Aug. 26, 1947. B. A. BELS 2,426,429

ELECTRICAL CONNECTOR

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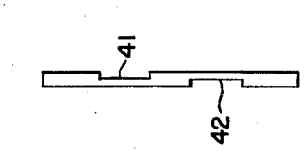


FIG. 3b

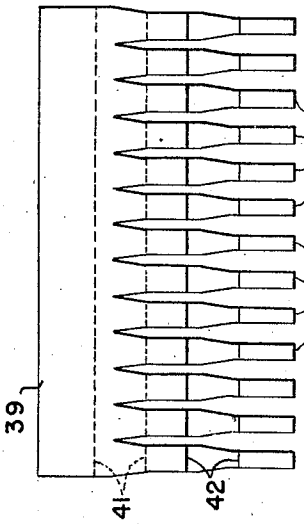


FIG. 3a

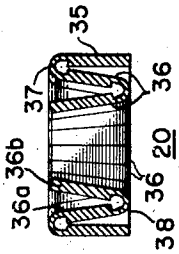


FIG. 2

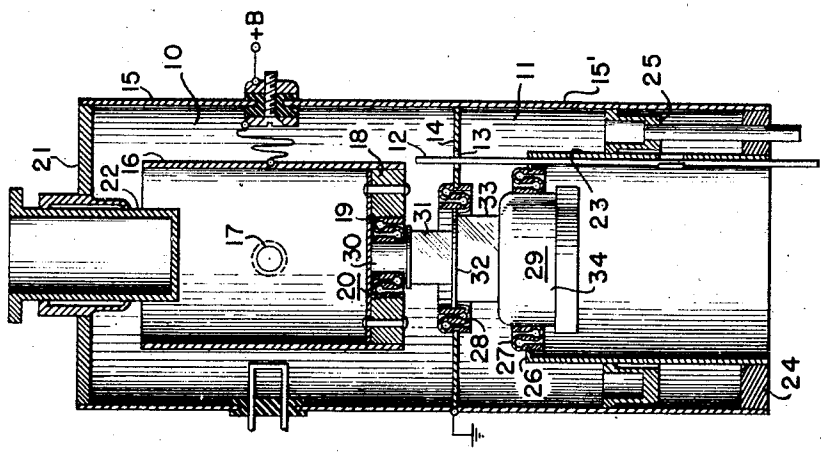


FIG. 1

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ELECTRICAL CONNECTOR

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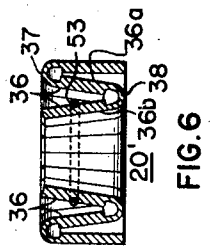


FIG.6

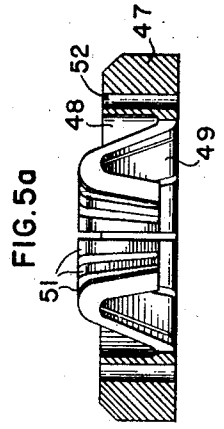


FIG.5a

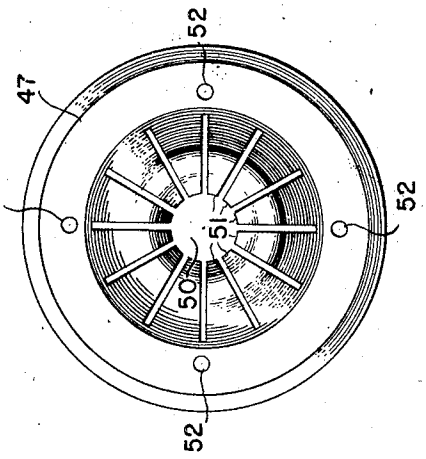


FIG.5b

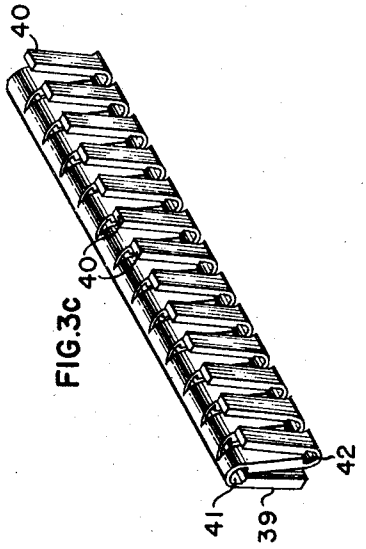


FIG.3c

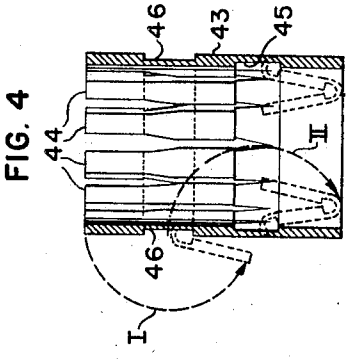


FIG. 4

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2,426,429

UNITED STATES PATENT OFFICE

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ELECTRICAL CONNECTOR

Basil A. Bels, Great Neck, N. Y., assignor, by mesne assignments, to Hazeltine Research, Inc., Chicago, Ill., a corporation of Illinois

Application January 6, 1945, Serial No. 571,610

11 Claims. (Cl. 173—324)

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The present invention relates to electrical connectors and, particularly, to such connectors which are adapted to engage an approximately cylindrical conductive contact member. While the invention is of general application, it has particular utility as an electrode-terminal connector for use with vacuum tubes of the type having an electrode terminal sealed through, or directly supported by, a wall of an evacuated glass envelope and will be described in that connection.

It frequently is desirable to provide an electrical connector adapted to engage an approximately cylindrical conductive contact member. No essential problem is encountered in a simple connector of this type when the only requirement to be met is that of providing a positive consistent electrical contact with the contact member. However, problems of design arise when the connector must additionally provide adequate and consistent thermal contact with the contact member, to enable substantial conduction of thermal energy there-between and particularly is this true when the force required to effect complete engagement between the contact member and the connector must be minimized. The problems thus raised are multiplied where the connector must at the same time allow for some eccentricity of the contact member and for lateral and angular departures from coincidence of the axes of the contact member and connector.

To illustrate by example the problems encountered in providing an electrical connector of the type described, consider the case of an electrical connector for a vacuum tube of the type having an anode terminal sealed through or supported by one wall of a glass envelope. The power handled by the tube may be sufficiently large that the anode terminal heats so excessively as to fracture the glass seal unless precautions are taken to conduct thermal energy rapidly away from the anode terminal. The anode-terminal connector in such case must not only provide the required electrical connection to the anode terminal, but additionally must firmly engage most of the surface of the latter and be capable of furnishing a path of low thermal resistance to a thermal-dissipative surface if adequate cooling of the anode terminal is to be effected. This usually presents no undue problem if the anode connector is of split construction adapted to be placed over the anode terminal and clamped thereto. Where, however, it is required that the anode

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connector be simply slipped bodily over the anode terminal without subsequent clamping, serious problems arise concerning the manner of attaining the required firm thermal contact over a large contact area particularly since the force required to effect complete engagement of the connector and terminal cannot be large without danger of fracture of the tube glass envelope.

In many such applications, it is further necessary that the vacuum tube be physically inserted axially into operative position and that, during such insertion, the anode terminal and possibly one or more electrode terminals fully engage fixed electrical connectors provided therefor. The anode terminal in these tubes usually is positioned axially of the tube envelope at the inserted end thereof. It is quite difficult in practice accurately to center and axially to align the anode terminal at the time it is sealed to the glass envelope of the tube. The anode-terminal connector consequently must additionally be capable of permitting small lateral and angular departures from coincidence of the axes of the terminal and connector without placing undue strain on the terminal since this strain would be transmitted directly to the glass seal and would tend to fracture it.

It is an object of the present invention therefore to provide a new and improved electrical connector adapted to engage an approximately cylindrical conductive contact member.

It is a further object of the invention to provide a new and improved electrical connector, adapted to engage an approximately cylindrical conductive contact member, having greater thermal conductivity than has readily been heretofore obtainable in a connector of the type described.

It is an additional object of the invention to provide an electrical connector, adapted to engage an approximately cylindrical conductive contact member, of simplified, improved and relatively inexpensive construction.

It is another object of the invention to provide a new and improved electrical connector, adapted to engage an approximately cylindrical conductive contact member, which insures positive, consistent and substantially uniform electrical and thermal contact with such contact member while minimizing the force required to effect complete engagement of the contact member with the connector while, at the same time, permitting relative lateral and angular departures from coincidence of the axes of the contact member and connector.

In accordance with the invention, an electrical connector adapted to engage an approximately cylindrical conductive contact member comprises a relatively rigid cylindrical element of conductive material and a plurality of conductive resilient contact fingers positioned internally of the element but resiliently connected at one extremity thereto and extending inwardly from the element radially with respect to the axis of the element. Each of the contact fingers has two relatively rigid linear portions connected at one end by a resilient portion to provide for each such finger a V-shaped cross-sectional configuration at its intersection with a plane which includes the axis of the aforementioned cylindrical element. The radial dimensions of the element are so selected with relation to the diameter of the contact member that the innermost linear portions of the contact fingers are adapted to make consistent and substantially uniform electrical and thermal contact with the contact member along a substantial portion of their lengths while at the same time the contact fingers permit relative departures from coincidence of the axes of the element and of the contact member and minimize the force required to effect complete engagement of the contact member with the connector.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

Referring now to the drawings, Fig. 1 illustrates a high-frequency wave-signal oscillator which utilizes electrical connectors embodying the present invention; Fig. 2 is an enlarged cross-sectional view of one form of electrical connector of the present invention; Figs. 3*a*, 3*b* and 3*c* illustrate certain steps employed in one method of forming the electrical connector of the invention; Fig. 4 illustrates a second method of forming the electrical connector; Figs. 5*a* and 5*b* illustrate an electrical connector embodying the invention formed by a machining process; and Fig. 6 illustrates a portion of an electrical connector embodying a modified form of the invention.

Referring now more particularly to Fig. 1 of the drawings, there is illustrated a high-frequency wave-signal oscillator which utilizes electrical connectors embodying the present invention. This oscillator is disclosed and claimed in a copending application of Harold A. Wheeler, entitled Wave-signal translating device, Serial No. 565,828, filed November 30, 1944, and assigned to the same assignee as the present application. Reference is made to this copending application for a detailed description of the oscillator and its mode of operation. Briefly, the oscillator includes a first or anode cavity resonator **10** and a second or cathode cavity resonator **11** which is capacitively coupled to the resonator **10** by a probe **12** arranged to extend through an aperture **13** in a diaphragm **14** separating the cavity resonators **10** and **11**. The cavity resonator **10** includes a cylindrical hollow outer conductor **15** and a cylindrical hollow inner conductor **16** which are maintained in fixed coaxial relationship by insulating spacers **17** secured between the conductors **15** and **16** at points suitably spaced around the circumference thereof. One end of the inner conductor **16** is closed by a disc **18** having a centrally positioned coaxial aperture **19** in which is secured by a pressed fit or other suitable means an electrical connector **20** embodying the present invention and presently to be described in greater detail. The outer conductor **15** of the cavity resonator **10** is closed at its end opposite the diaphragm **14** by a disc **21** which supports, in coaxial relation with the conductor **15**, a cylindrical conductor **22** of diameter appreciably smaller than that of the inner conductor **16**. The conductor **22** effectively forms a re-entrant portion of the outer conductor **15** and is used for purposes of tuning this resonator **10**.

The second or cathode resonator **11** similarly includes an outer hollow cylindrical conductor **15'**, which may be an extension of the conductor **15**, and an inner hollow cylindrical conductor **23** which is supported by a conductive ring **24** in coaxial relation with the outer conductor **15'**. A conductive ring **25** is positioned between and electrically engages the inner and outer conductors **23** and **15'**, this ring being adjustable axially along these conductors for purposes of tuning the cathode cavity resonator. The end of the inner conductor **23** adjacent the diaphragm **14** is closed by a disc **26** having a centrally positioned coaxial aperture in which is secured an electrical connector **27** having a construction similar to that of the electrical connector **20**. The diaphragm **14** likewise has a centrally positioned coaxial aperture in which is secured an electrical connector **28** also embodying a construction similar to that of the electrical connector **20**.

A vacuum tube **29** has an approximately cylindrical conductive contact member or anode terminal **30** hermetically sealed to one end of a cylindrical glass envelope portion **31**, a conductive grid disc **32** which is hermetically sealed between the envelope portion **31** and a second cylindrical glass envelope portion **33**, and a conductive cathode terminal **34** sealed to one end of the glass envelope portion **33**. The tube **29** is insertable axially through the center of the hollow conductor **23** of the cathode cavity resonator **11** into operative position with its anode terminal **30** engaging the electrical connnector **20**, its grid terminal disc **32** engaging the electrical connector **28** and its cathode terminal **34** engaging the electrical connector **27**. For purposes of simplicity, certain electrical connectors which extend out of the flat base of the tube **29** are not shown nor is the means shown for maintaining tube **29** in the operative position described.

Reference is made to the aforementioned copending Wheeler application for a detailed description of the oscillator described. Briefly considered, oscillations developed in the cathode cavity resonator **11** are repeated by the vacuum tube **29** to the anode cavity resonator **10** and a portion of the oscillatory energy developed in the latter is applied by the probe **12** back to the cathode cavity resonator **11** to maintain sustained oscillation of the oscillator.

During operation of the oscillator, it is necessary that the anode terminal **30** of the tube **29** be electrically connected by the electrical connector **20** through the disc **18** and the inner conductor **16** of the anode cavity resonator **10** to a source of anode potential indicated as +B. The vacuum tube **29** during operation translates sufficient power that the temperature of the anode terminal **30** is raised to a high value. There is consequently danger of fracturing the glass seal between the anode terminal **30** and the tube en-

velope portion 31 unless thermal energy is conducted rapidly away from the anode terminal. Hence, it is necessary that the electrical connector 20 make good thermal contact with the anode terminal 30 over a major portion of the surface of the latter and that the connector provide a path of good thermal conductivity to the disc 18 and the conductor 16 in order that the latter elements may act as thermal radiators to maintain the anode terminal 30 at a relatively low safe temperature.

An additional requirement of the electrical connector 20 is that it must accommodate eccentricities of the anode terminal 30 and permit relative departures from coincidence of the axes of the anode terminal and the connector while the vacuum tube 29 is in its operative position in the oscillator and also during insertion and withdrawal thereof. Otherwise a mechanical strain is placed upon the anode terminal 30 which may fracture the seal between the anode terminal and the tube envelope portion 31. For a like reason, the electrical connector 20 must minimize the force required to effect complete engagement and disengagement of the anode terminal 30 with the connector.

Certain of the requirements last mentioned with relation to the electrical connector 20 apply, though to a lesser degree, to the electrical connectors 27 and 28.

Considering now in greater particularity the portion of the oscillator arrangement described which embodies the present invention, the electrical connector 20 is illustrated in enlarged cross-sectional view in Fig. 2. The connector, which as heretofore explained is adapted to engage the approximately cylindrical conductive contact member 30, includes a relatively rigid cylindrical element 35 of conductive material, for example, beryllium copper, and a plurality of conductive resilient contact fingers 36 resiliently connected at one extremity 37 to one edge of the element 35 and extending inwardly from the latter radially with respect to the axis of the element. As shown, the contact fingers 36 are connected to the upper edge of the element 35 and are arched toward the lower edge of this element, each of the fingers having a V-shaped cross-sectional configuration at its intersection with a plane which includes the axis of the element 35. Further, each of these fingers has two relatively rigid linear portions 36*a*, 36*b*, which are connected at one end by a resilient portion 38. These contact fingers provide a substantially continuous laminated cylindrical contact surface symmetrical with relation to the axis of the element 35.

The radial dimensions of the element 35 are so selected with relation to the diameter of the contact member with which the electrical connector is to be used that the innermost linear portions 36*b* of the contact fingers 36 are adapted to make consistent and substantially uniform electrical and thermal contact with the contact member along their lengths, as shown more clearly in Fig. 1, while at the same time the contact fingers permit relative departures from coincidence of the axes of the element 35 and the contact member and minimize the force required to effect complete engagement of the contact member with the connector 20. Fig. 1 illustrates the manner in which the contact finger portions 36*a* and 36*b* move radially outward by virtue of the resilient connecting portions 37 and 38 to accommodate a cylindrical contact member.

Figs. 3*a*, 3*b* and 3*c* illustrate one method of

forming the electrical connector 20. As shown in the plan view of Fig. 3*a*, an elongated strip of conductive sheet material 39, which may, for example, be beryllium copper, is first serrated along a longitudinal edge to provide a plurality of serrations 40. The shape of the serrations shown permits the material 39 to be rolled into a cylindrical configuration after the contact fingers have been formed in a manner presently to be described. Either before or after forming the serrations, a longitudinal groove 41, shown more clearly in the end view of Fig. 3*b*, is preferably rolled into the material 39 on one side thereof along the roots of the serrations and a similar longitudinal groove 42 is rolled into the opposite side of material 39 at a region spaced from the first groove 41 toward the ends of the serrations. The serrations 40 are then bent back upon the material 39 at the first groove 41, and on the side of the material 39 of the groove 41, and the end portion of each of the serrations is then bent back upon itself at the second groove 42, and on the side of the serration of the second groove, thus to provide an elongated structure having the configuration shown in Fig. 3*c*. This structure is then formed into a cylindrical configuration with the serrations 40 pointing inwardly to provide the electrical connector shown in Fig. 2, the ends of the unserrated portion of the material 39 then being in abutting relation. The forming preferably is accomplished by using several flat templates of relatively thick stock material. These templates have turned into one face thereof a cylindrical groove of width only wide enough to receive the unserrated portion of the material 39 and a concentric groove formed radially inside of the first groove and of a width to accommodate the contact fingers 36. The diameters of these grooves are relatively large for the first template and become progressively smaller for successive templates until the last template has grooves of diameter equal to that which the finished connector is to have. Starting with the structure of Fig. 3*c*, the unserrated portion of the material 39 is pressed, starting at one end of the material, into the cylindrical grooves of that template having the largest diameter grooves. This causes the unserrated portion of the material 39 to take a permanent cylindrical set or deformation. By repeating this process using successive templates of smaller groove diameter, the electrical connector is ultimately formed to have the cylindrical configuration of Fig. 2.

Fig. 4 represents an additional method of forming an electrical connector embodying the present invention. Here the connector is formed from a hollow cylinder 43 of conductive material, for example, beryllium copper, serrated at one end to provide the serrations 44 having a shape similar to the serrations 40 of Fig. 3*a*. A groove 45 is rolled or otherwise suitably formed on the inside of the cylinder 43 at the roots of the serrations 44 while a groove 46 is rolled or otherwise suitably formed on the exterior surface of the cylinder 43 approximately at the midpoint of the serrations 44. Each of the serrations 44 is then bent outwardly and back upon itself at the groove 46, as indicated by the broken-line arrow I, and each serration is then bent inwardly of the cylinder 43 at the inner groove 45, as indicated by the broken-line arrow II, to provide the electrical connector shown in Fig. 2.

From the foregoing description of the Fig. 4 method of forming the electrical connector, it will be apparent that yet another method is to

use a serrated, grooved, flat stock as in Fig. 3*a*, to roll this flat stock into the cylindrical configuration of Fig. 4, and then to proceed as described in connection with the latter figure.

An additional method of forming the electrical connector of the present invention is illustrated by the cross-sectional side view of Fig. 5*a* and the top view of Fig. 5*b*. Here a circular piece of conductive material **47** has a concentric groove **48** machined into one surface thereof, a similar concentric groove **49** machined into its opposite face, and a tapered centrally machined bore **50**. The grooves **48**, **49** and the bore **50** has a contour such as to provide the desired V-shaped cross-sectional configuration of the contact fingers. The central portion of the material **47** is then slotted radially with respect to its axis to provide a plurality of resilient contact fingers **51**. Suitable mounting holes **52** may be drilled or otherwise formed in the material **47** if desired.

For some applications of the electrical connector of the present invention, it may be desirable to employ a soft copper for the material of the connector and to use additional means by which to bias the contact fingers of the connector radially inwardly of the connector to provide the required electrical and thermal contact with a contact member. Fig. 6 illustrates an electrical connector **20'** similar to that of Fig. 2 and represents a modification of the invention of the type last mentioned. Elements of Fig. 6 corresponding to similar elements of Fig. 2 are designated by similar reference numerals. In this modification, the outside surface of the inner linear portion **36***b* of the contact fingers **36** is grooved, in a plane normal to the axis of the electrical connector **20'**, to receive a spring-steel split ring **53**. The split ring **53** thus encircles a portion of the contact fingers and biases the contact fingers radially toward the axis of the electrical connector. The advantage of using soft copper in the electrical connector, in preference to beryllium copper, for example, lies in the fact that the heat conductivity of soft copper is greater thus permitting a greater transfer of thermal energy between the electrical connector and the contact member used therewith.

It will be apparent from the above description of the invention that an electrical connector embodying the invention insures positive, consistent and substantially uniform electrical and thermal contact with a cylindrical conductive contact member while minimizing the force required to effect complete engagement of the contact member with the connector. At the same time, the electrical connector of the present invention permits relative lateral and angular departures from coincidence of the axes of the contact member and connector. The electrical connector of the present invention has the additional advantage that it provides much higher thermal conductivity than has readily been heretofore obtainable in a connector of this type and yet the connector is of simplified, improved and relatively inexpensive construction.

While there have been described what are at present considered to be the preferred embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. An electrical connector adapted to engage an approximately cylindrical conductive contact member comprising, a relatively rigid cylindrical element of conductive material and a plurality of conductive resilient contact fingers positioned internally of said element but resiliently connected at one extremity thereto and extending inwardly from said element radially with respect to the axis of said element, each of said fingers having two relatively rigid linear portions connected at one end by a resilient portion to provide for said each finger a V-shaped cross-sectional configuration at its intersection with a plane which includes said axis, the radial dimensions of said element being so selected with relation to the diameter of said contact member that the innermost linear portions of said contact fingers are adapted to make consistent and substantially uniform electrical and thermal contact with said contact member along a substantial portion of their lengths while at the same time said contact fingers permit relative departures from coincidence of the axes of said element and said contact member and minimize the force required to effect complete engagement of said contact member with said connector.

2. An electrical connector adapted to engage an approximately cylindrical conductive contact member comprising, a relatively rigid cylindrical element of conductive material and a plurality of conductive resilient contact fingers positioned internally of said element but resiliently connected at one extremity thereto and extending inwardly from said element radially with respect to the axis of said element to provide a substantially continuous laminated cylindrical contact surface symmetrical with relation to said axis, each of said fingers having two relatively rigid linear portions connected at one end by a resilient portion to provide for said each finger a V-shaped cross-sectional configuration at its intersection with a plane which includes said axis, the radial dimensions of said element being so selected with relation to the diameter of said contact member that the innermost linear portions of said contact fingers are adapted to make consistent and substantially uniform electrical and thermal contact with said contact member along a substantial portion of their lengths while at the same time said contact fingers permit relative departures from coincidence of the axes of said element and said contact member and minimize the force required to effect complete engagement of said contact member with said connector.

3. An electrical connector adapted to engage an approximately cylindrical conductive contact member comprising, a relatively rigid cylindrical element of conductive material and a plurality of conductive resilient contact fingers positioned internally of said element but resiliently connected at one extremity to one edge of said element and extending inwardly from said element radially with respect to the axis of said element, each of said fingers having two relatively rigid linear portions connected at one end by a resilient portion to provide for said each finger a V-shaped cross-sectional configuration at its intersection with a plane which includes said axis, the radial dimensions of said element being so selected with relation to the diameter of said contact member that the innermost linear portions of said contact fingers are adapted to make consistent and sub-

stantially uniform electrical and thermal contact with said contact member along a substantial portion of their lengths while at the same time said contact fingers permit relative departures from coincidence of the axes of said element and said contact member and minimize the force required to effect complete engagement of said contact member with said connector.

4. An electrical connector adapted to engage an approximately cylindrical conductive contact member comprising, a relatively rigid cylindrical element of conductive material and a plurality of conductive resilient contact fingers positioned internally of said element but resiliently connected at one extremity to one edge of said element and extending inwardly from said element radially with respect to the axis of said element with said fingers arched toward the other edge of said element, each of said fingers having two relatively rigid linear portions connected at one end by a resilient portion to provide for said each finger a V-shaped cross-sectional configuration at its intersection with a plane which includes said axis, the radial dimensions of said element being so selected with relation to the diameter of said contact member that the innermost linear portions of said contact fingers are adapted to make consistent and substantially uniform electrical and thermal contact with said contact member along a substantial portion of their lengths while at the same time said contact fingers permit relative departures from coincidence of the axes of said element and said contact member and minimize the force required to effect complete engagement of said contact member with said connector.

5. An electrical connector adapted to engage an approximately cylindrical conductive contact member comprising, a relatively rigid cylindrical element of conductive material having a plurality of resilient conductive finger serrations at one edge of said element; said finger serrations extending inwardly from said element approximately at the roots of said serrations and having a reverse bend at an intermediate point along their length to provide fingers each having a V-shaped cross-sectional configuration at its intersection with a plane which includes the axis of said element and extending radially with respect to said axis, the radial dimensions of said element being so selected with relation to the diameter of said contact member that the innermost linear portions of said contact fingers are adapted to make consistent and substantially uniform electrical and thermal contact with said contact member along a substantial portion of their lengths while at the same time said contact fingers permit relative departures from coincidence of the axes of said element and said contact member and minimize the force required to effect complete engagement of said contact member with said connector.

6. An electrical connector adapted to engage an approximately cylindrical conductive contact member comprising, a relatively rigid cylindrical element of conductive material having a circumferential groove on its inner side spaced from one end thereof to provide an area of increased resilience and a plurality of contact finger serrations at the opposite end of said element and extending into said groove, said finger serrations extending inwardly at said groove radially with respect to the axis of said element, said fingers having a groove spaced from one end thereof to provide an area of increased resilience and having a reverse bend at the said last-mentioned groove to provide fingers each having a V-shaped cross-sectional configuration at its intersection with a plane which includes said axis, the radial dimensions of said element being so selected with relation to the diameter of said contact member that the innermost linear portions of said contact fingers are adapted to make consistent and substantially uniform electrical and thermal contact with said contact member along a substantial portion of their lengths while at the same time said contact fingers permit relative departures from coincidence of the axes of said element and said contact member and minimize the force required to effect complete engagement of said contact member with said connector.

7. An electrical connector adapted to engage an approximately cylindrical conductive contact member comprising, a relatively rigid cylindrical element of conductive material having a circumferential rolled groove therein on its inner side spaced from one end thereof to provide an area of increased resilience and a plurality of contact finger serrations at the opposite end of said element extending inwardly at said groove radially with respect to the axis of said element, each of said fingers having a rolled groove at a region spaced from one end thereof to provide an area of increased resilience and having a reverse bend at said last-mentioned groove to provide for each said finger a V-shaped cross-sectional configuration at its intersection with a plane which includes said axis, the radial dimensions of said element being so selected with relation to the diameter of said contact member that the innermost linear portions of said contact fingers are adapted to make consistent and substantially uniform electrical and thermal contact with said contact member along a substantial portion of their lengths while at the same time said contact fingers permit relative departures from coincidence of the axes of said element and said contact member and minimize the force required to effect complete engagement of said contact member with said connector.

8. An electrical connector adapted to engage an approximately cylindrical conductive contact member comprising, a relatively rigid cylindrical element of conductive material and a plurality of conductive resilient contact fingers connected at one extremity thereto and extending inwardly from said element radially with respect to the axis of said element, each of said fingers having a V-shaped cross-sectional configuration at its intersection with a plane which includes said axis, spring means for biasing said contact fingers radially toward said axis to increase the contact pressure of said fingers on said contact member during engagement of said contact member and said connector, the radial dimensions of said element being so selected with relation to the diameter of said contact member that the innermost linear portions of said contact fingers are adapted to make consistent and substantially uniform electrical and thermal contact with said contact member along a substantial portion of their lengths while at the same time said contact fingers permit relative departures from coincidence of the axes of said element and said contact member and minimize the force required to effect complete engagement of said contact member with said connector.

9. An electrical connector adapted to engage an approximately cylindrical conductive contact member comprising, a relatively rigid cylindrical

element of conductive material and a plurality of conductive resilient contact fingers connected at one extremity thereto and extending inwardly from said element radially with respect to the axis of said element, each of said fingers having a V-shaped cross-sectional configuration at its intersection with a plane which includes said axis, a split ring spring member encircling said contact fingers for biasing said contact fingers radially toward said axis to increase the contact pressure of said fingers on said contact member during engagement of said contact member and said connector, the radial dimensions of said element being so selected with relation to the diameter of said contact member that the innermost linear portions of said contact fingers are adapted to make consistent and substantially uniform electrical and thermal contact with said contact member along a substantial portion of their lengths while at the same time said contact fingers permit relative departures from coincidence of the axes of said element and said contact member and minimize the force required to effect complete engagement of said contact member with said connector.

10. The method of fabricating an electrical connector adapted to engage an approximately cylindrical conductive contact member which comprises the steps of serrating along a longitudinal edge an elongated strip of conductive sheet material, forming a longitudinal groove in said material on one side thereof along the roots of said serrations and forming a longitudinal groove on the opposite side of said material in a region spaced from said first groove toward the ends of said serrations, bending said serrations back upon said material at said first groove and on the side thereof of said first groove, bending the end portion of each of said serrations back upon said each serration at said second groove and on the side thereof said second groove, and bending the unserrated portion of said material into a cylinder with said serrations extending inwardly radially of the axis of said cylinder to provide a relatively rigid cylindrical element of conductive material and a plurality of conductive resilient V-shaped contact fingers connected at one extremity to one edge of said element and extending inwardly from said element radially with respect to the axis thereof and arched toward the other edge of said element.

11. A method of fabricating an electrical connector adapted to engage an approximately cylindrical conductive contact member which comprises the steps of serrating along a longitudinal edge an elongated strip of conductive sheet material, rolling a longitudinal groove in said material on one side thereof along the roots of said serrations and rolling a longitudinal groove on the opposite side of said material in a region spaced from said first groove toward the ends of said serrations, bending said serrations back upon said material at said first groove and on the side thereof of said first groove, bending the end portion of each of said serrations back upon said each serration at said second groove and on the side thereof of said second groove, and bending the unserrated portion of said material into a cylinder with said serrations extending inwardly radially of the axis of said cylinder to provide a relatively rigid cylindrical element of conductive material and a plurality of conductive resilient V-shaped contact fingers connected at one extremity to one edge of said element and extending inwardly from said element radially with respect to the axis thereof and arched toward the other edge of said element.

BASIL A. BELS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,754,446	Sachs	Apr. 15, 1930
1,321,934	Merchant	Nov. 18, 1919

FOREIGN PATENTS

Number	Country	Date
558,199	Great Britain	Dec. 24, 1943
88,613	Austria	May 26, 1922