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PIEZOELECTRIC CRYSTAL

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Fig. 1

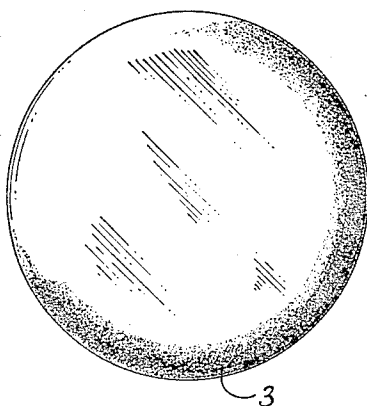
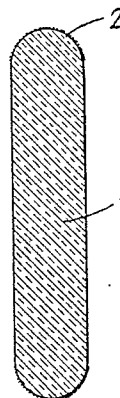


Fig. 2



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PIEZOELECTRIC CRYSTAL

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5 Claims. (Cl. 171—327)

The invention is related to the construction of a piezoelectric crystal for which severe demands are made respecting a sharp wave-length value (mono-wave property), as is true, for instance, of filter circuits. Fundamentally speaking, it is known that the single-wave property of rectangular or quadrangular crystals may be improved by removing the corners of the plates in such a way that parts of the original contour edges are left. However, it has been found that such beveling or chamfering of the corners does not yet result in single-wave property to the degree as required where these crystals are used in filter circuits. In the operation of filters, even the most minute natural resonance at a point of the frequency band differing from or outside the main resonance makes itself very annoyingly felt, for the reason that the filter will then transmit or exclude certain frequencies for which it should really be blocking or transmitting. Even where circular crystals are concerned, that is, crystals which no longer have real corners or angles, it is impossible to guarantee that the filter will handle only the prescribed one frequency or wave. Now, the present invention is predicated upon the idea that not merely the corners of the contour of the crystal are beveled or chamfered, but that this is done also with the edges between the surfaces or faces of the crystal and the narrow sides. In fact, by proper grinding, resonator or oscillator crystals may thus be made in which, even with most sensitive means no additional resonance points are ascertained away from and outside the chief resonance point, that is, at a more or less great distance therefrom.

Fig. 1 shows an elevation of a crystal plate designed according to the invention viewed from above; and

Fig. 2 shows the crystal of Fig. 1 in section.

The sectional view shows that all edges are rounded so that at vibrating points of the crystal there are no longer any sharp corners. Maximum precision and reproducibility of conditions are securable with circular crystals, for in these, the grinding of the rims could be effected, for instance, in a grinding lathe, with the result that the rounded-over portion 2 throughout the circumference will turn out absolutely uniform, indeed, precision can be made of any desired high value. For filter work, for this reason, circular crystals with faceted edges have proven particularly advantageous. The facet may be either a straight grind or else, as shown in Fig. 1, it may be rounded. In either

case, faceting means not only a substantial improvement of the vibratory properties, but also simplification in the holder means because there is a chance to clamp the crystal at its outermost rim without damping of the vibrations being caused incidentally. The crystal element may be either a thickness mode crystal or a contour mode crystal, i. e. one cut to correspond to a frequency which is a function of a dimension other than thickness. However, although contour mode crystals are generally used for low frequency filter crystals, the invention need not necessarily be limited to either type.

If for some reason stray resonance points should turn up in addition to the main resonance point, and this is liable to happen whenever crystals are manufactured in large numbers in one working stage, perfect uni-wave property is obtainable by damping the faceted marginal regions. This most simply and effectively is obtainable by coating or painting the marginal zones with an elastic rubbery substance 3 which will respond to the vibrations of the crystal without being destroyed. It will be understood that this substance should not exhibit fatigue or ageing effects lest the vibratoriness of the crystal might be slowly altered. In the operation of a crystal coated with rubbery substance, as mentioned above, if one assumes that the amplitude of the desired frequency is, for example, ten units, and that the amplitude of any spurious frequency is three units, assume further that if the spurious frequency is to be rendered undisturbing it must be reduced to two units or less. Now, if the crystal is damped by the rubbery elastic substance so that it will vibrate less vigorously, the amplitude of its desired frequency may be reduced one or two units, that is, to nine or ten units, but at the same time the amplitude of the spurious frequency will be reduced to the undisturbing value of two or one unit, respectively. The fact that the amplitude of the desired response may be somewhat reduced is of but little moment if the spurious frequency is thereby reduced so that its effect is no longer present.

What is claimed is:

1. A piezoelectric crystal for use in a filter circuit having but a single resonant frequency comprising a crystal having all of its edges between the faces of the crystal rounded over, and a coating of elastic substance located on said rounded over edges to exclude undesired frequency in said filter circuit.

2. A piezoelectric crystal for use in a filter

circuit having but a single resonant frequency comprising a circular crystal having all of its edges ground sphero-convex in form between the faces of the crystal, and a coating of elastic substance located on said sphero-convex edges to exclude undesired frequencies in said filter circuit.

3. A piezoelectric crystal for use in a filter circuit having but a single resonant frequency comprising a crystal having all of its edges between the faces of the crystal rounded over to exclude undesired frequencies in said filter circuit, and a coating of rubbery substance on said rounded edges to damp out any spurious frequencies other than the desired resonant frequency.

4. The method of making a piezoelectric crystal having but a single resonant frequency in-

cluding the steps of grinding the crystal to a predetermined size for the desired frequency, grinding a rounded-over edge on all the edges of said crystal, and painting the marginal zones of said crystal with an elastic rubbery substance.

5. A piezoelectric crystal for use in a filter circuit having but a single resonant frequency response comprising a crystal having all of its edges between the faces of the crystal rounded over to exclude undesired frequencies in said filter circuit, and a coating of rubbery elastic substance located on all the edges of said crystal for damping out the spurious frequencies so that only the single resonant frequency response then predominates.

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