Nov. 15, 1955 M. A. RUDNER 2,724,095

SUB-MINIATURE TUBE SOCKET

Filed Oct. 6, 1952

FIG.9

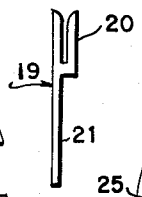


FIG.1

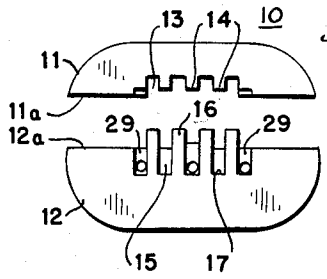


FIG.3

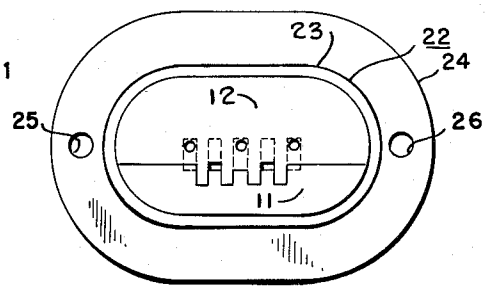


FIG.2

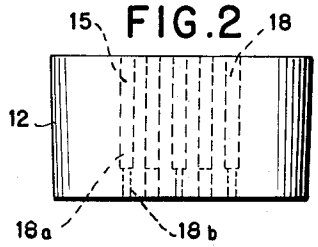


FIG.4

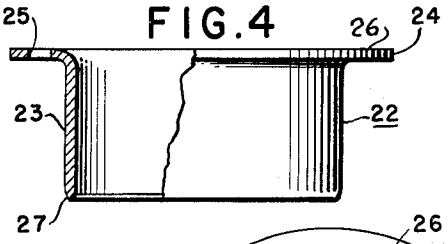


FIG.5

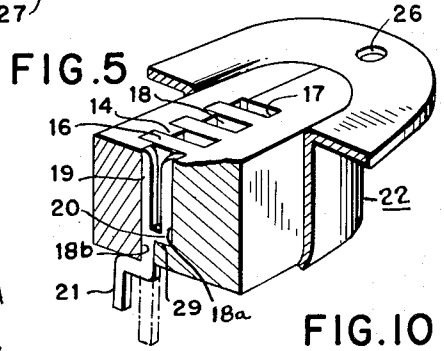


FIG.6

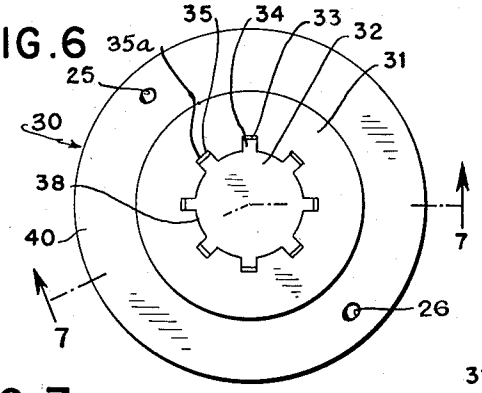


FIG.10

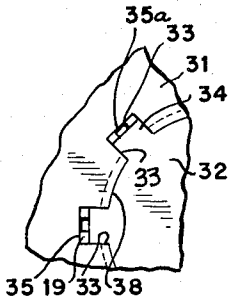


FIG.8

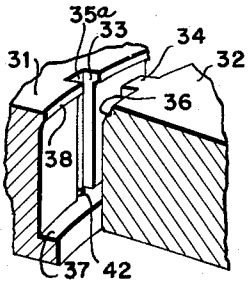
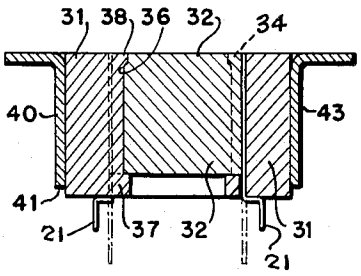


FIG.7



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SUB-MINIATURE TUBE SOCKET

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3 Claims. (Cl. 339—192)

This invention relates to electronic tube sockets, and particularly to sub-miniature tube sockets.

The miniaturization of electronic components for both military and civilian uses has presented a problem of making very small or miniature electron tubes, and, consequently, very small or miniature tube sockets for receiving those tubes, to establish appropriate electrical connections to the circuits in which the tubes are to be utilized.

A tube socket in the accepted conventional form consists of a body of insulating material with suitable recesses for accommodating several metallic terminal elements, that are suitably anchored to the insulating material. Each such element usually has, a hollow body portion to receive and to resiliently grip a terminal pin of the electron tube. Each body portion has an extending tail piece portion to serve as a terminal for receiving an electrical connection to a conductor from an external circuit to which the corresponding pin of the electron tube is to be connected.

The recesses or cavities that are formed in the body of insulating material must be suitably separated to keep the metallic terminal elements insulated from each other. That is ordinarily done by providing a thin wall of the insulating material between the spaces or cavities for the pin-gripping bodies of the terminal elements. In order to keep the overall dimensions of the socket within desired prescribed limits, and to distribute the cavities or recesses at appropriate spacings to receive the pins of the miniature or sub-miniature electron tubes, the insulating walls between the spaces become so thin that it is difficult to assure their complete and proper formation by adequate flow of the plastic material in the usual injection mold process that has been heretofore used for the purpose of making such sub-miniature sockets of thermosetting materials.

Among the resins that have suitable and desirable insulating qualities are the fluoro-carbon resins. Their chemical, physical and electrical characteristics make them suitable materials for many applications, particularly for use as insulating materials or supports for electrical contacts or terminals. One of these materials, polytetrafluoroethylene is made and sold under the trademark Teflon; and another material, polymonochlorotrifluoroethylene is sold under the trademark KEL-F.

For convenient reference, the trademark will be used to refer to the specific material, with the understanding that the material itself is intended.

One of the striking physical characteristics of Teflon and of KEL-F is their ability to resist wetting or sticking. They are impervious to water and moisture. The resistivity of these materials is very high. Their power factor is low. Those characteristics combine to make these materials excellent base materials for electronic applications.

These materials are provided in their raw state as powders, which may be formed and molded by pressure and heat to any simple shapes that may be desired. The

materials may also be formed in bar or sheet stock and then machined to shape, where complex shapes are desired that may not be readily adapted to simple molding or extruding operations, for example.

The characteristics of these fluoro-carbon resin materials make them ideal bases for miniature or sub-miniature base tube sockets.

One object of this invention is to provide one or more forms of construction that will permit the utilization of these fluoro-carbon resin compounds, and particularly Teflon, as the insulating base support for the pin terminals that are to receive and grip the pins of a sub-miniature electron tube.

Another object of this invention is to provide a sub-miniature tube socket in which the separating walls between cavities of the socket shall be always completely formed during the manufacturing process, thereby assuring minimization or elimination of rejects for that reason, and further assuring a substantially solid wall structure that will provide adequate and proper strength and insulation in the final tube socket.

Another object of this invention is to provide a novel structure for such a sub-miniature tube socket, together with a novel method of making the socket.

Another object of this invention is to provide a sub-miniature tube socket of novel design, in which the socket may be composed of two or more individual sections that can be individually made with an assurance of substantial dimensional control, within satisfactory tolerance limits, and the parts then fitted together with an assurance of proper inter-fitting physical dimensions for maximum physical strength and electrical insulation.

The manner in which a sub-miniature tube socket is constructed, according to the principles of this invention is illustrated in the accompanying drawings, in which

Figure 1 is a plan view of two insulator sections shaped with mortise grooves and tenon extensions for assembly in close-coupled fitting relationship to provide in-line spaces or cavities for accommodating pin-receiving terminal elements;

Figure 2 is front elevational view of one of the elements shown in Figure 1;

Figure 3 is a bottom plan view of an encircling or corseting band for holding the two elements of Figure 1 in closely interfitted operative relation;

Figure 4 is a side elevational view, partly broken away, of the band of Figure 3;

Figure 5 is a perspective view showing portions of the two elements of the socket of Figure 1, assembled in tight interfitting operating relationship, and disposed in and confined by the encircling band of Figures 3 and 4, with one pin-receiving terminal element in place in one cavity;

Figure 6 is a plan view of a second modification of a sub-miniature tube socket, in which the socket consists of an outer ring and central plug, to provide terminal spaces arranged in a circle;

Figure 7 is a vertical sectional view of the plug and outer ring of Figure 6, held within an encircling band having a mounting bracket;

Figure 8 is a perspective view of a portion of the plug and a portion of the outer ring, showing how they are to interfit to define a cavity or space to receive a pin-receiving terminal;

Figure 9 is a side elevation of a pin-terminal as used in the socket; and

Figure 10 is an enlarged plan view of a portion of the assembled socket of Figure 6, to show the disposition of a pin terminal in a cavity between the central plug and the ring of the socket.

As shown in Figure 1, one form of sub-miniature socket **10** consists of two comb-shaped elements **11** and **12**, whose

inner facing walls 11*a* and 12*a*, respectively, are provided with mortise cavities 13 and tenons or teeth 14 on element 11, and with cavities 15 and tenons or teeth 16 on element 12. The cavities and the tenons are of corresponding width, to permit the two elements 11 and 12 to be snugly fitted together.

The cavities 13 and the tenons 14 of the narrower element 11 are shallower and shorter than the cavities 15 and the tenons 16 of the mating element 12. Thus, when the two elements 11 and 12 are mated and pressed to close-fitting position, the longer tenons 16 are pressed home in the short cavities 13, but the short tenons 14 remain spaced from the backwalls 17 of the long cavities 15. The spaces 18 (Figures 2 and 5) thus defined between the ends of the short tenons 14 and the back walls 17 of the long cavities 15 serve to accommodate pin-receiving contact terminals 19 for receiving and gripping the pins of sub-miniature tubes that are to be received by the sub-miniature socket.

As shown in Figure 9 the pin-receiving contact terminal 19 consists of an upper forked element 20 having two prongs or fingers mounted to embody a certain amount of resilience and spaced a distance just slightly less than the thickness of the pin of a sub-miniature tube, so the pin will be tightly and resiliently gripped by the prongs of the forked element 20 of the contact terminal 19. A tail piece 21 extends downwardly from the fork 20, and provides the terminal portion to which a conductor from an external circuit may be soldered or otherwise tightly connected to establish the desired circuit connection for the corresponding pin of the electron tube which is inserted into the sub-miniature socket.

When the tenon-and-grooved elements 11 and 12 are assembled in mated interfitting position, they are then pressed into an encircling and confining band 22 (Figures 3 and 4) which is formed as a slightly oval ring or shell 23 with an upper rim flange 24 provided with two or more holes 25 and 26 to serve to receive holding-down screws, to anchor the shell together with its insulating socket elements in place where desired.

The bottom rim edge 27 of the shell 23 is peened radially inward slightly to retain the fitted elements 11 and 12 against expulsion from the shell when an electron tube is pressed to force its pins into the contact forks 20. The band 23 is otherwise sufficiently tight in itself, around the two elements 11 and 12, to retain them against exiting from the band when an electron tube is being removed from the socket.

One of the characteristics of the fluoro-carbon resins, and particularly of the Teflon resin, is its limited amount of compressibility and resiliency. Consequently, when the two sections 11 and 12 are forced under pressure into the confining metal shell 23, the metal shell 23 serves to tightly grip the two elements, both to hold those two elements 11 and 12 in proper relative position, and also to hold those two elements against removal when an electron tube is pulled out of the socket.

After the two comb-shaped elements 11 and 12 are assembled and mated, the contact terminals 19 may be installed. One such terminal 19 is shown in Figure 5. That Figure 5 also shows the ledge or shelf 29 that serves as a floor to support the fork 20 of the contact terminal 19.

Each space 18 is thus defined between the long tenons 16 and between the front ends of the short tenons 14 and the back walls 17. The space 18 has an upper compartment 18*a* to accommodate the fork 20 of the contact terminal above the shelf or floor 29, and has a lower passage 18*b*, passing the shelf 29, to permit the tail-piece 21 of the contact terminal to be extended therethrough for proper disposition and seating of the fork 20 of the contact terminal 19. After the terminal is properly inserted and seated, the tail-piece 21 is folded to form a double right-angle bend, immediately against the under sides of the two comb-shaped elements 11 and 12, alternately, to space the ends of the tail-pieces and make them more conveniently accessible for soldering a connection to each of them, and to provide more spacing as insulation.

In Figures 6 and 7, a second modification 30 of a sub-miniature tube socket is shown, in which the pin terminals are arranged in a circle. The sub-miniature socket 30 comprises an outer ring element 31 and a central plug 32. The outer ring element 31 is provided with mortise cavities 33 for receiving the tenons 34 of corresponding width, formed on the central plug element 32. As in the first modification shown in Figure 1, the tenons in this case are somewhat shorter than the depth of the cavities 33 into which they fit, in order to provide a small but definitely defined cavity space or pocket 35*a* between each tenon 34 and the back wall 35 of the mortise cavity 33, for accommodating a pin-receiving contact terminal 19 such as shown in Figure 9.

As shown in more detail in the sectional view of Figure 7, the outer diameter of the circular peripheral surface of the central plug element 32 between the tenons 34, and along the lower part of the plug body, is made somewhat larger than the normal inner diameter of the regular surface of the outer ring element 31. Along its upper edge, the plug 31 is slightly indented between the tenons 34 to embody a curved seat 36.

The outer ring element 31 is formed to embody a radially inwardly extending shoulder 37 along and around its bottom region, to serve as a shelf for the central element or plug 32, and to serve as a proper stop limit for that central plug element 32 when it is inserted into the outer ring 31 and assembled to constitute the sub-miniature structure.

By reason of that larger diameter of said central plug 32, the arcuate segments 38 between the mortise cavities 33 and along the upper inner edge of the outer ring element 31, will first be pressed back, out of the way of the plug 32 when the plug is assembled within the outer ring 31, and until the plug is pressed home, down against shelf 37. The arcuate segments 38 will then resume their positions and move radially inwardly over the top seat edge 36 of the central plug 32.

The resiliency and the tensile and shearing strength of the fluoro-carbon resin material, particularly the Teflon material, is sufficient to permit the entire ring 31 to be expanded slightly, by centrifugal pressure of the plug, and particularly the centrifugal radial pressure against the arcuate sections 38 will deflect them to enable the central plug 32 to be pressed home into the position shown in the assembled view in Figure 7.

Once the two elements have been assembled as shown in Figure 7, they are both pressed into the circular confining shell or band 40 unlike the band 22 in Figure 4. This band 40 is provided with a lower rim edge 41 that stops short of the lower surface of the outer ring element 31, for purposes of insulation. The tight pressure between the confining band 40 and the two elements of the socket is sufficient, however, to hold those elements against removal from the socket by the sole friction force engagement of the contact forks 19 on, and against, the pins of any miniature electron tube that may be removed from the socket.

The tail pieces 21 will be bent under directly at the under surface of the ring 31 in the same manner as shown in Figure 5. Each contact terminal is thus anchored against removal when a tube is pulled out of the socket.

Various modifications in the structural design may be made to fit several pieces together and then bind them tightly together, while leaving spaces suitably located and oriented to accommodate contact terminals for specific tubes and spacings required. It is contemplated that all such modifications may be made within the scope of the invention as disclosed herein.

The contact fork 20 will be seated in each cavity in the circular arrangement, as shown in Figure 10, with the fork resting on the shoulder shelf or floor 37, and the

tail piece **21** extending down through a passage **42**, Figure 8, at the bottom of the space **35***a*.

What is claimed is:

1. A sub-miniature tube socket comprising two comb-shaped elements of insulating material having their respective teeth disposed to permit the two elements to be interfitted with the teeth of each element fitting into the cavities of the other element, with the teeth of one comb falling short of fully filling the complementary cavities of the other comb element to provide spaces of pre-determined dimensions for accommodating pin-receiving terminals for the pins of a sub-miniature tube, and means for holding the two combs tightly interfitted.

2. A sub-miniature tube socket comprising a hollow tubular section of insulating material, and a central plug section shaped and dimensioned to fit snugly within the tubular section, the two section being provided with mortice and tenon interfitting cavities and extensions, the tenon extensions being slightly short of filling the mortice cavities to leave closely defined spaces for accommodating pin-receiving terminals for the pins of sub-miniature electronic tubes.

3. A sub-miniature socket for sub-miniature electronic tubes, comprising a hollow tubular element provided with radial mortice cavities on its inner surface, a central circular plug element having radial tenons on its periphery to fit into the mortice cavities of the tubular element and leave small spaces for accommodating pin-receiving terminals, retaining means on said tubular element for retaining the central circular plug in place, and a tight confining band encircling the hollow tubular element.

References Cited in the file of this patent

UNITED STATES PATENTS

1,674,253	Lightfoot	June 19, 1928
1,954,252	Maus	Apr. 10, 1935
2,436,284	Bondon	Feb. 17, 1948
2,443,706	Jansen	June 22, 1948
2,453,014	Jackson	Nov. 2, 1948

FOREIGN PATENTS

595,186	Great Britain	Nov. 28, 1947
644,540	Great Britain	Oct. 11, 1950