

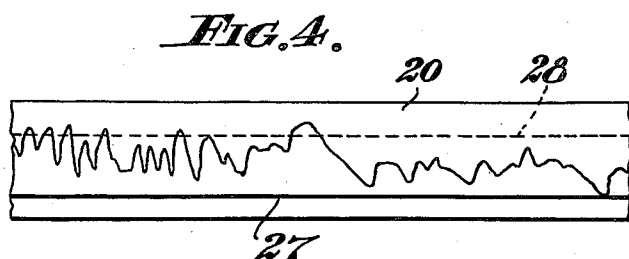
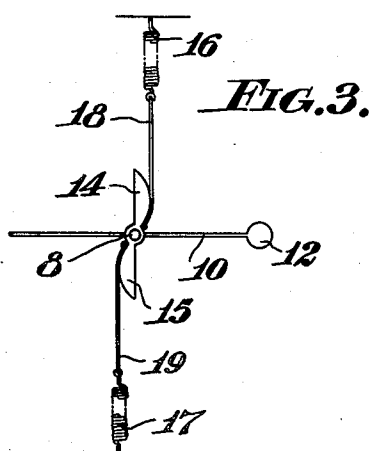
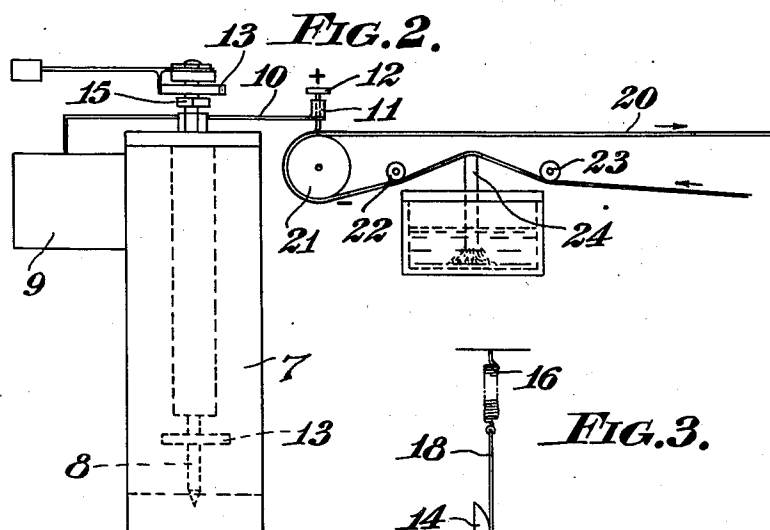
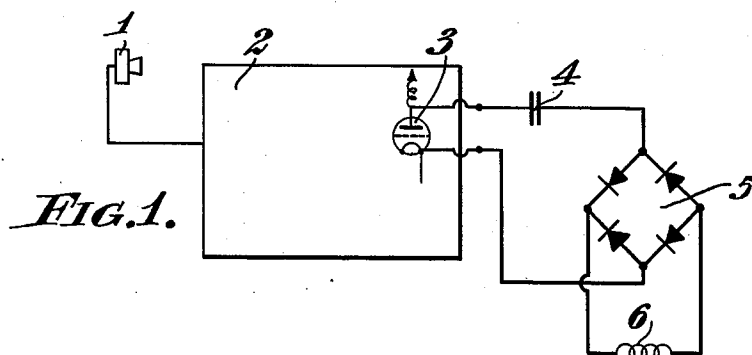
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METHOD OF AND MEANS FOR RECORDING CHARACTERIZATION OF VOICE PRODUCTION

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METHOD OF AND MEANS FOR RECORDING
CHARACTERIZATION OF VOICE PRODUCTION

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4 Claims. (Cl. 179—100.1)

This invention relates to a method of and means for recording characteristics of sound waves. When sound waves are converted into electrical impulses, for example, for transmission by wireless telephony, or for the production of gramophone or like records, it is well known that distortion is likely to occur due to the overloading of various electrical circuits. This is especially the case with singers, who are positioned near to a microphone, and certain notes or sounds tend to overload the electrical apparatus more than others, so that great care must be exercised by the singer to modulate the voice properly.

This invention relates particularly to a method of and means for recording characteristics of voice production and has in view to provide a method and apparatus for the detection of distortion i. e. forced and harsh sounds or notes and for recording same, so that the record made during the delivery of a speech or singing of a song can be inspected later by the speaker or singer as evidence of the characteristics of his voice in the above respect. Such distortion though not so readily detectable to the ear when a singer or speaker is listened to in person, becomes particularly unpleasant when mechanically or electrically reproduced and the present invention has in view to train the speaker or singer to deliver without producing distortion.

When sound waves of two different amplitudes are produced the ear does not interpret the difference in amplitude proportionally but interprets the sounds as differing approximately by log to the base 10 of the ratio of the two amplitudes, hence the amplitude of a sound wave can be increased by twice, yet its audible loudness will only seem to increase by approximately 0.3 and it is to be understood that this is what is meant hereinafter by the phrase audible loudness. It is evidence therefore that the ear can appreciate a very large change of amplitude, but an electrical apparatus for recording or amplifying sound waves produces an output directly proportional to the amplitude of the sound.

Thus, when the sounds are electrically amplified or reproduced they are likely to be distorted, and it is very difficult for a singer or performer to appreciate which sounds cause the distortion. Distortion is likely to occur in the microphone circuit of the electrical apparatus, and is far more apparent with the carbon type of microphone.

The invention is particularly applicable to the training of voices of singers or speakers so that they may avoid producing the voice in such a way as to cause distortion when sounds are elec-

trically amplified, as in the case of broadcast of public address systems, or electrical recording apparatus or the like. According to this invention, the apparatus for recording sound waves comprises a microphone, an electric amplifier with the output passed through a condenser to a full wave rectifier, the output being directly proportional to the peak alternating voltage across the condenser, the direct current output fed to the coil of a moving coil type recording instrument means associated with said instrument to produce a permanent and visible record of the variations in the audible loudness of the sound wave. By obtaining a record proportional to the audible loudness, and not directly proportional to the amplitude, and by arranging the record so that it can be seen when the loudness of the sound delivered exceeds or approaches a certain value, a performer, e. g., a soloist or conductor will be able to judge at what points the production of the sound must be controlled in order to avoid distortion in the electrical apparatus.

The angular deflection of the coil is made proportional to the loudness and not to the amplitude of sound by arranging the restraining force on the coil in such a way that the deflection is not directly proportional but is proportional to the logarithm of the restraining force.

Preferably, the movement of the coil is permanently recorded by electro-chemical means in a moving tape or ribbon.

The coil is provided with an arm which carries a stylus arranged to mark a line on paper tape as it is drawn past said stylus. Preferably, the line is formed by causing the stylus to be at a different potential from the paper, and treating the paper with a solution of such a nature that an electrolytic deposit is formed where the stylus touches the paper. By treating the paper with a solution of starch and potassium iodide, a deposit of iodine is formed where the stylus touches the paper, resulting in a blue line on the paper which gradually turns brown.

The speed at which the tape moves past the stylus may be regulated so that a record may be produced of such a length equal to the length of the manuscript copy of the music. The tape may then be cut up and pasted on the manuscript in such a way that the points on the record line lie adjacent vertically to the corresponding printed notes. With such an arrangement the singer can observe where distortion would occur during electrical reproduction.

In order that the invention may be better understood, reference will now be made to the accompanying sheet of drawings, which illustrate a preferred form of apparatus constructed in accordance with the invention, and wherein:—

Figure 1 illustrates the circuit arrangement of the apparatus.

Figure 2 is a diagrammatic side view of the recording mechanism.

Figure 3 is a plan view of the restraining mechanism of the coil and

Figure 4 is a portion of a tape showing the record produced by the apparatus.

Referring firstly to Figure 1, the microphone 1 is of the condenser type, since this type is capable of handling large volumes without overloading. Said microphone is connected to the input of an amplifier 2, with sufficient gain to feed a suitable power valve 3, whose output is passed through a condenser 4 to a bridge type or other full wave rectifier 5. The mean direct current output of this rectifier is directly proportional to the peak A. C. volts across the condenser. The direct current output of the rectifier is fed to the moving coil 6 of the recording instrument.

Referring now to Figure 2, the recording instrument has a permanent magnet 7, arranged to give a substantially uniform field. The coil 6 which is very light and substantially in the form of a rectangular frame is mounted in the usual manner in the magnetic field by means of a spindle 8, and the movement of the coil 6 is damped by suitable means such as a dash pot 9. The said spindle carries an arm 10, which is provided with a socket 11 at its outer end, in which slips a stylus 12.

In addition to the usual helical restraining springs 13, additional restraining means are provided, comprising two cams 14, 15 mounted on the spindle 8. Two tension springs 16, 17 are provided each anchored at one end to a fixed part of the instrument and each anchored at the other end by means of cables or flexible strips 18, 19 respectively, to the cams, in such a manner that each cable or strip bears on the outer face of a cam. The faces of the cams are so shaped that the angular deflection of the arm 10 is proportional to the log 10 of the restraining force. Means (not shown) may be provided to adjust the tension of the springs 16, 17.

The record is formed on a moving paper tape 20, fed over suitable rollers, one of which 21, is shown. Two jockey rollers 22, 23 are provided to hold the outer face of the paper against a wick 24, so that this surface of the paper is moistened with a solution of starch in potassium iodide.

The stylus 12 rests lightly on the surface of the paper 20, and is not held in any way in the socket 11.

The apparatus operates as follows:—The tape is driven to travel at the desired speed, and the sound produced by the singer is converted into electric impulses by the microphone 1. After amplification, the impulses are converted into direct current, and fed to the coil of the instru-

ment. The angular movement of the coil, hence the angular movement of the arm 10 is proportional to the loudness of the sound, not the intensity and the variations in the loudness will produce a line on the tape 20, an example being shown in Figure 4.

The lines on the paper are produced by keeping the stylus 12 at a higher potential than the tape, so that a deposit of iodide is formed on the strip.

In Fig. 4 the line 27 represents the zero line, and the dotted line 28 represents a line above which the recorded line should not pass if distortion is to be prevented.

A second stylus may be used for marking either of these lines or the strip may be supplied with one or both of these lines printed thereon. The zero line may be dispensed with, the line 28 being marked by the second stylus and adjusted to suit requirements.

I claim:—

1. Apparatus for recording sound waves comprising a microphone, an electric amplifier with the output passed through a condenser to a full wave rectifier, the output being directly proportional to the peak alternating voltage across the condenser, the direct current output fed to the coil of a moving coil type recording instrument, means associated with said instrument to produce a permanent and visible record of the variations in the audible loudness of the sound wave.

2. Apparatus for recording sound waves comprising a device for converting the sound waves into electrical impulses an electric amplifier for such impulses with the output passed through a rectifier, and then fed to a moving coil recording instrument, having a rectangular frame a spindle supporting said frame a stylus arm carried by said spindle the angular movement of said stylus being proportional to the audible loudness of sound, and means associated with the stylus to produce a record of the angular movements on a moving tape.

3. Apparatus for recording sound waves comprising a device for converting the sound waves into electric impulses an electric amplifier for such impulses with the output passed through a full wave rectifier and then fed to a moving coil recording instrument having a stylus arm adapted to produce a visible and permanent wave track record on a moving tape, said stylus arm carried by the moving coil supporting spindle, said spindle having a cam device co-operating with resilient members to produce an angular deflection of the stylus proportional to the audible loudness to be recorded.

4. Apparatus for recording sound waves, according to claim 2 wherein the spindle carries a pair of opposite cams at right angles to the spindle, a pair of tension springs one for each cam each anchored at one end to a fixed part of the instrument, and at the other end to the respective cam, each said spring acting on its associated cam face to produce a deflection proportional to the audible loudness.

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