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D. J. LESLIE

2,622,693

APPARATUS FOR IMPOSING VIBRATO ON SOUND

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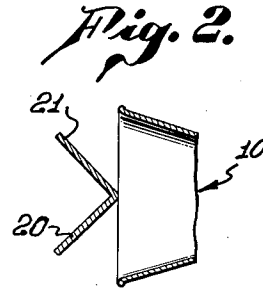
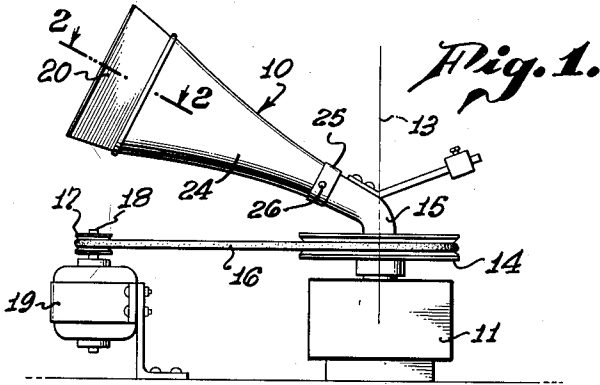


Fig. 7.

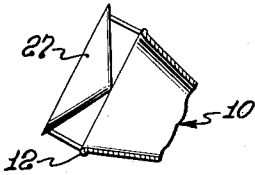


Fig. 3.

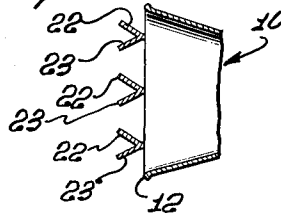


Fig. 4.

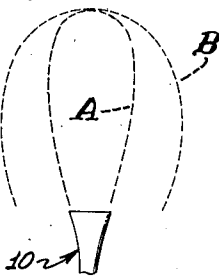


Fig. 5.

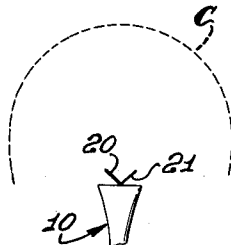
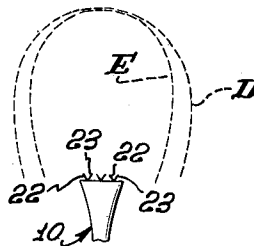


Fig. 6.



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## UNITED STATES PATENT OFFICE

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APPARATUS FOR IMPOSING VIBRATO  
ON SOUND

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603,850. Divided and this application April 30,  
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7 Claims. (Cl. 181-27)

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The present invention relates to the production of musical tones, and more particularly to the production of tones possessing pitch tremolo or vibrato.

This application is a division of my application for "Acoustic Apparatus," filed July 9, 1945, Serial No. 603,850, now Patent No. 2,489,653, which is a continuation-in-part of my application for "Acoustic Apparatus," filed December 10, 1940, Serial No. 369,413, now abandoned.

In playing an ordinary musical instrument, as a stringed or wind instrument, or in singing, the pleasing quality of the music may be enhanced by producing a pitch tremolo or vibrato. This vibrato effect in the case of an instrument is produced by a slight, rapid motion of the finger on the appropriate key or string, causing cyclic and rapid minor variations of pitch.

As described in the above applications, a tremolo effect can be produced by moving a sound transmitting channel at a certain rate, of the order of between five and eight cycles per second. The sound transmitting channel may be associated with a loud speaker, the rotation of the channel causing its mouth to move alternately toward and away from the listener at a frequency corresponding to the vibrato. In this manner, the pitch of the sound issuing from the speaker and heard by the listener is alternately increased and decreased.

In connection with a rotating sound channel, such as a horn communicating with a speaker, horns of comparatively small dimensions are usually employed for medium and high frequencies. The higher sound frequencies emitted from such horns have strong directional characteristics, and are not widely distributed. The medium frequencies are more widely distributed, but also have marked directional characteristics.

Accordingly, it is an object of the present invention to provide an arrangement for altering the character of the vibrato issuing from a horn or similar sound channel.

Another object of the invention is to provide a horn apparatus in which the higher and medium frequencies issuing from the horn are more widely distributed.

Still another object of the invention is to provide a sound apparatus embodying a horn in which the directional characteristics affecting the vibrato can be varied.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several forms in which it may be embodied. Such forms are shown in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that such

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detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a side elevation of an apparatus embodying the invention;

Fig. 2 is a fragmentary section on an enlarged scale, taken along the line 2-2 on Fig. 1;

Fig. 3 is a view similar to Fig. 2, showing another embodiment of the invention;

Figs. 4, 5 and 6 are diagrams of radiation patterns useful in explaining certain aspects of the invention;

Fig. 7 is a fragmentary view, similar to Fig. 2, of another embodiment of the invention.

As disclosed in Fig. 1, a directional sound horn 10 is adapted to transmit sound from a stationary speaker 11, or similar source, with which it is in sound communication. The horn is of generally elbow shape, with its outlet opening 12 disposed eccentrically or to one side of the axis 13 about which the horn is to be rotatable. Rotation of the horn is accomplished by securing a pulley 14 to its inner hub end 15, a belt 16 passing around this pulley and also around a driving pulley 17 secured to the shaft 18 of an electric motor 19.

The horn 10 is rotated at a speed capable of imparting the desired vibrato to the sound emitting from its mouth 12 (which, as indicated above, is of the order of five to eight cycles or revolutions per second). Where the frequencies supplied by the speaker 11 are in the medium and high ranges, the horns ordinarily are of rather small dimensions. Such horns have a radiation pattern of the form indicated by the broken lines in Fig. 4. The sound emitted will have a peak amplitude directly in front of the horn, the higher frequencies having strong directional characteristics, as indicated by the curve marked A, and the medium frequencies being more widely distributed, as indicated by the curve marked B.

By providing a deflector comprising a pair of plates 20, 21 oppositely inclined across the mouth 12 of the horn in the plane of rotation of the horn, the radiation pattern may be changed to have a form such as that indicated by the curve C in Fig. 5. In that figure, it will be noted that the peak amplitude in front of the horn has been substantially reduced and the sound distributed over a wider area. Furthermore, the directional properties of the higher frequencies have been decreased so that these and the medium frequencies have about the same distribution. Such a deflector arrangement also affects the vibrato by increasing the apparent length of the horn which increases the Doppler effect.

As shown most clearly in Fig. 2, the plates 20, 21 are large with respect to the mouth 12 of the

horn 10, and are disposed at right angles with respect to each other. Various radiation patterns may be provided by utilizing larger or smaller plates, or a different inclination, or both. Thus, in Fig. 3, several pairs of smaller plates 22, 23, more steeply inclined, are shown as provided across the mouth 12 of the horn. The radiation pattern for a horn with such a deflector may be of the type indicated in Fig. 6, and is generally intermediate the curves A and B of Fig. 4 and the curve C of Fig. 5. The amplitude peak directly in front of the horn is not very pronounced, and the sound is quite broadly distributed, the medium frequencies (curve D) being somewhat more widely distributed than the higher frequencies (curve E).

The directional characteristics of a horn in the plane of rotation strongly affect the vibrato, while the same characteristics in a plane normal thereto have no effects. Accordingly, if a horn with different directional effects in the two planes is arranged so that its directivity is effective in either its plane of rotation or at ninety degrees thereto, completely different effects can be obtained. Other effects can also be obtained by directing the horn at an intermediate position. To permit adjustment of the mouth 12 and plates 20, 21, or 22, 23 of the horn, the horn is formed of two sections, namely, an inner section 15 and an outer section 24. One of these sections, as the outer section 24, has a collar 25 secured to it which can be attached to the inner section 15 by means of a set screw 26. Tightening of the set screw against the inner section serves to couple the two sections 15, 24 together.

By loosening the set screw 26, the outer section 24, which has different directional properties in different planes, by virtue of the directivity plates 20 and 21, or 22 and 23, may be angularly adjusted upon the inner section 15 to vary the vibrato; whereupon, the set screw 26 is again tightened.

It may be desirable to provide a deflector which will produce the same radiation pattern in all planes. For this purpose, as shown in Fig. 7, a horn 10 may be provided having a conical deflector 27 suitably supported at its mouth portion 12. Obviously, the proportions of the conical deflector 27 may be varied to produce different characters of vibrato.

The inventor claims:

1. In apparatus for imposing vibrato on musical sound, a source of said sound, means forming a sound channel for directing the sound from said source and having a sound emitting opening, means mounting said sound channel for rotation about an axis spaced from the opening, a cone facing said opening to alter the radiating properties of said channel, and means for continuously rotating said sound channel about said axis.

2. In apparatus for imposing vibrato on musical sound, a source of said sound, means forming a sound channel for directing the sound from said source and having a sound emitting opening, means mounting said sound channel for rotation about an axis spaced from the opening, and a pair of oppositely inclined plates extending across said opening to broaden the radiating properties of said channel in planes normal to said axis of rotation, and means for continuously rotating said sound channel about said axis.

3. In apparatus for imposing vibrato on musical sound, a source of said sound, a horn for

directing the sound from said source and having a sound emitting opening, means for continuously rotating said horn about an axis spaced from the opening, and means providing one or more inclined surfaces extending across said opening to broaden the radiating properties of said horn in planes normal to said axis of rotation.

4. In apparatus for imposing vibrato on musical sound, a source of said sound, means forming a sound channel for directing the sound from said source and having a sound emitting opening, means mounting said sound channel for rotation about an axis spaced from the opening, a plurality of pairs of oppositely inclined plates extending across said opening to broaden the radiating properties of said sound emitting opening in planes normal to said axis of rotation, and means for continuously rotating said sound channel about said axis.

5. In apparatus for imposing vibrato on sound, a source of said sound, a horn for directing the sound from said source, said horn having an inner portion communicable with said source and an outer portion provided with a sound emitting opening, means adjustably securing said inner and outer portions together to enable said outer portion to be shifted angularly with respect to said inner portion, means for rotating said horn about an axis spaced from the opening, and means forming a deflector cooperating with said opening to vary the directive properties of said horn in different planes.

6. In apparatus for imposing vibrato on sound: a source of sound; means forming a sound channel for directing the sound from said source and having a sound emitting opening; means for continuously rotating said sound forming channel at a rate of from five to eight revolutions per minute, about an axis spaced from the sound emitting opening; and a deflector cooperating with the opening and having a deflecting surface that is transverse to the direction of motion of the surface.

7. In apparatus for imposing vibrato on sound: a source of sound; means forming a sound channel for directing the sound from said source, said means including walls defining a sound emitting opening that provides broadened directive properties in one direction transverse to said channel; means mounting said channel forming means for rotation about an axis spaced from the opening; and means for continuously rotating said channel forming means about said axis; said mounting means being so arranged and constructed that said one direction substantially coincides with the instantaneous direction of rotation of said opening about said axis.

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