July 1, 1952 R. J. M. C. LANGLOYS 2,601,801

TUNING FORK WITH SIMULTANEOUS MULTIPLE FREQUENCIES

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Fig. 1

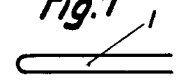


Fig. 6a

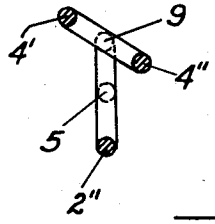


Fig. 2

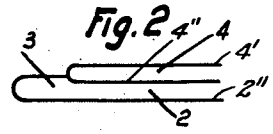


Fig. 3

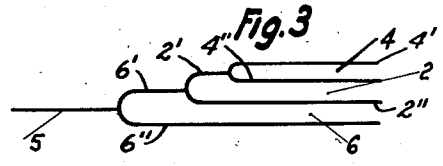


Fig. 4

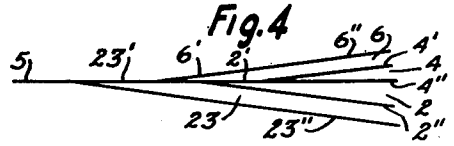


Fig. 5

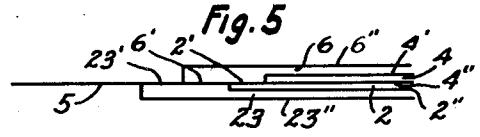


Fig. 9

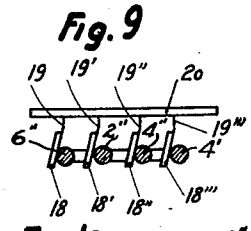


Fig. 6

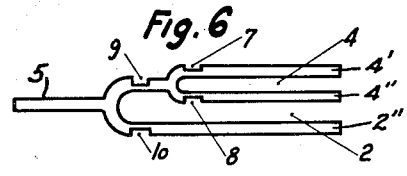


Fig. 10

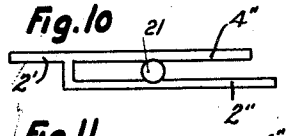


Fig. 7

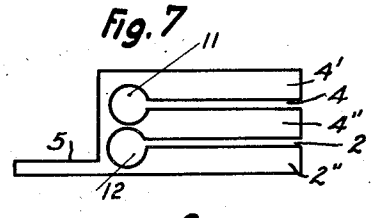


Fig. 11

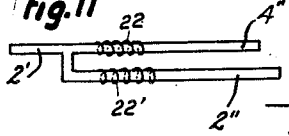
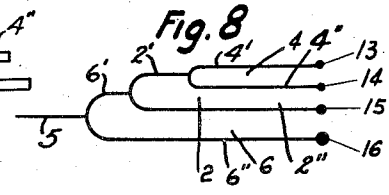


Fig. 8



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TUNING FORK WITH SIMULTANEOUS MULTIPLE FREQUENCIES

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16 Claims. (Cl. 84—457)

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The present invention relates to a tuning-fork of complex shape whose excitation by striking or by a bow or any other means generates simultaneously several fundamental frequencies.

The object of the invention will become apparent as the following detailed description progresses, reference being had to the accompanying drawing, wherein:

Fig. 1 illustrates a standard tuning fork,

Figs. 2–8 illustrate various complex-shaped tuning forks according to the invention,

Fig. 9 is a sectional view of a tuning fork according to the invention taken on line IX—IX of Fig. 3, wherein, however, the tuning fork is provided with damping means, and

Figs. 10 and 11 are partial views of the tuning fork shown in Fig. 3 provided with different types of damping means.

Let a standard tuning-fork 1 be considered first on Fig. 1 comprising as well known a pair of tines arranged in spaced parallel alignment. Let another tuning-fork 2 (Fig. 2) be also considered with no tail as the first fork, in which a part of the upper leg 3 is replaced by a fork 4 which is identical with fork 1 of Fig. 1.

If the lower tine of the fork 2 is struck in a vertical direction, the complex-shaped tuning fork (lower tine, tail member 3 and double tine fork 4) will vibrate as if its upper tine (tail member 3 and fork 4) were identical to the said lower tine; the compound fork will vibrate as a standard tuning fork on its normal pitch.

On the contrary if the upper tine of the upper fork 4 is struck in a vertical direction, the two tuning forks 2 and 4 constituted by the three tines will vibrate, generating simultaneously the fundamental corresponding to the upper fork 4 and the fundamental corresponding to the lower fork 2. For in fact the striking action on the upper tine of fork 4 will not only vibrate the small fork but also its tail portion 3 and consequently the other tuning fork 2. Naturally it is necessary for making the second fork 2 vibrate to adjust its upper leg 3 which has been cut for fixing the aforesaid fork 4.

According to the same process it will be possible to build (see Figure 3) another complex-shaped fork 2, 4, 6 with three frequencies and so on; the final fork will be fitted with a tail to meet the service requirements.

The shapes shown on Figs. 1, 2 and 3 are non restrictive, it being quite possible to have shapes and designs which differ widely from them, as for example those shown on Figs. 4 and 5. The compound, or complex-shaped tuning-fork according to Figure 4 comprises a fixed fork 4 having tines 4' and 4'' and a tail part 2' to which is fixed a tine 2'' forming a first compound fork 2—4. In its turn the said first compound fork is provided with a tail portion 6' to which is fixed in any appropriate manner a tine 6'' forming a second compound fork comprising the forks 4—2 and 6. Finally, the said second compound fork is provided with a tail portion 23' on which is fixed a tine 23'' forming a third compound fork, comprising the forks 4, 2, 6 and 23 the latter being provided with a tail 5 corresponding to the tail 5 of Figure 3. As explained for the compound fork in Figure 2, the compound fork according to Figure 4, upon a striking action on the first fork 4 vibrates the tail part 2' and consequently the first compound fork 2 and its tail portion 6' which makes the second compound fork 6 to vibrate. The said second compound fork vibrates the tail portion 23' which in its turn makes the third compound fork 23 to vibrate. As any one of these forks vibrates on its own frequency, it can be seen that the compound fork of Figure 4 when made to vibrate generates four fundamental frequencies i. e. those corresponding to the forks 4, 2, 6 and 23 respectively. If a compound fork generating 5 fundamentals is to be designed, this can be made by replacing a part of the tine 4' of the fork 4 and by fixing to the remaining tine part another smaller standard fork. In a general way a compound fork generating fundamentals comprises $n+1$ tines.

The compound fork according to Figure 5 is similar to that shown in Figure 4 and differs only from the latter in that all its tines are parallel to each other and bent at right angles over the tail portion 5.

The fundamental principle lies in the fact that each fork except the first one is constituted by a complex fork supporting on one of its legs a complex or standard fork.

The various legs of the ensemble can be welded, brazed, or made of one single piece.

The constituent forks such as 2, 4, 6 or 23 may be disposed in different planes which may be of advantage in certain cases (overall dimensions, relative dosage of frequencies, etc.). In these cases, the planes of vibration of the various composite forks are not in common as is the case in most of the forks shown in the drawing.

Such compound fork is shown in Fig. 6a which is a cross-sectional view of Fig. 6. As shown in Fig. 6a the tail portions or supporting reeds 5 and 9 together with the tine 2'' lie in a common

plane, whereas the tines 4' and 4'' which constitute the constituent fork 4 lies in a different plane.

The vibrations of the compound forks according to the Figures 2 to 5 do not only generate the fundamentals of the several forks but also the higher partials which are neglected as being remote from the fundamentals by approximately 3 octaves. If the ratio of these frequencies of the upper partials 2, 3, 4 to the frequency of the fundamental is to be increased, the tines of the forks may be provided either with notches 7, 8, 9 and 10 (Fig. 6), or with hollowed portions 11 and 12 (Fig. 7) or with weights such as 13 14, 15 and 16 in Fig. 8.

The legs of a complex fork can perfectly be calibrated so that the frequencies produced are for instance the 1st, 2nd, 3rd, 4th, 5th and 6th harmonics of a given fundamental.

The complex fork can thus replace strings in certain musical instruments such as the piano, harpsichord, harp, zither, etc.

It can replace with advantage the rods and forks used in certain musical instruments such as the dulcitone, typophone, celesta, xylophone, glasschord, etc.

Besides those forks can be used for all cases for which those various instruments instead of generating sounds through the channel of a sound-board would produce them through any amplifying system (for instance: a fork vibrating near a polarized coil transmitting induced voltages to the terminals of a pick-up in a radio set, the final source of sounds being a loud speaker instead of the sound-board).

In this order of ideas the complex fork is quite advisable for constituting the vibrating elements of certain types of electric chimes with a loud speaker.

Figs. 9 to 11 show a new device for damping the forks described above. According to Fig. 9 which is a section of Figure 3 along lines IX—IX each of the tines 6'', 2'', 4'', 4' of for example the compound fork of Figure 3 is in contact with a small strip of felt 18, 18', 18'', 18''' suspended from a common support 20 by means of strip of cloth 19, 19', 19'', 19''' which acts as a flexible articulation, the said common support being slidable in order to permit the damper to be put in service or to be put out of action.

According to Fig. 10 which shows two tines corresponding to any one of the partial forks of Figures 2 to 8 a lump of damping material 21 (felt, wool, etc.) is inserted between the legs 2'', 4'', of the fork while according to Fig. 11 the damper consists of helical coils 22, 22' made of wool or any other material wound and fixed upon legs 2'', 4'' of the fork at appropriately chosen points.

Naturally the invention of the complex fork is in no way limited to the embodiments shown and described and which were chosen only by way of example.

What I claim is:

1. A vibratory complex fork having a supporting reed and two oppositely vibrating tines secured to said reed, in which one of said tines comprises a tuning fork, a first tail portion carrying said tuning fork, a vibratory tine fixed to said first tail portion and a second tail portion fixed to said supporting reed.

2. A vibratory complex fork having a supporting reed and two opposed vibratable tines secured to said reed, in which at least one tuning fork is fixed to one of said tines.

3. A vibratory complex fork having a supporting reed and two opposed vibratable tines secured to said reed, in which at least one tuning fork is secured to one of said tines, said one tuning fork being located in a plane different from that determined by the other tine and the supporting reed.

4. A vibratory complex fork having a supporting reed and two opposed vibratable tines secured to said reed, in which at least one tuning fork is secured to one of said tines, said one tuning fork being located in the plane determined by the other tine and the supporting reed.

5. A vibratory complex fork having a supporting reed and two opposed vibratable tines secured to said reed, in which one of said tines carries at least one tuning fork having two opposed vibratable legs, and in which the other tine and at least one of said legs are provided with means for eliminating undesirable harmonics of the fundamentals produced by the vibrations.

6. A vibratory complex fork according to claim 5, wherein said harmonic eliminating means includes notches on said other tine and said one leg, said notches being located near the fixed ends thereof.

7. A vibratory complex fork according to claim 5, wherein said harmonic eliminating means includes masses fixed to the free ends of said other tine and of said one leg.

8. A vibratory complex fork having a supporting reed and a first fork including two opposed vibratable members secured to said reed, in which one of said members carries at least a second tuning fork having two opposed vibratable members and in which the other member of said first fork and at least one of the members of said second fork are provided with damping means.

9. A vibratory complex fork according to claim 8, in which said damping means includes a strip of a damping material freely bearing on its associated member.

10. A vibratory complex fork according to claim 8, in which the damping means is formed by a lump of damping material inserted between the said other member of said first fork and said one member of said second fork.

11. A vibratory complex fork according to claim 8, in which the damping means is constituted by a helical winding of a damping material on its associated member.

12. A vibratory complex fork having a supporting reed and two opposed vibratable tines secured to said reed in which one of said tines has a reduced length, and a succession of tuning forks supported on the free end of said one tine, each fork in said succession except the last having a tine or reduced length carrying the next fork in said succession.

13. A vibratory complex fork comprising a succession of progressively shorter tuning forks having each two opposed vibratable tines, all but the shortest of said forks having one tine shorter than the other and in which all but the longest of said tuning forks is carried by the shorter tine of the next longer tuning fork.

14. A vibratory complex fork as defined in claim 12, in which each of said forks but the longest extends over the free end of the longer tine of the next longer fork.

15. A vibratory complex fork as defined in claim 12, in which at least one tuning fork of said succession is located in a plane different from that determined by the other tuning forks and the supporting reed.

16. A vibratory complex fork as defined in claim 12, in which all of the tuning forks of said succession and the supporting reed are located in a same plane.

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