2019 IPIC Patent Agent Training Course

Drafting & Prosecution

Exercise #1 – Drafting

Sample Answer

A complete patent specification and drawing sheets follow. The specification is based on the instructions for Exercise 1 plus further consultation with the inventor regarding a theoretical embodiment where a sealing projection is present on the undersurface of a bolt head. Although the use of a threaded stud and two sealing nuts may be the ideal solution, another party might try to take advantage of a market for the patented nuts by selling sealing bolts that could be used with the nuts. Before including the sealing bolt embodiment, it would be important to ascertain that it is part of the invention contemplated by the inventor and to obtain the inventor's information regarding the manner in which such an embodiment should be constructed and used.

It would be an adequate response for the Agent's Exam if one were to draft the application without including the sealing bolt embodiment and to simply describe and claim an invention based on the sealing nut. In this regard, the exam answer could combine the limitations of claims 1 and 5. The subject matter of claims 3, 4, 6, 9, 12, 14, and 15 could be retained and claims 7, 8, 10, 11, 13, and 16 excluded. Claim 17 could also be retained, amended in paragraph (i) to delete reference to the fastener of claim 7 or 8 and in the remaining paragraphs to only refer to a pair of nuts and a stud (with equivalent amendments made to claims 18-20). Also, the detailed description of the alternate embodiment, the brief description of Figures 4 and 5 and the drawing sheet containing Figures 4 and 5 would not be included.

It is desirable to include as many claim categories as possible but if time does not permit on the Exam, the most important claims for this exercise are claims directed to the fastener and method claims. The method claims are important because they are the best vehicle for including limitations that relate to the use of "thicker" bolts. If one includes such a limitation in the fastener claims, the fastener would be defined by a term that is relative to something that is not included in the claim. That approach could be objected to as "indefinite".

You may have noticed that much of the inventor's communication is suitable for inclusion in the description. In such a situation, you might elect to cut and paste portions of the question into an exam booklet, making appropriate changes in manuscript form. As an example,

I include two sample pages showing the changes I made to the inventor's text for the detailed description portion (up to the part describing the alternate embodiment). Handwritten annotations must be legible and you should not spend more time annotating the material as compared to simply writing a new description. Do not expect the exam material to be appropriate for inclusion in the patent specification in this way and you should be prepared to draft the entire specification.

The changes I made on the attached sample pages are quite extensive and many of them would not be necessary for the Exam. I have approached the sample answer as being a "real-life" situation and the inserted text is intended to provide support for the claim terminology and possibly for amendments that might have to be made during prosecution (depending upon the Examiner's attitude towards the original claims and whether they are sufficiently definite).

A number of the changes that I have made are intended to remove terms such as "preferably", "required", etc., in situations where the terms appear to be unnecessarily limiting. One should also be very careful in employing text that could be construed as a promise.

This is an example of a simple invention that is difficult to claim because of the need to define the invention according to what it is (rather than what it is not) and to avoid unqualified use of relative terms such as "near" or "adjacent". However, the prior art sealing nut illustrates the projection on that nut as actually forming the "rim" of the threaded hole. This realization allows one to claim the new sealing nut by means of simple, structural terminology.

Some writers may be concerned about the functional language in claim 1. I deliberately chose the functional language in this claim to provide context for the "projection" as not being some manufacturing artifact or the like. I elected to define the projection as being circular and concentric to the threaded portion because otherwise, it would not likely create a proper seal upon rotation.

Some writers may be concerned that the second reference is not relevant to the present invention and should not be included in the Background. In "real-life", you might decide to not describe that document or you might refer to it elsewhere (e.g., in the detailed description) as an example of how one might construct the projection for forming a seal. However, on the Exam, you should mention all the references you are given in the Background section, to demonstrate that you are prepared to comply with Patent Rule 80(1)(c).

Chris Robinson

ABSTRACT

Threaded fasteners are provided that are useful for repair of flanged pipe joints under pressure. The fasteners comprise a threaded portion and a portion for contacting a surface surrounding a bolt hole, the portion for contacting comprising a circular projection apart from and concentric to the threaded portion, for forming a seal against said surrounding surface upon tightening of the fastener. The fastener may be a closed-ended nut or a bolt having the projection on the undersurface of the bolt head. Also provided are kits comprising such fasteners as well as a method for repair of leaking flanged joints. Use of these fasteners allow for sealing of flanges that have a notch in a bolt hole rim and also allow for use of replacement bolts as large in diameter as permitted for a particular bolt hole.

THREADED SEALING FASTENERS

Field

This disclosure relates to threaded fasteners for sealing a bolt hole, such as in repair of leaking flanged joints.

Background

U.S. Patents 3,xxx,xx7 and 3,xxx,xx9 (which is a divisional of 'xx7) describe a sealing nut with a hardened, bevelled, projecting portion on its open end forming the rim of the thread hole of the nut. The nut is fitted to bolt after the well-known step of welding a band around the outside of the pipe flanges. The projection fits partially into the bolt hole of a flange, with the bevelled portion contacting the edge of the bolt hole to cause the rim of the bolt hole to deform when the sealing nut is tightened. Sometimes the bolt hole rim has a notch which is too deep to be ironed out without deformation by the projecting bevelled portion. Moreover, in order to provide an annular space to permit the projection on the sealing nut to partially enter the bolt hole, the threaded portion of the bolt must be smaller in diameter, potentially weaker, than the original.

U.S. Patent 3,xxx,xx0 describes the use of two annular members (one soft, the other hard with a sharp circular edge) to form a seal between the end of a piston and a wall that the piston abuts at the bottom of its stroke. The seal is intended to be imperfect to allow leakage of air or fluid.

Summary

In one aspect, this disclosure provides a fastener comprising a threaded portion and a portion for contacting a surface surrounding a bolt hole, the portion for contacting comprising a circular projection apart from and concentric to the threaded portion, for forming a seal against said surrounding surface upon tightening of the fastener. Such a fastener may be a sealing nut or a sealing bolt as described herein. Also provided is a combination of a sealing nut and a bolt or a threaded stud. Such a bolt may be a sealing bolt as described herein.

In another aspect, this disclosure provides a kit comprising a plurality of fasteners as described herein. Such a kit may further comprise packaging for one or more components of the kit and/or instructions for use of the kit to seal a bolt hole.

In another aspect, this disclosure provides a method for repairing a leaking joint comprising opposing flanges that are fastened by a pre-existing fastener in a bolt hole in the flanges, the method comprising: (i) replacing the pre-existing fastener with a bolt or with a threaded stud; (ii) threading the bolt or stud of (i) to one or a pair of sealing nuts as disclosed herein until the circular projections of the opposing nuts or the opposing nut and bolt contact the flanges; and (iii) tightening the opposing nuts or nut and bolt thereby forming circular seals on the opposing flanges, concentric to the bolt hole. The bolt in step (i) may be a sealing bolt as described herein.

This disclosure provides sealing nuts and bolts that may be used to repair leaking flanged pipe joints while the pipe is in service and under pressure. In one embodiment, a closed end nut has a circular rib concentric with the nut placed apart from a thread and having a V-shape cross-section, projecting from the open end of the nut. In another embodiment, such a circular rib is present on the underside of the bolt head that faces the flange. In such a sealing nut or bolt, the sealing area is positioned away from a bolt hole. This causes the seal between the sealing nut or bolt and the flange to be formed on the face of the flange. The face is machined flat when manufactured to provide a flat bearing surface for nuts and therefore is a good surface for forming a seal. It is less likely that a deep notch or groove would be found on a flange face away from the bolt hole rim. The present sealing nut or bolt also permits a repair to be made with the same diameter of fastener that was originally employed, permitting restoration of the intended bolt strength at the joint. Thus, one embodiment of the method disclosed herein employs fasteners of the same diameter as the originals. In some embodiments, the projections on the open ends of the sealing nut or nuts (and on the undersurface of a sealing bolt head, if present) are near the outer perimeter of the sealing nut or the head of the sealing bolt, and having a sharp leading edge to form a groove in the flange face which provides a metal-to-metal seal between the projection and the face of the corresponding flange while the nuts or the nut and bolt are tightened.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a pipe fitting in side elevation with a conventional flanged joint in its original state and another flanged joint after being repaired according to the present disclosure.

Fig. 2 shows in cross-section along the line 2--2 of Fig. 1, a portion of the flanged joint.

Fig. 3 is an enlarged view of a portion of Fig. 2 showing the projection on the open end of a sealing nut.

Fig. 4 is a side view of a sealing bolt.

Fig. 5 is a cross-sectional view taken along line 5--5 of Fig. 4, showing the sealing projection on the undersurface of the bolt head.

DETAILED DESCRIPTION OF REPRESENTATIVE EMBODIMENTS

Referring to Fig. 1, a tee-pipe fitting is shown having a flange **10** which is connected to a flange **12** on a pipe by conventional bolts and nuts in a conventional manner before any repair. While a tee is shown, this invention may be used to repair any leaking flanged joint in piping and valves. The tee also has a flange **9** and a flange **10'**. The open flange **9** and seat **26** are shown for information only and have no involvement with the other flanges. Obviously, in actual use, where a leak is being repaired on a line under pressure, there would be a flange bolted to the flange **9**. The flange **10'** is connected to a flange **12'** on a pipe **6**. These two flanges, **10'** and **12'**, illustrate a leaking flanged pipe joint which has been repaired using a plurality of sealing nuts **58** and **60** of the present invention. Bolts **62** are not visible in Fig. 1 but are shown in Fig. 2 passing through bolt holes **22** in the flanges **10'** and **12'**. As illustrated, these bolts are in the form of threaded studs. Seat **24** on the flange **10'** and seat **26'** hold a gasket **14** confined therebetween in sealing relation. Returning to Fig. 1, as is known in the art a band **16** is shown encircling the flanges **10'** and **12'** and welded to them by a pair of fillet welds **18** and **20** respectively. The band **16** may be applied in two semi-circular sections to facilitate its application and after the two sections are in place they are joined by a pair of butt welds **21** across the band **16**.

Now referring to Fig. 2, the difference between the sealing nuts **58** and **60** will be described. Short sealing nut **58** has a threaded length somewhat longer than a standard nut due to the end of a recess **36**, formed in the nut blank before threading, and the material needed to form a closed end **38**. Lone sealing nut **60** has an additional thread length **46** that causes the nut **60** to be longer than the regular sealing nut **58**. The nuts ideally have a threaded bore of sufficient

length to develop the full tensile strength potential of the nut and bolt combination. Because of the closed end **38** on the sealing nuts **58** and **60**, the length of the bolt **62** should leave space inside the sealing nuts **58** and **60** when the nuts are tightened to seal against the flanges **10'** and **12'** and the long sealing nut 60 provides room for a nut **60**, such as the uppermost nut **58** shown in Fig. 1, and therefore both the sealing nuts **58** may be used. Both the nuts **58** and **60** have the closed end **38** and a projection **70** located towards the outer perimeter of the open end of the nut. The projection **70** may be a circular rib, concentric to the threaded hole of the nut and vee-shaped in cross-section. The projection may be sharp and hardened to facilitate formation of a groove in the face **72** of the flanges **10'** and **12'**. As the nut is rotated, the projections and groove thus effect a seal against pressurized fluids leaking from the interior of the joint past the gasket **14**. The projection may be located anywhere between the outer perimeter and threaded hole of the nut and may be located nearer the outer perimeter. The projection will be positioned sufficiently away from the threaded hole so that the apex of the projection is not at the rim of the threaded hole.

In the sealing nut described in U.S. Patent No. x,xxx,xx7, an undersized bolt is used to allow room in the annular space between the bolt and the bolt hole for a bevelled projection on the earlier sealing nut to bear against a rim **42** and form a seal between the bevelled projection and the rim **42**. Occasionally a notch is found on the rim **42**, and if it is deep enough, it cannot be ironed out by turning the earlier type sealing nut. However, the face **72** of the flanges **10'** and **12'** provide a good place to cut or form a sealing groove with the new sealing nuts **58** and **60** because the face **72** has been machined flat when manufactured. An outer side **34** of seal nut **58** and an outer side **44** of seal nut **60** may be shaped (e.g., a hexagon shape) to fit conventional wrenches.

In operation, when a pipe flange gasket, like gasket **14**, is leaking and it is not practical to shut down the line and disassemble the joint for repair, it has been conventional practice to weld a band like the band **16** to the outside of flanges **10** and **12**, then weld around each nut, like the nuts **52**, with two fillet welds, one sealing between nut and flange and one sealing between nut and bolt. This is time consuming and the sealing nuts described in U.S. Patent No. x,xxx,xx7 eliminated this tedious and difficult welding operation. The present invention permits the bolts **62** used in the repair, to correspond to the bolt hole (including full size diameter), since there is no need for the bevelled projection of the earlier sealing nut to partially enter the bolt hole. The

projections **70** of the sealing nuts can bear on a flat surface on the face **72** of the flanges, free of the problem of notches in the bolt hole rim **42** described above.

To install the improved sealing nuts of this invention after welding the band **16** to the flanges **10'** and **12'**, one of the original bolts, like the bolt **50**, is removed by removing one or both of the original nuts, like the nut **52**. Bolt **62** (which may be of the same diameter as the original bolt **50**) is inserted through the bolt holes **22** and threaded into the seal nut **58** until the bolt and nut are sufficiently engaged. Then the long sealing nut **60** is threaded onto the other end of the bolt **62** until the projections **70** of both nuts **58** and **60** have been brought into contact with the faces **72** of their adjoining flanges **10'** and **12'** respectively. After bringing both the projections **70** into contact with the faces **72**, the sealing nuts **58** and **60** may be alternately tightened, approximately one-quarter of a turn at a time, until fully tightened. This alternate tightening is one method to maintain rotation under pressure of the projection **70** on the face **72**, which action forms the sealing groove. Another method would be to tighten the nuts **58** and **60** simultaneously. After the first bolt **50** has been replaced with the bolt **62** and tightened, the others are replaced.

In most flanged pipe joints in high pressure pipe lines, the flanges **10'** and **12'** are steel as well as are the bolts **62**. The sealing nuts **58** and **60** may be made of cold rolled, hardenable, hexagonal steel bars. They can be made on a turret lathe or on an automatic screw machine depending on the quantities required. If much larger quantities were required, the nut blank might be formed by a forging process and then threaded. It has been found practicable to harden and temper the entire nut **58** and **60** rather than just the projection **70**. In special instances, non-ferrous metal or plastic bolts **62** and/or sealing nuts **58** and **60** may be desirable.

The bolts illustrated in Fig. 1-3 and described above are in the form of a threaded stud intended to be used with a pair of sealing nuts threaded on opposite ends of the stud. It will be recognized that a bolt also takes the form of a threaded shaft with a bolt head at one end thereof. Such a bolt is intended to engage a nut only by its threaded end. The bolt head is typically an enlargement on the threaded shaft having an undersurface, all or a portion of which is intended to contact a surface surrounding a bolt hole. Installation of a sealing projection as described above onto that portion of the bolt head will provide for the formation of a seal against the surface surrounding the bolt hole, in the same manner as described above for a sealing nut of this

invention. In order to provide for rotation of the sealing bolt head to form the seal, the head is typically provided with wrench engaging surfaces or other means to facilitate rotation of the bolt.

Fig. 4 shows a sealing bolt **158** of this invention. The bolt comprises a threaded portion (shaft **162**) and head **138**. Circular projection **170** is located on the underside of the head concentric to shaft **162**. The shape of the projection is more clearly seen in the cross-sectional view of Fig. 5. In this embodiment, the apex of circular projection **170** forms an edge and the projection is located approximately mid-way between the threaded portion and the outer perimeter of the bolt head. The projection may be located closer to the outer perimeter of the head, or closer to shaft **162** as long as the apex of the projection is apart from the shaft. In operation, sealing bolt **158** and an opposing sealing nut are tightened. The tightening may be in an alternating fashion or simultaneously, in the same manner as described above regarding use of two sealing nuts and a threaded stud.

Although the invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it will be readily apparent to those of skill in the art in light of the teachings herein that changes and modifications may be made thereto without departing from the scope of the appended claims.

WHAT IS CLAIMED IS:

1. A fastener comprising a threaded portion and a portion for contacting a surface surrounding a bolt hole, the portion for contacting comprising a circular projection apart from and concentric to the threaded portion, for forming a seal against said surrounding surface upon tightening of the fastener.

2. The fastener of claim 1, wherein the projection is a circular rib.

3. The fastener of claim 1 or 2, wherein the circular projection has an apex that forms an edge.

4. The fastener of claim 1, 2 or 3, wherein at least the circular projection of the fastener is hardened.

5. The fastener of any one of claims 1 to 4 which is a nut having a closed end and an open end, the open end having an outer perimeter and wherein the threaded portion is a threaded hole in the open end and the projection is laterally displaced from the threaded hole towards the outer perimeter.

6. The fastener of claim 5, wherein the circular projection is closer to the outer perimeter than to the threaded hole.

7. The fastener of any one of claims 1 to 4 which is a bolt having a head and a threaded shaft as the threaded portion, wherein the bolt head has an outer perimeter and the circular projection is located on a surface of the head facing the shaft and the projection is laterally displaced from the shaft towards the outer perimeter.

8. The fastener of claim 7, wherein the circular projection is closer to the outer perimeter than to the shaft.

9. A combination of a nut as defined in claim 5 or 6 and a bolt, wherein the nut and the bolt have compatible threads.

10. The combination of claim 9 comprising two of said nuts and wherein said bolt is a threaded stud.

11. A combination of a bolt as defined in claim 7 or 8 and a nut as defined in claim 5 or 6, wherein the nut and the bolt have compatible threads.

12. A kit comprising a plurality of fasteners as defined in any one of claims 1 to 8.

13. The kit of claim 12 comprising a plurality of nuts as defined in claim 5 or 6.

14. The kit of claim 13, wherein the nuts are of at least two different lengths.

15. The kit of claim 13 or 14 further comprising a plurality of threaded studs having threads compatible with the nuts.

16. The kit of claim 13 or 14 comprising a plurality of bolts as defined in claim 7 or 8, the bolts having threads compatible with the nuts.

17. A method for repairing a leaking joint comprising opposing flanges that are fastened by a pre-existing fastener in a bolt hole in the flanges, the method comprising:

(i) replacing the pre-existing fastener with a replacement fastener having a threaded shaft as defined in claim 7 or 8 or with a threaded stud;

(ii) threading the replacement fastener to a fastener with a circular projection as defined in claim 5 or 6 or threading the stud to a pair of fasteners with circular projections as defined in claim 5 or 6, until the circular projections of opposing fasteners contact each flange; and

(iii) tightening the opposing fasteners thereby forming seals on the opposing flanges apart from and concentric to the bolt hole.

18. The method of claim 17, wherein the opposing fasteners are tightened simultaneously.

19. The method of claim 17, wherein the opposing fasteners are alternately tightened.

20. The method of claim 17, 18 or 19, wherein the threaded stud or the shaft of the fastener in (i) has a diameter corresponding to the diameter of the bolt hole.

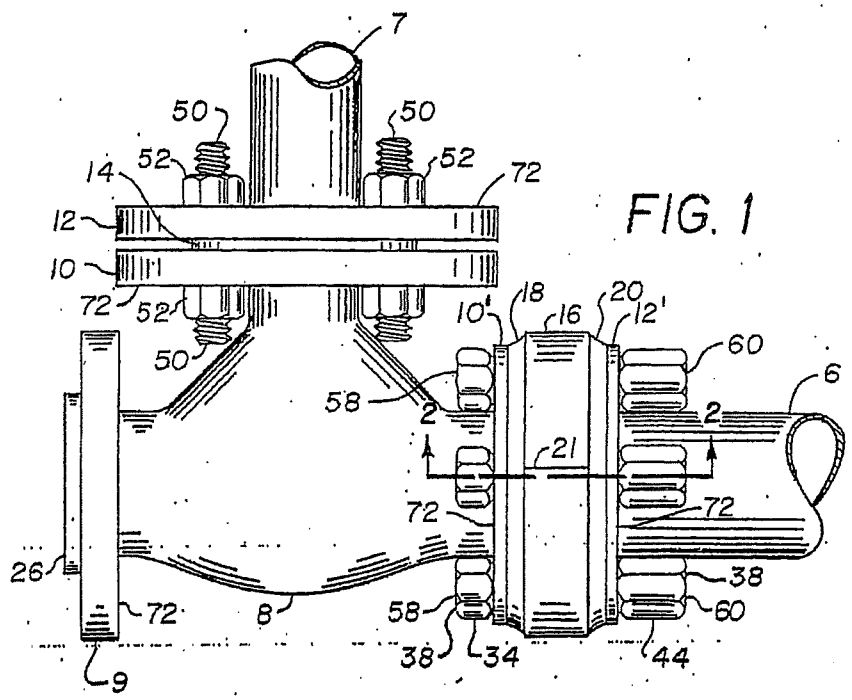

FIG. 1

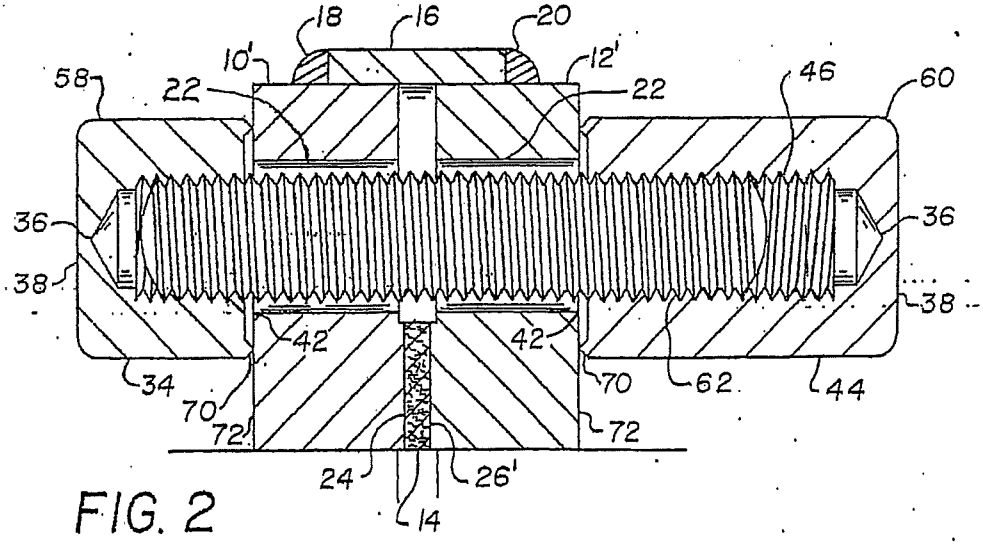

FIG. 2

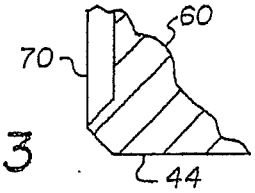

FIG. 3

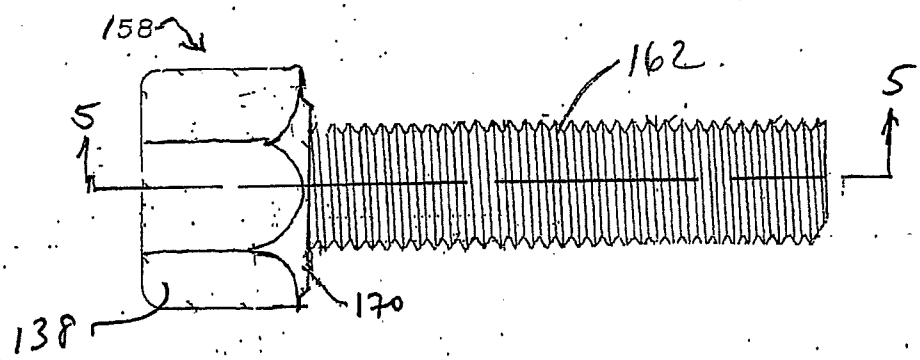

FIG. 4

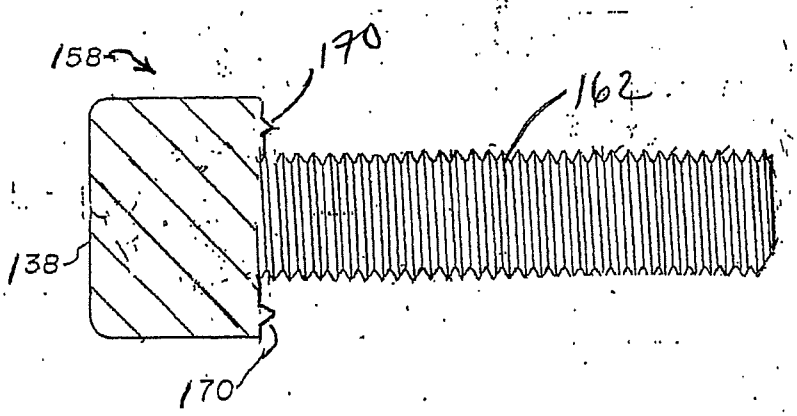

FIG. 5

DETAILED DESCRIPTION OF REPRESENTATIVE EMBODIMENTS

Referring to FIG. 1, a tee-pipe fitting is shown having a flange 10 which is connected to a flange 12 on a pipe by conventional bolts and nuts in a conventional manner before any repair. While a tee is shown, this invention may be used to repair any leaking flanged joint in piping and valves. The tee also has a flange 9 and a flange 10'. The open flange 9 and seat 26 are shown for information only and have no involvement with the other flanges. Obviously in actual use, where a leak is being repaired on a line under pressure, there would be a flange bolted to the flange 9. The flange 10' is connected to a flange 12' on a pipe 6. These two flanges, 10' and 12', illustrate a leaking flanged pipe joint which has been repaired using a plurality of sealing nuts 58 and 60 of the present invention. Bolts 62 are not visible in FIG. 1 but are shown in FIG. 2 passing through bolt holes 22 in the flanges 10' and 12'. Seat 24 on the flange 10' and seat 26' on the flange 12' hold a gasket 14 confined therebetween in sealing relation. Returning to FIG. 1, as is known in the art a band 16 is shown encircling the flanges 10' and 12' and welded to them by a pair of fillet welds 18 and 20 respectively. The band 16 ~~is usually~~ applied in two semi-circular sections to facilitate its application and after the two sections are in place they are joined by a pair of butt welds 21 across the band 16.

Now referring to FIG. 2, the difference between the sealing nuts 58 and 60 will be described. ~~The regular~~ sealing nut 58 has a threaded length somewhat longer than a standard nut due to the end of a recess 36, formed in the nut blank before threading, and the material needed to form a closed end 38. ~~In deep~~ sealing nut 60 an additional thread length 46 causes the nut 60 to be ~~thicker~~ than the regular sealing nut 58. ~~All~~ nuts ~~require~~ sufficient ~~thread~~ length to develop the ~~potential~~ tensile strength of the bolt. Because of the closed end 38 on the sealing nuts 58 and 60, the length of the bolt 62 should leave space inside the sealing nuts 58 and 60 when the nuts are ~~tightened~~ to seal against the flanges 10' and 12' and the ~~deep~~ sealing nut 60 provides room for a practical length tolerance in the bolt 62. Some locations do not provide room for the ~~deep~~ sealing nut 60, such as the uppermost nut 58 shown in FIG. 1, and therefore both the sealing nuts 58 ~~and 60 are needed~~. Both the nuts 58 and 60 have the closed end 38 and a projection 70 located ~~near~~ the perimeter of the ~~open~~ end of the nut. The projection 70 is ~~preferably~~ a ~~concentric~~ circular rib, vee-shaped in cross section, sharp and hardened, to ~~enable it to form~~ a groove in the face 72 of the flanges 10' and 12'. As the nut is rotated, the projections and groove thus effect a seal against pressurized fluids leaking from the interior of the joint past the gasket 14.

In the sealing nut described in U.S. Pat. No. x,xxx,xx7, an undersized bolt is used to allow room in the annular space between the bolt and the bolt hole for a bevelled projection on the earlier sealing nut to bear against a rim 42 and form a seal between the bevelled projection and the rim 42. Occasionally a notch is found on the rim 42, and if it is deep enough it cannot be ironed out by turning the earlier type sealing nut. However, the face 72 of the flanges 10' and 12' provides a good ~~plate~~ to cut or form a sealing groove with the new sealing nuts 58 and 60 because the face 72 has been machined flat when manufactured. An outer side 34 of ~~the regular~~ seal nut 58 and an outer side 44 of ~~the deep~~ seal nut 60 ~~are hexagon~~ shaped to fit conventional wrenches ~~used on the original nuts 52.~~

correspond to the bolt hole (including full size diameter),

In operation, when a pipe flange gasket, like gasket 14, is leaking and it is not practical to shut down the line and disassemble the joint for repair, it has been conventional practice to weld a band like the band 16 to the outside of flanges 10 and 12, then weld around each nut, like the nuts 52, with two fillet welds, one sealing between nut and flange and one sealing between nut and bolt. This is time consuming and the sealing nuts described in U.S. Pat. No. x,xxx,xx7 eliminated this tedious and difficult welding operation. The present invention permits the bolts 62 used in the repair, to ~~be full size diameter~~, since there is no need for the bevelled projection of the earlier sealing nut to partially enter the bolt hole. The projections 70 of the sealing nuts can bear on a flat surface on the face 72 of the flanges, free of the problem of notches in the bolt hole rim 42 described above. To install the improved sealing nuts ~~58 and 60~~ after welding the band 16 to the flanges 10' and 12', one of the original bolts, like the bolt 50, is removed by removing one or both of the original nuts, like the nut 52. ~~Using a~~ bolt 62 of the same diameter as the original bolt 50, it is inserted through the bolt holes 22 and threaded into the ~~regular~~ seal nut 58 until the bolt 62 is ~~engaged sufficiently to develop the tensile strength of the~~ adequately engaged on bolt 62. Then the ~~deep~~ sealing nut 60 is threaded onto the other end of the bolt 62 until the projections 70 of both nuts 58 and 60 have been brought into contact with the faces 72 of their adjoining flanges 10' and 12' respectively. After bringing both the projections 70 into contact with the faces 72, the sealing nuts 58 and 60 ~~are~~ may be alternately tightened, approximately one-quarter of a turn at a time, until fully tightened. This alternate tightening is ~~a~~ one method to ~~obtain a~~ maintain rotation under pressure ~~action~~ of the projection 70 on the face 72, which action forms the sealing groove. Another method would be to tighten the nuts 58 and 60 simultaneously. After the first bolt 50 has been replaced with the bolt 62 and tightened, the others are replaced ~~one at a time~~.

In most flanged pipe joints in high pressure pipe lines, the flanges 10' and 12' are steel as well as are the bolts 62. The sealing nuts 58 and 60 ~~are~~ may be made of cold rolled, hardenable, hexagonal steel bars. They can be made on a turret lathe or on an automatic screw machine depending on the quantities required. If much larger quantities were required, the nut blank might be formed by a forging process and then threaded. It has been found practicable to harden and temper the entire nut 58 and 60 rather than just the projection 70. In special instances, non-ferrous metal or plastic bolts 62 ~~and~~ and/or sealing nuts 58 and 60 may be desirable."