

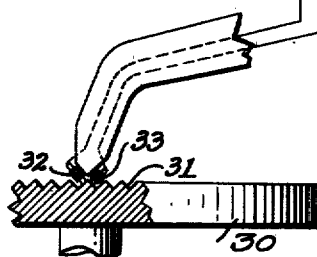
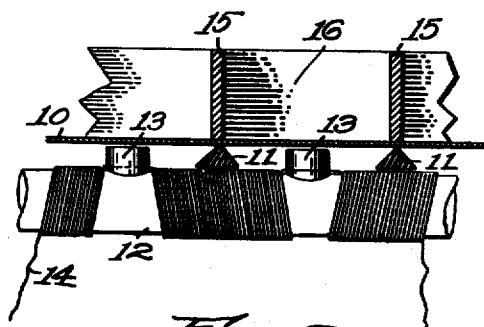
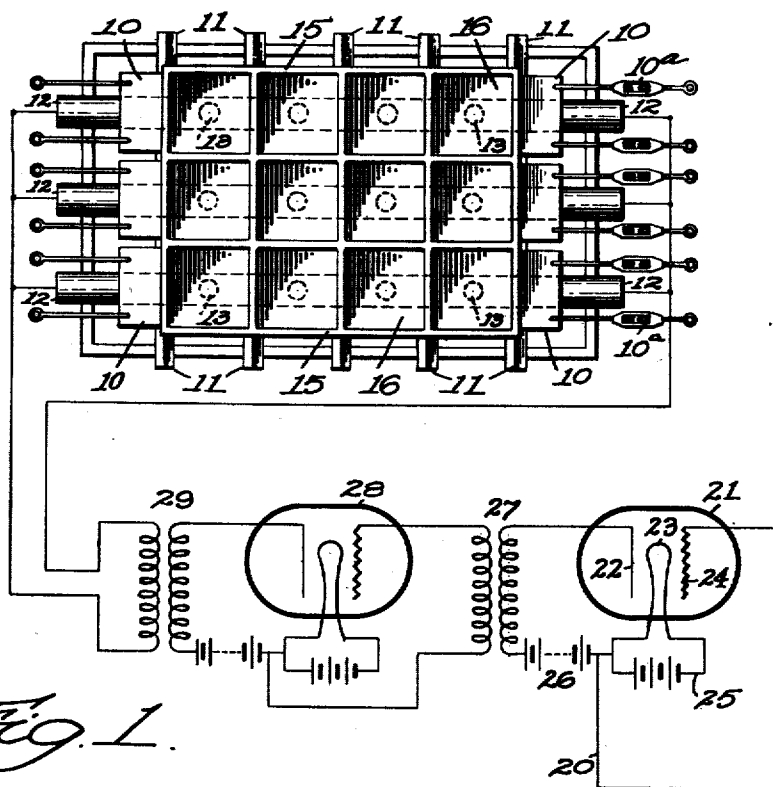
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SOUND REPRODUCING DEVICE

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UNITED STATES PATENT OFFICE.

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SOUND-REPRODUCING DEVICE.

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This invention relates to apparatus for reproducing sound and particularly to an improved diaphragm or amplifier adapted for use with phonographs or other similar machines. The usual reproducing diaphragm is of considerable size. When sounds are reproduced by such a diaphragm additional audible notes or overtones are developed which depend in a general way upon the size, shape and material of the diaphragm. Other overtones represent the natural frequency of the horn, box or air chamber with which the diaphragm is associated. These overtones alter the character of the sound reproduced by the diaphragm and detract from its quality.

It is the general object of our invention to provide a novel form of sound reproducing apparatus by the use of which these objectionable overtones may be avoided and by which the purity and clearness of the original sound may be closely reproduced. In the preferred embodiment of our invention we employ a sound reproducing device comprising a large number of relatively small vibrating elements. The natural notes or overtones of these small vibrating elements and their associated air chambers, if any, are so high that they are not audible to the human ear.

These elements are caused to vibrate in unison by electrical or other suitable means. The volume of sound produced by a single such small element is correspondingly small but the desired loudness or volume of sound is attained by greatly increasing the number of vibrating elements. Provision may also be made for directing the sound in a definite direction if so desired.

The construction and operation of our improved reproducing apparatus may be understood by reference to the accompanying drawings, in which—

Fig. 1 is a plan of one form of our improved reproducing apparatus, and

Fig. 2 is a detail sectional elevation.

In the form shown in the drawings, the relatively small vibrating elements comprise parts of continuous thin metallic ribbons 10 which are supported on knife edges 11 and which are preferably tightly stretched over the knife edges in any convenient manner as by turn-buckles 10^a. Each portion of each ribbon between adjacent knife edges constitutes a separate vibrating element by which

audible sounds may be reproduced but which is so small that it has no audible overtone of its own.

Any suitable means may be provided for vibrating the several parts of the steel ribbons in unison, such for instance, as the electro-magnetic mechanism shown in Fig. 2 in which an iron or steel bar 12 extends beneath each ribbon 10 and is parallel thereto. The bars 12 are provided with spaced projections 13, one of which is positioned centrally beneath each separately vibrating element of the ribbon 10. A wire 14 is wound around each bar 12, the winding being reversed between each pair of projections 13.

When a current of electricity is sent through the wire 14 the bars 12 are thus divided into a series of electromagnets, the adjacent projections 13 being of opposite polarity. A separate electro-magnetic circuit is thus provided between each pair of projections and includes the portion of the bar between the projections and also the portion of the steel ribbon extending from one projection to the other and closely adjacent thereto.

It is frequently desirable to direct the sound from the vibrating elements in a definite direction and for this purpose we may provide a cellular or grid-like framework 15 supported adjacent the ribbons 10. This framework provides small air chambers or cells 16 substantially corresponding in area and position to each vibrating ribbon element. The upright walls of the cells direct the air in the desired direction.

By using this cellular structure comprising a large number of air chambers in place of the usual box or horn we avoid all objectionable overtones associated with the usual large horn or air chamber. The overtones of the chambers 16 are of too high frequency to be detected by the ear.

Any suitable provision may be made for supplying a variable electric current to the wire or wires 14. One form of apparatus suitable for supplying such current is shown in Fig. 1 and comprises an electric circuit 20 adapted to carry a small variable current of electricity such as may be received from a phonograph record or from a telephone transmitter. The current in the circuit 20 is conducted to an amplifier of suitable form, which may comprise a vacuum tube 21, a

plate 22, a filament 23, a grid 24, a filament heating battery 25 and a high tension battery 26. The current is first increased in voltage and then transformed and increased in volume by a transformer 27. It may be still further increased by the use of one or more additional amplifiers 28 and transformers 29. By this or similar apparatus the slight variable current taken from a phonograph or telephone circuit may be increased to an amount sufficient to effectively magnetize the bars 12 and projections 13 and to cause such vibrations of the ribbon elements as will produce the desired volume of sound.

We have also indicated in Fig. 1 a form of phonograph record and record-engaging element by which a variable current may be developed direct from the phonograph record. For this purpose the record is formed upon a steel disc 30 having a spiral ridge 31 formed thereon. The record is formed by variably magnetizing the different parts of the ridge 31, and the reproducing element engaging the disc comprises two magnets 32 and 33 having their pole pieces touching the opposite sides of the V-shaped ridge 31. These magnets are connected in series in the circuit 20, and the small variable current induced by the varying magnetism of the ridge 31 passes through the amplifier 21 and such additional amplifiers 28 as may be necessary, until the current is of such volume that it will effectively magnetize the electro-magnets having the projections or pole pieces 13. These magnets thereupon cause all of the steel ribbon sections between the supports 11 to vibrate in unison and with the same amplitude, thus producing a small volume of sound from each element, free from audible overtones. The total volume of sound may be increased as desired by adding more vibrating elements, the number of which may be extended indefinitely.

Having thus described our invention it will be evident that changes and modifications may be made therein by those skilled in the art within the spirit and scope of our invention as set forth in the claims, and we do not wish to be otherwise limited to the details herein disclosed but what we claim is:—

1. A sound reproducing device comprising a unitary resilient vibrating member subdivided by engagement of contacting elements therewith into a large number of relatively small connected vibrating portions each reproducing the same sound and each of a length so short that its natural tones are inaudible.

2. A sound reproducing device comprising a unitary resilient vibrating member sub-

divided by engagement of contacting elements therewith into a plurality of relatively small connected vibrating portions each of a length so short that its natural tones are inaudible, and means for separately vibrating each such portion, all of said portions being vibrated simultaneously and with equal amplitude.

3. A sound reproducing device comprising a unitary resilient vibrating member subdivided by engagement of contacting elements therewith into a large number of relatively small connected vibrating portions each of a length so short that its natural tones are inaudible, electrically operated devices for vibrating all of said portions simultaneously, means to produce small variable currents of electricity, and amplifying devices interposed between said means and said electrically operated devices whereby an effective variable current is supplied to said devices.

4. A sound reproducing device comprising a steel ribbon, a plurality of spaced supports for said ribbon effective to sub-divide said ribbon into separately vibrating connected portions, each of a length so short that its natural tones are inaudible, and magnetic means to separately vibrate the portion of said ribbon between each pair of supports.

5. A sound reproducing device comprising a steel ribbon, a plurality of spaced supports for said ribbon effective to sub-divide said ribbon into separately vibrating connected portions, means to stretch said ribbon tightly over said supports to render its natural tones less audible, and magnetic means to vibrate the portions of said ribbon between the pairs of supports.

6. A sound reproducing device comprising a sounding box of cellular construction, a unitary member sub-divided by engagement of contacting elements therewith into relatively small connected vibrating portions, each subdivided portion thereof being positioned at the back of a cell in said box, and means to vibrate all of said portions in unison.

7. A sound reproducing device comprising a unitary vibrating member sub-divided by engagement of contacting elements therewith into a large number of relatively small connected vibrating portions, means to vibrate all of said portions simultaneously, and a plurality of relatively small air chambers, one of said chambers being associated with each small vibrating portion, whereby the direction of the sound waves may be controlled.

In testimony whereof we have hereunto affixed our signatures.

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