

Sept. 15, 1931.

W. D. SMITH

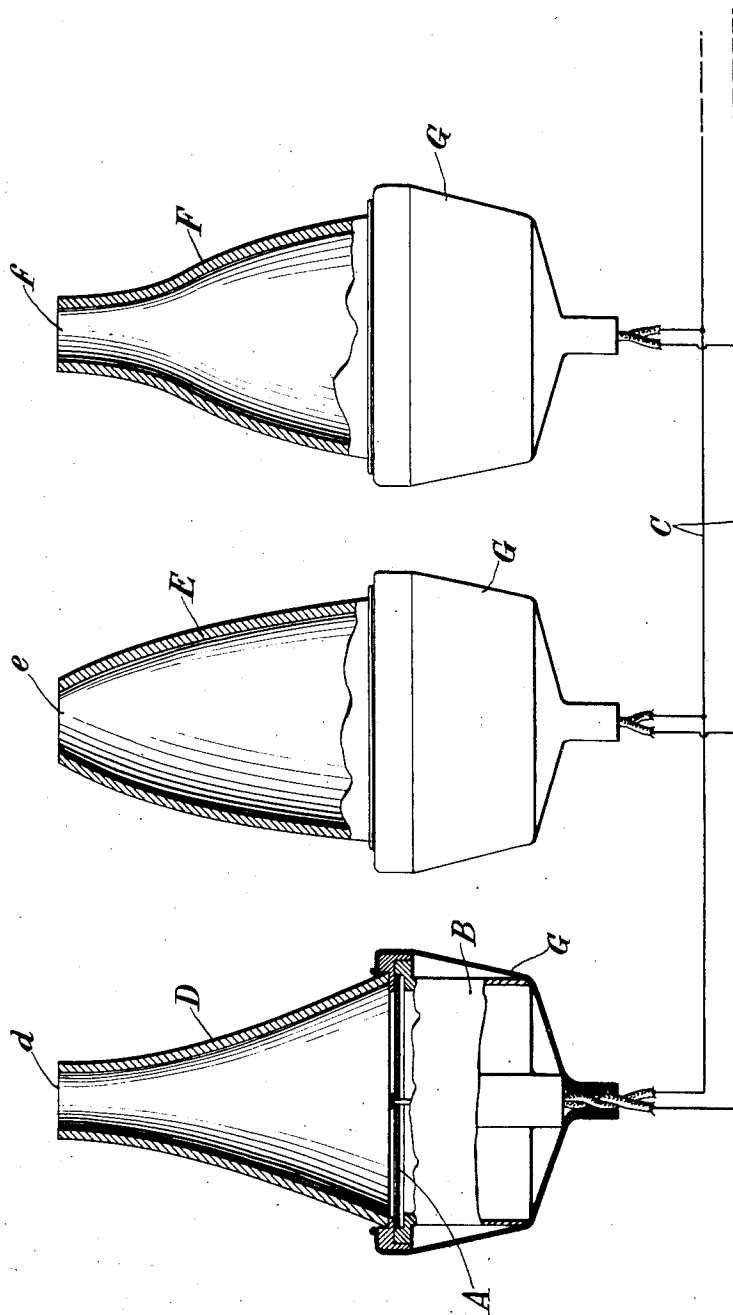
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SYSTEM OF ARTICULATE SOUND REPRODUCTION

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2 Sheets-Sheet 1

Fig. 1



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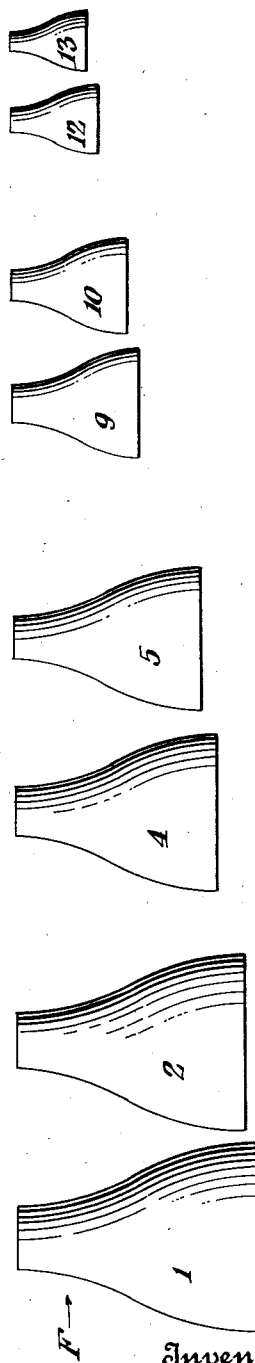
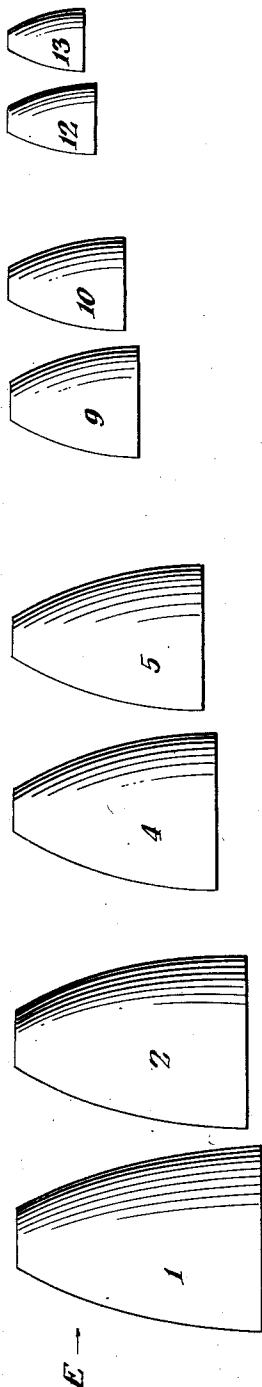
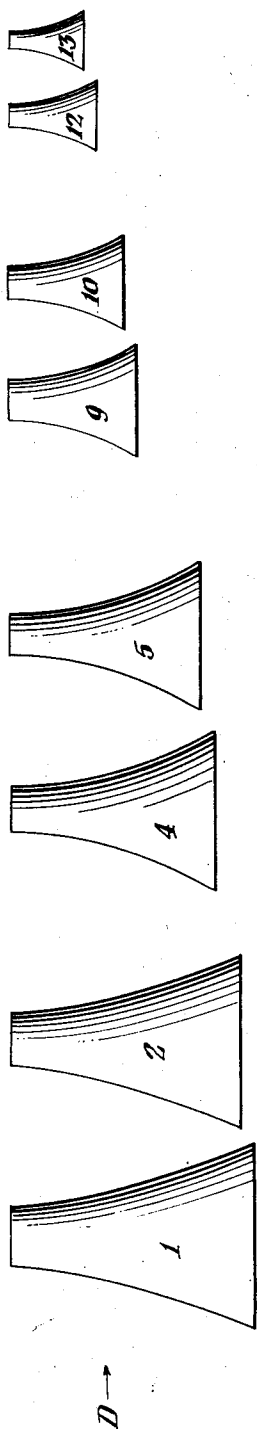
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2 Sheets-Sheet 2

Fig. 2



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SYSTEM OF ARTICULATE SOUND REPRODUCTION

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In the art of sound reproduction as practiced with the instrumentalities at present in use, articulation that is created at the source of sound, whether produced by the human voice, or musical instrument, or other means, is either imperfectly rendered, or wholly lost. This is due to the fact that no single reproducing device known to me is of such nature that it can faithfully repeat all of the great variety of articulations, with or without resonance, found in vocal utterances and in the playing of musical instruments, without obstruction.

The tonal qualities of sound, between high and low pitches, its timbre or tone color, its intensity in varying volume, etc., are quite incapable of true reproduction through the medium of a single device with its obstructing influences.

Therefore, my investigations have led me to devise a system of multiple reproducing devices wherein each device differs from the others in some respect, and each device is characterized as being capable of faithfully reproducing a particular sound quality with maximum efficiency and intensity.

Since with my invention any desirable number of reproducing devices may be provided in a group, each one being adapted for the efficient repetition of a particular sound quality, it will be apparent that the system enables the different qualities of articulated sound to be selectively delivered by their respective most highly efficient reproducing media.

In carrying out my invention I provide a series of reproducing devices, all differing from one another in some respect. These devices are alike in being tubular, with a larger end to carry the palpitating member and a smaller end for sound emission.

As stated these devices all differ from one another. The difference may be in size alone or in the interior contour of the walls.

The tubular contour interiorly should best be truly concentric throughout and have a cubical capacity that encompasses an air column best suited to emit at the exit orifice a particular articulated sound, with its pitch sympathies, while presenting no obstruction

to free flow of the sound wave created through the transmitting diaphragm.

As an example of different interior contours which may be employed some of the reproducing devices may be longitudinally convex to aid in the true repetition of the softer articulations, such for example as the vocal articulation of the letter W and words beginning therewith like Who, etc. When the interior contour of the device is longitudinally concave, it is better suited for the emission of harder articulations, like the letter P and words beginning therewith, such as Pouf, etc. Also for true articulated renditions of sounds including both soft and hard articulations the interior of the device may be a longitudinal compound of both convex and concave contours.

For instance, a device of compound contours, with a terminal concave portion, preceded by a convex portion, lends itself to true repetition of the articulated word Whoopee, while a device of compound contours, with a terminal convex portion, lends itself to true repetition of the articulated word sound Prewar.

Also, as stated, the qualities of intensity, pitch, timbre, etc., are rendered sensitive to faithful reproduction by providing units in the system of varying sizes, and in contracting or expanding the area of the exit orifices.

Further in the interest of facsimile articulation the diaphragm or palpitating member may be of suitable size and form and composed of such material as will bring it into the closest affinity with either the vocal cords or reed impulses. Thus, for sharper articulations a stiffer material is more appropriate than for the majority of human voice characterizations, either in speech alone or speech written to a musical score.

Another feature of my invention consists in the provision of means for reinforcing the sound production by the diaphragm for delivery through the air column in advance thereof. This reinforcing effect is achieved with the aid of a resilient covering for the opposite side of the diaphragm, to yieldingly confine the air space thereat. For example, a flexible rubber apron stretched across the

back of the diaphragm and attached to the support or casing for the diaphragm, will itself respond to the pulsations in the confined rearward area, and impart vibratory equalization to the diaphragm without adding resonance to the delivered sounds.

Other features and advantages of my invention will hereinafter appear.

In the drawings: Figure 1 shows a group of different, articulated sound reproducing devices such as may be employed in my improved system, the members of the group represented each having a palpitating element or diaphragm, indicated at A, here shown as supported by a casing B, which contains the usual electro-magnetic actuating means—all included in the same circuit C. Fig. 2 is a diagrammatic view showing sets of articulators having different contours, each set comprising devices of different sizes.

It will be noted, however, that each member of the group is provided with a forwardly directed sound delivery device, they being identified respectively by the reference characters D, E and F, and each formed with different interior contours, which contours all present a relatively constricted emission orifice, indicated respectively at *d*, *e*, *f* and whereby articulated sounds are more efficiently produced. As already set forth the interior wall-surfaces of devices D, E, F all present concentric, tubular contours, but longitudinally their contours differ, for the purpose of enabling them to reproduce respectively different articulations. Thus, the device D is longitudinally convexed and contracted in its cross-sectional area toward its orifice *d*; the device E is longitudinally concaved and contracted in its cross-sectional area toward its orifice *e*; and the device F is longitudinally both concaved and convexed and contracted toward its orifice *f*, all for the purpose already set forth.

Obviously I am not limited to the particular contours represented for the interiors of my reproducing devices, since my improved system comprehends the use of a group of any desirable number of devices, whereof some may have the contours illustrated and others variants of said contours, it being necessary that all shall be contracted toward their emission orifices. While the devices D, E, F are all shown in Fig. 1 as of one size, it is necessary in articulate sound reproduction that the system should comprise a group whose members are of different sizes, some of said members being relatively very small, and others relatively very large, whereby a plurality of these devices, in grouped relation, will selectively repeat, with efficient articulation, intensity, tone color and resonance, all the originated sounds of speech and music.

A complete group of my improved sound reproducing devices may include, for example, thirteen devices of varying sizes hav-

ing each the contour of the device D, whereby the complete set of thirteen devices will reproduce the respective notes of the chromatic scale. Also such complete group may include thirteen devices like the device E, all of different sizes, and thirteen devices like the device F, all of different sizes. In Fig. 2 I have shown such a group wherein the thirteen devices D, are indicated by the character D with accompanying numerals from 1 to 13 to indicate their respective successive cubical capacities, although for convenience in illustration not all of the thirteen devices appear in the drawings.

The thirteen devices E and F are similarly indicated in Fig. 2.

Thus each set of articulators D, E and F comprises devices of variable size, so that an octave in concert pitch is capable of reproduction with each set.

It will be seen that variable formations should best be matched to a fixed chromatic note in concert pitch so that the cubical air space within each articulator should be as accurate as if it were to be a bell in such musical scale.

This chromatic scale should best be in a very high octave so that the common articulation of speech in its highest frequency may be had, and so that if variable pitch is desired, air columns of a shape, form and material may be continued from each periphery of sufficient cubic inch displacement to reach the depth of the musical pitch desired in its fundamental and timbre.

Whereas each articulator has its main fundamental note, as in the construction of bells, yet there exist in each the same characteristics as in all inclosed pipes, to wit:—The natural inherent tendency to emit a fundamental and sensation of a lower tone first harmonic, a perfect upper first harmonic and very positive splits above the second register, so that and when used in connection with air columns of correct chromatic compressions a positive fundamental in pitch is achieved and as wide in octave pitch as may be desired, which should give an oscillation test of absolute even peak compression in concert pitch throughout the entire sound range, either in complete range of musical chromatics or speech characteristics.

For the purpose of stabilizing the vibratory affect of the diaphragm, as premised, I have shown at G a membrane of flexible rubber, stretched over the casing B, at the back of diaphragm A, and secured to said casing, said membrane enclosing the area behind the diaphragm and serving to compensate for the resistance presented to the diaphragm by the air column at the forward side thereof.

Variations within the spirit and scope of my invention are equally comprehended by the foregoing disclosure.

I claim:

1. A sound reproducing system comprising a plurality of hollow devices, commonly actuable, whose emission orifices are smaller than their reception orifices, and which respectively possesses different articulating characteristics.

2. Articulated sound reproducing means comprising a plurality of hollow devices, commonly actuable, whose emission orifices are smaller than their reception orifices, and which respectively have different interior surface contours.

3. Articulated sound reproducing means comprising a plurality of hollow devices, commonly actuable, whose emission orifices are smaller than their reception orifices, and which are respectively of different sizes.

4. Sound reproducing means comprising a group of articulating devices, commonly actuable, including members varying in their interior surface contours, members varying in size, and members varying both in their interior surface contours and in size.

5. The combination with a sound reproducing device including a diaphragm, of articulating means at one side thereof, and pressure equalizing means at the other side.

6. The combination with a sound reproducing device, including a diaphragm, of articulating means at one side thereof, and a resilient, airtight covering at the other side.

New York, N. Y., January 30th, 1930.

WINFIELD D. SMITH.