Dec. 29, 1953 J. D. HARLIN 2,664,475

ELECTRICAL RECEPTACLE, PLUG, AND SWITCH

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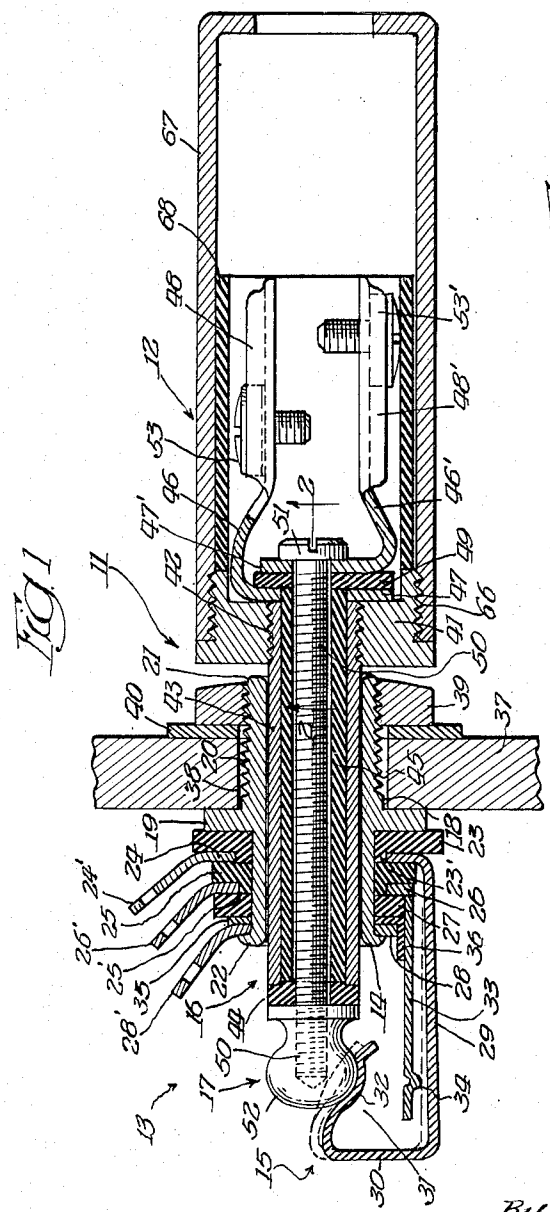

FIG. 1

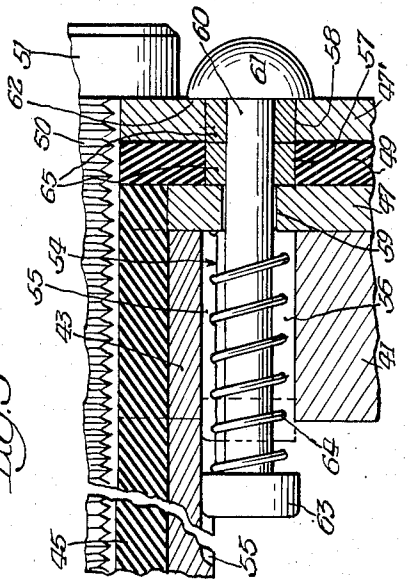

FIG. 3

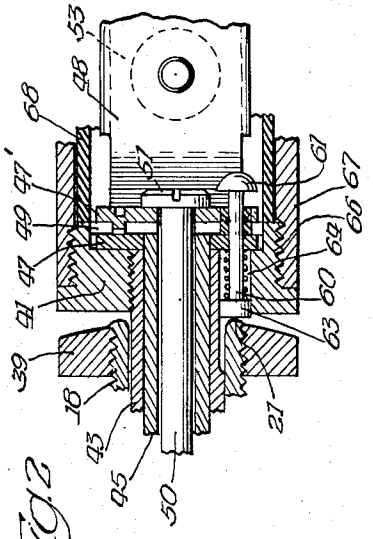

FIG. 2

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ELECTRICAL RECEPTACLE, PLUG, AND SWITCH

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The present invention relates in general to electrical circuit connections, and has more particular reference to an improved connector jack structure.

Connectors of the sort herein contemplated are commonly employed for the detachable interconnection of electrical impulse generating equipment with electrical translation systems of the sort commonly designated as public address systems, which normally include means for amplifying impulses received from the generating equipment for broadcast purposes. Plug-in jacks and like connector devices, when used with sound generators and amplifiers, frequently cause the production of undesirable squealing or screeching noises in the public address system if the active electrode of the conductor device accidentally comes into electrostatic relationship with an electrified object when disconnected from the jack receptacle or socket with which it is designed for interfitting connection. The mere accidental touching of the active electrode of a jack by a person in handling the same may result in the production of such undesirable noises in the broadcasting system with which the jack is electrically connected, since the person touching the active electrode of the jack constitutes an electrostatically charged object.

An important object of the present invention is to provide an electrical connector device having means incorporated therein for conditioning the same to prevent the production of screeching noises in a sound producing system with which it is connected, if and when the jack should come into noise producing relationship with an electrified body when disconnected from its receptacle socket.

Another important object is to provide a connector of the character mentioned with a simple, inexpensive, short-circuiting switch, normally serving to disable the jack when the same is disconnected from its cooperating receptacle socket, and operable upon insertion of the jack in its socket to condition the connector mechanism for operation in required fashion.

Another important object is to provide a jack plug with a normally closed short-circuiting switch, openable, upon insertion of the jack plug in its cooperating receptacle socket, to condition the connector device for normal operation.

The foregoing and numerous other important objects, advantages, and inherent functions of the invention will become apparent as the same is more fully understood from the following description, which, taken in connection with the

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accompanying drawings, discloses a preferred embodiment of the invention.

Referring to the drawings:

Fig. 1 is a sectional view through a jack plug and its cooperating receptacle socket, showing the parts in relatively connected position;

Fig. 2 is a sectional view taken substantially along the line 2—2 in Fig. 1, to illustrate plug conditioning means embodying the present invention; and

Fig. 3 is an enlarged sectional view of a portion of the structure shown in Fig. 2.

To illustrate the invention, the drawings show connector mechanism 11 comprising a jack plug 12 and a cooperating receptacle socket structure 13.

While the device of the present invention is particularly adapted for connecting a radio type amplifier with a musical instrument or the like, it will be obvious that the present invention is not necessarily limited to such use, but may have useful application wherever the facilities contemplated by the present invention may be desirable.

While the receptacle 13 may comprise any preferred construction providing a pair of relatively insulated electrodes 14 and 15 for engagement and electrical connection respectively with cooperating electrode elements 16 and 17 of the jack plug 12, the receptacle structure may be formed as shown in Fig. 1, in which the electrode 14 comprises a sleeve adapted to snugly and slidingly receive the electrode stem of the jack plug, for frictional engagement and electrical contact with the electrode element 16 thereof.

To this end, the electrode 14 may comprise a cylindrical element 18 of electrical conducting material, having a peripheral outstanding flange 19 medially of the ends thereof, the outer surfaces of the element 18 being screw threaded, as at 20, between the flange 19 and the outer end 21 thereof, the element 18, between the flange 19 and the opposite or inner end 22, being finished with a smooth, preferably cylindrical outer surface upon which a plurality of disk-like elements or washers may be assembled and secured in stacked relation.

These disk-like elements may include a washer 23 of suitable insulating material, snugly encircling the element 18 in position resting against and supported by the flange 19. If desired, the washer 23 may have a central embossment 23', forming an annular shoulder encircling the element 18 in position to support a disk 24 of electrical conducting material upon the washer 23,

in position concentric with respect to and insulated from the sleeve element 18. A washer 25 of insulating material may also be assembled upon the element 18 in position to hold the disk 24 in place on the washer 23. The washer 25 also may be provided with a central embossment 25', forming an annular shoulder encircling the element 18 in position to support a disk 26 of electrical conducting material upon the washer 25, in position concentric with respect to and insulated from the sleeve element 18. A washer 27 of insulating material may also be assembled upon the element 18 in position to hold the disk 26 in place on the washer 25. A disk 28 of electrical conducting material may also be assembled upon the element 18, in position resting against the washer 27, and the inner end 22 of the element 18 may be peened over upon the disk 28, as shown, in order to clampingly hold the disks and washers in assembled relationship upon the element 18 between the flange 19 and the peened end 22.

The disks 24, 26 and 28 may each respectively be provided with soldering lugs 24', 26' and 28' for electrically connecting the same, as with wave generating or other electrical translation means. The disk 24, also, may be provided with a resilient extension 29, comprising a finger extending from the edge of the disk in a direction parallel with respect to the axis of the sleeve element 18, said extension having an inwardly bent portion 30 and a portion 31 forming the electrode 15, said electrode portion being normally disposed opposite the end of the element 18, at an inclination with respect to the axis thereof, and formed with a cup-like depression 32 adapted to interfittingly engage and electrically contact with the electrode element 17 of the jack plug, when the same is fully positioned in the receptacle socket. When so engaged, the finger 29 and the electrode portion 31 occupy the positions shown in solid lines in Fig. 1; but normally occupy the position shown in dotted lines when the jack plug is retracted from the socket.

The disk 26 also may be provided with an extension forming a finger 33 extending adjacent and parallel with respect to the finger 29. One of said fingers may be provided with an offset projection 34 extending toward the other finger, in position to engage and make electrical contact therewith when the finger 29 is in the dotted line position, such contact being broken upon the insertion of the jack into operative position in the receptacle. If desired, also, a washer 35, of thin insulating material, may be secured on the element 18 between the disk 28 and the washer 27, said washer having a marginal tab 36 extending between the edge of the disk 26 and the finger 33 in order to assure against electrical contact therebetween.

The threaded portions 20 of the sleeve element 18 afford means for mounting the receptacle, as on a support panel 37, formed with an opening 38 sized to freely receive the threaded portion of the element 18, whereby said threaded portion may be inserted through the opening 38 in the panel and the receptacle assembly clamped upon the panel between the flange 19 and a clamping nut 39 applied to the projecting threaded end of the sleeve 18, a washer 40 being preferably assembled upon the panel, around the sleeve 18 behind the clamping nut 39. So mounted, the receptacle will be supported with the outer end 21 of the sleeve 18 in position exposed on one side of the panel for the reception of the stem of the jack plug 12 in the opening or channel provided by the sleeve element 18, said outer end 21 of the sleeve forming an annular shoulder defining the receptacle opening.

The jack plug 12, as shown, comprises a preferably circular plate or head 41, having a central opening 42 in which the end of a tube 43 of electrical conducting material is press fitted. This tube 43 extends axially of the head 41 and forms the electrode element 16 of the jack plug, said element being sized to frictionally fit within and electrically contact with the sleeve 18 of the receptacle socket. The end of the element 43 remote from the head 41 carries a washer 44 of insulating material; and the tube is fitted with a tubular lining 45 of insulating material preferably throughout its entire length from the washer 44 to and slightly beyond the opposite end of the tube 43.

A pair of connector elements 46, 46', of electrical conducting material, each having a disk portion 47, 47', and a conductor attaching lug 48, 48', are assembled in stacked relationship on the head 41 in concentric relation with the end of the tube 43. To this end, the disk 47 engages and electrically contacts with the head 41 and the connected end of the sleeve 43, the end of the insulating sleeve 45 extending within said disk, a washer 49 of insulating material overlies the disk 47, and the disk 47' overlies the washer 49, the parts being clampingly secured together by means of an elongated threaded stud 50 of electrical conducting material, having a head 51 overlying and electrically connecting the disk 47' and a shank extending through the tube 43 and the insulating sleeve 45, as well as the disk 44, and having threaded engagement and electrical contact with a generally spherical, knob-like element 52 of electrical conducting material forming the electrode element 17.

It will be seen from the foregoing that the electrode element 16 is electrically connected with the lug 46; that the electrode element 17 is electrically connected with the lug 46'; and that the said electrodes and lugs are relatively insulated by means of the washers 44 and 49 and the sleeve 45. The portions 48 and 48' of the lugs 46 and 46' may be fitted with clamping screws 53 and 53' for the electrical connection of the electrodes 16 and 17 with conductors leading to a sound reproducing system, in order to connect the system with a sound impulse generator, of which the receptacle structure forms an outlet, by inserting the jack plug in operative circuit forming position in the socket.

As a safety measure, the electrode element 16 and its connection terminal 48 should be connected with the low or grounded side of the translation system with which it is used; and the electrode element 17 should be connected with the high, active or hot side of the system. When so connected, conditions resulting in the production of howling noises in the sound producing device of the system will be established if the hot electrode element 17 comes into electrostatic relationship with an electrified object, as when said electrode is touched by the person handling the jack plug, or if the hot electrode is accidentally or otherwise brought into engagement with, or into close proximity to, any electrified body, and particularly bodies having an electrostatic or condenser action.

In order to eliminate the unwanted production of such howling or screeching noises, the

present invention contemplates the provision of means for conditioning the jack plug to render it incapable of causing such noises when accidentally touched, or otherwise brought into proximity with electrified objects, at all times when it is disconnected from the cooperating receptacle socket structure. To this end, as shown more particularly in Figs. 2 and 3, a channel 54, having an axis parallel with respect to the axis of the plug prong, is formed through the head 41, the terminal disks 47 and 47', and the insulating washer 49. This channel is disposed in position so that, when the jack plug is inserted in the socket structure, the axis of the channel is in alinement with the rim 21 of the socket structure, regardless of the relative angularity of the plug with respect to the socket structure; and said channel may be formed partially in the sleeve member 43, which may have a groove 55 forming a part of the channel. The portions 56, 57 and 58 of the channel 54, which extend respectively in the head 41, the disk 47', and the washer 49, are relatively large as compared with the channel portion 59 through the disk 47.

A pin or stem 60 of electrical conducting material, sized to snugly, yet slidingly fit the channel portion 59, is mounted in the channel. Said pin has a head 61 at one end overlying the end of the channel opening through the disk 47', so that the marginal portions of said head may engage and make electrical contact with the disk 47' at a seat 62 formed thereon at and around the end of the channel. The opposite end of the stem 60 is also provided with an integral head 63 which projects beyond the opposite end of the channel, which opens on the face of the head 41. Resilient means, preferably a helical spring 64 encircling the stem 60, within the channel portion 56, and bearing at its opposite ends upon the head 63 and the disk 47 around the channel portion 59, is provided to normally urge the stem 60 in the channel in a direction to engage the head 61 on the seat 62.

From the foregoing, it will be seen that the stem 60 will at all times be electrically connected with the disk 47, and hence with the electrode element 16 and the connection terminal 48. The stem will also be electrically connected through the head 61 with the disk 47', and hence with the electrode element 17 and the connection terminal 48', so long as the head 61 is in electrical engagement with the seat 62, under the influence of the spring 64. Upon the insertion of the jack plug 12 fully into the socket structure, into position therein engaging the electrode elements 15 and 17, the head 63 of the pin 60 will engage and be depressed by the rim 21 of the socket structure. When so depressed against the influence of the spring 64, the pin will be axially shifted in the channel 54 in a direction to disengage the head 61 from the seat 62, thereby breaking electrical connection of the pin with the disk 47', the electrode element 17, and the connection terminal 48'.

It will be noted that the pin 60 is guided in the channel 54 by snug, sliding engagement within the channel portion 59, and hence is held in position out of contact with the disk 47' except when the head 61 is in engagement with the seat 62. If desired, a sleeve or sleeves 65 of insulating material may be disposed around the stem 60 within the enlarged channel portions 57 and 58, in order to assure the insulation of the stem from the disk 47'; and the channel portion 57 in the insulating washer 49 may, of course, be formed to snugly receive the stem 60, if desired.

The head 41 may be threaded, as at 66, for detachable engagement with a preferably cylindrical cover member 67, and a sleeve of insulating material 68 may be disposed within the cover member in position enclosing the connection terminals 48 and 48'.

The operation of the pin 60 in the manner described serves to electrically interconnect, and thus short-circuit, the hot electrode with the grounded electrode of the plug, at all times when the jack plug is disconnected from its cooperating socket structure, thereby assuring against the production of howling noises in the sound reproducing system with which the plug is used. Whenever the jack is in operative position in its cooperating socket structure, the electrode elements 16 and 17, however, are and remain electrically disconnected for normal circuit forming operation.

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the form herein disclosed being a preferred embodiment for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

1. An electrical connector comprising a jack plug device having a body and a projecting prong formed for interfitting engagement with a cooperating connector structure having a prong receiving cavity and a rim defining the open end of said cavity, said prong comprising a pair of relatively insulated contact elements adapted for connection making contact with corresponding contacts of the cooperating connector structure when interfitted therewith, a stem of electrical conducting material mounted on said body, electrically connected with one of said contact elements and axially slidable into and out of electrical connection with the other contact element, and means yieldingly urging said stem normally into engagement with said other contact element and to present an end of said stem in position projecting from a face of said device for stem depressing engagement with the rim of the cooperating connector structure, to disconnect said stem from said other contact element when said device is interfittingly engaged with said cooperating connector structure.

2. An electrical connector device, formed for interfitting engagement with a cooperating connector structure and comprising a pair of relatively insulated contact elements adapted for connection making contact with corresponding contacts of the cooperating connector structure when interfitted therewith, a pair of stacked members electrically connected respectively with said contact elements, a layer of insulation disposed between said members, said layer and members having a channel therethrough, a stem of electrical conducting material axially slidable in said channel in electrical contact with one of said members and out of electrical contact with the other member, said stem having a head adapted to engage and disengage a seat formed on said other member, and spring means normally urging said stem in a direction to engage said head with said seat at one end of said channel, whereby to electrically connect said members

through said stem and seated head, and to project the head remote end of the stem at the opposite end of the channel in position for stem depressing engagement with the cooperating connector structure, to disconnect said head from said seat and electrically isolate said members when the device is interfittingly engaged with said cooperating connector structure.

3. An electrical connector comprising a plug device having a pair of relatively insulated contact elements and a cooperating receptacle socket structure adapted for interfitting engagement with said plug to electrically connect the contact elements thereof respectively with cooperating contacts of the socket structure, said plug embodying a pair of stacked members electrically connected respectively with said contact elements, a layer of insulation disposed between said members, said layer and members having a channel therethrough, a stem of electrical conducting material axially slidable in said channel in electrical contact with one of said members and out of electrical contact with the other member, said stem having a head adapted to engage and disengage a seat formed on said other member, and spring means normally urging said stem in a direction to engage said head with said seat at one end of said channel, whereby to electrically connect said members through said stem and seated head, and to project the head remote end of the stem at the opposite end of the channel in position for stem depressing engagement with the cooperating connector structure, to disconnect said head from said seat and electrically isolate said members when the device is interfittingly engaged with said cooperating connector structure.

4. An electrical connector comprising a jack plug device having a body and a projecting prong providing a pair of relatively insulated contact elements respectively at the body remote end of and in the lateral portions of said prong, and a receptacle socket structure having a rim defining a cavity for interfittingly receiving said prong and providing contacts for electrical connection respectively with the said contact elements of the jack plug, a pair of stacked members electrically connected respectively with said contact elements, a layer of insulation disposed between said members, said layer and members having a channel therethrough, a stem of electrical conducting material axially slidable in said channel in electrical contact with one of said members and out of electrical contact with the other member, said stem having a head adapted to engage and disengage a seat formed on said other member, and spring means normally urging said

stem in a direction to engage said head with said seat at one end of said channel, whereby to electrically connect said members through said stem and seated head, and to project the head remote end of the stem at the opposite end of the channel in position for stem depressing engagement with said rim, to disconnect said head from said seat and electrically isolate said members when the device is interfittingly engaged with said cooperating connector structure.

5. An electrical connector comprising a jack plug device having a body and a projecting prong formed for interfitting engagement in a prong receiving cavity of a cooperating receptacle socket structure, said device comprising a pair of relatively insulated contact elements, including a sleeve and a knob respectively forming the sides and the body remote end of the prong and positioned to make electrical connection with corresponding contacts of the socket structure when interfitted therewith, a pair of stacked members on said body and electrically connected respectively with said contact elements, a layer of insulation disposed between said members, said body, layer and members having a channel therethrough, a stem of electrical conducting material axially slidable in said channel in electrical contact with one of said members and out of electrical contact with the other member, said stem having a head adapted to engage and disengage a seat formed on said other member, and spring means normally urging said stem in a direction to engage said head with said seat at one end of said channel, whereby to electrically connect said members through said stem and seated head, and to project the head remote end of the stem from said body at the opposite end of the channel in position for stem depressing engagement with the cooperating connector structure, to disconnect said head from said seat and electrically isolate said members when the device is interfittingly engaged with said cooperating connector structure.

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