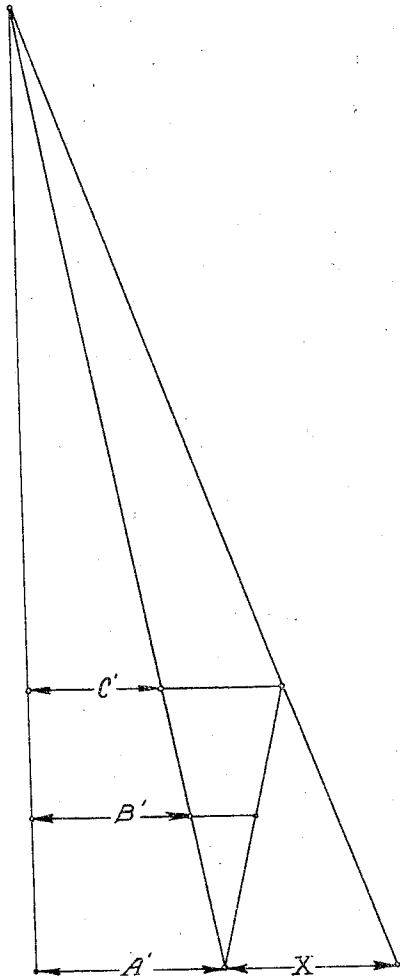


1,190,787.

Patented July 11, 1916.
2 SHEETS—SHEET 1.



Full size construction
to obtain length of "X."

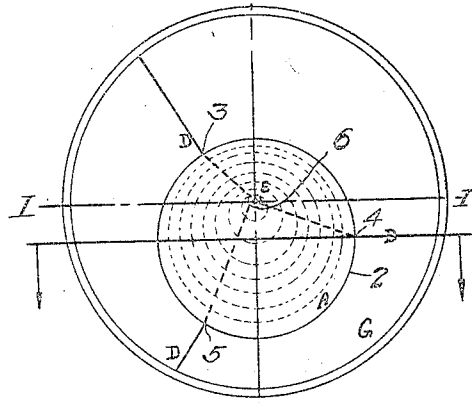


Figure 2.

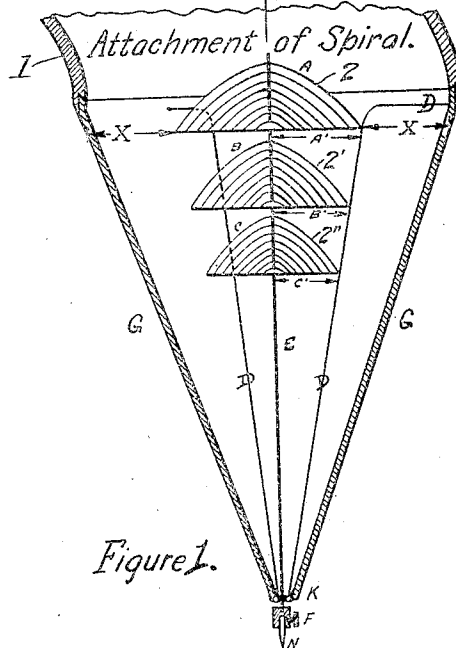


Figure 1.

The general form for radius of Voice Cone
of θ and Volume V is " r " = $\sqrt[3]{\frac{V \times 3 \tan \frac{\theta}{2}}{\pi}}$

WITNESSES:

James J. McLean
Ernest Blue Brown

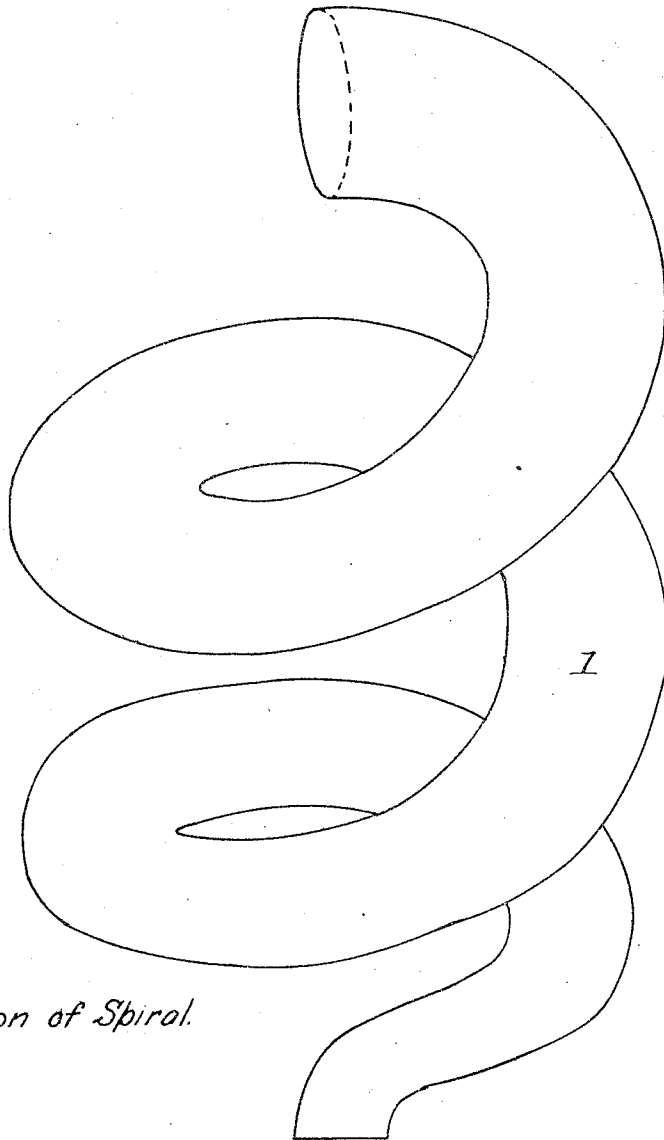
INVENTOR

Frank Ebenzer Miller

F. E. MILLER.
VOICE AND SOUND RECORDING MACHINE.
APPLICATION FILED FEB. 9, 1915.

1,190,787.

Patented July 11, 1916.
2 SHEETS—SHEET 2.



Elevation of Spiral.

Figure 3.

WITNESSES:
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UNITED STATES PATENT OFFICE.

FRANK EBENEZER MILLER, OF NEW YORK, N. Y.

VOICE AND SOUND RECORDING MACHINE.

1,190,787.

Specification of Letters Patent.

Patented July 11, 1916.

Application filed February 9, 1915. Serial No. 7,085.

To all whom it may concern:

Be it known that I, FRANK EBENEZER MILLER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a new and useful Voice and Sound Recording Machine, of which the following is a specification.

My invention relates to improved sound-mechanism having features applicable both to the recording of sound and to the reproduction of sound from a record or other known means.

The object of my invention is to provide functioning parts for overtones and the many peculiar refinements of sound as well as for fundamental tones.

A further object of my invention is to provide a sound-mechanism as nearly omnifunctioning as possible relatively to the variations in tone and quality without the excluding or limiting effect of a mechanical medium having itself a definite pitch period or pitch periods of too limited variation.

More concretely expressed, the object of my invention is to improve upon the employment of a flat disk of vibratory material for the reproduction of or the recording of sounds. That is, to improve such a disk, for example, as is commonly employed in a telephone receiver or phonograph sound box.

My experiments have taught me that a flat disk is greatly limited in its range of pitch periods in that its vibration is dependent upon nodal arrangements wholly in the same plane, while my special study and practice in connection with the human anatomy of the auditory and vocal organs has taught me that nature never limits its sound mechanism to a nodal arrangement in a unitary plane. For example, the outer ear of the human anatomy comprises approximately two and one-half turns of what may be termed a sound spiral and then terminates inwardly against the tympanum which itself is a cup-shaped diaphragm having the umbo peculiarly eccentric relatively to the tympanic ring to which the margin of the tympanum is attached. It is against this eccentric projection of the cup called the umbo with which the engaging end of the malleus or hammer-bone cooperates in the sound-functioning of the bones of the ear. I have discovered that the umbo is located relatively to three equi-distant points on the

margin of the tympanum at distances 3, 4 and 5. It has likewise come under my observation that the three main cavities of the human voice anatomy likewise have the volumetric proportion of 3, 4, 5. They are respectively the laryngeal cavity, the nasal cavities, and the mouth cavity.

In carrying out the objects of my invention I purpose to simulate in a large degree the peculiar anatomical features as to proportion, shape, and arrangement to be found in the human ear.

The above will be pointed out in the accompanying claims and will be more fully understood by reference to the illustrative embodiment of my invention described in the following specification, which should be read in connection with the embodiment illustrated in the accompanying drawings, which form a part hereof, in which like characters designate corresponding parts in the several figures, and in which—

Figure 1 is a vertical section through line I—I of Fig. 2; Fig. 2 is a plan view of the parts shown in Fig. 1; and Fig. 3 is a perspective elevation drawn to a reduced scale of a spiral horn.

G is a cone-shaped receptacle suitably formed and fabricated to form a closed terminal structure for the spiral horn I. I sometimes desire to determine the diameter of the base of this cone-shaped structure G for a given volume and a given angle at the apex of the cone. In such event, when radius of the base= r ; volume= v ; and θ =the apex angle of the cone, I find that the following formula is useful—

$$r = \sqrt[3]{\frac{V \tan \frac{\theta}{2}}{\pi}}$$

The receptacle G ends in a ring K at approximately the apex and to this ring are attached three relatively equally spaced supporting wires D which extend obliquely upward within the receptacle G and their upper ends are bent upwardly and suitably secured to the inner walls of the receptacle G. These wires D serve as the supports for the principal sound-functioning mechanism of my invention.

Fundamentally, this principal sound-functioning mechanism is a diaphragm 2 formed of tin or other suitable pliable material into a peculiar eccentric cup-shape, as shown in the drawings and approximating

in configuration what I term a sound spiral or the configuration of a nautilus shell when viewed in a trans-axial section. Furthermore, this cup also simulates the tympanum of the human ear and the individual growth-partitions of the nautilus shell. This cup 2 may be suitably supported as by friction or by soldering from the three wires D at the points 3, 4 and 5. I prefer that the contour and configuration of this cup 2 be such that the eccentric cupola or umbo 6 of the cup be located in the proportionate distance from the points 3, 4 and 5, respectively 3, 4 and 5 units as shown in the drawings. I likewise prefer to locate the cup 2 within the conical receptacle G substantially, so that the points 3, 4, and 5 are respectively at distances in the proportions 5, 4 and 3 from the most adjacent portions of the interior of the conical receptacle G, all as shown in the drawings.

I preferably construct the cup 2 of a size so that its content-volume approximates the content-volume of the mouth cavity of the human voice anatomy.

A rod E projecting through the ring K at the end of the conical receptacle G is fitted with a chuck and set screw F for the purpose of holding a suitable vibration co-operator shown in the form of a stylus N. This rod E is suitably extended and secured to the umbo 6 of the cup 2. In this way I have provided a vibratory medium in the form of the cup 2 which I may describe as having vibratory functions in planes of many directions and also as having vibratory pitch periods coördinating in the proportion 3, 4 and 5, just as is present in the tympanum of the human ear.

The better to carry out further refinements in sound functioning I propose the employment not merely of a single vibratory means such as the single cup 2 but contemplate in amplification the employment of a complete nest or set of cups A of which I have shown eight in all, seven nested within the cup 2. Likewise, I have appreciated the advantage of the employment of a plurality of nests of cups and have illustrated three nests, B and C in addition to the nest A. In the nest B the cup 2' I prefer to form of a volumetric capacity equivalent to the volumetric capacity of the nasal cavities of the human voice

anatomy. Likewise, I purpose to form the cup 2'' of the nest C of a volumetric capacity equal to the volume of the laryngeal or back throat cavity of the human voice anatomy. Like the nest of the cups A, the nest of cups B comprises eight, seven nested within the cup 2', and the nest C comprises eight cups, seven nested within the cup 2''. The rod E connects at the umbo with each of the cups of the various sets regardless of how many sets or how many cups in a set are employed, so that sound vibrations from each cup are transferred to and through the rod E to the stylus N, or vibrations are transferred from the stylus N to and through the rod E to be reproduced as sound by the cups.

It is to be understood that the conical receptacle G and the spiral horn 1 are useful in amplifying the sound or vibrations made through the functioning of the cup or cups and that the positioning of each cup permits sound reflection without interference.

What I claim and what I desire to secure by United States Letters Patent is:

1. In a sound-functioning mechanism, a vibratory medium in the shape of an eccentric cup-shaped diaphragm; and vibration transmitting means coöperating with said diaphragm at the umbo of eccentricity.
2. In sound mechanism, a sound diaphragm having a substantially circular periphery and being cup-shaped with the locality of maximum displacement spaced in substantially the proportion of 3, 4 and 5 from three equi-distant points at the periphery of the diaphragm.
3. In sound mechanism, a diaphragm approximating the shape of the tympanum of the human ear; and a transmitter of vibrations coöperating with said diaphragm at the locality corresponding to the umbo of the human tympanum.
4. In a sound mechanism, an eccentric cup-shaped diaphragm having a volumetric capacity approximating the volumetric capacity of one of the three cavities of the human voice anatomy.

FRANK EBENEZER MILLER.

Witnesses:

JAMES J. MCLEAN,
ERNEST CLIVE BROWN.