

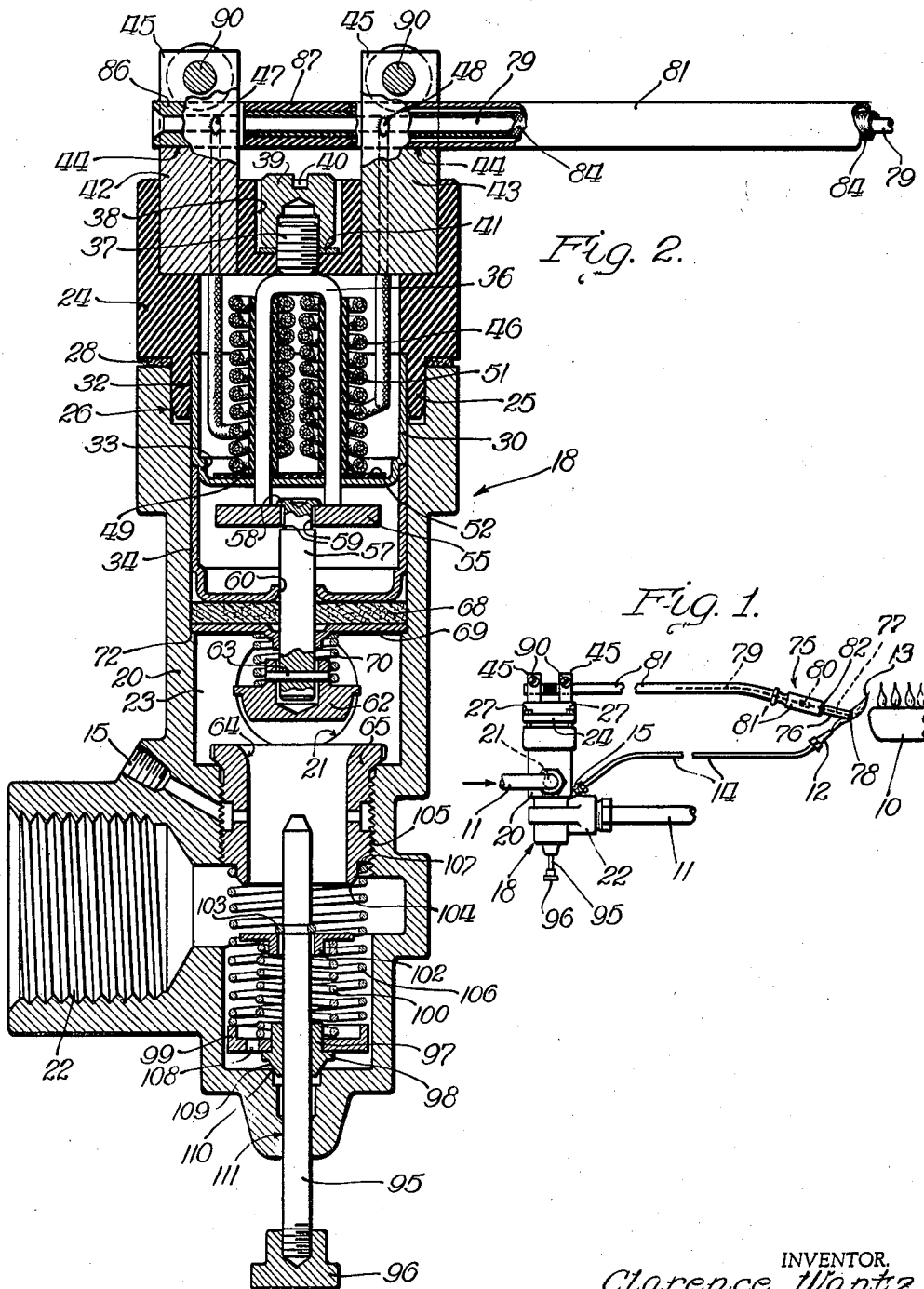
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LEAD CONNECTOR

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2,344,192

LEAD CONNECTOR

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5 Claims. (Cl. 136-4)

This invention relates to lead connectors and has particular relation to an improved thermocouple lead connector for connecting the leads of a thermocouple to a thermoelectric safety device for heating and other apparatus.

The present application is a division of my copending application Serial No. 239,790, filed November 10, 1938, now Patent 2,307,870, dated Jan. 12, 1943.

One of the main objects of the present invention is to provide an improved lead connector which is adapted to provide a quick detachable connection between the lead conductors and the connected device, and particularly an improved quick detachable connection between the lead conductors of a thermocouple and a thermoelectric safety device.

The chief advantage of the improved quick detachable lead connector of the present invention is its ability to permit the thermocouple and lead conductors to be quickly and conveniently detached from and attached to the thermoelectric safety device. The quick detachable connection thus afforded permits the thermocouple and lead conductors to be detached and shipped disconnected or separately from the thermoelectric safety device, and it permits replacement of the thermocouple and lead conductors without returning the entire thermoelectric safety device to the manufacturer. Moreover, thermocouples with lead conductors of different lengths may be readily interchanged, and where, for instance, a thermoelectric safety device is shipped to a user with a thermocouple having lead conductors which are not of the proper length, the thermocouple and its lead conductors may be returned in exchange for a thermocouple having lead conductors of the proper length without returning the entire thermoelectric safety device.

It is also an object of the invention to provide a quick detachable lead conductor of relatively simple and inexpensive construction and which is composed of few parts adapted for convenient assembly; also, an improved lead conductor adapted to permit quick and convenient detachment from and attachment to the thermoelectric safety or other device and also adapted, when attached, to provide a good thermoelectric connection between the thermocouple lead conductors and the connected device.

Further objects and advantages of the invention will appear from the following detailed description, taken in connection with the accompanying drawing in which:

Figure 1 is a diagrammatic view showing, ap-

plied to heating apparatus, a thermoelectric safety device and connected thermocouple having a thermocouple lead connector embodying the present invention; and

Figure 2 is a sectional view through the thermoelectric safety device illustrated in Figure 1 and showing in section the thermoelectric lead connector.

Referring first to Figure 1, the burner 10 is any suitable or preferred main burner—by way of example, for an oven or for a room heater, or a water heater, or it may be one of the main top burners of a gas range, or any other main burner.

A pipe 11 supplies gaseous or any other suitable fuel to the burner 10, and disposed in juxtaposition to the burner 10 is a pilot burner 12 which maintains a pilot light 13 for igniting the main burner. The pilot burner 12 is supplied with fuel by a tube 14 connected, for example, at 15, to the interior of the valve body 20, by way of example in the manner disclosed in my copending application heretofore identified. The tube 14 may, of course, be connected to the fuel supply pipe 11 anterior to the valve body 20 within the scope of the present invention.

The thermoelectric control device designated in its entirety at 18 comprises the valve body 20 having an inlet 21 and an outlet 22 for connection into the fuel supply pipe 11.

The valve assembly is of the general character disclosed and claimed in the patent to Harold A. Mantz, Number 2,213,844 dated Sept. 3, 1940.

The lead connection cap and magnet and armature housing assembly is mounted upon the top of the valve body 20 as the same is viewed in Figure 2, and, when in place, closes the upper end of the bore 23 thereof. The lead connection cap 24, which is preferably formed of "Bakelite" or any other suitable or preferred insulating material may be of the external form shown, or of any other suitable or preferred form. It has at its lower end, as viewed in Figure 2, an integral cylindrical extension 25 which fits into a counterbore 26 at the upper end of the bore 23, and the cap 24 is fastened in place upon the top of the valve body 20, for instance by cap screws, and preferably with a sealing gasket or washer 28 between the cap and the valve body.

The magnet housing 30 is in the form of an upwardly opening cup-shaped metal shell mounted on the cap 24, for example by secured pressed fit engagement of its open upper end in the cap 24 at 32. The housing or shell 30 is reduced at its lower end at 33 and the armature housing 34, which is also in the form of an up-

wardly opening cup-shaped metal shell, is mounted on the shell 30, for example, by secure pressed fit engagement of its open upper end telescopically over the reduced lower end 33 of the shell 30. The lower end of the shell 34 is preferably reduced, as shown.

The electromagnet comprises a generally U-shaped magnet frame 36 positioned within the shell 30 with its legs extending through openings in the lower end of this shell and presenting pole ends within the armature housing 34. The magnet frame 36 has a threaded stud 37 integral therewith, or welded, or otherwise rigidly joined thereto. This stud 37 extends into an opening or recess 38 in the top of the cap 24 and has threaded engagement with a nut member 39 for clamping the magnet frame rigidly and, at the same time, removably in place. The nut member 39 has a kerf 40 for engagement by a screw driver or other suitable tool, and a spring washer or gasket may be provided between the nut member 39 and the bottom of the recess 38 as indicated at 41.

Fixed rigidly in the cap 24 as, for example, by molding the insulating material of the cap thereto, and extending endwise from the cap, are a pair of spaced metallic terminal connectors 42 and 43. These terminal connectors have aligned openings 44 and are split outwardly of these openings as shown at 45. The electromagnetic coil 46 surrounds the legs of the magnet frame 36, and the leads or ends of this coil extend out through the terminal connectors 42 and 43 and have their bared ends connected to the terminals 42 and 43 at 47 and 48, respectively, in a manner to have good conducting contact therewith. The connections at 47 and 48 are shown disposed outside of the cap 24 and laterally of the openings for receiving the terminal means on the thermocouple lead conductors. The coil 46 is preferably covered with insulation between its bared ends at 49. Suitable insulation may be interposed between the turns of the coil 46 and the legs of the magnet frame 36, and between the lower end of the shell 30 and the adjacent end of the coil 46 as shown, by way of example, at 51 and 52 respectively.

The armature 55 is disposed in the armature housing 34 and is adapted to be held in attracted position against the pole ends of the magnet frame 36 upon energization of the electromagnet. The armature 55 is of disc-like form and is secured to the upper end of a reciprocating valve stem 57. The attachment of the armature to the valve stem 57, at 58, is preferably sufficiently loose as indicated at 59 to permit self-accommodation of the armature to the pole ends of the magnet frame by a generally universal movement of the armature upon the upper end of the valve stem. The stem 57 is disposed generally concentrically of the armature housing 34 and extends downwardly for reciprocating movement through an opening 60 in the lower end of the housing 34.

The valve member 62 is fixed by a pin 63 upon the lower end of the valve stem 57 preferably for some relative movement thereon so as to have self-accommodating seating engagement with the cooperating valve seat 64 at the upper end of the valve seat member 65. Packing 68 of felt or other suitable or preferred material is interposed between the bottom of the armature housing 34 and a metal valve spring seating disc 69. The valve spring 70 is in the form of a coiled compression spring interposed between the valve

member 62 and the spring seating disc 69, and centered, if desired, at opposite ends about integral hub-like portions on the valve member 62 and valve seating disc 69. The spring 70 resiliently moves the armature 55 to retracted position and the valve member 62 into seating engagement with the valve seat 64 to shut off the flow of fuel to the outlet 22 and thereby to the main burner 10 when the electromagnet is deenergized.

The disc 69 seats downwardly upon a shoulder 72 in the bore 23, and the action of the spring 70 tends to compress the packing 68 and maintains same in seating engagement with the bore 23 and with the valve stem 57 to seal the interior of the armature housing 34 from the gaseous or other fuel which passes through the valve body, and to seal the valve body against the escape of fuel out around the connection cap and magnet and armature housing assembly. The device is further sealed against the escape of fuel by the gasket or washer 28.

The lead connection cap and magnet and armature housing assembly is of simple and inexpensive construction, and is adapted to be applied to and removed from the valve body 20 or similar structure expeditiously and as a unitary structure. At the same time the armature housing 34 is detachable from the magnet housing 30 to permit access to the armature 55 and the pole ends of the magnet frame 36. The magnet housing 30 may also be adapted for detachment from the lead connection cap 24 to permit access to the magnet frame 36 and magnet coil 46.

The thermocouple and lead connection therefor, except for the improvements which the present invention provides in the lead connector means thereof, are of the general character disclosed and claimed in Oscar J. Leins Patent No. 2,126,564, granted August 9, 1938. The thermocouple 75 comprises an outer tubular metallic thermocouple member 76 and an inner metallic thermocouple member 77 disposed within the outer thermocouple member and joined at one end to the end of the outer thermocouple member to form the thermal junction 78 which is placed in position to be heated by the pilot light 13. An inner lead conductor 79 is joined to the inner thermocouple member to form an internal thermal junction 80, and an outer tubular lead conductor 81 is connected to the outer thermocouple member through a sleeve 81' to form a third thermal junction 82. The outer lead conductor 81 encloses the inner lead conductor and, with the outer thermocouple member, constitutes an enclosure about the inner thermocouple member and the inner lead conductor and the inner thermocouple junction 80. The inner lead conductor 79 is insulated from the outer lead conductor by a wrapping of insulation on the inner lead conductor as indicated at 84.

The inner and outer lead conductors 79 and 81 are preferably of a character that will permit bending as desired to permit disposing the thermocouple in any desired position. At the same time the lead connection is preferably of a character to support the thermocouple in any desired position, although supporting brackets or other means may be employed for supporting the thermocouple and lead connection. At the opposite end the inner lead conductor 79 extends from the outer lead conductor 81 and has a metallic terminal sleeve 86 fixed thereon in good conductive contact therewith and spaced from the end of

the outer lead conductor 81. An insulating sleeve 87 is interposed between the terminal sleeve 86 and the adjacent end of the outer lead conductor 81.

A quick detachable connection is thus provided between the thermocouple leads and the terminals 42 and 43 for the electromagnet coil 46. The thermocouple is connected to the terminals 42 and 43 by slipping the terminal end of the thermocouple lead means through the opening 44 in one terminal 43 and into the opening 44 in the other terminal 42, with the terminal sleeve 86 in the opening 44 in one terminal 42 and the end of the tubular thermocouple lead 81 in the opening 44 in the other terminal 43. The screws 90 are then tightened to clamp the split portions 45 of the terminals 42 and 43 into good conductive contact and gripping engagement with the terminal sleeve 86 and tubular lead 81 respectively. The thermocouple is disconnected from the device by loosening the screws 90 and withdrawing the terminal end of the thermocouple leads from the terminals 42 and 43.

The quick detachable connection permits the thermocouple with its leads to be detached from the control device in shipment. At the same time the thermocouple may be connected to the control device expeditiously and, when connected, good conductive contact is secured. This is important where the current is a relatively weak thermoelectric current such as that produced by the heat of the pilot light 13 on the thermal junction 78 of the thermocouple.

The heat of the pilot light 13 upon the thermocouple is sufficient to hold the armature 55 in attracted position and the valve member 62 in open position, as shown, when the armature is engaged with the pole ends of the magnet frame, but this thermoelectric current is not capable of moving the armature to attracted position and the valve member 62 to open position. In order, therefore, to provide for opening the valve member 62 and for setting the armature to attracted position upon initial operation of the device and to reset the device after the same closes to shut off the supply of fuel when the pilot light is extinguished, reset means is provided. This reset means comprises a reset stem 95 coaxial with the valve 62 and extending through the lower end of the valve housing 20. The stem 95 is provided at its lower end with a reset stem knob or button 96.

Fixed upon the stem 95 for reciprocatory movement therewith is a reset member 97 which has abutting engagement at 98 with a reset spring cup 99. A fuel flow interrupter spring 100 is interposed between the spring cup 99 and a flow interrupter disc valve 102, a retainer being provided at 103 for limiting inward movement of the disc valve 102 relative to the stem 95. The disc valve 102 is adapted to seat upon the valve seat 104 at the lower end of the valve seat member 65 to shut off or interrupt the flow of fuel to the outlet 22 and thereby to the main burner during the resetting operation and until the valve member 62 is held in open position by the thermoelectric current and the reset stem 95 is released.

The valve seat member 65 is in the form of a sleeve threaded into the valve body 20 at 105, and a coiled spring 106 is interposed between the shoulder 107 on the valve seat member 65 and the spring cup 99. The spring cup 99 is provided with a vent opening 108, and the reset member 98 has a conical valve part 109 which seats upon a shoulder 110 in the valve body and seals the

opening 111 through which the stem 95 extends when the parts are positioned as shown.

The operation of the device is as follows:

When the pilot light 13 is burning the heat thereof upon the thermal junction 78 produces a thermoelectric current in the coil 46. The magnet frame 36 and armature 55 are preferably formed of an alloy of relatively low magnetic reluctance and, as a result, the relatively weak thermoelectric current produces a magnetic field of sufficient strength so that when the armature 55 is placed in contact with the pole ends of the magnet frame by pushing the reset button 96 the magnetic attraction holds the armature in attracted position against the magnet frame with a force greater than the force exerted by the spring 70, thereby holding the valve 62 in open position as long as the pilot flame is burning.

If the pilot flame is extinguished the holding action of the electromagnet ceases to be sufficient to hold the armature 55 and valve 62 in attracted position, and the spring 70 moves the valve member 62 to closed position. Where the device is installed vertically as shown, the spring is aided by gravity in closing the valve, but the spring is preferably of sufficient tension to close the valve without the aid of gravity so that the device may be installed in any desired position. The spring 70 also assures detachment of the armature 55 from the electromagnet upon deenergization of same and notwithstanding any residual magnetization therein. The closing of the valve 62 shuts off the supply of fuel to the main burner.

When it is desired to reset the device the reset button 96 is engaged with the hand and pressed inwardly. The accompanying inward movement of the stem 95 and reset member 97 moves the reset spring cup 99 inwardly against the tension of the springs 100 and 106. The reset member 97 forces the flow interrupter valve disc 102 inwardly through the spring 100 until the disc 102 seats upon the valve seat 104 and interrupts or shuts off the flow of fuel through the outlet 22 and thereby to the main burner. Continued inward movement of the reset stem 95 brings the inner end of this stem into contact with the valve member 62 and moves this valve member and the valve stem 57 and armature 55 upwardly as a unit until the armature comes into contact with the pole ends of the magnet frame 36 or is brought into attracted position and the valve member is positioned in open position as shown.

In resetting the device the flow interrupter valve disc 102 shuts off the outlet 22 against the passage of fuel therethrough while the valve 62 is in open position during the resetting operation and, at the same time, fuel is free to pass through the pilot burner connection 15 to the pilot burner upon opening the valve member 62 in resetting the device. As the valve 62 is opened in the resetting operation, fuel passes out through the pilot port connection 15 to the pilot burner so that the pilot burner may be ignited to set up the thermoelectric current for energizing the electromagnet to hold the armature in attracted position and the valve 62 open.

If the pilot burner 12 is lighted and sets up a thermoelectric current to hold the armature in attracted position, the valve 62 will remain open, and when the resetting button 96 is released, the springs 100 and 106, and particularly the reset spring 106, return the reset button to downwardly or outwardly projected position as shown. As the reset stem is projected downwardly, the retainer

103 engages the valve disc member 102 and returns the same to open position against the tension of the spring 100, whereupon the desired supply of fuel is set up to the burner 10 for ignition by the pilot light 13.

If, on the other hand, the pilot burner is not lighted to produce the thermoelectric current for holding the valve 62 open, this valve will move to closed position upon release of the button 96. In this manner the device prevents the passage of fuel through the outlet 22 to the main burner until the pilot burner is lighted and a thermoelectric current set up to hold the armature in attracted position.

I do not intend to be limited to the precise details shown or described.

I claim:

1. In combination, a thermoelectric control device having terminal members provided with substantially aligned openings, a thermocouple and lead conductor comprising an outer metallic tubular thermocouple member, an inner metallic thermocouple member joined to said outer thermocouple member to form a thermal junction, an outer tubular lead conductor joined to said outer thermocouple member to form a second thermal junction, an inner lead conductor joined to the inner thermocouple member to form a third thermal junction and extending from the opposite end of the tubular lead conductor, the end of the tubular lead conductor being adapted to enter the opening in one of said first terminal members for contact with said member, a terminal on the extending end of said inner lead conductor adapted for insertion through the opening in one of said terminal members and into the opening in the other terminal member for contact therewith in entering the tubular conductor in the other terminal member, a support on said thermoelectric control device for supporting said terminal members in insulated spaced relation independently of said lead conductor means, an insulating sleeve surrounding the extending end of said inner lead conductor and positioned endwise between the terminal on said inner lead conductor and the end of said outer lead conductor, said terminal members being of split form adjacent the openings therein, and means for clamping the split portions of said terminal members in contact with the terminal at the end of the inner lead conductor and with the outer tubular lead conductor respectively.

2. In combination, a thermoelectric control device having terminal members provided with substantially aligned openings, a thermocouple and lead conductor comprising an outer metallic tubular thermocouple member, an inner metallic thermocouple member joined to said outer thermocouple member to form a thermal junction, an outer tubular lead conductor joined to said outer thermocouple member to form a second thermal junction, an inner lead conductor joined to the inner thermocouple member to form a third thermal junction, and extending from the opposite end of the tubular lead conductor, the end of the tubular lead conductor being adapted to enter the opening in one of said first terminal members for contact with said member, a terminal on the extending end of said inner lead conductor adapted for insertion through the opening in one of said terminal members and into the opening in the other terminal member for contact therewith in entering the tubular conductor in the other terminal member, a sup-

port on said thermoelectric control device for supporting said terminal members in insulated spaced relation independently of said lead conductor means, an insulating sleeve surrounding the extending end of said inner lead conductor and positioned endwise between the terminal on said inner lead conductor and the end of said outer lead conductor, said terminal members being of split form adjacent the openings therein, means for clamping the split portions of said terminal members in contact with the terminal at the end of the inner lead conductor and with the outer tubular lead conductor respectively, and conductors connected in circuit with said device and extending out through said support and connected to said terminal members externally of said support and adjacent said openings.

3. The combination with a device having a pair of terminal members mounted thereon, of a thermocouple and lead connection comprising an outer metallic tubular thermocouple member, an inner metallic thermocouple member disposed within said outer tubular thermocouple member and joined thereto to form a thermal junction, an outer tubular lead conductor joined to said outer tubular thermocouple member to form a second thermal junction, an inner lead conductor joined to the inner thermocouple member to form a third thermal junction and extending from the opposite end of the outer tubular lead conductor, a terminal member on the extending end of said inner lead conductor and an insulating sleeve surrounding the extending end of the inner lead conductor and positioned between said last mentioned terminal member and the end of the outer tubular lead conductor to separate said terminal member from the outer tubular lead conductor, the terminal member on the extending end of the inner lead conductor being adapted for application to one of said first mentioned terminal members and the end of the tubular lead conductor and the terminal member on the extending end of the inner lead conductor constituting a unitary assembly for application of the end of the tubular lead conductor to one of said first mentioned terminal members by the application of the terminal member on the extending end of the inner lead conductor to the other of said first mentioned terminal members.

4. In combination, a control device having terminal members provided with substantially aligned openings, an outer tubular lead conductor, an inner lead conductor disposed within the tubular lead conductor and extending from the end of said tubular lead conductor, the end of the tubular lead conductor being adapted to enter the opening in one of said terminal members for contact with said member, a terminal on the extending end of said inner lead conductor adapted for insertion through the opening in one of said terminal members and into the opening in the other terminal member for contact therewith in entering the tubular conductor in the other terminal member, means on the control device for supporting said terminal members in insulated spaced relation independently of said lead conductors, an insulating sleeve surrounding the extending end of said inner lead conductor and positioned endwise between the terminal on said inner lead conductor and the end of the outer lead conductor to separate the terminal on said inner lead conductor from said outer lead conductor, and means for detachably clamping the terminal at the end of the inner lead conductor and the end of the outer lead conductor in the

openings in the terminal members and in contact with said terminal members.

5. In combination, a control device, a pair of terminal members supported in insulated spaced relation on said device, said terminal members having aligned openings and split adjacent said openings, a thermocouple comprising elements of different thermoelectric characteristics joined to provide a junction adapted to be heated by a flame, a tubular lead conductor joined to one of said thermocouple elements at one end and adapted to enter the opening in one of said terminal members at its opposite end, an inner lead conductor disposed within said tubular lead con-

ductor, said inner lead conductor being joined at one end to the other thermocouple element and, at its opposite end, extending from said tubular lead conductor and adapted to pass through the opening in the terminal member in which the end of the tubular lead conductor is entered and to enter the opening in the other terminal member, and clamping means cooperating with the split portions of said terminal members for clamping the ends of the inner and tubular lead conductors in said openings and in contact with said terminal members.

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