removable tensioning means configured to apply tension to a load bearing surface of the bridge member so as to transfer tension to the stud;

wherein the actuator is operable to lock the locking means when the desired preload in the stud is achieved, and

wherein the tensioning means comprises a jacking nut or a multi-jackbolt tensioner consisting of a plurality of jackbolts or cap screws.

The provision of a tensioning apparatus comprising at least some components that are removable after a desired preload for a stud is achieved is found to be particularly advantageous, as only a single tensioner (e.g. multi-jackbolt tensioner etc.) is required to tension multiple studs. By contrast, conventional techniques require a permanent tensioner for each and every stud, which must remain in place even after the stud is tensioned to the desired preload.

Therefore, the present invention allows reuse of the same tensioner, which avoids the costs of having to acquire multiple tensioners.

It is to be appreciated that the use of the term "stud" herein is intended to cover all kinds of studs, bolts, threaded rods and shafts, and indeed the apparatus of the present invention may be used with all kinds of fastening devices that are typically used to compress bolted joints to a required tension and where a tensioner of a multi-jackbolt type, for instance, is conventionally used to apply tension to the joint.

By "bolted joint" we mean any mechanical joint, coupling or connection between two or more components or mechanical assemblies that may be fastened or compressed together without limitation.

In particularly preferred embodiments, the locking means may be a threaded nut. The nut is preferably threaded so as to reciprocally engage

the threading of the stud. In this way, the locking means may then be simply screwed onto the stud.

this is not preferred. But it is possible that such an arrangement could be used in some applications and/or implementations.

As mentioned in the first aspect, ~~The~~ the removable tensioning means ~~preferably~~ comprises a jacking nut or a multi-jackbolt tensioner consisting of a plurality of jackbolts or cap screws. Indeed, in exemplary embodiments, the tensioner is ideally a nut-type multi-jackbolt tensioner having a pitch circle diameter of cap screws as known in the prior art.

The use of a multi-jackbolt tensioner is beneficial as it allows the many advantages of this type of tensioner to be utilised in the present application. Therefore, the stud may be tensioned to relatively large preload tensions by the application of only a relatively low torque to each of the cap screws. As a result, only simple hand tools or pneumatic devices need be used to load the bolted joint to the required tension. Moreover, as multi-jackbolt tensioners tighten the stud in pure tension there is no torsional strain.

The apparatus may further comprise a washer removably disposed between the tensioning means and the bridge member, such that the washer abuts the closed end of the bridge member. The washer is preferably made from hardened steel and serves to prevent damage to the closed end surface of the bridge member when the cap screws are tightened in the tensioner.

In use, the present apparatus tensions the stud to a desired preload by applying torque to each of the cap screws. The bridge member preferably sits atop the bolted joint and covers the locking means which have been engaged with the stud (e.g. the nut has been threaded onto the stud) and tightened against the surface of the bolted joint. The hardened washer preferably sits between the bridge member and the tensioning means (e.g. multi-jackbolt tensioner), which is also threaded onto the stud and rests against the washer on top of the bridge member.

and actuator may then all be removed from the bolted joint, leaving the locking means in place to keep the joint together.

As a result, the removable components may then be advantageously re-used to tighten a further bolted joint, without the need for another tensioner. The only component that is not re-used is the locking means, but this is not as elaborate (or as expensive) to replace as another tensioner. Of course, the locking means may be subsequently re-used if it no longer becomes necessary to maintain the bolted joint under compression.

The use of the locking means not only saves costs but also permits easy maintenance of the bolted joint, as if it becomes necessary to release the compression of the joint only one component need be relaxed (i.e. un-tightened), as opposed to the multiple cap screws of conventional tensioners – which are themselves very quick to release. Hence, the present invention provides significant advantages over the prior art and can minimise downtime for maintenance and repair etc.

~~According to a second aspect of the present invention there is a provided~~Herein disclosed is a tensioning kit for use with a tensioner of a type such as a multi-jackbolt tensioner, the kit comprising:

a locking means for engaging a stud in a bolted joint;

a bridge member arranged to at least partially enclose the locking means and to receive the stud therethrough, the bridge member being operable to transfer tension to the stud under the action of the tensioner; and

an actuator operable to actuate the locking means through the bridge member and to lock the locking means when a desired preload in the stud is achieved.

The kit is most preferably used with a conventional nut-style multi-jackbolt tensioner of the sort having a plurality of individual jackbolts or cap

CLAIMS

1. An apparatus for tensioning a stud in a bolted joint to a desired preload, the apparatus comprising:

a locking means adapted for engagement with the stud;

a removable bridge member arranged to at least partially enclose the locking means and to receive the stud therethrough;

a removable actuator operable to actuate the locking means through the bridge member; and

removable tensioning means configured to apply tension to a load bearing surface of the bridge member so as to transfer tension to the stud;

wherein the actuator is operable to lock the locking means when the desired preload in the stud is achieved.

2. The apparatus of Claim 1, wherein the locking means is a threaded nut.

3. The apparatus of Claim 1 or Claim 2, wherein the nut comprises at least one radial bore hole through the body of the nut.

4. The apparatus of Claim 3, wherein the nut comprises a plurality of radial bore holes.

5. The apparatus of any preceding claim, wherein the bridge member comprises at least one aperture through which the actuator may releasably engage with the locking means.

6. The apparatus of Claim 5, when dependent on Claim 3 or Claim 4, wherein the actuator comprises an elongate rod adapted to engage with at least one of the radial bore holes.

7. The apparatus of any preceding claim, wherein the tensioning means comprises a jacking nut or a multi-jackbolt tensioner consisting of a plurality of jackbolts or cap screws.

8. The apparatus of any preceding claim, further comprising a washer removably disposed between the tensioning means and the bridge member.

9. The apparatus of any preceding claim, wherein the bridge member has a second surface for engaging with the bolted joint.

10. The apparatus of any preceding claim, wherein the action of the tensioning means on the bridge member brings about an elastic deformation of the stud along its length.

11. A tensioning kit for use with a tensioner of a type such as a multi-jackbolt tensioner, the kit comprising:

a locking means for engaging a stud in a bolted joint;

a bridge member arranged to at least partially enclose the locking means and to receive the stud therethrough, the bridge member being operable to transfer tension to the stud under the action of the tensioner; and

an actuator operable to actuate the locking means through the bridge member and to lock the locking means when a desired preload in the stud is achieved.

CLAIMS

1. An apparatus for tensioning a stud in a bolted joint to a desired preload, the apparatus comprising:

a locking means adapted for engagement with the stud;

a removable bridge member arranged to at least partially enclose the locking means and to receive the stud therethrough;

a removable actuator operable to actuate the locking means through the bridge member; and

removable tensioning means configured to apply tension to a load bearing surface of the bridge member so as to transfer tension to the stud;

wherein the actuator is operable to lock the locking means when the desired preload in the stud is achieved, and

wherein the tensioning means comprises a jacking nut or a multi-jackbolt tensioner consisting of a plurality of jackbolts or cap screws.

2. The apparatus of Claim 1, wherein the locking means is a threaded nut.

3. The apparatus of Claim 1 or Claim 2, wherein the nut comprises at least one radial bore hole through the body of the nut.

4. The apparatus of Claim 3, wherein the nut comprises a plurality of radial bore holes.

5. The apparatus of any preceding claim, wherein the bridge member comprises at least one aperture through which the actuator may releasably engage with the locking means.

6. The apparatus of Claim 5, when dependent on Claim 3 or Claim 4, wherein the actuator comprises an elongate rod adapted to engage with at least one of the radial bore holes.

7. The apparatus of any preceding claim, further comprising a washer removably disposed between the tensioning means and the bridge member.

8. The apparatus of any preceding claim, wherein the bridge member has a second surface for engaging with the bolted joint.