

Feb. 25, 1941.

M. ALDEN

2,233,067

CONTACT PLUG

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Fig. 1.

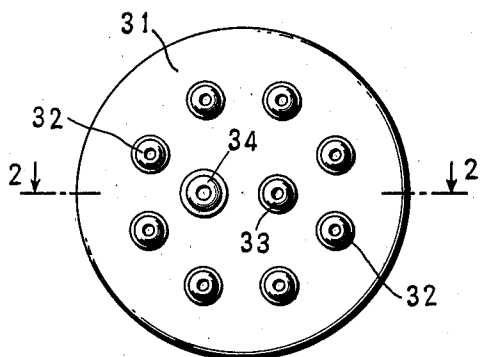


Fig. 2.

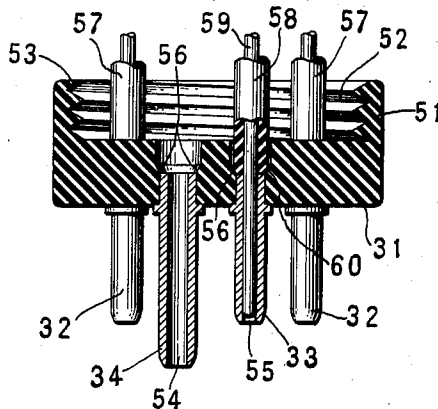
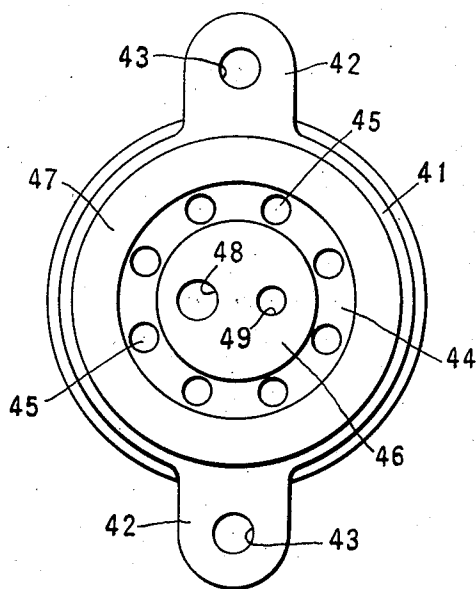


Fig. 3.



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2,233,067

CONTACT PLUG

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Original application February 25, 1936, Serial No. 65,581. Divided and this application August 13, 1938, Serial No. 224,677

2 Claims. (Cl. 173—361)

This present application is a division of my application Serial Number 65,581 filed February 25, 1936, for an Electrical plug and socket, now matured into U. S. Patent 2,135,267 issued November 1, 1938.

This invention relates to connecting plugs or tube bases and sockets used in connection therewith but is also applicable to plug and socket combinations as used for other purposes.

More particularly this invention relates to such plugs and sockets as necessarily include a large number of electrically discrete circuits carried in a structure of comparatively small physical dimensions.

In the art of electron tube bases and sockets therefor, it has been found necessary with the advent of such electron tubes having a great number of elements therein, to provide a tube base and socket which could afford connection to the large number of elements in such tubes. Owing to space limitations, especially in connection with modern radio receiving sets, great difficulty has been found in affording a connection for more than eight circuits with such plug and socket type of connections. If an attempt is made to supply more than eight prongs in a circle of the largest radius which it is practicable to employ for such structures, there is encountered great difficulty in making the prongs and sockets therefor sufficiently large to have the required mechanical rigidity and strength, and at the same time to allow sufficient distance between such individual prongs and sockets as will afford adequate insulation for the comparatively high voltages which are often employed in modern radio receivers.

It has been found, for example, that even with the so-called "octal" type of tube base and socket, difficulty is very frequently experienced, which takes the form of a flash-over or short circuiting discharge between adjacent individual prongs, which may carry a large difference of potential therebetween. Even if such a short circuit does not occur, yet the leakage path is so very short that detrimental leakage often occurs, especially under conditions of high humidity or upon the collection of dust or dirt between the prongs or the individual sockets for such prongs.

This invention has as one object the provision of a tube base or plug member which will be adequately insulated, physically strong, easy to manufacture, cheap to construct and readily attached to connecting wires.

Another object of this invention is to provide a plug or base which, when used with the wir-

ing assembly of this invention, will allow the inclusion of at least ten circuits in an area not exceeding that required for the present eight circuits, and yet will furnish a degree of spacing and insulation at least equal to that of the present octal plug.

A still further object of this invention is to provide a plug member of the type above described, into which insulated wires may be fastened and which will cooperate with the insulation upon such wires so as to afford an extremely high degree of insulation within the interior of such plug.

Yet another object of my invention is to provide an electrical connecting plug having provision for reducing opportunities for accidental short circuits or electrical leakage occurring in the interior thereof.

Referring now to the drawing, I have illustrated a typical embodiment of my invention.

Fig. 1 is a plan view of the bottom of a base or plug embodying my invention.

Fig. 2 is an elevation partly in section of the structure of Fig. 1, taken upon the line 2—2.

Fig. 3 is a plan view of a socket suitable for use with the plug of Fig. 1.

Referring now to Fig. 1, there is shown a body portion 31 of suitable insulating material, into which are fastened a series of projecting metallic pins 32, 32 extending at right angles to the plane of body 31. These pins are arranged substantially equi-distant from one another so as to occupy points on the circumference of a circle whose center will coincide with the center of the surface of body 31. These prongs are of such size and location as to correspond with the openings 45 as shown in the tube socket of Fig. 3 and may be connected either to external electrical conductors or to the elements of an electronic tube according to whether this structure is to be used as a connecting plug or as a tube base.

Owing to the improved insulation and reduction of surface leakage afforded by my invention, as hereinafter explained, it is also possible to locate additional prongs 33 and 34 within the circle formed by prongs 32. For purposes of determining the proper angular location of the plug when inserted within the socket, it has been found convenient to make one of these inner prongs, 34 of a larger diameter than the remainder of the prongs. Likewise it has also been found desirable to make this same prong 34 of greater length than the other prongs, so that it will prevent the shorter prongs from making accidental contact with the contact-making por-

tions of the socket, until such longer prong has first entered its proper opening, under which condition it will be possible for the other prongs to enter only the openings respectively corresponding thereto. During the insertion of the plug within its socket, it will also be found that the annular depression 44 (Fig. 3) aids in the proper location of the circularly arranged prongs 32, as fully explained in my co-pending application above referred to.

Referring now more particularly to Fig. 2, I have here shown the plug of Fig. 1 partly in cross-section, illustrating the particular manner in which I attach the conductors to their respective prongs, in carrying out my invention, whereby I am enabled to attach conductors not only to the prongs lying in a circular formation, but also am enabled to attach additional conductors to the other prongs lying within such circular formation, notwithstanding that each of these last mentioned conductors may be located at a distance from an adjacent conductor less than the distance between adjacent conductors extending to the prongs arranged in circular formation. The particular mode of fastening the conductors within a portion of the insulating body and the mode of connecting them to their respective prongs, as hereinafter described in detail, allow this physical separation of the prongs and of the conductors to be much less than has been found advisable when employing the methods of such fastening and connecting as practiced in the prior art, since by the use of my invention I obtain a path over which surface leakage can take place between adjacent wires, much longer than that which would be determined merely by the physical distance therebetween, and I furthermore provide means whereby a portion of such path is substantially completely blocked by solid insulation, so that moisture and dirt are kept out of contact with the wires, thereby greatly enhancing the effective insulation between such wires.

The body portion 31 of the plug is shown with lateral walls 51 and with a hollow interior portion 52. The inner surface of walls 51 may conveniently be threaded as indicated at 53 in order to allow a cap or other suitable closure member to be screwed therein, but it is to be understood that any other method of closure is possible, or that the plug may be left open at the top if so desired.

Prongs 34 and 33 are shown in section, illustrating the hollow passages 54 and 55 respectively which extend longitudinally of these prongs. The bottom of interior chamber 52 is tapered away from the upper end of each prong, as indicated at 56, 56. Several insulated conductors 57 are shown entering the prongs. Such conductors may consist of an outer insulating sheath 58, and an internal metallic conductor 59. The outer sheath 58 may be of a nature which will allow it to slide to a limited extent along the core 59. Such a conductor is shown inserted in place within prong 33. The metallic core 59 may occupy substantially the entire length of the prong and may conveniently be attached thereto by a drop of solder (not shown), inserted at the point indicated by reference numeral 55. When such a conductor is inserted in prong 33, the insulating sheath 58 may be pushed back to a limited degree and then the inherent elasticity of such sheath will tend to force it into the enlarged opening formed in body 31 by the space between the tapered portions 56, 56.

This brings about a close insulating union between the insulating sheath of the conductor and the insulating material of which body 31 is composed, as indicated at the point 60. In case that insulating sheath 53 is not of a nature such that it will slide along core 59, a portion of the insulating sheath may be removed and the conductor inserted in prong 33 until sheath 58 is in close engagement with tapered portions 56, and thereby substantially the same results as just pointed out may be secured.

It may be seen that the close engagement of the conductors within the body portion of my plug, as far as insulating portions of each are concerned, will minimize the current leakage and possibility of flash-overs, which difficulties have been hereinbefore described.

Referring now to Fig. 3, I have here illustrated a type of socket, especially suited for use with the form of plug shown in Figs. 1 and 2. This socket comprises an insulating body 41, provided with ears 42. These ears may conveniently be provided with apertures 43 in order that the socket may be secured to a panel or other suitable mounting. An annular depression 44 is provided with apertures 45, within which apertures may be located the socket contacts (not shown) for engaging the plug prongs entering such apertures. Within annular depression 44 is located a portion of the socket whose surface lies on substantially the same plane as the outer portion 47 of the socket. This portion 46 is provided with two apertures 48 and 49, of which aperture 49 may conveniently be the same size as apertures 45, while aperture 48 may be made considerably larger in diameter. Apertures 48 and 49 may likewise be provided with internal contacts (not shown) which enable them to afford electrical contact to plug prongs entering therein.

It can be seen that the plug structure shown in Figs. 1 and 2 will readily enter the socket shown in Fig. 3, the large prong 34 entering the large aperture 48 and the small prong 33 entering the aperture 49.

The entry of these two particular prongs, not only will cause the other prongs 32 to register with their respective correct apertures 45, but also will afford two additional circuit connections, by virtue of prongs 31 and 34 functioning as additional connecting prongs. Thus it can be seen that I have devised a plug which will afford a means of circuit connection for any number of circuits up to ten, without an increase in size over the usual plug employed in connection with octal sockets and also without reducing the factor of safety of insulation between such circuits. Likewise this same type of structure can be employed to afford a lesser number of circuit connections with already existing sockets of conventional types or to afford a greater number of connections by the use of a larger number of prongs and apertures.

The many practical uses of such a combination plug structure will be apparent to those skilled in the art. For example it is frequently desired to insert an attachment plug in a tube socket, in lieu of the tube base itself in order that all the circuits entering such socket may be brought out to an external measuring or indicating device such as a radio set analyzer. Likewise it is desirable for a plug and socket combination to carry more than eight circuits, especially in such cases as remote control devices which may be plugged into a set. It can

be seen that by the use of the plug of this invention, a set analyzer or other measuring device may be plugged into such sockets as are constructed according to the design of Fig. 3, where
5 ten connections must be obtained.

With the development of the art, the number of element connections necessary for an electronic tube has been continually increasing and therefore when further advance in the art
10 may render necessary the connection to nine or ten tube elements, the adoption of a socket in accordance with the form disclosed in Fig. 3 and the adoption of a tube base in accordance with the design of plug shown in Figs. 1 and 2, will
15 afford a ready means of securing this result. Other uses and advantages of my invention will be apparent to those skilled in the art.

I claim:

1. The method of connecting a plurality of
20 wires covered with compressible insulation to a plurality of hollow metallic pins held in an insulating body which includes the steps of inserting each of said pins into said body so that one end of each pin lies below one surface of said
25 body, shaping the insulating material of said body between said pin end and said surface of said body so as to form an inwardly tapered passageway, removing the insulation from near the end of each wire for a distance approximating
30 the length of said hollow pin, inserting said bared end of each wire within each pin until the insulation of each wire makes a firm contact

with the inner walls of each tapered passageway, exerting forward pressure upon each wire so as to compress the insulation thereof into said tapered passageway until substantially no free
5 air space exists between said insulation and the upper end of each pin, and fastening each wire in said respective described positions, whereby is formed a substantially air-tight seal with the walls of the passageway so that surface leakage
10 between adjacent pins is substantially reduced.

2. An electrical plug and connecting wire assembly including an insulating body provided with apertures extending completely there-
10 through, a plurality of hollow prongs located partly in said apertures and projecting from the underside of said plug, a plurality of tapered
15 passageways each located between the top of one prong and the upper surface of said body, a plurality of electrical conductors each having a bared portion entering one hollow prong from
20 the upperside of said plug and fastened thereto, and solid elastic insulating material covering the portion of said conductor not entering said prong, compressed within the tapered passage-
25 way above said prong and substantially filling all the space between the upper end of said prong and said conductor, whereby any free air surface leakage path extending from said conductor to an adjacent conductor is substantially
30 precluded by said compressed insulation.

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