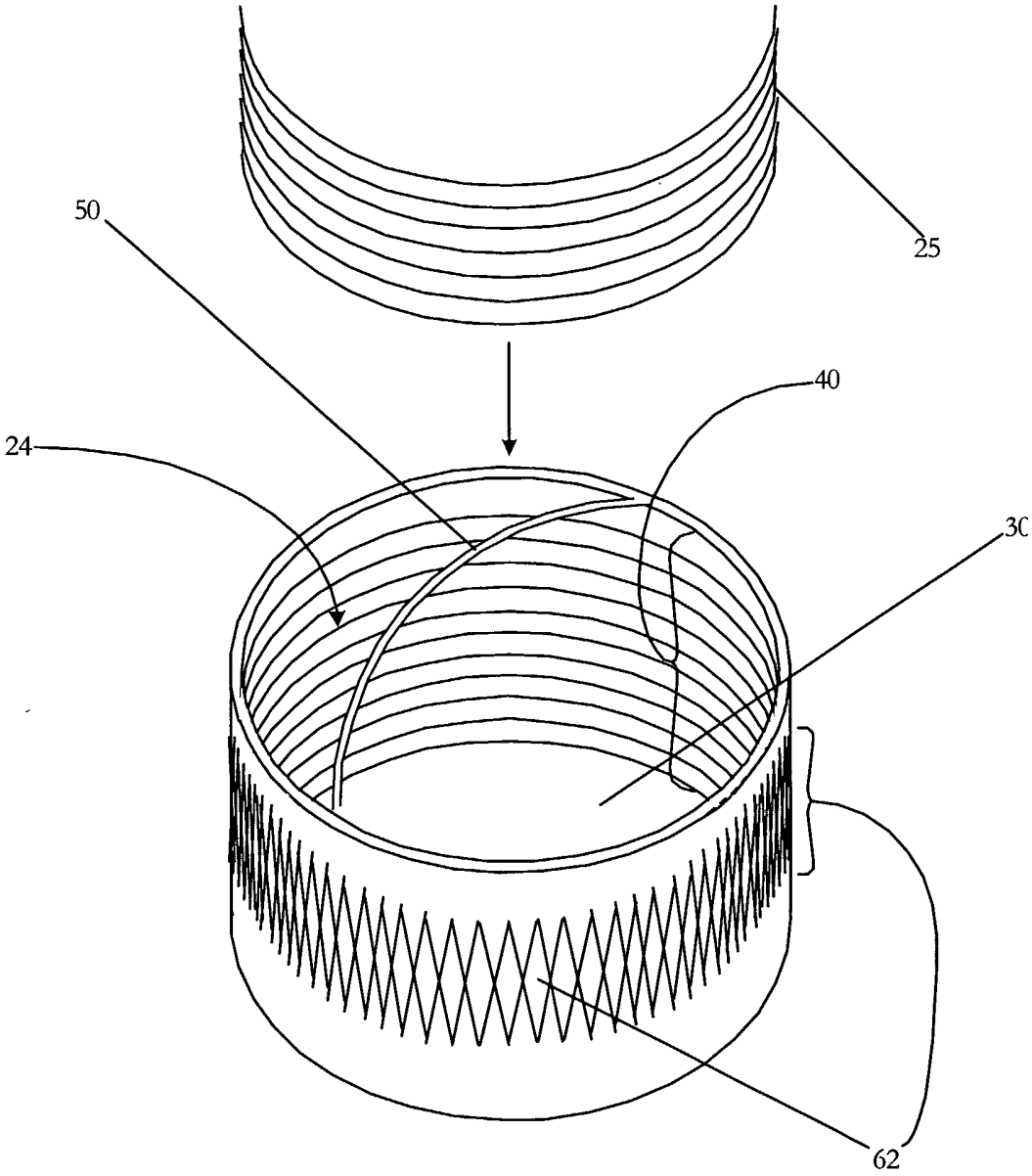

FIG. 4

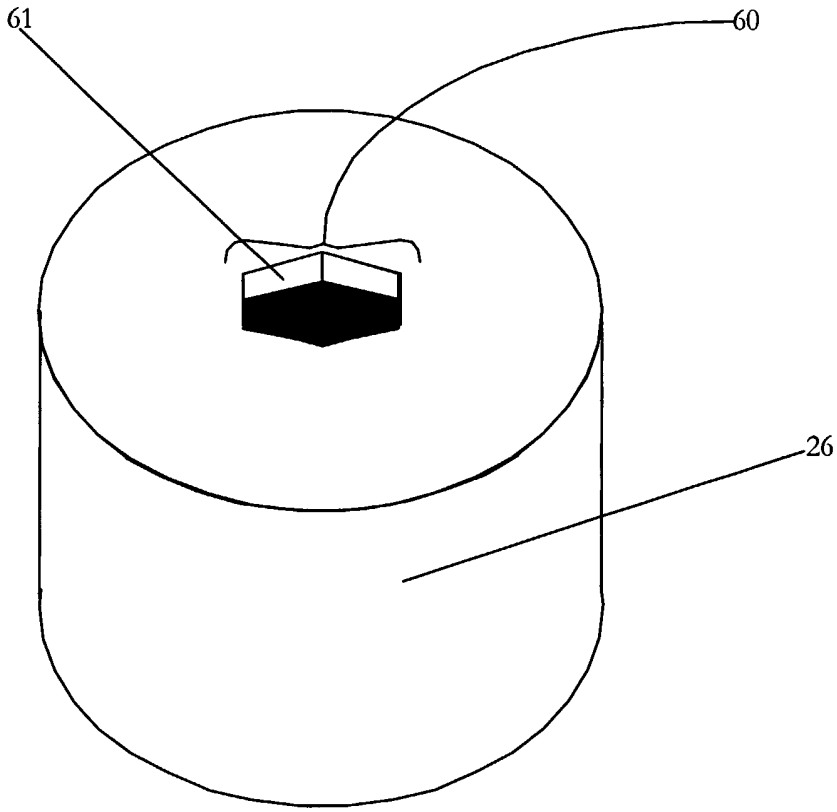

FIG. 5

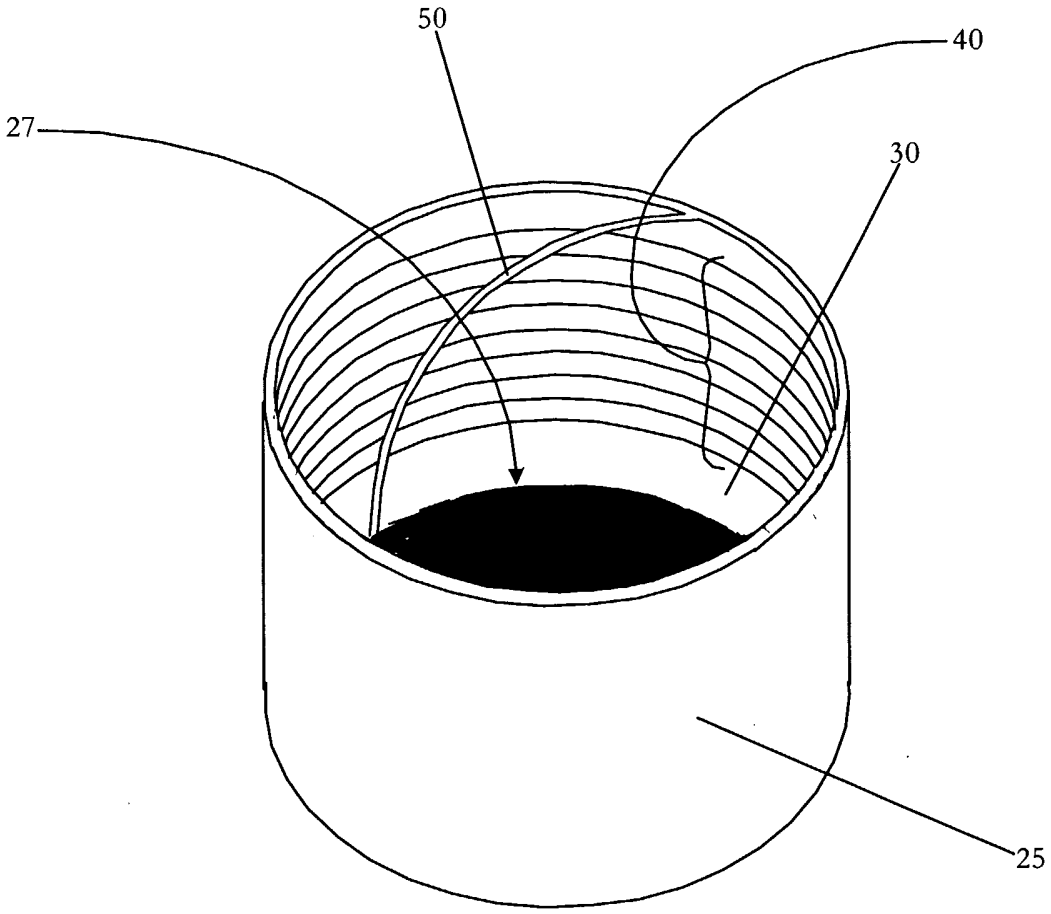

FIG. 6