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J. K. DELANO

SOUND RECORDING AND REPRODUCING APPARATUS

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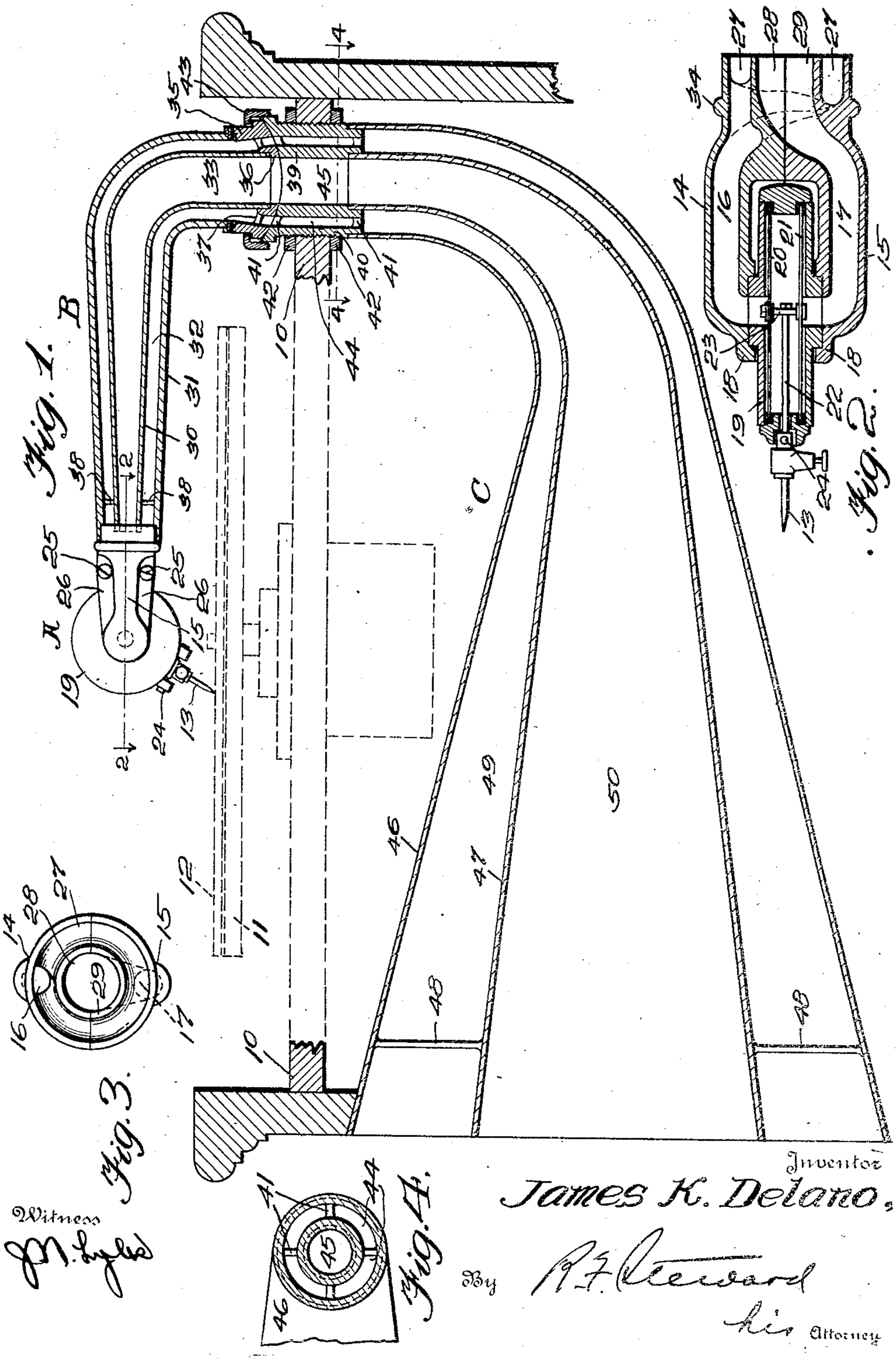

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Witness

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UNITED STATES PATENT OFFICE.

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SOUND RECORDING AND REPRODUCING APPARATUS.

Application filed July 19, 1917. Serial No. 181,514.

To all whom it may concern:

Be it known that I, JAMES K. DELANO, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Sound Recording and Reproducing Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to sound recording and reproducing apparatus; and it has to do more particularly with apparatus of this general class in which the sound conducting or amplifying means comprises conduits which provide separate sound paths between the vibratory element or diaphragm of the sound box and the opposite extremity of said sound conducting or amplifying means. More specifically, the invention relates to a talking machine or phonograph having a sound box or reproducer provided with a plurality of separate impulse chambers in operative relation to the vibratory element of the sound box, in combination with a compound tone arm and an amplifying horn both embodying. in a compact unitary structure, separate conduits which afford separate continuous sound paths between said impulse chambers and the outer end of the amplifying horn.

It is recognized in the art that the ordinary method of conducting sound from the sound box through the usual simple tone arm and amplifying horn of a sound reproducing machine, or vice versa when recording, does not give optimum results for both high and low pitched tones, and that the form, dimensions, and other characteristics of such tone arm and horn as usually constructed are in the nature of a compromise between the characteristics theoretically best suited to tones of widely differing pitch. As a result of such compromise, the resultant sounds, as recorded or reproduced by the ordinary talking machine, differ in composition, power and tonal value from the original sounds.

One of the objects of the present invention is the elimination in large measure of the stated difficulties inherent in talking machines at present commonly in use, thereby making possible much more nearly correct recording and reproduction of sounds.

Another object of the invention, is to materially increase the sound volume and power of which the usual talking machine is capable, while at the same time guarding against interference of sound impulses, a defect characterizing constructions heretofore proposed.

Another object of the invention is to embody the above advantages in a construction which is simple and compact mechanically and which is comparatively inexpensive to manufacture.

With these objects in view, as well as others which will be hereinafter apparent to those skilled in this art, the invention comprises the novel construction and arrangement of apparatus parts as hereinafter described and as pointed out in the claims.

In order to more fully explain the broad principles underlying the invention, reference is made to the accompanying drawings which illustrate one concrete example of apparatus within the scope of the invention. It is to be understood that the invention is not limited to this particular form of apparatus, although this form embodies important practical advantages and especially desirable features of construction. In these drawings, which are more or less diagrammatic in character,

Fig. 1 is a vertical section through the tone arm and horn of a talking machine constructed in accordance with the invention, certain parts being in elevation;

Fig. 2 is a section through the sound box on the line 2—2 of Fig. 1;

Fig. 3 is an end view of the sound box throat; and

Fig. 4 is a transverse section through the coupling between the tone arm and horn, on the line 4—4 of Fig. 1.

Referring to that form of the invention shown in the drawings, 10 represents conventionally the case of a talking machine of the concealed horn type, the usual rotary table and a sound record disk mounted thereon being indicated in dotted lines at 11 and 12, respectively. The sound box or reproducer, tone arm, and horn or amplifier are indicated generally at A, B, and C, respectively. In the present example the horn is stationary, while the tone arm has a swivel mounting permitting it to move freely as the stylus 13 tracks in the record groove.

Referring now to the detailed construction of the sound box or reproducer, the

particular form here shown comprises two tubular parts or sections 14 and 15, affording separate lateral sound passages or chambers 16 and 17, which are substantially circular in section and which communicate with opposite sides of the sound box diaphragm to be referred to later. The sound box sections may conveniently be metal castings, formed with opposed terminal flanges 18 which support between them the holder 19 for the vibratory impulse-transmitting element, said element in this instance taking the form of a double diaphragm, 20—21, although a single diaphragm may be employed. The diaphragm or diaphragms may be thin plates or sheets of mica, glass, copper, or other material suitable for the purpose. The actuating means for the double diaphragm here shown comprises the stylus bar or lever 22 secured to the diaphragm members by cross piece 23, and pivoted at 24 to the holder or support 19, the stylus or needle being secured to the stylus bar in the usual manner. The two parts 14 and 15 of the sound box may be secured together in any suitable manner, as by screws 25 passing through pairs of mating flanges of which the pair on part 15 is shown at 26 (Fig. 1).

As clearly shown in Figs. 2 and 3, the sound box sections are so formed at the throat end, or end away from the diaphragm, that, when the sections are assembled, the passage 16 expands rearwardly into an annular passage or conduit 27, while the passage 17 merges rearwardly into the central passage or conduit 28, which may be circular in cross section and coaxial with the annular conduit, as shown, the wall 29 being common to both passages.

The compound tone arm B is of such character as to provide tone conducting and amplifying continuations of the separate passages of the reproducer. In the present example the tone arm comprises inner and outer coaxial tubes 30 and 31, respectively, which flare gently from their junction with the reproducer and which provide the outer annular conduit 32 and the inner conduit 33. The junction between the reproducer and the double tone arm may be effected in any appropriate manner, but in the present construction the central tube 30 fits snugly within central conduit 28 of the reproducer, while the outer tube slips over the throat of the reproducer and into contact with bead 34 thereon which serves as a stop. The tone arm and the reproducer are thus held together frictionally in the present instance.

The double tone arm, after extending horizontally for the necessary distance from the reproducer, bends downwardly and terminates in a double bearing collar consisting of annuli 35, 36, secured to the ends of the tone arm tubes, the annuli being spaced apart and held together by thin webs 37. Similar spacing and securing webs 38 are provided between the tubes near the other end of the tone arm. The lower edges of the annuli 35, 36, are spherically convex for bearing engagement with the spherically concave upper edges of a stationary bearing and coupling member extending vertically through the case and comprising the inner and outer coaxial tubes 39 and 40, secured together, in spaced relation by thin webs 41, the coupling being held in position as by threaded collars 42 engaging external threads on the coupling. A flanged retaining collar 43 loosely engaging an external shoulder on collar 35 and screwing down on the upper end of the stationary coupling and bearing member, maintains the tone arm on its bearing, permitting slight up and down movement and free lateral swing. By the means described, the conduits 32 and 33 of the tone arm are maintained always in registry respectively, with the outer annular passage 44 and the central passage 45 of the coupling member. While the described form of coupling is a good one, any other type of coupling may be used which will permit swiveling or universal movement of the tone arm and at the same time maintain continuity of the tone arm conduits with the horn conduits to be hereinafter described.

The horn or amplifier C comprises the outer horn 46 and the inner horn 47, the horns being arranged coaxially and frictionally or otherwise held in proper spaced relation at their smaller ends by the coupling member, while spacing and securing means such as thin webs 48 may be provided near the large ends. The resultant annular conduit 49 is thus a continuation of annular conduits 32 and 44 before mentioned, while the central conduit 50 is similarly a continuation of the central conduits 33 and 45. The horn may have any desired shape in cross section, such as circular, elliptical or rectangular.

In the construction described it will be seen that provision is made for separately amplifying tones of high and low pitch, the larger horn 46 and the intermediate passages connecting it to the reproducer chamber 16 having characteristics especially adapted to amplify tones of low pitch; while the smaller horn 47, communicating by an independent path with the reproducer chamber 17, is adapted to amplify tones of relatively high pitch. Besides the effect produced by thus employing a plurality of amplifying means of different sizes and characteristics, while maintaining the sound impulses in the several amplifying means substantially separate and distinct until the final point of emergence or projection, there is the further effect, in the specific construction illustrated, produced by the presence of the outer an-

nular amplifying chamber which has amplifying characteristics peculiar to itself as distinguished from merely a large horn. Also, by using suitable vibratory material for the wall common to the amplifying conduits, the tone in each conduit may be modified advantageously by vibration transmitted from the other conduit; but this is not to be understood as an essential feature of the invention, broadly considered. Apart from all other considerations, the construction of the separate sound conduits with a wall in common, especially where the conduits are nested or coaxially disposed as in the specific example given, is mechanically advantageous and desirable.

Where a double reproducer diaphragm is employed, the character and especially the amplitude of the sound impulses supplied to the separate conduits leading from the sound box may in some cases be differentiated to advantage by employing diaphragms of different vibratory characteristics. For example, the diaphragms may be of different thicknesses, or of different diameters, or of different materials; or the stylus may act upon the diaphragms at different leverages. As a rule, the vibrations of greater amplitude should be transmitted through the larger horn, and those of less amplitude through the smaller horn. In general, each diaphragm should be connected to that horn best adapted to convey impulses characteristic of said diaphragm.

While the principles of the invention have been explained in connection with a talking machine in which the amplifying horn is stationary, it is evident that the broad invention may be embodied in machines in which there is no relative movement between the horn and the tone arm, as, for example, where the horn swings with the tone arm.

Other changes and modifications coming fairly within the appended claims are contemplated by the invention.

What I claim is:

1. The combination, with a sound box having a plurality of vibratory diaphragms and provided with a separate sound conduit leading from each of said diaphragms, of a tone arm embodying separate sound conduits constituting continuations of the sound box conduits, an amplifying horn also embodying separate sound conduits, and a swivel coupling between said tone arm and said horn, said coupling being arranged to permit movement of the tone arm while holding the tone arm conduits and horn conduits in proper respective registry.

2. In a talking machine or the like, the combination with a sound box comprising a plurality of vibratory elements, of a compound tone arm having separate substantially coaxial conduits each separately communicating with one of said vibratory elements, a compound horn affording separate substantially coaxial amplifying chambers adapted to communicate, respectively, with the tone arm conduits, and a coupling between said tone arm and horn arranged to maintain the tone arm conduits respectively in registry with the corresponding horn chambers, while permitting movement of the tone arm.

3. In a talking machine or the like, the combination with a sound box comprising two diaphragms and common actuating means therefor, of two tone arms arranged one within the other and communicating by separate passages with the two diaphragms, two amplifying horns arranged one within the other, and coupling means connecting said horns, respectively, with said tone arms in such manner as to permit relative movement between said tone arms on the one hand and said horns on the other, while maintaining continuity of communication between each tone arm and its cooperating horn.

4. In a talking machine or the like, the combination, with a sound box having a plurality of vibratory diaphragms and provided with separate sound conduits leading from opposite sides of each of said diaphragms, of amplifying means embodying separate sound conduits arranged one within the other constituting continuations of the respective sound box conduits, said amplifying means comprising a plurality of sections so connected as to permit relative movement between the sections while maintaining the continuity of the separate sound conduits embodied therein.

In testimony whereof I hereunto affix my signature.

JAMES KENDALL DELANO.