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SPECIFICATION

ELECTRICAL CONNECTOR WITH
IMPROVED TERMINAL RETENTION MEANS ✓

Field of the Invention

5 This invention generally relates to the art of electrical connectors and, particularly, to an improved system for retaining terminals in connector housings.

Background of the Invention

10 There are a variety of electrical connectors which are used for making a required electrical connection between a flat electrical cable, such as a flat flexible cable or a flexible printed circuit board, and an associated electrical device which may include a second printed circuit board. Such connectors typically include a plurality of terminals press-fit in a dielectric housing.

15 The terminals have contact portions for engaging the conductors of the flat cable or the male terminal pins of a mating connector, thus making the required electrical connection to the associated electrical device. The terminals may have solder tails projecting from the

20 dielectric housing for soldering to circuit traces on the associated printed circuit board.

Problems continue to be encountered in providing an adequate system or means for retaining the terminals within the housings of connectors as described above.

25 Movement of the terminals, particularly the contact portions thereof, relative to the connector housings can have a considerable adverse effect on the connections between the terminals and the flat cable, for instance.

In particular, a terminal typically is inserted

30 into a slot in the connector housing. The terminal includes a resiliently deflectable contact section extending into a portion of the slot for engaging a conductor of the cable. A terminating section, such as a



solder tail, projects outwardly of the housing. An intermediate retention section typically is disposed somewhere between the contact section and the terminating section to retain the terminal in the slot of the housing.

5 For instance, the retention section may be a barb or leg press-fit into a portion of the terminal slot. In other words, both the contact section and the terminating section of the terminal are connected directly to the press-fit retention section. If undesirable forces are applied to

10 the terminating section which, in turn, disturbs the retention section, the contact section likewise is disturbed or moved.

The above problem is magnified in electrical connectors wherein the terminals are inserted into their

15 respective slots in the connector housing and, thereafter, the terminating sections are bent or formed to create particular configurations, such as solder tails which may be bent transversely of the insertion direction of the terminal. This subsequent bending or forming step has a

20 tendency to disturb the retention means for the terminal.

The present invention is directed to solving these problems by isolating the retention means for the contact section of the terminal from the retention means for the terminating section of the terminal, thereby

25 isolating any forces on the terminating section from being transmitted to the contact section.

Summary of the Invention

An object, therefore, of the invention is to provide a new and improved retention system or means for

30 retaining terminals in electrical connectors of the character described.

In the exemplary embodiment of the invention, an electrical connector includes a dielectric housing having an opening for receiving a flat electrical cable. The

35 housing has a plurality of terminal-receiving slots spaced along the opening, with each slot including first and



second sub-slots. A plurality of terminals are received in the slots. Each terminal includes a resiliently deflectable contact section extending into the first sub-slot of a respective one of the slots, a U-shaped intermediate retention section press-fit into the second sub-slot of the respective slot, and a terminating section extending outside the housing. The U-shaped intermediate retention section defines a pair of retaining legs each independently press-fit into portions of the second sub-slot. One retaining leg is connected to the contact section and the other retaining leg is connected to the terminating section to thereby isolate any forces on the terminating section from being transmitted to the contact section.

As disclosed herein, the U-shaped intermediate retention section includes a freely movable bight portion integrally connecting the pair of retaining legs. The portions of the second sub-slot comprise grooves in opposite walls thereof, and the retaining legs of the U-shaped intermediate retention section have barbed projections press-fit into the grooves. The housing includes partition means separating the first and second sub-slots, and the opening in the housing intersects the first sub-slots. The terminating portions of the terminals comprise tail portions bent transversely to the terminal-receiving slots.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

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Brief Description of the Drawings

5 The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

10 FIGURE 1 is a front-to-rear section through an electrical connector according to the present invention;

FIGURE 2 is an elevational view of the rear or terminating face of the connector;

FIGURE 3 is an enlarged side elevational view of one of the stamped and formed terminals; and

15 FIGURE 4 is a plan view of a plurality of the stamped and formed terminals still connected to a carrier strip during manufacture.

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Detailed Description of the Preferred Embodiment

Referring to the drawings in greater detail, and first to Figures 1 and 2, the electrical connector of the invention includes a dielectric housing, generally designated 1, unitarily molded of plastic material. A plurality of terminals, generally designated 2, are stamped and formed of conductive sheet metal material. The terminals are press-fit into a plurality (sixteen) of terminal-receiving slots, generally designated 3, in the direction of arrow "A" (Fig. 1). The housing has an opening 0 extending longitudinally between its ends, the opening being adapted for receiving a flat electrical cable.

Specifically, each terminal-receiving slot 3 includes first and second sub-slots 4 and 5, respectively. Cable-receiving opening 0 intersects first sub-slots 4. A partition P separates the first sub-slots from the second sub-slots. First sub-slot 4 is generally rectangular in cross-section and is open at the front and rear faces of housing 1 as shown best in Figure 1. Second sub-slot 5 also is generally rectangular in cross-section, but the second sub-slot opens only at the rear face of the housing. Lastly, each second sub-slot 5 includes a rib or shelf 7 on each opposite wall thereof to define a pair of grooves 5a and 5b in each of the second sub-slots for purposes described hereinafter.

Referring to Figures 3 and 4 in conjunction with Figures 1 and 2, terminals 2 are stamped and formed from conductive sheet metal material whereby the terminals extend laterally as parallel branches from a carrier strip 11 (Fig. 4). Each terminal 2 includes a contact section 8 having an angled contact portion 8a integrally connected to a contact leg 8b which, in turn, is integrally connected to a contact base 8c extending transversely across the respective first sub-slot 4. Each terminal also includes a U-shaped intermediate retention section 9 defining a pair of retaining legs 9a and 9b joined by a curved bight



portion 9c. Retaining leg 9a is integrally connected to a terminating tail section 10 of the terminal. Retaining leg 9b is integrally connected to contact section 8 of the terminal, particularly base portion 8c of the contact section.

Retaining legs 9a and 9b of the U-shaped intermediate retention section 9 have thrusting projections or barbs 12 and 13 nearest to the curved bight portion 9c of the U-shaped configuration, and stabilizing projections or barbs 14 and 15 spaced from barbs 12 and 13 on the opposite longitudinal edges of the retaining legs. Stabilizing barbs 14 and 15 are similar to thrusting barbs 12 and 13 in size and shape. As seen best in Figure 3, stabilizing barbs 14 of retaining leg 9a are stamped or coined toward retaining leg 9b, whereas stabilizing barbs 15 of retaining leg 9b are stamped or coined toward retaining leg 9a. In addition, stabilizing barbs 14 of retaining leg 9a are longitudinally offset relative to stabilizing barbs 15 of retaining leg 9b. As best seen in Figure 3, stabilizing barbs 15 of retaining leg 9b are located nearest the transition point between retention section 9 and contact section 8, whereas stabilizing barbs 14 of retaining leg 9a are located nearest the transition point between retention section 9 and terminating section 10.

All of the terminals 2 are press-fit into terminal-receiving slots 3 in the direction of arrow "A" (Fig. 1). During insertion, contact sections 8 of the terminals enter sub-slots 4 and intermediate retention sections 9 of the terminals enter sub-slots 5. The thrusting barbs 12 and 13 of retaining legs 9a and 9b of each U-shaped intermediate retention section 9 of each terminal enter grooves 5a and 5b. The stabilizing barbs 14 of retaining leg 9a abut against the lower (as viewed in Fig. 1) surface of rib 7, thus causing retaining leg 9a to be biased against the bottom surface of groove 5a. On the other hand, the stabilizing barb 15 of retaining leg 9b



abuts against the upper surface of rib 7, thus causing retaining leg 9b to be biased against the top surface of groove 5b.

5 While retaining legs 9a and 9b are press-fit and rigidly fixed within grooves 5a and 5b, curved bight portion 9c of retention section 9 is freely movable within second sub-slot 5. Consequently, the retention means provided by retaining leg 9a is totally independent from the retention means provided by retaining leg 9b. As a result, any forces, including outside forces, applied to retaining leg 9a will be isolated or prevented from being transmitted to retaining leg 9b and, in turn, to contact section 8.

15 After contact sections 8 and retention sections 9 of terminals 2 are inserted into their respective terminal-receiving slots 3 and sub-slots 4 and 5, terminating sections 10 of all terminals 2 are bent alternately in opposite directions as seen in Figures 1 and 2. During this bending or forming process, forces tend to be applied to retention sections 9 of the terminals. However, such forces are isolated or prevented from being transmitted to contact sections 8 of the terminals because the above-described retention means for retaining legs 9a and 9b are independent and isolated from each other.

25 It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

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CLAIMS:

1. An electrical connector, comprising:
a dielectric housing (1) having an opening (0)
for receiving a flat electrical cable and a plurality of
5 terminal-receiving slots (3) spaced along the opening, each
slot including first (4) and second (5) sub-slots; and
a plurality of terminals (2) received in said
slots (3), each terminal including a resiliently
deflectable contact section (8) extending into the first
10 sub-slot (4) of a respective one of the slots (3), a U-
shaped intermediate retention section (9) press-fit into
the second sub-slot (5) of the respective slot (3), and a
terminating section (10) extending outside the housing (1),
the U-shaped intermediate retention section defining a pair
15 of retaining legs (9a,9b) each independently press-fit into
portions (5a,5b) of the second sub-slot (5), one retaining
leg (9b) being connected to the contact section (8) and the
other retaining leg (9a) being connected to the terminating
section (10) to thereby isolate any forces on the
20 terminating section (10) from being transmitted to the
contact section (8).
2. The electrical connector of claim 1 wherein
said U-shaped intermediate retention section (9) includes
a freely movable bight portion (9c) integrally connecting
25 the pair of retaining legs (9a,9b).
3. The electrical connector of claim 1 wherein
said portions (5a,5b) of the second sub-slot (5) comprise
grooves in opposite walls of the second sub-slot, and the
retaining legs (9a,9b) of the U-shaped intermediate
30 retention section (9) have barbed projections (12,13,14,15)
press-fit into the grooves (5a,5b).
4. The electrical connector of claim 1 wherein
said housing (1) includes partition means (P) separating
the first and second sub-slots (4,5).





5. The electrical connector of claim 1 wherein said opening (0) in the housing (1) intersects the first subs-slots (4) of the plurality of terminal-receiving slots (3).

5 6. The electrical connector of claim 1 wherein said terminating sections of the terminals comprise tail portions (10) bent transversely of said terminal-receiving slots (3).

10 7. The electrical connector of claim 1 wherein said retaining legs (9a,9b) of the U-shaped intermediate retention section (9) have enlarged press-fit portions (12, 13,14,15), with the press-fit portion of one leg (9a,9b) being longitudinally offset relative to the press-fit portion of the other leg (9a,9b).

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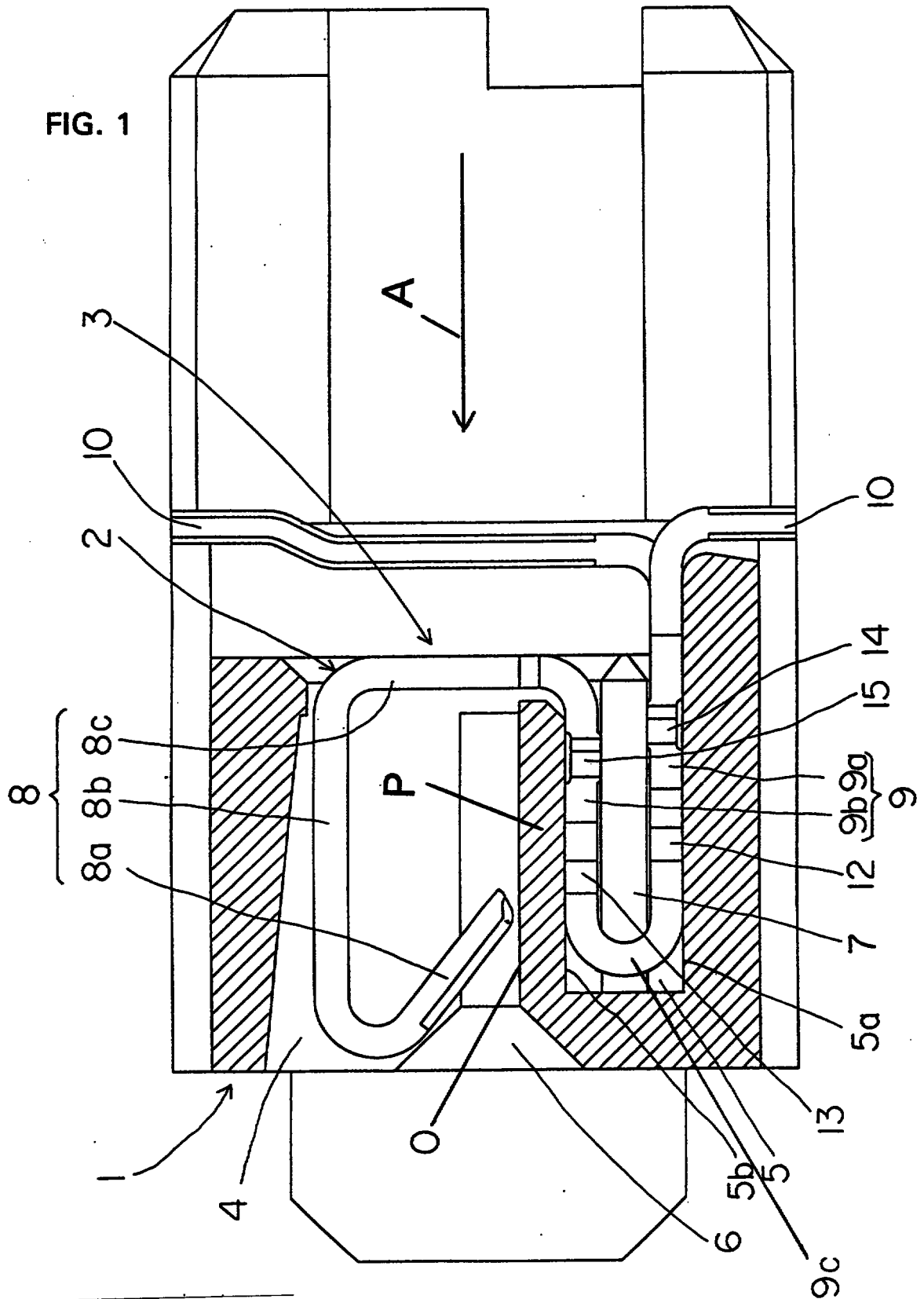


ABSTRACT:**ELECTRICAL CONNECTOR WITH IMPROVED TERMINAL RETENTION MEANS**

5 An electrical connector includes a dielectric housing (1) having an opening (0) for receiving a flat electrical cable and a plurality of terminal-receiving slots (3) spaced along the opening. Each slot includes first (4) and second (5) sub-slots. A plurality of terminals (2) are received in the slots (3). Each terminal (2) includes a resiliently deflectable contact section (8) extending into the first sub-slot (4) of a respective one of the slots (3), a U-shaped intermediate retention section (9) press-fit into the second sub-slot (5) of the respective slot (3), and a terminating section (10) extending outside the housing. The U-shaped intermediate retention section (9) defines a pair of retaining legs (9a,9b) each independently press-fit into portions (5a,5b) of the second sub-slot (5). One retaining leg (9b) is connected to the contact section (8) and the other retaining leg (9a) is connected to the terminating section (10) to thereby isolate any forces on the terminating section (9) from being transmitted to the contact section (8).

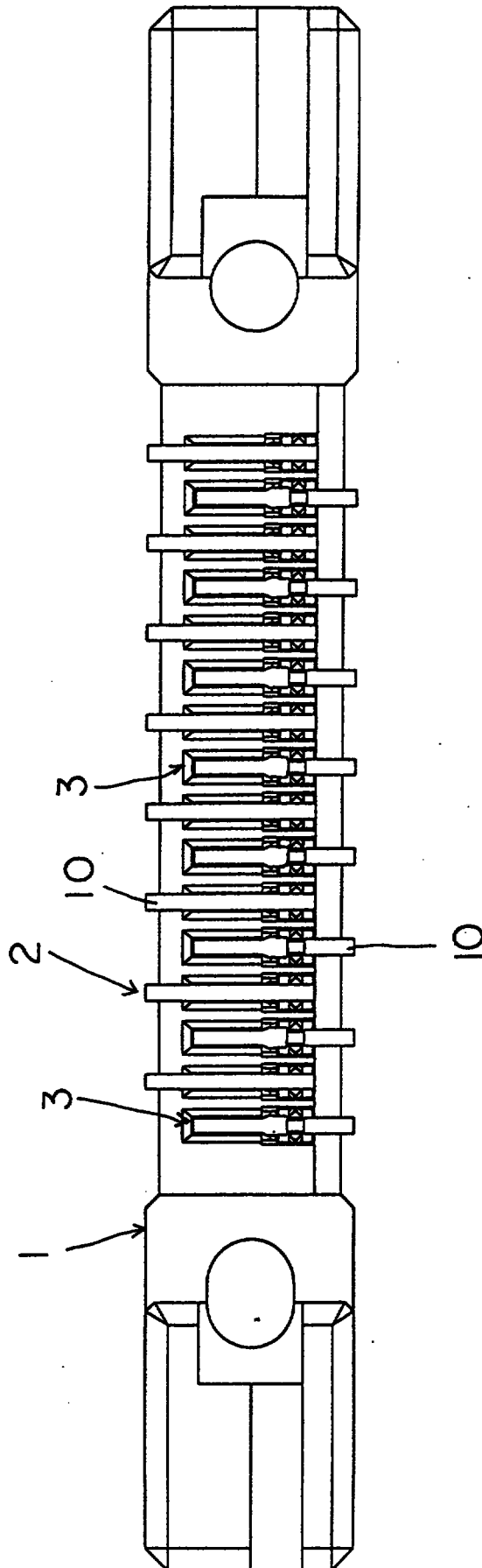
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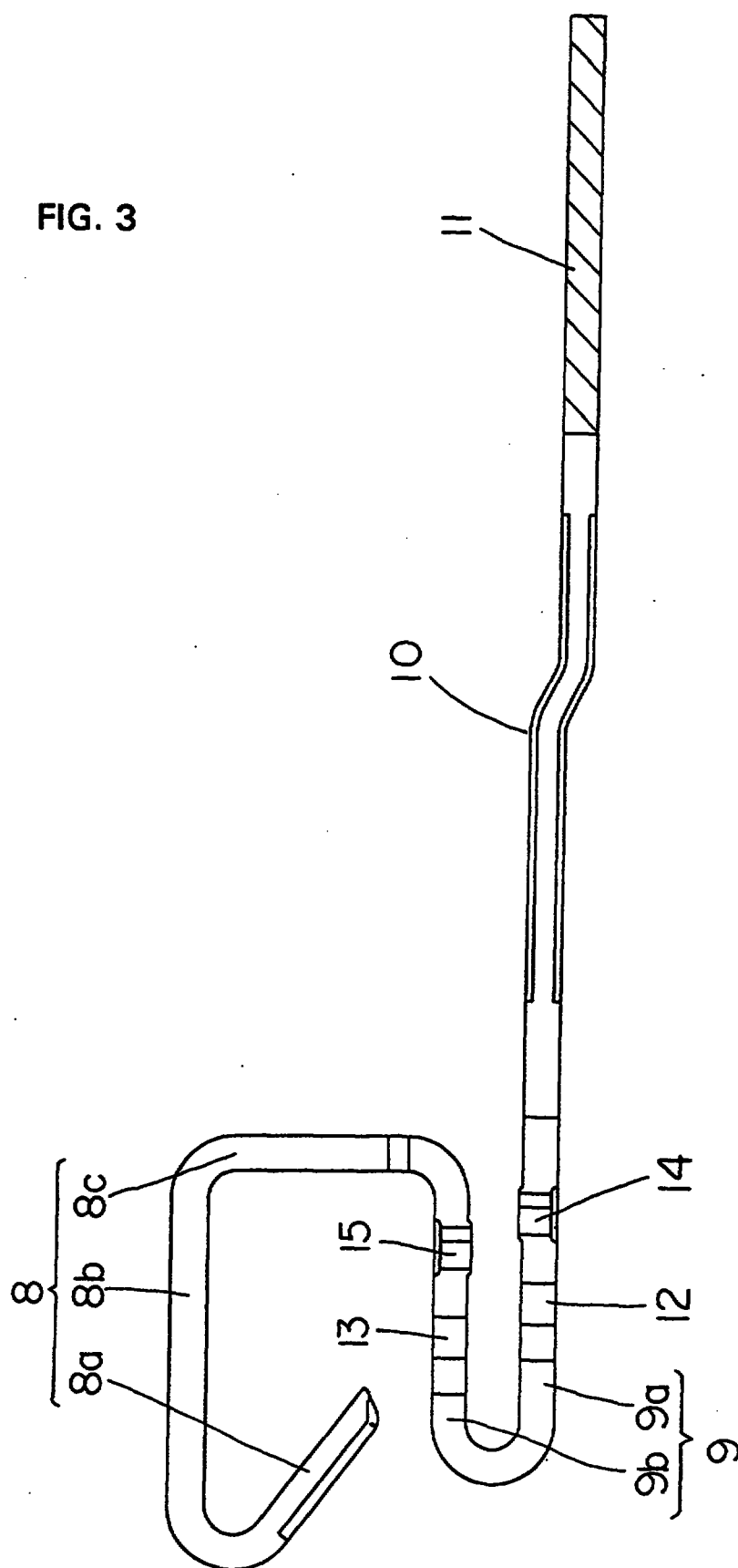
FIG. 2



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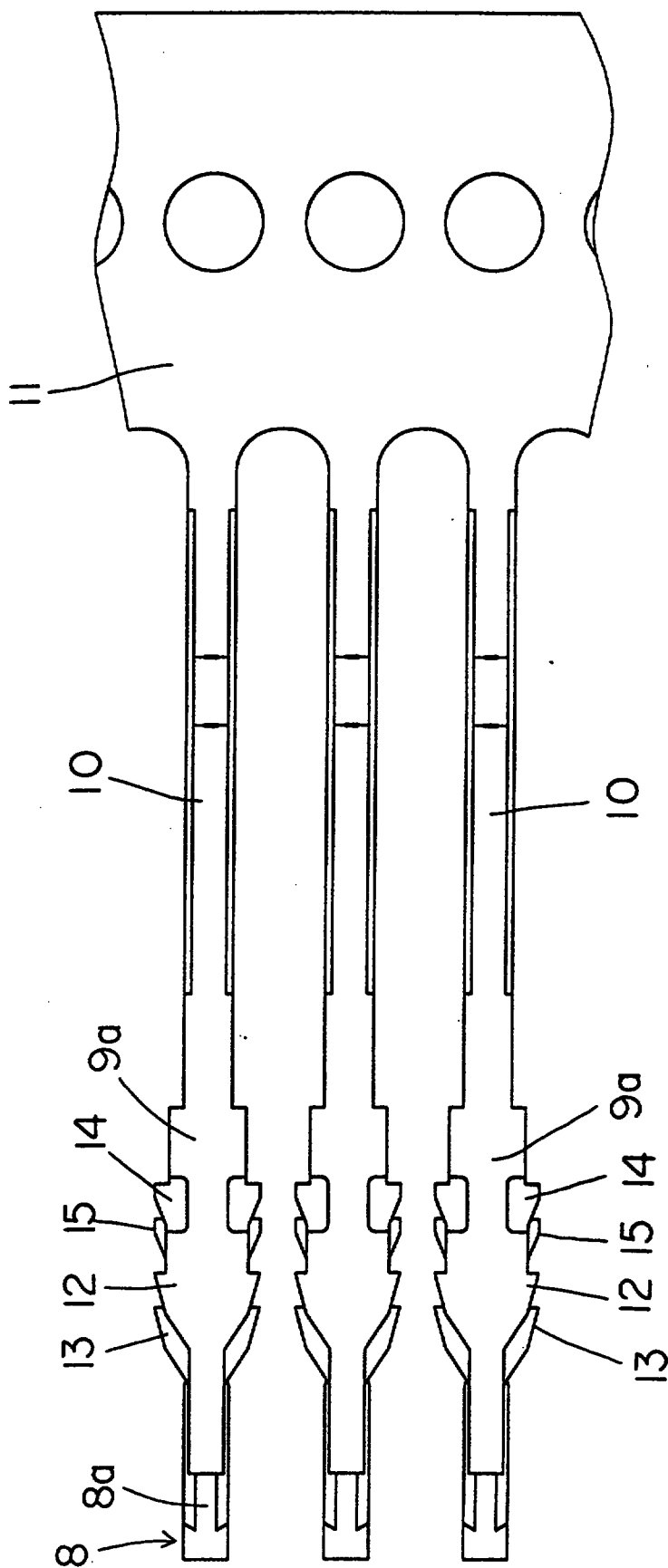
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FIG. 4



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SPECIFICATION

REPLACEMENT SHEET

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ELECTRICAL CONNECTOR WITH
IMPROVED TERMINAL RETENTION MEANS

Field of the Invention

5. This invention generally relates to the art of electrical connectors and, particularly, to an improved system for retaining terminals in connector housings.

Background of the Invention

- 10 There are a variety of electrical connectors which are used for making a required electrical connection between a flat electrical cable, such as a flat flexible cable or a flexible printed circuit board, and an associated electrical device which may include a second printed circuit board. Such connectors typically include a plurality of terminals press-fit in a dielectric housing.
- 15 The terminals have contact portions for engaging the conductors of the flat cable or the male terminal pins of a mating connector, thus making the required electrical connection to the associated electrical device. The terminals may have solder tails projecting from the
- 20 dielectric housing for soldering to circuit traces on the associated printed circuit board.

- Problems continue to be encountered in providing an adequate system or means for retaining the terminals within the housings of connectors as described above.
- 25 Movement of the terminals, particularly the contact portions thereof, relative to the connector housings can have a considerable adverse effect on the connections between the terminals and the flat cable, for instance.

- In particular, a terminal typically is inserted
- 30 into a slot in the connector housing. The terminal includes a resiliently deflectable contact section extending into a portion of the slot for engaging a conductor of the cable. A terminating section, such as a

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solder tail, projects outwardly of the housing. An intermediate retention section typically is disposed somewhere between the contact section and the terminating section to retain the terminal in the slot of the housing. For instance, the retention section may be a barb or leg press-fit into a portion of the terminal slot. In other words, both the contact section and the terminating section of the terminal are connected directly to the press-fit retention section. If undesirable forces are applied to the terminating section which, in turn, disturbs the retention section, the contact section likewise is disturbed or moved.

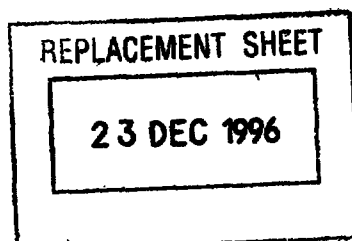
The above problem is magnified in electrical connectors wherein the terminals are inserted into their respective slots in the connector housing and, thereafter, the terminating sections are bent or formed to create particular configurations, such as solder tails which may be bent transversely of the insertion direction of the terminal. This subsequent bending or forming step has a tendency to disturb the retention means for the terminal.

The present invention is directed to solving these problems by isolating the retention means for the contact section of the terminal from the retention means for the terminating section of the terminal, thereby isolating any forces on the terminating section from being transmitted to the contact section.

Summary of the Invention

An object, therefore, of the invention is to provide a new and improved retention system or means for retaining terminals in electrical connectors of the character described.

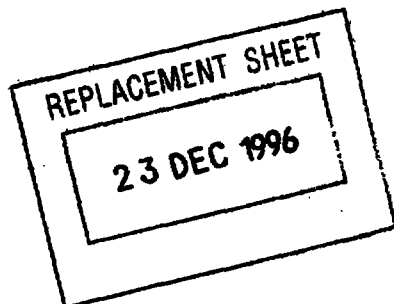
In the exemplary embodiment of the invention, an electrical connector includes a dielectric housing having an opening for receiving a flat electrical cable. The housing has a plurality of terminal-receiving slots spaced along the opening, with each slot including first and



second sub-slots. A plurality of terminals are received in the slots. Each terminal includes a resiliently deflectable contact section extending into the first sub-slot of a respective one of the slots, a U-shaped intermediate retention section press-fit into the second sub-slot of the respective slot, and a terminating section extending outside the housing. The U-shaped intermediate retention section defines a pair of retaining legs each independently press-fit into portions of the second sub-slot. One retaining leg is connected to the contact section and the other retaining leg is connected to the terminating section to thereby isolate any forces on the terminating section from being transmitted to the contact section.

As disclosed herein, the U-shaped intermediate retention section includes a freely movable bight portion integrally connecting the pair of retaining legs. The portions of the second sub-slot comprise grooves in opposite walls thereof, and the retaining legs of the U-shaped intermediate retention section have barbed projections press-fit into the grooves. The housing includes partition means separating the first and second sub-slots, and the opening in the housing intersects the first sub-slots. The terminating portions of the terminals comprise tail portions bent transversely to the terminal-receiving slots.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.



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Brief Description of the Drawings

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIGURE 1 is a front-to-rear section through an electrical connector according to the present invention;

FIGURE 2 is an elevational view of the rear or terminating face of the connector;

FIGURE 3 is an enlarged side elevational view of one of the stamped and formed terminals; and

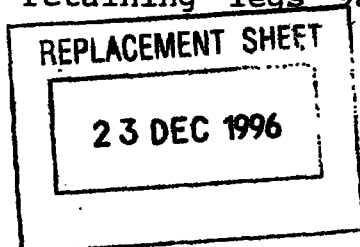
FIGURE 4 is a plan view of a plurality of the stamped and formed terminals still connected to a carrier strip during manufacture.

Detailed Description of the Preferred Embodiment

Referring to the drawings in greater detail, and first to Figures 1 and 2, the electrical connector of the invention includes a dielectric housing, generally designated 1, unitarily molded of plastic material. A plurality of terminals, generally designated 2, are stamped and formed of conductive sheet metal material. The terminals are press-fit into a plurality (sixteen) of terminal-receiving slots, generally designated 3, in the direction of arrow "A" (Fig. 1). The housing has an opening 0 extending longitudinally between its ends, the opening being adapted for receiving a flat electrical cable.

Specifically, each terminal-receiving slot 3 includes first and second sub-slots 4 and 5, respectively. Cable-receiving opening 0 intersects first sub-slots 4. A partition P separates the first sub-slots from the second sub-slots. First sub-slot 4 is generally rectangular in cross-section and is open at the front and rear faces of housing 1 as shown best in Figure 1. Second sub-slot 5 also is generally rectangular in cross-section, but the second sub-slot opens only at the rear face of the housing. Lastly, each second sub-slot 5 includes a rib or shelf 7 on each opposite wall thereof to define a pair of grooves 5a and 5b in each of the second sub-slots for purposes described hereinafter.

Referring to Figures 3 and 4 in conjunction with Figures 1 and 2, terminals 2 are stamped and formed from conductive sheet metal material whereby the terminals extend laterally as parallel branches from a carrier strip 11 (Fig. 4). Each terminal 2 includes a contact section 8 having an angled contact portion 8a integrally connected to a contact leg 8b which, in turn, is integrally connected to a contact base 8c extending transversely across the respective first sub-slot 4. Each terminal also includes a U-shaped intermediate retention section 9 defining a pair of retaining legs 9a and 9b joined by a curved bight



portion 9c. Retaining leg 9a is integrally connected to a terminating tail section 10 of the terminal. Retaining leg 9b is integrally connected to contact section 8 of the terminal, particularly base portion 8c of the contact section.

Retaining legs 9a and 9b of the U-shaped intermediate retention section 9 have thrusting projections or barbs 12 and 13 nearest to the curved bight portion 9c of the U-shaped configuration, and stabilizing projections or barbs 14 and 15 spaced from barbs 12 and 13 on the opposite longitudinal edges of the retaining legs. Stabilizing barbs 14 and 15 are similar to thrusting barbs 12 and 13 in size and shape. As seen best in Figure 3, stabilizing barbs 14 of retaining leg 9a are stamped or coined toward retaining leg 9b, whereas stabilizing barbs 15 of retaining leg 9b are stamped or coined toward retaining leg 9a. In addition, stabilizing barbs 14 of retaining leg 9a are longitudinally offset relative to stabilizing barbs 15 of retaining leg 9b. As best seen in Figure 3, stabilizing barbs 15 of retaining leg 9b are located nearest the transition point between retention section 9 and contact section 8, whereas stabilizing barbs 14 of retaining leg 9a are located nearest the transition point between retention section 9 and terminating section 10.

All of the terminals 2 are press-fit into terminal-receiving slots 3 in the direction of arrow "A" (Fig. 1). During insertion, contact sections 8 of the terminals enter sub-slots 4 and intermediate retention sections 9 of the terminals enter sub-slots 5. The thrusting barbs 12 and 13 of retaining legs 9a and 9b of each U-shaped intermediate retention section 9 of each terminal enter grooves 5a and 5b. The stabilizing barbs 14 of retaining leg 9a abut against the lower (as viewed in Fig. 1) surface of rib 7, thus causing retaining leg 9a to be biased against the bottom surface of groove 5a. On the other hand, the stabilizing barb 15 of retaining leg 9b

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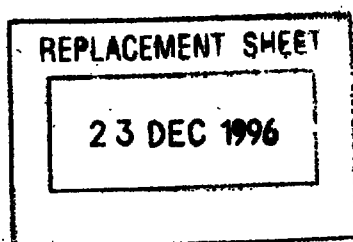
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abuts against the upper surface of rib 7, thus causing retaining leg 9b to be biased against the top surface of groove 5b.

5 While retaining legs 9a and 9b are press-fit and rigidly fixed within grooves 5a and 5b, curved bight portion 9c of retention section 9 is freely movable within second sub-slot 5. Consequently, the retention means provided by retaining leg 9a is totally independent from the retention means provided by retaining leg 9b. As a
10 result, any forces, including outside forces, applied to retaining leg 9a will be isolated or prevented from being transmitted to retaining leg 9b and, in turn, to contact section 8.

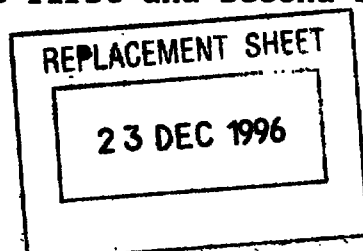
15 After contact sections 8 and retention sections 9 of terminals 2 are inserted into their respective terminal-receiving slots 3 and sub-slots 4 and 5, terminating sections 10 of all terminals 2 are bent alternately in opposite directions as seen in Figures 1 and 2. During this bending or forming process, forces tend to
20 be applied to retention sections 9 of the terminals. However, such forces are isolated or prevented from being transmitted to contact sections 8 of the terminals because the above-described retention means for retaining legs 9a and 9b are independent and isolated from each other.

25 It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and
30 the invention is not to be limited to the details given herein.



**CLAIMS:**

1. An electrical connector, comprising:
a dielectric housing (1) having an opening (0)
for receiving a flat electrical cable and a plurality of
5 terminal-receiving slots (3) spaced along the opening, each
slot including first (4) and second (5) sub-slots; and
a plurality of terminals (2) received in said
slots (3), each terminal including a resiliently
deflectable contact section (8) extending into the first
10 sub-slot (4) of a respective one of the slots (3), a U-
shaped intermediate retention section (9) press-fit into
the second sub-slot (5) of the respective slot (3), and a
terminating section (10) extending outside the housing (1),
the U-shaped intermediate retention section defining a pair
15 of retaining legs (9a,9b) each independently press-fit into
portions (5a,5b) of the second sub-slot (5), one retaining
leg (9b) being connected to the contact section (8) and the
other retaining leg (9a) being connected to the terminating
section (10) to thereby isolate any forces on the
20 terminating section (10) from being transmitted to the
contact section (8).
2. The electrical connector of claim 1 wherein
said U-shaped intermediate retention section (9) includes
a freely movable bight portion (9c) integrally connecting
25 the pair of retaining legs (9a,9b).
3. The electrical connector of claim 1 wherein
said portions (5a,5b) of the second sub-slot (5) comprise
grooves in opposite walls of the second sub-slot, and the
retaining legs (9a,9b) of the U-shaped intermediate
30 retention section (9) have barbed projections (12,13,14,15)
press-fit into the grooves (5a,5b).
4. The electrical connector of claim 1 wherein
said housing (1) includes partition means (P) separating
the first and second sub-slots (4,5).

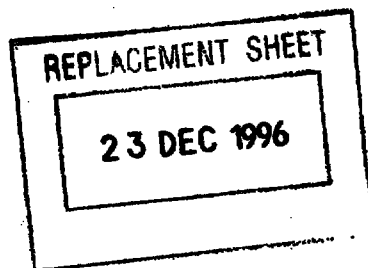




5. The electrical connector of claim 1 wherein said opening (0) in the housing (1) intersects the first subs-slots (4) of the plurality of terminal-receiving slots (3).

5 6. The electrical connector of claim 1 wherein said terminating sections of the terminals comprise tail portions (10) bent transversely of said terminal-receiving slots (3).

10 7. The electrical connector of claim 1 wherein said retaining legs (9a,9b) of the U-shaped intermediate retention section (9) have enlarged press-fit portions (12, 13,14,15), with the press-fit portion of one leg (9a,9b) being longitudinally offset relative to the press-fit portion of the other leg (9a,9b).



ABSTRACT:**ELECTRICAL CONNECTOR WITH IMPROVED TERMINAL RETENTION MEANS**

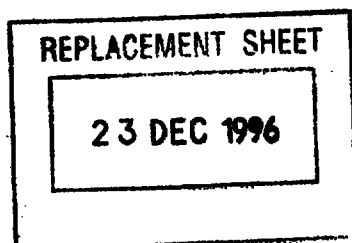
5 An electrical connector includes a dielectric housing (1) having an opening (0) for receiving a flat electrical cable and a plurality of terminal-receiving slots (3) spaced along the opening. Each slot includes first (4) and second (5) sub-slots. A plurality of terminals (2) are received in the slots (3). Each terminal (2) includes a resiliently deflectable contact section (8) extending into the first sub-slot (4) of a respective one of the slots (3), a U-shaped intermediate retention section (9) press-fit into the second sub-slot (5) of the respective slot (3), and a terminating section (10) extending outside the housing. The U-shaped intermediate retention section (9) defines a pair of retaining legs (9a,9b) each independently press-fit into portions (5a,5b) of the second sub-slot (5). One retaining leg (9b) is connected to the contact section (8) and the other retaining leg (9a) is connected to the terminating section (10) to thereby isolate any forces on the terminating section (9) from being transmitted to the contact section (8).

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Fig. 1



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FIG. 1

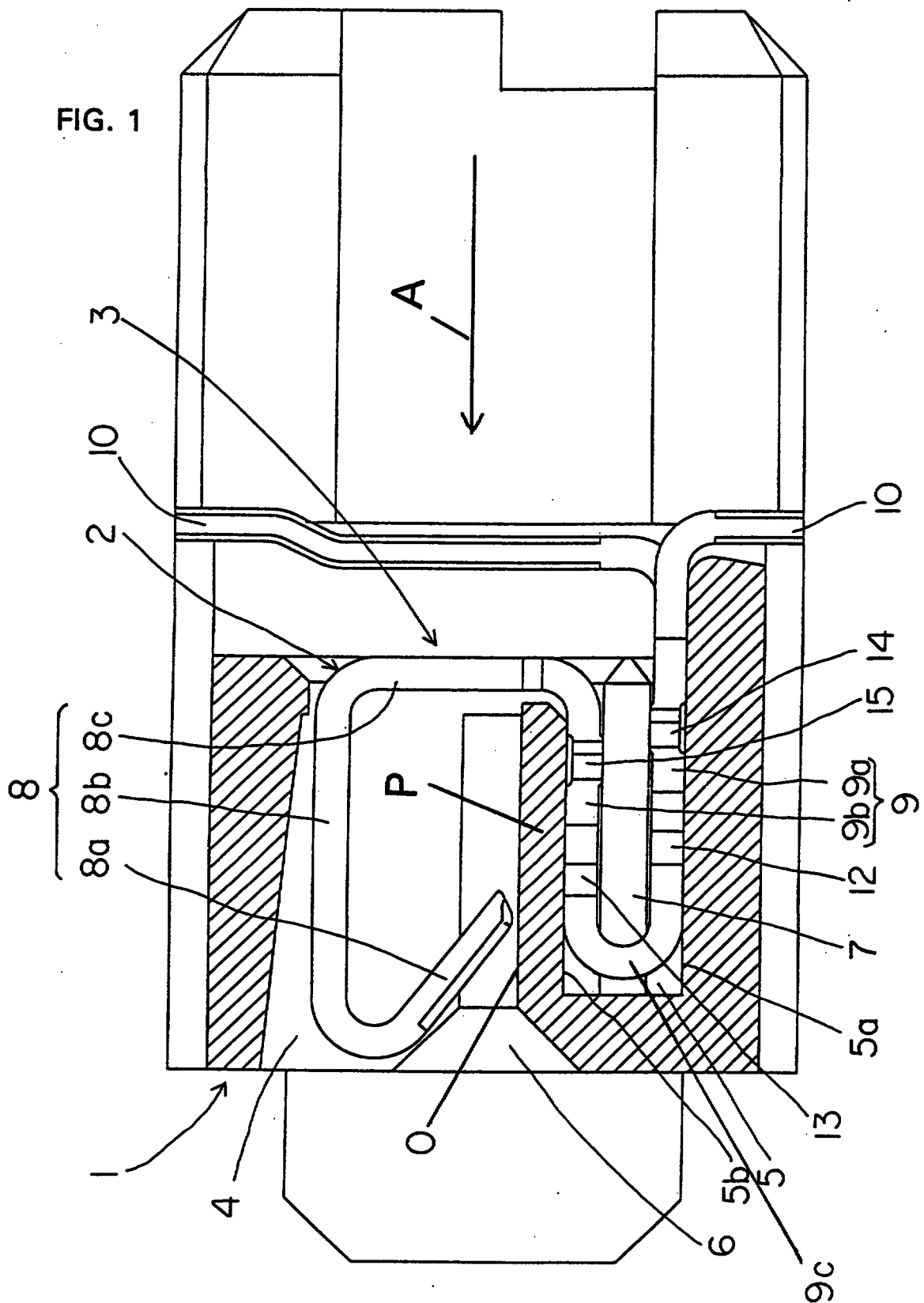


FIG. 2

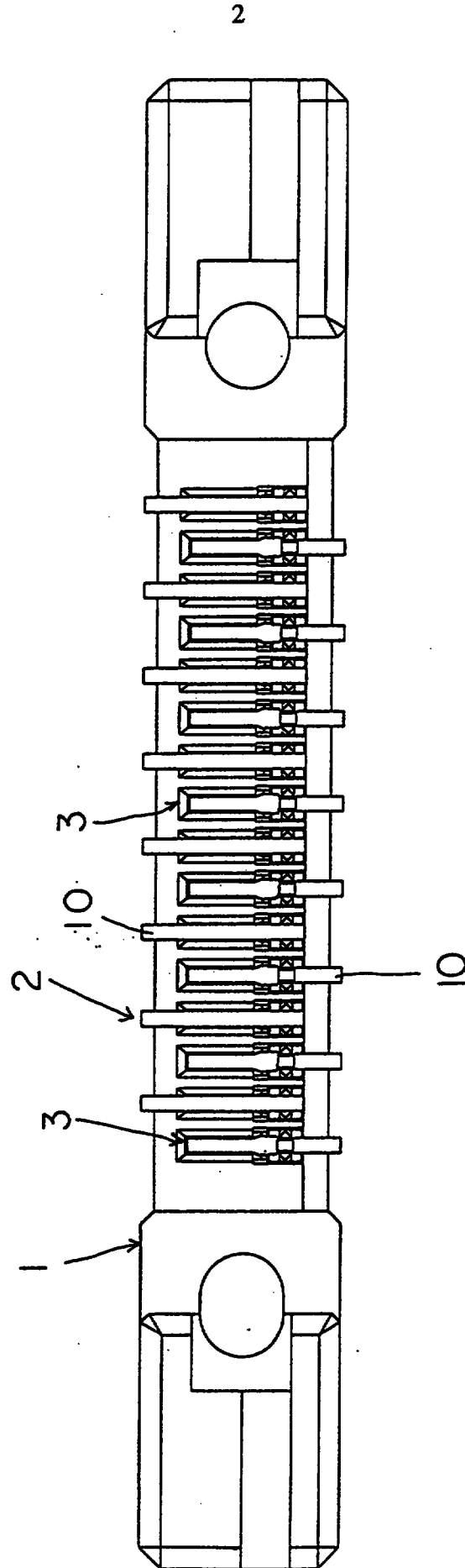
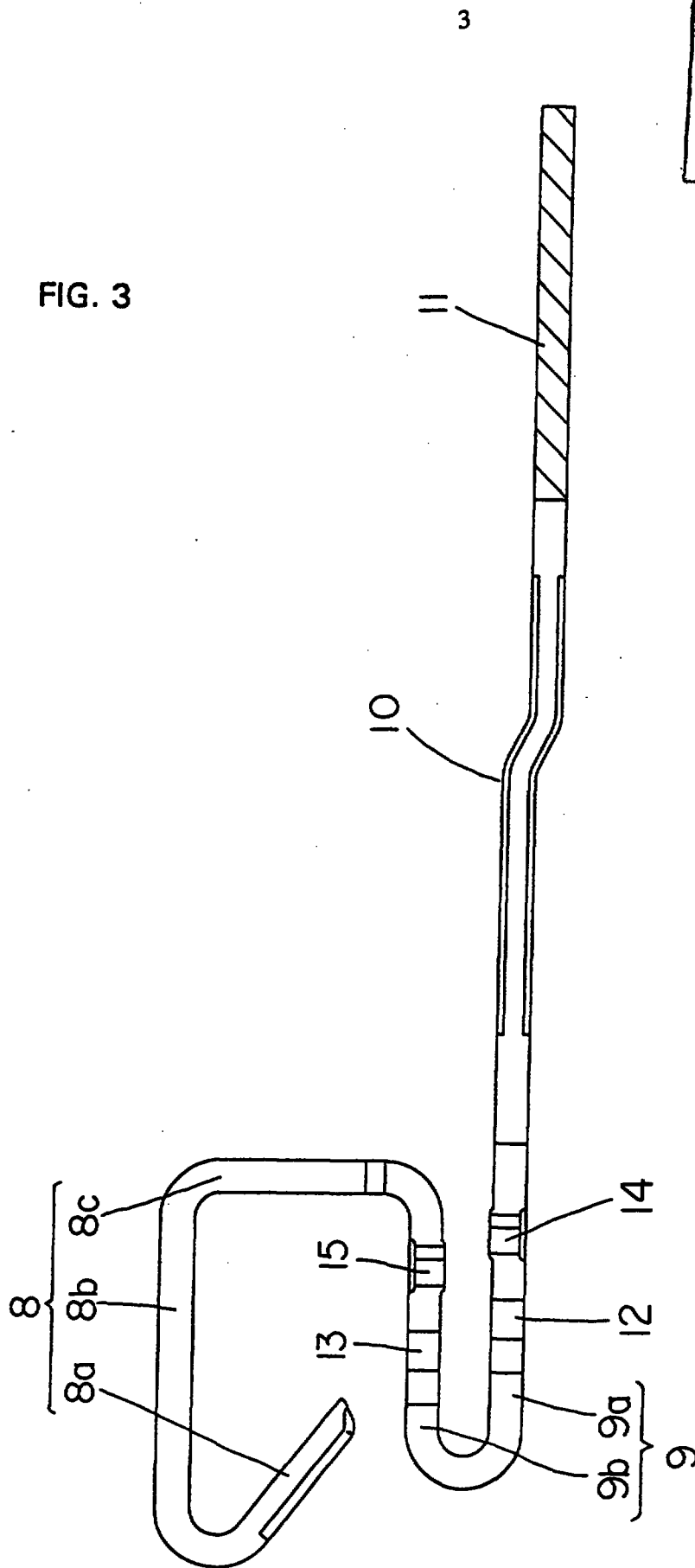


FIG. 3



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FIG. 4

