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(54) Sealing leaks in pipes and pipe joints

(57) This invention concerns packing seals for leak sealing clamps suitable for on line leak sealing. The packing seals (26) are suitable for use between a sealing clamp (18) and a flange (16) or pipe being sealed, and fit by compression as well as by bonding to surfaces. The packing seals preferably comprise woven mineral or synthetic fibres impregnated with a thermosetting resin, particularly one that sets at a high temperature. The seals 26 are heated after assembly of the clamp 18 by, for example, the heat of the pipeline. The sealing clamps 18 comprise two halves bolted together and having grooves 24 for the seals 26.

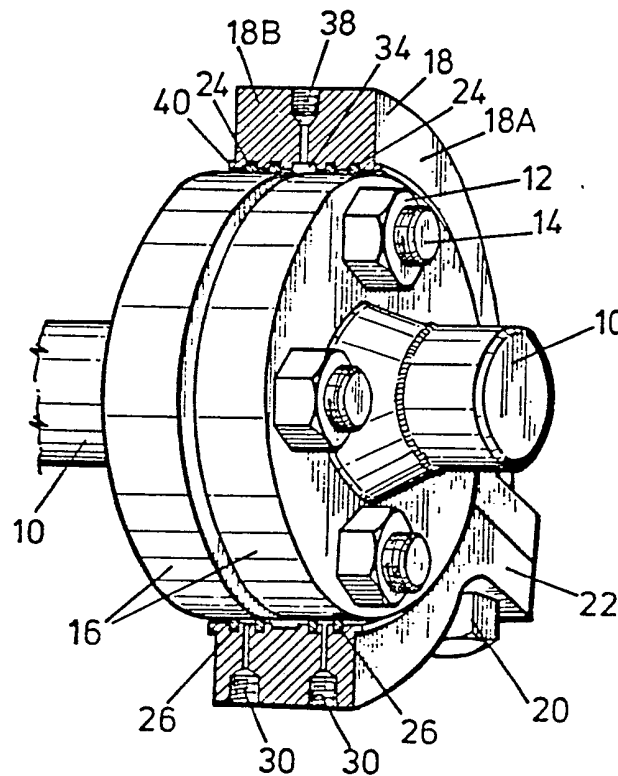


FIG. 1

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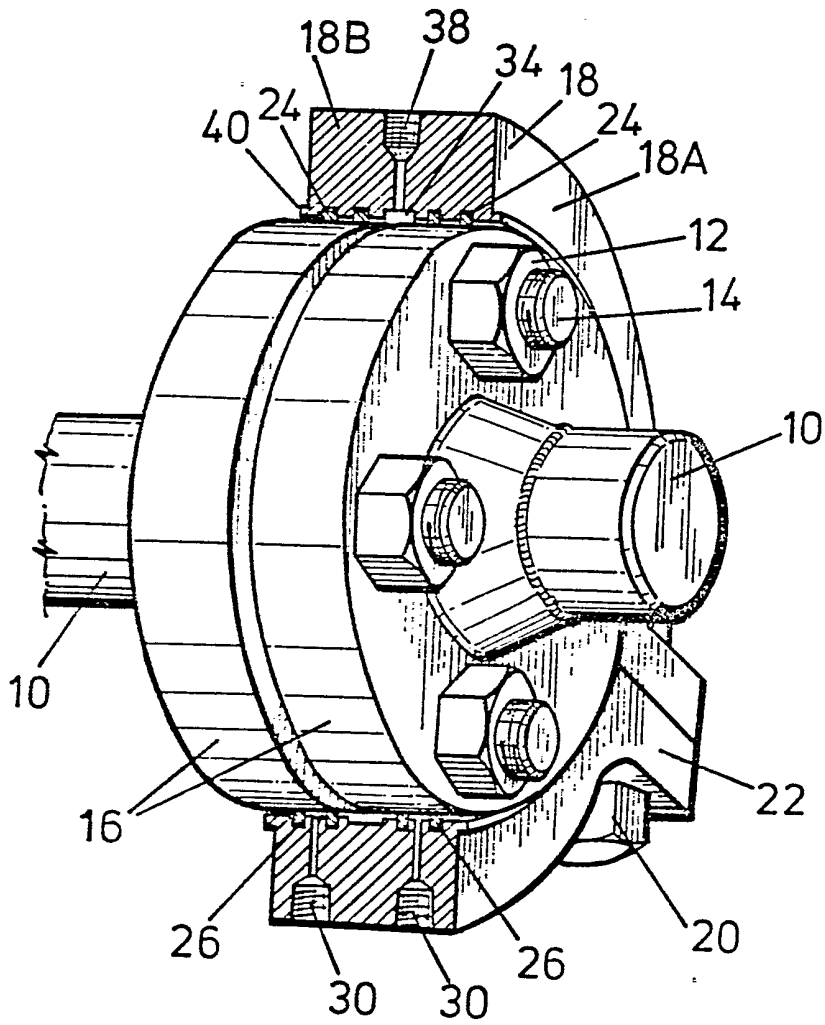


FIG. 1

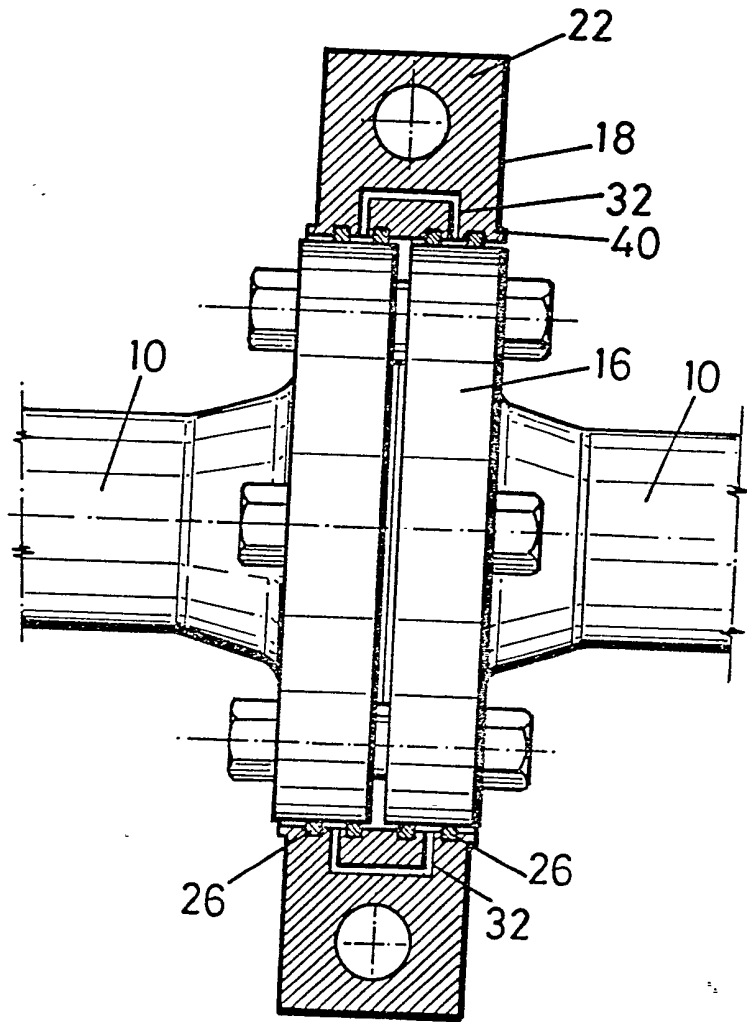


FIG. 2

3 — 3

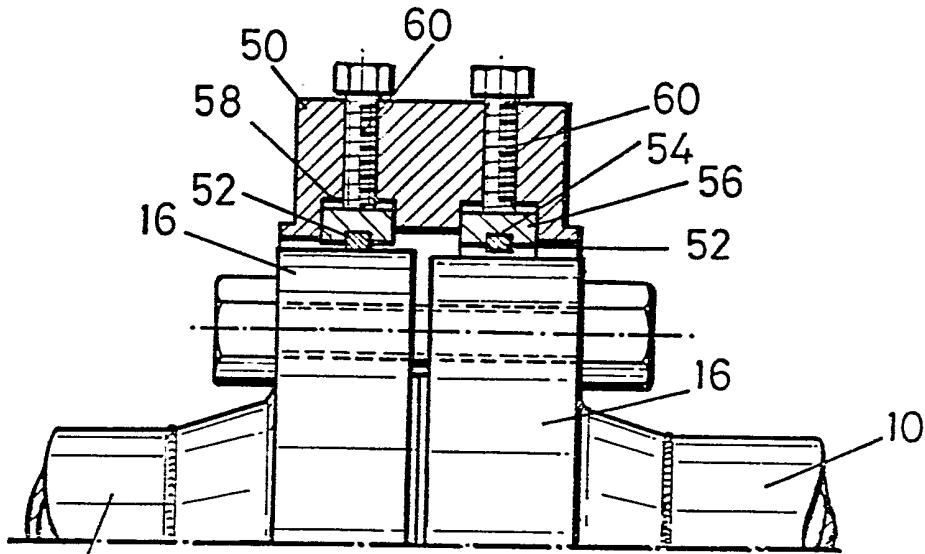


FIG. 3

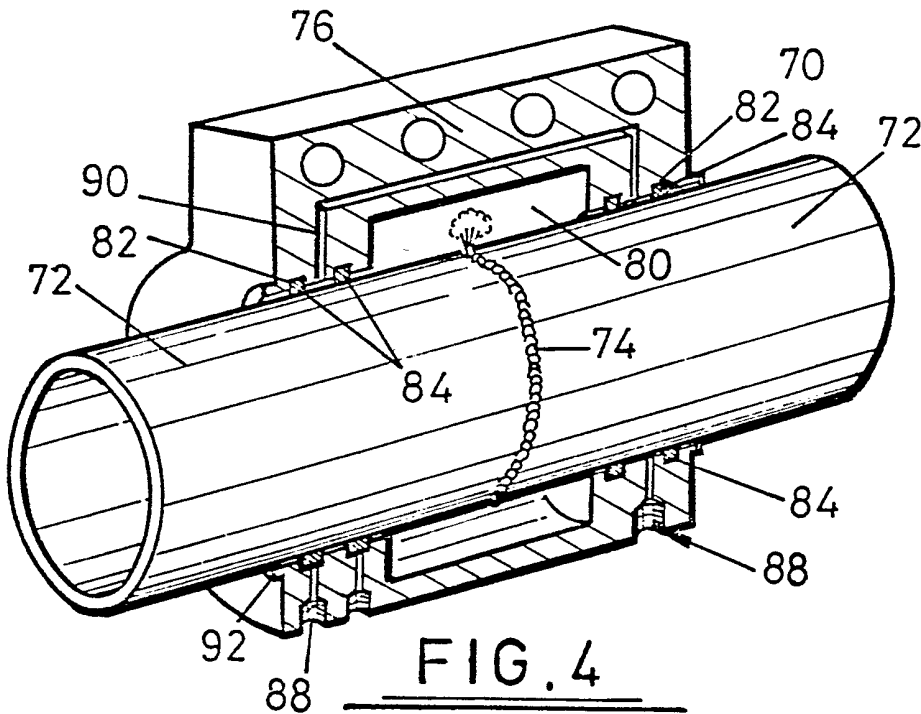


FIG. 4

SPECIFICATION

Leak sealing

5 This invention concerns leak sealing and, in particular, packing seals for leak sealing clamps suitable for on line leak sealing.

10 Pipeline leaks can occur in several places, such as between flange connections of pipeline ends, between a valve body and a bonnet flange on the pipeline and in the pipeline itself, say in a welded connection. Leak Sealing clamps usually made of steel have been used for many years to seal such leaks. Various means have been used for forming a seal between the steel clamps and the flanges or pipelines to which they have been fitted. These means usually involve the use of a flexible metallic or non-metallic seal deformed by compression by the action of clamping bolts or by pipeline pressure but have not been entirely satisfactory.

20 The object of this invention is to provide means suitable for sealing between sealing clamps and flanges or pipes, particularly when hot.

30 According to the invention packing seals are provided, suitable for use between a sealing clamp and a flange or pipe being sealed, which fit by compression as well as by bonding to surfaces.

35 The preferred packing seals comprise woven or plaited mineral or synthetic fibrous materials impregnated with a thermosetting resin, particularly one that sets at high temperatures.

40 Examples of suitable fibrous materials for making the packing seals of the invention include asbestos, carbon fibres and aramid fibres.

45 Examples of suitable thermosetting resins include epoxides, esters, furanes, phenolic and urea formaldehyde resins. The preferred packing seal can, therefore, be compressed and the resin can bond it to metal surfaces. Furthermore, the preferred packing seals can be used on hot pipelines, whereby the resin will be set by heat from the pipeline.

50 To compress the packing seals any suitable means may be used. One preferred means may be by injection of a sealant to compress the seal against a surface. Alternatively, mechanical means may be used and this could possibly be more useful when the surface onto which the seal is being compressed is uneven. For this, the packing seals could be mounted on piston-like members, such as piston rings, with means for urging the pistonlike members in a desired direction.

60 Sealing clamps are usually provided as two halves clamped together by bolts through lugs thereof and to accommodate packing seals according to the invention annular grooves may be provided in the inner face of the clamp. Two or more grooves will be provided for packing seals on each side of the leak. Preferably two pairs of packing seals will be pro-

vided.

70 The sealing clamp may be provided with various ports for injection of sealant and/or pressure relief. Injection ports may be provided for compressing the packing seals by means of sealant unless mechanical compression is to be used. Where pairs of packing seals are used injection ports may be provided for injecting sealant between the seals of each pair and ports may be provided for pressure relief from a leaking pipeline or flange connection and then for injection of sealant into the leak itself. The latter ports will usually be centrally located so that one or more can be used for accurately locating a sealing clamp onto a pair of flanges by means of a peg through the port to locate in a space between the flanges.

80 The adjoining faces of connecting lugs of the sealing clamps may be provided with channels or grooves for sealant and those channels or grooves will be open to a source of sealant, say from between the seals of each pair of packing seals.

85 The sealing clamps envisaged herein may also have caulking lips for deformation to meet any uneven contact with or out-of-roundness the pipeline or flanges thereof.

90 Further features and advantages of the invention will be apparent from the following exemplary description with reference to the accompanying drawings, in which:

95 Figure 1 shows a flanged pipeline connection with a leak sealing ring clamp partly cutaway;

100 Figure 2 is a side view of the pipeline connection of Figure 1 with one half of the leak sealing ring clamp in place;

105 Figure 3 is a part-section through a pipeline flange connection with a leak sealing ring clamp suitable where the pipeline flanges are misaligned; and

110 Figure 4 shows a welded pipeline connection with a leak sealing box clamp partly cutaway.

Referring to Figures 1 and 2, a pair of pipes 10 connected by nuts and bolts 12 and 14 respectively through holes in facing flanged ends 16 of the pipes 10. For the purpose of sealing a leak from the flanged connection, a steel clamp ring 18 is fitted about the flanges 16. (The method of fitting will be described later.) The clamp ring 18 is in two halves 18A, 18B connected by lug bolts 20 through lugs 22 of each ring half.

120 The clamp ring halves 18A, 18B each have two pairs of annular grooves 24 in their surfaces facing the flanges 16. These annular grooves 24 receive packing seals 26 of woven mineral or synthetic fibre impregnated with a thermosetting resin. Access to the rear of the annular grooves 24 is provided by ports (not shown) through the clamp ring whereby sealant can be injected to force the packing seals 26 onto the flanges 16 and to

improve the seal between the packing seals and the clamp ring. This may be particularly important should there be axial misalignment between the flanges or areas of corrosion of the flange surfaces resulting in out-of-roundness.

The clamp ring 18 has further ports 30 for access between the packing seals of each pair, whereby sealant may be injected. In addition at the faces of lugs 22 are provided with a groove or channel 32 linking the spaces between the pairs of packing seals, whereby sealant injected via the ports 30 can also provide a seal between the adjoining lugs 22.

The clamp ring also has a central annular channel 34 with further ports 38 giving access thereto for injection of sealant or to act as pressure relief ports. Thus, while the clamp ring is being fitted and sealed, pipeline fluid can continue to leak to avoid a build up of pressure. The ports 38 may also be used for accurate location of the clamp ring on the flange using dowels through one or more ports to locate in the space between the flanges.

Finally, the clamp ring 18 has a caulking lip 40 on each side which can be deformed by hammer blows onto the flange surface to prevent egress of sealant, say in an area of corrosion, if necessary.

The clamp ring 18 is particularly suitable for on line sealing leaks in flange connections of pipelines, wherein the substance in the pipeline is hot. This will be apparent from the following exemplary procedure for fitting the clamp ring 18 to the flanges 16.

Firstly, the outside diameter of the flanges 16 is accurately measured and the ring clamp inside diameter machined to a slightly larger size. The packing seals of woven mineral or synthetic fibre impregnated with high temperature thermosetting resin are then pressed into each of the annular grooves 24 leaving some of the packing proud of the surface of the ring. At each end of the ring halves the packing seal is cut flush therewith.

The clamp ring halves 18A, B are then fitted onto the flange using a dowel through one of the ports 38 for accurate location, the dowel locating in the space between the flanges. The lug bolts 20 are then fitted and used to draw the two ring halves 18A, B into engagement applying a compressive loading to the abutting faces of the lugs.

Thermosetting sealant is next injected into the ports leading to the annular grooves 24 so forcing the packing seals into compressive contact with the flanges. This compensates for any misalignment or surface irregularities of the flanges. Sealant is then injected into the space between each pair of annular grooves 24 via the ports 30 as well as into the channels 32. This sealant is maintained under pressure while heat from the pipeline causes the packing seals to bond both to the flanges

and to the clamp ring. After bonding the location dowel is removed.

A suitable leak sealing compound is then injected into the central exhaust ports 38 to finally seal the leak or indeed any other suitable leak sealing process may be used that may be independent of the clamp ring.

Turning to Figure 3, the clamp ring 50 here shown is especially intended for use when pipeline flanges are misaligned.

The clamp ring 50 based on that of Figures 1 and 2 and so similar features have been given the same reference numerals for simplicity. The clamp ring is again in two halves connected by lug bolts through lugs thereof. However, it has only two packing seals 52. The packing seals 52 are of woven mineral or synthetic fibre impregnated with thermosetting resin and are in annular grooves 54 of piston rings 56 themselves in annular grooves 58 of the clamp ring. The piston rings 56 are connected to screws 60 radially disposed about the clamp ring 50 whereby the packing seals can be forced into engagement with the flanges 16.

Finally in Figure 4 a leak sealing box clamp 70 is shown fitted to a pipeline 72 leaking at a welded connection 74 therein. The box clamp 70 is in two halves only one of which is shown and that partially cutaway to reveal features of the clamp. The two halves have lugs 76 connected by lug bolts (not shown) and are relieved centrally at 80. The box clamp will be positioned over the pipeline with the leak more or less centrally provided that the areas of the pipeline to each side of the leak are not defective. The size of the central relieving may give sufficient latitude for positioning of the box to avoid having to seal on defective areas of the pipeline.

To each side of the area 80 the box clamp has a pair of annular grooves 82 in which are packing seals 84. Ports 86 give access to the grooves 82 for injection of sealant to force the seals 84 onto the pipeline and to the seal between the packing seals and the annular grooves.

Further injection ports 88 are provided for injecting sealant into the spaces between the seal 84 of each pair and channels 90 linking these spaces. The ends of the box clamp 70 are provided with a caulking tip 92.

The fitting process for the box clamp 70 is basically the same as for the clamp ring of Figure 1 and 2 except that the final injections of sealant is not required.

The above are only examples of application of the present invention and it will be appreciated that the use of packing seals as proposed may be extended to other leak sealing devices.

CLAIMS

1. A method of sealing leaks in a pipeline or a pipeline joint using a sealing clamp having

packing seals which fit by compression as well as by bonding to surfaces, comprising fitting the sealing clamp around the leak and compressing and heating the packing seals,

5 2. A method as claimed in claim 1, wherein the packing seals comprise woven mineral or synthetic fibre impregnated with a thermosetting resin.

10 3. A method as claimed in claim 2, wherein the thermosetting resin sets at high temperatures.

4. A method as claimed in claim 1, wherein heating of the seal is via hot pipeline contents.

15 5. A method as claimed in claim 1, wherein the seals are heated by external means.

20 6. A method as claimed in any one of claims 1 to 5 wherein the packing seals are compressed by injection of sealant to compress the seals against a surface.

7. A method as claimed in any one of claims 1 to 5, wherein the packing seals are compressed mechanically.

25 8. A method as claimed in claim 7, wherein the packing seals are mounted on piston-like members with means for urging the piston-like members to compress the seals against a surface.

30 9. A packing seal suitable for use between a sealing clamp and a flange or pipe being sealed, which fits by compression as well as by bonding to surfaces.

35 10. A packing seal as claimed in claim 9 comprising woven mineral or synthetic fibre impregnated with a thermosetting resin.

11. A packing seal as claimed in claim 10, wherein the thermosetting resin sets at high temperatures.

40 12. A sealing clamp for use in the method of claim 1 comprising two halves clamped together by bolts through lugs thereof with annular grooves provided in the inner face of the clamp to accommodate the packing seals.

45 13. A sealing clamp as claimed in claim 12 having two or more grooves for packing seals on each side of the leak.

14. A sealing clamp as claimed in claim 12 or 13 having ports for injection of sealant and/or pressure relief,

50 15. A sealing clamp as claimed in claim 14 having injection ports provided for compressing the packing seals by means of sealant.

55 16. A sealing clamp as claimed in claim 14 or 15, wherein injection ports are provided for injecting sealant between the seals of a pair and ports are provided for pressure relief from a leaking pipeline or flange connection and then for injection of sealant into the leak itself.

60 17. A sealing clamp as claimed in claim 16, wherein the pressure relief ports are centrally located so that one or more can be used for accurately locating a sealing clamp onto a pair of flanges by means of a peg through the port to locate in a space between the flanges.

65 18. A sealing clamp as claimed in claim 12,

wherein adjoining faces of connecting lugs of the sealing clamp are provided with channels or grooves for sealant and those channels or grooves will be open to a source of sealant from between the seals of a pair of packing seals.

70 19. A sealing clamp as claimed in claim 12, also having caulking lips for deformation to meet any uneven contact with or out-of-roundness the pipeline or flanges thereof.

75 20. A method of sealing leaks in a pipeline or a pipeline joint substantially as hereinbefore described with reference to Figures 1 and 2, Figure 3 or Figure 4 of the accompanying drawings.

80 21. A packing seal substantially as hereinbefore described with reference to and as illustrated in Figures 1 and 2, Figure 3 or Figure 4 of the accompanying drawings.

85 22. A sealing clamp substantially as hereinbefore described with reference to and as illustrated in Figures 1 and 2, Figure 3 or Figure 4 of the accompanying drawings.

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