Dec. 3, 1957 K. J. HUTCHINGS 2,815,494

JACK CONNECTOR WITH RESILIENT WALL

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FIG. 1

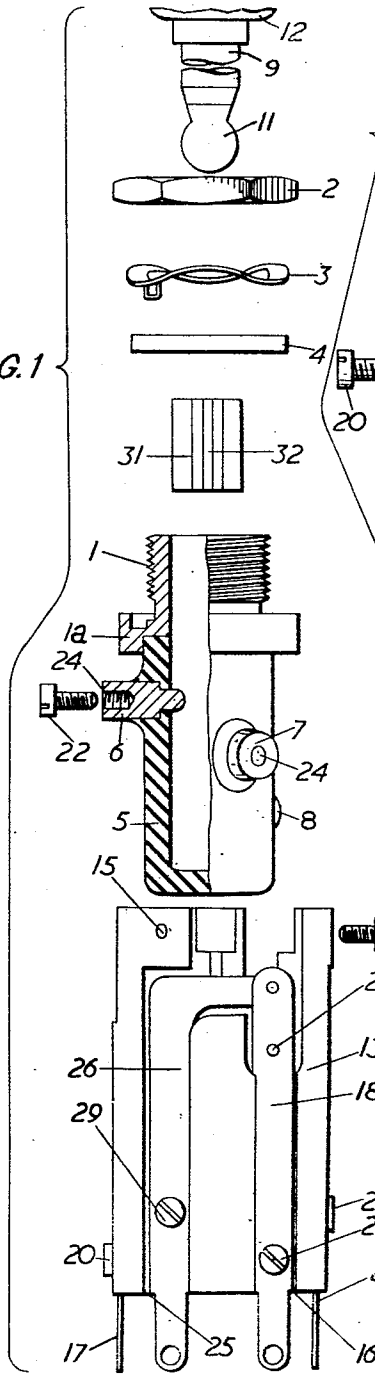


FIG. 2.

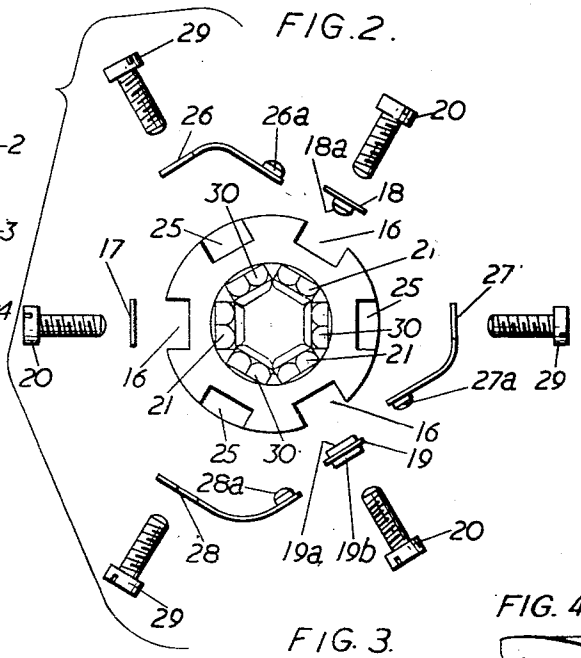


FIG. 3.

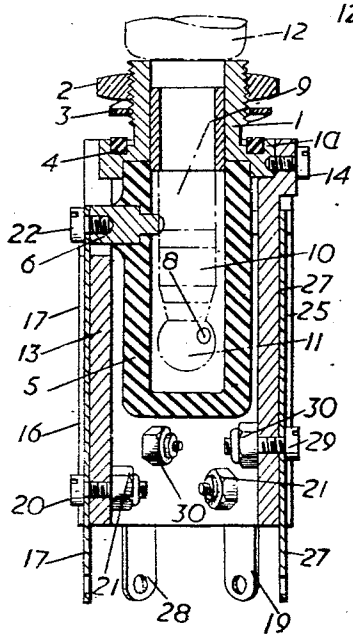
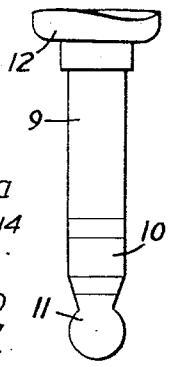


FIG. 4



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JACK CONNECTOR WITH RESILIENT WALL

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14 Claims. (Cl. 339—61)

The present invention relates to electrical connectors of the kind which are commonly called "telephone jacks" and comprise a socket having plural electric contacts adapted to be engaged by contacts on a plug which is adapted to be inserted in the socket. Such jacks are commonly employed for the plug-in connection of telephones, microphones, telephone lines and other instruments or circuits. Such jacks normally comprise an apertured boss or member which forms part of or is adapted to be secured to a panel or a wall of a casing or housing and behind which are arranged spring contact sets adapted to be engaged with the contacts on the plug when the latter is inserted through the aperture in the boss. The aperture in the boss forms an open passage between the front and rear sides of the panel, which makes known jacks unsuitable for fitting into equipment of which the casing has to be closed or sealed against the ingress of rain, moisture, sand or the surrounding atmosphere.

The present invention has for its object to provide a sealed jack, that is one in which the aperture in the boss into which the plug is inserted is entirely closed in behind the panel so that moisture, dirt or the atmosphere cannot pass through this aperture to reach the equipment behind the panel.

According to the present invention, the apertured boss or member has a fluid-tight sack or bag of rubber or other resilient and fluid impervious material extending rearwardly thereof with the cavity in the sack connecting in fluid-tight manner with the aperture in the boss or member, one or more jack contacts, with which the plug is adapted to engage, being secured in a fluid-tight manner through the wall of the sack to extend from the internal to the external surface thereof. By means of this construction, the aperture through the boss or member is completely closed on its rear side by the sack, the resilience of which allows the jack contacts to move outwardly upon the insertion of the plug. According to a feature of the invention, springs, preferably leaf springs, are arranged externally of the sack and bear upon the contacts to assist in holding them in firm engagement with the plug contacts. The movement of the jack contacts may also be used to actuate further contacts, for example spring contact sets, arranged externally of the sack.

The fluid-tight connection between the sack and the apertured member is preferably effected by bonding the natural or synthetic rubber of the sack to the metal of the member by known rubber bonding techniques. Similarly, the jack contacts which pass through the wall of the sack are preferably sealed therein by rubber-to-metal bonding.

In one embodiment, a contact support member made of rigid insulating material is carried from the rear of an apertured boss and is of generally tubular form to surround the sack, the bore of this support member being sufficiently large to allow the side walls of the sack to distend to allow the jack contacts to move when the plug is inserted therein. The contacts passing through the wall of the sack are attached at their outer ends, that is the ends which project away from the external surface of the sack, to leaf springs secured to the support member. The attachment may be effected by means of screws passing through apertures in the leaf springs and into threaded apertures on the outer ends of the jack contacts. These springs may be arranged longitudinally of the support member and spaced around its external surface. They serve to restrain distortion of the shape of the sack and to hold the inner ends of the contacts in firm engagement with the contacts on the plug when the latter is inserted therein. The leaf springs also constitute the terminals for connection to the jack contacts.

One or more additional contacts may be carried by the support member and be adapted to be engaged by the leaf springs, or contact points thereon, when the leaf springs move in consequence of the insertion or withdrawal of the plug. These additional contacts may be carried by further leaf springs, and may effect "make" or "break" or "changeover" connections upon the insertion of the plug.

The bore of the aperture in the boss may be provided with a channel in its surface to allow any water which may have entered the interior of the sack to be ejected upon the insertion of the plug. Alternatively, the bore of the boss may be fitted with a sleeve of insulating material which may be formed with one or more flats on its external periphery so as to allow one or more gaps between the sleeve and the bore of the boss through which the water may be expelled.

In order that the invention may be more clearly understood, reference will now be made to the accompanying drawings in which:

Figure 1 shows an exploded side view of the components of the jack and plug, some of which are shown partly in section,

Figure 2 shows an exploded end view,

Figure 3 is a side section through the jack when the parts are assembled together, and Figure 4 is a view of a jack plug for use with the jack.

Referring to the drawing, the device comprises an apertured metal boss **1**, having a threaded portion and a shoulder portion **1***a*, the threaded portion being adapted to be inserted through an aperture in the panel or the like so that the boss can be secured in position by means of a nut **2**, a spring washer **3** and a sealing washer **4**, for example of rubber. In a recess at the inner side of the shoulder portion **1***a* of the boss is bonded a rubber sack **5**, through the wall of which are also bonded three metal contacts **6**, **7**, **8**, so that their inner ends project inside the sack. These contacts **6**, **7** and **8** are disposed equi-angularly around the sack and are spaced longitudinally thereof so that they will engage respectively with the "sleeve" **9**, "ring" **10** and "tip" **11** contacts respectively of the plug **12** which is shown in Figure 4 of the drawing. The sack **5** may conveniently be made of an acrylonitrile synthetic rubber.

The shoulder portion **1***a* of the boss is adapted to be inserted into the end of a support member **13** moulded in tubular form of insulating member material, and be secured therein by screws **14** which pass through apertures **15** in the end of the support member and into threaded apertures in the shoulder portion **1***a* of the boss. The support member **13** surrounds the sack **5** with a small clearance. Disposed in axially extending grooves **16** arranged equi-angularly around the external surface of the member **13** are three leaf springs **17**, **18**, **19** which are secured to the member **13** adjacent its rear end by screws **20** and nuts **21**. The leaf springs **17**, **18**, **19** are connected respectively to the contacts **6**, **7** and **8** by small screws **22**

which extend through apertures **23** in the springs and screw into threaded apertures **24** in the outer ends of the contacts.

In further longitudinal grooves **25** on the external periphery of the member **13** and disposed intermediate the grooves **16** are three further leaf springs **26**, **27** and **28** which are secured in their respective grooves **16** by screws **29** and nuts **30**. These further leaf springs are L-shaped with their transversely extending limbs at their ends which are adjacent the boss **1**. The end of spring **26** fits beneath the end of spring **18**; both of the ends are provided with silver or equivalent contacts **26***a*, **18***a*. The end of spring **27** fits beneath the end of spring **19** and the end of spring **28** above the end of spring **19**, the spring **19** being provided with silver contacts **19***a*, **19***b* on both its surfaces which are adapted to engage with silver contacts **27***a*, **28***a* on the springs **27** and **28** respectively. When the plug is not inserted in the jack, the contacts **18***a* and **26***a* engage as do also the contacts **19***a* and **27***a*. When the plug is inserted, the jack contacts **7** and **8** move outwardly thus moving springs **18** and **19** outwardly; thus the contact **18***a* on the spring **18** moves out of engagement with the contact **26***a* on spring **26** and likewise the contact **19***a* of spring **19** moves from engagement with contact **27***a* and contact **19***b* moves into engagement with contact **28***a*.

Into the bore of the aperture in the boss **1** is fitted a split tube **31** of insulating material, such as the material known under the registered trademark "Bakelite," having a flat **32** formed on its external surface so as to allow space through which water may be ejected from the sack upon the insertion of the plug **12** into the jack.

While a particular embodiment has been described, it will be understood that various modifications may be made without departing from the scope of the invention. Thus some or all of the additional springs **26**, **27** and **28** can be dispensed with or other arrangements of the springs may be devised for effecting different switching connections upon the insertion and withdrawal of the plug. Furthermore, the boss need not be made of metal, and could, if desired, be made integral with the sack. The rigidity of the boss could be increased by the inserted tube **31**, or by incorporating a reinforcing insert in the boss portion.

I claim:

1. An electrical socket connector comprising a member having an aperture, a sack of resilient and fluid-impervious material, said sack having a cavity which is closed at one end and open at the other, said open end being connected in fluid-tight manner to the apertured member with the cavity substantially aligned with the aperture, and a plurality of jack contacts secured in fluid-tight manner through the wall of the sack and extending from the internal surface to the external surface thereof, said jack contacts being spaced along the wall of the sack, the resiliency of the sack allowing said contacts to move outwardly upon the insertion of a plug in said cavity.

2. Connector as claimed in claim 1, wherein at least one spring is arranged externally of the sack, said spring bearing upon and being electrically connected to the outer end of the jack contact and including terminal means for making an external connection to said jack contact.

3. Connector as claimed in claim 2, wherein said spring forms part of a spring contact set arranged externally of the sack, the movement of the jack contact actuating the spring contact set.

4. Connector as claimed in claim 1, wherein the sack is of cylindrical form and is surrounded by a contact support member of generally tubular form, the bore of the support member being sufficiently large to allow the sack to distend to allow the jack contact to move when the plug is inserted, the outer end of the jack contact being attached and electrically connected to a leaf spring which is secured to the support member and terminal means on said leaf spring for making an external connection to said jack contact.

5. Connector as claimed in claim 4, wherein at least one additional contact is carried by the support member and is adapted to make and break contact with the leaf spring in dependence upon the movement of the leaf spring.

6. An electrical socket connector comprising a member having an aperture, a sack of resilient and fluid-impervious material, said sack having a cavity which is closed at one end and open at the other, said open end being secured in fluid-tight manner to the apertured member with the cavity substantially aligned with the aperture, a plurality of jack contacts secured in fluid-tight manner through the wall of the sack and extending from the internal surface to the external surface thereof, said jack contacts being spaced along the wall of the sack, a contact support member secured to said apertured member, a plurality of leaf springs secured to said support member, and means connecting the free ends of said leaf springs respectively to the outer ends of the jack contacts.

7. A connector as claimed in claim 6, comprising also at least one additional leaf spring carried by said support member with its free end overlying a movable part of one of said leaf springs, and contact points respectively on the overlying parts of said one leaf spring and said further leaf spring.

8. An electrical socket connector comprising a boss having an aperture, a sack of cylindrical form of resilient and fluid-impervious material, said sack having a longitudinal cavity which is closed at one end and open at the other, said open end being secured in fluid-tight manner to the boss with the cavity substantially aligned with the aperture in the boss, a plurality of jack contacts secured in fluid-tight manner through the wall of the sack and extending from the internal surface to the external surface thereof, said jack contacts being spaced along and radially around the wall of the sack, a contact support member of generally tubular form secured to said boss and surrounding the sack, a plurality of leaf springs secured in radial positions around said support member, and means connecting the free ends of said leaf springs respectively to the outer ends of the jack contacts.

9. A connector as claimed in claim 8, comprising also at least one additional leaf spring carried by said support member with its free end overlying a movable part of one of said leaf springs, and contact points respectively on the overlying parts of said one leaf spring and said further leaf spring.

10. A plug and socket connector comprising a socket consisting of a member having an aperture, a sack of resilient and fluid-impervious material, said sack having a cavity which is closed at one end and open at the other, said open end being secured in fluid-tight manner to the apertured member with the cavity substantially aligned with the aperture, a plurality of jack contacts secured in fluid-tight manner through the wall of the sack and extending from the internal surface to the external surface thereof, said jack contacts being spaced along the wall of the sack, and a plug having a stem adapted to be inserted through said aperture into the cavity in the sack, said stem comprising contacts which are insulated from one another and are adapted respectively to engage, when the plug is inserted in the socket, the inner ends of the jack contacts within the sack and to move the jack contacts radially outwards, the resilience of the sack permitting the jack contacts to move while holding the jack contacts in engagement with the plug contacts.

11. A plug and socket connector comprising a socket consisting of a member having an aperture, a sack of elongated form of resilient and fluid-impervious material, said sack having a longitudinal cavity which is closed at one end and open at the other, said open end being secured in fluid-tight manner to the apertured member with the cavity substantially aligned with the aperture, a plurality of

jack contacts secured in fluid-tight manner through the wall of the sack and extending from the internal surface to the external surface thereof, said jack contacts being spaced along the wall of the sack, a contact support member of generally tubular form secured to said apertured member and surrounding the sack, a plurality of leaf springs secured to said support member, means connecting the free ends of said leaf springs respectively to the outer ends of the jack contacts, and a plug having a stem adapted to be inserted through said aperture into the cavity in the sack, said stem comprising contacts which are insulated from one another and are adapted respectively to engage, when the plug is inserted in the socket, the inner ends of the jack contacts within the sack and to move the jack contacts radially outwards, the resilience of the sack and the leaf springs permitting the jack contacts to move while holding the jack contacts in firm engagement with the plug contacts.

12. A plug and socket connector comprising a socket consisting of a metal boss having an aperture, a sack of cylindrical form of resilient and fluid-impervious rubber material, said sack having a longitudinal cavity which is closed at one end and open at the other, said open end being bonded in fluid-tight manner to the metal boss with the cavity substantially aligned with the aperture in the boss, a plurality of jack contacts bonded in fluid-tight manner through the wall of the sack and extending from the internal surface to the external surface thereof, said jack contacts being spaced along and radially around the wall of the sack, a contact support member secured to said boss and surrounding the sack, a plurality of leaf springs secured in radial positions around said support member, means connecting the free ends of said leaf springs respectively to the outer ends of the jack contacts, at least one additional leaf spring carried by said support member with its free end overlying a movable part of one of said leaf springs, contact points respectively on the overlying parts of said one leaf spring and said further leaf spring, a sleeve in the bore of the boss and providing a passage between the sleeve and the said bore which connects the cavity to the external atmosphere, and a plug having a stem adapted to be inserted through said sleeve into the cavity in the sack, said stem comprising contacts which are insulated from one another and are adapted respectively to engage, when the plug is inserted in the socket, and the inner ends of the jack contacts within the sack and to move the jack contacts radially outwards, the resilience of the sack and the leaf springs permitting the jack contacts to move while holding the jack contacts in firm engagement with the plug contacts, and the movement of the jack contact connected to said one leaf spring effecting circuit closing and opening movement between said contact points.

13. An electrical socket connector comprising a member having an aperture, a sack of resilient and fluid impervious material, said sack having a longitudinal substantially cylindrical cavity which is closed at one end and open at the other, said open end being connected in fluid-tight manner to the apertured member with the cavity substantially aligned with the aperture and a plurality of jack contacts secured in fluid-tight manner through the wall of the sack and extending from the internal surface to the external surface thereof, said jack contacts being spaced along and radially arranged around the wall of the sack.

14. An electrical socket connector comprising a member having an aperture, a sack of resilient and fluid impervious material, said sack having a longitudinal substantially cylindrical cavity which is closed at one end and open at the other, said open end being connected in fluid-tight manner to the apertured member with the cavity substantially aligned with the aperture, and at least one jack contact secured in fluid-tight manner through the wall of the sack to extend from the internal surface to the external surface of said sack, said at least one jack contact being formed with a contact head portion projecting from the adjacent internal surface of the sack into said cavity and terminal means at the other end of said at least one jack contact located externally of said sack, the resiliency of the sack allowing said at least one contact to move outwardly upon the insertion of a plug in said cavity.

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