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

(11) Publication number: **0 235 549 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87100977.5**

(51) Int. Cl.4: **H01R 43/01**

(22) Date of filing: **22.01.87**

(30) Priority: **22.01.86 DE 3601792**

(43) Date of publication of application:
09.09.87 Bulletin 87/37

(84) Designated Contracting States:
BE CH DE ES FR GB IT LI NL SE

(71) Applicant: **MINNESOTA MINING AND MANUFACTURING COMPANY**
3M Center, P.O. Box 33427
St. Paul, Minnesota 55133-3427(US)

(72) Inventor: **Myschik, Dieter Hermann Heinrich**
Struckholt 24
D-2000 Hamburg 63(DE)

(74) Representative: **Dipl.-Ing. H. Hauck Dipl.-Phys. W. Schmitz Dipl.-Ing. E. Graalfs Dipl.-Ing. W. Wehnert Dr.-Ing. W. Döring**
Neuer Wall 41
D-2000 Hamburg 36(DE)

(54) Flat cable connector device.

(57) Device for connecting a flat band cable (1) to a multi-contact connector (3), the device comprising a connector location, a cable support track (17) in which a cable is advanceable into an open connector being at the connector location (15), and a clamping plate (25) adapted to be pressed onto the laid-on cable, characterized in that a guide (31) leading to the connector location is provided for an open connector, in that the clamping plate is supported to be movable parallel with itself normally of the cable support track, and in that the clamping plate is supported only unilaterally and permits, upon being lifted, to shift the cable inwards and outwards in the direction of the guide.

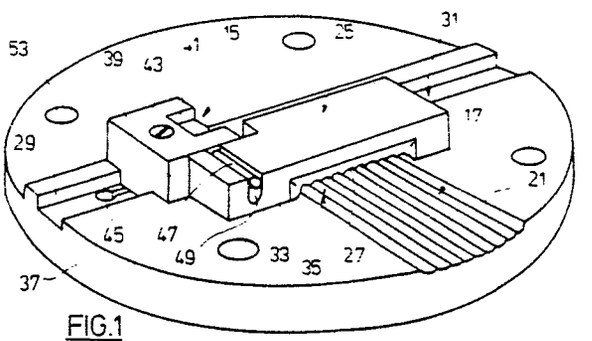


FIG.1

EP 0 235 549 A1

Flat Cable Connector Device

The invention relates to a device according to the preamble of claim 1.

In a known device of the kind indicated (German disclosure letter 27 11 062), the connector location is designed as a trough-like depression, and the clamping plate is pivotally supported at its own end laterally of the cable support track and can be clamped fast at its other side in its closing position pivoted onto the cable support track. For connecting a connector, the latter must be inserted into the trough-like depression, the cable must be laid on the cable support track, and the clamping plate must be pivoted into its closed position and clamped fast. Then, the connection can be effected by a relative movement between the connector and the cable normally of the cable support track. Thereafter, the clamping plate must be released and pivoted upwards, and the connected connector then can be withdrawn from the connector location and removed. These steps of operation are intricate, require a relative great amount of time, and cannot be performed automatically by simple means. Also, the structure of the device is rather complicated.

It is the object of the present invention to provide a structurally simple device which is suited for automation and by which multicontact connectors can be simply, conveniently, and rapidly connected to multi-core flat band cables.

According to the invention, that object is attained by the device according to claim 1.

In the device according to the invention, the connector can be moved into the connector location simply by shifting in the guide, and can be again shifted away from the connector location after the connection has been made, the flat band cable connected to the connector lifting the clamping plate and moving therebelow transversely of the cable support track when the connector is shifted out. This moving to and fro can be performed much simpler and more rapidly, and is more apt to become automated than the complicated movements which are necessary to lay a connector into a depression and to remove it again from the depression. In the device according to the invention, the clamping plate operates automatically and need not be pivoted open and closed, nor clamped first and again released. There are no complicated movably supported structural parts provided to clamp the clamping plate fast.

In total, there results from a most simple structure a very simple mode of operation which permits high working speeds when working manually as well as in the case of mechanized, automatic operation. Automation will not be difficult.

Preferably, the guide extends linearly normally of the cable support track. This will result in a still further simplification.

The clamping force with which the clamping plate is biased can be produced very simply in that the clamping plate has sufficient weight to generate the clamping force. Then, moreover the advantage is obtained that the clamping force is independent upon the level of the clamping plate above the cable support track.

Further, the clamping force can be, of course, generated also by spring force. This will result in the advantage that the device can be operated substantially independently of its position.

Normally, multi-contact connectors comprise a lower part provided with cutting contact elements, and an upper part which can be plugged together with the lower part, and can be pressed together from an open position in which an introduction opening for the cable is formed between the lower part and the upper part, into a closed position in which the cable is connected and the parts of the connector are securely interengaged. According to a development of the invention, the guide is designed for the insertion of the upper part and is arranged in a fixed position relative to the cable support track. Thus, it is not necessary to provide a relative movability between the cable support track and the guide, because the relative movement which is necessary to close the connector can be performed solely by pressing-on the lower part which is arranged on top.

With the device according to the invention, about 10 to 15 connectors per minute can be connected by manual work. With the initially described known device, only a fraction of that working speed can be obtained.

For the sake of completeness, it should be mentioned that it is known to shift a flat band cable manually into a pre-assembled bipartite connector and to connect it by pressing the connector together. In doing so, an exact guiding and smoothening of the cable cannot be sufficiently ensured because of the limited dimensions of the connector, and the manual threading-in the cable is time-consuming and forms a step which cannot be automated at an acceptable expense.

Furthermore, there are automatic connecting devices in which the two parts of the connector and the flat cable to be connected are brought up from stock and assemble automatically. While a threading-in will be avoided in this manner, the mechanical expense is considerable.

The invention will be subsequently described by means of embodiment examples in connection with the drawings.

Fig. 1 is a diagrammatic perspective view of a device according to the invention.

Fig. 2 illustrates in a similar representation as Fig. 1 the shifting of a connector into the guide.

Fig. 3 is a partial sectional view of a detail of the device shown in Fig. 2.

Fig. 4 is a perspective partial view, showing fractions of a connector upper part shifted into the guide.

Fig. 5 shows in a similar representation as Fig. 1 the connector when shifted into place but still open, and the flat band cable inserted thereto.

Fig. 6 shows, similarly as Fig. 3, a detail of Fig. 5.

Fig. 7 illustrates the shifting-out of the finished connection with the clamping plate being lifted.

Fig. 8 shows, similarly as Fig. 3, a detail of Fig. 7.

Fig. 9 is a diagrammatic perspective view of another embodiment of a device according to the invention.

Fig.10 shows, in a diagrammatic representation which is enlarged with respect to Fig. 9, a part of Fig. 9.

The Figures show a device for connecting an electrical multi-core flat band cable 1 (Fig. 2) to a multi-contact connector 3 (Figs. 2, 5 and 7), which in the usual manner comprises a lower part 7 provided with cutting contact elements 5, and an upper part 9 guided thereon. By pressing the parts 7 and 9 together in the direction 11, they can be transferred from the open position illustrated in Figs. 2 and 5 in which an opening 13 is formed between the parts 7 and 9 for the insertion of the cable 1, into a closed position (Fig. 7) in which the connector is electrically and mechanically connected to the cable 1.

A connector location 15 is defined on the device. If the connector is arranged there, it is located in a receiving position suited for the connection with the cable 1, as illustrated in Fig. 5. The device furthermore comprises a cable support track 17 on which the cable 1 to be connected can be shifted in the direction of the arrow 19 (Figs. 2, 5) into a ready position in an open connector being in the receiving position (Fig. 5). The cable support track 17 has grooves 21 for slidingly guiding the longitudinal ridges 23 of the cable 1 which are formed by the cable cores (Figs. 2, 5).

The device furthermore comprises a clamping plate 25 which is movable relative to the cable support track 17 and in the illustrated embodiment also has grooves 27 in an arrangement corresponding to the grooves 21 of the cable support track 17.

It is appropriate to limit the insertion of the cable into the connector by an abutment which can be provided at the device or at the connector 3. In the illustrated embodiment, such an abutment 29 is provided at the device.

At the device, a straight guide leading to the connector location 15 is provided, in which an open connector 3 to be connected can be advanced into the receiving position, i.e. into the connector location 15.

The clamping plate 25 is supported to be movable parallel with itself in a direction normally of the cable support track 17, i.e. normally of the advancing direction 19 of the cable 1 (Figs. 2, 5). The clamping plate 25 is biased towards the cable support track 17 and forms at its front surface 33 which faces away from the connector location 15 an insertion hopper 35 with the cable support track 17.

The clamping plate 25 is supported only unilaterally and when lifted permits that the cable which is arranged between the clamping plate and the cable support track 17 is shifted inwards and outwards transversely of the cable support track 17, i.e. in the illustrated embodiment in the direction of the guide 31, whereby the completely connected connector can be removed from the device simply by moving it backwards in the guide 31 (Figs. 7, 8).

In the illustrated embodiment, the bias of the clamping plate is created simply by the weight thereof. The weight is dimensioned so that the desired clamping force is obtained when the device is arranged in the illustrated orientation in which the clamping plate 25 is disposed above the cable support track 17. Alternatively, or in addition thereto, the clamping plate also can be biased by spring force. This is not illustrated in the Figures.

In the illustrated embodiment, the guide 31 is designed to guide the upper part 9 of the connector 3 and is arranged in a fixed position relative to the cable support track 17. Thus, the connector is inserted into the guide 31 upside down, i.e. with the upper part being below.

In the illustrated embodiment, a particularly simple structure is obtained in that the cable support track 17 as well as the guide 31 which simply is formed as a straight groove are formed unitarily in a base plate 37.

In the illustrated embodiment, the connector location 15 is defined by a block 39 which comprises an abutment profile 41 for the connector 3.The block 39 is secured in the guide 31 by means of a screw 43. In the illustrated embodiment, a plurality of throughgoing openings 45 for the screw 43 are provided in the bottom of the guide 31 at mutual distances in the direction of the guide, whereby the block 39 can be secured along

the guide 31 in different positions. Also, a continuous adjustability can be obtained by providing a slot instead of individual openings 45. The adjustability of the block 39 can be useful or necessary for adaptation to different embodiments of connectors.

For supporting the clamping plate 25, very simply a pin 47 is provided in the illustrated embodiment, which is secured in the block 39 and enters into a groove 49 of the clamping plate 25. The groove 49 is disposed so closely besides the adjacent end of the clamping plate 25 that if desired, the clamping plate, after having been lifted, also can be pivoted about the pin 47 away from the cable support track 17. This can be appropriate if a connector shall be connected to a throughgoing cable; in such a case, the device would have to be designed without the abutment 29, for instance by correspondingly reducing the height of the wall of the guide 31 which forms the abutment 29.

In the illustrated embodiment, a cable channel 51 (Fig. 3) is formed between the cable support track 17 and the clamping plate 25, which limits the insertion path of the cable 1 laterally. For forming the insertion hopper 31, the front end of the part of the cable channel 51 disposed in the clamping plate 25 is chamfered.

The base plate 37 is provided with mounting holes, for instance 53, so that it can be easily attached at any point.

If desired, a snapping device can be provided which cooperates with the connector 3 when the latter is in the receiving position (at the connector location 15), whereby the correct position of the inserted connector can be recognized more easily as a snapping-in process.

In Fig. 5, a snapping spring 55 which is suitable as a snapping device is illustrated, which cooperates with a mounting hole of the connector 3; in Fig. 5, the corresponding mounting hole 57 at the other end of the connector 3 is illustrated.

The pressing-together of the connector is effected at the connector location by means of any suitable device, for instance a press having a limited pressing force.

In Figs. 9 and 10, parts which appear correspondingly in Figs. 1 to 8, are designated with the same reference numerals as there, however, with a prefixed "9". Insofar, with respect to Figs. 9 and 10, reference is also made to the description of Figs. 1 to 8.

The embodiment according to Figs. 9 and 10 is particularly suited for the frequently occurring case of working with flat conductor cables which have different widths, i.e. different numbers of conductors, but are structurally similar in other respects.

In a base plate 937 which comprises mounting holes 953, a cable support track 17 is provided with a width so that the track is suited for a given maximum number of conductors, for instance 64, and comprises a corresponding number of grooves 921. As according to Figs. 1 to 8, a guide 931 for a connector to be attached (not illustrated) extends transversely of the grooves 921, and a block 939 is provided which is adjustable along the guide 931 and determines the connector location 915. The block 939 is connected with a lateral stop 59 for a longitudinal edge 61 of an end portion of a flat conductor cable 901 to be introduced, whereby the position of a cable 901, in the direction of the guide 931, which is introduced while being in contact with the stop 59, is dependent upon the setting of the block 939. Thus, it can be particularly achieved that a pressing force center point 63 (corresponding to the area where the center of a non-illustrated pressing ram will be effective) which is predetermined on the device will be disposed centrally of the introduced cable 901 and the non-illustrated connector. This is advantageous with a view to a uniform pressing-together of the connector. In order to facilitate and ensure the introduction in contact with the lateral stop 59, a second lateral stop 65 is provided in the illustrated embodiment, which is also adjustable in the direction of the guide 931, and which is shifted to the other longitudinal edge 67 of the cable 901 so that an introduction channel fitting in width will result between the lateral stops 59 and 65. In order to facilitate the introduction of the cable end portion, the front ends of the lateral stops 59 and 65 are provided with chamfers 69 and 71, respectively, in the embodiment illustrated. In order that the lateral stops are always correctly aligned with one of the grooves 921, the lateral stops are provided, in the embodiment illustrated, on their bottom sides each with at least one protrusion which enters into the grooves 921. Such a protrusion 73 can be recognized in the larger illustration of Fig. 10. The protrusions are radiused in order that they can slide over of the grooves 921 when the side stops 59, 65 are adjusted, and the cable 901 can be easily taken out laterally after the attachment of the connector, with the second side stop 65 being displaced upwardly by the flat conductor cable.

In the embodiment illustrated, a graduation 75 is provided which indicates the position of the block 939 in the guide 931 and comprises markings 77 for different numbers of conductors, i.e. certain widths, of the employed type of flat conductor cable 901. The graduation 75 is designed so that with an adjustment to the number of conductors of the particular cable 901 introduced, the pressing force center point 63 will be disposed substantially centrally of the cable width.

In the illustrated embodiment, a particularly simple structure is obtained in that the block 939 and the lateral stop 59 are adjustably supported at the clamping plate 925. This has the advantage that the clamping plate 925 and the lateral stop 59 are lifted in common, and the support of the clamping plate 925 can be designed in any manner on the device, independently of the block 939. For the same reasons, also the second lateral stop 65 is, in the embodiment illustrated, adjustably supported at the clamping plate 925. In the illustrated embodiment , the support of the clamping plate 925 comprises, similarly as according to Figs. 1 to 8, a pin 947 which engages into a groove 949. Mounting blocks 79 and 81 serve as a lateral delimitation of the support and for holding the pin.

In the illustrated embodiment, the clamping plate 925 has, as in the embodiment according to Figs. 1 to 8, a chamfered introduction funnel 935 which leads, in the advancing direction 919, to the support surface 83 proper of the clamping plate 925. In the illustrated embodiment, the clamping plate 925 furthermore has a plate-shaped extension 85 which extends oppositely to the advancing direction 919 and serves to guide the lateral stops 59 and 65. To this end, the lateral stops 59 and 65 are guided at the front surface 87 and the lower surface of the extension 85. Relatively thin continuations 89 and 91, respectively, of the lateral stops 59 and 63, respectively, extend across the lower surface of the extension 85. Screws extend from those continuations through slots 93 and 95, respectively, which extend parallel with the guide 931. By means of nuts 97 and 99, respectively, screwed onto those screws, the lateral stops 59 and 63 can be clamped fast. The continuation 89 of the first lateral stop 59 continues to form the block 939.

In the illustrated embodiment, handling is facilitated in that the clamping plate 925 comprises a conveniently grippable handle 101 so that removing of a cable with the connector attached thereto can be conveniently facilitated by lifting the clamping plate 925.

Furthermore, in the embodiment illustrated in Figs. 9 and 10, the introduction path of an end portion of a cable 901 is limited in the advancing direction 919 by an abutment 929 which can be moved out of the introduction path. Thereby, the device can be used also with continuous cables. In the illustrated embodiment, the abutment 929 is designed at a shifting piece 103 which is shiftable in a slot which extends parallel with the guide 931, and can be clamped fast by means of a screw knob 107.

Claims

1. Device for connecting an electrical multicore flat band cable (1) to a multi-contact connector (3), the connector comprising two parts (7, 9) which are adapted to be relatively pressed from an open position into a closed position and to be electrically and mechanically connected to the cable by the closing step, the device comprising a connector location (15) adapted to receive a part of the connector (3) and to thereby put the same into a connector receiving position suited for the connection with the cable (1), a cable support track - (17) on which a cable (1) can be shifted forward into a ready position suited for the connection with the connector (3), the cable support track (17) preferably having grooves (21) to slidingly receive the longitudinal ridges (23) of the cable formed by the cable cores, and a clamping plate (25) which is movable relatively to the cable support track (17) and preferably also has grooves (27) in an arrangement corresponding to the grooves (21) of the cable support track (17), and preferably an abutment (29) which is effective when connecting a cable end to limit the advancing of the cable (1), characterized in that a guide (31) is provided which leads to the connector location(15) and in which an open connector (3) to be connected can be advanced into the connector receiving position, in that the clamping plate (25) is supported to be movable parallel with itself in a direction normal to the cable support track (17), is biased towards the cable support track (17) with a force sufficient to lay down the cable(1), and forms, at its front surface which faces away from the connector location (15), an insertion hopper with the cable support track - (17), and in that the clamping plate (25) is supported only on one side and permits, upon being lifted, a shifting of the cable (1) in the direction of the guide (31).

2. Device according to claim 1, characterized in that the guide (31) is straight and extends normally of the cable support track (17).

3. Device according to claim 1 or 2, characterized in that the cable support track (17) and the guide (31) are formed unitarily in a base plate (37).

4. Device according to one of the preceding claims, characterized in that the clamping plate - (25) has a weight dimensioned to generate a sufficient clamping force.

5. Device according to one of the preceding claims, characterized in that the clamping plate is biased by spring force.

6. Device according to one of the preceding claims, characterized by a snapping device (55, Fig. 5) for snapping-in the connector (3) at the connector location (15).

7. Device according to one of the preceding claims, for connectors which comprise a lower part (7) provided with contact elements (5) and an upper part (9) and can be connected to an inserted cable (1) by moving the upper part (9) relative to the lower part (7), characterized in that the guide - (31) is designed for guiding the upper part (9) and is arranged in a fixed position relative to the cable support track (17).

8. Device according to one of the preceding claims, characterized by a block (39; 939) which is adjustable along the guide (31; 931) and defines the connector location (15; 915).

9. Device according to claim 8, characterized in that the block is connected to a lateral stop (59) for a longitudinal edge (61) of an end portion of a flat conductor cable (901) to be introduced, the lateral stop being disposed on the cable support track - (917).

10. Device according to claim 9, characterized by a second lateral stop (65) for the other longitudinal edge (67) of the flat conductor cable (901), the second lateral stop being disposed on the cable support track (917) and being adjustable in the direction of the guide (931).

11. Device according to claim 10, characterized in that the lateral stops (59, 65) comprise chamfers (69, 71) at their front ends, which facilitate the introduction of the flat conductor cable (901).

12. Device according to one or a plurality of the claims 9 to 11, wherein the cable support track (917) comprises grooves (921) to slidingly receive the longitudinal ridges formed by the cores of the flat conductor cable (901), characterized in that the lateral stop (59, 65) comprises at least one protrusion (73) which enters into the grooves (921).

13. Device according to claim 12, characterized in that the protrusion (73) is radiused.

14. Device according to one of the claims 8 to 13, characterized by a graduation (75) indicating the position of the block (939), the graduation comprising markings (77) for different numbers of cores, i.e. different widths of the employed type of a flat conductor cable (901), so that with a corresponding adjustment of the block (939), a predetermined pressing force center point (63) is disposed essentially centrally of the cable width.

15. Device according to one or a plurality of the claims 9 to 14, characterized in that the block - (939) and the lateral stop (59) connected therewith are adjustably supported at the clamping plate - (925).

16. Device according to claim 15, characterized in that the second lateral stop (65) is adjustably supported at the clamping plate (925).

17. Device according to one of the claims 8 to 14, characterized in that the clamping plate (25) is supported at the block (39) and is adjustable together with the block in the direction of the guide - (31).

18. Device according to one of the claims 8 to 17, characterized in that the block (39) is securable in the guide (31).

19. Device according to one of the claims 8 to 18, characterized in that the block is securable along the guide (31) in predetermined different positions.

20. Device according to one of the preceding claims, characterized in that the clamping plate - (925) comprises a conveniently grippable handle - (101) in an area spaced from the support of the clamping plate.

21. Device according to one of the preceding claims, and including an abutment disposed in the introduction path (919) of an introduced cable end portion, characterized in that the abutment (929) is movable out of the introduction path.

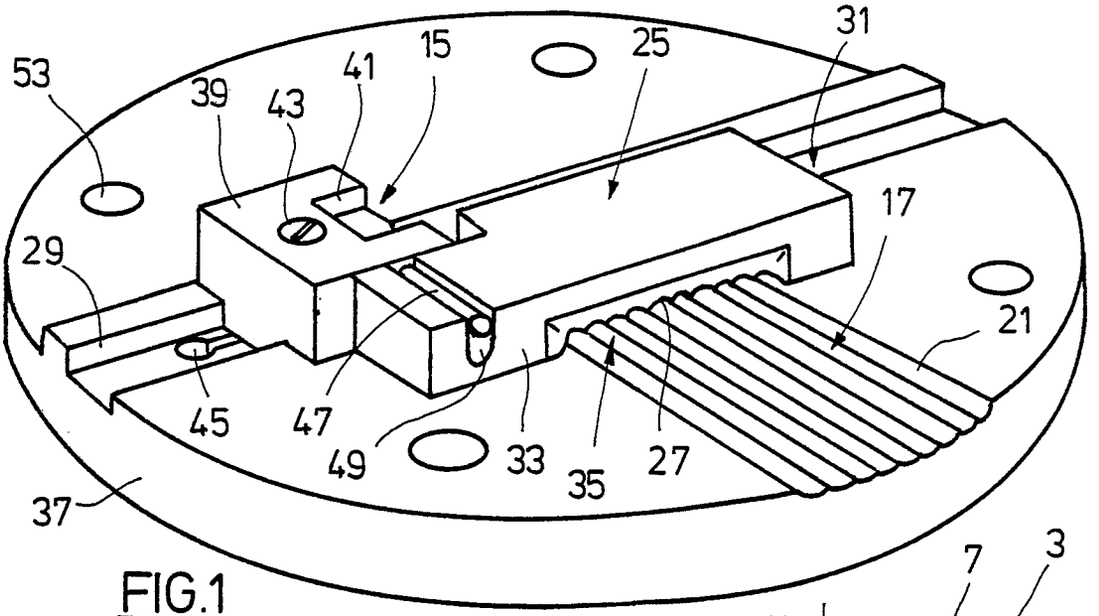


FIG.1

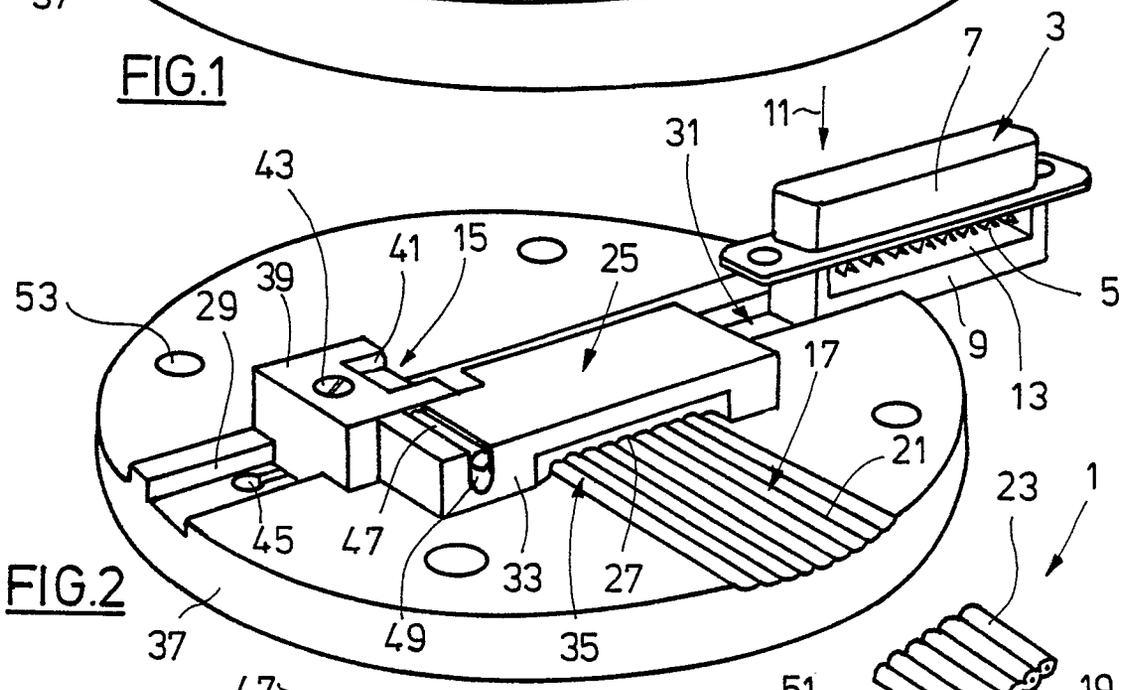


FIG.2

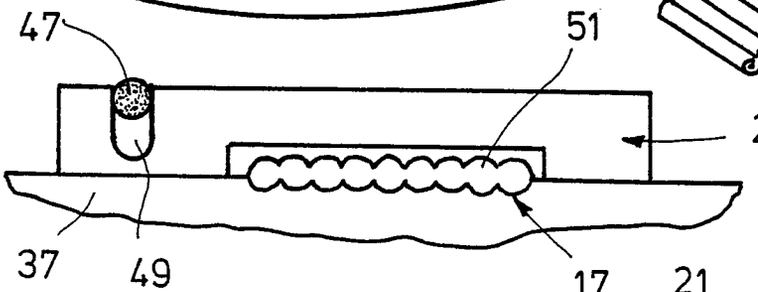


FIG.3

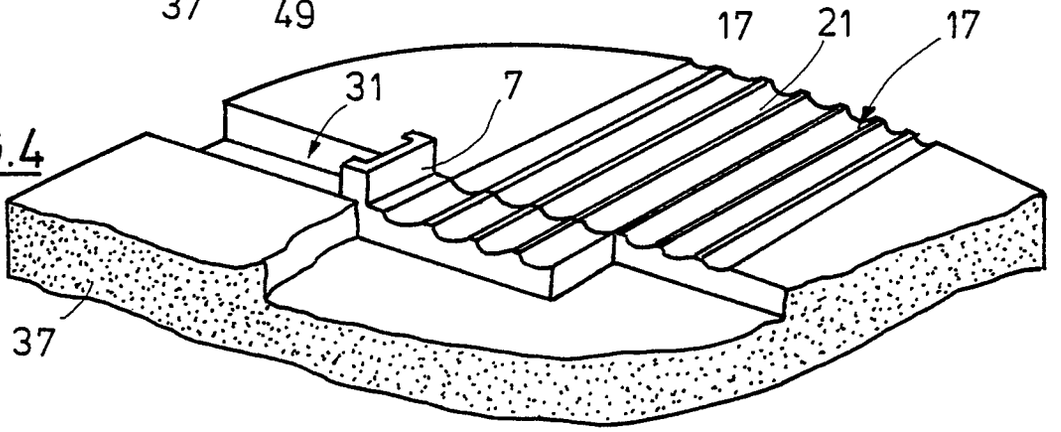
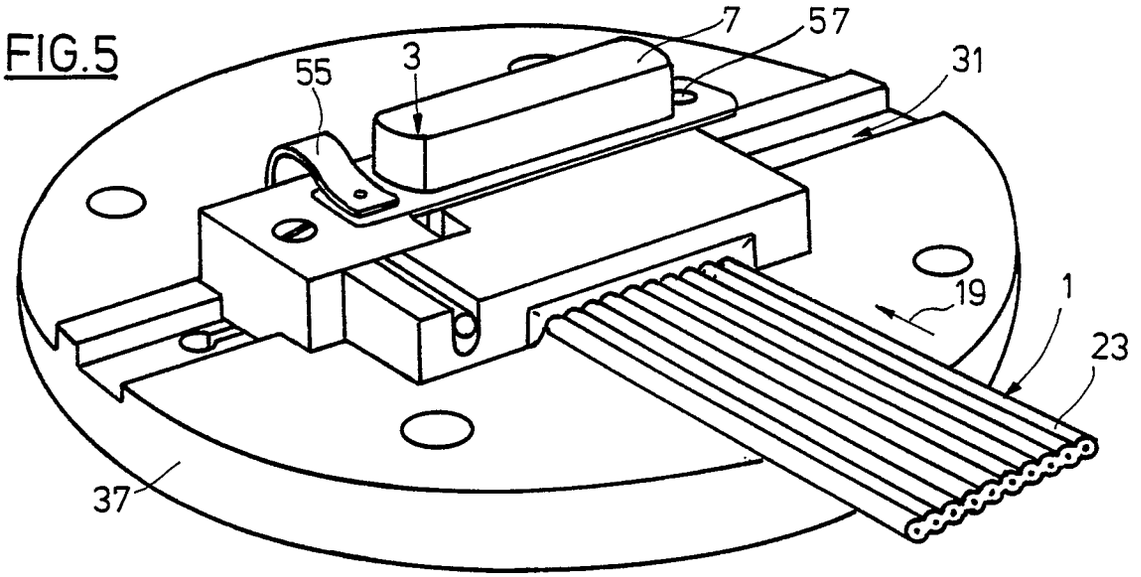


FIG.4

FIG.5



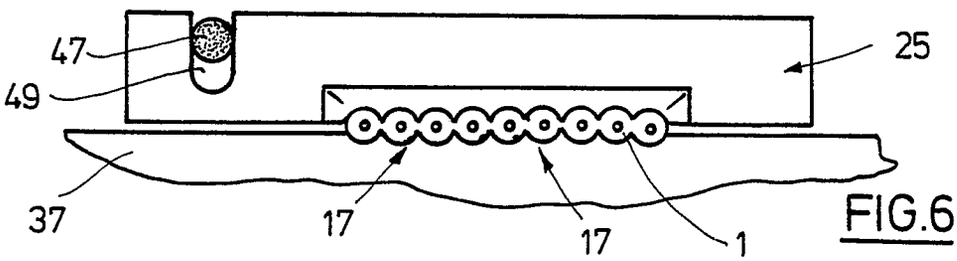


FIG.6

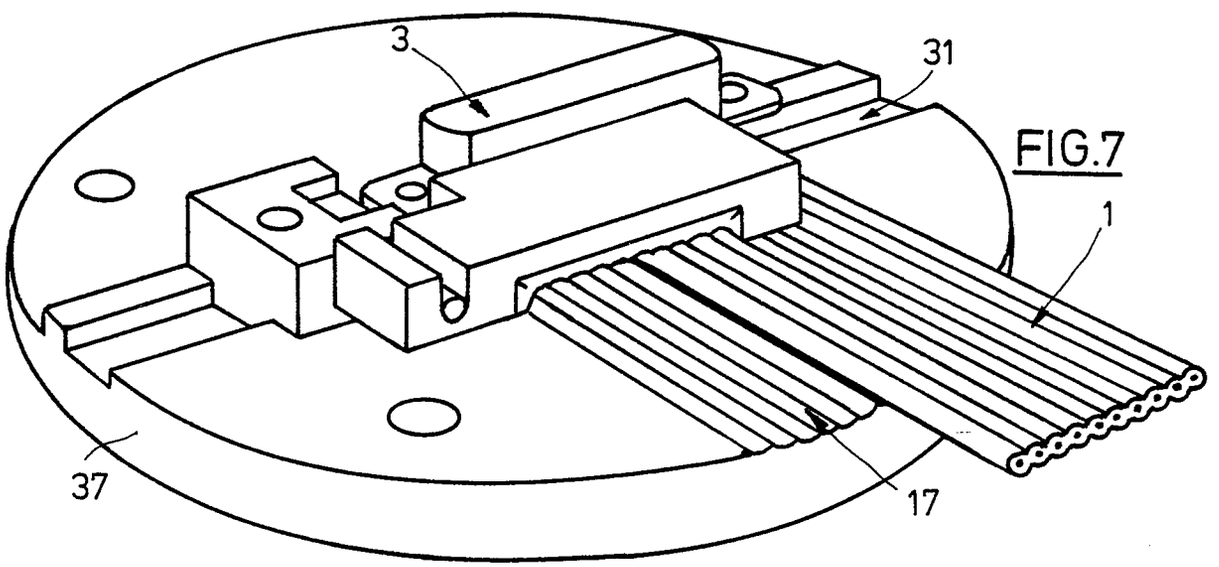


FIG.7

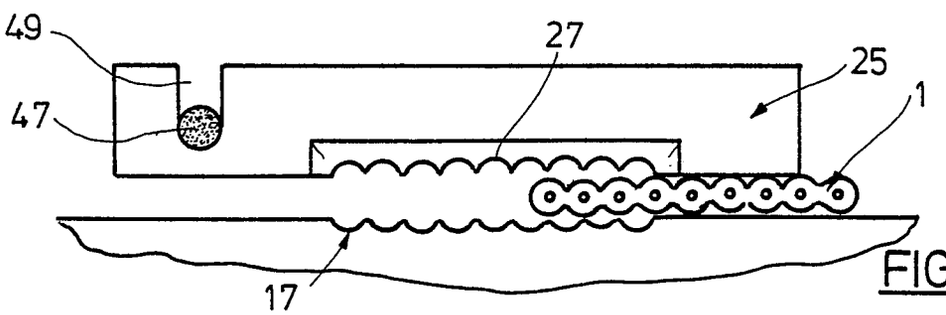


FIG.8

FIG. 9

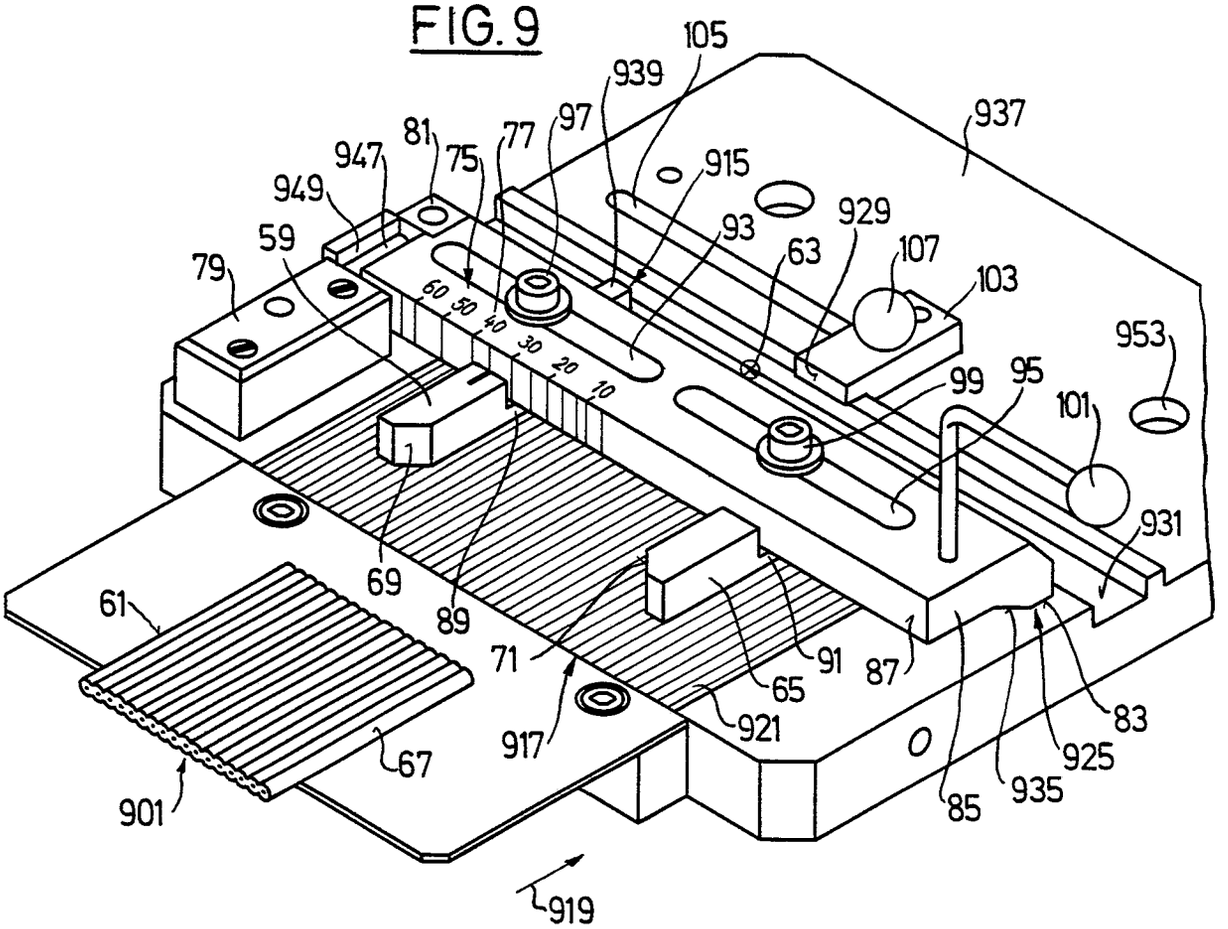
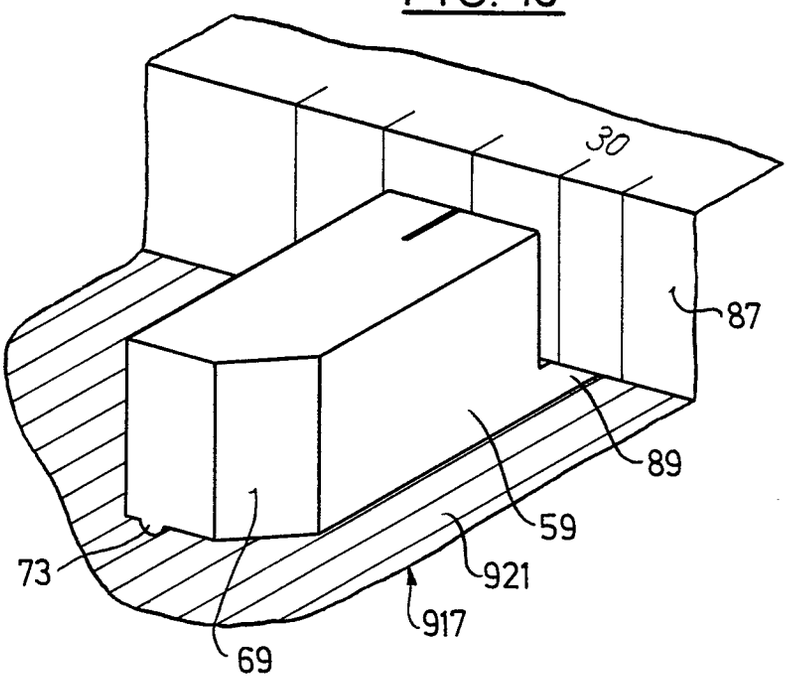

105
939
937
81
77
97
947
75
915
949
929
93
59
63
107
79
103
953
99
95
101
931
69
89
71
61
91
87
65
921
83
917
67
925
935
85
901
919

FIG. 10


30
87
89
59
73
921
917
69

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 87 10 0977

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.4)
Y	US-A-4 020 540 (A. CASCIOTTI et al.) * column 3, lines 34-52; column 5, lines 13-22; column 5, line 51 - column 6, line 6; figures 1,2,4,14 *	1,2,5, 6,8-10	H 01 R 43/01
Y	US-A-4 561 178 (L.L.J. VAN DE KERKHOF) * column 3, line 67 - column 4, line 7; column 5, lines 1-45; figures 2-6,15 *	1,2,5, 6,8-10	
A	US-A-4 488 353 (J.E. CAVENEY et al.) * column 4, lines 17-32; figures 1,5,6 *	3,7	
A	EP-A-0 099 684 (MINNESOTA MINING & MANUFACTURING) * page 6, lines 10-15; page 7, lines 16-21; figure 1 *	1,2,14	TECHNICAL FIELDS SEARCHED (Int. Cl.4) H 01 R 43/00
A	US-A-4 429 455 (D.C. ROEKER) * column 2, lines 50-60; column 3, lines 21-26; figure 1 *	1,3	
A	US-A-4 519 129 (J.E. CAVENEY et al.) * column 5, lines 18-23; figure 1 *	1,2	

-/-

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	22-04-1987	LEOUFFRE M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503 03 82

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 87 10 0977

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.4)
D,A	DE-A-2 711 062 (AMP) * page 17, line 29 - page 18, line 5; page 19, lines 19-21; figure 3 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	22-04-1987	LEOUFFRE M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503 03 82