

The invention relates to a two-part metal clamping connector for connecting pipes or tubes according to the preamble of claim 1 and as known from DE-A-3813815.

The clamping connectors according to the prior art (US-A-4 293 147, DE-A-36 08 843, DE-A-38 13 815) comprise, as a common feature, a cylindrical, ribbed support sleeve which is limited by a collar and onto which a socket, formed onto the end of the pipe or tube, can be fitted, and a clamping sleeve, which is fitted onto the pipe or tube and is displaceable with its flared opening facing the socket, can be press-fitted over the fitted socket in order to create the connection, the bore of the clamping sleeve being formed in such a way that the pipe or tube socket material fills all cavities between the support sleeve and the clamping sleeve.

A further clamping connector for tubes, in which the clamping sleeve acts as a force transmitter, is also known from FR-A 905 791. In this case, the clamping force is applied by a slide ring. Prior to the start of the displacement process of the ring, the clamping sleeve is already fitted over the connecting element inserted in the tube lumen. When the ring is displaced over the outer circumference of the clamping sleeve, the latter is axially compressed and thereby securely presses the tube onto the connecting element. The clamping sleeve is also slightly displaced axially - by the sliding force of the ring -, abuts against an incline on the collar of the connecting element, is pressed into a recess adjoining the incline and thereby additionally secures the clamping sleeve on the tube.

Single-axis clamping connectors are usually manufactured by turning. A profile rod is used as the starting material. The smaller the collar, the smaller the profile rod which can be used. Particularly in the case of fittings where a clamping connection is fitted on one side and a thread on the other, it is preferable to select a polygonal-profile rod,

which is left unmachined and acts as a grip for the tool for manufacturing the threaded connection. Nowadays, fork wrenches are no longer used. However, when water-pump tongs are used, it is possible to dispense with standard wrench widths. Thus, the polygonal-profile rod can be provided with the same diameter as the thread. Often it is only necessary to take into account the collar when selecting the size of the profile rod.

Multiple-axis clamping connectors are usually manufactured by drop forging or casting with subsequent chip-forming machining. Here too, high collars, and also steep collars, as illustrated in the embodiments of the prior art, are a disadvantage.

In the manufacture of clamping connectors by drop forging, there is a danger of fold and overlap formation, which can impair the function of the clamping connector. It is also possible for the blank to become stuck in the mould. The rapidly cooling blank which is fixed in the mould halves between the collars can become more or less visibly torn. In addition, a correspondingly powerful press is required in order to forge out the dominating heights on the blank.

In the manufacture of clamping connectors by casting, there is a danger of air, cinders, mould residues, etc. collecting, which can impair the function of the product. Collars can represent material accumulations within the casting. When the blank cools, the outer skin hardens first, so that collapsed areas, caused by shrinkage, can be formed on the side of the bore opposite material accumulations, which collapsed areas need to be compensated by increased use of mould and material in order to prevent wall weaknesses.

In the clamping connector manufacturing methods described above, difficulties are experienced with the conventional, relatively high collar.

The abutment of the taper bore mounted clamping sleeve against the collar does not contribute to the sealing effect of the clamping connector. Pipes and hoses made of polymer material cannot be manufactured with a uniform circumferential wall thickness. Consequently, the clamping sleeve can never be press-fitted so as to be completely flush with the axis: it rather lies at an angle. At the site where the clamping sleeve contacts the collar, a gap is formed on the opposite side of the circumference. When the clamping sleeve is fixed at an angle to the tool, which cannot always be avoided, a gap is also formed between the clamping sleeve and the collar. There are no recognisable optical or technical advantages of these known designs. For the attachment of the tool alone for the clamp-fitting of the clamping sleeve, it is essential that the collar is not too high. The higher, or the larger the diameter of the collar, the higher the manufacturing costs of the clamping connector.

It is therefore the object of the invention to provide a clamping connector, which obviates the disadvantages of the prior art and which is in particular more economical in itself and in respect of its manufacturing costs.

The object is achieved according to the invention by the characterising feature of claim 1.

This has the advantage of low weight, with a corresponding influence on material costs, transportation, handling, smaller production machines with reduced costs, reduced machining or more rapid machining with less cutting.

Further developments of the invention are described in the subclaims.

Embodiments of the invention are reproduced in the drawings, which are each an axial half-view:

Fig. 1 is a side view of the support sleeve with a longitudinal section through the socket,

Fig. 2 is a side view of the support sleeve with a longitudinal section through the socket and a longitudinal section through the clamping sleeve, which is approximately in the half press-fitted position,

Fig. 3 as Fig. 2, but with the clamping sleeve in the fully press-fitted position,

Fig. 4 shows a support sleeve with a channel in the collar,

Fig. 5 is a full longitudinal section through the clamping sleeve,

Fig. 6 is a side view of the support sleeve with a partial section through the collar, with socket and a clamping sleeve with cylindrical end core in the press-fitted position, and

Fig. 7 is a side view of the support sleeve with a partial section through the collar, with socket and a clamping sleeve with end bore flaring in a curve in the press-fitted position,

The clamping connector 1 comprises a support sleeve 2, onto which a socket 41, formed onto the pipe or tube end 4, is fitted. The support sleeve 2 is provided with cylindrical, circular ribs 21. Furthermore, a collar 22 is provided against which the socket 41 abuts. A clamping sleeve 3 is pushed over the socket 41 using a pressing tool not shown in the drawings, the clamping sleeve enclosing the socket 41 with a press-fit. The clamping connector 1 with the metal support sleeve 2 and the clamping sleeve 3 is suitable for pipes or tubes 4 made of polymer materials, including in particular materials made of cross-linked polyethylene (abbreviation: VPE, more recently PE-X). VPE has properties lying between

those of a thermoplastic material, such as polyethylene, and an elastic material, such as rubber.

In order to produce the connection, a cylindrical socket 41 needs to be formed onto the tube end 4. This can be effected using a mechanical tool at the usual temperatures for conduit laying. Expansions of 20% are taken up by the material without damage. The socket 41 needs to be widened beyond the diameter of the support sleeve 2 onto which it is fitted. After removal of the widening tool, shrinkage of the socket 41 occurs immediately. Up to 10 seconds are required in order to fit the pipe or tube 4 with the formed-on socket 41 onto the support sleeve 2 of the clamping connector 1. The excess socket material produced during creation of the connection is merely compressed by the clamping sleeve 3, but is in no way shorn off or otherwise damaged. The socket 41 adapts to match the contours of the support sleeve 2 and the clamping sleeve 3 without damage to the material.

The socket 41 attempts to return to the diameter of the pipe or tube. It presses against the ribs 21 of the support sleeve 2. A sealing effect is already produced before the clamping sleeve 3 is press-fitted. The shrinkage force of the socket 41 also impedes the outflow of material from the clamping area.

The material VPE is not susceptible to primary or secondary tearing. Consequently, the support sleeve 2 can be constructed with cornered webs and/or deep grooves. The high edge compression and anchoring which can be obtained in this manner provide the sealing effect and longitudinal frictional locking of the connection.

Pipes and tubes 4 manufactured from VPE material are able to absorb the pressures and temperatures occurring in the case of drinking water supply in buildings with the required degree of safety and service life. However, VPE has a greater

temperature-induced volume expansion than metal. Consequently, the material located between the metal components can be compressed during heating, but tends to return to its original position again.

Fig. 2 shows the clamping sleeve 3 as it is being press-fitted and Fig. 3 shows the clamping sleeve in its final position. The structural shape of the clamping connector 1 needs to be such that the displacement of the pipe or tube material is limited in the clamping region. It is therefore necessary to ensure that the clamping connector 1 is manufactured without cavities in the clamping region. The three components 2, 3, 4 forming the clamping connector 1 are therefore adapted to one another in such a manner that no cavities are formed even in the case of unfavourable tolerance formations. However, this means that excess socket material is produced. In Figs. 1, 2 and 3, the support sleeve 2 is provided in a first embodiment with a groove 23. In this embodiment, the groove 23 is used for receiving the excess socket material produced during the press-fitting process. The groove 23 can be simply formed using turning technology and can be regarded as a reinforcement of the collar 22. Consequently, the clamping connector 1 with the support sleeve 2 according to Figs. 1, 2 and 3 can be kept relatively short.

In a second embodiment shown in Figs. 4, 6 and 7, the support sleeve 5 is provided with a channel 53. In this embodiment, the channel 53 in the collar 52 acts as receiving space for the excess socket material. If this receiving space were not provided, the socket material could be squeezed out between the metal components formed by the support sleeve 5 and clamping sleeve 3, and/or the metal components could be deformed and a higher pressing force would be necessary for the clamping sleeve 3 (Figures. 6, 7). The edges 521, 522 (Fig. 4) act as further sealing edges, i.e. zones with increased surface compression, in addition the rib edges 511 on the support sleeve 5. This applies to cases where the pipe

or tube end 4 or the socket 41 is cut off at exact right-angles to the axis, which can be easily effected using a corresponding tool. The socket material (Figures. 6, 7) extruded into the channel 53 increases the resistance of the clamping connector 1 to leakage as a result of bending of the clamped pipe or tube 4.

The groove 23 for receiving the excess socket material produced when the joint is formed is easier to manufacture using turning technology and weakens the collar 22 less than the channel 53. The clamping connector with the groove 23 can therefore be made shorter than a clamping connector with the channel 53. However, the groove 23 tapering the collar 22 towards its outer diameter cannot contribute to improving the bendability of the connector. The groove 23 also has one less sealing edge (231, 232; 531, 532, 533) than the channel 53. The decision to use either the channel 53 or the groove 23 when constructing the clamping connector 1 needs to be based on the expected operating conditions of the conduit and the material used for the pipe or tube 4.

In the clamping connector 1 according to Figs. 1 to 6, the clamping sleeve 3, starting from its flared opening 31, continues into a cylindrical bore 32, which then, widened in stepped fashion, joins onto a cylindrical bore 33 extending as far as the end of the clamping sleeve 3 or joins onto a plurality of cylindrical bores, each flaring in stepped fashion and extending as far as the end of the clamping sleeve 3. As shown in Fig. 3, the step 34 prevents the clamping sleeve 3 from sliding backwards.

In contrast, as shown in Fig. 7, the clamping sleeve 6, starting at its flared opening 61, continues into a cylindrical bore 62, onto which joins a bore 63 widening conically or in a curve and extending as far as the end of the clamping sleeve 6.

The clamping connector 1 can be used for drinking water conduits and radiator connection pipes in buildings. It is assumed that these conduits are operated at varying pressures and temperatures. Owing to the fact that the socket material made of VPE polymer material has a greater degree of temperature-induced expansion than that of the metal components enclosing the socket, an excess of socket material is produced during heating. This can be compressed into cavities still remaining on the support sleeve 2, 5 and clamping sleeve 3, 6 or into the receiving space formed in the described embodiments as a groove 23 or channel 53, but also onto the side of the pipe or tube. It cannot therefore be ruled out that the compression force between the socket outer side and the clamping sleeve 3; 6 decreases somewhat with time. It is therefore expedient to secure the clamping sleeve 3; 6 against displacement by its intrinsic weight or a limited external force. It should be emphasized that the VPE material, which is particularly suitable for the clamping connection, is flow-resistant as a result of its shrinkage force and its excellent elastic behaviour. During cooling, the socket material made of VPE attempts to return to its position prior to heating. The flare of the bore on the one hand and the step 34 or the conical or curved widening 63 on the other hand secure the clamping sleeve 3; 6 axially on two sides against displacement by its intrinsic weight or by a limited external force. Whether the inner cavity of the clamping sleeve 3; 6 according to Figures. 5 and 6 or Figure. 7 is used depends on the manufacturing process. The contour of the inner cavity of the clamping sleeve 3; 6 can be manufactured by turning out or deep-drawing suitable starting materials.

CLAIMS

1. Two-part metal clamping connector (1) for connecting pipes or tubes, the pipes and tubes consisting of polymer material and the clamping connector being provided with a cylindrical, ribbed and collared (22) support sleeve (2; 5) onto which a socket (41), formed onto the end of the pipe or tube, can be fitted, and a displaceable clamping sleeve (3; 6), which is fitted onto the pipe or tube, can be press-fitted over the fitted socket in order to create the connection, the bore of the clamping sleeve being formed in such a way that the pipe or tube socket material fills all cavities between the support sleeve and the clamping sleeve, and the clamping sleeve (3, 6) can, during the jointing process, be moved into an end position by sliding it over the socket formed prior to the push-fit process, and the internal diameter of the end of the clamping sleeve towards the socket flares out in conical fashion towards the socket, characterised in that the clamping sleeve envelops the collar (22) in its end position.
2. Clamping connector according to claim 1, characterised in that, on its flank facing the socket (41), the collar (22) comprises a semi-circular groove (23) tapering the collar (22) towards the outside.
3. Clamping connector according to claim 1, characterised in that, on its flank facing the socket (41), the collar (52) comprises a circumferential channel (53), the opening of which is smaller than the wall thickness of the socket (41).
4. Clamping connector according to claim 1, characterised in that, starting at its flared opening (31), the clamping sleeve (3) continues into a cylindrical bore (32), widens in stepped fashion, joins onto a cylindrical bore (33)



extending as far as the end of the clamping sleeve (3) or joins onto a plurality of cylindrical bores, each flaring in stepped fashion and extending as far as the end of the clamping sleeve (3) (Fig. 5).

5. Clamping connector according to claim 1, characterised in that, starting at its flared opening (61), the clamping sleeve (6) continues into a cylindrical bore (62), onto which joins a bore (63) which flares conically or in a curve and extends as far as the end of the clamping sleeve (6) (Fig. 7).

