

The invention relates to a connection element which can be clamped in a hole of a structural component, according to the preamble of Claim 1, and a method for producing the connection element according to the preamble of Claim 8.

A connection element of the initially-mentioned type is disclosed in DE-A 32 37 468. The known connection element has a bolt and two wedge-shaped sleeves. At one end, the bolt comprises a collar and at the other end a threaded section. As a result of a nut, supported on an object to be secured, being tightened on the threaded section, the sleeves are pushed together in that they slide on their oblique surface edges. As they slide, the sleeves are pressed radially against the wall of the bore hole in the direction of their longest surface line. In order to prevent the sleeve abutting the bolt collar from slipping back, there is disposed at the tip of the wedge of the sleeve an extension which is supported on the nut. As the nut is tightened, the extension breaks or is bent. The known connection element is expensive to produce.

GB-A 14 75 839 discloses a further connection element of the initially-mentioned type which is made of plastics material. This

connection element has two connection parts which are held together via predetermined breaking points which break when the parts to be inserted in a hole are pulled towards one another. The parts are pulled towards one another by means of a screw which is inserted through the one part and of which the thread engages the second part. When the parts have broken away from one another, the latter part has two wedge-shaped attachments which can be pulled into V-shaped recesses in the first part in such a way that the V-shaped legs are pressed outwardly against the wall of the hole. The spreading effect of this connection element depends on the degree to which the two parts are drawn into one another and this in turn depends on the force to be applied by the screw to the second part without tearing out the thread in the plastics material which is cut when the part is screwed in. A reasonably satisfactory hold of the connection element in the hole can only be achieved with a good degree of "fine feeling".

A connection element not of the initially-mentioned type is described in CH-A-429 317 and is used in the construction of scaffolding for producing tube connections. It consists of two identical wedge sleeves of which the inclined sliding surfaces are superimposed inside a tube

end to be secured to a connection member. By means of a clamping screw which is to be screwed into a thread of the connection member and engages through the sleeves, the two wedge sleeves, since they are located on the connection member or on the screw head at the end face turned away from the sliding surface, are pulled in a sliding manner towards one another on the sliding surfaces and as a result thereof are forced against the inner surface of the tube end, as a result of which the tube end is connected to the connection member.

A further connection element not of the initially-mentioned type and described in DE-C-35 23 155 differs from the initially-mentioned types in that it has a single sleeve which is in the form of a spreading sleeve widened by a spreading cone which can be drawn thereinto by means of a clamping screw. In this case also, the clamping screw is screwed into a connection member against which the end face of the spreading sleeve abuts. As a result of the widening, this spreading sleeve is forced against the inner surface of a tube end to be secured to the connection member.

A similar connection element, likewise not of the initially-mentioned type, is disclosed

in DE-A-35 28 744 and is to be used as a wall plug. In contrast to DE-C-35 23 155, in this case the wall thickness is thinner and a second spreading slot is provided which has a predetermined breaking point and two diametrically opposite projections, which dig into the wall of the bore hole.

In the case of a further securing element for tubes which can be pulled out telescopically, described in US-A-2 643 143 and not of the initially-mentioned type, one tube end comprises a wedge-shaped attachment which engages in a V-shaped continuous cut-out of a sleeve which is flush with the tube end with the same outer diameter in the unstressed state as the tube. The sleeve is reinforced with a clamping bolt which is drawn into the tube interior by means of a compression spring. The clamping bolt can be moved axially by means of a lever against the force of the compression spring. If the pressure on the compression spring is relieved, the tube end can be moved in a reciprocating manner in a second tube. If the compression spring is operating, the V-shaped cut-out of the sleeve is drawn onto the attachment and thus spread open, as a result of which it is forced against the inner wall of the second tube. As a result thereof,

displacement of the two tubes towards one another is to be prevented. The securing element described in this case requires complicated mechanical operations to be performed on one of the tubes and is only suitable for connecting two tubes.

Further connection devices are disclosed in US-A-3 945 743, FR-A 2 278 978, CH-A-488 120 and US-A-3 815 198.

The connection devices and connection elements described above can either be used only when there is high tension, or are complicated to manufacture.

The object of the invention is to overcome these disadvantages. The invention, as characterised in Claim 1, achieves the object of providing a simple connection element which is cheap to manufacture and enables parts to be assembled rapidly.

The method for producing the connection element according to the invention is the subject matter of Claim 8.

Particular embodiments of the invention are indicated in the dependent claims, further objects achieved thereby and resultant advantages emerging from the following explanation of the invention.

In the following, embodiments of the connection element according to the invention will be described in further detail with reference to the drawings, in which:

Figure 1 is a side view of a connection element, which can be secured on a connection member and clamped in a tube, and has two sleeves, the tube being illustrated in section in order to illustrate better the sleeves;

Figure 2 is a diametrically opposite side view of a variant of the connection element;

Figure 3 is a rear view of the connection element illustrated in Figure 2;

Figure 4 is a side view of a further variant of a connection element;

Figure 5 is a side view of the variant in Figure 4, rotated through 90°;

Figure 6 is a side view of the variant in Figure 4, rotated through 180°;

Figure 7 is a plan view of a stamped and partially

bent end piece of a sheet metal strip;

Figure 8 is a plan view of the end face of a sleeve after a first bending process, viewed in direction VIII in Figure 7, the elements of stations g) and h) having been removed;

Figure 9 is a plan view of the end face of a sleeve after a second bending process following the first, viewed in direction IX in Figure 7, the completely bent sleeves in station h) having been removed;

Figure 10 is a plan view of the end face of a sleeve on completion of the bending processes, viewed in direction X in Figure 7;

Figure 11 is a side view of a variant with a toothed, wedge-shaped attachment and an associated V-shaped cut-out of adjacent sleeves;

Figure 12 is a diametrically opposite side view of the sleeves illustrated in Figure 11; and

Figure 13 is partial section through a variant of the connection element in which the clamping screw is non-detachably held in the screwed-in position with a clamping sleeve.

The connection element 1 illustrated in Figure 1 has in each case a cylindrical sleeve 4 and 5 provided with a V-shaped cut-out 2 and a wedge-shaped attachment 3, as well as a clamping screw 7, acting as a clamping element, which is screwed into a continuous thread 9 of a total of three identical diagonal continuous threads 9, 10 and 11 of a component in the form of a spherical connection member 13. The connection element 1 connects a tube 14, as a further component, to the adjacent connection member 13. In order to illustrate better the sleeves 4 and 5, the tube 14 retained by the sleeve 4 is shown in section.

On the screwhead, the clamping screw 7 comprises, as a holding device, a narrow coaxial shoulder 15, which merges by means of a bead 16 into the screw shaft 17. At its top end, the sleeve 5 is bent about the bead 16 in such a way that it can be rotated with clearance about the shoulder 15 but cannot be pulled off without the use of force. As a result, the clamping screw 7 is undetachably connected to the sleeve 5. The thread of the clamping screw 7 matches the threads 9, 10 and 11. A hexagonal recess 18 or 19 respectively is provided in each case in the screwhead and the screw end. The coaxial

attachment 15 and the bead 16 are produced by turning the screwhead of the clamping screw 7.

As illustrated in broken lines in Figure 1, on its rear opposite the cut-out 2, the sleeve 4 comprises a groove 21 into which a tongue 23 of the sleeve 5 engages as an axial guide for the two sleeves 4 and 5.

The attachment 3 and the entire sleeve 5 are separated by a slot 24 necessitated by manufacturing conditions, as explained below with reference to the example of a variant of the connection elements 70. The attachment 3 has three wedge surface pairs 25a, 25b, 26a, 26b, 27a and 27b, wherein the surfaces a and b of each of the surface pairs 25, 26 and 27 are inclined at the same angle relative to the attachment axis in the manner of a mirror image. The surface pairs 25 and 26 are separated by an edge pair 29, of which the edges extend along surface lines of the sleeve 4 or 5 respectively, and the surface pairs 26 and 27 are separated by a further pair of edges 31, of which the edges extend along surface lines of the sleeve 4 or 5 respectively. The pairs of surfaces 27a and b converge to form an acute angle.

The cut-out 2 is constructed in a similar manner to the attachment 3, i.e with respect to the wedge surface pairs 25, 26 and 27 it also has three wedge surface pairs 33, 34 and 35 with the same wedge angle, which are separated from one another in a similar manner to the edge pairs 29a/b and 31a/b by edge pairs 37a/b and 39a/b.

The edge pairs 29 and 37 as well as 31 and 39 are separated from one another by spaces 41a and 41b and 43 respectively corresponding to a clearance. The wedge surfaces 25a/33a, 25b/33b, 26a/34a, 26b/34b, 27a/35a and 27b/35b are connected via a predetermined breaking point produced by a stamping process similar to the stamping process of the connection element 70. By means of this predetermined breakage point the two sleeves 4 and 5 are undetachably connected to one another, ie. and also to the clamping screw 7. The predetermined breaking points only break when the clamping screw 7 is tightened. The harder the attachment 3 is forced into the section 2 by the clamping screw 7, the greater the spaces 41a and 41b or 43 are and the harder the spreading sleeve 4 is pressed against the inner wall of the tube 14. In the state when they are not pressed together, the diameter of the sleeve 4 is precisely of such a size that it can be forced

together with a sleeve 5 into the tube 14 with great clearance.

The sleeves 4 and 5 consist of flat material, the shape, as described below, is stamped out of flat sheet and subsequently curved into the shape of a sleeve. The wedge angles of the wedge surface pairs 33, 34 and 35 and the edge pairs 37 and 39 are selected to be of a size such that automatic locking does not occur in order that, when the clamping screw 7 has been unscrewed, the attachment 3 automatically slides out of the cut-out 2. As a result, the sleeves 4 and 5 are no longer locked with the inner surface of the tube and the connection element 1 can be withdrawn from the end of the tube when the clamping screw 7 has been completely screwed out of the connection member 13.

Instead of the above-described three wedge surface pairs 25, 26 and 27 as well as 33, 34 and 35, it is possible to operate with only one pair of wedge surfaces per attachment and cut-out when the pressure force is not too great, however problems can then occur in the manufacturing process when the sleeves are being bent since the predetermined breaking points may possibly break during the bending process and thus the sleeves

can slide apart from one another along the wedge surfaces thereof, as a result of which the non-detachability of the individual connection element parts is no longer ensured.

Instead of the two sleeves 4 and 5, three sleeves 50, 51 and 52 can be used in a connection element 54; a side view, similar to Figure 1, is illustrated in Figure 2 and a rear view in Figure 3.

As shown in Figure 2, the sleeves 50 and 51 each have an attachment 53a and 53b which engages in a recess 55a and 55b respectively in the sleeve 52. Two further attachments 65a and 65b lie opposite one another on each of the end faces of the sleeve 52. The attachments 65a and 65b each engage in a recess 67a and 67b in the sleeves 50 and 51, as illustrated in Figure 3. In the dismantled state, the attachments 53a and 53b, similar to the connection element 1, are connected to the cut-outs 55a and 55b by predetermined breakage points produced during the manufacturing process. Likewise, the two recesses 55a and 55b in the dismantled state are separated in each case by a web 57a and 57b respectively from an elongate slot 59. After assembly in the tube 14, the webs 57a and 57b break when the clamping screw 7 is

tightened as they are predetermined breaking points, and the two cut-outs 55a and 55b are connected to one another via the elongate slot 59; the sleeve 52 is broken open.

Figure 3 shows a toothed arrangement 61 of the sleeve 52 in each case with two projections which are forced in each case into two recesses on the opposite side. When the webs 57a and b have broken, the two halves of the sleeve 52 are held together by this toothed arrangement 61 in such a way that the two halves can be forced against the inner surface of the tube 14 but do not fall apart. The separating line 63 of the toothed arrangement 61 likewise separates each of the attachments 65a and 65b of the sleeve 52.

When the connection element 54 is mounted in the tube 14, the three sleeves 50, 51 and 52 are forced against one another as a result of the clamping screw 7 being tightened when the predetermined breakage points have broken. As a result thereof, the attachment 53a moves into the cut-out 55a and the attachment 53b moves into the cut-out 55b, as a result of which the elongate slot 59 of the sleeve 52 is forced apart and the halves of the sleeve 52 are forced against the inner surface of the tube 14. In a similar

manner, the attachments 65a and 65b force the cut-outs 67a and 67b in the sleeves 50 and 51 apart, as a result of which the sleeves 50 and 51 are likewise forced against the inner surface of the tube 14. The four attachments 53a and b and 65a and b produce uniform pressure of the sleeves 51 and 52 against the inner surface of the tube 14, the three sleeves 50, 51 and 52 being superimposed in a flush manner.

A further variant of a connection element 70 having two sleeves 71 and 72 is illustrated in Figures 4, 5 and 6. Figure 4 illustrates the two sleeves 71 and 72 similar to the illustration of the two sleeves 4 and 5 in Figure 1. In contrast to the sleeve 4, the sleeve 71 comprises on its attachment 74 only two pairs of wedge surfaces 75a/b and 76a/b and the sleeve 72 comprises only two pairs of edges 79a/b and 80a/b on its cut-out 77. The sleeve 72 is likewise bent at the upper end thereof about the bead 16 on the clamping screw 7 in such a way that it can rotate about the shoulder 15 with clearance but cannot be pulled off. The wedge-shaped attachment and V-shaped cut-out on each sleeve are disposed such that they are diametrically opposite one another.

Figure 5 shows the connection element 70 in a position rotated through 90° with respect to Figure 4. In the illustrations in Figures 4 to 6 the tube 7 is illustrated in section to show the sleeves 71 and 72 more clearly. The sleeve 71 has two attachments 81 (one attachment 81 can be seen in Figure 5) which engage in a recess 82 (a recess 82 can be seen in Figure 4) in the sleeve 72. The attachments 81 and the recesses 82 are approximately symmetrical relative to the attachment 74 and cut-out 77 but this is not absolutely necessary for their method of operation, as described below. There is a gap 84 in each case between the end of the attachment 81 and the base of the recess 82. The attachment 81 widens towards its end and the recess 82 widens towards its base. As a result, the attachment 81 and recess 82 mesh with one another in an undetachable manner; however, they can be moved towards one another by the width of the gap 84. The width of this gap is selected such that, within permissible limits, it is larger than the maximum axial displacement of the sleeves 71 and 72 in the process in which they are pressed against the inner surface of the tube 7 described below.

Figure 6 shows the connection element 70 in a position rotated through 180° relative to Figure 4. An elongate slot 85 divides an attachment 87 of the sleeve 72, of which the wedge surface pairs 89a/b and 90a/b are the same length and have the same wedge angle as the wedge surface pairs 75 and 76. The edge pairs in the recess 92 are formed in a similar manner. As already described in the case of the sleeve 52, the elongate slot 55 merges into a toothed arrangement 93 with two projections and recesses in each case of which the method of operation is identical to that in the case of the sleeve 52.

When the clamping screw 7 is tightened, the attachment 74 and the attachment 87 force the sleeves 72 and 71 respectively apart, as a result of which both sleeves 71 and 72 are forced against the inner surface of the tube 14 uniformly.

The production of the connection elements is described in Figure 7 with reference to the connection element 70, which consists of a sheet steel strip 95 unwound from a roll (not illustrated). Lateral elements for guiding the sheet metal strip 95 are not illustrated. The individual processing stations are designated with the letters a) to e) in Figure 7. Station f)

illustrates the bent sleeves 71 and 72 as illustrated looking towards the end face of the sleeve 72 in Figure 8. Station g) shows a further bending process, the view towards the end face of the sleeve 72 in Figure 9 being illustrated; the cut-out 77 is cut by separating a web 96. In the station h), the sleeves 71 and 72 are completely curved and rigidly mesh with one another by means of the toothed arrangement 93. The sleeve 72 is illustrated in Figure 10 in the view towards the end face thereof.

In the processing station a), the four gaps 84 and a transportation hole 97 (a plurality of the latter can also be used) are stamped into the sheet metal strip 95. A pin (not illustrated) engages in the transportation hole 97 in order to move the sheet metal strip from station to station.

In the station b) the edges of the unwound shape 99 and 100 of the sleeves 71 and 72 are stamped in such a way that the recesses and projections in the toothed arrangement 93 and one web 98 with respect to the sheet metal section of the station a) remain; as a result, the front edge both of one of the sleeves 72 (station a)) and the

front edge of one of the sleeves 71 (station b)) are stamped.

In station c), the unwound shapes 99 and 100 of the two sleeves 71 and 72 are stamped in such a way that their separating line, as the predetermined breaking point, begins to break but both shapes are still connected.

Nothing occurs in station d), and in station e) the shape 100, is forced by the stamping process in station c) out of the sheet metal plane back into the sheet metal plane (straightening station); the two shapes are still joined to one another. The station d) is necessary for separating the stamping process of station c) spatially from the straightening station e).

In station f) a first bending process is performed, in which the two shapes 99 and 100 are bent to form the shape illustrated in Figure 8, viewed in the direction of the end faces. A second bending process occurs in station g) to shape the parts as illustrated in Figure 9, the web 96, as already indicated above, being separated after the bending process.

In station h) the shapes 99 and 100 are bent to form the sleeves 71 and 72 and are cut away from the sheet metal strip 97. When the parts are completely bent around, the recesses and projections of the toothed arrangement 93, forming a press-fit, are rigidly forced into one another.

As a result of this processing, the two sleeves 71 and 72 are produced together. The separating line between the two sleeves 71 and 72 only breaks completely the first time the clamping screw 7 is screwed into the tube 14. The two sleeves 71 and 72 mesh undetachably with one another via the two attachments 81 and recesses 82 but are axially displaceable in such a way that the sleeves can be moved into one another to such an extent that they can be rigidly forced against the inner surface of the tube 14. Since both sleeves 71 and 72 are mechanically connected during the bending process beyond the separating line, they cannot be forced apart from one another by means of their attachments 74 and 87 out of the cut-outs 77 and 92 - of which the separating lines have not yet been perforated.

Instead of the sleeves 3, 4, 50, 51, 52, 71 and 72 being produced from steel bands, other resilient materials can also be used. If the

connection element 1 is only to be used once, non-resilient materials can also be used.

The sleeves 4 and 5, as well as the sleeves 50 and 52, and the sleeves 51 and 52, can be locked, in a similar manner to the sleeves 71 and 72, by means of attachments (similar to 81) and corresponding recesses (similar to 82) in order to retain the sleeves such that they are undetachably flush with one another. The wedge-shaped attachment(s) of one sleeve can also mesh with the associated V-shaped cut-out(s), as shown in Figures 11 and 12 with reference in each case to a wedge-shaped attachment 101, 102, varying from the wedge-shaped attachments 74 and 87, as well as the V-shaped cut-outs 77 and 92 of the sleeves 71 and 72 and in each case a variant wedge-shaped cut-out 103 and 104, with a toothed arrangement 105a/b and 106a/b. The object of these toothed arrangements 105a/b and 106a/b is similar to a predetermined breaking point, as already described above, between the edges of the cut-out 103 and the attachment 101 and the cut-out 104 and the attachment 102. The object of the predetermined breaking point and toothed arrangement is the same, ie. to retain the sleeves undetachably and prevent the sleeves sliding away from one another on their wedge surfaces during

the bending process. One advantage of the toothed arrangement 105a/b and 106a/b with respect to the predetermined breaking point lies in the possibility of transferring more power over the separating line as well as in identical properties even if the connection element 70 is used repeatedly. The toothed arrangement is not absolutely necessary to render the sleeves captive since this is already ensured by the attachments 81 and 82.

Instead of mounting a bead 16 on the clamping screwhead and bending the adjacent sleeve edge around the said bead, a clamping element can also be used between the screw thread and the inner surface of one of the sleeves 4, 5, 50, 51, 52, 71 or 72. The clamping element can, for example, be a perforated disc having a U-shaped cross-section which is resiliently clamped between the screwthread and the inner surface of the sleeve, one leg pressing against the screwthread and the other leg pressing against the inner wall of one of the sleeves 4, 5, 50, 51, 52, 71 or 72. Advantageously, the clamping screw 7 is held centrally and undetachably in one or both sleeves in order to facilitate screwing of the screwthread into the connection member 13 when the tube 14 is assembled on the connection member 13.

Instead of the clamping screw 7 being held captive by means of resilient perforated discs or by a curved edge of the sleeve adjacent the clamping screwhead, a clamping sleeve 107, partially illustrated in section in Figure 13, can also be used. At each sleeve end, the clamping sleeve 107 has a clamping ring 109a and 109b which presses against the sleeve 71 and 72 respectively. The clamping sleeve 107 sits with a slight press-fit in its narrowed section 111 on the shaft of the clamping screw 7. As mentioned above, the clamping sleeve 107 holds the clamping screw 7 on the one hand captive in the two sleeves 71 and 72 and on the other hand it holds the screwthread in the screwed-in position so that it can easily be screwed into one of the threads of the connection member 13.

As a result of the clamping together of adjacent sleeves and as a result of the clamping screw 7 being retained in one of the sleeves 4, 5, 50, 51, 52, 71 or 72, all the parts of the connecting element 1, 54 or 70 are undetachably connected to one another in the correct assembly position and can be moved as a single component into the end of the tube. As a result thereof, the time for assembling the connection element is

substantially reduced with respect to the known connection elements.

The connection elements 1, 54 and 70 according to the invention can easily be detached, ie. the connection can always be released and used again for connecting other tubes 14 to connecting members 13.

Owing to the production process according to the invention, the sleeves 4 and 5, as well as 50, 51 and 52 or 71 and 72 can be manufactured in an extremely cost-favourable manner from a sheet metal strip 95. The stamping process produces a satisfactory surface of the wedge and edge surfaces such that further processing to improve their sliding over one another is no longer necessary. The design and manufacturing process were also designed in such away that all the sleeves 4, 5, 50, 51, 52, 71 and 72 of the connection element 1, 54 or 70 can be manufactured simultaneously together and already clamped. Since the clamping screw 7 in the assembled position is also already held captive in one of the sleeves 4, 5, 50, 51, 52, 71 and 72, the connection element 1, 54 and 70 according to the invention is also suitable for connecting tubes rapidly and easily.

The unexpectedly good clamping effect of the sleeve 4 in the tube 14 and the low tension of the clamping screw 7 derive from the fact that the attachment 3 with wedge surface pairs 25, 26 and 27, distributed over the entire surface thereof, forces the cut-out 2 apart. As a result thereof the cylindrical sleeve 4 is uniformly widened over the entire length thereof and thus the entire peripheral surface thereof lies against the inner wall of the tube. The latter produces large-scale uniform static friction. This also applies to the attachments 74 and 87 of the sleeves 71 and 72 as well as to the wedge surfaces 53a, 53b and 65a, 65b, the latter embodiment having a plurality of attachments instead of a plurality of wedge surface pairs on one attachment.

The slight tension to be applied to the clamping screw 7 results from the fact that only resilient bending force of the thin-walled sleeves 4 and 5 or 50, 51 and 52 and 71 and 72 has to be overcome. The majority of the tension is used to force the sleeves against the inner wall.

The connection element is preferably used in the production of shelves, sale stands, racks and similar tube constructions. It can, however, also be used as a so-called straddling dowel for

securing doors for example in a bore hole of a
door frame.

CLAIMS

1. Connection element (1) which can be clamped in the hole of a structural component, preferably inside a tube (14), for connecting an adjacent second structural component (13), having at least two sleeves (4, 5; 50, 51, 52; 71, 72) which comprise oblique surface edges, which are held together undetachably in an at least approximately aligned manner, and which can be moved axially with respect to one another by means of a central clamping element (7), in order to be pressed against the hole interior by the wedge effect of the oblique surface edges, characterised in that the sleeves (4, 5; 50, 51, 52; 71, 72) are curved out of a sheet metal piece (99, 100) in such a way that edge sections of the sheet metal which, before bending, lie opposite one another are adjacent one another in the curved state and form a continuous elongate slot (63, 85).

2. Connection element according to Claim 1, characterised in that the sleeves (71, 72) are held against each other by a mutual tooth arrangement (81, 82, 84) in such a way that they can be moved axially towards one another but axial movement away from one another is restricted.



3. Connection element according to Claim 1 or 2, characterised in that each of the sleeves (4, 5; 50, 51, 52; 71, 72) comprises on one side a wedge-shaped attachment (3, 53a/b; 65a/b; 101, 102) and on the opposite side a V-shaped cut-out (2, 55a/b; 67a/b; 103, 104), wherein the wedge-shaped attachment (3, 53a/b; 65a/b; 101, 102) of one sleeve engages in the V-shaped cut-out (2, 55a/b; 67a/b; 103, 104) of the adjacent sleeve and the V-shaped cut-out completely separates the sleeve in the longitudinal direction or merges into a separating slot or into a predetermined separating breaking point such that each of the sleeves is spread open when the wedge-shaped attachment of the adjacent sleeve is inserted in the V-shaped cut-out thereof.

4. Connection element according to any one of Claims 1 to 3, characterised in that in each case one of two adjacent sleeves (4, 5; 50, 51, 52; 71, 72) on each side of the elongate slot (63, 85) has an attachment piece in the form of a wedge section, the attachment pieces being pressed against each other under the wedge effect when the clamping element, preferably in the form of a clamping screw (7), is tightened.



5. Connection element according to any one of Claims 1 to 4, characterised in that one sheet metal edge of the elongate slot (63, 85) comprises at least one projection and the other sheet metal edge comprises at least one recess matching the projection in order to hold the sheet metal edges clamped in one another (61, 93).

6. Connection element according to any one of Claims 1 to 5, characterised in that the clamping element (7) is held undetachably on at least one of the sleeves (4, 5; 50, 51, 52; 71, 72) preferably centrally on the smooth area thereof.

7. Connection element according to any one of Claims 1 to 6, characterised in that the sleeves (71, 72) together form a cylindrical shape such that they can be inserted as a unit into the hole of the first structural component (14).

8. Method of producing the connection element according to any one of Claims 1 to 7, characterised in that an evolute shape (99, 100) of adjacent sleeves (71, 72) is stamped out of a flat metal sheet (95) in such a way that during the bending process the two sleeves do not slide apart from one another along their separating line



between the respective wedge-shaped attachment and the associated V-shaped cut-out.

9. Method according to Claim 8, characterised in that there are stamped on the separation line of the evolute shape (99, 100) apertures (84) of which the dimensions are selected such that adjacent sleeves (71, 72) are toothed with respect to one another such that they are axially displaceable in order to be spread apart but are undetachable.