Dec. 17, 1935. H. L. STRONGSON 2,024,547

PLUG SOCKET

Original Filed April 21, 1926

Fig. 1

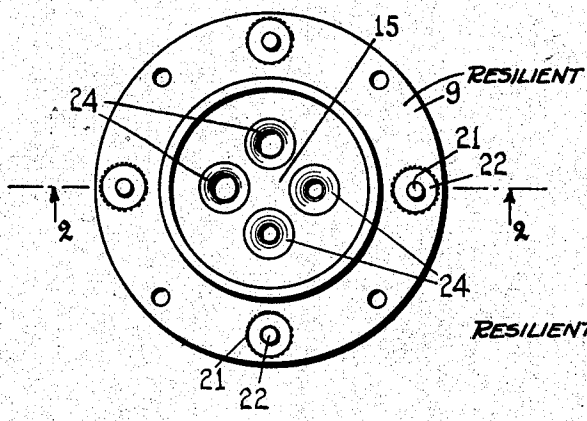
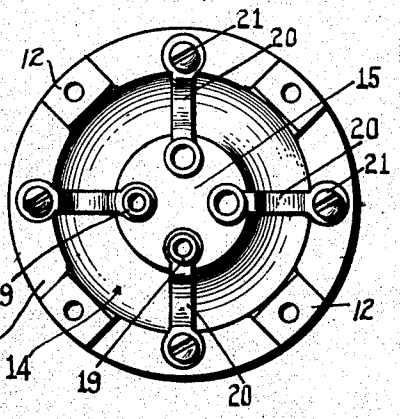


Fig. 4



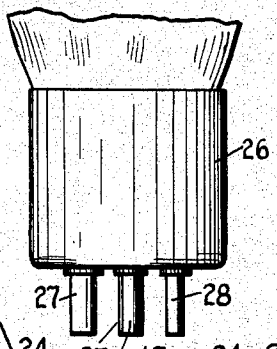


Fig. 3

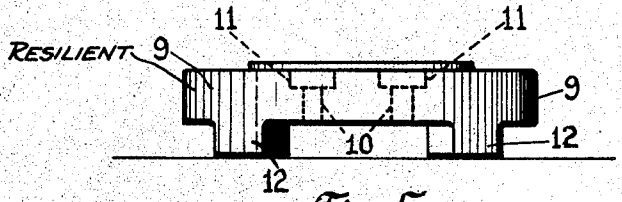


Fig. 5

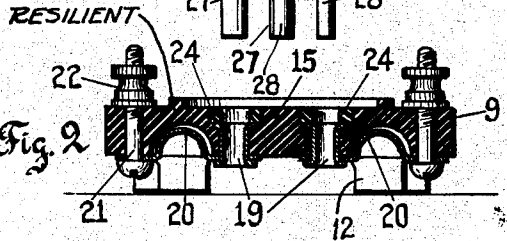


Fig. 2

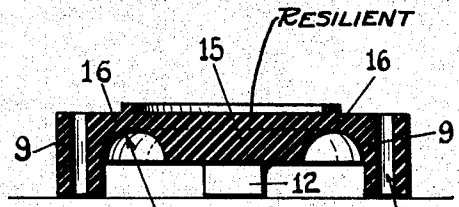


Fig. 6

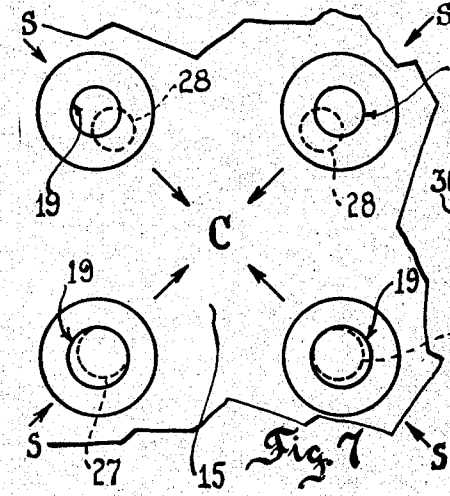


Fig. 7

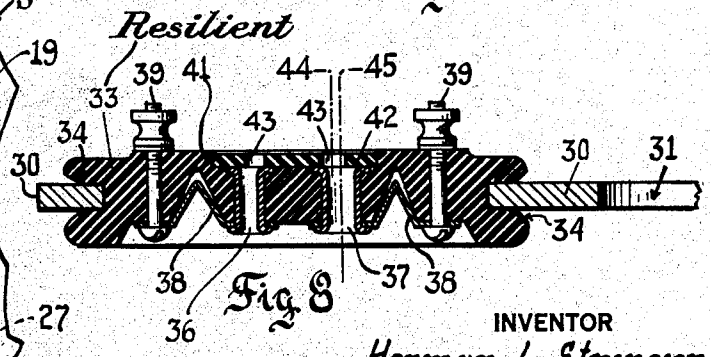


Fig. 8

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PLUG SOCKET

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26 Claims. (Cl. 173—328)

This invention relates primarily to electric push plug connections, base receptacles, plug sockets, etc. In particular it relates to or rather it is shown as an example of new mounting means as a cushion socket for audions, electric vacuum tubes, and the like.

An object of the invention is to produce a new type of electrical plug-in connection or base receptacle by which separable electrical circuits are connected and this purpose is carried out without employing spring metal contact members.

A further object of the invention is to produce a new type support or cushion socket for vacuum tubes and I employ elastic material for this purpose to simplify the construction and reduce the cost of manufacture and at the same time produce a socket which possesses shock absorbing properties and which is non-microphonic.

A further object of the invention is to produce a cushioning socket for electric vacuum tubes, the base or body of which is made entirely of elastic, yieldable, or compressible material, as for example rubber, the object being to utilize the compressible member with its inherent spring or elastic properties to accomplish several purposes; namely, to avoid all necessity of flexible metal spring contacts in a vacuum tube mounting or support or in any other plug connecting element, to also afford a shock absorbing mounting means for the tube by which vibrations are damped out and eliminated to protect the tube, and to employ the compressible member as a base and insulating mounting means to hold the contacts.

Having the above and other objects in view, the principles of the invention will now be described, and an example thereof is shown in the accompanying drawing wherein:

Figure 1 shows a bottom view of the socket; and Figure 2 shows a section through Figure 1 on the line 2—2.

Figure 3 shows a vacuum tube or is an example of any electrical plug with its contact terminals or pins above the contacts or eyelet receptacles of the socket to illustrate how the tube or plug connector cooperates with the socket in a novel way to establish electric connection as will be explained.

Figure 4 is an underneath plan view of the socket showing the assembly of the sheet metal conductor strips on the elastic base.

Figures 5 and 6 show a side elevation and a cross-section respectively of the molded elastic soft rubber base before the metal contact parts are assembled therewith.

Figure 7 is a diagram illustrating the principle of the invention and serving to show how the cushion socket base itself, the material of which it is made, possesses inherent elastic flexure or compressibility which property is utilized for the several purposes heretofore named.

Figure 8 shows a modified form of the invention, a feature being an improved means of mounting a cushion socket or any number thereof on a vacuum or radio tube panel.

Referring further to the drawing, as to Figures 5 and 6, for an understanding of the first form of the invention, there is shown an integral base 9 preferably molded of rubber because of the fact that it possesses the desired property of elasticity or yieldability, compression, and flexure without at the same time having the objectional property of magnifying vibration as characteristic of coil springs and the like. In other words, a rubber cushion base does not have a period of vibration and is not sensitive to movement of outside bodies and does not acquire or take on motion within itself because of the density of its mass which tends to absorb shock and damp out attendant vibration. The elastic base 9 is molded in any suitable shape, a satisfactory form for many purposes being disk-like as shown.

The rubber base is molded elastically, that is, to retain its elasticity as distinguished from the molding of hard rubber, in any suitable socket form and the one shown here is a mere example of a base for one vacuum tube socket but it may be made for several vacuum or radio tubes. The base 9 has apertures 10 molded therein for the reception of eyelet receptacle contact parts. The four holes 10, or any suitable number, are molded into the integral elastic body 9 and thereafter the contact parts are assembled in the base. The holes 10 are, in some forms of the invention, shouldered at the upper end thereof to form an enlargement or shoulder socket 11 for the reception of insulation material to be described. The base 9 may be made with pads 12 so as to raise it above the surface of a panel or board on which the socket is mounted. Screw holes 17 are made through the base 9 and pads 12 by which to anchor the socket in stationary service position.

Into the holes 10 are inserted contact eyelet receptacles 19 of tubular form which are spun down on each end thereof to anchor the eyelets in the elastic body. A lead-in conductor strip 20 is made with an aperture punched in both

ends and one end is placed over the eyelet 19 before riveting or spinning down the said eyelet end and this operation very securely anchors that end of a conductor strip under the lower extremity of an eyelet 19. When the eyelet receptacles 19 have their extremities flared and spun outwardly to anchor same in the elastic and compressible base 9, it follows that the yieldable material is compressed in the region immediately adjacent the eyelet. This compression takes place by reason of the eyeleting tool or machine which inserts the contacts 19 and when the socket is removed from the eyeleting machine there results an expansion of the rubber annularly around each eyelet 19 which expansion occurs along a line parallel to the eyelet axis and this action positively forces the end of the conductor strip 20 against the eyelet head thereby producing positively hard pressed surface and electrical contact between the parts 19 and 20 so that the manufacturer of these sockets does not have to solder around the eyelet head adjacent the conductor strip to produce a finished product.

The molded elastic base 9, in some forms of the invention, may be made with an annular groove 14 extending around the group of contact receptacles 19 cutting up into the body of the elastic base. In this way the holes 10 are placed in a central rubber mass 15 having substantial body and thickness to better carry the contact parts 19, the portion 15 being joined to the periphery of the elastic base by a relatively thin annular portion 16 of increased elasticity by reason of its thinness. This thin annular connecting portion 16 thus mounts the rubber mass 15 and contacts 19 in the center of the base 9 with the result that this center portion is quite flexible and yieldable, and the springiness and shock absorbing properties and the cushioning effect are increased by reason of the reduced amount of material at the thin annular portion 16.

Remembering that the periphery of the elastic base may be screwed down by or through its pads or feet 12, it is noted that a vacuum tube will readily bend or swing out of its normal vertical position under strain of one's hand which may accidently come into engagement therewith, and the elasticity of the annular portion 16 quickly returns the tube to normal upright position. In other words, the periphery of the cushion socket, since it is screw fastened down in service position, may be more or less rigid, but this rigidity does not extend to the central portion 15 because the base is elastic and particularly because of the annular groove 14 which provides the thin elastic joining portion 16 which increases the elasticity at the center of the socket.

The conductor strips 20 may to advantage be arched into the annular groove 14 so as to increase somewhat their length thereby imparting flexibility thereto. The lead-in conductors 20 thus conform to the contour of the groove 14 and have their other ends secured under the heads of lead-in terminals or binding post screws 21, on the upper ends of each of which a nut 22 is mounted. The binding post nut 22 is tightened down on the ends of lead wires adapted to be connected with the cushion socket base receptacle. The arched or bowed flexible sheet metal part 20 bends and gives with the relative movement of the central rubber mass 15.

An insulating washer of rubber, fibre, or other suitable material 24 is compressed into the socket 11 just above and on top of the upper extremity of each contact eyelet receptacle 19. The insulating washer 24 thus seals over the upper end of the eyelet 19 and in effect embeds the eyelet in the compressible rubber mass 15. In this way, premature contact cannot be made when mounting or plugging vacuum tubes into the socket, i. e. the voltage intended only for the plate in a vacuum tube cannot be accidently impressed on the filament terminals of the tube which would destroy the vacuum tube, as is commonly known. This danger is avoided by sealing the upper ends of the contact eyelets in the elastic socket by the method of construction just explained or by other means.

Figure 3 shows the lower end of an audion or vacuum tube the base of which is indicated at 26, and the contact pins or terminals 27 and 28 of which are shown fractionally out of alignment with the contact receptacle eyelets 19 so that it is seen that the vacuum tube may be plugged into the contact receptacles 19 of the cushion socket. This plugging in is accompanied by a novel mode of cooperation between the two electrical devices 26 and 9 because the elastic mass 15 must give slightly when the terminals 27 and 28 slide into the receptacles 19, thus causing the insulating elastic member to exert a yielding contact pressure on and between the cooperating contact parts. It is preferred that the center axes of the four contact eyelets 19 be either closer together or further apart than the center axes of the vacuum tube terminal pins 27 and 28. By thus manufacturing the socket 9 with its contacts 19 slightly off center, either further apart or closer together, in respect to the push type terminals 27 and 28, which are standard as to spacing, it follows that the rubber cushion socket is subjected to compression or expansion when the device 26 is plugged into the socket 9. This action produces a frictional rubbing electrical contact between the two separable sets of contacts on the vacuum tube and socket, or between any other electrical plug-in device which may employ my principle.

By reference to Figure 7, which is a diagram to further illustrate the principles of the invention, there is shown in full lines the eyelet receptacles 19 together with terminals 27 and 28 in dotted lines. These terminals 27 and 28 are exemplary of any electrical plug-in device and are standard as to spacing and distance apart. One set of terminals 27 has registered with one set of eyelets 19, but it is observed that the terminals 28 rest slightly out of registration with their respective eyelet receptacles 19 with the result that the pins 28 must be gently pressed or forced downwardly by sliding movement between the ends of the terminals and the upper flared opening of the insulating fibre washers 24 or flared mouth of the contact receptacles 19. Thus by pressing the pins 27 and 28 into registration with the four contact eyelets, it follows that compression of the central elastic mass 15 takes place thereby setting up a positive rubbing electric contact between the plug-in terminals of any electric plug and the contacts of the socket or base receptacle which produces positive electric contact without employing flexible metallic spring parts heretofore used.

It is noted therefore that I off-set from standard practice my contacts 19 in the elastic base, i. e. they are spaced apart slightly out of alignment with the jack prongs or plug-in blades 27 and 28 of all standard electrical plug connectors, but the elasticity inherent in the base receptacle

itself permits the contacts to line up with all standard plug connector jacks and contact blades.

It may be preferred to manufacture the receptacle with the eyelets 19 disposed on a circumference greater than that of the pin contacts 27 and 28 and this arrangement means that compression of the central region 15 of the socket takes place as shown by the direction of the arrows C indicating compression at the center of the cushion base, while slight stretching or yielding action occurs around the outer portion of the rubber base and this condition is indicated by arrows S.

Elastic and shock absorbing mounts for delicate vacuum tubes made in accordance with my invention fills a long felt want. Many changes in form or size may be resorted to, but I retain the principle of employing contacts 19, which may be rigid or stiff in themselves, mounted in an elastic body by which the contacts, while in themselves rigid, are rendered movable in function relatively to each other and relatively to rigid and immovable contacts such as found on vacuum tubes and a variety of other push plug connecting devices, all this by reason of the elasticity of the base member which exerts a yielding contact pressure between the terminals of the vacuum tube and the contacts in the socket base. The principle of this invention is adapted to various and sundry uses as regards electric push plug connecting functions.

Referring now to Figure 8, there is shown a second form of the invention comprising a vacuum tube support panel 30 provided with any suitable number of apertures 31 for the reception of cushion sockets made in accordance with my invention. Reference is made to this view to explain a further improved construction and method of mounting the cushion socket in service position and this may be accomplished without the use of screws as will be understood.

An elastic disk-like circular plug or body 33 is made with an annular groove 34 formed in its periphery, the groove 34 being formed between adjacent parallel circular flanges. The groove 34 is adapted to be pressed into the apertures 31 in the bakelite or board panel 30 by springing back a flange to set the socket receptacle 33 in the holes 31 of the panel, and in this way any suitable number of cushion sockets 33 are mounted in the panel 30.

Eyelet contact receptacles 36 and 37 are either anchored or moulded in the elastic socket member 33. A conductor strip 38 connects each eyelet with a lead-in terminal or binding post screw 39, and the conductor strip 38 is made in any suitable form to properly connect the binding post terminal 39 with its respective eyelet receptacle 36. A good electrical connection is made between the conductor strips and the contact receptacles by reason of the expansion of the rubber which presses together the eyelet head and conductor lead-in strips.

The upper surface of the elastic plug or socket base 33 is provided with a depression 41 and the upper ends of the eyelets 36 and 37 terminate in this depression. The upper eyelet extremities are compressed into the rubber so that the upper surface of the depression 41 is flush and smooth for the reception of an insulating washer which covers the upper ends of the socket receptacle contacts.

A single insulating washer or cover 42 is placed in the rubber depression 41 over the several contact receptacles 36 and 37 and this part may be hard rubber, fibre or other suitable material. This washer 42 seals in the top ends of the contacts which in effect embeds them in the elastic body 33, and the washer 42 has guide holes 43 for the reception of push-plug terminals, which guide holes are immediately above the contact receptacles 36 and 37 but may be somewhat out of alignment therewith that is, eccentric with respect thereto because the guide holes 43 are standard spacing and the contacts 36 and 37 are not. The axis line 44, as an example, defines the center of the insulating washer guide hole 43 while the axis line 45 defines the axis of the contact receptacle 37 and it is noted that the two axes 44 and 45 are fractionally off-center and out of alignment with each other. In this form of the invention, the guide holes 43 preferably have a standard spacing, i. e. they are equal in distance to that of standard push-plug devices, while the contact receptacles immediately underneath are slightly or fractionally different from standard spacing so as to produce pressing or rubbing contact between the cooperating parts when plug-in connection is made.

The fibre washer 42 does not interfere with the elasticity of the rubber mass immediately underneath thereof. Hence the rubber base yields or compresses when the contact pins of the radio tube or any other plug-in connection are thrust through the guide insulating holes 43 into the contact receptacles 36 and 37. It is noted therefore that the insulating holes 43 are rigidly spaced by which to guide the plug-in terminal pins or contact jacks into the contact receptacles and as the pins 27 and 28 move through the holes 43 and come into engagement with the receptacles 36 and 37, the rubber compresses sufficiently to permit the axis of the holes 43 and contact receptacles to line up.

In accordance with the above, I employ as a modified form one rigid insulating cover 42 to seal in the several contact receptacles 36 and 37. The cover 42 is standard in form as to the spacing of the guide openings 43, while the elastically mounted rigid contacts 36 and 37 are not of standard spacing but they move slightly relatively to the cover. In other words, the contacts slide slightly under the cover 42 to accommodate themselves to the entering movement of the push-plug terminals, the elasticity of the base material permitting the relative motion of the contacts under said insulating cover 42.

While I have disclosed the off-center or eccentric non-standard receptacle contacts embedded in the integral rubber base and have explained how the elasticity of the base permits the contacts to move to a position equal to standard plug-connector contacts, it is to be understood that modifications of this principle may be made. I may prefer to simply mount the receptacle contacts in the base and utilize the compression or extension of the rubber to produce and exert a yielding contact between the registering terminals of various electrical connecting devices. Whether or not the contact receptacles in the base are disposed or spaced apart according to standard practice, makes no difference, particularly as to the non-microphonic cushioning properties of a socket of this type for vacuum tubes. That feature and advantage is independent of all contact making functions and is so considered in making claims to the several features of this invention.

What I claim is:

1. An electric socket receptacle to receive terminals of push-plug connectors, an electric contact retaining base made of rubber and being elastic throughout, and contacts carried in the elastic base and normally out of alignment with standard push-plug connector terminals but capable of yielding relative motion in the elastic base to attain alignment and registration with said push-plug connectors.

2. An electric socket receptacle as defined in claim 1 but in which insulating means is placed on the base to conceal the contacts, and said insulating means provided with apertures leading to the contacts.

3. An electric socket receptacle as defined in claim 1 but in which a non-elastic insulating part is applied to the elastic base, said non-elastic insulating part having guide apertures of standard spacing being the same distance apart as terminals of push-plug connectors and thus being slightly out of alignment with but leading to the elastically mounted contacts.

4. In combination with rigid push-plug terminals which are fixed and immovable in relation to each other on a movable body, a socket base into which the push-plug terminals are received to connect separable electric circuits and said socket base including means for stationary service mounting, said socket base being made wholly of elastic material, rigid contacts carried in the elastic socket base and spaced apart a distance fractionally different from that of the rigid immovable push-plug terminals, and said rigid contacts being movable relatively to each other within the elastic base when the push-plug terminals are engaged therewith.

5. In combination with fixed push-plug terminals immovable in relation to each other on an electric fixture, an electric base receptacle made wholly of elastic material, rigid contacts carried in the elastic material base and spaced apart a distance fractionally different from that of the push-plug terminals but subject to yielding motion in relation to each other by virtue of the elasticity of the base material, an insulating cover mounted on the elastic base to conceal the contacts, said insulating cover having guide holes spaced apart a distance equal to that of the push-plug terminals and adapted to easily receive them, and said push-plug terminals acting to spring the rigid but elastically mounted contacts into alignment with the holes in the insulating cover and into alignment with said push-plug terminals by yielding of the elastic base.

6. An electric push-plug socket receptacle comprising, a base made of insulating material and holes molded therein to receive contacts, a contact part anchored in each hole, one end of the contact being embedded and concealed below the top surface of the base within said hole, elastic material surrounding the contact part which permits said contact to move relatively to and within the base, and non-elastic material carried by the base immediately above the contact part and defining the hole and forming a guide aperture to the elastically mounted contact part.

7. In combination with the rigid stationary terminals of an electric vacuum tube, an elastic contact retaining base made wholly of elastic material, contacts carried in the elastic base, said contacts being spaced apart in the elastic base a distance differing fractionally from the distance apart of the aforesaid rigid stationary terminals on the vacuum tube, and said contacts of the elastic base being adapted to move relatively therein to register with the rigid stationary terminals when the vacuum tube is plugged into the elastic base.

8. Mounting means for vacuum tubes comprising a base member made of elastic material including means by which it is secured in stationary service position for the reception of a vacuum tube having terminals, rigid contacts embedded in the elastic base and being movable in relation to each other by reason of the elasticity of said base, said contacts being spaced apart a distance differing fractionally from the terminals of the vacuum tube, and said contacts of the base being pressed into engagement with the terminals of the tube by reason of the elasticity of said base member.

9. An electric plug connection for plug-in connectors comprising, a rubber base molded elastically in suitable shape with holes therein which are spaced apart a distance fractionally different from the plug-in connectors, contacts anchored in the holes and relatively movable by virtue of the elastic base which permits the contacts to be forced into alignment with plug-in connectors, an insulating portion over the contacts, and said portion having guide apertures of standard spacing leading to the contacts.

10. An electric base receptacle comprising; a single rubber body including a thick elastic center, a thick perimeter, and a thin elastic joining portion between the center and perimeter; electric contacts anchored in the thick elastic center, lead-in terminals mounted on the perimeter, and an electric connection established between the lead-in terminals and the contacts.

11. The same structure as defined in claim 10 but modified as to the electric connection wherein said connection is a flexible part which extends across the thin elastic joining portion and is itself similarly elastic.

12. A socket including a soft rubber base, contacts carried in the center thereof, a deep annular groove being formed in the elastic base around the group of contacts which produces a thin annular portion integral with the center and the rest of the base of increased elasticity supporting the group of contacts in the center of the socket.

13. In combination with a panel member provided with a plurality of socket receiving means formed therein, an elastic base mounted in the receiving means, and electric contacts molded in the elastic base and capable of motion relative to the panel and to each other.

14. In combination with a panel, having holes for the reception of electric base receptacles or sockets, a rubber disk having annular parallel mounting flanges formed on its periphery and defining therewith a deep groove which seats against the hole edge in the panel, and electric contact and lead means carried on the rubber disk.

15. Electric connecting means comprising, a metal contact part adapted to receive the terminal of an electrical device, a soft rubber elastic insulating body supporting the part and exerting a yielding contact pressure thereon, a rigid insulating member carried on the elastic insulating body above the contact part, and said rigid insulating member having a guide hole eccentric to and leading to the contact part through which enters said terminal of the electrical device.

16. Electric connecting means comprising, an elastic insulating member capable of compres-

sion and extension, a tubular contact member embedded therein, and a rigid insulating member mounted in the elastic insulating member and provided with an aperture leading to the tubular contact member.

17. Electric connecting means comprising, a non-spring metal contact, a soft rubber elastic body in which is embedded the contact, said elastic body acting to impart a yielding pressure to the non-spring contact, and a hard non-elastic insulating means within the elastic body and having a guide entry hole eccentric to and leading to the contact.

18. In combination, for radio apparatus, panel means provided with an aperture, a resilient rubber body carried within the aperture, and electrical connection means mounted in the rubber body.

19. A receptacle comprising an elastic body having groove means formed on its perimeter to secure it to a supporting means, and electrical plug-in contact means carried by the elastic body.

20. An electrical receptacle comprising a disk-shaped circular elastic rubber member, having a circumferential groove adapted to engage the edge of an opening within a support panel to mount said receptacle in service position, and electrical contact means mounted in the rubber member.

21. A base receptacle for radio tubes, comprising a flat disk-shaped resilient rubber body of circular form, said rubber body being provided with a circumferential groove molded therein and defined by flanges which yield to adapt the receptacle to be pressed into a circular opening of a support panel by which said groove secures the receptacle in service position, a plurality of tubular contacts extending thru the rubber body and open at each end to receive the contact pins on a radio tube which are adapted to be projected thru the flat rubber body and resiliently held in place thereon, and conductor strips adjacent one surface of the rubber body and attached to one open end of the tubular contacts by which wiring connections are established with the receptacle.

22. A base receptacle to receive radio tubes and the like, comprising a circular elastic member, provided with a circumferential groove molded therein to engage the rim of a hole formed in a support panel, and tubular contacts secured in the elastic member to receive the contact prongs of said radio tubes and the like.

23. An electrical plug-in base receptacle adapted to support plug-connecter means, comprising a circular disk-shaped resilient rubber body having flat parallel surfaces, and provided with a groove formed circumferentially between its parallel surfaces, contacts mounted in the rubber body and formed of tubular parts opening thru both surfaces of said rubber body, and flanged-over ends made at each extremity of the tubular contacts and compressed into the two surfaces of the rubber body to anchor said contacts therein.

24. An electrical plug-in base receptacle adapted to support plug-connecter means, comprising a circular disk-shaped soft rubber body having flat parallel surfaces, contacts mounted in the rubber body and formed of tubular parts opening thru both surfaces of said rubber body, and flanged-over ends made at each extremity of the tubular contacts and compressed into the two surfaces of the rubber body to anchor said contacts therein.

25. A base receptacle for radio tubes, comprising a flat disk-shaped rubber resilient body of circular form, means at the periphery thereof to secure the receptacle in service position to a support, binding-post means carried thereon proximate the periphery of said rubber body, a plurality of tubular eyelet-contact means projecting thru the flat rubber body and opening at each end to provide open contacts thru the receptacle, each end of the tubular eyelet-contact means being shouldered down on the rubber body to compress the latter and anchor the contacts in said rubber body, and conductor strips establishing electrical connection between the binding-post means and the eyelet-contact means.

26. An electric socket receptacle adapted to receive a number of electric terminals of a push-plug connector comprising, a base made of rubber and being elastic throughout, contacts carried by the base; and at least one of said contacts in the base being normally out of alignment with at least one of the push-plug electric terminals with which the latter is adapted to be engaged, but yielding as a consequence of the elastic base to attain alignment and sliding registration with said terminal, to thereby force the other terminals of the push-plug connector into electrical engagement with the other contacts in said base.

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