

**Reference 5 English translation**

**Patent No.95637 (Classification No. 207-9 Electric engineering)**

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Specification

The title of the invention:

Piezoelectric oscillator plate

The purpose and essential point of the invention:

The purpose of this invention is to provide a piezoelectric oscillator plate which is easy to use and its oscillation power is strong. This piezoelectric oscillator plate is made by cutting a quartz crystal in parallel or nearly in parallel to the face of rhombohedron.

The detailed description of the invention

In the case of the conventional piezoelectric oscillator plate, when the electrodes are placed in parallel to the electric face <sup>\*1</sup>, the static piezoelectric effect is most strongly appears. However, when the plate is electrically excited by utilizing the piezoelectric effect in order to generate the oscillation with the natural oscillation frequency of the plate, there is a weak point that the oscillation power is very weak.

The reason why the oscillation power is weak comes from the fact described below. The direction of the largest elastic movement when the plate is excited to generate the oscillation with the natural frequency of the plate is much different from the direction of the largest static displacement. Studies on the vibration modes of a quartz crystal makes it clear that the displacement is strongest in the vertical direction to the rhombohedron face of a quartz crystal (Miller-Indices 100 \*2) in despite to the arrangement of the electrodes. The results of the experiment of oscillation using the quartz crystal plate which has the surfaces parallel or nearly parallel to the rhombohedron face shows that the oscillation is very active and the oscillation current is several times higher than those of oscillation using the conventional quartz crystal plate. The rhombohedron face of quartz crystal grows most perfectly and has the most brilliant luster. The molecules which organize the crystal align most densely along the rhombohedron face. Therefore it is thought that the both of the share vibration along the rhombohedron face or the vertical vibration to the rhombohedron face are most natural behavior of the quartz crystal plate. When the quartz crystal plate made by this patent is equipped in the electric oscillation circuit, the oscillation activity is scarcely affected even if the electrodes are treated roughly, the distance between the surface of the plate and the electrode is changed or the plate itself is clamped. Also this plate oscillates actively even if the surface of the plate is dried only with a soft towel after polished with carborundum. It is thought that these easy handling characteristics come from the surface of the quartz crystal plate having the dense molecules alignment. In the case of the conventional quartz crystal plate, it is required to handle the plate very carefully when the plate is installed between the electrodes and also the careful handling of the plate is required every time.

#### The scope of claims

In order to realize the goal described in the specification above, it is claimed that the piezoelectric oscillation plate having the surfaces parallel or nearly parallel to the rhombohedron face of the quartz crystal is most appropriate.

Foot note (The translator adds the following explanation)

\*1: The electric face is parallel to the Y-axis of the quartz crystal.

\*2: Miller-Bravais Indices for rhombohedron is (10-11).

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