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(54) **Title:** COMPRESSION FITTINGS FOR STEEL PIPES

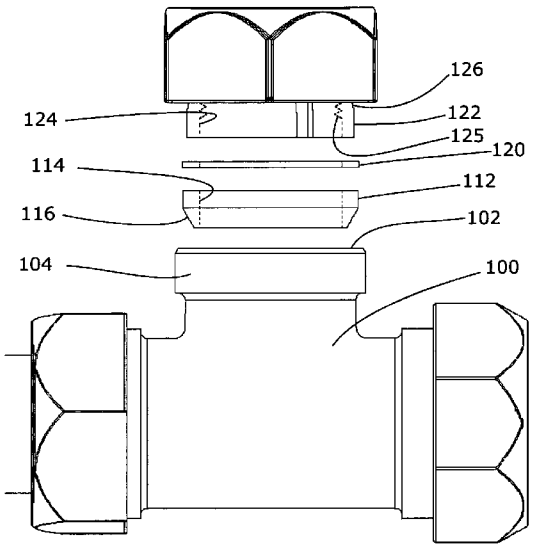


Fig 4

(57) **Abstract:** A compression fitting is described that is suitable for connecting steel pipes as a first fit device. It comprises an externally threaded housing having a bore for receiving a pipe and a seat around the bore, a polymeric or elastomeric sealing ring adjacent the seat, a nut engageable with the external thread thereby to urge the sealing ring onto the seat, the housing having an inwardly directed stop within the bore adapted to prevent further insertion of the pipe, and a compressible or crushable element in front of the stop. Further, a grip ring, with inwardly directed circumferential teeth on the inner axial face, can be provided adjacent the nut, for engagement with the exterior of a pipe passing through the nut into the bore and to assist in hindering withdrawal of the pipe if subjected to longitudinal forces.

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Compression fittings for steel pipes

FIELD OF THE INVENTION

The present invention relates to compression fittings for steel pipes.

BACKGROUND ART

Compression fittings are well known for connecting copper pipes for use in domestic plumbing, and typically comprise a threaded nut that is tightened onto a tubular body so as to compress an olive between bearing surfaces on the nut and the body. As a result, the olive is forced towards a copper pipe that has been placed within the body, and deformation of the olive and/or the pipe ensue. As a result of the deformation, an intimate contact is achieved between the connector body, the olive and the pipe and a watertight seal is achieved.

Copper pipes can also be joined via soldered fittings, in which a fitting or connector ends with a copper sleeve slightly oversized with respect to the outside diameter of the copper pipe. This is fitted over the copper pipe with only a small clearance therebetween, and both are heated. A solder alloy is introduced at the end of the small gap between them and is melted by the elevated temperatures. Once melted, the alloy flows so as to fill the small clearance and create a watertight seal. The alloys chosen are able to bond intimately to the copper fitting and copper pipe.

It is also common to use steel pipes for plumbing applications. These would usually be employed in heavier duty or higher pressure applications, although not exclusively. It will be appreciated, however, that neither of the above jointing techniques are suitable for use in steel as both rely on the nature of the copper substrate, either its relative softness in the case of compression fittings or its alloying and thermal properties in the case of solder joints. Accordingly, an alternative method of fixing must be used. Typically, for a new installation that this will be by way of a pre-threaded end. The free end of the steel pipe to be jointed is provided with an external thread, and this is used to make a watertight seal with the required fitting.

Pre-threading the steel pipes is normally done during manufacture, which therefore requires the steel pipe to be manufactured to suit a particular installation so that the correct lengths are supplied to fit into the required space. From time to time, there will be errors and/or a need for unanticipated lengths, and in such circumstances the steel pipe will be threaded on site. This is however a difficult process and requires skilled labour. Accordingly, steel pipework is typically only installed by skilled workers who have completed a relatively long apprenticeship. Such workers are becoming less common and this is limiting the uptake of steel piping.

It will occasionally be necessary to repair or adapt an existing steel fitting, in which case providing an external thread to the cut or repaired end is likely to be extremely inconvenient. To overcome this, a compression fitting for steel pipes is available under the trade mark PRIMOFIT, from George Fischer. Figure 1 shows a partial section through the George Fischer connector, and figure 2 shows an exploded view in which the parts making up the connection and seal are shown separated. Referring to figure 1, a pipe 10 is to be joined to a connector 12. The latter is formed generally cylindrically so that it has an inner bore 14 into which the pipe 10 can extend. An outer collar 16 is provided to the bore 14 which is only slightly oversized with respect to the outside diameter of the pipe 10. This has an external threading 18, onto which a nut 20 is secured. The opening of the bore 14 is provided with a slight taper 22, and an elastomeric sealing ring 24 sits in that taper. The sealing ring 24 itself is provided with a

corresponding and opposite taper so that it seats neatly within taper 22 of the bore 14. A washer 26 sits on top of the sealing ring 24 and separates it from a grip ring 28. The nut 20 has an internal collar 30 which bares against the axial end face of the grip ring 28. Accordingly, tightening the nut 20 compresses the collar 30 against, in sequence, the grip ring 28, the washer 26 and the sealing ring 24 which are compressed against the tapered end 22 of the bore 14.

Thus, tightening the nut 20 causes both the grip ring 28 and the seal 24 to be compressed. In particular, the seal 24 is compressed radially inwardly by the taper 22 of the bore 14. This inward radial compression causes it to make contact with the outside diameter of the pipe 10 and create an air and watertight seal.

Meanwhile, the inner faces of the grip ring 28 are provided with a plurality of ridges 32, 34 thus, as the grip ring 28 is compressed in an axial direction by way of suitable tapers formed to the shoulder 30 of the nut 20, the ridges 32, 34 engage with the outside surface of the pipe 10 and locally deform it. As a result, the grip ring 28 achieves a satisfactory mechanical connection between the connecter 12 and pipe 10.

Whilst this seal is generally satisfactory, its present market cost is roughly an order of magnitude greater than an externally threaded joint, and this combined with the superior sealing that is achievable by a threaded joint means that these connectors are only generally used for repair and maintenance work. For so-called "first fit" work in which a new installation is provided from scratch, such connectors are not considered economically viable or technically preferable.

SUMMARY OF THE INVENTION

The present invention seeks to provide a compression fitting suitable for connecting steel pipes which is both economically and technically satisfactory for use as a first fit device.

It therefore provides a pipe compression fitting, comprising an externally threaded housing having a bore for receiving a pipe and a seat around the bore

for an elastomeric or polymeric sealing ring adjacent the seat and a nut engageable with the external thread thereby to urge the sealing ring onto the seat.

The sealing ring is suitably of polyurethane, EPDM or PTFE, preferably with a Shore A hardness of at least 60 and preferably about 90, but other hardness values can be selected as a function of application. A washer can be disposed between the sealing ring and the nut to assist in tightening the nut without distorting the sealing ring.

Further, a grip ring can be provided adjacent the nut, for engagement with the exterior of a pipe passing through the nut into the bore and to assist in hindering withdrawal of the pipe if subjected to longitudinal forces. The nut can then have a tapered internal face adjacent the grip ring, to assist in driving the grip ring into contact with the pipe surface. The grip ring can have a radiused face adjacent the taper to ensure that it makes contact regardless of minor variations in the precise relative position.

The grip ring can be shaped as an incompletely circular arc, with a gap between opposing ends thereof. This gap allows the grip ring to close as it is forced into contact with the pipe and thereby allows for the use of a rigid material.

Indeed, the design of the grip ring is novel in itself and accordingly, in another aspect, the invention relates to a pipe compression fitting comprising an externally threaded housing having a bore for receiving a pipe and a seat around the bore, a sealing ring adjacent the seat, a nut engageable with the external thread thereby to urge the sealing ring onto the seat, and a grip ring adjacent the nut for engagement with the exterior of a pipe passing through the nut into the bore.

The present invention also allows for improvements in relation to the question of reducer assemblies. Rather than maintain stock of pipe fittings adapted for all the possible combinations of pipe sizes, we provide a pipe compression fitting as described above in which a reducer assembly is fitted in

the bore, comprising a adaptor spacer adapted to bear against the seat and having an inner seat to accept the sealing ring, and a grip spacer having an external taper adapted to be driven by the nut thereby to drive the adaptor spacer into a sealing contact with the seat. We also prefer that the grip spacer has an internal taper adapted to urge the grip ring onto the exterior of the pipe.

In this way, the same connector can be used, in combination with appropriate reducer kits to enable a smaller diameter pipe to be fitted therewithin.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the present invention will now be described by way of example, with reference to the accompanying figures in which;

Figure 1 shows a partial section through a known PRIMOFIT compression fitting;

Figure 2 shows a PRIMOFIT fitting, disassembled;

Figure 3 shows a cross-section through a first embodiment of the present invention;

Figure 4 shows a compression fitting according to a second embodiment of the present invention, partially disassembled;

Figure 5 shows a section through the seal area of the disassembled compression fitting of figure 4;

Figure 6 shows an axial view of a grip ring according to the present invention;

Figure 7 shows a side view of the grip ring of figure 6;

Figure 8 shows a reducer assembly;

Figure 9 shows a part of the reducer assembly for a different size difference;

Figures 10 and 11 show two alternative reducer assemblies; and

Figure 12 shows a reducer coupling.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Figure 3 shows a first embodiment of the present invention, in section. A small part of the fitting is illustrated, but it will of course be appreciated that the sealing mechanism illustrated therein is potentially applicable to any fitting with a pipe of the appropriate size and physical properties.

Thus, a generally annular body section 40 is sized to accept the end 42 a pipe section 44, the upper halves of each of which are illustrated. The lower halves are identical in that the fitting is rotationally symmetric with the exception of the sealing ring as will be described later. A stop 46 is provided within the body section 40, in the form of an inwardly directed radial step in the inner face of the annular body section. This allows the pipe section 44 to be inserted to the correct depth; if too deep, it will prevent a pipe being inserted to an adequate depth from the other end of the fitting, while if not deep enough then an adequate seal may not be obtained.

A flat spring washer 48 is provided adjacent the stop 46 to allow for some movement of the pipe section 44. This comprises a flat (or spring) washer that is provided with one or more a small axial deformations out of the plane of the washer. In effect, the washer is made from a wire or strip that has a periodic pattern – between one and three maxima is preferred. This allows the washer to be compressed under a sufficient force, thereby taking up axial movement of the pipe section 44.

At the opening of the annular body section 40, a seat 50 is formed by way of a flared section. A sealing ring 52 is located in the seat 50 and has an outer taper that generally corresponds to the flare. An inner face 54 of the sealing ring 52 is cylindrical, and thus the sealing ring fills the gap between the outer diameter of the pipe section 44 on one side and the inner face of the body section 40 on the other.

The sealing ring can be made of a range of possible materials. Particularly suitable materials are elastomeric or polymeric in nature. Of these, we prefer PU90, EPDM and PTFE. The example shown in figure 3 is of EPDM.

At its outer end, i.e. the end facing away from the body section 40, the sealing ring 52 has a generally radial face. This abuts a washer 56, allowing an axial force to be exerted on the sealing ring 52 via the washer 56 without deforming the sealing ring 52. Such a force is exerted via a grip ring 58, an incomplete ring (see figures 6 and 7 and associated description) that is compressed against the washer 56 by an external nut 60 that is screwed onto a threaded section 62 on the exterior of the body section 40. An interior face of the nut 60 is tapered at 64 so as to exert a force on the grip ring 58 that is inclined radially inwardly, thereby urging the grip ring axially into the body section 40 and also radially inward. The incomplete nature of the grip ring 58 allows it to be compressed radially, thereby forcing it into a close frictional contact with the pipe section 44; inwardly directed circumferential teeth 66 on the inner axial face of the grip ring 58 assist in doing so.

Thus, as the grip ring 58 is urged radially inwardly, it makes a firm contact with the pipe section preventing it from being withdrawn or sliding out. As the grip ring 58 is urged axially into the body section 40, it compresses the sealing ring into a sealing contact with the pipe section 44 and the body section 40. This will move the pipe section 44 slightly into the body section 40, but this movement is accommodated by compression of the spring washer or compliant element 48.

Thus, this embodiment of the invention ensures both that the pipe end is held securely within the fitting, and that a seal is made between the exterior of the pipe and the interior of the fitting.

Figure 4 shows a partial exploded view of a compression fitting according to a second embodiment. The fitting illustrated in figure 4 is a Tee fitting but it will (again) be appreciated that the sealing mechanism illustrated therein is

potentially applicable to any fitting with a pipe of the appropriate size and physical properties.

Thus, the pipe fitting 100 has a seat 102 externally threaded at 104. Figure 5, which should be viewed in conjunction with figure 4, shows that the opening 106 of the seat 102 is flared to (inter alia) aid insertion. Behind the flared opening 106 there is a generally parallel-sided conduit section 108 which is sized to the outside diameter of the pipes for which the fitting is intended. This will of course vary from fitting to fitting depending on the nominal outside diameter of the available pipes that are in use. This parallel sided section 108 ends with a shoulder 110 at which point the conduit narrows slightly. The shoulder 110 provides a stop against which pipes inserted into the conduit can be pushed to provide positive feedback that they have been inserted a sufficient distance.

In front of the shoulder 110 is a spring washer or compliant element 111 to accommodate movement of the pipe during tightening. This should resist the insertion force exerted by the fitter and (if necessary) the weight of the pipe, but give way to the axial forces exerted by the compression fitting. As illustrated, a spring washer is used, but other arrangements are possible such a crushable or honeycomb spacers.The compliant element 111 can simply sit on the stop 110, as illustrated. Often, the friction between the compliant element and the side wall of the bore will retain the former in place. Alternatively, it can be positively retained in place by a small lip on the bore side in front of the compliant element, or by a recess in the bore side in front of the stop 110, into which the compliant element 111 can partly fit, while still projecting into the bore.

Next to the flared opening, there is a sealing ring 112. This is of a polymeric construction such as high temperature polyurethane PU90 having a hardness of at least 60 and preferably about 90 Shore A, but other hardness values can be selected as a function of application. Other possibilities are EPDM (Ethylene Propylene Diene Monomer) and PTFE (polytetraflouroethylene). It is in the form of an annular ring having an inside diameter 114 sized to fit over the outside diameter of the pipe, and an external taper 116 matching the flare 106

of the pipe fitting 100. The sealing ring 112 also has a small flare 118 at its open end so as it assist with easy insertion of a pipe.

The relative rigidity of the sealing ring combined with the low friction surface of PU90, PTFE and other suitable polymeric compounds means that a relatively small tolerance around the nominal pipe diameter can be provided without causing the pipe to "stick" during insertion through the seal. Existing designs such as PRIMOFIT™ use rubbery seals that must have a large gap between the inside diameter of the seal and the outside diameter of the pipe in order to allow easy insertion.

Immediately adjacent to the sealing ring 112, there is a washer 120. This is sized so as to allow the pipe to pass easily within it, and allows axial compressive forces to be exerted on the sealing ring 112 without excessively twisting it.

Above the washer 120 there is a grip ring 122. This is, again, generally annular with an inside diameter 124 suited to fit the pipes for which the fitting is designed. The internal axial face of the grip ring 122 consists of inwardly directed circumferential teeth 125 to assist in forcing a close frictional contact onto the pipe when tightened. At its open end, the grip ring has a slight external radius or taper 126.

A nut 128 is then fitted over the assembly of the sealing ring 112, the washer 120 and the grip ring 122. This nut has an internally threaded bore 130 that corresponds to the external threading 104 on the compression fitting, and allows the nut to be screwed home. After the internal threading 130, the nut has a tapered section 132 that narrows towards the open end 134 of the nut and which corresponds to the external taper 126 on the grip ring 122. Alternatively, one or both of the nut 128 and the grip ring 122 could be formed with a radius instead of the taper. A slight radius on the contact face helps to reduce friction and reduce the risk of external dirt preventing a good contact when assembled. Thus, when the nut is put in place, after a few turns the external taper 126 or radius of the grip ring 122 meets the internal taper 132 or radius of the nut, and

further rotations of the nut 128 begin to compress the grip ring 122 by way of the taper action and also drive the grip ring 122 down onto the washer 120.

In this process, an axial compressive force is exerted on the sealing ring 112 via the washer 120. That axial compressive force causes the sealing ring 112 to be compressed axially against the flare 106 of the compression fitting and (in conjunction with the taper 116 of the sealing ring 112) this compresses the sealing ring 112 radially against a pipe that it surrounds.

Thus, in combination the various elements of the compression fitting provide both mechanical anchorage of a pipe therewithin and also an air and water tight seal. The mechanical anchorage is derived from the grip ring 122 who resists any attempt to withdraw the pipe. The seal is provided by the sealing ring 112 whose somewhat lesser rigidity allows it to be compressed into a more intimate contact with the pipe.

We have found that the use of a more rigid polymeric seal such as PU90, EPDM, PTFE, etc have distinct advantages over known highly flexible elastomeric seals as discussed above, in that the greater rigidity and lower friction offered by the rigid polymeric seal means that is less likely to "catch" on a pipe that is being inserted into the assembled compression fitting. As a result, insertion of the pipe is very much easier, and (together with the stop) this ensures that a user can be significantly more confident that the pipe has been inserted properly, in a correct alignment, and to the correct depth. However, the sealing qualities of the ring 112 do not appear to be adversely affected as a result of this.

Figures 6 and 7 show the grip ring 122 in more detail. It can be seen that the grip ring is nearly a complete circle, apart from a small gap 136 formed part way round its circumference of approximately 10° – 15°. This allows the grip ring 122 to compress when required, while still being made of a rigid material. Suitable materials include various metallic alloys including steel.

Figures 8 and 9 show an alternative solution to the problem of providing a reducer assembly. Reducers are used when it is necessary to connect two pipes

of differing diameters, and in the past these have consisted of connectors having a compression fitting at either end which is sized to fit the required pipe size. Given the number of different pipe sizes and the number of different connectors (in-line, tee, elbow etc), the number of permutations is very large, and this results in a correspondingly amount of stock that needs to be held if all the possible combinations are to be catered for. Figure 8 shows how this can be overcome.

A pipe fitting 100 is, in this example, a simple straight through connection but could of course be a tee, elbow or the like. A nut 128 is fitted to the pipe fitting 100 in the same way as discussed above. A sealing ring 112, a washer 120, and a grip ring 122 are provided within the bore of the pipe fitting 100, again in the same way, but sized to fit a pipe 138 which is of the intended diameter - less than the diameter of the pipe fitting 100. These operate around the pipe 138 in the same way as the above-described embodiments.

As the pipe 138 is of the smaller diameter than that intended for the pipe fitting100, the washer 120 and grip ring 122 do not fit within the bore of the pipe fitting 100 or the nut 128. Therefore, two spacers are provided, being a adaptor spacer 140 and a grip spacer 142.

The adaptor spacer 140 is a cylindrically symmetric item having an internal bore 144 which replicates the internal bore of a pipe fitting intended for a pipe of the size of pipe 138. Thus, it has an end stop 146 to locate the end of the pipe (together with a compressible element 147 in the form of a spring washer), a substantially parallel sided section 148, and a flare 150 which accepts the sealing ring 112. The external diameter of the adaptor spacer 140 can include a tapered portion 152 which corresponds to the flare 106 of the pipe fitting 100.

Other sealing options include a slight ridge 160 at some point along the taper (as shown in figure 10), or change in the geometry of the mating face 152 to that shown so as to produce a more defined contact point, or the addition of

an o-ring 162 or other sealing ring between the two faces (as shown in figure 11).

The grip spacer 142 is also cylindrically symmetric and has an external taper 154 which corresponds to the internal taper 132 of the nut 128. Within that external bound, there is a cylindrically symmetric L-profile comprising two transverse legs; first, an inward projection 156 which extends towards to the grip ring 122 and ends in an internally tapered section corresponding to the external taper 126 of the grip ring 122. Second, there is an axially extending section 158 which extends longitudinally within the pipe fitting 100 and abuts an end face of the adaptor spacer 140.

Thus, the pipe fitting 100, spacers and sealing elements etc are assembled loosely and the pipe 138 is inserted until it abuts against the end stop 146. The nut 128 can then be tightened. The action of the internal taper 132 of the nut against the external taper 154 of the grip spacer 142 then has two effects. First, the grip ring 122 is urged against the exterior of the pipe 138. Second, the sealing spacer 140 is pressed home against the flared opening 106 of the pipe fitting 100. This allows a good seal to be created between the adaptor spacer 140 and the pipe fitting 100.

As in the simple examples given above, the grip ring 122 is then urged by its taper 126 against the washer 120 and the sealing ring 122. That sealing ring is then urged against the taper 150 of the sealing spacer 140 and against the external diameter of the pipe 138 to create a seal between the pipe 138 and the sealing spacer 140.

Thus, the reducer assembly of figure 8 effectively allows a very much smaller pipe 138 to be fitted within a pipe fitting 100 suitable for very much larger pipes. By fitting a standard sealing assembly to the other end of the pipe fitting 100, a larger pipe of the size intended for that pipe fitting 100 could then be fitted allowing a union between the two different sized pipes. Of course, a smaller pipe could also be fitted at the other end of the pipe fitting 100 using an appropriate reducing assembly. It would of course be preferable to choose a

narrower pipe fitting 100 in order to reduce the number of seals required, but stock availability may dictate otherwise.

The reducer assembly illustrated in figure 8 is designed to accept a 15mm outside diameter pipe within a pipe fitting intended for 50mm diameter pipes. Suitable adjustment of the dimensions of the spacers will allow for other combinations. For example, figure 9 shows a revised sealing spacer 140' suitable for accepting a 40mm diameter pipe within a 50mm diameter fitting. As can be seen, the spacer is generally narrower so as to accept a larger a diameter pipe. However, an essentially corresponding internal and external shape is provided is provided with an end stop 146, a parallel-sided portion 148, and a taper 150 on the interior face, together with a taper 152 on the exterior face for engagement with the flare 106 of the pipe fitting. A flat end face 160 is provided for the grip spacer 142 to bear against.

In the way the stocking of reducer connectors can be entirely eliminated. Instead, a connector is chosen to fit the largest size of pipe and the required connector geometry (tee, in-line etc), and a reducer assembly is used to adapt that connector to the smaller size pipe(s) that are to be inserted.

Alternatively, a reducer coupling can be used as shown in figure 12. The reducer body 164 largely corresponds to the body section 100 of figure 5 except that its diameter reduces at its midpoint 166. On either side thereof are two connector assemblies, each comprising a sealing ring 168, a washer 170, a grip ring 172 and a nut 174 which grip the pipe, and a spring washer or compliant element 176. Each connector assembly is sized to fit the appropriate diameter of its respective end of the reducer body 164.

Among the features of the pipe fitting described above, this spring washer 48 is particularly useful in that it allows longitudinal movement of the pipe end without requiring the fitter to allow space therefor. The process of ensuring that such space is allowed has previously required that the fitting is assembled, the pipe is marked at the end of the fitting, and that the pipe is withdrawn to leave a specified clearance between the mark and the end of the fitting. This is

inaccurate and tiresome; the use of the spring washer or compliant element permits a fitter to assemble the joint simply by pressing the pipe against the washer 48 and stop 46; the pipe then moves to the correct position. Other features of specific interest (both in combination with the spring washer or other compressible element and in isolation thereto) include the range of materials from which the sealing ring is made, the range of preferred hardnesses of the sealing ring, and the incomplete nature of the grip ring.

It will of course be understood that many variations may be made to the above-described embodiment without departing from the scope of the present invention.

CLAIMS

1. A pipe compression fitting, comprising;

an externally threaded housing having a bore for receiving a pipe and a seat around the bore;

a polymeric or elastomeric sealing ring within the seat;

a nut engageable with the external thread thereby to urge the sealing ring toward the seat;

the housing having an inwardly directed stop within the bore adapted to prevent further insertion of the pipe, and a compressible element in front of the stop.

2. A pipe compression fitting according to claim 1 in which the sealing ring is of one of polyurethane, EPDM and PTFE.

3. A pipe compression fitting according to claim 1 or claim 2 in which the sealing ring has a Shore A hardness of at least 60.

4. A pipe compression fitting according to any one of the preceding claims in which a washer is disposed between the sealing ring and the nut.

5. A pipe compression fitting according to any one of the preceding claims in which a grip ring is provided within the nut for engagement with the exterior of a pipe passing through the nut into the bore.

6. A pipe compression fitting according to claim 5 in which the grip ring is provided with inwardly directed circumferential teeth on the inner axial face thereof.

7. A pipe compression fitting according to claim 5 in which the nut has a internal face around the grip ring that is tapered.

8. A pipe compression fitting according to claim 5 or claim 7 in which the grip ring has an external face within the nut that is tapered or radiused.

9. A pipe compression fitting according to any one of claims 5 to 8 in which the grip ring is shaped as an incompletely circular arc with a gap between opposing ends thereof.

10. A pipe compression fitting according to any one of the preceding claims in which the compressible element comprises a spring washer.

11. A pipe compression fitting according to claim 10 in which the spring washer comprises a wire formed in one plane into a ring, and in another plane transverse thereto into a series of undulations.

12. A pipe compression fitting according to claim 10 in which the spring washer comprises a flat shim formed in one plane into a ring, and in another plane transverse thereto into a series of undulations.

13. A pipe compression fitting, comprising;

an externally threaded housing having a bore for receiving a pipe and a seat around the bore;

a sealing ring within the seat;

a nut engageable with the external thread thereby to urge the sealing ring toward the seat; and

a grip ring within the nut for engagement with the exterior of a pipe passing through the nut into the bore .

14. A pipe compression fitting according to claim 13 in which the nut has a internal face around the grip ring that is tapered.

15. A pipe compression fitting according to claim 13 or claim 14 in which the grip ring has an external face within the nut that is tapered or radiused.

16. A pipe compression fitting according to any one of the preceding claims, in which a reducer assembly is fitted in the bore, comprising an adaptor spacer adapted to bear against the seat and having an inner seat to accept the sealing ring, and a grip spacer having an external taper

adapted to be driven by the nut thereby to drive the adaptor spacer into a sealing contact with the seat.

17. A pipe compression fitting according to any one of claims 5 to 15 in which a reducer assembly is fitted in the bore, comprising an adaptor spacer adapted to bear against the seat and having an inner seat to accept the sealing ring, and a grip spacer having an external taper or radius adapted to be driven by the nut thereby to drive the sealing spacer into a sealing contact with the seat and an internal taper adapted to urge the grip ring onto the exterior of the pipe.

18. A pipe compression fitting substantially as herein described with reference to and/or as illustrated in the accompanying figures 3 to 12.

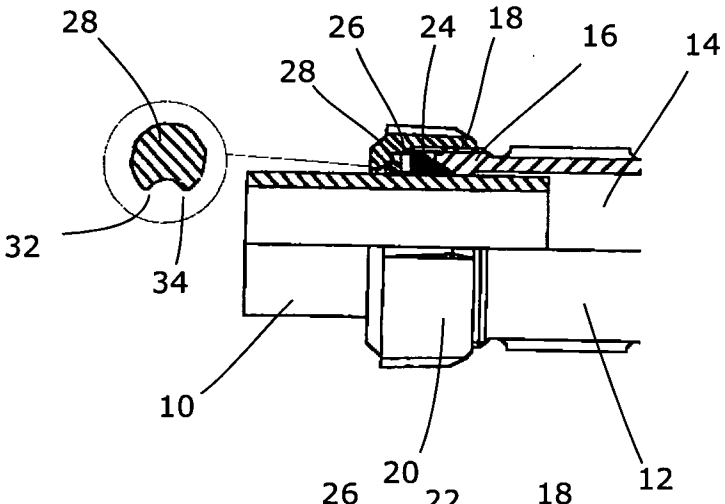


Fig 1

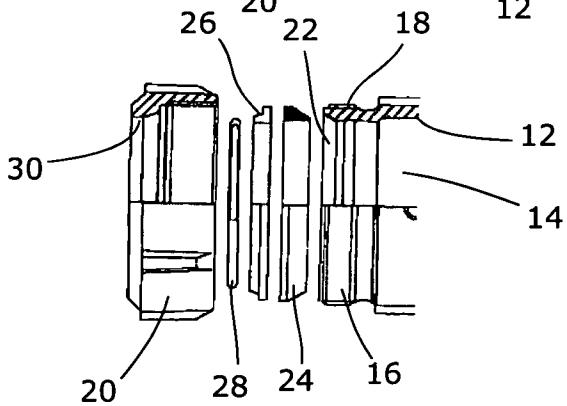


Fig 2

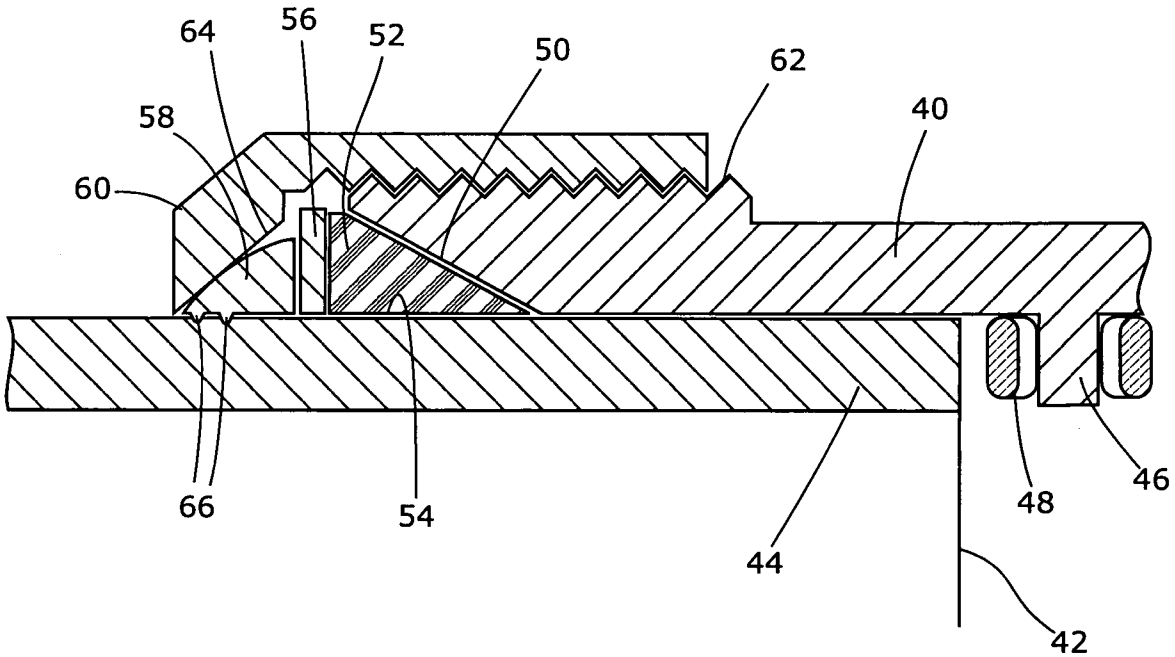


Fig 3

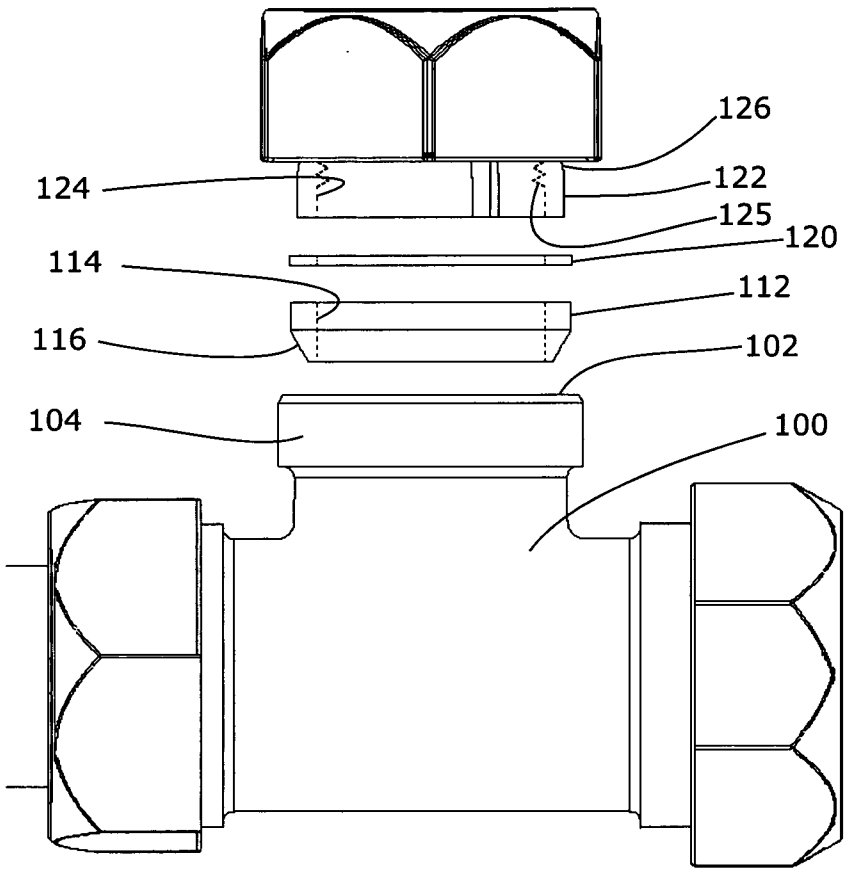


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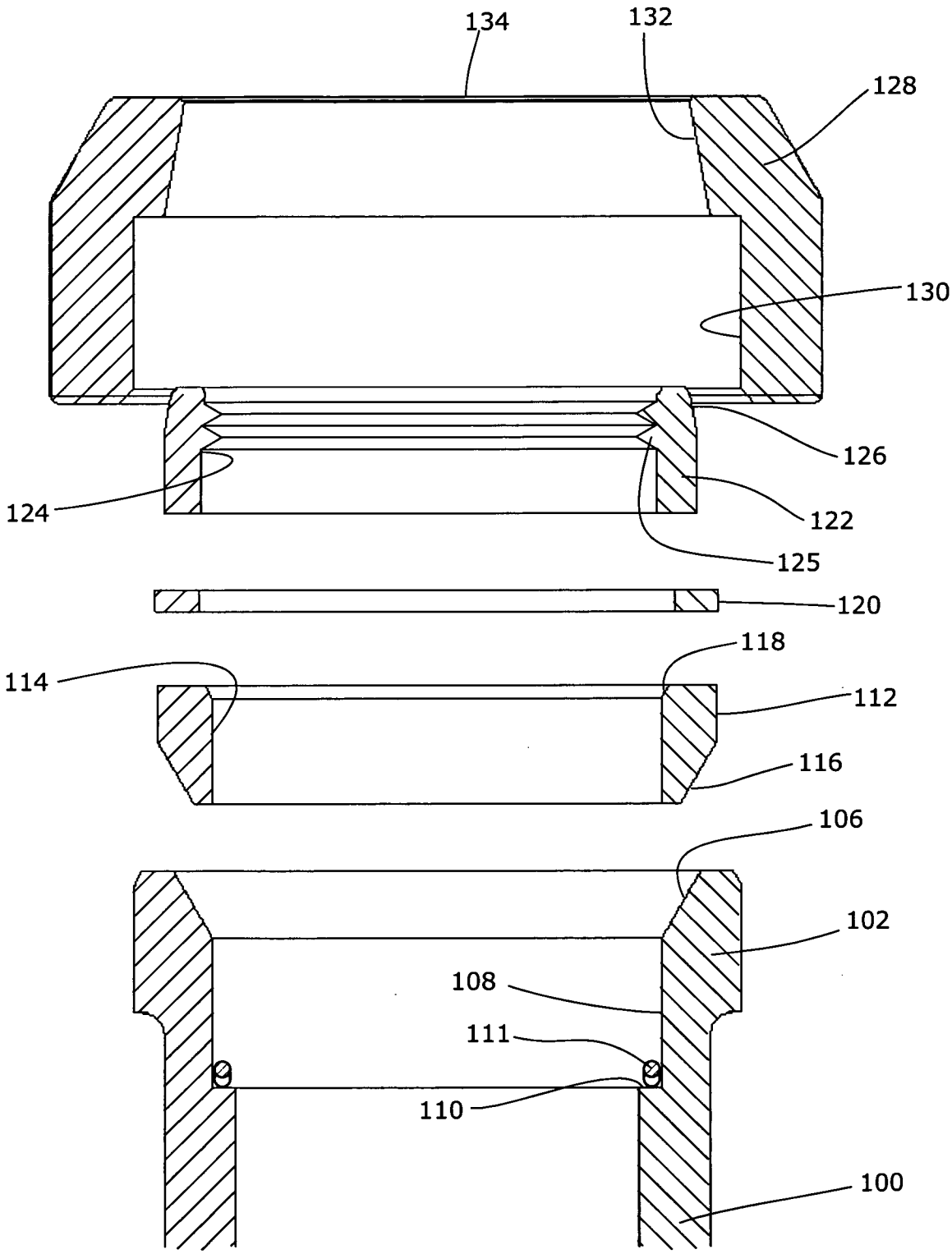

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Fig 5

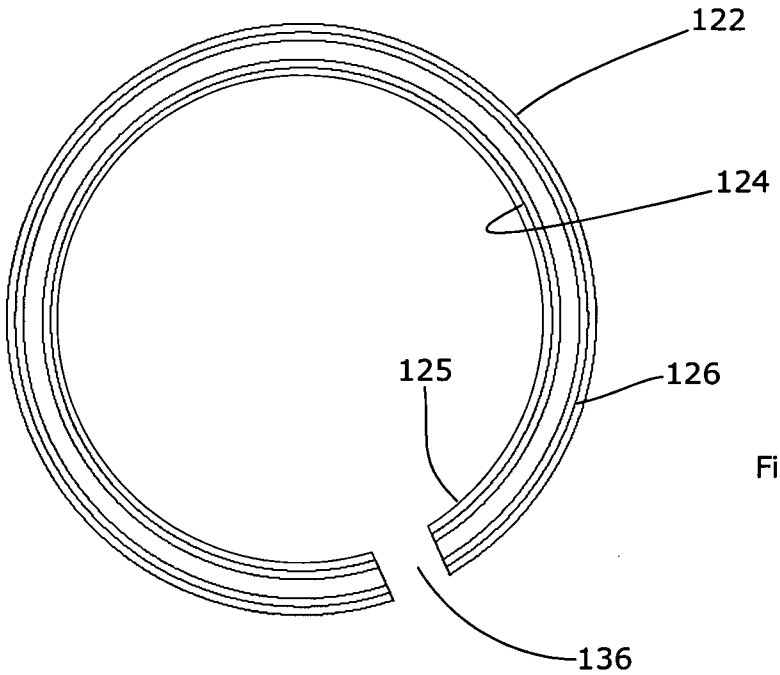


Fig 6

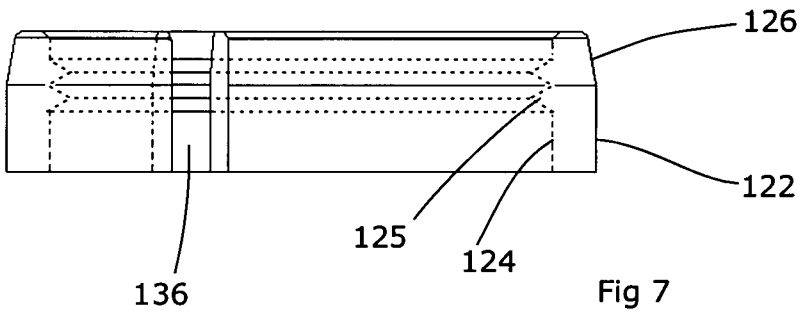


Fig 7

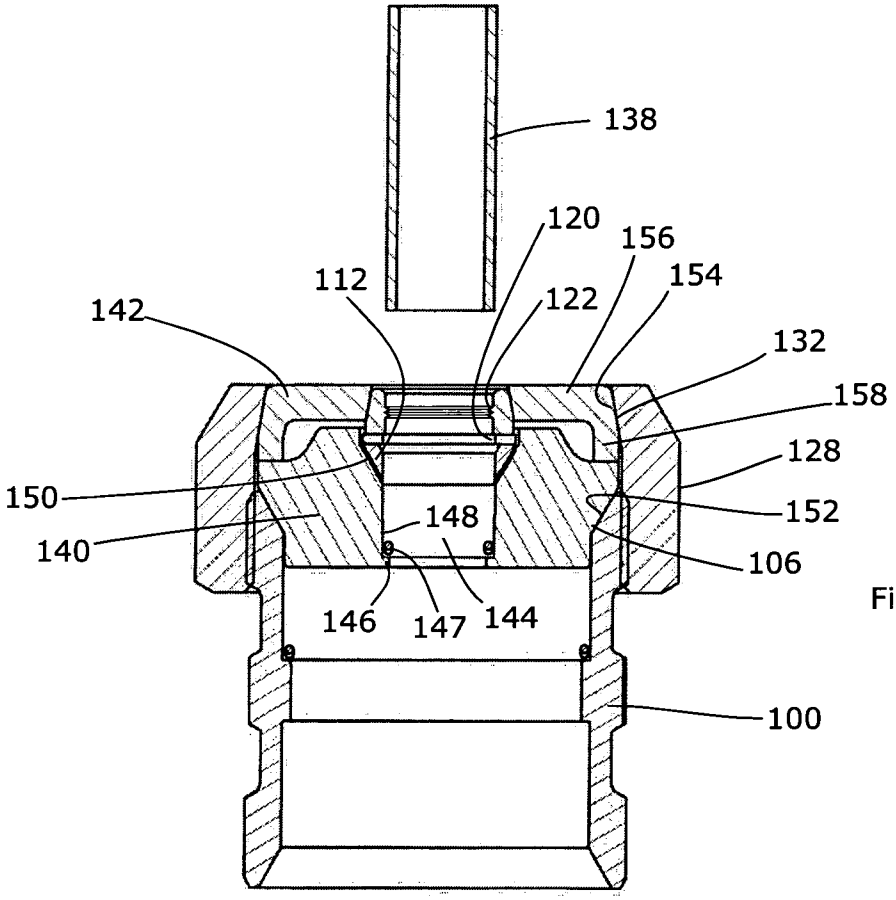

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Fig 8

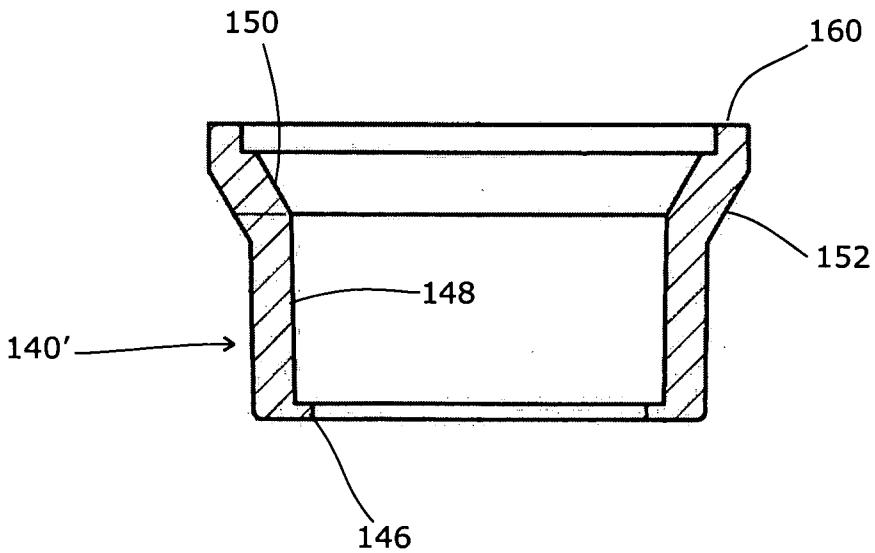

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146

Fig 9

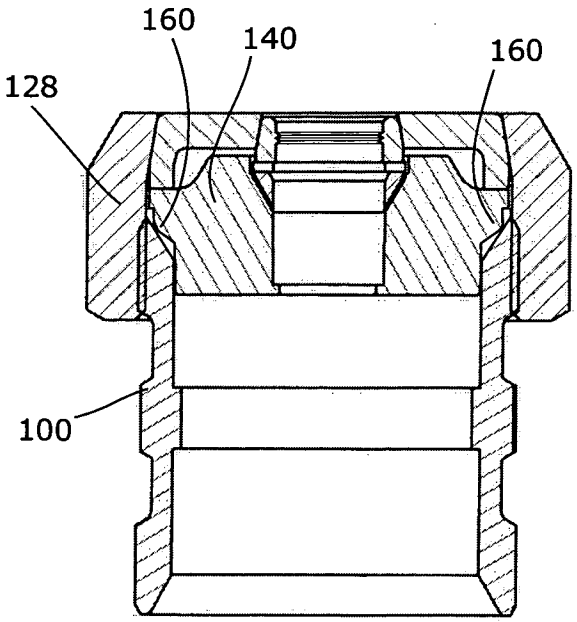


Fig 10

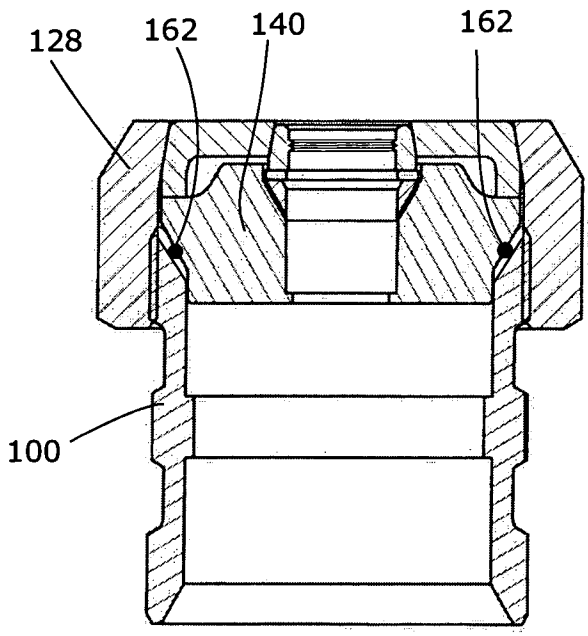


Fig 11

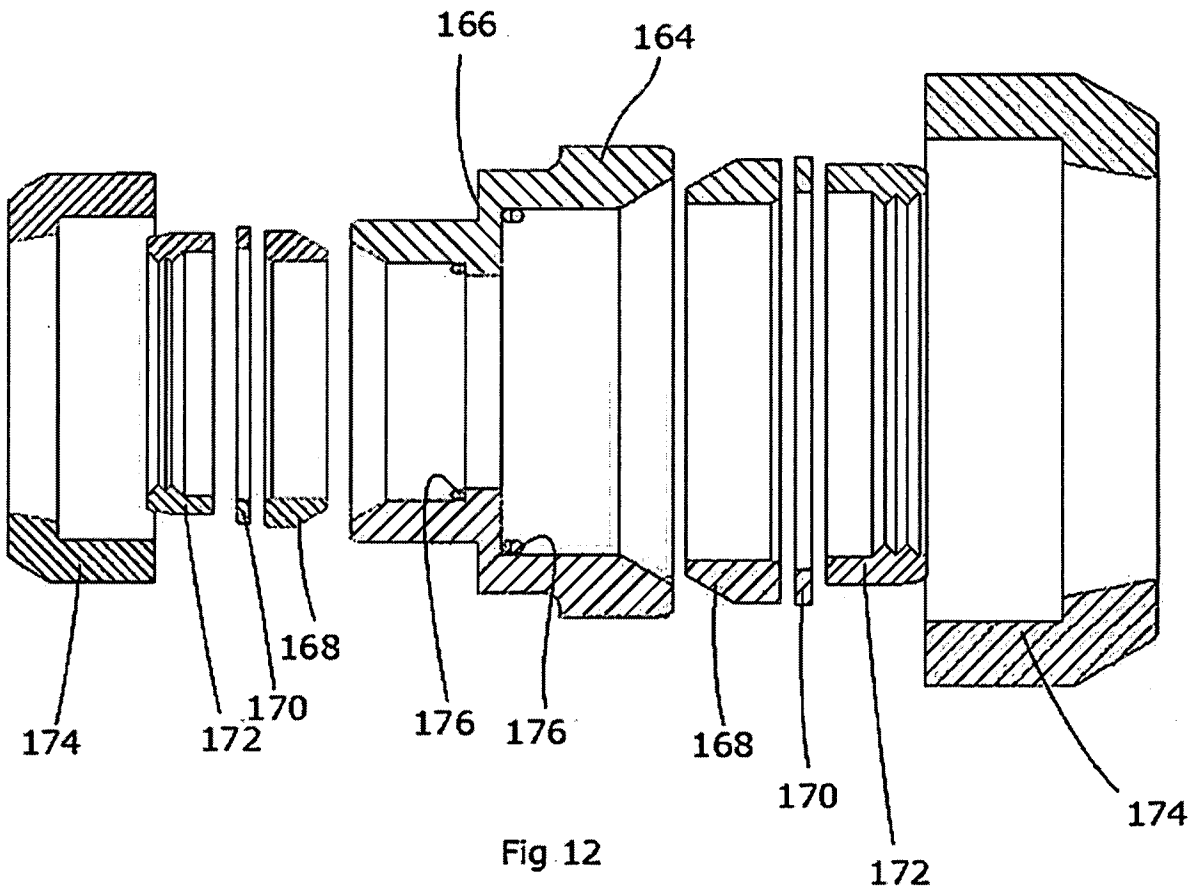


Fig 12