Aug. 1, 1961 T. B. GIBBS 2,994,241

TUNING FORK

Filed Oct. 23, 1958

Fig. 1.

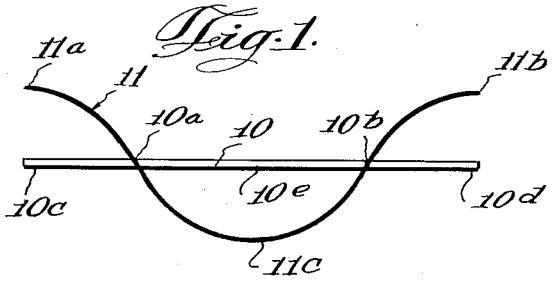


Fig. 2.

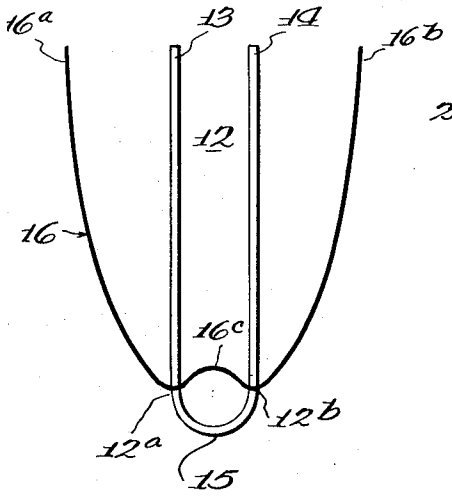


Fig. 4.

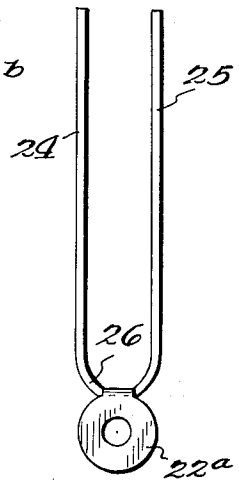


Fig. 5.

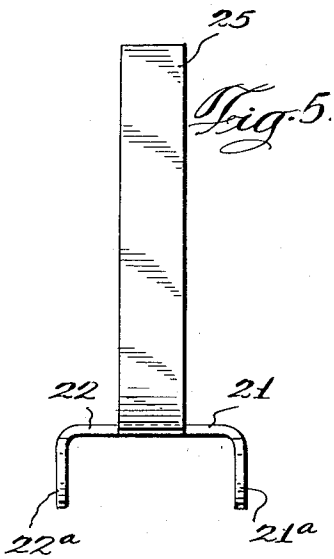
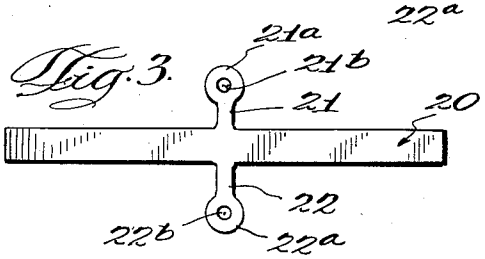


Fig. 3.



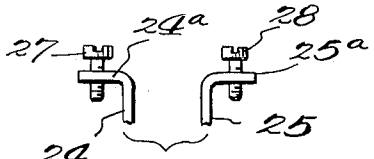


Fig. 6.

Inventor

Thomas B. Gibbs

By Schroeder, Hofgren, Brady & Wegner

attorneys

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TUNING FORK

Thomas B. Gibbs, Lake Delavan, Wis., assignor to Gibbs Manufacturing & Research Corporation, a corporation of Wisconsin

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2 Claims. (Cl. 84—409)

This invention relates to a vibratory device or tuning fork and particularly to a tuning fork for low power, electrically driven use.

The usual tuning fork, used for musical and certain control purposes, is generally U-shaped in configuration and has two legs of relatively heavy bar-like stock. The base of the U is a heavy enlarged portion from which a supporting member extends. The thickened base portion of the U has the effect of damping the vibrations of the legs or tines of the fork, and increasing the power required to keep the fork vibrating. This renders the usual tuning fork unsuitable for electrically driven use where the electrical power rating is an important factor. The relatively great thickness of the tines or legs of the fork require that the legs be quite long in order to achieve low frequency vibrations. This is undesirable where mounting space for the fork is a consideration.

A principal object of the present invention is the provision of a novel tuning fork of thin sheet stock having extremely low losses and a relatively small size at low frequencies.

One feature of the invention is the provision of a vibratory device comprising an elongated body of resilient sheet material formed into a generally U-shaped configuration. Another feature is that the device is of substantially uniform thickness and has a width which is several times its thickness.

A further feature is the provision of means for mounting the body of sheet material, as an ear extending outwardly from the base of the U.

Still another feature is the provision of means for tuning the device as a tuning member carried at the end of the leg of the U and movable longitudinally thereof.

And a further feature is the method of making a vibratory device, comprising cutting an elongated element of sheet material and forming the element into a generally U-shaped configuration.

Further features and advantages of the invention will readily be apparent from the following specification, and from the drawings, in which:

FIGURE 1 is a diagrammatic illustration of a thin sheet element and its principal mode of vibration;

FIGURE 2 is a diagrammatic illustration of a thin sheet element similar to FIGURE 1, formed into a U-shaped configuration and indicating its principal mode of vibration;

FIGURE 3 is a plan view of a blank from which a tuning fork embodying the invention is formed;

FIGURE 4 is an elevational view of a tuning fork embodying the invention;

FIGURE 5 is an elevational view taken at right angles to FIGURE 4; and

FIGURE 6 is a fragmentary detail view illustrating means for adjusting the frequency of the fork.

An unconstrained or free body **10** of elastic or resilient material has a principal mode of vibration as illustrated by curve **11** in FIGURE 1 of the drawings. The vibrating element **10** may be a strip of a suitable thin material, as a steel alloy. The principal mode of vibration has nodal points **10***a* and **10***b*, spaced one quarter of the length of the element from the ends, and points of maximum amplitude, indicated at **11***a*, **11***b* and **11***c*, occuring at the ends **10***c* and **10***d* and at the midpoint **10***e* of the element. Although there are often minor vibrations in other modes

and at harmonic frequencies, it is the principal mode or fundamental frequency of vibration with which the present discussion is concerned.

When the thin flat vibratory element of FIGURE 1 is formed into a U-shaped configuration, as in the customary tuning fork, the principal mode of vibration is modified as illustrated in FIGURE 2. In this figure, the vibratory member **12** has elongated parallel legs **13** and **14** joined by a curved, and generally semi-circular, base portion **15**. The vibrational nodes **12***a* and **12***b* are moved toward the relatively rigid base portion **15**, with the entire legs **13** and **14** vibrating as a single segment. The free ends of the legs **13** and **14** have a maximum amplitude of vibration **16***a* and **16***b*, while the center of base portion **15** also vibrates, but to a much lesser extent, as indicated at **16***c*.

With the normal tuning fork where the base portion joining the legs from the fork is solid, the vibrations of the base portion are practically eliminated, and the legs of the tuning fork act as single bars fixed at one end. The restriction of the vibration in the central or base portion of the fork has a damping effect on the vibration of the legs, requiring substantial power to keep the fork vibrating. In the fork of FIGURE 2, the central portion of the body is not constrained or unduly rigidified and the vibration of the device is more analogous to the vibration of a flat bar as illustrated in FIGURE 1. The eliminations of rigidity in the base portion of the U reduces the power requirements for driving the fork.

In accordance with the invention, a vibratory device or tuning fork may be formed from a steel alloy having the proper elastic characteristics for the particular frequency and operating conditions of the fork. The main body **20** of the blank (FIGURE 3) is generally rectangular in configuration with the length related to the frequency of operation and a width which may be determined by desired physical characteristics, including necessary strength of the fork. (The width has relatively little effect on the frequency.)

Extending outwardly from the center portion of the blank **20** are a pair of integral mounting portions or ears **21** and **22**, with ends **21***a* and **22***a* which are enlarged and provided with openings **21***b* and **22***b* to receive a screw, bolt or other mounting device. The mounting portions **21** and **22** are made as narrow as possible depending upon the strength required for mounting the fork, to reduce objectionable effects on the vibration of the base portion, as will appear.

The blank **20** is formed into a U-shaped configuration as illustrated in FIGURE 4, with leg portions **24** and **25** extending generally parallel with each other throughout substantially their entire length. The central portion **26** of the blank forms an integral base for the U-shaped fork, having a generally semi-circular configuration. The mounting ears **21** and **22** are centrally located with respect to the mid or base portion **26** of the fork and are preferably left extending straight out from the edges of the base portion. This, together with the reduced width of the ear portions minimizes the damping effect of the supporting means on the central section **26** of the fork. The enlarged portions **21***a* and **22***a* at the ends of portions **21** and **22** may be formed downwardly as shown in FIGURES 4 and 5, generally at right angles to the portions **21** and **22**, or in any other suitable direction, to facilitate mounting of the fork.

As the blank **20**, from which the tuning fork is formed, is preferably stamped from a sheet or strip of stock material, and the normal production stamping operation does not have a very high degree of accuracy, provision is made for easily adjusting the frequency of the fork. In FIGURE 6, the end portions **24***a* and **25***a* of the legs **24** and **25** are formed outwardly from the major portion

of the legs, at generally a right angle. These end portions or tabs are drilled and tapped to receive two threaded adjusting screws 27 and 28 which have a significant mass relative to the mass of the legs 24 and 25 and may be adjusted in position longitudinally of the legs to control the resonant frequency of the fork.

The tuning fork described herein is suitable for general purpose tuning fork applications.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. A vibratory device, comprising: an elongated body of resilient sheet material of generally U-shaped configuration; and a mounting ear extending outwardly and laterally from the base of said U.

2. A vibratory device, comprising: an elongated body of resilient sheet material of substantially uniform thickness throughout its length and of U-shaped configuration in a plane generally at right angles to the plane of the sheet material; and a pair of mounting ears extending outwardly and laterally from said elongated body at the base of said U.

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