

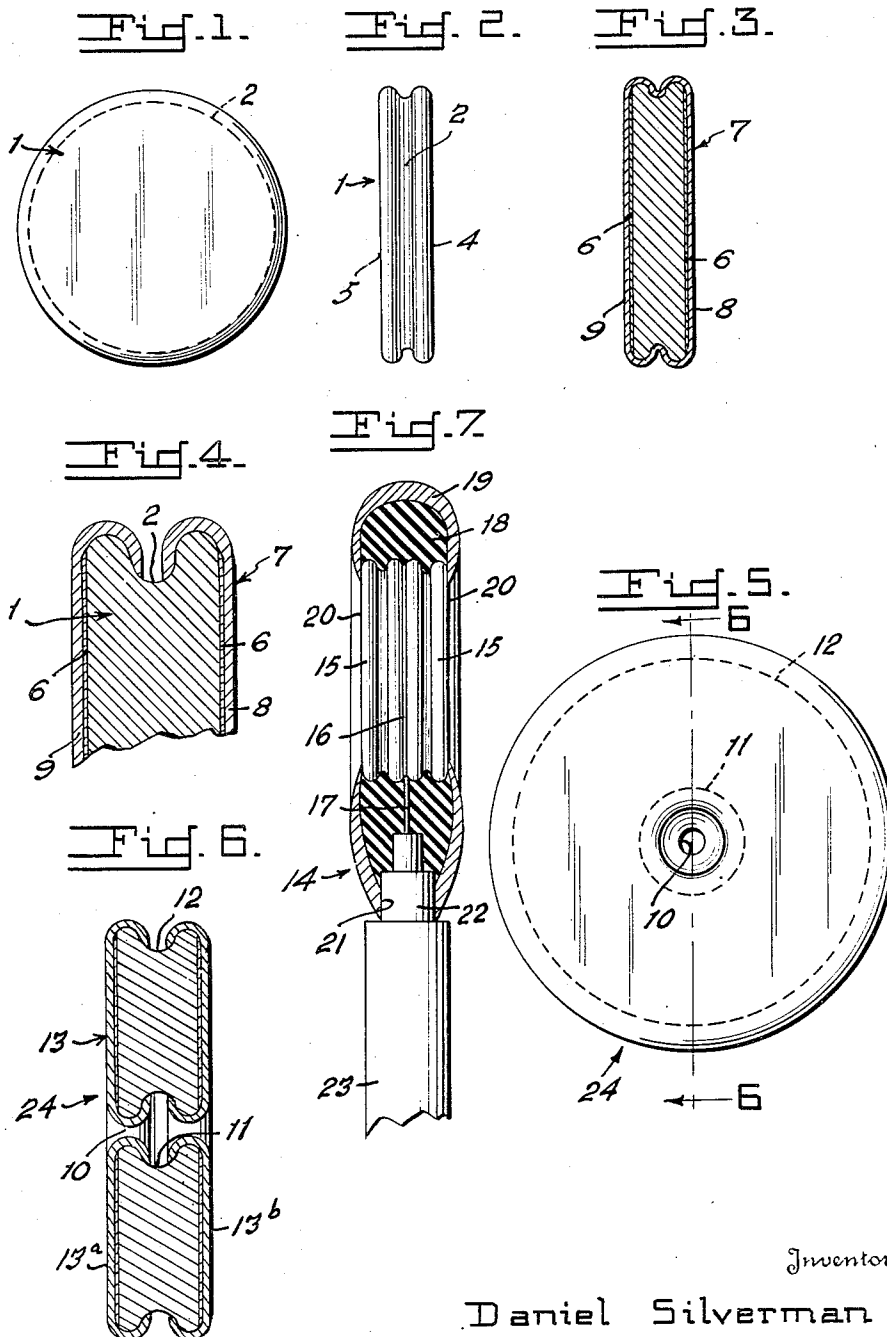
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TOURMALINE CRYSTAL ELEMENTS FOR PRESSURE GAUGES

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TOURMALINE CRYSTAL ELEMENTS FOR
PRESSURE GAUGES

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This invention relates to improvements in and methods of constructing tourmaline crystal pressure gages and crystal elements for said gages.

An object of this invention is to provide the electrode surfaces of a tourmaline crystal for pressure gages with electrodes positively bonded to said surfaces.

Another object of this invention is a method for producing a tourmaline crystal element with electrodes bonded to the electrode surfaces of the crystal regardless of the diameters of the crystal disks.

Another object of the invention is to produce a tourmaline crystal pressure gage employing crystals having metallic electrodes bonded to the crystals.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from the following description and accompanying drawings in which:

Figure 1 shows, drawn to an enlarged scale, a tourmaline crystal disk, peripherally grooved.

Figure 2 is an edgewise view of the disk.

Figure 3 is a cross sectional view taken along the transverse axis of a tourmaline crystal disk with a metallic coating applied to all surfaces.

Figure 4 is an enlarged fragmentary cross sectional view showing the metallic coating removed entirely from the root of the groove.

Figure 5 shows a tourmaline crystal disk of relatively large diameter and centrally pierced.

Figure 6 is a view taken along line 6-6 of Figure 5, showing electrodes bonded to the pierced tourmaline disk of relatively large diameter.

Figure 7 illustrates a tourmaline crystal pressure gage of the invention.

The tourmaline element of this invention consists of a disk 1 of tourmaline cut perpendicular to the longitudinal axis of the crystal having its peripheral surface centrally grooved as at 2. The groove 2 is made by mounting the tourmaline disk 1 on a spindle, not shown, and grinding the peripheral surface to form the groove 2 by means of a brass or copper disk grit wheel. The grooved disk is then cleaned and its electrode surfaces 4 and 5 silver plated as indicated by reference character 6. The silvered disk is then completely copper coated as generally indicated by reference numeral 7 in Figure 3. The final operation of the process of construction involves removing a sufficient amount of copper from the groove, particularly removing all of the copper at the root of the groove to insulate electrodes 8 and 9 from each other. This may be con-

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veniently accomplished by means of a cord saturated in a grit mixture or by a grit wheel.

The process of completely copper plating all the surfaces of the disk and removing the copper plating at the root of the groove provides a positive bond between the copper electrodes and the disk edges. While this process is most effective for small diameter crystals, it is also applicable and has been used for tourmaline disks up to approximately $\frac{3}{4}$ " diameter. For large size tourmaline slabs the stiffness of the copper electrode is not sufficient to maintain positive contact between the electrode and the surfaces of the disk. This may be overcome to some extent by a thicker coating of copper, but an adverse effect will be introduced due to the increased mass and inertia of the thicker coating. To obtain the desired bond for large diameter tourmaline crystal disk, as indicated by reference numeral 24, and avoid the adverse effects of mass and inertia experienced when thick copper coating is employed, the slab is first, as indicated at 10, pierced centrally and the circumferential surface of the hole is provided with a groove 11. The peripheral surface of the disk is also provided with a groove 12 and the entire disk is treated in the same manner as the smaller diameter disk. The copper coating 13 is removed from the roots of both grooves to insulate the electrodes 13a and 13b from each other.

While the process has been described in terms of tourmaline crystal disks and copper coating of said disks, any type piezoelectric crystal that is not injured by contact with water, such as quartz, may be used. Also, any metallic coating may be used in place of copper. Once disks are provided with electrodes by the process described, any number of disks can be assembled into a pile by tinning corresponding electrode surfaces and sweating them together, as shown in Fig. 7.

Another embodiment of the invention is shown in Figure 7 wherein the tourmaline crystal gage 14 is provided with an even number of crystal elements 15 made in accordance with the process outlined above. It being understood that any even number of elements may be used. The elements 15 are bonded to each other as at 16 by tinning and a lead 17 is carried from the bonded surfaces through a ring of insulation 18 surrounding the periphery of the disks 15. A metallic ring 19 being semicircular in cross section embraces the insulation and its edges are bonded to the copper electrodes of the disks as at 20 thus providing a complete shield, as can be seen

from examination of Figure 7. The metallic ring is perforated as at 21 to admit the lead 17 and the grounded shield tube 22 which is bonded to the metallic ring. The shield tube 22 is covered by rubber insulation 23 externally of the metallic ring 19. This type of tourmaline crystal pressure gage construction offers considerable advantage because of its ruggedness and because of the complete shielding provided by the grounded metallic covering formed by the metallic electrodes, ring and shield tube.

I claim:

1. An element for crystal pressure gages comprising a crystal disk having silver plated electrode surfaces, said disk being further plated with a metallic substance to form a positive bond between the edges of said disk and said silver plating, said further metallic plating having an electric discontinuity between said surfaces and constituting electrodes of said element.

2. An element for crystal pressure gages comprising a crystal disk having silver plated electrode surfaces, the periphery of said disk being grooved intermediate its electrode surfaces, said disk having a copper plating except at the bottom of said groove to form a positive bond between the edges of the crystal and plating, said plating forming electrodes of said element and said bottom providing insulation between said electrodes.

3. An element for crystal pressure gages comprising a crystal disk of relatively large diameter having silver plated electrode surfaces, said disk being peripherally grooved intermediate its electrode surfaces, and centrally bored, the wall formed by said bore being grooved intermediate the electrode surfaces, all surfaces of said disk being completely copper plated to form electrodes having a positive bond with the edges of said disk, said plating being removed from the bottom of said grooves to insulate said electrodes.

4. In a tourmaline crystal pressure gage, an

even number of crystal disk elements in axial alignment, each of said disks having silver plated electrode surfaces, peripheral grooves and all surfaces copper plated except at the bottom of said grooves forming electrodes positively bonded to the edges of said disks, the adjacent electrode surface of each element sweated together and forming a unit, the peripheral surface of said unit encased in a ring of insulation, said ring being completely surrounded by a copper ring being U-shaped in cross section, said copper ring having its edges bonded to outer electrode surfaces of said unit and perforated to receive a shield tube forming one lead from the unit and housing a lead from the adjacent sweated electrode surfaces.

5. The method of constructing crystal disk elements for pressure gages which comprises the steps of grinding a groove in the circumferential surface of the crystal disk, silver plating the flat surfaces of the disk, copper plating all surfaces of the silvered disk, and removing the copper from the bottom of said groove.

6. The method of constructing crystal disk elements for pressure gages wherein the crystal disk is of large diameter comprising the steps of centrally piercing the crystal disk, grinding a groove in the circumferential surface of said disk and the wall of the aperture formed by said piercing step, silver plating the flat surfaces of said disk, copper plating all surfaces of the silvered disk, and removing the copper from the bottom of said grooves.

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