Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2425376 C 2007/07/10

(11)(21) 2 425 376

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2001/10/31
(87) Date publication PCT/PCT Publication Date: 2003/04/08
(45) Date de délivrance/Issue Date: 2007/07/10
(85) Entrée phase nationale/National Entry: 2003/04/08
(86) N° demande PCT/PCT Application No.: EP 2001/012615
(87) N° publication PCT/PCT Publication No.: 2002/037614
(30) Priorité/Priority: 2000/11/02 (DE100 54 290.5)

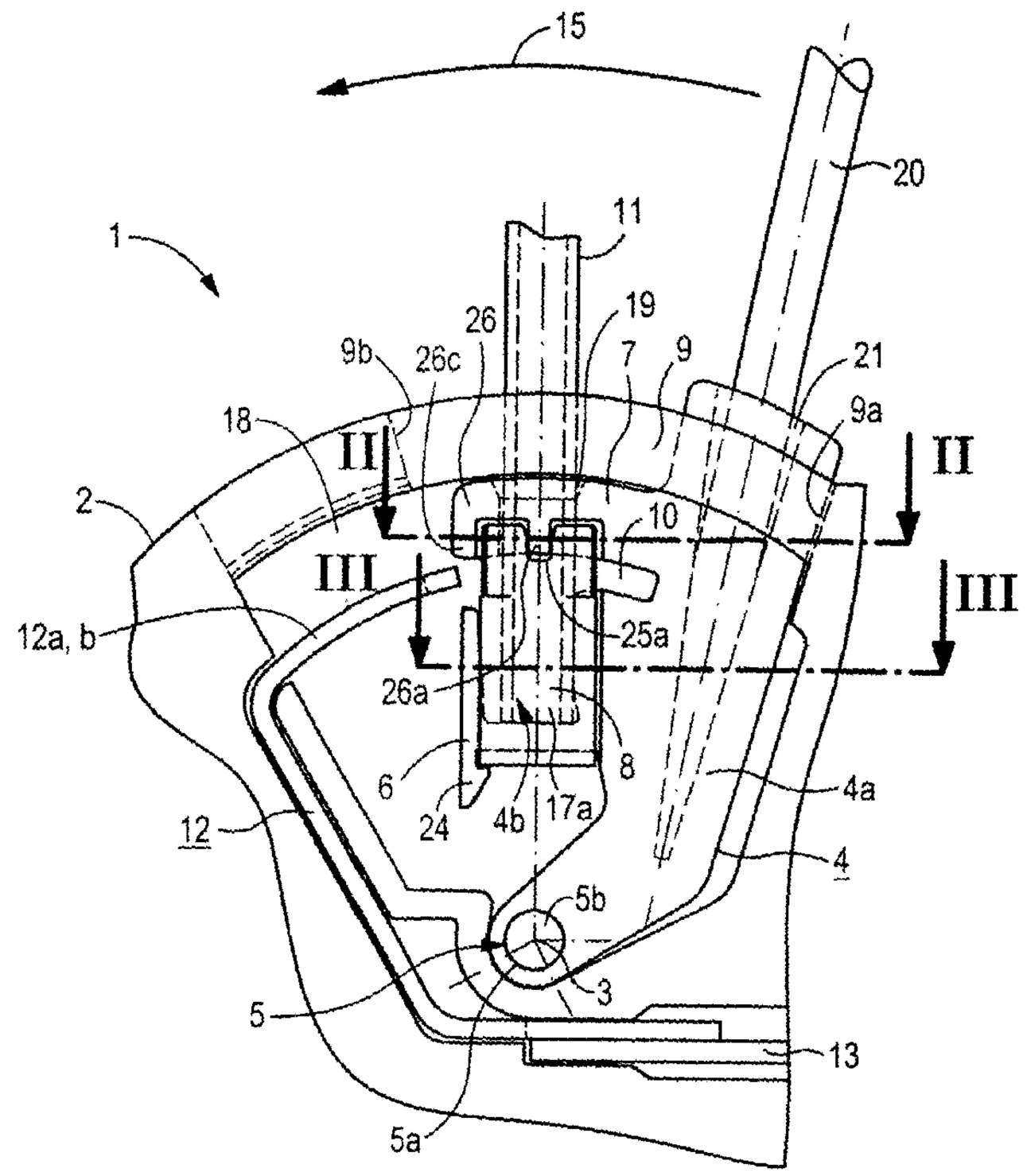
(51) Cl.Int./Int.Cl. *H01R 4/24* (2006.01)

(72) Inventeur/Inventor:
SUSS, CHRISTIAN, DE

(73) Propriétaire/Owner:
WIELAND ELECTRIC GMBH, DE

(74) Agent: MARKS & CLERK

(54) Titre : BORNE DE RACCORD SANS VIS
(54) Title: SCREWLESS CONNECTOR CLAMP



(57) Abrégé/Abstract:
The invention relates to a screwless connector clamp (1), comprising an insulating pivoting clip (4), mounted in a clamp housing (2) with a guide head (4b), which grips an electrical lead (11) introduced into the clamp housing (2) and contacts against a fixed

CA 2425376 C 2007/07/10

(11)(21) 2 425 376

(13) C

(57) Abrégé(suite)/Abstract(continued):
insulation displacement connector (12) by means of pivoting. According to the invention, a U-shaped spring element (6) is provided in the guide head (4b) of the insulated clip (4). Two contact arms (12a, 12b) of the insulation displacement connector (12) slide internally along the spring element legs (8a, 8b) on pivoting the insulated clip (4), which accommodate the lead (11) between them.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
10. Mai 2002 (10.05.2002)

PCT

(10) Internationale Veröffentlichungsnummer
WO 02/37614 A1

(51) Internationale Patentklassifikation[7]: H01R 4/24

(21) Internationales Aktenzeichen: PCT/EP01/12615

(22) Internationales Anmeldedatum:
31. Oktober 2001 (31.10.2001)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
100 54 290.5 2. November 2000 (02.11.2000) DE

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: **WIELAND ELECTRIC GMBH** [DE/DE]; Brennerstrasse 10-14, 96052 Bamberg (DE).

(72) Erfinder; und
(75) Erfinder/Anmelder *(nur für US)*: **SÜSS, Christian** [DE/DE]; Bergstrasse 15, D-96 129 Strullendorf (DE).

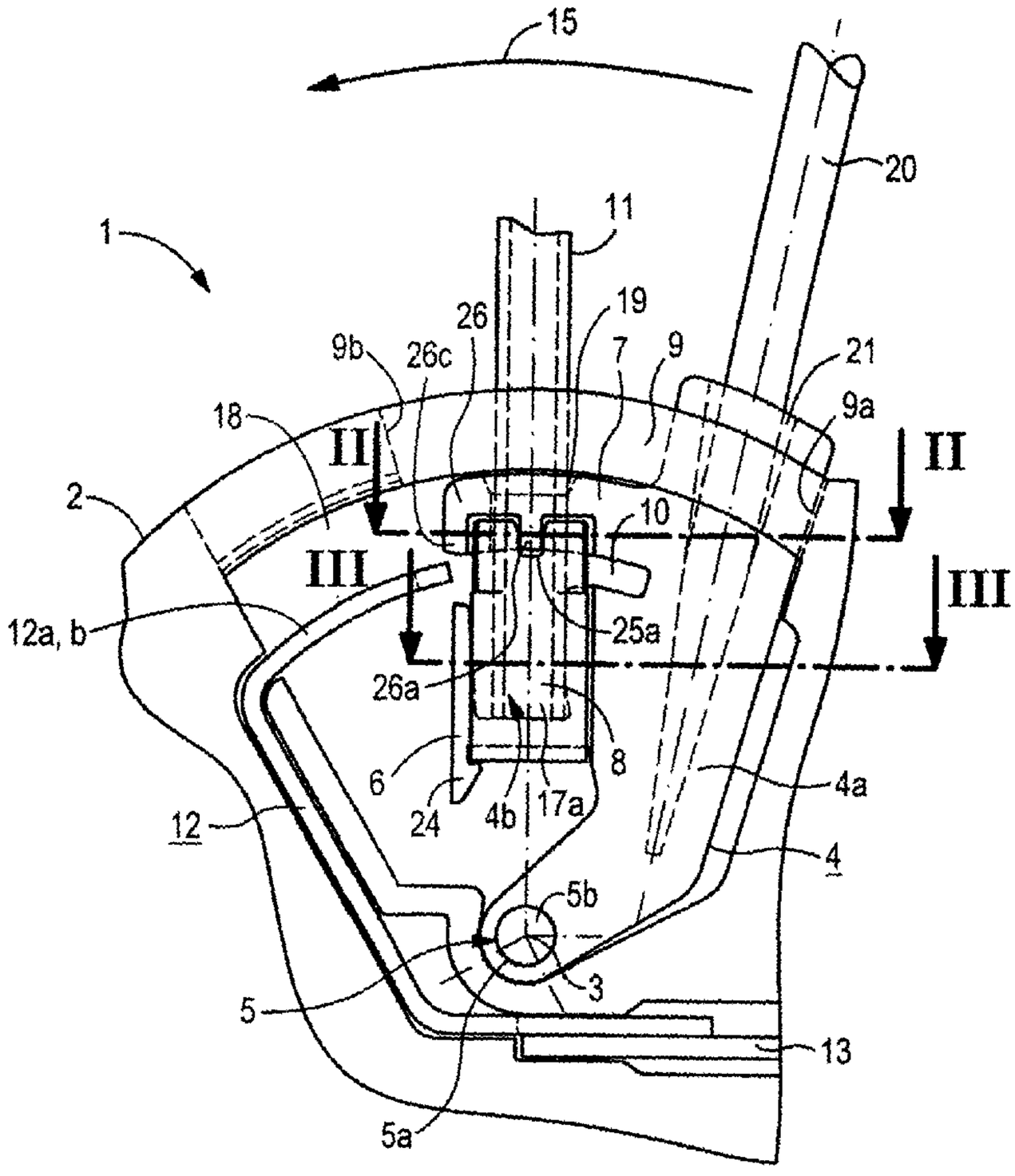
(74) Anwalt: **TERGAU & POHL**; Mögeldörfer Hauptstrasse 51, 90482 Nürnberg (DE).

(81) Bestimmungsstaaten *(national)*: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP,

[Fortsetzung auf der nächsten Seite]

(54) Title: SCREWLESS CONNECTOR CLAMP

(54) Bezeichnung: SCHRAUBENLOSE ANSCHLUSSKLEMME



(57) Abstract: The invention relates to a screwless connector clamp (1), comprising an insulating pivoting clip (4), mounted in a clamp housing (2) with a guide head (4b), which grips an electrical lead (11) introduced into the clamp housing (2) and contacts against a fixed insulation displacement connector (12) by means of pivoting. According to the invention, a U-shaped spring element (6) is provided in the guide head (4b) of the insulated clip (4). Two contact arms (12a, 12b) of the insulation displacement connector (12) slide internally along the spring element legs (8a, 8b) on pivoting the insulated clip (4), which accommodate the lead (11) between them.

(57) Zusammenfassung: Eine schraubenlose Anschlussklemme (1) weist einen in einem Klemmengehäuse (2) schwenkbar gelagerten Isolierstoffbügel (4) mit einem Führungskopf (4b) auf, der einen in das Klemmengehäuse (2) eingeführten elektrischen Leiter (11) erfasst und durch Verschwenken gegen einen unbeweglichen Schneidklemmkontakt (12) kontaktiert. Erfindungsgemäß ist ein in den Führungskopf (4b) des Isolierstoffbügels (4) eingesetztes U-förmiges Federelement (6) vorgesehen. An deren Federschenkeln (8a, 8b) gleiten innenseitig beim Verschwenken des Isolierstoffbügels (4) zwei Kontaktarme (12a, 12b) des Schneidklemmkontaktes (12) entlang, die den Leiter (11) zwischen sich aufnehmen.

WO 02/37614 A1

WO 02/37614 A1

KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW.

(84) Bestimmungsstaaten *(regional)*: ARIPO-Patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), eurasisches Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI-Patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

— *mit internationalem Recherchenbericht*

— *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen*

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

Screwless Connector Clamp

The invention relates to a screwless connector clamp having a pivoting insulated clip, mounted in a clamp housing, with a guide head which grips an electrical conductor introduced into the clamp housing through an opening in the housing and contacts against a fixed insulation displacement connector connected with a stationary contact rail by pivoting the insulated clip.

A screwless connector clamp of this type is known from the German Utility Model DE 299 08 384 U1. In a clamp housing, it comprises an insulation displacement connector and a pivoting insulated clip which has a guide head for the conductor introduced into the clamp housing. The insulation displacement connector is stationary and thus immovablly connected with a contact rail situated in the clamp housing. The conductor introduced into the clamp housing through the opening in the housing is gripped by the guide head and led in a rotary manner against the fixed insulation displacement connector and along its cutting edges by pivoting the insulated clip by means of an actuating tool acting on it. The difficulty in this case is that the cutting edges not only penetrate the conductor insulation, but also at the same time contact the conductor core which, in addition to an undesirable damage, often results in an inadequate clamp contact.

Thus, an object of the invention is to design a screwless connector clamp of the aforementioned type in such a way that an especially reliable clamp contact of a conductor is obtained in a simple manner while avoiding the noted disadvantages.

According to an aspect of the present invention, there is provided a U-shaped spring element placed

in the guide head is provided which can preferably be inserted into the insulated clip or swivel clip from the underside of the guide head facing the swivel axis of the insulated clip. When the insulated clip is pivoted, spring legs of the spring element extending in direction of the housing opening slide with their inner edges facing one another along the outer edges of contact arms of the insulation displacement connector which accommodate the conductor between them.

The spring element legs are advantageously curved with cambers facing one another. Moreover, in an especially advantageous embodiment, on the end, the contact arms of the insulation displacement connector are provided with cutting edges that extend in a V-shape to one another that are adjoined in direction of pivot by non-cutting and parallel contact surfaces. The distance of the contact surfaces is thereby adapted to the diameter of the core of the conductor.

With this design, it is obtained that, by pivoting the insulated clip, the conductor introduced into its guide head first comes into contact only with the V-shaped cutting part of the insulation displacement connector and that the conductor insulation is thereby cut by means of its cutting edges. The two legs of the U-shaped spring element and the two contact arms of the insulation displacement connector are then not as yet engaged with one another, so that the contact arms are not acted upon by the spring element during the cutting of the conductor insulation. Only when the insulated clip or pivot is turned further into its final assembled position, do the spring element legs contact the contact arms of the insulation displacement connector. The contact arms flattened on their inner edges and thus non-cutting are thereby acted upon by pressure by the legs due to the spring force of the spring element, so that a reliable surface pressure of the contact arms against the core is attained and thus a reliable clamp contact of the conductor. Moreover,

a cutting by the contact arms of the insulation displacement connector on the core and thus damage to it are reliably avoided. Thus, in the final assembled position, the U-shaped spring element holds the contact arms of the insulation displacement connector firmly together, so that a solid force fit is assured between the insulation displacement connector and the conductor.

To position and hold the U-shaped spring element on the insulated clip, the legs of the spring element are provided with a recess on the free end into each of which a corresponding profiled part of the guide head of the insulated clip engages. This profiled part is advantageously m-shaped, so that it engages in the recesses and, in addition, surrounds the spring legs on their narrow sides facing the insulation displacement connector above the contact arms.

Advantageously, a catch which grips behind the U-shaped spring element ot the bottom is attached to the guide head of the insulated clip on the opposite end. Thus, when the spring element is inserted into the insulated clip, the profiled part of the guide head holds the spring legs at the end, while the inserted spring element is secured in addition by means of the catch in the final assembled position. As a result, the insulated clip and the spring element can be easily produced as an integral pivoting body of the connector clamp in a preassembly step.

In a further advantageous embodiment, the guide head has two guide arms spaced radially from one another and formed on a swivel arm of the insulated clip. They accommodate the contact arms of the insulation displacement connector between them which are laterally pressure-loaded by the arms of the spring element when the conductor is in a clamped position. This creates a holding or clamping area which is almost rectangular in cross section and at the same time with a depth stop for the conductor

in the integral swivel body of the connector clamp formed by the insulated clip and the spring element. To this end, a first guide arm of the guide head which is closest to the swivel axis has an more or less U-shaped recess onto which the spring element is slipped in a staggered manner at a right angle. On the side facing away from the contact arms of the insulation displacement connector of the holding or clamping area formed in the guide head, a shaped part of the insulated clip forming a form-locking contact surface for the conductor protrudes into it. Moreover, a second guide arm of the guide head, situated in a chamber area between the housing opening and the insulation displacement connector, has an opening for the conductor which is aligned with the recess or holding chamber of the first guide arm and with the opening in the housing.

The insulated clip is supported in an articulation about a swivel axis that is advantageously above the contact rail. In this case, the pivoting leg of the insulated clip extends outward through the housing opening, advantgeously configured as a curved oblong hole, and is thus guided in it. To pivot the insulated clip, its pivoting leg has a preferably conically-tapered contact opening for an actuating tool, e.g. for a screwdriver.

To obtain as effective a lever as possible of the swivel body consisting of insulating material while at the same time keeping the spatial dimensions as small as possible, both the pivoting insulated clip and the insulation displacement connector are preferably crescent-shaped. In addition, its contact arms and an engagement slot accommodating it when the insulated clip is pivoted is designed in such a way that it extends in a curved manner in the guide head having a curved shape that is adapted to the swivel camber described by the insulated clip.

The advantages obtained with the invention consist, in particular, therein that, by inserting a U-shaped spring element

into the pivoting insulated clip of a connector clamp having a stationary insulation displacement connector, a reliable force fit of the conductor is obtained on the one hand and on the other hand undesirable damage to its core can be easily prevented. It is thereby especially advantageous that the cutting edges move ahead of the clamping area of the insulation displacement connector formed by the non-cutting contact surfaces. As a result, the conductor insulation is cut in a state in which the contact arms of the insulation displacement connector are not as yet acted upon by the spring element. Only after the cutting process does the clamping take place due to the continuous action upon the contact arms by the two legs of the spring element.

A further advantage lies therein that it is possible to assemble the spring element and insulated clip beforehand and combine them to form an integral component. In this case, the same integral component can be engaged with various types of contact arms. In view of the fact that, as a result of the interaction of the spring element with the contact arms, they do not have to have any special spring properties, the contact rail can also be used directly as an insulation displacement connector.

According to an aspect of the present invention there is provided a screwless connector clamp comprising a pivoting insulated clip mounted in a clamp housing with a guide head which grips an electrical conductor into the clamp housing via an opening in the housing and contacts against an insulation displacement connector immovably connected with a stationary contact rail, and further comprising a U-shaped spring element inserted in the guide head of the insulated clip, having spring element legs extending in a direction of the housing opening, wherein the contact arms of the insulation displacement connector, which accommodate the conductor between them, slide along mutually facing inner edges of the spring element legs when the insulated clip is pivoted.

An embodiment of the invention will be described in the following with reference to the drawings, showing:

Fig. 1 by parts, a connector clamp according to the invention which can be actuated with a tool in a sectional representation in a contactless function position,

Fig. 2 the connector clamp in a sectional representation along the line II-II in Fig. 1,

Fig. 3 the connector clamp in a sectional representation along the line III-III in Fig. 1,

Fig. 4 the connector clamp in a contacted function position, and

Fig. 5 the connector clamp in a sectional representation along the line V-V in Fig. 3.

Corresponding parts are provided with the same reference numbers in all figures.

The screwless connector clamp 1 is, for example, designed as a series-connected clamp and comprises a clamp housing 2 with an insulated clip 4 pivoted about a pivot or swivel axis 3. This more or less crescent-shaped or hook-shaped swivel clip 4 made of insulating material has, in addition, an articulation 5 on the foot of a pivoting leg 4a with the clamp housing 2 which also consists of insulation material. The articulation 5 is advantageously formed by a clip hole 5a provided at the foot of the insulated clip 4 and an articulation pin 5b stationary in it which is preferably attached to it inside the clamp housing 2.

A fork-shaped guide head 4b extending in direction of the pivoting motion of the insulated clip 4 is formed on the pivoting leg 4a of the insulated clip 4. In the area of the guide head 4b formed by two guide arms 6 and 7, a spring element 8 is placed or slipped onto the insulated clip 4 which is U-shaped, according to Figs. 2 and 4, and thus has two spring legs 8a, 8b.

For the cutting/clamping contact of a conductor 11 inserted into the clamp housing 2 via an elongated housing opening 9 and thereby pushed out via an engagement slot 10 in the insulated clip 4, the guide head 4b of the insulated clip 4 carrying the spring element 8 and accommodating the conductor 11 interacts with an insulation displacement connector 12. It is firmly connected with a stationary contact rail 13 inside the insulation housing 2 and thus especially immovable, e.g. by welding,

screwing or riveting. The articulation 5, and thus the swivel axis 3, is situated above the contact rail 13 and spaced from it.

According to Figs. 2 and 4, the insulation displacement connector 12 has two contact arms 12a, 12b spaced from one another which have cutting edges 14a or 14b, respectively, extending in a V-shaped to one another on the free end of the contact arms facing the guide head 4b. In direction or swivel 15 indicated in Figs. 1 and 2, these are adjoined by non-cutting contact surfaces 16a or 16b whose distance from one another is adapted to the outside diameter of the core 11a of the conductor 11.

The guide arms 6 and 7 of the guide head 4b, situated radially above one another with respect to the swivel axis 3 are arranged spaced from one another in such a way that they accommodate the contact arms 12a, 12b of the crescent-shaped insulation displacement connector 12 between them in the engagement slot 10 adapted to the shape of the contact arms 12a, 12b. The lower (first) guide arm 6 closest to the swivel axis 3 is thereby designed as a U-shaped recess 17a on which the similarly U-shaped spring element 8 is placed, staggered by 90°. As can be seen in Fig. 3, a holding or clamping area 17 which is more or less rectangular in cross section is thereby formed in the guide head 4b. On the side of the clamping area 17 facing away from the contact arms 12a, 12b of the insulation displacement connector 12, a shaped part 17c of the insulated clip 4 protrudes into it. The shaped part 17c forms a form-locking contact surface 17b for the conductor 11 and is, moreover, semicircular, i.e. in the manner of a round half shell.

The upper (second) guide arm 7 extends above the contact arms 12a, 12b in a chamber area 18 formed between them and the housing opening 9. In this case, the second guide arm 7 has an opening 19 which aligns, on the one hand, with the housing opening 9 and, on the other hand, with the U-shaped recess 17 in the first guide

arm 6 which is almost closed laterally by the spring element 8. The conductor 11 led via the housing opening 9 into the clamp housing 2 thus penetrates the opening 19 first in the second guide arm 7 and extends from there into the recess 17 of the guide head 4b, limited laterally by the spring element 8.

This guide head 4b, limited on all sides above the contact arms 12a, 12b by the opening and below the contact arms 12a, 12b by the U-shaped recess 17 and the legs 8a, 8b of the spring element 8, positions the conductor 11 and, by pivoting the insulated clip 4, brings it from the contactless position shown in Figs. 1 and 2 into the contact position shown in Figs. 3 and 4. The conductor 11 is thereby rotated due to the pivoting motion of the insulated clip 4 enabled by means of the articulation 5. For moving the conductor 11 on a circular path, the contact arms 12a, 12b of the stationary insulation displacement connector 12 have a crescent or curved shape adapted to the corresponding circular path.

The insulated clip 4, forming an integral component together with the spring element 8, is pivoted by means of an actuating tool 20, for example, by means of a screwdriver. For this purpose, the pivoting leg 4a of the insulated clip 4 extending outward through the housing opening 9 has a conically tapered contact opening 21 for the actuating tool 20. During pivoting of the insulated clip 4, opposite opening edges 9a or 9b of the elongated housing opening 9, adapted to the circular arc shape, serve as a stop for the respective end positions of the insulated clip 4 shown in Figs. 1 and 3.

As can be clearly seen by comparison in Figs. 2 and 4, the V-shaped cutting part of the insulation displacement connector 12 with its cutting edges 14a, 14b first reaches into the area between the two legs 8a and 8b of the spring element 8 during pivoting of the insulated clip 4 in direction of pivot 15. The

two spring element legs 8a and 8b are thereby curved, with the cambers 22a and 22b facing one another, in such a way an expanded inlet area for the contact arms 12a, 12b is produced. Accordingly, their two cutting edges 14a and 14b are still not exposed to the spring action of the spring element 8 due to an outer contact on the inner edges 23a, 23b of the spring element legs 8a and 8b when the insulation 11b of the conductor 11 is already being cut by the cutting edges 14a, 14b. Only when the non-cutting clamp area adjoining it in direction of pivot 15 comes into contact with the contact surfaces 16a and 16b of the contact arms 12a, 12b in the area of the narrowest point between the two spring element legs 8a, 8b, the contact arms 12a, 12b of the insulation displacement connector 12 is acted upon by pressure on the outside due to the spring action of the spring element 8.

As a result of this pressure action on the outside, the two contact arms 12a and 12b are moved toward one another while simultaneously clamping the core 11a of the conductor 11, as can be seen in the pivoting or final assembled position shown in Fig. 4. As a result, an especially effective clamping of the conductor 11 is obtained while at the same time avoiding damage to the conductor core 11a. In particular, an undesired cutting of the insulation displacement connector 12 in the conductor core 11a is reliably prevented.

The insulated clip 4 and the spring element 8 are at first separate production parts which are joined together in a pre-assembly step to form an integral pivot body 4,8. The spring element 8 is then slipped, relative to its position shown in Figs. 1 to 4, onto the insulated clip 4, i.e. onto its guide head 4b, from the bottom. To fix the spring element 8, a catch 24 is formed on the guide arm 6 of the guide head 4b, said catch 24 engaging on the outside on the crossbar 8c of the spring element 8 connecting the two spring legs 8a and 8b while forming a firm

grip from behind.

For the exact positioning of the spring element 8, its arms 8a and 8b are provided with a recess 25a and 25b on the free end, into which an m-shaped profiled part 26 provided on the upper guide arm 7 of the insulated clip 4 engages with profile pins 26a and 26b, respectively. On the narrow sides 27a, 27b of the respective spring leg 8a and 8b facing the insulation displacement connector 12, it surrounds an outer profiled contour 26c of the profiled part 26.

List of Reference Numbers

1	Connector clamp	18	Chamber area
2	Clamp housing	19	Opening
3	Swivel axis	20	Actuating tool
4	Insulated clip	21	Inlet opening
4a	Pivoting leg		
4b	Guide head		
5	Articulation	22a,b	Camber
5a	Clip hole	23a,b	Inner edge
5b	Articulation pin	24	Catch
6	First guide arm	25a,b	Recess
7	Second guide arm	26	Profiled part
8	Spring element	26a,b	Profile pin
8a,b	Spring leg		
9	Housing opening	26c	Profiled outer edge
10	Contact slot	27a,b	Narrow side
11	Electrical conductor		
11a	Conductor core		
11b	Conductor insulation		
12	Insulation displacement connector		
12a,b	Contact arm		
13	Contact rail		
14a,b	Cutting edge		
15	Direction of swivel		
16a,b	Contact surface		
17	Holding/Clamping area		
17a	Recess		
17b	Contact surface		
17c	Shaped part		

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A screwless connector clamp comprising a pivoting insulated clip mounted in a clamp housing with a guide head which grips an electrical conductor into the clamp housing via an opening in the housing and contacts against an insulation displacement connector immovably connected with a stationary contact rail, and further comprising a U-shaped spring element inserted in the guide head of the insulated clip, having spring element legs extending in a direction of the housing opening, wherein the contact arms of the insulation displacement connector, which accommodate the conductor between them, slide along mutually facing inner edges of the spring element legs when the insulated clip is pivoted.

2. The connector clamp according to claim 1, wherein the legs of the spring element are curve-shaped with cambers facing one another.

3. The connector clip according to claim 1 or 2, wherein the contact arms of the insulation displacement connector have cutting edges on the end that extend in a V-shape to one another and adjoining non-cutting and parallel contact surfaces in direction of swivel.

4. The connector clamp according to any one of claims 1 to 3, wherein the legs of the spring element have a recess on the free end into which profile pins of a profiled part of the guide head engage.

5. The connector clamp according to claim 4, further comprising an m-shaped profiled part which surrounds the spring legs on their narrow sides facing the insulation displacement connector.

6. The connector clamp according to any one of claims 1 to 5, wherein a catch is formed on the guide head of the insulated clip which grips behind the U-shaped spring element on the bottom.

7. The connector clamp according to any one of claims 1 to 6, wherein the guide head has two guide arms formed on a pivoting leg of the insulated clip and spaced radially from one another, said guide arms accommodating the contact arms of the insulation displacement connector, which are laterally pressure-loaded by the arms of the spring element, between them when the conductor is in the clamping position.

8. The connector clamp according to any one of claims 1 to 7, wherein a first guide arm of the guide head closest to the swivel axis has a U-shaped recess for the conductor on which the spring element is slipped, offset by 90°.

9. The connector clamp according to claim 8, wherein a second guide arm of the guide head situated in a chamber area between the housing opening and the insulation displacement connector has an opening for the conductor aligning with the U-shaped recess of the first guide arm and with the opening in the housing.

10. The connector clamp according to claim 8 or 9, wherein a shaped part of the insulated clip forming a form-locking

contact surface for the conductor protrudes into a holding or clamping area formed by the U-shaped recess and the spring element.

11. The connector clamp according to any one of claims 1 to 10, wherein the insulated clip is pivoted about a swivel axis above the contact rail in an articulation.

12. The connector clamp according to any one of claims 1 to 11, wherein the insulated clip and the insulation displacement connector are crescent-shaped.

13. The connector clamp according to any one of claims 1 to 12, wherein the insulated clip in the housing opening is guided with its pivoting leg which has an inlet opening for an actuating tool for pivoting the insulated clip.

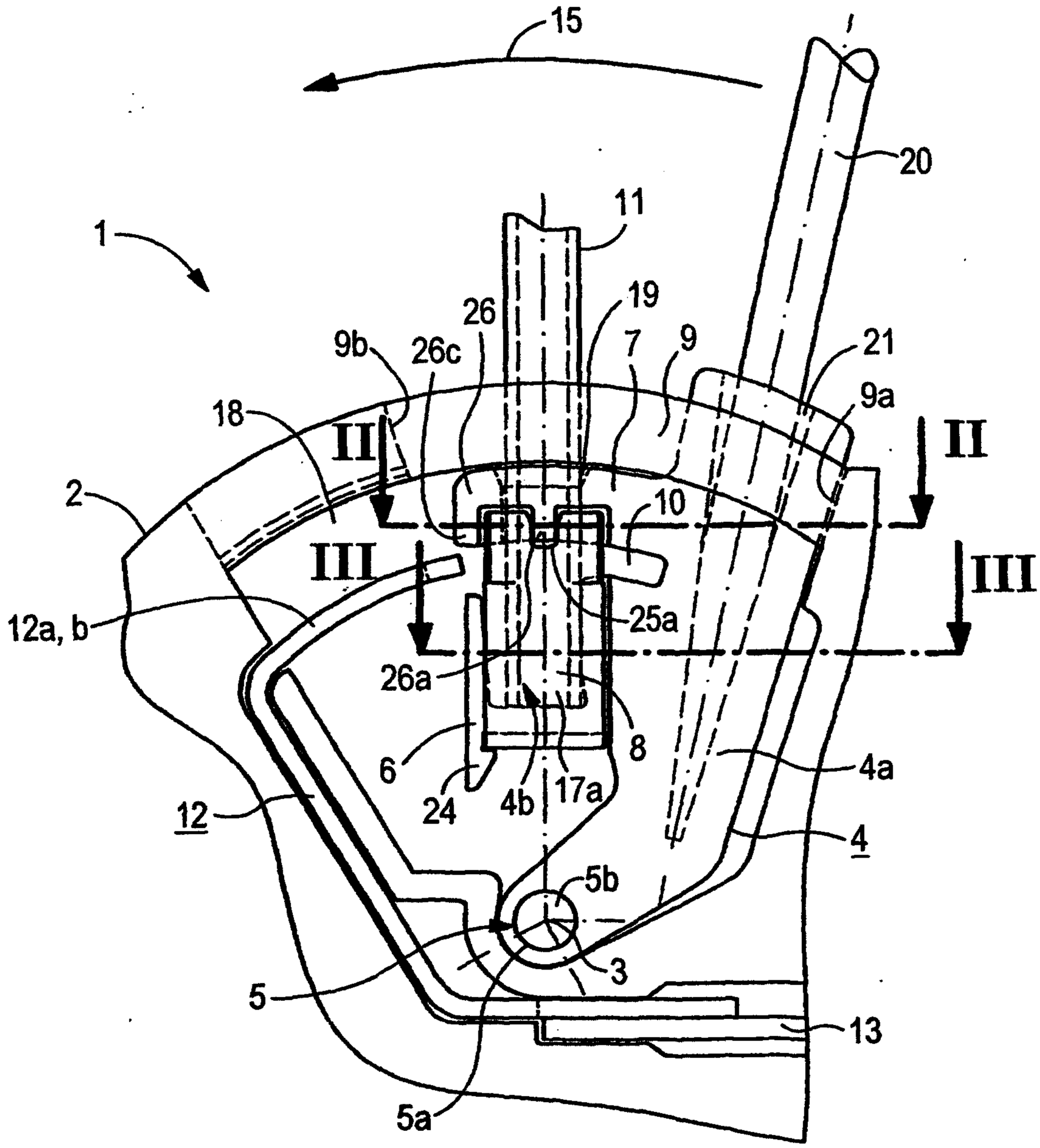


Fig. 1

Marks & Clerk

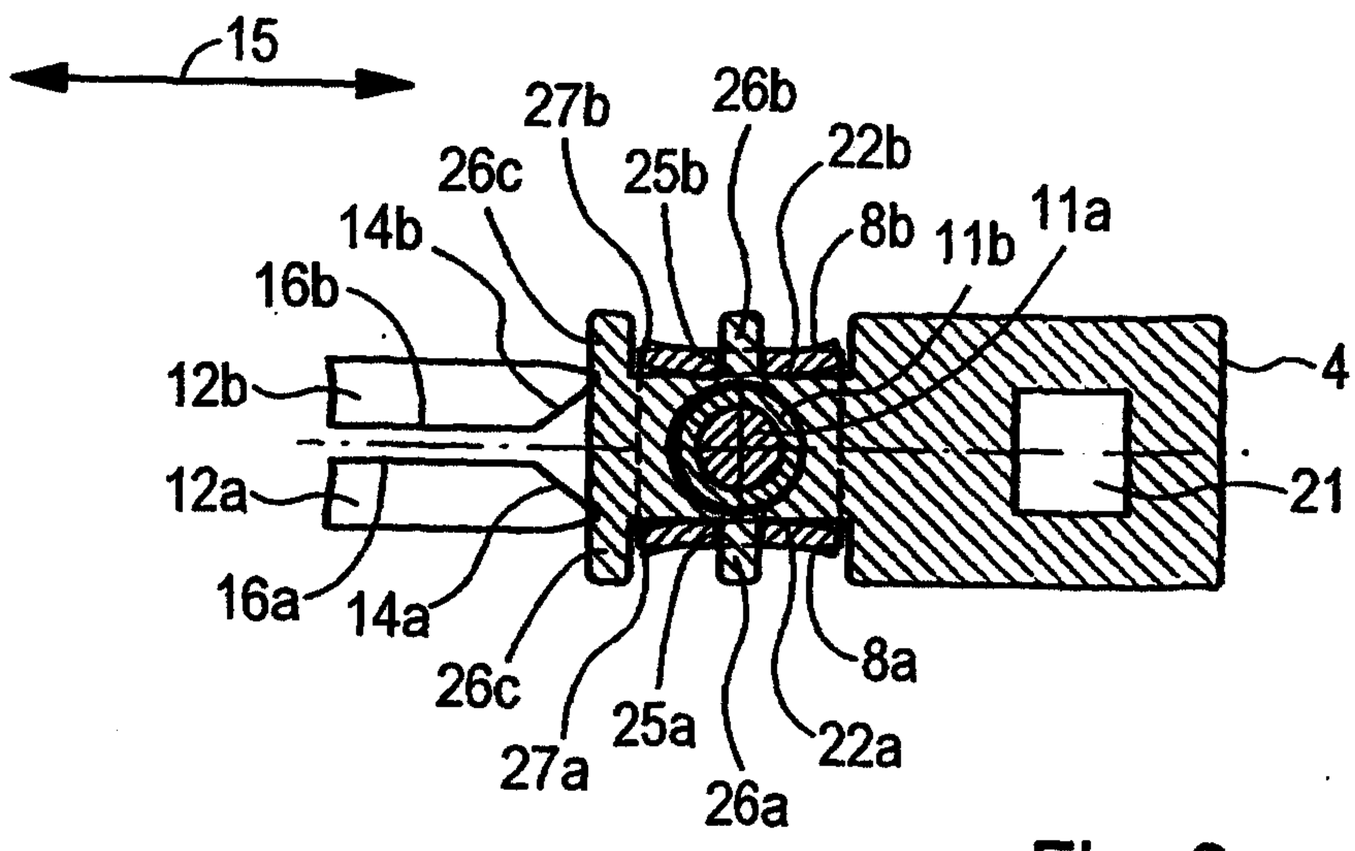


Fig. 2

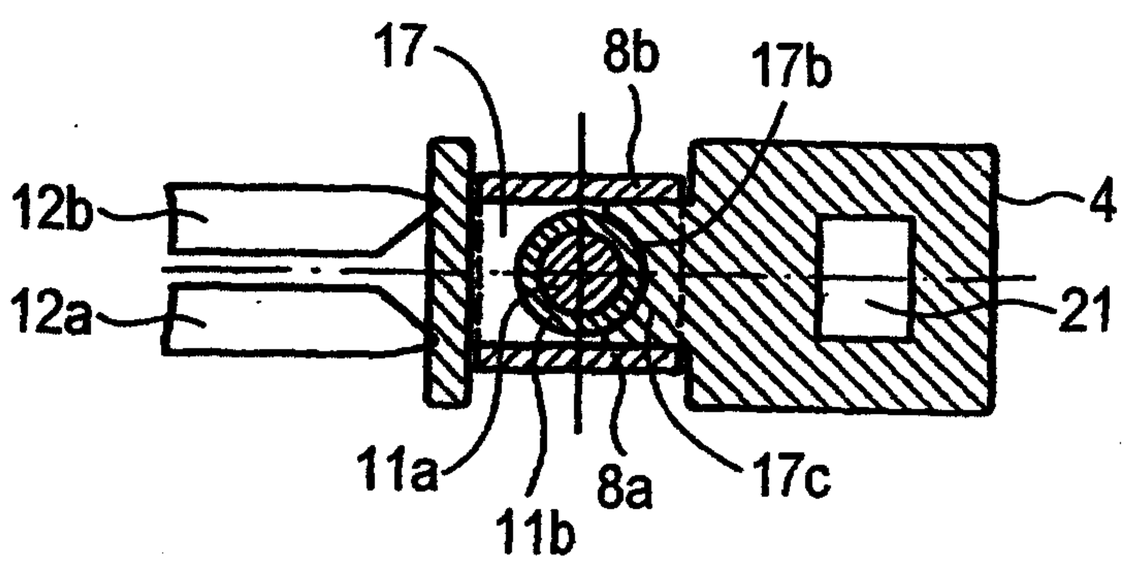


Fig. 3

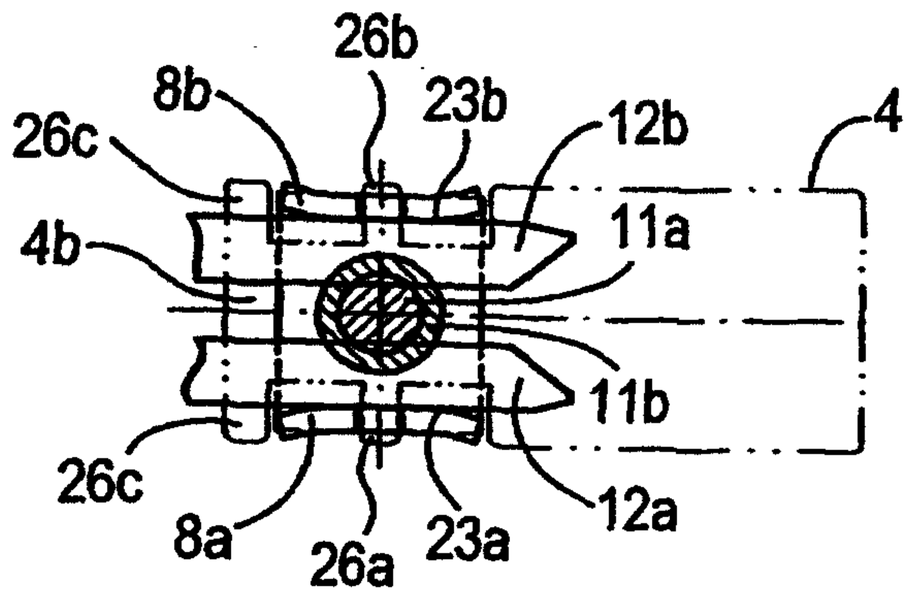


Fig. 5

Marks & Clerk

ERSATZBLATT (REGEL 26)

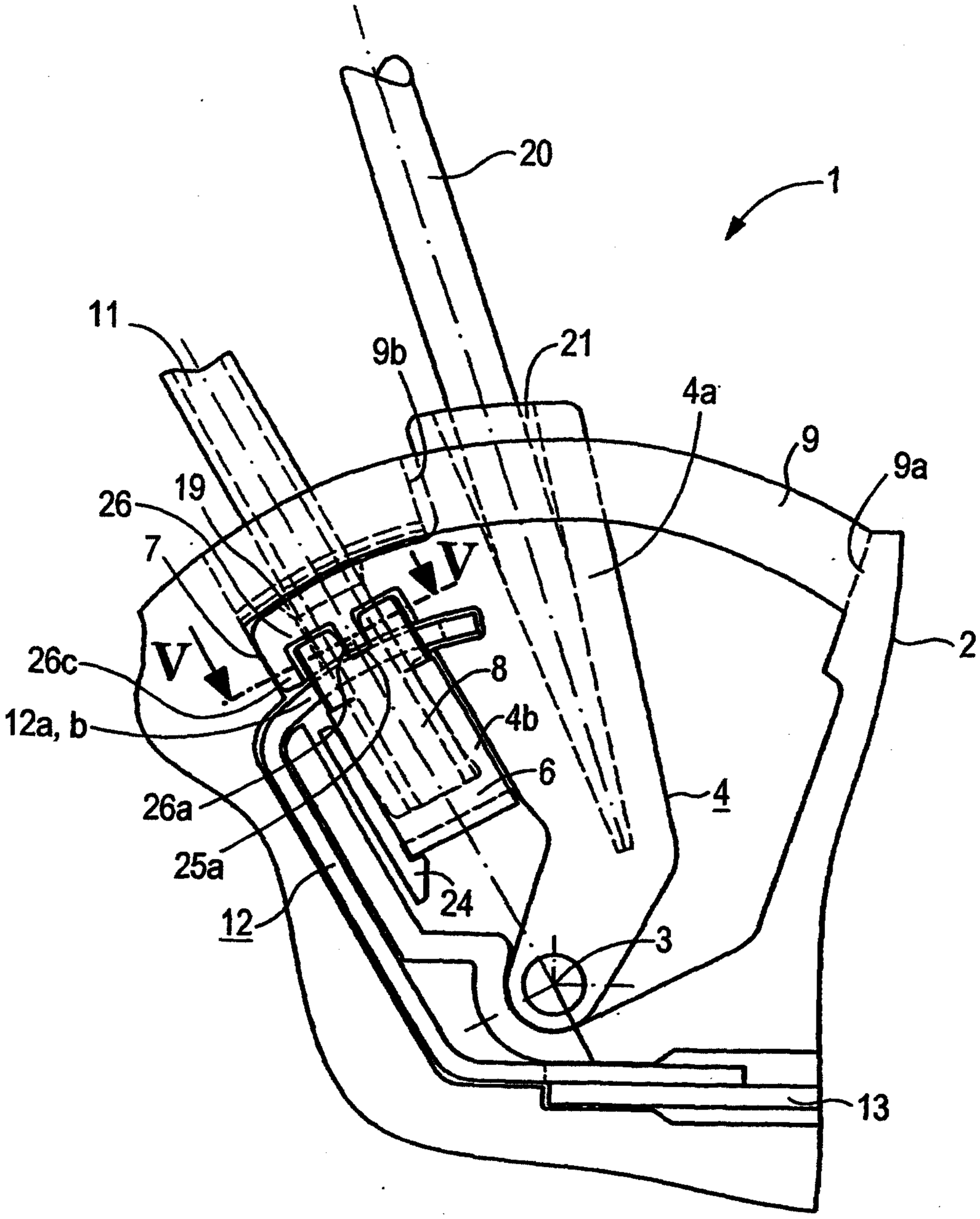
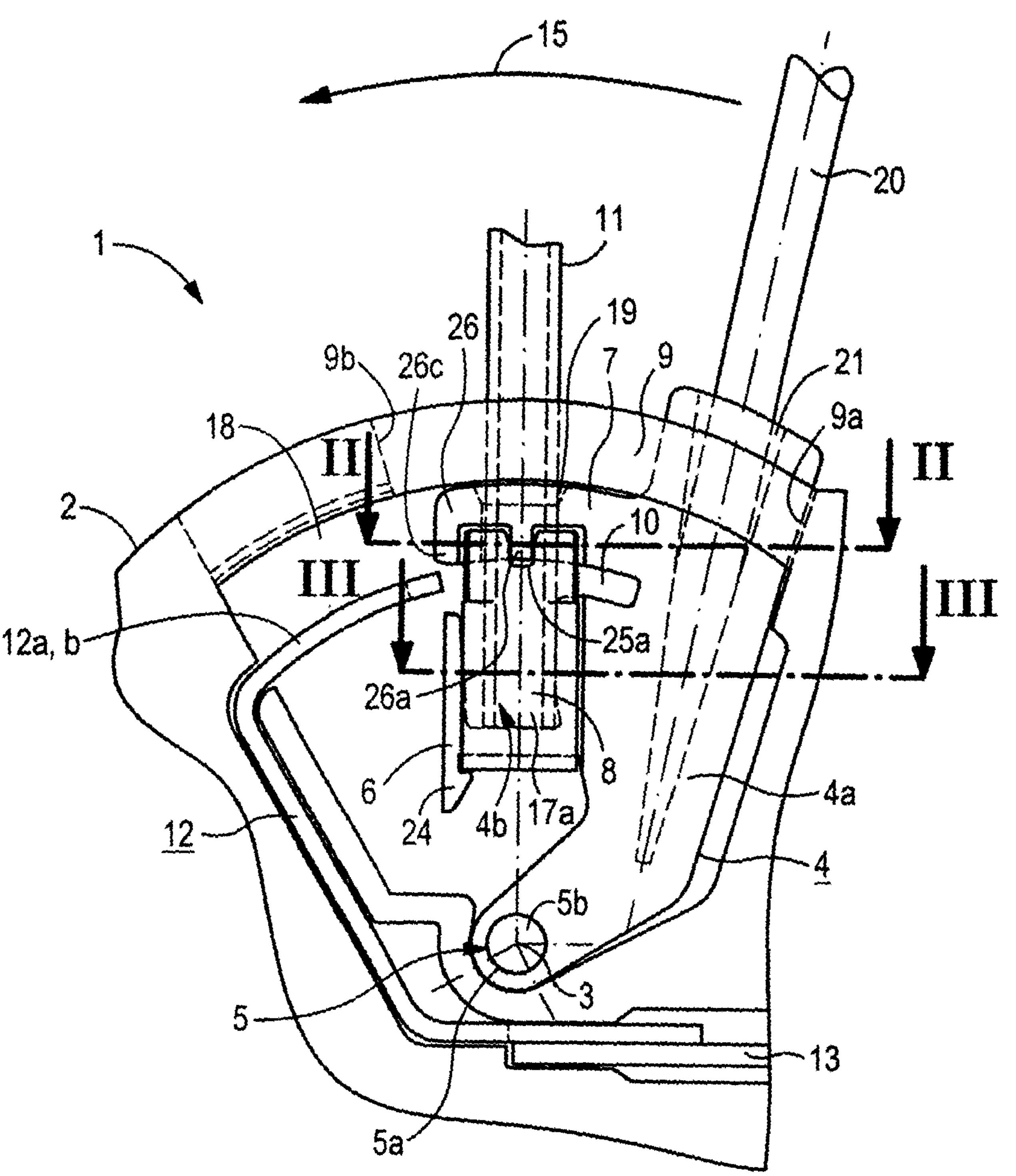


Fig. 4


15
1
20
11
26
19
9b
26c
7
9
21
18
II
9a
II
2
10
III
III
12a, b
25a
26a
6
8
4a
24
4b
17a
12
4
5b
3
5
13
5a