Oct. 31, 1950 F. R. DICKINSON 2,528,121

ELECTRICAL CONNECTOR

Filed May 20, 1948 2 Sheets-Sheet 1

FIG. 1

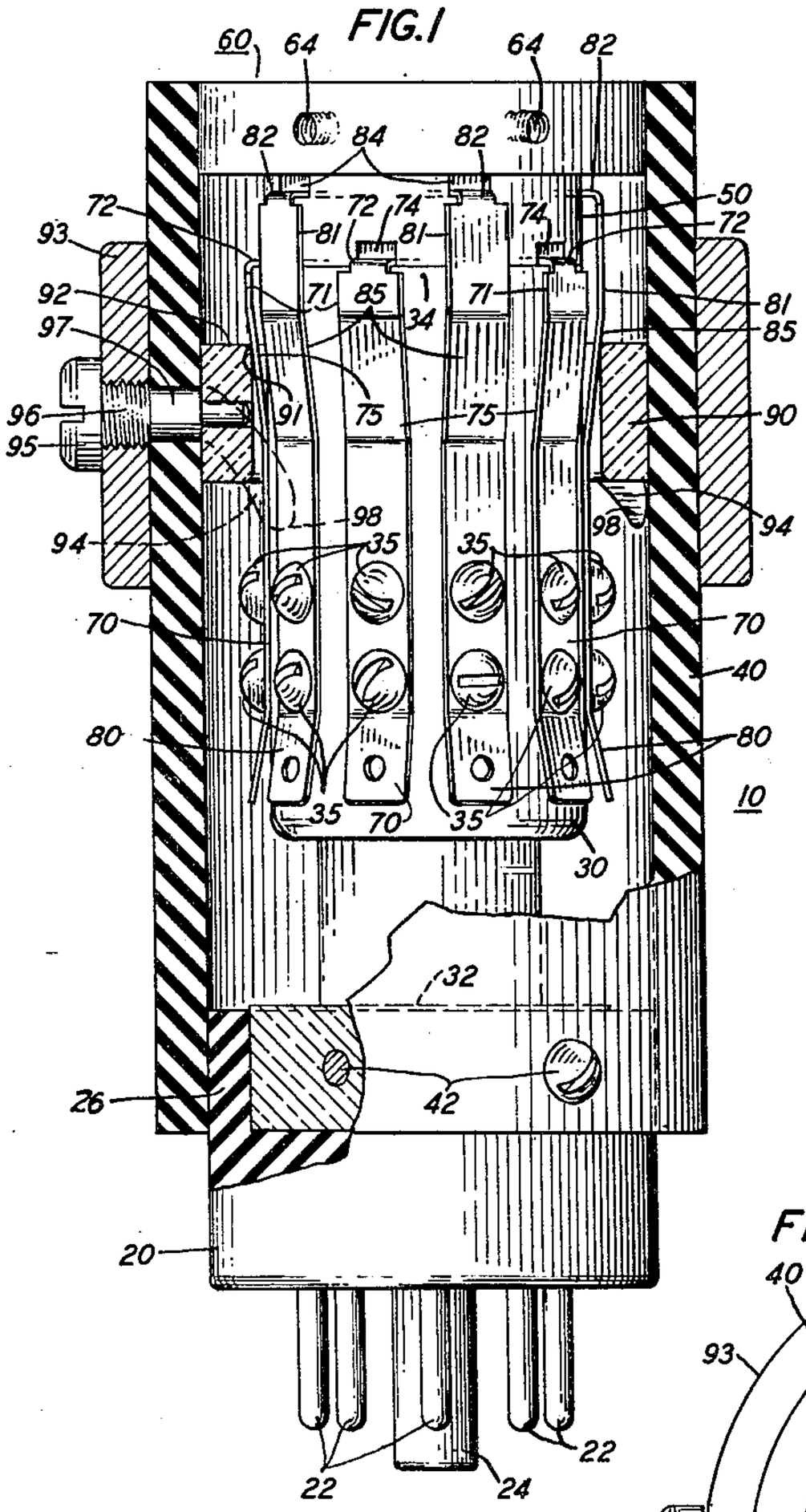

FIG. 3

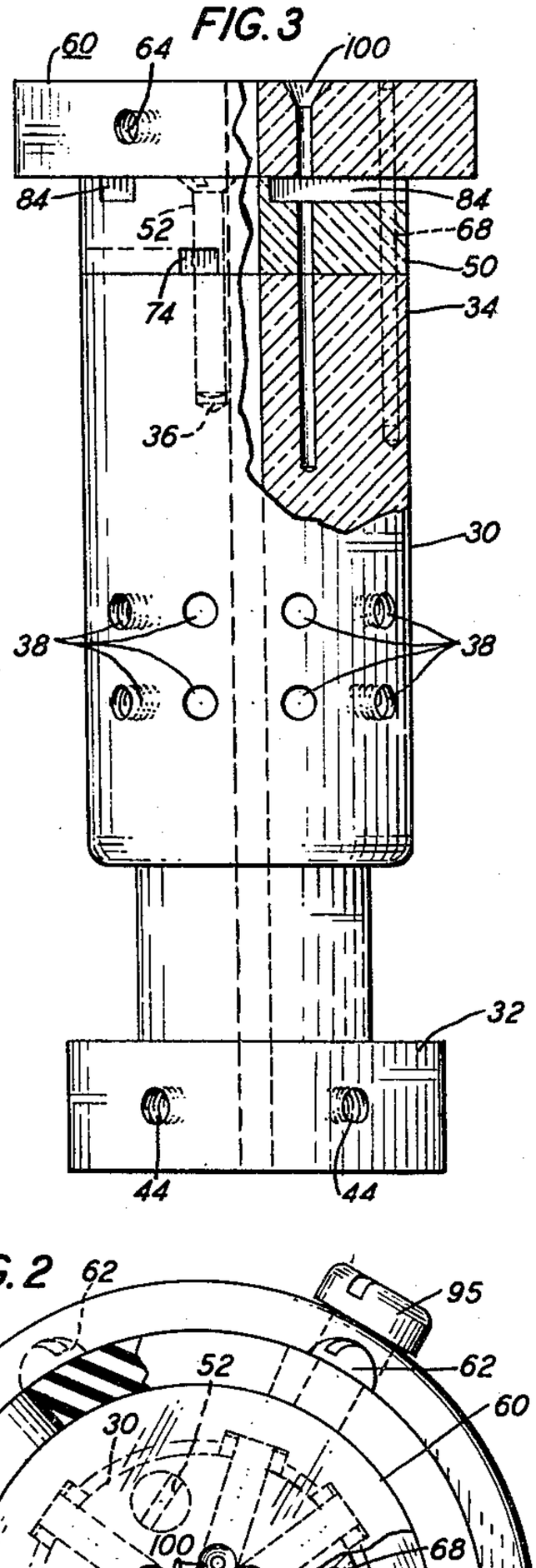

FIG. 2

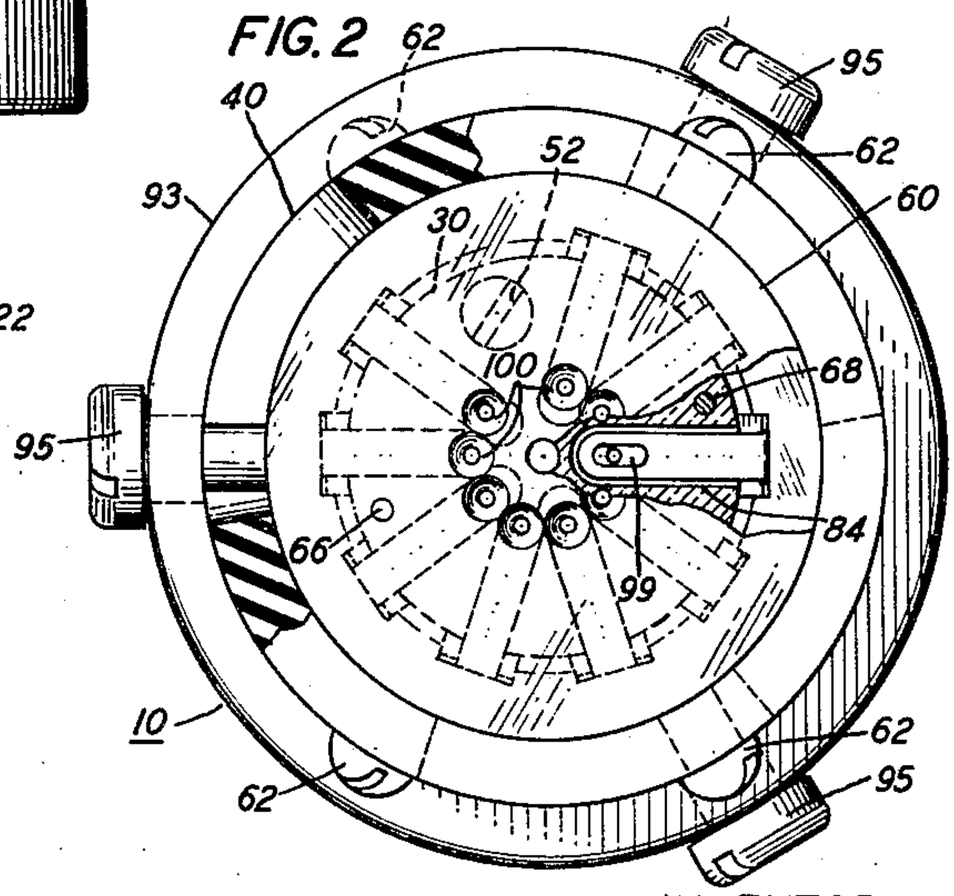

FIG. 4

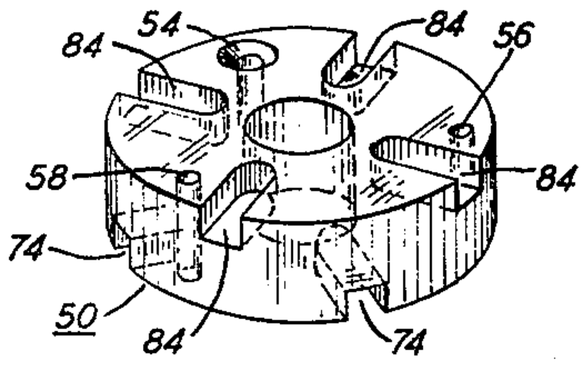

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FIG. 5

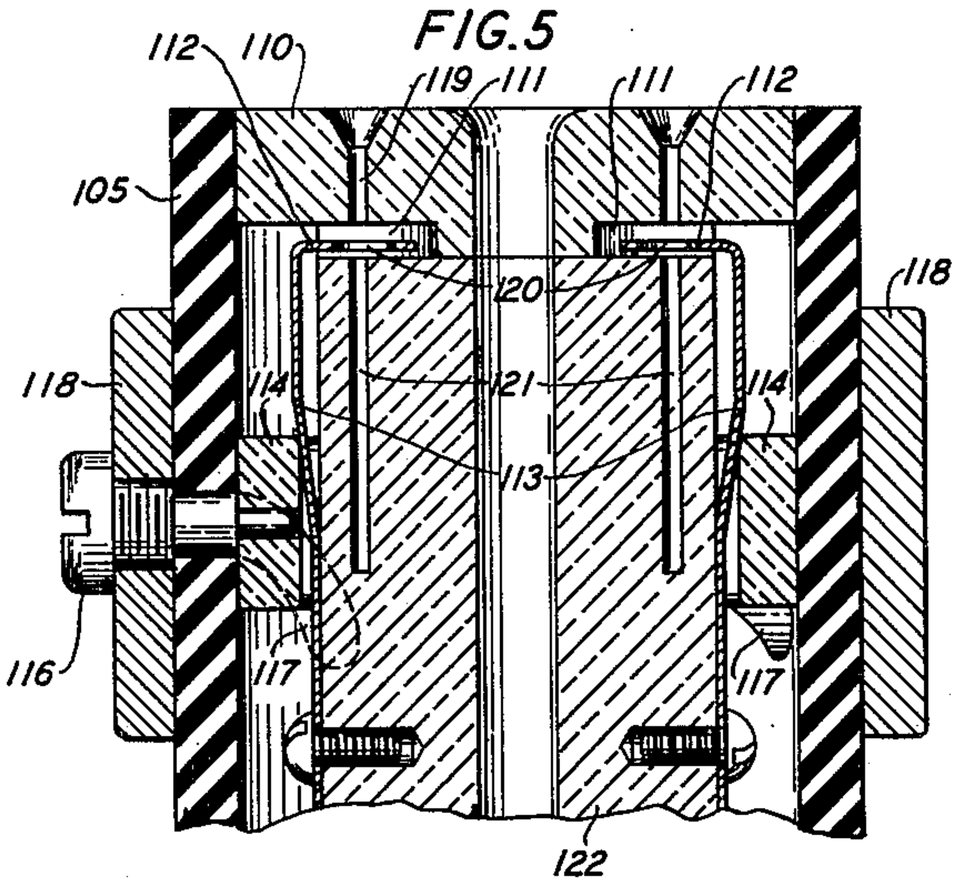


FIG. 6

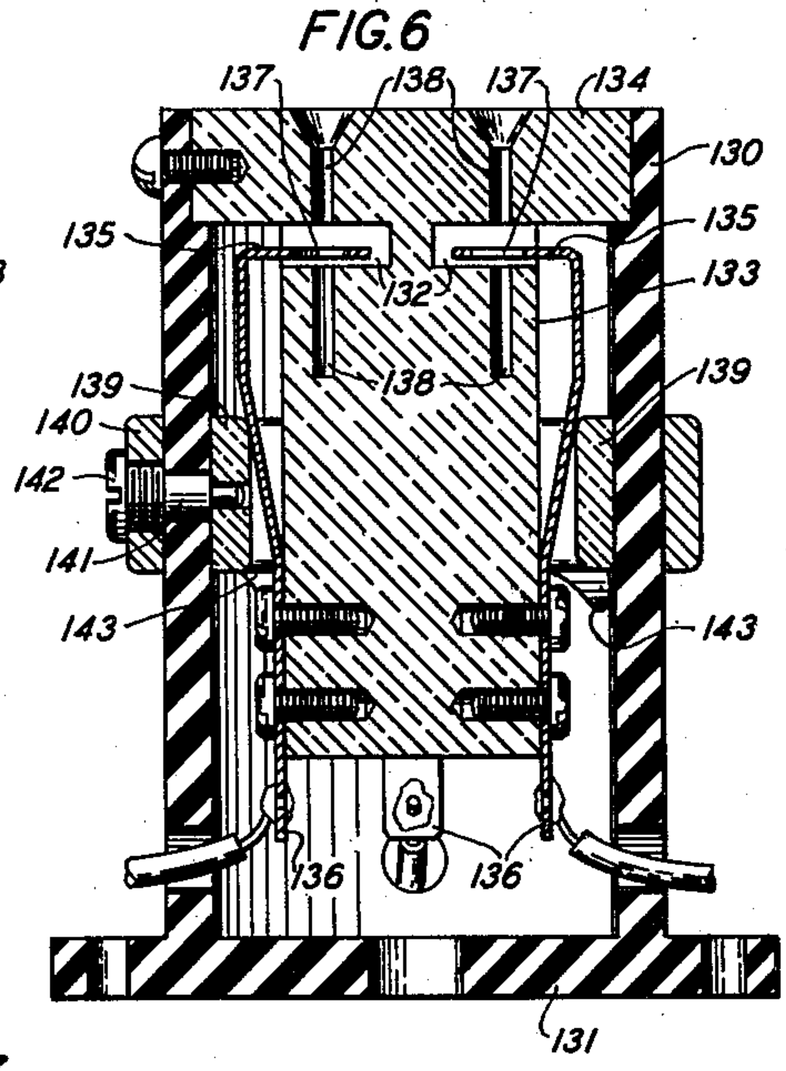


FIG. 7A

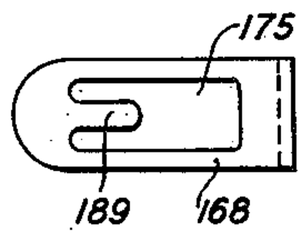


FIG. 7

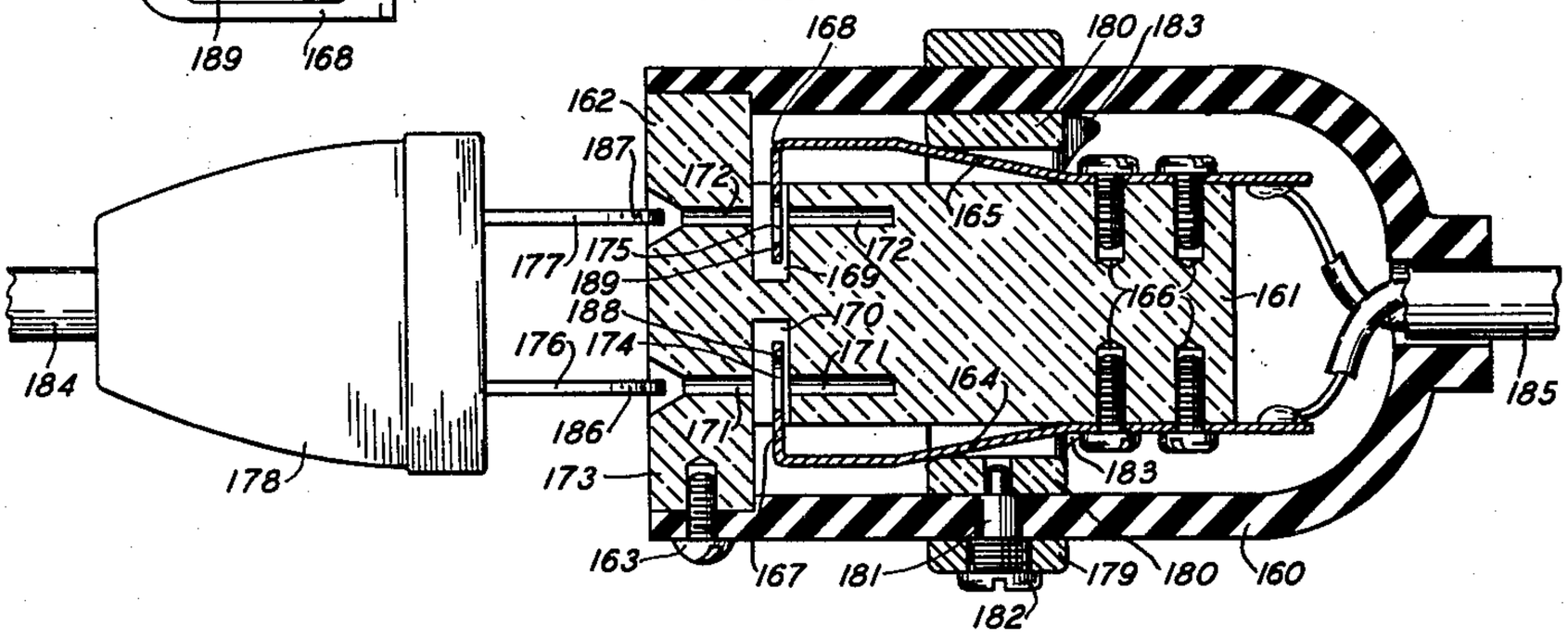
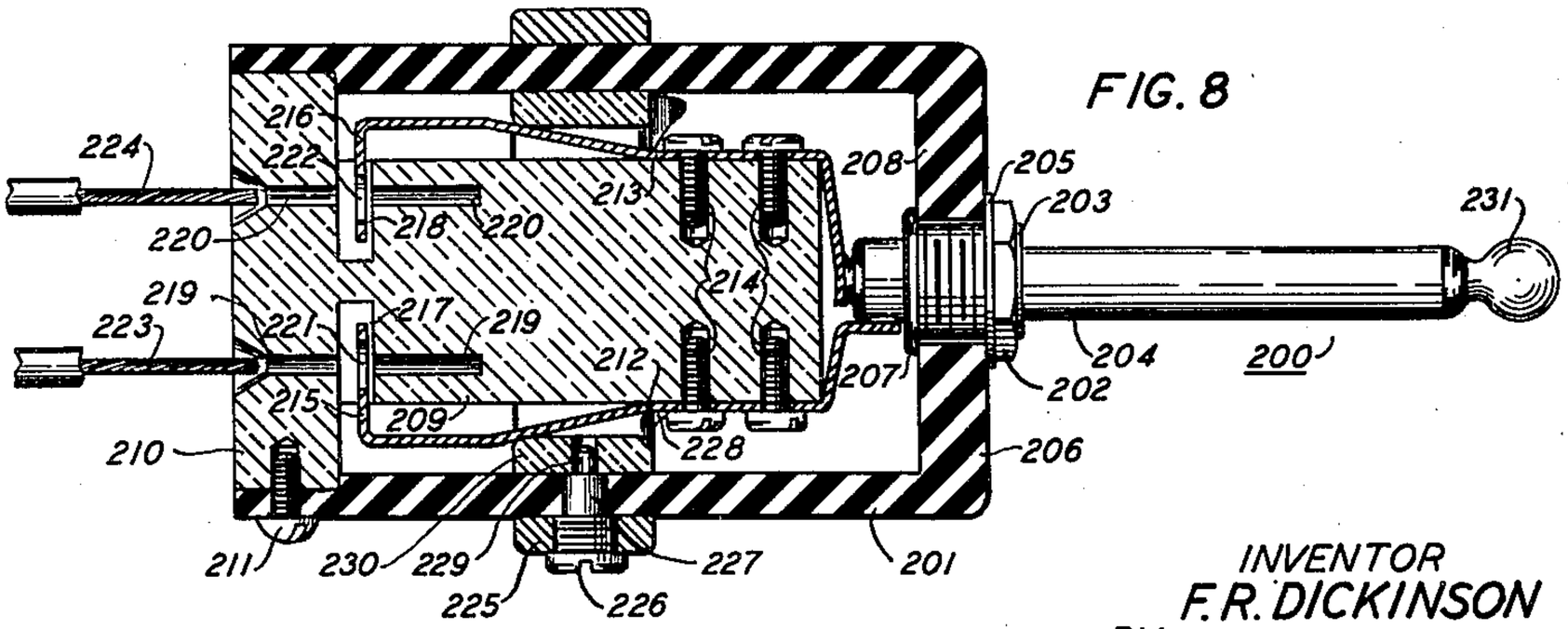


FIG. 8



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UNITED STATES PATENT OFFICE

2,528,121

ELECTRICAL CONNECTOR

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9 Claims. (Cl. 173—344)

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This invention relates to electrical connectors and more particularly to separable electrical connectors for a plurality of conductors.

Heretofore, in making electrical tests of some vacuum tubes before their bases were applied, their lead-in wires, which may be flexible and not readily attached to a socket, were temporarily fastened to clips on an insulating post attached to a socket. This arrangement was time consuming and exposed the operator to the hazard of electrical shocks.

One object of this invention is to facilitate the electrical testing of vacuum tubes during their manufacture.

Another object of this invention is to issue positive and firm engagement between the conductors and the associated contacts on a connector therefor.

A further object of this invention is to expedite the establishment of electrical connection with a plurality of flexible conductors.

A vacuum tube adapter illustrative of one embodiment of this invention overcomes the difficulties above mentioned by facilitating the insertion of the flexible lead-in wires of an unbased tube into apertures in the adapter or their removal therefrom. The adapter is designed for insertion into a conventional tube socket for electrical connection to the testing circuits. This construction encloses the lead-in wires and eliminates the hazard of electrical shock to the operator.

A feature of this invention relates to means for gripping the conductors after they are inserted through the apertures of the device.

Another feature of this invention relates to means for simultaneously compressing a plurality of resilient springs within the device.

The nature of the present invention will be more fully understood from a consideration of the embodiments illustrated in the accompanying drawings in which:

Fig. 1 is an elevational view partly in cross section of a vacuum tube adapter illustrative of one embodiment of the invention;

Fig. 2 is a plan view of the adapter of Fig. 1 with part of the casing cut away;

Fig. 3 is an elevational view of the central post and casing closure of the adapter of Fig. 1;

Fig. 4 is a perspective view of the slotted portion of the central post adjacent to the casing closure of the adapter of Fig. 1;

Fig. 5 is a cross-sectional view of a portion of an embodiment of the invention in which the slots are cut in the casing closure;

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Fig. 6 is a cross-sectional view of another embodiment of the invention in which the casing is designed for attachment to a flat surface and the casing closure and central post are in one piece;

Fig. 7 is a cross-sectional view of an embodiment of the invention especially suitable for the electrical connection to a conventional electric lamp cord plug; and

Fig. 7A is an end view of one of the resilient springs shown in Fig. 7.

Fig. 8 is a partial cross-sectional view of another embodiment of the invention in which a conventional telephone-type jack plug is attached to the casing of the device.

Referring now to Figs. 1, 2, 3 and 4, the vacuum tube adapter **10** includes a conventional pronged vacuum tube base **20** for insertion in a vacuum tube socket. Base **20** is of an insulating material as, for example, a phenolic condensation product, supporting a plurality of metallic conducting plugs **22** extending through and moulded therein. A cylindrical axial guide post **24** forms a unitary portion of the moulded base **20**. A cylindrical central post **30** composed of a clear plastic material as, for example, vinylite, has an enlarged cylindrical end **32** inserted in a cupped portion **26** of base **20**. Base **20** is inserted into the lower end of casing **40** which is composed of an insulating material, as for example, phenol fibre. Base **20**, central post **30** and casing **40** are rigidly secured together by machine screws **42** which pass through clearance holes in cup **26** and casing **40** and are threaded into tapped holes **44** in end **32** of central post **30**.

Cylinder **50**, shown in perspective view in Fig. 4, is composed of the same plastic material as post **30** and is rigidly attached to upper end **34** thereof by a machine screw **52** which passes through a clearance hole **54** in cylinder **50** and threads into a tapped hole **36** in central post **30**. A cylinder **60** composed of the same plastic material as post **30** rests upon the upper surface of cylinder **50** and forms a closure for the upper end of casing **40** and is secured thereto by machine screws **62** which pass through clearance holes in casing **40** and thread into tapped holes **64** in cylinder **60**. Central post **30**, cylinder **50** and cylinder **60** are held in rigid alignment by metallic pins **66**, **68** fitted tightly in perforations through cylinder **60**, and in perforations **56**, **58** through cylinder **50** and in aligned holes in post **30** and terminating therein.

A plurality of holes **38** are drilled and tapped radially to the axis of post **30**. A plurality of

resilient springs 70, 80 are attached to post 30 by machine screws 35 which thread into holes 38. The upper ends 72 of springs 70 are bent normal to the axis of post 30 and enter slots 74 in cylinder 50. The upper ends 82 of springs 80 similarly are bent normal to the axis of post 30 and enter slots 84. Springs 70 are shorter than springs 80 so that slots 74 may be formed in the lower face of cylinder 50 and slots 84 may be formed in the upper face thereof "to avoid interference between adjacent springs and thus permit inclusion of more springs in a given space." Resilient springs 70, 80 are formed with portions 71, 81 adjacent to the bent ends 72, 82 in parallel relation to the axis of post 30 but apart therefrom. Springs 70, 80 are depressible for moving their parallel portions 71, 81 closer to post 30 for thrusting their bent ends 72, 82 further into slots 74, 84 respectively.

A cylindrical sleeve 90 composed of insulating material, as for example, a phenolic condensation product, surrounds springs 70, 80 substantially at their middle portions with the inner edge 91 of its upper circular face 92 making contact with angular portions 75, 85 of springs 70, 80. Sleeve 90 is slidable reciprocally and also revolvable on the inner surface of casing 40. A cylindrical metallic sleeve 93 surrounds casing 40 and is slidable reciprocally and also revolvable on the outer surface of casing 40. A plurality of helical slots 94, two of which are partially visible in Fig. 1, are cut through the casing 40. Pins 95 are threaded into holes 96 in sleeve 93 adjacent to each helical slot 94 and each has a shank 97 extending through a helical slot 94 in casing 40 and has a smaller shank 98 entering a hole in sleeve 90. Pins 95 couple sleeve 93 to sleeve 90 and when sleeve 93 is rotated about casing 40 the resulting motion imparts a similar motion to sleeve 90. Pins 95 being restrained in helical slots 94 cause reciprocal motion of sleeve 93 and sleeve 90.

Reciprocal motion of sleeve 90 results in movement of springs 70, 80. When pins 95 are in the position shown in Fig. 1, shanks 97 are at the upper end of their travel in helical slots 94 in one direction, sleeve 90 has been reciprocated to the highest point in its travel and its inner edge 91 has pressed springs 70, 80 inward toward post 30. When sleeve 93 is now rotated, pins 97 sliding in helical slots 94 cause sleeve 90 to move downward, and in so doing inner edge 91 slides downward over the surface of angular portions 75, 85 of springs 70, 80 allowing springs 70, 80 to spring radially outward in a direction away from the axis of post 30. This motion is arrested when shanks 97 of pins 95 strike the lower ends 98 of helical slots 94.

As shown in Fig. 2, springs 70, 80 have apertures 99 in their ends 72, 82. When the springs 70, 80 are depressed by sleeve 90 to the positions shown in Fig. 1, apertures 99 are in alignment with apertures 100, one of which is shown in the cross-sectional portion of Fig. 3. Apertures 100 extend through cylinder 60 and cylinder 50 into post 30 and terminate within the body of post 30.

The operation of this embodiment of the invention is as follows: With apertures 99 in alignment with apertures 100, wires connecting to a device that is to be electrically tested may be readily inserted in the latter. For example, a plurality of lead-in wires extending from the envelope of an unbased vacuum tube may be inserted in apertures 100 into the body of post 30, to a point substantially below the lower surfaces

of slots 74, 84. Rotation of sleeve 93 and resulting movement of pin shanks 97 to the lower ends 98 of helical slots 94 will move sleeve 90 downward and allow spring ends 72, 82 to move outward radially in a direction away from the axis of post 30. The lead-in wires of the vacuum tube in apertures 100 will restrain the outward radial movement of spring ends 72, 82 and firm electrical contact will be established between the lead-in wires of the vacuum tube and the resilient springs 70, 80. Rotation of sleeve 93 and the return of pin shank 97 to the position shown in Fig. 1 will release the lead-in wires in apertures 100.

Fig. 5 shows a modification of the embodiment of this invention shown in Figs. 1, 2, 3 and 4 in which the closure 110 of outer casing 105 has a plurality of slots 111 all in the same plane into which bent ends 112 of the resilient springs 113 reciprocate in a horizontal plane when sleeve 114 is reciprocated by movement of shank 115 of pin 116 in helical slot 117 in casing 105 when sleeve 118 is rotated about casing 105. Wires to be electrically connected to this device may be inserted in apertures 119 of closure 110 and through apertures 120 in springs 112 into apertures 121 of central post 122. Spring ends 112 will grip such wires when sleeve 114 is reciprocated downward by rotation of sleeve 118 about casing 105, and will be again released when sleeve 118 is restored to the position shown in Fig. 5.

Another embodiment of this invention is shown in Fig. 6 in which the cylindrical casing 130 has a flat mounting surface 131 and a plurality of slots 132 are formed in central post 133 which is supported by its upper end 134 which forms a closure for casing 130. The bent ends 135 of resilient springs 136 have apertures 137 which align with apertures 138 in central post 133 when in the position shown in Fig. 6. Wires inserted in apertures 138 will be gripped by spring ends 135 when sleeve 139 is reciprocated downward by rotation of sleeve 140 about casing 130 which movement will slide shank 141 of pin 142 in helical slot 143 and the wires will be released when sleeve 140 is restored to the position shown in Fig. 6.

Fig. 7 shows another embodiment of the invention in the form of a socket in which a pair of contacts are provided for making electrical connection with a conventional two-conductor lamp cord plug. A feature of this arrangement is the provision of means for locking the contacts of the cord plug in the socket to prevent their removal therefrom. Cylindrical casing 160 rigidly supports a central post 161 by means of shoulder 162 attached by screw 163. Resilient springs 164, 165 are rigidly attached to central post 161 by screws 166 and have bent ends 167, 168 which extend into slots 169, 170 respectively in post 161. Apertures 171, 172 having rectangular cross-sections enter central post 161 from the end 173 thereof. Apertures 174, 175 in spring ends 167, 168 respectively are in alignment with apertures 171, 172 respectively in the position shown in Fig. 7. Contact pins 176, 177 of a conventional lamp cord attachment plug 178 can be inserted into apertures 171, 172.

Contact pins 176, 177 have round apertures 186, 187 near their outer ends as is conventional in commercial cord plugs. Bent ends 167, 168 of resilient springs 164, 165 have prongs 188, 189 extending radially away from the axis of central post 161. Rotation of sleeve 179 about casing 160 will move sleeve 180 to the right as shank 181 of

pin 182 slides in helical slot 183. This motion of sleeve 179 will allow spring ends 167, 168 and prongs 188, 189 to move outward away from the axis of central post 161. Prongs 188, 189 will enter apertures 186, 187 respectively of cord plug contact pins 176, 177 when the latter have been inserted in apertures 171, 172 respectively and will lock contact pins 176, 177 to prevent their withdrawal from socket 160. When sleeve 179 and pin 182 are restored to the position shown in Fig. 7 prongs 188, 189 will be withdrawn from contact pins 176, 177. Two-conductor electric cord 184 can thus be electrically connected to a similar cord 185.

Still another embodiment of this invention is shown in Fig. 8 which is a conventional telephone-type jack plug in which a two-conductor plug 200 is rigidly supported axially in one end of a cylindrical casing 201 by nut 202 which is threaded upon shoulder 203 which is formed upon the outer circumference of sleeve 204 of plug 200. A washer 205 lies between nut 202 and end face 206 of casing 201 and nut 202 draws shoulder 207 of sleeve 204 into secure contact with inner surface 208 of the end of casing 201. Central post 209 is rigidly attached to casing 201 by the cylindrical end 210 of central post 209 and is securely held by screw 211.

Resilient springs 212, 213 are rigidly attached to central post 209 by screws 214 which enter threaded holes in the body of central post 209. Bent ends 215, 216 of springs 212, 213 enter slots 217, 218. Apertures 219, 220 drilled from face 210 of posts 209 enter the body of post 209 and are intersected by slots 217, 218 respectively. Apertures 221, 222 in spring ends 215, 216 align with apertures 219, 220 when springs 212, 213 are in the position shown in Fig. 8. Conducting wires 223, 224 can be inserted in apertures 219, 220 passing through apertures 221, 222 of spring ends 215, 216 respectively. If sleeve 225 is then rotated about the outer surface of casing 201 pin 226 will move its shank 227 in helical slot 228 and shank 229 will cause sleeve 230 to move to the right which will allow spring ends 217, 218 to move outwardly away from the axis of post 209 and conductors 223, 224 will be gripped by spring ends 221, 222 respectively. Conductors 223, 224 may then be released by rotating sleeve 225 to the position shown in Fig. 8.

Within the casing 201 spring 212 is electrically connected to plug sleeve 204 and spring 213 is electrically connected to tip 231 which extends through and is insulated from sleeve 204 in the manner conventional in telephone plugs.

While the invention has been disclosed with reference to specific embodiments, it is to be understood that it is to be considered as limited in scope by the appended claims only.

What is claimed is:

1. A separable connector comprising a sleeve member, a closure on one end of said member having a plurality of spaced apertures and radial slots intersecting said apertures, a central post within said member carried by said closure, a plurality of resilient springs attached to said post and having bent ends extending through said slots, a reciprocable collar encompassing said springs, and means including a rotatable ring on said sleeve member and coupled to said collar for reciprocating said collar.

2. A separable connector comprising a base, a central post and a cylindrical casing attached at one end to said base, a closure for the opposite end of said casing and attached to the opposite

end of said post, said closure having a plurality of spaced apertures therein, said post having a plurality of parallel apertures spaced in alignment with the spaced apertures in said closure, said post having radial slots intersecting said apertures, a plurality of resilient springs attached to said post and having their free ends formed normal to the body thereof, said free ends extending into said slots, a reciprocable collar encompassing said springs, and an exterior concentric ring on said casing coupled to said collar for reciprocably moving said collar.

3. An electrical connector comprising a cylindrical casing, closures at both ends of said casing, a central post extending between said closures within said casing, one of said closures having a plurality of spaced apertures therethrough and having a plurality of radial slots on the inner surface thereof intersecting said apertures, said post having a plurality of parallel apertures spaced in alignment with the spaced apertures in said one closure, a plurality of resilient springs attached to said post and having bent perforated ends extending into said slots and means including a reciprocable collar for reciprocally moving the bent ends of said springs simultaneously in said slots.

4. A separable electrical connector comprising a central column, a base attached to one end of said column, an outer casing attached to said base, a member attached to the opposite end of said column forming a closure for said casing, said column having a plurality of spaced radial slots in the said opposite end thereof, said closure having an aperture normal to each slot extending through said closure, said central column having a plurality of parallel apertures spaced in alignment with the apertures in said closure, a resilient spring for each slot attached to said column near said base and having the free end bent normal to the axis of said column and extending radially into the slot for reciprocal movement therein, the bent end of each spring having an aperture positioned to align with one of said parallel apertures when said spring end is fully moved into said slot, a reciprocating and partially revolvable collar within said casing for reciprocating the spring ends in said slots and means for imparting reciprocating and partially revolving motion to said collar.

5. A separable connector comprising a circular sleeve member, a central member having one end expanded to form a closure for one end of said sleeve member, said central member having a plurality of spaced radial slots adjacent to the expanded end thereof and having a plurality of apertures extending through said expanded end spaced to intersect said slots, a plurality of resilient springs attached to said central member and having one end of each spring bent normal to the body thereof and positioned for reciprocal movement of the bent end in one of said slots, the bent end of each of said springs having an aperture positioned for alignment with an aperture in said central member when said bent end is thrust fully into a slot, an inner cylindrical collar engaging said springs within said sleeve member slidable reciprocally and partially revolvable on the inner surface of said sleeve member, a helical slot through said sleeve member at a position substantially opposite the middle portion of said springs, an outer cylindrical collar on the outer surface of said sleeve member slidable reciprocally and partially revolvable upon the outer surface of said sleeve member, and a pin coupling

said outer and inner collars through said helical slot whereby motion of said outer collar may impart motion to said inner collar.

6. A separable connector comprising a cylindrical sleeve, a pillar coaxial with said sleeve and having a cylindrical end portion forming a closure for one end of said sleeve, said pillar having a plurality of spaced radial slots adjacent to said cylindrical end portion thereof and having a plurality of apertures through said end portion parallel to the axis of said sleeve with each slot bisecting one of said apertures which terminate within said pillar, a plurality of resilient springs attached to said pillar and having ends bent into said slots and positioned for radial movement into said slots when said springs are pressed against said pillar, the bent end of each spring having an aperture positioned for alignment with one of said spaced apertures when the spring is pressed against said pillar, and reciprocal means including a partially rotatable ring for simultaneously pressing said springs against said pillar.

7. A separable electrical connector comprising a cylindrical cup, a closure for the open end of said cup having a post extending coaxially into said cup, said closure having a plurality of spaced apertures extending therethrough into said post, said post having a radial slot adjacent to said closure for each aperture and intersecting said aperture, a resilient spring for each slot attached to said post and having an end bent normal to the body thereof and extending into the slot, the bent end of each spring having an aperture for alignment with a spaced aperture when said spring is pressed against said post, and means including a reciprocable and partially rotatable ring for simultaneously pressing said springs against said post.

8. A separable electrical connector comprising a cylindrical cup, a closure for the open end of said cup having a post extending coaxially into said cup, said post having a plurality of spaced apertures extending through said closure and having a radial slot adjacent to said closure for each aperture and intersecting the aperture, a

resilient spring for each slot attached to said post and having an end bent normal to the body thereof and extending into the slot, the bent end of each spring having an aperture for alignment with a spaced aperture when said spring is pressed against said post, an inner cylindrical collar engaging said springs within said cup slidable reciprocally and partially revolvable on the inner surface of said cup, said cup having a helical slot therethrough positioned substantially opposite the middle portion of said springs, an outer cylindrical collar on the outer surface of said cup slidable reciprocally and partially revolvable upon the outer surface of said cup, and a pin coupling said outer and inner collars through said helical slot whereby motion of said outer collar may impart motion to said inner collar.

9. A separable electrical connector comprising a cup, a closure for the open end of said cup, said closure having a pair of apertures extending into said closure and having a radial slot adjacent said closure for each aperture and intersecting the aperture, a resilient spring for each slot attached to said post and having an end bent at an angle to the body thereof and extending into the slot, the bent end of each spring having an aperture for alignment with one of said pair of apertures when said spring is pressed against said post and having a prong extending into the aperture of said spring in the direction radially outward from the axis of said post, and means including a reciprocable and partially rotatable ring for simultaneously pressing said springs against said post.

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