M. L. SEVERY.

SOUND PRODUCING DEVICE.

APPLICATION FILED MAR. 22, 1913.

1,218,324.

Patented Mar. 6, 1917.

3 SHEETS—SHEET 1.

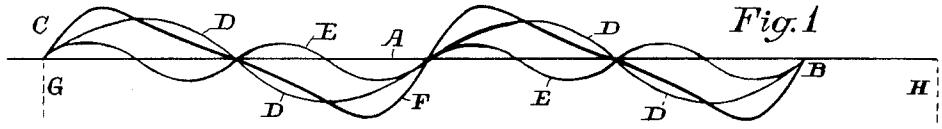


Fig. 1

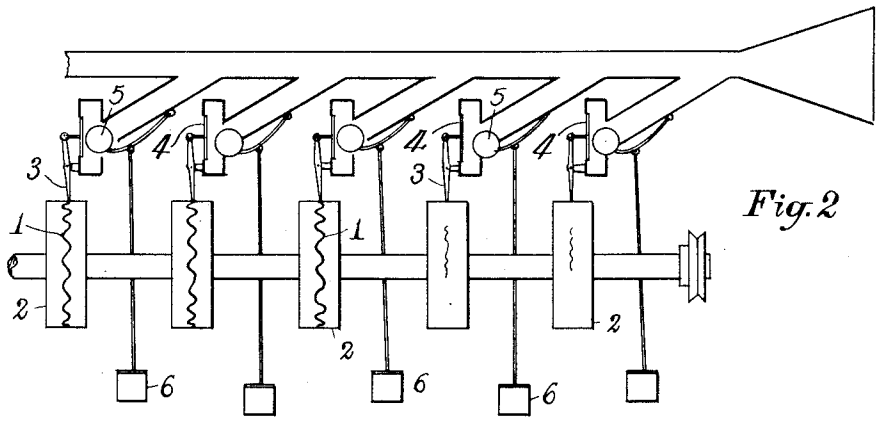


Fig. 2

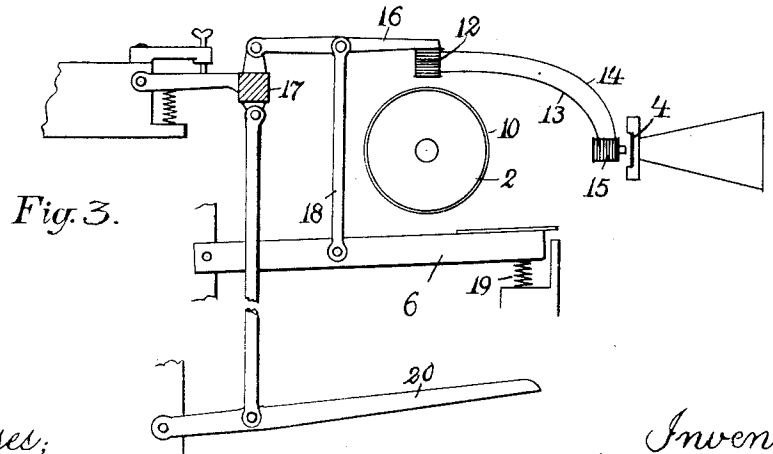


Fig. 3.

Witnesses;

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3 SHEETS—SHEET 2.

Fig. 4.

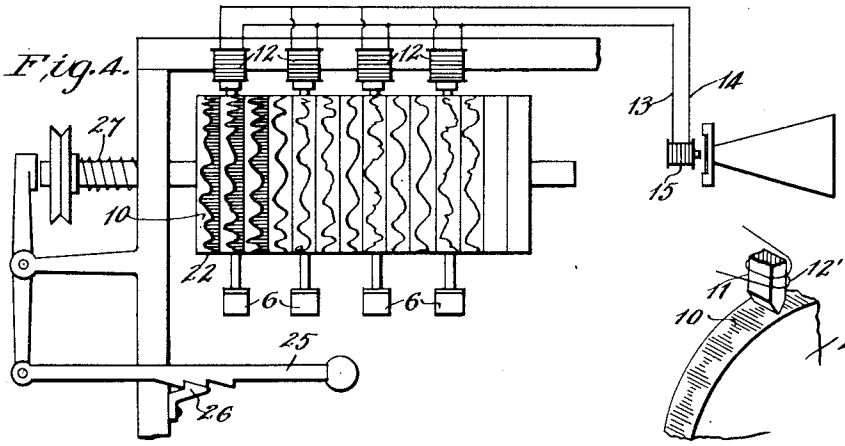


Fig. 5.

Fig. 6.

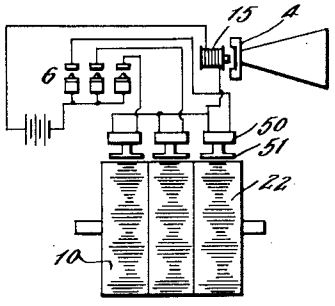


Fig. 7.

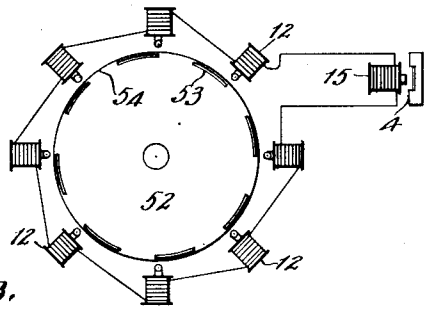
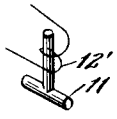


Fig. 8.



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3 SHEETS—SHEET 3.

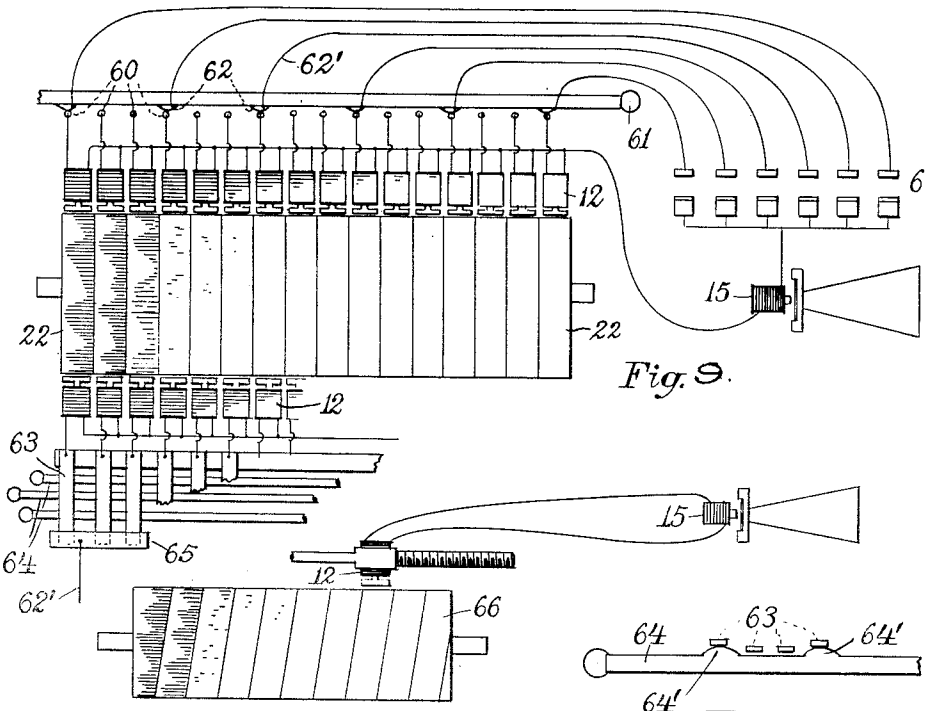


Fig. 9.

Fig. 13.

Fig. 10.

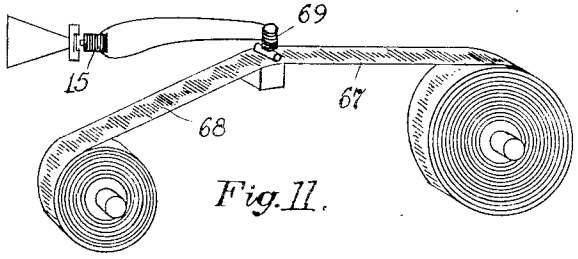
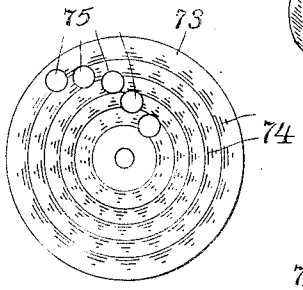


Fig. 11.

Fig. 14.



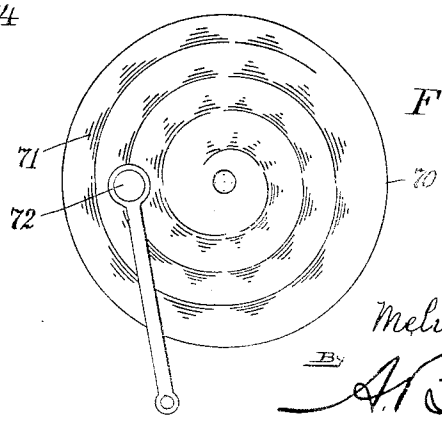


Fig. 12.

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UNITED STATES PATENT OFFICE.

MELVIN L. SEVERY, OF ARLINGTON HEIGHTS, MASSACHUSETTS.

SOUND-PRODUCING DEVICE.

1,218,324. Specification of Letters Patent. Patented Mar. 6, 1917.

Continuation of application Serial No. 357,978, filed February 18, 1907. This application filed March 22, 1913. Serial No. 756,169.

To all whom it may concern:

Be it known that I, MELVIN L. SEVERY, a citizen of the United States, and a resident of Arlington Heights, in the county of Middlesex and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Sound-Producing Devices, of which the following is a full, clear, and exact description.

The object of the present invention is the construction of an improved musical instrument in which the sonorous vibrations are produced electromagnetically by the movement of phonograms of magnetic material past electromagnetic sound producing mechanism.

The complete device is a keyed instrument capable of delivering a wide range of tones varying both in quality and pitch. Subsidiary features of the invention are a magnetic phonogram or timbre form of even surface and varying lateral extent and a special form of magnet pole piece for coaction with such timbre form, these devices being peculiarly adapted to the musical instrument of the type herein described because they permit a ready tone control both by pedal and key action.

In the drawings:—

Figure 1 is a diagram graphically representing a sound vibration;

Fig. 2 is an elevation of a musical instrument embodying in a crude form the fundamental idea of the invention;

Fig. 3 represents in side sectional elevation a preferred embodiment of the invention;

Fig. 4 is a front elevation of the same;

Fig. 5 is a perspective view of one of the timbre form disks;

Fig. 6 is a diagrammatic view showing the use of microphones;

Fig. 7 is a diagrammatic view showing a multiple arrangement of electro-magnets or similar responsive devices;

Fig. 8 is a perspective view of a preferred form of magnet pole piece;

Fig. 9 is an elevation of a type of device embodying my invention, and in which a plurality of timbre forms differing in the quality of tone production but of the same pitch are adapted to be operatively connected with the translating device singly or in any desired combination;

Fig. 10 is a detail view of certain of the features shown in Fig. 9;

Fig. 11 is a perspective view of a tape provided with timbre forms;

Fig. 12 is a face view of a disk having spirally disposed timbre forms;

Fig. 13 is a view of a cylinder having a helical arrangement of timbre forms; and

Fig. 14 is a face view of a disk having a series of concentric circular timbre forms.

In Fig. 1 which is the graphic representation of certain sound vibrations A represents a string stretched between the points B and C. D represents the string when vibrating with three nodal points and E the string vibrating with seven nodal points, these being two of the string's harmonics. When the string is vibrated to produce both harmonics simultaneously its resultant form is that shown in the heavy line F.

By engraving an endless groove 1 patterned after this line F in the periphery of a disk 2 (Fig. 2), and having one end of a small lever 3 engage such groove with its opposite end connected with the diaphragm 4 of a gramophonic reproducer, the rapid rotation of said disk will cause the reproducer to emit a musical tone embracing the two harmonics illustrated, the pitch depending upon the speed of rotation of the disk.

The disk being in continuous motion, with a damper 5 normally pressed against the diaphragm 4, no music will be heard except when such damper is removed as by the depression of a key 6. By a duplication of such devices, as is indicated in Fig. 2, but with the grooves 1 suitably varied in distances from crest to crest, a musical instrument may be produced capable of any desired range of melody and harmony. The device of Fig. 2 is illustrated merely to make clear the fundamental idea of my invention and the availability of timbre forms derived empirically or graphically as contradistinguished from sound records.

In my preferred construction I use a superficially variable acoustic timbre form 10 upon the smooth periphery of the disk 2

as shown in Fig. 5, composed of some magnetic substance, or magnetically attractive substance and rotated in close proximity to a magnet whose pole 11 is laterally extended. The magnetic variations thus set up in the windings 12′ are communicated through suitable wires 13, 14 to the magnet 15 (see Fig. 3) and cause the latter to vibrate its diaphragm 4 and emit a musical tone corresponding to that for which the form 10 was designed. The timbre forms 10 may be along one side of a straight line, as shown in Fig. 4, but I prefer to have them double as indicated in Fig. 5, the opposite edges being symmetrical with reference to each other. This places the center of attraction at the center of the magnetic pole piece 11, and consequently affects the windings 12′ more uniformly. Instead of making the core 11 a sharpened plate I prefer to make it T-shaped as shown in Fig. 8, and this gives satisfactory results with less material.

The magnets 12 may normally be elevated beyond the possibility of being affected by the forms 10, each being capable of depression by a key 6 almost into touch with the corresponding form. As shown in Fig. 3 each magnet 12 is supported by an arm 16 pivoted to the bar 17 and joined by a rod 18 to a corresponding key 6. The stiff spring 19 holds the key 6 in its normal position and hence holds its magnet 12 away from its form 10. The yielding resistance of such springs gives to the performer the ability of varying the loudness of the music in proportion to the pressure applied to the keys.

By having the bar 17 spring supported and capable of depression by a pedal 20 the loudness of all the notes simultaneously sounded can be varied by a suitable actuation of such pedal, irrespective of the individual control of the notes. As shown in Fig. 3 the depression of this pedal 20 moves the magnets 12 farther from the timbre forms and thus diminishes the loudness of all the notes.

It is not necessary to furnish a separate translating device for each magnet 12, inasmuch as all or any number of the latter can be wired to a single magnet 15 and thereby superpose a large number of different vibrations upon a single diaphragm 4. The system of wiring adapted for this is the one illustrated in Fig. 4, wherein is shown means by which the instrument can be shifted at will to emit musical tones of various timbres. Upon a cylinder 22 is a plurality of timbre forms 10 for each magnet 12, any one of which can be brought beneath such magnet by adjusting the roller longitudinally. The timbre forms thus furnished to each magnet are shown as three in number with the central one of each set presented to its magnet, and while the three forms are preferably of the same pitch or frequency of repetition, they are designed to be quite dissimilar in tone quality.

By releasing the stop 25 from its lock 26 this roller is easily shifted longitudinally to present one set of the three qualities of timbre forms to their magnets, a spring 27 acting to retain said stop in engagement with its lug.

It is evident that by having one set of timbre forms arranged to reproduce the tone of a violin; another those of a flute; another those of a piano and so on, a considerable variety in the quality of the music can be had.

Fig. 6 illustrates a modified construction in which a microphone 50 is wired in circuit with the telephone or other translating device, each microphone having a transverse arm 51 located close to a magnetic timbre form 10. To increase the energy of the magnetic pulsations transmitted, and hence the loudness of the music produced, several microphones may be provided for each timbre form, the microphones being located at identical phases of the timbre form so that their action will be cumulative. An arrangement of this sort is illustrated in Fig. 7 in which, in order that the phase relation may be made clear I illustrate a disk 52 having alternate magnetic and nonmagnetic sections 53, 54, the various inductive magnets 12 illustrated in this case being connected to a common magnet 15 in attractive relation to a diaphragm.

There are many ways in which the timbre forms may be made, such as stamping them from thin sheet metal; printing them on the cylinder with a magnetic ink; printing them with a sticky ink and then dusting the impression with iron filings or other magnetic particles; by electroplating, or by using a coating of paste impregnated with magnetic filings and various other methods, as will be obvious. The main idea is to secure a uniform layer of magnetic material whose lateral extent varies according to the variations of the sound waves to be produced.

Instead of longitudinally shifting the cylinder for the purpose of varying the quality of the timbre forms delivered to the translating device, (as described with reference to Figs. 3 and 4) each of the timbre forms 10 may be provided with a magnet of its own, switches being introduced for cutting such magnets in and out. As shown in Fig. 9 each of the timbre forms rotates beneath a fixed magnet 12 which is given a terminal 60. By moving the bar 61 to put its contact 62 into touch with any one of said terminals the magnets connected with such terminals are put into circuit with the magnet 15 of the translating device. Three timbre forms of different quality but

of equal pitch are here shown as provided for each note, but the number of forms is obviously subject to variation. In the construction above described with reference to Fig. 9 for switching at will the pulsations from any one set of magnets 12 to the translating device 15, different combinations of such pulsations cannot be transmitted to the translating device. To accomplish this I show an additional series of magnets 12 which may or may not be used in conjunction with those first described, but each of which magnets is wired to a spring finger 63 normally out of touch with a contact bar 65. Immediately below these fingers are as many stop bars 64 as there are sets of magnets and qualities of timbre forms. As I have illustrated three sets of timbre forms alike in pitch but different in tone quality for each note in the instrument, I provide three stop bars 64 and give each stop bar cam-lugs 64′ spaced to contact with and elevate finger 63 three spaces apart as shown in Fig. 10.

By moving said stop bars longitudinally to elevate said fingers in accordance with a definite plan all such fingers may be put into touch with the contact bar 65 and hence into circuit with the wire 62′, or any one or any two thereof may be put into such circuit. This makes it possible for the operator to deliver to the translating device any one set of timbres or qualities of music or any combination of the same.

It is evident that by having some fine singer deliver into a phonautograph one or more complete octaves of musical notes, singing the broad A, for instance, and then having these phonautographs reproduced into timbre forms the instrument can be adapted for the repetition of the tones of the human voice. It is only necessary to secure a phonautograph of a single octave of the original notes for the reason that the other tones required are the mere variants in speed of the first.

Thus far I have mainly restricted the apparatus to musical work, but the records may not be timbre forms alone, but may be adapted to the production of any kinds of sounds. For example, a timbre form of my characteristic type involving a strip of magnetic material varying in lateral extent might be used for continuous records of songs, speeches and so on, in the manner indicated in Fig. 11. Similar disk records might be made and would have the form diagrammatically represented in Fig. 12. A cylinder record would similarly take the form shown in Fig. 13. A plurality of circular timbre forms may be concentrically arranged on a single disk as illustrated in Fig. 14. In Fig. 11 I show the timbre form as symmetrical with reference to its median line, while in Figs. 12, 13, and 14 one boundary line is straight. While I prefer the arrangement shown in Fig. 11 the two are interchangeable for most purposes including the specific types of records shown in Figs. 11 to 14 inclusive.

Disk records such as shown in Fig. 14 may obviously be substituted for a group of disks of the type shown in Fig. 9.

What I claim as my invention and for which I desire Letters Patent is as follows, to wit:—

1. The combination of a plurality of acoustic timbre forms having smooth surfaces, each composed of magnetically attractive material of varying lateral extent; magnets having their poles within the influence of said forms; a telephonic receiver wired to said magnets; means controlling the circuits of said magnets for causing any one or more to affect said receiver; and means for producing relative travel of said forms past said magnets.

2. In an instrument for producing acoustic vibrations the combination of a rotatable member having a smooth surface of magnetic material whose lateral extent varies according to the sound vibrations to be produced; a magnet having a laterally extended pole piece presented to such surface; and a telephonic device connected with said magnet and actuated by the magnetic variations produced therein by the movement of said magnetic surface past said pole piece.

3. In a musical instrument the combination of a rotating cylinder having a superficially variable magnetically attractive surface; a wound magnet having a T-shaped pole piece presented to such surface; and a vibrating body affected by said magnet.

4. A rotating circularly arranged line of repetitions of magnetic variations; a plurality of magnets disposed to present the poles thereof at points about said line spaced to correspond with said repetitions; and a translating device actuated by all said magnets simultaneously.

5. In a musical instrument the combination of a plurality of timbre forms each comprising a rotatable member having a smooth surface of magnetic material whose lateral extent varies according to sound vibrations to be produced by the respective forms; magnets having laterally extended pole pieces, corresponding to said timbre forms; a lever mechanism for moving all said magnets simultaneously toward or from said forms; a telephonic device associated with said magnets and operable thereby; and keys, one for each magnet, for causing said magnet to operate said telephonic device when said key is actuated.

6. In a musical instrument the combination of a plurality of timbre forms each

comprising a rotatable member having a smooth surface of magnetic material whose lateral extent varies according to sound vibrations to be produced by the respective forms; magnets having laterally extended pole pieces, corresponding to said timbre forms; a lever mechanism for moving all said magnets simultaneously toward or from said forms; a telephonic device associated with said magnets and operable thereby; and keys, one connected to each magnet for moving said magnets individually toward their corresponding timbre forms.

In testimony that I claim the foregoing invention, I have hereunto set my hand this 17th day of December, 1912.

MELVIN L. SEVERY.

Witnesses:

EDWARD S. CROCKETT,

A. B. UPHAM.