Aug. 17, 1965 G. W. DEAN 3,201,744

CONTACT TERMINAL FOR AN ELECTRICAL CONDUCTOR MEMBER

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FIG. 1.

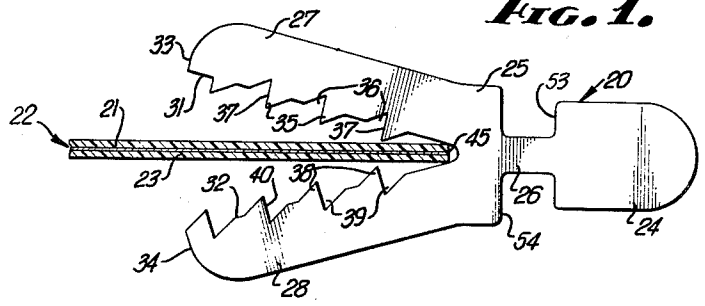


FIG. 2.

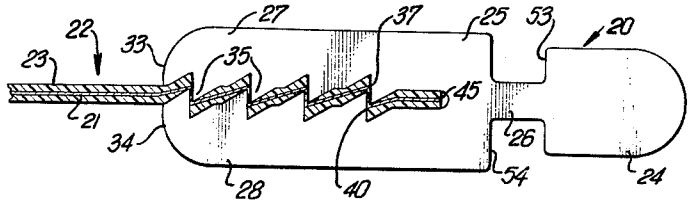
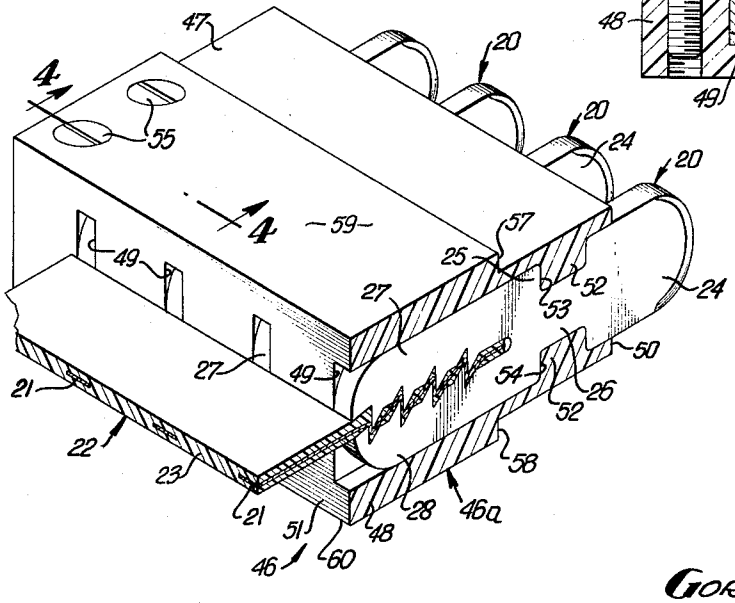


FIG. 3.



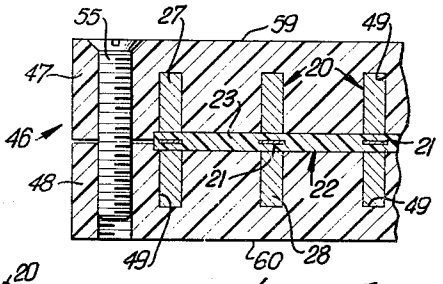


FIG. 4.

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FIG. 5.

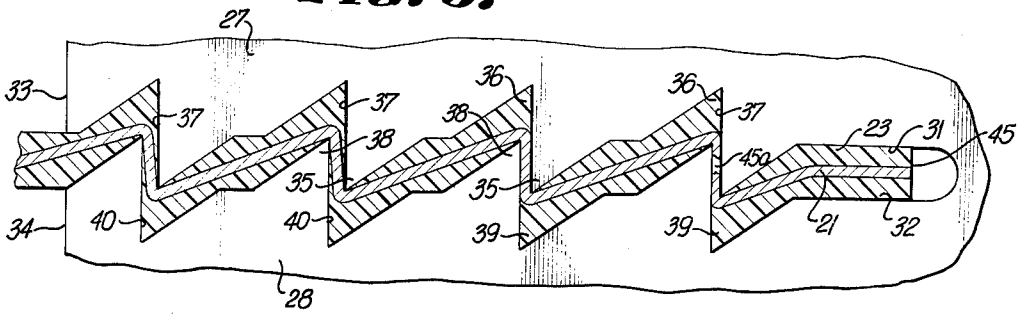

FIG. 6.

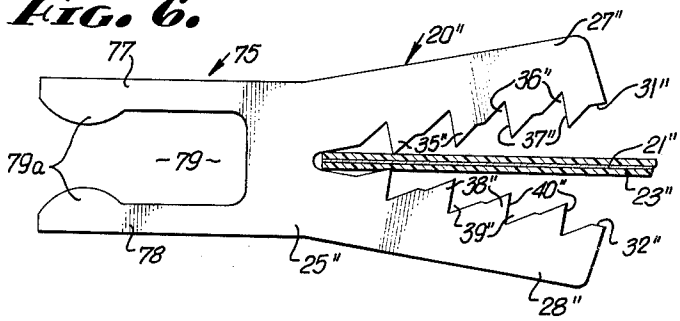

FIG. 7.

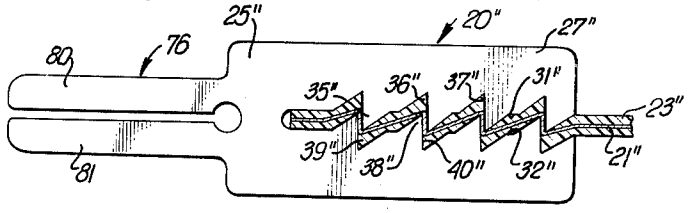

FIG. 8.

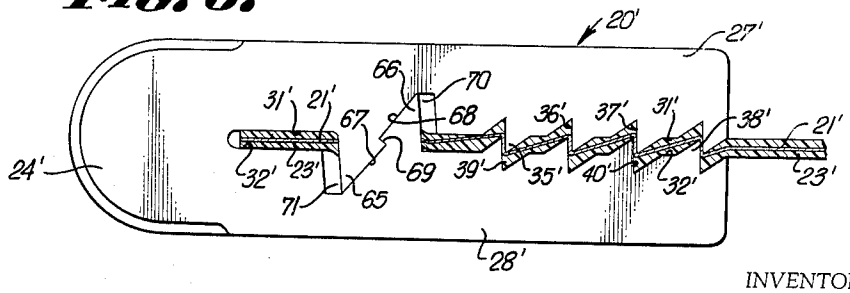

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FIG. 10.

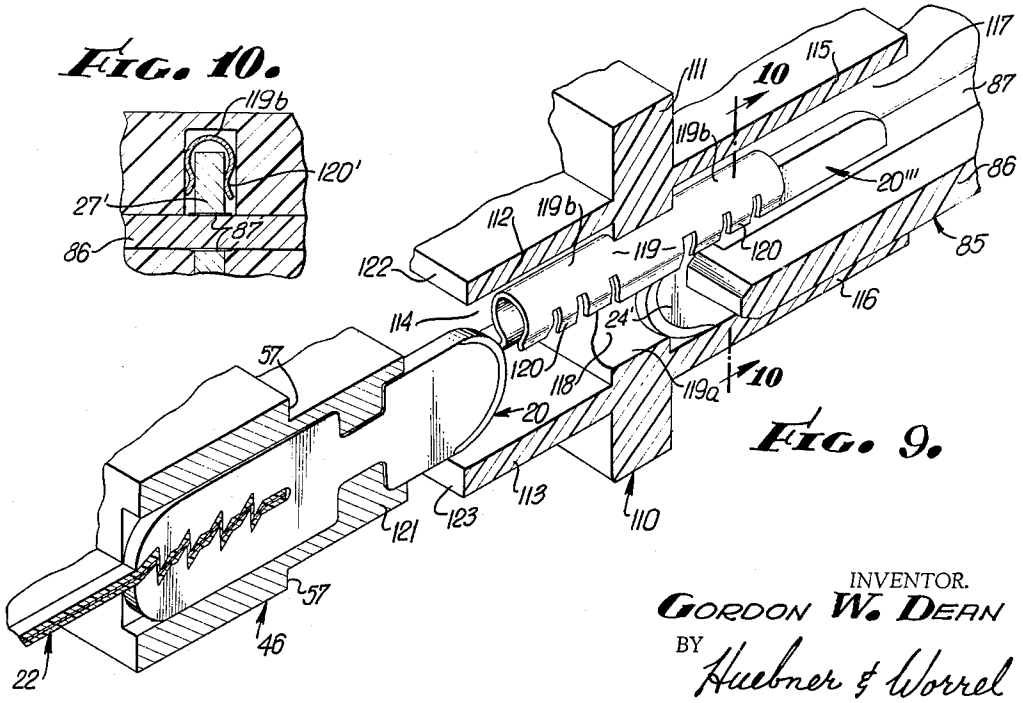

FIG. 9.

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CONTACT TERMINAL FOR AN ELECTRICAL CONDUCTOR MEMBER

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Filed Feb. 15, 1961, Ser. No. 89,538
6 Claims. (Cl. 339—97)

This invention relates to contact terminals for electrical conductor members and more particularly to a contact terminal having bifurcated parts adapted to grip a strip cable, printed circuit board, or other electrical conductor member.

The contact terminal of this invention comprises a member of conducting material having front and rear ends wherein the member has a forward contacting portion which is adapted to mate with another terminal, and a pair of gripping arms or tongs extending rearwardly from the contacting forward portion which are adapted to clamp upon opposite surfaces of a conductor member.

It is an object of this invention to provide a contact terminal which may be adapted to grip and complete a contact with various types of electrical conductor members and the terminal is especially suitable in conjunction with a conductor member having a generally flat surface, such, for example, as a strip cable or a printed circuit board.

Another object of this invention is to provide a contact terminal matable with another contact terminal forming an electrical connector, wherein the electrical conductor members which are engaged by the respective contact terminals may be of different types as for example a printed circuit board and an insulated cable.

A further and more specific object of this invention is to provide a contact terminal having a pair of gripping arms which are provided with teeth and notches and are adapted to be closed upon an insulated conductor whereby the teeth will slice through the insulation of the conductor and complete a connection between the conductor and the contact terminal.

Another object of this invention is to provide a contact terminal having a pair of initially diverging gripping arms which are provided with locking means to clamp the arms together when converged into connection relationship upon an electrical conductor member.

A further object of this invention is to provide in one form thereof a contact terminal wherein the gripping arms embody one or more locking fingers which are engageable in holes or sockets formed in a printed circuit board.

Further objects and advantages of the invention will appear from a consideration of the description which follows wherein the details of construction of embodiments thereof are described with reference to the accompanying drawings in which:

FIGURE 1 is a side elevational view of one form of the contact terminal (pin type) in open position with a strip cable in position to be clamped;

FIGURE 2 is a side elevational view of the same contact terminal clamped upon the strip cable;

FIGURE 3 is a perspective view of an electrical plug comprising a plurality of the novel contact terminals mounted within an insulation housing;

FIGURE 4 is a cross-sectional view taken on line 4—4 of FIGURE 3;

FIGURE 5 is an enlarged fragmentary side elevational view of the terminal as illustrated in FIGURE 2 but more clearly showing the engagement of the teeth with the strip cable;

FIGURE 6 is a side elevational view of the contact terminal illustrating a socket contact instead of pin;

FIGURE 7 is a side elevational view of the contact terminal illustrating a modified pin contact portion adapted to be received in the socket portion of the embodiment shown in FIGURE 6;

FIGURE 8 is a side elevational view of the contact terminal illustrating locking dogs for retaining the respective arms in parallel closed relationship;

FIGURE 9 is a perspective view partially in section of contact terminals of the types illustrated in FIGURE 2 coupled within a socket adaptor to effect an electrical connection between a strip cable and a printed circuit board; and

FIGURE 10 is a cross-sectional view taken on line 10—10 of FIGURE 9.

Illustrated in FIGURES 1 through 8 of the drawings are contact terminals generally designated 20 all of which are adapted to grip a conductor strip or ribbon 21 of an electrical strip cable 22.

The strip cable 22 is formed in the usual manner of a plurality of the generally flat flexible conductor strips 21 spaced one from the other in a generally parallel relationship. The conductor strips 21 are encased within a strip or tape of flexible insulation material 23.

The contact terminals 20 preferably are formed of a fairly hard, durable, conductive material, as for example beryllium copper or phosphor bronze. It should be susceptible to taking a set under application of pressure. In width a terminal corresponds generally with the width of a conductor 21 and is formed with a rounded forward contact section 24, a rear cable gripping section 25, and a reduced intermediate neck section 26 joining the forward section 24 and rear section 25. A pair of initially divergent elongated jaws or clamping arms 27 and 28 are embodied as parts of the rear section 25, having inner edge surfaces 31 and 32 and ends 33 and 34.

On inner edge surface 31 of jaw 27 are formed a plurality of spaced apart pointed teeth 35 projecting from the surface 31, and a plurality of spaced apart notches 36 positioned between the teeth 35. Each tooth 35 and adjacent notch 36 are partially defined by a common wall 37 which is generally perpendicular to the inner surface 31. In my preferred embodiment I illustrate four such alternating teeth and notches. However, a lesser or greater number may be used to achieve the same result.

The lower jaw 28 on its inner surface 32 is provided with a plurality of similarly spaced apart pointed teeth 38 projecting toward the upper jaw 27 from the surface 32, and a plurality of spaced apart notches 39. There are common walls 40 forming one side of each tooth 38 and notch 39 comparable and complementary to the walls 37 of the upper jaw 27. The positioning of the teeth 38 and notches 39 on the surface 32 is such that a notch 39 is aligned under a tooth 35 on the jaw 27 and the notch 36 is aligned and adapted to receive a tooth 38 on the lower jaw, when the two jaws are closed generally parallel to each other as shown in FIGURES 2 and 5.

The longitudinal relative spacing of the teeth, notches and walls of the two jaws is such that when the jaws are closed and consequently the respective teeth 35 and 38 enter into the notches 36 and 39, the space between the respective walls 37 and 40 will be graduated in width from the teeth closest to the neck 26 toward the teeth nearest ends 33 and 34. The reason for the spacing will be subsequently explained.

In order to complete a connection between a terminal 20 and a conductor strip 21 of the strip cable 22, an end 45 of the cable is inserted between the jaws 27 and 28 so that the end is in close proximity to the point where the jaws converge, the conductor strip 21 is parallel to and aligned between the jaws 27 and 28. In this position the two jaws 27 and 28 are pressed together in any convenient manner so that the pointed teeth 35 and 38

engage the insulation 23 on both sides of the conductor strip 21.

As the jaws are brought together the teeth 35 and 38 bite into the insulation on each side of the conductor and slice and peel the insulation away, thus baring the conductor 21 so that a connection is made between the wall 37 with one side of the conductor 21 and wall 40 with the other side of said conductor, as illustrated in FIGURE 5. As the insulation is peeled by the biting action it is forced into and packs in the respective notches 36 and 39.

In the manufacture of strip cable 22 there is generally a manufacturing tolerance of ±.0002 in the thickness of each conductor strip 21. In order to assure adequate connections between the terminal teeth walls and the conductor strip, because of this tolerance, it has been found that best contact results are achieved if the spacing between the middle set of teeth is set for the exact dimension of the thickness of the conductor strip 21 as specified by the manufacturer, while the spacing between the teeth nearest the neck 26 is set for the minimum tolerance or slightly less than the specified thickness of the conductor so that teeth will bite into the conductor, and possibly rupture it as at 45*a* as shown in FIGURE 5. The spacing of the teeth nearest the ends 33 and 34 of the jaws is set for the maximum tolerance or slightly wider than the specified thickness of the conductor strip 21.

In this way it will be seen that the flexible conductor 21 will be connectively engaged by at least one of the teeth depending on its thickness as the jaws 27 and 28 are closed upon each other. Further, with the utilization of a series of teeth having graduated spacing, the conductor 21 will always be retained within the contact terminal 20, and should the teeth adjacent the neck 26 rupture the conductor strip 21 one or more of the other teeth will retain the conductor within the jaws.

An assembly in the nature of a plug 46 retaining and mounting a series of terminals 20 which are severally secured to conductors 21 of strip cable 22, is illustrated in FIGURES 3 and 4. This plug comprises a housing block 45*a* which includes an upper section 47 and a similar lower section 48, formed of insulation material. The sections 47 and 48 are each provided with a series of elongated laterally spaced parallel slots 49 which extend through the sections from the front surface 50 to the rear surface 51 of the housing. The slots 49 are of a size and configuration to snugly accommodate the major portions of the contact terminals 20 and are spaced from each other to correspond to the spacing of the conductors 21 within the strip cable 22. This configuration incorporates similar flanges 52 which extend toward each other within the slots. These flanges engage walls 53 and 54 defining upper and lower recesses formed by the reduced neck 26 of the terminals 20.

The terminals 20, after being clamped on the conductors 21, are inserted in the slots 49 of the lower section 48, and the upper section is superimposed over the lower section with the sections 47 and 48 being held together in any conventional manner, as for example by screws 55.

When the plug is assembled at the end of the strip cable as described, the rounded front pin contact sections 24 of the terminals 20 project beyond the front surface 50 of the housing and are thus adapted to mate with sockets of a receptacle (not shown) in order to complete a connector comprising plug and receptacle.

It is found desirable to incorporate ledges 57 and 58 on the top surface 59 and bottom surface 60 of the respective sections 47 and 48 to act as stop means which engage a suitable complementary stop element (not shown) on a receptacle housing or adaptor such as on a panel board or the like.

Referring to FIGURE 8, there is shown there a contact terminal 20′ generally identical to the form shown in FIGURES 1–5, but with the added feature of latching

means on the jaws or arms 27′ and 28′ to lock the respective jaws together and consequently upon the conductor 21′ when the jaws are in closed parallel relationship. The latching means comprises a pair of resilient pointed dog latch members 65 and 66 extending from the respective inner surfaces 31′ and 32′ toward each other and longitudinally offset one from the other so that as the jaws 27′ and 28′ are closed together the conductor strip 21′ and insulation 23′ is pierced and broken by the points of the latches 65 and 66.

There is provided a space 70 in jaw 27′ in front of the latch member 66 and another space 71 in jaw 28′ at the rear of latch member 65. These spaces 70 and 71 will allow the members 65 and 55 to give as they contact each other along biased camming surfaces 67 and 68 and snap lock together at offset complementary abutting faces 69.

FIGURES 6 and 7 illustrate contact terminals 20″ wherein the contact portion in FIGURE 6 is a form of socket 75 adapted to mate with a pin 76 of FIGURE 7. The socket 75 is of a generally prong type, having upper and lower resilient spring contact arms 77 and 78 which extend forward from the rear portion 25′ and define an opening 79. The pin portion 76 shown in FIGURE 7 includes a pair of generally parallel resilient spring fingers 80 and 81 adapted to slide within the arms 77 and 78.

Protrusions 79*a* are formed on the arms 77 and 78 to provide a restricted opening for entrance of the pin 76 and consequently a good frictional contact.

FIGURE 9 illustrates a form of coupling receptacle 110 which is adapted to connect a strip cable 22 with a printed circuit board 85 or connect any other conductor elements both provided with the terminals 20. The coupling 110 utilizes a monoblock construction formed of insulation material. It includes a panel wall 111 and extending generally perpendicular from one side of said wall an upper and lower shelf 112 and 113 which are parallel with and spaced from each other. The wall 111 and shelves 112 and 113 define an opening 114. On the other side of said wall 111 are similarly spaced shelves 115 and 116 defining a second opening 117. The wall 111 is provided with a plurality of generally dumbbell shaped openings 118 each of which is aligned with an opening 114 and an opening 117 communicates therewith.

A double ended snap-in socket 119 generally circular in cross-section is inserted in opening 118 so that gripping portions 119*b* of flared fingers 120 extend into the opposite openings 114 and 117.

In order to complete a connection between the conductors of a printed circuit board and strip cable, a terminal and circuit board assembly, generally designated 20‴, is inserted in the opening 117 so that the pin portion 24′ and a part of the jaws are engaged by and retained in the fingers 120. Also the pin portion 20 and forward reduced portion 121 of plug 46 is inserted into opening 114 where the pin portion 20 will be engaged by the fingers in the gripping portion 119*b* of the socket 119. The ledges 57 rearwardly terminating the reduced portion 121 will act as forward stops and abut the ends 122 and 123 of the respective shelves 112 and 113.

While specific embodiments of the present invention have been disclosed in the foregonig description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore, it is intended that no limitation be imposed on the invention except as defined by the scope of the appended claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A contact terminal and conductor member attached thereto and said contact terminal adapted to mate with another terminal, said combination comprising: a member of conductive material having front and rear ends, said member having a forward contacting portion adapted

to mate with another terminal, a pair of clamping arms extending rearwardly from said contacting portion in generally parallel relationship to each other, said arms having opposed inner surfaces, and a conductor member held between said clamping arms, means provided on said inner surfaces for retaining said conductor member between said inner surfaces against longitudinal relative displacement, wherein said means includes a tooth projecting from each of said respective inner surfaces and longitudinally spaced from each other, and wherein each of said teeth embodies an edge wall extending from the point of the tooth back into the clamping arm and the arm is cut out adjacent the edge wall to provide a notch, which notch accommodates a tooth projecting from the opposite arm, the adjacent edge walls lying in generally parallel proximity, and the conductor member is frictionally engaged between and by said proximate walls.

2. A contact terminal and conductor member combination as defined in claim 1 wherein each inner surface is provided with a plurality of longitudinally spaced teeth and notches.

3. A contact terminal and conductor member combination as defined in claim 2 wherein the longitudinal spacing beetween the edge walls on the gripping arms is varied.

4. An electrical contact terminal and insulated conductor strip member secured thereto and said contact terminal adapted to mate with another contact terminal, said combination comprising: a member of conductive material having front and rear ends, said member having a forward contacting portion adapted to mate with another terminal, a pair of clamping arms extending rearwardly from said contacting portion in generally parallel relationship to each other, said arms having opposed inner surfaces, said conductor member being a tape of conductive material covered by a ribbon coating of insulation, an end portion of said conductor member being inserted between the inner surfaces of said clamping arms with said conductive tape extending parallel with and in the plane of said clamping arms and bite means on the inner surfaces of said arms penetrating said insulation from opposite sides of said conductive tape and which the conductive tape is held with said bite means said bite means meshing to define a zig-zag space within in engagement with the conductive material of the conductor member.

5. An electrical contact terminal and insulator conductor strip member as defined in claim 4 wherein the bite means penetrating said insulation include opposed teeth on the respective inner surfaces.

6. A combination as defined in claim 5 wherein relief notches are formed adjacent the teeth to receive insulation removed from the conductive tape.

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