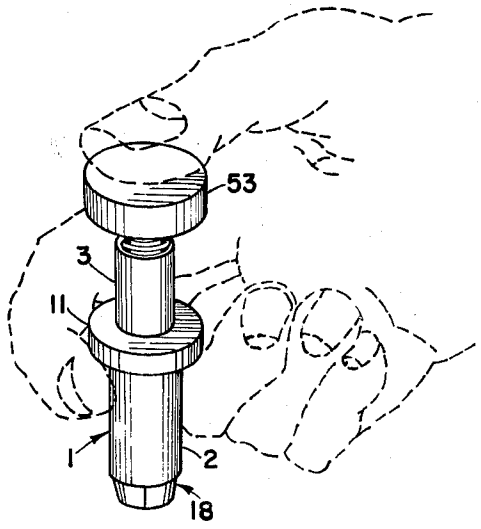
Oct. 12, 1965 B. J. JOHANSON ETAL 3,210,836

ELECTRICAL COMPONENT REMOVER AND/OR INSERTER

Filed May 21, 1963



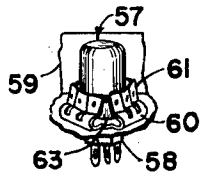


FIG 1

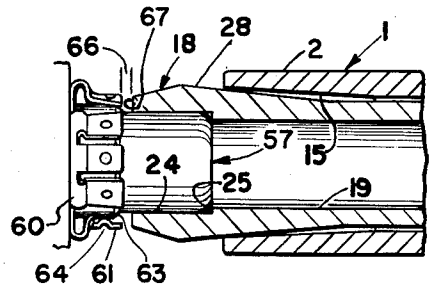


FIG 5

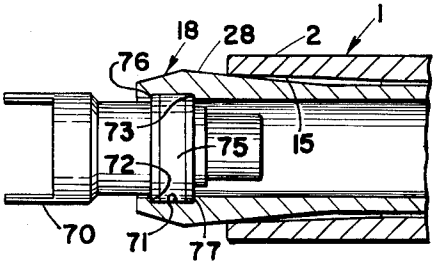


FIG 6

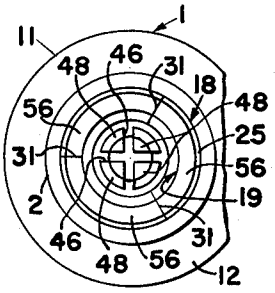


FIG 3

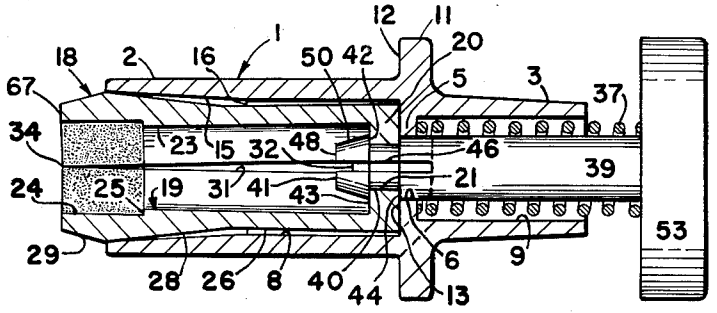


FIG 2

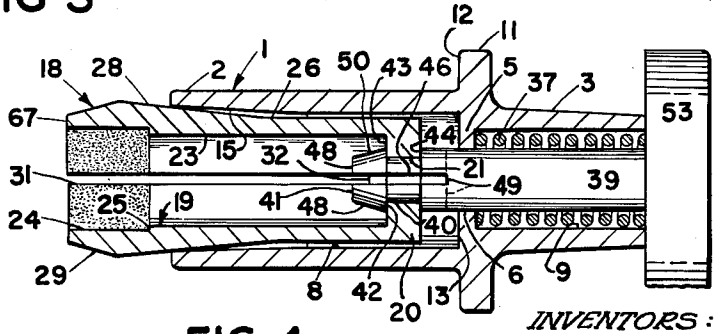


FIG 4

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3,210,836

ELECTRICAL COMPONENT REMOVER AND/OR INSERTER

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1 Claim. (Cl. 29—278)

This invention pertains to the removal and insertion of electrical and electronic plug-in type components, especially miniature components such as micro-electron tubes, from and into respectively, their mounting means or sockets and more particularly, the invention covers a device for effectively accomplishing one or both of the same.

In this modern day with its great emphasis, in the electronics industry especially, on maximum possible reduction in size and weight and on extreme compactness, electron tubes have recently been devised and placed on the market which are extremely small in size. These tubes extend only one half inch in height above the socket when mounted, with only five sixteenths of an inch of height extending above the tube encircling saddle, associated with the socket, and available for gripping for removal of the tube. The tube is further only about five sixteenths of an inch in diameter over such portion available for gripping.

Because of the great emphasis on compactness and minimum weight, these extremely tiny tubes are also closely surrounded and crowded in their mounted condition by an array of other electrical and electronic equipment, components, and parts and by portions of chassis, structural supports, wires and the like and together with the very minuteness of these tubes and especially of the extremely small portion thereof extending above the saddle and available for gripping, these tubes are most difficult to get at in the first instance aside from trying to get a grip on the extremely small portion thereof available for gripping with the ends of only two fingers.

These tiny tubes also have all metal casings, rather than glass as in the larger tubes and also serving the function of tube shields, which get extremely hot in use rendering them impossible to touch with the fingers without severely burning the same unless prolonged cooling periods are allowed. Such cooling periods, of course, are most inconvenient and time consuming and therefore expensive, especially taking into account many such tubes over a substantially long period of time.

These tubes are further very tight in their sockets and the surrounding rings of closely spaced, exceptionally tightly gripping, strong spring fingers of the saddles and are impossible to extract without the obtaining of a good grip and the expenditure of great force. The outer cylindrical surfaces of the sheet metal casings of these tubes are moreover and significantly perfectly smooth which makes it impossible to get a good grip on the extremely small available surface of each tube above the saddle therefor with the ends of two fingers in any event.

Aside from the extremely high heat of the metal casings of these tubes and the retention of heat by the same, the minuteness of these tubes, and the closely surrounded and crowded, almost hidden condition of these tiny tubes in their mounted condition, even, all of which in themselves would make removal of these tubes quite difficult, the smooth cylindrical sheet metal surface of the extremely

small portion of each tube extending above the saddle and available for gripping together with the exceptionally tight reception of the tube within its socket and tightly clamping saddle makes it completely impossible to extract the tube from such socket and saddle manually by the use of the ends of two fingers, the rounded ends of the latter merely camming or slipping off without effecting the slightest change of the tube in its mounted relation even after repeated tries.

In view of the above existing situation, it is the primary object of the invention to provide a device for removing the above described tubes from their sockets and saddles when the tubes are in their mounted condition.

Another object of the invention is to provide such a device which can be used to remove the above described tubes from their mounted positions within their sockets and saddles immediately without waiting for any cooling of the metal tubes to occur and without burning one's fingers.

Still another object is to provide such a device which can be easily inserted in the restricted spaces occupied by the tubes and caused to engage over the respective tubes for their removal.

Yet another object of the invention is to provide a device as indicated which can be easily and quickly used merely by three fingers of one hand and also while the arm is in a fully outstretched position where this is necessary.

A still further object is to provide such a device which will automatically and effectively grip the outer smooth casing of the above described tube upon letting the device relax in one's fingers after being placed over the tube to be removed, for subsequent removal of the tube merely by pulling upwardly or outwardly, depending upon the position of mounting of the tube, on a portion of the device.

It is also an important object of the invention to provide a device as indicated above which will in no way cause any damage to the critically or exactingly constructed and easily damageable saddles within which the tubes rest when the device is engaged on the tubes preliminary to the pulling and removal thereof.

Another important object is to provide such a device which is also fully effective for inserting tubes such as the above into their sockets through the restricted space available and further, without any damage to the critically constructed and easily damageable saddles associated with the sockets.

A further object is to provide such a device which can also be used for carrying or transporting the minute tubes which can very easily be dropped from the fingers including into unaccessible areas of electronic or other apparatus to be lost therein and also with possibilities of shorting out and burning equipment because of the metal casings, such carrying or transporting especially being incident to removal or insertion of the tubes.

Still another object is to provide a device as above indicated which can be made of any extensive length for getting into otherwise totally unaccessible locations including into spaces only very slightly larger than the tubes themselves for the insertion and removal of tubes into and from their mounted relation.

Yet another object is to provide such a device which is easily assemblable without the need and use of any tools or external devices whatsoever, the final parts merely

being caused to snap into interlocking relation with each other after the other part has simply been laid or placed in a proper position.

A still further object of the invention is to provide such a device which is completely devoid of any means such as screws, nuts, bolts, clamps, fittings or the like, the device preferably being constructed entirely of non-heat conductive material such as plastic except for a single spring of metal.

Another object of the invention is to provide a device as above indicated which is easy and inexpensive to manufacture yet dependable and effective in use and also which is most durable for a long life usage thereof.

Other objects, advantages, and features of the invention will appear in the course of reading and considering the following description, in conjunction with the accompanying drawing, in which:

FIG. 1 is a perspective veiw of a preferred form of the device of the invention shown in position over a micro-tube, as set forth in the preamble, to be pulled and also with a hand being shown in phantom in position to operate the device preparatory to insertion of the same over the tube, for removal of the latter from its mounted relation;

FIG. 2 is a longitudinal sectional view of the device of FIG. 1 taken thrrough the center of the device and shown the latter in the normal condition thereof;

FIG. 3 is an end elevational view of the device as seen from the left in FIG. 2;

FIG. 4 is a view like FIG. 2 but showing the device in a fully extended or operated condition when being fully squeezed between the thumb and two fingers of a person's hand;

FIG. 5 is a view similar to FIG. 2 but fragmentary and showing a micro-tube, as set forth in the preamble, within the device and ready for pulling from its mounted condition with the device being in an unpressed, tube gripping condition; and

FIG. 6 is a view like FIG. 5 but showing a slight modification as applied to a modified type of micro-tube.

Referring to the drawing figures in detail and first to FIGS. 1 through 5 thereof, reference numeral **1** generally designates an outer or casing member having a forward body or barrel portion **2** of generally cylindrical form and a rearward body portion **3** also of generally cylindrical form and somewhat smaller in size than the forward portion **2**. Portions **2** and **3** are of course, co-axial to each other, the portion **3** being somewhat tapered on its outer surface, as is evident from FIGS. 2 and 3.

A vertical wall **5** is provided intermediate the two portions **2** and **3**, the wall having a centrally disposed bore **6** therethrough. The cylindrical natures of the body portions **2** and **3** together with the medially disposed interior wall **5** provide interior cavities **8** and **9** for the two portions respectively. The casing **1** is further provided with an integral, outwardly extending annular flange **11** for the purpose of resting against two somewhat spread or spaced apart fingers of a person handling the device as indicated in FIG. 1, the forward plane surface **12** of the projecting flange **11** being in the same plane as the forward plane surface **13** of the inner wall **5** and at or near the juncture of the two portions **2** and **3** of the casing for better strength considerations as well as for appearance.

The body portion or barrel **2** of the casing **1** is also provided with an inner frusto-conical surface **15** extending from an intermediate point or circular line along the inside of the cavity **8** at **16** forwardly to the end of the portion **2**, for instance, this surface converging towards the rear of the device or the right as seen in FIG. 2 and diverging towards the front or left as seen in this figure.

An inner member or body generally designated **18** is contained within the body cavity **8** of the body portion or barrel **2** of the casing **1**. This member **18** is cup-haped with a generally cylindrical sidewall and, accordingly, has an inner cavity generally designated **19** and a rear wall **20** having a centrally disposed bore **21** therethrough of somewhat smaller diameter than the bore **6** in the wall **5** of the outer casing **1**. When the inner member **18** is in a relaxed or unstressed condition as seen in FIG. 4, the inner surfaces **23** and **24** as well as the rearward outer surface **26** thereof are at least generally co-axial cylindrical surfaces. The forward cylindrical surface **24** is of somewhat larger diameter than the surface **23** rearwardly thereof, being separated therefrom by a flat annular shoulder **25** for a purpose which will be brought out hereinafter.

The inner member **18** is further provided with a frusto-conical outer surface **28**, when in the unstressed condition thereof shown in FIG. 4, which extends forwardly from the cylindrical surface **26** until terminated by the frusto-conical surface **29**, when in the FIG. 4 condition of the member **18**, which latter surface extends to the forward end of the member **18**. The frusto-conical surface **28** converges toward the rear of the device or towards the right as seen in FIG. 4 while the surface **28** converges forwardly or to the left as seen in the figure.

The inner body or member **18** is also and importantly provided with three solts **31** extending from the forward end of the member reawardly terminating at **32** only the far slot being seen in FIGS. 3 and 4. In the position of the member **18** shown in FIG. 2 which is the extreme rearward position thereof, the frusto-conical surfaces **15** of the outer member **2** and **28** of the inner member **18** have engaged each other to contract or collapse the inner member forwardly of the rear ends **32** of the slots **31** bringing the forward end portions of the member **18** adjacent the slots **31** together as at **34** for the far slot shown in FIG. 2.

A compression coil spring **37** is received within the cavity **9** of the rear body portion **3** of the outer casing **1** normally projecting substantially therebeyond as shown in FIG. 2. This spring abuts at its forward end against the rear surface of the wall **5** of the casing **1**. An axially extending stem member **39** is received within the coil spring **37**, this member also passing through the bore **6** in the wall portion **5** of the outer casing **1** in freely slidable relation with said wall portion. The stem member **39** has a reduced portion **40** near the forward end thereof which extends through the bore **21** of the inner body or member **18**, the stem member further being provided with an enlarged terminal or head portion **41** the rear flat surface **42** of which engages the front flat surface **43** of the wall **20** of the inner member **18** which together with the engagement of the flat annular shoulder **44** of the main part of the stem **39** with the flat rear face **45** of the wall **20** secure the inner member **18** and stem member **39** together. Actually the enlarged head portion **41** of the stem member **39** is divided by a pair of cross slots **46** (see FIG. 3) at right angles to each other into four equal segments **48**. The cross slots **46** extend rearwardly through the stem **39** to the point **49** (see FIG. 4). The slots **46** extending through the enlarged head **41** and well rearwardly thereof in the stem member **39** together with the frusto-conical or tapered cam surface **50** of the enlarged end portion **41** or, more specifically, of the four segments **48** thereof constitute an important feature of the invention. This construction permits simple and quick assembly of the device in but a single movement without the need of any tools or any other aids whatsoever and further without the need of any fastening devices such as screws, bolts, nuts, washers, clips and the like. According to this construction, the stem member **39** with its enlarged end portion **53** of the rear thereof is simply inserted through the coil spring **37**, after the latter is dropped within the cavity **9** of the outer casing **1** of the device, and the bore **6** of the wall portion **5** of the casing and the enlarged head portion **41** pushed through the reduced opening **40** in the inner member **18** by virtue of a collapsing or contracting of the forward part of the

stem because of the presence and provision of the slot **46** assisted by the frusto-conical surface **50** which permits a camming in of the four quandrants or segments **48** to a collapsed condition to admit passage of the enlarged end portion **41** through the bore **40**. After the enlarged head **41** has passed completely through the opening **40**, the four segments **48** thereof spring outwardly due to the resiliency of the material of which the stem **39** is constructed, thus to inter-lock the stem and the inner body or member **18** securely together.

The tight securement of the inner member **18** and stem member **39** together permits the latter member to move or actuate the inner member **18** in a rectilinear direction alternately forwardly and rearwardly relative to the outer or casing member **1** as should be apparent from the drawing or, which is the same thing or equivalent thereof, the outer casing **1** can be moved alternately rearwardly and forwardly relative to the combined inner member **18** and stem member **39** through the use of the stem member **39** which terminates in the large disc like portion **53** against which the rear end of the compression coil spring **37** bears and against which the thumb presses or bears in actuation of the device together with the use of the annular flange **11** of the outer member or casing **1**.

Going into the matter of actuation farther, it should be apparent from viewing FIG. 1 that the thumb engages or bears against the upper, or the rear hand if viewing FIGS. 2 and 4, surface of the enlarged button head or disc portion **53** while the forefinger and second finger straddle the barrel **2** of the casing **1** forwardly of the annular flange **11** bearing against the front, flat annular face **12** the latter at opposite sides of the flange. Pressure of the thumb towards to the other two fingers or upward or rearward pressure, in the FIG. 1 and the FIGS. 2 and 4 positions of the device, respectively, of the other two fingers towards the thumb will draw the annular flange **11** and button head **13** together into a position represented by FIG. 4 in which the head **53** abuts against the rear end of portion **3** and the coil spring **37** is greatly compressed. In the latter or FIG. 4 condition of the device, the inner member or body **18** has been moved forwardly relative to the outer body or casing **1** or the latter has been moved rearwardly relative to the inner member **18** and stem member **39** to cause the inner member to project from the outer member a substantially greater amount as compared to the FIG. 2 condition as is evident in FIG. 4 This new relation places the inner frusto-conical surface **15** of the outer member **1** and the outer frusto-conical surface **28** of the inner body **18** in a different relation to each other permitting substantial or at least appreciable expansion of the previously collapsed principle part of the inner member **18** or at least the elimination of the inward forces thereon for permitting introduction or insertion of a micro-tube within the forward inner surface **24** of the inner member **18**. Ceasing the application of pressure or the squeezing action by the fingers bearing against the annular flange **11** and the thumb bearing against the top or end of the device allows the compression spring **37** to apply pressure in the opposite direction at least tending to spread the outer member or casing **1** and the portion **53** apart with a very substantial amount of force and cause partial collapse or contraction of the principle part of the side wall portion of the inner member **18** and particularly the forward part thereof wherein the surface **24** is and in any event initiating a firm inward clamping or gripping action through the interaction of the frusto-conical surfaces **15** and **28** of the outer and inner members **1** and **18**, respectively, by the three segments or fingers **56** of the inner member **18** provided by the three slots against the outer cylindrical surface of the micro-tube generally designated **57**. FIG. 5 shows the gripping engagement of the tiny tube **57** within the surface **24** of the device preparatory to pulling or extracting the tube from its plugged-in mounted condition within

the socket **58** mounted in the chassis portion **59** of the electronic device wherein the tube is employed.

The device is preferably inexpensively constructed entirely of a suitable hard or firm yet resilient plastic except for the metal spring **37**. Such a plastic construction prevents the transmission of any heat from the extremely hot tube which is being removed.

Because of the rather slick nature of the plastic, if not also because of the relatively soft nature of the surfaces thereof, together with the smooth sheet steel surface of the metal casing of the tube, it is impossible to get a proper grip on the tube for the removal thereof from the socket and tightly gripping saddle which will hold without special provision. To provide the necessary grip on the tube, grit such as Carborundum powder which is caused to be suitably embedded at least partially within the surface **24** of the inner member **18**, and indicated by the stippling in the drawing, the use of such grit constituting an important part of the invention. This Carborundum powder alters the otherwise rather slick, smooth surface **24** of the inner member **18** providing the necessary friction between said surface and the very small smooth metal casing of the tube **57** when within the surface and the device is allowed to assume the gripping relation shown in FIG. 5 of the drawing. The use of such grit Carborundum powder turns an otherwise inoperative device when applied to a tube mounted within the socket and tightly gripping saddle as below set forth into a most effective one for easily and quickly extracting a tiny metal tube such as **57** from its socket. It is pointed out in this connection that a multiplicity of spring figners **61** of the saddle **60** associated with the socket **58** surround the lower half of the tube and engage the top of the enlarged lower portion **63** thereof very tightly, gripping the latter through the dimple **64** (see FIG. 5) with a very great amount of force for a very important operative relation with the metal casing of the tube **57** which is not within the confines of the present invention and therefore will not be gone into herein. The fingers of said saddle **60** have a very critical spacing therebetween for very important reasons which will not be gone into herein and moreover the formation of each individual finger **61** is critical for the proper pressure against the lower part of the tube. It is accordingly essential that the critical formation and uniformly spaced relation of the fingers be totally undisturbed by any tube pulling or extracting device or any device used for insertion of the tubes into their mounted relation. Accordingly, the shoulder **25** of the instant device is so positioned and the length of the surface **24** is such as to limit the downward or inward movement of the device over the tube so as to provide a definite space **66** (see FIG. 5) between the lower or front end **67** of the device and the upper or outer ends of the saddle fingers when the movement is completed to accordingly totally prevent any damage or disruptive contact therewith whatsoever. This forms a very important aspect or feature of the invention.

It should be apparent from the drawing that the outer diameter of the barrel or outer body portion **2** is only slightly greater than that of the tube **57** itself and particularly of the tube and socket combination and together with the outwardly converging frusto-conical or tapered surface **29** of the inner member **18** which extends forwardly of the outer member **1**, the present device is able to be inserted into a space hardly greater than the size of the tube itself and almost the same size as the socket and saddle and tube combination, a space otherwise totally inaccessible to a person's fingers, for the extraction and even insertion of the tube. This is very significant in the extremely crowded conditions in which tubes and other electronic components are so often used at the present time. It is pointed out that with the advent of the present device, uniformly and extremely crowded and compact tube and other electronic mountings may be had, thus to

produce extremely small or compact electronic devices bringing a definite advance to the field.

Although a device of certain proportions and a particular length has been disclosed, it should be understood that a device of much greater length can be provided by merely increasing the length of the barrel **2** and of the inner member **18** to any desired amount within the strength capability of plastic, if this material should be used, just forward of the annular flange **11** and rearwardly of the ends **32** of the slots **31** of the inner member **18** without affecting the operations of this device in any material way at all. Such an elongated device could be used to reach otherwise totally inaccessible locations not only for the withdrawal or extraction of tubes but also for the insertion thereof or of other electrical or electronic components for the handling of which the present device can be very easily sized or designed.

FIG. 6 of the drawing discloses a slightly different form of the device adapted for use with a slightly different form of the micro-tube **70**. In this form of device, the surface **71** thereof, which is the equivalent of surface **24** of the previous form and which also contains the embedded Carborundum powder for good frictional engagement of the tube, is of fairly narrow length, limited at the front and rear thereof by spaced, facing annular shoulders **72** and **73**. The tube **70** which is receivable within the surface means **71** is provided with an enlarged portion **75** of rather limited extent lengthwise which latter enlargement is received within the surface **71** of the device. It should be apparent that the inner and outer annular surfaces or shoulders **76** and **77**, respectively, of the enlargement **75** of the tube are engageable with the shoulder **72** and **73**, respectively, of the device.

Because of the relatively limited extent of the enlargement **75** of the tube lengthwise, the annular shoulders **72** and **73** are provided in the device for engagement with the inner and outer annular surfaces of the enlargement in order to assist in retaining the tube within the device and for applying an axial force on the tube in either direction together with that which can be imparted to the tube through the frictional engagement between the surface **71** of the device and the outer cylindrical surface **79** of the tube for both removal of the tube from its mounted engagement within the socket and saddle and also for insertion of the tube into such a mounted condition.

Although the present device has been described in connection with the removal and insertion of micro-electron tubes having extremely small metal casings, the device can of course be used for larger tubes of different casing designs, if desired, in which case, of course, the device would have to be of a larger size to accommodate such tubes. The device can also be sized and particularly designed for the removal and/or insertion of other electrical and electronic devices such as capacitors of the plug-in type, small relays which are preferably round in form semi-conductors, and in general anything that plugs into a socket or similar mounting means.

It is thus seen that a very simple and inexpensive, yet most effective and reliable device has been provided to fill a critical need; namely, the removal, particularly, and also the insertion of the new micro-tube described in the preamble of this application from and into its mounted relation and without which device it would be impossible to so remove the tube from its very tight socket and saddle mounting if not also to insert the same, particularly in very crowded or otherwise inaccessible mounting locations. Such device additionally has the very important feature of permitting immediate withdrawal of the tube while very hot without the need of waiting for the same to cool which would otherwise be necessary to avoid burning of the fingers and which would be quite inconvenient and time consuming, even if the tube could be removed by the fingers which of course is impossible as carefully gone into above.

As previously indicated, the device can be used to get into very small, restricted spaces otherwise very difficult or impossible to get into and also to get into inaccessible places except where the device is used. Besides the removal of the tiny hot electron tubes or other electrical components, the present device, as above indicated, can also be used for the insertion of such members into their mounted relation and in very restricted spaces as well as in totally inaccessible places.

It is further pointed out before closing that even aside from the tiny tube being tightly or strongly gripped by the saddle requiring considerable force to remove the tube therefrom and even aside from the extremely small size of the tube and especially of the portion thereof available for gripping above the saddle and the cramped or often very restricted space available for trying to get into for removal of the tube, for instance, and the very hot nature of the tube unless allowed to cool, a person could very easily cut his fingers, in trying to remove or insert the tube, without the use of the present device on the various sharp corners and edges of the very thin sheet metal saddle especially if there are any burrs or ragged edges and also especially when one is trying to rotate the tube within the saddle for mounting or removal of the tube.

Although the tube socket has been disclosed as including the tight gripping saddle, the device may, of course, be used for the removal and insertion of tubes or other components from and into respectively, sockets not having saddles or one's strongly gripping the components themselves where such sockets should be employed in which case where a plastic device or inner member is employed the use of grit such as Carborundum powder may be dispensed with especially if the tubes or other components are not particularly tightly received within their sockets.

Any use in the appended claim of words such as "vertical," "front," "rearwardly," and the like or any other references bearing on direction or the position of the device are intended to be relative to the position of the device shown in FIGS. 2 through 6 only and are therefore not to be taken as absolute terms, it of course being understood that the device may be used in any position in which it may be necessary to so use it.

Although two embodiments of the invention have been disclosed, it should be clearly understood that other modifications in detail as well as other embodiments of the invention may be had and are in fact contemplated and accordingly, the appended claim should be limited only by its own term construed in the broad overall light of the invention in its various aspects and possibilities.

What is claimed is:

A device for the removal and/or insertion of electrical or electronic plug-in type components comprising an inner and an outer member each open at the front thereof and reciprocally movable relative to the other, said inner member being constructed to receive a component therewithin and having inner means engageable with the component when properly within the inner member, spring means normally resiliently biasing the outer member forwardly relative to the inner member for effecting the engagement of the component when the component is properly within the inner member, said outer member being rearwardly movable relative to the inner member against the action of said spring means, said spring means comprising coil spring means and an elongated member extending from the inner member passing through the open interior of the coil spring means and said elongated member having a finger-engageable end portion extending laterally outwardly thereof, said inner member having a wall portion with an opening therethrough, said elongated member being constructed of resilient material and having a head portion part of which latter portion is normally larger than the opening in said wall portion, the elongated member further having a portion from which the head portion extends of such size as to be received within said opening, the head portion being of no greater

size at the terminum thereof farthest from the portion of the elongated member from which the head portion extends than said opening, the head portion and also at least part of the portion of the elongated member from which the head portion extends being so slotted as to permit resilient contraction of the head portion, as the latter is being pushed through the opening in said wall portion during assembly, sufficiently to permit such passage of the head portion through the opening for the assembly of the elongated member with the inner member after which passage the head portion springs into an enlarged condition with part of the head portion being larger than the opening in said wall portion for retaining the elongated member on the inner member.

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