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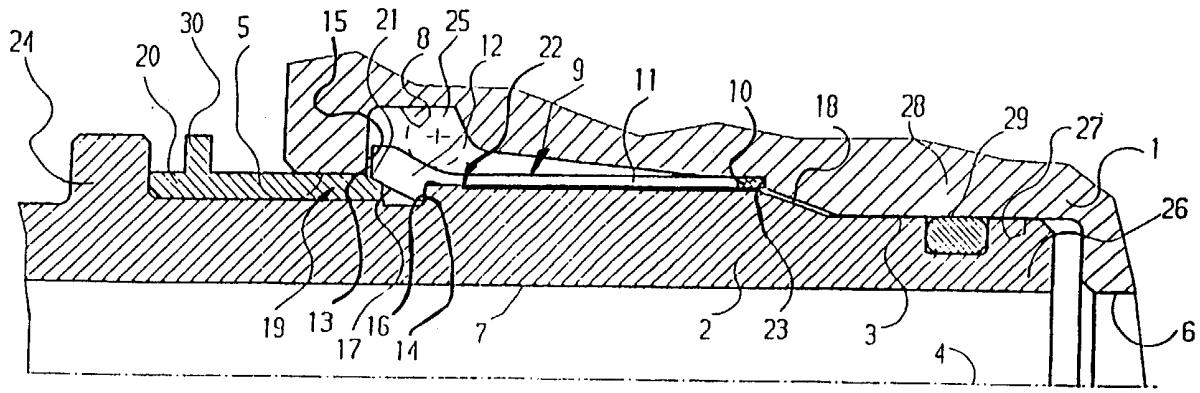
(54) Abstract Title
Coupling for connecting hydraulic ducts

(57) Coupling for connecting hydraulic ducts, comprising a female coupling (1), having a receptacle and forming a first locking face (15), arranged around a longitudinal axis; a male coupling (2), forming a second locking face (16), arranged around the longitudinal axis, and which can be inserted in the direction of the longitudinal axis through an opening into the receptacle (3); a holding element (9) having a ring (10), several spring elements (11), formed on the ring (10) and extending parallel to the longitudinal axis (4), and locking elements (12), formed on the free ends of the spring elements (11), wherein the spring elements (11) are, respectively, elastically deformable against a spring force radially out of a locking position into a releasing position and wherein, in the inserted condition of the male coupling, the first locking face (15) and the second locking face (16) are facing each other and the locking elements (12) are supported in the locking position of the spring elements (11) on the first locking face (15) and on the second locking face (16).

FIG.1



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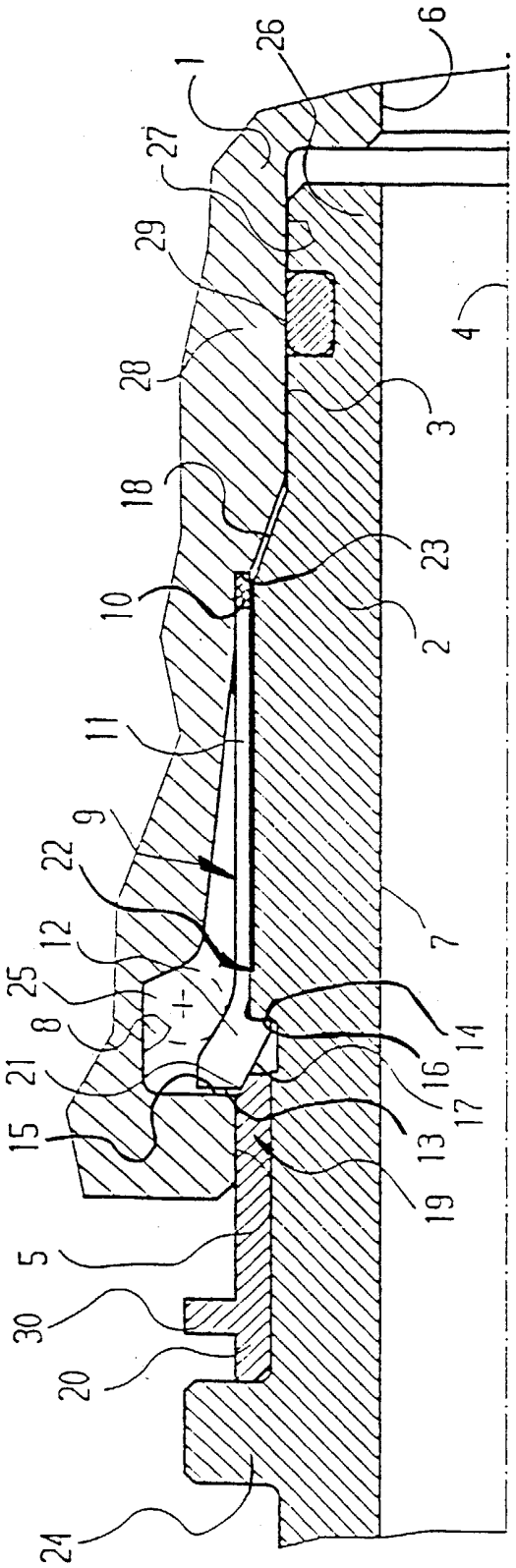
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FIG.1

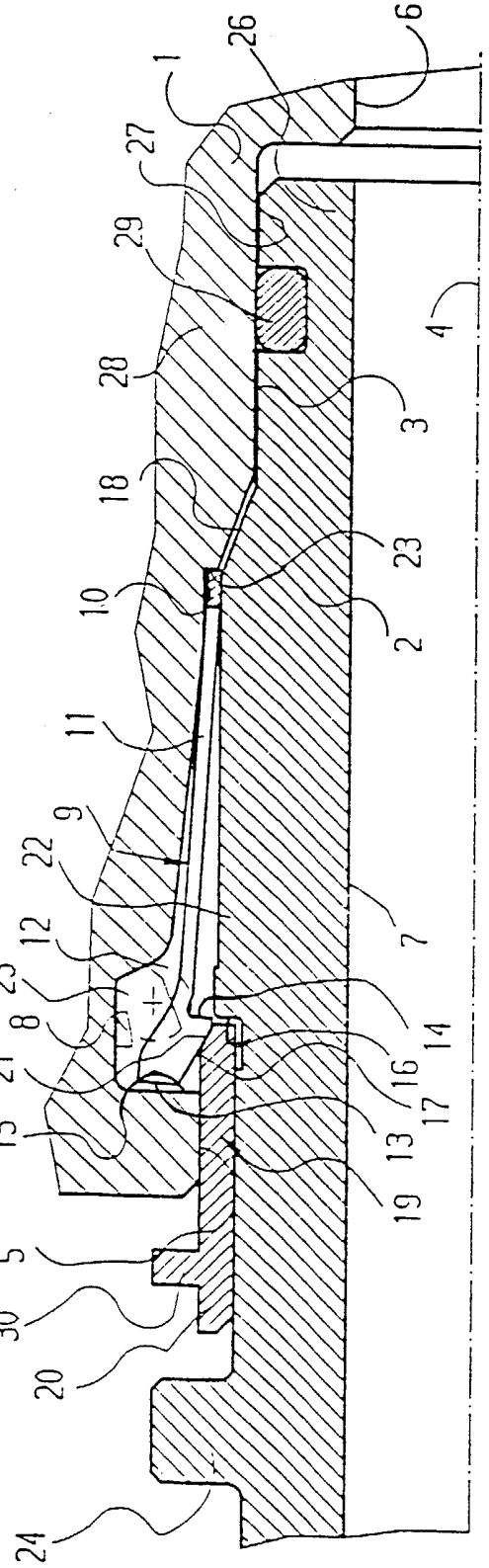
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FIG.2

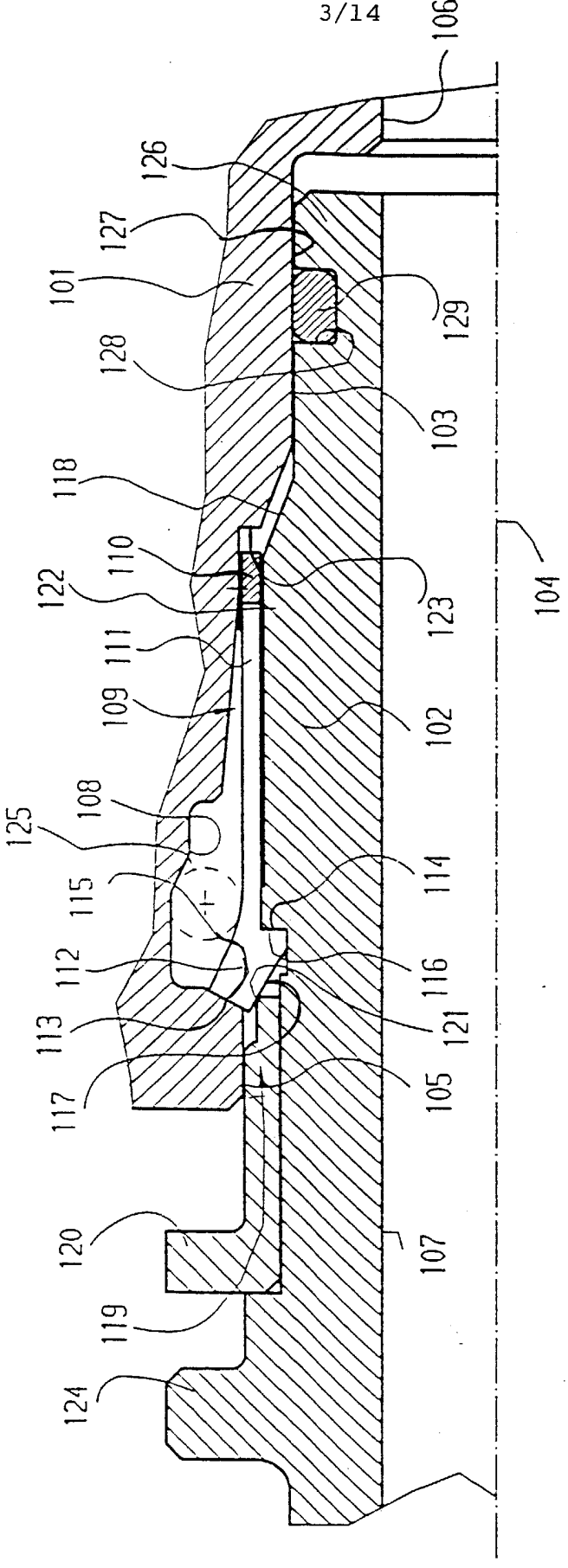
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FIG.3

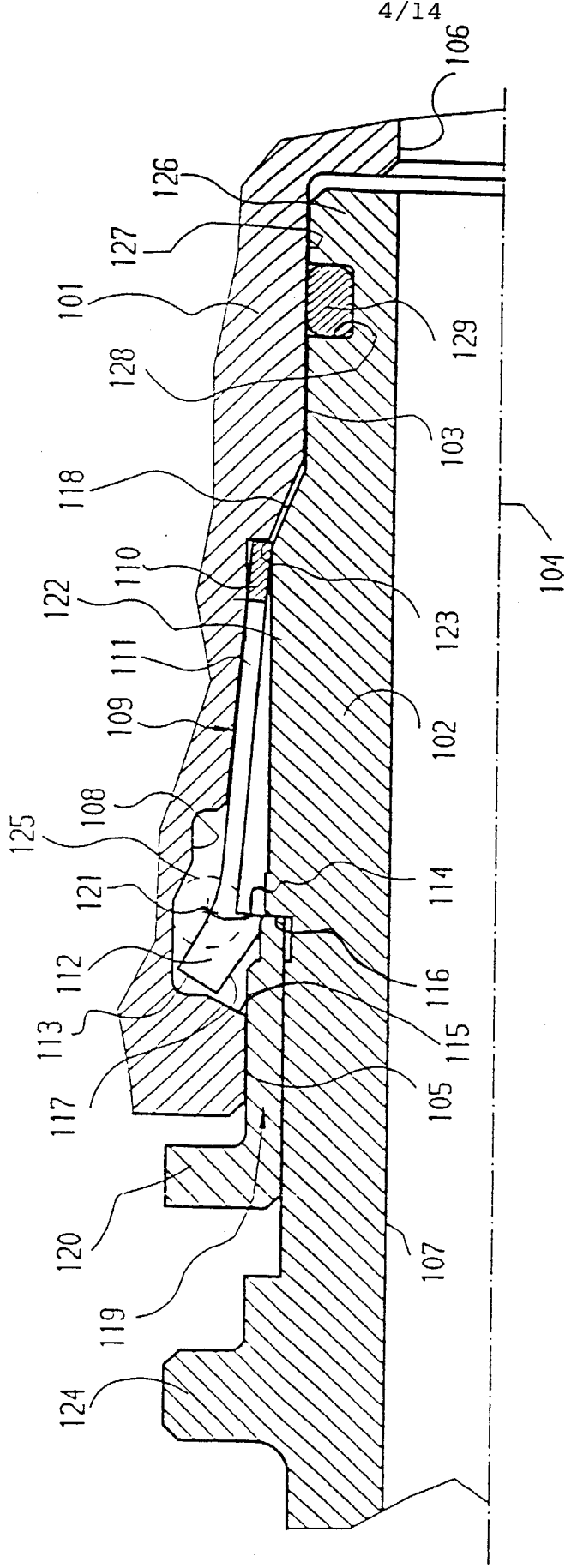
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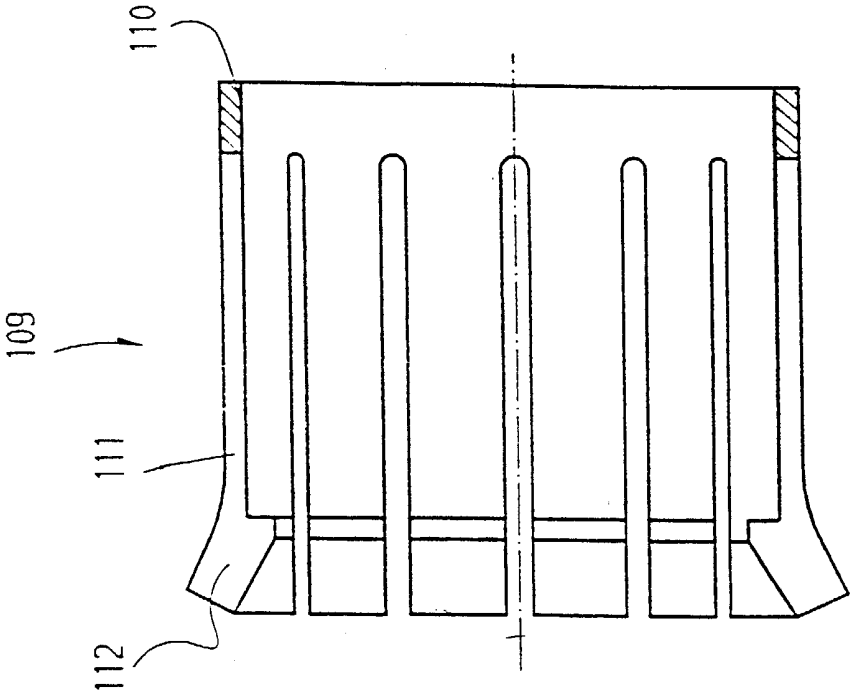
FIG.4



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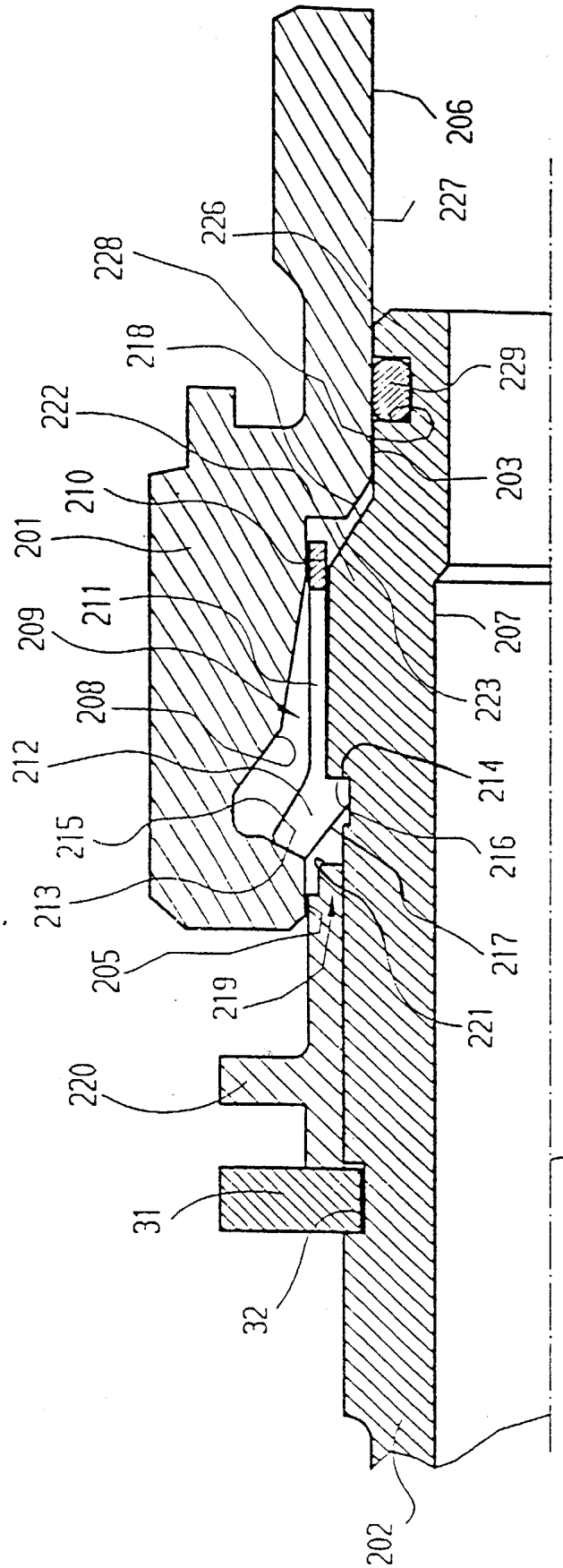
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FIG.6

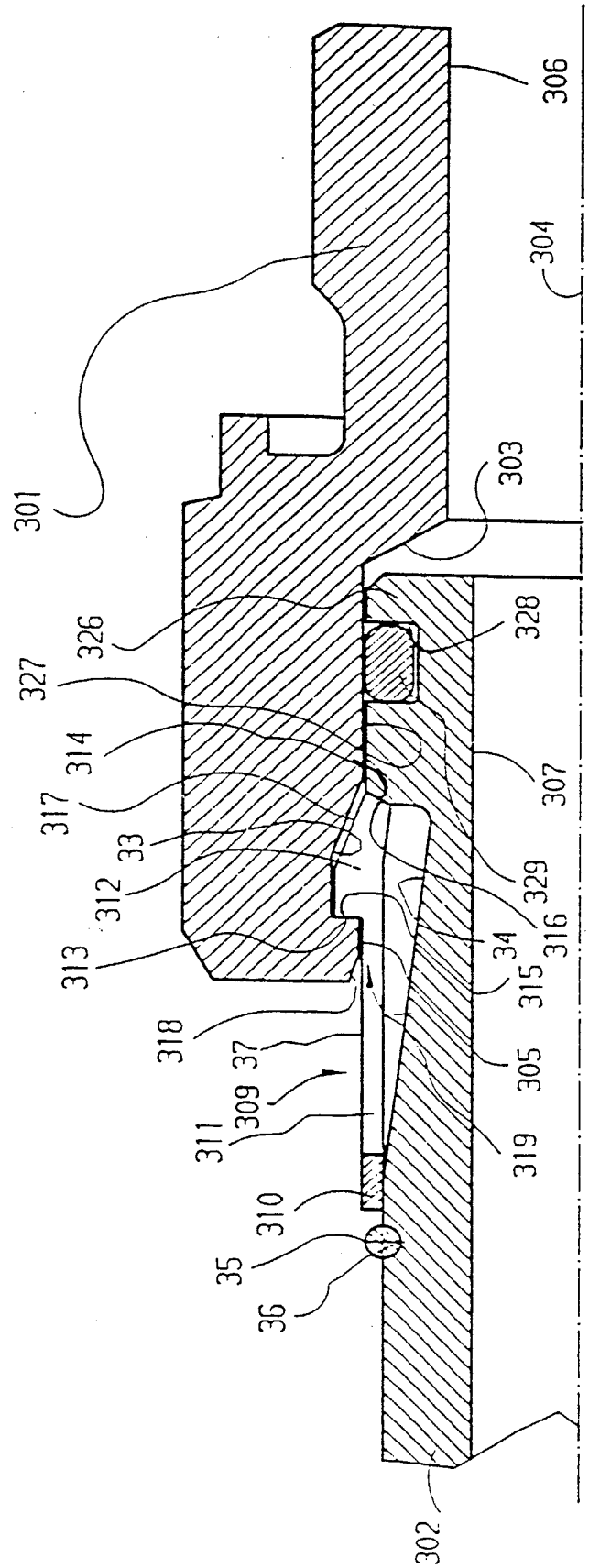
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FIG.7

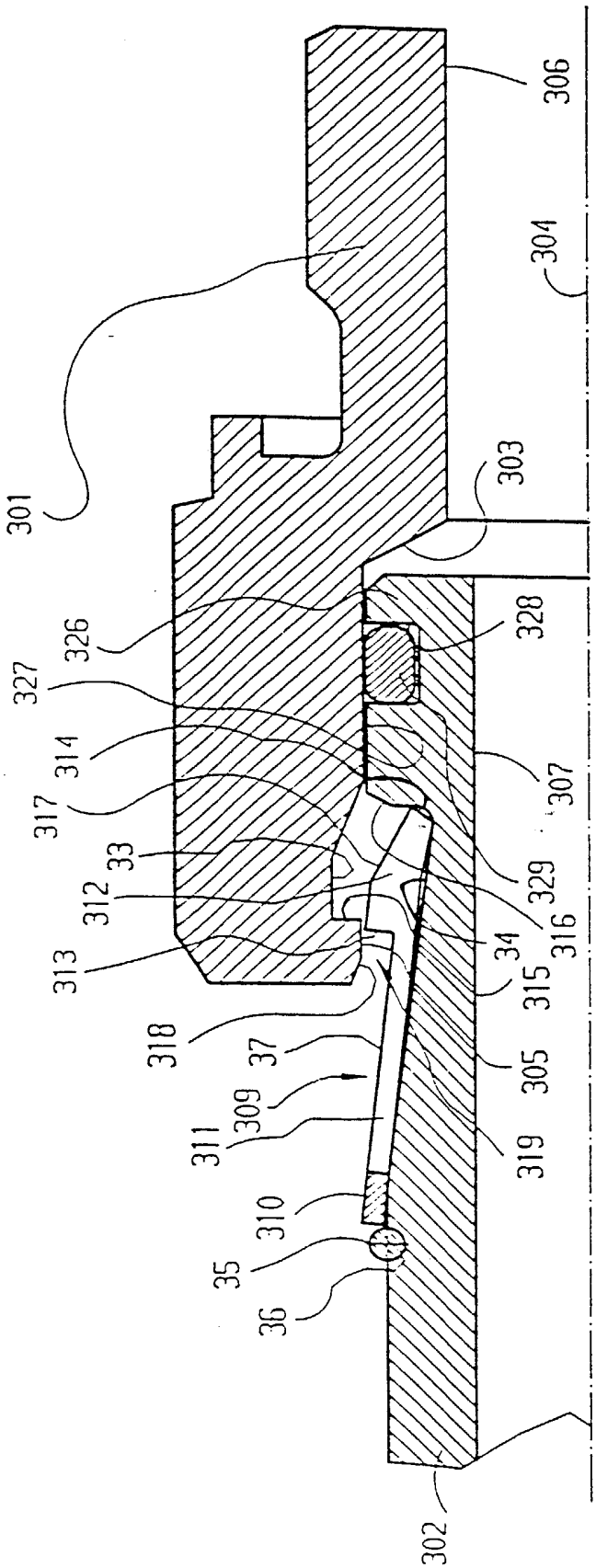
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FIG.8

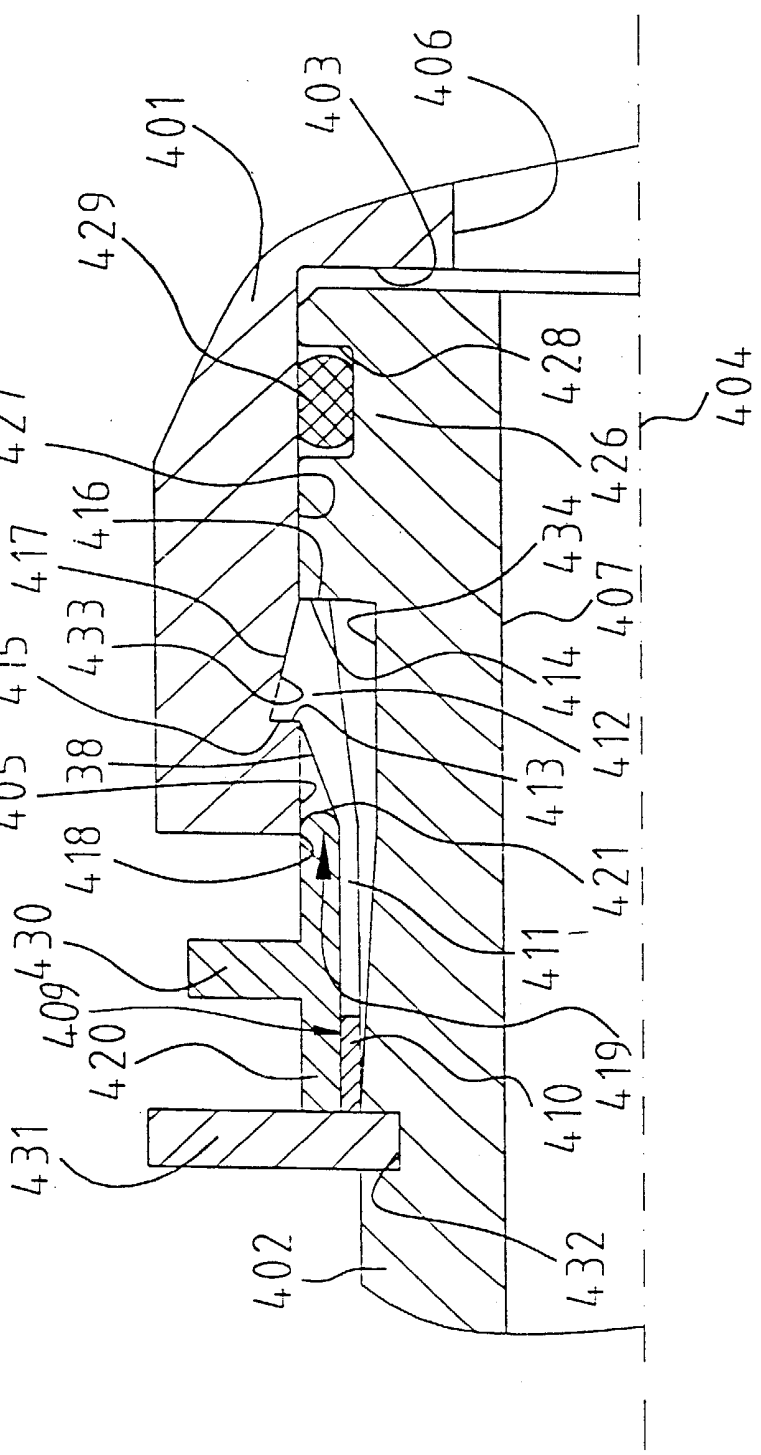
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FIG. 9

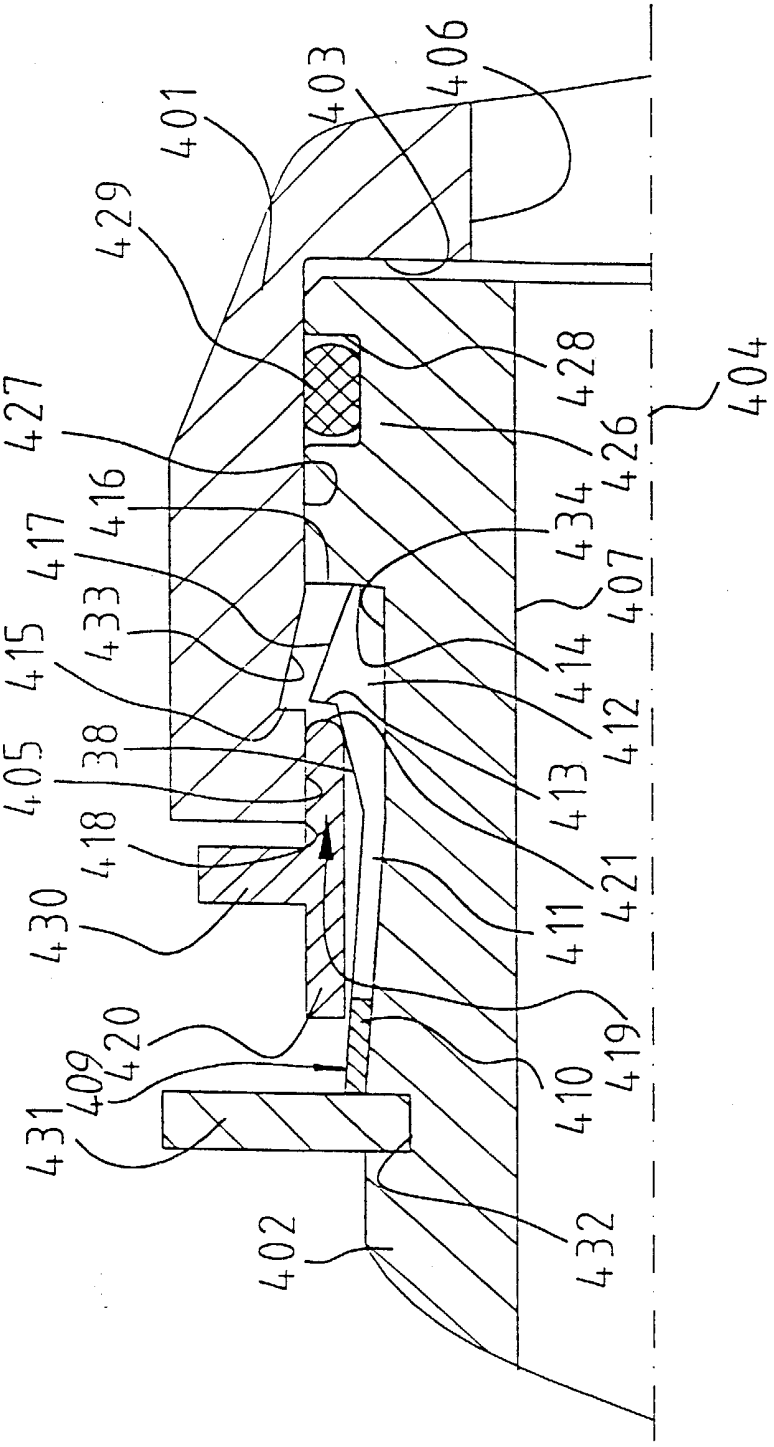
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FIG. 10

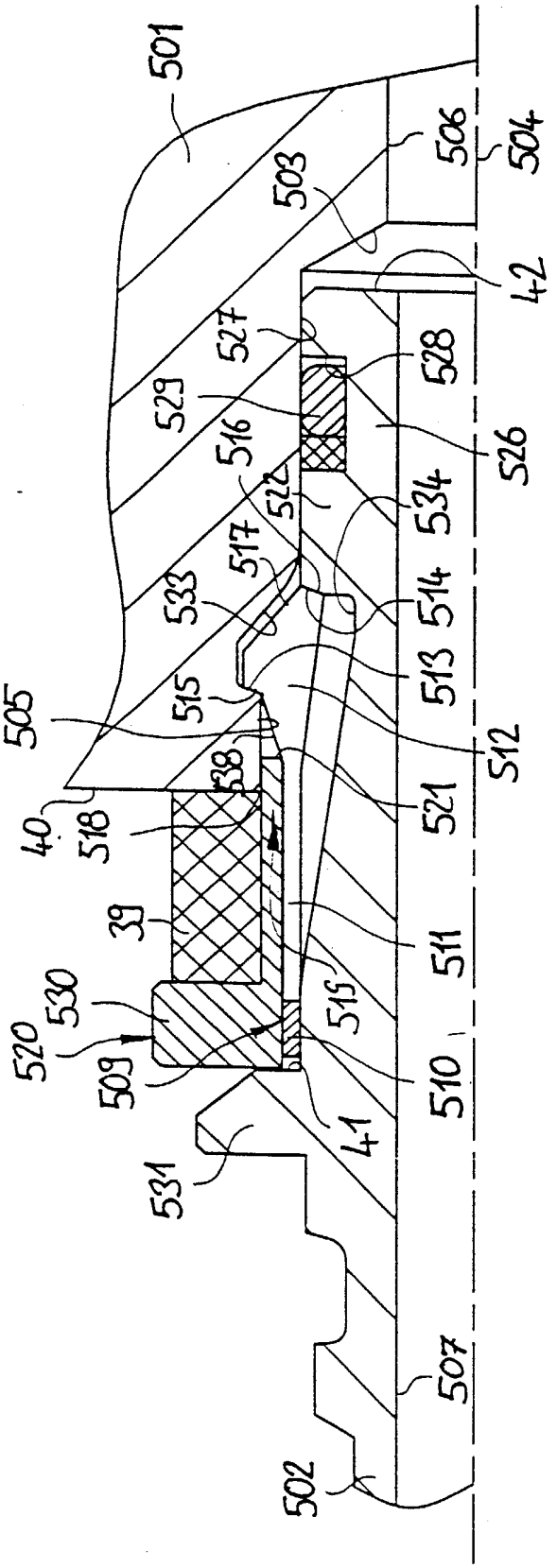
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FIG. 11

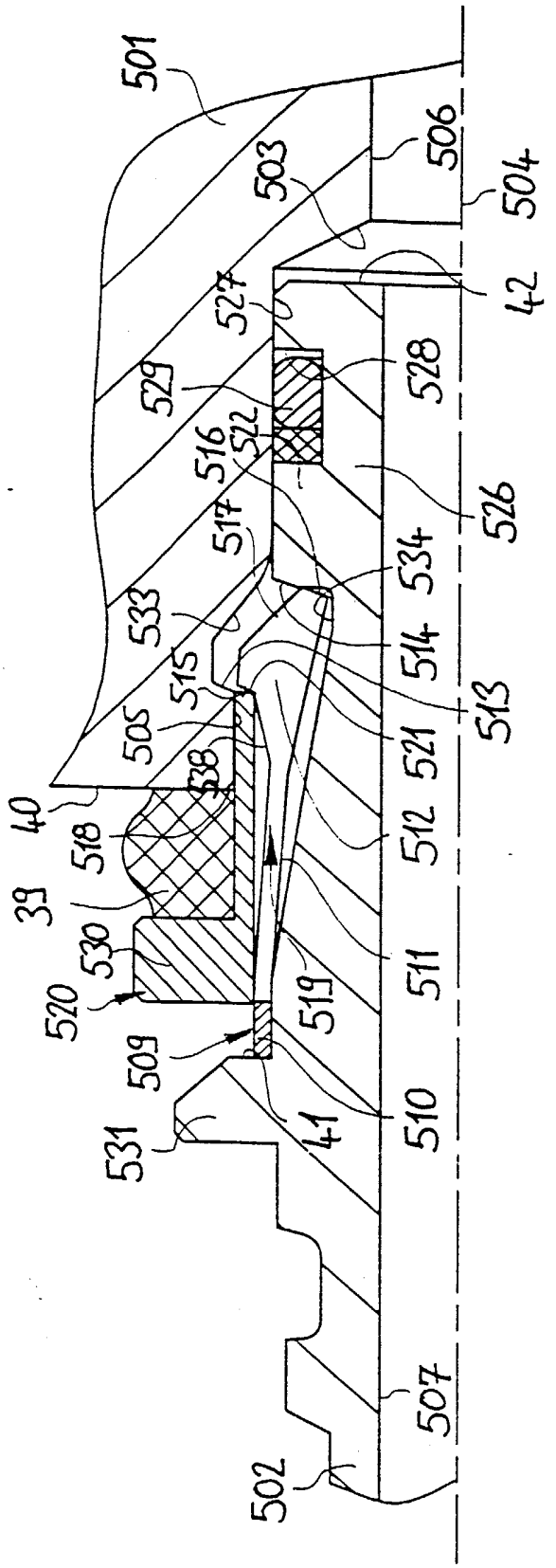
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FIG. 12

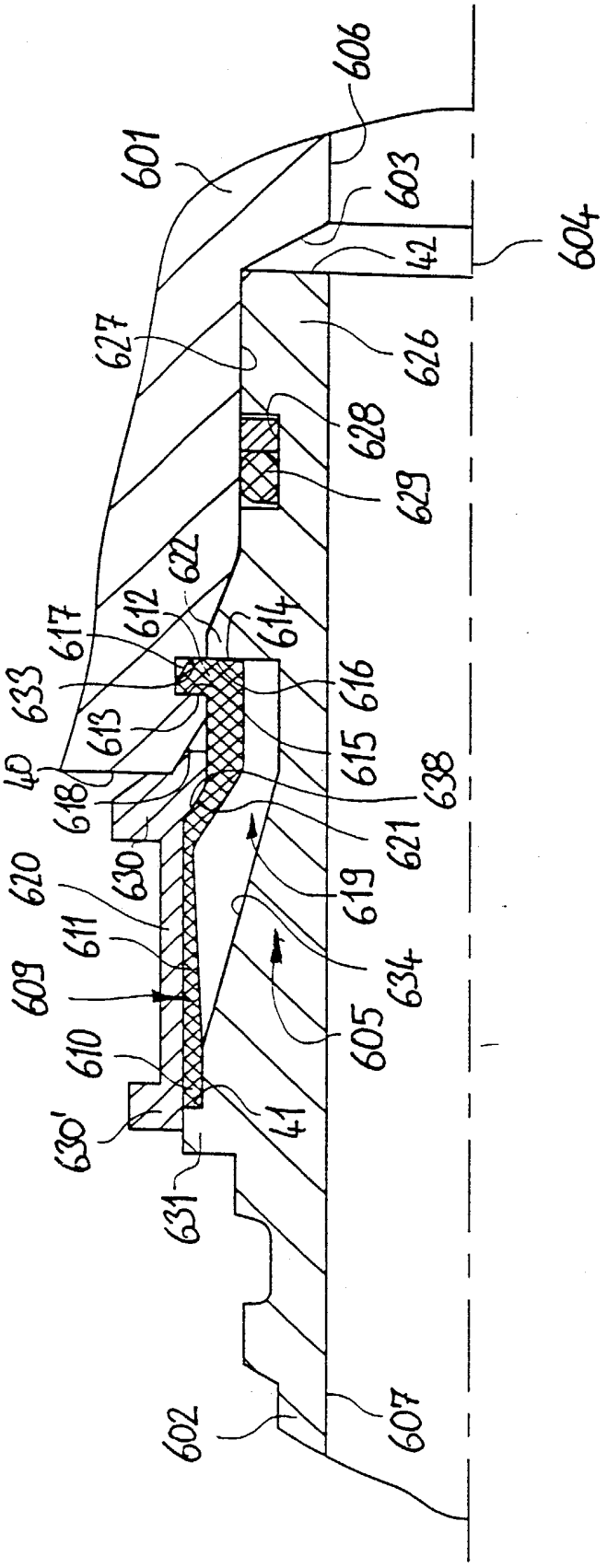
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FIG. 13

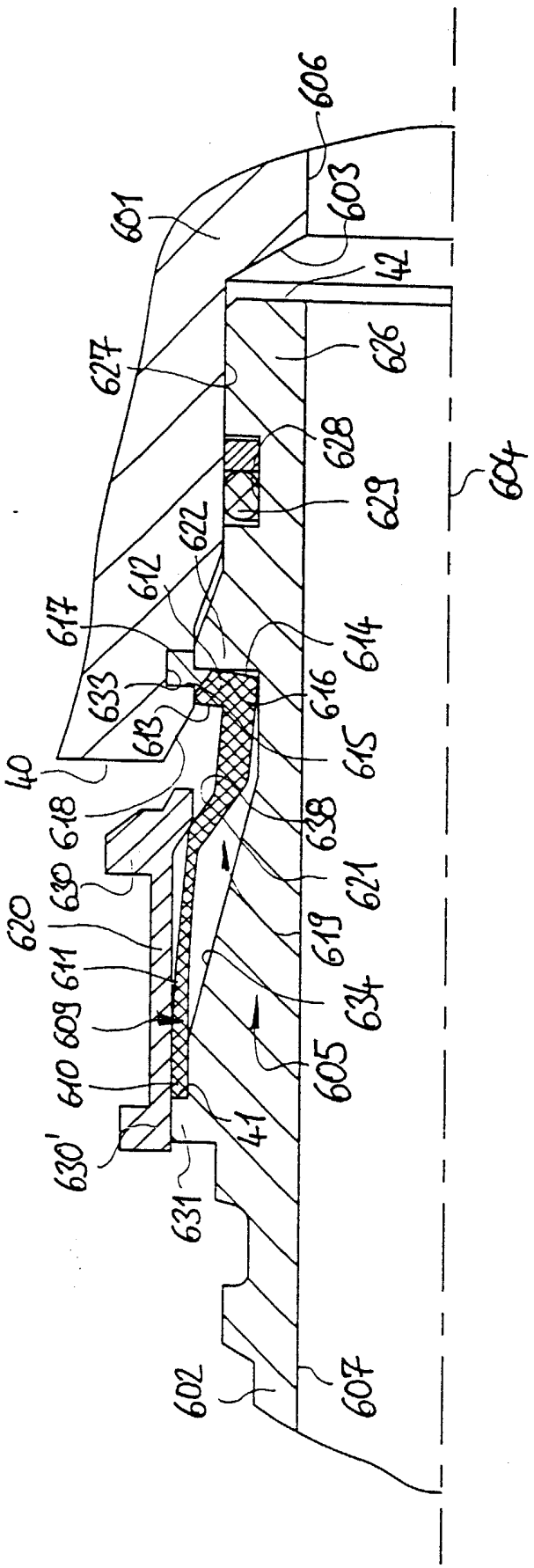
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FIG.14

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Title: Coupling for Connecting Hydraulic Ducts

Description of Invention

The invention relates to a coupling for connecting hydraulic ducts.

WO 9635906 A1 describes a coupling for hydraulic ducts with a female coupling and a male coupling. The female coupling has a receptacle, into which the male coupling can be inserted through an opening of the receptacle. In the opening an inner circumferential groove is provided, in which a multitude of locking elements rests. The locking elements in form of annular segments are distributed around the circumference of the inner circumferential groove and are supported on each other. The locking elements are springingly acted upon towards the inside at the end of the inner circumferential groove, distanced from the opening, by means of an elastic O-ring, so that these together, in a locking position, form a conical inner circumferential face and project partially from the inner circumferential groove to the inside.

The male coupling has a displacement face at its end insertable into the female coupling, which interacts with the inner faces of the locking elements in such a way, that these are moved from the locking position outwardly into the releasing position. In this position the locking elements are completely arranged within the inner circumferential groove, so that the male coupling can be inserted. The male coupling, further, has an outer circumferential groove, into which the locking elements are pressed into by means of the elastic O-ring, as soon as the male coupling is far enough inserted into the receptacle. In this position of the male coupling the locking elements are axially supported on the support face of the inner circumferential groove as well as on a locking face of

the outer circumferential groove, so that the male coupling is retained against withdrawal.

Within the outer circumferential groove of the male coupling a ring made from plastics is provided, which is narrower than the outer circumferential groove. If the male coupling is inserted further into the receptacle, the locking elements slide on the outer circumferential face of the plastic ring and, therefore, are moved into the releasing position. As the friction force between the locking elements and the ring made from plastics is higher than the friction force between the ring made from plastics and the male coupling, the ring made of plastics slides, when withdrawing the male coupling connector, within the outer circumferential groove, till it abuts the locking face of the outer circumferential groove. The outer diameter of the ring made from plastics is at least as large as the outer diameter of the male coupling at its end, so that, when further pulling out the male coupling, the locking elements slide from the plastic ring onto the outer circumferential face of the male coupling and the male coupling can be completely pulled out.

Disadvantageous in this coupling is that, when loosing a locking element, the residual locking elements are not held in the inner circumferential groove anymore, as they cannot support each other. Furthermore, a high number of components is necessary, so that the assembly is cumbersome. Furthermore, the ring made from plastics, is loaded by a high mechanical loading, so that the outer diameter of the plastic ring may be reduced by wearing off so far, that it becomes smaller than the outer diameter of the male coupling. Because of this a jamming of the male coupling during withdrawal is caused.

DE 199 32 307 A1 discloses a coupling with a female coupling having a receptacle, into which a male coupling is inserted through an opening of the receptacle. A circlip sits in an inner circumferential face of the receptacle and

projects with a portion of its cross-sectional face from this radially to the inside. The male coupling has on its end a displacement face, by which the circlip is pushed radially deeper into the inner circumferential groove during the insertion of the male coupling into the receptacle, so that the male coupling can be inserted. The male coupling has an outer circumferential groove, into which the circlip, after further insertion of the male coupling, enters. In this position the circlip is supported axially on the locking face of the outer circumferential groove as well as on the locking face of the inner circumferential groove, so that the male coupling is retained against a withdrawal.

Starting from the opening of the receptacle an annular gap is formed between the female coupling and the male coupling, through which an unlocking sleeve is inserted from the outside into the receptacle. By axial displacement of the unlocking sleeve into the receptacle the circlip is axially moved along the conical locking face of the outer circumferential groove and, therefore, widened and radially pushed out off the outer circumferential groove, so that the male coupling can again be removed from the receptacle.

As the locking face of the outer circumferential groove is formed as steep as possible towards the longitudinal axis, i.e. the angle, which the conical locking face encloses, is as large as possible, to ensure the best possible axial support of the circlip between the locking face of the outer circumferential groove and the locking face of the inner circumferential groove a high force has to be applied to push the circlip out off the outer circumferential groove. Furthermore, there is the danger, that the circlip is widened irregular, and is therefore, not widened round, because it is cut at one position, so that the ends of the circlip can lock between the locking faces.

DE 26 27 397 A1 describes a coupling comprising a male coupling and a female coupling. A holding element has a ring, which forms a collar extending radially inside towards the longitudinal axis. On this ring radially extending

spring elements are formed, which are formed radially elastic. The collar of the ring rests in a circumferential groove of the male coupling and fixes, therefore, the holding element thereon. The ring is cut at one position, to enable assembly.

At the free ends of the spring elements a groove is, respectively, provided, in which a collar, extending radially towards the longitudinal axis, engages, when the male coupling is inserted into the female coupling. Therefore, the male coupling is securely held in the female coupling, as during a loading in withdrawal direction the spring elements are tensioned and retain the male coupling. Around the holding element an unlocking sleeve is arranged, which slides during the displacement towards the female coupling, i.e. in insertion direction of the male coupling into the female coupling, against abutment faces of the spring elements and pushes these radially to the inside, till the collar of the female coupling does not rest anymore in the groove of the spring elements and a withdrawal of the male coupling is enabled. Disadvantageous is, however, that the spring elements in the connected condition of the coupling, are tensioned and have to be formed correspondingly massive. Because of this, a large annular gap between the male coupling and the female coupling is necessary, through which the spring elements are passed through. Furthermore, when releasing the coupling, the unlocking sleeve has to be moved against the withdrawal direction of the male coupling, so that a single-handed operation is not possible.

The object of the present invention is, to provide a coupling for connecting hydraulic ducts, which has few components and is easily pre-assembled.

According to the invention, we provide a coupling for connecting hydraulic ducts, comprising:

a first coupling element in the form of a female coupling, having a receptacle and affording a first locking face, arranged around a longitudinal axis of the coupling;

a second coupling element in form of a male coupling affording a second locking face, arranged around the longitudinal axis and insertable in the direction of the longitudinal axis through an opening into the receptacle of the first coupling element;

a holding element having a ring and several spring elements, formed onto the ring and extending parallel to the longitudinal axis, and having locking elements, provided on the free ends of the spring elements;

wherein the spring elements are, respectively, elastically deformable against a spring force radially out of a locking position into a releasing position; and

wherein in the connected condition of the coupling elements the first locking face and the second locking face face each other and the locking elements are supported in a locking position of the spring elements on the one side on the first locking face and on the other side on the second locking face.

By means of this layout of the holding element consisting of one ring with several spring elements connected thereto, it is ensured, that no locking element can get lost. Furthermore, the coupling is, therefore, constructed of a small number of components and can be assembled quickly and easily.

The first coupling element in the form of a female coupling can be provided as a separate component, which can be connected to a hydraulic duct, e.g. a hydraulic hose. The first coupling element can, however, also be formed as an integral component of e.g. a valve block, i.e. formed integrally therewith.

In a first embodiment of the invention the holding element may rest in an annular recess of the receptacle of the first coupling element,

the second coupling element affords a first displacement face, arranged around the longitudinal axis, and

by means of insertion of the second coupling element into the receptacle the first displacement face interacts, respectively, with one abutment face of the locking elements in such a way, that the spring elements are movable from the locking position into the releasing position. Preferably, it is provided, that the second coupling element has a shoulder, forming the second locking face as well as the first displacement face.

To release the coupling with simple means and for this to move the spring elements from their locking position into the releasing position, starting from the opening of the first coupling element between the first coupling element and the second coupling element in its inserted condition an annular gap may be formed, through which an unlocking sleeve extends and projects from the receptacle. The unlocking sleeve is axially displaceable on the second coupling element between a locking position and a releasing position. Furthermore, the unlocking sleeve has a second displacement face, interacting, respectively, with the abutment faces of the locking elements in such a way, that by means of moving the unlocking sleeve from the locking position into the releasing position, the spring elements are moveable into their releasing position.

The unlocking sleeve in the releasing position may be supported on the second locking face and the outer diameter of the unlocking sleeve may be at least as large as the outer diameter of the shoulder in the area of transition between the unlocking sleeve and the shoulder.

The path, along which the unlocking sleeve is axially displaceable, can be limited in such a way, that the unlocking sleeve, in the locking position, is supported axially on a shoulder of the second coupling element or on a circlip, which rests in a circumferential groove of the second coupling element.

To be able to move the unlocking sleeve with a tool, e.g. a screw driver or a specially adapted lever, it may be provided that the unlocking sleeve has engaging means for a tool.

To support the elastic effect of the spring elements, it may be provided, that in the annular recess an elastically deformable O-ring rests, which acts upon the spring elements to take up their locking position.

Different arrangements of the locking faces are possible. A first possibility is, that the first locking face and the second locking face extend parallel to each other. In this arrangement of the locking faces relative to each other it is ensured, that the locking elements, without having to move the coupling elements axially towards each other, can be moved from the locking position into the releasing position. Therefore, the coupling can be released also under hydraulic pressure.

To prevent the releasing and therefore, the opening of the coupling under pressure, in a second possible arrangement of the locking elements towards each other it can be provided, that the first locking face is formed conical and opens facing away from the opening, and that the second locking face is arranged on a plane, arranged perpendicular to the longitudinal axis. Therefore, the distance of the locking faces towards each other is reduced in the direction to the second position of the locking elements, so that the locking elements can only be moved from the locking position into the releasing position, when the second coupling element is further inserted into the receptacle of the first coupling element. This only can be achieved, when no inner pressure is acting.

The same effect can be achieved in a third possible arrangement of the locking faces towards each other. Here, the first locking face is formed conical and opens facing away from the opening. The second locking face is also formed conical, wherein the angle, enclosed by the second locking face, opens

facing away from the opening and is larger than the angle, which is enclosed by the first locking face.

Preferably, it is provided in a non-parallel arrangement of the locking faces towards each other, that, starting from the opening of the first coupling element, between the first coupling element and the second coupling element in its inserted condition an annular gap is formed, through which the spring elements with their free ends project into the receptacle. The spring elements can have engaging means for a tool, by means of which they can be moved from the locking position into the releasing position.

In a second embodiment of the invention it is provided that the holding element is arranged around the second coupling element, that the first coupling element has an inner circumferential groove, forming the first locking face, that the first coupling element in the area of the opening of the receptacle forms a first displacement face arranged around the longitudinal axis, and that by means of inserting the second coupling element into the receptacle the first displacement face interacts, respectively, with an abutment face of the locking elements in such a way, that the spring elements are movable from the locking position into the releasing position.

Further, an elastically deformable O-ring can be arranged between the spring elements of the holding element and an outer circumferential face of the second coupling element, acting upon the spring elements to take up their locking position, to assist the elastic effect of the spring elements.

Preferably it is provided, that, starting from the opening of the first coupling element, between the first coupling element and the second coupling element in its inserted condition an annular gap is formed, through which the spring elements project with their free ends into the receptacle. The spring elements can have engaging means for a tool, by means of which they are moved from their locking position into the releasing position.

Also in the second embodiment the locking faces can be arranged differently towards each other. A first possibility is, that the first locking face and the second locking face extend parallel to each other. In this layout of the locking faces towards each other it is ensured, that the locking elements, without having to move the coupling elements towards each other, can be moved from the locking position into the releasing position. Therefore, the coupling can also be released, when an inner pressure is acting.

To prevent the releasing and, therefore, the opening of the coupling when an inner pressure is present, in a second possible arrangement of the locking faces towards each other it can be provided, that the first locking face is arranged on a plane, arranged perpendicular to the longitudinal axis, and that the second locking face is formed conical and opens facing away from the opening. Therefore, the distance of the locking faces towards each other is reduced in the direction towards the second position of the locking elements, so that the locking elements can only be moved from the locking position into the releasing position, when the second coupling element is further moved into the receptacle of the first coupling element. This, however, can only be achieved, when no inner pressure is present.

The same effect can also be achieved in a third possible arrangement of the locking faces towards each other. In this case, the second locking face is formed conical and opens facing away from the opening. The first locking face is also formed conical, wherein the angle, enclosed by the second locking face, opens facing away from the opening and is larger than the angle enclosed by the first locking face.

Preferably, in a non-parallel arrangement of the locking faces towards each other, it is provided that the holding element is held axially displaceable on the second coupling element and that the second coupling element, in the connected condition of the coupling elements, is axially displaceable together

with the holding element between a first position, in which the locking elements of the holding element abut the second locking face, and a second position, in which the ring of the holding element is movable axially to abut an abutment face.

In this case, the abutment face can be formed by a retaining ring resting in a circumferential groove of the second coupling element.

To release the coupling with simple means and for this, to move the spring elements from their locking position into their releasing position, starting from the opening of the first coupling element between the holding element and the second coupling element in its inserted condition an annular gap may be formed, through which an unlocking sleeve passes and projects from the receptacle. Furthermore, the unlocking sleeve may be axially displaceable on the second coupling element between a locking position and a releasing position, and the unlocking sleeve have a second displacement face, interacting, respectively, with the second abutment faces of the locking elements in such a way that, by means of moving the unlocking sleeve from the locking position into the releasing position, the spring elements are movable into their releasing position.

A further embodiment is characterised in that an unlocking sleeve is arranged so as to be axially displaceable on the second coupling element and is movable by means of relative movement to the second coupling element against the insertion direction of the second coupling element into the receptacle from a locking position into a releasing position, and the unlocking sleeve has a second displacement face, respectively, interacting with second abutment faces of the locking elements in such a way that, by moving the unlocking sleeve from the locking position into the releasing position, the spring elements are movable into their releasing position.

Therefore, it is ensured, that by displacing the unlocking sleeve against the insertion direction, i.e. in the withdrawal direction of the male coupling, initially the holding element is released and then the male coupling can be withdrawn from the receptacle.

For this it is provided, that the second abutment faces may be arranged in the axial direction against the insertion direction with increasing distance towards the longitudinal axis.

To form the annular gap between the first coupling element and the second coupling element as small as possible, it is provided, that the abutment faces, in the inserted condition of the second coupling element, may be arranged outside of the receptacle.

The second coupling element has preferably a first shoulder, forming the second locking face.

In this case, the holding element can be supported in the axial direction on the second locking face and on an abutment face of the second coupling element. The abutment face can, in this case, be formed by a second shoulder.

To ensure an easy assembly of the holding element, it is provided, that the inner diameter of the ring may be larger than the maximum outer diameter of the second coupling element between the abutment face and an end face, which is arranged on the free end of the second coupling element, which is the end to be inserted into the receptacle.

Further it can be provided, that the unlocking sleeve has an inner diameter, which is, outside the area of the second displacement face, larger than the outer diameter of the ring.

Preferred embodiments of the invention will now be described in detail with reference to the drawings, of which:

Figure 1 is a longitudinal sectional view of a coupling according to the invention comprising a holding element, resting in an annular recess of the first

coupling element, wherein the spring elements are shown in their locking position;

Figure 2 is a longitudinal sectional view of the coupling of Figure 1, wherein the spring elements are shown in their second position;

Figure 3 is a longitudinal sectional view of a coupling, in which the locking faces are not arranged parallel to each other, wherein the spring elements are shown in their locking position;

Figure 4 is a longitudinal sectional view of the coupling of Figure 3, wherein the spring elements are shown in their second position;

Figure 5 is a longitudinal sectional view of the holding element of the coupling of Figure 3;

Figure 6 is a longitudinal sectional view of a coupling, in which an unlocking sleeve is axially supported on a circlip;

Figure 7 is a longitudinal sectional view of an alternative embodiment of a coupling according to the invention comprising a holding element, arranged around the second coupling element, wherein the spring elements are shown in their locking position;

Figure 8 is a longitudinal sectional view of the coupling of Figure 7, wherein the spring elements are shown in their second position;

Figure 9 is a longitudinal sectional view of a coupling, in which the holding element is arranged on the second coupling element and the spring elements are shown in the locking position;

Figure 10 is a longitudinal sectional view of a coupling of Figure 9, wherein the spring elements are shown in their releasing position;

Figure 11 is a longitudinal sectional view of a coupling of Figure 9, wherein between the flange portion of the unlocking sleeve and the first coupling element an elastic ring is arranged;

Figure 12 is a longitudinal sectional view of the coupling of Figure 11, wherein the spring elements are shown in their releasing position;

Figure 13 is a longitudinal sectional view of a further embodiment coupling according to the invention, wherein the spring elements are shown in their locking position; and

Figure 14 shows a longitudinal sectional view of the coupling of Figure 13, wherein the spring elements are shown in a releasing position.

Figure 1 shows a coupling according to the invention for connecting hydraulic ducts, having a first coupling element 1 in form of a female coupling and a second coupling element 2 in form of a male coupling. The first coupling element 1 has a receptacle 3, into which the second coupling element 2 is inserted in the direction of a longitudinal axis 4 through an opening 5. The first coupling element 1 has a first axial bore 6 and the second coupling element 2 has a second axial bore 7, which, respectively, are connected to hydraulic ducts.

In the receptacle 3 of the first coupling element 1 an annular recess 8 is provided, in which a holding element 9 rests. The holding element 9 comprises a ring 10, arranged coaxially to the longitudinal axis 4. On the ring 10 axially extending spring elements 11 are formed, which form on the free ends locking elements 12. The holding element 9 is received in the annular recess 8 in such a way, that the free ends of the spring elements 11 are facing the opening 5.

The locking elements 12 have, respectively, a first abutment face 13, which is facing the opening 5, and a second abutment face 14, which is facing away from the first abutment face 13. The first abutment face 13 and the second abutment face 14 are arranged parallel to each other and perpendicular to the longitudinal axis 4. In the locking position shown in Figure 1, the first abutment face 13 is supported on a first locking face 15, formed by the annular recess 8 and extending parallel to the first abutment face 13. Furthermore, the second abutment face 14 is supported on a second locking face 16, formed by a first

shoulder 22 of the second coupling element 2 and extending parallel to the second abutment face 14. Therefore, the second coupling element 2 is secured against a withdrawal from the receptacle 3, as axial forces are transmitted from the first shoulder 22 of the second coupling element 2 via the locking element 12 onto the first locking face 15 of the first coupling element 1.

This position of the coupling is achieved in the following a way, when the second coupling element 2 is inserted into the receptacle 3 of the first coupling element 1. In this case, an abutment face 17 of each locking element 12 slides on a conical first displacement face 18 of the second coupling element 2, formed by the shoulder 22, wherein the locking elements 12 are moved from their locking position into the releasing position. As soon as the second coupling element 2 has been moved far enough into the receptacle 3, the locking elements 12 pass the first shoulder 22, so that these are moved because of the spring force of the spring elements 11 back into their first position and the second abutment face 14 of the locking elements 12 come into contact to the second locking face 16.

For releasing the coupling an annular gap 19 is provided between the opening 5 of the first coupling element 1 and the second coupling element 2, through which an unlocking sleeve 20 is inserted from the outside into the receptacle. The unlocking sleeve 20 is arranged coaxially to the longitudinal axis and is held so as to be axially displaceable on the second coupling element 2. The unlocking sleeve 20 forms a second displacement face 21, interacting with the abutment faces 17 of the locking elements 12 in such a way, that, when inserting the unlocking sleeve 20 into the receptacle 3, the locking elements 12 slide on the second displacement face 21 and are moved from their locking position into the releasing position. This position is represented in Figure 2. As during the axial displacement of the unlocking sleeve 20 also axial forces are transmitted onto the holding element 9, the holding element 9 is supported on a

support face 23 of the annular recess 8. In this case, the abutment face 17 can form a small angle towards the longitudinal axis 4, so that the axial forces are as small as possible and the radial forces are as large as possible. The force to be applied to displace the unlocking sleeve 20, is, therefore, small. Furthermore, the axial displacement path of the unlocking sleeve 20 out off the receptacle 3 is limited by a shoulder 24 of the second coupling element 2. As engaging means for a tool for the axial displacement of the unlocking sleeve 20 the latter has a flange portion 30.

To assist the elastic effect of the spring elements 11, an elastically deformable O-ring 25, indicated in Figures 1 and 2 by a dashed line, can be provided in the annular recess 8, wherein the O-ring 25 is supported on the base of the annular recess 8 and on the spring elements 11 of the holding element 9.

For centering the second coupling element 2 within the receptacle the second coupling element 2 has a cylindrical centering portion 26, insertable into a corresponding centering bore 27 of the receptacle 3. In the centering portion 26 a circumferential groove 28 is provided, in which a sealing ring 29 rests, wherein this abuts in a sealing manner the inner face of the centering bore 27.

Figures 3 and 4 show a coupling, corresponding mainly to the coupling according to Figures 1 and 2, wherein corresponding components or components with the same effect are provided with reference numerals increased by the amount 100, and are as described in connection with Figures 1 and 2.

The difference of the coupling according to Figures 3 and 4 compared to the coupling of Figures 1 and 2 is that the first abutment face 113 and the second abutment face 114 and, therefore, also the first locking face 115 and the second locking 116 are arranged at an angle to each other. The first abutment face 113 and the first locking face 115 are formed conical, wherein the angles, which they enclose, open facing away from the opening 105. Compared to this

the second abutment face 114 and the second locking face 116 are arranged perpendicular to the longitudinal axis 104. Therefore, the distance between the first abutment face 113 and the second abutment face 114 and also the distance between the first locking face 115 and the second locking face 116 diminish radially from the inside towards the outside. This means, that when moving the unlocking sleeve 120 into the receptacle 103 to unlock the coupling, initially the second coupling element 102 together with the holding element 109 has to be displaced axially further into the receptacle 103, to displace the spring elements 111 together with the locking elements 112 from their locking position into the releasing position. This means, further, that the second coupling element 102 can only then be moved deeper into the receptacle 103, when no hydraulic inner pressure is acting in the axial bores 106, 107. Therefore, it is ensured, that the coupling can only be released, when no inner pressure is applied.

Figure 5 shows the holding element 109 in a longitudinal sectional view and is as described in connection with Figures 3 and 4.

Figure 6 shows a coupling, which more or less corresponds to the coupling of Figures 3 and 4, wherein corresponding components are provided with reference numerals, which are further increased by the value 100, and have been described in connection with the preceding Figures.

The unlocking sleeve 220 is, however, axially not supported on a shoulder but on a circlip 31, which rests in a circumferential groove 32 of the second coupling element 202.

Figures 7 and 8 show an alternative coupling for connecting hydraulic ducts. Components, which achieve the same function as the components in Figures 1 and 2, are provided with reference numerals, increased by the value 300 compared with those in Figures 1 and 2, and are as described there.

In this embodiment the holding element 309 is arranged on the second coupling element. The first coupling element 301 has an inner circumferential groove 33, affording the first locking face 315. The second coupling element 302 has an outer circumferential groove 34, into which the locking elements 312 in the second position of the spring elements 311 can be moved radially inwardly. Furthermore, the outer circumferential groove 34 affords the second locking face 316.

The first coupling element affords the first displacement face 318, which, during the insertion of the second coupling element 302 into the receptacle 303 of the first coupling element 301 interacts with the abutment face 317 of each locking element 312 in such a way, that the locking elements 312, together with the spring elements 311, are pushed radially inwardly into the releasing position.

The holding element 309 is arranged on the second coupling element 302 in such a way, that the spring elements 311 with their free ends and, therefore, with the locking elements 312 project through an annular gap 319 between the first coupling element 301 and the second coupling element 302 into the receptacle 303. A part of the spring elements 311 can, therefore, be reached from the outside and can be compressed for releasing the coupling with a tool, wherein the tool engages outer faces 37 of the spring elements 311.

The holding element 311 is axially supported with the ring 310 on a retaining ring 35, resting in a circumferential groove 36 of the second coupling element 302.

A further embodiment of the coupling like that of Figures 7 and 8 is shown in Figures 9 and 10. Components achieving the same function like the components of Figures 7 and 8, are provided here with reference numerals, increased by the value 100 and described in Figures 7 and 8.

In this embodiment the holding element 409 is also arranged on the second coupling element 402, wherein an unlocking sleeve 420 is axially displaceably arranged around the holding element 409. In the connected condition of the coupling, i.e, when the second coupling element 402 is inserted into the receptacle 403 of the first coupling element 401, an annular gap 419 is formed between the holding element 409 and the second coupling element 402, through which the unlocking sleeve 420 extends and projects from the receptacle 403. The unlocking sleeve 420 is axially displaceable between a locking position and a releasing position. By moving the unlocking sleeve 420 from the locking position into the releasing position the unlocking sleeve 420 interacts with a second abutment face 38 of the locking elements 412 in such a way, that the locking elements are moved from their locking position into their releasing position. In this case, the spring elements 411 are pushed into the outer circumferential groove 433.

Figures 11 and 12 show a similar embodiment of the coupling as shown in Figures 9 and 10. Corresponding components are provided with reference numerals, further increased by the value 100.

The outer diameter of the centering portion 526 of the coupling element 502 is smaller than the inner diameter of the ring 510 of the holding element 509. Therefore, the holding element 509 and the unlocking sleeve 520 can be pre-assembled starting from the centering portion 526 on the second coupling element 502. In the pre-assembled condition the holding element 509 is supported on a second shoulder 531 and on the second abutment face 514. The unlocking sleeve 520 is axially held between the second shoulder 531 and the second abutment face 538. Therefore, the holding element 509 as well as the unlocking sleeve 520 are held securely on the second coupling element 502 in the pre-assembled condition.

Furthermore, an elastic ring 39 is provided, arranged around the unlocking sleeve 520 and is supported on the flange portion 530 and on an end face 40 of the first coupling element 501. The elastic ring 39 acts upon the unlocking sleeve 520 in its releasing position. Furthermore, the elastic ring 30 serves as sealing element, to prevent dirt entering.

Figure 13 shows a further embodiment of coupling according to the invention, for connecting hydraulic ducts, with a first coupling element 601 in form of a female coupling and a second coupling element 602 in form of a male coupling. The first coupling element 601 has a receptacle 603, into which the second coupling element 602 is inserted in the direction of a longitudinal axis 604 through an opening 605. The first coupling element 601 has a first axial bore 606 and the second coupling element 602 has a second axial bore 607, which, respectively, are connected to hydraulic ducts.

On the second coupling element 602 a holding element 609 is arranged. The holding element 609 comprises a ring, arranged coaxially to the longitudinal axis 604. On the ring 610 axially extending spring elements 611 are provided, which form on their free ends locking elements 612.

The locking elements 612 have, respectively, a first abutment face 613 and a second abutment face 614, arranged facing away from each other. In the represented embodiment the first abutment face 613 and the second abutment face 614 are arranged parallel to each other and perpendicular to the longitudinal axis 604. In the locking position of the spring elements 611 shown in Figure 13 the first abutment faces 613 of the locking elements 612 are supported on a first locking face 615, formed by an inner circumferential groove 633 and extending parallel to the first abutment faces 613. Furthermore, the second abutment faces 614 are supported on a second locking face 616, formed by an outer circumferential groove 634 of the second coupling element 602 and extending parallel to the second abutment face 614. The first locking

face 615 and the second locking face 616 are facing each other, so that in the connected condition shown in Figure 13, the second coupling element 602 is secured against a withdrawal from the receptacle 603.

The position of the coupling shown in Figure 13 is achieved by inserting the second coupling element 602 into the receptacle 603 of the first coupling element 601 axially of the longitudinal axis 604, in an insertion direction. Thus, the abutment faces 617 of the locking elements 612 slide on a displacement face 618 of the second coupling element 602. The displacement face 618 is formed in the area of the opening 612. During this, the locking elements 612 are moved radially inwardly from their locking position of Figure 13 into their releasing position of Figure 14. The spring elements 611 are, hereby, pushed deeper into the outer circumferential groove 634. As soon as the second coupling element 602 is moved far enough into the receptacle 603, the spring elements 611 are moved back into their locking position and simultaneously into the inner circumferential groove 633 and in engagement behind the first locking face 615.

The holding element 609 is arranged on the second coupling element 602 in such a way, that the spring elements 611 with their free ends and, therefore, with the locking elements 612 project through an annular gap 619 between the first coupling element 601 and the second coupling element 602 into the receptacle 603. The holding element 609 is axially supported on the second locking face 616 and further on an abutment face 41. Therefore, the holding element 609 is securely arranged on the second coupling element 602.

To centre the second coupling element 602 within the receptacle 603 the second coupling element 602 has a cylindrical centering portion 626, movable into a corresponding centering bore 627 of the receptacle 603. In the centering portion 626 a circumferential groove 628 is provided, in which a sealing ring

629 rests, wherein this sealing ring is in sealing contact to the inner face of the centering bore 627.

Around the holding element 609 an unlocking sleeve 620 is axially arranged. The unlocking sleeve 620 is axially displaceable between a locking position and a releasing position. In the locking position the unlocking sleeve 620 is arranged with a smaller distance to the first coupling element 601 than in the releasing position. By means of moving the unlocking sleeve 620 from the locking position to the releasing position, i.e. against the insertion direction of the second coupling element 602, this interacts with the second abutment faces 638 of the locking elements 612 in such a way, that the locking elements 612 are moved from their locking position into their releasing position. For this, the unlocking sleeve 620 has engaging means for a tool in form of a circumferentially extending flange portion 630. This can be supported in a first alternative on the end face 40 of the first coupling element 601. In this case, the flange portion 630 is formed conical towards the first coupling element 601, so that one can push a tool formed fitting the same or a screw driver between the flange portion 630 and end face 40 of the first coupling element, to displace the unlocking sleeve 620.

The flange portion 630 can be arranged in a second alternative distanced from the end face 40 of the first coupling element 601. Therefore, a sealing ring can be arranged around the unlocking sleeve in correspondence to the coupling of Figures 11 and 12.

The second abutment faces 638 are arranged outside of the receptacle 603 and in a direction away from the receptacle 603 with increasing distance to the longitudinal axis 604. In this case, the unlocking sleeve 620 slides with a second displacement face 621 on the second abutment faces 638 of the spring elements 611.

For a simple assembly the ring 610 has a larger inner diameter than the second coupling element 602 between the abutment face 41 and an end face 42, which is arranged on the free end of the second coupling element 602 inserted into the receptacle 603. Therefore, the holding element 609 can be pushed on starting from the end face 640. The inner diameter of the holding element 609 in the area of the locking elements 612 is smaller than the maximal outer diameter of the centering portion 626, so that when assembling the holding element 609 the spring elements slide on the centering portion 626 and are bent towards the outside. After passing the centering portion 626 the spring elements 612 lock behind the second locking face 616, so that the holding element 609 is securely held between the abutment face 41 and the second locking face 616.

The unlocking sleeve 620 has an inner diameter, which is larger than the outer diameter of the ring 610 of the holding element 609, so that these can be pushed over the holding element 609. Only in the area of the second displacement 621 the unlocking sleeve 620 has a smaller diameter than the ring 610. Because of this, the axial path of the unlocking sleeve 620 is limited in a direction against the insertion direction in reference to the holding element 609. Furthermore, the outer diameter of the holding element 612 is larger than the inner diameter of the unlocking sleeve 620 in the area of the second displacement face 621, when the spring elements 611 are in their locking position. Therefore, the unlocking sleeve 620 is axially securely fixed on the holding element 609.

The first abutment face and the second abutment face and, therefore, also the first locking face and the second locking face can be arranged at an angle towards each other. The first abutment face and the first locking face can be formed conical, wherein the angle, which they enclose, is facing away from the opening. Compared to this, the second abutment face and the second locking face can be arranged perpendicular to the longitudinal axis, so that the

distance between the first abutment face and the second abutment face and the distance between the first locking face and the second locking face are reduced radially from the inside to the outside. Therefore, it is ensured, that, when moving the spring elements into their releasing position, the second coupling has to be initially pushed axially deeper into the receptacle together with the holding element. Therefore, the coupling can only be released, when no inner pressure is active.

In the present specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS

1. A coupling for connecting hydraulic ducts, comprising:

a first coupling element in the form of a female coupling, having a receptacle and affording a first locking face, arranged around a longitudinal axis of the coupling;

a second coupling element in form of a male coupling affording a second locking face, arranged around the longitudinal axis and insertable in the direction of the longitudinal axis through an opening into the receptacle of the first coupling element;

a holding element having a ring and several spring elements, formed onto the ring and extending parallel to the longitudinal axis, and having locking elements, provided on the free ends of the spring elements;

wherein the spring elements are, respectively, elastically deformable against a spring force radially out of a locking position into a releasing position; and

wherein in the connected condition of the coupling elements the first locking face and the second locking face face each other and the locking elements are supported in a locking position of the spring elements on the one side on the first locking face and on the other side on the second locking face.

2. A coupling according to Claim 1, wherein the holding element rests in an annular recess of the receptacle of the first coupling element,

the second coupling element affords a first displacement face, arranged around the longitudinal axis, and

wherein by insertion of the second coupling element into the receptacle, the first displacement face interacts, respectively, with one abutment face of the

locking elements in such a way that the spring elements are movable from the locking position into the releasing position.

3. A coupling according to Claim 2, wherein the second coupling element has a shoulder, forming a second locking face as well as a first displacement face.

4. A coupling according to Claim 2 or Claim 3, wherein

starting from the opening of the first coupling element between the first coupling element and the second coupling element in its inserted condition an annular gap is formed, through which an unlocking sleeve extends and projects from the receptacle,

the unlocking sleeve is axially displaceable on the second coupling element between a locking position and a releasing position, and

the unlocking sleeve has a second displacement face, interacting, respectively, with the abutment faces of the locking elements in such a way, that by moving the unlocking sleeve from the locking position into the releasing position the spring elements are movable into their releasing position.

5. A coupling according to Claim 4 and Claim 3, wherein the unlocking sleeve, in the releasing position, is supported on the second locking face and the outer diameter of the unlocking sleeve in the area of the transition between the unlocking sleeve and the shoulder is at least as large as the outer diameter of the shoulder.

6. A coupling according to Claim 4 or Claim 5, wherein the unlocking sleeve, in the locking position, is axially supported on a shoulder of the second

coupling element or on a circlip, resting in a circumferential groove of the second coupling element.

7. A coupling according to any one of Claims 4 to 6, wherein the unlocking sleeve has engaging means for a tool.

8. A coupling according to any one of Claims 2 to 7, wherein in the annular recess an elastically deformable O-ring rests, acting upon the spring elements for taking up their locking position.

9. A coupling according to any one of Claims 2 to 8, wherein the first locking face and the second locking face extend parallel to each other.

10. A coupling according to any one of Claims 2 to 9, wherein the first locking face is of conical form and opens facing away from the opening, and the second locking face is arranged in a plane, disposed at a right angle to the longitudinal axis.

11. A coupling according to Claim 10, wherein the holding element is held so as to be axially displaceable in the annular recess and the second coupling element, in the connected state of the coupling elements, together with the holding element are axially displaceable between a first position, in which its locking elements abut the first locking face, and a second position, in which the ring of the holding element abuts a support face of the annular recess.

12. A coupling according to Claim 1, wherein the holding element is arranged around the second coupling element;

the first coupling element has an inner circumferential groove, forming the first locking face;

the first coupling element, in the area of the opening of the receptacle, forms a first displacement face arranged around the longitudinal axis; and

by means of inserting the second coupling element into the receptacle the first displacement face interacts, respectively, with an abutment face of the locking elements in such a way, that the spring elements are movable from the locking position into the releasing position.

13. A coupling according to Claim 12, wherein starting from the opening of the first coupling element, between the first coupling element and the second coupling element in its inserted condition an annular gap is formed, through which the spring elements project with their free ends into the receptacle.

14. A coupling according to Claim 13, wherein the spring elements have engaging means for a tool, by means of which these can be moved from the locking position into the releasing position.

15. A coupling according to any one of Claims 12 to 14, wherein the first locking face is arranged on a plane, arranged at a right angle to the longitudinal axis, and the second locking face is of conical form and opens facing away from the opening.

16. A coupling according to any one of Claims 12 to 15, wherein the holding element is held axially displaceable on the second coupling element, and the second coupling element, in the inserted condition, together with the holding element is axially displaceable between a first position, in which the locking

elements of the holding element abut the second locking face, and a second position, in which the ring of the holding element is axially displaceable to abut an abutment face.

17. A coupling according to Claim 16, wherein the abutment face is formed by a retaining ring, resting in a circumferential groove of the second coupling element.

18. A coupling according to any one of Claims 12 to 17, wherein

starting from the opening of the first coupling element, between the holding element and the second coupling element in its inserted condition an annular gap is formed, through which an unlocking sleeve passes and projects from the receptacle;

the unlocking sleeve is axially displaceable on the second coupling element between a locking position and a releasing position; and

the unlocking sleeve has a second displacement face, respectively, interacting with the second abutment faces of the locking elements in such a way that by means of moving the unlocking sleeve from the locking position into the releasing position the spring elements are movable into their releasing position.

19. A coupling according to Claim 12 or Claim 13, wherein

an unlocking sleeve is arranged axially displaceable on the second coupling element and is, by being moved relative to the second coupling element against the insertion direction of the second coupling element into the receptacle, displaceable from a locking position into a releasing position; and

the unlocking sleeve has a second displacement face, respectively, interacting with second abutment faces of the locking elements in such a way, that by means of moving the unlocking sleeve from the locking position into the releasing position the spring elements are movable into their releasing position.

20. A coupling according to Claim 19, wherein the second abutment faces are arranged in axial direction opposite to the insertion direction with increasing distance to the longitudinal axis.

21. A coupling according to Claim 19 or Claim 20, wherein the abutment faces in the inserted condition of the second coupling element are arranged outside the receptacle.

22. A coupling according to any one of Claims 19 to 21, wherein the second coupling element has a first shoulder forming the second locking face.

23. A coupling according to Claim 22, wherein the holding element is supported in the axial direction on the second locking face and on an abutment face of the second coupling element.

24. A coupling according to Claim 23, wherein the abutment face is formed by a second shoulder.

25. A coupling according to any one of Claims 19 to 24, wherein the inner diameter of the ring is larger than the maximum outer diameter of the second coupling element between the abutment face and an end face, which is arranged

on the end of the second coupling element which is the free end insertable into the receptacle.

26. A coupling according to any one of Claims 19 to 25, wherein the unlocking sleeve outside the area of the second displacement face has an inner diameter, which is larger than the outer diameter of the ring.

27. A coupling substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

28. Any novel feature or novel combination of features described herein and/or in the accompanying drawings.

Application No: GB 0303379.2 **Examiner:** Darren Williams
Claims searched: 1-28 **Date of search:** 11 August 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1-3, 9	GB 2199102 A	(HUNTING) see whole document
X	1-3, 9	EP 0466218 A1	(AEROSTRUCTURES) see whole document
X	1-3, 9	EP 0140995 A2	(ROSSI) see whole document
X	1-3	DE 2627397 A1	(ERMETO) see figs 1 & 2 and WPI abstract accession number 1978-A0636A [01]
X	1	US 5195905	(PESCI) see whole document

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The following online and other databases have been used in the preparation of this search report :

EPODOC, JAPIO, WPI