United States Patent [19]

Moray

[11] **3,740,702**

[45] **June 19, 1973**

[54] **ELECTRICAL WIRE TERMINAL**

[76] Inventor: **Forest J. Moray**, 1513 Brooks Street, Renton, Wash. 98055

[22] Filed: **May 21, 1971**

[21] Appl. No.: **145,898**

Related U.S. Application Data

[63] Continuation of Ser. No. 743,424, July 9, 1968, abandoned.

[52] **U.S. Cl.** ..... **339/223 S**, 339/275 T, 339/276 T

[51] **Int. Cl.** **H01r 11/06**

[58] **Field of Search** 339/112, 223, 276, 339/275

[56] **References Cited**

UNITED STATES PATENTS

2,895,195	7/1959	Ehmann	24/123
2,938,069	5/1960	Toedtman et al	339/278 X
2,604,570	7/1952	Aversten	339/275 RB X
2,741,752	4/1956	Edwards	339/276 T

FOREIGN PATENTS OR APPLICATIONS

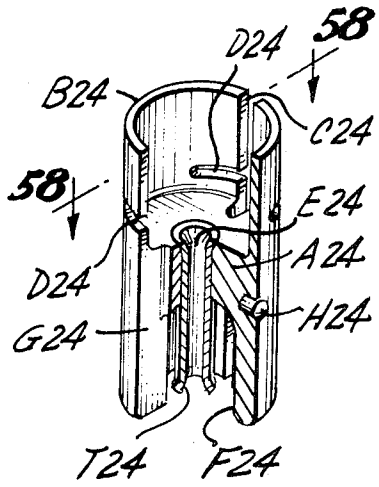
459,819	9/1949	Canada	339/223 R

Primary Examiner—Richard E. Moore
Attorney—Robert W. Beach

[57] **ABSTRACT**

A connecting body has at one end a wire-engaging socket which is of hole or channel type extending lengthwise of a wire a considerable distance. Such channel can be of the side-opening type or the end-opening type so that a wire can be moved lengthwise or transversely of its length into the channel. Such channel may be of a size to embrace the wire snugly or may be brought into intimate contact with the wire by being closed on it. The body may also carry a collar or band for embracing the insulation encircling the wire. In addition, the body has a cylindrical contact surface either of internal type engageable with a post or of external type engageable in a socket of an electrical component such as a distributor, a spark plug or an ignition coil. The wire may be secured in its socket by soldering, clamping or wedging.

3 Claims, 107 Drawing Figures

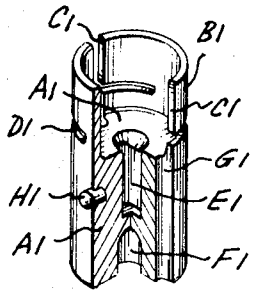


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Fig. 1.



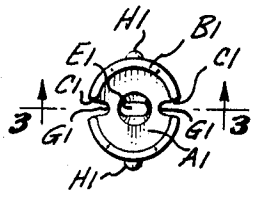


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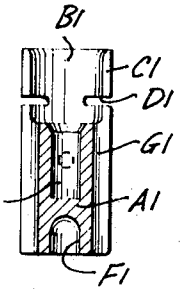
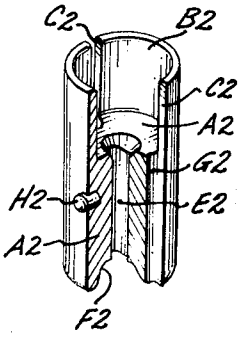


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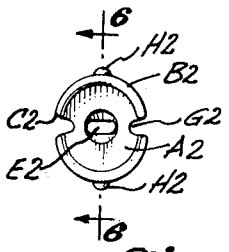


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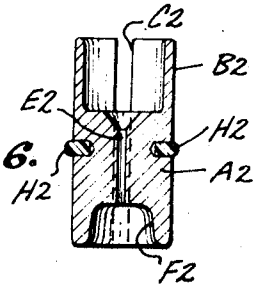
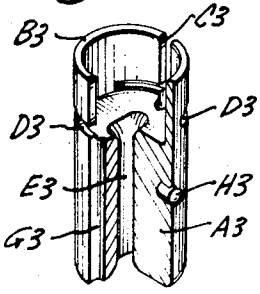


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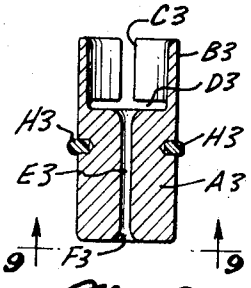
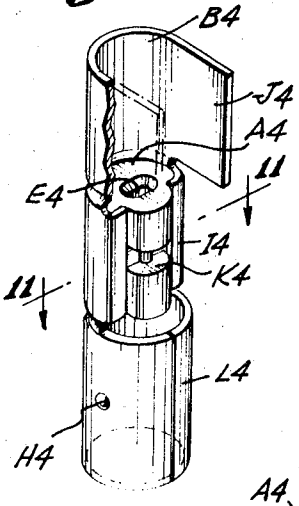


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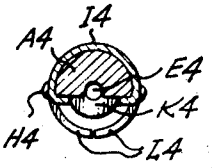
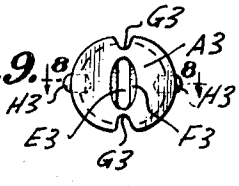


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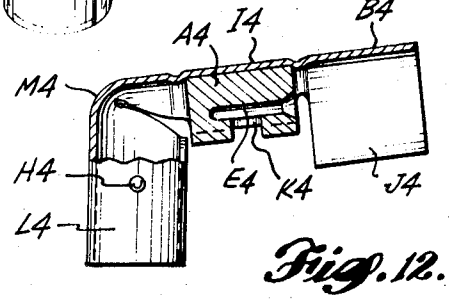


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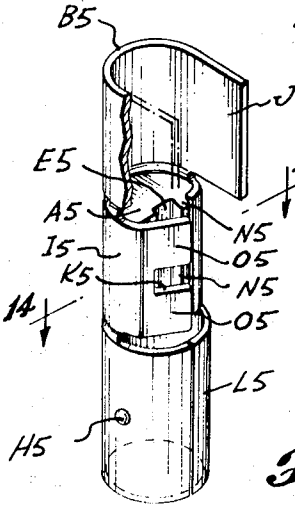


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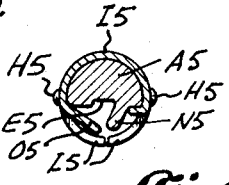


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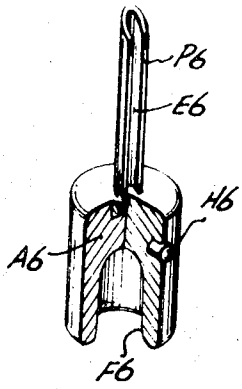
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PATENTED JUN 19 1973

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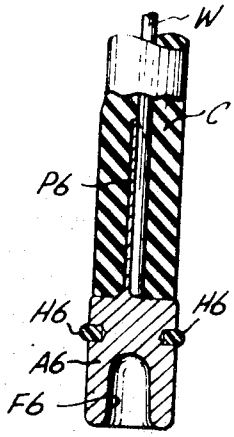
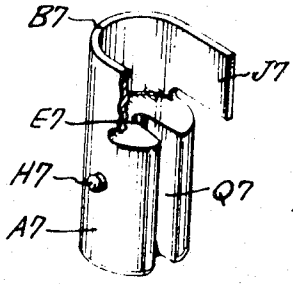


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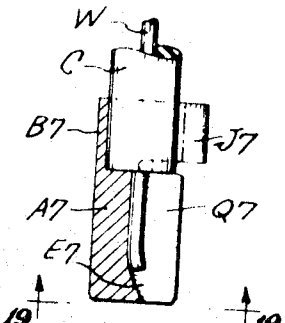


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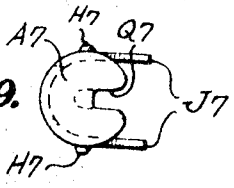
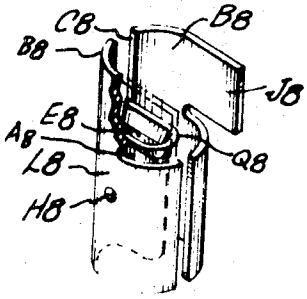


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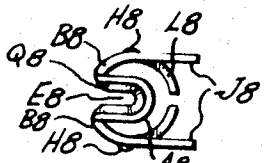


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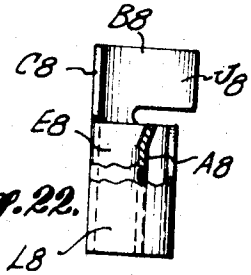
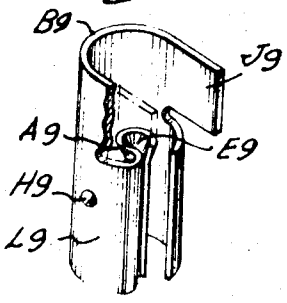


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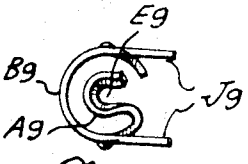


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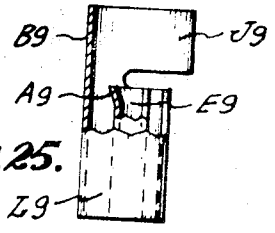
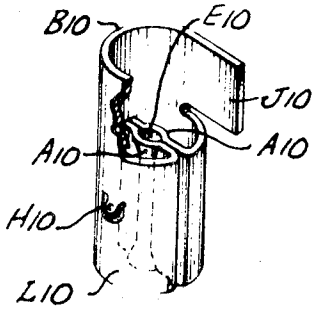


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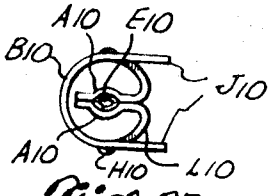
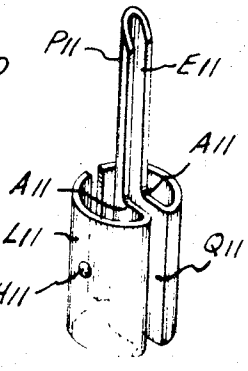


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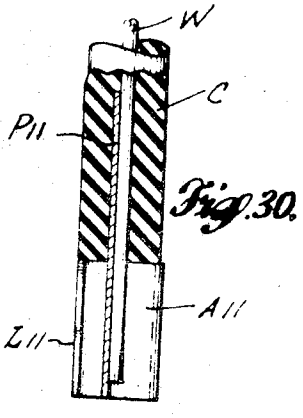


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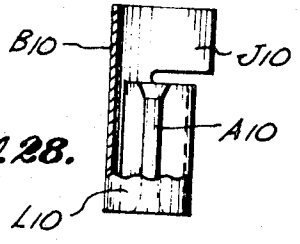


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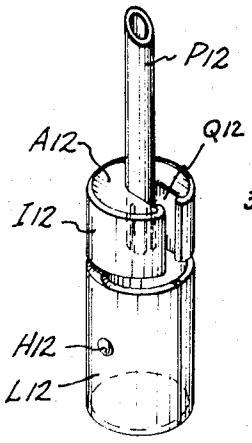


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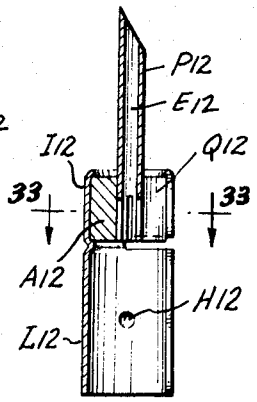
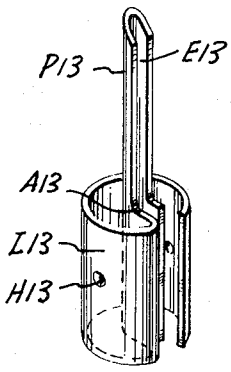


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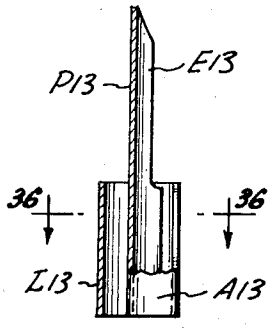


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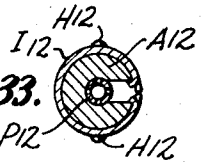


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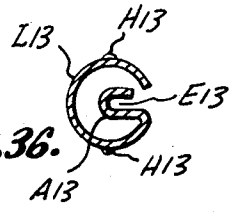
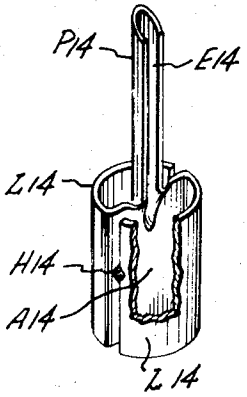


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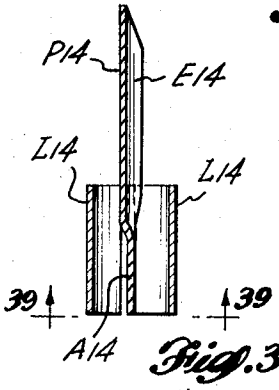


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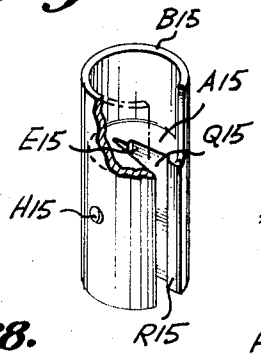
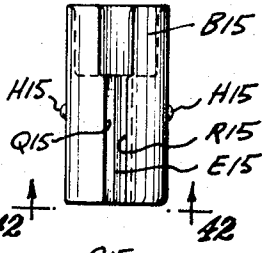


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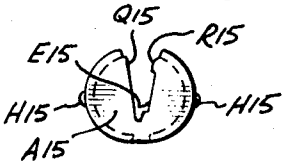


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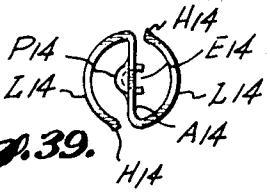


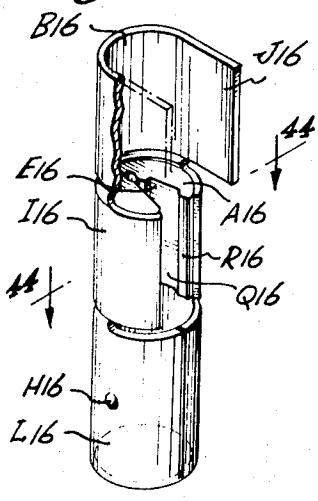
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Fig. 43.



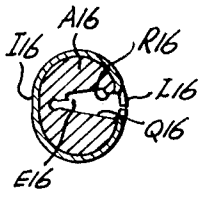


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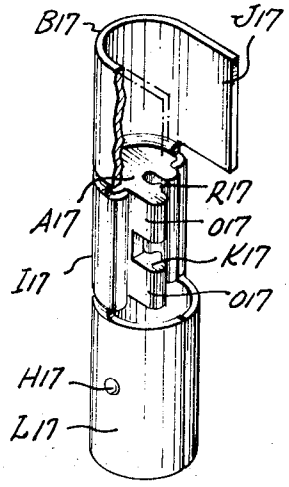


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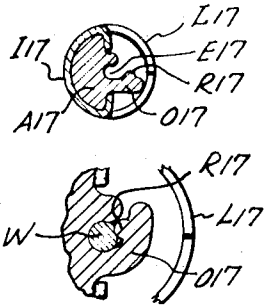
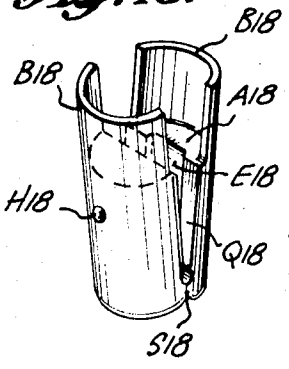


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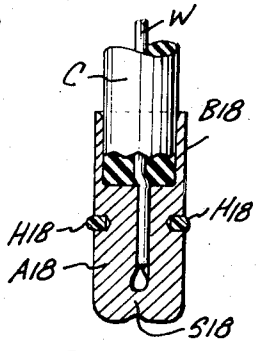
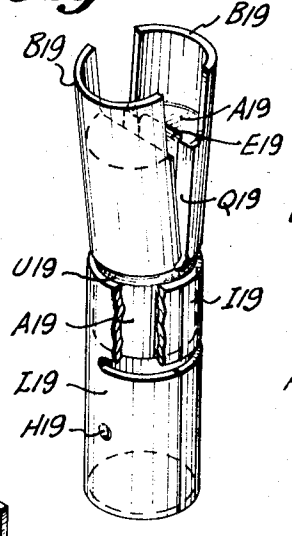


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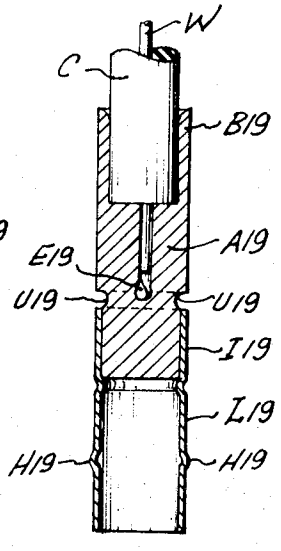


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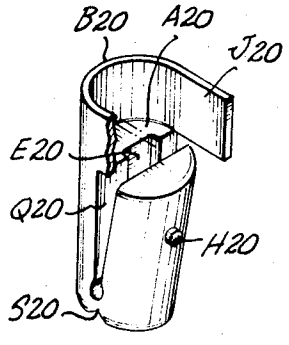


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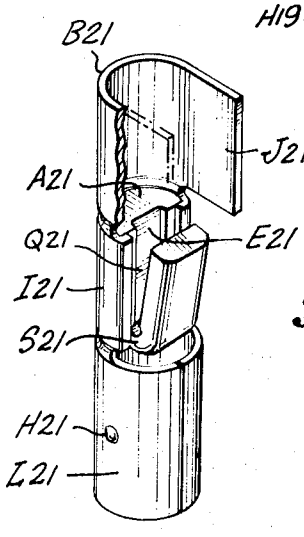


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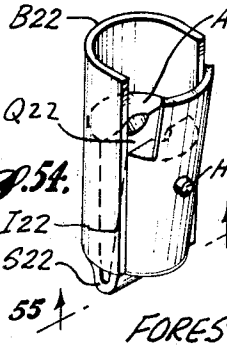


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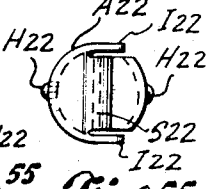


Fig. 55.

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ATTORNEY

Fig. 56.

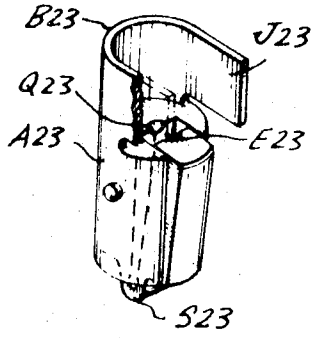


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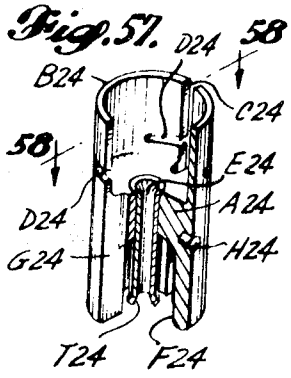
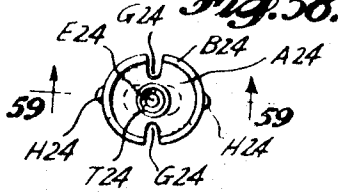


Fig. 58.



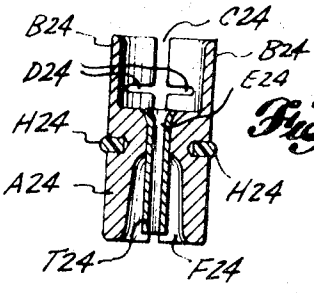


Fig. 59.

Fig. 60.

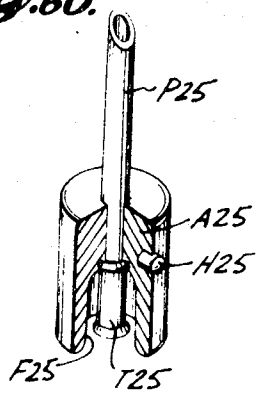
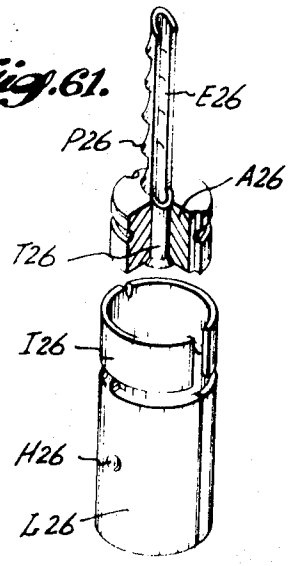


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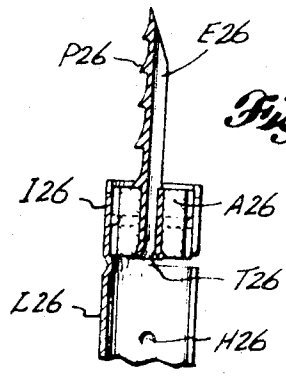


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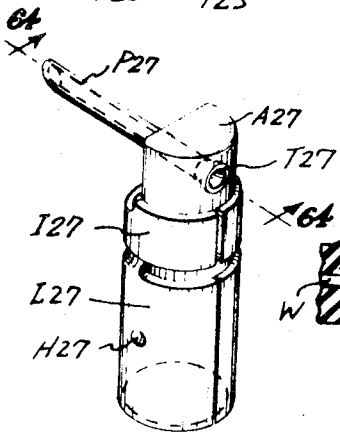


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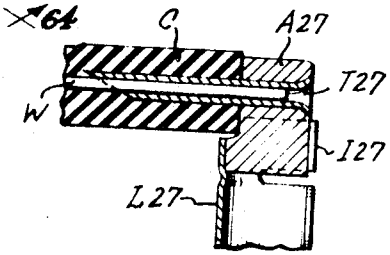


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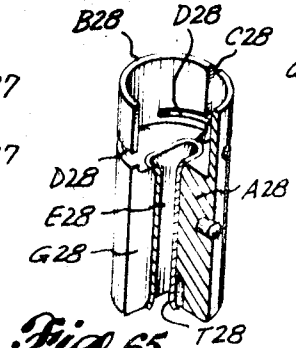


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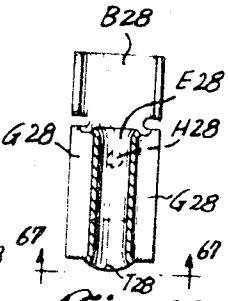


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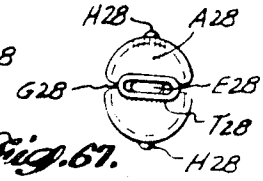


Fig. 67.

FOREST J. MORAY

Robert W. R.

Fig. 68.

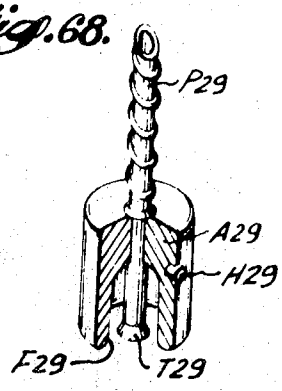


Fig. 69.

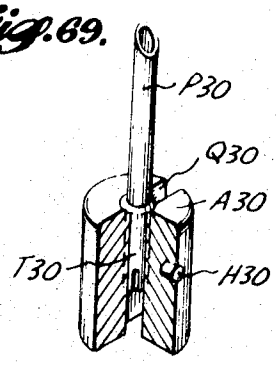


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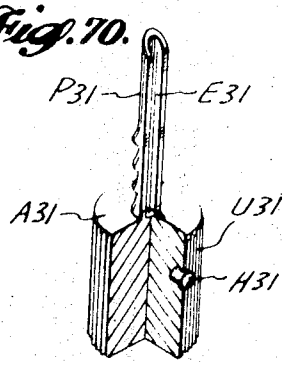


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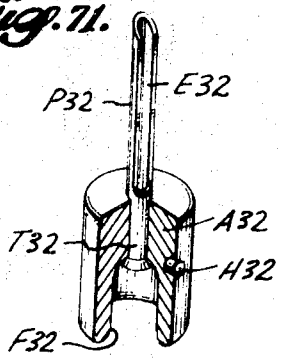


Fig. 72.

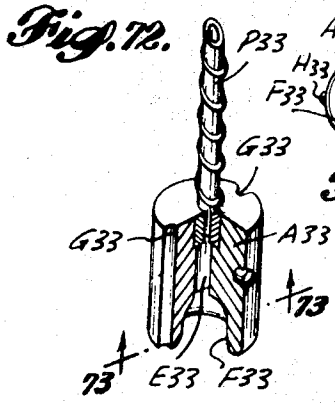


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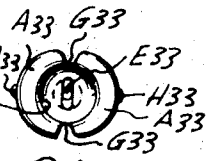


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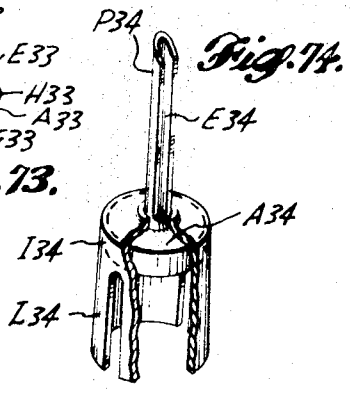


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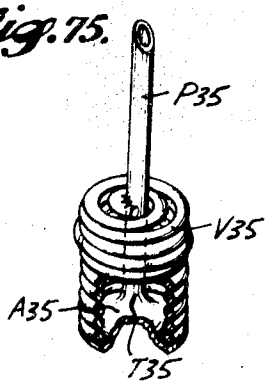


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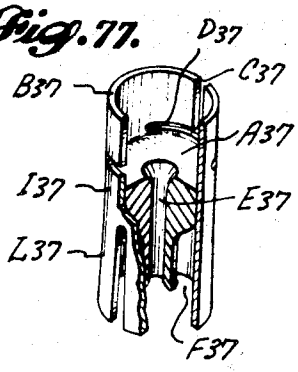


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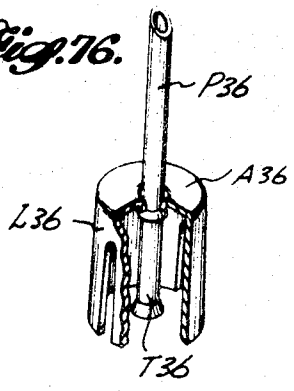
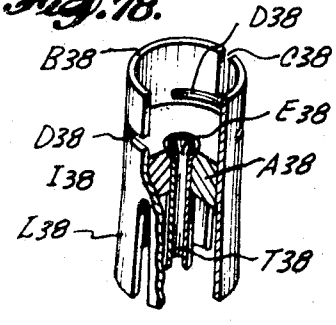


Fig. 78.



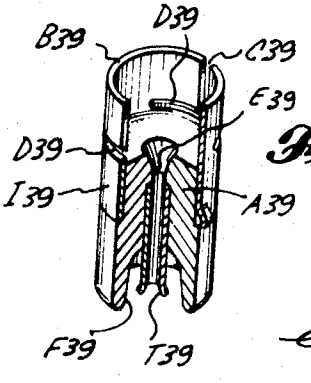


Fig. 79.

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FOREST J. MORAY

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Fig. 80.

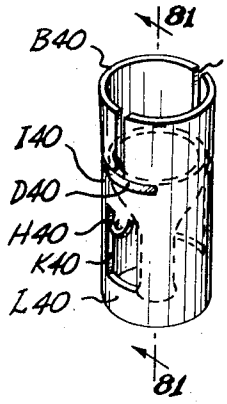


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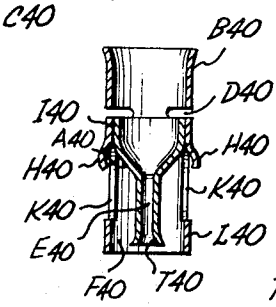
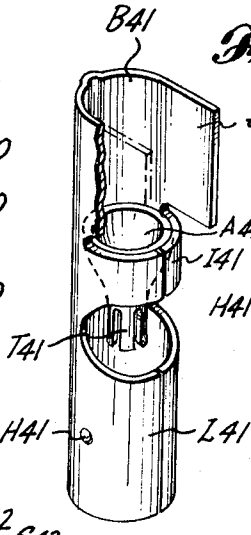


Fig. 82.



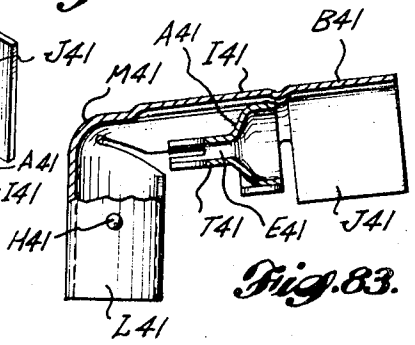


Fig. 83.

Fig. 85.

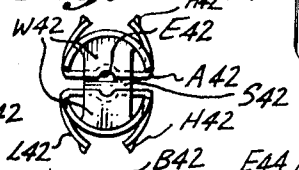
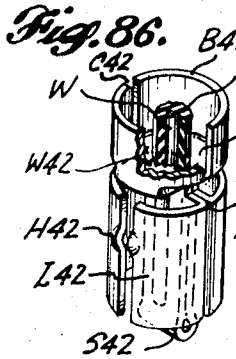


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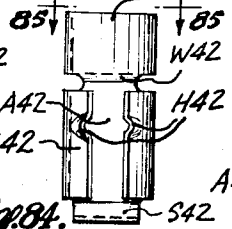
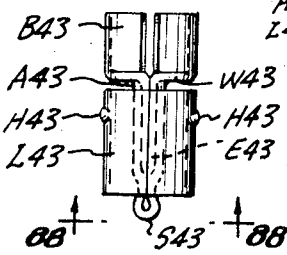


Fig. 84.

Fig. 87.



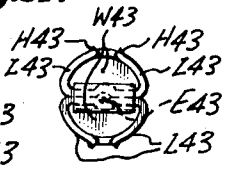
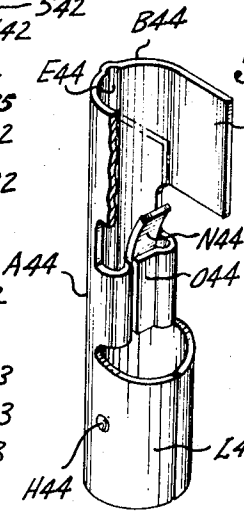


Fig. 88.

Fig. 89.



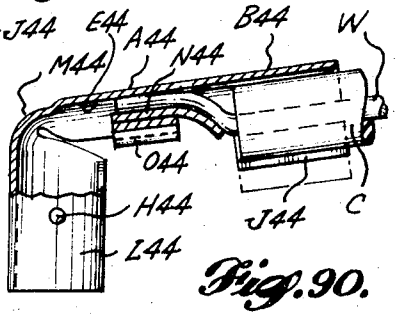


Fig. 90.

Fig. 94.

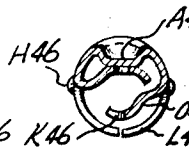
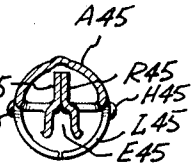


Fig. 92.



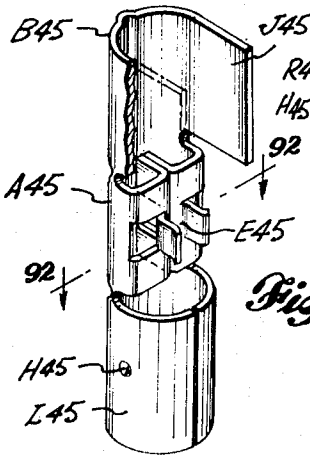


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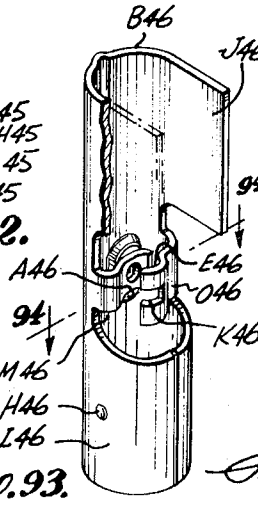


Fig. 93.

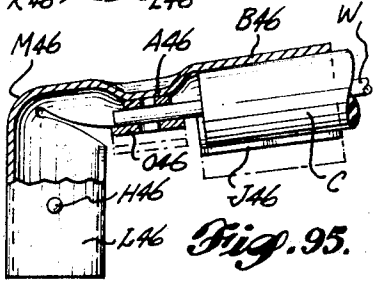


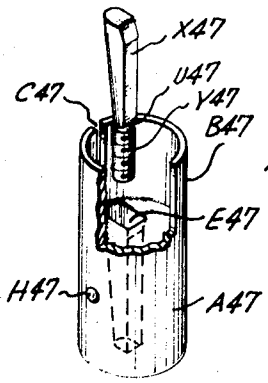
Fig. 95.

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Fig. 96.



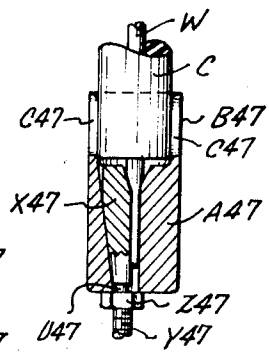


Fig. 97.

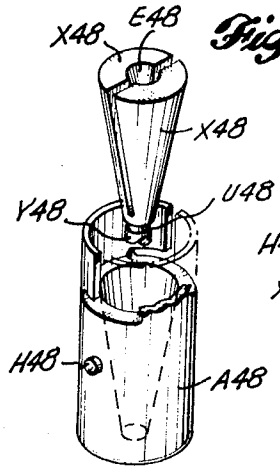


Fig. 98.

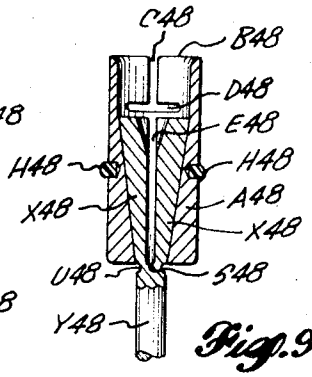
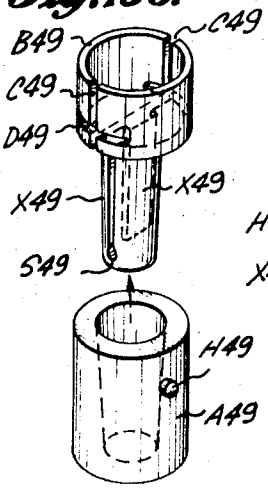


Fig. 99.

Fig. 100.



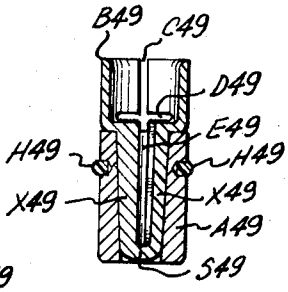
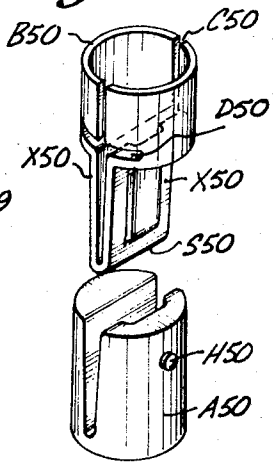


Fig. 101.

Fig. 102.



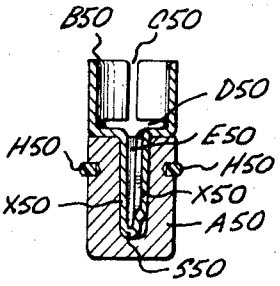


Fig. 103.

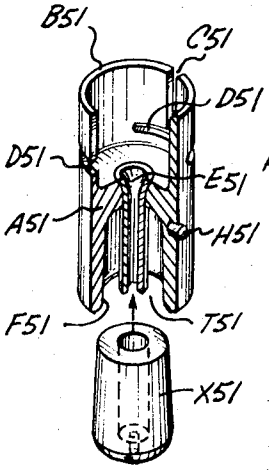


Fig. 104.

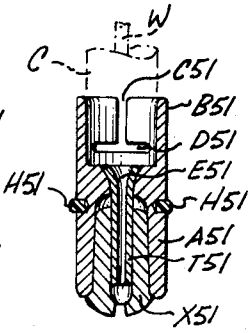


Fig. 105.

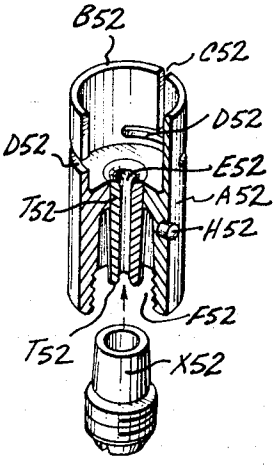


Fig. 106.

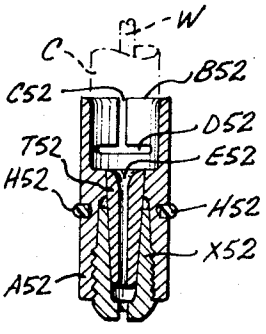


Fig. 107.

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ELECTRICAL WIRE TERMINAL

This application is a continuation of my application Ser. No. 743,424 filed July 9, 1968 for Electric Wire Terminal, now abandoned.

Various types of electrical installations, and particularly the high-tension portion of an internal-combustion engine ignition system, have not afforded continuous effective transmission of electricity through the wiring system. In particular there is often poor conductivity between a wire and an electrical component such as an ignition coil, a distributor or a spark plug because of inadequate area for rapid transfer of electrical current. In internal combustion engine ignition systems in particular it is important that a large flow of electricity occur very quickly and, if such electricity must pass from a wire to an electrical component along a restricted path, such restriction impedes the flow of electricity so that a sufficient supply of current to a spark plug does not occur quickly enough, such as in perhaps a millionth of a second. Consequently the intensity of the spark is not sufficient to ignite the fuel in the cylinder as effectively as desirable.

It is a principal object of the present invention, therefore, to provide a conductive path for electricity from a wire to an ignition system component which will have adequate transfer area to facilitate passage of electricity from the wire to the electrical component.

More specifically, it is an object to accomplish the general object specified above by providing a terminal for a wire which can be manufactured economically in quantity by automatic equipment and which can be applied easily and quickly to the end of a wire either manually or by a machine.

The drawings illustrate a large number of different types of terminals capable of accomplishing the foregoing objects.

FIG. 1 is a top perspective with parts broken away, FIG. 2 is an end view and FIG. 3 is a section on line 3—3 of FIG. 2 of a straight, crushable, block-body connector having an external contact surface.

FIG. 4 is a top perspective with parts broken away, FIG. 5 is an end view and FIG. 6 is a section on line 6—6 of FIG. 5 of another type of straight, crushable, block-body connector having an external contact surface.

FIG. 7 is a top perspective having parts broken away, FIG. 8 is a section on line 8—8 of FIG. 9 and FIG. 9 is an end view seen from line 9—9 of FIG. 8 of still another straight, crushable, block-body terminal having an external contact surface.

FIG. 10 is a top perspective with parts broken away and FIG. 11 is a section on line 11—11 of FIG. 10 of a straight, solderable-connection, block-and-sheet-body terminal having an external or internal contact surface.

FIG. 12 is a side view with parts broken away of a terminal similar to that shown in FIGS. 10 and 11 but of angle type.

FIG. 13 is a top perspective with parts broken away and FIG. 14 is a section on line 14—14 of FIG. 15 of a straight, closeable, block-and-sheet-body terminal having an external or internal contact surface.

FIG. 15 is a top perspective with parts broken away and FIG. 16 is a longitudinal section of a straight, slide-connection, block-body terminal having an external contact surface.

FIG. 17 is a top perspective with parts broken away, FIG. 18 is a longitudinal section and FIG. 19 is an end view from line 19—19 of FIG. 18 of a straight, closeable, block-body terminal having an external contact surface.

FIG. 20 is a top perspective with parts broken away, FIG. 21 is an end view and FIG. 22 is a side view with parts broken away of a straight, closeable, sheet-body terminal having an external contact surface.

FIG. 23 is a top perspective having a portion broken away, FIG. 24 is an end view and FIG. 25 is a side view having parts broken away of a straight, solderable-connection, sheet-body terminal with an external contact surface.

FIG. 26 is a top perspective having a portion broken away, FIG. 27 is an end view and FIG. 28 is a side view with parts broken away of a straight, clamping, sheet-body terminal having an external contact surface.

FIG. 29 is a top perspective and FIG. 30 is a longitudinal section of a straight, slide-connection, sheet-body terminal having an external contact surface.

FIG. 31 is a top perspective, FIG. 32 is a longitudinal section and FIG. 33 is a section on line 33—33 of FIG. 32 of a straight, slide-connection, combination block-and-sheet-body terminal having an external or internal contact surface.

FIG. 34 is a top perspective, FIG. 35 is a longitudinal section and FIG. 36 is a section on line 36—36 of FIG. 35 of a straight, slide-connection, sheet-body terminal having an external contact surface.

FIG. 37 is a top perspective having parts broken away, FIG. 38 is a longitudinal section and FIG. 39 is an end view taken from line 39—39 of FIG. 38 of a straight, slide-connection, sheet-body terminal having an external contact surface.

FIG. 40 is a top perspective with parts broken away, FIG. 41 is a side view and FIG. 42 is an end view seen from line 42—42 of FIG. 41 of a straight, side-closeable, block-body terminal having an external contact surface.

FIG. 43 is a top perspective with parts broken away and FIG. 44 is a section on line 44—44 of FIG. 43 of a straight, side-closeable, combination block-and-sheet-body terminal having an external or internal contact surface.

FIG. 45 is a top perspective having a portion broken away, FIG. 46 is a transverse section and FIG. 47 is an enlarged fragmentary section of a straight side-closeable, block-and-sheet-body terminal having an external or internal contact surface of a different type.

FIG. 48 is a top perspective and FIG. 49 is a longitudinal section of a straight, closeable, block-body terminal having an external contact surface.

FIG. 50 is a top perspective with parts broken away and FIG. 51 is a longitudinal section of a straight, closable, block-and-sheet-body terminal having an external or an internal contact surface.

FIG. 52 is a top perspective with a portion broken away of a straight, end-closeable, block-body terminal having an external contact surface.

FIG. 53 is a top perspective with a part broken away of a straight, end-closeable, block-and-sheet-body terminal having an external or an internal contact surface.

FIG. 54 is a top perspective and FIG. 55 is an end view seen from line 55—55 of FIG. 54 of a straight, end-closeable, block-body terminal having an external contact surface.

FIG. 56 is a top perspective with a portion broken away of a straight, end-closeable, block-body terminal having an external contact surface.

FIG. 57 is a top perspective with parts broken away, FIG. 58 is an end view and FIG. 59 is a section on line 59—59 of FIG. 58 of a straight, crushable, block-and-sheet-body terminal having an external contact surface.

FIG. 60 is a top perspective of a straight, slide-connection, block-and-sheet-body terminal having an external contact surface.

FIG. 61 is a top perspective with parts in exploded relationship and FIG. 62 is a longitudinal section of a straight, slide-connection, combination block-and-sheet-body terminal having an external contact surface.

FIG. 63 is a top perspective and FIG. 64 is a section on line 64—64 of FIG. 63 of an angle, slide-connection combination block-and-sheet-body terminal having an external or an internal contact surface.

FIG. 65 is a top perspective with parts broken away, FIG. 66 is a longitudinal section and FIG. 67 is an end view seen from line 67—67 of FIG. 66 of a straight, crushable, combination block-and-sheet-body terminal having an external contact surface.

FIG. 68 is a top perspective with parts broken away of a straight, slide-connection, combination block-and-sheet-body terminal having an external contact surface.

FIG. 69 is a top perspective with parts broken away of a straight, slide-connection, combination block-and-sheet-body terminal with external contact surface of a solderable type.

FIG. 70 is a top perspective with parts broken away of a straight, slide-connection, block-body terminal having an external contact surface.

FIG. 71 is a top perspective having parts broken away of a straight, slide-connection, combination block-and-sheet-body terminal with an external contact surface of still a different type.

FIG. 72 is a top perspective with parts broken away and FIG. 73 is an end view seen from line 73—73 of FIG. 72 of a straight, slide-connection and crushable, block-body terminal with a external contact surface.

FIG. 74 is a top perspective with parts broken away of a straight, slide-connection, sheet-body terminal having an external contact surface.

FIG. 75 is a top perspective having parts broken away of a straight, slide-connection, sheet-body terminal having an external contact surface.

FIG. 76 is a top perspective with a portion broken away of a straight, slide-connection, sheet-body terminal with an external contact surface.

FIG. 77 is a top perspective having parts broken away of a straight solderable-connection, combination block-and-sheet-body terminal having an external contact surface.

FIG. 78 is a top perspective with parts broken away of a straight, solderable-connection, combination block-and-sheet-body terminal with an external contact surface of a different type.

FIG. 79 is a top perspective with parts broken away of a straight, solderable-connection, combination block-and-sheet-body terminal with external contact surface of still a different type.

FIG. 80 is a top perspective and FIG. 81 is a section on line 81—81 of FIG. 80 of a straight, solderable-connection, sheet-body terminal having an external contact surface.

FIG. 82 is a top perspective with parts broken away and FIG. 83 is a side view with parts broken away of an angle, solderable-connection, sheet-body terminal having an external or internal contact surface, FIG. 82 showing such terminal prior to being bent into angle shape.

FIG. 84 is a side view of a straight, end-closable, sheet-body terminal having an external contact surface, shown in open position. FIG. 85 is an end view of such terminal from line 85—85 of FIG. 84. FIG. 86 is a top perspective of such terminal in closed position with parts broken away.

FIG. 87 is a side view and FIG. 88 is an end view seen from line 88—88 of FIG. 87 of a straight, clamping, sheet-body terminal with an external contact surface.

FIG. 89 is a top perspective with parts broken away of a straight, clamping, sheet-body terminal having an external or an internal contact surface.

FIG. 90 is a side view with parts broken away of an angle, clamping, sheet-body terminal with an external or an internal contact surface having a structure similar to that of FIG. 89.

FIG. 91 is a top perspective with a portion broken away and FIG. 92 is a section on line 92—92 of FIG. 91 of a straight, solderable-connection, sheet-body terminal having an external or internal contact surface.

FIG. 93 is a top perspective with a portion broken away, FIG. 94 is a section on line 94—94 of FIG. 93 and FIG. 95 is a side view with parts broken away of an angle, clamping or solderable-connection, sheet-body terminal with an external or internal contact surface, FIG. 93 showing such terminal prior to being bent into angle configuration.

FIG. 96 is a top perspective with parts broken away and parts being shown in exploded relationship and FIG. 97 is a longitudinal section through a straight, wedging, block-body terminal having an external contact surface.

FIG. 98 is a top perspective with parts broken away and with components being shown in exploded relationship and FIG. 99 is a longitudinal section through a straight, wedging, block-body terminal having an external contact surface of a different type.

FIG. 100 is a top perspective with parts in exploded relationship and FIG. 101 is a longitudinal section through a straight, wedging, block-body terminal having an external contact surface of still a different type.

FIG. 102 is a top perspective with parts in exploded relationship and FIG. 103 is a longitudinal section of a straight, wedging, block-and-sheet-body terminal with an external contact surface.

FIG. 104 is a top perspective with parts broken away and with parts in exploded relationship and FIG. 105 is a longitudinal section of a straight, wedging, combination block-and-sheet-body terminal having an external contact surface.

FIG. 106 is a top perspective with parts broken away and parts in exploded relationship and FIG. 107 is a longitudinal section of a straight, wedging, block-body terminal with an external contact surface of still another type.

In solving the problem of transmitting high-tension electricity effectively from a wire to a component of an electrical engine ignition system, for example, the most important consideration is to provide a terminal which will afford a large transfer area for the electricity both from the wire to the terminal and from the terminal to

a post or socket of the electrical component. A terminal for accomplishing this purpose can have a variety of structures such as illustrated in the various figures of the drawings. All of such terminals have three principal parts, two being a socket for receiving the end of a connecting wire and a contact surface which is of the external type for fitting into a socket of the ignition system component or of the internal type for embracing a post of such component. A distributor normally has contact sockets for receiving a terminal plug having an external contact surface. A spark plug usually has a post on which a collar providing an internal contact surface can be fitted. An ignition coil may have either a socket or a post or both for accommodating a wire terminal.

The third element of the terminal of the present invention is a body which connects the wire socket and the terminal contact surface, which body may be a block or be of sheet material or may be a combination of a block and sheet material. Such body can also carry a band or collar for embracing and confining the end portion of insulation on a connecting wire.

In the terminal of FIGS. 1, 2 and 3, the body A1 is formed as a block having an insulation-embracing collar B1 projecting from one end of the body and integral with it. This collar has longitudinal slots C1 in its opposite sides communicating with circumferential slots D1 which render the collar expansible so that it can receive and clamp the the outer surface of insulation. The body has a wire-receiving socket in it in the form of a blind hole E1 opening at the same end of the body as the collar B1. Such hole is of flattened cross section and has a flared conical opening. The opposite end of the body may have in it a recess F1 principally for lightening purposes and for economy.

The exterior of the body A1 is preferably of cylindrical shape and in its diametrically opposite sides deep grooves G1 extend axially along such body. Such grooves are in the same plane as the major axis of the hole E1. Such body and collar can be formed by a cold-forming operation. The minimum width of the hole E1 should be great enough to accommodate an electric wire of the largest size to which the terminal is to be fitted. When the wire end has been inserted into the socket E1 and the end of the insulation has been fitted within the collar B1,a crushing force can be applied to the body in a direction perpendicular to the plane in which the grooves G1 are located so as to crush the body sufficiently so that the wire in the socket E1 will be clamped tightly between its opposite walls. Since it is desirable for the external surface of the body to be of true cylindrical form after the terminal has been thus attached to the wire, the body when it is formed should have a cross section which is somewhat elliptical having its minor axis in the plane of the grooves G1 and its major axis perpendicular to such plane.

When the terminal has been attached to the wire in this fashion, the cylindrical exterior of the body constitutes an external contact surface of large area from which electricity can be transmitted to the complemental surface of a socket in which the terminal is fitted. To hold the terminal in place in such a socket pellets H1 of high-temperature silicone rubber, or plastic such as Teflon, may be embedded in diametrically opposite sides of the body projecting slightly from such sides to provide a friction engagement with the socket. Also, the intimate engagement of the wire end with the walls of the socket E1 will provide efficient transfer of electricity between the wire and the terminal body. Intimate contact of the wire and the body can be accomplished by squeezing the terminal in a press or by hammering the terminal until the wire is squeezed tightly in its socket. In addition, if the wire has been tinned before it is inserted into the terminal socket, the terminal can be heated to a temperature higher than the melting point of the solder with which the wire is tinned so that the wire end also can be bonded to the wall of the socket.

As mentioned above, a terminal of this type can be manufactured by a cold-forming operation and if desired the body can be made by forming two halves, one for each side of the body at one side of the plane of the grooves G1, such as the element shown in FIG. 3. Such two elements could then be welded or brazed together to complete the body shown in FIG. 2.

The terminal shown in FIGS. 4, 5 and 6 and the terminal shown in FIGS. 7 and 8 are quite similar to the terminal of FIGS. 1, 2 and 3. Thus, the terminal of FIGS. 4, 5 and 6 has a body of block type A2, an insulation-receiving collar B2 projecting from one end of such body and a longitudinal hole E2 in the body constituting a socket for a wire end. In this instance, however, while the collar B2 has longitudinal slots C2 in longitudinal alignment with grooves G2 in opposite sides of the body, the collar does not have the circumferential slots D1 of FIGS. 1 and 3.

The principal difference between the connector of FIGS. 4, 5 and 6 and the connector of FIGS. 1, 2 and 3 is that the socket hole E2 is a through hole, as shown best in FIG. 6. The end of this hole adjacent to the insulation-embracing collar B2 is flared to receive the wire easily and the wire can be clamped in this hole by crushing the body A2 either by use of a press or by hammering, as discussed in connection with the connector of FIGS. 1, 2 and 3. After the wire end has thus been secured in the socket hole or even without securing the wire end in this fashion, the wire end can be bonded in the socket hole by supplying solder to such socket hole through the cavity F2 whether or not the wire end was tinned with solder. A terminal of this type can be held in a socket by the rubber or plastic pellets H2 as described in connection with FIGS. 1, 2 and 3.

The body A3 of the connector shown in FIGS. 7, 8 and 9 has an insulation-gripping band or collar B3 with longitudinal slots C3 and circumferential slots D3 in it like the corresponding structure of the terminal shown in FIGS. 1, 2 and 3 described above. In this instance, the socket for the wire is a hole E3 of flattened cross section extending through the body similar to the hole E2 in the terminal of FIGS. 4, 5 and 6. Also, the body A3 has longitudinal grooves G3 disposed at diametrically opposite sides of the body corresponding to the grooves G1 of the terminal shown in FIGS. 1, 2 and 3.

The principal difference between the terminal of FIGS. 7 and 8 and those of FIGS. 1, 2 and 3 and FIGS. 4, 5 and 6 is that the through socket E3 does not open at the end of the body opposite the collar B3 into a cavity of substantial size as in the terminal of FIGS. 4, 5 and 6, but terminates in a small flared mouth which is flared just sufficiently to enable solder to be fed easily into the hole E3 alongside the wire so that the wire can be bonded readily to the terminal to improve the transmission of the electricity from the wire to the terminal. The exterior of this terminal should also be of cylindrical shape when its attachment to the wire has been

completed so that it can be received in a cylindrical socket of an electrical circuit component. Again the pellets H3 projecting slightly from opposite sides of the body can function to hold the body frictionally in a socket into which it is inserted.

In the terminal of FIGS. **10** and **11** the body is of combination type including the block portion A4 and the metal sheet I4 which embraces the block portion of the body and is secured to it by inturned flanges extending along opposite edges of the sheet. In this instance the insulation-engaging band B4 projects from one end of the sheet portion of the body and has wings J4 at its opposite edges which can be bent around the wire insulation.

Again the socket E4 is of the blind hole type, as shown best in FIG. **12.** Also, such hole need not have a nonsymmetrical cross section, although it is desirable for the hole to have a flared opening so that the wire end can be inserted into it readily. FIG. **11** shows the hole as being of circular cross section at the location of the section line **11—11** in FIG. **10.** It is desirable for the side of the body A4 not covered by the metal sheet portion I4 of the body to have in it an aperture affording access to one side of the socket. Such aperture is shown in FIGS. **10** and **11** as the slot K4, although the aperture could be in the form of a circular hole if desired. When a wire end has been inserted into the socket hole E4 solder can be supplied to the hole through the aperture K4 for bonding the wire end to the interior of the socket.

In the terminal of FIGS. **10** and **11** the body at the location of the section **11** is not cylindrical. Consequently, it is desirable to provide an element carried by the body which forms a cylindrical contact surface. Such element is shown in FIG. **10** as the sheet metal skirt L4 projecting endwise from the body. Such skirt can be formed of a strip curled into cylindrical shape so that its exterior could constitute an external contact surface to be fitted into a contact socket of an ignition system component. Alternatively, its interior could constitute an internal contact surface to fit onto a contact post of an ignition system component. The wall of such a skirt could be dimpled to form a button H4 protruding from each side of the skirt to secure such skirt in place in a socket or such dimpling could produce internal buttons to secure the skirt over a post.

Except for the skirt the terminal of FIG. **12** is the same as the terminal of FIGS. **10** and **11.** In the terminal of FIGS. **10** and **11** the skirt L4 projects linearly from the body A4,I4 whereas in FIG. **12** such skirt is at an angle to the body. The skirt and sheet portion I4 of the body in this instance are connected by the bend M4 of sheet material. In this instance, also, the skirt L4 could engage either a socket or a post to provide an electrical connection to an ignition system component. Thus, the type of construction shown in FIGS. **10, 11** and **12** is well adapted to provide either a straight terminal or an angle terminal, as may be desired, the only difference being in the amount of material provided and the contour of such material for forming the straight connection between the skirt and the body or the angle connection between the skirt and the body.

In the terminal of FIGS. **13** and **14,** again the body is of the composite type including the block A5 and the embracing metal sheet component I5. The band B5 and wings J5 for clamping the insulation of a connecting wire are the same as the corresponding elements of FIGS. **10, 11** and **12.** Also, the contact skirt L5 and retaining button H5 are the same as the skirt L4 and buttons H4 of the terminals shown in FIGS. **10** and **11** and FIG. **12.** Thus, the contact skirt L5 can be of the straight type as shown or the terminal could be of the angle type corresponding to that of FIG. **12.** In either instance the skirt could form either an external contact surface or an internal contact surface as might be preferred.

The principal difference between the terminal of FIGS. **13** and **14** and that of FIGS. **10, 11** and **12** is in the type of socket provided for securing the connecting wire to the terminal. In this instance the socket E5 is formed between one wall of the body block A5, a tongue N5 and a flap or flaps O5 formed by extensions of one edge of the metal sheet cover I5. The wire end can be moved lengthwise into the socket until the insulation end abuts the end of the body block A5. The tongue N5 can then be bent toward the body A5 which may have a groove in its wall of a depth less than the diameter of the wire. The flaps O5 can then be bent toward the terminal body and the tongue N5 to complete the closure of the socket.

While the metal of the tongue N5 may be sufficiently deformable and strong so that when it is closed over the wire end such wire end will be clamped tightly in its socket, it may be desirable also to bond the wire to its socket. For that reason it is preferred that two flaps be provided projecting from the metal sheet wall I5 instead of a single flap. The two flaps can be spaced apart sufficiently to provide an aperture K5 as shown in FIG. **13** through which solder can be fed to the socket groove in which the wire is fitted. Terminals of this type will be manufactured with the tongue N5 and the flaps O5 in the relationships shown in FIG. **14** so that a wire can be inserted easily in the socket. The tongue and the flaps will then be bent into wire-retaining position by the user, whether that user be an automobile manufacturer, an automotive repair shop or an automobile owner.

The terminal of FIGS. **15** and **16** has a metal block-body A6 with a cavity F6 in one end for lightening purposes and to save metal, which cavity may be of any desired size and shape while leaving a body wall of adequate thickness to enable its exterior to constitute an external contact surface. In such body pellets H6 can be provided to secure the body plug in a contact socket of an electrical ignition system component. The principal difference between the terminal of FIGS. **15** and **16** and that of FIGS. **1, 2** and **3** is in the type of socket provided for the wire end.

In the terminal shown in FIGS. **15** and **16** the wire socket E6 is formed as a channel in a spear P6 projecting lengthwise from the body A6 and having an oblique end. This spear is made of metal sheet material sufficiently thin that the spear can be worked between the wire W and the insulation cover C of a connecting wire as shown in FIG. **16.** The interior of the channel should be of a size and shape to embrace the wire closely. The pressure of the insulation on the outer side of the channel will hold the channel in snug engagement with the wire to provide a good contact for transfer of electricity from the wire to the spear and to the body of the terminal. Better contact between the spear and the wire can be produced by squeezing the insulation to bend or contract the channel to pinch the wire.

In the terminal of FIGS. 17, 18 and 19 the body A7 is of the block type and carries, projecting from one end, a band B7 having wings J7 which can be bent around the end of insulation on a wire to confine and clamp it as discussed in connection with the construction of the terminal shown in FIGS. 10 and 11. The principal difference of the terminal shown in FIGS. 17, 18 and 19 is the type of socket E7 provided for receiving the end of a wire W. In this instance the socket is of the side-opening type formed by the bottom of a deep groove Q7 opening at the periphery of the body as well as at its opposite ends. When the wire has been lodged in the bottom of the groove, as shown in FIG. 18, the wings J7 can be bent around the insulation cover C to retain the wire end in its socket. Such wire end can then be secured in the socket by filling at least the inner portion of the groove Q7 with solder supplied through the groove opening. The end of the socket groove remote from the band B7 may be restricted as shown in FIG. 18 to deter solder running from the groove. The exterior of the terminal body A7 is of cylindrical shape, constituting a plug to fit snugly in a cylindrical socket of an ignition system electrical component. The body can be retained in such a socket by rubber or plastic pellets H7 embedded in opposite side walls of the body and projecting slightly beyond them.

The terminal shown in FIGS. 20, 21 and 22 is of metal sheet construction instead of having a block-type body. Such terminal can be bent to shape from a flat blank by successive forming operations. One end of the sheet-body A8 carries band elements B8 separated by a longitudinal slot C8, which band elements are engageable with the insulating cover of a connecting wire. Such band elements have projecting wings J8 that can be folded around the insulation of a connecting wire when the end of such wire has been inserted in the socket E8 formed in the terminal body. Such socket, like that of the terminal shown in FIGS. 17, 18 and 19, is of the deep-groove type being formed by the bottom of the groove Q8 which opens both at one side of the terminal body and also at its opposite ends.

To form the body A8 with its deep groove Q8 and skirt side portions L8, as shown in FIGS. 20, 21 and 22, the sheet is formed generally in the shape of return bends at opposite sides of the wire socket E8. One side of each of such bends forms a side of the deep groove Q8 and the ends of such bend portions adjacent to the band portions B8 are bent away from each other to some extent to form a flaring end entrance to the wire socket and deep groove. Such flaring entrance facilitates insertion of a wire end into the groove. Engagement of the wire insulation with the band portions B8 prevent the wire end from moving sidewise out of the groove Q8. The outer side of each return-bent portion of the sheet preferably is curved in the shape of a cylindrical arc to form the skirt portions L8 which will cooperate to constitute an external contact surface for insertion into a cylindrical socket of an electrical ignition system component in which the skirt can be held by buttons H8 formed by dimpling the metal sheet.

When a wire end has been lodged in the side-opening terminal socket E8, and preferably after the wings J8 have been bent to clamp the insulation of the wire, solder can be supplied to the deep groove 8 to fill at least its inner portion so as to bond the wire end to the socket and to confine the wire end in such socket.

The terminal of FIGS. 23, 24 and 25 also is made of metal sheet. The socket-engaging skirt L9 and retaining buttons H9 are generally similar to the skirt L8 and buttons H8 of the terminal described in connection with FIGS. 20, 21 and 22. The insulation-embracing band B9 is formed as an extension of the skirt L9 and has wings J9 which can be bent around the insulation of a connecting wire. The principal difference between this terminal and that illustrated in FIGS. 20, 21 and 22 is the structure of the wire-receiving socket.

As shown best in FIGS. 23 and 24 the wire-receiving socket E9 is formed by the interior of a return bend constituting one-half of a reversely-bent body A9 formed in continuation of one edge of the skirt L9. The socket E9 is open at both ends as well as opening at the side, and the end of such socket adjacent to the insulation-embracing band B9 is flared to some extent, as shown best in FIG. 25, to facilitate insertion of a wire end into the socket by lengthwise movement of such wire. After the wire end has been lodged in the socket, such wire end can be bonded to the socket by solder applied into the socket channel between the reversely-bent body component A9 of the terminal and the adjacent free edge of the skirt L9. The terminal of FIGS. 26, 27 and 28 is also of the metal sheet type. The skirt insulation-embracing band and wing components L10, B10 and J10 of this terminal are similar to the corresponding components L9, B9 and J9, respectively, of the terminal described in connection with FIGS. 23, 24 and 25. The retaining buttons H10 also can be similar to the retaining buttons H9 of the terminal of FIGS. 23, 24 and 25. The principal difference between the terminal of FIGS. 26, 27 and 28, the terminal of FIGS. 20, 21 and 22 and the terminal of FIGS. 23, 24 and 25 is in the type of socket provided for a wire end. In this instance the sheet material of which the terminal is made can be spring steel or brass and the terminal can be blanked from a flat sheet and body portions A10 integral with the skirt L10 bent into the form illustrated by successive forming operations.

In this terminal the wire socket E10 is formed by skirt edge portions A10 bent in the shape of return bends and having cooperating grooves in them,as shown in FIG. 27, in which the end of a wire may be received and by which it may be clamped. Because of the character of the material of which this terminal is made, the strip portions of the terminal forming the socket E10 must be wedged or pried apart in order to afford sufficient clearance for insertion of a wire end into the socket by lengthwise movement of such wire. Such tool for spreading apart the socket strips may be a wedging tool such as a cold chisel or wedging pliers. When the wire has been inserted in the socket and the spreading tool removed, the cooperating elements of the socket will clamp the wire end. Such clamping force may be sufficient to hold the wire end with a good contact fit, but preferably the end of the socket remote from the insulation-embracing band B10 is flared to receive solder for bonding the end of the wire to the terminal.

In the metal sheet terminal shown in FIGS. 29 and 30, a skirt portion L11 having a retaining button H11 is very similar to the skirt portion L8 and buttons H8 of the terminal shown in FIGS. 20, 21 and 22. In this terminal, also, the body is formed of sheet elements bent inward from opposite portions of the skirt to form a deep groove Q11 like the deep groove Q8 of the terminal shown in FIGS. 20, 21 and 22. Again the bottom

of such deep groove forms a wire-receiving socket E11.

The difference between the terminal shown in FIGS. 29 and 30 and the terminal shown in FIGS. 20, 21 and 22 is principally in the provision of an endwise extension of the socket formed by the deep groove Q11 as a channel in one side of the spear P11. The spear portion of the connector projecting from the sheet-body A11 is generally of the type P6 shown in FIG. 15 in having an oblique end which can be worked between a wire W and its insulating covering C as shown in FIG. 30. In this instance, however, the insulation should be cut back from the end of the wire W a distance approaching the axial extent of the skirt portion L11. When the spear P11 has been worked between the wire and the insulation covering to the position shown in FIG. 30 in which the insulation abuts the adjacent ends of the body elements A11 and of the skirt elements L11, if such skirt elements are sufficiently small, the wire will be secured tightly by the insulation C in the socket P11. It is possible, however, if desired, to bond the wire to the terminal by inserting solder into the open side of the deep groove Q11.

The terminal of FIGS. 31, 32 and 33 has a composite block-and-sheet-body somewhat comparable to the terminals shown in FIGS. 10, 11 and 12 and FIGS. 13 and 14. In this instance the block-body A12 of generally cylindrical shape has its periphery enclosed by a metal sheet shell I12 from which the skirt L12 extends as in the terminals of FIGS. 10 and 11 and FIG. 13. Such skirt can be fitted into a socket to provide an external contact surface or it can be fitted over a post to provide an internal contact surface. In the former case buttons H12 can be provided by dimpling the skirt to hold it in place in the socket.

In this instance instead of providing an insulation-embracing band as in the terminals of FIGS. 10 and 11 and FIG. 13 the socket E12 for a wire end is formed by the bore of a spear P12. Such spear is a tube having an oblique end which can be worked between a wire and an insulating cover. Preferably the insulation is cut back somewhat so that the end of the wire can project into the body A12 beyond its end from which the spear projects. The spear can be worked between the wire and its insulating cover until the end of the insulation abuts the adjacent end of the body A12. In addition to the action of the wire insulation holding the spear against the wire passing through the socket bore E12 of the spear, the wire end can be bonded to the end of the spear embedded in the terminal body A12 by supplying solder to the wire and its socket through the side opening of the deep groove Q12 in which the inner end of the spear P12 is received. Such spear end is slotted to afford axis of solder to the wire passing through the bore of the spear.

The terminal shown in FIGS. 34, 35 and 36 is quite similar to the terminal of FIGS. 23, 24 and 25 as to the body A13, skirt L13 and retaining button H13 as compared to the body A9, skirt L9 and retaining button H9 of the connector shown in FIGS. 23, 24 and 25. In the connector of FIGS. 34, 35 and 36, however, instead of having an insulating clamping band like the band B9 of the terminal in FIGS. 23, 24 and 25, the terminal of FIGS. 34, 35 and 36 has a channel-shaped spear P13 carried by the body A13. Such spear and body provide a side-opening socket E13. The spear of the terminal shown in FIGS. 34, 35 and 36 is of a construction comparable to the spear P11 of FIGS. 29 and 30 and is used in the in the same way to secure the terminal to the end of a connecting wire.

The terminal of FIGS. 37, 38 and 39 is of the metal sheet type having a body A14 from which a channel-shaped spear P14 projects to provide a side-opening socket E14 for receiving a connecting wire to which the terminal is to be attached. Such spear has an oblique end and is comparable to the spear P13 of FIGS. 34 and 35 and the spear P11 of FIGS. 29 and 30 and is used in the same way. In this instance, however, the body A14 constitutes the central element of a reversely-bent sheet structure shown best in FIG. 39. The exterior portions L14 of this structure are bent in cylindrically arcuate shape and cooperate to form a skirt which can be inserted as a plug in a socket of an electrical ignition system component. The skirt can be held in such a socket by edge burrs H14. The spear P14 is carried by and is integral with the central web of the return-bent structure, which web constitutes the body A14 of the terminal.

The terminal of FIGS. 40, 41 and 42 has a block-body A15 from one end of which projects a band or collar B15 for receiving the end of a wire insulation cover. The exterior of such body has two opposite sides formed of substantially cylindrically arcuate shape having pellets H15 of rubber or plastic material embedded in and projecting from them to deter removal of the terminal from a socket in which it is fitted. Opening at the periphery of the body is a deep groove Q15 which provides a socket E15 for a connecting wire. Preferably, such socket is a channel-shaped recess in one wall of the groove of a depth considerably less than the diameter of a wire to be inserted lengthwise into the socket.

When a terminal of this type is manufactured the sides of the deep groove Q15 will be flared toward the periphery of the body A15 at an angle of 10° to 20° so as to receive a wire in the socket by movement of such wire transversely of its length. The wire can be secured in the socket by approach movement of the two sides of the body to close the slot. While engagement of the collar B15 with the insulation cover of the wire will deter movement of the wire out of the slot, the socket recess E15 may have a rib R15 at its outer side as shown in FIG. 42 to prevent lateral movement of the wire out of the slot as the closing action of the opposite body portions exert wedging pressure on the wire producing a force tending to expel the wire from the groove. After closure of the groove solder can be inserted into it through its partially open side to bond the wire to the body. Upon completion of the slot-closing operation the body should be of substantially cylindrical shape.

The body A16 of the terminal shown in FIGS. 43 and 44 is essentially the same as the body A15 of the terminal of FIGS. 40, 41 and 42. The deep groove Q16 having the socket recess E16 in one side and the rib R16 at the outer side of the wire socket recess are the same as the deep groove Q15 or socket recess E15 and rib R15 of FIGS. 40, 41 and 42. Also, the opposite sides of the body A16 can be closed in the same manner as the sides of the body A15 shown in FIGS. 40, 41 and 42 to clamp the wire and the wire can be soldered in place if desired. The principal difference of the terminal shown in FIGS. 43 and 44 over that of FIGS. 40, 41 and 42 is in the construction of the body as being of composite block and sheet type having a sheet shroud I16 extending around the body periphery generally like the

shroud I12 of the terminal shown in FIGS. 31, 32 and 33.

In this instance the band B16 is carried by the metal sheet cover or shroud I16 as in the terminals shown in FIGS. 10, 12 and 13. Such band has wings J16 similar to the wings of such previous terminal bands which can be bent around the insulation cover of a wire to hold it in place and to retain the wire end in the deep groove Q16. From the other edge of the shroud I16 projects the skirt L16, the structure of which again is comparable to the skirts L4 and L5 of the terminals previously described. Such skirt will afford either an external contact surface when inserted in a socket in which it can be retained by buttons H16 or such skirt can provide an internal contact surface when fitted over a post as described above.

In the terminal of FIGS. 45, 46 and 47 the body again is of the composite type, including the block A17 covered by the metal sheet shroud I17 secured around the block-body by edge flanges like the body arrangement of the terminal shown in FIGS. 10 and 11. The shroud I17 carries at one end the insulation-embracing band B17 and wings J17 and at its other end the skirt L17 having retaining buttons H17 all like the corresponding parts B16, J16, L16 and H16 of the terminal described in connection with FIGS. 43 and 44. The structural difference of this terminal over that of the terminal shown in FIGS. 13 and 14 is in the closure for the wire-receiving socket 17. Again the wire end can be placed in its socket by movement of the wire transversely of its length and the wire is then retained in its socket by bending toward the body flaps O17 spearated by a notch K17. Each of these flaps has on its inner side a rib R17 which will engage and exert concentrated pressure on the wire W in the socket E17 when the flaps are bent inward. The material of such flaps should be sufficiently stiff so that when bent as shown in FIG. 47 they will hold the wire tightly in its socket, but the wire also can be soldered in such socket after the flaps are bent over by inserting solder through the notch K17.

FIGS. 48 and 49 show a terminal having a block-body A18 with an end-opening deep groove Q18 in one side of which is a recess constituting the wire socket E18. The opposite sides of such deep groove can flare about 10° from the web S18 joining the two parts of the body and constituting a hinge. From the ends of each body portion remote from such hinge project curved band parts B18 adapted to embrace opposite sides of an insulation cover on a wire when the two portions of the body A18 are closed on the wire W as shown in FIG. 49. When the terminal body portions have thus been closed on the wire the band portions B18 should clamp the insulation covering C of the wire tightly. The wire may stop short of the hinge web S18 sufficiently, as shown in FIG. 49, to enable solder to be supplied to the inner end of the socket groove E18 at opposite sides of the wire for bonding the wire to the terminal.

When the body portions A18 of the terminal shown in FIGS. 48 and 49 have been closed on the wire, the exterior of the terminal should be of substantially cylindrical shape to fit into a socket of an electrical ignition system component. In such case the exterior of the body would provide an external contact surface with such socket of large area and pellets H18 of rubber or plastic projecting from opposite sides of the body would retain such body in the socket in the manner described above.

FIGS. 50 and 51 also show a connector having an end-closable block-body A19 which is substantially identical with the body of the terminal shown in FIGS. 48 and 49. The terminal of FIGS. 50 and 51 also has insulation band sections B19, a deep groove Q19 and a wire socket E19 corresponding respectively to the parts B18, Q18 and E18 of the terminal shown in FIGS. 48 and 49. In the terminal of FIGS. 50 and 51, however, instead of the exteriors of the closable body parts forming a plug to be inserted into a socket, the body A19 includes a projection beyond the closable parts which is encircled by a metal sheet shroud I19. This shroud I19 carries a depending skirt L19, the exterior of which can fit into a socket or the interior of which can be fitted over a post as described in connection with the terminals of FIGS. 10, 11, 13 and 14. In this instance the hinge action of the closable body parts enabling such parts to be moved toward each other into the positions of FIG. 51 to clamp a wire W and insulation cover C is provided by the peripheral groove U19 encircling the bases of the closable parts of the body A19.

The terminal of FIG. 52 is comparable to the terminal of FIGS. 48 and 49 being of the end-closable block-body type. The body A20 has a deep end-opening groove Q20 in which a wire socket recess E20 is provided corresponding to the parts A18, Q18 and E18 of the terminal shown in FIGS. 48 and 49. Also, the closable body parts of the terminal of FIG. 52 are joined by a hinge web S20 and have retaining pellets H20 corresponding to the hinge web S18 and retaining pellets H18 of the terminal shown in FIGS. 48 and 49. The difference of the FIG. 52 terminal over the terminal of FIGS. 48 and 49 resides in the provision of a wire insulation clamping band element B20 and wings J20 projecting from such band element comparable to the band element B4 and wings J4 shown in FIGS. 10 and 11 instead of the band elements B18 of the type shown in FIGS. 48 and 49.

The terminal of FIG. 53 is the same as the terminal of FIG. 52 except that instead of the body A21 of block type being the only body portion, this terminal also has a metal sheet body portion I21 constituting a shroud encircling one side of the block-body element A21 and secured to it by edge flanges as the metal sheet is secured to the block-body in FIG. 10. Also, such metal sheet portion of the body carries a depending metal sheet skirt L21 having buttons H21 for fitting into a socket or over a post comparable to the skirt L4 and buttons H4 of the terminal shown in FIGS. 10 and 11. The end-opening deep groove Q21 between the body parts, the wire-socket recess E21, the insulation-clamping band portion B21 and the wings J21 are comparable to the deep groove Q20, the recess E20, the band portion B20 and the wings J20 of the terminal shown in FIG. 52.

The terminal of FIGS. 54 and 55 has an end-opening body A22, the two parts of which are joined by a hinge S22 generally comparable to the structure of the terminal shown in FIGS. 48 and 49. A deep groove Q22 is formed between the closable parts of the body and the exterior of such body parts are formed as cylindrically-arcuate surfaces. Also, such body parts have pellets H22 of rubber or plastic projecting therefrom for deterring withdrawal of the body parts from a socket in which they may be fitted as a plug. The difference between the terminal of FIGS. 54 and 55 and that of FIGS. 48 and 49 is in the provision on one of the body

parts of metal sheet projections or flanges I22 which overlap the other body part as shown best in FIG. 55 so that, when the body parts are closed together, such flanges will insure that the body parts are not cocked relatively by the hinge S22. Because of the guidance provided by the flanges I22, the hinge S22 can be of lighter construction than the hinge web S18 in the terminal of FIGS. 48 and 49.

FIG. 56 shows another terminal having a body A23 providing an end-closable deep groove Q23 affording a wire-receiving socket E23. This terminal is generally similar to that shown in FIG. 52 in having insulation-engaging band and wing parts B23 and J23, respectively, corresponding to the parts B20 and J20, respectively, of the terminal shown in FIG. 52. In this instance, however, instead of the body A23 being composed of two parts that are similar, one of such body parts is of generally channel shape and having an external cylindrical surface constituting a major arc of a cylinder. The other body member joined to the first at one end by a hinge S23 is of a width to fit between the flanges of the first body element and has a external surface of circular arcuate shape providing a minor arc of a cylinder. The two parts of the body can be closed on a wire end in the manner described in connection with FIGS. 48 and 49, however, and the band B23 and wings J23 can be clamped around a wire-insulating cover in the manner described in connection with the band element B4 and wings J4 of the terminal shown in FIGS. 10 and 11.

In FIGS. 57, 58 and 59 a terminal having a block-body A24 and insulation-confining band or collar elements B24 with axial slots C24 and circumferential slots D24 similar to the body A1, band element B1 and slots C1 and D1 of FIGS. 1, 2 and 3 is shown. Also, the exterior of the body is of cylindrical shape when it has been attached to a wire and has longitudinal grooves G24 in its opposite sides comparable to the grooves G1 in the terminal of FIGS. 1, 2 and 3 and for the same purpose, namely, to enable the body of the terminal to be contracted to clamp a wire in a socket provided in the body for it. Prior to such contraction the block A24 has an out-of-round curved periphery as shown in FIG. 58 with a major axis and a minor axis. The grooves G24 are located at opposite ends of the minor axis as shown in that figure and facilitate constriction of the block in squeezing it to clamp the wire in the block hole.

The terminal of FIGS. 57, 58 and 59 differs from the terminal of FIGS. 1, 2 and 3 in providing a through hole to constitute a socket E24 for a wire which is generally comparable to the through hole in the terminal of FIGS. 4, 5 and 6 to provide the wire-receiving socket E2. Also, a cavity F24 may be provided in the end of the body A24 remote from the insulation-embracing band elements B24 and such cavity can be of any desired shape. In this terminal, however, the body is of composite character by the fact that the hole through the block-body A24 is not of a size to embrace snugly the projecting end of a wire, but instead is of a size to receive therethrough a tube T24, the hole through which constitutes the socket E24 for the wire.

Use of such a tube enables the wire-receiving socket E24 formed by the bore to be much longer than would be possible otherwise. Also, the same type of plug body can be adapted to receive wires of different size simply by inserting in the hole through the body different tubes having the same external diameter, but having bores of different sizes corresponding to the sizes of wires to be fitted in them, respectively. The end of such a tube adjacent to the insulation-engaging band B24 may have in it a bore with a flared end to facilitate insertion into it of the end of a connecting wire by lengthwise movement of such wire end. The wire may have a snug fit in the tube bore to provide good transfer of electrical energy between the wire and the terminal or solder can be supplied to the end of the tube bore remote from the insulation-engaging band portions B24 for the purpose of bonding the wire to the tube. The hollow portion of the body beyond the body hole forms a skirt longer than the portion of tube T24 projecting beyond the body hole for protecting such tube.

The body A25 of the terminal shown in FIG. 60 also has a tube T25 extending through it for the purpose of forming a socket for a connecting wire. In this instance the body is quite similar to the body of the terminal shown in FIGS. 57, 58 and 59, except that instead of the body being crushable to effect tight clamping of the wire by the terminal, the portion of the tube T25 projecting beyond one end of the body forms a spear P25 having an oblique end which is similar to the spear of the terminal shown in FIGS. 31, 32 and 33. Such spear can be worked between the wire and insulating cover of a connecting wire as described in connection with FIGS. 15 and 16, FIGS. 29 and 30 and FIGS. 31 and 32 to provide an intimate and large contact area between the wire and the terminal body. The exterior of the block-body A25 is cylindrical so as to form a connecting plug with an external contact surface and having pellets H25 protruding from its walls to anchor the body in a socket.

The terminal of FIGS. 61 and 62 has a composite body including the block A26 encircled by a metal sheet shroud I26 similar to the construction of the terminal shown in FIGS. 31 and 32. In this instance, however, the spear P26 is of channel shape in cross section defining the wire socket E26 and having an oblique end. Such spear differs from that shown in FIGS. 15 and 16, for example, in having barb-like ribs which deter withdrawal of the spear from a position lodged between a wire and its insulation cover. The tube T26 extends through the hole in the body A26 and can be a press fit in such body or the tube can be bonded to the block-body hole in any suitable fashion. The block-body in turn can fit into the metal sheet shroud I26 having a skirt L26 to complete the terminal.

A terminal of the type shown in FIGS. 61 and 62 would be supplied from the factory in two parts which are shown in exploded relationship in FIG. 61. The part composed of the block-body A26 and the spear P26 would be applied first to a connecting wire between the wire and the insulating cover as illustrated in FIG. 16. The spear could be held to the wire simply by being wedged between the wire and the cover or solder could be supplied between the wire and the spear through the flared end of the tube T26 shown best in FIG. 62 before the two parts of the terminal are assembled. When the spear has thus been affixed to the wire end, the block-body A26 can be inserted into the metal band I26 and bonded to it by solder supplied through the slot in the shroud. The solder will flow around a peripheral groove in the body block A26 to bond such block to the shroud. Such block may also have longitudinal grooves spaced circumferentially of it that cross the circumferential groove so as to enable solder to flow more readily

between the juxtaposed external surface of the plug-body A26 and internal surface of the sheet shroud I26.

When the two parts of the terminal have been assembled in this fashion, as shown in FIG. 62, the skirt L26 carried by the shroud I26 can be fitted into a socket or fitted over a post to provide an external contact surface or an internal contact surface as described in connection with the terminal shown in FIGS. 10 and 11. The terminal can be retained in a socket by opposed buttons H26 protruding from the skirt as explained in connection with terminals described above, such as those of FIGS. 10 and 13.

The shroud I27, skirt L27 and retaining button H27 of the terminal shown in FIGS. 63 and 64 can be the same as described in connection with the terminal of FIGS. 61 and 62. In this instance, however, the body block A27 is different from the body block A26 of the terminal in FIGS. 61 and 62. In this instance the body block has a bore extending through it perpendicular to the axis of the shroud I27 and skirt L27 to receive a tube T27, the projecting portion of which forms a spear P27 having an oblique end. Such spear is comparable to the spear B12 of the connector shown in FIGS. 31 and 32 and can be worked between a wire W and an insulating covering C as shown in FIG. 64.

Like the terminal of FIGS. 61 and 62, the terminal of FIGS. 63 and 64 can be supplied by the factory in two parts, namely, one part including the block-body A27 and spear P27 and the other part including the sheet shroud I27 and the skirt L27. In installing such a terminal the spear P27 can be inserted between the wire W and the insulation cover C in the position shown in FIG. 64 before the block-body A27 is assembled with the shroud I27. The wire W can be bonded to the spear P27 by supplying solder in the flared end of tube T27 shown at the right of FIG. 64. Subsequently, the block-body projection can be inserted within the shroud band I27 and soldered to it in the manner described in connection with the terminal shown in FIGS. 61 and 62. The terminal will then be complete and will be attached to the connecting wire W so that the skirt L27 can be inserted into a socket or over a post to secure it to an electrical ignition system component as discussed in connection with the terminals shown in FIGS. 10 and 13.

The terminal of FIGS. 65, 66 and 67 is quite similar to the terminal of FIGS. 57, 58 and 59. Thus, the body A28 has longitudinal grooves G28 in its opposite sides corresponding to the body A24 and grooves G24 of the terminal shown in FIGS. 57, 58 and 59. Also, the insulation-embracing band B28 and its slots C28 and D28 are the same as the band B24, slots C24 and slots D24 of the terminal illustrated in FIGS. 57, 58 and 59. The principal difference between the terminal of FIGS. 65, 66 and 67 and that of FIGS. 57, 58 and 59 is in the shape of the tube T28 forming the socket E28 for the connecting wire. While the tube T24 of the connector in FIGS. 57, 58 and 59 is of substantially circular cross section, the tube T28 of the connector in FIGS. 65, 66 and 67 is of flattened cross section. Such flattened cross section is similar to the flattened hole through the terminal of FIGS. 7 and 8, but in the terminal of FIGS. 65, 66 and 67 the wire socket is formed by the aperture through the tube T28 instead of directly by the body hole. In manufacturing the terminals of FIGS. 65, 66 and 67, therefore, wires of different size can be accommodated simply by inserting in the connector bodies tubes having apertures through them of different sizes of cross section while the exterior shapes and sizes of the several tubes are alike.

The terminal shown in FIG. 68 has a block-body A29 through which a wire socket tube T29 extends, encircled by a recess F29, comparable to the block-body A25, tube T25 and recess or cavity F25 of the terminal shown in FIG. 60. Also, the body A29 has a retaining pellet H29 like the pellet H25 in the terminal of FIG. 60. The terminal of FIG. 68 differs from that of FIG. 60 in the structure of the spear P29 of the tube T29 shown in FIG. 68, as compared to the spear P25 formed by the tube T25 of FIG. 60. In FIG. 68 the spear P29 not only has an oblique end, but has a helical rib projecting from the exterior of the spear P29 so that the spear can be screwed between a wire end and its encircling insulation cover instead of merely being pushed longitudinally into this position or oscillated during such movement lengthwise of the wire.

In the terminal of FIG. 69 the block-body A30 is virtually the same as the block-body of the terminal shown in FIGS. 17 and 18. In this instance, however, instead of a connecting wire being inserted into a deep groove Q30 opening at the periphery of the body,a tube T30 having a spear P30 is moved into such groove transversely of the length of the tube. Such tube can be soldered to the body by supplying solder through the groove opening. The spear P30 can then be worked into the space between a wire end and its insulation cover until the end of the insulation abuts the end of body A30 adjacent to the spear. The wire can then be bonded to the tube T30 by supplying solder to the end of such tube opposite the spear through the portion of the slot Q30 beyond the inner end of the tube T30. The body A30 may be provided with retaining pellets H30 functioning as described above.

In the terminal of FIG. 70 the spear P31 is formed integral with the block-body A31. Such spear is of channel cross section providing a side-opening socket E31 to receive an ignition wire. The exterior of such spear may have barb ribs like the spear P26 shown in FIGS. 61 and 62. The exterior of the block-body A31 may have flutes or splines extending lengthwise of it to afford better contact with the wall of a socket in which it is fitted if desired.

The block-body A32, cavity F32 and retaining buttons H32 of the terminal shown in FIG. 71 may be the same as the corresponding parts A29, F29 and H29 of the terminal shown in FIG. 68. In this instance, however, the tube T32 forming the socket for the connector wire is different from the tube T29 of the FIG. 68 terminal. In FIG. 71 the flared end of the tube T32 projects only a short distance, if any, into the cavity F32 while the flared end T29 in FIG. 68 projects almost entirely through the cavity F29. Also, the spear P32 is of channel cross section providing the side-opening wire socket E32. In this instance the spear is similar to that shown in FIGS. 15 and 16 and can be inserted between a wire and its insulation covering as shown in FIG. 16. In the instance of FIG. 71, however, the wire can be bonded to the tube T32 by supplying solder to the interior wire socket of such tube through the body cavity F32 and the flared end of the tube T32 opening into such cavity.

In the terminal of FIGS. 72 and 73 the block-body A33 is similar to the block-body of the terminal shown in FIGS. 4, 5 and 6. Thus, the body A33 has grooves

G33 in its opposite sides extending longitudinally of it and a cavity F33 in one end. Such components compare to the body A2, longitudinal grooves G2 and cavity F2 of the terminal illustrated in FIGS. 4, 5 and 6. In the terminal of FIGS. 72 and 73, however, the wire-receiving socket E33 is formed by a spear P33 projecting from one end of the body A33 and having one end embedded in such body. Such spear is shown to be of tubular shape and has a helical rib on its external surface constituting a thread for drawing the spear between a wire and its insulation covering by relative rotation of the body A33 and the wire as discussed in connection with the terminal of FIG. 68.

In applying the terminal of FIGS. 72 and 73 to a wire end, the bare wire should project a substantial distance beyond the end of the insulation so that such bare wire end will pass through the spear tube and into the through hole of the body. One end of the spear is anchored in one end of such body hole. The body may then be crushed to clamp the wire end in such hole by crushing the body in a direction perpendicular to the plane defined by the opposite grooves G33. Additionally, the wire received in the body hole can be bonded to the body by supplying solder to the wire socket E33 through the cavity F33 in the end of the body A33 opposite the spear P33.

In the terminal of FIG. 74 the block-body A34 carries a spear P34 integral with it which is of channel cross section comparable to the spear P6 integral with the body A6 of the terminal shown in FIGS. 15 and 16. As in the terminal of those figures, the spear P34 of FIG. 74 forms a side-opening socket E34 to receive a wire. The spear is inserted between a wire and its insulation cover in the manner illustrated in FIG. 16. The terminal of FIG. 74 differs from that of FIGS. 15 and 16, however, in having a metal sheet shroud I34 covering the block-body A34 and carrying the skirt L34. In this instance the skirt is made from resilient metal sheet, such as brass or spring steel, so that when the skirt is inserted into a socket of an electrical ignition system component, such as an ignition coil or the cap of a distributor, the resilience of the metal sheet having at least one and preferably two longitudinal slots in it will hold the terminal firmly in place in its socket. If it is desired for the skirt to have greater resilience, additional longitudinal slots can be provided in the skirt spaced circumferentially of it.

In the terminal of FIG. 75 an alternative type of structure is provided to retain the terminal in a socket. In this instance the body A35 is generally in the form of a disk integral with one end of a tube T35, the opposite end of which forms a tubular spear P35, comparable to the spear P12 shown in FIGS. 31 and 32 and functioning for the same purpose. The body plate A35 carries on its periphery a closely-wound helical spring V35, the opposite end of which extends inward and is wound tightly around the spear P35. Such end of the helical coil should be brazed or soldered to the spear so as to form a good electrical contact between the spring, the spear P35 and the body A35 to transmit electricity to the spring. When confined in a socket, the spring will yield sufficiently to press tightly against the internal socket wall at various locations to provide an ample area for effective transmission of electricity between the body of the terminal and such a socket.

The terminal of FIG. 76 is similar to the terminal of FIG. 68, except that the block-body A29 of such terminal is replaced by a metal sheet body A36. Such body encircles the wire socket tube T36 and one end portion of such tube having an oblique end protects beyond the body A36 to form a spear P36 defining a wire-receiving socket. Such spear is not shown as having a helical rib like the spear P29 of FIG. 28, but has a plain exterior like the spear P30 of the terminal shown in FIG. 69. The sheet-body A36 is made of resilient material, such as brass or stainless steel, and carries integral with it a metal sheet skirt L36 comparable to the metal sheet skirt L34 of the terminal shown in FIG. 74. Such skirt may have one or more slots in it to maintain the skirt resiliently in a socket as described in connection with the terminal of FIG. 74. In the terminal of FIG. 76 the wire socket tube T36 extends for almost the entire distance lengthwise of the skirt L36 comparable to the extent of the tube T29 in the terminal of FIG. 68.

The terminal of FIG. 77 has a block body A37 encircled by a metal sheet shroud I47. Such shroud has insulation-engaging band elements B37 at one end separated by axial slots C37 and circumferential slots D37 comparable to the construction described in connection with FIGS. 1 and 3, except that in this instance the insulation-engaging band elements are integral with the shroud I37 instead of being longitudinal extensions of the block-body itself. The skirt L37 carried by the shroud I37 is of resilient metal sheet, such as brass or spring steel, and has in it one or more longitudinal slots which are effective to retain the skirt in a socket as discussed in connection with the skirt L34 of the terminal shown in FIG. 74.

In the terminal of FIG. 77 the socket E37 for receiving the end of a connecting wire is a through hole in the block-body A37. In order to increase the length of such a hole the block-body has a neck integral with it which projects concentrically within the skirt L37 to leave an annular cavity F37. Both ends of the wire-receiving socket E37 are flared so that a connecting wire can be inserted easily into one end of the socket and the wire can be bonded to such socket by supplying solder to it through the flared opposite socket end.

Like the terminal of FIG. 77, the terminal of FIG. 78 also has a block-body A38. This body is encompassed by a metal sheet shroud I38 which carries the insulation-confining band elements B38 having axial slots C38 and circumferential slots D38 at one end and the metal sheet skirt L38 at the opposite end having one or more longitudinal slots. Such elements are the same as elements I37, B37, C37, D37 and L37, respectively, of the terminal shown in FIG. 77. The terminal of FIG. 78 differs from that of FIG. 77 in that the socket for the wire is formed by a tube T38 extending through a hole in the center of the block-body A38. The central bore of such tube provides a socket E38 for a wire. The end of such tube adjacent to the insulation band B38 is flared to enable the wire end to be inserted easily into the interior of the tube and such wire can be bonded to the tube, if desired, by supplying solder to the opposite end of the tube. The tube T38 can be secured to the body A38 by a press fit or the tube can be secured to the body by soldering or brazing.

The terminal of FIG. 79 includes features both of the terminal shown in FIG. 77 and of the terminal shown in FIG. 78. In this instance the terminal has a block-body A39, one end portion of which is encircled by a metal sheet shroud I39. Such shroud carries a band portion B39 having axial slots C39 and circumferential

slots D39 for the purpose of clamping the insulation cover of a wire, the projecting end of which is inserted into a hole in the block-body A39 constituting a socket E39 for the wire. The exterior of the block-body is of cylindrical shape so as to constitute a plug to be fitted into the socket of an electrical ignition system component.

In the terminal of FIG. 79 a tube T39 is inserted into a portion of the central bore of the block-body A39 to form a continuation of the other portion of such bore and the wire-receiving socket. The end of such tube remote from the insulation-engaging band B39 projects into the cavity F39 of the terminal body. The tube T39 can be secured to the block-body A39 by a press fit or it can be bonded to the body by solder or brazing. The wire end inserted into the socket E39 and interior of the tube T39 can also be bonded to such tube by supplying solder to the end of such tube extending into the cavity F39 of the body A39.

The terminal shown in FIGS. 80 and 81 is made entirely of metal sheet material. In this instance the metal sheet body of the terminal is of generally funnel shape having a tubular neck T40, the hole through which provides a socket E40 to receive the end of a connecting wire. The large end of the funnel-shaped body is substantially cylindrical and is connected to the tubular neck T40 by a conical transition section. A shroud sheet I40 encircles the enlarged cylindrical portion of the funnel-shaped body A40. Such shroud carries the insulation-clamping band B40 at one end having longitudinal slots C40 and circumferential slots D40 and at its other end carries a skirt L40 having projecting tabs H40 for the purpose of anchoring the skirt in a socket. The body A40 can be integrated with the shroud I40 by soldering or brazing and the wire end inserted in its socket E40 can be secured in place by solder supplied to the flared end of the tubular neck T40 projecting into the cavity F40. Alternatively or additionally, the wire end may be secured in the socket E40 by pinching the tubular neck T40 against the wire. For this purpose pinching tools can be inserted into the interior of the skirt L40 through apertures K40 in its opposite sides to engage the opposite sides of the tube T40.

In the terminal of FIGS. 82 and 83 the body A41 again is of funnel-shaped sheet construction having an enlarged end encircled by the metal sheet shroud I41 to which it is soldered or brazed. The smaller portion of the body forms a tubular extension T41 providing a socket E41 for reception of a connecting wire end. In this instance the shroud I41 carries the insulation-clamping band B41 having wings J41 generally of the type disclosed in FIG. 10.

The edge of the shroud I41 opposite the insulation-clamping band carries the skirt L41 which may have retaining buttons H41. This skirt is shown in aligned relationship to the body A41 in FIG. 82 and is shown bent at an angle to such body in FIG. 83 comparable to the arrangement of the skirt L4 in FIG. 12. The skirt is joined to the shroud by the bend M41. When the end of a wire has been inserted in the socket E41 of body tube T41 and the insulation of the wire has been clamped by the band B41 and the wings J41, the end of the wire can be soldered in its socket by solder supplied through slots in the end of tube T41. The skirt L41 can then be inserted into a socket or fitted over a post as described in connection with FIG. 12.

A different type of terminal is shown in FIGS. 84, 85 and 86 which can be manufactured by being bent from a flat blank. The body A42 is composed of metal sheet members generally in the form of strips which face each other. Corresponding ends of such strips are joined by the fold S42. The opposite ends of the body strip members carry arcuate band sections B42 engageable with opposite sides of insulation. The body strips A42 have complemental grooves E42 cooperatively forming a wire-receiving socket.

The corresponding side edge portions of the opposite body strips A42 are bent away from each other in return-bent shape to form skirt sections L42 which provide external contact surfaces for fitting into a socket. Burrs H42 on the skirt edges will hold the terminal in a socket. This terminal would be received from the factory with the body strips A42 spaced apart somewhat or diverging from the fold S42 at an angle of 5° to 10° as shown in FIG. 85. A wire can then be inserted by lengthwise movement into the socket E42 between the grooves of the spaced body strips until the end of the insulation cover C engages web portions W42 connecting body strips A42 and band sections B42. When the wire has thus been inserted into the socket the body strips A42 can be closed together to pinch the wire W as indicated in FIG. 86. Simultaneously, the insulation-clamping band portions B42 will be pressed into engagement with the wire insulation. The body strips A42 can thus be pressed closely by inserting the jaws of a squeezing tool between the adjacent spread-apart edges of the skirt sections L42. Simultaneously or subsequently the wire end inserted into the cooperating socket grooves can be bonded into place. Prior to its insertion into the socket the wire end can be tinned so that a set of heated anvils applied to opposite sides of the body strips A42 will heat the wire end to melt the solder and bond the wire to the body strips. The skirt sections L42 can then be bent more from strips A42 so as cooperatively to be of substantially cylindrical shape as indicated in FIG. 86.

The terminal of FIGS. 87 and 88 has components generally of the same configuration as the corresponding parts of the terminal shown in FIGS. 84, 85 and 86. Thus, the body strips A43, the insulation-clamping band portions B43, the skirt sections L43 and the burrs H84 correspond to the body strips A42, band portions B42, skirt sections L42 and burrs H42 of the terminal in FIGS. 84, 85 and 86. In the terminal of FIGS. 87 and 88, however, the fold S43 is tight and the body strips A43 are in contact as the terminal is supplied by the factory. Consequently, it is necessary to insert wedging members between the body strips A43 at their junctions with the return-bent portions L43 to pry apart the insulation-clamping band portions B43 in order to enable a wire end to be inserted between them and into the socket between the body strips. Such wedging members may be opposing jaws of a pliers type of tool.

When the wire end has thus been inserted into the socket E43 between the grooves in the body strips A43 until the end of the wire-insulating cover engages the web portions W43 connecting body strips A43 and insulation-clamping band portions B43, the wedging members can be withdrawn from between the body strips A43. The metal sheet material of which the terminal is made can be resilient sheet brass or spring steel so that the body strips will spring together to clamp the wire tightly.

The terminal shown in FIGS. 89 and 90 also can be fabricated by being bent from a flat metal sheet blank. In this instance the metal sheet body portion A44 carries at one end an insulation band portion B44 having wings J44 comparable to the band B4 and wings J4 of the terminal shown in FIG. 10. The portion of the body A44 opposite the band B44 carries the skirt L44 having projecting buttons H44 like the skirt shown in FIGS. 10 and 12. Such skirt can be inserted into a socket or fitted over a post as described in connection with those figures. Also, FIG. 89 shows the skirt aligned with the body as in the terminal of FIG. 10 and FIG. 90 shows the skirt connected by an angle M44 to the body like the skirt of the terminal in FIG. 12.

The socket for the wire W shown in FIG. 90 is formed by a groove E44 extending lengthwise of the body A44 produced by a crease in the metal sheet. The wire is then held in place by a flange or tongue N44 being bent into engagement with the wire and a flap O44 being bent from the opposite side of the body A44 into a position overlapping the tongue N44. This type of wire-securing arrangement is generally comparable to that used for securing the wire in the socket as described in connection with FIGS. 13 and 14. At the same time the insulation covering C is secured in place by bending the wings J44 around it as shown in FIG. 90.

Another terminal which can be formed from a flat metal sheet blank is shown in FIGS. 91 and 92 as having the metal sheet body A45. An insulation-clamping band portion B45 having wings J45 is carried by one end of the sheet body A45 and the skirt L45 having buttons H45 is carried by the opposite portion of the body . Flanges forming opposite sides of the body A45 are first turned toward each other and then inturned to form abutting ribs R45. A socket E45 is provided for a wire by cutting ears out of the inturned flanges and bending them toward each other. Such ears can be closed around the wire after it has been inserted between them and the insulation covering has been clamped by the band B45 and wings J45.

Another terminal which can be fabricated by being formed from a flat metal sheet blank is shown in FIGS. 93, 94 and 95. In this instance the sheet-body A46 again carries at one side an insulation-clamping band portion B46 having wings J46 and at its other side a metal sheet skirt L46 having buttons H46. Such insulation-clamping band elements and skirt are comparable to the parts B4, J4 and L4 of the terminal shown in FIG. 12 in which the skirt is connected to the body by a bend M4 corresponding to the bend M46 of the terminal shown in FIG. 95. In FIG. 93 the terminal is shown prior to the portion M46 being bent.

The metal sheet-body A46 has two parts, one of which is the sheet connecting the insulation-engaging band part B46 and the skirt L46 which is dented inwardly and the other part is a tongue projecting from one edge of such body sheet portion and folded over into overlapping relationship with the dent. A flap O46 projects from the opposite edge of the body sheet section into overlapping relationship with the tongue to form the wire-receiving socket E46 between these elements. The end of the flap O46 has in it a notch K46 affording an opening through which solder can be supplied to solder the wire to such flap when it has been bent from the broken-line position shown in FIG. 95 and the solid-line position of FIG. 94 into the solid-line position of FIG. 95. Provision of a hole in the body tongue A46 will enable solder to flow between the tongue and the indented portion of the metal sheet-body so that these elements are bonded together.

The provision of a crease extending longitudinally of the body sheet A46 from its indentation to the edge of the insulation band B46 will stiffen the sheet-body. Also, a tool may be fitted into the indentation of the body when the flap O46 is being bent into wire-clamping position to prevent buckling of the terminal during such clamping operation. Preferably the wire W is clamped in the body after the insulation covering C has been clamped into position by bending the wings J46 over it, although the two clamping operations may be performed simultaneously. The soldering operation for bonding the wire to the flap O46 and the body tongue behind it will follow the clamping operation.

In the terminal of FIGS. 96 and 97 the wire W is secured in place by a wedging operation. In this terminal the block-body A47 has an aperture through it providing a socket E47 for receiving the end of wire W and for accommodating a wedge X47 having a threaded shank Y47 on one end on which a nut Z47 can be screwed. From one end of such body projects band members B47 similar to the band members B2 of FIG. 4 and having longitudinal slots C47 to provide resiliency for the insulation-clamping bands. One side of the wedge X47 can be concave to fit one side of wire W. Such wedge and the wire end are moved conjointly within the clamping skirt portions B47 and are then inserted together into the hole through body A47 until the threaded shank of the wedge projects beyond the opposite end of the body. The nut Z47 can then be screwed onto the shank and tightened to draw the wedge into the tapered hole of the body so as to wedge the wire W tightly in its socket formed by such hole. The wedging member X47 can be made of metal softer than the terminal body A47, such as aluminum, lead, zinc or an alloy of such metals. The wedge will thus be deformed to the contour of the body cavity when it is pulled into place. Also an annular weakening groove U47 encircles the wedging member X47 at the base of its threaded shank Z47. If rotation of the nut is continued after the wedge has been drawn tightly into its socket the wedging member will part at the groove U47 to leave an end flush with the end of body 47. A pellet H47 can be provided in the body wall to retain it when the body is inserted as a plug into a contact socket.

The terminal of FIGS. 98 and 99 also secures the wire by a wedging action. In this instance the body A48 has a concentric conical hole through it for receiving a complementally tapered wedging member X48 having two semi-conical portions joined by a hinge neck S48 from which a plain stem Y48 extends. The adjacent sides of the semi-conical portions of the wedge X48 have complemental facing grooves cooperating to form a socket E48 for a wire. Also the wedging member has an annular weakening groove U48 at the base of its shank Y48. Such wedging member is of relatively soft metal like the member X47, Y47 of FIGS. 96 and 97. From the end of the body A48 in which the larger end of the conical hole through the body is located, insulation-clamping band elements project which are comparable to the insulation-clamping band elements B1 of the terminal shown in FIG. 1. Such band elements are separated by longitudinal slots C48 and circumferential slots D48.

To attach a connecting wire to the terminal the wire end is inserted into the socket E48 of the wedge X48. The outer ends of the grooves forming this socket can be flared as shown in FIG. 99 to facilitate insertion of the wire into the socket. The wedge is then inserted into the conical hole of the body A48 so that the stem Y48 will project beyond the opposite end of the body. A tool can then be applied to grip such stem and bear against the end of the body A48 so that a pulling force can be exerted on the stem to draw the wedge X48 into the conical body hole until it bears tightly against the body hole and the wire. The friction between the exterior of the wedge and the wall of the hole through the body A48 will prevent movement of the wedge outwardly after it has once been drawn firmly into the body hole. The stem Y48 can be parted by the stress exerted on it at the location of groove U48 in pulling the wedge into seating position, or after the wedge is seated sufficiently snugly the stem can be clipped or broken off close to the end of the body. The body can function as a plug to fit a contact socket and may have pellets H48 in its opposite sides to retain the body in such a socket.

In the terminal of FIGS. 100 and 101 the insulation-clamping band portions B49 are carried by the conical wedging element X49 instead of directly by the body A49 as in the terminal of FIGS. 98 and 99. The insulation-clamping band portions B49 are separated by longitudinal slots C49 and circumferential slots D49 like the slots C1 and D1 separating the band portions B1 of the insulation-clamping arrangement of the terminal shown in FIG. 1.

The block-body A49 has a tapered hole through it complemental to the conical exterior of the cooperating portions of the wedge X49 joined by the hinge portion S49 bridging the slot between such cooperating portions. The exterior of the body A49 can form an external contact surface to fit a socket and the body can be held in such socket by opposed pellets H49 embedded in its wall. The wedge X49 does not have a stem projecting from it comparable to the stem Y48 projecting from the wedge of the terminal shown in FIGS. 98 and 99, but such a stem could be provided by which the wedge X49 could be pulled into the tapered hole of the body A49. Alternatively, the body can be driven onto the wedge X49 after a wire has been inserted into the slot between the wedge portions and the insulation has been fitted between the insulation-clamping band portions B49. The portions of the wedge at opposite sides of its slot may be received from the factory spread sufficiently to receive the wire and insulation or it may be necessary to pry the slot open somewhat in order to insert the wire end insulation into it.

The terminal of FIGS. 102 and 103 is similar to the terminal shown in FIGS. 100 and 101 except that in this instance the body A50 in the wall of which pellets H50 are embedded has a flared generally planar slot instead of a conical hole as in the body A49 of the FIG. 100 terminal. The wedge X50 has flat plate portions connected in generally parallel arrangement by the hinge S50. The ends of the plate members remote from the hinges 50 carry the insulation-clamping band portions B50 which are separated by longitudinal slots C50 and circumferential slots D50 comparable to the slots C1 and D1 separating the insulation-clamping band portions B1 of the terminal shown in FIG. 1. A wire can be fitted between the plate portions of the wedge X50 and the insulation-clamping band portions B50 when such portions are spread apart either as a result of manufacture or when they have been pried apart. The flared slot of the body A50 can then be started over the fold S50 and the body driven into the position of FIG. 103 to pinch the plate portions of the wedge X50 together for clamping the wire end tightly between them. After the body has thus been driven onto the wedge, solder may be supplied through one or both edges of the slot between the plate portions of the wedge X50 to bond the wire to the wedge.

The terminal of FIGS. 104 and 105 has a block-body A51 with insulation-clamping band portions B51 projecting from one end which are separated by longitudinal slots C51 and circumferential slots D51 comparable to the body A24 and the insulation-clamping band portions B24 separated by slots C24 and D24 of the terminal shown in FIGS. 57 and 59. Also, the terminal of FIGS. 104 and 105 has a tube T51 extending through a hole in the body A51 to provide a wire-receiving socket E51. Such tube projects in the cavity F51 of the body, which construction is similar to the arrangement of the tube T24 in the body A24 of the terminal shown in FIG. 59 in which the tube projects into the body cavity F24.

Differing from the terminal of FIGS. 58 and 59 the body A51 of the terminal shown in FIGS. 104 and 105 is not crushable, but its exterior is of cylindrical shape and has pellets H51 embedded in its walls to retain the body in a socket. In this instance the connecting wire W is secured in the socket E51 of tube T51 by wedging, constricting action rather than by crushing the body A51. Such wedging action is accomplished by making the walls of the cavity F51 flared outwardly complemental to the taper of a tubular wedge X51. The aperture through such wedging member flares toward the inner end of such member and its exterior tapers toward the same end. The aperture of the wedge will be large enough to be started onto the end of tube T51 projecting into the cavity F51 of the body A51 and the exterior of the wedge will be small enough so that it can be started into such body cavity. The wedge can then be driven longitudinally into the position shown in FIG. 105 in which endwise movement of the wedge has constricted the tube T51 around the end of a wire. The wedge tube can be made of a metal which is rather soft, such as zinc or lead, so that it will deformed to fit the body cavity intimately. After the wedge has been driven into place the wire can be soldered to the tube T51 and such tube can be soldered to the wedge by supplying solder through the outer end of the aperture extending through the tubular wedge.

The terminal shown in FIGS. 106 and 107 is similar to the terminal of FIGS. 104 and 105 as to the body A52, insulation-clamping band portions B52, slots C52 and D52, tube T52 providing socket E52 and pellets F52 which are comparable to the body A51, insulation-clamping bands B51 having slots C51 and D51, tube T51 and pellets H51 of the terminal illustrated in FIGS. 104 and 105. Also, in the terminal of FIGS. 106 and 107 the tube T52 is constricted by longitudinal movement of a tubular wedging member X52 over it. The difference between the two terminals in the structure for effecting longitudinal movement of the wedge X52 provided in the terminal of FIGS. 106 and 107.

As in the terminal of FIGS. 104 and 105 the aperture through the wedge X52 flares toward its inner end so

that it can be started over the end of tube T52 of soft metal projecting into the cavity F52 of the body A52. Also, the wall of such cavity flares outwardly generally complemental to the exterior of the wedge X52 which tapers toward its inner end. The outer end portion of the cavity F52, however, has an internal screw thread complemental to an external screw thread on the outer end of the wedge X52. Also, the outer end of such wedge has a cross slot in which the bit of a screwdriver can be engaged. The wedge X52 can, therefore, be moved longitudinally into the cavity F32 by engaging the threads of the wedge with the threads of the cavity and rotating the wedge relative to the body A52 for screwing it to the cavity to effect constriction of the tube. The threads of the wedge and body cavity could be tapered to increase the resistance of the wedge to rotation as it is screwed farther into the body.

I claim:

1. An electrical wire terminal comprising an electrically-conductive body having an aperture extending completely through its central portion and including an elongated wire-encircling hole, the material of said body extending completely around such hole in uninterrupted continuity, and an insulation-clamping collar integral with and projecting from one end of said body, the cross-sectional shape of said body and said collar transversely of the length of such wire-encircling hole having an out-of-round curved periphery with a major axis and a minor axis, said body having open-ended grooves of a depth greater than one-half of the maximum radial thickness of said body between the exterior of said body and such wire-encircling hole located substantially at opposite ends of the minor axis of said body cross section and extending throughout the entire length of said body, said collar having slots in opposite sides thereof throughout the full axial extent of said collar and located substantially at opposite ends of the minor axis of said collar cross section in axial alignment with such open-ended grooves in opposite sides of said body, respectively, said body and collar being contractable by application of pressure in a direction generally parallel to the major axis to convert said body to substantially cylindrical contour by constriction of such grooves and to convert said collar to substantially cylindrical contour by contraction of its slots, such contraction of said body effecting clamping of a wire in the body wire-encircling hole and such contraction of said collar clamping insulation of the wire.

2. The terminal defined in claim 1, and a tube extending lengthwise through such wire-clamping body hole and receiving the wire therein, said tube being of a length considerably greater than the length of the body wire-clamping hole and having its end portion from the collar projecting a substantial distance beyond the corresponding end of such body hole, the exterior of said tube substantially throughout its perimetral extent being in intimate engagement with the wall of the body wire-clamping hole, and said projecting end of said tube being open for receiving solder to bond said tube to a wire received in said tube.

3. The terminal defined in claim 2, in which the body includes a skirt projecting oppositely from the collar and completely encircling the end of the tube projecting beyond the body wire-clamping hole, the length of said skirt being greater than the length of the tube portion projecting beyond the body wire-clamping hole.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,740,702 Dated June 19, 1973

Inventor(s) Forest J. Moray

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 28, line 19, after "portion" insert --remote--.

Signed and sealed this 27th day of November 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents