Nov. 16, 1948. C. J. ADAMS 2,453,826

CONTACT FOR VACUUM TUBE SOCKETS

Filed Nov. 12, 1946

Fig. 1.

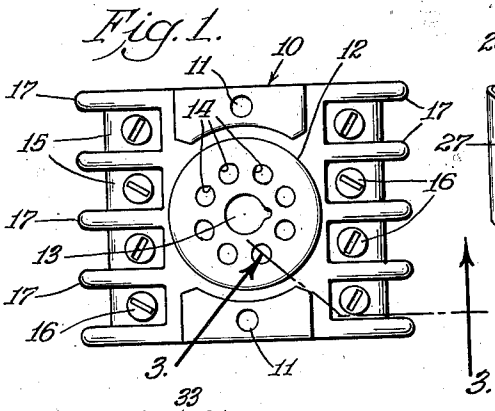
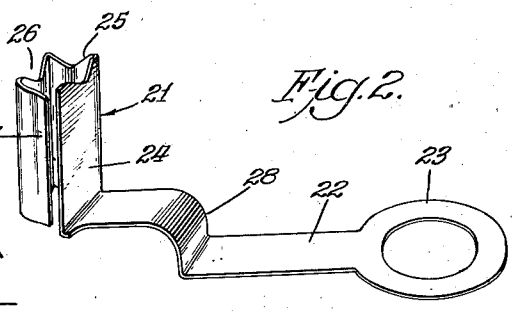


Fig. 2.



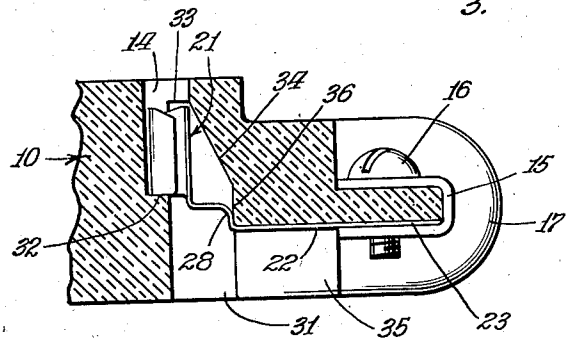


Fig. 3.

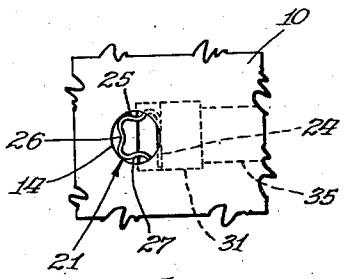


Fig. 4.

Fig. 5.

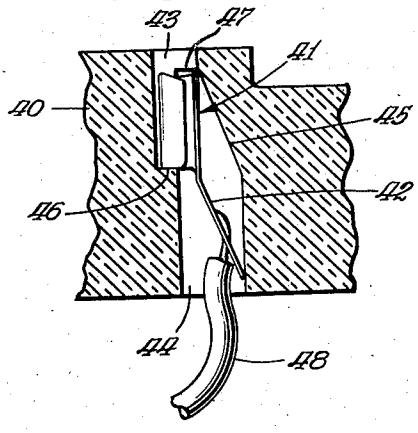
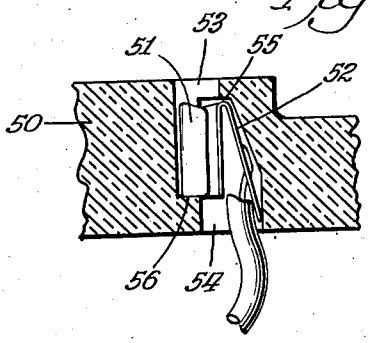


Fig. 6.



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UNITED STATES PATENT OFFICE

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CONTACT FOR VACUUM TUBE SOCKETS

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5 Claims. (Cl. 173—328)

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This invention relates to sockets of the type commonly used for electronic tubes and is specifically directed to a push-in contact for these sockets.

There are many obvious advantages in the provision of a socket contact so designed that it will snap in place and secure itself in its mounting, since this type of construction eliminates the necessity of providing screws, rivets or other fastening means to hold the individual contacts in place. Another distinct advantage is that the contacts can be bench assembled to the ends of the individual wires and then merely pushed in place in the dielectric socket body which was previously fastened in place. In this manner insulation is complete and no conducting surfaces are exposed to possible body contact. This avoids an enormous amount of manufacturing difficulty in the operation of soldering the lead wires to the socket contacts. Further, many dielectric materials, particularly polystyrene and polyethylene, soften appreciably in close proximity to relatively low heats—170° F. for polystyrene—and are apt to be damaged when the lead wires are soldered. If adequate means for a push-in contact can be provided, this disadvantage can be obviated. Also, the fact that the contacts are separately removable facilitates the changing of individual contacts in servicing without disrupting an entire circuit.

These advantages, inherent in the push-in type of construction, have been recognized in the art for many years and many different types of push-in contacts have been designed. However, the types of contacts previously devised have not been entirely successful, largely by reason of the fact that they have been of unsound mechanical design, difficult to manufacture and subject to frequent failure in use. For one thing, the usual types of push-in contacts of the prior art have been characterized by the provision of some form of barb, hook, or tab arranged to secure the contact in place. Since the physical size of these contacts is quite small, the contacts must be formed of very thin sheet metal, with the result that the various prior art structures have been delicate to manufacture and fragile in use. Further, most of the prior devices known to this applicant have been characterized by a construction which required that the body of the socket be formed to include thin slots, delicate edges, difficult undercuts, etc. so that the manufacture of the moulded insulating material of the socket has been an expensive operation and has discouraged the use of this type of device in a competitive market.

The general aim of this invention is to provide a push-in contact and socket of improved mechanical design so that it is at once stronger, more smiple, more easily assembled, and yet more economical in manufacture than those heretofore known.

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More specifically, it is the primary object of the present invention to provide a vacuum tube socket and push-in contact so constructed that the insulating portions of the socket may be moulded with a simple core formation, and so that the individual metallic contacts may consist of a single sheet metal piece of comparatively simple design, characterized by a complete absence of any tabs, hooks or similar delicate portions.

Another object of the invention resides in the provision of a socket having push-in contacts secured in place solely by the engagement of the contacts with the walls of the openings in the socket base, yet designed to permit a socket construction of relatively small height.

The foregoing objects are achieved in the socket illustrated and described here by the combination of a socket block formed of plastic, ceramic, or other insulating material with cored openings to receive the pins of the vacuum tubes and the metallic elements of the socket contacts, to cored openings being so arranged that each includes a shoulder on one side of the top of the cavity and a cooperating shoulder on the opposite side of the lower end of the cavity; so that the portions of the contacts gripping and surrounding each of the pins of the vacuum tube are restrained against upward movement by one shoulder and supported against downward thrusts by the other; together with an arrangement whereby the individual contacts may be inclined and moved out of engagement with the shoulders so that they may be individually snapped into position, and removed at will.

Referring now to the drawings attached to and forming a part of this specification,

Figure 1 is a plan view of a socket constructed in accordance with the teachings of this disclosure.

Figure 2 is a perspective view of a push-in contact for the socket.

Figure 3 is a detail sectional view taken substantially on the plane of the line 3—3 of Figure 1.

Figure 4 is a fragmental plan view of the upper surface of the socket with the push-in contact in position.

Figure 5 is a sectional view similar to Figure 3 showing a modified form of construction, and

Figure 6 is a sectional view similar to Figure 5 showing a second modified form.

The socket illustrated in Figure 1 includes a socket block 10 having screw holes 11 to facilitate mounting and including a generally circular portion 12 on which a vacuum tube or plug may be positioned. The circular portion 12 includes a central opening 13 to receive the cen-

ter pin of the vacuum tube and a plurality of openings 14 surrounding the central opening and spaced to receive the individual contact pins of the tube. The particular socket shown is designed for a vacuum tube having eight contact pins, each of which is inserted in one of the openings 14 to engage a metallic contact element in a cavity which extends from one of the openings 14 to one of the terminal pieces 15. The terminal pieces 15 are secured in position by screws 16 which also function to establish electrical connections between the terminals and lead wires extending to other apparatus. The individual terminal pieces are electrically isolated from each other by insulating flanges 17.

The individual metallic elements by which the pins of the vacuum tube are engaged are illustrated in Figure 2. Each of these elements includes a sleeve portion 21 to slidably grip the lower extremity of the vacuum tube pins when they are inserted in the socket, together with a relatively flat strip 22 extending from the sleeve 21 to a terminal portion 23. The terminal portion may be of circular formation and preferably surrounds one of the screws 16 so that a positive electrical connection will be assured when the screw is tightened.

In the exact form of the contact illustrated, the sleeve 21 includes a flat portion 24 and side walls 25, 26 and 27, which cooperate to provide metal surfaces adapted to extend almost completely around the contact pin of the vacuum tube and to engage the pin from all sides simultaneously. The peculiar configuration of the sleeve 21 as shown is known as the "cloverleaf" form of contact and is disclosed in greater detail and claimed in my copending United States Patent application Serial No. 631,690 filed November 29, 1945. While this cloverleaf contact is ideally suited to use with the present invention, the principles of this invention are of broader scope and may be utilized with sleeves or gripping portions of different design and configuration.

The flat strip 22 of the contact is offset at 28 to assist in maintaining the contact in position in the block, as will appear hereinafter.

The moulded socket block 10 is provided with a number of contact cavities including rectangular cored openings 31 extending upwardly from the lower surface of the socket to inersect the cored openings 14 extending downwardly from the top surface thereof. Preferably, a half-round side of the opening 14 extends downwardly to a point just below the maximum projection of the contact pins on the tube for which the socket is designed, and terminates in an upwardly facing right angled shoulder 32 having a flat surface of substantial area on which the sleeve 21 of the contact is supported. Similarly, the rectangular opening 31 extending upwardly from the bottom surface of the socket intersects the opening 14 and extends upwardly to a point just below the upper surface of the socket, where it terminates in a right angled shoulder 33. The opening 31 is illustrated as being almost square at its lower end but it includes an inclined portion 34 slanted inwardly toward the opening 14, so that the upper end of the opening 31 is rectangular and extends about half way across the generally circular opening 14. It is somewhat wider than the maximum width of the opening 14, however, so that a downwardly facing shoulder of substantial area is presented to limit the upward movement of the sleeve 21 of the metallic contact (see Figure 4).

The lower surface of the socket also includes a

slot or channel 35 extending from each of the cored openings 31 to one of the terminal pieces 15 so that each individual contact element may extend directly from the opening 14 in the socket to the corresponding terminal piece.

Examination of Figure 3 will disclose that when the sleeve portion 21 of the contact is in vertical alignment under the opening 14, its downward movement will be limited by the shoulder 32 and its upward movement will be limited by the shoulder 33. Since these shoulders are spaced apart a distance only slightly greater than the length of the sleeve 21, it follows that the sleeves will be secured against any perceptible vertical movement in the socket. The contacts are formed of relatively light sheet metal, however, so that they can flex sufficiently to be inserted from the lower end of the opening 31. This is done by merely pressing a contact upwardly against the inclined surface 34 until the laterally extending connecting portion 22 flexes enough to allow the lower end of the sleeve to snap over the shoulder 32. When the sleeve is in position the outer extremity of the connecting strip 22 is lifted to engage the terminal ring 23 under one of the terminal elements 15. When this is done the offset portion 28 will engage the vertical wall 36 at a point just below the lower end of the inclined portion 34 so that the lower end of the sleeve will be restrained against movement to the right as seen in the drawings. The sleeve portion of the contact is thus firmly supported on the surface of the shoulder 32. With the socket assembled in this manner, the sleeve 21 will be held in alignment immediately below one of the openings 14, so that when the tube is inserted into the socket the individual contact pins of the tube will project downwardly through these openings 14 and come into positive electrical contact with the sleeves of the various individual contact elements. It is desirable that the contact elements engage the individual contact pins of the socket quite securely so that a positive electrical connection is made. The natural result of this rather positive engagement is that a material amount of force must be exerted to slide the pins into the sleeves. This may be done without difficulty with this arrangement, however, since the shoulder 32 on which the sleeve is supported presents a relatively broad surface extending half way under the sleeve and extending straight downwardly to the lower surface of the socket so that it has strength far in excess of any strains that will normally be imposed.

When the tube is to be removed from the socket it will be drawn upwardly and the substantial amount of friction present between the individual contact pins of the tube and the sleeves of the contact elements of the socket will cause a tendency for the contact elements to be lifted upwardly with the tube. However, it has been previously pointed out that the upper ends of the sleeves 21 are also in engagement with the downwardly facing surfaces of the shoulders 33. These shoulders also have mechanical strength far in excess of any strains apt to be imposed on them, so that the sleeves will be effectively stripped from the individual contact pins as the tube is withdrawn.

From the foregoing it will be seen that the structure just described provides a highly satisfactory mechanical construction of a push-in contact for a socket or other type of connector, since although the individual parts are of relatively simple formation, they cooperate with each other

to hold the contacts firmly in position, both during the insertion and during the removal of the vacuum tube. Moreover, it is to be noted that when the tube is in position in the socket, the pins themselves maintain the sleeves 21 in exact vertical alignment and prevent any possibility of tilting any individual sleeve to the degree necessary to permit it to be removed.

The individual contact elements may be easily snapped in position as the socket is assembled, and when once assembled will retain themselves in position both during the insertion and removal of tubes from the socket. However, if it is found necessary to remove one or more of the individual contacts, it may be done very easily by detaching the connecting portion 23 of the contact from the corresponding terminal piece 15 and drawing the outer end of the connecting strip 22 downwardly to flex the strip sufficiently so that the offset portion 28 of the strip disengages the vertical wall 36 of the opening 31. When this is done the lower end of the sleeve 21 may be shifted to the right as viewed in the drawings, to disengage the lower end of the sleeve 21 from the shoulder 32. The sleeve of the contact will then be in an inclined position, more or less parallel to the inclined surface 34, and may be withdrawn from the cavity by moving it downwardly through the opening 31. Even after having been so withdrawn, it is to be noted that the contact has not been permanently bent or distorted and, if desired, it may be again inserted in the same manner as originally.

The form of the invention shown in Figure 5 includes a sleeve portion 41 identical with the sleeve just described but connected with a soldering strip 42 attached at the lower end of the sleeve and bent outwardly at an angle with respect to the vertical walls of the sleeve. This type of fitting is adapted to be positioned in a socket 40 having one or more contact cavities each comprising a generally cylindrical upper cored opening 43 intersecting a generally rectangular lower cored opening 44 having an inclined surface 45 at the upper end. This construction provides a lower shoulder 46 and an upper shoulder 47 identical to the shoulders 32 and 33 heretofore described and differs from the type of cavity shown in Figure 3 only in that the channel 35 is omitted. With this type of construction the flexible wire leads 48 for the several individual contacts of the socket are soldered directly to the connecting strips 42 before the contacts are inserted in position. The contacts are then individually inserted in the lower end of the cored openings 44 and urged upwardly to the position shown. The inclined upper surfaces 45 of each of the openings serves to shift the upper end of the sleeve 41 into position directly below the opening 43. The inherent spring tension between the sleeve 41 and the connecting strip 42 permits the contact to flex until the lower extremity of the sleeve moves above the shoulder, at which time the contact will snap into the position shown and will secure itself against removal. Here all conducting surfaces are completely enclosed, and since the insulation on the lead wire may extend into the cavity of the socket any possibility of short circuit with other wires or accidental body contact is avoided.

The second modification of the invention, illustrated in Figure 6, includes a socket block 50 similar in construction to that shown in Figure 5, but thinner. The sleeve 51 is formed to include a contract strip 52 doubled back from the upper extremity of the sleeve rather than from its lower end, so that it will extend angularly downwardly beside the sleeve. In this instance the cylindrical cored opening 53 of the contact cavity may be identical with those heretofore described, but the rectangular core 54 is preferably formed somewhat wider to present a right angled shoulder 55 of even greater area than the upper shoulders of the other two forms. The contact element shown in Figure 6 functions in the same manner as the other forms, and may be inserted by merely forcing the contact upwardly through the opening 54 until the sleeve 51 is snapped into position by the inherent spring tension of the strip 52. It may also be removed by utilizing any sharp instrument to move the lower end of the sleeve to the right as viewed in the drawings until lower end of the sleeve disengages the shoulder 56 so that the contact can be withdrawn downwardly. The structure of Figure 6 is advantageous, however, in that it permits the teachings of this disclosure to be utilized in a construction having a vertical dimension hardly greater than the overall projection of the pins of the vacuum tube for which any given socket is designed, as well as including the other advantages discussed in connection with the other forms disclosed.

In conclusion it may be repeated that the teachings of this disclosure provide a push-in contact for vacuum tube sockets including practical advantages not found in the prior art, and that these practical advantages are of such importance as to constitute the difference between unsatisfactory prior devices and commercially successful modern sockets.

When so constructed, a vacuum tube socket of this type requires no screws, rivets, or other fastening means to hold the individual contacts in place. The individual lead wires of the socket can be soldered to the contacts in bench assembly and later inserted into the body of the socket, so that the usual difficulties of soldering a large number of wires in close proximity to each other are avoided. Thus there is no danger of damaging the insulating material of the socket by the heat of soldering, and the possibility of bridging the space between individual contacts of the socket with molten solder is avoided. Any possibility of spilling soldering flux on the socket surfaces is also eliminated. The assembly may be completed so that the insulation on the several lead wires extends completely into the cavities of the socket, so that there are no exposed conducting surfaces and so that any possibility of short circuiting between the tube elements or of accidental body contact with live wires is avoided; yet any individual contact may be removed for inspection or repair without disturbing other connections. Moreover, the push-in contacts themselves are characterized by the absence of any variety of barb, hook, or tab, so that although the contacts are formed of thin sheet metal they are strong and dependable in use and comparatively easy to manufacture.

In addition, the body of the socket includes no narrow slots, thin edges, or undercuts, and may be easily moulded. It is stronger than previously known types and more easily assembled, yet is economical to manufacture, with the result that it is a generally more desirable and satisfactory construction than those previously used.

The exact forms of the invention illustrated are shown for the purpose of disclosing the inventive thought and represent present preferred

forms now in commercial manufacture. It is to be recognized, however, that the scope of the inventive thought is not limited to these exact structures, but extends to various other possible modifications and should be regarded as limited only by the terms of the appended claims.

Having thus disclosed the invention, what I claim as new and desire to protect by Letters Patent is:

1. In a socket or the like comprising a base member with one or more cavities to receive the contact pins of a tube or plug, and contact elements for said pins adapted to be inserted in said cavities, the combination of cavities each including a vertical contact portion extending downwardly from a generally circular pin orifice, with a lower abutment shoulder at the bottom of the contact portion, but on one side of the cavity and extending only partially across the area thereof; an upper abutment shoulder at the top of the contact portion and on the opposite side thereof with a broad flat surface extending around at least three sides of the cavity; with an offset entrance channel extending from the lower surface of the base to the contact portion of the cavity to permit the insertion of a metallic contact into the cavity from the bottom of the socket; a metallic contact including a hollow sleeve adapted to surround a contact pin and bear against the pin on at least two sides, the sleeve being of uniform cross section throughout its length, and adapted to be positioned in the cavity between and in engagement with the upper and lower abutment shoulders; a cam surface within the entrance channel to guide the upper end of the sleeve into engagement with the abutment shoulder and locate it in vertical position below the pin orifice during insertion of the contact, and a soldering lug including a metal strip extending outwardly from the contact sleeve and engaging the wall of the entrance channel to maintain the lower end of the contact sleeve in position on the lower abutment shoulder.

2. In a socket or the like comprising a base member with one or more cavities to receive the contact pins of a tube or plug, and contact elements for said pins adapted to be inserted in said cavities, the combination of cavities each including a vertical contact portion extending downwardly from a generally circular orifice, with a lower abutment shoulder at the bottom of the contact portion and an upper abutment shoulder at the top of the contact portion; an offset entrance channel extending from the lower surface of the base to the contact portion of the cavity to permit the insertion of a metallic contact into the cavity from the bottom of the socket; a contact including a hollow sheet metal sleeve having opposite parallel side walls adapted to surround and frictionally grip the pin on at least two sides and along the entire length of the sleeve to establish intimate mechanical and electrical contact therewith; said walls extending between the upper and lower abutment shoulders and adapted to engage the lower abutment shoulder during insertion of the pin of a tube or plug into the contact, and to engage the upper abutment shoulder during removal of the pin, to strip the contact from the pin; together with a cam surface within the offset entrance channel to guide the upper end of the sleeve into position below the pin orifice during insertion of the contact into the base.

3. In a socket or the like comprising a base member with one or more cavities to receive the

contact pins of a tube or plug, and contact elements for said pins adapted to be inserted in said cavities, the combination of cavities each including a vertical contact portion extending downwardly from a generally circular pin orifice, with a lower abutment shoulder at the bottom of the contact portion and an upper abutment shoulder at the top of the contact portion with a broad flat surface extending around at least three sides of the cavity; an offset entrance channel extending into the cavity from the lower surface of the base to permit the insertion of a metallic contact from the bottom of the socket, and a metallic contact including plural side walls disposed in parallel relation on opposite sides of the pin to effect a friction grip on a contact pin along a substantial portion of its length and establish intimate mechanical and electrical contact therewith; said side walls extending between the upper and lower abutment shoulders and adapted to engage one of said abutment shoulders during insertion of the pin of a tube or plug into the contact, and to engage the other during removal of the pin to strip the contact from the pin.

4. In a socket or the like comprising a base member with one or more cavities to receive the contact pins of a tube or plug, and contact elements for said pins adapted to be inserted in said cavities, the combination of cavities each including a vertical contact portion extending downwardly from a generally circular pin orifice, with a lower abutment shoulder at the bottom of the contact portion, but on one side of the cavity and extending only partially across the area thereof; an upper abutment shoulder at the top of the contact portion having a broad flat surface extending around at least three sides of the cavity; with an entrance channel extending from the lower surface of the base to the contact portion of the cavity to permit the insertion of a metallic contact into the cavity from the bottom of the socket; a metallic contact including means to grip a contact pin in secure frictional engagement on at least two sides thereof and adapted to be positioned in the cavity between and in engagement with the upper and lower abutment shoulders; means within the entrance channel to locate the contact in exact vertical position below the pin orifice, and a soldering lug including means for engaging the wall of the entrance channel to maintain the lower end of the sleeve in position on the lower abutment shoulder.

5. In a socket or the like comprising a base member with one or more cavities to receive the contact pins of a tube or plug, and contact elements for said pins adapted to be inserted in said cavities, the combination of cavities each including a vertical contact portion extending downwardly from a generally circular pin orifice, with a lower abutment shoulder at the bottom of the contact portion on one side of the cavity and extending across at least half the area thereof and an upper abutment shoulder at the top of the contact portion having a broad flat surface with an area no less than the area of the pin orifice to permit a contact to be held in floating assembly between said abutment shoulders; an offset entrance channel extending from the lower surface of the base to the contact portion of the cavity to permit the insertion of a contact sleeve from the bottom of the socket; and a floating contact including a sheet metal sleeve of uniform cross section throughout its

length adapted to be inserted into the cavity in tilted position, with means comprising a cam surface in the offset channel and a soldering lug on the contact sleeve to position the upper and lower ends of the sleeves against the upper and lower abutment shoulder respectively, and to guide the upper end of the sleeve into position below the pin orifice and maintain the sleeve in vertical position to receive the pin but permit limited lateral floating movement to compensate for dimensional variations in manufacture.

CHARLES J. ADAMS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,886,199	Kulka	Nov. 1, 1932
1,983,511	Johnson	Dec. 4, 1934
2,205,146	Larkin, Jr.	June 18, 1940
2,332,483	Doty	Oct. 19, 1943

FOREIGN PATENTS

Number	Country	Date
361,056	Great Britain	Nov. 19, 1931