M. L. SEVERY.

MUSICAL INSTRUMENT.

APPLICATION FILED APR. 9, 1907.

973,391. Patented Oct. 18, 1910.

4 SHEETS—SHEET 1.

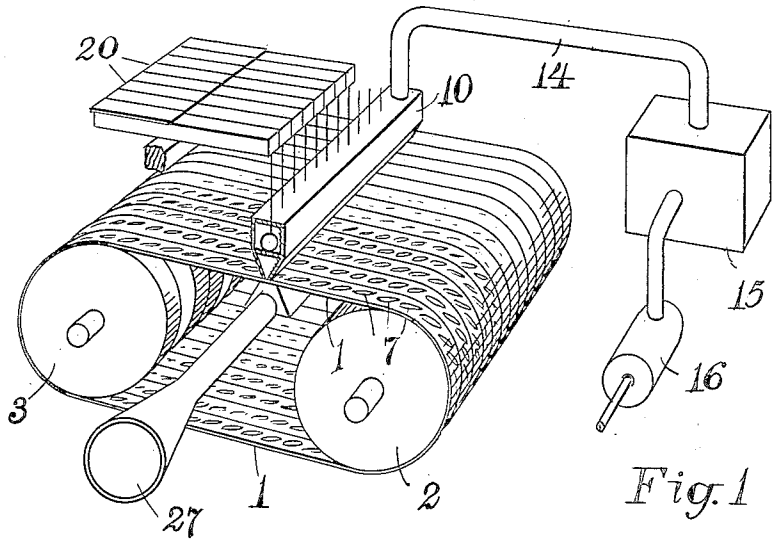

Fig. 1

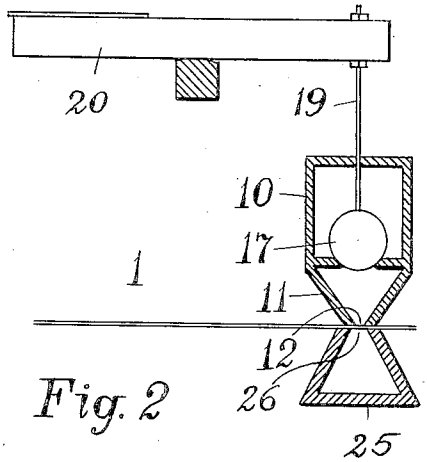

Fig. 2

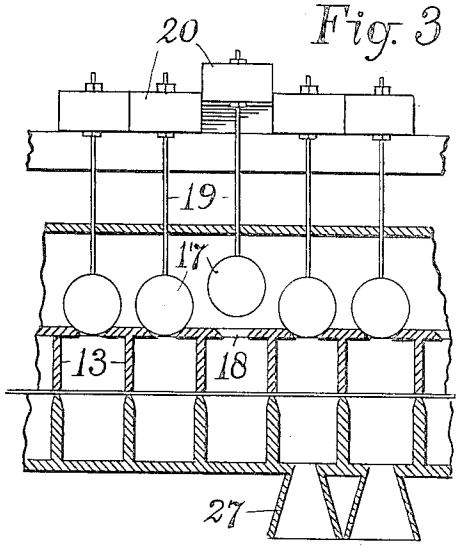

Fig. 3

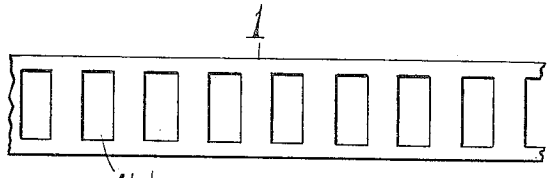

Fig. 4

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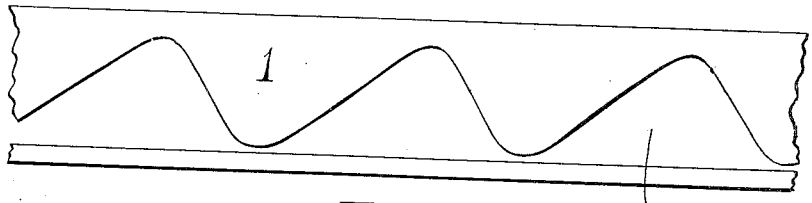

Fig. 5

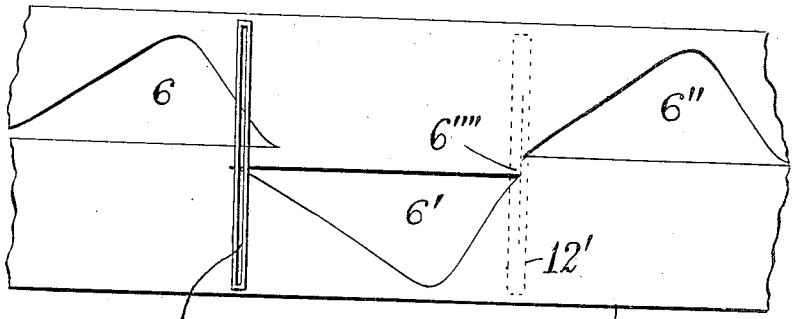

Fig. 6

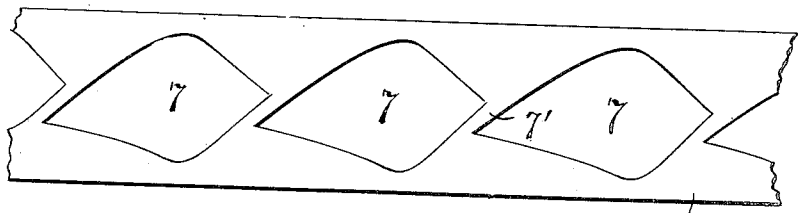

Fig. 7

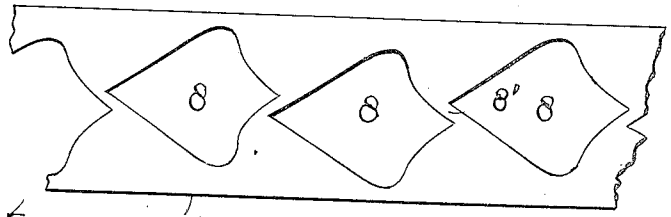

Fig. 8

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4 SHEETS—SHEET 3.

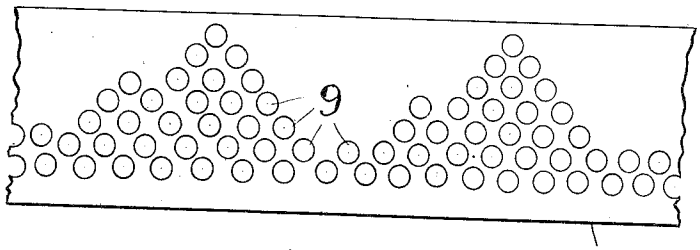

Fig. 9

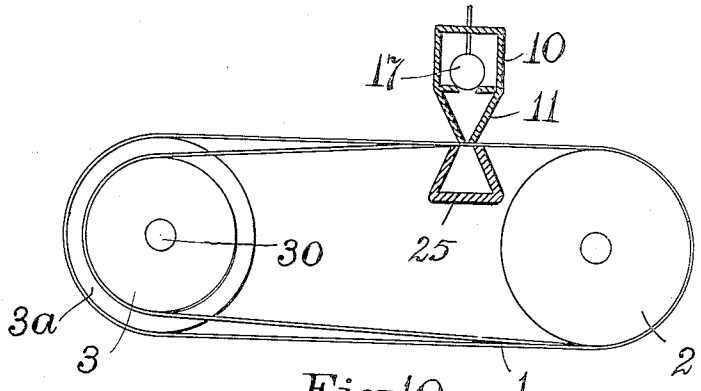

Fig. 10

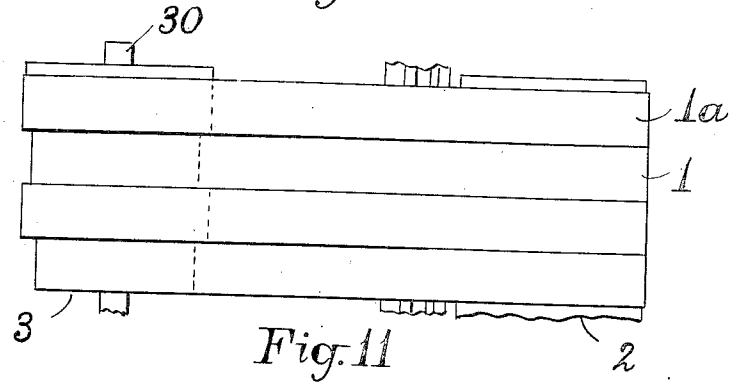

Fig. 11

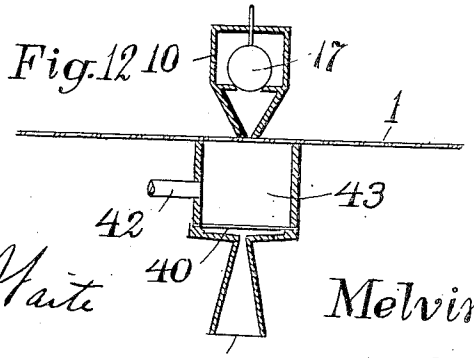

Fig. 12

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4 SHEETS—SHEET 4.

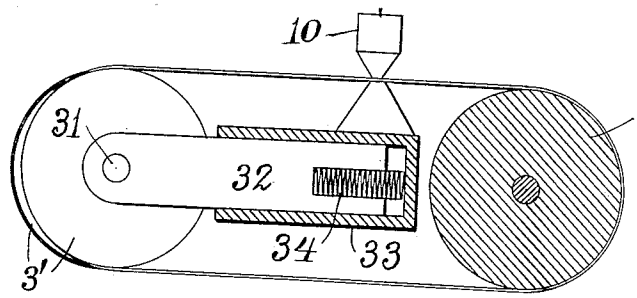

Fig. 13

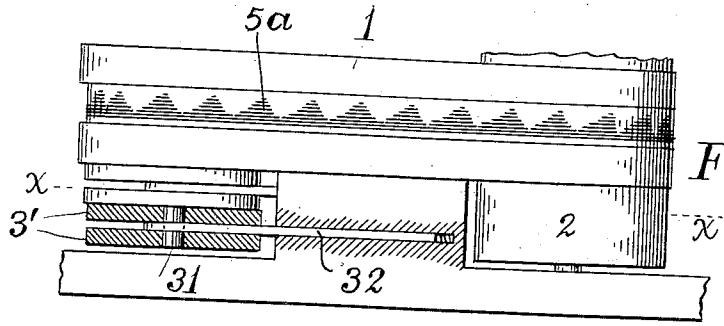

Fig. 14

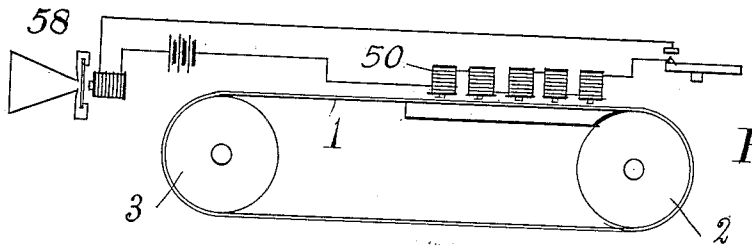

Fig. 15

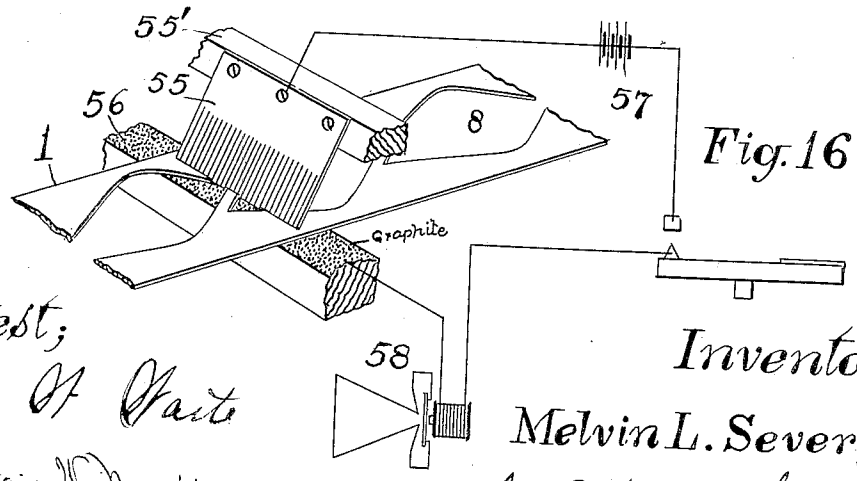

Fig. 16

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His Attorney

UNITED STATES PATENT OFFICE.

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MUSICAL INSTRUMENT.

973,391. Specification of Letters Patent. Patented Oct. 18, 1910.

Application filed April 9, 1907. Serial No. 367,216.

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 Musical Instruments, of which the following is a full, clear, and exact description.

This invention is especially designed for the production of musical sounds, although it is equally well adapted for the production of other sonorous vibrations, such as the articulation of words either spoken or sung.

Referring to the drawings forming part of this specification, Figure 1 is a perspective view of an instrument embodying the essential features of my invention. Fig. 2 is a transverse section, on a larger scale, of the blast-directing devices. Fig. 3 is a longitudinal section of the same. Fig. 4 is a face view of a fundamental type of blast-interrupting belt or tape. Fig. 5 is a face view of a blast-intercepting belt by means of which the blast is not interrupted, but caused to uniformly vary in emission. Fig. 6 is a face view of a belt wherein the openings, although separated, do not interrupt the blast. Fig. 7 shows another form of such belt wherein the openings are separated by forming them with a slight obliquity. Fig. 8 shows a similar belt wherein the openings are alternately laterally displaced for the same purpose. Fig. 9 shows a type of belt in which such openings are composed of groupings of small holes. Fig. 10 is a side view of my preferred form of belt-supporting and driving mechanism. Fig. 11 is a plan view of the same. Fig. 12 is a sectional view of a modification of the blast-receiving chamber. Fig. 13 is a side sectional elevation on the line x—x in Fig. 14 of a modified form of my belt-supporting mechanism. Fig. 14 is a plan view of the same, but with parts thereof in section. Fig. 15 is a side elevation of a form of my invention wherein a belt is provided with a variable layer of electrically attractive material, and a series of electro-magnets is arranged to coact therewith; a number of such magnets being shown as simultaneously affected by the same belt for the purpose of intensifying the sound produced. Fig. 16 is a perspective view showing a belt formed with openings and acting to variably interrupt a plurality of contact fingers in a single circuit for the purpose of suitably actuating a translating device.

The reference numeral 1 designates an endless belt or tape formed of thin sheet metal, paper or other suitable material, supported and kept in motion by the rolls 2 and 3. In this belt are numerous lines of openings against each of which lines can be directed a key-controlled air-blast, such openings being disposed to interrupt or vary the blast with a frequency and uniformity to produce a musical note. The means for thus directing the blasts of air consists of the conduit 10 into which air is forced through a pipe 14 from a wind-chest 15 kept supplied by a suitable air pump 16. Beneath this conduit is a V-shaped trough 11 divided by vertical partitions 13 into as many compartments as there are lines of openings in the belt 1, the narrow slits 12 being the discharge-mouths for the air. Through the roof of each said compartment is a port 18 normally closed by a soft ball or other form of stopper 17 designed to be raised for opening said port by means of its stem 19 attached to the rear end of a key 20. See Figs. 1, 2 and 3. By having the various lines of openings adapted for the production of several octaves of musical notes, and the keys 20 arranged similar to those of the usual key-board, this instrument can be played like a piano or organ.

To better retain the belt against the slits 12, a box 25 is supported with a narrow opening or slot 26 immediately beneath said slits, as shown in Fig. 2. One or both ends of this box may have a horn 27 for the better emission of the sonorous vibrations, or said box may be partitioned and a horn provided for each note, or for any combination of notes, as shown in Fig. 3.

While a frequent repetition of plain holes 4 shown in Fig. 4 will produce a musical note of a pitch depending upon their speed beneath the air-blast, yet such a note is practically not of pleasing quality. To render it pleasing, I form each line of openings continuous, with one or both edges thereof conforming to a resultant line such

as that illustrated in Fig. 5. Such a continuous opening through the belt, as shown in Fig. 5, or along an edge of it, is feasible, but I have devised the following ways of accomplishing the same results without cuting the belt apart; 6, 6′ are two sets of openings in Fig. 6, the one the duplicate of the other but in reverse, with the end of an opening 6 so far overlapping the neighboring end of an opening 6′ that the slit 12 continues to direct the air blast through one until the air is also blowing through the next. Hence the result is precisely the same as though the two sets of openings 6, 6′ were continuous, or formed like the opening 5 shown in Fig. 5. One drawback to this construction, however, is that it requires the belt 1 containing it to be double the width of the one in Fig. 5. This is remedied in two ways; that shown in Fig. 7, wherein the openings 7 are made approximately symmetrical laterally, but are each slightly tilted to bring their overlapping points out of contact and so leave a neck 7′ of material by which the belt is held together. The construction of Fig. 8 is much the same, with the exception that the openings 8 are all laterally symmetrical, but are alternately laterally displaced to provide the binding necks 8′. The advantage of this over the preceding is that it is much easier to lay out the curves, but after the proper form of the opening 7 can be more cheaply produced, inasmuch as a single punch and a step-by-step movement of the belt is sufficient for the manufacture thereof. Fig. 9 shows still another way in which the openings can be formed, that is by means of a large number of small holes 9 grouped into approximately the contour shown in Fig. 5.

Although there may be a single broad belt for all the lines of openings, it is more or less objectionable on account of the fact that certain of the notes in an octave are fractional as to numbers of vibrations per unit of time, and it is not productive of the best results to have a line of openings include a fraction of an opening. While this can be partially neutralized by having the belt considerably elongated, reducing the size and increasing the number of openings in a line, and making such number the nearest whole number to the fractional number theoretically required, I much prefer to have each line of openings spaced with absolute accuracy. To do this, each line of openings is formed upon a narrow tape, as shown in Fig. 1, and means are provided for suitably supporting these tapes or narrow belts when made of different lengths adjusted to receive in each case a non-fractional number of openings. The simplest way of doing this is to have the idler or supporting member a series of separate wheels or rolls 3, 3ª, loose upon a shaft 30, the driving cylinder 2 being of uniform diameter, as shown in Figs. 1 and 10, and also in Fig. 11. Each roll is made of the proper diameter to accommodate its belt 1, or 1ª when the latter is proportioned to receive a non-fractional number of openings. Another method of accomplishing the same result is that illustrated in Figs. 13 and 14. Here the rolls 3′ are all of equal diameter, but are provided with movable bearings to accommodate their respective tapes or belts. I prefer to use two thin disks 3′ for each belt, in order to locate the longitudinally movable bearing-arm 32 between the same, as shown in Fig. 14. The spindle 31 for such pair of disks is rigid with the latter but loosely held in the said bearing-arm; the latter being located in the ways 33 and resiliently pressed outward by a spring 34. Another advantage of this resilient arrangement is that the belts are all kept uniformly taut, no matter how much they stretch.

Instead of having the air-blast through the openings in the tape or belt 1 pass on to the horn 27, I may sometimes use a diaphragm 40 to which the vibrations are communicated by the succession of puffs from said openings; while the vibrations of such diaphragm are acoustically emitted through the horn 41 coöperating therewith; as shown in Fig. 12. An outlet 42 from the chamber 43 between such diaphragm and openings, allows a sufficient escape for the inrushing air-blasts.

The above described elimination of fractional timber forms is equally applicable to tapes carrying magnetically attractive substance arranged like the openings aforesaid, whether each line of attractive timber forms is associated with one magnet 50, or several of them as shown in Fig. 15. This is possible because the uniform spacing throughout each tape enables the number of magnets to be located at equal spaces apart, and so all to be simultaneously affected by the same phases of the timber forms. This greatly increases the strength of the magnetic pulsations delivered to the translating device 58, since it is the resultant of all the magnets acting together. This elimination of fractional timber form openings makes it equally possible to arrange several air-blasts to simultaneously act upon a tape, and similarly increase the volume of the sound produced.

Fig. 16 illustrates how a tape 1 having openings 8 therein, such as are used in connection with the air-blast above described, can be employed for electrically operating a translating device. Here the tape is made to travel across a bar 56 preferably of high resistance, as graphite, in circuit with a telephone receiver or translating device 58, and beneath a series of fine transversely ar-

ranged fingers 55 in circuit with a current-source and said receiver; said fingers being preferably of metal. When, by the depression of a key and the closing of the circuit, an electric current passes to the receiver, the latter's magnet will be energized in proportion to the number of said fingers in contact with the bar 56, and such number will depend upon the cross-section of opening at such instant beneath. Consequently, as the tape rapidly travels across said bar, the receiver will be made to yield a musical note of a pitch dependent upon the rapidity of such travel, and of a timber dependent upon the shape of the openings. The fingers 55 are held by the fixed rail 55′, and the current-source may be the batteries 57.

The reference numeral 5ª in Fig. 14 designates timber forms composed of a magnetically attractive substance, as iron filings, pasted upon the belt or tape; and which may be used in connection with a single magnet or several, as above described. Where several electromagnets 50 are used, as illustrated in Fig. 15, it is of course necessary to have them spaced the same as the magnetic material 5ª shown in Fig. 14, in order that all shall be affected synchronously. The timber form here illustrated is wholly continuous, as it is hardly so necessary to interrupt the timber forms as it is in the cases where the same are openings through a thin belt, in order to preserve the integrity of such belt. There are cases where such mechanical interruption is necessary, however, even for an unperforated belt. For example, when a single reciprocating printing surface is used for applying a sticky ink to the belts with a step-by-step motion of the latter, it is preferable to have the impressions slightly separated instead of overlapping to prevent inequality in thickness of ink applied, and consequently inequality in thickness of iron filings later incorporated therein. This would be especially the case where the iron filings composed a part of the ink or paste applied as above.

Although I have described the belts 1 shown in Fig. 10 as moved by the cylinder 2, while the unequal rolls 3 3ª are the ones loose on their shaft 30, it is evident that such arrangement is capable of reversal; that is, the rolls 3, 3ª may all be fixed on their shaft 30 and driven thereby, and the cylinder 2 be made a series of equal rolls loosely mounted on a common shaft. In such case, the rolls 3, 3ª would become the driving cylinder, but having its diameter varied to accommodate the belts thereon.

In addition to the paste of iron filings 5ª shown in Fig. 14, as described above, a thin sheet iron or steel belt can be used in connection with one or more electromagnets in the same manner; such belts being made like that shown in Fig. 5, which strictly speaking is not formed with openings, but is serrated along one edge, and may as is evident be made similarly serrated along both edges.

In the types of separated overlapping timber form openings described hereinbefore, the air blast is described as so thin that the overlapping is necessary in order that there shall be no interruption of such blast. By making the slit 12 somewhat wider said overlapping becomes unnecessary, since the blast will be issuing from one edge of the slit through one extremity of the opening before it has ceased issuing from the opposite edge through the extremity of the preceding opening. This is illustrated in Fig. 6, where the adjacent ends of the timber form openings 6′, 6″ are shown as terminating upon the same transverse line, and the dotted lines indicate the slit 12′. The advantage of this construction is that the outlines of the timber form openings can be formed in the same manner as the opening 5, and then the openings 6′, 6″ moved bodily apart, as it were, to leave the connecting necks 6″ ″.

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

1. A musical instrument comprising a thin laterally extended member having means for continuous motion in its own plane and formed with openings through it, and means for directing a fluid current against the face of said member, said current being transversely extended with respect to the direction of motion of said member at the place where said current strikes it, and said openings being in the form of so-called sine-waves, each opening being longer than the distance from its center to the center of the next opening, and the extremities of adjacent openings being laterally shifted to avoid each other.

2. The combination of a series of endless belts composed of flexible material, means for supporting and moving them, the moving means for said belts being rotated in unison, said belts being each formed with a longitudinally-arranged series of operating areas, and means actuated by the passage of said operating areas for producing musical tones, each belt's area coacting with said means for producing a note of the musical scale different from that of its neighbors, and said belts being made of proper lengths to avoid forming fractional operating areas.

3. The combination of a series of endless belts composed of flexible material, means for supporting and moving them, and means operated by the passage of definitely located areas on said belts for producing acoustic vibrations; said belts being of proper lengths to avoid fractional parts of said areas, and

said supporting and moving means consisting of a cylinder common to all the belts, a shaft, and rolls equal in number to said belts located on said shaft, said cylinder and rolls being of proper diameters to support the belts suitably taut.

In testimony that I claim the foregoing invention, I have hereunto set my hand this 4th day of April, 1907.

MELVIN L. SEVERY.

Witnesses:
HARRY L. PEABODY,
A. B. UPHAM.