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E. KLEINMANN ET AL

2,032,847

ELECTRICAL CONTACT PLUG

Filed Jan. 8, 1930

Fig. 1.

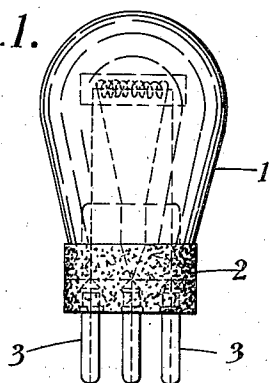


Fig. 2.

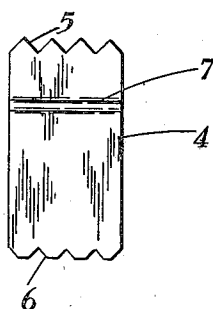


Fig. 3.

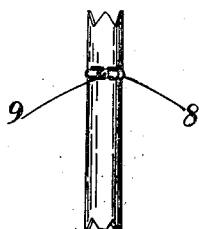


Fig. 4.

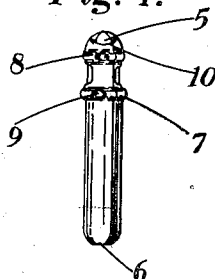


Fig. 5.

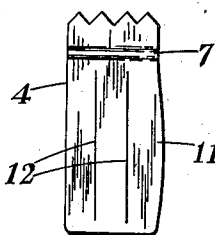


Fig. 6.

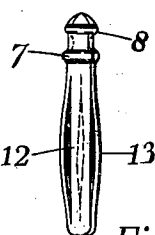


Fig. 7.

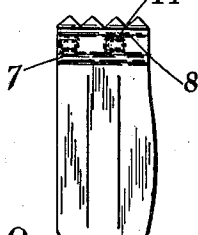


Fig. 8.

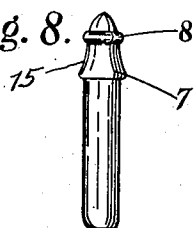
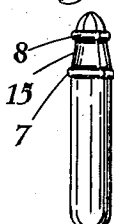


Fig. 9.



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UNITED STATES PATENT OFFICE

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ELECTRICAL CONTACT PLUG

Ernst Kleinmann and Alfred Mendel,
Berlin-Lichtenberg, GermanyApplication January 8, 1930, Serial No. 419,341
In Germany January 31, 1929

11 Claims. (Cl. 173—361)

This invention relates to electrical contact plugs such as are commonly used in electron discharge tubes. Such plugs are now generally made in what is called banana shape, that is they are substantially cylindrical but are bulged outwards about their centres so as to make resilient contact with the sockets into which they are inserted. Sometimes the plugs are taken and bored from solid rods, the tops being left closed, but generally they are hollow throughout and open at the top. In the manufacture of electron discharge tubes these plugs are moulded into position in bases of bakelite or the like so that special devices have to be inserted in the tops of the plugs to close them, or the bakelite would enter the plugs and completely fill them. The bakelite moulding is bored through so as to provide a passage for the leading-in wires of the various electrodes of the electron discharge tube or the like. One object of the present invention is to avoid the necessity of inserting special devices during the moulding operation. Another object of the invention is to provide a contact plug well able to withstand lateral stresses. Yet another object of the invention is to devise a novel plug capable of being manufactured cheaply by mass production.

According to the present invention, an electrical contact plug is made from a single piece of stamped sheet metal having a closed top, so that when it is moulded into position in the base of a valve or the like, none of the moulding materials can enter the plug. In carrying the invention into effect it is preferred to stamp the top edge of each section of flat sheet metal in zig-zag form, the section being then bent and shaped into cylindrical form and the zig-zags being bent inwards so as to close the top. When it is desired to make banana plugs, slits may be cut longitudinally in the flat sheet metal, but not extending to either end, and after the metal has been rolled into cylindrical form the cylinder may be subjected to an axial pressing action so that its centre part bulges outwards. These slits are preferably formed by dividing the metal without any material being actually removed. By this means when the plug has been pressed into banana shape the openings formed by the slits are only of such a width that they will not allow the leading-in wire which is passed through the plug to escape sideways through a slit.

Yet a further feature of the invention consists in forming the lower ends of the sheet metal sections with zig-zags, and in cutting off the tips of the zig-zags when the metal is rolled into cylin-

dricul form. These zig-zags can then be turned inwards, but owing to the fact that their tips have been removed a small hole will be left at the bottom of the plug which allows of the introduction of a small piece of solder to fix the leading-in wire close to the bottom of the plug on the inside.

According to yet a further feature of the invention, in order to increase the resistance of the plug to lateral stresses the top of the plug is made in the shape of a frustum of a cone having its narrow end adjacent to the closed end of the plug. This frustum may very conveniently run between two transverse ridges which may be embossed during the process of manufacture.

In order that the invention may be clearly understood and readily carried into effect, several plugs constructed in accordance therewith will now be described by way of example with reference to the accompanying drawing, in which

Figure 1 is a view of an electron discharge tube showing several contact plugs moulded in position in the base;

Figure 2 shows the sheet metal stamping from which the cylinder is formed;

Figure 3 shows the stamping of Figure 2 after being rolled into cylindrical form, and

Figure 4 shows the finished plug.

Figure 5 shows a modified form of stamping for making banana plugs;

Figure 6 shows the finished banana plug, and

Figure 7 shows another form of stamping.

Figure 8 shows another modified form of plug, and

Figure 9 shows yet a further modified form of plug.

Referring first to Figure 1, an electron discharge tube 1 is illustrated with a moulded base 2 containing contact plugs 3. Each of these plugs is formed from a stamping 4 having at the upper end zig-zags 5 and at the lower end zig-zags 6, the tips of which are cut off. At the same time as the sheet metal is stamped into the shape shown in Figure 2, a ridge 7 is embossed upon it. The sheet metal stamping 4 is then rolled into the cylindrical form shown in Figure 3. It is found in practice that the bore of the cylinder is too small to allow of a former being employed, and the rolling of the metal is preferably effected by bending it twice at right angles so as to form a channel section and then pressing the channel section into a cylinder. The zig-zag ends 5 and 6 are then closed in by means of cup-like dies, and at the same time a second ridge or annular projection 8 is formed. This is effected by holding the lower part of the plug tightly, and

pressing the upper part towards it axially so that some of the metal is compelled to bulge outwards to form the ridge 8. These ridges 7 and 8 are provided in order that the finished plugs 3 may be easily located within the moulding 2 of an electron discharge tube, and may be prevented from moving axially. A series of interruptions 9 may be formed around one or both ridges 7 and 8 so as to prevent the plugs rotating within the moulding 2.

The lower zig-zag projections 6 are closed in, but since their tips are cut away a small hole is left in the bottom of the plug through which the leading-in wires can be soldered to the inside of the plug.

It is found in practice that it is best if the closed in top of the plug is pointed and has curved sides as shown in Figure 4, and that the angle indicated by 10 should lie between 80 and 120°. In other words, the angle of the pointed arch of the closed head or top is determined approximately by taking both the tangents of the curved sides, and the reference numeral 10 merely designates the ordinary circular line running between the two tangents and showing the angle in question.

In the construction shown in Figures 5 and 6, the stamping 4 is made with one straight side and with one side slightly bulged outwards as shown at 11, the bulge being greatly exaggerated in the figure. Two slits 12 are cut in the sheet metal during the stamping operation, these slits being purely division of the metal and no actual material being removed. The stamping 4 is then bent and shaped into cylindrical form as before, and at the same time that the top and bottom are closed in, the whole plug is compressed axially so that it assumes the banana shape shown in Figure 6. Since no metal is cut away in forming the slits 12, the openings produced when the plug is forced into banana shape are not so wide that they will allow the leading-in wires of an electron discharge tube to pass through. The opening shown at 13 in Figure 6, which is produced at the seam of the cylinder, is equally of suitably narrow width on account of the bulging out of the part 11 during the stamping operation, whereas if both sides of the stamping were made straight the opening at the seam would be too wide after the axial compression.

In the stamping shown in Figure 7, in addition to the projection 7 two rectangular portions 14 are embossed on the stamping in such a way as to form flats on the finished cylinder. These flats assist to prevent rotation of the plug during and after the moulding operation.

In the construction shown in Figure 8, the upper part of the plug between the ridges 7 and 8 is made in the shape of a frustrum 15 of a cone instead of being cylindrical. The construction is such that the ridge 7 projects outwards from the plug only on its lower side but on its upper side runs straight into the conical surface. By means of this arrangement the upper part of the plug is particularly able to resist lateral stresses during the moulding operation so that there is no tendency for it to yield laterally. This resistance to lateral stress may be increased still further by means of the construction shown in Figure 9 in which the two ridges 7 and 8 both project fully out from the plug and are connected by a conical frustrum 15.

With the novel plug no bakelite or other moulding powder can enter the plug during the operation of moulding the base, with the result that

it is only necessary to bore through the moulding above the plugs and then through the pointed ends of the plugs in order to introduce the leading-in wires into the plugs.

It is to be understood that the claims are not limited to the constructions shown in the drawing since clearly modifications may be made and, therefore, the claims are intended to be construed to cover all such modifications as their language will allow in the light of the prior art.

From the foregoing description, it is apparent that where reference is made to the "closed top" of the plug, it means that portion of the plug which is imbedded in the molded base of electron discharge tubes and the like, or it may be more exact to refer to the so-called "top end" as the "inner end" of the plug, for the reason that the opposite end is the outer end when it is mounted for operation in connection with such a discharge tube. Therefore, in the claims the terms "top" and "inner" as referring to the ends of the plug may be regarded as alternative expressions or synonymous.

We claim:—

1. An electrical contact plug comprising a single piece of sheet metal formed with at least one longitudinal slit terminating short of each end of the piece, the portions of said piece on either side of said slit being longitudinally convexed, and the said plug having a closed inner end and an outer end for insertion into a socket.

2. An electrical contact plug comprising a single piece of sheet metal shaped into substantially cylindrical form and having a pointed closed inner end, the outer end thereof being adapted to be inserted in a socket.

3. An electrical contact plug comprising a single piece of sheet metal shaped into substantially cylindrical form and having a pointed closed inner end, the outer end thereof being adapted to be inserted in a socket, the said inner end having curved sides.

4. An electrical contact plug comprising a single piece of sheet metal shaped into substantially cylindrical form and having a closed conical inner end adapted to be imbedded in a tube base the sides of which when seen in side view subtend an angle lying between 80 and 120°.

5. An electrical contact plug comprising a single piece of sheet metal shaped into substantially cylindrical form, having two transverse projecting ridges and a closed conical inner end of anchorage in a tube base.

6. An electrical contact plug comprising a single piece of sheet metal shaped so as to present a substantially cylindrical portion, a closed inner end adapted to be anchored in a tube base and having an outer end adapted to be inserted in a socket, the said plug having a frusto-conical portion with its narrow end adjacent said closed inner end, said frusto-conical portion joining said closed inner end and said cylindrical portion.

7. An electrical contact plug comprising a single piece of sheet metal and shaped so as to present a closed inner end adapted to be anchored in a tube base and having an outer end adapted to enter a socket, a substantially cylindrical portion, two transverse projecting ridges, one of said ridges running into said cylindrical portion and the other of said ridges running into said inner end, and a conical portion connecting together said ridges.

8. An electrical contact plug comprising a single piece of sheet metal shaped into substantially cylindrical form and adapted to be inserted in a

socket at one end and having the other end conical in shape and completely closed for imbedment in a plastic base.

5 9. An electrical contact plug comprising a single piece of sheet metal shaped into substantially cylindrical form, the metal at one end of the cylinder being in the form of a plurality of converging portions bent inwards to bring their adjacent edges into contact to close the end, the
10 opposite end of the cylinder being adapted to be inserted in a socket.

10 10. An electrical contact plug comprising a single piece of sheet metal shaped into substantially cylindrical form, the metal at one end of the
15 cylinder being provided with tapered serrated

portions, which portions are bent inwardly with their adjacent edges in contact to close said end, the opposite end of the cylinder being adapted to be inserted in a socket.

11. A bulged electrical contact plug comprising a single piece of sheet metal shaped into substantially cylindrical form with opposite edges contiguous, one of these edges being curved outwards so that the contiguity of said edges is maintained substantially uniform in spite of the
10 bulge, an end of said plug being adapted for insertion in a socket.

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