

June 19, 1934.

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MECHANICAL VIBRATING ELEMENT

1,963,719

Filed March 18, 1931

FIG. 1

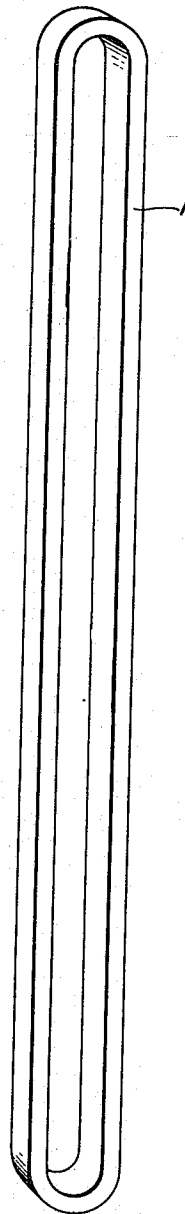


FIG. 2

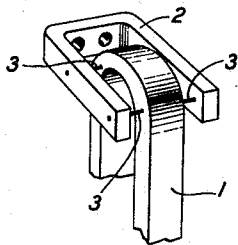
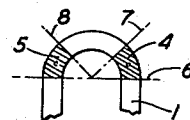


FIG. 3



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1,963,719

MECHANICAL VIBRATING ELEMENT

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Application March 18, 1931, Serial No. 523,459

5 Claims. (Cl. 84-402)

This invention relates to constant frequency systems, in which the frequency is controlled by means of a mechanical vibrating element.

In the production of electrical waves of constant frequency the most satisfactory system has been found to be one which uses the vibrations of a mechanical element to control the electrical wave, a portion of the energy in the electrical system being fed back to the mechanical element to cause it to continue vibrating at its resonant frequency. In such systems a tuning fork, or V-shaped bar, has been largely used. Such a system has energy losses due to the longitudinal motion of the fork as a whole, and also due to the discontinuity of medium at its ends. It is an unbalanced vibrating system. A tuning fork cannot be supported without damping, as it has no true nodes.

The object of this invention is to provide a mechanical vibrating element which will be free from the above objectionable characteristics.

A mechanical vibrating element built in the shape of a circular ring has perfect symmetry so that there are no losses due to discontinuity of medium, but it cannot serve as a mechanical vibrator because it has no true nodes; that is, the nodes with respect to radial motion are antinodes with respect to peripheral motion.

My invention consists in a relatively narrow oval ring, which overcomes both of the above objections. Such an oval ring is symmetrical and, therefore, balanced. There are no energy losses due to movement of the ring as a whole, as in the case of a tuning fork or V-shaped bar. There is no discontinuity of medium at the end, and hence no reflection losses. There are true nodes near each end so that it can be supported without damping.

In the drawing, Fig. 1 is an elevation of a mechanical vibrating element of rectangular cross-section, in the shape of a narrow oval ring.

Fig. 2 is an elevation of a mounting for such a tuning fork, and

Fig. 3 is a sketch showing how the nodes may be found.

It is desirable for the element to be of rectangular cross-section because of the mechanical simplicity of such a design, and the resulting assurance that the manufactured article will have perfect balance.

For the same reasons the curved portions at the ends of the oval ring are shaped to be semi-circular. This is an important feature, as these portions are particularly difficult to make with perfect symmetry, and any lack of symmetry in-

roduces energy losses, changes the frequency, and tends to cause variations in the frequency with use.

A mechanical vibrating element of the type illustrated by Fig. 1 has been operated as in accordance with the present disclosure and found to have the attributes there described. Such mechanical element had the following dimensions: Length $24\frac{1}{2}$ inches; outside width $1\frac{3}{8}$ inches; width of the prongs, that is, the dimension in the direction of the width of the element as a whole, $\frac{1}{8}$ inch; and depth of the prongs $\frac{5}{8}$ inch.

As shown in Fig. 2 a rigid supporting member 2 has securely fastened thereto four pins 3 which engage the vibrating element 1 at the two nodal points at one end of the fork. The fork is preferably mounted horizontally, with a similar supporting member at the other end, although obviously there are several alternatives, the essential condition being a nodal point mounting.

In Fig. 3 there is illustrated a method of determining the nodal points. If a line 6 is drawn across the vibrating element, perpendicular to the straight portion, through the points joining the straight portion with the semi-circular curved portion, and lines 7, 8 are drawn as shown, making 45° angles with line 6, the nodes will lie within the shaded portions 4, 5 thus determined. The nodes will usually be closer to the lines 7, 8 than to line 6. The exact location of the nodes may be found by experiment, since clamping at such nodal points will give the smallest decrement to the fork.

Very small depressions may usually be provided at the nodal points without harmful effect on the characteristics of the fork. This will permit the mounting to be more rigid, and will also permit the fork to be mounted more quickly and easily a second time if it is necessary to remove it from its original mounting.

An illustration of how a vibrating element may be controlled to produce electric waves of constant frequency may be found in United States Patent 1,560,056, issued November 3, 1925, to J. W. Horton, in which a tuning fork is set into vibration, and an electromotive force is induced in a coil adjacent thereto. The electromotive force is impressed on a vacuum tube amplifier, and a part of the output current is used to drive the fork by means of a second coil.

The vibrating element may also be used as a selective filter in a manner similar to that shown in United States Patent 1,708,945, issued April 16, 1929, to J. W. Horton, in which a wave is im-

pressed on a fork by means of a coil, and the filtered wave is taken off by means of a second coil. The vibrating element suppresses all frequencies other than the resonant frequency of the fork.

What is claimed is:

1. A resonantly vibratory mechanical element in the shape of a relatively narrow oval ring.
2. An elastically vibratory mechanical element shaped like an elongated closed loop which is symmetrical about a system of three mutually right-angularly related axes.
3. An elastically vibratory mechanical element

of rectangular cross-section, in the shape of a relatively narrow oval ring.

4. A resonantly vibratory mechanical element in the shape of a relatively narrow oval ring, comprising parallel side bars joined at the ends by semi-circular portions.

5. In combination, a resonantly vibratory mechanical element in the shape of a relatively narrow oval ring, whereby it tends to have nodes and anti-nodes of vibration, and a means for supporting said element at one or more of its nodes of vibration.

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