# United States Patent

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[54] **TRAILER CONNECTOR**
**6 Claims, 6 Drawing Figs.**


[52] **U.S. Cl.** ..... **317/99,** 337/113, 337/338
[51] **Int. Cl.** ..... **H01h 61/01**
[50] **Field of Search** ..... 337/113, 187, 188, 189, 197, 198, 199, 338; 317/99; 200/51 R



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,315,131 | 4/1967 | Klimak et al. | 317/99 |
| 3,270,249 | 8/1966 | Unsworth | 337/113 (X) |
| 3,059,073 | 10/1962 | French, Jr. | 200/51 R (X) |



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**ABSTRACT:** A multiconductor electrical connector socket comprising a conducting flange, having a permanently affixed ground conductor and plug receiving chamber, and a detachable molded insulating base containing circuit breakers. The detachable base has permanently affixed circuit breakers, conducting pins and buss strips in order to minimize the number of manual connection terminals. The connector is constructed so that when the flange and base are joined, an enclosure is formed, protecting the circuit breakers from damaging external forces.

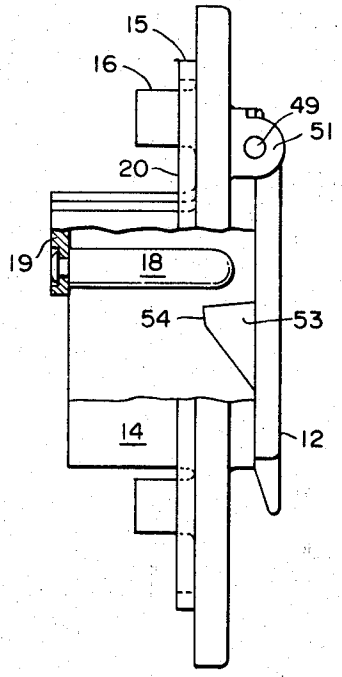



FIG. 1

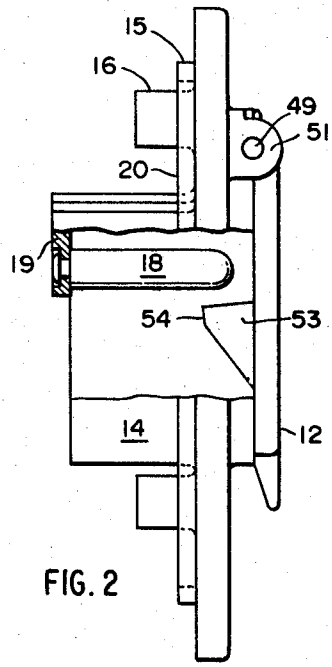



FIG. 2

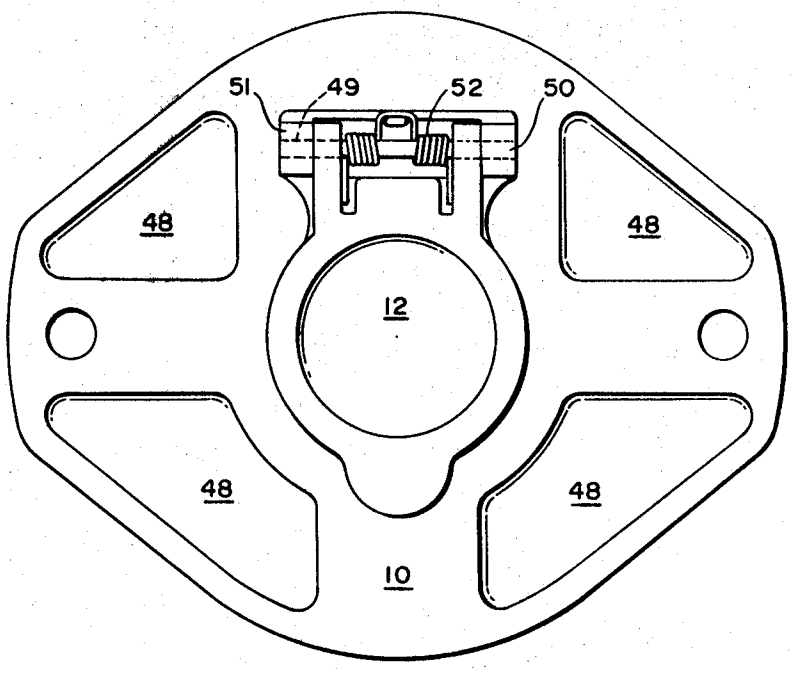
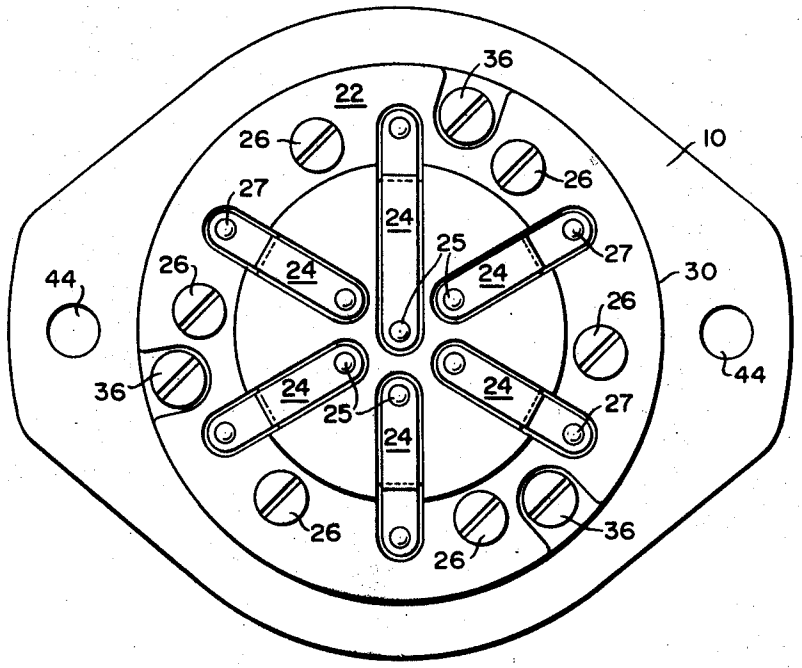



FIG. 3




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FIG. 4

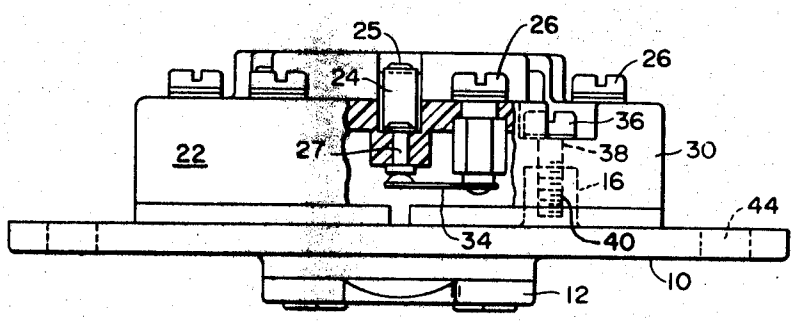



FIG. 5

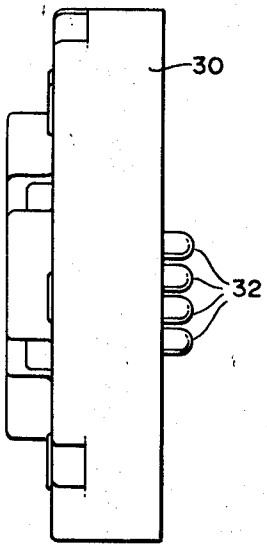
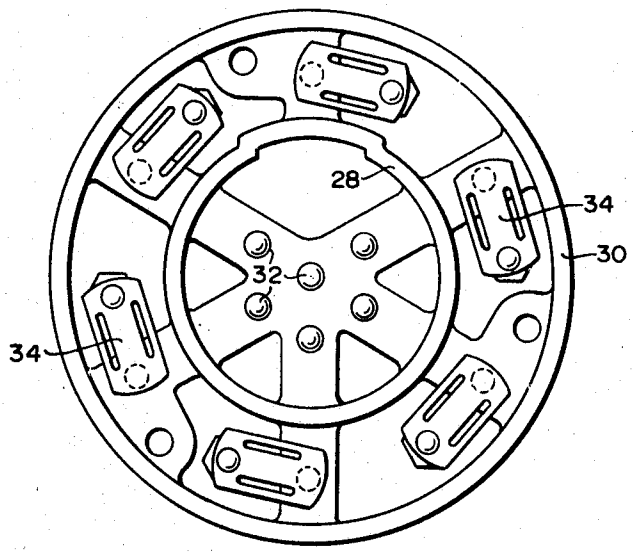



FIG. 6




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# TRAILER CONNECTOR

This invention relates generally to multiconductor electrical connectors used to connect electrical devices with a power source. More specifically, the invention relates to improvements in multiconductor electrical connector sockets for automotive trailers where such sockets have integrated protective circuit elements. The electrical connectors are used to energize the lighting system and other electrical devices of a trailer from the power source of a vehicle such as an automotive tractor.

When an automotive vehicle is hitched to a trailer, power or, in some cases, electrical control switches and relays, must be interconnected with electrical equipment in the trailer. The interconnection is normally achieved by means of a multiple contact cable plug and socket. Usually, the vehicle plug is a female type which is connected through switches or controls to the power source by a multiconductor cable. The male socket is mounted on the wall of the trailer facing the vehicle or tractor and has conducting pins disposed within a plug receiving chamber. Each electrical device is connected to its appropriate socket terminal which, in turn, is connected to a conducting pin. To assure that each individual circuit of the trailer is properly connected with the power source when the male socket and female plug are joined, the socket and plug are provided with a key or other indexing means such as an outsized conducting pin.

In order to avoid damage to the electrical devices and the power source, protective circuit elements are usually employed in each circuit. These protective elements are most commonly circuit breakers or fuses which are inserted in each circuit. Heretofore, a plurality of individually removable circuit breakers have been used. However, there are normally quite a few conducting pins, each with related terminals and circuit breakers. When each circuit breaker is individually removable, the number of manual electrical connections is large. Furthermore, it is often difficult to ascertain precisely which of several circuit breakers may be faulty or need replacement and considerable time may be needed to determine and correct the fault. The present invention contemplates more convenient, more efficient, and cheaper servicing by making it possible to replace all circuit breakers in a single operation rather than having to check each individual circuit breaker. Although the cost of parts is obviously greater, the time spent in diagnosing faults and replacing circuit elements where a large number of manual connections must be disconnected and then reconnected is more costly than the parts.

The invention is embodied in an improved electrical connector socket having a plurality of permanently affixed circuit breakers contained in a removable, integral unit. An unskilled operator is thus enabled to easily service and replace the base plate of the connector unit containing circuit breakers by making a minimum of manual electrical connections.

The socket of the invention also safeguards the protective circuit elements from damage caused by weather or accidental contact with other objects.

Furthermore, a permanently affixed ground conducting pin in the socket assures an improved ground contact and further reduces the number of manual electrical connections.

Other features of this invention include a better and stronger guiding means for a female plug, permanently affixed bus strips which eliminate manual electrical connections and which reduce the danger of short circuiting from bus strip flexing, and a more durable construction.

In the drawings:

FIG. 1 is a plan view of a connector flange,

FIG. 2 is a side view of the flange of FIG. 1 with a fragmentary sectional view revealing a ground pin,

FIG. 3 is a rear plan view of the connector flange of FIG. 1 and an insulated base therefor,

FIG. 4 is a side view, partly in section of the insulating base and flange of FIG. 3,

FIG. 5 is a side view of the insulating base; and



FIG. 6 is a front sectional elevation of the insulating base.

The invention is particularly adapted to be used in an automotive trailer, although it could easily be employed wherever several electrical devices are protectively connected to a power source. While the specific connector socket shown and described is a 7-conductor electrical connector adapted to receive a conventional automotive tractor cable, the number of conductors may be more or less than seven, as dictated by the application of the connector.

In FIGs. 1 and 2, there may be seen a housing member which includes a die cast flange **10** having a hinged cover **12**. A raised tubular receiving chamber **14** and a circular ridge **15** and bosses **16** are formed on the back of the flange **10**. A permanently affixed ground conducting pin **18** extends from the back wall and within the chamber **14**. The wall of the chamber **14** defines the inner boundary of a circular recess **20** on the back of said flange **10**.

A molded base **22**, of insulating material having a raised central area is shown in FIGS. **3** and **4**. Radially arrayed in deep recesses in the back of the base **22** by rivets or other suitable fasteners are a plurality of conducting bus strips **24**. The bus strips **24** connect a plurality of conducting pin bases **25** individually to a like plurality of rivets **27** disposed in a circular array and passing through the base **22**. On the opposite or front surface of the base **22**, a raised inner base wall **28** and outer base wall **30** are formed. A plurality of conducting pins **32** and bimetallic circuit breakers **34** are also disposed on the inner face of said base **22**. The conducting pins **32** are arrayed within the inner base wall **28**, while the bimetallic circuit breakers **34** lie in the recess between the inner base wall **28** and the outer base wall **30**. When the insulating base **22** is placed in the housing member and the two parts are joined together by means of screws **36** passing through holes **38** in the base **22** into threaded holes **40** in the bosses **16** or by other similar means, the conducting pins **32** extend into the plug receiving chamber **14**, and the circuit breakers **34** will be contained within the recess **20** which is completely enclosed by the flange **10**, the ridge **15**, the outer base wall **30**, the base **22**, the inner base wall **28**, and the receiving chamber wall **14**.

The flange **10** is preferably constructed of a strong, lightweight, electrically conducting material such as aluminum. The flange is of a generally oval shape to provide areas in which holes **44** are bored to permit the flange **10** to be secured to the wall of a trailer. The flange **10** may be die cast with recesses **48** to save material and to lighten the weight of the connector socket without substantially weakening its structure. A hinge pin **50** passes through the cover **12** and small openings **49** in the flange cover brackets **51** to hold the cover **12** in place. A coiled spring **52** wound around the hinge pin **50** may serve to maintain the cover **12** in a normally closed position.

The cover **12** has a tongue **53** formed on its inner surface which is of a shape and orientation with respect to the cover **12** that, when the cover is lifted to accommodate a cable or plug, the plug is held in place by the spring-loaded pressure of the tongue. An arcuate surface **54** is formed on the end of the tongue **53** and it conforms to the perimeter of the cable or plug to hold the cover in its raised position and to hold the cable securely in place in the socket.

Also, the cover has a reentrant inner edge formed by two ridges to fit over a ridge around the socket opening of the flange **10** to prevent the entry of dirt, water, and other unwanted matter into the plug receiving chamber.

The design of the assembled socket elements is such that, upon installation in a suitable opening in the trailer wall, only the die cast flange **10** and ridge **15** are in contact with the trailer wall. The base **22**, made of more fragile nonconducting material is thus protected from the shock and strain that is encountered in normal use where the trailer is subjected to travel over rough roads or terrain. The receiving chamber **14** may, if desired, have an out-of-round enlargement to serve as a keyway for a conforming key on the cable plug, although the conducting pins may equally well serve to index the mating elements. The ground conducting pin **18** is firmly held in posi-

tion as by staking to a segment **19** formed as a portion of the bottom wall of the receiving chamber **14**. The segment **19** defines the depth of the plug receiving chamber and aligns the pin **18** parallel to the receiving chamber wall **14** while assuring a good electrical connection without need for a manual connection terminal. Since it is not a part of the removable insulating base **22**, it is not necessary to put in a new ground pin when the base **22** is replaced, resulting in more efficiency and less cost for such replacement.

The molded insulating base **22** is made of a strong, **42** insulating base **22** and the die cast flange **10** nonconducting, waterproof material, such as Bakelite. The conducting pins **32** are disposed within and parallel to the inner base wall **28** which is larger than, but of the same shape as, the receiving chamber **14**. When the insulating base **22** and the die cast flange **10** are fitted together, the wall of the receiving chamber **14** provides guiding means for the base **22**. Positive alignment and orientation are readily achieved with the aid of indexing means such as the previously mentioned out-of-round areas formed on the inner base wall **28** and receiving chamber wall **14**, respectively. The conducting pins **32** are so disposed that when the two parts are properly joined together, the conducting pins do not interfere with the ground pin **18**, and the pin holding segment **19** will be substantially flush against the base **22**.

Each conducting pin **32** has an end of reduced diameter **25** anchored in an opening in the base **22** and riveted to one end of a bus strip **24** which is set in a recessed area on the back of the base. The bus strips **24** are bent to conform to the surface of the base **22** and are deeply recessed along their entire lengths, eliminating any chance of short-circuiting between strips or between connector terminals and strips. The structure also protects against short-circuiting by foreign objects coming in contact with the back of the connector. An end of each bus strip **24** is riveted through the base and the opposite end of each rivet forms a contact point for the nonsecured end of a bimetallic circuit breaker **34**, the secured end of each circuit breaker being riveted to a terminal into which a screw **26** is threaded as shown in FIG. **4**. Each of the bus strips **24** is protected from contact with another strip by being substantially recessed into the insulating base. Furthermore, since the bus strips are permanently affixed, they are not subject to wear and potential breakage from the flexing which accompanies the replacement of individual breakers as they are found in comparable devices known in the art.

The integrally mounted bimetallic circuit breakers **34** are entirely enclosed within the recess formed by the inner base wall **28**, the outer base wall **30** and the two basic parts of the device, namely the flange and the base. An end of each circuit breaker **34** is firmly held in position by a rivet so positioned in the base that the free end of each circuit breaker **34** will make contact during normal operation with a rivet connected to a bus strip **24**. When a circuit is overloaded, the bimetallic element will heat up and at its "breaking point" will bend upward, opening the circuit and cutting off the flow of current.

In some situations, as where a trailer is made of nonconducting material such as Fiberglas or plywood, the grounding pin may be effectively connected to ground by a wire from the mounting screw in one of the mounting holes **44**, the ground pin being integral with the flange.

Finally, unlike prior art devices, the trailer connector of the present invention has only two major parts easily disassembled by removing three screws and equally easily assembled by replacing those screws. Moreover, the formation of the receiving chamber as a part of the relatively strong flange rather than as a part of the relatively fragile base adds to the strength and durability of the connector.

Because the ground pin is directly fixed to the flange, it does not project through the backplate and a symmetrical array of widely spaced terminals is thus made possible which permits unobstructed, easy connection of wires. The recessing of the bus strips prevents contact with terminal lugs which otherwise might swivel and cause shorts or bypass the circuit breakers.

What has been shown and described is a preferred embodiment of the present invention. The scope of the invention, however, is defined in the following claims.

What we claim is:

**1.** In an electrical connector socket for use in environments of exposure to weather and rough motion wherein power and control currents are transferred between said socket and a cable plug, the combination of a flange of conducting material having a receiving chamber formed therein, at least a portion of the bottom of said chamber being defined by a conducting segment, a ground pin fixed to said conducting segment and projecting into said chamber, a detachable insulating base mounted on said flange, a plurality of conducting pins mounted on said base and projecting into said chamber parallel to said ground pin, said insulating base having a recess formed therein, a plurality of circuit breakers disposed in said recess, means connecting one end of each of said circuit breakers to one of said conducting pins, and terminal connector means connected to the other end of each of said circuit breakers.

**2.** In an electrical connector socket as defined in claim **1**, the combination wherein said means connecting one end of each of said circuit breakers to one of said conducting pins comprises a plurality of individual bus strips, said insulating base having a like plurality of second recesses formed therein, said bus strips being individually permanently affixed in said second recesses.

**3.** In an electrical connector socket as defined in claim **1**, for use with a trailer said flange being adapted for mounting on said trailer, the combination wherein said insulating base includes spaced concentric walls formed on the surface thereof adjacent said flange, said walls, said base and said flange defining said recess and enclosing said circuit breakers.

**4.** In an electrical connector socket as defined in claim **1**, the combination which includes a spring-loaded normally closed hinged cover mounted on said flange to cover said receiving chamber and a tongue formed on the inner surface of said cover, said tongue being adapted to engage an element inserted in said receiving chamber upon opening of said hinged cover.

**5.** An electrical connector socket for a trailer comprising two major elements, a flange of conducting material and a base of insulating material for attachment to said flange, said flange having a circular recess formed in a surface thereof and said base having a generally matching recess formed in a surface thereof whereby a closed volume is formed by assembling said flange and said base together, a plurality of circuit breakers permanently fixed to said base and disposed in said closed volume, a plurality of conducting pins fixed in said base each said pin being electrically connected to one of said circuit breakers, said base having a cylindrical chamber formed therein, said conducting pins being disposed in parallel array in said chamber.

**6.** In an electrical connector socket for a trailer as defined in claim **5**, the combination therewith of a segment of conducting material disposed at an end of said chamber and electrically connected to said flange and a ground pin mounted on said segment and extending into said chamber in parallel relationship to said conducting pins.