(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 006 627 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.06.2000 Bulletin 2000/23

(51) Int. Cl.[7]: **H01R 43/042**

(21) Application number: **98309872.4**

(22) Date of filing: **02.12.1998**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

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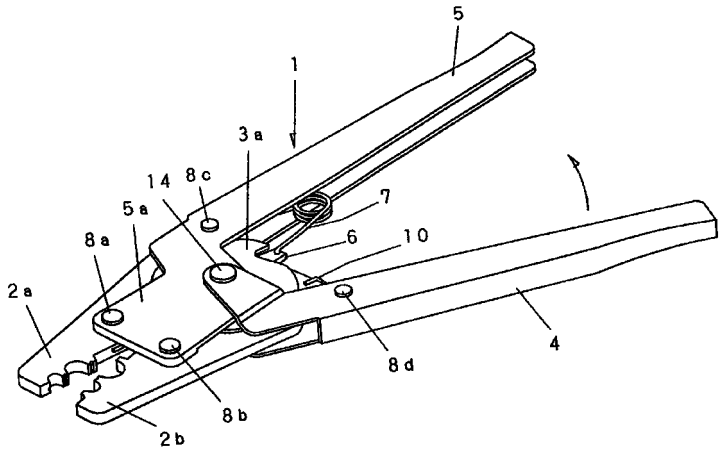
(54) Hand tool for contact crimping

(57) A contact crimper (1) for crimping contacts (30) on wire ends (35) has a cam means (3a,3b) rotatable only in one direction, a pair of manual levers (4,5) for driving the cam means to rotate, and a pair of first jaw (2a) and second jaw (2b) both operatively connected by the cam means to the manual levers so as to crimp the contact. The jaws (2a,2b) respectively have cam followers (16a, 16b) formed at proximal ends and kept in contact with the cam means' periphery. The cam means (3a,3b) has protuberances (3b1) protruding radially and outwardly, and a spring (15) intervenes between the jaws so as to urge their distal ends away from each other.

Fig. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a contact crimper for crimping crimp contacts or the like terminals to the ends of wires or leads so as to electrically connect them together.

Prior Art

[0002] It has been known and practiced to insert a lead end into a cylindrical body of a crimp contact and subsequently depress the body. Figs. 8 and 9 show a crimper used to carry out such a prior art method wherein the lead end is fixedly brought into an electrical contact with the crimp contact. Fig. 10(a) illustrates an example of the crimp contact 30 that is made of a metal and consists of a terminal 31 and a cylindrical body 32 formed integral therewith. Fig. 10(b) shows the contact 30 that has been crimped on a naked end 35 of an electric wire or lead 34 coated with an insulating mantle. The contact's body 32 partially depressed as indicated at the reference numeral 33 will firmly fix therein the wire end 35.

[0003] The prior art crimper 'A' comprises a pair of first and second jaws 20a and 20b, a pair of manual levers or handles 21a and 21b, and a ratchet mechanism 17. Those jaws connected to each other by pins 18a and 18b and a tie piece 19 are rotatable an angle relative to each other. A further pin 18c is inserted through the proximal end of one jaw 20a and the distal end of one manual lever 21a, so that these jaw and lever are rotatable relative to each other within an allowed angle. Likewise, a still further pin 18d inserted through the proximal end of the other jaw 20b and the distal end of the other lever 21b so as to permit them rotatable within the allowed angle.

[0004] A pivot 18e rotatably connects those manual levers or handles 21a and 21b, to which the respective ends of the ratchet mechanism 17 are fixed.

[0005] In Fig. 8, the jaws 20a and 20b of the crimper 'A' are shown in their closed state. When opening those jaws, the manual levers 21a and 21b have to be gripped together more strongly so as to rotate causing their proximal ends to get nearer one another. As a result, the ratchet mechanism 17 will become free so that the levers 21a and 21b may be opened, enabling the jaws 20a and 20b to open themselves.

[0006] The prior art crimper will be used in the following manner. At first the manual levers 21a and 21b are rotated towards each other from their free position shown in Fig. 9, by such an angle that the distal ends of the jaws 20a and 20b can grip between them an undepressed new contact, terminal or the like. One or more wire ends will then be inserted in a cylindrical body of the contact before the levers or handles 21a and 21b are further forced towards one another. The jaws are thus completely closed to depress and crimp the contact body on the wire ends, thereby electrically connecting them together.

[0007] However, such prior art crimpers have proved somewhat problematic from the following aspects.

[0008] It has been difficult for operators to close with their one hands the manual levers 21a and 21b so widely opened as shown in Fig. 9. They have to initially grip the distal portions of those levers when setting the wire ends in the contact bodies. Subsequently, they must shift their hands onto the manual levers' proximal ends to finally crimp the contacts on the wire ends.

[0009] Due to such a change in position of the operators' hands, the wire ends have often tended to slip off from the contacts, rendering less efficient the wiring works. In other cases, the wire ends would not slip off but be displaced a noticeable distance within the contact bodies, thereby causing imperfect crimping. On the other hand, the requisite strong re-gripping of those manual levers 21a and 21b after the crimping step has been making it inefficient to restore the ready-to-reuse or home position of the crimper. Due to the levers to be opened so wide, the prior art crimpers are not necessarily adapted for use in narrow spaces.

SUMMARY OF THE INVENTION

[0010] The present invention was made in view of and for resolving the problems in the prior art. A principal object of the present invention is therefore to provide a contact crimper that improves the efficiency and quality of the crimping operations.

[0011] In order to achieve the object, a contact crimper provided herein for crimping contacts on wire ends does comprise a cam means, a pair of manual levers, and a pair of jaws. The manual levers are intended to drive the cam means to rotate only in one direction, and the cam means operatively intervenes between the manual levers and the jaws. Thus, the levers are operable to drive the jaws to crimp the contacts each on and around the wire ends.

[0012] In the present invention, an included angle defined between the pair of jaws being opened depends on an angle to which the cam means has rotated from one of its home positions. The manual levers that are for example such handles as shown in Fig. 1 may be gripped and then released successively a few times so as to rotate stepwise the cam means. Such an incremental rotation of the cam means will cause the jaws to open also incrementally from their closed position to their full open position. By virtue of this feature, the maximum opening angle of the manual levers is now reduced to such a surprising degree as remarkably improving operativity of the contact crimper. Users of the crimper of the present invention need no longer to

change the position of their hands gripping the levers during the crimping operations. Further, such a small angle included by and between the fully opened levers will enable the crimper to be used even in considerably narrow spaces.

[0013] The pair of jaws consist of a first jaw and a second jaw that have at their proximal ends first and second cam followers, respectively. The cam means may have around itself and integrally therewith a desirable plurality of radial and outward protuberances. In addition, a spring means for urging the jaws' distal ends away from each other may be interposed between said jaws.

[0014] The spring means keeps the cam followers in contact with the periphery of the cam means, so that when the first and second cam followers are on the protuberances, the distal ends of the first and second jaws will be closed to press and crimp a cylindrical contact or terminal on a wire end. Thereafter, the cam means will be rotated further to bring the cam followers into contact with the cam means' recessed regions, to thereby permit the jaws' proximal ends to approach one another and allow the jaws' distal ends to open. Thanks to an appropriate configuration of the cam means, the users of this novel crimper will no longer require any excessive force that have been applied to the levers after the crimping step using the prior art crimpers.

[0015] The cam means may consist of a pair of disc cams secured on a common cam shaft. In connection therewith, the contact crimper of the invention may further comprise a ratchet wheel and a detent gear. Both the wheel and gear are mounted on the cam shaft and interposed between the disc cams. The ratchet wheel is capable of rotating only in one direction and the detent gear will prevent said wheel from rotating in a reverse direction. Operatively connected to one of the manual levers is a ratchet pawl in engagement with the ratchet wheel for driving the disc cams. Similarly, a stopper is operatively connected to the other lever so as to engage with the detent gear. The cam followers may preferably comprise a first and second rollers rotatably born by the proximal ends of the first and second jaws, respectively. Each of those rollers may be held in contact with both the disc cams.

[0016] The ratchet pawl having one end fixed to the manual lever can repeatedly engage with and disengage from the ratchet wheel, by pressing and releasing said lever in opposite directions. Both the ratchet wheel and the detent gear will thus be driven to rotate in the one angular direction. The stopper always kept in mesh with the detent gear will act to prevent those wheel and gear from reversely turning. The first and second disc cams are fixedly secured to one and the same shaft (viz., the cam shaft) as said wheel and gear, so that all these cams, wheel and gear are rotatable in unison only in said one angular direction. Each of the first and second rollers serving as the cam followers is urged to contact both the disc cams (as the cam means) at two points, as discussed above. Consequently, each roller can slide smoothly on and along the periphery of such a cam means, ensuring that the jaws operate reliably and in a highly accurate manner.

[0017] Each protuberance of each disc cam consists of a first peripheral zone and a second one extending therefrom in the direction in which said disc cam rotates, wherein the first zone preferably has a smaller radius of curvature than that of the second one. The second peripheral zone is located adjacent to a starting point of each protuberance, with the first one at a tip end thereof. (Thus, each roller will transfer from the second peripheral zone towards the first one in each cycle of the crimping operation.)

[0018] Thanks to such a configuration of the disc cams, the jaws will be driven to 'stride' until gripping the contact or terminal in a shortened period of time. However, the jaws will 'step short' towards each other just before and during crimping the contact or terminal onto the wire end strongly with a reduced intensity of the user's manual force. Efficiency and easiness will thus be afforded to the crimping operations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

Fig. 1 is a perspective view of a contact crimper provided in an embodiment of the present invention;

Fig. 2 is a plan view of the contact crimper shown in Fig. 1;

Fig. 3 is a plan view of the crimper shown partly in cross section illustrating the internal structure thereof;

Fig. 4 is also a plan view of the crimper whose manual levers or handles have been rotated relative to each other by one pitch;

Fig. 5 is similarly a plan view of said crimper whose levers have been operated two more pitches towards and then away from each other;

Fig. 6 is a plan view of one of disc cams included in the crimper;

Fig. 7 is a side elevation of a principal part of the crimper;

Fig. 8 is a plan view of the prior art crimper, with the jaws thereof being shown in their closed position to crimp a cylindrical contact on a wire end;

Fig. 9 is likewise a plan view of the prior art crimper, wherein the jaws are in their open state for receiving a new contact.

Fig. 10(a) is a perspective view of a crimp contact that has not yet been crimped on a wire end; and

Fig. 10(b) is a side elevation of the contact already crimped and shown partly in cross section.

THE PREFERRED EMBODIMENTS

[0020] A contact crimper 1 provided in an embodiment comprises a first jaw 2a and a second jaw 2b. The crimper also comprises a first and second disc cams 3a and 3b and manual levers (viz., handles) 4 and 5.

[0021] The first jaw 2a has teeth protruding therefrom and the second jaw 2b has recesses along an inner face thereof. In use, the teeth will be driven into the recesses. For example, a crimp contact may be placed in one of the recesses so as to be depressed with the corresponding tooth.

[0022] A pin 8a is inserted through a middle portion of the first jaw 2a, with a further pin 8b being inserted also through a middle portion of the second jaw 2b. A tie plate 5a formed integral with a distal end of one handle 5 that will stand almost still while the other 4 is being pressed. Since both the pins 8a and 8b are fixed to and through the tie plate 5a, both the jaws 2a and 2b are operable towards and away from each other.

[0023] Both the first and second disc cams 3a and 3b are fixedly secured on a cam shaft 14 and are rotatable in unison therewith. A ratchet wheel 13 also fixed on the cam shaft 14, and a ratchet pawl 6 comprises a body that is connected by a pivot 8d to the handle 4. Thus, an active end of the pawl 6 is engageable with one of the ratchet wheel's teeth and subsequently disengageable therefrom to engage with another tooth adjacent to the one tooth. A spring 10 always urges the ratchet pawl 6 onto the ratchet wheel 13.

[0024] A distal end of the handle 4 is swingably connected by the cam shaft 14 to the tie plate. Therefore, the handle 4 can be forced towards the other handle 5, as shown at an arrow in Fig. 1. A stopper 9 is pivoted at 8c to the other handle 5 and is urged by a spring 7 to remain in mesh with the ratchet wheel 13, or alternatively with a detent wheel not shown. In any case, the ratchet wheel 13 as well as the disc cams 3a and 3b are inhibited from reversely turning.

[0025] The spring 7 has one end hooked to the stopper 9 and the other end hooked to the ratchet pawl 6, so that the handles 4 and 5 are always urged away from each other.

[0026] Function and operation of the contact crimper of a structure discussed above will now be described referring particularly to Figs. 3 to 5.

[0027] In the present embodiment, one of the handles 4 will be driven to repeat three angular strokes, by gripping it towards and then releasing it away from the other handle 5, when carrying out each cycle of the crimping operation. Figs. 3, 4 and 5 illustrate an initial stage, a mediate stage and a final stage in each cycle, respectively.

[0028] As seen in Fig. 3 showing the initial stage where the jaws are fully opened, a first roller 16a as one of cam followers is held on and by the proximal end of the first jaw 2a. Similarly, a second roller 16b as the other cam follower is carried by the proximal end of the second jaw 2b. The first roller 16a consists of a pin 11a inserted through the first jaw 2a and a ring member 12a spinnable around the pin 11a. The second roller 16b consists of a further pin 11b inserted through the second jaw 2b and a further ring member 12b also spinnable around the pin 11b.

[0029] A spring 15 intervening the first and second jaws 2a and 2b is a member for always urging them away from each other and also keeping the rollers 16a and 16b in contact with the peripheries of disc cams 3a and 3b.

[0030] The cam shaft 14 penetrating the pair of disc cams 3a and 3b is keyed thereto. Those cams are spaced apart by the ratchet wheel 13 but superimposed one on another in the present embodiment. Thus, the wheel and cams will rotate synchronously with each other.

[0031] Both the ratchet pawl 6 and stopper 9 are in engagement with the ratchet wheel 13 in this embodiment so that both the disc cams 3a and 3b will rotate in unison with said wheel and only in one direction.

[0032] Alternatively, a detent gear or pinion (not shown) may be employed in addition to and displaced in parallel with the ratchet wheel. In this case, the stopper 9 engages with such a detent gear which may have a periphery formed with smaller teeth. Such smaller teeth of the detent gear will be effective to perfectly inhibit the ratchet wheel from reverse rotation at all instants during the crimping operation, thus more surely protecting the crimp contact from slipping off.

[0033] By driving the handle 4 to make one angular stroke from its position shown in Fig. 3, it will take a new position shown in Fig. 4.

[0034] With the disc cams 3a and 3b having rotated counter-clockwise an angle, the first and second rollers 16a and 16b have been pushed outwards to move the proximal ends of the jaws 2a and 2b a transverse distance away from each other. Consequently, these jaws pivoting about the respective pins 8a and 8b have their distal ends having approached one another generally the same transverse distance.

[0035] Next, the handle 4 will be operated once more in the same manner as shown at two arrows in Fig. 4. The jaws 2a and 2b will thus firmly grip therebetween a contact (see Figs. 10(a) and 10(b) of the accompanying drawings), because the disc cams 3a and 3b have been inhibited from reverse rotation.

[0036] Finally, the handle will be driven again to make a further angular stroke in the same way as the preceding steps, so as to cause the jaws to take a crimping position as shown in Fig. 5 wherein their distal ends are completely closed to crimp the contact on the wire end (see Fig. 10(b) referred to above).

[0037] An additional angular stroke of the handle 4 shown in Fig. 5 will return the crimper snappingly to its initial or home position shown in Fig. 3. Thanks to a substantially constant radius of curvature which a end region of each protuberance of each disc cam has, a

reduced force will suffice in causing the crimper back into its initial position. Also such a gentle curvature is effective to enhance durability of the crimper, because slight abrasion of the periphery of each disc cam would not adversely affect the function thereof to any noticeable degree.

[0038] In the present embodiment, three reciprocal angular strokes of the handle 4 are needed to conduct one crimping cycle. More or less times of the handle's strokes may be adopted for every cycle, but two to four times are preferable for efficient labor. In any case, such repeated smaller strokes for every crimping cycle render smaller an angle at which the handles are opened to the utmost limit. By virtue of this feature, the users of this crimper need no longer to change their hands during each crimping cycle. The other advantages have already discussed above.

[0039] Configuration of the disc cams 3a and 3b will now be described in detail with reference to Fig. 6, wherein it is to be noted that both the cams are of the same shape so that one of them 3b is exemplified herein.

[0040] The disc cam 3b has along its periphery four protuberances 3b1 and a central bore for receiving the cam shaft.

[0041] As seen in Fig. 6, each protuberance 3b1 has a generally pointed end from which a first gentler region 3b11 extends along the direction 20, in which the cam will rotate. A second sharper region 3b12 continuing from the first region 3b11 does also extend in the same direction to a basal point of said protuberance. The radius of curvature of the first region is designed to be greater than that of the second one.

[0042] This difference in the radius of curvature is adopted taking into account the fact that the first region serving to actually crimp the contact, with the second region merely causing the jaws to grip between them the crimp contact.

[0043] The gentler slope provided by and long the first region 3b11 contributes to reduction of the final manual force the final stage of every crimping cycle, for the purpose of an easier crimping of the contact. The sharper slope of the second region 3b12 accelerates the speed of the jaws 2a and 2b approaching one another, to thereby shorten the period of time until they grip the contact. The end of said first region 3b11 is rounded so that the users need not grip the handles 4 and 5 with any increased force when causing the crimper to return to its initial state.

[0044] It will also be seen in Fig. 6, each protuberance 3b1 extends for an angle of about 90 degrees. Thus, each of the three angular strokes of the handle 4 will result in a rotation of the disc cams 3a and 3b by about 30 degrees, until finish of the crimping cycle.

[0045] Fig. 7 shows a further detail in structure of the present contact crimper 1, when seen from the side of the other handle 5.

[0046] The disc cams 3a and 3b are space apart from each other but superimposed one on another. The rollers 16a and 16b are both kept in contact each with both disc cams 3a and 3b, as already mentioned above.

[0047] Each of the rollers, i.e., cam followers 16a and 16b can thus smoothly slide along the paired disc cams 3a and 3b. Due to this feature, the jaws 2a and 2b are smoothly driven towards and way from each other, thus accurately crimping every contact that is being stably held in place between said jaws.

[0048] The manually operable handles or levers 4 and 5 may be replaced with any other type of handles or levers, provided that they can drive the disc cams ordinarily. Likewise, the disc cams and the sprig 15 may be replaced with any other equivalent members. The protuberances may of any modified configuration other than those illustrated in the embodiment, and the number of said protuberances of each cam may also differ from "four (4)".

[0049] Any other modifications will be allowed insofar as they do not deviate from the scope of the present invention as defined in the accompanying claims.

Claims

1. A contact crimper (1) for crimping contacts on wire ends, comprising: a cam means (3a,3b) rotatable only in one direction; a pair of manual levers (4,5) for driving the cam means to rotate; and a pair of jaws (2,2b) operatively connected by the cam means to the manual levers so as to be driven thereby to crimp the contacts, CHARACTERIZED IN THAT the jaws are a first jaw (2a) and a second jaw (2b) respectively having cam followers (16a, 16b) formed at proximal ends thereof and kept in contact with an outer periphery of the cam means (3a,3b), the cam means has protuberances (3b1) protruding radially therefrom, and a spring (15) intervenes between the jaws and urging distal ends thereof away from each other.

2. A contact crimper as defined in claim 1, characterized in that the cam means (3a,3b) consists of a single disc cam (3b) or a pair of disc cams (3a,3b) secured on a common cam shaft (14) and spaced apart from each other, the crimper further comprising a ratchet wheel (13) with or without a detent gear wherein both the wheel (13) and gear are mounted on the cam shaft and interposed between the disc cams (3a,3b), the ratchet wheel (13) is capable of rotating only in one angular direction by being directly prevented or indirectly prevented via the detent gear from rotating in a reverse direction, and wherein one of the manual levers (4) is operatively connected to a ratchet pawl (6) in engagement with the ratchet wheel (13) for driving the disc cams (3a,3b), and a stopper (9) is operatively connected to the other lever (5) so as to engage with the ratchet wheel (13) or detent gear, the cam fol-

lowers (16a, 16b) comprises a first and second rollers rotatably born by the proximal ends of the first and second jaws (2a,2b), respectively, and held in contact with the one or two disc cams (3a,3b).

3. A contact crimper as defined in claim 1 or 2, characterized in that each protuberance (3b1) has a first zone (3b11) extending from an end of the protuberance in the angular direction and a second zone (3b12) continuing from the first zone, such that a radius of curvature of the first zone is greater than that of the second zone.

Fig. 1

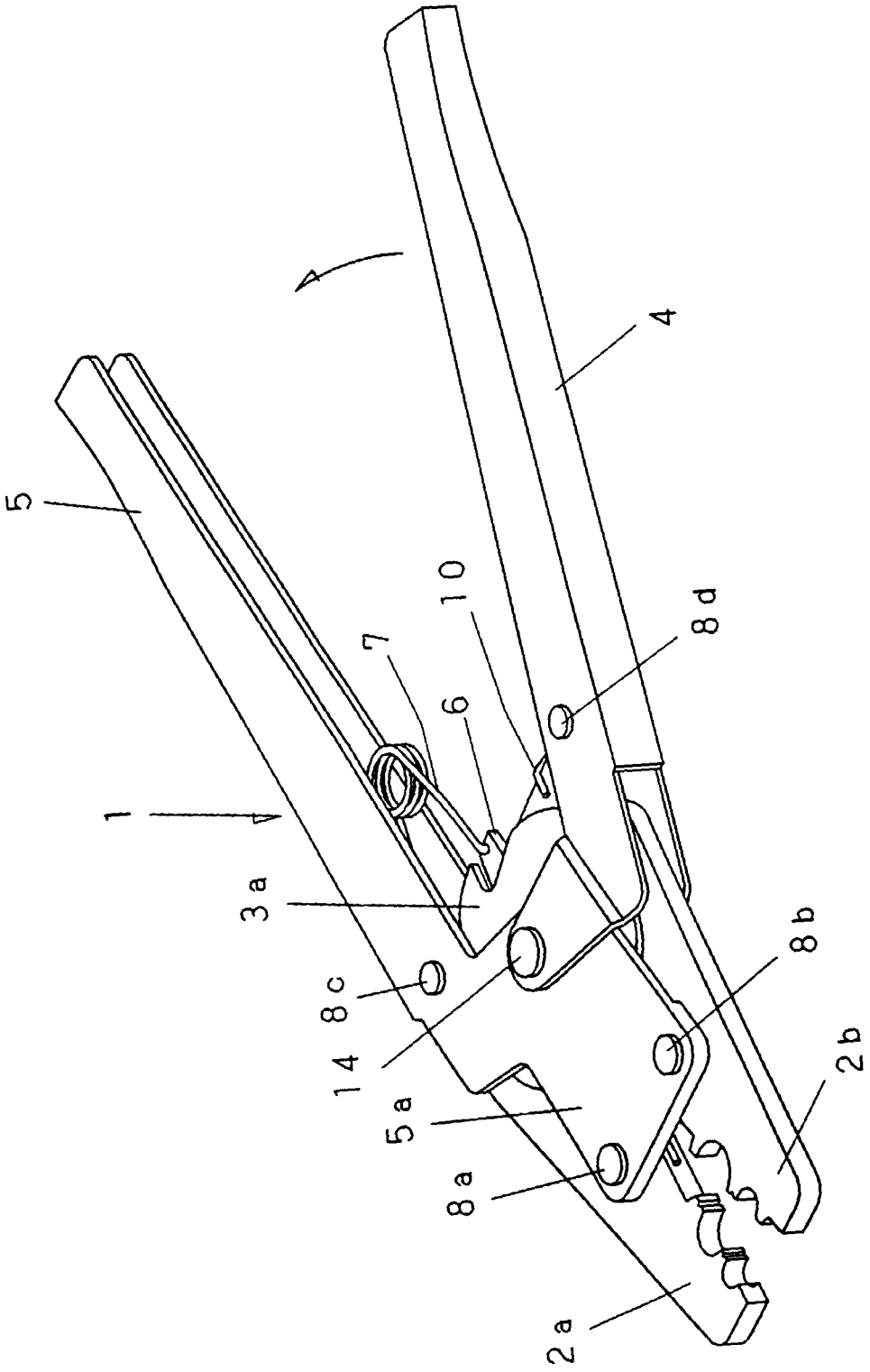


Fig. 2

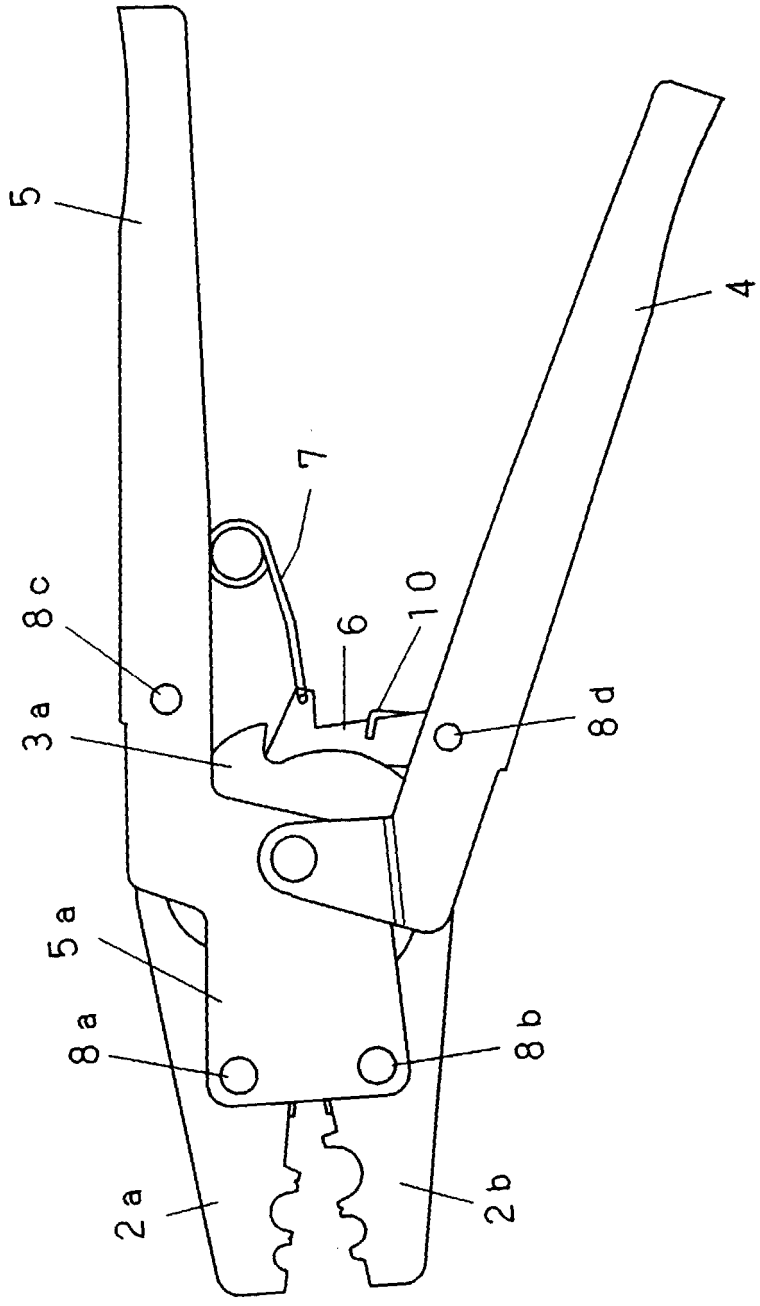


Fig. 3

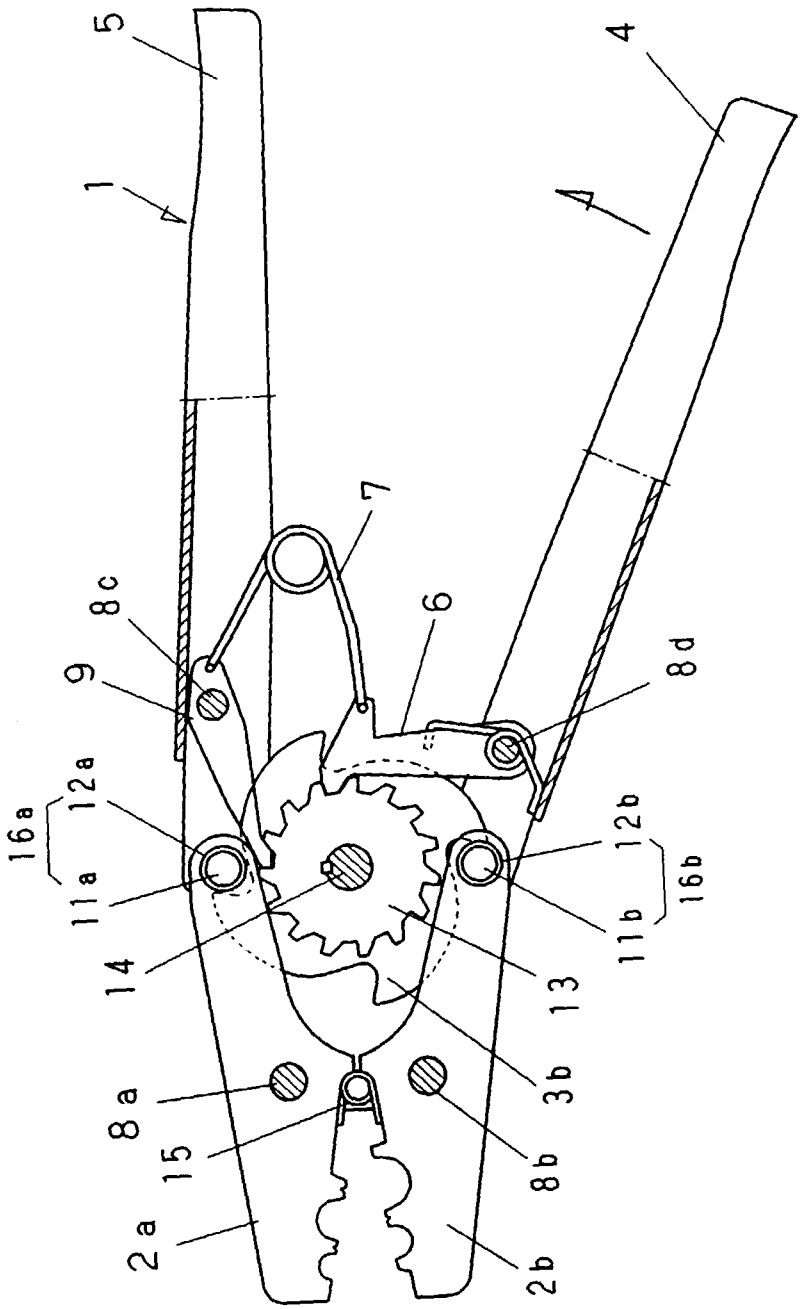


Fig. 4

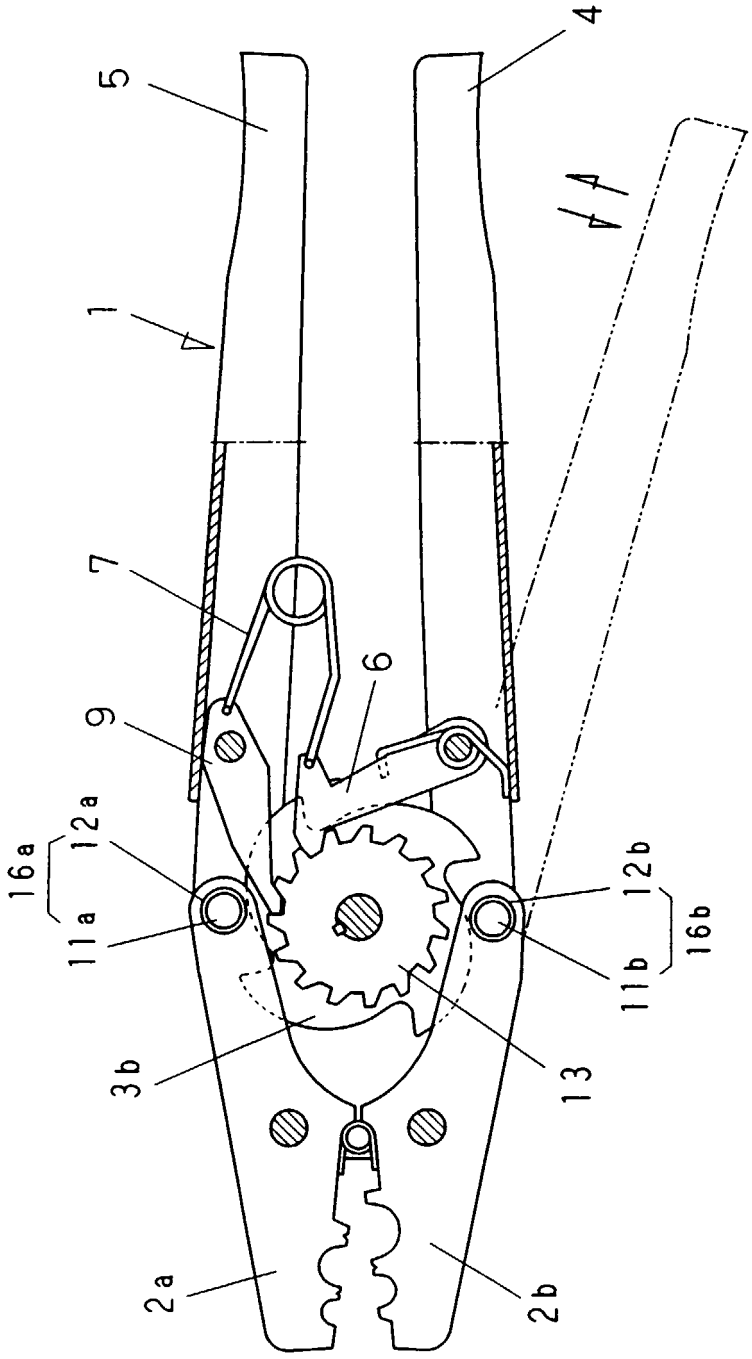


Fig. 5

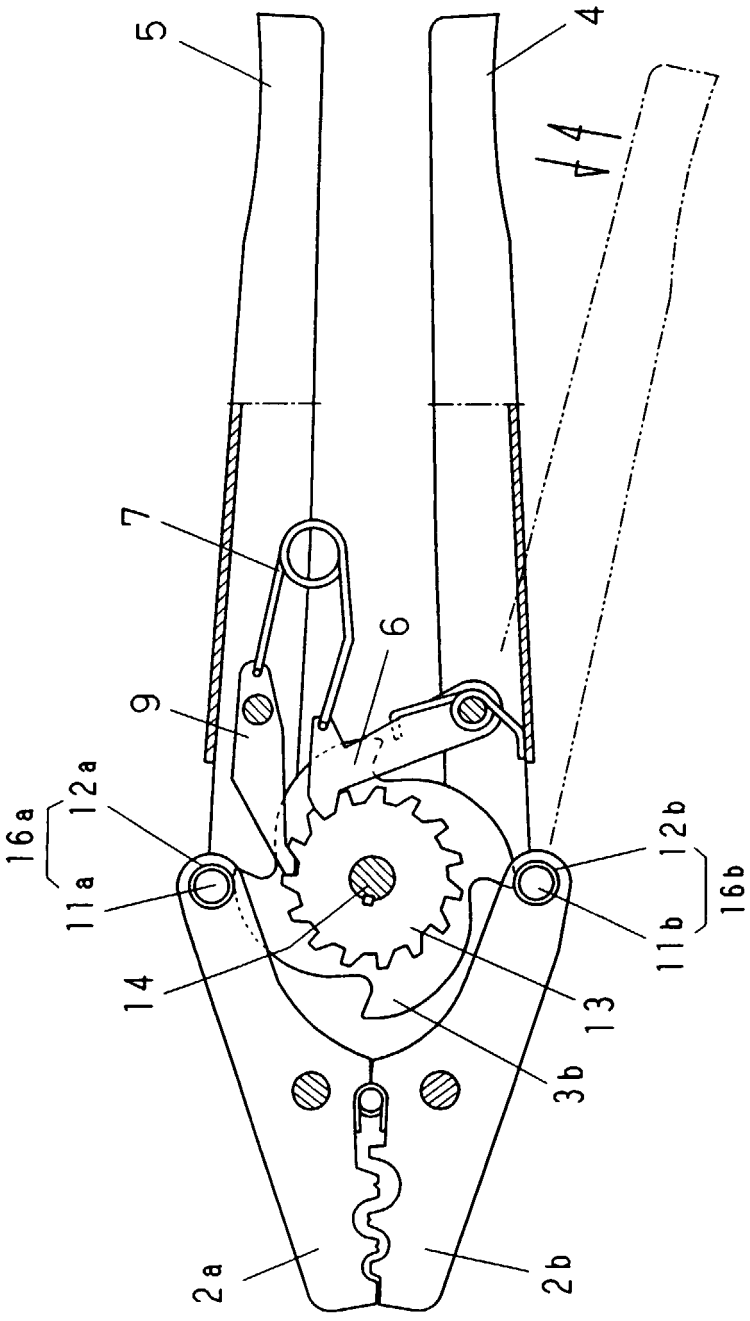


Fig. 6

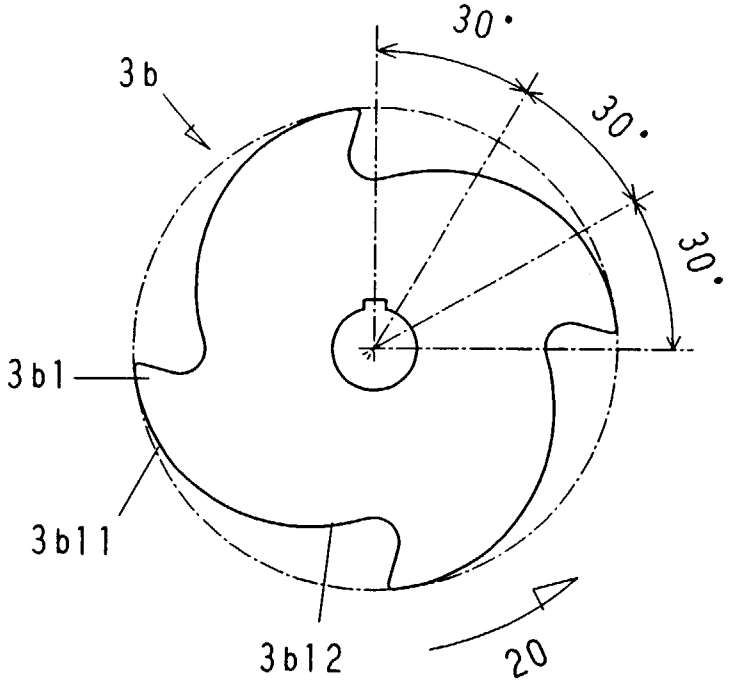


Fig. 7

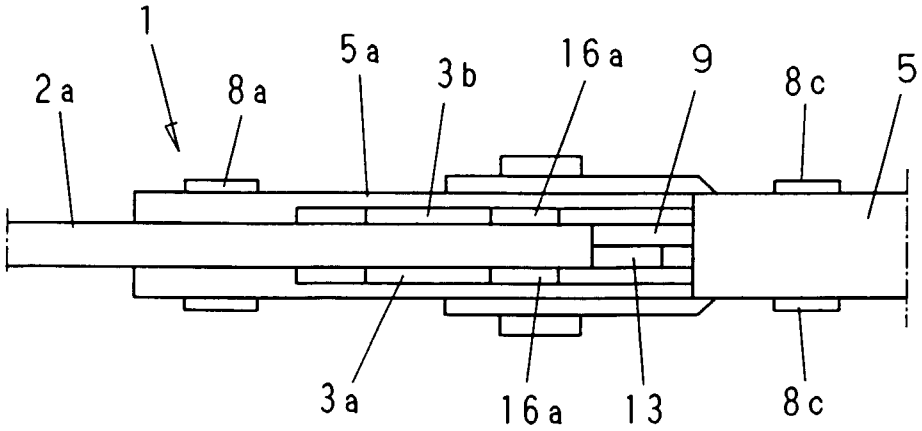


Fig. 8

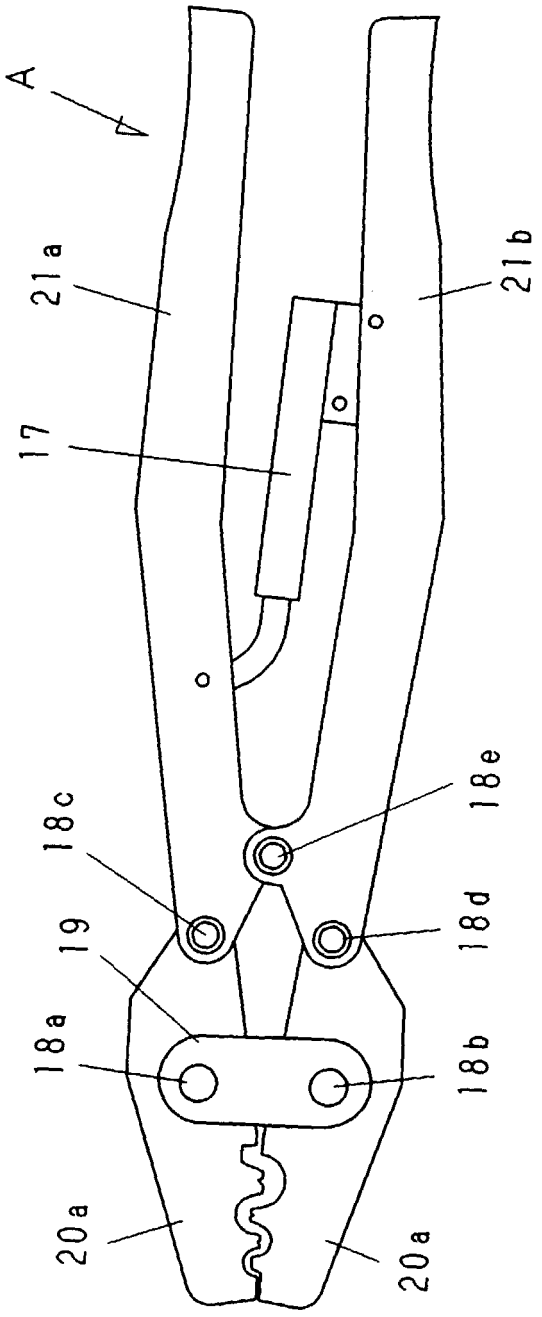


Fig. 9

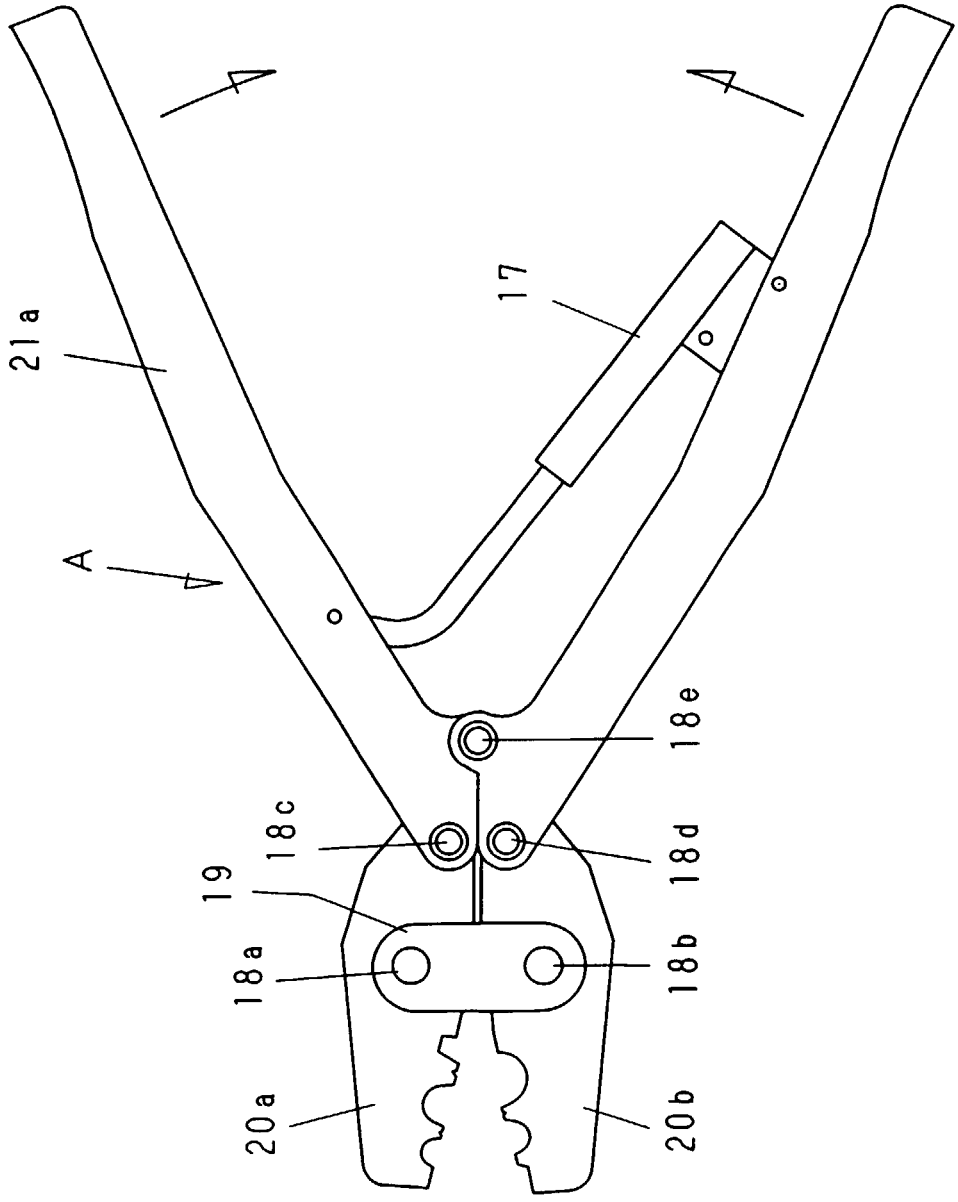


Fig. 10(a)

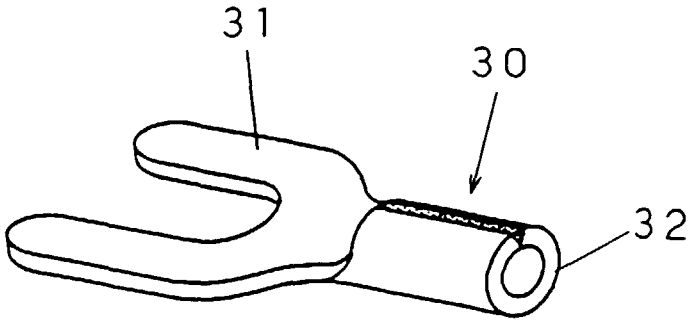
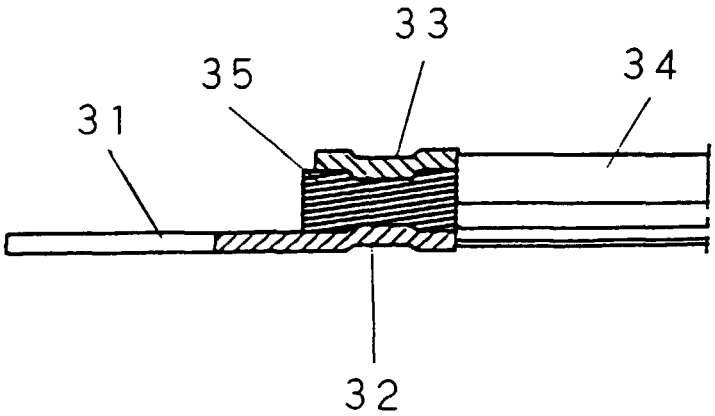


Fig. 10(b)



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EUROPEAN SEARCH REPORT

Application Number
EP 98 30 9872

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 2 861 491 A (ROZMUS W.J.) 25 November 1958 * column 3, line 26 - line 45; figures 1,2 * ---	1-3	H01R43/042
A	GB 2 291 616 A (BIEGANSKI ZDZISLAW) 31 January 1996 * page 5, paragraph 3; figure 1 * ---	1-3	
A	US 5 331 742 A (SCHMODE HARTMUT ET AL) 26 July 1994 * abstract; figures 1,2 * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 March 1999	Demol, S

CATEGORY OF CITED DOCUMENTS

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18-03-1999

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