April 14, 1959 J. P. MORONE, JR 2,882,512

SOCKET STRUCTURE

Filed July 20, 1955

Fig. 1

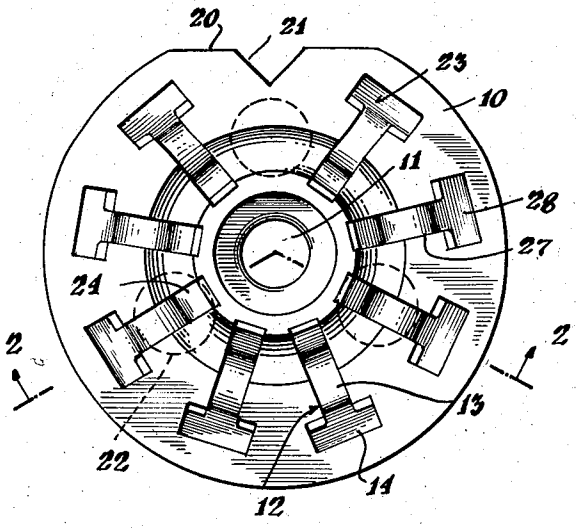


Fig. 3

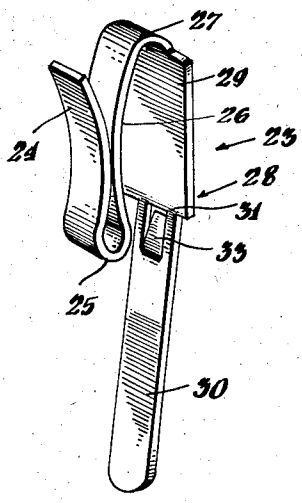


Fig. 2

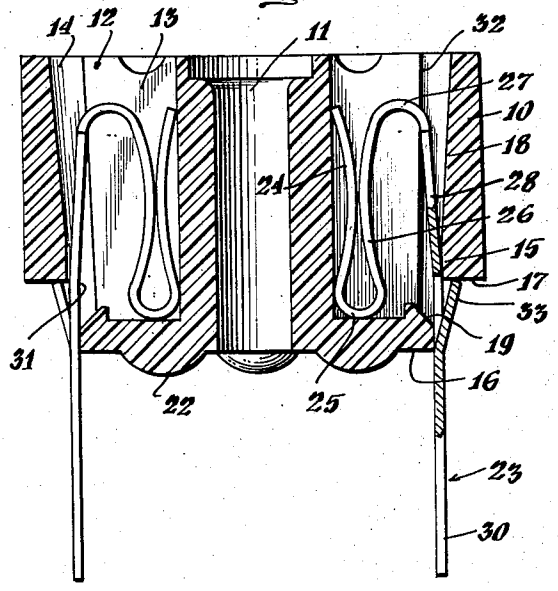
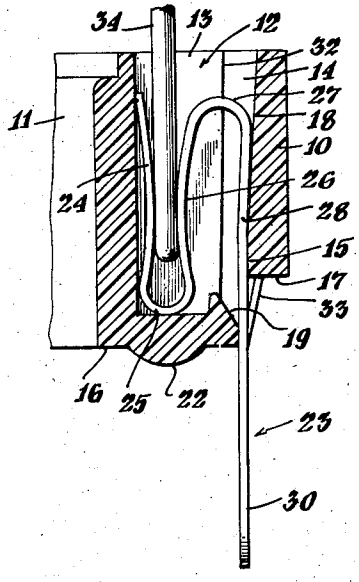


Fig. 4



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United States Patent Office 2,882,512 Patented Apr. 14, 1959

2,882,512

SOCKET STRUCTURE

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Application July 20, 1955, Serial No. 523,272

5 Claims. (Cl. 339—193)

This invention relates to socket structures for use with devices having contact prongs, and, more particularly, to tube sockets for electron tubes of small dimensions, such as for so-called subminiature tubes.

One common form of conventional tube socket comprised a socket body of molded insulating material having a plurality of prong-receiving bores formed therein corresponding in number to the contact prongs or pins of the tube. A contact member generally formed of spring metal was held in each of said bores and was so constructed and arranged as to frictionally grip the prong or pin of the tube, thereby not only providing electrical connection of low resistance between the prong and the contact member but also holding the tube against accidental displacement.

While conventional tube sockets of the described general type have been satisfactory for standard size tubes, they had serious deficiencies when it was attempted to adapt their structural organization for miniature and subminiature tubes. In that case, it was necessary to proportionately reduce the dimensions of all socket components, making it impossible to accommodate contact members or springs having sufficient compliance to assure good electrical contact. Therefore, commercially available tube sockets for subminiature tubes had several recognized deficiencies, the principal ones being high and erratic contact resistance and poor tube retention characteristics. Although various suggestions and proposals were made to provide a satisfactory tube socket for subminiature tubes, none of these suggestions and proposals was completely satisfactory and successful on a practical and industrial scale.

It has been discovered that the outstanding problem may be solved in a remarkably simple manner.

It is an object of the present invention to improve tube sockets for electron tubes of small dimensions, such as for subminiature tubes.

It is another object of the present invention to provide a novel tube socket, particularly suitable for subminiature tubes in printed circuit applications, having improved electrical and mechanical characteristics.

It is a further object of the invention to provide a novel and improved tube socket for button base and flat-press subminiature tubes which is simple in structure, has low contact resistance and good tube retention characteristics, and which may be readily manufactured on a quantity production scale at a low cost.

Other and further objects and advantages of the present invention will become apparent from the following description, taken in conjunction with the accompanying drawing, in which:

Fig. 1 is a top elevational view of a tube socket for eight-pin, button base, subminiature tubes embodying the principles of the present invention;

Fig. 2 is a section, having parts in elevation, taken on line 2—2 of Fig. 1;

Fig. 3 is a perspective view of one of the contact members used in combination with the tube socket shown in Figs. 1 and 2; and

Fig. 4 is a sectional view similar to Fig. 2, but somewhat fragmentary in character, illustrating the tube socket of the invention in its operative position in which the tube pins or prongs are resiliently gripped by appropriately constructed and arranged portions of the contact member.

Referring now more particularly to the drawing, illustrating a preferred embodiment of the invention, reference numeral **10** denotes a generally cylindrical socket body formed of a suitable insulating material, for example, by molding, and having a central aperture **11** extending therethrough for accommodating a rivet or other fastening element whereby the socket body may be secured to a supporting member. A plurality of prong-receiving cavities **12** are circumferentially arranged in the socket body and extend from one face of the body a substantial distance toward the other face of said body. Cavities **12** are formed in a T-shaped configuration, with the vertical portion **13** of the T extending radially of the socket body and with the transverse portion **14** of the T extending perpendicularly to the radii of a circle concentrically inscribed on the said body. A restricted passage **15** extends from the bottom of each cavity to the other or bottom face **16** of the socket body, the object of which will appear as the description proceeds. As it will be best observed in Fig. 2, the portion **14** of each cavity **12** ends at a slightly higher level than the portion **13** thereof and the lower portion of the socket body is formed with a smaller diameter than its upper portion, thereby defining a circumferential ledge **17**. It will be further noted that portion **14** of the cavities and the entrance to restricted passages **15** are formed with sloped surfaces **18** and **19**, respectively, to facilitate the insertion of the terminal portion of a contact member therein. A flat surface **20** and a V notch **21** are formed in the upper portion of the socket body whereby the socket can be properly oriented with respect to component placement devices in an automatic assembly line. A plurality of bosses **22** are integrally formed with the bottom surface of the socket body to space the said body from a supporting member or panel upon which the socket is secured.

A contact member generally denoted by numeral **23** is provided in each cavity **12** and is integrally formed of a single piece or strip of spring metal by a plurality of bending operations. As best shown in Fig. 3, this contact member comprises a first portion or leg **24** extending downwardly to an inversion point or heel **25**, where it reverses its direction and extends upwardly as a second portion or leg **26** up to a second bend **27**, from where it extends again downwardly as a third portion or leg **28**. It will be further noted that the upper portion **29** of the leg **28** is considerably wider than its lower portion **30**, which extends beyond the socket body and constitutes an electrical terminal or lug to which a conductor, such as a portion of a printed circuit, may be secured by soldering or in any other appropriate manner. Leg **28** is slightly bent along a form line **31** to insure that its upper portion **29** is biased against the innermost wall **32** of the transverse portion **14** of the T shaped cavity. This biasing effect insures a certain minimum amount of deflection of the leg portion **29** which otherwise would not be provided because of tolerances and occasional excessive stressing in assembly. A lug or ear **33** is struck up from the wider portion **29** of the contact member, the function of which will appear presently.

Portions **24** and **26** of the contact member are bowed toward each other in a bi-convex configuration to constitute guide and gripping means for a tube pin or prong inserted therebetween and have approximately the same width as the radially extending portion **13** of cavity **12** in

which they are housed. Portions 26 and 29 of the said contact member, on the other hand, are bent in a plan-convex configuration and provide spring energy storage means by elastic deformation thereof, this being facilitated by the fact that inner circumferential wall 18 of cavity 12 is spaced at a substantial distance from the portion 29 of the contact member. The said portion 29 has a width which is approximately the same as that of transverse portion 14 of the cavity.

In assembling the tube socket of the invention, the terminal end 30 of each contact member is inserted through restricted passage 15 of the corresponding cavity 12 and the contact member is pushed in as far as possible. This operation is greatly facilitated by sloping surfaces 18 and 19, along which the said terminal end may slide. Lug 33 of the contact member will then snap beneath ledge 17 of the socket body so that the said member will be securely retained as a result of the spring relationship between heel 25 and lug 33 of the contact member.

Upon insertion of a tube in the socket (Fig. 4), pin or prong 34 of the tube will be guided by convex portions 24 and 26 of the contact member into a position where two sides of the prong will be gripped over a relatively large contact area, thus assuring reliable contact of low electrical resistance. A considerable amount of spring energy will be stored up by resilient deformation of all three portions or legs of the contact member, of which 24 will be slightly flattened and portions 26 and 29 will be bent away from the prong in the operative position of the socket, thus assuring low contact resistance and good tube retention characteristics.

It will be noted that the principles of the present invention provide various important advantages. To mention only the most important ones, the snap-in arrangement of the contact member permits the use of a high-strength, precipitation-hardened, beryllium-copper spring, whereas conventional tube sockets had to use inferior spring material in order to be able to form, clinch or stake the contact member in place. Upon tube lead or prong insertion, spring energy is stored not only in both of the spring portions (24, 26) contacting the lead or prong, but also in the portion (29) apart from the lead. The superior performance of the unit of the invention over those now on the market is to a large extent due to the high compliance of the contact member, its greater effective spring volume and the possibility of using a superior spring material. The monoblock construction of the socket body is free of moisture traps, and in mounting the socket on a panel or chassis, bosses 22 slightly elevate the body to permit evaporation of condensate between body and chassis. Sturdy mounting is effected by means of a rivet through center aperture 11 of the socket body and through a corresponding aperture in the supporting panel or chassis (not shown) having properly aligned openings through which terminal lugs 30 of the socket may extend. The rivet, in addition to its function as a fastening element, also serves as a shield interposed between the several contact members and the tube prongs. Soldered connections to the terminal lugs, which, particularly in the case of printed circuit applications, may be both above and below the panel, are not endangered during insertion or removal of the tube, since the insertion forces are opposed at the bottom of the contact member cavity and the withdrawal forces are opposed at ledge 17 of the socket body mating with retention lug 33. The terminals define a circle of considerably larger diameter than that of the circle defined by the tube leads or pins, which is an important advantage when the socket of the invention is used in automatic circuit assembly operations in that it permits large, widely spaced printed circuit terminations.

Although the principles of the present invention have been disclosed as applied to a tube socket for subminiature tubes having a circular array of leads or pins, they are applicable with equal or similar results to "in-line" sockets for so-called "flat-press" tubes and to various other devices having prongs, such as connectors, vibrators, capacitors, relays, transistors, and the like. All of these variations and modifications are considered to be within the true spirit and scope of the present invention, as disclosed in the foregoing description and defined by the appended claims.

I claim:

1. In a socket structure for use with a device having contact prongs, the combination which comprises a socket body of insulating material having a plurality of prong-receiving bores extending from one face for a substantial distance into the socket body, the innermost surface of each bore being radially equidistant from the axis of said body and the outermost surface of each bore being upwardly sloped away from said axis, a restricted passage extending from the bottom of each bore to the other face of said body, and an elongated contact member integrally formed of spring metal strip in each of said bores having a first downwardly extending portion, a second upwardly extending portion, and a third downwardly extending portion protruding through said restricted passage and constituting a terminal at its end, said first and second portions being bowed towards each other into substantially contacting bi-convex relation and being adapted to frictionally grip a contact prong inserted therebetween, said first portion being normally biased at its free end into contact with said innermost surface of the bore, and said third portion being normally biased away from the outermost surface of the bore whereby upon insertion of a contact prong between said bowed first and second portions, said first and second portions will be somewhat flattened and said third portion will be displaced into contact with said upwardly sloping surface of the bore thus storing substantial amounts of spring energy in all three portions of said contact member.

2. In a socket structure for use with a device having contact prongs, the combination which comprises an insulative socket body having a plurality of prong-receiving cavities extending from one face thereof for a substantial distance, the innermost surface of each cavity being radially equidistant from the axis of said body and the outermost surface of each cavity being upwardly sloped away from said axis, a restricted passage extending from the bottom of each cavity to the other face of said body, and an integral contact member of spring metal strip in each of said cavities bent into a double hairpin shape to define three legs of which the first two are bowed towards each other into substantially contacting bi-convex relation and constitute frictional gripping means for an interposed prong, and the last one extending through said passageway constitutes terminal means, said terminal means having a lug struck out therefrom adapted to engage a ledge of the socket body and to retain said contact member in the cavity as a result of the spring relationship between the bend intermediate to the first two legs of the contact member and the said lug, said first leg being normally biased at its free end into contact with said innermost surface of the cavity, and said third leg being normally biased away from the outermost surface of the cavity whereby upon insertion of a contact prong between said bowed first and second legs, said first and second legs will be somewhat flattened and said third leg will be displaced into contact with said upwardly sloping surface of the cavity thus storing substantial amounts of spring energy in all three legs of said contact member.

3. In a tube socket, the combination which comprises an insulative socket body having a plurality of prong-receiving cavities arranged in a circle and extending from one face of said body for a substantial distance, the innermost surface of each cavity being radially equidistant from the axis of said body and the outermost surface of each cavity being upwardly sloped away from said axis, a restricted passage extending from the bottom of each cavity to the other face of said body, and an integral contact member in each of said cavities bent from spring

metal strip into a double hairpin shape to define three legs of which the first and second are bowed towards each other into substantially contacting bi-convex relation to constitute converging guide and frictional gripping means for an interposed tube prong, and the third one extending through said passageway constitutes terminal means, said first leg being normally biased at its free end into contact with said innermost surface of the cavity, and said third leg being normally biased away from the outermost surface of the cavity whereby upon insertion of a contact prong between said bowed first and second legs, said first and second legs will be somewhat flattened and said third leg will be displaced into contact with said upwardly sloping surface of the cavity thus storing substantial amounts of spring energy in all three legs of said contact member.

4. In a tube socket, the combination which comprises a cylindrical insulative socket body having a plurality of T-shaped prong-receiving cavities arranged in a circle in radial direction and extending from one face of said body for a substantial distance, the innermost surface of each cavity being radially equidistant from the axis of said body and the outermost surface of each cavity constituting the transverse portion of the T being upwardly sloped away from said axis, a restricted passage extending from the bottom of each cavity to the other face of said body, and an integral contact member in each of said cavities bent from spring metal strip into a double hairpin shape to define three legs of which the first and second are bowed towards each other into substantially contacting bi-convex relation to constitute converging guide and frictional gripping means for an interposed tube prong, and the third one extending through said passageway constitutes terminal means, the first and second legs of the contact member being held in and having substantially the same width as that of the radially extending portion of said T-shaped cavity and the third leg of the contact member having an upper portion being held in and having the same width as that of the transversely extending portion of said T-shaped cavity, said first leg being normally biased at its free end into contact with said innermost surface of the cavity, and said third leg being normally biased away from the outermost surface of the cavity whereby upon insertion of a contact prong between said bowed first and second legs, said first and second legs will be somewhat flattened and said third leg will be displaced into contact with said upwardly sloping surface of the cavity thus storing substantial amounts of spring energy in all three legs of said contact member.

5. The socket structure as set forth in claim 4 wherein the upper portion of the third leg of the contact members is slightly bent along a transverse form line to bias the same against the innermost wall of the corresponding cavity portion.

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