April 24, 1962 W. GLUCK 3,031,635

SOCKET FOR RADIO TUBES OR THE LIKE

Filed June 20, 1957 2 Sheets-Sheet 1

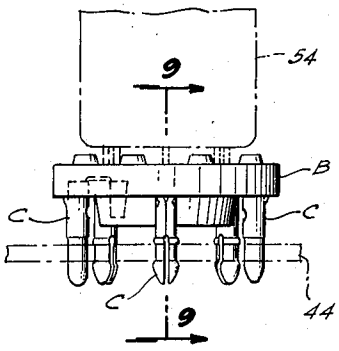


FIG. 1

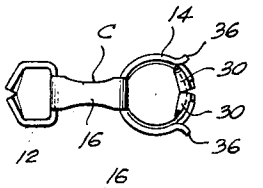


FIG. 3

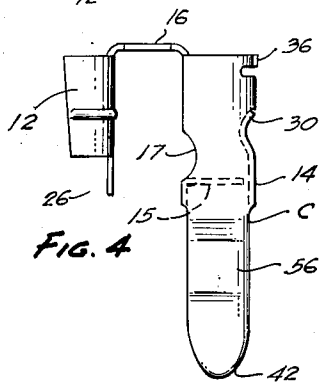


FIG. 4

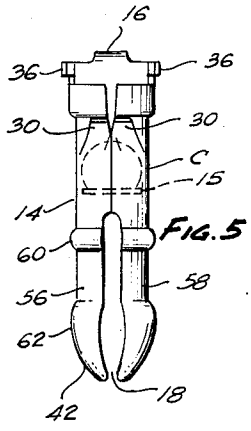


FIG. 5

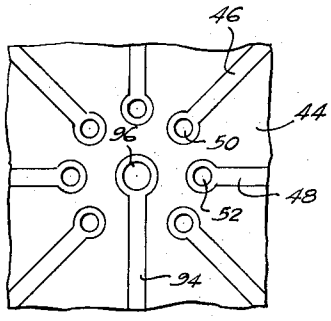


FIG. 2

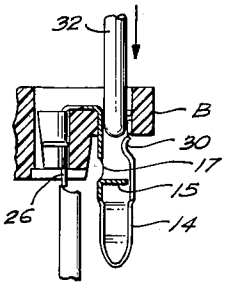


FIG. 6

FIG. 8

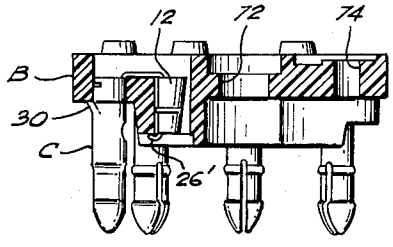


FIG. 9

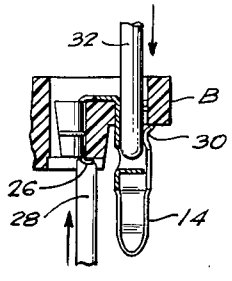
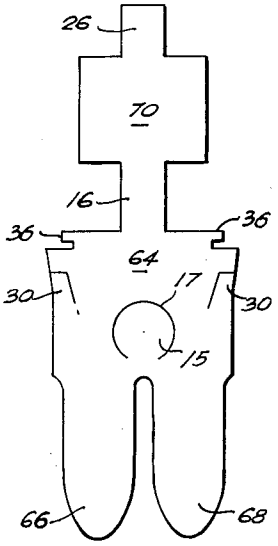


FIG. 7



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SOCKET FOR RADIO TUBES OR THE LIKE

Filed June 20, 1957 2 Sheets-Sheet 2

Fig. 10

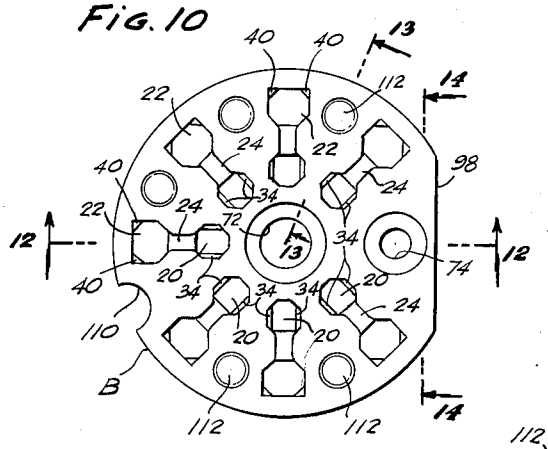


Fig. 11

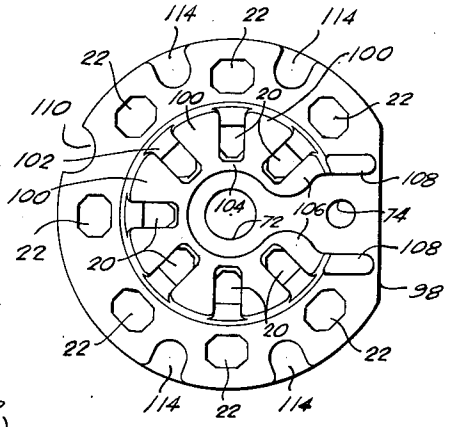


Fig. 13

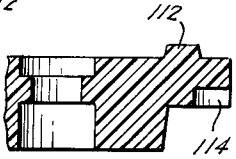


Fig. 14

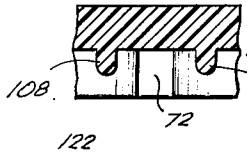


Fig. 12

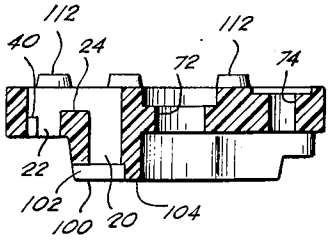


Fig. 15

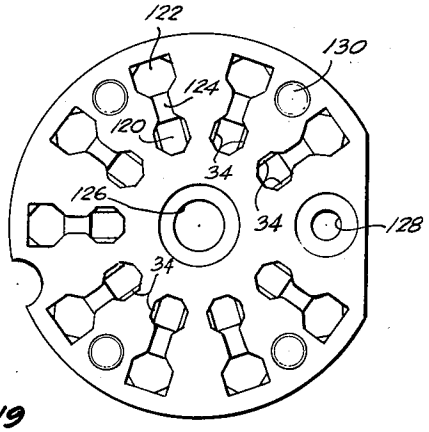


Fig. 16

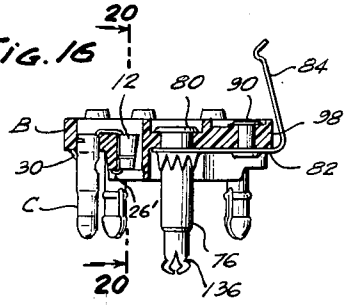


Fig. 19

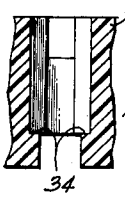


Fig. 18

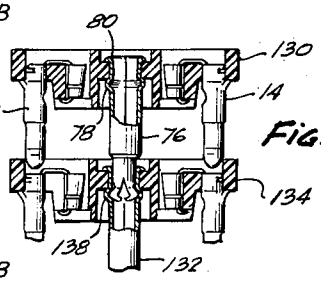


Fig. 17

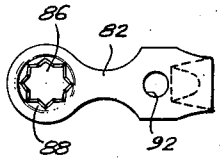
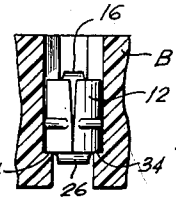


Fig. 20



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United States Patent Office 3,031,635 Patented Apr. 24, 1962

3,031,635

SOCKET FOR RADIO TUBES OR THE LIKE

William Gluck, Yonkers, N.Y., assignor to Industrial Electronic Hardware Corp., a corporation of New York

Filed June 20, 1957, Ser. No. 666,916
2 Claims. (Cl. 339—14)

This invention relates to sockets for multiple pin connectors, especially for electron emission tubes, and particularly for use in printed circuits.

The primary object of the present invention is to generally improve tube sockets for use with printed circuits. A more particular object is to provide a socket having a one-piece molded insulation base. A further object is to provide such a socket in which the vertical dimension of the base is minimized, being fully comparable in that respect to an electrically inferior laminated socket. Ancillary objects, relative to a laminated socket, are to greatly improve the high voltage breakdown characteristic; to avoid the need for assembly of wafers; and to make it possible to supply the purchaser with bases made of different desired plastics materials to suit his requirements.

Additional objects are to provide such a molded socket which may be readily pushed into mating holes in a printed circuit board, and which is preferably received with a firm snap engagement for dependable retention of the socket pending a soldering operation, typically a pot soldering operation. Other objects are to provide such a socket which may be made with or without a center post, and with or without a ground strap, and to provide an improved ground strap for improved electrical and mechanical connection between the ground strap and the center post.

Another object is to provide such a socket, the base of which may be automatically loaded with metal contacts in an assembly machine substantially the same as that disclosed in my copending application Serial No. 595,008 filed June 29, 1956, and entitled "Manufacture of Vacuum Tube Sockets," since issued on October 11, 1960, as Patent No. 2,955,555.

Still another object of the invention is to provide such a socket which may be stacked or formed into sticks of superposed sockets, and which may be automatically inserted in a printed circuit board as described in my copending application Serial No. 579,664 filed April 20, 1956, and entitled "Radio Tube Sockets," since issued on November 29, 1960 as Patent No. 2,962,690.

To accomplish the foregoing general objects, and other more specific objects which will hereinafter appear, my invention resides in the socket elements and their relation one to another as are hereinafter more particularly described in the following specification. The specification is accompanied by drawings in which:

FIG. 1 is a side elevation of a socket embodying features of the present invention, and showing its relation to a printed circuit board and a vacuum tube;

FIG. 2 is a bottom plan view of a fragmentary portion of a printed circuit board;

FIG. 3 is a plan view of one of the metal contacts forming a part of the socket;

FIG. 4 is a side elevation of the same;

FIG. 5 is an end view of the same;

FIG. 6 is a view showing an intermediate stage in the assembly of the contacts in the base;

FIG. 7 is a similar view but showing a later stage in the assembly operation;

FIG. 8 is a development of the sheet metal blank used to form the contact;

FIG. 9 is a section taken approximately in the plane of the line 9—9 of FIG. 1;

FIG. 10 is a plan view of the insulation base;

FIG. 11 is a bottom view of the insulation base;

FIG. 12 is a section taken in the plane of the line 12—12 of FIG. 10;

FIG. 13 is a fragmentary section taken approximately in the plane of the line 13—13 of FIG. 10;

FIG. 14 is a fragmentary section taken approximately in the plane of the line 14—14 of FIG. 10;

FIG. 15 is a plan view similar to FIG. 10, but showing the base for a socket having nine pins instead of seven;

FIG. 16 is a section generally similar to FIG. 9, but showing a socket having a center ground post and a ground strap;

FIG. 17 is a bottom plan view showing the ground strap drawn to enlarged scale;

FIG. 18 is a sectional view showing the interengaged relation of stacked sockets; and

FIGS. 19 and 20 are fragmentary sections at 20—20 of FIG. 16, with the contact omitted in FIG. 19.

Referring to the drawing, and more particularly to FIG. 1, the socket comprises a one-piece molded insulation base B, and a plurality of metal contacts C. Each contact comprises a single piece of sheet metal, and is formed out of a blank having the configuration shown in FIG. 8, which is appropriately pressed in a progressive die to take the form of the finished contact shown in FIGS. 3, 4 and 5. Each contact comprises a pin grip 12 which is preferably of the split sleeve type. It further comprises a generally cylindrical post 14. The grip and post are connected at their upper ends by a bridge 16. The post is longitudinally split at its lower end, as shown at 18 in FIG. 5, in order to be resiliently compressible.

Referring now to FIGS. 10, 11 and 12, the insulation base B is generally circular, and is provided with a ring of holes 20 dimensioned to receive the pin grips (12 in FIG. 4). The base is also provided with a larger diameter ring of holes 22 dimensioned to receive the posts (14 in FIG. 4). As shown in FIG. 10, the top of the base has a plurality of radial slots 24 connecting the grip holes 20 and the post holes 22, for receiving the bridges of the contacts (16 in FIGS. 3 and 4). The slots 24 are rather deep, as is best shown in FIG. 12, and thus the contacts are received in and are recessed well below the top surface of the base, as is clearly shown in FIGS. 9 and 16.

The socket is further provided with means to anchor the contacts in the base. For this purpose, the contact is provided with tangs on the post, and a lug on the pin grip. The latter is clearly shown at 26 in FIGS. 4 and 8 of the drawing. After the contact has been inserted in the base, this lug may be bent radially outward beneath the base, as is shown at 26' in FIGS. 9 and 16. The change in position of the lug is also shown by comparison of FIGS. 6 and 7, the latter figure showing how the lug may be bent outward toward the post 14 by a suitable punch 28. The lug 26' prevents upward movement of the pin grip 12.

The post 14 is provided with tangs 30 (FIGS. 7, 9 and 16). To form these, the metal of the blank is preferably preliminarily slit as is indicated at 30 in FIG. 8. During the formation of the contact, the excised metal is indented, as is best shown at 30 in FIG. 4. Thus, the post 14 is readily passed through its mating hole 22 when loading the base with contacts. By thereafter forcing a punch 32 downward into the hollow post, the indented metal is forced outward, as shown by the change from FIG. 6 to FIG. 7 of the drawing. In this way the two tangs 30 are displaced outward beneath the bottom surface of the base B, and thereafter serve to hold the post against upward movement relative to the base.

It was previously mentioned that one advantage of the socket is that the contacts may be formed, and the base may be assembled with the contacts as they are formed, by an automatic machine substantially the same as that disclosed in my copending application Serial No. 595,008, now Patent 2,955,555. The said machine employs a

punch to transfer a contact downward into the base, and referring to FIGS. 6 and 7, the punch **32** serves to first insert the contact in the base, and continued movement of the punch after the contact has been seated in the base automatically projects the tangs **30** into locking position, as shown in FIG. 7.

The cooperation of the bridge **16** on one side of the base, and the lug **26'** or/and tangs **30** on the other side, could suffice to anchor the contact in the base. However, I prefer to additionally employ ledges to positively support the pin grip against the force of insertion of a tube. These ledges are best shown at **34** in FIG. 19, and they positively support the lower end of the pin grip **12**, as shown in FIG. 20. The ledges **34** are visible when the base (without the contacts) is viewed from above, as will be seen in FIGS. 10 and 15.

The upper end of post **14** is provided with tabs **36** (FIGS. 3, 4 and 5) to help support it at points remote from the bridge **16**. Referring to FIG. 8, the parts **36** act later as the said tabs for the post. It will be understood that the base as molded is provided with recesses to receive the tabs **36**. Referring to FIGS. 10 and 12, the tabs are received in spaced recesses **40** (FIG. 10), which in the present case are triangular in outline.

The lug **26** is not bent directly against the insulation base, and the spacing between the bridge **16** and the lug **26** is slightly greater than the thickness of the insulation therebetween. Similarly, the spacing between the tabs **36** and the tangs **30** is slightly greater than the thickness of the insulation therebetween. Also, the width of the slots **24** (FIG. 10) is somewhat greater than the width of the metal bridge **16** of the contact. The holes **20** (FIG. 10) which receive the pin grips are larger in cross section than the pin grips. The net effect of all this is that the contacts are individually slightly movable or self-adjustable within the base, so as better to adapt themselves to the pins of the vacuum tube, and to the holes in the printed circuit board. Moreover, the bridge **16** is not subjected to a direct stress each time a tube is inserted in the socket, for the bridge is elevated slightly from the base, when the lower end of the pin grip rests on the ledges **34**. This prevents possible fatigue of the metal of the bridge.

Referring to FIGS. 4 and 5, the post **14** is substantially longer than the pin grip **12**. It is hollow for stiffness. The lower end is pointed somewhat in the shape of a bullet nose, as shown at **42**. The term "pointed" is intended to include "rounded," for either will facilitate insertion of the socket in the holes of a printed circuit board.

Referring to FIG. 2, an insulation panel or board **44**, only a fragment of which is shown, has conductors **46**, **48**, etc. printed thereon, these leading to holes **50**, **52** etc. In the present case, the socket is designed to receive a so-called "miniature" tube having seven pins. There are seven holes at the spacing of eight, and these receive the lower ends of seven posts of seven contacts for the seven pins of the tube. However, different numbers and spacings may be provided. The assembly is shown in FIG. 1, in which the socket is mounted on an insulation printed circuit board **44**, and a miniature tube **54** having seven pins at its lower end is inserted in the socket.

Reverting to FIG. 5, the post **14** is bifurcated at its lower end, that is, there are legs **56** and **58** separated by diametrically opposed slots **18**. The post is therefore resiliently compressible at its lower end, thereby facilitating insertion of the socket in the mating ring of holes in the board. The annular rib **60** acts as a stop means to limit insertion of the post in the panel. The lower end of the post is preferably provided with another annular bead **62**, in consequence of which the post is received in the hole with a snap fit, and the socket is held securely in the board even before the soldering operation.

A section through the post between the beads is substantially circular, but a section through the post at the beads is generally elliptical rather than circular. This is so because the beads are not truly annular, and instead taper off at the slots **18** so that the diameter of the post as viewed in FIG. 4 is substantially uniform. The reason for this is that the legs **56** and **58** of the post are compressible toward one another as viewed in FIG. 5, but the individual legs are not compressible from left to right as viewed in FIG. 4.

It will be understood that the bead **60** functions as a stop, and need not necessarily be a bead. For example, the upper portion of the post might be continued upward at the same elliptical diameter or cross-sectional shape as at the bead **60**, in which case the post would still function as here described. In other words, instead of thinking of the post as having two spaced beads **60** and **62**, one might think of its as being a larger post having a constricted or necked portion where it is to receive the printed circuit board, the said constricted or necked portion having an axial length corresponding to the thickness of the printed circuit board with which the socket is to be used.

Referring now to FIG. 8 of the drawing, the blank comprises a body portion **64** with two depending leg portions **66** and **68**, and a head portion **70**. The body and leg portions **64**, **66**, **68** are shaped to form the post **14**. The head **70** is shaped to form the pin grip **12**. The post and pin grip are located at opposite ends of a neck **16**, and in the finished contact are bent substantially at right angles to the neck, which then acts as a bridge.

In FIG. 4, it will be noted that a disc of metal **15** has been struck inward and downward. This is formed from a generally circular cut **17** in the face of the post opposite the slit, as is best shown at **15**, **17** in FIG. 8. The disc **15** forms a barrier or dam to prevent upward rise of either flux or solder. Either of these may tend to rise by capillary action, because of the comparatively small diameter of the post. Moreover, flux previously applied may tend to rise during the soldering operation because of the heat of the solder applied to the lower end of the post. Flux or/and solder have been found objectionable if carried up high, and the barrier **15** solves the problem. It will be understood that the barrier **15** is circular in the present case because the post is circular in section, and that if the hollow post had some other sectional shape, the barrier could be similarly modified in shape.

The socket shown in FIGS. 1 and 9 does not have a center ground post nor a ground strap. However, the base B is molded to accommodate either a ground post, or a combination ground post and strap. For this purpose, the base is provided with a center hole **72** (FIGS. 10 and 11) and with a side hole **74**. Referring to FIG. 16 of the drawing, the center ground post **76** is inserted in the center hole, and is suitably secured therein. As shown in FIG. 18, the shank of post **76** preferably has a bead **78** which acts as the lower part of an eyelet. The cylindrical upper end of the post is flanged outward, as shown at **80**, thereby anchoring the post on the base.

Such a post may be used with or without a ground strap. In FIG. 16, a ground strap **82** has been added. This extends radially outward from post **76**, and is turned upward at **84** to engage a metal tube shield. To insure good electrical contact between the post and strap, and to anchor the strap on the post, the material at the center hole **86** (FIG. 17) of strap **82** is formed into a ring of serrations **88** which slope downward and inward to a diameter substantially smaller than the diameter of the center post. When the strap is forced over the free end of the post all the way up to the base, the serrations bite into the center post and insure good electrical contact. They also hold the strap securely on the post. They fit around bead **78**.

The strap may be provided with additional holding means, and in the present case, this consists of a small eyelet **90** (FIG. 16) which passes through the previously mentioned side hole **74** of the base, and through a registering hole **92** (FIG. 17) in the strap **82**.

Reverting to FIG. 2, the printed circuit there shown is intended for use with a center ground post, and a printed

conductor **94** extends to a center hole **96**. This receives the center post.

The socket so far described has seven pins at the spacing of eight. The generally circular base preferably has a flat **98** (FIGS. 10 and 11) at the omitted contact. The radially directed ground strap passes through the gap provided by the omitted contact, and when bent upward, as shown in FIG. 16, does so at the flat **98**. The side hole **74** for rivet **90** is located near the flat **98**.

The molded base is preferably raised or thickened at the bottom to provide insulation barriers between adjacent pin grips, and between the pin grips and the center ground post and ground strap. Referring to FIGS. 11 and 12, the parts **100** between the pin grip holes **20** form insulation barriers. This barrier applies also to the outwardly turned lugs **26'** (FIG. 16), which are received at the recessed surfaces marked **102** (FIG. 12). The extra thickness of insulation is maintained on the circular arc **104** (FIG. 11), and is carried outward at **106** and **108**. The generally circular wall **104** acts as an insulation barrier between the center ground post and the pin grips. The walls **106** and **108** act as an insulation barrier between the ground strap and the adjacent contacts.

The arcuate notch shown at **110** (FIGS. 10 and 11) is to facilitate orientation of the base . The flat **98** also may be used to fix the orientation of the base. The studs **112** shown at the top of the base are intended merely to limit the maximum insertion of tube prongs by physically bearing against the bottom end of the tube. The recess **114** (FIG. 11) on the bottom of the base may be used to receive the tongues of a tube shield which is not removable as in my copending application Serial No. 684,968, filed September 19, 1957, and now Patent No. 2,990,532, or the saddle for a tube shield which is removable.

As so far described, the socket has seven contacts, but it will be understood that similar features of construction may be used for a socket receiving a different number of pins, and FIG. 15 is a plan view of an insulation base similar to FIG. 10, but showing the base of a socket having nine contacts at the spacing of ten. The holes **120** are for the pin grips. The holes **122** are for the posts. The radial slots **124** are for the bridges. The center hole **126** is for a center ground post. The side hole **128** is for the ground strap eyelet. The studs **130** correspond to the studs **112**, and so on. The contacts used are the same as those previously described, and similar provision is made to receive the pin grips at ledges **34**, and the top tabs, as well as the outwardly curled bottom lug **26** and the tangs **30**.

An important advantage of the present socket, when provided with center ground post in preferred form, is that the sockets may be stacked or formed into a stick of connected sockets. This is in accordance with the disclosure in my U.S. application Serial No. 579,664, now Patent 2,962,690 mentioned above, which describes a machine for automatically inserting sockets in printed circuit boards. For stacking, the lower end of the center post **76** (FIGS. 16 and 18) is so related dimensionally to the upper end of the center post, that the lower end of the post **76** of an upper socket **130** may be received in the upper end of the post **132** of a subjacent socket **134** with a resilient fit, and preferably with a snap engagement. In the specific form here illustrated, the lower end is undercut at **136** (FIG. 16), and is radially slit to be resiliently compressible. This mates with an annular space formed by the bead **138** (FIG. 18) of post **132** (corresponding to bead **78** of post **76**). Thus, the sockets may be anchored together with a snap fit.

The relative length of the contact posts **14** is preferably such that the lower ends of posts **14** are reecived in the upper ends of the holes formed in socket **134** for its posts. In other words, the lower ends of posts **14** of the upper socket, are received in the large ring of holes in the base of the lower socket when the center posts are engaged with their snap engagement, and this additionally steadies the stack of sockets, and holds them against relative rotation so that they may be maintained in uniform orientation, that is, with the flats all on one side.

It will be understood that the snap engagement between superposed sockets may be obtained in different fashion. For example, the lower end of the center post may be rigid, and the upper end of the center post may be provided with yieldable mating means. Such an arrangement is disclosed in my copending application Serial No. 663,852 filed June 5, 1957, and entitled Stacking Radio Tube Socket, since issued June 21, 1960 as Patent 2,942,230, and the center post there disclosed may be used in the present socket in lieu of that here shown.

It is believed that the construction, the method of assembly, and the method of use of my improved molded socket for printed circuits, as well as the advantages thereof, will be apparent from the foregoing detailed description. Compared to a laminated socket, the present socket has a one-piece insulation body; requires no assembly of wafers; no eyelet or other means to assemble them; has a voltage breakdown about three times as high; and the plastics material may be varied to suit the needs of a customer. Thus, the base may be molded out of a black general purpose phenolic plastics material, or it may be molded out of a yellow colored mica filled phenolic, and so on.

Compared to molded sockets previously made, the present socket has the advantage of having a small compact insulation body, with minimum vertical dimension. It has the advantage that contacts may be automatically assembled with the base, and the finished sockets may be automatically inserted in printed circuit boards, by means of automatic machinery already developed for use with laminated sockets, because in the present molded socket, the base is relatively thin and wafer-like, and is dimensionally comparable to a laminated socket. The socket may be made with or without a center ground post, and with or without a ground strap. The sockets may be stacked. A barrier against flux and solder is provided, as well as an improved connection between the center ground post and the ground strap.

It will be apparent that while I have shown and described my improved socket in several preferred forms, changes may be made in the structures shown without departing from the scope of the invention, as sought to be defined in the following claims.

I claim:

1. A socket for printed circuits, said socket comprising a one-piece molded insulation base, and a plurality of metal contacts, each contact comprising a single piece of sheet-metal formed into a pin grip and a post connected at the upper end of the post by a bridge, said insulation base being generally circular and provided with a ring of open ended holes to receive the pin grips, a larger ring of open ended holes to receive the posts, and a plurality of radial slots on the upper side of the base connecting the grip holes and post holes for receiving the bridges, said base having narrow support ledges beneath the pin grips at the bottom of the pin grip holes to positively support the pin grips against downward movement without obstructing the passage of tube pins through the pin grips, said posts being disposed transversely of the base and extending downward from the base, the inner portion of the base radially inward of the posts being thicker than the vertical height of the pin grips, the peripheral portion of said base receiving the posts having a thickness only about half that of the inner portion receiving the pin grips, said posts being hollow for stiffness and the peripheral portion of said base being sufficiently thick around the upper ends of the posts to hold the posts in desired upright position, the posts having outwardly excised tangs directly beneath the base to prevent upward movement of the posts, the lower ends of the pin grips having lugs bent radially outward toward the posts to prevent upward movement of the pin grip, the posts being substantially longer than

the pin grips and each being longitudinally split at its lower end to be resiliently compressible, the lower tip of each post being shaped to facilitate insertion in a mating hole in a printed circuit panel having a ring of such holes, said posts having means to limit their insertion in said panel with the base and pin grips spaced above the panel and with the lower tips of the posts passing through and somewhat beyond the panel for soldering to printed circuitry.

2. A socket for printed circuits, said socket comprising a one-piece molded insulation base, and a plurality of metal contacts, each contact comprising a single piece of sheet-metal formed into a pin grip and a post connected at the upper end of the post by a bridge, said insulation base being generally circular and provided with a ring of holes to receive the pin grips, a larger ring of holes to receive the posts, and a plurality of radial slots on the upper side of the base connecting the grip holes and post holes for receiving the bridges, said posts being disposed transversely of the base and extending downward from the base, the inner portion of the base radially inward of the posts being thicker than the vertical height of the pin grips, the peripheral portion of said base receiving the posts having a thickness only about half that of the inner portion receiving the pin grips, said posts being hollow for stiffness and the peripheral portion of said base being sufficiently thick around the upper ends of the posts to hold the posts in desired upright position, means to prevent upward movement of the contacts, a center ground post, a ground strap extending radially from the center ground post at the height of the bottom of the peripheral portion of the base, whereby the inner portion of the base provides an insulation barrier between the pin grips and the center ground post and strap, the posts being substantially longer than the pin grips and each being longitudinally split at its lower end to be resiliently compressible, the lower tip of each post being shaped to facilitate insertion in a mating hole in a printed circuit panel having a ring of such holes, said posts having means to limit their insertion in said panel with the base and pin grips spaced above the panel and with the lower tips of the posts passing through and somewhat beyond the panel for soldering to printed circuitry.

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