Jan. 14, 1930. L. J. WOLF 1,743,178

OSCILLATION GENERATOR

Filed Feb. 4, 1929

Fig. 1.

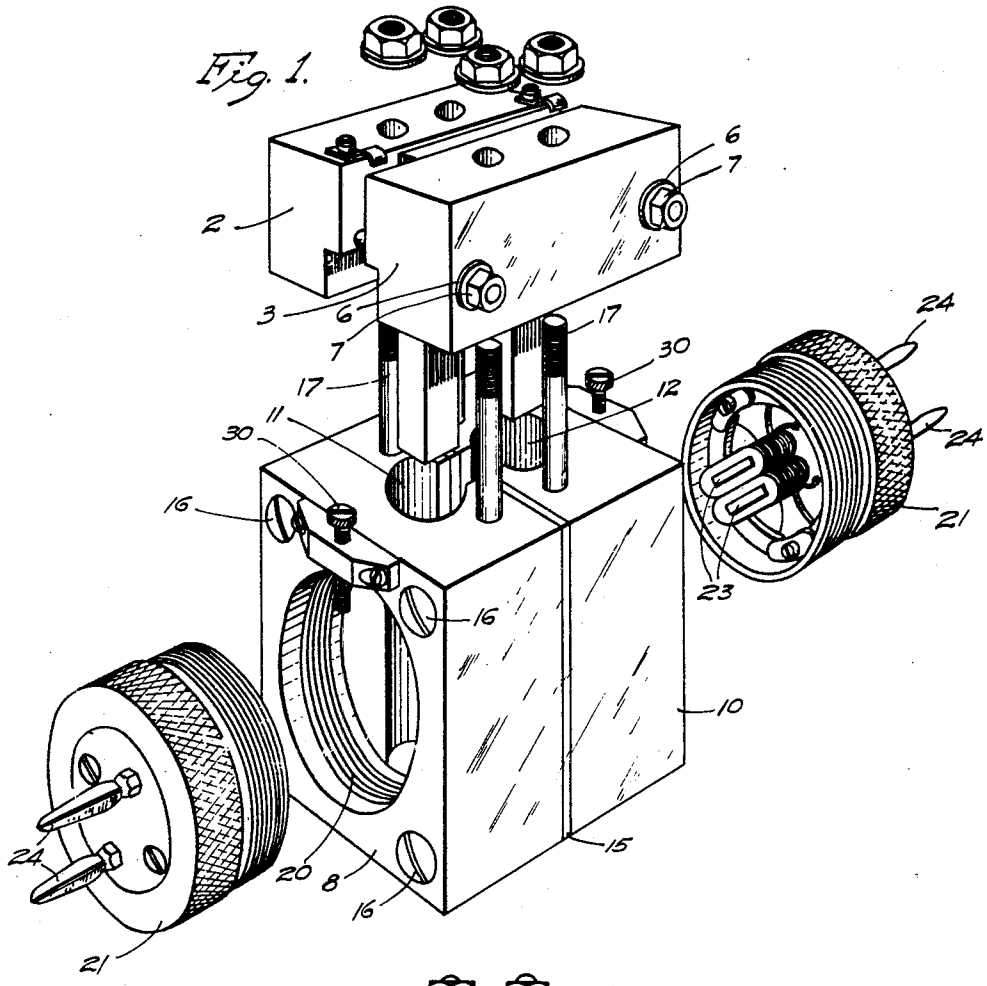
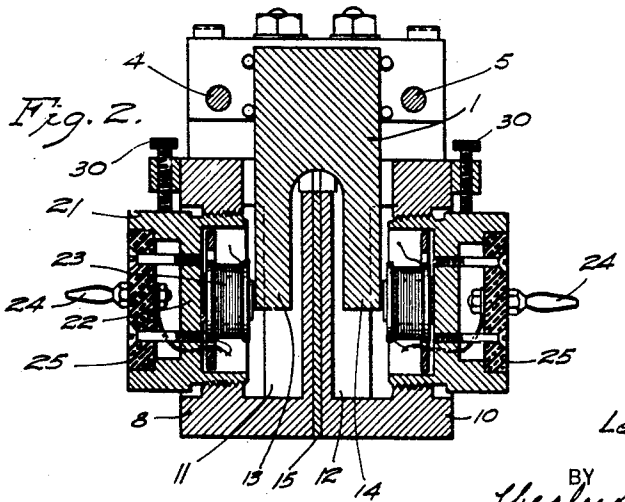


Fig. 2.



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UNITED STATES PATENT OFFICE

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OSCILLATION GENERATOR

Application filed February 4, 1929. Serial No. 337,476.

My invention relates to oscillation generators, and it has particular relation to vibratory frequency-controlling devices adapted for use in such generators to maintain constant the oscillation-frequency thereof.

The rapid increase in the number of radio transmitting stations operating in restricted areas renders it obligatory that the transmitting-frequencies of such stations shall be kept spaced apart at least ten kilocycles in order to obviate interference between them. It is also necessary that each station shall keep strictly to its assigned frequency and, for this purpose, the majority of transmitting stations now utilize oscillators controlled, as to frequency, by piezo-electric crystals.

Unfortunately, piezo-electric crystal sections are quite prone to break during use, especially if subjected to abnormal potentials and, for that reason, oscillation-controlling devices of more sturdy character are often desired. It has, accordingly, been suggested that a tuning fork, excited and kept in oscillation at its natural period by suitable means, might advantageously be substituted for the customary quartz crystal-section. The patent to Horton, No. 1,560,056, illustrates and describes several possible ways of utilizing a tuning fork in an oscillation-generator system, and it also discloses a particular mounting device for the tuning fork per se.

I have noted, however, that systems of the general type disclosed in the Horton patent do not always operate in an entirely satisfactory manner to deliver a constant frequency. Among the causes of irregular operation may be mentioned direct coupling between the driving and controlling coils associated with the fork, partial oscillations of the fork itself, oscillations of the supporting device and temperature variations.

It is, accordingly, an object of my invention to provide a tuning-fork holder wherein means are incorporated for preventing direct coupling between a plurality of driving and controlling coils associated with the fork.

Another object of my invention is to provide a tuning-fork holder that shall protect a fork supported thereby against temperature variations.

Another object of my invention is to provide a novel combination between a tuning fork, a support therefor, and adjustable driving and controlling coils for maintaining the fork in oscillation at its natural period.

Another object of my invention is to provide a novel combination of the type described that shall be capable of functioning as a filter for differentiating between electrical oscillations at the natural period of the fork and other oscillations at heterogeneous frequencies.

In practicing my invention, I suspend a tuning fork in the interior of a massive non-magnetic, metallic, housing provided with adjustable electro-magnetic means for applying driving impulses to the tines of the forks, and also for deriving electrical potentials proportional to the oscillations thereof.

The housing further comprises means for preventing magnetic interaction between the tines of the fork and for preventing magnetic and electrostatic interaction between the driving coils associated therewith. Such means is preferably constituted by a shield comprising a plurality of thicknesses of magnetic and non-magnetic material maintained in firm contact with each other and interposed between the tines of the fork and, consequently, between the aforesaid coils. The shield may or may not be an integral part of the fork-housing.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment, when read in connection with the accompanying drawing, in which:

Fig. 1 is an exploded perspective view of a preferred embodiment of my invention, and

Fig. 2 is a cross-sectional view of the device shown in Fig. 1, taken in a vertical plane intersecting the tines of the fork and the driving coils associated therewith.

The apparatus illustrated in the drawing comprises a steel tuning fork 1, the non-

vibratory end of which is tightly clamped between two massive blocks 2 and 3 of non-magnetic metal. A plurality of tie-rods 4 and 5 extend through aligned transverse openings in the clamping blocks, each tie rod preferably being provided with a lock-washer 6 and a nut 7.

The clamping blocks 2 and 3 rest upon the upper end of a fork-housing constituted by two blocks 8 and 10 of non-magnetic material, such as brass or the like, having vertically disposed channels 11 and 12 therein in which the tines 13 and 14 of the tuning fork depend. A sheet 15 of magnetic material is interposed between the blocks constituting the fork-housing and is held rigidly in position by a plurality of assembly bolts 16 that extend transversely through aligned openings in the said blocks.

Vibratory movement of the fork and the associated clamping blocks with respect to the fork-housing is prevented by four or more tie-bolts 17, the lower ends of which are imbedded in the housing, and the upper ends of which extend through vertical openings in the clamping blocks.

The side walls of the fork-housing that intersect a plane passing through both of the depending tines of the fork are each provided with a relatively large threaded opening 20 that communicates with one of the vertical channels in which a tine of the fork is disposed.

Each of the openings 20 is internally threaded to accommodate an externally threaded cylindrical member 21 provided with an interior partition 22 on which a driving magnet 23 is mounted. The terminals of the driving magnet are connected to a plurality of contact elements 24 that are mounted upon, and project rearwardly from, a circular insulating plate 25 fitted into the outer end of the cylindrical member 21.

The pitch of the threads cut upon the exterior of the cylindrical member 21 is preferably quite small in order that the space between the cores of the driving magnet and the tine of the fork associated therewith may be adjusted with nicety. The adjustment, when once made, is prevented from changing by a set-screw 30 that may be screwed down against the cylindrical member.

When a device such as I have described is utilized in any of the circuits illustrated in the Horton patent, previously referred to, or for any other purpose that necessitates the frequency of the fork being held to within .01 per cent of its natural period, it must be kept at a constant temperature. Preferably, the device is enclosed in a cabinet, or the like, provided with a heating device, a thermostat and means for causing a constant current of heated air to pass over and around the fork-housing. No specific form of cabinet is illustrated, since its construction should be fairly obvious to anyone skilled in the art.

Inasmuch as the massive blocks that enclose the fork have a high thermal-lag, the fork itself, after it has once assumed the temperature of the blocks, will be effectively protected against rapid changes in temperature of the surrounding air. This characteristic of my improved fork-holder is extremely important in that it obviates the necessity of adjusting the thermostat to operate within close limits.

The bimetallic shield, constituted by the walls of the channels into which the tines of the fork depend and the plate of magnetic material held between the fork-housing blocks, is also a very important part of my invention, since it effectually prevents any direct electromagnetic and electrostatic coupling between the driving magnet associated with one of the tines of the fork and the driving magnet, or generating coil, associated with the other tine. This feature of my invention, in addition to being of material value in oscillation generators, is particularly advantageous in television systems, and the like, wherein it is necessary to differentiate between an incoming control-frequency and a plurality of heterogeneous frequencies occasioned by static, by interfering signals, or by other disturbances. In such systems, the incoming control-frequency, together with other frequencies that have accompanied it through the amplifying apparatus, is applied to one of the driving coils associated with a fork tuned to the said frequency. The other driving coil is interposed in the input circuit of an amplifying device and serves to impress the control-frequency thereon just so long as the fork is maintained in the vibratory state by the incoming frequency. The fork, by reason of the fact that its oscillations persist for a short space of time, even in the absence of excitation, is able to both bridge over the periods when the reception of the control-frequency is interrupted and to prevent any interfering frequencies from being applied to the subsequent amplifier.

Many additional advantages of my invention, as well as modifications thereof, will be apparent to those skilled in the art to which it pertains. My invention, therefore, is not to be restricted to the specific embodiment chosen for purposes of illustration but is to be limited only by prior art and by the spirit of the appended claims.

I claim as my invention:

1. In combination, a tuning fork, a support therefor, and shielding means interposed between the tines of the fork.

2. In combination, a tuning fork, a support therefor, and metallic shielding means interposed between the tines of the fork.

3. In combination, a tuning fork, a support

therefor, and bimetallic shielding means interposed between the tines of the fork.

4. In combination, a tuning fork, a support therefor, and metallic shielding means interposed between the tines of the fork, a portion of said shielding means being integral with said support.

5. In combination, a tuning fork, a support therefor, and bimetallic shielding means interposed between the tines of the fork, a portion of said shielding means being integral with said support.

6. In combination, a tuning fork, a support therefor constituted by a plurality of massive blocks, means for clamping said blocks together, and shielding means interposed between said blocks.

7. A supporting device for a tuning fork comprising a plurality of massive blocks having openings therein for accommodating the tines of a fork and means for clamping said blocks together.

8. A supporting device for a tuning fork comprising means for clamping the fork and means for shielding the fork against temperature variations.

9. A supporting device for a tuning fork comprising means for clamping the fork, means for shielding the fork against temperature variations, means for subjecting the fork to magnetic influences and means for preventing magnetic interaction between the tines of the fork.

10. In combination, a tuning fork, means for subjecting the fork to magnetic influences, means for deriving electric potentials corresponding to fork-vibrations, and means for preventing interaction between said subjecting means and said deriving means.

In testimony whereof, I have hereunto subscribed my name this 25th day of January 1929.

LESTER J. WOLF.