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CRYSTAL CONTACT DEVICE

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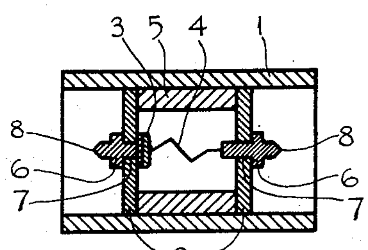

FIG. 1

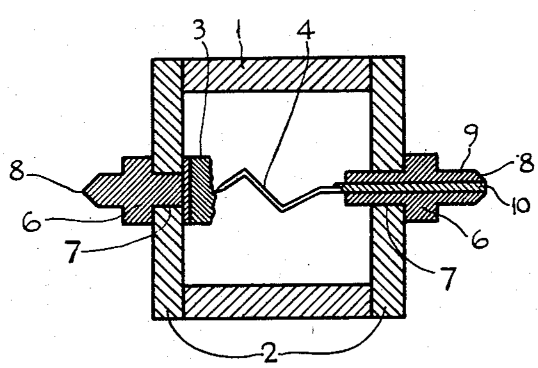

FIG. 2

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CRYSTAL CONTACT DEVICE

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6 Claims. (Cl. 250—31)

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The present invention relates to crystal contact devices.

More particularly the invention relates to crystal contact devices of the kind adapted for connection to a co-axial line, in which the crystal element and its co-operating metallic contact member are housed in a hollow circular metal cylinder to which either the crystal element or the metallic member are arranged to be connected whilst the other one is connected to an inner contact co-axial with the cylinder. The cylinder and the inner contact co-axial therewith are arranged for connection to the outer and inner conductor respectively of a co-axial line and are suitably dimensioned to match, approximately at least, the characteristic impedance of the co-axial line.

A further example of a crystal contact device of the kind specified is one in which the crystal element and its co-operating metallic member are each connected to individual inner contacts situated adjacent to opposite ends of the metal cylinder. A detachable bridge piece is then provided for connecting one or other of the inner contacts to the cylinder so that a co-axial line can be connected to the device by connection to the end opposite to that at which the bridge piece is connected. The direction of the easy flow of current through the crystal will then be dependent upon which of the inner contacts is connected to the cylinder by the bridge piece. Such a device to which a co-axial line may be connected at either end of the cylinder will hereafter be referred to as a "double-ended" crystal contact device.

One object of the present invention is to provide improvements in crystal contact devices of the kind specified.

A further object of the present invention is to simplify the manufacture of such devices.

According to the present invention there is provided a crystal contact device of the kind specified in which the crystal element and the metallic member co-operating therewith are each secured to supporting members of disc, annular or like form, which are positioned co-axially within the metal cylinder, and in which a collar, whose outer diameter is equal to or not much less than the inner diameter of said cylinder and whose inner surface at least is metallic and is effectively electrically connected to said cylinder, serves to maintain said supporting members at a predetermined distance apart and to reduce to a more desirable value the characteristic impedance of that portion of the device bounded by said collar. The crystal contact device may be provided with a central inner conductor at one or both ends. The collar may be formed integrally with the cylinder and may be metallic or of insulating material. In the latter case, at least the inner surface will be provided with a metallic coating which is electrically connected (at least at radio frequency) to the cylinder.

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One embodiment of the present invention will now be described, by way of example, with reference to a crystal contact device of the kind specified which is of the double-ended form. The embodiment of the present invention will be described with reference to the accompanying drawings wherein Figure 1 is a sectional elevation of a double ended crystal contact device and Figure 2 is an enlarged sectional elevation of the inner portion of a slightly modified arrangement of the device.

Referring now to Figure 1, the device is housed in a hollow circular metal cylinder 1 in which are secured co-axial with the cylinder two discs 2 of insulating material, such as a ceramic material, which serve to support the crystal element 3 and the co-operating metallic member 4 respectively. At metal collar 5 whose external diameter is slightly less than that of the internal diameter of the cylinder so that the collar is an easy fit therein, is fixed between the two discs with each of the annular end faces of the collar in contact with a face of one of the discs. The diameter of the discs is slightly less than that of the collar, and each disc is provided with a central inner conductor comprising a metallic stud 6 passing through a central hole 7 in the disc, the portion of each stud lying within the space between the discs being suitably shaped to support the crystal element 3 and the co-operating metallic member 4 respectively. The portion of each stud 6 projecting from the outer surface of the corresponding disc is shaped to co-operate with the inner conductors of co-axial lines to which the device is to be connected, and the dimensions of this portion of the stud are chosen relative to the internal diameter of the cylinder, so that this portion of the device has a characteristic impedance substantially matched to that of the co-axial lines. In a similar manner the diameter of the portion of the studs passing through the hole 7 in the discs is also chosen relative to the internal diameter of the cylinder and having regard to the dielectric constant of the material of which the discs 2 is formed, so that the characteristic impedance of this portion of the device is, as far as practically possible and necessary, substantially matched to the adjacent portions of the device. The characteristic impedance of the portion of the device between the two discs will be determined primarily by the diameter of the metallic member co-operating with the crystal and the internal diameter of the collar, so that the internal diameter of the collar is also arranged as far as possible to give the required characteristic impedance to this portion of the device.

In assembling the device the crystal element 3 and the metallic member 4 are each secured to the studs 6 on the appropriate discs 2, and each disc is then placed over one end of the collar 5 and secured to the collar by a suitable synthetic resin plastic. The interior of the collar in which the crystal element and the metallic member are now situated is arranged to be hermetically sealed by the plastic by which the discs are secured to the collar. The length of the collar 5 is chosen so that with the crystal element 3 and the metallic member 4 cooperating therewith of predetermined dimensions and fixed in a predetermined position relative to their supporting discs 2, bringing the two discs into contact with opposite ends of the collar is just sufficient to bring the contact point of the metallic member 4 into contact with the surface of the crystal element 3 at a suitable contact pressure, the metallic member having sufficient resilience to take up manufacturing tolerances in the various dimensions concerned. The outer surface of the collar is next tinned with solder, and the assembly of the collar and disc is inserted into the cylinder until it is in a central position along the length of the cylinder. This may conveniently be arranged by placing the cylinder in an upright position on a flat surface, inserting an annular ring in the cylinder, which annular ring will come to rest on the flat surface, and inserting the assembly into the cylinder until it comes to rest on the annular ring. By making the annular ring of the correct length, the assembly is easily positioned in a predetermined position. The cylinder is then heated sufficiently to melt the solder on the collar, so that on cooling the collar is secured in the required position. The reason for making the discs of slightly smaller diameter than the collar is to ensure that the discs do not bind on the side of the cylinder when inserting the assembly in the cylinder.

It will be understood that in the absence of the collar, due to the fact that the metallic member cooperating with the crystal element is normally of small diameter wire, the characteristic impedance of the portion of the device between the two discs would be undesirably high and would be a substantial mismatch with the adjoining portions. It will be appreciated therefore that the collar serves the dual function of maintaining the discs at a predetermined distance apart and of reducing to a more desirable value the characteristic impedance of that portion of the device bounded by the collar, that is the portion between the two discs.

Figure 2 illustrates a slightly modified arrangement of the device which without departing from the scope of the present invention presents an alternative method of obtaining a good point contact between the crystal element and the co-operating metal member. In this case the metallic stud 6 associated with the metallic member 4 is concentrically bored throughout its length, the bore 9 being tinned and of a diameter sufficient to accommodate a metal rod 10 upon which the co-operating metal member is mounted to be passed therethrough and which after adjustment is secured in position by heating the device sufficiently to allow the tinning to melt; any excessive projection of the metal rod 10 being severed after soldering.

Although the invention has been described with reference to a double-ended form of crystal contact device, it is to be understood that it is equally applicable to a single-ended crystal contact device of the kind specified. Thus the arrangement described above might be modified by making one of the discs of electrically conducting material so that the member supported thereby is electrically connected to the metal cylinder, the projection of the stud from the outer side of this disc no longer being necessary in this case as the co-axial line is connected only to the other end of the cylinder. Moreover, although the collar has been described as a separate member from the cylinder, the collar may in fact be provided integral with the cylinder by forming the cylinder with an intermediate portion of reduced internal diameter. The separate collar is preferred as the integral collar is more difficult to produce to the required degree of accuracy. Moreover, the collar may be of insulating material, provided that the inner surface at least is provided with a metallic coating which is effectively electrically connected to the cylinder, at any rate at the radio frequencies concerned, so that the collar can still serve to reduce to a more desirable value the characteristic impedance of that portion of the device bounded by the collar.

We claim:

1. A crystal contact device for use at a radio frequency, said device comprising a hollow metal cylinder, a collar whose inner surface is metallic, said collar being disposed wholly within the metal cylinder, the outer surface of said collar being in contact with the juxtaposed portion of the inner surface of the cylinder over the entire length of the collar, said inner surface of the collar being effectively electrically connected to the cylinder at said radio frequency, a crystalline element and associated supporting member, and a cooperating metal member and associated supporting member, said supporting members being of disc form and situated one against each end of the collar, said crystalline element, said cooperating metal member and said associated supporting members being disposed wholly within the metal cylinder, and said crystalline element and said cooperating metal member being disposed wholly within the collar.

2. A crystal contact device in accordance with claim 1 wherein the collar is metallic.

3. A crystal contact device in accordance with claim 1 wherein the collar is metallic and formed integrally with the hollow metal cylinder.

4. A crystal contact device in accordance with claim 3 wherein the supporting members are of insulating material.

5. A crystal contact device in accordance with claim 4 wherein the crystalline element and the cooperating metal member are coaxially situated within the hollow metal cylinder.

6. A crystal contact device in accordance with claim 1 wherein the collar is metallic and the supporting members are of insulating material.

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