Feb. 3, 1959 T. R. HARRIS 2,871,551

CHAIN OF COMBINED TERMINAL AND SUPPORT MEMBERS FOR ELECTRICAL ELEMENTS

Filed Oct. 19, 1955 2 Sheets-Sheet 1

Fig. 1

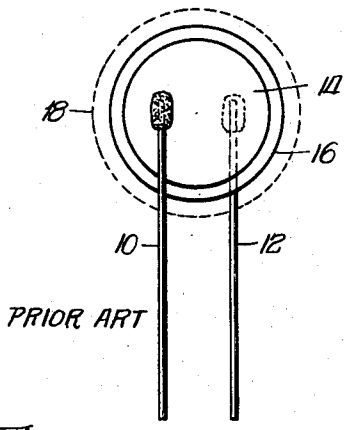

Fig. 2

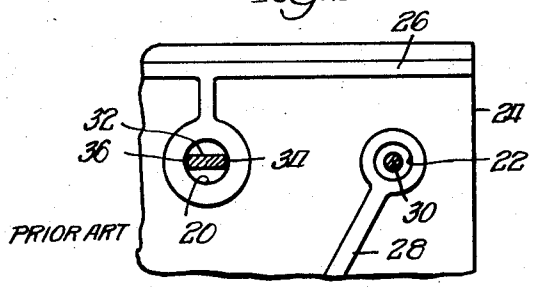

Fig. 6

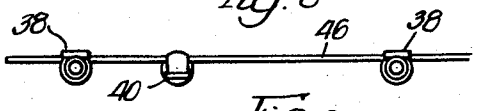

Fig. 5

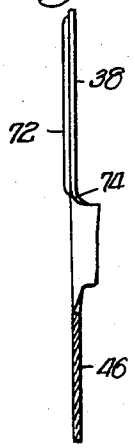

Fig. 5a

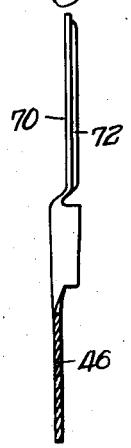

Fig. 3

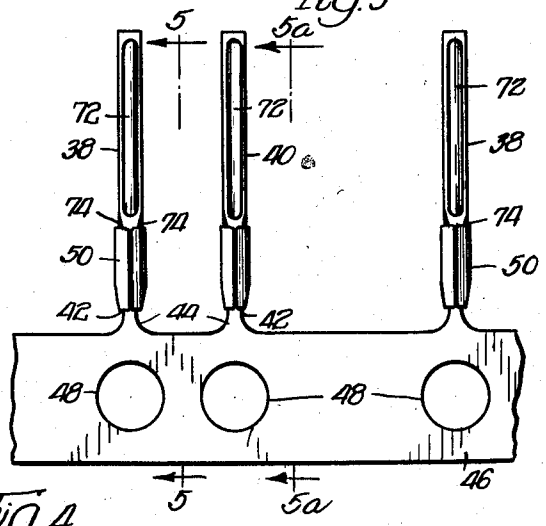

Fig. 4

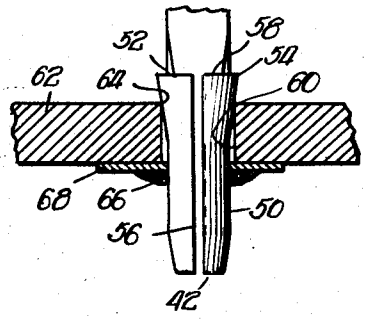

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Fig. 7

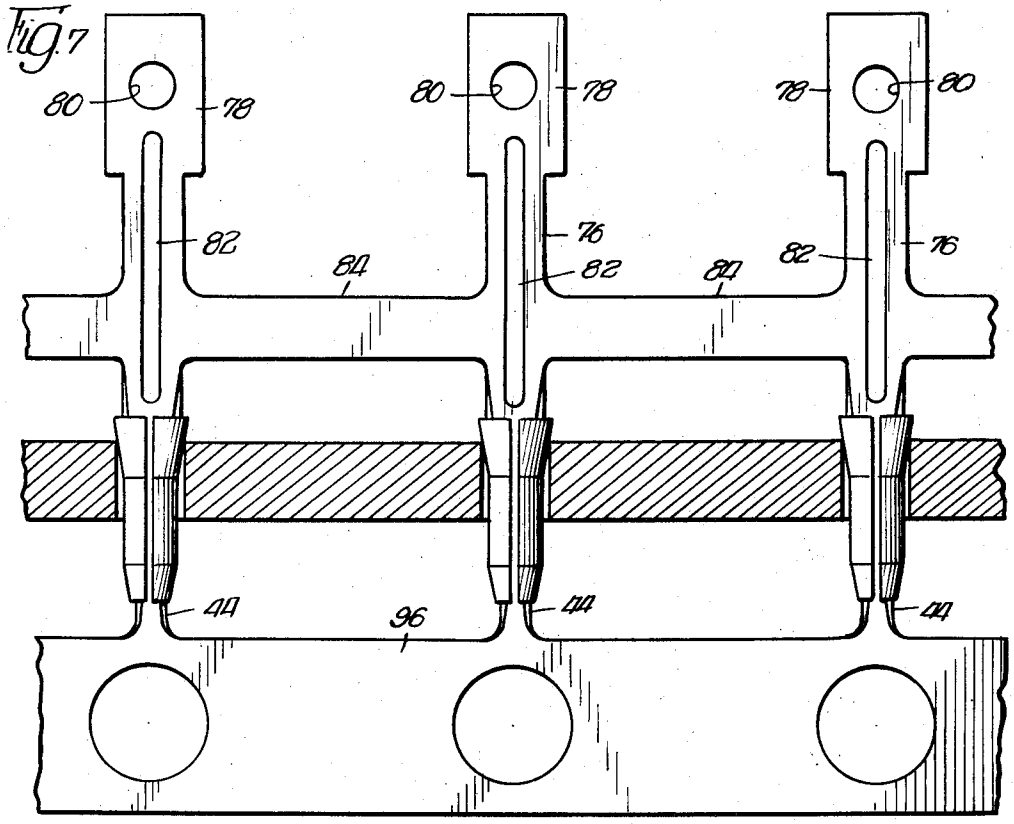
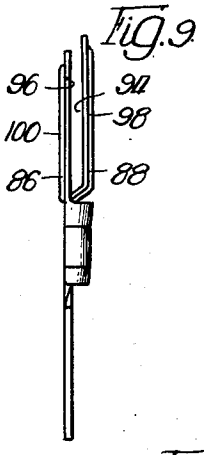


Fig. 9



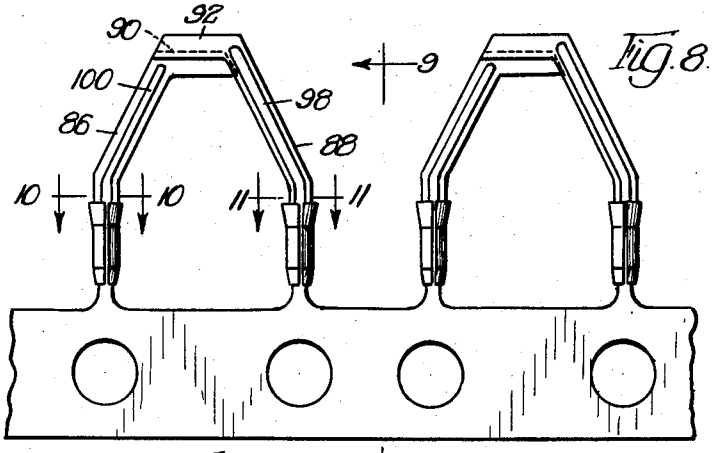


Fig. 8.

Fig. 10

Fig. 11

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CHAIN OF COMBINED TERMINAL AND SUPPORT MEMBERS FOR ELECTRICAL ELEMENTS

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Application October 19, 1955, Serial No. 541,372

2 Claims. (Cl. 29—193.5)

This invention relates to a combined terminal and support member for electrical elements and more particularly to a terminal capable of being fabricated in the form of a chain suitable for feeding into automatic machines and which is particularly adapted for use with printed circuit boards.

It is, therefore, an object of this invention to provide a combined terminal and support member for electrical elements of the character described which is particularly useful in the automatic assembly of electronic circuit components. It is a further object to provide a terminal which is particularly useful for installation in printed circuit boards, the terminal being adapted to be disposed in such boards accurately and positively and also being adapted to be readily secured permanently in position in such boards.

In addition, it is an object to provide terminals fabricated in the form of a chain and disposed substantially in fixed spaced relation to each other while they are in this chain form. Still another object is to provide a chain of terminals of the character described in which the terminals are so disposed and so fabricated that they serve as a temporary support for the electrical elements to which they are subsequently permanently secured. Yet another object is to provide terminals of the character described which are self aligning.

Further objects and advantages of this invention will become evident as the description proceeds and from an examination of the accompanying drawings which illustrates one embodiment of the invention and in which similar numerals refer to similar parts through the several views.

In the accompanying drawings:

Figure 1 is a plan view of one form of prior art terminal shown in association with a disc capacitor.

Figure 2 is a plan view of a fragmentary portion of a printed circuit board, two terminal receiving openings being shown with two forms of prior art terminals disposed therein and shown in cross section.

Figure 3 is a view in elevation of a fragmentary portion of a chain of combined terminal and support members incorporating one form of the present invention.

Figure 4 is an enlarged side view of a fragmentary portion of one of the terminals shown in Figure 3 after having been removed from the chain and installed in a printed circuit board, the board being shown in vertical section.

Figure 5 is a view in side elevation of one of the terminals shown in Figure 3, the view being taken along the line 5—5 of Figure 3.

Figure 5*a* is a view in side elevation of another of the terminals shown in Figure 3, the view being taken along the line 5*a*—5*a*.

Figure 6 is an end view in elevation of two of the terminals shown in Figure 3.

Figure 7 is a plan view of a fragmentary portion of a chain of terminals having an alternative form of construction.

Figure 8 is a view in elevation of a fragmentary portion of a chain of terminals incorporating another alternative form of construction.

Figure 9 is a view in side elevation and partly in vertical section of two of the terminals shown in Figure 8, the view being taken along the line 9—9 of Figure 8.

Figure 10 is a view in horizontal cross section of one of the terminals shown in Figure 8, the view being taken along the line 10—10.

Figure 11 is a view in horizontal section of one of the terminals shown in Figure 8, the view being taken along the line 11—11 of Figure 8.

Referring now to Figures 1 and 2 of the drawing, one form of combined terminal and support member of the prior art is shown in Figure 1. The two terminals 10 and 12 are in the form of wires of circular cross section. They are each secured by soldering in association with a metallic disc 14 disposed on opposite sides of an insulating disc 16 of dielectric material. The entire disc assembly is normally coated with a suitable insulating covering material, indicated by the dotted line 18, after the supporting members 10 and 12 have been secured to the discs 14 thereto. The finished assembly forms a miniature capacitor which can be mounted in an electronic circuit through the wires 10 and 12, in any suitable manner.

In Figure 2 a fragmentary portion of a printed circuit board is shown, the two holes 20 and 22 in the board 24 having associated therewith strips 26 and 28 of electrically conducting material, as is conventional practice in the fabrication of such printed circuits. The manner in which the wire terminals 10 and 12 would be likely to be received within one of these circular openings is illustrated in the opening 22 in Figure 2. The wire 30 is shown in cross section in the center thereof, the diameter of the opening 22 being substantially larger than the diameter of the wire 30. Obviously, unless the wire 30 is of a diameter very slightly smaller than the diameter of the hole 22, it will be very difficult to secure an electrical element in association with the printed circuit board by inserting terminals such as the terminals 10 and 12 in the holes 20 and 22. Not only is there a problem of adequate temporary support for the electrical element being so mounted but there is also a problem of obtaining a satisfactory permanent electrical connection between the wire terminal and the printed circuit which, in the case of the hole 22, is the ribbon of electrically conducting material 28 which circumscribes the hole 22.

A flattened form of support member 32, also common to the prior art, is shown in association with the other opening 20 in the printed circuit board 24 shown in Figure 2. This type of support member may have a tapered form so that it will seat in the opening 20, after it has been inserted a sufficient distance. Here the problem of adequate support is partially answered but again there is a problem of satisfactory connection between the printed circuit portion 26 and the terminal 32. The only parts of the terminal 32 which are in close association with the portion 26 of the printed circuit which circumscribes the hole 20 are the two lateral edges 34 and 36. It is customary to simultaneously solder all of the supporting and terminal elements to the printed circuit by bringing the surface of the board having the circuit thereon into association with the surface of a bath of molten solder. The connection between the supporting and terminal elements and the printed circuit is thereby made by molten solder being deposited on and between those two elements, and the subsequent solidification thereof. In the case of the support element 30 shown in Figure 2, such a deposit would probably not take place because of the relatively large annular space between the support element 30 and the printed circuit portion 28. In the case of the

support element 32, a deposit of solder interconnecting the element 32 and the portion 26 of the printed circuit would be made at the two lateral edges 34 and 36, but there would not be sufficient capillary action to entirely fill the space between the edge of the hole 20 and the flat side of the element 32 with molten solder and the resultant joint would not be satisfactory in many instances.

In Figure 3 an improved form of combined terminal and support member is disclosed which overcomes this difficulty of possible defective connection between the terminal and the printed circuit. The terminals 38 and 40 shown therein are preferably formed integrally from a strip of conductive material such as a suitable metal. In the forming operation one end 42 of each terminal is left secured to a tongue member 44 which is an integral part of the feeding strip 46. This strip may be provided with suitable perforations 48 to aid in the feeding thereof to an automatic terminal dispensing and setting machine.

The end 42 of each terminal is in the form of a substantially tubular base portion 50 best shown in Figure 4. This base portion may be formed of two sides 52 and 54 rolled to form a generally tubular section with a longitudinal gap 56 between the upper edges of the two sides 52 and 54. The upper end 58 of the base portion 50 in addition is preferably flared outwardly, while the end 42 is preferably tapered inwardly, thus giving an area of increased diameter at the end 58 and an area of reduced diameter at the end 42. This construction of the base portion permits the terminal to be readily inserted in a suitable opening such as the opening 60 in the printed circuit board 62 shown in Figure 4. When so inserted, the area of enlarged diameter 58 will be brought into abutment with the upper edge 64 of the opening 60 and it will, therefore, provide a means of aligning the terminal with respect to the opening 60 and will cause it to stand upright in the board 62. The main body of the base portion 50 will, therefore, be held substantially in the position shown in Figure 4 by the flared upper end 58.

The alignment of the terminal in this position will permit the forming of a satisfactory soldered joint 66 between the main body of the base portion 50 and the portion of the printed circuit 68 which is in association with the hole 60. Because of the relatively narrow annular opening between the terminal and the hole 60, the solder, through capillary action, will flow and solidify to form an annular joint completely around the pin or terminal, contrary to the condition which is likely to result in connection with pins of the form shown in Figure 2.

As shown in Figures 5, 5*a* and 6, it may be desirable to have the shank portion 70, Fig. 5*a*, of one of each pair of terminals offset. This will permit the insertion of a disc such as that represented in Figure 1 between a pair of adjacent terminals, and each terminal will be in contact with the opposite face of a disc capacitor as shown in Figure 1. It may also be desirable to provide the shank portions with a rib 72, adding strength and rigidity to the terminal so that it will form a firm support for the electrical element associated therewith. The terminal may preferably be further strengthened by flaring the base of the shank portion on both sides thereof, as best shown at 74 in Figure 5, so as to provide an area of greater strength between the base portion 50 and the shank portion 70.

The strip 46 can be utilized to chain feed the terminals into automatic machinery for severing, feeding and applying them to printed circuit boards. The terminals are preferably severed at the end 42 so that the tongue 44 is removed clearly from the terminal.

An alternative form of terminal pin incorporating the invention is shown in Figure 7. In this alternative form the upper end 78 of the shank portion is in the form of a flat, plate-like member having an opening 80 therein to assist in securing the end 78 to the electrical element to be supported. A strengthening rib 82 is provided in the central portion of the shank similar to the rib 72 previously described. The shank members 76 are also connected together by a narrow ribbon of material 84 forming an electrical connection therebetween. Although three adjacent terminals are shown connected together in Figure 7, it is obvious that adjacent pairs of terminals could be connected by a connecting ribbon 84, or the entire chain of terminals could be so connected. The particular pattern for this connecting strip 84 will depend, of course, upon the use to be made of the terminals. Where it is desirable to have several terminals interconnected, the strip 84 can be utilized for this purpose. It would also, of course, be possible to have all of the terminals so connected and to sever portions of the strip 84, as desired, at the same time that the terminals are severed from the tongue 44 connecting to them to the strip 46. The offsetting of the shanks of the terminals can also be coordinated with the pattern of the connecting strip 84 since normally terminals on opposite sides of the supported electrical element would not be so connected together.

Figure 8 illustrates still another form of terminal embodying the invention, this particular form being particularly adapted for use in the manufacture of disc capacitors, any like flat elements such as printed resistors or resistor-capacitor combinations. As shown in Figure 8, pairs of terminals 86 and 88 are formed so that their upper extremities 90 and 92 overlap. In addition, the upper ends 90 and 92 are brought into close association so that a disc capacitor element of the type shown in Figure 1, for example can be frictionally held therebetween. This characteristic is best shown in Figure 9 where the shank 94 of the terminal 88 is shown displaced inwardly toward the shank 96 of the terminal 86. In addition, as shown in Figure 8, the major portion of the shanks 94 and 96 are angularly disposed with respect to the bases of the terminals so that they angle inwardly toward each other. The upper extremities 90 and 92 are likewise angularly disposed with respect to the shanks 94 and 96 so that they are substantially horizontal and overlap each other to a substantial degree. A strengthening rib 98 may be provided in the shank 94 and a strengthening rib 100 in the shank 96 as best shown in cross section in Figures 10 and 11. The base portion of the terminals shown in Figure 8 is substantially the same as that previously described in connection with the form shown in Figures 3 and 7.

As previously mentioned, a longitudinal slit 56 is provided in the base portion of all the forms of terminal just described. This provides a spring action in the base portion which facilitates the proper seating of the terminal. Likewise, the fact that the terminals are maintained in proper alignment by being integrally formed with the strip 46 makes it much easier to carry out the proper positioning and temporary support of any electrical element to be subsequently secured to and permanently supported thereby. A pair of terminals of the form shown in Figure 8, for example, forms a holding fixture for the electrical element to be supported which obviously eliminates considerable handling of individual parts and greatly simplifies the assembling operation when an electrical element is to be secured thereto by soldering, for example. Contrary to the form shown in Figure 1, for example, if terminals of the form shown in Figure 8 are utilized a disc capacitor can be readily assembled and soldered since the disc element can be held between the terminals 94 and 96 during the soldering operation merely by the spring pressure resulting from the terminal 94 being displaced toward the terminal 96 at its upper end, as best shown in Figure 9.

In the drawing and specification, there has been set forth several preferred embodiments of the invention, and although specific terms are employed, they are used

in a generic and descriptive sense only and not for purposes of limitation. Changes in form and in the proportion of parts, as well as the substitution of equivalents are contemplated, as circumstances may suggest or render expedient, without departing from the spirit or scope of this invention as further defined in the following claims.

What is claimed is:

1. A chain of combined terminal and support members for electrical elements comprising a perforated strip of electrically conducting material, a plurality of combined terminal and support members formed integrally with and extending laterally from said strip in spaced relation to each other, each said terminal and support member including an elongated flat shank portion having a longitudinally disposed strengthening rib formed therein and extending substantially the entire length of the shank portion, the shank portions of each pair of adjacent terminals being disposed in offset parallel planes and forming a temporary holding fixture for an electrical element to be sunbsequently permanently secured thereto, an integral substantially tubular base portion, said base portion being outwardly flared at its end connected with said shank portion to provide an end diameter greater than the width of said shank portion and to provide a conical area of contact adapted to be seated in a circular opening in a printed circuit board, the opposite end of said base portion being inwardly tapered toward the outer extremity thereof to form a tapered nose substantially smaller in diameter than the diameter of said circular opening, said base portion being longitudinally split to form a longitudinal slot of substantial width to allow resilient contraction of the circumference of the base portion when inserted into said circular opening, and a severable tongue integrally connecting the base portion of each of said terminal and support members to said strip adjacent said tapered nose.

2. A chain of combined terminal and support members for electrical elements comprising a perforated strip of electrically conducting material, a plurality of combined terminal and support members formed integrally with and extending laterally from said strip in spaced relation to each other, each said terminal and support member including an elongated flat shank portion having a longitudinally disposed strengthening rib formed therein and extending substantially the entire length of the shank portion, an integral substantially tubular base portion, said base portion being outwardly flared at its end connected with said shank portion to provide an end diameter greater than the width of said shank portion and to provide a conical area of contact adapted to be seated in a circular opening in a printed circuit board, the shank portions of each pair of adjacent terminals being provided with parts angularly disposed with respect to said base portions so that said parts of each adjacent pair of shank portions overlap to form a holding fixture for an electrical element, the opposite end of said base portion being inwardly tapered toward the outer extremity thereof to form a tapered nose substantially smaller in diameter than the diameter of said circular opening, said base portion being longitudinally split to form a longitudinal slot of substantial width to allow resilient contraction of the circumference of the base portion when inserted into said circular opening, and a severable tongue integrally connecting the base portion of each of said terminal and support members to said strip adjacent said tapered nose.

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