

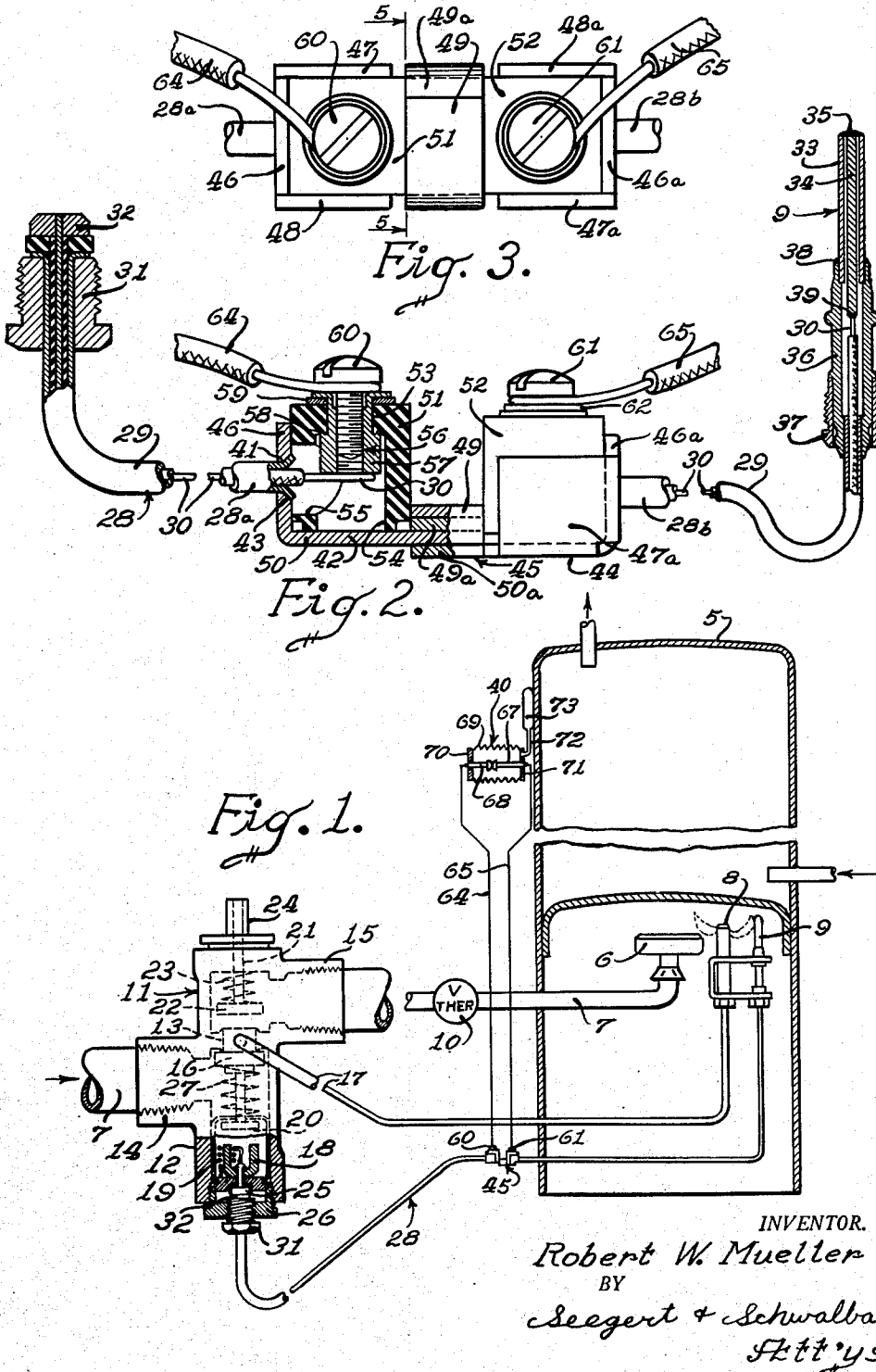
May 27, 1958

R. W. MUELLER
UNITARY THERMOELECTRIC GENERATOR, LEAD AND
JUNCTION BLOCK ASSEMBLIES

2,836,640

Original Filed Dec. 14, 1953

3 Sheets-Sheet 1



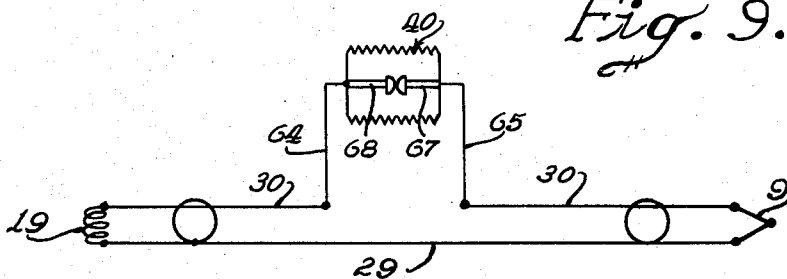
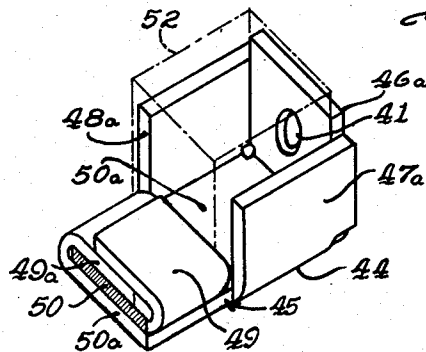
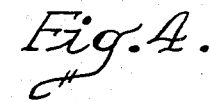
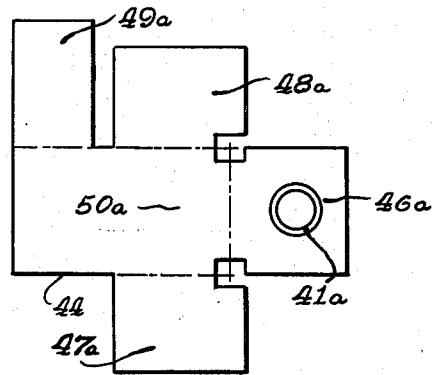
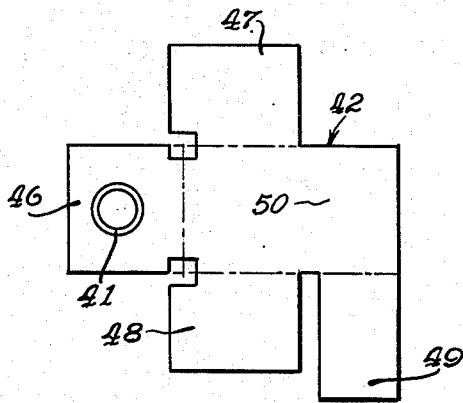
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3 Sheets-Sheet 2



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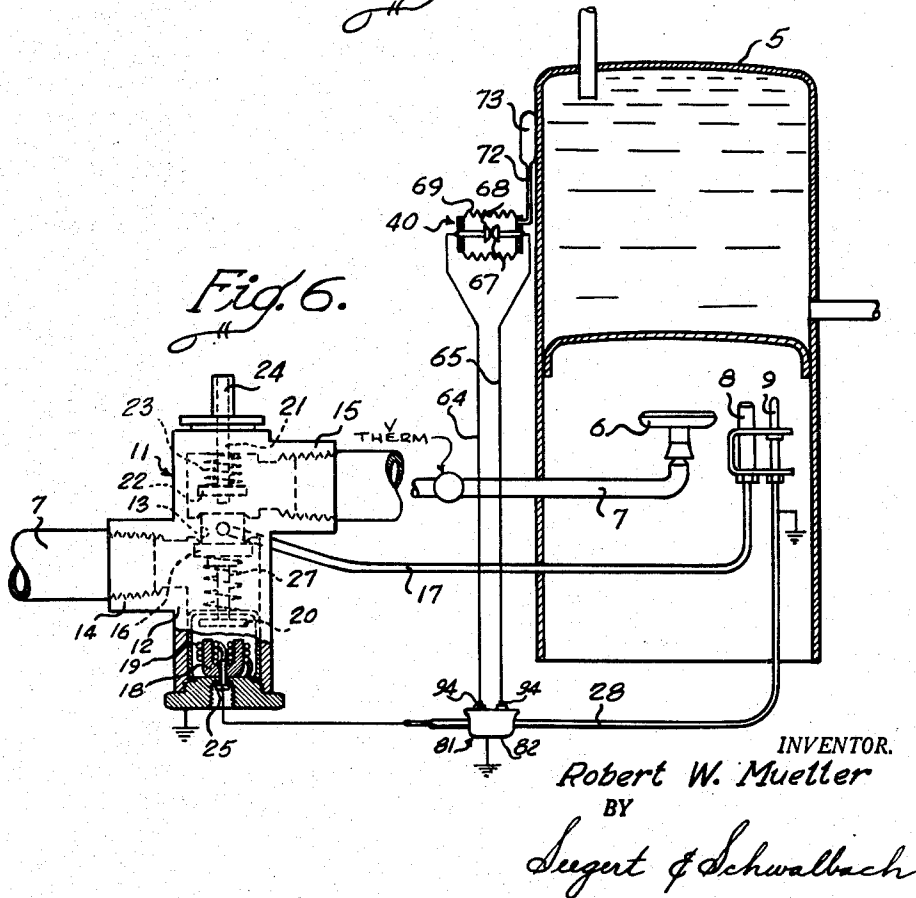
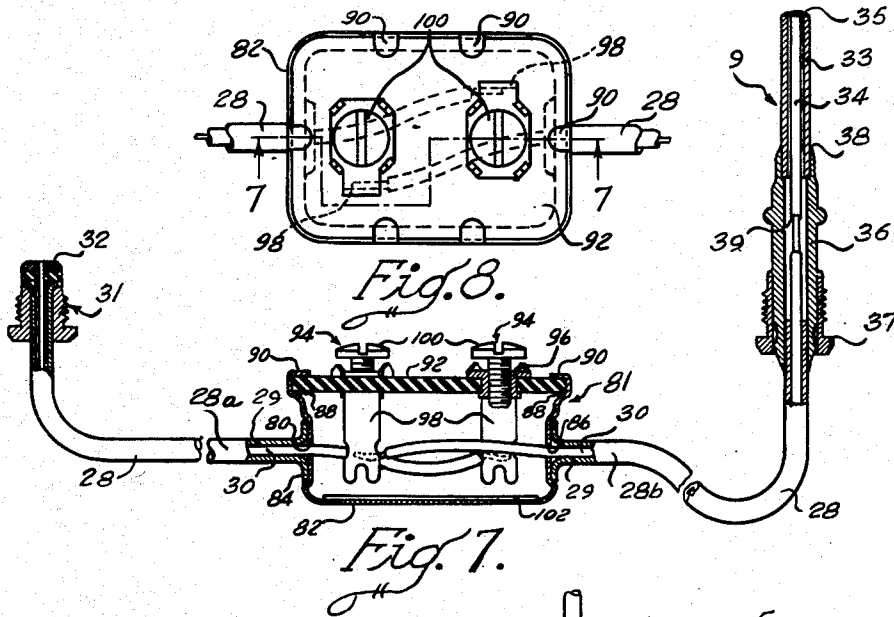
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3 Sheets--Sheet 3



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2,836,640

UNITARY THERMOELECTRIC GENERATOR, LEAD AND JUNCTION BLOCK ASSEMBLIES

Robert W. Mueller, Milwaukee, Wis., assignor to Baso Inc., Milwaukee, Wis., a corporation of Wisconsin

Continuation of applications Serial Nos. 397,896, December 14, 1953 and 484,290, January 26, 1955. This application July 17, 1957, Serial No. 674,267

13 Claims. (Cl. 136—4)

This invention relates to improvements in unitary thermoelectric generator, lead and junction block assemblies, and this application is a continuation of my applications Serial Number 397,896, filed December 14, 1953, now abandoned, and Serial Number 484,290, filed January 26, 1955, now abandoned.

In the control of fuel flow to fluid fuel burners, it has become standard practice to utilize a thermoelectrically powered safety shut-off device which is operable to shut off the flow of fuel to both main and pilot burners upon extinguishment of the pilot burner flame. In the systems of the aforementioned character the thermoelectric generator which supplies the power for the system is usually connected to the safety shut-off device by means of a coaxial type lead having a metallic tubular outer conductor and an insulated inner conductor, the outer conductor being grounded.

In many applications of the aforementioned type of safety shut-off system it has been found desirable to protect the installation from dangers other than those resulting from pilot burner failure, for example the danger occasioned by the existence of excessive temperature conditions in the space being heated by the burner, as in a water heater tank, clothes drier, space heater or the like. A desirable means of providing this additional protection is to insert in the safety shut-off system a condition responsive, for example temperature responsive, circuit-controlling device in series circuit with the thermoelectric generator and the safety shut-off device. Heretofore, however, no entirely satisfactory means has been available for effecting the aforementioned series circuit connection, particularly where a coaxial type thermoelectric generator lead is utilized.

With the above in mind it is a general object of the present invention to provide means for readily connecting a circuit-controlling device or the like into the electrical circuit of a thermoelectrically powered control system utilizing a coaxial type thermoelectric generator lead.

Another object of the invention is to provide an improved coaxial lead and junction block assembly wherein the inner conductor of the lead thereof is formed of two sections and wherein the junction block thereof is provided with terminal connectors in circuit with said conductor sections and affording electrical connections therewith.

Another object of the invention is to provide an improved unitary thermoelectric generator, lead and junction block assembly which is interchangeable with presently installed thermoelectric generator and lead assemblies of the coaxial type, said assembly having a space requirement not substantially greater than that of a conventional generator and lead assembly, and therefore being well adapted for use in conversion of existing installations in which only limited space is available.

Another object of the invention is to provide in an improved unitary thermoelectric generator, lead and junction block assembly of the aforementioned character,

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a coaxial lead comprising two sections, the outer conductors of which are physically and electrically joined by a metallic member, there being insulated terminal connectors mounted on said member in circuit with the inner conductors of said lead sections, said member and connectors constituting the junction block of said assembly.

Another object of the invention is to provide an improved unitary thermoelectric generator, lead and junction block assembly of the character described wherein the junction block thereof can be located at any point in the length of said lead in accordance with requirements of the particular installation.

Another object of the invention is to provide an improved unitary thermoelectric generator, lead and junction block assembly of the aforementioned character which is inexpensively constructed of a relatively small number of parts and which lends itself well to mass production manufacture.

Further objects and advantages of the invention will appear as the description proceeds, reference being had to the accompanying drawings illustrating two complete embodiments of the invention and wherein like characters of reference indicate the same parts in all of the views.

In the drawings:

Figure 1 is a semi-diagrammatic elevational view, partly in section, illustrating a first embodiment of the improved unitary thermoelectric generator, lead and junction block assembly in a control apparatus for a water heater;

Figure 2 is an enlarged fragmentary view of the first embodiment of the improved generator, lead and junction block assembly shown partly in longitudinal section and partly in side elevation;

Figure 3 is a fragmentary plan view taken along the line 3—3 of Figure 2;

Figures 4 and 4a are plan views of the blanks from which the junction block bracket of the first embodiment of the improved assembly is formed;

Figure 5 is a fragmentary perspective and transverse sectional view taken along the line 5—5 of Figure 3 and illustrating certain constructional details of the junction block bracket of the first embodiment, all other parts being removed and an insulating block shown in dot and dash lines;

Figure 6 is a semi-diagrammatic elevational view, partly in section, illustrating a second embodiment of the improved unitary thermoelectric generator, lead and junction block assembly in a control apparatus for a water heater;

Figure 7 is an enlarged fragmentary view of the second embodiment of the improved generator, lead and junction block assembly shown partly in longitudinal section with the junction block being sectioned substantially along lines 7—7 of Figure 8;

Figure 8 is a fragmentary plan view of a portion of the second embodiment of the improved lead and junction block assembly shown in Figure 7; and

Figure 9 is a diagram of the electrical circuits of the control apparatus shown in Figures 1 and 6.

Referring to Figures 1 and 6, the illustrated control apparatus in which the first and second embodiments of the improved generator, lead and junction block assembly are respectively embodied are shown somewhat schematically. While the illustrated control apparatus are associated with water heaters, the invention is not limited to use with this particular installation, but may be utilized equally well in any thermoelectrically powered control apparatus having a coaxial type thermoelectric generator lead. Each of the water heaters illustrated in Figures 1 and 6 comprises a tank 5 provided with a main fuel burner 6 which is supplied with fuel from a suitable source through

a supply pipe 7. A pilot burner 8 is mounted in coaxing relationship with the main burner 6 and with a thermoelectric generator 9 which may take the form of a thermocouple. A suitable thermostatic fuel control valve 10 as well as an electromagnetically operated safety shut-off valve 11 are interposed in the fuel supply pipe 7 to control the flow of fuel to the burner 6. The specific constructional details of the valve 11 form no part of the present invention and will not be described herein, it being sufficient for present purposes to state that said valve is provided with a body 12 having a passage indicated more or less diagrammatically in dotted lines at 13, said passage providing communication between an inlet 14 and an outlet 15. A safety shut-off valve, shown in dotted lines at 16, is adapted to seat, for example, upon a valve seat at the lower end of the passage 13, to shut off the flow of fuel to the main burner 6 as well as to the pilot burner 8, the latter flow being through a pilot fuel supply pipe 17 communicating with the passage 13.

An electromagnet having a magnet frame 18 and a coil 19 coacts with an armature shown in dotted lines at 20 connected to the valve member 16, said valve member being biased toward closed position by a spring shown in dotted lines at 27. One end of the electromagnet coil 19 is grounded, and the other end of said coil is connected to a terminal tip 25 exposed within a socket provided by a centrally bored and internally threaded nut 26 closing one end of the body 12.

Reset means is provided for moving the valve 16 to open position and the armature 20 into engagement with the magnet frame 18, said means including a reset stem shown in dotted lines at 21 and engageable with the valve member 16 on depression of a manual reset button 24. The aforementioned reset means may also include flow interruption means in the form of a disc 22 carried by the stem 21 and biased by a spring 23 toward a seat, said disc being adapted to seat upon a valve seat at the upper end of the passage 13 to prevent fuel flow to the burner 6 upon depression of the button 24.

The thermoelectric generator 9 forms a part of each of the embodiments of the improved unitary thermoelectric generator, lead and junction block assembly. Each of the embodiments of the aforementioned assembly also includes a coaxial type lead 28 joined at one end to said generator and having a metallic tubular outer conductor 29 and an insulated inner conductor 30. The lead 28 is provided at its other end with a connector nut 31 which is threaded into the central bore of the nut 26 (Figures 1 and 6) to effect a low resistance connection between the terminal tip 25 of the safety shut-off valve 11 and an insulated terminal tip 32 on said lead and in circuit with the inner lead conductor 30.

The thermoelectric generator 9, in each of the illustrated embodiments, comprises a thermocouple having an outer tubular thermal element 33 and a dissimilar inner thermal element 34 spaced coaxially within the said outer element. The elements 33 and 34 are suitably joined, as at 35, to provide a "hot" junction adapted to be heated by the flame of the pilot burner 8. The outer lead conductor 29 is suitably joined to the outer thermal element 33, for example through a mounting sleeve 36 provided with a mounting nut 37, the point 38 at which the outer thermal element 33 connects with the mounting sleeve 36 constituting a "cold" thermal junction. The inner lead conductor 30 is suitably joined to the inner thermal element 34, as at 39, to form a second "cold" junction.

Each of the embodiments of the improved thermoelectric generator, lead and junction block assembly affords means for connecting a circuit controlling device, for example the circuit-controlling device 40 shown in Figures 1 and 6, in series circuit with the generator 9 and the electromagnet coil 19 of the valve 11. As shown in Figures 2 and 3, the lead 28, when constructed for use in the first of the several illustrated embodiments, is formed in two sections 28a and 28b, each of said sections

having an inner end portion intermediate the length of the lead 28. The inner end portion of the lead section 28a extends through a suitable aperture 41 in a metallic connecting member 42 and has its outer conductor 29 flared, as at 43, and joined, as by soldering, to the inner surface of said connecting member at the margin of the aperture 41. The inner end portion of the lead section 28b is similarly associated with a metallic connecting member 44. The connecting members 42 and 44 are inter-fitted and joined in a manner to be described hereinafter to provide a generally U-shaped supporting bracket 45 which forms a part of the junction block portion of the assembly and provides a physical as well as an electrical connection between the outer tubular conductors 29 of the lead sections 28a and 28b.

The connecting members 42 and 44 may take the form of identical metal stampings which may be made from identical blanks shown in Figures 4 and 4a. The blanks for the connecting members 42 and 44 respectively have rectangular base panels 50 and 50a, rectangular end panels 46 and 46a having apertures 41 and 41a, opposite side panels 47 and 48 and 47a and 48a, and laterally projecting rectangular tongues or flanges 49 and 49a. The end panels 46 and 46a and the side panels 47, 47a, 48 and 48a are bent upwardly along the dot and dash lines shown in Figure 4 to provide flanges disposed in planes normal to the respective base panels 50 and 50a, as shown most clearly in Figure 5.

Mounted on the connecting members 42 and 44 and nested within the upturned panels thereof, are similar rectangular insulating blocks 51 and 52. As shown in Figure 2, the block 51 is formed with a bore 53 and a counterbore 54 normal to the base panel 50 of the connecting member 42, said block also being formed with a transverse bore 55 in registry with the aperture 41 of the end panel 46 and intersecting the counterbore 54 as shown. Positioned within the bore 53 and counterbore 54 is a terminal connector which may take the form of an axially bored internally threaded metallic screw machine part or fitting 56 having an enlarged portion 57 within the counterbore 54 provided with means for preventing rotation of said fitting within the block 51. In the illustrated embodiment, the portion 57 of the fitting 56 is formed with pointed projections 58 which penetrate the material of the block 51 to lock the fitting against rotation. The opposite end of the fitting 56 projects from the bore 53 and is spun over a washer 59 to tightly hold the fitting 56 in position within the block 51.

The inner end portion of the inner conductor 30 of the lead section 28a projects through the transverse bore 55 of the block 51 and is fixed, as by soldering, to the fitting 56. The insulating block 42 is provided with a terminal connector 62 similar to the connector 56, said connector being fixed, as by soldering, to the inner end portion of the inner conductor of the lead section 28b. Terminal screws 60 and 61 are threaded into the terminal connectors 56 and 62 respectively, and are adapted to receive conductors 64 and 65 respectively which extend to the circuit-controlling device 40 as shown in Figure 1.

The connecting members 42 and 44 are fixed together in a novel manner to firmly hold the insulating blocks 51 and 52 in position while at the same time providing a rigid physical as well as electrical connection between said connecting members. As shown in Figure 2, the end portion of the base panel 50 adjacent the flange 49 overlaps the end portion of the base panel 50a adjacent the flange 49a, and snugly abuts the insulating block 52. The flanges 49 and 49a are transversely aligned, the flange 49a being bent inwardly to overlap the base panel 50, and the flange 49 being bent inwardly to overlap the flange 49a as shown most clearly in Figures 2, 3 and 5. The overlapping panels 50 and 50a and flanges 49 and 49a are rigidly joined together, as by welding, to form the supporting bracket 45. As shown in Fig-

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ure 2, opposite edges of the flanges 49 and 49a have a snug frictional engagement with the insulating blocks 51 and 52. This fit, together with the connections of the inner end portions of the inner lead conductor with the terminal connectors 56 and 62 prevents displacement of the blocks 51 and 52.

The condition responsive circuit-controlling device 40 illustrated takes the form of an encapsulated contact thermostat mounted on the tank 5 and comprising a pair of normally engaged relatively movable electrical contacts 67 and 68 connected respectively to the conductors 65 and 64 and mounted within and insulated from an hermetically sealed expansible and contractible bellows 69. The bellows 69 has a pair of opposing relatively movable end walls 70 and 71, each of which carries one of the contacts 67 and 68. A capillary tube 72 affords communication between a temperature sensing bulb 73 and the interior of the bellows 69, said bulb being in temperature sensing contact with the surface of the tank 5. The bulb 73, tube 72 and bellows 69 are filled with a volatile fluid which is adapted to expand and contract to cause corresponding expansion and contraction of the bellows upon changes in temperature sensed by the bulb 73. The volatile fill does not react with the contacts to create films or other foreign matter which might create undesirable resistance between said contacts.

Figure 9 illustrates the electrical circuit of the control apparatus shown in Figure 1, said circuit showing the electromagnet coil 19 and the thermostat 40 with its contacts 67 and 68 connected in series circuit relation with the thermoelectric generator 9.

During normal operation of the control apparatus illustrated in Figures 1-5 inclusive, the heat of the pilot burner flame causes the thermoelectric generator 9 to energize the electromagnet coil 19, and the armature 20 is thereby held in contact with the pole faces of the electromagnet frame 18, the valve member 16 being simultaneously held in open position to permit fuel flow to the main burner 6 and pilot burner 8. Outage of the pilot burner flame causes cooling of the thermoelectric generator 9 and thereby reduces the current output of the generator to below the drop-out current value of the electromagnet coil 19. When this happens, the armature 20 is drawn away from the magnet frame 18 by the spring 27, and the valve member 16 is simultaneously snapped to closed position, thereby shutting off all fuel flow to the main burner 6 and pilot burner 8.

If, during operation of the first embodiment of the improved control apparatus, and while the pilot burner 8 is functioning normally, the temperature within the tank 5 should exceed a predetermined maximum safe value, the fill within the bellows 69 expands to cause the contacts 67 and 68 to separate at least sufficiently to reduce the current flowing through the electromagnet coil 19 to the drop-out value of said coil. As a result, the armature 20 is pulled by the spring 27 away from the pole faces of the electromagnet frame 18, and the valve member 16 is simultaneously snapped to closed position, shutting off all fuel flow to the main and pilot burners and preventing further heating of the tank.

In the manufacture of the improved generator, lead and junction block assembly of the illustrated first embodiment, sub-assemblies comprising the lead sections 28a, connecting members 42, insulator blocks 51, and terminal connectors 56 may be made up in volume and with lead sections 28a of different lengths. Similarly sub-assemblies comprising the lead sections 28b, generator 9, insulating blocks 52, and terminal connectors 62 may be made up in volume and with different length lead sections 28b. Having on hand the aforementioned sub-assemblies in a variety of lengths, completed assemblies having any desired length, and having the junction blocks thereof located at any desired point in the length thereof, can be readily produced by interfitting the con-

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necting members 42 and 44 of sub-assemblies of the proper length, and securing said connecting members together, as by welding.

As hereinbefore explained with reference to the first embodiment of the present invention, the second embodiment of the improved thermoelectric generator, lead and junction block assembly also includes means for connecting a circuit controlling device, for example the circuit controlling device 40 shown in Figures 1 and 6 and hereinbefore described in detail, in series circuit with the generator 9 and the electromagnet coil 19 of the valve 11, said connecting means of the second illustrated embodiment being shown most clearly in Figures 7 and 8. As shown in Figures 7 and 8, the lead 28 is formed in two sections 28a and 28b, each of said sections having an inner end portion intermediate the length of the lead 28. The inner conductor 30 of the lead section 28a extends through a suitable aperture 80 formed in an end wall of a metallic cup-shaped junction block body member 82, and the outer conductor 29 of said lead section is flared, as at 84, said flared portion being seated in a circular recess surrounding the aperture 80 and joined, as by soldering, to said end wall. The opposite end wall of the junction block body member 82 is formed similarly to the first-mentioned end wall, having an aperture 86 and a surrounding recess as shown. The inner conductor of the lead section 28b extends through the aperture 86 into the interior of the junction block body 82, and the outer conductor of said lead section is flared, and said flared portion is seated in the recess surrounding the aperture 82 and joined, as by soldering, to the adjacent end wall of the body 82. As shown in Figures 7 and 8, the lip of the junction block body member 82 is flared outwardly to form a peripheral shoulder 88, said lip also being provided with tabs or ears 90 for retaining an insulating cover 92 within said lip and in abutting relation with the shoulder 88 as shown. The cover 92 affords a closure for the junction block body member 82 and is held in operative position by bending the tabs 90 against the exterior surface of said cover 92 after the same has been positioned in the aforementioned abutting relation with respect to the shoulder 88.

The cover 92 carries a pair of terminal members 94 each of which is formed with a bushing portion 96 extending through an opening formed in the cover 92. The terminal members 94 are rigidly secured to the cover 92 by flaring the inner ends of the bushing portions 96 outwardly as shown. Each of the terminal members 94 is formed with a depending lug 98 inserted through a suitable slot in cover 92 during assembly of the terminal member 94 to cover 92. The inner conductors 30 of lead sections 28a and 28b are each mechanically and electrically secured to a separate one of the lugs 98 as by means of soldering or the like. A terminal screw 100 is threaded into each of the bushing portions 96 and permits ready attachment and detachment of circuit conductors, for example conductors 64 and 65 leading to the circuit-controlling device 40. To avoid electrical contact of the inner conductors 30 with the bottom wall of the metallic body member 82, I employ a strip of insulating material 102 secured in any well known manner to the interior surface of the bottom wall of said member 82.

The cup-shaped configuration of member 82 permits the same to be stamped or formed in a press utilizing mass production forming dies which may or may not require a drawing operation. Such ease of mass producing the junction block body renders manufacture of the improved junction block assembly relatively inexpensive.

During normal operation of the control apparatus illustrated in Figures 6, 7 and 8, the heat of the pilot burner flame causes the thermoelectric generator 9 to energize the electromagnet coil 19, and the armature 20 is thereby held in contact with the pole faces of the electromagnet frame 18, the valve member 16 being simultaneously

held in open position to permit fuel flow to the main burner 6 and pilot burner 8. Extinguishment of the pilot burner flame causes cooling of the thermoelectric generator 9 and thereby reduces the current output of the generator to below the drop-out current value of the electromagnet coil 19. When this happens the armature 20 is drawn away from the magnet frame 18 by the spring 27, and the valve member 16 is simultaneously snapped to closed position, thereby shutting off all fuel flow to the main burner 6 and pilot burner 8.

If during operation of the improved control apparatus, and while the pilot burner 8 is functioning normally, the temperature within the tank 5 should exceed a predetermined maximum safe value, the fill within the bellows 69 expands to cause the contacts 67 and 68 to separate at least sufficiently to reduce the current flow in the circuit to the drop-out valve for the electromagnet coil 19. As a result, the armature 20 is pulled by the spring 27 away from the pole faces of the electromagnet frame 18, and the valve member 16 is simultaneously snapped to closed position shutting off all fuel flow to the main and pilot burners and preventing further heating of the tank.

The illustrated unitary thermoelectric generator, lead and junction block assemblies are compact and are readily interchanged with thermoelectric generator and lead assemblies of a presently installed thermoelectrically powered control system utilizing a coaxial type generator lead, even though the space available in the installation is limited. By making this substitution in existing installations which are responsive only to pilot burner outage, said installations can be readily equipped with a condition responsive circuit-controlling device to provide dual control, including, for example, the aforedescribed high limit protection.

The resistance of each of the improved assemblies and of the electrical connections associated therewith is preferably matched to the output of the thermoelectric generator thereof so that the current delivered to the power unit by the respective assembly is substantially the same as that on which said power unit is designed to operate, i. e., the current formerly delivered to said power unit by the replaced generator and lead assembly. This is especially important where the generator in the improved assembly has a substantially greater power output than that of the generator replaced thereby. As a result of the aforementioned matching, the operating characteristics of the power unit remain substantially the same after conversion as they were before conversion. Since conversion by the use of the improved assemblies of the present invention does not require a change in the power unit, said conversion can be effected with minimum cost.

While the illustrated embodiments of the invention are applied to water heaters, they may obviously be applied to any suitable fuel burning equipment having thermoelectrically powered control systems in which it is desired to provide dual control, including, for example, high limit protection. Examples of other types of equipment to which the invention may be applied are clothes driers and space heaters.

The specific illustrations and the corresponding description are used for the purpose of disclosure only, and are not intended to impose unnecessary limitations on the claims, or to confine the patented invention to a particular use. Various changes and modifications may be made without departing from the spirit of the invention, and all of such changes are contemplated as may come within the scope of the claims.

What is claimed as the invention is:

1. A unitary thermoelectric generator and lead assembly comprising a thermoelectric generator coaxial lead of predetermined length fixed to said generator and having a tubular outer conductor and an insulated inner conductor, said lead being formed in two sections to provide a pair of inner end portions intermediate the length of

said lead, a metallic connecting member to which the inner end portions of said outer lead conductor are fixed by fused connections to provide electrical connection of predetermined low resistance therebetween, and terminal means electrically connected to the inner end portions of said inner lead conductor by a predetermined low resistance fused connection and insulatably mounted on said connecting member, whereby low resistance electrical connection between said inner end portions of said inner conductors may be effected through said terminal means.

2. A unitary thermoelectric generator and lead assembly comprising a thermoelectric generator coaxial lead of predetermined length fixed to said generator and having a tubular outer conductor and an insulated inner conductor, said lead being formed in two sections to provide a pair of inner end portions intermediate the length of said lead, metallic connecting means to which the inner end portions of said outer lead conductor are fixed to provide electrical connection of predetermined low resistance therebetween, and terminal means electrically connected to the inner end portions of said inner lead conductor by a predetermined low resistance connection and insulatably mounted on said connecting means, whereby low resistance electrical connection between said inner end portions of said inner conductors may be effected through said terminal means.

3. A unitary thermoelectric generator, lead and junction block assembly comprising, a thermoelectric generator, a coaxial lead connected at one end to said generator, low resistance coaxial inner and outer connectors at the other end of said lead, said lead having an outer tubular conductor and an insulated inner conductor and being formed in two sections to provide a pair of inner end portions intermediate the length of said lead, and a junction block on said lead, said junction block comprising, a metallic bracket to which the inner end portions of said outer lead conductor are fixed to provide an electrical connection of predetermined low resistance therebetween, said bracket having peripheral flanges providing recess means, insulating means nested within said recess means, and terminal connectors carried by said insulating means and to which the inner end portions of said inner lead conductor are respectively connected to provide an electrical connection of predetermined low resistance therebetween.

4. In an electrical apparatus wherein a thermoelectric generator is in circuit with one end of a coaxial lead having inner and outer conductors and a control device is in circuit with the other end thereof to afford generation and transmission of thermoelectric power from said generator to said control device, the combination with said coaxial lead of a junction block intermediate the length of said lead and dividing the latter into two sections contiguous therewith, said junction block comprising stamped sheet metal bracket means, each of the contiguous sections of said outer conductor being fixed by a low resistance connection to said bracket means, said bracket means having peripheral flanges providing recess means, insulating means within said recess means and a pair of terminals on said insulating means having portions disposed internally and externally of said bracket means, the inner conductor of each of said contiguous lead sections extending within said bracket means and being connected in circuit with a separate one of said terminals by a low resistance connection, whereby connection of an additional electrical device with said terminals affords a series circuit connection of said device with said generator and control device.

5. A unitary thermoelectric generator and lead assembly comprising a coaxial lead of predetermined length, a thermoelectric generator connected to one end of said lead, said lead having an outer tubular conductor and an insulated inner conductor and being formed in two sections to provide a pair of inner end portions intermediate

the length of said lead, a metallic connecting member fixed by a fused connection to each of the inner end portions of said outer lead conductor to provide low resistance electrical connections therebetween, and a terminal connector insulatably mounted on each of said connecting members and connected in circuit respectively with an inner end portion of said inner lead conductor by a low resistance fused connection, said connecting members being fixed together to provide a bracket affording a low resistance electrical connection between the outer conductor of said lead sections and a support for said terminal connectors.

6. A unitary thermoelectric generator, lead and junction block assembly comprising, a thermoelectric generator, a coaxial lead connected at one end to said generator, low resistance coaxial inner and outer connectors at the other end of said lead, said lead having an outer tubular conductor and an insulated inner conductor and being formed in two sections to provide a pair of inner end portions intermediate the length of said lead, and a junction block on said lead, said junction block comprising, a metallic bracket to which the inner end portions of said outer lead conductor are fixed by solder connections to provide an electrical connection of predetermined low resistance therebetween, said bracket having peripheral flanges providing a pair of recesses, an insulator nested within each of said recesses, and terminal connectors carried by said insulators and to which the inner end portions of said inner lead conductor are respectively connected by a solder connection to provide an electrical connection of predetermined low resistance therebetween.

7. A unitary thermoelectric generator, lead and junction block assembly comprising a thermoelectric generator, a coaxial lead connected at one end to said generator, low resistance coaxial inner and outer connectors at its other end, said lead having an outer tubular conductor and an insulated inner conductor and being formed in two sections to provide a pair of inner end portions, and a junction block on said lead, said junction block comprising a metallic bracket having upstanding end flanges and having opposite upstanding side flanges adjacent each end flange, said bracket also having overlapping side flanges intermediate its length providing with the aforementioned side and end flanges a pair of spaced recesses, one of the upstanding flanges at each of said recesses being apertured to receive an inner end portion of said lead, the outer lead conductor of said lead sections being fixed by a fused connection to said bracket at the margins of said flange apertures to provide a physical connection and an electrical connection of predetermined low resistance between said outer lead conductor sections, an insulator nested within each of said recesses, said insulators each being formed with a main bore normal to said bracket and with an intersecting cross bore, each of the latter being in registry with a flange aperture, and terminal connectors having portions fixed within the main bores of said insulators, the inner end portions of said inner lead conductors extending within said insulator cross bores and being fixed by a low resistance fused connection respectively to said terminal connectors.

8. In an electrical apparatus wherein a thermoelectric generator is in circuit with one end of a coaxial lead having inner and outer conductors and a control device is in circuit with the other end thereof to afford generation and transmission of thermoelectric power from said generator to said control device, the combination with said coaxial lead of a junction block intermediate the length of said lead and dividing the latter into two sections contiguous therewith, said junction block comprising a pair of stamped sheet metal brackets, each of the contiguous sections of said outer conductor being fixed by a low resistance fused connection to a separate one of said brackets, each of said brackets being formed with a flange portion by which said brackets are fixed to each other to provide low resistance electrical con-

tinuity between said outer conductor sections, each of said brackets having a peripheral flange providing individual recesses, an insulator within the recess of each of said brackets providing therewith an enclosed cavity, and a terminal on each of said insulators having portions disposed internally and externally of the corresponding cavity, the inner conductor of each of said contiguous lead sections extending within a separate one of said cavities and being connected in circuit with the terminal portion therewith by a low resistance fused connection, whereby connection of an additional electrical device with said terminals affords a series circuit connection of said device with said generator and control device.

9. A unitary thermoelectric generator and lead assembly comprising a thermoelectric generator coaxial lead of predetermined length fixed to said generator and having a tubular outer conductor and an insulated inner conductor, said lead being formed in two sections to provide a pair of inner end portions intermediate the length of said lead, a cup-shaped one-piece metallic connecting member to which the inner end portions of said outer lead conductor are fixed to provide electrical connection of predetermined low resistance therebetween, and terminal means electrically connected to the inner end portions of said inner lead conductor within said cup-shaped connecting member by a predetermined low resistance connection and insulatably mounted on said connecting member, whereby low resistance electrical connection between said inner end portions of said inner conductors may be effected through said terminal means.

10. A unitary thermoelectric generator and lead assembly comprising a thermoelectric generator coaxial lead of predetermined length fixed to said generator and having a tubular outer conductor and an insulated inner conductor, said lead being formed in two sections to provide a pair of inner end portions intermediate the length of said lead, the inner end portions of said outer conductor being flared, a metallic connecting member formed with a pair of apertured recesses for receiving respectively the flared inner end portions of said outer conductor, means affording a connection between each of said recesses and its respective flared end portion to provide electrical connection of predetermined low resistance therebetween, and terminal means electrically connected to the inner end portions of said inner lead conductor by a predetermined low resistance connection and insulatably mounted on said connecting member, whereby low resistance electrical connection between said inner end portions of said inner conductors may be effected through said terminal means.

11. A unitary thermoelectric generator and lead assembly comprising a thermoelectric generator coaxial lead of predetermined length fixed to said generator and having a tubular outer conductor and an insulated inner conductor, said lead being formed in two sections to provide a pair of inner end portions intermediate the length of said lead, the inner end portions of said outer conductor being formed with an annular shoulder, a metallic connecting member formed with a pair of apertured recesses, each of the inner end portions of said coaxial lead having the annular shoulder of its outer conductor within a separate one of said recesses and its inner conductor extending through the aperture in the respective recess, means affording a connection between each of said recesses and the annular shoulder of its respective inner end portion of said outer conductor to provide electrical connection of predetermined low resistance therebetween, and terminal means electrically connected to the inner end portions of said inner lead conductor by a predetermined low resistance connection and insulatably mounted on said connecting member, whereby low resistance electrical connection between said inner end portions of said inner conductors may be effected through said terminal means.

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12. A unitary thermoelectric generator and lead assembly comprising a thermoelectric generator coaxial lead of predetermined length fixed to said generator and having a tubular outer conductor and an insulated inner conductor, said lead being formed in two sections to provide a pair of inner end portions intermediate the length of said lead, each of the inner end portions of the outer conductor being formed with shoulder means, a cup-shaped metallic connecting member having opposite side walls each of which is formed with an apertured recess, each of the inner end portions of said coaxial lead having the shoulder means of its outer conductor within a separate one of said recesses and its inner conductor extending through the aperture in the respective recess, means affording a fused connection between each of said side wall recesses and the shoulder means of its respective inner end portion of said outer conductor to provide electrical connection of predetermined low resistance therebetween, and terminal members electrically connected to a separate one of the inner end portions of said inner lead conductor within said cup-shaped connecting member by a predetermined low resistance fused connection, said terminal members being insulatably mounted on said connecting member and insulated from each other, whereby low resistance electrical connection between said inner end portions of said inner conductor may be effected through said terminal members.

13. In an electrical apparatus wherein a thermoelectric generator is in circuit with one end of a coaxial lead hav-

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ing inner and outer conductors and a control device is in circuit with the other end thereof to afford generation and transmission of thermoelectric power from said generator to said control device, the combination with said coaxial lead of a junction block intermediate the length of said lead and dividing the latter into two sections contiguous therewith, said junction block comprising a stamped cup-shaped sheet metal member formed with a pair of apertured recesses, each of the contiguous sections of said outer conductor being fixed by a low resistance fused connection to said member within a separate one of said recesses formed therein, said cup-shaped member having a peripheral shoulder, an insulator fixed against said peripheral shoulder of said cup-shaped member to provide therewith an enclosed cavity, each of the contiguous sections of said inner conductor extending through a separate one of the apertures in said recesses formed in said cup-shaped members, and a pair of terminals on said insulator each having a portion disposed internally and a portion disposed externally of said cavity, the inner conductor of each of said contiguous lead sections being connected in circuit with the terminal portion within said cavity by a low resistance fused connection, whereby connection of an additional electrical device with the external portions of said terminals affords a series circuit connection of said device with said generator and control device.

No references cited.