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2,696,535

SOCKET AND CONTACT

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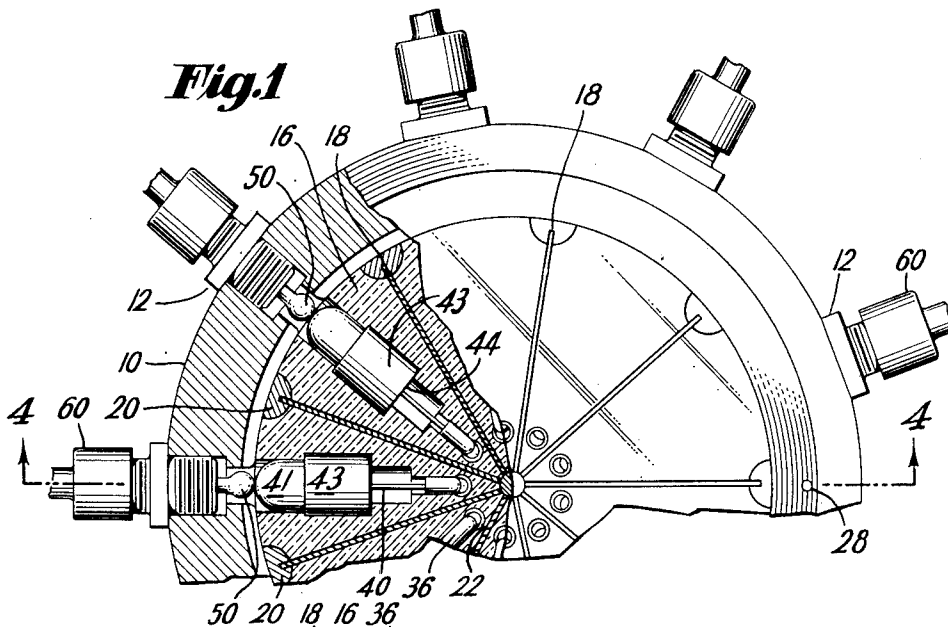


Fig.1

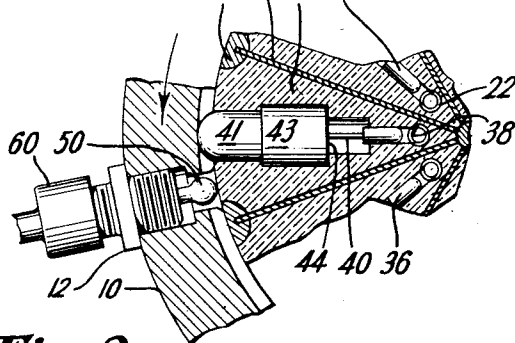


Fig. 2

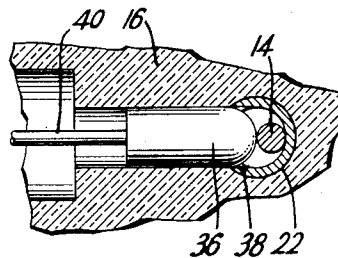


Fig. 3

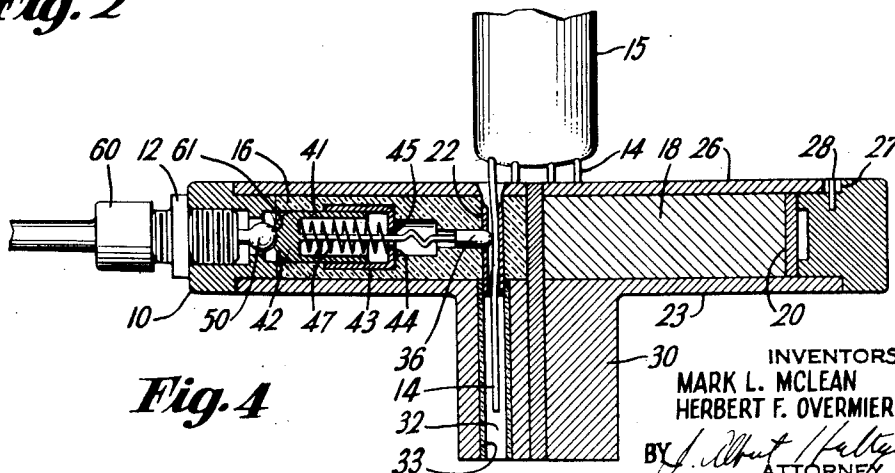


Fig. 4

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SOCKET AND CONTACT

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The present invention relates to plug in sockets and more particularly to a socket device for testing subminiature tubes which are provided with long, somewhat flexible wire terminal leads rather than heretofore conventional contact prongs.

An object of the present invention is the provision of an improved socket for subminiature tubes.

Another object of the present invention is the provision of an improved socket for making connections to terminals of an electrical device, particularly when making capacity measurements between the internal elements associated with the terminals of the device.

Still another object of the present invention is the provision of a socket device into which flexible terminal leads may be plugged.

Still a further object of the present invention is the provision of a socket device having means for relieving the contact spring pressure to facilitate the insertion of terminals of a device to be tested into the socket.

The foregoing objects and others which may appear from the following detailed description are attained in accordance with an aspect of the present invention by providing a test socket having a number of terminal or lead receiving apertures properly spaced to receive the long, flexible wires serving as lead-in wires for a subminiature tube.

Each aperture is preferably lined with a conductive sleeve having a side aperture therein, through which a spring pressed pressure member may protrude to securely grip the terminal or lead-in wire between it and the opposing side wall of the tube. Camming means are provided for each of the spring plungers, so the spring pressure of the plungers may be selectively applied or released. In the position of the camming means which relaxes the spring pressure, the through apertures in the conductive sleeves by means of which contact is made to the lead-in wires of the tube are substantially free and clear, so that the wires may be inserted to their full length with no tendency to bend or buckle. After the tube is inserted, an operation of the cam operating means applies the spring pressure to all of the plungers simultaneously, thus positively making electrical connection between the contact tubes and the lead-in wires.

Since the present socket arrangement is primarily designed for capacity measurement purposes, each contact sleeve is as completely as possible electrically shielded from the exterior and from every other contact sleeve by conductive walls, and coaxial cable connectors are provided in connection with each of the spring pressed plungers whereby a capacity measuring bridge or the like may be connected across any pair of internal elements of the tube.

The present invention will be more fully understood by reference to the following detailed description which is accompanied by a drawing in which

Figure 1 illustrates in partial plan view and partially in section an embodiment of the present invention with the top shield plate removed, while

Figure 2 is a fragmentary showing of a part of Figure 1 in a different operating position.

Figure 3 is an enlarged view of a detail of Figure 1, and

Figure 4 is a sectional view taken along line 4—4 of Figure 1 but with the top shield in position.

The partial plan view shown in Figure 1 shows an outer metal ring 10 having a number of coaxial cable connectors 12 equally spaced about the ring and extending ra-

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dially through the ring. The connectors are of conventional construction, having an outer threaded sleeve and a coaxially arranged inner conductor each of which carries an end contact 50. The number of coaxial cable connectors is equivalent to the maximum number of lead-in conductors 14 of any tube which is to be tested. One such tube is shown at 15 in Figure 4. Within ring 10 there is carried an inner assembly, including a number of pie-shaped sections of insulating material 16, each separated from the other by conductive fins 18. The fins 18 come together at a common point at the center of the inner assembly, and are conductively joined, while at the outer ends the fins are supported by posts 20. Regularly spaced around the circumference of a circle, centered at the junction of the fins 18, are a number of tubular contact members or sleeves 22, one between each pair of fins 18. Posts 20 which terminate the outer ends of fins 18 are rigidly secured to or are an integral part of bottom plate 23 (Fig. 4), which is received in a rabbet around the lower inner edge of ring 10. Similarly, the top of the central area of the socket is covered by a metal plate 26, (Fig. 4), the outer edge of which is received in a rabbet around the upper, inner edge of ring 10. Plates 23 and 26, being secured, as by screws threaded into posts 20 or otherwise, to the central structure of the socket and being rigidly separated thereby form a guiding track permitting ring 10 to rotate about the center of the device. The rotation of ring 10 is limited to the desired amount, by means of a slot 27 provided near the outer edge of plate 26 in which a pin 28, carried by ring 10, plays. Bottom plate 23 may be provided with a central conductive stud 30 by means of which contact to the ground terminal of the capacity measuring bridge (not shown) may be made. Plates 26 and 23 are provided with apertures in alignment with contact tubes 22. The apertures in bottom plate 23 extend into the central stud 30 as shown at 32 in Figure 4, and are preferably lined with insulating material, such as glass tubes 33, so that lead-in conductor 14 may not contact the conductive walls of aperture 32. The apertures in plate 26 which are in alignment with contact sleeves 22 are preferably somewhat larger than the outside diameter of contact sleeves 22, and are countersunk for the purpose of avoiding accidental contact between plate 26 and sleeve 22 and for facilitating the insertion of lead-in conductors 14 into the contact sleeves.

Positive electrical contact between lead-in conductors 14 and the contact sleeves 22 is provided by spring pressed contact plungers 36 which enter contact sleeves 22 laterally through side apertures 38. From an inspection of Figure 3, it will be seen that the lead-in conductor 14, shown in this figure in section, is tightly pressed against the interior wall of contact sleeve 22 by the action of plunger 36. Good electrical connection is thus assured. However, if the spring action of plunger 36 is not relaxed when a tube is to be inserted it will be found that the long, lead-in wires or terminals 14 tend to buckle when they encounter the plunger 36 and the insertion of tube 15 into the test set is greatly hampered. Therefore, the rear end of spring wire 40, which supplies the spring force to plunger 36, is carried by a sleeve 41 which has a closed end 42. Sleeve 41 is in turn slidably received by a second sleeve 43 having a closed end 44 provided with central aperture 45, through which spring wire 40 passes. A light spring 47 tends to urge sleeves 41 and 43 apart, thus tending to draw plunger 36 out of the contact sleeve 22. The center conductors of each of the coaxial connectors 12 each carry a ball end contact 50, which, when it is in alignment with the closed end 42 of sleeve 41, forces the sleeve radially inwardly against the pressure of spring 47, whereby plunger 36 is forced into contact sleeve 22 and into engagement with conductor 14. This is the situation shown in Figures 1 and 4. However, when ring 10 is rotated counterclockwise to a position as shown in Figure 2, the ball end 50 clears end 42 of sleeve 41, allowing spring 47 to press sleeve 41 to the left in Figure 2 as far as it will go. Plunger 36 is thereby withdrawn from contact sleeve 22, whereby lead-in conductor 14 may be freely inserted.

In utilizing the test adapter of the present invention, stud 30 of the device is first seated in a socket in the

capacity test set, which is adapted to receive it, ring 10 is then turned counterclockwise until pin 28 engages one end of slot 27, when it is known that each of the contact sleeves 22 are open and clear. An electron tube 15 or other device to be tested then has its leads straightened and arranged in a circle corresponding to the diameter of the circle defined by contact sleeves 22, the conductors are introduced into the contact sleeves 22 a distance such that a minimum length of the lead-in conductors 14 is exposed. Ring 10 is then rotated in a clockwise direction until pin 28 engages the other end of slot 27. In this position, each of the ball ends 50 of the central conductors of the coaxial connectors 12 are in coaxial alignment with sleeves 41 and press them radially inward, whereby plungers 36 enter apertures 38 in contact sleeves 22 and make good electrical contact between conductors 14 and the plunger. Thereafter, coaxial cable ends, such as the one illustrated at 60 in Figures 1 and 2 are connected to those of the coaxial cable connectors 12 which are connected to the elements of tube 15 between which it is desired to make capacity measurements. All of the remaining coaxial cable connectors 12 are then preferably capped by short circuited sections of coaxial transmission line, whereby the tube electrodes to which they are connected are brought to ground potential. That is, they are all electrically connected to ring 10. By suitably shifting the coaxial lines which are associated with the capacity testing instrument with relation to the connectors 12 it is possible to measure the capacity between any pair of adjacent elements in the tube. It should be understood that in making capacity measurements, a bridge arrangement is employed which is sensitive substantially only to the capacity between a pair of connections to selected coaxial connectors 12. In general, and within limits, the bridge is not sensitive to capacity between each of these terminals and ground represented by the conductive casing of the socket of the present invention. Therefore, the fact that the capacity between the casing of the socket and the contacts may be rather large does not influence the measurement of the capacity between a chosen pair of leads 14.

In order to provide a positive locking position for outer ring 10 when it is in its clockwise position pressing the spring plungers 36 into the connector sleeves 22, the closed ends 42 of slidable sleeves 41 may be provided with a concave portion as indicated at 61 in Figure 4. The concavity 61 cooperates with the ball end 50 of the inner conductor of the coaxial transmission line connectors to act as a detent to hold ring 10 in its operating position.

The main body portion of the test socket may be formed by casting plastic insulating material 16 in a cavity containing the prearranged shielding members 18, or by molding the individual sections under pressure, and thereafter drilling out the holes for the spring plungers. Alternatively, individual molded or machined segments of insulating material 16 may have the shielding members 18 painted, sprayed or plated onto the surface. The individual segments thus produced may be internally drilled and machined to receive the spring pressed plunger arrangement and thereafter the individual sections may be joined together to form a single unitary central body.

While the foregoing description has been predicated on the assumption that the socket is particularly adapted to test long, lead subminiature tubes, it is evident that short, lead tubes may be tested equally well. By rearranging the number of contact sleeves 22 and their disposition and size, a test socket may be constructed which may be adapted for any type of tube. Where tubes having short flexible leads or conventional socket bases are to be tested, the provision of the deep cavity 32 for accommodating the excess lead length may be unnecessary and may be omitted if desired.

While we have shown and particularly described a number of modifications of the present invention, it should be clearly understood that our invention is not limited thereto, but that modifications may be made.

What we claim is:

1. A connector terminal including a contact sleeve adapted to receive a conductive wire, a side aperture in said sleeve, a resilient plunger arranged to enter said aperture laterally of said sleeve, a pair of telescoping hollow cylinders arranged about said plunger, a spring between said cylinders urging said plunger away from said contact sleeve, and cam means for overcoming the effect of said spring whereby said plunger is resiliently pressed into said side aperture to bind said wire in said sleeve.

2. A connector terminal including a contact sleeve adapted to receive a conductor wire, a side aperture in said sleeve, a resilient plunger passing through said aperture and adapted to grip said wire between said plunger and the opposite side wall of said sleeve, a spring urging said plunger out of said aperture, and cam means for disabling said spring to cause said plunger to grip said wire.

3. A test socket including a number of contact sleeves arranged in a circle, radially arranged springs pressing plungers through lateral apertures in said sleeves, further springs arranged to withdraw said plungers from said sleeves, and cam means for simultaneously disabling said further springs whereby said plungers enter said sleeves, said means including a rotatable ring about the interior of said socket and insulated contact fingers carried by said ring and adapted to be moved into alignment with said further springs.

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