

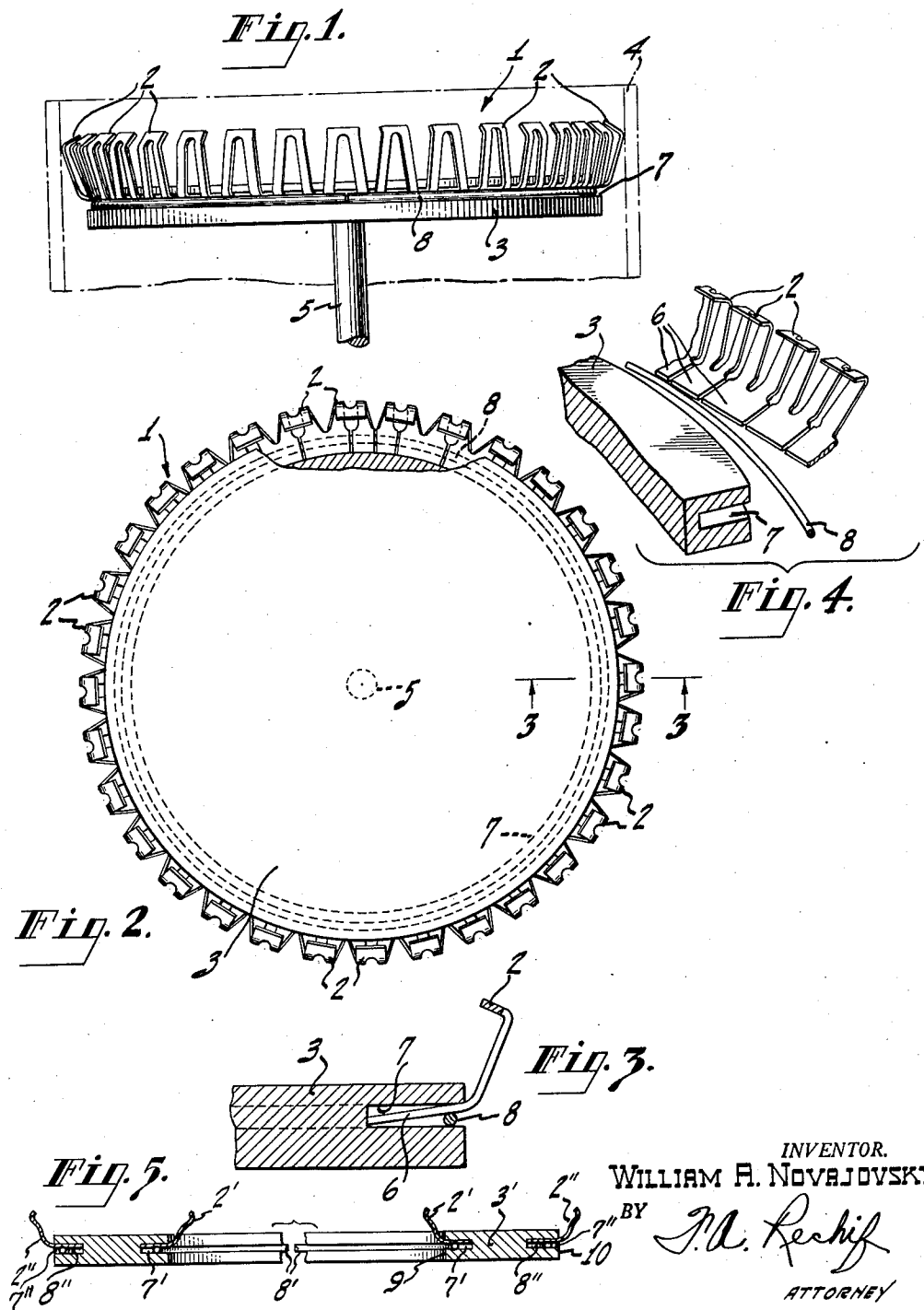
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SPRING FASTENING CONSTRUCTION

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SPRING FASTENING CONSTRUCTION

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This invention relates to a spring fastening construction, and particularly to a construction useful for fastening spring contact stock to the body of an electrical tuning element which might be used in high frequency radio apparatus.

Prior to this invention, several different methods have commonly been used to fasten spring contacts to transmitter tuning element bodies. Among these may be mentioned soldering the spring contacts to the tuning element body, spot welding the spring contacts to the tuning element body, and fastening the spring contacts to the tuning element body by means of screws. However, each of the three aforementioned constructions has at least one definite disadvantage. When solder is used, it is necessary to apply heat (in order to effect the soldering) whenever damaged springs must be replaced; the application of heat may damage the costly assembly which is being repaired. Also, with this type of construction high operating temperatures (particularly, temperatures above the melting point of solder) cannot be utilized, since otherwise the solder will melt and loosen the fastening. When spot welding is employed, damaged springs cannot be replaced without the use of special equipment. Also, with this construction the number of points of contact between the spring and the tuning element body is limited, and this can be disadvantageous. When screws are employed, the contact between the spring and the tuning element body is made only near the individual screws, rather than continuously over the entire length or circumference of the spring, and this is a decided disadvantage, particularly for high powers.

An object of this invention is to provide a novel construction for fastening a spring contact, such as might be used for a sliding electrical contact, to the metallic body of a tuning element.

Another object is to provide a novel fastening construction which eliminates the disadvantages referred to in connection with prior constructions. A construction according to this invention does not require heat to effect the fastening, and high operating temperatures have no detrimental effect on the fastening. Moreover, for the construction according to this invention no special equipment is required when the time comes to replace damaged springs, and continuous contact between the spring and the tuning element body is effected, over the entire length or circumference of the spring.

The objects of this invention are obtained, briefly, in the following manner: a groove, which is preferably although not necessarily U-shaped in cross section, is milled or otherwise cut into a surface of the tuning element body, which body may have a circular outer configuration. The lower end or tang of the spring contact stock is inserted into this groove. Then, to fasten it into place, a piece of wire whose diameter is equal to the width of the groove and whose length is substantially equal to the length of the groove is forced into the groove, in the space between one groove wall and the tang of the contact stock. This wire is deformable, so that it can be

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forced into the available space. The wire forces one face of the spring stock into intimate engagement with one wall of the groove, throughout the length of the spring stock.

A detailed description of the invention follows, taken in conjunction with the accompanying drawing, wherein:

Fig. 1 is a front elevation of a slidable contact assembly according to this invention, the application of this assembly to a portion of a transmission line or cavity resonator being indicated by dot-dash lines;

Fig. 2 is a top view of the Fig. 1 device without the dot-dash lines, certain parts being broken away for clearness;

Fig. 3 is a partial sectional view, taken along the line 3—3 of Fig. 2;

Fig. 4 is a partial exploded view, showing the parts before they are assembled; and

Fig. 5 is a sectional view of a modified construction.

Referring now to the drawing, Fig. 1 shows a slidable contact assembly 1 according to this invention in operative position, mounted to function as a sliding contact within a transmission line or cavity resonator of a radio transmitter, for example. The assembly 1 preferably has a generally circular outer configuration and includes a plurality of metallic spring contact fingers 2 which extend radially beyond the periphery of the metallic cylindrical body member 3. The fingers 2 are arranged circularly around the member 3 and are adapted to slidably engage or contact the inner cylindrical wall of a hollow cylindrical metallic member 4 (indicated in Fig. 1 by dot-dash lines) which may be, for example, a transmission line conductor or a cavity resonator in a radio transmitter. The contact assembly 1 can be used to great advantage in high and low power UHF and VHF transmitters. A rod 5 is firmly attached to one side of the body member 3, at the center thereof, in order to enable convenient axial movement of assembly 1 with respect to member 4 (the axes of member 4 and member 3 being collinear and the axial movement referred to corresponding to vertical movement in Fig. 1). The rod 5 may be driven by any suitable mechanical driving arrangement (not shown) so as to effect the desired movement of assembly 1.

The body member 3 is relatively thick (in the axial direction) and rigid, as compared to the fingers 2. Although member 3 is illustrated in Fig. 1 as being a solid disc-like plate or cylinder, it can be a torus 3' as illustrated in Fig. 5, or even a thin-walled annular member, depending upon the particular constructional environment wherein the contact assembly is desired to be used. If the body member is a torus 3' as in Fig. 5, it can be mounted to function as a sliding contact between the inner and outer conductors of a coaxial transmission line, or between the inner and outer conductors of a coaxial-type cavity. In this case, both the inner cylindrical surface or wall 9 and the outer cylindrical surface or wall 10 of the torus 3' can be provided with a plurality or set of spring contact fingers. The spring contact fingers 2' at the inner surface 9 of the torus 3' would engage or contact the outer cylindrical wall of the inner coaxial conductor, while the spring contact fingers 2'' at the outer surface 10 of the torus 3' would engage or contact the inner cylindrical wall of the outer coaxial conductor. When the body member is a torus 3', two or more rods such as 5 (Fig. 1) may be required to enable convenient movement of the slidable contact assembly. The rigid metallic body member 3 or 3' preferably has a circular periphery and an appreciable thickness in the axial direction (the direction of movement), and also has an appreciable radial dimension. Member 3 or 3' is fashioned out of metal

having good electrical conducting characteristics, such as brass, for example.

The contact fingers 2 (or 2' and 2'') are formed from a piece of thin contact stock (having a thickness of 10 mils, for example) which is bent to provide upstanding and outstanding spring fingers 2 (or 2' and 2''). Each of the tang portions 6 of the stock joins together (at the bottom) two adjacent fingers 2 (or 2' and 2'') which are separated at the top. Note Fig. 4. Thus, the spring contact stock of which fingers 2 or (2' and 2'') are a part is a single piece which may be cut off to any predetermined length and is capable of being bent to circular configuration. The spring contact stock is made of metal, such as Phosphor bronze for example, which has the resilient characteristic desired for spring contacts.

This invention is concerned with the spring (contact) fastening construction, or in other words with the method of and means for fastening the spring contact stock 2, 6 to the relatively thick and rigid body member 3 or 3', so as to form the slidable contact assembly 1. The spring fastening construction of the embodiment of Figs. 1-4 will now be described.

A continuous groove 7 is cut around the entire periphery of member 3, this groove being substantially U-shaped in cross section with the legs of the U extending radially of member 3, as shown clearly in Figs. 3 and 4. This groove may be cut in any suitable way, such as on a lathe or a milling machine, and as illustrated is cut in the outer surface of body member 3. The depth of groove 7 is made sufficient to accommodate the length of tang 6, as illustrated in Fig. 3, and of course the radial dimension of member 3 must be greater than the depth of groove 7. Since member 3 is relatively thick, its axial dimension is greater than the width of groove 7, so that there is metal stock defining both walls of the groove. The width of groove 7 is substantially greater than the thickness of the stock from which the member 2, 6 is formed; as an example, if the member 2, 6 is formed from 10-mil stock, the width of groove 7 may be 50 mils.

To form the contact assembly 1, a piece of spring contact stock (preformed with contact fingers 2 and tangs 6) is cut to a length substantially equal to the circumferential length of groove 7, which groove, as previously stated, is cut in the body member 3 which is to receive the spring contact 2, 6. Then, the tang 6 of the spring contact piece is positioned in the groove 7, as illustrated in Fig. 3, leaving a space 40 mils wide, if the groove is 50 mils wide and the spring contact stock is 10 mils thick.

Next, a wire 8 is cut to a length substantially equal to the circumferential length of groove 7. Wire 8 is made of a material having sufficient mechanical strength and high electrical conductivity, such as silver plated copper bus wire. It is also desirable to use wire with a coefficient of thermal expansion similar to that of member 3. The diameter of wire 8 is preferably substantially equal to the width of groove 7, that is, a diameter of 50 mils if groove 7 is 50 mils wide. Thus, the diameter of the wire 8 (50 mils) is somewhat greater than the width (40 mils) of the space available after tang 6 is positioned in the groove 7, so that wire 8 must be forced into the groove. After the tang 6 of the spring is positioned in groove 7, the wire 8 is driven or forced into the space between the bottom surface (in Fig. 3) of tang 6 and the lower wall of groove 7. When the wire 8 (which is somewhat deformable, but at the same time has rather high mechanical strength) is forced into the groove 8, it wedges the upper surface of tang 6 of the member 2, 6 into intimate engagement with the upper wall of groove 7. This wedging action also causes member 2, 6 to be bent to circular configuration, following groove 7 around member 3. Then, the member 2, 6 is held in tight engagement with member 3, completing

the slidable contact assembly 1 and providing the desired spring fastening construction.

Good electrical contact is made between member 2, 6 and the upper wall of groove 7 due to the intimate engagement between tang 6 and this wall; good electrical contact is made at the lower wall of groove 7 by the wire 8, which is electrically conductive and which firmly engages both the lower wall of groove 7 and the bottom surface of tang 6.

Due to the fact that the wire 8 is chosen to have a coefficient of thermal expansion similar to that of member 3, firm contact between members 3, 6, and 8 is maintained at all temperatures.

In the embodiment of Fig. 5, in which the body member 3' is a torus and in which there are two separate sets 2' and 2'' of spring contact fingers, a continuous groove 7' is cut in the inner cylindrical surface or wall 9 of member 3'. This groove 7' may have the same cross-sectional dimensions as groove 7 and is substantially U-shaped in cross section with the legs of the U extending radially of member 3'; groove 7' extends around the entire inner surface 9 of member 3'. Likewise, a continuous groove 7'' is cut in the outer cylindrical surface or wall 10 of member 3'. Groove 7'' may have the same cross-sectional dimensions as groove 7 and is substantially U-shaped in cross section with the legs of the U extending radially of member 3'; groove 7'' extends around the entire outer surface or periphery of member 3'. The radial dimension of member 3' (that is, the difference between its outer and inner radii) must of course be greater than the sum of the depths of grooves 7' and 7''. As a typical example, the thickness of member (torus) 3' may be of the same thickness (axial dimension) as member 3.

In this embodiment, a piece of spring contact stock (preformed with contact fingers 2' and tangs similar to tangs 6) is cut to a length substantially equal to the circumferential length of groove 7'. The tang of this spring contact piece is positioned in groove 7'.

Next, a piece 8' of wire is cut to a length substantially equal to the circumferential length of groove 7', the diameter of this wire preferably being substantially equal to the width of groove 7'. Wire 8' may be made of the same material as wire 8. After the tang of the spring is positioned in groove 7', the wire 8' is driven or forced into the space between one surface of the tang and one side wall of groove 7'. Wire 8' wedges one surface of the tang into intimate engagement with the other side wall of groove 7'. The member 2', etc. is then held in tight engagement with member 3', completing the inner spring fastening portion of the slidable contact assembly. The central aperture in member 3' allows the same to slide freely over the outer wall of a cylindrical electrical conductor, while spring fingers 2' are adapted to engage such wall.

Another piece of spring contact stock (preformed with contact fingers 2'' and tangs similar to tangs 6) is cut to a length substantially equal to the circumferential length of groove 7''. The tang of this spring contact piece is positioned in groove 7''.

Next, a piece 8'' of wire is cut to a length substantially equal to the circumferential length of groove 7'', the diameter of this wire preferably being substantially equal to the width of groove 7''. Wire 8'' may be made of the same material as wire 8. After the tang of the spring is positioned in groove 7'', the wire 8'' is driven or forced into the space between one surface of the tang and one side wall of groove 7''. Wire 8'' wedges one surface of the tang into intimate engagement with the other side wall of groove 7''. The member 2'', etc. is then held in tight engagement with member 3', completing the outer spring fastening portion of the slidable contact assembly. Spring fingers 2'' are adapted to engage the inner wall of a cylindrical electrical conductor, just as disclosed in Fig. 1, when the torus 3' is positioned between the inner and

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outer conductors of a coaxial transmission line, or between the inner and outer conductors of a coaxial-type cavity.

It should be apparent that with this invention no heat is needed to fasten the spring contact stock to the tuning element body 3 or 3'. Also, since the wire 8 and the spring contact piece 2, 6 each has a length substantially equal to the circumferential length of groove 7 and since wire 8 engages tang 6 throughout the length of piece 2, 6, a continuous contact between member 3 and tang 6, around the entire periphery of member 3, is provided. This is true also for the tangs and member 3' in Fig. 5.

What is claimed is:

1. An electrical contact device for transmitters and the like comprising a rigid metallic member of circular outer configuration and having an outer cylindrical surface, said member having a continuous circumferential groove formed in its outer cylindrical surface; a thin resilient metallic member of substantially annular configuration positioned with one edge in said groove, and a deformable elongated metallic wire forced into said groove to wedge said thin resilient member into intimate contact with one of the walls of said groove, the circumferential length of said wire being substantially equal to the circumferential length of said groove.

2. An electrical contact device for transmitters and the like comprising a rigid metallic toroidal member having inner and outer cylindrical surfaces, said member having

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continuous circumferential groove in its outer cylindrical surface and also having a continuous circumferential groove formed in its inner cylindrical surface; a first thin resilient metallic member of substantially annular configuration positioned with one edge in said outer groove, a first deformable elongated wire forced into said outer groove to wedge said thin resilient member into intimate contact with one of the walls of said outer groove, the circumferential length of said wire being substantially equal to the circumferential length of said outer groove; a second thin resilient metallic member of substantially annular configuration positioned with one edge in said inner groove, and a second deformable elongated wire forced into said inner groove to wedge said second thin resilient member into intimate engagement with one of the walls of said inner groove, the circumferential length of said second wire being substantially equal to the circumferential length of said inner groove.

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