June 24, 1969 R. A. FEE 3,452,167

POWER INLET WITH AUXILIARY CIRCUIT CONTROLLING SWITCH

Filed Nov. 25, 1966 Sheet 1 of 2

Fig. 1.

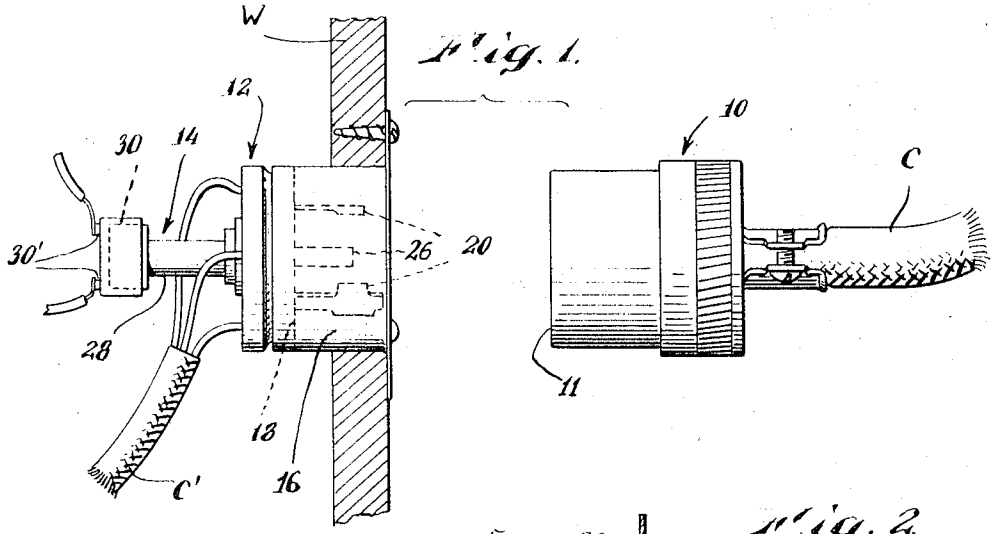

Fig. 2.

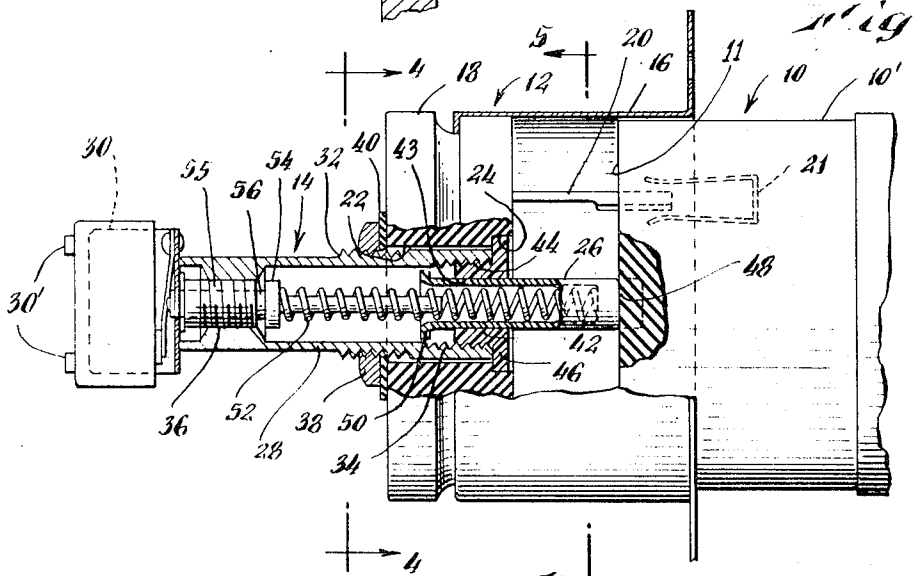

Fig. 3.

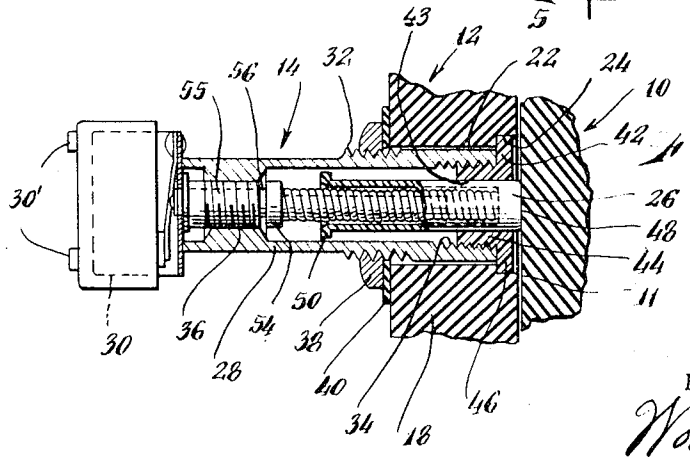

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Fig. 4.

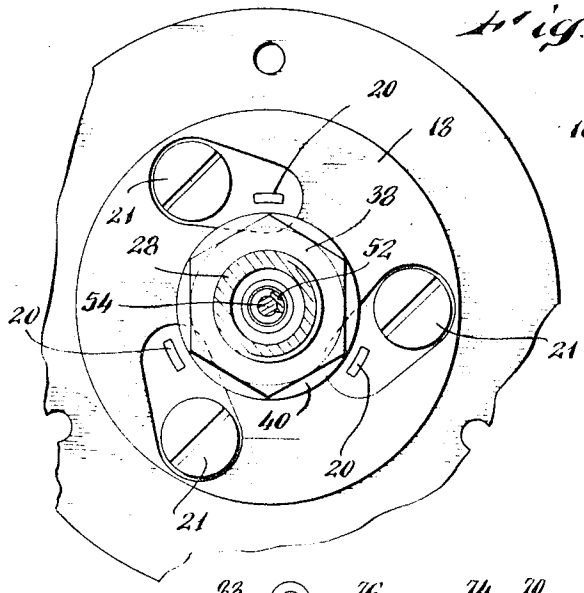


Fig. 5.

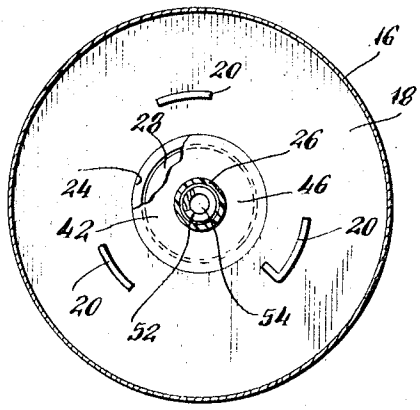


Fig. 6.

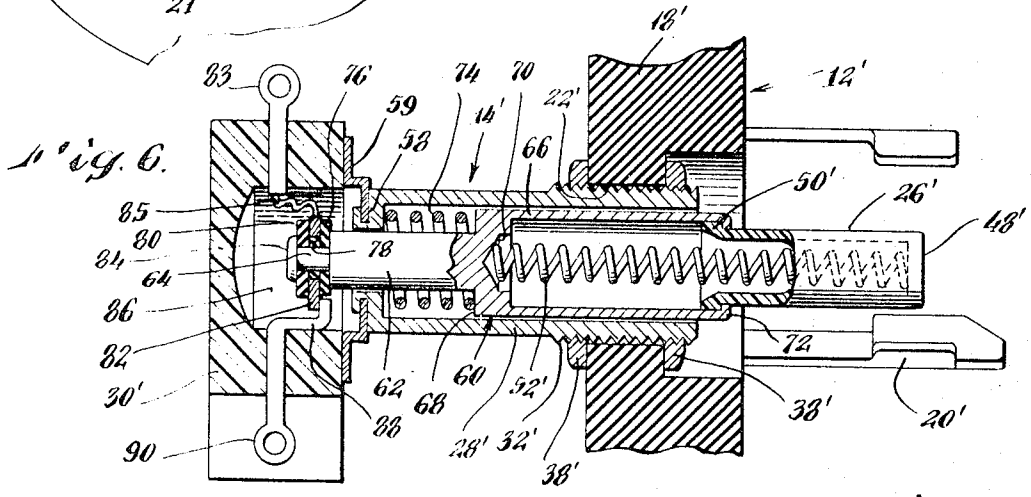
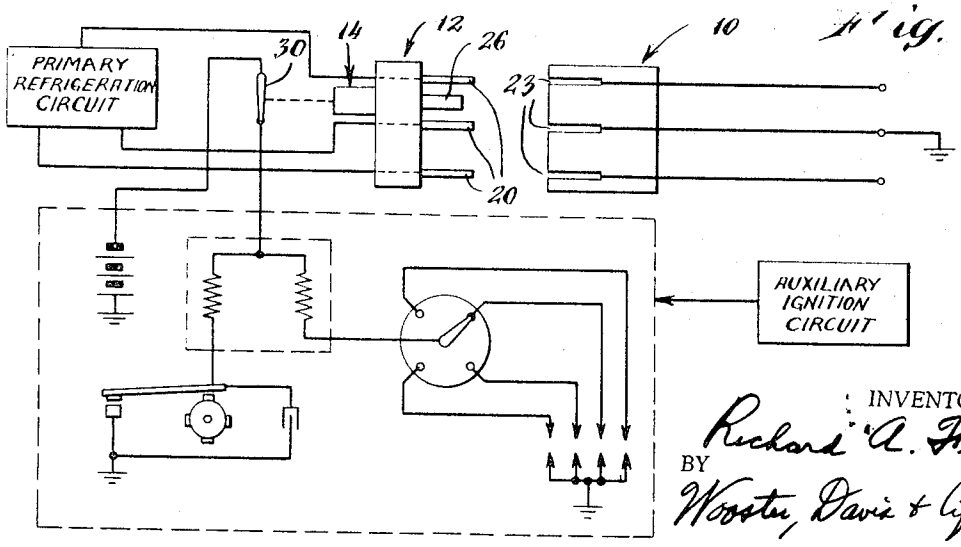


Fig. 7.



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POWER INLET WITH AUXILIARY CIRCUIT CONTROLLING SWITCH

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7 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a power inlet for supplying electrical power to a primary circuit and for controlling a secondary circuit. The power inlet includes a body having a plurality of contact elements with electrical terminals secured thereto which may be connected in the primary circuit. It also carries an auxiliary circuit switch which is actuated by the connecting and disconnecting of the power inlet with a mating electrical connector device.

This invention relates to a locking electrical connector and, more particularly, to an improved locking electrical connector wherein the connection and disconnection of the connector parts actuates a switch controlling an auxiliary circuit.

It is known to supply a temporary source of electrical power to an electrical system or device on a mobile unit through a separable locking electrical cable connector. For example, to supply electrical power from a supply cable connector body to a power inlet on a refrigeration unit of a truck or to the electrical system of a yacht. Of course, when the electrical requirements of the mobile unit are satisfied, the connected connector parts, i.e. power inlet and connector body, are disconnected and the mobile unit is ready to be moved. However, problems arise in practice when the mobile unit, for example, a refrigerator truck or a moored yacht, is inadvertently moved away from a dock without disconnecting the connector body from the power inlet. This usually results in destruction of the electrical power cable and/or connector, and subsequent expensive repairs and "down time" of the power supply dock.

Accordingly, it is a primary object of the present invention to provide an improved electrical connector which incorporates a switching means arranged to be connected in an auxiliary electrical circuit to be controlled, for example, the ignition circuit of a truck or yacht, to control the auxiliary circuit in a desired manner, for example, to prevent the engine of the truck or yacht from being started while the power cable is connected to its power inlet.

Another object of the invention is to provide an improved electrical power inlet having switching means for controlling an auxiliary circuit.

Still another object is to provide in combination a power circuit and an auxiliary circuit wherein the condition of the power circuit controls the condition of the auxiliary circuit.

To accomplish all of these objects, in one form, a power inlet and connector body are provided wherein a main source of electrical power is conducted through said body and inlet to supply a primary circuit, and a switching means is incorporated into said power inlet and arranged to control an auxiliary circuit in response to the connection and disconnection of said power inlet and connector body.

Other objects and further details of that which I believe to be novel and my invention will be clear from

the following description and claims taken with the accompany drawings, wherein:

FIG. 1 is a side elevational view of a separated connector body and power inlet constructed in accordance with the present invention;

FIG. 2 is an enlarged side elevational view of the FIG. 1 connector body and power inlet shown in position during their connection prior to full connection, with portions of the power inlet broken away and shown in section to illustrate the auxiliary circuit switch in the power inlet;

FIG. 3 is a fragmentary sectional view of the FIG. 2 construction, showing the connector body and power inlet completely connected;

FIG. 4 is a sectional view taken substantially along line 4—4 of FIG. 2;

FIG. 5 is a sectional view taken substantially along line 5—5 of FIG. 2;

FIG. 6 is a vertical sectional view of a modified power inlet; and

FIG. 7 is a wiring diagram showing a representative circuit including a primary circuit, an improved connector therefor, and a secondary circuit controlled by the connector.

With particular reference to the drawings there is illustrated a connector body **10** connected to a source of electrical power through a usual electrical power supply cable C. The connector body **10** is constructed to be selectively connected to the flanged power inlet **12** which is secured to the wall W of a mobile unit, for example, a refrigeration truck or the like. The power inlet **12** is, in turn, electrically connected in a primary electrical circuit of the mobile unit, such as the refrigeration circuit shown in FIG. 7, by means of another electrical cable C'. An auxiliary circuit switch assembly **14** including a switch **30** is connected in an auxiliary circuit to be controlled, such as the ignition circuit for the engine of the mobile unit, as shown in FIG. 7. The switch **30** is designed to be normally closed allowing the ignition circuit to be actuated; however, when the primary circuit power supply connector parts **10** and **12** are connected, as a result of their construction the switch **30** is opened, thus preventing the actuation of the ignition circuit.

The power inlet **12** is provided with a flanged metal shell **16**, insulation body member **18** and contact blades **20**, one of which may be formed to function as a key and be a grounding contact. The leads of cable C' are wired to the terminals of contact blades **20**. The insulation body member **18** includes a bore **22** and a counterbored seat **24**, arranged to accept the auxiliary circuit switch assembly **14**. The connector body **10** may be of known construction and need not be specifically described; it does contain internally disposed receptacle contacts **21** arranged to receive contact blades **20**, and includes an insulation body member having a substantially flat face **11**.

The auxiliary circuit switch assembly **14** comprises a spring biased plunger **26** of electrical insulation material mounted for sliding movement in a central opening in bushing **42** of electrical insulating material mounted in one end of a tubular member **28**, and a switch **30**, which may be a miniature switch or other suitable switch means, mounted at the other end of the member **28**. The tubular member **28** is open at both ends and includes an external threaded portion **32**, a first internal threaded portion **34** and a second smaller diameter internal threaded portion **36**. Member **28** is positioned in the bore **22** of the power-inlet body member **18** and held in place by the clamping action of the lock nut **38** (threadedly mounted on threaded portion **32** and spaced from the body member **18** by the fiber washer **40**) and the annular flange **46** of bushing **42** which has an external threaded portion **44** threadedly engaged with the first internal threaded portion **34** to

mount it in the member 28. The flange 46 limits engagement of the bushing 42 with the tubular member 28 and also is mounted in the counterbored seat 24 to secure the tubular member 28 in the bore 22.

The spring biased plunger 26 comprises a tubular member including a closed normal wall 48 at one end and a circumferential flange 50 at its other end. The flange 50 is normally biased against the internal rim about the central opening 43 of bushing 42 by the operating coil spring 52 within which is mounted guide-drive rod 54. One end of the spring 52 bears against the inner side of wall 48 and the other end biased against the head of rod 54 which, in turn, is biased against the switch actuating button 56 of the switch 30. The switch 30 has a threaded mounting hub 55 secured in the tubular member 28 in threaded engagement with the smaller diameter threaded portion 36. The switch 30 is constructed in a known manner, and in one form is commercially available as a "Micro" switch and, therefore, will not be described in detail. It includes internal contacts (not shown) and terminals 30' for securing leads of the auxiliary circuit, and it is constructed to have its contacts engaged normally when the switch button 56 projects to its outermost position and to have its contacts disengaged when the switch button is depressed.

FIG. 6 illustrates a modified power inlet having a modified auxiliary circuit switch assembly. The basic features of the modified power inlet are similar to the first one described with reference to FIGS. 1–5, and similar parts are given similar reference numbers with a prime (') added. The operation of both power inlets is the same, but the modified form may be considered economically desirable.

In FIG. 6 there is illustrated the main elements of a power inlet 12' carrying a modified auxiliary circuit switch assembly 14' having a switch means 30'. The switch assembly 14' includes a tubular member 28' secured in the bore 22' of the insulation body member 18' of power inlet 12' by a pair of spaced lock nuts 38' which are in threaded engagement with the threaded portion 32' of member 28'. The switch 30' is mounted at one end of the tubular member 28' by means of a cup-shaped member 59 which is secured to it and an end of member 28', as by the flange 58.

Disposed at the interior of the tubular member 28' is push rod 60 comprising a solid portion 62 having a reduced portion 64 at one end and an enlarged tubular portion 66 at its other end. An annular radial shoulder 68 connects the rod portion 62 with the tubular portion 66. The push rod 60 further comprises an internal central recess forming a spring seat 70 at one end of tubular portion 66 and an inwardly turned circumferential lip 72 located at the other end of the tubular portion 66. The tubular plunger 26' made of electrical insulation material is retained for sliding motion within the tubular portion 66, and includes a closed normal wall 48' at one end and a circumferential flange 50' at its other end, which flange cooperates with the circumferential lip 72 to retain the plunger within the tubular portion 66. An operating coil spring 52' biases the plunger axially to its projecting position shown in FIG. 6, in which it will be disposed to interfere with the face of a connector body member when it is connected to the power inlet. The operating spring 52' also urges the push rod 60 axially in the opposite direction, biasing it against the coil spring 74, which is located between the push rod shoulder 68 and the flange 58 of member 28'.

The reduced rod portion 64 is arranged to carry the insulating washers 76, 78 and 80, and the annular electrical contact element 82, concentrically disposed about the insulating washer 78, between washers 76 and 80, all of which are firmly secured by the spun over end 84 of reduced rod portion 64. The contact element 82 is connected to a terminal 83 through a flexible lead 85. Rod portion end 64 with the contact element 82 located thereon is movably disposed within the chamber 86 formed in the insulation body of switch 30' and arranged to engage and disengage the stationary electrical contact element 88 rigidly mounted in the switch body and including a terminal 90, thereby controlling the electrical current flow in an auxiliary circuit of which the switch 30' forms a part.

The operation of the improved power inlets should be readily apparent. With reference to the FIGS. 1–5 embodiment, the separable rotatably locking electrical connector parts 10 and 12 are electrically wired in the primary circuit in the normal manner, while the switch 30 is wired in the auxiliary circuit. When the connector body 10 is connected to the power inlet 12, and before electrical contact is made between the contact blades 20 and receptacle contacts 21 of the power inlet 12 and connector body 10, respectively, the connector body face 11 engages and pressure is exerted on the plunger 26, as clearly illustrated in FIG. 2. As the plunger 26 is forced axially into the switch assembly, on further movement of the connector body relative to the power inlet, the operating spring 52 is compressed and the spring force is transmitted to the head of the operating rod 54, thereby depressing the switch button 56 of switch 30 which remains depressed until the connector body 10 is removed. Depression of the switch button results in opening the contacts of switch 30 and breaking the auxiliary circuit. The total travel of the plunger 26 required to actuate the switch is very small compared to the total length of travel of the plunger and occurs at the initial movement of the plunger before the primary circuit is closed. The amount of travel needed can be increased or decreased by adjustment of the spring tension which is effected by the position of securing means 38 and 42 on the tubular member 28.

The operation of the embodiment disclosed in FIG. 6 is similar to that just described with regard to the embodiment of FIGS. 1–5. When a connector body is connected to the power inlet 12' the plunger 26' is forced axially into the switch assembly 14', causing the operating spring 52' to move the push rod 60, thereby opening the switch contacts 82 and 88. In order for the push rod 60 to be moved, the operating spring 52' must overcome the force of the coil spring 74 which urges the push rod 60 axially in the opposite direction. Adjustment of the spring tension of the coil spring 74 may be effected by the positioning of the spaced lock nuts 38' on the tubular member 28'. This adjustment controls the amount of travel of the plunger 26' required to cause the operating spring 52' to overcome the force of the coil spring 74 and result in opening the contacts 82 and 88.

Referring to the schematic wiring diagram shown in FIG. 7, there is illustrated a primary circuit denoted as a refrigeration circuit which is a part of an electrical system on a mobile unit, such as a truck, requiring electrical power. This primary circuit receives electrical power through the power inlet 12 when the connector body 10 is connected to it. As is readily apparent, connection of the connector parts causes elements of the auxiliary circuit switch assembly 14 to be actuated mechanically, thereby opening the switch 30 and breaking the auxiliary circuit which is denoted as an ignition circuit, which may be that of the truck. This prevents inadvertent operation of the vehicle while the connector parts are connected and thus protects the primary electrical supply cable and its connector.

The switch of the power inlet may contain normally closed contacts, normally open contacts or both to control plural auxiliary circuits. If normally closed contacts are used, the power inlet will inactivate the auxiliary circuit. Conversely, the auxiliary circuit will be activated if normally open contacts are used. Should the switch contain both normally open and normally closed contacts, it then becomes possible to control two auxiliary circuits

with a single device and open one and close the other.

It is understood that the present disclosure has been made only by way of example, and that numerous changes in details of construction and the combination and arrangement of parts may be resorted to without departing from the true spirit and the scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An improved electrical power inlet for supplying power to a primary circuit and controlling an auxiliary circuit, comprising: an insulator member having an exposed face defined by a planar wall and including an aperture formed therethrough intersecting said planar wall; a plurality of electrical contacts carried by said member; a plurality of electrical terminals secured to said contacts and arranged to be connected in a primary electrical circuit; a switch means carried by said insulator member and arranged to control the auxiliary circuit said switch means having actuating means mounted in said aperture and extending beyond said exposed face which is responsive to the connecting and disconnecting of said power inlet with a mating electrical connector device.

2. The improved power inlet defined in claim 1 wherein said switch means comprises electrical contact means for opening and closing the auxiliary circuit and said actuating means comprises: a tubular housing member mounted on said insulator member within said aperture behind said exposed face; a plunger mounted for reciprocation within said tubular housing; a push rod disposed within said tubular housing and arranged to actuate said electrical contact means; and resilient means between said push rod and said plunger for biasing said push rod in a first direction and biasing said plunger oppositely in a second direction to a position in which said plunger extends beyond said exposed face and interferes with the connecting of a mating eelctrical connector device, such that when a mating electrical connector device is connected with said power inlet said plunger will be moved into said insulator member and a force will be transmitted in the first direction through said resilient means to said

push rod to change the condition of said electrical contact means.

3. The improved power inlet defined in claim 2 wherein a second resilient means is disposed within said tubular housing to bias said push rod in the second direction so that the force of said first resilient means tending to move said push rod in the first direction must overcome the oppositely directed force of said second resilient means in order for said push rod to change the condition of said electrical contact means.

4. The improved power inlet defined in claim 3 wherein said resilient means are coil springs.

5. The improved power inlet defined in claim 2 wherein said electrical contact means is disposed within a miniature switch assembly which is carried by said tubular housing member and is actuated by a switch button moved by said push rod.

6. The improved power inlet defined in claim 3 wherein said electrical contact means is disposed within a chamber defined in an insulator body and comprises a stationary contact element and movable contact element, said movable contact element being carried by said push rod.

7. The improved power inlet defined in claim 1 including a housing member adjustably mounted in said insulating member; and wherein said switch means is carried by said housing member and said actuating means is partially disposed in said housing member and extends beyond said exposed face of said insulating member.

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