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(54) Electrical edge connector.

(57) Edge connector for a printed circuit board (35) comprises a housing (1) having terminals (21) therein. Terminals have spaced apart spring arms (26) which contact opposite surfaces of the circuit board (35). The terminals (2) are in a first position when the circuit board (35) is inserted into the housing (1) such that the spring arms (26) are spaced apart and the circuit board can be readily inserted. After initial insertion, the circuit board (35) and terminals (21) are moved relative to the housing (1) and camming surfaces in the housing (1) cam the arms (26) towards each other and against the circuit board (35).

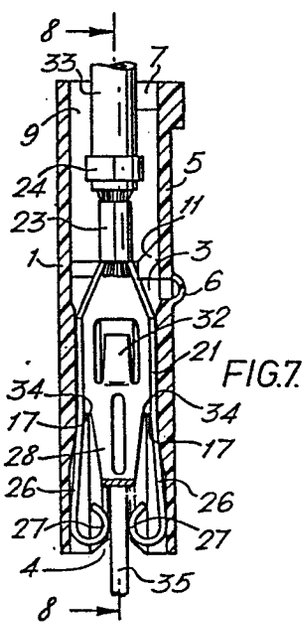

FIG.7.

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ELECTRICAL EDGE CONNECTOR

This invention relates to an electrical edge connector for a printed circuit board, ceramic substrate or the like and is particularly concerned with providing the so-called LIF, low insertion force or ZIF, zero insertion force function in such a connector.

LIF or ZIF functions are desirable in multi-way connectors to reduce engagement and disengagement forces between mating connectors. It is known to provide connectors which can be engaged or disengaged with complementary contacts disengaged so that there is no abrasive engagement of the contact surfaces during connector housing engagement. Contact engagement is then effected by relative movement of complementary contacts, for example, by a cam member moveable on the connector housing.

The avoidance of abrasive engagement between contacts of an edge connector and a printed circuit board or substrate is particularly important where edges of the board or substrate may be sharp, due to their manufacturing process, since the sharp edges may severely damage the contact surfaces. For example, ceramic substrates may be cut to size by laser with resultant sharp edges at the cut portions.

It is an object to provide an edge connector which may be engaged with the edge of a board or substrate without initial engagement of the contact surfaces with the board or substrate edges and which avoids the need for additional members to the housing and contact or contacts and is economic to produce.

According to the invention an edge connector for a printed circuit board or substrate comprising an insulating housing formed with a contact receiving through cavity and a slot for receiving the board or substrate traversing the cavity at one end, the contact having a pair of spring arms with free ends presenting contact surfaces disposed at opposite sides of the slot for engaging opposite sides of the board or substrate, is characterized in that the contact is moveable within the cavity in

the insertion direction of the board or substrate between a first condition in which the contact surfaces are disposed outside opposite sides of the slot, and a second condition in which they are disposed within the slot width.

Suitably the contact has a portion disposed between the spring arms and which, in the first condition, projects into the slot, whereby engagement of the connector with the board or substrate edge registers the projecting portion with the edge to effect movement of the projecting portion rearwardly of the slot and movement of the contact to the second condition.

The projecting portion is suitably formed with a spring extension engaging a ramp surface formed on a wall of the cavity and arranged to bias the contact towards the first condition.

Movement of the contact between the first and second conditions is suitably limited by stops formed in the cavity.

The contact is suitably formed with divergent spring arms, and the cavity is of reduced width, rearwardly of the slot, whereby on movement of the contact between the first and second conditions, the spring arms are constrained together, by the reduced width cavity portion, to enter the contact surfaces into the slot.

The invention also includes a contact in or for a connector according to the invention which comprises a channel shaped body, sides of the channel being extended at one end to define a pair of spring arms with opposed contact surfaces, characterized in that the base of the channel shaped body is formed with an extension projecting forwardly between the arms to a position rearwardly of the contact surfaces.

The extension of the base is suitably folded back at a rearward inclination as a spring arm with its free end spaced from the base of the channel portion between the channel sides.

Suitably the spring arms formed with the contact surfaces diverge away from the channel shaped body.

The invention will now be described, by way of example, with reference to the accompanying partly diagrammatic drawings, in which:-

Figure 1 is an elevation of a connector housing from one side;

Figure 2 is a section taken on the line 2-2 of figure 1;

Figure 3 is an elevation of the connector of figure 1 from the opposite side with an end cavity shown in section;

Figure 4 is a plan view of the connector of figure 1;

Figure 5 is a side elevation of a contact for the connector of figures 1 to 4, but to an enlarged scale;

Figure 6 is a plan view of the contact of figure 5;

Figure 7 is a sectional view of a cavity of the connector viewed from an opposite direction to that of figure 2, and containing a contact according to figures 5 & 6, and in an initial condition of engagement with a substrate;

Figure 8 is a section taken on the line 8-8 of figure 7, viewed in the direction of the arrows;

Figure 9 is a view similar to that of figure 7 but with the substrate fully engaged with the connector, and

Figure 10 is a view similar to that of Figure 8 but with the contact in a condition similar to that of figure 9.

The connector housing of figures 1 to 5 is formed of resilient plastics insulating material as a unitary molding, and comprises a connector body portion 1 of generally rectangular slab-like form having at one major face, a mounting and retention section 2. The body 1 is formed with five through cavities, 3 arranged in a row and with a slot 4 for receiving a substrate edge extending transversely of the cavities 3 between opposite sides of the body 1, at a lower end as seen in figure 2. At the upper end on a face opposite the mounting section 2, the body 1 is formed with a flap 5 extending from side to side of the body across all of the cavities 3 and integral with the body 1 at a hinge 6 at a middle portion of the body between upper and lower ends thereof. The flap 5, at its upper edge is formed

with a series of latch projections 7, each having a latch aperture 8 and arranged to project transversely over walls 9, separating the cavities 3, the apertures 8 engaging projection 10 formed on walls 9 to secure the flap 5 in the position shown.

It will be understood that the flap 5, with the latch projecting 7 disengaged from wall projections 10, is moveable by bending at the hinge 6 between an open position at 90 degrees counterclockwise from the position shown, to the closed portion shown.

The flap 5 is formed adjacent the hinge 6, and internally of the cavities 3, with a series of inwardly projecting shoulders 11, one to each cavity 3, the shoulders having downwardly facing shoulder surfaces for contact retention purposes as will be described later in connection with figures 7 to 10.

Each cavity 3 is formed substantially at the level of hinge 6 and on one of the cavity sides bridging the slot 4 with an inward projection 12 having upper and lower ramp surfaces 13, 14 for camming engagement with a portion of a contact as will be described later. On the opposite side of each cavity there is formed a shallow groove 15 extending upwardly from the mouth of slot 4, beyond slot 4 and terminating opposite the projection 12 in a downward facing shoulder 16 for contact retention purposes as will be described later. These sides of each of the cavities are formed adjacent the other pair of sides with shallow projections defining upward facing shoulders 17 slightly above the level of the slot 4, which serve to limit contact insertion. The other pair of sides, below the shoulders 17 diverge to a lower cavity portion surrounding the slot 4, of enlarged width, as seen in figure 2.

The mounting section 2 comprises a pair of spaced latch arms 18 depending from a bridge portion 19 stood away from the body 1. The arms 18 are of channel form open sides of the channels facing outwards as seen in figures 1 and 4, and lower ends of the channels being closed by latch portions 20 having upper and lower ramp surfaces. It will be understood that the

lower ends of the arms can be resiliently flexed together to enable engagement or disengagement of the latch projections 20 with complementary means on a fixture for releasably securing the connector to the fixture.

The contact of figures 5 and 6 comprises a channel shaped middle portion 21 having at one end a wire connecting section 22 of conventional form comprising a U-shaped wire crimp ferrule 23 and insulation support ferrule 24 extending from a carrier strip 25. At the other end of the portion 21, opposite sides of the channel are extended in divergent manner, as spring arms 26, to free ends which are turned inwards in arcuate manner to present opposed arcuate contact portions 27. As seen in figure 5 in side elevation the spring arms 26 are progressively reduced in width towards the free ends.

The base of the channel shaped portion 21 is formed between the arms 26 with an extension 28 which, as seen in figure 6, is reduced in width forwardly and is stiffened by a central embossment 29. The extension 28 is further extended by a bent back portion 30 which extends rearwardly and upwardly between the arms 27 to project at its free end 31 above the channel portion 21. The free end 31 is bent down in arcuate manner to present an upwardly convex engagement surface.

The base of the channel portion 21 is formed with a downwardly and rearwardly extending retention latch 32 pushed out of an aperture in the base behind the embossment 29.

In use the contact of figures 5 and 6 is severed from the carrier strip 25 and crimped to a stripped wire end 33 in conventional manner to present a terminated lead for assembly to the connector housing of figures 1 to 4 as shown in figures 7 to 10. In figures 7 and 9 the mounting section 2 of the connector housing is not shown. For assembly of terminated leads to the connector housing, the flap 5 is moved to an open condition so that the projections 11 are clear of the cavities 3. The contacts are inserted into respective cavities 3, leading ends of the contact springs 26 initially engaging opposite sides of the

cavities 3 below the hinge 6 and thereby flexed inwardly to allow passage into the cavities until the retention latch 32 enters the groove 15 and engages the shoulder 16 to secure the contact against withdrawal from the housing. During the insertion the free end 31 of the extension 29, 30 engages the ramp surface 13 to flex the extension 30 inwardly until the free end 31 engages the ramp surface 14. At this condition, which corresponds to figures 9 and 10, the spring arms 26 are constrained inwardly by the cavity walls, and shoulders 34 at the lower end of the channel section 21 on opposite sides of the extension are spaced above the housing shoulders 17. The contact is thus capable of further downward movement through the cavity 3 and the flexure of the extension 30 against the ramp surface 14 exerts a downward force on the contact to move it downwardly until the shoulders 34 and 17 engage to resist further downward movement. The contact is now in the condition of figures 7 and 8.

In this condition the spring arms 26 enter the lower cavity portion of increased width and flex apart on opposite sides of the slot 4 with the contact ends 27 outside the slot 4. The forward or lower end of the extension 28 is disposed within the slot 4, and the retention latch 32 is spaced below the shoulder 16.

When all of the contacts have been assembled into respective cavities 3, the flap 5 is closed to the condition shown in figures 7 and 9 so that the projections 11 enter respective cavities behind and above the channel sections 21 in a position to register with rear or upper edges of the channel sections 21 as shown in figures 9 and 10 to provide a secondary contact retention to that provided by latch 32 and shoulder 16.

In the condition of figures 7 and 8, the connector can be assembled to a substrate 35 by entering the edge of the substrate 35 into the slot 4 between the contact ends 27 until the edge of the substrate 35 engages the forward lower end of the contact extension 28. In this position, shown in figure 7,

the contact ends 27 are clear of the slot and are not engaged by the substrate 35, so that risk of damage of the contact surfaces by sharp edges of the substrate 35 and by abrasion is avoided. Further movement of the substrate 35 into the slot 4 drives the contact upwardly or rearwardly in the cavity 3, the extension 30 being flexed inwardly by the ramp 14 and the spring arms 26 being flexed inwardly by being drawn into the cavity portion of reduced width. The contact ends 27 are thus urged against opposite sides of the substrate, as shown in figure 9 to exert contact force.

The substrate 35 is suitably supported in a fixture, now shown, having means complementary to the latch arms of the mounting section 2 of the connector so that the latch arms 18 at their ends 20 engage the complementary means in a snap fit releasably to secure the connector in the condition of figures 9 and 10. To release the connector, the latch arms 18 may be flexed together, and the connector withdrawn from the substrate 35 by upward movement of the housing in the figure 9 position to that of figures 7 and 8. The spring extension 30 and the engagement of its free end 31 with the ramp, serves to drive the contact downwards relative to the housing so that the contact ends 27 flex apart from the substrate to the figure 7 condition before the connector is withdrawn from the substrate 35. In this way abrasion of the contact ends 27 with the substrate 35 and engagement with any sharp edges is avoided.

Claims:

1. An edge connector for a printed circuit board or substrate comprising an insulating housing (1) formed with a contact receiving through cavity (3) and a slot (4) for receiving an edge of the board or substrate (35) traversing the cavity (3) at one end, the contact having a pair of spring arms (26) with free ends presenting contact surfaces (27) disposed at opposite sides of the slot (4) for engaging opposite sides of the board or substrate (35) characterized in that the contact is moveable within the cavity (3) in the insertion direction of the board or substrate (35) between a first condition (figs. 7&8) in which the contact surfaces (27) are disposed outside opposite sides of the slot (4), and a second condition (figs. 9&10) in which they are disposed within the slot (4) width.

2. A connector as claimed in claim 1, characterized in that the contact has a portion (28) disposed between the spring arms (26) which, in the first condition, projects into the slot (4) whereby engagement of the connector with the board or substrate edge (35) registers the projecting portion (28) with the substrate edge (35) to effect movement of the projecting portion (28) rearwardly of the slot (4) and movement of the contact to the second condition.

3. A connector as claimed in claim 2, characterized in that the projecting portion (28) is formed with a spring extension (29) engaging a ramp surface (14) formed on a wall of the cavity (3) and arranged to bias the contact towards the first condition.

4. A connector as claimed in any preceding claim, characterized in that stops (16,11,17) are formed in the cavity (3) to limit movement of the contact between the first and second conditions.

5. A connector as claimed in claim 1, characterized in that the contact is formed with divergent spring arms (26) and the cavity (3) is of reduced width rearwardly of the slot (4) whereby on movement of the contact between the first and second conditions the spring arms (26) are constrained by the

reduced width cavity portion to move together to enter the contact surfaces (27) into the slot (4).

6. A contact in or for a connector as claimed in claim 1 and which comprises a channel shaped body (21) sides of the channel being extended at one end to define a pair of spring arms (26) with opposed contact surfaces (27), characterized in that the base of the channel shaped body (21) is formed with an extension (28) projecting forwardly between the arms (26) to a position rearwardly of the contact surfaces (27).

7. A contact so claimed in claim 6, characterized in that the extension (28) at its forward end is folded back at a rearward inclination as a spring arm (30) with its free end (31) spaced from the base of the channel portion (21) between the channel sides.

8. A contact as claimed in claim 6 or 7, characterized in that the spring arms (26) diverge away from the channel body (21).

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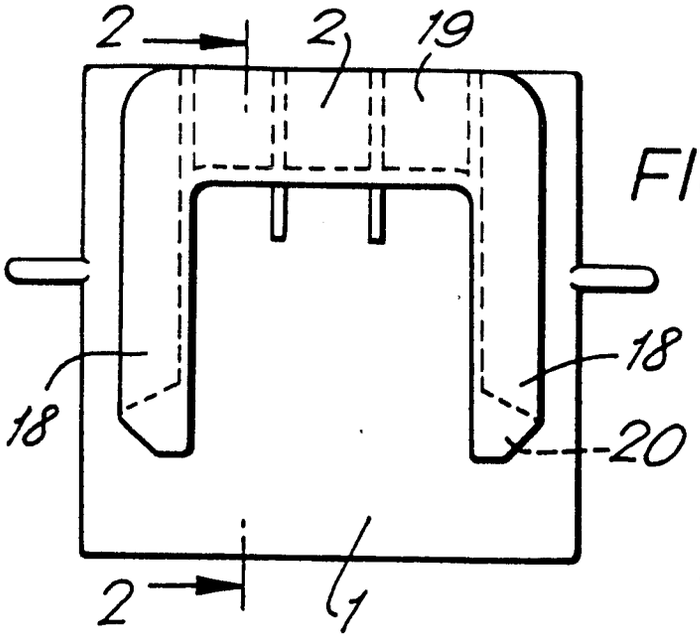


FIG.1.

FIG.2.

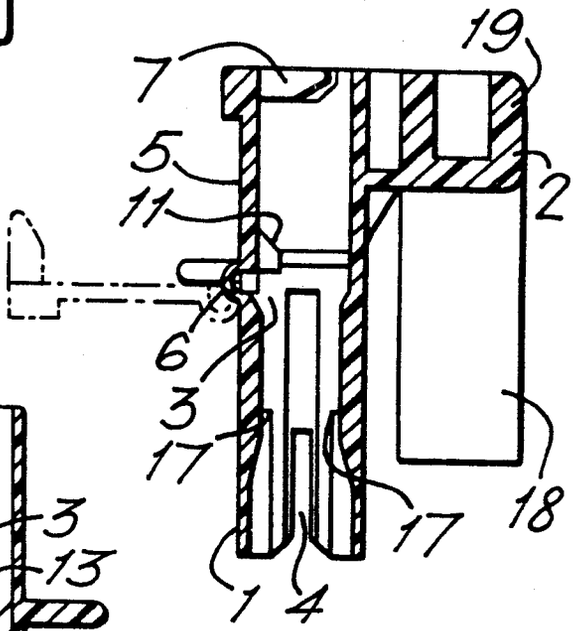


FIG.3.

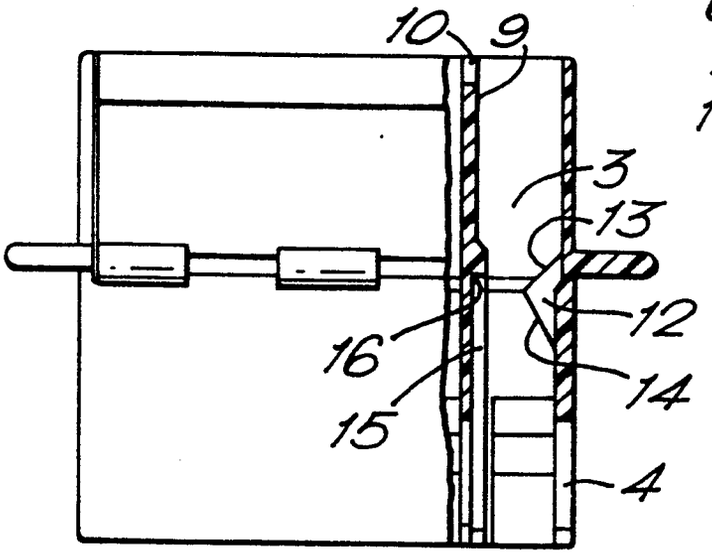


FIG.4.

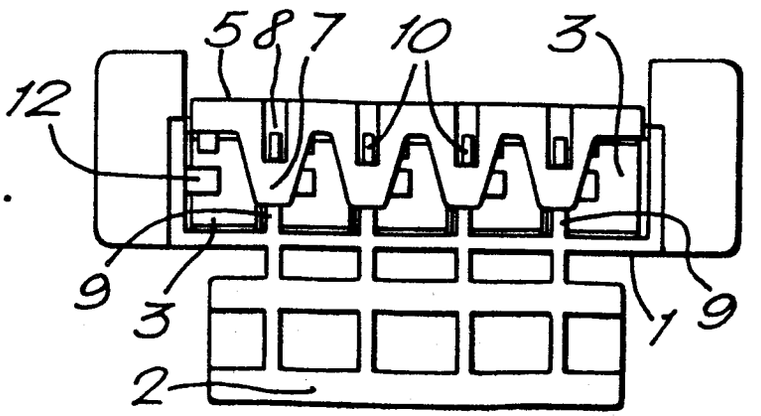


FIG.5.

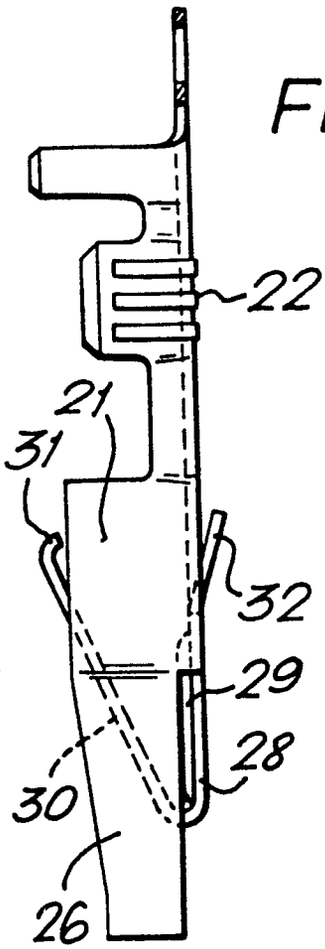
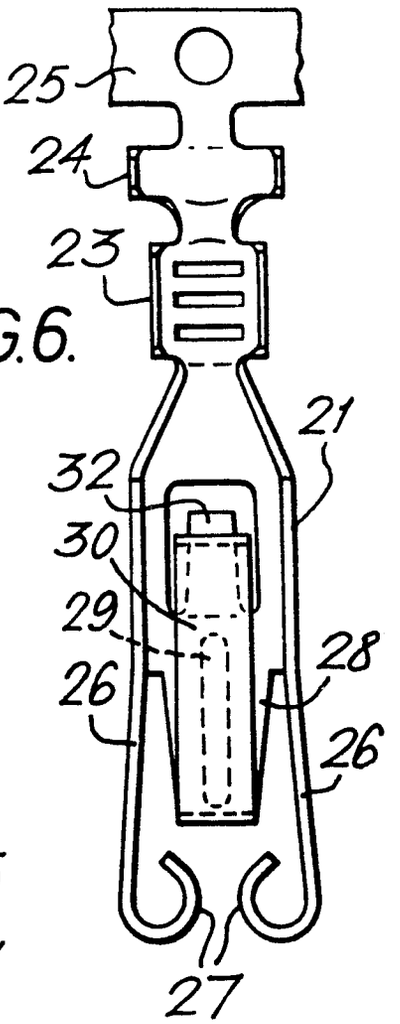


FIG.6.



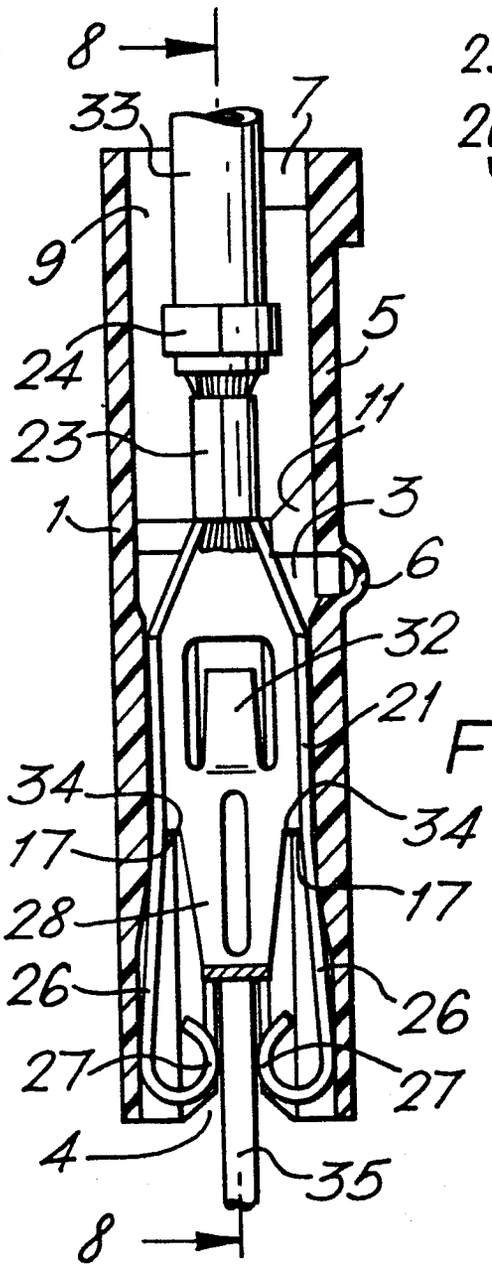


FIG.7.

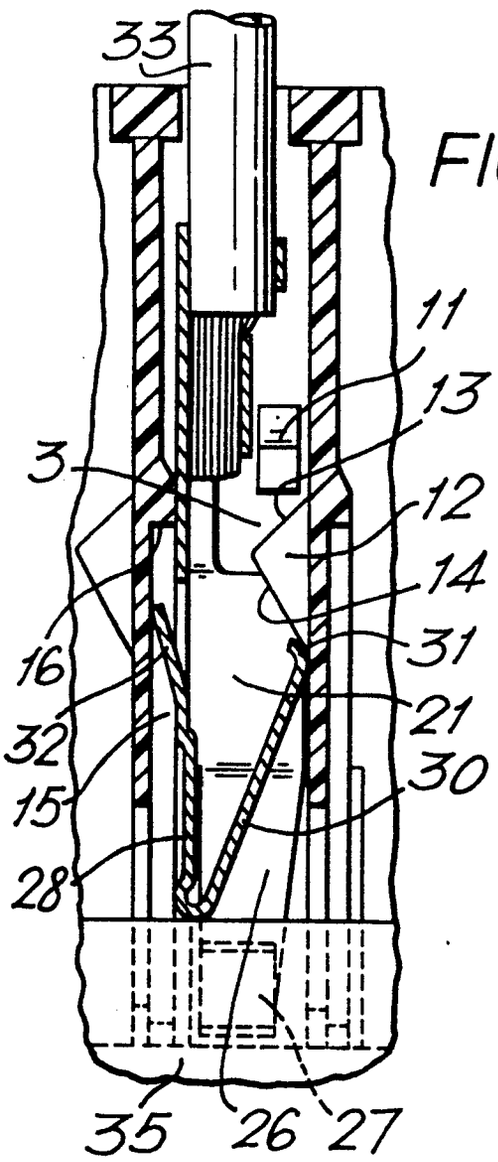


FIG.8.

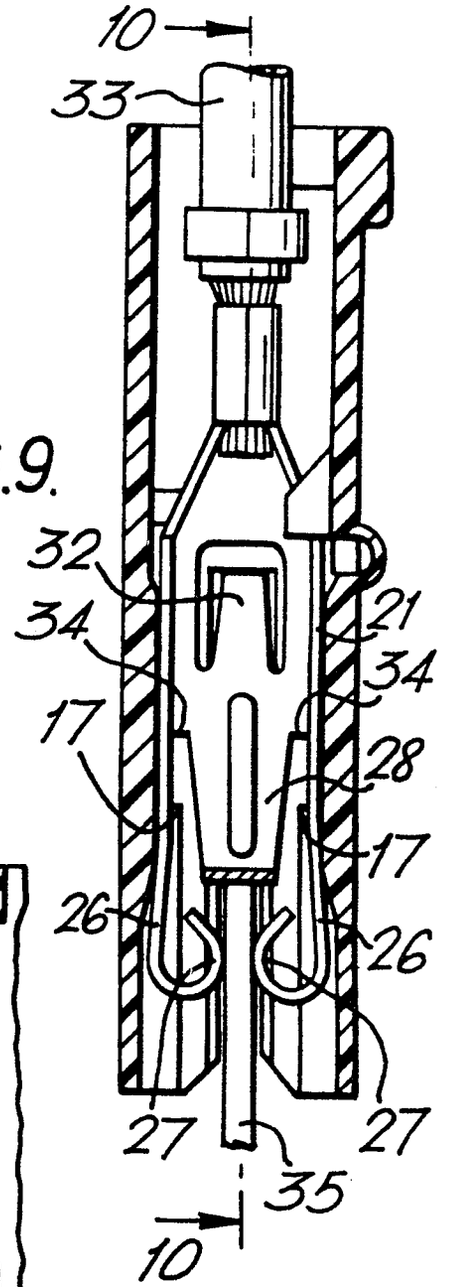


FIG.9.

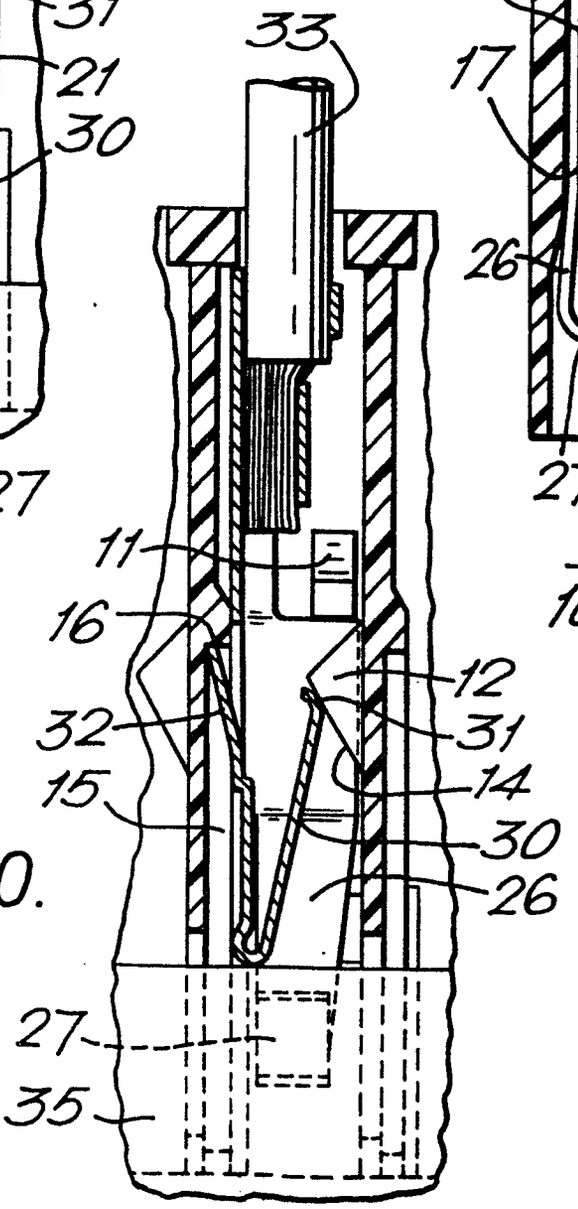


FIG.10.