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HORN HAVING RESONATING CHAMBERS AT ANTINODAL POINTS

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Fig 1

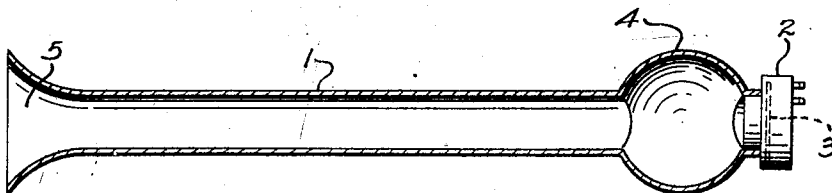


Fig 2

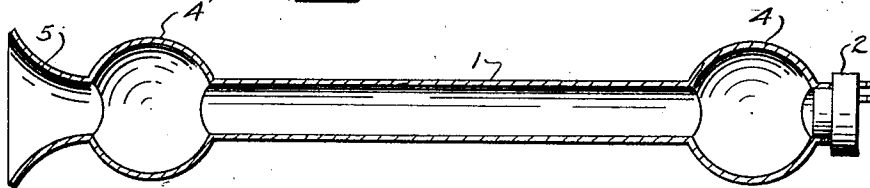
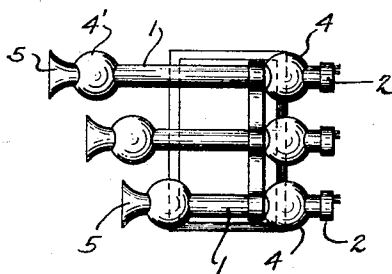


Fig 3



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HORN HAVING RESONATING CHAMBERS AT ANTINODAL POINTS

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This invention relates to sound propagating devices of the type in which a column of air is set into vibration by a mechanical diaphragm.

5 In devices where the column of air is contained in a horn-shaped member at the neck of which a diaphragm is located, the horn operates in a manner similar to an open end organ pipe which is resonant to waves having a length double that of the pipe. It is 10 well known that such a pipe will reinforce vibrations set up by a tuning fork of the right pitch to such a degree that they become audible at a considerable distance 15 therefrom while notes of other frequencies produce no noticeable effect.

The diaphragm of an electro-magnetic unit located at one end of a horn operates similar to such a tuning fork and sets up 20 vibrations or waves in the medium contained therein. If these waves are of the frequency to which the horn is resonant they will be reinforced and amplified thereby whereas other notes are discriminated 25 against.

This invention provides means for increasing the selectivity of the horn to such a degree that it will not respond to undesired impulses, such as static, while permitting the horn to respond freely to both 30 its fundamental and the various over-tones thereof.

The invention provides a substantially open end pipe having a mechanical diaphragm operatively associated therewith for 35 imparting vibrations to the medium contained therein. The gaseous medium such as air in such a pipe vibrates with a nodal point at the center and antinodal points at the two ends. Resonators are therefore introduced at the antinodal points and are designed to respond to notes of the fundamental frequency of the pipe and to the various overtones thereof but not to notes 40 of other frequencies and particularly to notes of lower frequencies, such as static. A plurality of such devices may be employed, each device being tuned to a separate note of the chromatic scale in order to provide for the accurate and undistorted repro-

duction of the entire musical range of frequencies.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth 55 and claimed.

Although the novel features which are believed to be characteristic of this invention will be specifically pointed out in the claims appended hereto, the invention itself, 60 as to its objects and advantages, the mode of its operation and the manner of its organization, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof in which like 65 reference characters have been used to denote like parts in the various figures. Since such illustration is, however, primarily for purposes of disclosure, it will be understood that the structure and the method of operation thereof may be modified in various respects without departing from the broad spirit and scope of the invention. 70

One embodiment of the invention has been shown for purposes of illustration in the accompanying drawings, in which 75

Fig. 1 is a diagrammatic illustration of a sound propagating device constructed in accordance with this invention, with a resonator at one antinodal point. 80

Fig. 2 shows a device having a resonator at each antinodal point and

Fig. 3 shows a plurality of such devices tuned to different frequencies. 85

In the following description and in the claims the various parts of the apparatus and details of the invention will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit. 90

Referring to the drawings more in detail, the invention is shown in Fig. 1 as comprising a pipe 1, of suitable length to resonate 95 to a definite note in the chromatic scale. An electromagnetic unit 2 of any desired form having a movable diaphragm 3 is secured to one end of said pipe, the diaphragm being adapted to operate on the column 100

of air located within said pipe for causing compressions.

At one antinodal point of said pipe adjacent electro-magnetic unit 2 is attached resonator 4 which is preferably of substantially spherical shape. Bell shaped horn 5 is located at the end of pipe 1 furthest from electromagnetic unit 2 for facilitating the propagation of the sound waves to the surrounding medium.

In the device shown in Fig. 2 the parts are similar to those shown in Fig. 1 and have been given similar reference numerals. A resonator 4' is however located at the open end on the horn. Resonators 4 and 4' are thus at the two antinodal points and operate in the manner to be hereinafter explained.

In the operation of this device when vibrations of the frequency to which pipe 1 is resonant are impressed upon diaphragm 3, sound waves are produced in the air contained in pipe 1 and are reinforced thereby. Whenever vibrations of other frequencies, however, are impressed upon diaphragm 3 they are not reinforced and the sound waves produced thereby will not be amplified by the resonant qualities of said pipe. Consequently the ratio of the amplitude of the desired musical notes to that of the undesired notes is increased and the effect produced of suppressing such undesired notes.

The above mentioned air waves in passing through the pipe are reflected at the two ends thereof and produce substantially stationary waves having a nodal point at the center of the pipe, and loops or antinodal points at the two ends. Resonators 4 and 4' being located at these antinodal points and tuned to the fundamental frequency of the pipe will readily respond to notes of this frequency and further increase the amplitude of the corresponding sound waves. Such resonators are sharply selective and respond but slightly to notes of other frequencies and particularly to notes lower than that to which they are tuned, such as for example, notes produced by static in a radio receiving set. The device therefore, serves selectively to amplify notes of the fundamental frequency of the pipe and over-tones thereof and to suppress notes of all other frequencies.

In order to amplify notes over the entire musical scale, a plurality of resonating devices as described above may be employed as shown diagrammatically in Fig. 3, each being tuned to a different note in one selected octave. The parts are similar to those of Fig. 2 and are correspondingly numbered. The twelve notes in an octave are thus reinforced by twelve resonators and since each is resonant to harmonics of its fundamental frequency, the various octaves comprising the complete range of musical frequencies may also be reproduced thereby.

It is thus necessary to employ a bank of only twelve resonating horns in accordance with this invention to accurately reproduce music without introducing distortion or discrimination against certain notes. The horns are however, sharply selective of their resonant frequencies and do not reinforce other waves such as for example, those produced by static or spark disturbances.

The device therefore, in addition to being an efficient means for propagating fine musical notes serves to suppress all undesired waves. Not only is static eliminated but other disturbances which would interfere with the music or produce distortion thereof are suppressed.

While certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. A sound propagating device comprising a vibrating diaphragm, a tubular member associated therewith and adapted to form an air column resonant to waves of a definite frequency, said column having nodal and antinodal points, and a resonator located at one of said antinodal points tuned to the same frequency as said tubular member.

2. A sound propagating device comprising a vibrating diaphragm, a tubular member associated therewith and adapted to form an air column resonant to waves of a definite frequency, said column having nodal and antinodal points, and resonators located at said antinodal points tuned to the same frequency as said tubular member.

3. An acoustic device comprising a tubular member adapted to form an air column resonant to waves of a definite frequency whereby nodal and antinodal points are formed, and a resonator tuned to said frequency located at an antinodal point in said column for reinforcing said waves and suppressing undesired noises.

4. A sound propagating device comprising an open end tubular member resonant to waves of a definite frequency, means for producing sound waves in said member and resonators tuned to said frequency located at the antinodal points in said tube, whereby waves of the fundamental frequency and overtones thereof may be amplified and propagated, and whereby waves of other frequencies may be suppressed.

5. An acoustic device comprising an open tubular member resonant to waves of a definite frequency, means for producing sound waves in said member and spherical resona-

tors located at the ends of said tubes tuned to the same frequency as said tubular member whereby waves of the fundamental frequency and overtones thereof may be amplified and propagated, and whereby waves of other frequencies may be suppressed.

notes of the chromatic scale, and means located at the antinodal points in said chambers resonant to fundamentals of the respective chambers for selectively amplifying waves of said frequencies while suppressing waves of other frequencies.

6. A device for propagating sound waves comprising an actuating unit having a vibrating diaphragm, a tubular member associated therewith and adapted to form a resonating column, a resonator located at each end of said member tuned to the same frequency as said tubular member, and a horn secured to the resonator furthest from said actuating unit, said assembly being capable of reproducing waves of a definite frequency and overtones thereof, and being substantially non-responsive to waves of other frequencies.

11. A sound propagating device comprising a plurality of actuating units having vibrating diaphragms associated therewith, tubular members associated with said diaphragms and adapted to form resonating chambers, said chambers being of different lengths and spherical resonators located at the antinodal points in said chambers, said chambers and resonators being tuned to different notes comprising an octave in the chromatic scale for selectively amplifying waves of frequencies corresponding to the notes of said scale while suppressing waves of other frequencies.

Signed at New York, in the county of New York and State of New York, this 23rd day of May, A. D. 1927.

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7. A device for propagating sound waves comprising a tubular member adapted to form a resonating column, a resonator located at each end of said member tuned to the same frequency as said tubular member, an actuating unit having a vibrating diaphragm located adjacent one of said resonators, and a bell shaped horn secured to the other of said resonators, said assembly being capable of reproducing waves of a definite frequency and overtones thereof, and being substantially non-responsive to waves of other frequencies.

8. A sound propagating device comprising a plurality of actuating units having vibrating diaphragms associated therewith, tubular members associated with said diaphragms and adapted to form resonating chambers, said chambers being of different lengths and respectively tuned to different notes of the chromatic scale and to the same note as the associated tubular member, and resonators located at the antinodal points of said chambers for selectively amplifying waves of certain frequencies while suppressing waves of other frequencies.

9. A sound propagating device comprising a plurality of actuating units having vibrating diaphragms associated therewith, tubular members associated with said diaphragms and adapted to form resonating chambers, said chambers being of different lengths and respectively tuned to different notes of the chromatic scale and to the same note as the associated tubular member, and resonators located at the ends of said chambers for selectively amplifying waves of certain frequencies while suppressing waves of other frequencies.

10. A sound propagating device comprising a plurality of actuating units having vibrating diaphragms associated therewith, tubular members associated with said diaphragms and adapted to form resonating chambers, said chambers being of different lengths and respectively tuned to different

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