



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**30.08.2000 Bulletin 2000/35**

(51) Int. Cl.<sup>7</sup>: **H01R 43/20**

(21) Application number: **00301374.5**

(22) Date of filing: **22.02.2000**

(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**

(72) Inventors:  
• **Fujita, Koji,**  
**Sumitomo Wiring System Ltd.**  
**Yokkaichi-city, Mie 510-8503 (JP)**  
• **Ohta, Yoshinobu,**  
**Sumitomo Wiring System Ltd.**  
**Yokkaichi-city, Mie 510-8503 (JP)**  
• **Shirakawa, Junichi,**  
**Sumitomo Wiring System Ltd.**  
**Yokkaichi-city, Mie 510-8503 (JP)**  
• **Hashimoto, Kenji,**  
**Sumitomo Wiring System Ltd.**  
**Yokkaichi-city, Mie 510-8503 (JP)**

(30) Priority: **25.02.1999 JP 4876799**  
**24.05.1999 JP 14309099**  
**24.05.1999 JP 14321299**  
**24.05.1999 JP 14346399**  
**24.05.1999 JP 14344899**

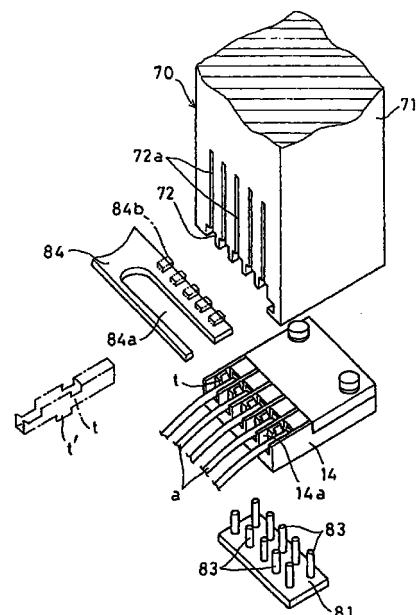
(71) Applicant:  
**SUMITOMO WIRING SYSTEMS, LTD.**  
**Yokkaichi City Mie 510 (JP)**

(74) Representative:  
**Spall, Christopher John**  
**BARKER BRETTELL**  
**138 Hagley Road**  
**Edgbaston Birmingham B16 9PW (GB)**

(54) **Improvements in or relating to mounting terminals with electric wires into connector housings**

(57) A process (method) and system (apparatus) for mounting terminals *t* with electric wires *a* in cavities *s* of connector housings *C*. Press-connecting terminals *t* are initially loaded in cavities *14a* arranged in an upper surface of a connector jig *14* and electric wires *a* are press-connected on the terminals *t* in the jigs *14*. Then, the terminals *t* with electric wires *a* are transferred from the connector jig *14* to cavities *72* arranged in a lower surface of an inserting jig *71* by pins *83* arranged to contact and push the terminals *t* from below in the transfer direction. Then, the terminals *t* are loaded from the inserting jig *71* to cavities *s* of connector housings *C* from the back by blades *73* arranged to contact and push the terminals from one end in the inserting direction.

[Figure 11]



## Description

**[0001]** The present invention concerns improvements in or relating to mounting terminals with electric wires into connector housings. The invention has particular, but not exclusive application, for connecting terminals with electric wires and then inserting the terminals with electric wires into connector housings from the back.

**[0002]** Press-connecting and press-clamping are mainly adopted for connecting electric wires with connector terminals in a wire harness and the like.

**[0003]** A press-connecting connection (hereinafter, merely referred to as press-connecting) is shown in Figure 27. The press-connecting terminals  $\underline{t}$  are loaded in the cavities  $\underline{s}$  of a connector housing C. Press-connecting blade guides 1 are matched with the connector housing C (Figure 27(a)), and electric wires  $\underline{a}$  are supplied (Figure 27(b)), and pressed and connected in the terminals  $\underline{t}$  by press-connecting blades 2 (Figure 27(c)). Namely, the press-connecting presses and loads the electric wires  $\underline{a}$  into a connector housing C from above.

**[0004]** A press-clamping connection (hereinafter, merely referred to as press-clamping) successively press-clamps the connecting pieces of the terminals on the bare conductors after removing the covering of the electric wires. Accordingly, in general, the press-clamping press-clamps the terminals to every electric wire, chucks pick up the terminals one by one with a hand 3 and insert them into the cavities  $\underline{s}$  of the connector housing C from the back (terminal-inserting inlet) as shown in Figure 29 (refer to Japanese Patent Publication (unexamined) Hei No.9-115642 and the like).

**[0005]** In the above-mentioned press-connecting, for example, in the case of the connector housing C having the cavities  $\underline{s}$  of two stages in a wire harness, the connector housing C is conventionally divided into an upper housing  $C_1$  and a lower housing  $C_2$  in order to press the electric-wires in from the upper face of each housing  $C_1$ ,  $C_2$  as shown in Figure 28. After the terminals  $\underline{t}$  and the electric wires  $\underline{a}$  are respectively loaded on the upper housing  $C_1$  and the lower housing  $C_2$  (from Figure 28(a) to Figure 28(b)), cover  $\underline{b}$  is closed and both  $C_1$  and  $C_2$  are integrally connected together (Figure 28(c)) (refer to Japanese Patent Publication (unexamined) Hei No.10-335037 and the like).

**[0006]** The conventional press-connecting requiring two housings  $C_1$  and  $C_2$  has further many working steps and it causes an increase in cost. Further, the walls  $\underline{e}$  between the cavities may be bent outwards and the housings swollen by pressing power during press-connecting. As a result, it can happen that the cover  $\underline{b}$  is not successfully closed and the upper housing  $C_2$  and the lower housing  $C_1$  are not successfully united. Further, from the viewpoint of reducing the bending problems of the cavity walls  $\underline{e}$ , this type of connector C for press-connecting has terminals  $\underline{t}$  in all of the cavities. However, it was found that mounting terminals  $\underline{t}$  in the cavi-

ties  $\underline{s}$  to which electric wires  $\underline{a}$  are not press-connected did not avoid the problems. Further, dismantling of both housings  $C_1$  and  $C_2$  is required for newly press-connecting electric wires  $\underline{a}$  in empty cavities  $\underline{s}$ . As a result the press-connecting is virtually impossible.

**[0007]** In the press clamping on the other hand, the terminals  $\underline{t}$  with the electric wires  $\underline{a}$  are mounted in the cavities  $\underline{s}$  one by one from the back. As a result, only one connector housing C (not divided) is required in place of the two stage type connector C as described above. However it is necessary to connect the electric wires  $\underline{a}$  on the terminals  $\underline{t}$  one by one, and it has a problem in workability. In addition, the connection of the terminals  $\underline{t}$  one by one is apt to cause a chucking miss. Further, since the electric wires  $\underline{a}$  are inserted while being held, the electric wires  $\underline{a}$  are apt to buckle as shown by the chain line of Figure 29, and such buckling causes a mounting miss.

**[0008]** Further, in the case of the connector housing C having the cavities  $\underline{s}$  of two stages or more, there is a connector housing which mounts the terminals  $\underline{t}$  in the cavities  $\underline{s}$  of the upper and lower stages so that their backs face each other. In this case, after the electric wires  $\underline{a}$  are chucked with the hand 3 as shown in Fig.30(a), the terminals  $\underline{t}$  are inserted in the rotational jig D as shown in Fig.30(b), rolled in the direction of the arrow mark under a condition in which the chucking is released, and chucked again to be inserted in the cavities  $\underline{s}$  as shown in Fig.30(c). The rolling action has occasionally the result of causing a twisting power on the electric wires  $\underline{a}$ , and there is a risk that the terminals  $\underline{t}$  cannot be straightforwardly re-chucked and a smooth insertion cannot be obtained.

**[0009]** The present invention aims to provide a solution to the problems and disadvantages of the known press-connecting and press-clamping connections above-described.

**[0010]** According to a first aspect of the present invention there is provided a process for mounting press-connecting terminals with electric wires into a connector housing characterised by loading the terminals into a terminal-connecting jig, connecting the electric wires with the terminals, removing terminals with electric wires from the terminal-connecting jig, and inserting the terminals with electric wires from the back into cavities of the connector housing.

**[0011]** By this invention, a process of connecting the electric wires on the terminals can be achieved which enables the terminals to be inserted and loaded with electric wires in the cavities of the connector housing from the back. As a result, a cost saving can be obtained.

**[0012]** In order to do so, if press-connecting terminals are firstly loaded in the jigs, the electric wires can be loaded from the upper surface of the jig for press-connecting in like manner to the conventional process. In this way, the press connecting terminals with electric wires can be obtained by press-connecting without any

trouble.

**[0013]** Then, if the press-connecting terminals with electric wires are removed from the press-connecting jigs and loaded in the connector housing, the press-connecting terminals can be inserted in the cavities of the connector housing from the back in like manner to the press-clamping terminals of Figure 29, and workability is splendid.

**[0014]** If press-clamping is carried out in place of press-connecting, for example, if press-clamping terminals are loaded in the jigs and the electric wires, after peeling, are press-clamped on the terminals, the press-clamping terminals can be inserted in the connector housing according to a similar action, and workability is again splendid.

**[0015]** Preferably, the steps of loading the terminals into the terminal connecting jig, connecting the electric wires with the terminals, removing the terminals with the wires from the terminal-connecting jig, and inserting the terminals with electric wires from the back into cavities of the connector housing are sequentially carried out automatically.

**[0016]** In the case where the housing has two stages, an upper stage and a lower stage, the housing is preferably rolled (inverted) for inserting the terminals with electric wires from the back into cavities of the upper and lower stages.

**[0017]** Advantageously, the terminals with electric wires are transferred to a terminal-inserting jig from the terminal-connecting jig, and the terminals with electric wires are inserted into the cavities of the connector housing from the terminal-inserting jig.

**[0018]** The terminals with electric wires may conveniently be loaded into cavities in the connecting jig and are preferably prevented from falling out by protrusions on spring plates below the cavities.

**[0019]** Preferably, the terminals with electric wires are transferred from the connecting jig to the inserting jig by pins of a pushing-out jig pushed up through holes below the terminals in the connecting jig.

**[0020]** Advantageously, each terminal with electric wire is transferred by two pins which contact the terminal in a longitudinal direction before and behind the electric wire connecting area.

**[0021]** Preferably, the terminals with electric wires are transferred from the connecting jig to cavities in the inserting jig and are preferably prevented from falling out of the cavities by a shutter. The terminals may conveniently be guided when pushed out of the inserting jig by guides on the shutter and a clearance is preferably provided in the shutter for the pins.

**[0022]** Advantageously, the terminals with electric wires are guided when transferred to the inserting jig by transfer guides on both sides of the cavities.

**[0023]** Preferably, the terminals with electric wires are transferred from the inserting jig to the cavities of the connector housing by members which push out the terminals in a longitudinal direction and support rear

end faces of the terminals.

**[0024]** In a preferred embodiment of the present invention, a method of mounting terminals with electric wires into connector housings comprises the steps of: -

- (a) providing a connector jig having one or more cavities for receiving a terminal;
- (b) inserting at least one terminal in a cavity of the connector jig;
- (c) connecting a wire to said at least one terminal located in said cavity;
- (d) providing an inserting jig having one or more cavities for receiving a terminal with a wire connected thereto;
- (e) relatively moving said connector jig and said inserting jig to position said connector jig below said inserting jig to align said cavity with the terminal and electric wire connected thereto in said connector jig with a cavity in said inserting jig;
- (f) transferring said at least one terminal with said wire connected thereto from said connector jig to said inserting jig by applying a force to an underside of said terminal to displace said terminal with said wire connected thereto upwards into said cavity in said inserting jig;
- (g) providing a connector housing having one or more cavities for receiving a terminal with a wire connected thereto;
- (h) relatively moving said inserting jig and said connector housing to align said cavity with the terminal and wire connected thereto in said inserting jig with a cavity in said connector housing; and
- (i) transferring said at least one terminal with said wire connected thereto from said cavity in said inserting jig to said connector housing.

**[0025]** According to a second aspect of the present invention there is provided a system for mounting press-connecting terminals with electric wires in a connector housing characterised by a mounting machine for mounting the terminals on a connecting jig, electric wire-measuring and wire-connecting machines for connecting wires to the terminals, and a terminal-mounting machine for removing the terminals with electric wires from the press-connecting jig and inserting the terminals with electric wires from the back into cavities of the connector housing.

**[0026]** Preferably, the machines are sequentially installed along guide rails.

**[0027]** Advantageously, an inserting jig is provided to receive the terminals with electric wires from the connecting jig and insert the terminals with electric wires into the cavities in the connector housing.

**[0028]** Preferably, a mechanism is provided for inserting the terminals with electric wires into the cavities of the connector housing by pushing out the terminals.

**[0029]** In one arrangement, the mechanism has a

plurality of blades movable in an inserting direction for inserting respective terminals with electric wires into the cavities of the connector housing. The blades may be independently movable. Alternatively, a selection mechanism may be provided for moving selected blades as a unit.

**[0030]** Advantageously, a roll over mechanism is provided for supporting the connector housing in either one of two positions to present selected cavities for inserting the terminals with electric wires. For example, the connector housing preferably has upper and lower stages and the roll over mechanism includes a frame for mounting the connector housing and means for rotating the frame through 180° to roll over (invert) the connector housing whereby the connector housing is supported in a first position to present the cavities of the upper stage for inserting the terminals and is rolled over and supported in a second position to present the cavities of the lower stage for inserting the terminal.

**[0031]** Preferably, the connecting jig has cavities for mounting the terminals arranged in parallel on an upper face and provided with penetration holes for pushing-up pins which contact a lower face of the terminals and strip off the terminals so that the terminals on which the electric wires are connected are capable of being stripped off upwards from the cavities.

**[0032]** Advantageously, the terminals are loaded from the front of the cavities in the connecting jig, contacted with the back of the cavities, and hooked on protrusions of spring plates arranged under the cavities to prevent the terminals falling out. In this way, the terminals are stabilised in the cavities and the action of attaching the wires such as the press-connecting or the like is stabilised.

**[0033]** More particularly, after the terminals are loaded in the respective cavities of the connecting jig, the electric wires are press-connected or press-clamped on the respective terminals from above, the pushing-up pins are raised through the penetration holes from below, and the terminals with electric wires attached are ejected from the cavities. Accordingly, the terminals are received and mounted in the connector housing. At this time, if the receiving of the terminals can be unified, a unified mounting can be carried out.

**[0034]** When the above-mentioned terminals are press-connecting terminals, the electric wires can be loaded from the top of the connecting jigs in like manner as a conventional process. The press-connecting terminals with electric wires can be obtained by press-connecting without any trouble if the press connecting terminals are loaded in the connecting jigs and the electric wires are press connected on the press-connecting terminals. In this case, it is designed to remove the terminals with electric wires from the connecting jigs and load them in the connector housings. Thus, the press-connecting terminals can be inserted in the cavities of the connector housings from the back in like manner as the press-clamping terminals of Figure 29, and worka-

bility is splendid. The press clamping can be also carried out on the retaining jigs.

**[0035]** Preferably, a mechanism is provided for transferring the terminals with electric wires from the cavities of the connector jig into the cavities of the inserting jig by pushing out the terminals.

**[0036]** In one arrangement, the connecting jigs can be provided with pushing-up pins. Thus, the pushing-up pins may be arranged under a condition capable of protrusion through respective penetration holes in a lower face of the cavities. For example, the pushing-up pins may be provided on a pushing-up plate freely movable on the base of the connecting jig with the pushing-up plate pushed up and elevated from the underside of the base by actuator means.

**[0037]** Thus, when the arrangement of cavities in the connector housing is changed and the connector jigs only need to be changed to correspond to the change. Namely, the actuator means to carry out the pushing-up action can be used in common with the connecting jigs of different modes (refer to the mode of operation in Figure 22 and Figure 23).

**[0038]** Preferably, springs are arranged on the base of the connecting jigs for moving the pushing-up plate in the return direction in which the pushing-up pins retreat from the cavities. As a result, the return action such as by self-weight of the pushing-up plates or the like, or the return action by the actuator means or the like becomes unnecessary. In this way, the return action becomes sure and the cost can be reduced.

**[0039]** Advantageously, two penetration holes are arranged in correspondence with the longitudinal direction of the terminals received in the cavities of the connector jig, and the pushing-up pins are arranged in correspondence with the penetration holes. As a result, the pushing-up pins are pushed up in the longitudinal direction of the terminals before and after the electric-wire connecting part of the terminals. In this way, the pushing-up action becomes stable because the pushing-up pins provide two contact points.

**[0040]** More particularly, the two contact points support the load caused by the self-weight of electric-wires and, because the two points are before and after the connecting parts, the load caused by the self-weight of electric wires is steadily supported. Accordingly, the pushing-up action becomes more stable.

**[0041]** In a preferred embodiment of the present invention there is provided apparatus for mounting terminals with connector wires into connector housings comprising:-

- (a) a connector jig having an upper surface;
- (b) at least one cavity in said upper surface for receiving a terminal;
- (c) at least one hole penetrating said cavity from below;
- (d) pin means for insertion in said at least one hole for displacing said terminal in an upwards direction;

(e) means for connecting a wire to said terminal in said connector jig cavity;  
 (f) an inserting jig having a lower surface;  
 (g) at least one cavity in said lower surface for receiving a terminal;  
 (h) means for aligning said at least one cavity in said upper surface of said connector jig with said at least one cavity in said lower surface of said inserting jig whereby said terminal with said wire connected thereto can be transferred from said connector jig to said inserting jig by actuation of said pin means;  
 (i) a connector housing having a rear surface;  
 (j) at least one cavity in said rear surface for receiving a terminal;  
 (k) means for aligning said at least one cavity in said lower surface of said inserting jig with said at least one cavity in said connector housing; and  
 (l) means for transferring said terminal with said wire connected thereto from said inserting jig to said connector housing.

**[0042]** Preferably, the connector jig has a plurality of cavities in the upper surface, the inserting jig has a plurality of cavities in the lower surface, and the connector housing has a plurality of cavities in the rear surface whereby one or more terminals with wires attached thereto can be transferred from the connector jig to the connector housing via the inserting jig.

**[0043]** Advantageously, a plurality of connector housings are provided and the inserting jig is operable to transfer terminals with wires connected thereto from the connector jig to the connector housings in a predetermined manner.

**[0044]** Other features, benefits and advantages of the invention will be apparent from the following description, given by way of example only, of embodiments of the invention in each of its aspects with reference to the accompanying drawings wherein:-

**Figure 1** is a schematic perspective view of apparatus embodying the invention;

**Figure 2** is a left side view partially in cross-section of the terminal-mounting part of the apparatus shown in Figure 1;

**Figure 3** is a partial front view of the terminal-mounting part shown in Figure 2;

**Figure 4** is a plan view of the hand part of the terminal-mounting part shown in Figures 2 and 3;

**Figure 5** is a front view partially in cross-section, of the hand part shown in Figures 2 and 4;

**Figure 6** is a bottom view of the hand part shown in Figures 2 to 5;

**Figure 7** is a plan view of a jig pallet;

**Figures 8(a)(b)** are perspective and cross-sectional views of the terminal press-connecting jig;

**Figure 9** is a detailed perspective view of part of terminal mounting part shown in Figure 3;

**Figure 10** is a schematic view of the terminal-mounting action of the apparatus;

**Figure 11** is an exploded perspective view of the delivery action from the press-connecting jig to the inserting jig;

**Figures 12 (a)(b)(c)** show the delivery action from the press-connecting jig to the inserting jig;

**Figures 13 (a)(b)** show the terminal-inserting action;

**Figure 14** shows a further detail of the terminal-inserting action;

**Figures 15 (a)(b)** show a comparison of the terminal-inserting action of the present invention and the prior art;

**Figures 16 (a)(b)** are a schematic cross-section and exploded perspective view of the retention-rolling part of the connector housing;

**Figures 17 (a)(b)** show schematically the terminal-mounting action to the connector housing;

**Figures 18 (a)(b)(c)** show the terminal-mounting in more detail;

**Figure 19** shows an alternative terminal-mounting;

**Figure 20** is a flow chart of the operation of the apparatus;

**Figure 21** is an example drawing of a wire harness manufactured by the apparatus;

**Figures 22 (a)(b)** show an alternative connecting jig before and after transfer of the terminals to the inserting jig;

**Figures 23 (a)(b)** show another detail of the connecting jig shown in Figures 22 (a)(b);

**Figures 24 (a)(b)** show the delivery action from the connecting jig to an alternative inserting jig;

**Figures 25 (a)(b)(c)** show details of the delivery action to the inserting jig of Figure 24;

**Figure 26** shows a further detail of the delivery action to the inserting jig;

**Figures 27 (a)(b)(c)** show a press-connecting action according to the prior art;

**Figures 28 (a)(b)(c)** show another press-connecting action according to the prior art;

**Figure 29** shows the mounting action of a press-clamping terminal according to the prior art; and

**Figures 30 (a)(b)(c)** shows a further detail of the mounting action according to the prior art.

**[0045]** One example of apparatus for producing wire harnesses in which terminals with electric wires are mounted in a connector housing according to the present invention is illustrated in Figure 1.

**[0046]** The apparatus has guide rails 11 equipped on a base stand 10. A mounting machine 20 for terminals  $\underline{t}$ , a measuring machine 30 for electric wires  $\underline{a}$ , a press-connecting machine 40, an inspection device 50 and a terminal-mounting machine 60 are arranged along the guide rails 11.

**[0047]** As disclosed in, for example, Japanese Patent Publication (unexamined) Hei No.10-241473, and Japanese Patent Applications Hei No.10-337249 and No.10-350013, a jig pallet 12 is moved from left to right by a conveyor as shown by the chain line arrow mark on the afore-mentioned guide rail 11. The jig pallet 12 descends downward by an elevator arm (not illustrated) when the pallet reaches the right end, is similarly moved to the left end by the conveyor, and is similarly positioned at the left end of the guide rail 11 by the elevator arm. Namely, the jig pallet 12 circulates the route (chain line arrow mark), and carries out the loading of the terminals  $\underline{t}$ , the press-connecting of the wires  $\underline{a}$ , and the delivery of the terminal.

**[0048]** The jig pallet 12 is a pallet in which six press-connecting jigs (blocks) 14 with cavities 14a supporting the terminals  $\underline{t}$  are arranged in parallel on a base 13 as shown in Figure 7. The numbers of the jigs 14 and the cavities 14a are arbitrary, and they are generally determined by the number of connector housings mounting the press-connecting terminals  $\underline{t}$  by one jig pallet 12 and the number of the cavities 14a. For example, this example is a case of producing the wire harnesses W wiring electric wires  $\underline{a}$  as shown in Figure 21 and the like. The number of connector housings C is 3, and the cavities of the connector housings have upper and lower stages with 5 cavities in each stage. Therefore, as described later, the group number of the press-connecting terminals mounted from the one jig pallet 12 is  $3 \times 2 = 6$ , and since the number of terminals in the group is 5, the jigs 14 are 6, and the cavities 14a are 5. For example, all of the jigs 14 can be constituted in a body.

**[0049]** In the jigs 14, as shown in Figure 8, strip

spring pieces 15b of spring blades 15 are arranged in the respective cavities 14 under plate 16 to which the base parts 15c of the respective spring blades 15 are fixed to the lower face with screws unifying the respective spring pieces 15b.

**[0050]** When the terminals  $\underline{t}$  are inserted in the cavities 14a from the arrow mark direction, the terminals  $\underline{t}$  are positioned by plates 16, and protrusions 15a of the spring plates 15 are deflected as shown by the chain line and hook on the terminals  $\underline{t}$  to prevent extraction of the terminals  $\underline{t}$ . The terminals can also be mounted from above.

**[0051]** The floating-up of terminals  $\underline{t}$  is prevented by providing stiffening plates 17 on the plates 16. The stiffening plates 17 are installed on the base 13 and are designed to be removed during the transfer of terminals  $\underline{t}$  described later (during pushing up). The plates 17 are usually lowered downward by the springs and oscillated upward resisting against the springs to allow upwards movement of terminals  $\underline{t}$ . Two penetration holes 18 pass through the respective cavities 14a from the lower face of the jigs 14.

**[0052]** The terminal-mounting machine 20 mounts the terminals  $\underline{t}$  in the respective cavities 14a of the above-mentioned jigs 14 by selectively cutting the various terminals  $\underline{t}$  one by one from the terminal belt of terminal reels  $T_1 - T_4$ , as described in, for example, Japanese Patent Publication (unexamined) Hei No.10-208844. At this time, the mounting of the terminals  $\underline{t}$  on the connector housing C is carried out by a unit of one jig 14, therefore the terminal  $\underline{t}$  corresponding to the inserted terminal sequence is mounted on the respective jigs 14 in the sequence. Accordingly, there is a case of having empty cavities 14a on the way. The terminal reels  $T_1 - T_4$  properly move as the arrow mark, and correspond to the position accepting the terminal belt of the terminal-mounting machine 20.

**[0053]** The electric wire-measuring machine 30 selects and sends the required electric wires  $\underline{a}$  from a plurality of supplies S, measures the requisite length of a plurality of wires  $\underline{a}$  at one time or one by one, and chucks the end of the wire with hand 31 to transfer the wire to the press-connecting machine 40 of the next stage, as disclosed in Japanese Patent Publication (unexamined) Hei No.10-154423, and Japanese Patent Applications Hei No.10-349947, No.10-337042 and the above-mentioned Japanese Patent Application Hei No.10-337249.

**[0054]** The hand 31 goes back and forth in like manner as the arrow mark between the electric wire exit of the measuring machine 30 and the position of the press-connecting machine 40. The hand 31 may comprise one arm (refer to Japanese Patent Applications Hei No.10-337042 and No.10-337249). Alternatively, hands comprising two arms alternately delivering both hands to the measuring machine 30 and the press-connecting machine 40 to transfer the wires may be provided (refer to Japanese Patent Application Hei No.10-

349947).

**[0055]** The press connecting machine 40 press-connects the electric wires a one by one, or selectively press-connects a plurality of wires, transferred by the hand 31, in the requisite terminals t in the jig 14, as disclosed in Japanese Patent Publications (unexamined) Hei No.10-241473, No.10-106370, No.10-106371, and the above-mentioned respective applications which are not opened yet. At this time, the jig pallet 12 moves left and right, the terminal t at the requisite position is positioned at the press-connecting position, and the press-connecting is carried out.

**[0056]** Accordingly, the press-connecting of various kinds of wiring arrangements can be carried out on the jig pallet 12, as disclosed in Japanese Patent Publication (unexamined) Hei No.10-241473. For example, as shown in Figure 1 and Figure 18, the jigs 14 are paired one after another in the direction of travel and the electric wires are only wired to the mutual pairs.

**[0057]** Alternatively, as shown in Figure 19, various kinds of wiring arrangements such as an arrangement of arbitrarily wiring the electric wires between the respective jigs 14 can be carried out. The mode of wiring in Figure 19 becomes the wire harness W shown in Figure 21 in which the electric wires are crossed. Therefore, the electric wires are wired on the respective jigs 14 in accordance with the wiring arrangements of wire harness W.

**[0058]** Further, when the jigs 14 are made of a hard metal such as steel or the like, the walls between the cavities 14a are not bent by the pressing power of the press-connecting on the jigs 14. Accordingly, in case of jigs 14 made of a hard metal, there is no problem for inserting the terminals in the subsequent processes or the like, even if empty cavities without terminals are provided.

**[0059]** Further, when the shapes of the cavities are the same, the press-connecting on the jigs 14 is carried out by the same jigs 14 irrespective of the shapes of connector housings. For example, the electric wire-measuring and press-connecting can be carried out by a robot uniting the electric wire-measuring machine 30 and the press-connecting machine 40 described in the fore-mentioned Japanese Patent Publication (unexamined) Hei No.10-106370.

**[0060]** The inspection device 50 is a machine which picks up a condition of press-connecting the electric wires into the respective terminals t by a CCD camera and judges whether the press-connecting is proper or not based on the images. For example, the machine judges the normal press-connecting condition in comparison with an abnormal condition. The judgement may be carried out by a person or automatically.

**[0061]** As shown in Figure 10, the terminal-mounting machine 60 is a machine in which the jig pallet 12 with terminals in which the electric wires a are press-connected moves as the arrow mark. When the pallet 12 comes to the terminal-inserting position O, the termi-

nals t are taken out from the respective jigs 14, and the terminals t are mounted in the housings C on the connector housing retaining plates (pallet) 61 which move left and right. The details are shown in Figure 1 - Figure 6. Namely, an air cylinder 82 elevating a terminal-protruding jig 81 is

**[0062]** arranged in the base stand 10 under the terminal-inserting position O. A hand 70 having a terminal inserting jig 71 is arranged above while keeping free elevation. The terminal-inserting jig 71 and the terminal-protruding jig 81 have the numbers of the terminals t which the I jig 14 can hold, the terminal-inserting jig 71 and pins 83 corresponding with the I jig 14 on the pallet 12. Terminal-inserting jig 71 has cavities 72 for the terminals t and grooves 72a in which blades 73 (described later) are to be inserted extend upwards from the cavities 72 (refer to Figure 11). Further, a shutter 83 installed on the hand 70 is capable of passing under terminal inserting jig 71, and the pins 83 pass through holes 84a of the shutter 84.

**[0063]** Accordingly, as shown in Figure 12(a), when the terminal-protruding jig 81 is elevated against the jigs 14 at the inserting position, the respective pins 83 protrude through the penetration holes 18 of the jigs 14 and transfer the terminals t in the cavities 14a to the inserting jig 71 as shown in Figure 12(b) and Figure 12(c). At the protrusion, the pins 83 contact the press-connecting member of the terminals t back and forth in the longitudinal direction at two pints p and q (Figure 14) and protrude the terminals t.

**[0064]** Further, as shown in Figure 5 and Figure 13, selected blades 73 (described later) preliminary proceed against other blades 73 and ends 73b contact end faces of the terminals t to which the electric wires a are connected. Therefore, nevertheless, being pulled backward by the gravity of the electric wires a, the terminals t are transferred (received) within the jigs 71 without being inclined.

**[0065]** The delivery is carried out at the cavities 14a and 72 between the jigs 14 and 71. Therefore, the pick-up miss (delivery miss) decreases remarkably, and the terminal insertion miss of subsequent processes decreases remarkably. It is preferable to carry out the protrusion at two points p and q (Figure 14) with two pins 83, but one pin may be sufficient, or three or more may be used. In either cases, the terminals t protrude the position to be transferred without being inclined.

**[0066]** As shown in Figure 2, the hand 70 is supported under free elevation on upper frame 91 of slide cylinder 90 on the base stand 10 through supporting plate 78 and slider 79, and transfers back and forth at the waiting position and the mounting position by the movement of the frame 91 as the arrow mark by the slide cylinder 90. The elevation of the supporting plate 78 is carried out by the actuator equipped on the frame 91, and the supporting plate 78 elevates three positions such as the waiting position at the highest position, the inserting position at the lowest position and the mount-

ing position at the middle position.

**[0067]** The above-mentioned terminal-inserting jig 71 is arranged on the lower face of the edge of the hand 70, and the above-mentioned shutter 84 is arranged adjacent. A cylinder 85 advances and retreats the shutter 84 and, when delivery from the above-mentioned jig 14 to the inserting jig 71 finishes, the shutter 84 is sent to the lower face of the jig 71 by the cylinder 85 and falling off of the terminals  $\underline{t}$  from the jig cavities 72 is prevented by providing the shutter 84 at the back and front of the lower face of the terminals  $\underline{t}$  during the elevation of the hand 70.

**[0068]** Further, gaps required for delivering the shutter 84 between the jigs 14 and 71 may be formed during the above-mentioned descent of the hand 70 but, after the protrusion of the terminals by the pins 83, the gaps may be formed together with the pins 83, or by elevation by the gaps of grooves of the hand 70. For example, when the jigs 14 and 71 approach closer, or preferably contact with each other, the delivery becomes more sure.

**[0069]** As shown in Figure 6 and Figure 13, the requisite number (five in the present mode of operation) of the insertion blades 73 are arranged in parallel on the insertion hand 70. Air cylinders 74 are respectively equipped on the respective blades 73. Selected insertion blades 73 are protruded by a requisite length (code  $\underline{r}$ ) in comparison with other blades by selectively driving the air cylinders 74.

**[0070]** Lock pins 75 are protruded with air cylinder 76 under the condition, and are passed through holes 73a of the respective blades 73. After the hand 70 approaches nearby the connector housing C under the condition, all the blades 73 proceed by the air cylinder 77, and only the selected blades 73 push the terminals  $\underline{t}$  and insert them in the cavities  $\underline{s}$  of the connector housing C as shown in Figure 13 (b). In Figure 5 and Figure 6, 74a are coil springs for returning the blades 73.

**[0071]** Further, as shown in Figure 5 and Figure 13, the end parts 73b of the selected blades 73 engage the end faces of the corresponding terminals  $\underline{t}$  to which the electric wires  $\underline{a}$  are connected. The terminals  $\underline{t}$  are supported with the end parts 73b and, therefore, nevertheless being pulled backward by the gravity of the electric wires  $\underline{a}$ , the terminals  $\underline{t}$  are transferred without being inclined.

**[0072]** As shown in Figure 4 and Figure 5 at this time, member 86 having the terminal-inserting jig 71 and member 87 with which the rod of the cylinder 77 is connected are arranged under free slide through the sliders 86a and 87a in back and forth directions along the rails 70a of the hand base, and are connected with the expand shafts 88.

**[0073]** One end of the shafts 88a of the expand shafts 88 is supported by one side of a protrusion part of the member 86 under free advancing and retreating, and the other end is fixed by penetration through a protrusion part of the member 87. Coil springs 88b are fit-

ted on the shafts 88a, lock rings 88c are fixed on the shafts 88a to provide abutments for one end of the springs 88b.

**[0074]** Accordingly, when the rod 77a of the cylinder 77 advances, both members 86 and 87 advance till one part of member 86 contacts with an adjustment screw 89, and after that, the other part of the member 87 proceeds against the biasing of the spring 88b. The blades 73 advance against the inserting jig 71, and push out the terminals  $\underline{t}$  and insert them into the connector housings C.

**[0075]** Further, it may be better to guide the terminals  $\underline{t}$  during the insertion. For this, as shown in the chain line of Figure 11, guide protrusions 84b may be formed on the shutter 84 and at the insertion of the terminals  $\underline{t}$ , stabilisers  $\underline{t}'$  at both sides of the terminals  $\underline{t}$  cross the guide protrusions 84b. Namely, the shutter 84 may preferably guide the insertion of terminals  $\underline{t}$ . Thus, the terminals  $\underline{t}$  are smoothly inserted without vibrating in a crosswise direction.

**[0076]** The selecting action of the respective blades 73 when inserting the terminals  $\underline{t}$  in the connector housing C is the same as the selecting action of the respective press-connecting blades described in Japanese Patent Publication (unexamined) Hei No.10-106371.

**[0077]** Thus, as shown in Fig. 15, when the terminals  $\underline{t}$  are inserted by pushing out the blades 73, closer spacing of the terminals  $\underline{t}$  becomes possible by the cavities  $\underline{s}$  of the connector housing C (Fig.15(a)) having smaller pitch than the pitch (Fig.15(b)) of the cavities  $\underline{s}$  for inserting the press-clamping terminals  $\underline{t}$  of Fig.26, because no hand 3 is required.

**[0078]** Further, as shown in Fig.26, when a plural number of the terminals  $\underline{t}$  are simultaneously mounted, the tact is remarkably shortened in comparison with a case of mounting the terminals one by one with the hand. For example, the tact-up is limited by one by one, and in addition, the mounting miss caused by chucking miss is apt to occur.

**[0079]** Further, when the intervals of the cavities  $\underline{s}$  are the same according to the selecting mechanism of the respective blades 73, housings C having different sizes and housings C having lock parts can be corresponded, and when the intervals of the cavities  $\underline{s}$  are an integer-fold, it can be corresponded.

**[0080]** As shown in Fig.2 and Fig. 3, the above-mentioned connector housing retention plate 61 is supported under free slide to left and right directions by guides 69 arranged on the base stand 10. One end of the plate 61 is fixed on moving part 64a of slide actuator 64 arranged on the base stand 10 and moves to left and right as shown in the chain line of Fig.3. The migration positions are 6 points in total including 3 points at which housing retention frames 62 described later correspond respectively with the terminal-mounting position 0, and 3 points from which they retreat at a requisite distance.

**[0081]** As shown in Fig.3 and Fig.9, the connector housing retention plate 61 is equipped with the housing

retention frames 62 under free rotation. The housing retention frames 62 have protrusions 65 which support the housings C by pushing and springs 65a which bias the protrusions 65. After stop rings 66 of the protrusions 65 are pulled and the housing C is fitted on the retention frames 62, the housings C are pushed by the springs 65a by removing the protrusions 65 (the stop rings 66) and surely fixed. The pressing power is regulated by the thrusting amount of the stop rings 66. The protrusions 65 are fitted in the regulators 66a and provide the housing retention frames 62 at the mounting position, the cavities s of the I stage of the housing C become the terminal-inserting position.

**[0082]** As shown in Fig.2 and Fig.16, the upper frame of the base stand 10 at the rear of the connector housing-retaining plate 61 is equipped with rotary cylinder 63 at the insertion position 0. When a drive part 63a of the rotary cylinder 63 rotates while being fitted in a drive hole 62a of the housing-retaining frames 62, the connector housing C rotates by 180 degrees as from (a) to (b) of Fig.17, and is upset (rolled). This operation is carried out for the respective retention frame of the retention plate 61.

**[0083]** At this time, concerning the rotation of the rotary cylinder 63 as shown in Fig.9, when the protrusions 65 are fitted in the regulators 66a, the cavities s of the I stage becomes the inserting position by the fitting as afore-mentioned, but when it is rolled, the rotation position is regulated by the cylinder 63 itself so that the cavities s of the other stage becomes the inserting position.

**[0084]** Accordingly, the terminals t facing the connector housings C by the above-mentioned hand 70 are inserted in the cavities s of the housings C at the insertion position 0 from the back in accordance with the advancing of the blades 73 and mounted.

**[0085]** When the terminals t are inserted in the I stage of the I housing C, the retention plate 61 moves by a requisite amount to left or right, the insertion hand 70 transfers to a motion of inserting the next terminals t with electric wires. The retreat of the afore-mentioned inserted housings C is carried out for preventing the entanglement of the electric wires a at receiving.

**[0086]** After completion of the inserting, the retention plate 61 moves so that the I housing C becomes the insertion position, then the I housing C is rolled and the insertion of the terminals t is carried out again. At this time, the insertion hand 70 is elevated in accordance with the migration of the retention plate 61, is positioned so that it does not interfere with the rolling action, and transfers to the inserting position by descending after the roll of the housings C.

**[0087]** As shown in Fig.18(a), (b) and (c), these actions insert the terminals t of the jigs 14 in the pallets 12 in sequence so that terminals t of jig a are inserted into the upper stage a of the I housing C, then the terminals t of jig b are inserted into the lower stage b of the I housing, and successively, the terminals t of jigs c, d, e

and f of the pallet 12 are inserted into the II housing C and the III housing C. The order of insertion is properly changed considering the wiring specification, the degree of entanglement and the like.

**[0088]** After completion of mounting the terminals t with electric wires into all of the connector housings C, the retention plate 61 moves to the right end, the connector housings C are removed from the retention frames 62 by a person or a robot and new connector housings C are mounted on the retention frames 62. On the other hand, the jig pallet 12 is transferred to the terminal-mounting machine 20. The flow chart of the actions above is shown in Fig.20.

**[0089]** Thus, the reason why the terminals t are inserted by rolling the connector housings C is to mount the terminals t arranged on the jig pallets 12 in parallel to the same direction so that the backs of the upper terminals and lower terminals face each other. When the directions are the same, the rolling is unnecessary. For example, the insertion of the terminals t whose backs face each other has been carried out after rolling. Further, the cavities are not limited to two stages, one stage may be used, and three stages or more may also be used. In the respective cases, the motion of the elevation of the insertion hand 70 and the like is corresponded with the number of stages.

**[0090]** For example, according to the above-mentioned terminal-mounting, the wire harness W shown in Fig.21 can be obtained. This is the wire harness in which the terminals t are inserted from the back of the cavities s in like manner as the wire harness W by the press-clamping terminals. Accordingly, when a mode of operation capable of mounting the press-clamping terminals t in the connector housings C for the press-clamping terminals is set, the press-clamping terminals and the connector housings C can be used in common. Further, when there are the empty cavities s, not only the press-connecting terminals but also the press-clamping terminals can be also inserted (mounted) in the empty cavities s.

**[0091]** Other examples of the retaining jigs 14 are shown in Fig.22 and Fig.23. In this arrangement the jigs 13 are provided with the protruding pins (pushing-up pins) 83. Namely, recesses 14b are formed under the jig base 14', and pushing-up plates (protruding jigs) 81 with the above-mentioned pins 83 are fitted in the recesses 14b under a condition of free elevation. The plates 81 are designed to be pushed up by the air cylinders 82, and the pins 83 are designed to be retreated from the cavities 14a by the biasing of springs 86.

**[0092]** In this mode of operation, the pushing-up plates 81 and the pins 83 are pushed up by the elevation of the piston rods 82' of the air cylinders 82 as shown in Fig.22(b), and the terminals t are pushed out (protruded) from the cavities 14a by the pins 83 and delivered to the inserting jig 71.

**[0093]** Even if the cavities s of the connector housings C are changed from Fig.23(a) to Fig.23(b) (even if

the width of the cavities is changed from A to B ( $A < B$ ), by installing the pins 83 on the retaining jigs 14 like this, only changing the jigs 14 is required to correspond with the connector housings C.

**[0094]** By contrast with the mode of operation of Fig. 12 not only must the jigs 14 be changed but also the pushing-up plates (protruding jigs) 81 with the pins 83 from the air cylinders 82 must be changed. This needs a tool-changing mechanism. It becomes a working in the base stand in hand-working, and troublesome.

**[0095]** Another example of the inserting jig 71 is shown in Fig.24 and Fig.25, in which transfer mounting guides 72b are provided on the lower face of the jig 71 on both sides of the cavities 72. As shown in Fig.26, in the absence of the guides 72b, the presence of the shutter 84 creates gaps between the connector jig 14 and inserting jig 71. If a twisting force is generated in the electric wires when the terminals t are pushed up from connector jig 14 by the pins 83, the terminals t are subject to rolling by the twisting force as shown by the arrow mark and there is a risk this may cause a delivery miss. However, as shown in Fig.24 and Fig.25, the terminals t are guided by the guides 72b during the transfer from the connector jig 14 to the inserting jig 71. In this way, the terminals t are smoothly transferred from the cavities 14a of the connector jig 14 to the cavities 72 of the inserting jig 71 without rolling.

**[0096]** Further, if the width of the cavities 14a of the connector jigs 14, the width of the cavities 72 of the inserting jig 71, and the width of the cavities s of the housings C are settled to be enlarged in this order, the terminals t having a narrowed crosswise width are inserted in the broader cavities in turn, and the inserting action becomes smooth.

**[0097]** Further, if the press-clamping can be carried out in the retaining jigs 14, a similar action effect as the above-mentioned press-connecting can be obtained in the press-clamping terminals.

**[0098]** As the present invention is the retaining jigs above, the press-connecting and the like are carried out in the jigs and the terminals can be mounted on the connector housings, the press-connecting terminals and the press-clamping terminals can be mounted on the connector housing, and the common-usability of the housing and cost-down can be designed. The cost-down of electric wires with a connector, for example, a wire harness can be designed.

## Claims

1. A process for mounting press-connecting terminals (t) with electric wires (a) into a connector housing (C) characterised by loading the terminals (t) into a terminal-connecting jig (14), connecting the electric wires (a) with the terminals (t), removing terminals (t) with electric wires (a) from the terminal-connecting jig (14), and inserting the terminals (t) with electric wires (a) from the back into cavities (s) of the

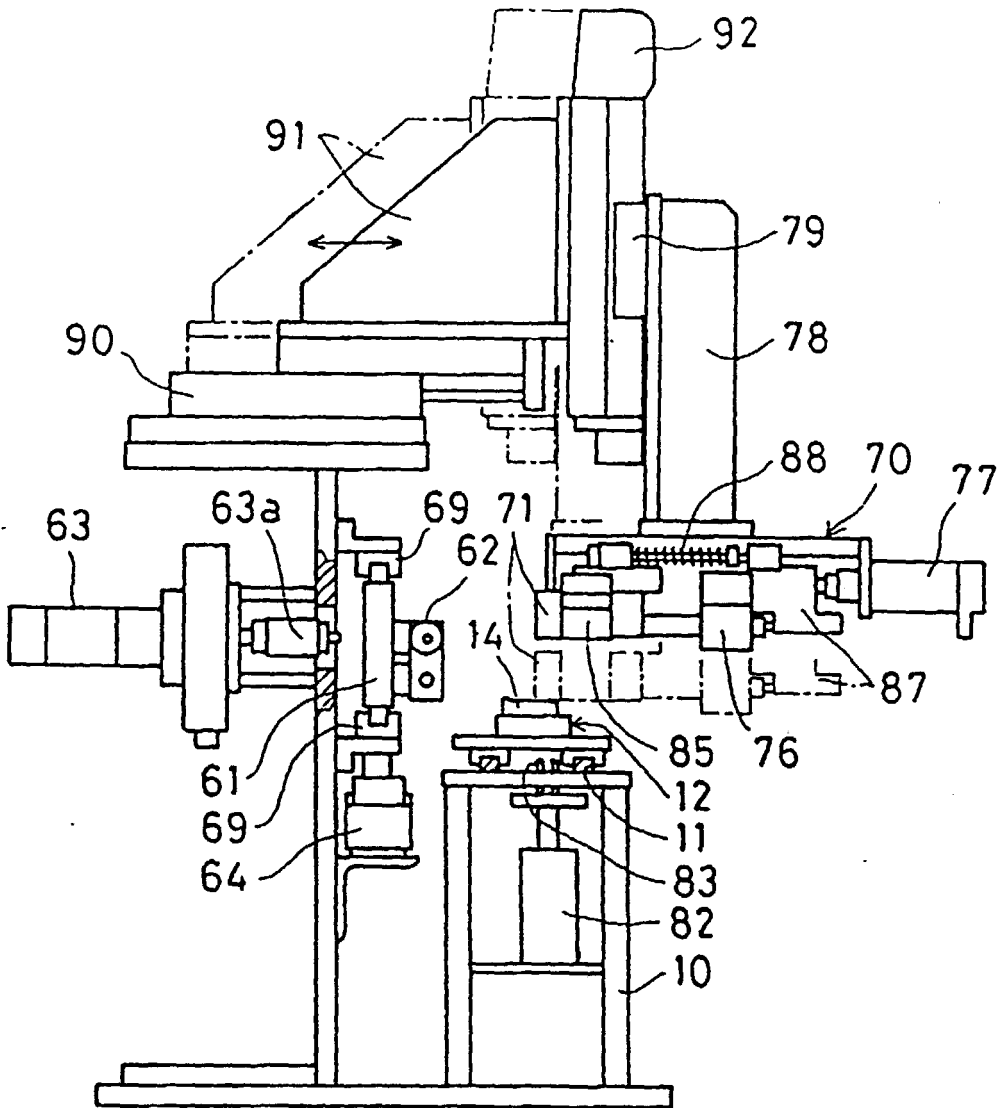
connector housing (C).

2. A process as set forth in claim 1 characterised in that the steps of loading the terminals (t) into the terminal connecting jig (14), connecting the electric wires (a) with the terminals (t), removing the terminals (t) with the wires (a) from the terminal-connecting jig (14), and inserting the terminals (t) with electric wires (a) from the back into cavities (s) of the connector housing (C) are sequentially carried out automatically.
3. A process according to claim 1 or claim 2 characterised in that the housing (C) has two stages, an upper stage and a lower stage, and the housing (C) is rolled (inverted) for inserting the terminals (t) with electric wires (a) from the back into cavities (s) of the upper and lower stages.
4. A process as set forth in any preceding claim characterised in that the terminals (t) with electric wires (a) are transferred to a terminal-inserting jig (71) from the terminal-connecting jig (14), and the terminals (t) with electric wires (a) are inserted into the cavities (s) of the connector housing (C) from the terminal-inserting jig (71).
5. A process as set forth in claim 4 characterised in that the terminals (t) with electric wires (a) are loaded into cavities (14a) in the connecting jig (14) and are preferably prevented from falling out by protrusions (15a) on spring plates (15) below the cavities (14a).
6. A process as set forth in claim 4 or claim 5 characterised in that the terminals (t) with electric wires (a) are transferred from the connecting jig (14) to the inserting jig (71) by pins (83) of a pushing-out jig (81) pushed up through holes (18) below the terminals (t) in the connecting jig (14).
7. A process as set forth in claim 6 characterised in that each terminal (t) with electric wire (a) is transferred by two pins (83) which contact the terminal (t) in a longitudinal direction before and behind the electric wire connecting area.
8. A process as set forth in any one of claims 4 to 7 characterised in that the terminals (t) with electric wires (a) are transferred from the connecting jig (14) to cavities (72) in the inserting jig (71) and are preferably prevented from falling out of the cavities (72) by a shutter (84).
9. A process as set forth in claim 8 characterised in that the terminals (t) are guided when pushed out of the inserting jig (71) by guides (84b) on the shutter (84).

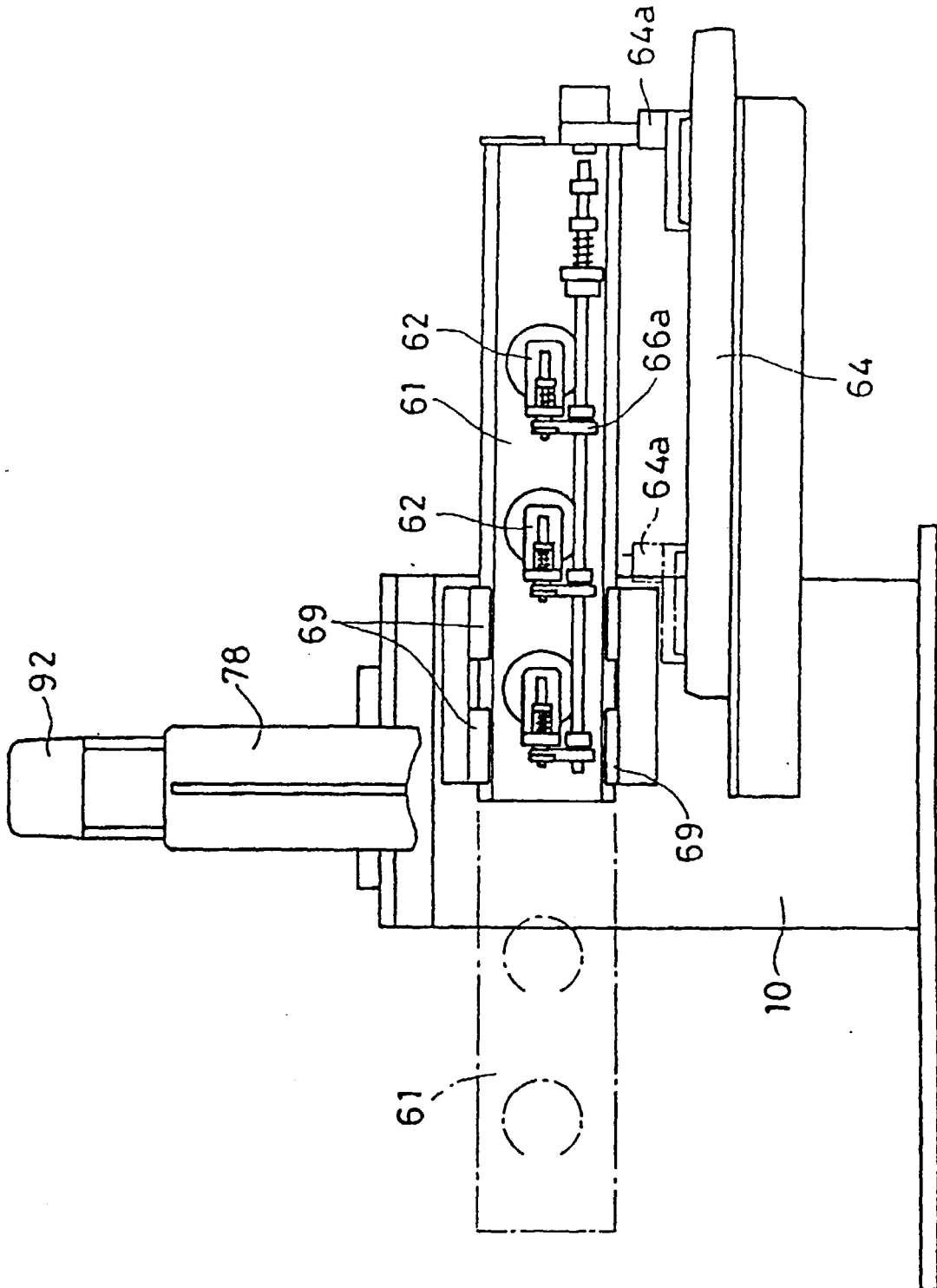
10. A process as set forth in claim 8 or claim 9 as dependent on claim 6 or claim 7 characterised in that a clearance (84a) is provided in the shutter (84) for the pins (83).
11. A process as set forth in any one of claims 8 to 10 characterised in that the terminals (t) with electric wires (a) are guided when transferred to the inserting jig (71) by transfer guides (72b) on both sides of the cavities (72).
12. A process as set forth in any one of claims 4 to 11 characterised in that the terminals (t) with electric wires (a) are transferred from the inserting jig (71) to the cavities (s) by members (73) which push out the terminals (t) in a longitudinal direction and support rear end faces of the terminals (t).
13. A system for mounting terminals with electric wires in a connector housing characterised by a mounting machine 20 for mounting the terminals (t) on a connecting jig (14), electric wire-measuring and wire-connecting machines (30;40) for connecting wires (a) to the terminals (t), and a terminal-mounting machine (60) for removing the terminals (t) with electric wires (a) from the press-connecting jig (14) and inserting the terminals (t) with electric wires (a) from the back into cavities (s) of the connector housing (C).
14. A system as set forth in claim 13 characterised in that the machines (20;30;40;60) are sequentially installed along guide rails 11.
15. A system as set forth in claim 13 or claim 14 characterised in that an inserting jig (71) is provided to receive the terminals (t) with electric wires (a) from the connecting jig (14) and insert the terminals (t) with electric wires (a) into the cavities (s) in the connector housing (C).
16. A system as set forth in claim 15 characterised in that a mechanism (70) is provided for inserting the terminals (t) with electric wires (a) into the cavities (s) of the connector housing (C) by pushing out the terminals (t).
17. A system as set forth in claim 16 characterised in that the mechanism (70) has a plurality of blades (73) movable in an inserting direction for inserting respective terminals (t) with electric wires (a) into the cavities (s) of the connector housing (C).
18. A system as set forth in claim 17 characterised in that the blades (73) are independently movable.
19. A system as set forth in claim 17 characterised in that a selection mechanism is provided for moving selected blades (73) as a unit.
20. A system as set forth in any one of claims 13 to 19 characterised in that a roll over mechanism is provided for supporting the connector housing (C) in either one of two positions to present selected cavities (s) for inserting the terminals (t) with electric wires (a).
21. A system as set forth in claim 20 characterised in that the connector housing (C) has upper and lower stages and the roll over mechanism includes a frame (62) for mounting the connector housing (C) and means (63) for rotating the frame (62) through 180° to roll over (invert) the connector housing (C) whereby the connector housing (C) is supported in a first position to present the cavities (s) of the upper stage for inserting the terminals (t) and is rolled over and supported in a second position to present the cavities (s) of the lower stage for inserting the terminals (t).



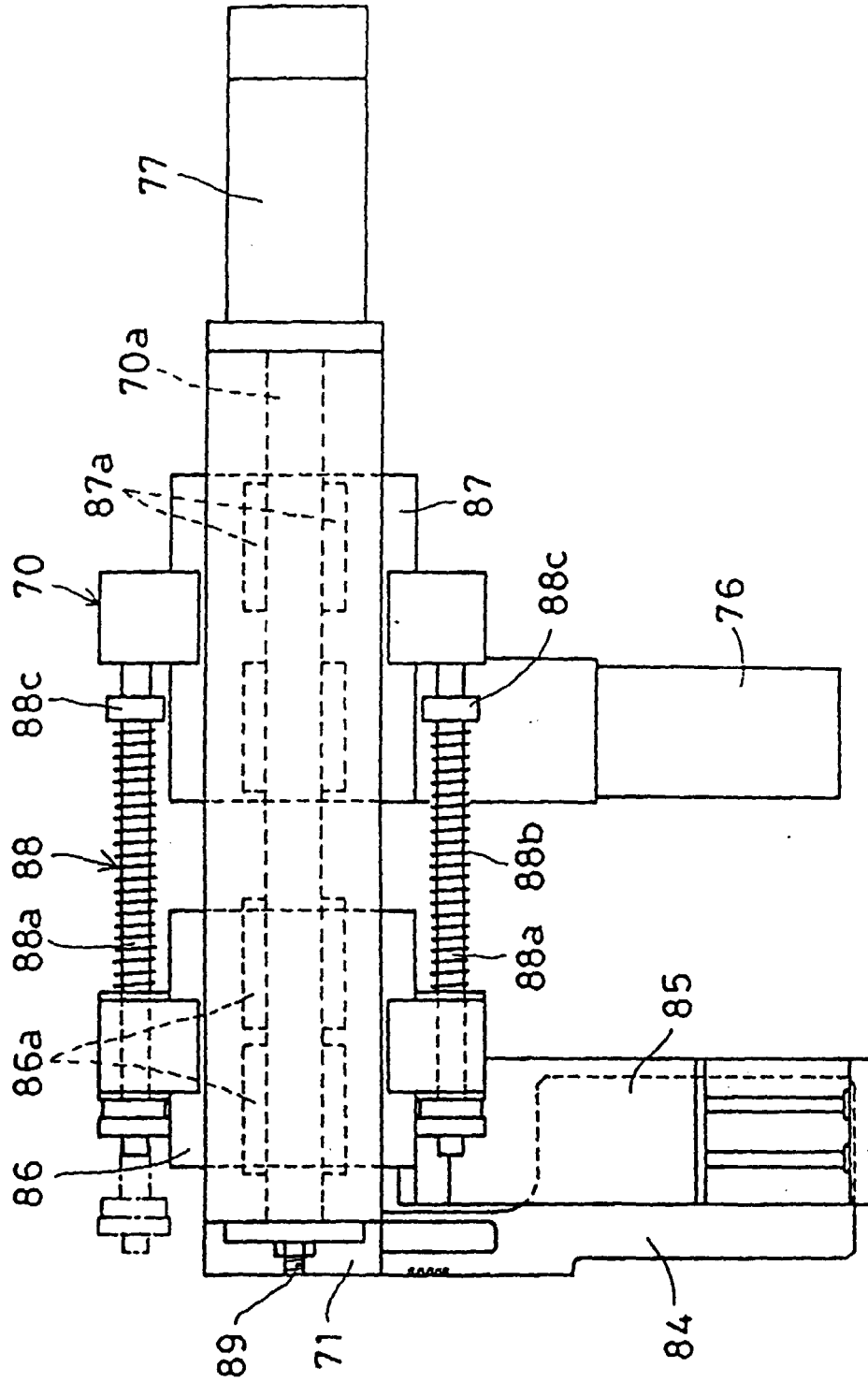
[Figure 2]



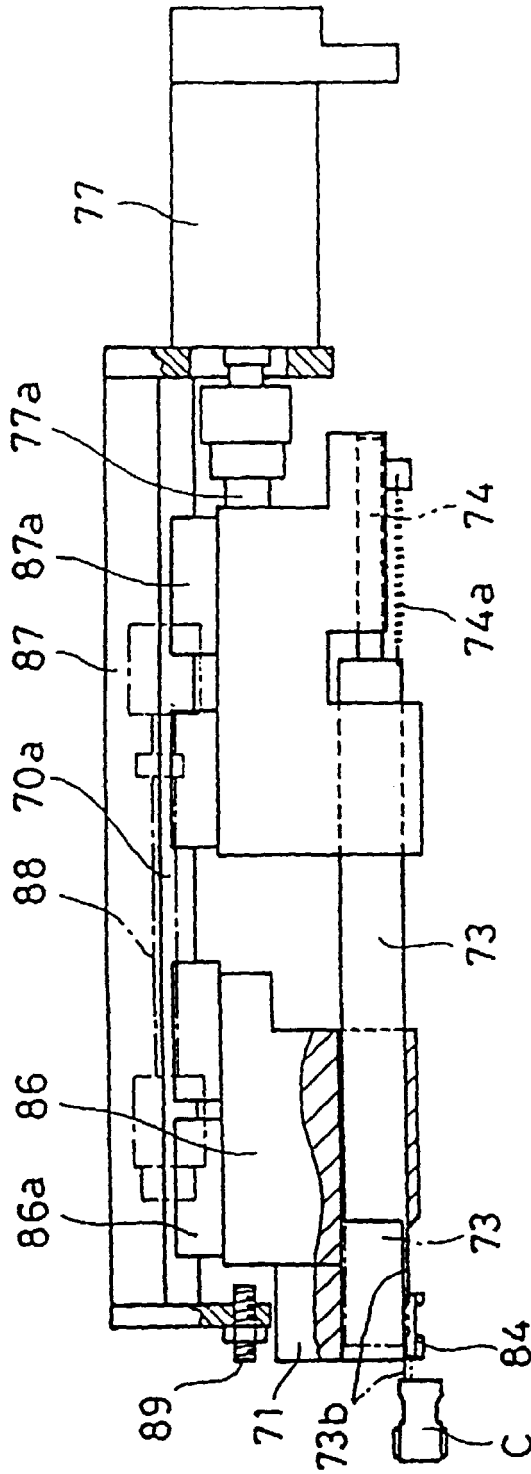
[Figure 3]



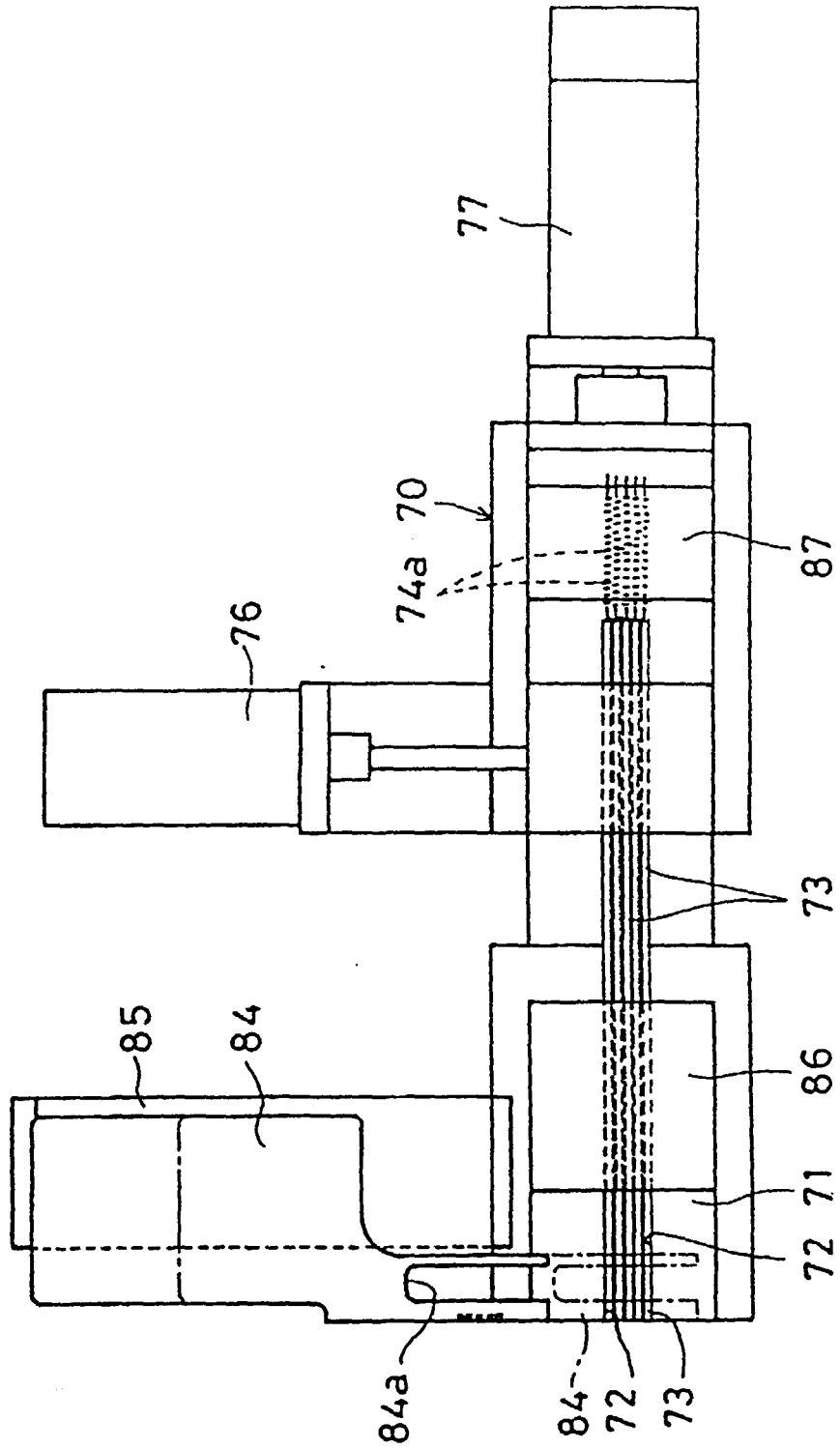
[Figure 4]



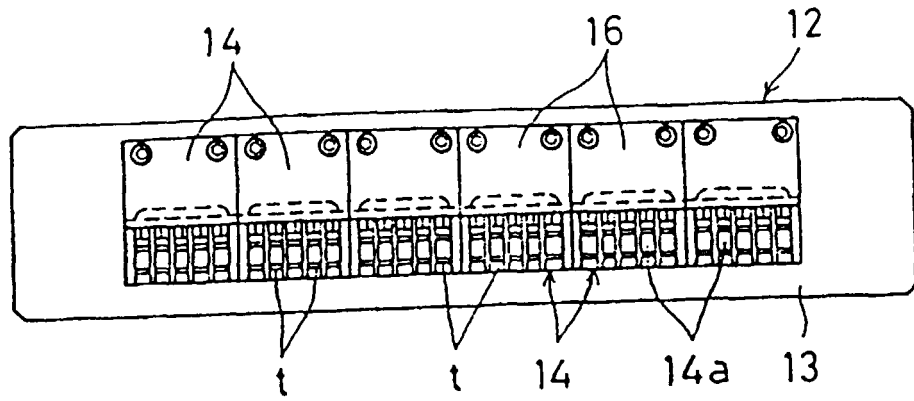
[Figure 5]



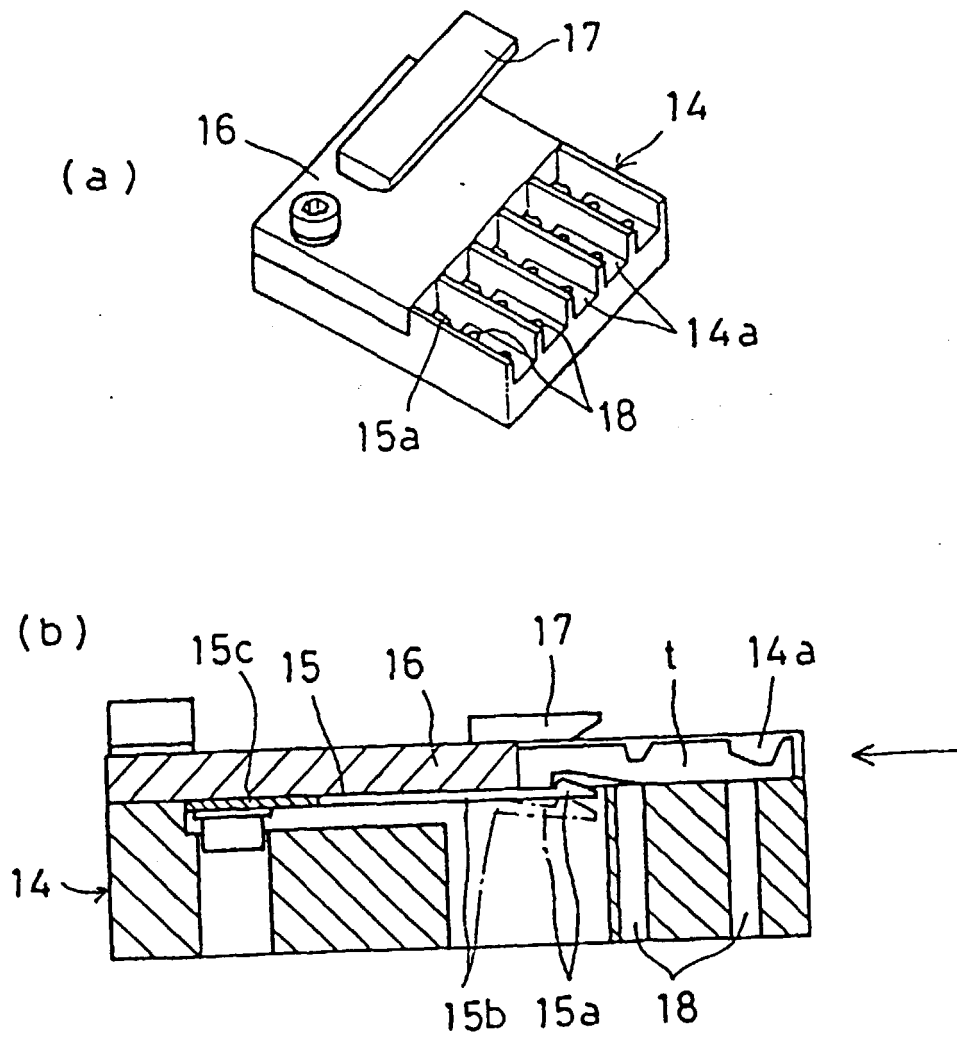
[Figure 6]



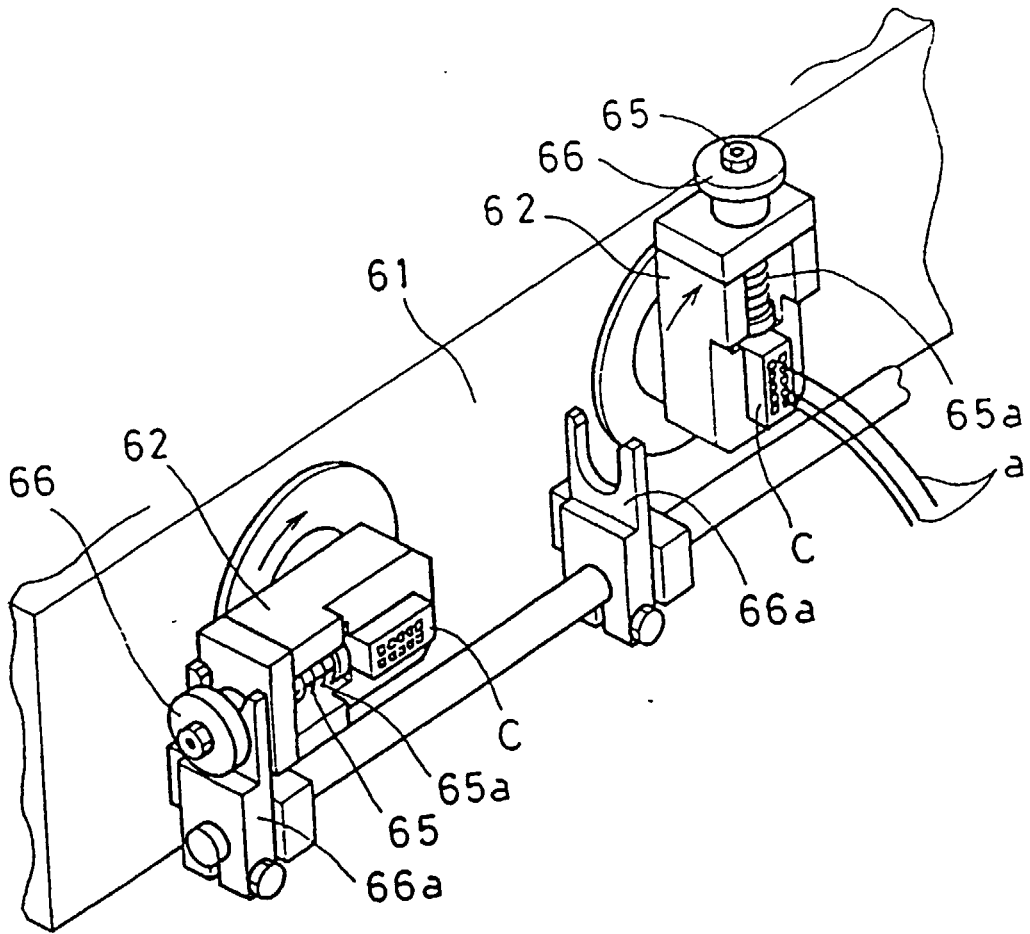
[Figure 7]



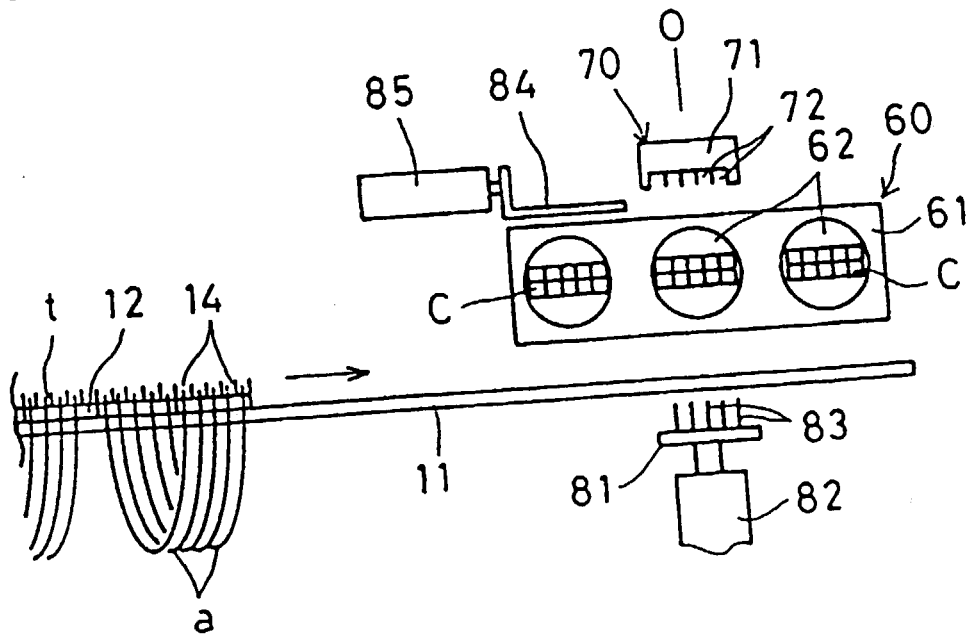
[Figure 8]



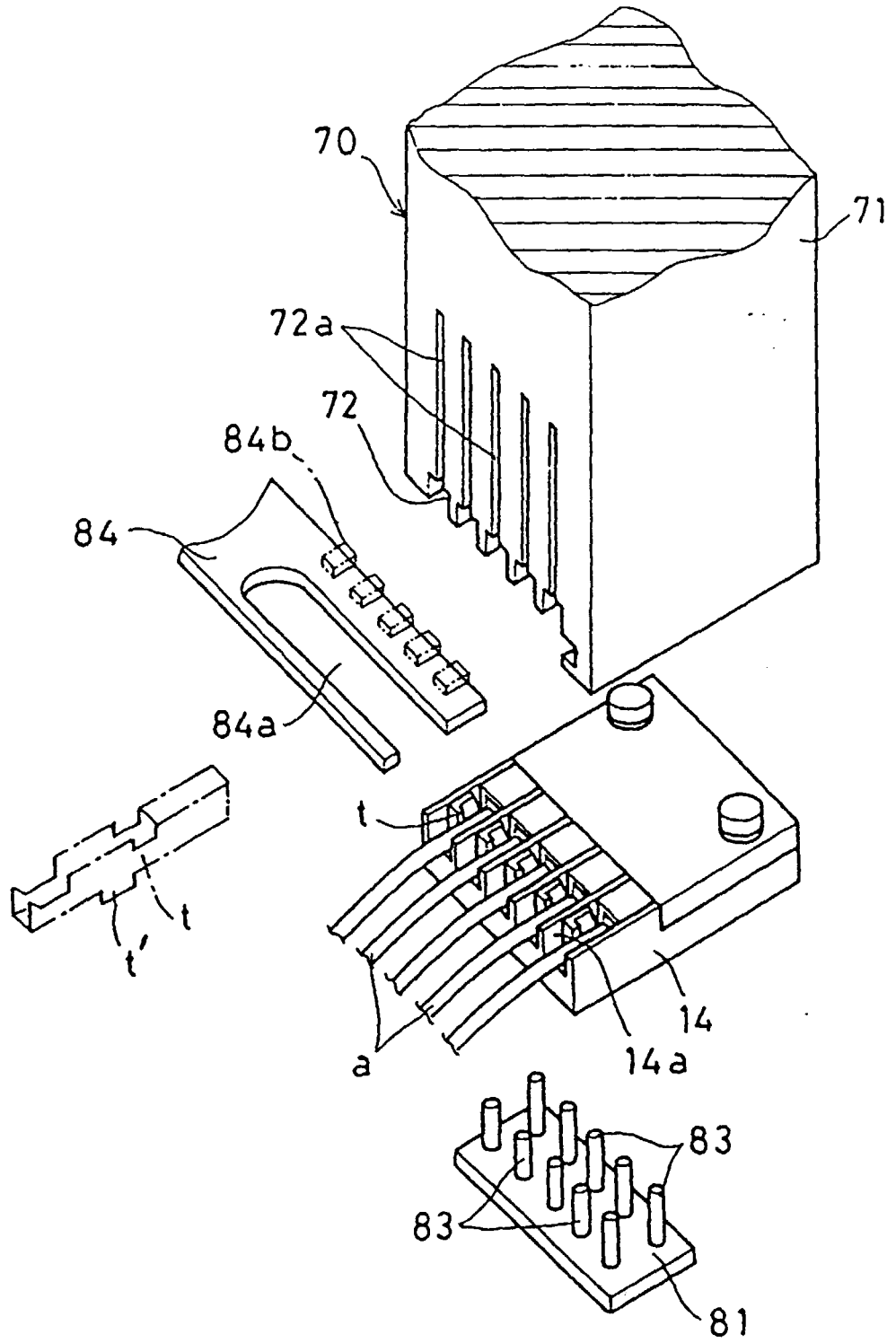
[Figure 9]



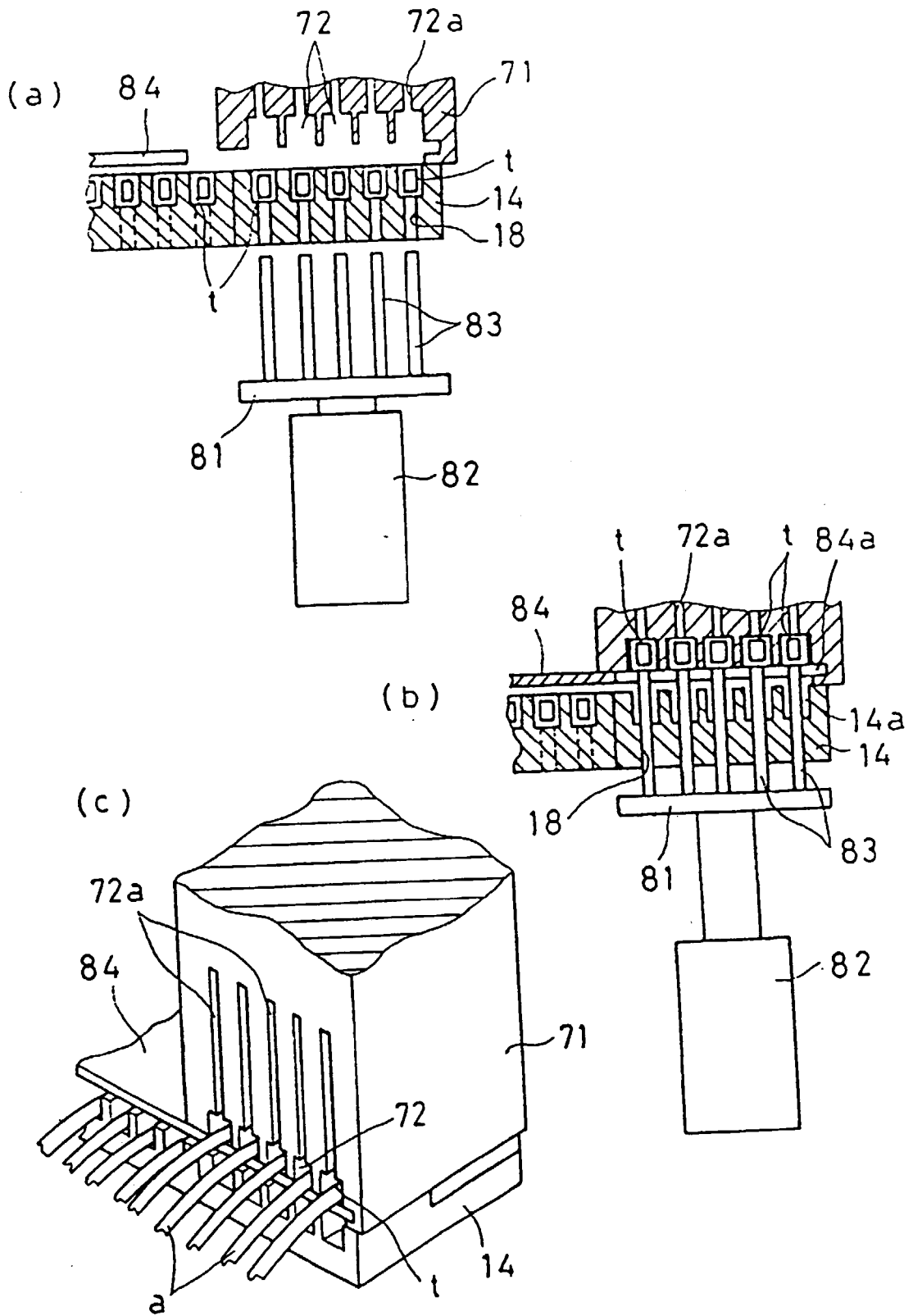
[Figure 10]



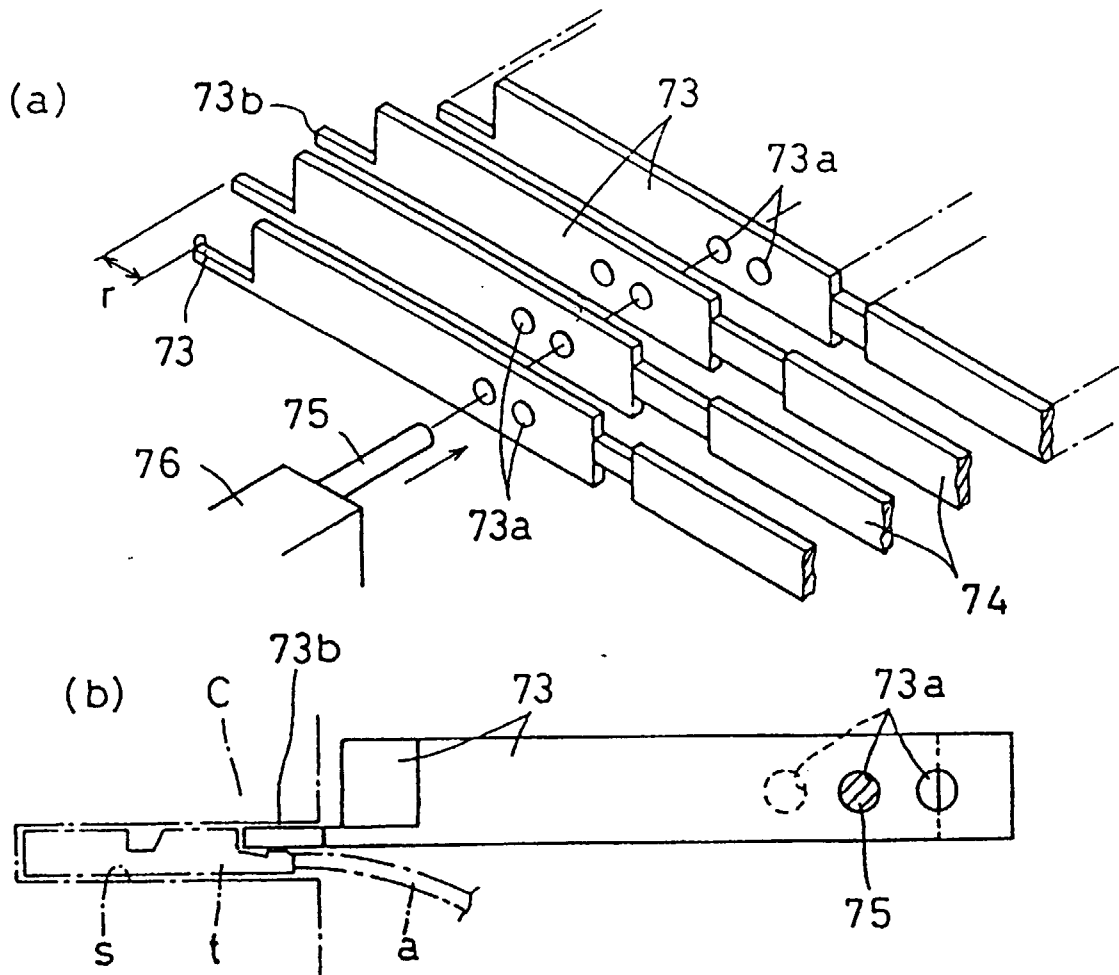
[Figure 11]



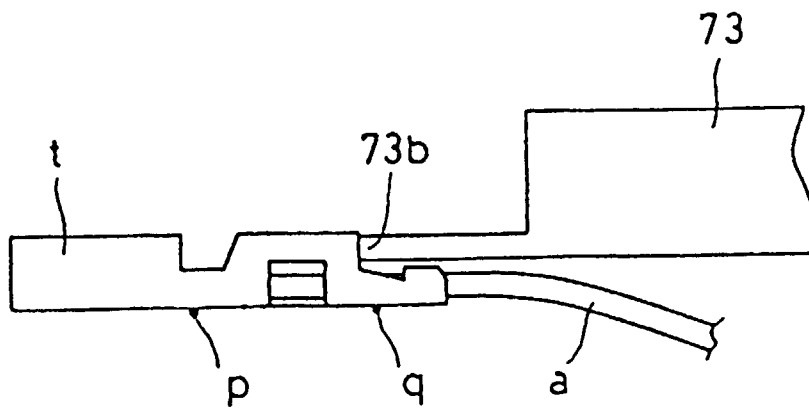
[Figure 12]



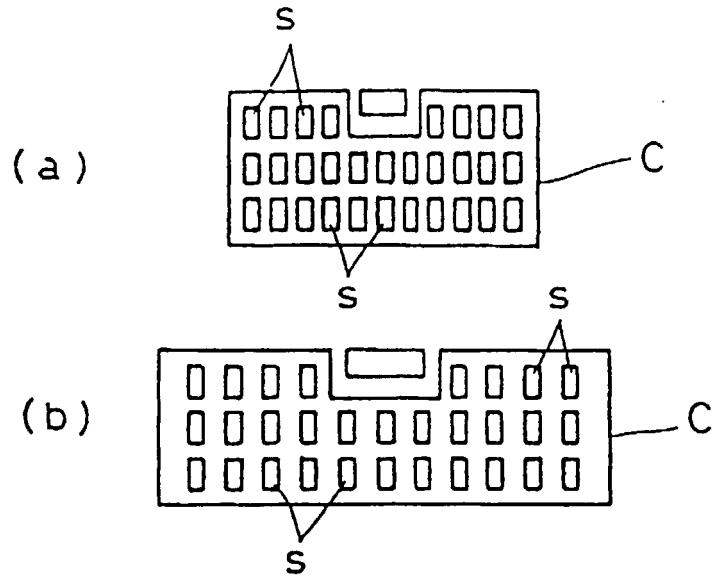
[Figure 13]



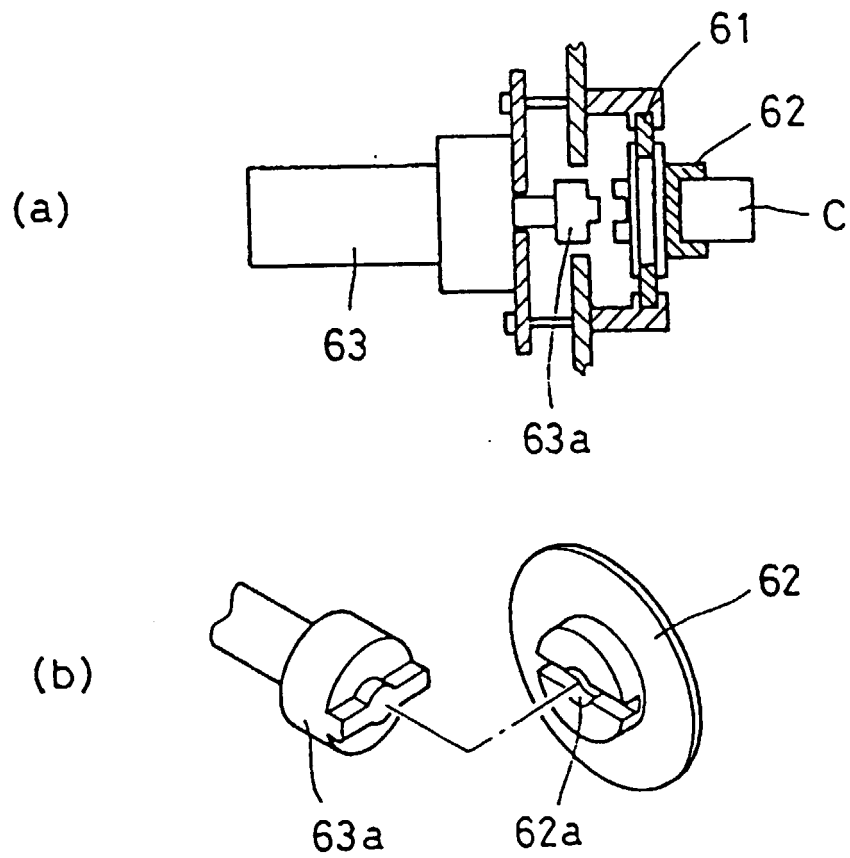
[Figure 14]



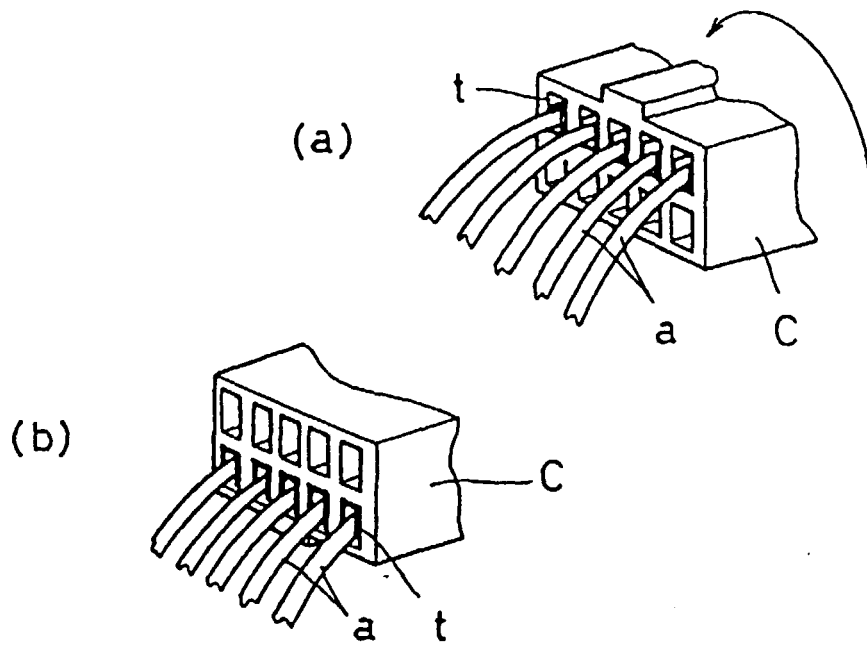
[Figure 15]



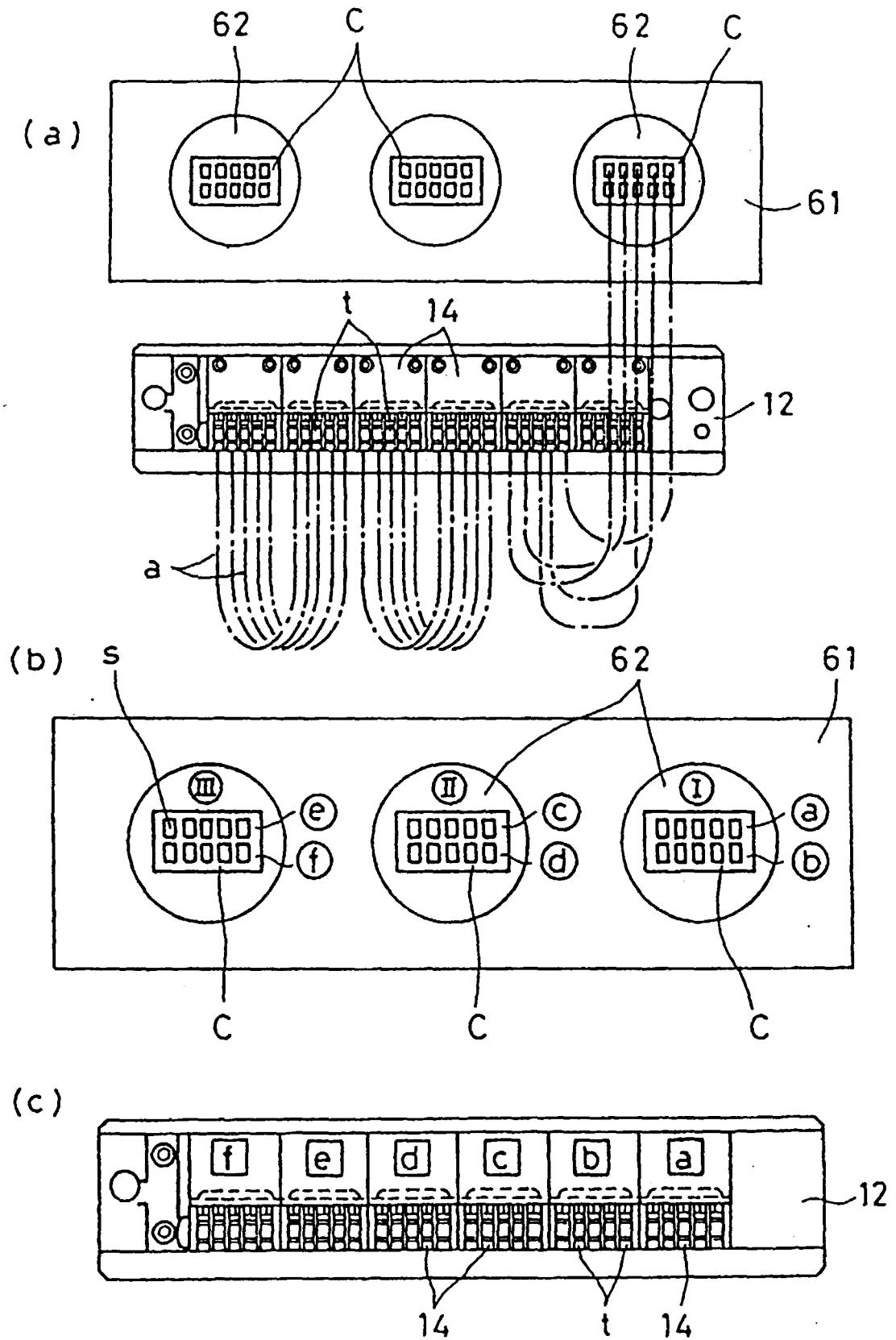
[Figure 16]



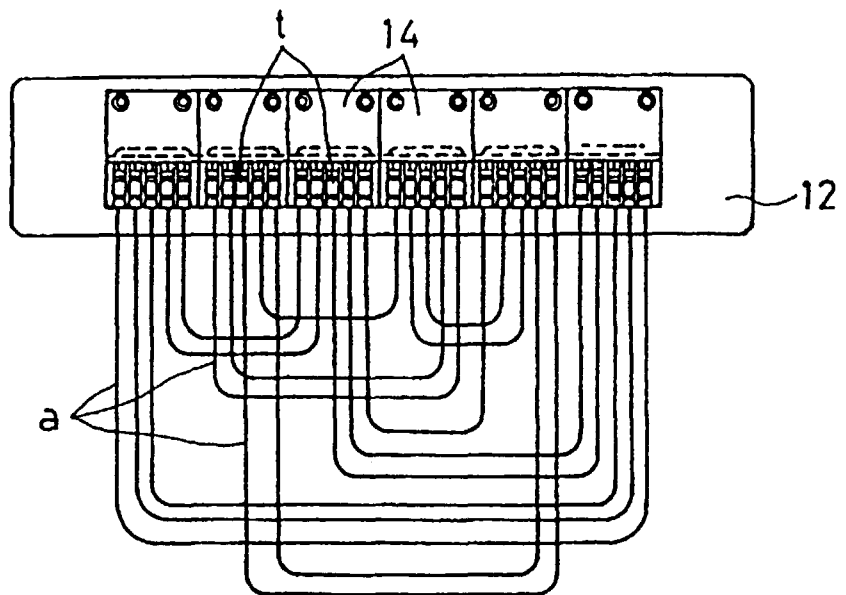
[Figure 17]



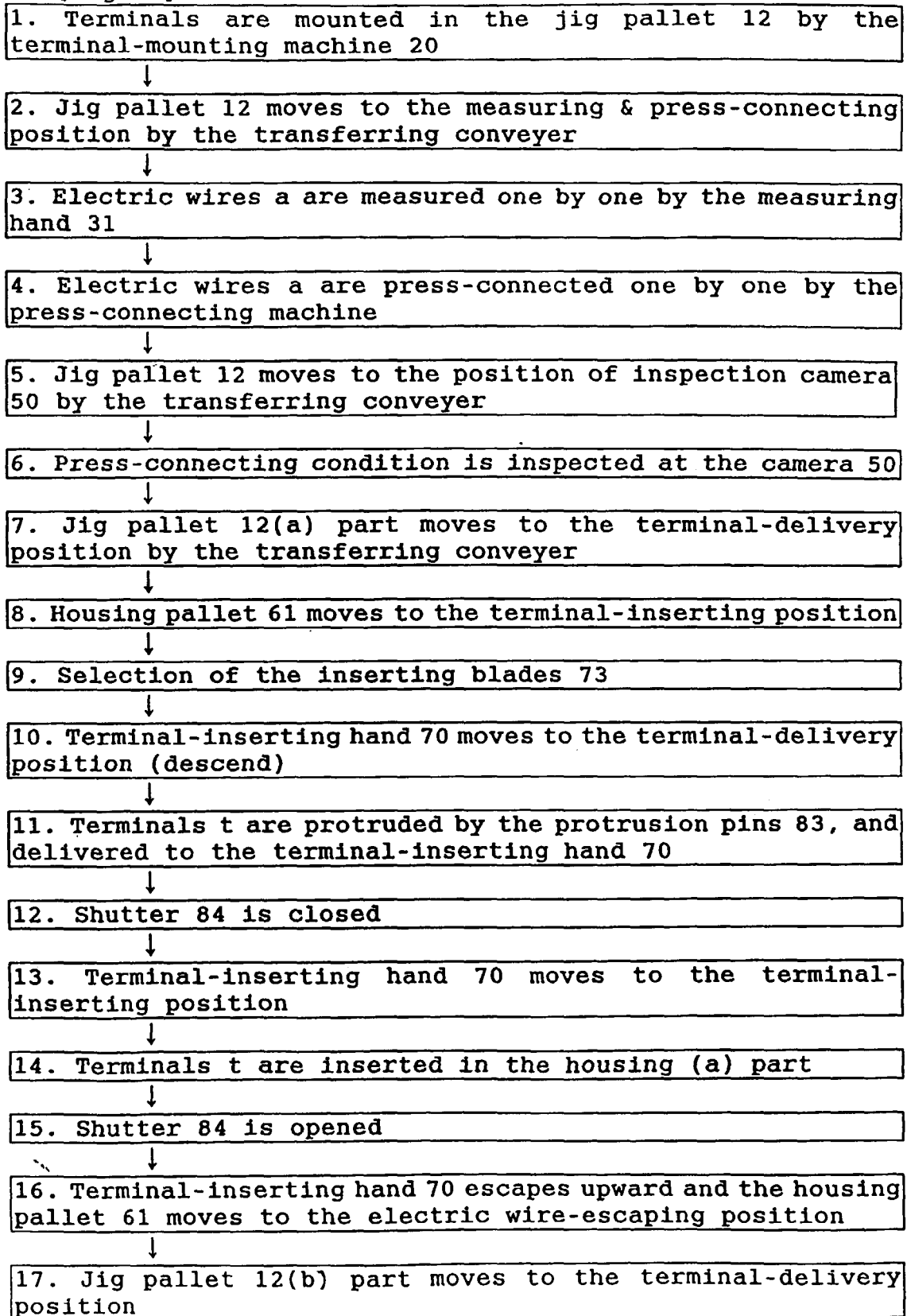
[Figure 18]

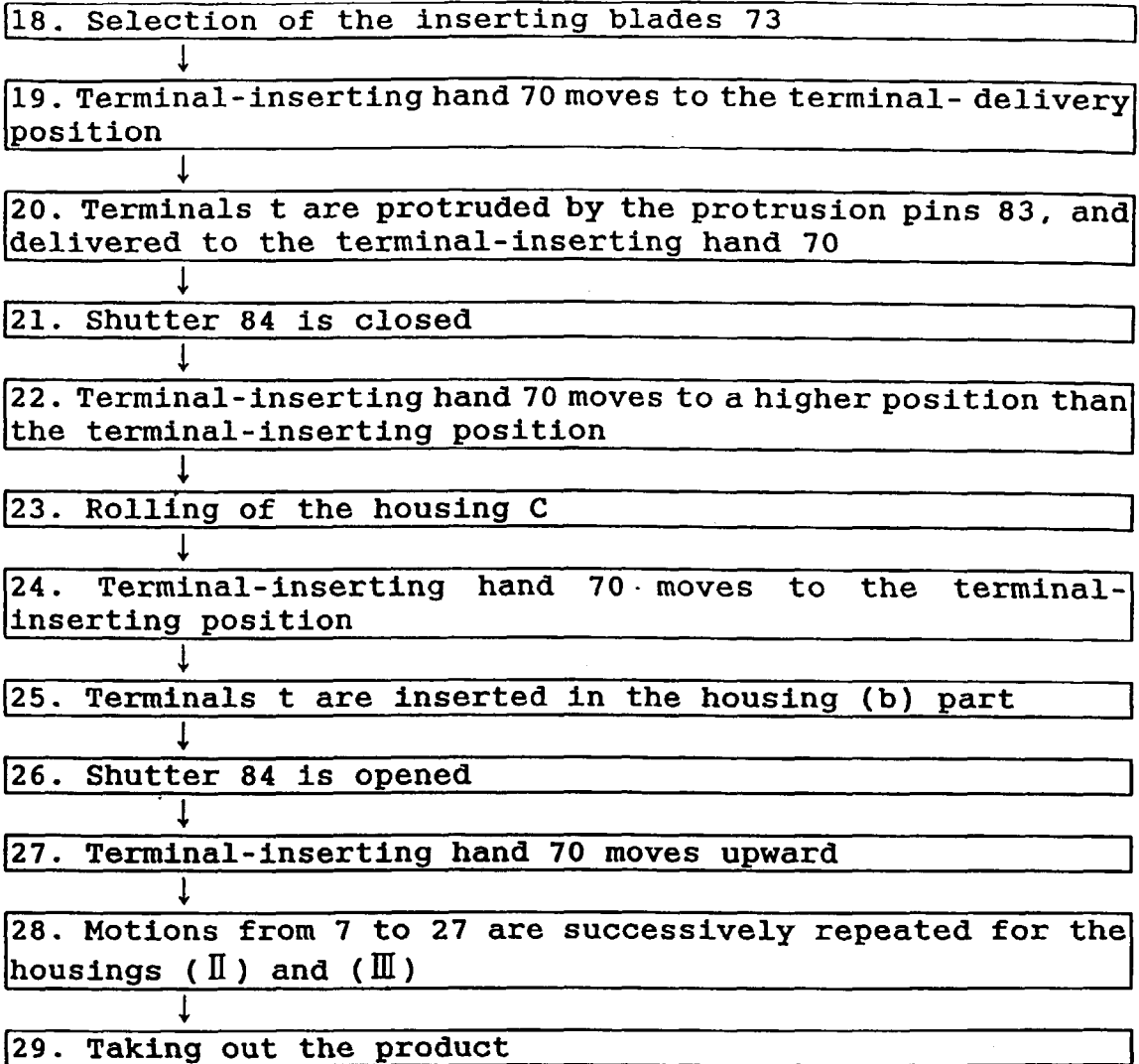


[Figure 19]

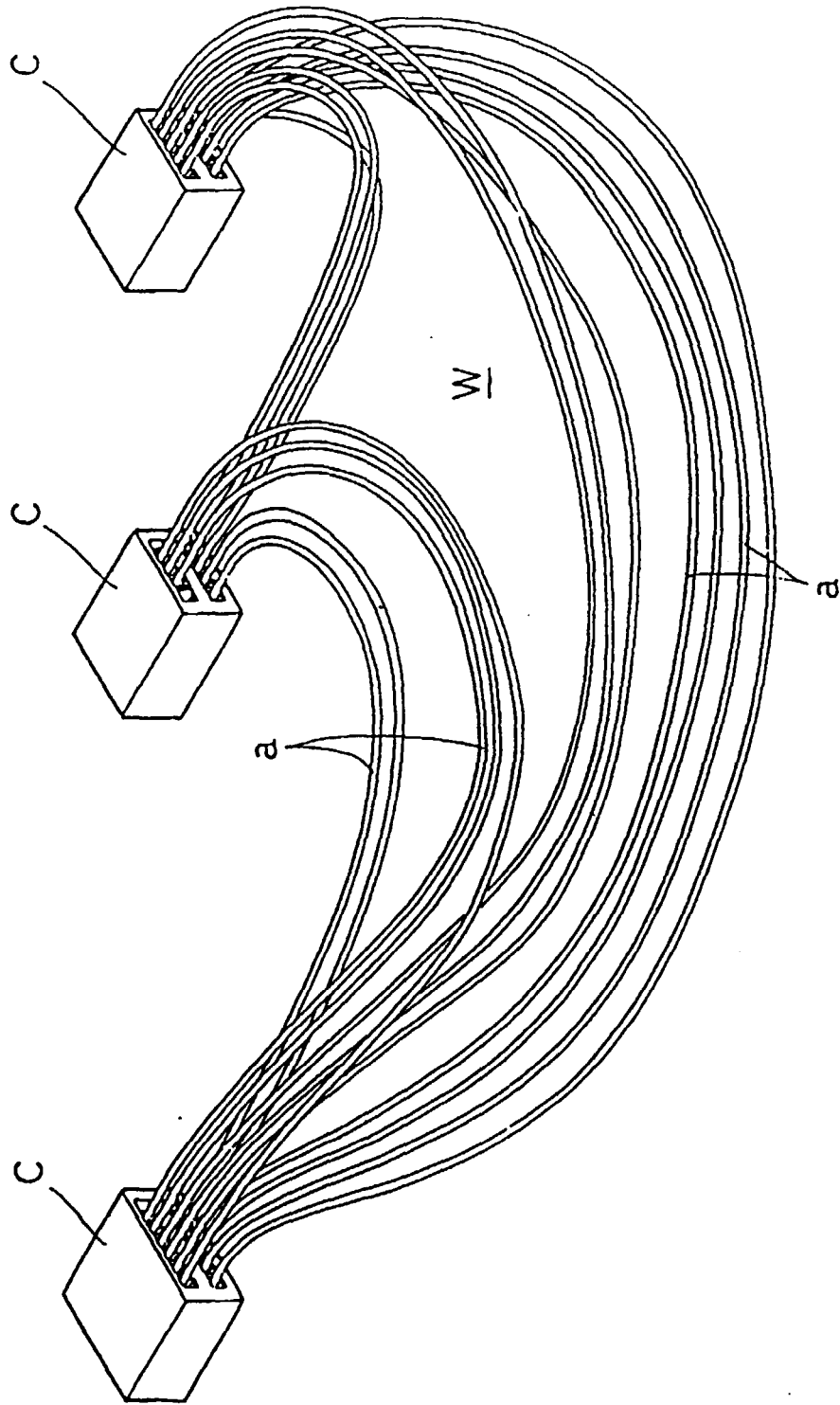


[Fig.20]

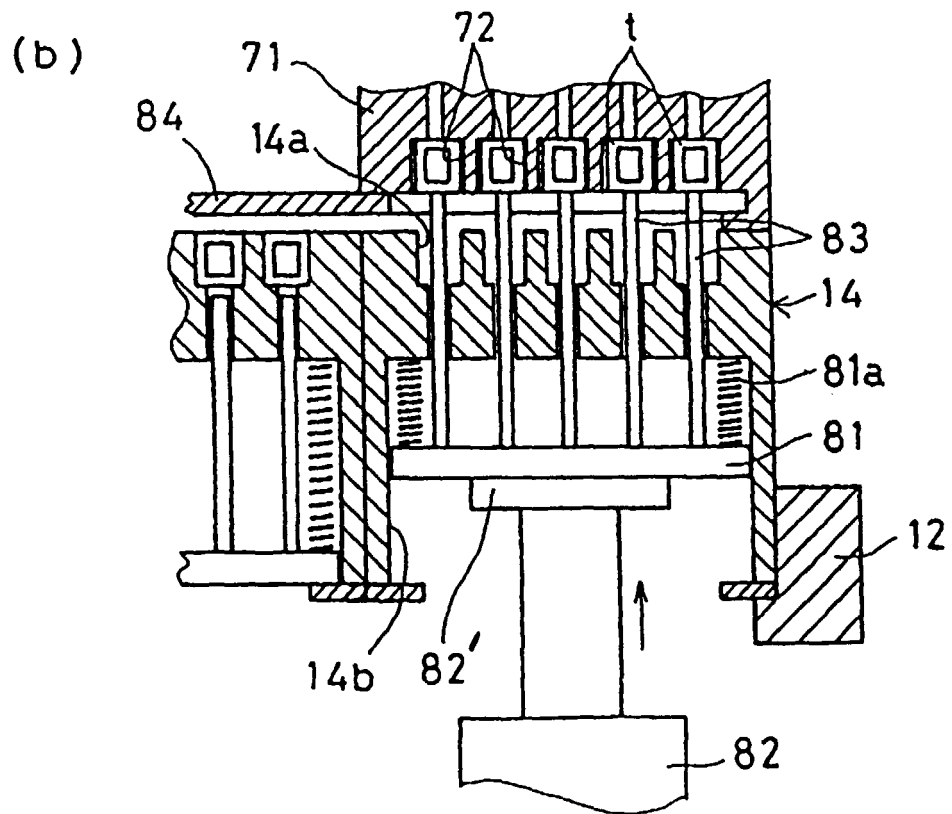
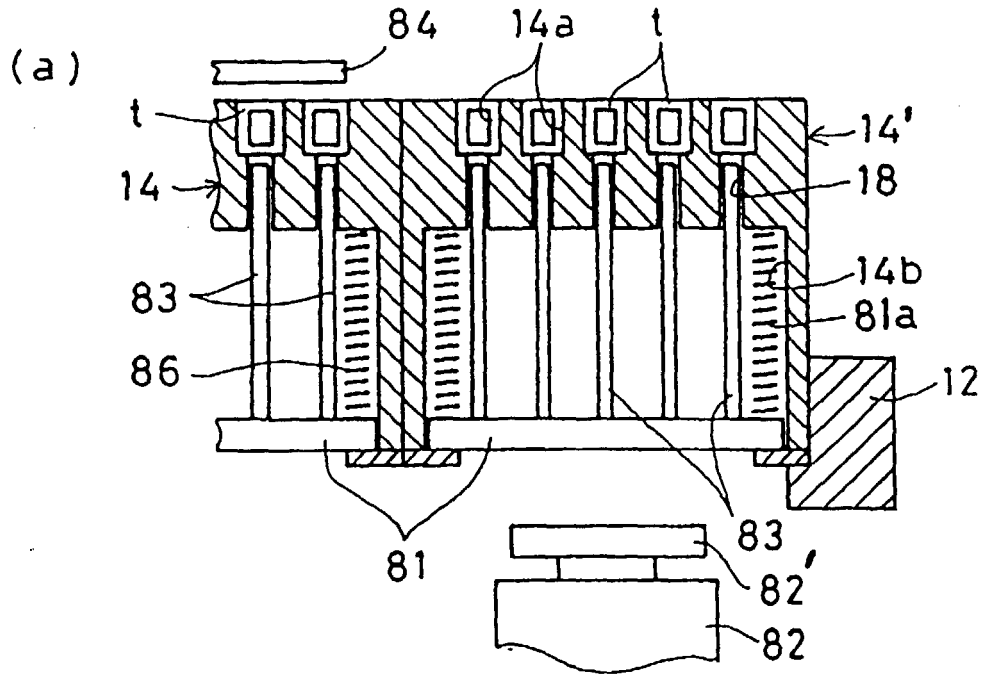




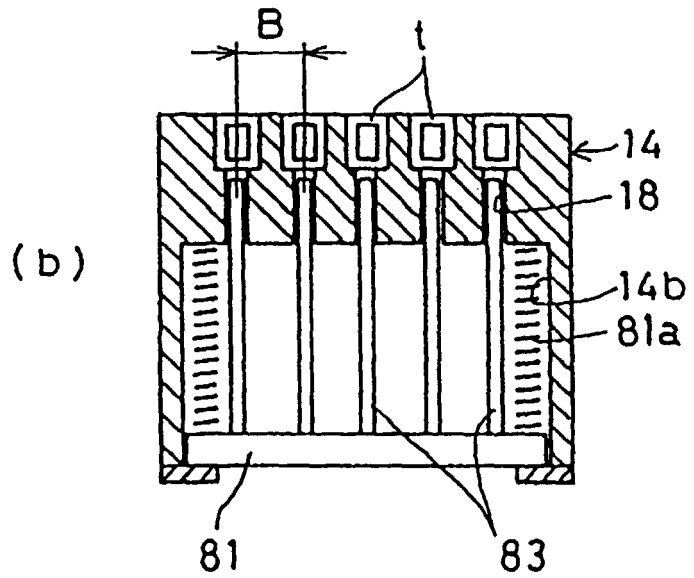
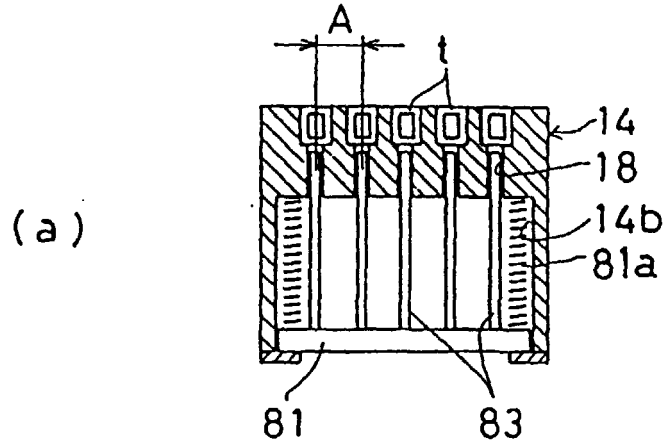
[Figure 21]



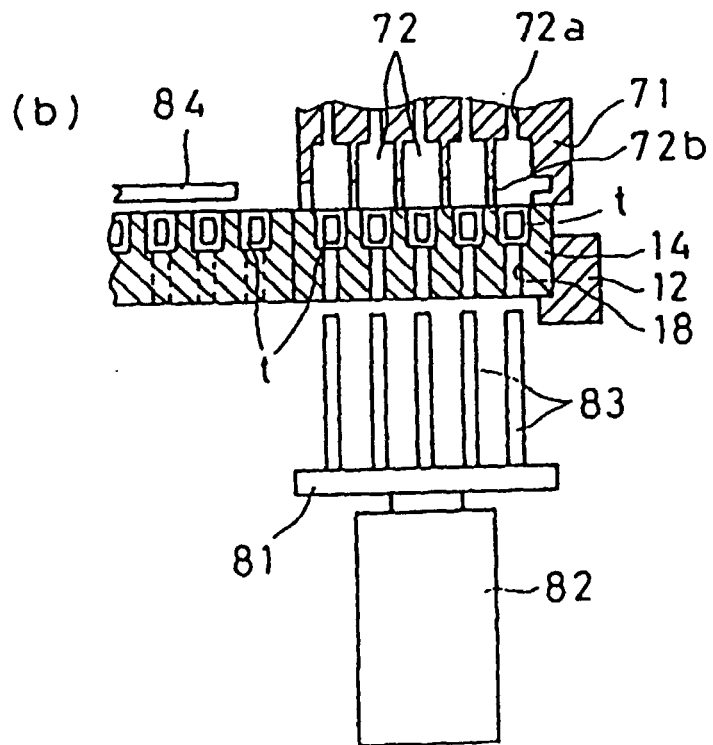
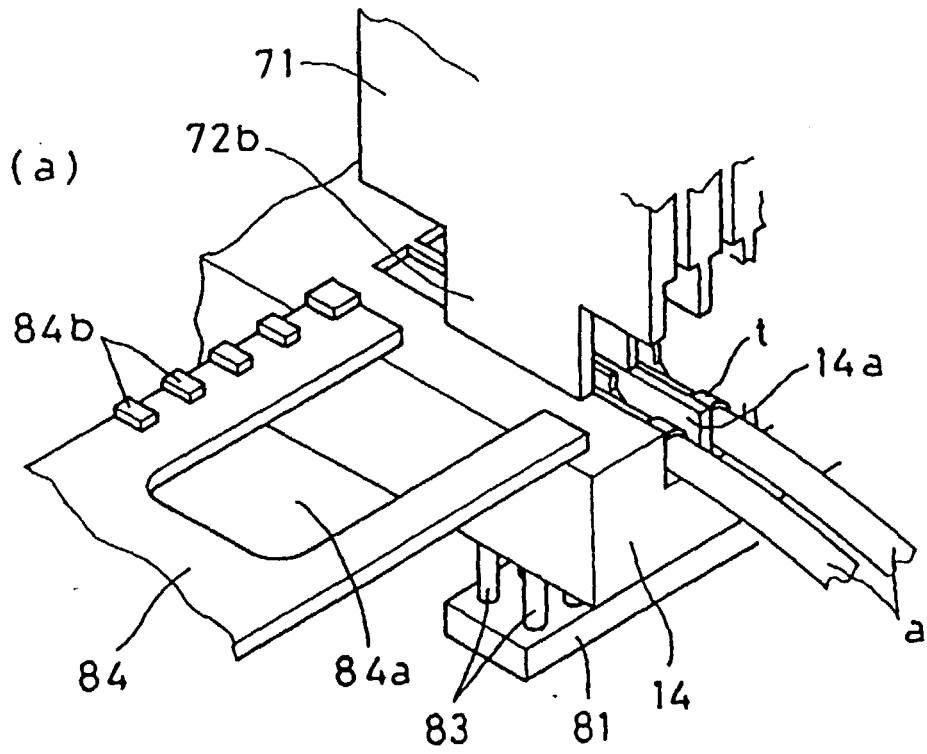
[Figure 22]



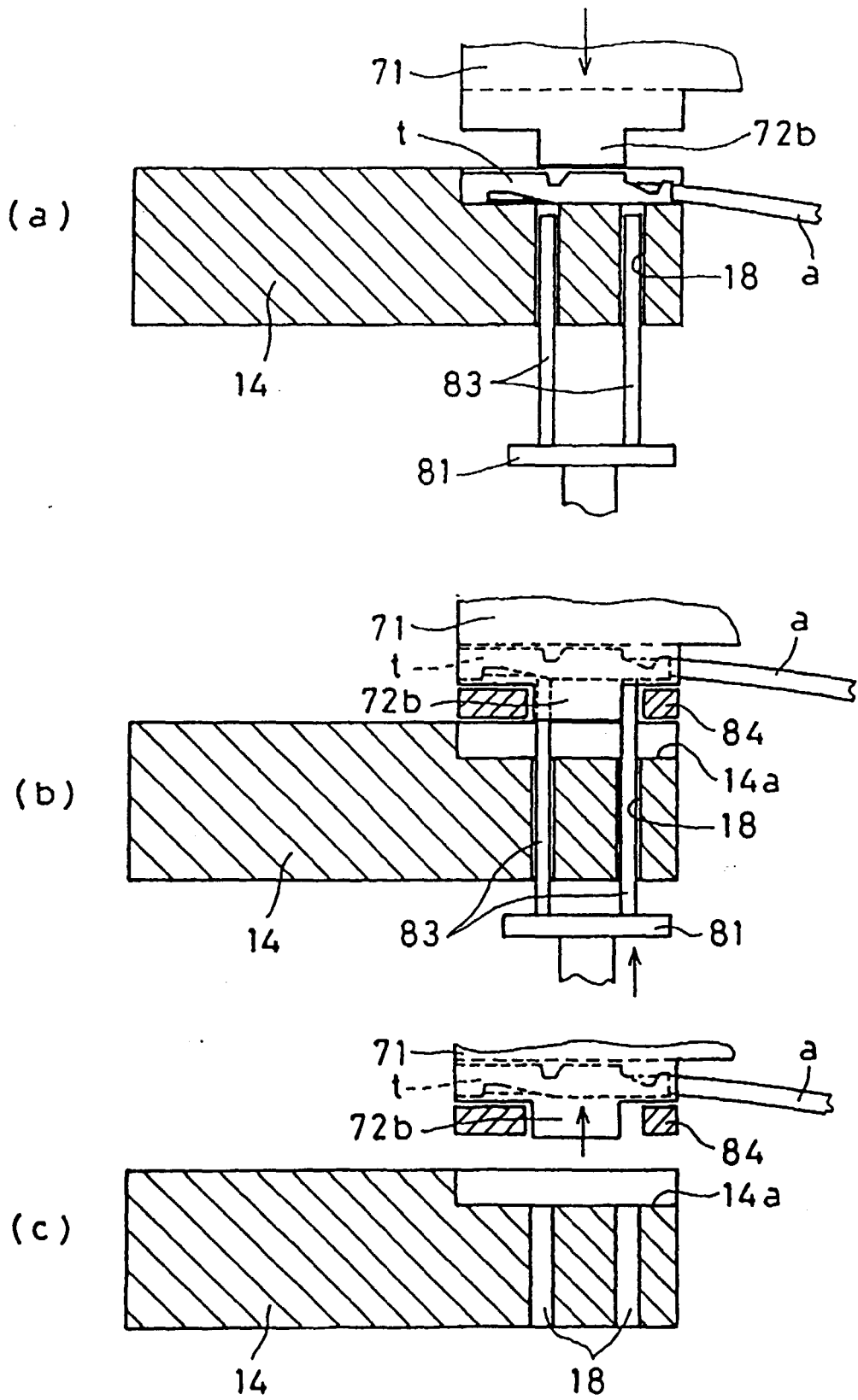
[Figure 23]



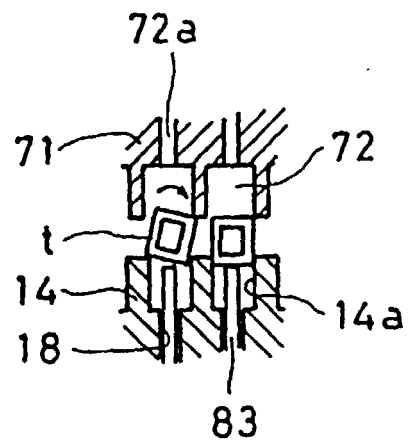
[Figure 24]



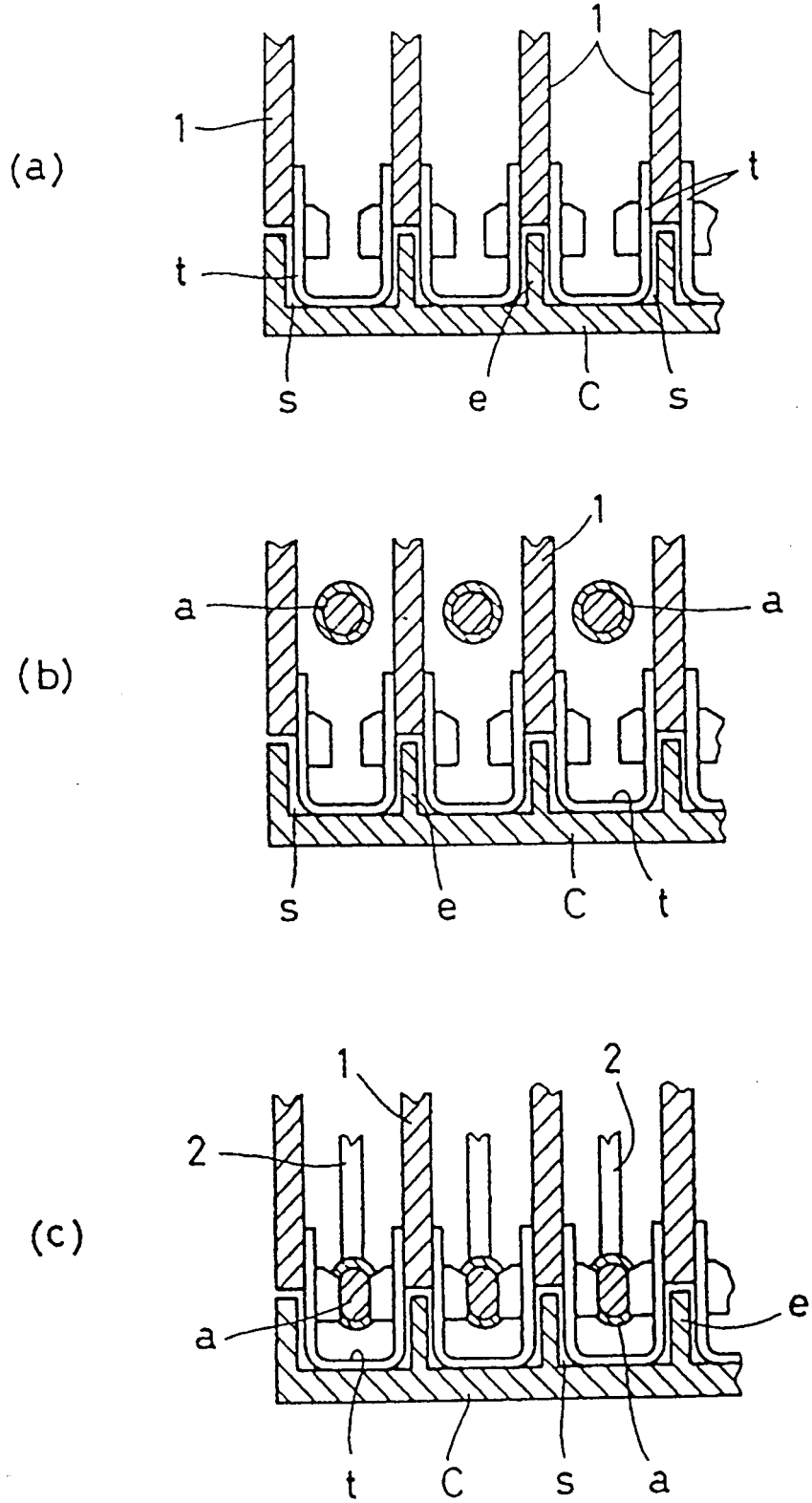
[Figure 25]



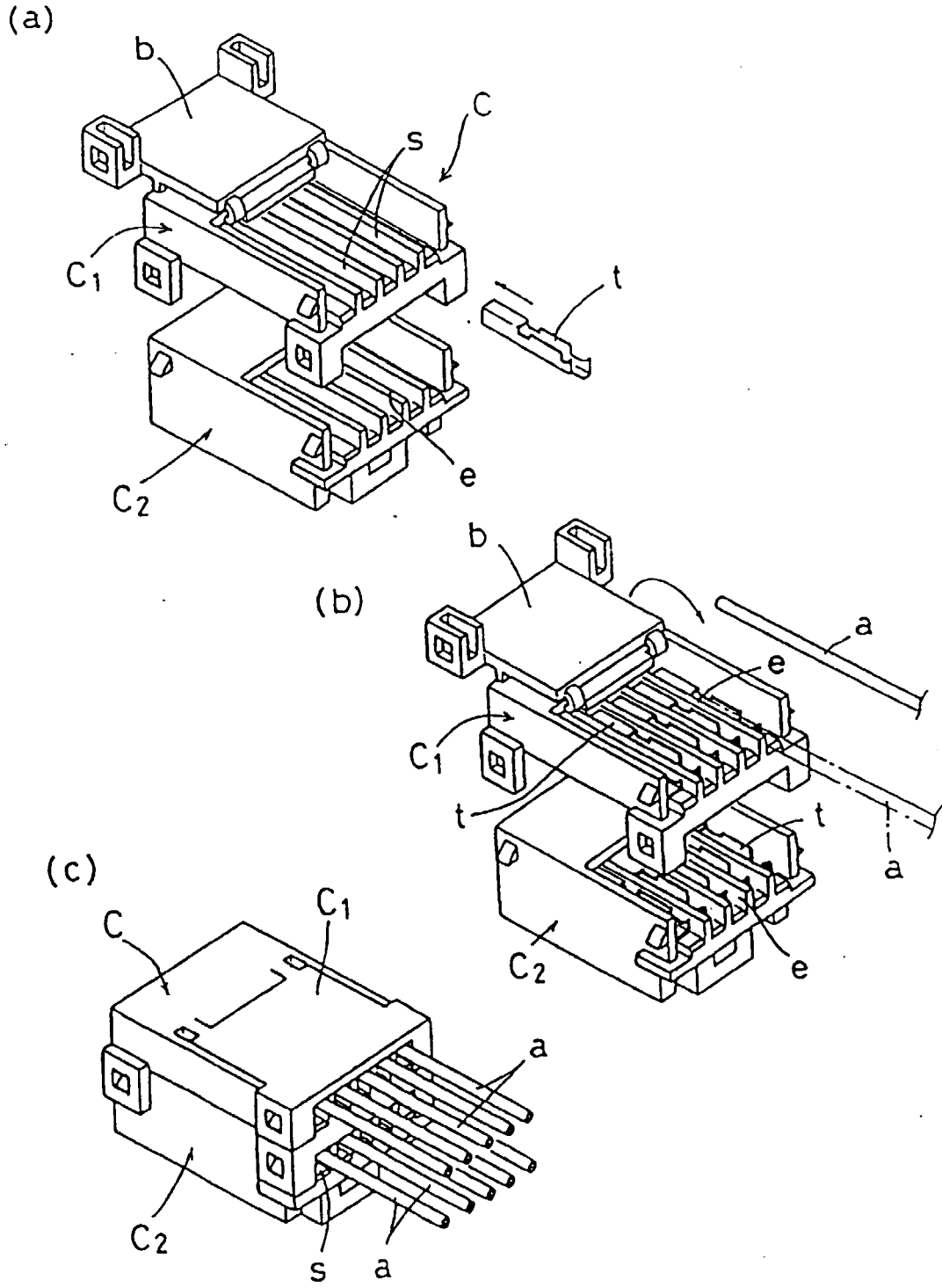
[Figure 26]



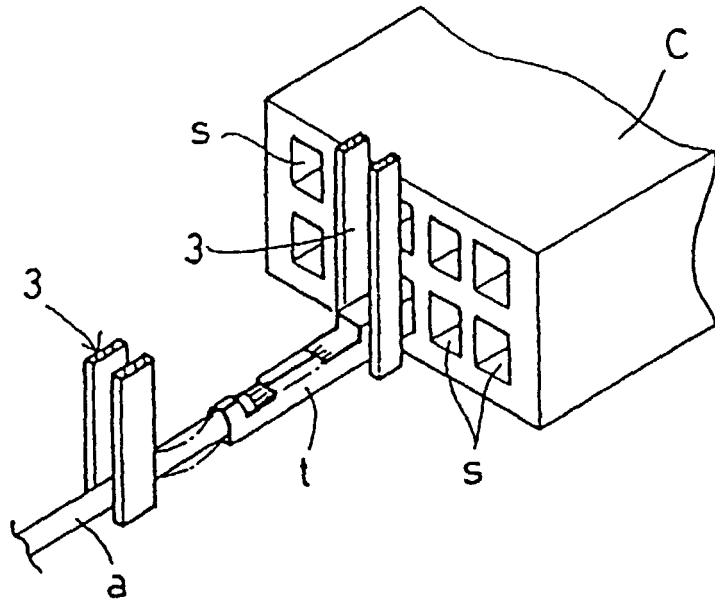
[Figure 27]



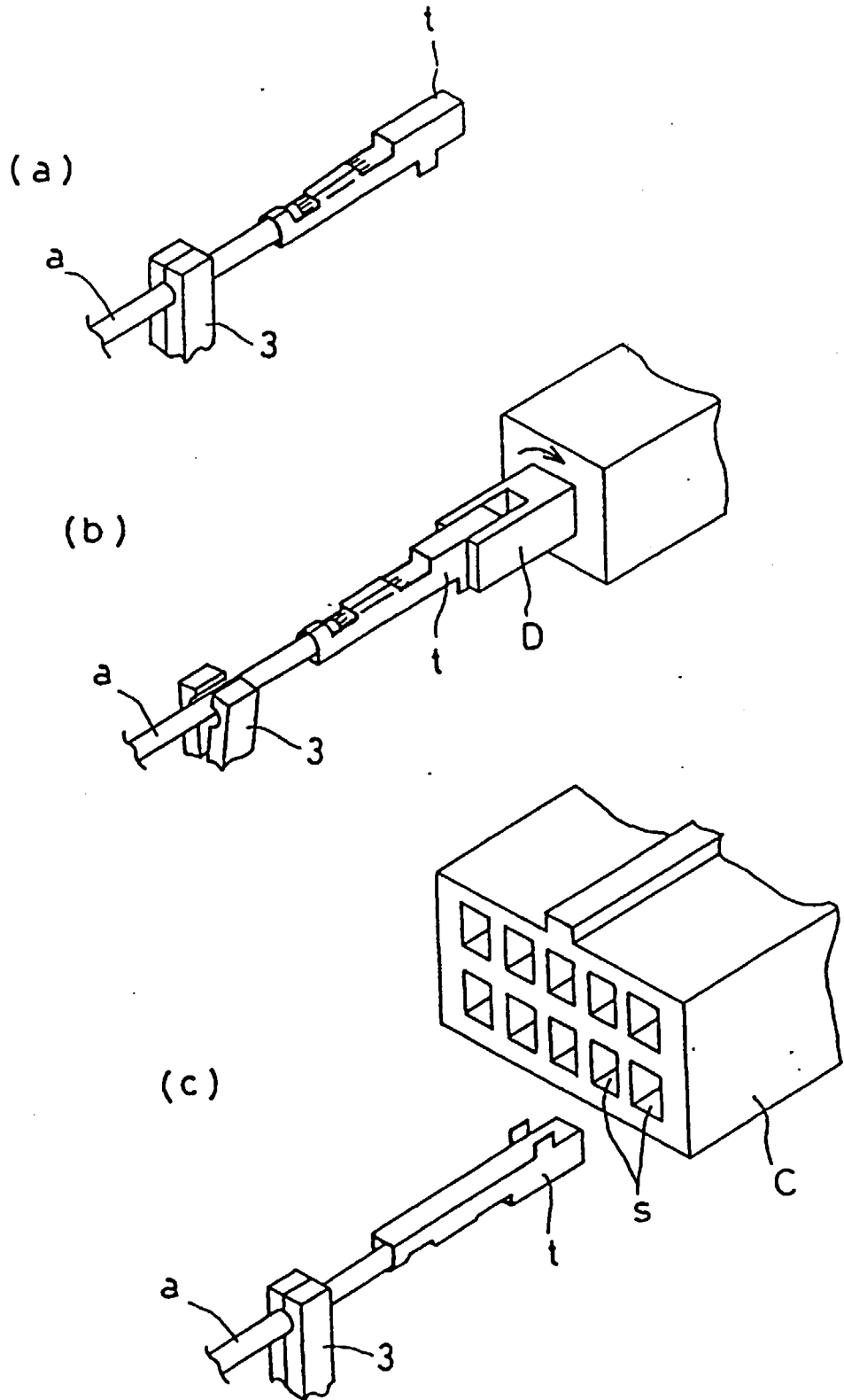
[Figure 28]



[Figure 29]



[Figure 30]





European Patent  
Office

EUROPEAN SEARCH REPORT

Application Number  
EP 00 30 1374

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.7)
Y	US 5 630 273 A (KOBAYASHI TAKASHI ET AL) 20 May 1997 (1997-05-20)	1	H01R43/20
A	* figures 10A-10C * * page 1, line 1-8 * * page 12, line 19 - page 13, line 6 *	4	
Y	PT 102 007 A (YAZAKI CORP) 28 November 1997 (1997-11-28) * figure 10 * * column 1, line 49 - column 2, line 9 * * column 2, line 51 - column 3, line 42 * * column 5, line 4-27 *	1	
A	US 4 375 229 A (MIKAMI HITOSHI ET AL) 1 March 1983 (1983-03-01) * figure 1 * * column 2, line 17-46 *	2,13,14	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01R
Place of search	Date of completion of the search	Examiner	
BERLIN	2 June 2000	Marcolini, P	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention	
X : particularly relevant if taken alone		E : earlier patent document, but published on, or after the filing date	
Y : particularly relevant if combined with another document of the same category		D : document cited in the application	
A : technological background		L : document cited for other reasons	
O : non-written disclosure		.....	
P : intermediate document		& : member of the same patent family, corresponding document	

EPO FORM 1503.03.92 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 30 1374

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-06-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5630273 A	20-05-1997	JP 8064333 A	08-03-1996
PT 102007 A	28-11-1997	JP 9306257 A	28-11-1997
		CN 1170210 A	14-01-1998
		US 5913553 A	22-06-1999
US 4375229 A	01-03-1983	JP 1005424 B	30-01-1989
		JP 1533580 C	12-12-1989
		JP 55144671 A	11-11-1980
		JP 1007468 B	08-02-1989
		JP 1603914 C	22-04-1991
		JP 55144672 A	11-11-1980
		JP 1411136 C	24-11-1987
		JP 55144673 A	11-11-1980
		JP 62012604 B	19-03-1987
		JP 1005425 B	30-01-1989
		JP 1533581 C	12-12-1989
		JP 55144674 A	11-11-1980
		JP 1428549 C	25-02-1988
		JP 55144675 A	11-11-1980
		JP 62036331 B	06-08-1987
		JP 55144676 A	11-11-1980
		DE 3015846 A	06-11-1980
		GB 2049500 A,B	31-12-1980

EPO FORM P0458

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82