

April 14, 1959

H. K. KRANTZ
ELECTRIC CIRCUIT CONNECTOR

2,882,514

Filed Oct. 11, 1955

3 Sheets-Sheet 1

FIG. 1

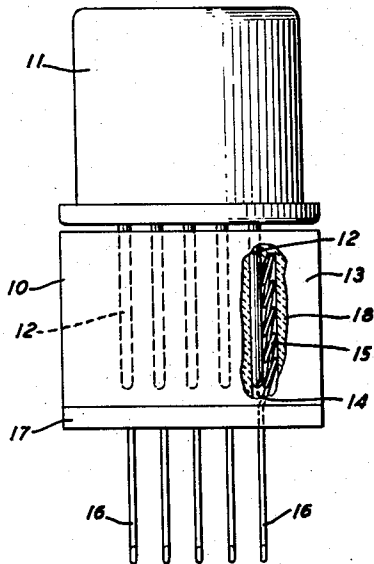


FIG. 4

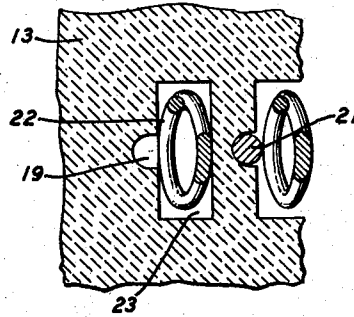


FIG. 3

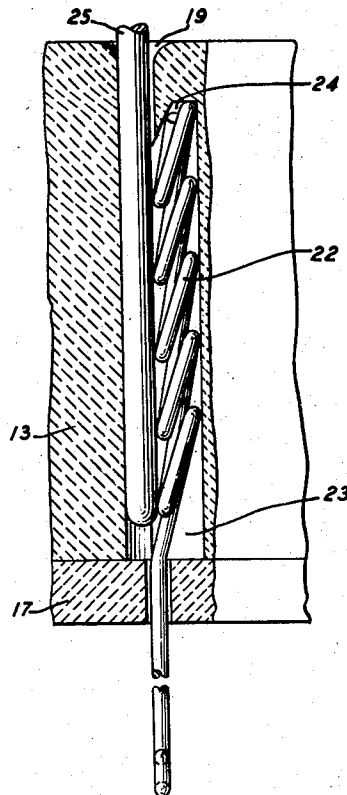
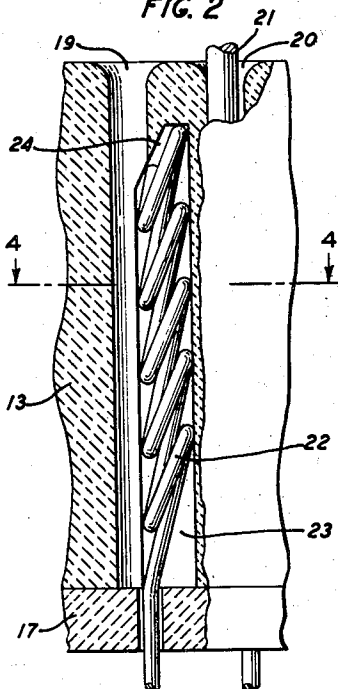


FIG. 2



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3 Sheets-Sheet 2

FIG. 6

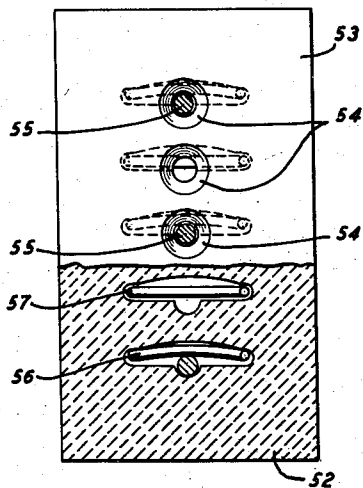


FIG. 8

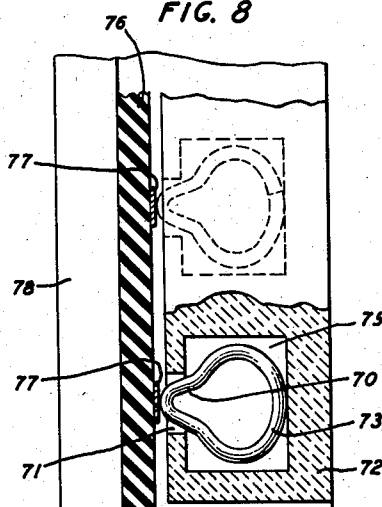


FIG. 5

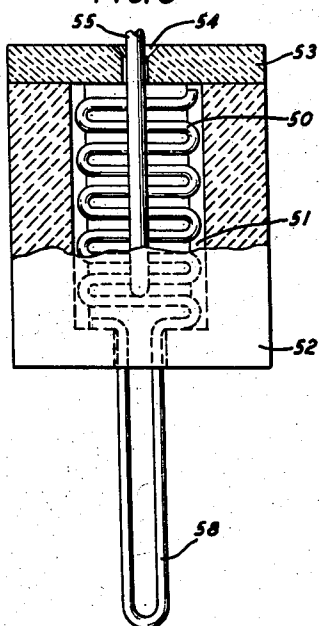
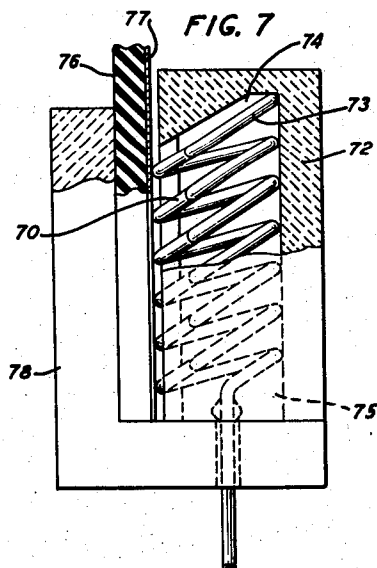


FIG. 7



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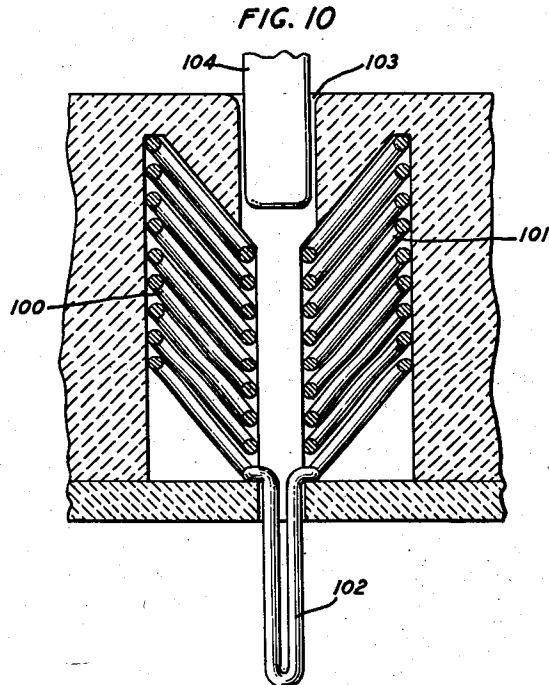
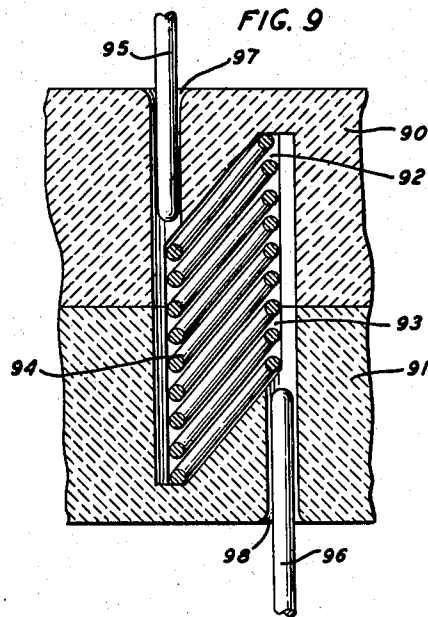
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3 Sheets-Sheet 3



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1

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ELECTRIC CIRCUIT CONNECTOR

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3 Claims. (Cl. 339-256)

This invention relates to electrical connectors and more particularly to miniature connectors of the socket type.

A general object of this invention is to provide an improved socket or connector of the plug-in type.

Another object of this invention is to provide a socket having improved mechanical and electrical reliability.

A further object of this invention is to provide a socket wherein a greater force is required to remove the lead-in wires from the socket than to insert them therein. Thus, it is an object of this invention to provide a socket wherein the electrical contacts are not disturbed by vibration or shock, while the lead-in wires may still be inserted readily and facily into the socket. Additionally, it is an object of this invention to attain this differential between the insertion and removal of the lead-in wires while employing straight, smooth-surfaced wire leads insertable into the connectors.

A further object of this invention is to attain a multiplicity of contact points, all of which apply a substantially equal and constant amount of pressure.

Another object of this invention is to facilitate production of socket connectors especially suitable for use with miniature and subminiature components.

Generally, connectors constructed in accordance with this invention involve a convoluted wire spring member confined within a receptacle having an offset aperture such that the plug-in contactor engages the outside or lateral surface of the wire spring member axially along the direction of its convolutions and is biased thereagainst. A preferred embodiment comprises a wire spring member in the form of a coil confined in an insulating receptacle member so as to increase the tilt of the coils from their initial configuration. The outer surface of the "low" side of each coil is aligned with the aperture for the plug-in member which when inserted engages this outer surface, thus causing the lower portion of each coil to move further downward and inward.

Thus, in one aspect this socket is arranged to admit the plug-in member with comparatively low mechanical resistance while providing a much higher mechanical resistance to withdrawal. Hence, a feature of the connector of this invention is its reliability of electrical contact despite vibration or shock which often disengages conventional plug and socket connectors of known constructions.

A further feature of this invention is found in the combination of the convoluted wire spring member and receptacle which insures a multiplicity of pressure point contacts despite variations in the size of the plug-in member and in the dimensional tolerances within which the receptacle and spring member are made.

The invention and its features and advantages will be understood more clearly from the following description taken in connection with the drawing, in which:

Fig. 1 is a view, partially in section, of one embodiment of this invention showing a transistor unit mounted therein;

Fig. 2 is an enlarged view showing two of the re-

2

ceptacles, one being partially in section and having a pin-type contactor inserted therein;

Fig. 3 shows the fully sectioned receptacle of Fig. 2 with a plug-in member inserted;

Fig. 4 is a sectional view of Fig. 2 taken at the line 4-4;

Fig. 5 is a view, partially in section, of another embodiment showing the plug-in member inserted;

Fig. 6 is a view of the embodiment of Fig. 5 seen from the top;

Fig. 7 is a side view partially in section of a further embodiment adapted for connecting printed circuit boards of which a portion of one is shown in section;

Fig. 8 is a top view, partially in section, of Fig. 7;

Fig. 9 is a sectional side view of a double-ended connector illustrative of another embodiment of this invention; and

Fig. 10 is a sectional side view of a further embodiment of this invention.

Referring to the drawing, Fig. 1 shows a five terminal socket 10 with an encased transistor 11 having five pin-type contactors 12. The socket member 10 comprises a housing 13 of insulating material having recesses 14 therein for the mounting of wire spring contact members 15. Each wire spring member 15 has an extension 16 for making an external connection thereto. The spring contact members 15 are retained in the recesses 14 in the insulating housing 13 by the flat cover plate 17 secured to the bottom of the insulating housing in any convenient fashion, as for example by means of screws into tapped holes in the block 13. The cutaway section 18 shows the general configuration of the spring contact member 15 with the transistor terminal pin 12 in contact therewith. While the plug-in component has been designated as an encased transistor, it should be apparent that other similarly housed electrical components may be mounted in like fashion. In a typical installation, a transistor housing of the type illustrated in Fig. 1 would have dimensions of approximately .40 inch over-all length by .33 inch height.

The partial cutaway section of Fig. 1 is shown in greater detail in Figs. 2 and 3. Fig. 2 shows a single aperture 19 in section with an outline of the adjacent aperture 20 with a pin contactor 21 mounted therein. The wire spring member 22 is confined within a recess 23 and distorted from the natural near horizontal coil configuration by the constriction in the upper end of the recess 24. Referring to Fig. 4, the rectangular cross section of the recess 23 and the manner in which the socket aperture 19 intersects the recess 23 are more readily apparent.

Fig. 3 is a further detail of a single socket 19 with the plug-in pin contact 25 inserted to the fully mounted position in lengthwise contact with the wire spring member 22. It will be noted that insertion of the pin meets with little resistance because it is required only that each coil be pushed in turn slightly downward and to the right, as viewed in Fig. 3. It will also be noted that this deflection requires that there be sufficient initial clearance between each turn of the coil to permit this downward and sideward deflection. Thus, in the embodiment shown, there result five pressure point contacts upon each pin member. It will be apparent that withdrawal of the pin member is inherently resisted by each turn of the coil, depending upon the friction generated at each point contact.

The section shown in Fig. 4 shows a top view of the recess 19 for receiving the pin contact member and, as previously noted, the rectangular recess 23 for retaining the coil spring member. As indicated, the left-hand socket is shown without a pin member, while the right-

hand shows the socket with a pin member 21 inserted. Typically, a socket housing in accordance with this embodiment may have dimensions comparable with those of the transistor housing, namely about .40 x .40 x .20 inch and capable of accepting a 16 mil diameter plug-in member having a length of .25 inch. It should be noted that the embodiment of this invention enables the facile construction of such subminiature components because of the readily formed coil member which need only be inserted in a molded block of the configuration shown with a retaining plate affixed to hold the coil members in place. Spring metal wire of 8 mil diameter has been found suitable for subminiature assemblies of this type.

Although the plug-in member has been disclosed herein as a "round" pin-type contactor it will be understood that a wide variety of plug-in contactors may be adapted to the connector of this invention. Thus, pin-type connectors may be of oval, square, or other rectilinear cross section, or may be the flat or so-called spade-type contactor. Also, as will be disclosed further hereinafter the plug-in member may be a printed circuit board having terminal strips along one edge, on one or both sides. Furthermore, plug-in members may be of a modified pin-type having toothlike or corrugated surfaces for engaging the convoluted wire member, thereby enabling a detent action with increased withdrawal resistance. Such a configuration enhances the cleaning or "wiping" effect upon insertion.

Other embodiments of this invention are shown in Figs. 5 through 8. Fig. 5 shows a convoluted wire spring contact member 50 in the form of a flat or substantially flat wound wire grid mounted in a recess 51 in a housing 52 of insulating material which may be, for example, a moldable phenolic. As in the case of the previously described embodiment of Figs. 1 through 4, the convoluted wire contact member 50 is retained within the recess by a cover plate 53 having apertures 54 therein for receiving the pin contact members 55 of electrical components of the type previously mentioned.

As shown by comparison of the lowest socket 56 of Fig. 6 and the next adjacent socket 57, the pin contact member 55 causes a deflection of the convoluted wire contact member 50 as it is inserted. It will be noted that a multiplicity of pressure point contacts likewise occurs in this embodiment; however, the insertion and withdrawal resistance will be substantially the same. This embodiment is most advantageous where spacing between plug-in members is so close as to prohibit the use of even very small coils for the convoluted wire spring member. The protruding terminal connecting portion may take any of a variety of convenient forms. The hairpin shape 58 shown in Fig. 5 offers obvious advantages from a fabrication standpoint and also for making connections thereto.

Figs. 7 and 8 illustrate a further variation of the coil configuration of Figs. 1 through 4. The coil members are constructed with a nose portion 70 which protrudes through an opening 71 in the insulating housing 72, as shown most clearly in Fig. 8. As in the case of the embodiment of Figs. 1 through 4, the coil member 73 is distorted by the shape of the upper portion 74 of the coil recess 75. A printed wiring board 76 having terminal wiring strips 77 on one side for some distance from the edge thereof is shown, partially in section, inserted in the socket. The member 78 which is also of insulating material such as moldable phenolic forms the other side of the socket as well as a bottom cover plate for the member 72. Although not shown, it will be apparent that a multiplicity of coil contact members may be mounted in a terminal block with suitable orientating and retaining slots for the printed wiring board which is inserted therein. Further, it will be understood that separate contact members may be mounted on opposite sides of the board for making separate

contact to printed circuits on both sides of the board.

The advantages previously pointed out for the embodiment of Figs. 1 through 4 are equally applicable for the arrangement shown in the printed wiring board socket of Figs. 7 and 8. An additional advantage of particular note where printed wiring boards are to be mounted and contacted is the accommodation this socket has for printed wiring boards of slightly varying thicknesses such as may be found in types of boards currently available. In other words, the insertion of the thickest possible board will not so deform the wire spring coil contact member as to inhibit its firm contacting of a successively mounted board of considerably less thickness.

A double-ended connector utilizing the coil spring contactor of this invention is shown in section in Fig. 9. In this embodiment two insulating housing members 90 and 91 have matching recesses 92 and 93 for retaining the helical wire spring member 94. Components having contact pins 95 and 96 may then be connected electrically by plugging-in from opposite sides into the apertures 97 and 98. In a further variation of the basic embodiment of this invention, as shown in the Figs. 1 through 4, the connection of Fig. 10 shows one way in which the total contact area may be increased. Two coiled wire spring contact members 100 and 101 may be formed from a single continuous length of wire with an external terminal member 102 in the form of a hairpin or the terminal member may comprise a separate prong welded or soldered to the wire spring member. The aperture 103 enables insertion of the plug-in member 104 between the two wire coils with an approximately two-fold increase in contact surface.

It is to be understood that the embodiments shown herein are but illustrative and that other variations may be devised without departing from the scope and spirit of this invention.

What is claimed is:

1. An electrical terminal socket for a plug-in contact member comprising a housing member having a recess in one side of said housing member and an aperture from the side opposite said one side, a portion of the surface defining said aperture intersecting a portion of the surface defining said recess so that a portion of the volume defined by the surface of said aperture adjoins a portion of the volume defined by the surface of said recess, the longitudinal axes of said aperture and said recess being substantially parallel, a wire spring helix member in said recess, means in said recess for retaining said helix in a skew configuration so that the turns of said helix member are slanted downwardly toward said one side of said housing member, said turns projecting into the volume of said aperture so that a plug-in contact member inserted in said aperture contacts the outside of each of said turns in approximately perpendicular sliding relation.

2. An electrical terminal socket for a plug-in contact member comprising an insulative housing member having a recess in substantially perpendicular relation to one side of an aperture from the side opposite said one side, a portion of the surface defining said aperture intersecting a portion of the surface defining said recess so that a portion of the volume defined by the surface of said aperture adjoins a portion of the volume defined by the surface of said recess, the longitudinal axes of said aperture and said recess being substantially parallel, a wire spring helix member in said recess, said recess having a protrusion at the end away from said one side having a surface sloping downward toward said one side so that said helix member is retained in a skew configuration with the turns of said helix member slanted downwardly toward said one side of said housing member and away from the side containing said aperture so that a plug-in contact member inserted in said aperture contacts the outside of each turn of said helix member in substantially perpendicular relation and on the outside periphery of each said turn,

5

and a cover member on said one side of said housing member.

3. An electrical terminal socket for a plug-in contact member comprising a housing member having a recess in one side of said housing member and an aperture from the side opposite said one side, a portion of the surface defining said aperture intersecting a portion of the surface defining said recess so that a portion of the volume defined by the surface of said aperture adjoins a portion of the volume defined by the surface of said recess, the longitudinal axes of said aperture and said recess being substantially parallel, a substantially flat wound convoluted wire spring member confined in said recess in lengthwise planar alignment with said aperture so that

5

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6

a plug-in contact member inserted in said aperture contacts the convolutions of said wire spring member in substantially perpendicular relation and deflects said wire spring member.

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