June 13, 1961 R. E. LARKIN 2,988,724

ELECTRICAL CONNECTORS

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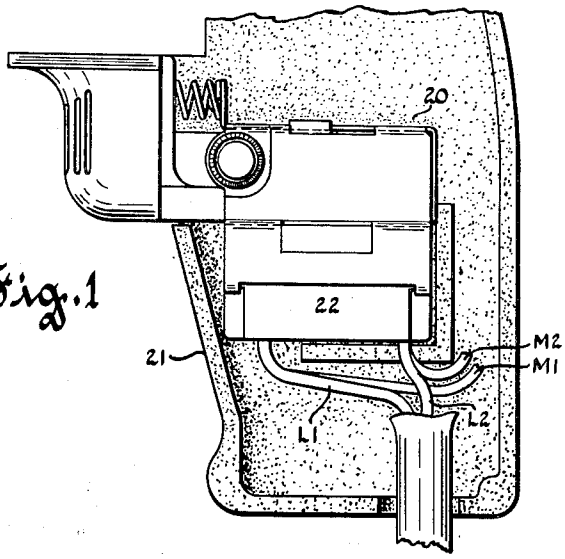
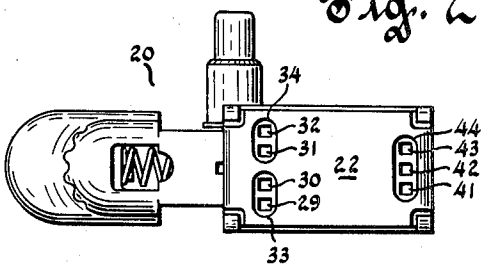



Fig. 1

Fig. 2



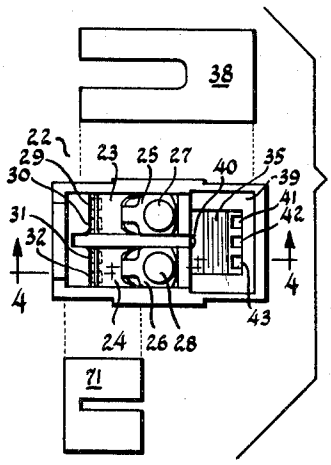




Fig. 3

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Fig. 4

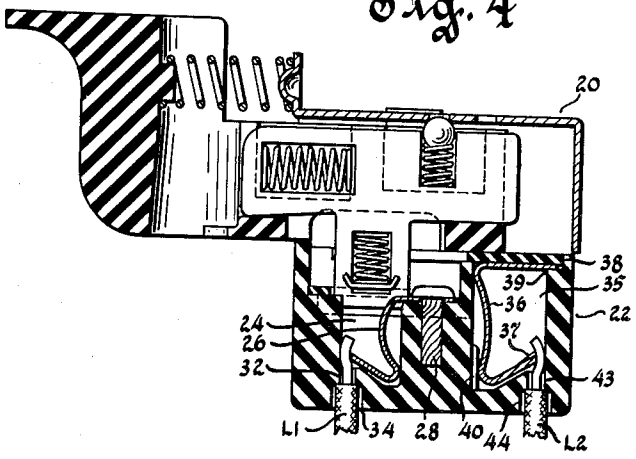



Fig. 6




Fig. 5

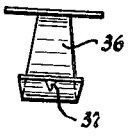



Fig. 8

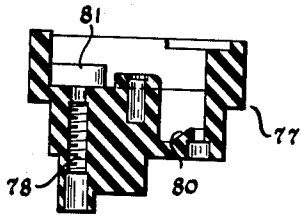



Fig. 7

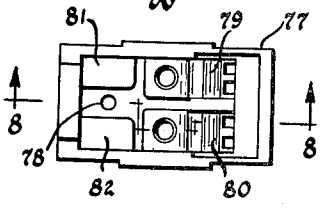
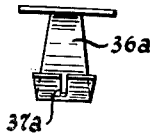



Fig. 9




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2,988,724

# ELECTRICAL CONNECTORS

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5 Claims. (Cl. 339—95)

This invention relates generally to electrical connectors.

More specifically the invention relates to spring or clip type electrical connectors adapted to be employed in electrical devices such as, but not limited to, switches.

It is an object of the invention to provide new and improved connecting means whereby electrical conductors may be quickly, conveniently and securely connected to electrical devices without the aid of tools.

Another object is to provide such connecting means which are simple, compact, and employ a minimum number of elements all of which lend themselves to economical mass production.

Still another object is to provide such connecting means whereby electrical conductors are securely locked in place but may be readily released.

A further object is to provide such connecting means having portions which serve as an integral part of the electrical device wherein they are employed.

A still further object is to provide connecting means which readily engage one or more wire conductors having the same or different diameters.

Other objects and advantages of the invention will appear hereinafter.

The accompanying drawings illustrate certain embodiments of the invention which will now be described, it being understood that the embodiments illustrated are susceptible of modifications with respect to certain structural details thereof without departing from the scope of the appended claims.

In the drawings:

FIGURE 1 is a side elevation of a trigger switch incorporating the invention shown within the handle of an electrical device such as a portable tool;

FIG. 2 is a bottom plan view of said switch;

FIG. 3 is a top plan view of the base portion of said switch with certain members removed to show details;

FIG. 4 is a sectional view of said switch showing it in "open" position; the upper portion of the section, specifically, the trigger lever, frame, contact carrier and both insulator plates the lower portion of the section, specifically, the base member, which is taken substantially along line 4—4 of FIG. 3;

FIG. 5 is a detail view of a bussing clip carried within the base of said switch;

FIG. 6 is a detail view of one of two contact clips carried within the base of said switch;

FIG. 7 is a top plan view of an alternative form of base member for use with said switch;

FIG. 8 is a sectional view of said alternative form of base member taken along line 8—8 of FIG. 7, and

FIG. 9 is a detail view of an alternative form of bussing clip which is similar in certain respects to that shown in FIG. 5.

FIGS. 1 and 2 show a trigger switch 20 incorporating the invention mechanically secured within the handle of a suitable device 21 such as a portable electric drill. Assume that device 21 employs an electric motor (not shown) from which the conductors M1 and M2 extend and that the motor (not shown) is energizable from the conductors L1 and L2 which extend into the handle of the device and which are appropriately connected to a suitable power source (not shown). Briefly, conductors M2 and L2, inserted into the base of normally open switch 20, are electrically connected to each other through



bussing means contained therein. Conductors M1 and L1 are each electrically connected to stationary contacts within switch 20 and when the contacts are bridged upon closure of the switch the motor (not shown) of device 21 is energized.

Referring specifically to FIGS. 1, 2, 3 and 4, switch 20 comprises a one-piece base member 22 which is preferably formed by molding from phenolic insulating material such as "Bakelite" or other suitable electrical insulating material. Base 22 is provided with chambers 23 and 24, best seen in FIG. 3, which accommodate the contact clips 25 and 26, respectively. Clip member 25, identical to clip 26 (see FIG. 6), is preferably formed by stamping from sheet bronze or other suitable resilient conductive material. The flat upper end portions of the clips 25 and 26 are perforated to accommodate the shanks of the brass drive screws 27 and 28, respectively, which when forced into suitable openings provided within base 22, secure the clips in their respective chambers. Each clip is in electrical contact with its drive screw and the head of each screw serves as one of the stationary contacts of the switch. If preferred, means of securement other than drive screws may be employed, provided that such other means are suitable as contacts. The mid-portion of each clip is bowed and the lower or free end of each clip, which terminates in a sharp working edge, is reversely curved as shown. Each clip is suspended or floats within its respective chamber so that space exists between the lower portion of the clip and the floor of the chamber. Such space allows for downward travel of the lower portion of clip incidental to force being exerted on a conductor in engagement with the clip tending to withdraw the conductor from the chamber, as will hereinafter become apparent. Since it is not necessary, prior to the insertion of a conductor, that portions of the clip bear against the rear wall of the chamber, special shaping or bending of the clip to critical tolerances to accomplish such positioning during assembly is avoided. It is apparent, however, that upon insertion of a conductor, the clip must bear against the rear wall of the chamber to effect proper engagement of the conductor. The sharp working edge of each clip is in proximity to, but does not touch, the forward wall of the chamber.

FIGS. 2, 3 and 4 make clear that the floor of each chamber 23 and 24 is provided with a pair of rectangular access holes 29 and 30, and 31 and 32, respectively, which open into recesses 33 and 34, respectively, formed in the lower outer surface of base 22. In practice, as is clear from FIGS. 1 and 4, the bare end of insulated conductor L1, which may be a solid wire or stranded wire which has been tinned to afford rigidity, is inserted through hole 32 into chamber 24 containing contact clip 26 thus forcing the free end of said clip upward in a direction away from the floor of said chamber and forcing the working edge of said clip away from the forward wall of said chamber. Simultaneously, a portion of the clip is forced against the rear wall of the chamber where it remains as long as the conductor is contained within the chamber. Preferably, conductor L1 is pressed sufficiently far into chamber 24 so that the insulated portion thereof extends into recess 34 thus insuring that no uninsulated portions extend from switch base 22. Conductor L1 slips between the working edge of clip 26 and the forward wall of chamber 24 and the tendency of said clip, now forced against the rear wall of that chamber, to spring back to normal position effects secure mechanical and electrical engagement of said conductor between the working edge and the forward wall. Forces exerted on conductor L1 tending to withdraw it from chamber 24 only serve to make the connection more secure as clip 26 is forced closer to the forward wall of said chamber by its own bias and by the downward pulling action of said conductor on the working edge of said

clip. To disconnect conductor L1 from clip 26, a suitable instrument or tool (not shown) such as a stiff piece of wire or the like, is inserted through hole 31 into chamber 24 to force said clip away from said conductor thus freeing the latter for removal. If preferred, conductor L1 may be inserted through hole 31 and hole 32 may be reserved for the use of the removal tool (not shown).

It is to be understood that conductor M1 is connected to contact clip 25 in the same manner that conductor L1 is connected to clip 26. Conductor M1 may be inserted into chamber 23 through hole 29 or 30, as desired, and the unoccupied opening reserved for the use of the removal tool (not shown). It is apparent that the connecting means hereinbefore described readily accommodates itself to engage wire conductors of varying diameters. Obviously, openings having shapes and sizes other than that shown may be employed to allow for insertion of conductors of various sizes. If preferred, instead of the separate holes 29 and 30, or 31 and 32, a single access hole or slot (not shown) having an elongated contour and capable of accommodating one or more conductors and the removal tool (not shown) may be employed.

Base 22 is further provided with a chamber 35 adapted to accommodate a bussing clip member 36, best seen in FIG. 5, which, while not electrically connected to any portion of switch 20, serves as a convenient means for electrically connecting conductors L2 and M2 to each other. Bussing clip 36, preferably formed of resilient bronze is provided with a flat, substantially rectangular, upper end portion and is bowed and reversely curved at its lower or free end in a manner similar to contact clips 25 and 26. In addition, the sharp working edge of clip 36 is provided with an indentation 37 which facilitates the location of the removal tool (not shown) when such tool is employed. Bussing clip 36 is suspended in chamber 35 and is secured therein by an insulating plate 38, preferably formed of molded phenolic insulating material such as "Bakelite" or similar material, which holds the upper portion of said clip against a shoulder or ledge 39 integrally formed in base 22. The lower or free end of clip 36 is disposed above the floor of chamber 35 and the reversely curved portion, after the conductors have been inserted, bears on a projection 40 integrally formed on the rear wall of chamber 35. Since, in the embodiment shown, clip 36 is to accommodate at least two conductors, chamber 35 is provided with three rectangular access holes 41, 42 and 43 which open into a recess 44, the purpose of which recess is the same as that of recesses 33 and 34, formed in the lower outer surface of base 22. Conductors L2 and M2 engage and are disengageable from bussing clip 36 in the manner explained in connection with conductor L1 and clip 26. Preferably, conductors L2 and M2 are inserted through holes 41 and 43, respectively, or vice versa, thus reserving center hole 42 for the use of removal tool (not shown), but obviously other arrangements are possible. Thus, openings having shapes and sizes other than those shown may be employed. If preferred, instead of three openings 41, 42 and 43, a single elongated access hole or slot (not shown) capable of accommodating a multiplicity of vari-sized conductors and a removal tool (not shown) may be employed. Clip 36 is pivotable on projection 40 so that the working edge of said clip is biased tightly against conductors employed therewith even if the diameters of two conductors being employed should differ. For example, if conductor L2 is of small diameter and conductor M2 is of somewhat larger diameter, or vice versa, both are tightly engaged by clip 36 since the clip adjusts itself by pivoting to accommodate them.

If preferred, instead of clip 36 a bussing clip like 36*a* shown in FIG. 9 may be employed in chamber 35. Clip 36*a* has a slot 37*a* dividing its lower end portion which allows the working edges on either side thereof to move independently to adjust themselves to the size of the particular conductor associated therewith.

If preferred, untinned stranded wire may be employed with the invention if the so-called removal tool (not shown) is utilized to effect the necessary displacement of clips 25, 26 or 36, as the case may be, to permit the insertion of such wire into the respective chambers.

FIGS. 7 and 8 show a base member 77 which may be employed with switch 20 instead of base 22. Base 77 may be secured within the handle in exactly the same manner as base 22. It is apparent, however, that base 77 is provided with a tapped opening 78 which enables switch 20, when employing such base, to be secured within a suitable device (not shown) in a manner other than that shown in FIG. 1. Base 77 is not provided with bussing means and it is apparent that the chambers 79 and 80 which are adapted to carry contact clips are disposed within base 77 in a location other than that shown in connection with base 22.

The novel press-in lead constructions hereinbefore described enables rapid, economical and positive attachment of conductors and permits convenient detachment thereof. The incorporation of bussing connections within the switch eliminates the necessity of a separate external connection. The materials employed and their arrangement and disposition with respect to each other insure that no exposed portions of the switch unit can be electrically charged.

I claim:

1. As a terminal connector in an electrical device, in combination, an insulating casing forming part of said device having a chamber formed therein, said chamber having laterally spaced side walls and a floor, a resilient conductive member comprising an upper flat end portion seating on a surface of said casing along the open end of said chamber, a bowed portion connecting with an end of said flat portion at the open end of said chamber and extending downwardly in said chamber in spaced convexly curved relation to one side wall thereof, a reversely curved portion connecting with the lower end of said bowed portion in spaced relation to the floor of said chamber, and a lower flat portion connecting with the other end of said reversely curved portion and extending at an angle to and terminating at a free end adjacent but in spaced relation to the side wall of said chamber opposite said one side wall, means securing said upper flat end portion of said member in place on said surface of said casing, and at least two apertures extending through said floor of said chamber exteriorly of said casing, each of said apertures accommodating a wire conductor disposed and gripped between the free end of said lower flat portion of said member and the last recited side wall of said chamber.

2. The combination according to claim 1 wherein said means securing said upper flat end portion of said conductive member on said surface of said casing comprises a conductive rivet having a head overlying said upper flat end portion which serves as a stationary contact for said electrical device.

3. As a bussing connector in an electrical device, in combination, an insulating casing forming part of said device, a chamber formed in said casing, said chamber having laterally spaced side walls, a floor and an integrally formed rib on one side wall of said chamber, a resilient conductive member comprising an upper flat end portion seating on a surface along the open end of said chamber, a bowed portion connecting with an end of said flat portion at the open end of said chamber and extending downwardly in said chamber in convexly curved relation to said one side wall of said chamber, a reversely curved portion connecting with the lower end of said bowed portion and engaging with said rib in spaced relation to said floor and a lower flat portion connecting with said reversely curved portion and extending at an angle to and terminating at a free end adjacent but in spaced relation to the side wall opposite said one side wall, means securing said upper flat end portion of said member in

place on said surface of said casing, and at least three apertures extending through the floor of said casing exteriorly of said casing, each of said apertures accommodating a wire conductor disposed and gripped between the free end of said lower flat portion of said member and the last specified side wall of said chamber.

4. The combination according to claim 3 wherein said conductive member has an indentation formed on the free end of its lower flat portion in line with one of said apertures to facilitate location of the insertion and removal tool.

5. The combination according to claim 3 wherein said conductive member has a slit extending inwardly from the free end of its lower flat portion to permit gripping wire conductors of different sizes on each side of said slit.



**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 2,523,782 | Sanda | Sept. 26, 1950 |
| 2,617,844 | Sanda | Nov. 11, 1952 |
| 2,705,785 | Benander | Apr. 5, 1955 |
| 2,705,787 | Benander | Apr. 5, 1955 |
| 2,718,626 | Benander | Sept. 20, 1955 |
| 2,738,482 | Benander | Mar. 13, 1956 |
| 2,773,248 | Smith | Dec. 4, 1956 |
| 2,779,828 | Despard | Jan. 29, 1957 |
| 2,841,673 | Benander | July 1, 1958 |
| 2,875,424 | Hubbell | Feb. 24, 1959 |