May 19, 1953 K. M. VAN GESSEL 2,638,660

ELECTRICAL INSULATOR

Filed April 3, 1945 5 Sheets-Sheet 1

Fig. 1.

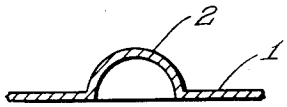


Fig. 2.

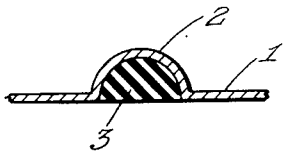


Fig. 3.

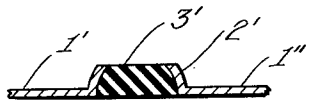


Fig. 4.

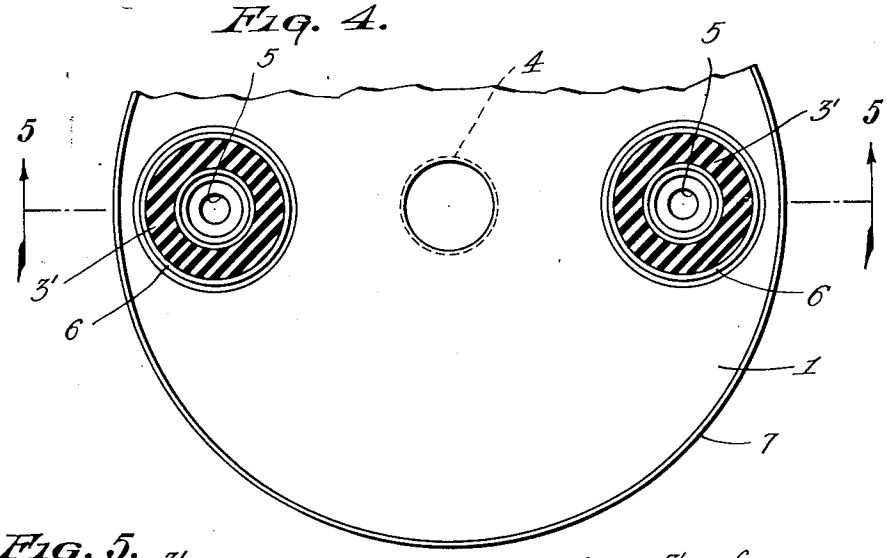


Fig. 5.

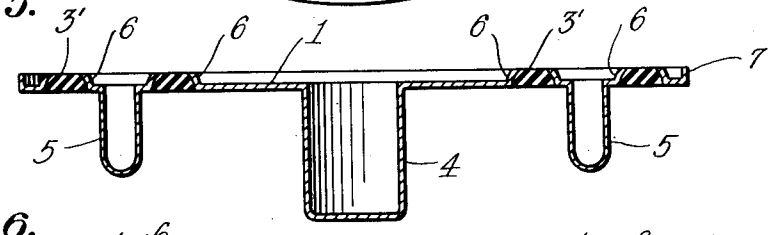
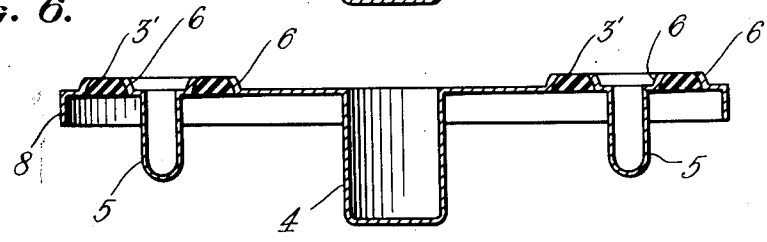


Fig. 6.



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May 19, 1953 K. M. VAN GESSEL 2,638,660

ELECTRICAL INSULATOR

Filed April 3, 1945 5 Sheets-Sheet 2

Fig. 7.

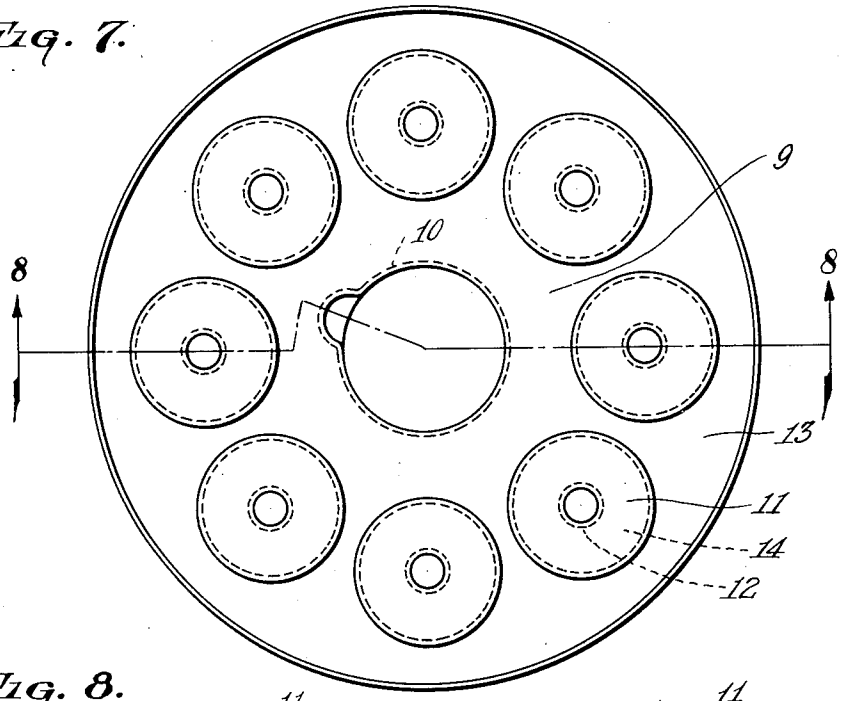


Fig. 8.

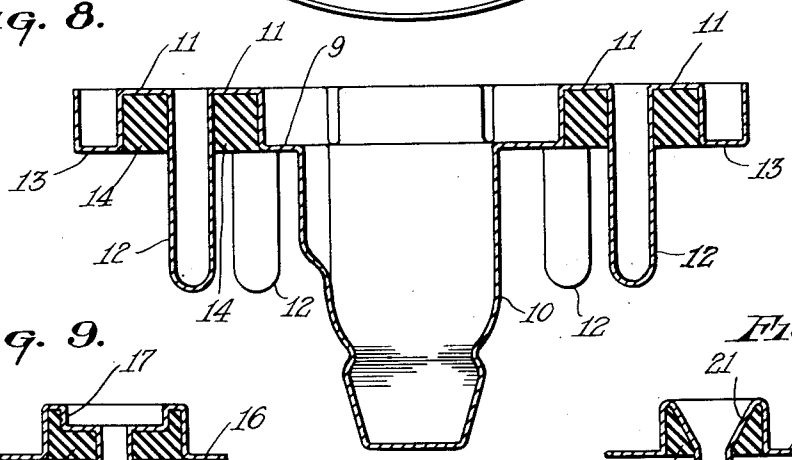


Fig. 9.

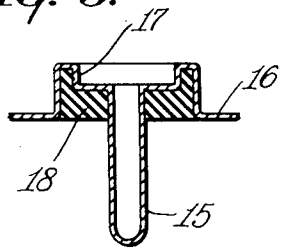
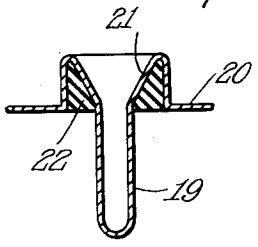


Fig. 10.



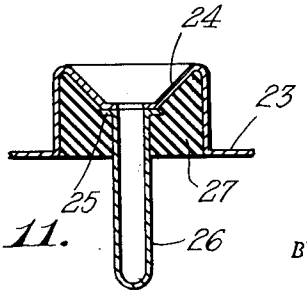


Fig. 11.

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May 19, 1953 K. M. VAN GESSEL 2,638,660

ELECTRICAL INSULATOR

Filed April 3, 1945 5 Sheets-Sheet 3

Fig. 12.

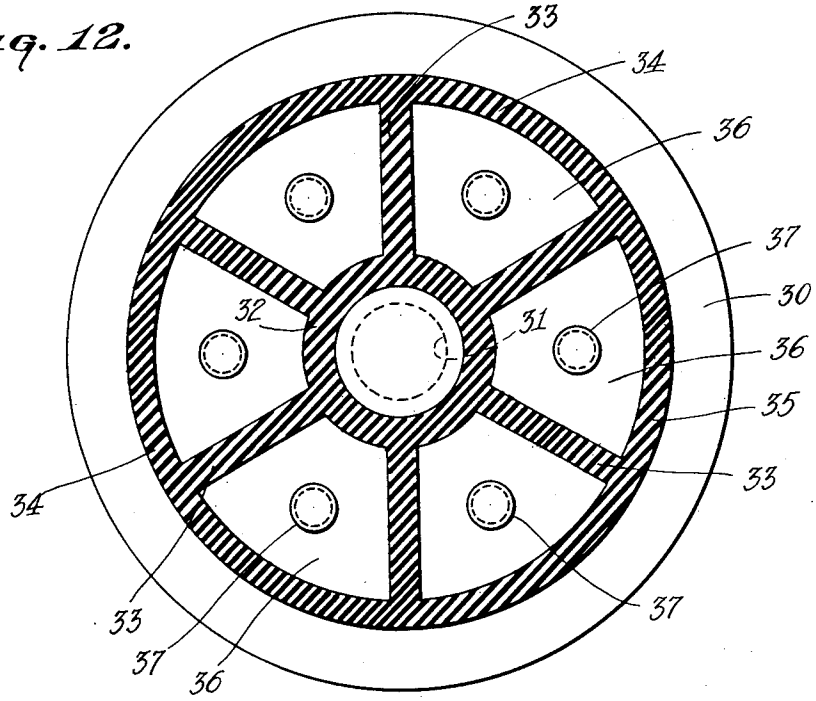
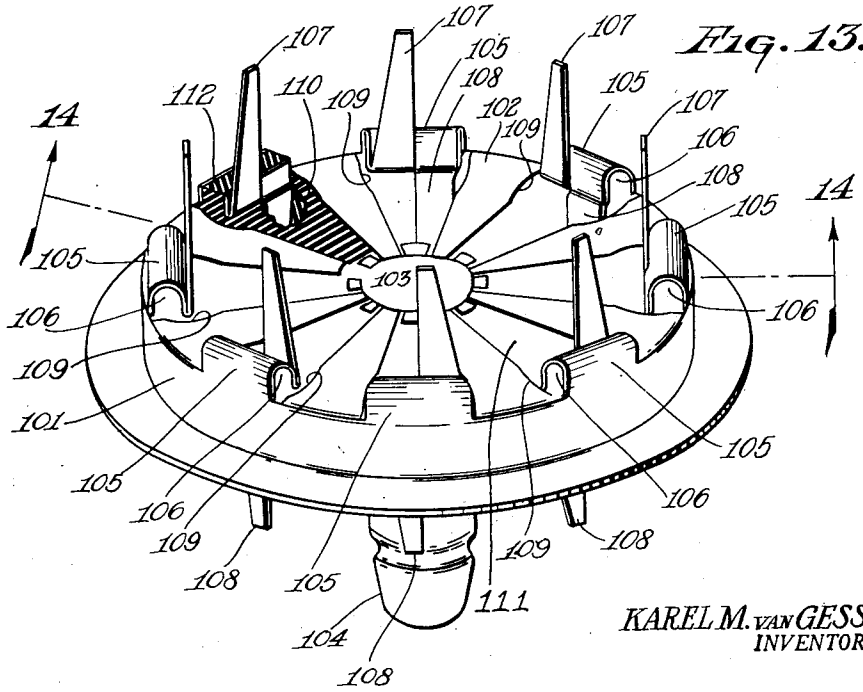


Fig. 13.



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May 19, 1953 K. M. VAN GESSEL 2,638,660

ELECTRICAL INSULATOR

Filed April 3, 1945 5 Sheets-Sheet 4

Fig. 14.

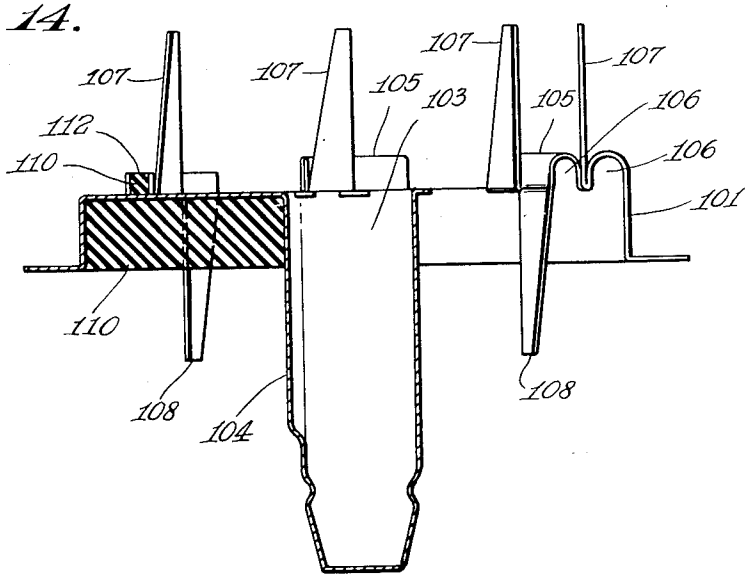
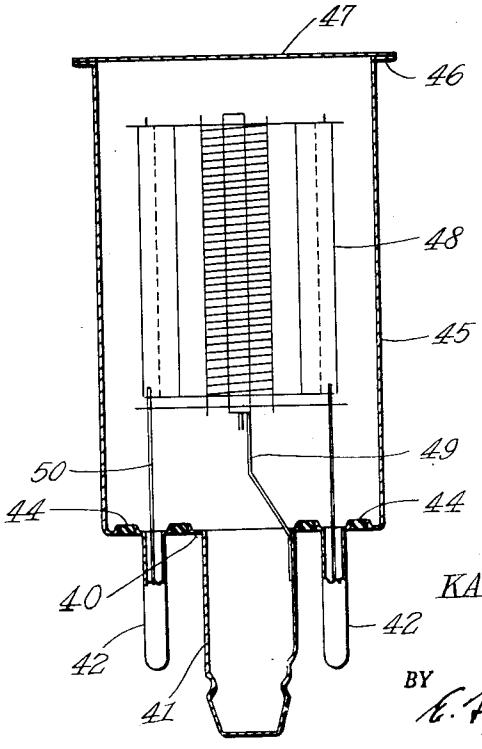


Fig. 15.



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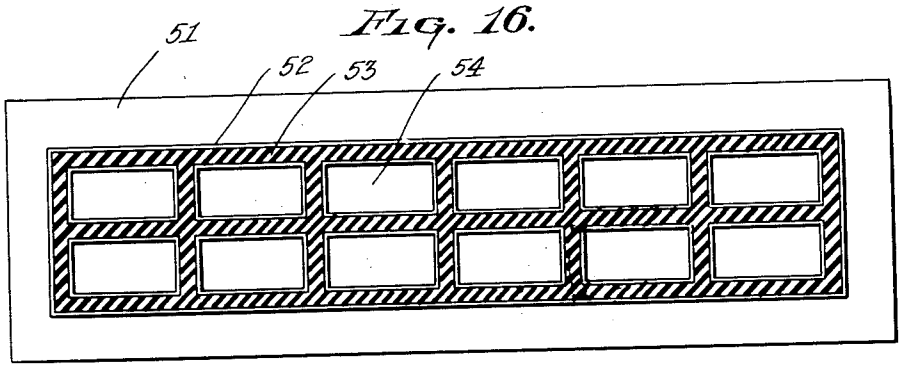
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May 19, 1953 K. M. VAN GESSEL 2,638,660

ELECTRICAL INSULATOR

Filed April 3, 1945 5 Sheets-Sheet 5

Fig. 16.



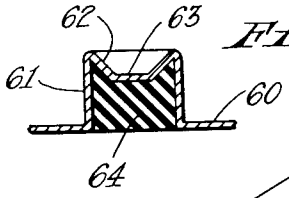


Fig. 21.

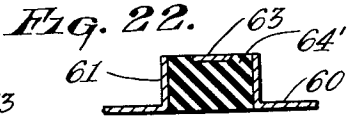


Fig. 22.

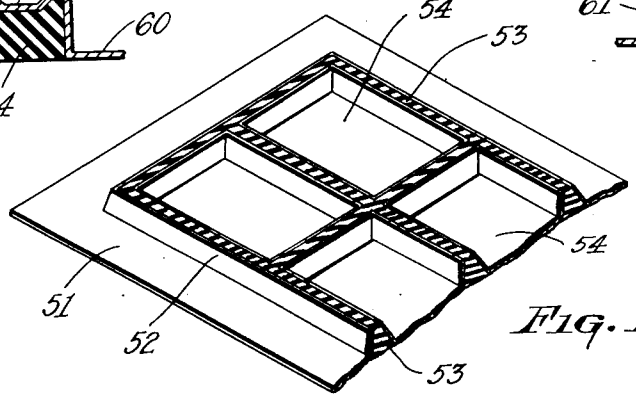


Fig. 17.

Fig. 18.

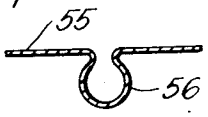


Fig. 19.

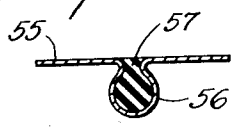
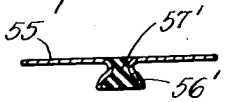


Fig. 20.



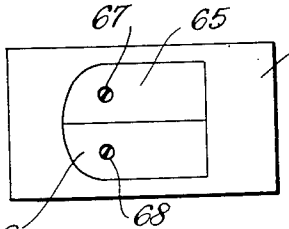


Fig. 23.

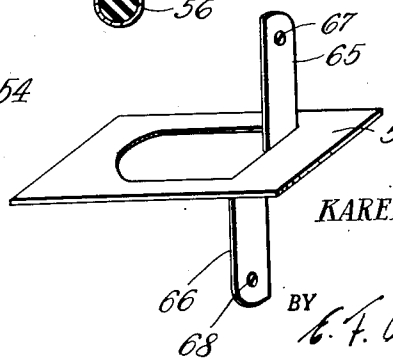


Fig. 24.

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Patented May 19, 1953 2,638,660

UNITED STATES PATENT OFFICE

2,638,660

ELECTRICAL INSULATOR

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Application April 3, 1945, Serial No. 586,283

5 Claims. (Cl. 29—25.15)

1

This invention relates to electrical apparatus, and more particularly to improved ways and means for electrically insulating metal parts and the like. The invention is of special interest in the manufacture of devices incorporating electrically insulated connecting elements such as electric discharge tubes, insulated connecting assemblies and the like.

It is an object of the present invention to facilitate the manufacture of insulated parts and to obtain insulated parts having improved characteristics.

It is another object of the invention to improve the bonding of insulating material to metal, and particularly, to provide improved metal to glass seals.

It is a further object of the invention to facilitate the predetermined physical alignment of parts to be insulated.

Another object of the invention is to improve the manufacture of devices incorporating electrically insulated connecting elements, such as electric discharge tubes, insulated connecting assemblies and the like, by reducing the time and cost of such manufacture and simplifying the procedures involved therein.

A further object of the present invention is to provide electric discharge tubes and other devices incorporating electrically insulated connecting elements distinguished by ruggedness of construction, simplicity and low cost.

Another object of this invention is to provide new methods for making bases for electric discharge tubes facilitating the manufacture thereof and resulting in an improved product.

Still another object of the invention is to provide improved electric discharge tubes facilitating the insulation of some of the electrodes, and the connection of others of the electrodes.

A still further object of the invention is to provide improved electric discharge tubes having a shield surrounding and screening the base pins arranged integral with the tube base.

Yet another object of the invention is to provide improved electric discharge tubes facilitating the support of the electrode assembly and the attachment of base pins and locating keys.

A further object of the invention is to provide improved insulated connecting assemblies made, for example, from a continuous piece of metal in a simple operation.

Another object of the invention is to provide improved insulated connecting assemblies wherein connectors for the individual connecting elements are made simultaneous with the insulation thereof.

2

Other objects, and the manner in which the same are attained, will appear from the following description:

Electrically insulated parts and devices incorporating electrically insulated connecting elements such as electrical discharge tubes, insulated connecting assemblies and the like heretofore were made by various methods which, in industrial practice, were found to be quite time-consuming, complex and costly so that methods of manufacturing such parts and devices more simply, more cheaply and more speedily, for a long time have been a desideratum in the electrical arts.

In the manufacture of electric discharge tubes, for example, it is common practice when making the stem or base of the tube to seal metal lead wires in glass tubing or in a glass disk. In most cases it is necessary to cement a cap of metal or some insulating material, such as Bakelite, over this stem to protect the lead-in wires from breaking and to form a firm support for the base pins and other contact or mounting elements.

The present invention contemplates to eliminate the above-mentioned and other time-consuming complex and costly procedures and to manufacture electrically insulated parts and devices incorporating electrically insulated connecting elements, such as electric discharge tubes, insulated connecting assemblies and the like, by providing a plate or disk of metal, such as copper, copper-plated steel, Kovar or any other convenient metal, forming a depression in such metal disk or plate, filling this depression with insulating material, such as powdered glass, for example, or in cases where no hermetic seal is required, Bakelite or similar insulating material, sintering the glass or curing the other insulating material whereby to effect a seal or bond with the metal, and removing the bottom of the depression so an insulating zone is created which is surrounded by the metal of the plate or disk thus treated. If the depression takes the form of a groove or channel, for example, surrounding a part of the metal plate or disk, this part is insulated from the remainder of the plate or disk by the strip of insulating material embedded in the open depression, groove or channel remaining after removal of the bottom thereof.

While in the case of glass, sintering establishes a perfectly air-tight metal-to-glass seal, and in certain other instances Bakelite and other insulating materials, after having been cured, are bonded to the metal in a firm bond, nevertheless, when Bakelite and other non-vitreous insulating materials are used, the invention contemplates

to so shape the depression, groove or channel pressed in the metal as to support the insert of insulating material which, after the removal of the bottom of the depression and the adjacent portion of the insulating insert, assumes the shape of a rivet so as to be firmly structurally supported in the open depression or groove, or truncated channel.

The invention contemplates further to form in the metal plate or disk, simultaneously with the forming of the aforenoted depression, contact or mounting elements such as the base pins or locating keys of electric discharge tubes, or in place of these elements proper, connecting portions whereby to attach these elements to the metal plate or disk, by pinching, soldering, welding or the like operations, or in the case of insulated connecting assemblies, for example, to cut, press or stamp lugs or other connector members from or in the metal disk, plate or sheet whereby to attach the wires leading to individual connecting elements.

The formation on the metal disk or plate designed as a base for electric discharge tubes, of bent down circumferential flange portions acting as side screening shields for the base pins and the like, is also within the province of the invention, as is a construction wherein the metallic base plate or disk is integral with the metallic envelope of an electric discharge tube the top of which is open and is sealed by welding or otherwise sealing thereto a metal or glass cover.

In the drawing accompanying this specification and forming part thereof, several embodiments of the invention are illustrated diagrammatically by way of example, but I wish it to be understood that I do not desire to be limited to the exact details of construction, design or methods shown and described as numerous modifications within the scope of the appended claims may occur to a person skilled in the art.

In the drawings,

Fig. 1 shows, in diagrammatic cross-section, part of a base plate or disk having a depression formed in it;

Fig. 2 shows, in section, the depression of Fig. 1 filled with insulating material;

Fig. 3 illustrates, in cross-section, the insulating insert remaining after fusion of the insulating material with the base material and removal of the bottom of the depression.

Fig. 4 is a diagrammatic plan view of a base for an electric discharge tube incorporating insulating elements according to Fig. 3;

Fig. 5 is a cross-section taken on lines 5—5 of Fig. 4;

Fig. 6 shows, in cross-section, a modification of the tube base shown in Fig. 5, involving side shielding of the base pins;

Fig. 7 is a plan view of another modification of a tube base;

Fig. 8 is a cross-section taken on lines 8—8 of Fig. 7;

Fig. 9 shows, in cross-section, a modification of a detail of Fig. 7 involving a blanked base pin;

Fig. 10 shows, in cross-section, another modification of a blanked base pin;

Fig. 11 shows, in cross-section, another modification of a detail of Fig. 7 involving a separate base pin;

Fig. 12 is a diagrammatic bottom view of another modification of a tube base involving concentric and radial channels;

Fig. 13 is a perspective showing of another modification involving a tube base having a circumferential channel;

Fig. 14 shows a vertical cross-section of the tube base shown in Fig. 13;

Fig. 15 shows, in diagrammatic cross-section, an electric discharge tube incorporating a tube base according to the invention which is provided integral with the envelope and mounts an electrode assembly;

Fig. 16 illustrates, in diagrammatic top view an insulated connecting assembly being another embodiment of the invention;

Fig. 17 is a perspective showing of a detail of Fig. 16;

Fig. 18 shows, in diagrammatic cross-section, a channel profile particularly adapted for use with non-fusing insulating material;

Fig. 19 shows the channel of Fig. 18 filled with insulating material;

Fig. 20 shows the filled channel of Fig. 19 with the bottom removed;

Fig. 21 illustrates a modification of a channel section involving projecting bottom portions;

Fig. 22 shows the channel section of Fig. 21 with the projecting bottom portions removed so as to leave a center strip for grounding purposes;

Fig. 23 shows, in diagrammatic top view, one of the connecting elements of Fig. 16 with connecting lugs formed therein, for example, at the time the channels are formed in the strip; and

Fig. 24 shows, in perspective, the connecting element of Fig. 23 with the connecting lugs bent at right angles to the surface of the element.

Referring now to the drawings, and first to Figs. 1 to 3, a base plate or disk 1 is shown to have formed in it, by pressing, stamping or any other conventional method, a depression 2. As shown in Fig. 2 this depression is filled with insulating material 3, such as powdered glass, for example, and in the preferred embodiment of the invention, is then heated, for example by high-frequency current, to fuse the insulating material with the material of the base plate to form an air-tight, hermetic seal.

Once the seal is formed, the bottom of the depression 2 is removed, for example, by grinding so the wall 2' of the depression encloses the fused portion 3' of the insulating material. This portion 3' constitutes an insulating zone within the metal. In the case of a small circular depression and a bottom-shaped insulating portion resulting from the afore-described treatment thereof, a conductor such as a lead-wire (not shown) may be passed through the portion 3' in a known manner, to be insulated from the metal plate or disk 1. In case the depression is formed as a channel or groove separating parts 1' and 1'' of the bare plate or disk, the portion 3' within the truncated channel walls 2' bars any electrically conductive connection between parts 1' and 1'' of the base plate, thus acting as an effective electrical insulating agent therebetween.

This basic concept of the invention finds a variety of applications in the electrical arts. One of the most important applications of the invention is to the manufacture of electric discharge tubes.

Referring now to Figs. 4 and 5, these show a base for electric discharge tubes including a base plate or disk 1, a locating key 4 provided, for example, integral with the base plate 1 by pressing, stamping or any other forming method, base pins 5 provided, for example, integral with the base plate or disk 1, and truncated channels 6 containing fused insulating material 3' surrounding each base pin 5. At its circumference or edge, the base disk or plate 1 terminates in a flange portion 7 which may be provided integral with, or

else may be attached to, the tube envelope (not shown in Figs. 4 and 5) in a manner outlined below in detail.

As shown in Fig. 6, the upwardly extending flange portion 7 on the base disk 1 may be replaced by a downwardly extending flange portion 8 serving as a side shield for the base pins 5.

A modification of a tube base according to the invention is shown in Figs. 7 and 8. Here the base is formed of a disk portion 9, a locating key 10 provided in the portion 9, rectangular channels 11 surrounding the base pins 12, and a peripheral channel 13, the channels 11 being filled with insulating material 14 prior to removal of their bottom portions while the channel 13 may or may not be treated in a similar manner. Once the bottoms of the channels are removed, the remaining strip of insulating material insulates the base pins 12 relative to the base disk 9 in the manner described above with reference to Figs. 1 to 6.

It will be noted that in the embodiments of the invention described thus far, the base pins (5 or 12) were provided integral with the base disk (1 or 9). Figs. 9 and 10 illustrate additional examples of blanked base pins, the former, Fig. 9, showing a base pin 15 extending from the base disk 16 by way of a step-shaped channel portion 17 which, after insertion of insulating material 18 followed by heating and fusion of the seal, is ground down to the step-portion, leaving the base pin firmly embedded in the insulating material; whereas the latter, Fig. 10, shows a base pin 19 extending from the base disk 20 by way of a channel 21 of substantially triangular shape, the triangle being truncated by removal of the channel bottom after heating and fusion of the insulating material 22 with the metal of the base. The sloping shape of the bottom part of the base pin 19, and the wedge shape of the insert of insulating material 22, lend added mechanical strength to the seal.

As illustrated in Fig. 11, the base pins also may be provided separate and attached to the base disk. As shown in Fig. 11, the base disk 23 is formed with a flanged channel portion 24 to which a corresponding flange 25 of the base pin 26 is attached, for example by soldering, welding or in any other convenient manner, the channel being filled with insulating material 27 and, after heating and fusion, the bottom of the channel 24 is removed in the manner described above with reference to the preceding figures of the drawings.

Fig. 12 illustrates a modification of a tube base according to the invention which is distinguished by a series of concentric channels interconnected by radial channels so the whole of the base disk is subdivided into segments, all insulated relative to one another, to the circular center portion and to the marginal portion of the base disk. As shown in Fig. 12, the base disk 30 has provided in its center a locating key 31 which is surrounded by a circular channel 32 concentric with the base disk 30. Radial channels 33 extend radially from the concentric channel 32 toward the marginal portion of the base disk 30 where they open into a second circular concentric channel 34.

The channels 32, 33, and 34 are filled with insulating material 35, heated and truncated in the above-described manner so as to constitute effective insulating portions subdividing the base into a number of segments 36 mounting the base pins 37. While six such insulated segments have been shown in the drawing, it is readily seen that by providing a greater number of radial channels and correspondingly reducing the area of the segments, a materially larger number of individual insulated segments may be provided.

Figs. 13 and 14 illustrate another and particularly important modification of a tube base according to the invention which is distinguished by particular simplicity and economy. Here the base is provided as a dished member 101 which is pressed, stamped or otherwise formed to have its top broken up in a number of individual segments, alternate segments 102 extending flat to a center opening, 103 wherein to mount a locating key 104, while the segment generally indicated at 105, located between any two segments 102, are formed to have a circumferential channel portion 106 and extending therefrom, an upwardly directed connector portion 107 and a downwardly extending connector portion 108. The segments 102 include cut-out parts 109 located in the vicinity of the adjacent channel portions 106 to avoid contact therewith.

The dish-shaped interior of the base member 101 is filled with insulatingly material 110 such as glass which by heating, for example, is bonded to the metal and which fills the openings 111 remaining after deformation of the segments 105, so as to form a hermetic seal with the metal of the base member 101.

In accordance with the basic concept of the invention, the bottom parts of channels 106 are now removed, for example, by grinding, leaving the truncated channel indicated at 112 from which extend, entirely insulated from other parts of the base member 101, the upper and lower connector elements 107 and 108, respectively. The electrode assembly and the base pins may be attached to these connector elements in any convenient manner, such as by welding, soldering or similar procedure.

Fig. 15 illustrates an electric discharge tube incorporating a base according to the present invention, showing particularly the manner in which the electrode assembly is mounted on the base. The base 40 includes a locating key 41, base pins 42 and channels 44 insulating the base pins. The envelope portion 45 is provided integral with the tube base 40; the envelope portion 45 is open at the top where it terminates in a flange 46, the envelope being closed by means of a flat plate or disk 47 of metal or glass, for example, resting on the flange 46 and sealed thereto by soldering, welding, fusion or any other suitable sealing procedure. The electrode assembly generally indicated at 48 is mounted on the tube base 40 by means of a supporting rod 49 mounted in the locating key 41 by soldering, for example, and supporting rods 50 mounted in the base pins 42 by pinching, soldering or any other convenient mounting method.

The several types of bases for electric discharge tubes incorporating the insulating channels according to the present invention facilitate materially the mass-production of electronic tubes in simplifying production methods, reducing the time and cost of manufacturing operations, speeding up the assembly and resulting in enhanced, uniform and rugged products adaptable for the diverse types of electronic equipment on the market.

The basic concept of the invention may be applied with advantage to the manufacture of insulted connecting assemblies having a number of connecting elements separated by insulating matter.

Figs. 16 and 17 illustrate a connecting assembly according to the invention which comprises a metal plate 51 wherein truncated channels 52 enclosing insulating material 53 are formed, for example, by pressing, heating and grinding in the manner outlined above. The system of channels 52 defines connecting elements 54 which are insulated from one another by means of the strips of insulating material 53.

In cases where the connecting assembly is to be air-tight a vitreous material such as powdered glass, for example, is preferred which upon heating, for example by means of high-frequency current, is fused to the metal of the channel walls to form a hermetic seal.

Insulating materials other than vitreous may be employed, particularly if no hermetic seal is required. Plastics such as Bakelite or other artificial resins may be used, for example.

Insulating materials which do not form a firm bond with metal may render it desirable to so shape the profile of the channels that after fusion of the insulating material and removal of the channel bottoms, the truncated channels will firmly support the strip of insulating material. An embodiment of the invention designed for insulating materials not at all, or not readily fusible to metal, is shown in Figs. 18 to 20 where 55 denotes part of a metal plate, 56 the channel pressed or otherwise provided in plate 55, 57 the insulating material such as powdered artificial resin, for example, filled into the channel 56, and 56′ and 57′ respectively, indicate the walls of the truncated channel and the somewhat rivet-shaped portion of insulating material, resulting from heating of the insulating material to fuse the same into a coherent mass, and from subsequently removing the bottom of the channel as outlined above. It is apparent that the rivet-shaped portion 57′ of insulating material is firmly mounted in the truncated channel section 56′.

At times it is desirable not only to separate adjacent contact elements by insulation, but moreover to arrange a ground connection between the elements thus separated. A structure of this kind is obtained in a simple manner according to the invention which contemplates in a case of this kind, as illustrated in Figs. 21 and 22, to provide in the metal base 60 a channel having side-walls 61, marginal projections 62 and a reentrant center portion 63. After the filling of the channel with insulating material 64 and the subsequent heating and fusion thereof, the projecting channel portions 62 are removed, for example by grinding, leaving the side-walls 61 of the channel and positioned therebetween and separated therefrom by strips 64′ of insulating material, the center portion 63 which is connected to ground.

The connecting elements shown at 54 in Figs. 16 and 17 commonly are required to be provided with some means for attaching wires, conductors, electrodes or the like. The invention contemplates to provide for this purpose, lugs or similar connectors by pressing, stamping or otherwise forming a corresponding part or parts of each connecting element simultaneously with the pressing, stamping or similar forming of the channels in the metal base, so as to obtain both the channels and the connectors or lugs in a single, uniform operation.

As shown in Figs. 23 and 24, the contact elements 54 are treated, at the time the channels (52 in Figs. 16 and 17) are formed, to press, stamp or otherwise form in the connecting elements two lug portions 65 and 66 which, when bent at right angles to the elements 54 in opposite directions, constitute connectors whereby to attach wires, conductors, electrodes or the like (not shown) to the top and bottom of the contact elements 54, respectively, screws 67 and 68 being provided in the lug portions 65 and 66 to facilitate such attachment. In place of the lug portions serving as connectors, a hollow pin may be formed in or attached to each connecting element (opening, in the latter instance, into a corresponding aperture made in the connecting element) so incoming contact, for example, is made by inserting a solid pin inside the hollow pin, while outgoing contact, for example, is made by sliding another hollow pin over the first named hollow pin (not shown).

It is apparent from the foregoing description that the insulated contact assemblies and the like according to the invention, by being made from a single metal plate and by having the insulating channels as well as the connectors formed in a single, simultaneous manufacturing operation, combine the advantages of simplicity and ruggedness of design with a reduction in the time and cost of manufacture.

The term "truncated" as used throughout this specification and the appended claims in connection with a depression, groove, channel or the like is intended to refer to a depression, channel, groove etc., part of the wall, usually a bottom part of which has been removed, so as to form an opening enclosed by side walls.

I claim:

1. In the manufacture of electric discharge tubes, the method of manufacturing a base therefor provided with a plurality of electrically conductive elements therein separated from one another by intermediate electrically insulating zones, comprising the steps of forming a depression in a metallic plate member, filling the depression with a powdered vitreous material, heating the powdered vitreous material to mold the vitreous material in the depression of said metallic plate member, and removing the bottom of the depressed portion of said metallic plate member to thereby provide electrically conductive elements in said base separated by a zone of electrically insulating material.

2. In the manufacture of electric discharge tubes, the method of manufacturing a base therefor provided with a plurality of electrically conductive elements therein separated from one another by intermediate electrically insulating zones, comprising the steps of forming a metallic plate with the elements therein and channels surrounding said elements, filling said channels with powdered glass, heating the powdered glass to mold the same in the channels of said plate member, and removing the bottom portions of said channels to thereby interpose insulating material between the elements and the metallic plate member.

3. In the manufacture of an electric discharge tube, the method of manufacturing a base therefor provided with a plurality of electrically conductive elements therein separated from one another by intermediate electrically insulating zones, comprising the steps of forming a metallic member integral with an envelope and with the elements therein and channels surrounding the elements, filling said channels with powdered glass, heating the glass to mold the same in said channels, and removing the bottom portions of said channels to thereby interpose insulating material between the elements and the metallic plate member.

4. In the manufacture of an electric discharge tube, the method of manufacturing a base therefor provided with a plurality of electrically conductive elements therein separated from one another by intermediate electrically insulating zones, comprising the steps of forming a metallic plate member with the elements therein and circumferential channels and radial channels joining each of said circumferential channels, filling said channels with powdered glass, heating the glass to mold the same in said channels, and removing the bottom portions of said channels to thereby interpose insulating material between sector portions of said metallic plate.

5. In the manufacture of an electrical discharge tube, the method of manufacturing a base therefor provided with a plurality of electrically conducting elements therein separated from one another by electrically insulating zones, comprising the steps of forming a metallic plate member to form individual segments in the top thereof, forming alternate segments in said plate member to include a circumferential channel and upwardly and downwardly extending connector portions, filling said metallic plate member including said channel portions with powdered glass, heating the glass to mold the same in said channels, and removing the bottom portion of the channel to thereby insulate each of said connector portions from other parts of said base.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,407,776	Stone	Feb. 28, 1922
1,592,326	Bastian	July 13, 1926
2,023,264	Brucker	Dec. 3, 1935
2,109,992	French	Mar. 1, 1938
2,120,099	Iams	June 7, 1938
2,166,830	Thorson	July 18, 1939
2,174,682	Beggs	Oct. 3, 1939
2,220,741	Thorson	Nov. 5, 1940
2,297,488	Luderitz	Sept. 29, 1942
2,334,631	Johnson	Nov. 16, 1943
2,486,065	Saucet	Oct. 25, 1949