A first annular ring (44) has a keyed opening (64) sized to fit around the nut region (40) of a male coupling (14), and a second annular ring (42) has a keyed opening (52) sized to fit around the nut (26) of a female coupling (12). Each ring (42, 44) has mating ratchet teeth (56, 62), and these rings (42, 44) are biased together, thereby engaging these teeth (56, 62) and preventing rotation of these rings. This in turn prevents the rotation of the male nut region (40) with respect to the female nut (26). For tube-to-bulkhead locking, one facet (70) of one ring (44) is notched, and a pin (88) is pressed into an opening (84, 86) in the bulkhead (80). This pin (88) is sized to fit within one of the notches (74) in the ring (44), thereby preventing rotation of this ring (44) with respect to the bulkhead (80).

26 Claims, 5 Drawing Figures
TUBE COUPLING DEVICE

ORIGIN OF THE INVENTION

The invention described herein was made by employees of the United States Government and may be manufactured and used by or for the government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This application is a continuation of application Ser. No. 692,801, filed Jan. 18, 1985 now abandoned.

TECHNICAL FIELD

This invention pertains generally to fluid coupling assemblies, and more particularly to an apparatus for positively locking such together.

BACKGROUND OF THE INVENTION

By their very nature, fluid couplings, which depend for their integrity upon one being threadably torqued into another, are subject to failure because unthreading may occur, particularly in an environment where there is vibration. The problem becomes acute where the fluids being coupled are hazardous or critical equipment failure may occur in the event of a leakage. Both undesirable states may occur where fluid being coupled is an ignitable fuel and the locale is an aircraft or space vehicle.

Currently, and perhaps the best presently known method to lock crucial fluid couplings together, is to secure them with a wire, there typically being openings in portions of mating fittings through which a wire from one to the other may be fastened. The typical problem with this means is that often the wire has too much slack or stretches, so some loosening may occur before positive locking is effected.

Another locking arrangement for locking elements of a conventional two-part fluid coupler is disclosed in U.S. Pat. No. 3,201,149. In this case, the coupling itself is specially constructed wherein a collar nut of one part of the fitting has teeth around an end which mesh with facing teeth on a locking ring of the second part of the fitting. This ring also has teeth around its internal diameter, and these fit over and lock to mating teeth on an outer diameter of a fixed portion of the second part of the fitting. This ring is spring biased to a position where the two sets of teeth are engaged wherein ultimate locking of the two parts of the fitting is effected.

It is the object of this invention to provide a locking assembly which is adapted to lock together elements of existing, standard, fluid couplers and to accomplish this by an assembly which is positive in its locking and yet is relatively simple and inexpensive to manufacture.

SUMMARY OF THE INVENTION

In accordance with this invention, the two relatively tightenable fittings of a coupled joint are each surrounded by a sleeve contoured to firmly grip each fitting, and the sleeves have interengaging teeth. After the fitting has been tightened, these sleeves are held in place by a spring which maintains a selected engagement between the teeth of the sleeves. As the teeth are spaced at a relatively small pitch, the fitting may be quite precisely tightened and yet the sleeves effect secure tightening of them.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded pictorial view, partially broken away, of the hydraulic line coupling device.

FIG. 2 is an exploded pictorial view, partially broken away, of one sleeve illustrating the notch orientation.

FIG. 3 is a planar view, partially broken away, of an assembled line-to-line coupling taken along line 3–3 of FIG. 2.

FIG. 4 is an exploded pictorial view, partially broken away, of an assembled line-to-component or bulkhead coupling taken along line 4–4 of FIG. 2.

FIG. 5 is a planar view, partially broken away, of the bulkhead and a fitting member showing the alternate pin openings.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring initially to FIG. 1, there is shown an exploded view illustrating the employment of tube locking assembly 10 to lock together fitting members 12 and 14 of a conventional fitting assembly 16. Fitting member 12 includes a tubular element 18 which is connected at one end by swage joint 20 to tube 22. The opposite end 24 of element 18 is typically tapered and machined for sealably engaging a complementary surface. A collar nut 26 encircles end 24 of tubular element 18, and nut 26 is movable both rotationally and longitudinally about tubular element 18.

Fitting member 14 has an end region 30 which is coupled via a swage connection 32 to tube 34, a protruding annular nose 36 having an end region machined to engage end 24 of tubular element 18, a threaded region 38 on which nut 26 is tightened to effect connection, and a hexagonal wrench gripping or nut region 40.

Locking assembly 10 includes two interlocking sleeves 42 and 44 and a split washer 46 which is nonplanar in order to function as a spring between the face 48 of nut 26 and inwardly extending shoulder 50 of sleeve 42. Sleeve 42 is generally annular, having a hexagonally keyed opening 52 sized to fit closely around nut 26 of fitting member 12 with little or no play or slippage whereby nut 26 is rotationally locked to sleeve 42. A major portion of the outer periphery of sleeve 42 is hexagonally shaped to enable gripping by a wrench (not shown). Edge 54 of sleeve 42 has a ring of ratchet teeth 56, these teeth generally extending in an axial direction. An annular notch 58 is formed between shoulder 50 and the hexagonal inner surface of sleeve 42, and a split washer 46 is installed in this notch by first contracting the washer, this enabled by the split in the washer. Face 60 of fitting member 14 slips through washer 46 and sealably engages with end 24 of element 18, and during such engagement, washer 46 is pressed against shoulder 50 by nut 26. When thusly pressed, washer 46 provides a spring bias that biases sleeve 42 away from nut 26. Split washer 46 would typically be a wave or Belleville washer.

Sleeve 44 is similar to sleeve 42, having a ring of ratchet teeth 62 facing and engageable with ratchet teeth 56 of sleeve 42. Ratchet teeth 56 and 62, which face each other, are configured such that, when they are compressably engaged, they enable sleeve 42 and thus nut 26 to be rotated in one direction, a tightening direction, with respect to sleeve 44 but prevent the rotation of nut 26 in an opposite direction. Hexagonally keyed opening 64 within sleeve 44 is similar to hexagonally keyed opening 52 of sleeve 42. It is sized to closely fit the nut 26. Sleeve 44 is aligned via a hinge (not shown) that clears the washer 46.
3. An assembly as set forth in claim 1 wherein said second sleeve is configured having a series of discrete and engageable surfaces, and said axially directed openings are located in one of said discrete and engageable surfaces of said second sleeve.

4. An assembly as set forth in claim 1 further comprising a third coupling member having a third region adapted to accept said additional threaded region of said second coupling member and including at least one receptacle positioned to be aligned with at least one of said axially directed openings of said second sleeve and a pin configured to extend into a said axially directed opening and a said receptacle.

5. An assembly as set forth in claim 4 wherein said third coupling member comprises a bulkhead.

6. An assembly as set forth in claim 5 wherein there are two said receptacles in said bulkhead equally spaced from said third region, each said receptacle being align-
as a stop to prevent the sleeve from slipping completely over the male coupling nut.

18. A locking assembly according to claim 12 further comprising:
   said second tubular sleeve having along its rear edge that forms its rear opening a plurality of axially directed openings adapted to receive a pin fitted within a surrounding bulkhead associated with said second coupling nut to completely lock the second tubular sleeve from rotation.

19. A locking assembly for couplings having a rotatable female collar nut with outer discrete wrench engageable surfaces and a fixed male collar nut with outer discrete wrench engageable surfaces which nuts are screwed together to effect a connection, comprising:
   a first tubular sleeve having a rear opening with an inner surface configured to slideably fit over said rotatable female collar nut and engage its outer discrete surfaces, and a forward opening formed by an annular shoulder extending from the inner surface of said sleeve;
   said first tubular sleeve having a ring of ratchet teeth on its forward edge surrounding the forward opening, and having an internal spring means adapted to cause a spring bias that urges said tubular sleeve forward;
   a second tubular sleeve having a rear opening with an inner surface configured to slideably fit over a rear portion of said male collar nut and engage its outer discrete surfaces, and having a forward opening formed by an annular shoulder extending from its inner surface which serves to cooperatively engage the ring of ratchet teeth on said first tubular sleeve to permit tightening rotation in one direction of said first tubular sleeve with its female collar nut but prevents loosening rotation in the opposite direction; and
   said second tubular sleeve having a ring of ratchet teeth on its forward edge surrounding the forward opening that cooperatively engage the ring of ratchet teeth on said first tubular sleeve to permit tightening rotation in one direction of said first tubular sleeve with its female collar nut but prevents loosening rotation in the opposite direction; and
   said internal spring means is a non-planar washer.

22. A locking assembly according to claim 20 further comprising:
   said internal spring is a wave washer.

23. A locking assembly according to claim 20 further comprising:
   said first tubular sleeve having a rear opening with a hexagonal inner surface, and
   said second tubular sleeve having a rear opening with a hexagonal inner surface.

24. In combination with a tube coupling having on one tube end a rotatable female collar nut with outer discrete wrench engageable surfaces and on another tube a fixed male collar nut with outer discrete wrench engageable surfaces and having a forward opening formed by an annular shoulder extending from its inner surface which serves to cooperatively engage the ring of ratchet teeth on said first tubular sleeve to permit tightening rotation in one direction of said first tubular sleeve with its female collar nut but prevents loosening rotation in the opposite direction; and

25. A locking assembly according to claim 20 further comprising:
   said internal spring means is a wave washer.

26. A locking assembly according to claim 20 further comprising:
   said first tubular sleeve having a rear opening with a hexagonal inner surface, and
   said second tubular sleeve having a rear opening with a hexagonal inner surface.
engageable surfaces, the nuts being screwed together to effect a coupling between ends of the tubes, comprising:

a first tubular sleeve having a rear opening receiving said female collar nut, said rear opening having an inner surface complementary to the outer discrete wrench engageable surface of said rotatable female collar nut;

said first tubular sleeve having a ring of ratchet teeth on its forward edge surrounding its forward opening;

said second tubular sleeve having a rear opening receiving said male collar nut, said rear opening having an inner surface complementary to the outer discrete wrench engageable surface of said male collar nut, and a forward opening through which the forward portion of the fixed male collar nut extends;

said second tubular sleeve having a ring of ratchet teeth on its forward edge surrounding the forward opening that cooperatively engage the ring of ratchet teeth on said first tubular sleeve to permit tightening in one rotational direction of said first tubular sleeve and said female collar nut to said second tubular sleeve and said male collar nut but prevents loosening thereof in the opposite rotational direction;

said first tubular sleeve having a spring biased means acting against said female collar nut to urge said first tubular sleeve forward and thereby keep its ring of ratchet teeth engaged with the ratchet teeth of said second tubular sleeve but permitting slight backward motion of the first tubular sleeve relative to the female collar nut as the ratchet teeth are moved to accommodate a tightening rotation, and permitting a manual pulling back of said first tubular sleeve against the forward spring bias to disengage the ratchet teeth of said first and second tubular sleeves and thereby allow loosening rotation.

25. The combination according to claim 24 further comprising:

said first tubular sleeve having a forward opening defined by an annular shoulder extending from its inner surfaces,
said spring biased means fitted between the rotatable female collar nut and the annular shoulder.

26. The combination according to claim 25 further comprising:

said spring biased means is a spring washer.

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