

The present invention relates to a locked joint between the plain end of a first tubular element and the socket of a second tubular element, of the type comprising a seal housed in the socket, a locking ring with
5 internal teeth surrounding the plain end, and a mating flange device equipped with means for fastening onto the socket and adapted so as to retain the locking ring without recoil. It applies especially to the laying of pipelines made from ductile cast iron.

10 Regardless of the type of packing used, having radial compression for so-called automatic joints or axial compression for so-called mechanical joints, locked joints of this type must make it possible to keep the recoil of the plain end down to a very low value when the
15 pipeline is pressurised, while at the same time being easy to install.

In addition, so that the locking of the tube junction may be ensured in an efficient and durable manner, and so that the durability of the tubular elements are not affected, it would be suitable to protect
20 the contact zones between the locking ring and the metal components which surround it against corrosion.

The objective of the invention is to supply a locked joint simultaneously fulfilling these three
25 conditions.

For this purpose, the subject of the invention is a locked joint of the aforementioned type, characterised in that a collar made from elastomer, overmoulded onto the locking ring, encases the latter on all sides except
30 on its toothed inner face, the said collar comprising, towards the front, at least one elastic lip which is interposed, in the longitudinal direction, between the locking ring and the rear face of a rigid abutment annulus surrounding the plain end.

35 According to other characteristics:

- the collar is terminated, towards the rear, by a cylindrical rear part connected to the elastic lip by means of a thin linking web constituting a coating for

the radially external face of the locking ring;

- the elastic lip and the rear cylindrical part are internally toothed in contact with the plain end and elastically clamp the latter;

5 - the collar comprises, towards the front, two diverging lips;

- a radial thin web projecting over the elastic lip extends the latter in the external radial direction;

10 - the elastic lip is a retaining ring made from elastomer with axial cells;

- the cylindrical rear part of the collar constitutes a gripping protuberance projecting axially beyond the mating flange.

When the joint has an axial compression seal, the
15 axial compression being provided by the mating flange device, the mating flange device advantageously comprises, on the one hand, a compression annulus which has a front face bearing on the packing and a rear face, this annulus constituting the said abutment annulus, and,
20 on the other hand, a mating flange equipped with the said fastening means and having a front thrust face which interacts with the rear face of the compression annulus and an internal face for retaining the locking ring which converges towards the rear.

25 When the joint has a radial compression seal, the radial compression being provided by the insertion of the plain end in the socket, the said abutment annulus is advantageously a spacer-annulus sandwiched between a radial face of the socket and the front face of the
30 mating flange.

Several embodiments of the invention will now be described with reference to the appended drawings in which:

35 - Fig. 1 is a half-view in axial section of a locked mechanical joint in accordance with the invention, during mounting;

- Figs 2 and 3 are similar views of two variants, in the mounted state;

- Fig. 4 is a similar view of another embodiment of the locked mechanical joint according to the invention, also in the mounted state; and

5 - Fig. 5 is a similar view of a locked automatic joint according to the invention.

Fig. 1 represents a locked joint between the plain end 1 of a first tubular element and the socket 2 of a second tubular element. The two tubular elements may in particular be two successive identical pipes of a pipeline, especially made from ductile cast iron, each
10 pipe comprising a plain end 1 at one end and a socket 2 at its other end. For the purposes of the present description, it will be assumed that, as represented, the two tubular elements have a horizontal common axis.

15 The plain end 1 is externally cylindrical, whereas the socket 2 externally, from its inlet, has a radially projecting collar 3 and then a converging surface 4. Internally, the socket has a frustoconical inlet surface 5 followed by a housing 6 whose surface
20 converges and is terminated by a virtually radial front end face 7.

The joint comprises an axial compression seal 8, a closed compression annulus 9, a locking device 10, a mating flange 11 and a series of fastening bolts 12.

25 The packing 8 is made from elastomer. When it is slipped over the male end and is in free abutment on the surface 7 of the socket, a free space may remain between its peripheral surface and the housing 6, as can be seen in Fig. 1.

30 The annulus 9, whose internal diameter is greater than the external diameter of the plain end, may penetrate into the socket with a considerable radial clearance and has a radial front (that is to say turned towards the bottom of the socket) face 13 and a rear face
35 14 which is also radial.

The locking device 10 is a composite component made by overmoulding and consists of a series of metal inserts 15, together constituting a locking ring,

embedded and bonded into a collar 16 made from elastomer. As a variant, the inserts 15 could be replaced by a split continuous ring, but the arrangement with several inserts is preferable because it is better adapted to the various peripheral configurations of the pipes.

Each insert 15 consists of a block having a curvilinear trapezoidal cross-section, with a large front radial face, and a small rear radial face, a radially external face 17 converging towards the rear, and domed, and a radially internal face of generally cylindrical or plane shape but provided with a series of teeth 18 for fastening onto the plain end.

The collar 16 comprises a cylindrical front part forming an elastic lip 19, which is internally toothed, a cylindrical rear part 20, also internally toothed, and a thin linking web 21 constituting a coating for the face 17 of the inserts. The rear part 20 comprises, in line with each insert, in the vicinity of its free end, an orifice 22, and it can be limited, outside the mating flange, to a series of axial tabs situated in these places. The collar 16 encases the inserts 15 on all sides, except on their toothed internal face. The cylindrical parts 19 and 20, which are respectively overmoulded onto the front and rear radial faces of the inserts, thus make it possible to retain the said inserts in the locking device 10, especially in the event of a local bonding fault.

The mating flange 11 is an annular body delimited by two radial faces, front 23 and rear 24, and by a radially internal surface 25 converging towards the rear and virtually conjugate with the surface 17 of the inserts. This body extends radially outwards by a thin radial web in which a series of axial holes 26 are made, and this thin web is provided with a peripheral protection rim 27 directed forwards.

The mounting of the joint thus described is performed as follows, the socket being in place.

It will be assumed firstly that we are in the so-called "maximum clearance" situation illustrated in Fig. 1 in which, taking the foundry tolerances into consideration, the male diameters are minimum, the female diameters maximum, and the axial dimensions are maximum for the female elements and minimum for the male elements.

The components 11, 10, 9 and 8 are successively slipped over the plain end with the packing at the end of this plain end and the other components distinctly offset towards the rear. The packing and the locking device lightly clamp the plain end.

Next, the plain end is introduced into the socket. The packing abuts on the face 7 of the latter, then slides onto the plain end until the latter has reached the desired axial position.

Then the annulus 9 is brought against the packing, the locking device 10 is thrust forwards until its part 19 abuts against the annulus 9, which is equally easy because this device is free from any radial compression, and the mating flange is brought along until its face 23 comes into contact against the face 14 of the annulus 9.

Next, the bolts 12 which comprise an eccentric nose 28 at their front end, are introduced into the holes 26, and the mating flange is clamped forwards by screwing nuts 29 on each bolt, the noses 28 bearing on the collar 3 of the socket and the nuts 29 on the rear face of the thin web of the mating flange. This clamping, by means of the annulus 9, axially compresses the packing 8 and thus seals the joint.

Due to the clearances, the mating flange does not come into contact, at this stage, with the locking device 10. In order to obtain this contact, the locking device is pulled backwards until it comes into contact with the mating flange, as indicated in dot and dash lines in Fig. 1, and this is by means of a rod 30 introduced through the holes 22, which are on the outside of the

mating flange, to the rear of the latter.

As a variant, the lip 19 may be sufficiently long so that the mating flange comes into contact with the device 10 via its internal surface 25 before its face 23 reaches the face 14 of the annulus 9. In this case, the tightening of the bolts furthermore brings about the radial compression of the inserts 15 on the plain end, and it is no longer necessary for the rear part 20 of the device 10 to exceed the mating flange.

In the inverse, so-called "minimum clearance" situation, after having introduced the plain end into the socket, the packing is introduced and manually precompressed for example by means of a hammer, in the housing 6, which is easy because the inlet to the socket is entirely free. When the mating flange is brought forwards, the latter abuts against the thin web 21 of the device 10, but an axial clearance remains between the faces 14 and 23. Then the nuts 29 are screwed.

The lip 19 then has sufficient stiffness to guarantee the application of the inserts 15 against the internal surface 25 of the mating flange, but this stiffness is sufficiently low to allow the advance of the mating flange until it comes into contact with the annulus 9 without substantially compressing the packing 8, this displacement of the mating flange towards the annulus 9 being furthermore made possible by the fact that the volume of elastomer substance defined by the lip 19 is sufficiently low relative to the volume offered by the expansion chamber delimited by the external surface of the plain end, the front radial face of the inserts, the internal surface 25 of the mating flange and the rear face 14 of the annulus 9.

Thus, the clamping of the bolts brings about, in a first instance, mutual contact between the faces 14 and 23 then, in a second instance, the axial compression of the packing 8 so as to seal the joint.

When the pipeline is pressurised, the plain end recoils by a certain distance x relative to the socket

and with this movement entrains the inserts, which thrust the mating flange backwards. However, the mating flange can only recoil very slightly, within the limits of its rigidity and that of the bolts 12. This recoil y of the mating flange relative to the socket is generally very much less than x , for example of the order of $x/10$. Consequently, the annulus 9 can only recoil by the distance y , so that the compression of the packing, and thus the sealing of the joint, is effectively maintained.

It should be noted that the internal teeth of the parts 19 and 20 of the locking device improve the sealing around the inserts 15, and hence their protection against corrosion, by creating sealed restrictions. The thin web 21, and a radially projecting front heel 21A of this thin web, also participate in this protection. This elastomer structure 19, 20, 21 and 21A as a whole, thus ensures sealing relative to external agents, and the confinement of the contact zones between the inserts and the metal faces on which they bear.

In order to enhance protection against corrosion of the inserts 15, recourse may be made to one or other of the variants of Figs 2 and 3.

The variant represented in Fig. 2 only differs from the joint of Fig. 1 in the following ways: the front part 19 of the locking device penetrates into an annular recess 31 provided in the rear face of the annulus 9 and comprises two diverging lips: one internal lip 19A, which presses on the plain end, and one external lip 19B, which presses elastically against the bottom of the recess 31. The lip 19A may also, under certain conditions of mounting, be pressed against the bottom of this recess. The rear part 20 of the locking device, for its part, is entirely contained in the mating flange and has a shape similar to two diverging lips, namely an internal lip 20A pressed on the plain end and an external lip 20B bearing elastically on the internal surface 25 of the mating flange.

The variant illustrated in Fig. 3 only differs from the joint of Fig. 1 in the following ways: the face 23 of the mating flange has an annular countersink 32 on its internal edge, in which countersink a thin radial web 19C projecting over the elastic lip 19 of the locking device is compressed, and this front part 19 is axially compressed against the bottom of an annular recess provided in the annulus 9. In addition, the rear part 20 of the locking device, entirely contained in the mating flange, has a U-shaped configuration forming a lip which presses elastically against the internal surface 25 of the mating flange.

The variant illustrated in Fig. 4 only differs from the joint of Fig. 1 in the following ways: the front part 19 of the locking device of Fig. 1 here consists of a circular retaining ring with axial cells, such a retaining ring having, by virtue of the cellular structure, a significant axial flexibility. In addition, the annulus 9 has a rectangular cross-section and, at mid-length, a collar 33 projecting radially outwards. Its front part can slide into the rear part, of cylindrical shape, of the housing 6 of the socket, and its rear part slidably receives the front part, which is also cylindrical, of the internal surface 25 of the mating flange, which bears on the collar 33, this arrangement thus making it possible to centre the annulus 9 relative to the retaining ring 19 and relative to the seal 8.

From the preceding description it may be seen that, in all the embodiments of the mechanical joints according to the invention, the following advantages are obtained simultaneously:

(1) no force is required to fit the plain end into the socket;

(2) ease of positioning and dismantling, by virtue of the independence of the mating flange device relative to the locking device 10, with convenient access to the seal in order to precompress it manually before fastening the mating flange where this is necessary;

(3) maintaining sealing between plain end and socket despite the recoil of the inserts when the pipeline is pressurised, and this is by virtue of the contact between the rigid abutment annulus and the mating flange, the said contact being obtained for a wide range of diametral tolerances on the assembled pipes and being allowed as a result of the small volume of elastomer of the elastic lip 19 facing the surrounding expansion chamber;

10 (4) keeping the recoil of the plain end down to a very low value, by virtue of the fact that, after mounting the joint and before pressurising the pipeline, we are certain of the application of the inserts 15 against the surface 24 of the mating flange, and hence of the absence of axial clearance in these places, and this being true for large diametral tolerances on the assembled pipes; and

(5) anti-corrosion protection, and hence durability of the contact zone between the inserts and the metal components which surround them by virtue of the sealing generated by the elastomer collar (16), and more particularly by the restrictions of the front and rear parts of the said collar.

Fig. 5 shows the application of the invention to an automatic joint, in which the housing 6 of the socket 2 comprises an inlet collar 34 radially extending the collar 3 inwards and defining, with the latter, a plane end segment 35 of the socket. The packing 8 is compressed radially in the housing 6 simply by introducing the plain end into the socket.

30 In this case, the locking device 10 is the same as in Fig. 1, and the variants of Figs 2 to 4 can be used. In contrast, the annulus 9 is a spacer-annulus with rectangular cross-section sandwiched between the faces 35 of the socket and 23 of the mating flange. In this case, the annulus 9 essentially serves to provide a bearing surface for the elastic lip 19 of the device 10, whereas the collar 34 comprises an internal chamfer 36 to

facilitate the introduction of the plain end into the socket. Consequently, as a variant, the annulus 9 may, in certain cases, be omitted, the mating flange 11 and the part 19 then bearing directly on the socket.

- 5 In such an application, we are again certain that the inserts 15 press without clearance onto the surface 25 of the mating flange before the pipeline is pressurised, and that the recoil of the plain end will consequently be minimal. In addition, as previously, the
- 10 mounting and dismantling of the joint is very convenient.



CLAIMS

1. Locked joint between the plain end (1) of a first tubular element and the socket (2) of a second tubular element, of the type comprising a seal (8) housed in the socket, a locking ring (15) with internal teeth (18) surrounding the plain end, and a mating flange device (9, 11) equipped with means (12) for fastening onto the socket and adapted so as to retain the locking ring without recoil, characterised in that a collar (16) made from elastomer, overmoulded onto the said locking ring, encases the latter on all sides except on its toothed inner face, the said collar comprising, towards the front, at least one elastic lip (19) which is interposed, in the longitudinal direction, between the locking ring (15) and the rear face (14) of a rigid abutment annulus (9) surrounding the plain end.
2. Locked joint according to Claim 1, characterised in that the collar (16) is terminated, towards the rear, by a cylindrical rear part (20) connected to the elastic lip (19) by means of a thin linking web (21) constituting a coating for the radially external face (17) of the locking ring (15).
3. Locked joint according to Claim 1 or 2, characterised in that the elastic lip (19) and the rear cylindrical part (20) are internally toothed in contact with the plain end (1) and elastically clamp the latter.
4. Locked joint according to any one of Claims 1 to 3, characterised in that the collar (16) comprises, towards the front, two diverging elastic lips (19A, 19B).
5. Locked joint according to any one of Claims 1 to 4, characterised in that a radial thin web (19C), projecting over the elastic lip (19), extends the latter in the external radial direction.
6. Locked joint according to any one of Claims 1 to 5, characterised in that the elastic lip (19) is a retaining ring made from elastomer with axial cells.
7. Locked joint according to any one of Claims 1 to 6, characterised in that the cylindrical rear part of the



collar (16) constitutes a gripping protuberance (20) projecting axially beyond the mating flange (11).

8. Locked joint according to any one of Claims 1 to 7, with an axial compression seal (8), the axial compression being provided by the mating flange device (9, 11), characterised in that the mating flange device comprises, on the one hand, a compression annulus (9) which has a front face (13) bearing on the packing (8) and a rear face (14), this annulus constituting the said abutment annulus, and, on the other hand, a mating flange (11) equipped with the said fastening means (12) and having a front thrust face (23) which interacts with the rear face (14) of the compression annulus and an internal face (25) for retaining the locking ring (15) which converges towards the rear.

9. Locked joint according to any one of Claims 1 to 7, with a radial compression seal (8), the radial compression being provided by the insertion of the plain end (1) in the socket (2), characterised in that the said abutment annulus (9) is a spacer-annulus sandwiched between a radial face (35) of the socket and the front face (23) of the mating flange (11).