June 7, 1932. I. S. BOBROVSKY 1,862,174

SOUND REPRODUCER

Filed Nov. 15, 1929

FIG. 1

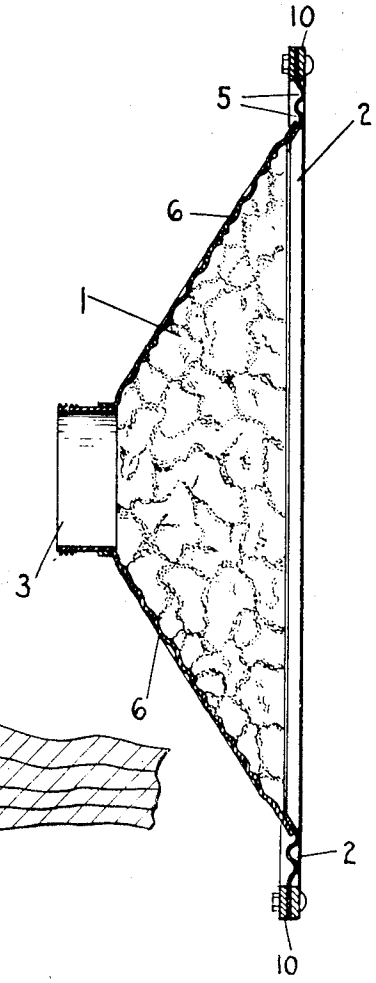


FIG. 4

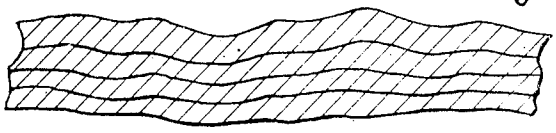


FIG. 2

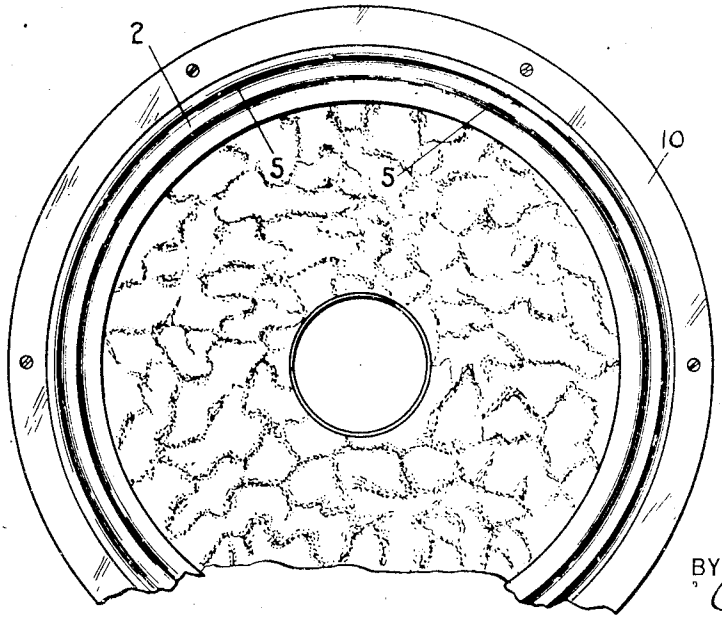
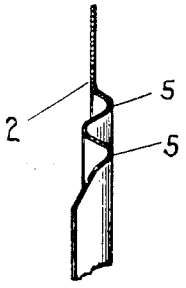


FIG. 3



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UNITED STATES PATENT OFFICE

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SOUND REPRODUCER

Application filed November 15, 1929. Serial No. 407,327.

This invention relates to sound radiating apparatus and more particularly to a preferred form of construction of the conical sound radiators commonly employed in loud speakers.

In loud speaker design it is desirable to produce radiating members which do not have selective absorption or radiation characteristics for sound frequencies which it is desired to reproduce. This selective action usually results in distortion due to suppression or over-emphasis of one or more frequencies or groups of frequencies due to the fact that the cone breaks up into a series of zones or segments in a manner usually dependent on frequency which zones or segments may or may not be effective radiators in themselves and may interfere with each other to a greater or less extent. In this manner, the cone itself imparts a selective radiation to the loud speaking device which is to say, it no longer faithfully radiates the vibrations impressed upon it.

It is an object of my invention to minimize the selective radiation characteristics, referred to above and thus to increase the fidelity of reproduction.

It is a further object of my invention to increase the radiation efficiency of the conical radiator.

It is a further object of my invention to provide means combined with my improved radiator to control or adjust the motional impedance of the entire loud speaker mechanism.

It is a further object of my invention to produce an inexpensive means of centering and suspending the sound radiator.

These and other objects of my invention will be apparent to those skilled in the art of loud speaker design.

The features of novelty which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its fundamental principles and as to its particular embodiments, will best be understood by reference to the specification and accompanying drawing, in which:

Fig. 1 is a sectional view of a conical diaphragm according to my invention;

Fig. 2 is a front view thereof;

Fig. 3 is a sectional view on an enlarged scale of the suspension, and

Figure 4 is a fragmentary sectional view on a greatly enlarged scale through the material of the sound radiator and showing the laminations therein.

Referring now more particularly to the figures, I show a radiator consisting of the cone proper 1, surounded by the suspension annulus 2, clamped between supporting rings 10 and provided at 3 with a voice coil or winding in the usual manner although it will be understood that other forms of actuating device may be employed if desired. I preferably corrugate, rib, or reinforce the sound radiating element in an irregular manner as shown by lines 6.

The ribbing or deformation of the radiator should preferably be irregular and I have found it of advantage to emboss the paper, of which the cone is composed, with an irregular pattern. Dies or rolls, similar to those used for embossing artificial leather may be used and "walrus", "pebble" or any deep grained irregular pattern produces such a breaking up of the body of the radiator as is desirable.

I have found it advantageous to use for my sound radiator, a paper composed of very long fibre, and in which all of the fibres lie in substantially the same direction. I offer no explanation of this fact, for the mechanics of the propagation of a disturbance from molecule to molecule is not well understood but the benefits are clearly shown in tests which I have made.

It is advantageous also if the fibres composing the mass do not run through the mass from the inner surface to the outer surface of the radiator, but lie along the length of the paper in laminations so as to produce a paper made up of several layers, easily separable, as shown in Figure 4.

The suspension annulus of the cone is preferably composed of a ring of paper or like substance in which concentric rings 5, 5, are embossed. The rings 5, 5, are provided to

give the paper sufficient rigidity so that the suspension annulus does not rattle or blast, and permit the use of paper somewhat thinner than that used in the cone itself. An added advantage is that the number, depth and size of the concentric corrugations together with the stiffness of the paper may be chosen with reference to the motional impedance. In fact, the impedance may be caused to vary over wide limits by the selection of these factors of the suspension.

I have found that a number of shallow, concentric corrugations produce a very flexible suspension while fewer, deeper corrugations produce more resistance to motion. The absorption effect of such a suspension I have found to be materially less than that observed when rubber, leather, or cloth is used, while the efficiency is correspondingly increased.

I have found that very satisfactory results are obtained when the cone itself is formed of corrugated, laminated paper as already described, having a thickness of about 0.010" while the suspension is formed of ordinary long fibre wrapping paper about .004" or .005" in thickness, having a pair of concentric corrugations. The annulus is preferably cemented to the periphery of the cone.

It will thus be seen that the elements entering into my improved construction for sound radiating members are first, that the paper or like material comprising the sound radiator should be long fibred and laminated. Second, the conical sound radiating element should be ribbed or reinforced in an irregular manner. Third, the supporting zone of the sound radiating member should be of paper, concentrically reinforced, zones of stiffness alternating with zones of flexibility.

It will thus be seen that I have produced a cheap, effective sound radiator, the efficiency of which is materially better than that of others commonly in use, and while I have described simple and effective means of producing the construction, I do not wish to limit myself to the particular structure described.

I claim:

1. In a sound radiating device, a direct-acting conical sound radiator of laminated, fibrous material, the active surface of which is deformed in an irregular manner.

2. In a sound radiating device, an embossed direct-acting conical radiator of laminated, fibrous material the active surface of which is embossed with a pattern which follows an irregular design.

3. In a direct-acting sound radiator the combination of a conical diaphragm of laminated paper, the surface of which is deformed in an irregular manner, and a relatively thin paper annulus secured to the periphery of said diaphragm, said annulus having concentric corrugations therein.

4. In a direct-acting sound radiator the combination of a conical diaphragm of laminated paper, the surface of which is deformed in an irregular manner and a relatively thin paper annulus concentrically corrugated and secured to the periphery of said diaphragm, said annulus being less in thickness than said diaphragm.

5. In a direct-acting sound radiator, the combination of a conical diaphragm of paper, a suspension therefor in the form of a rim said rim being of paper of less thickness than the paper of said diaphragm, and secured to said diaphragm at the periphery thereof, and having circular corrugations embossed therein.

6. In a direct-acting sound radiator, the combination of a conical diaphragm of paper, a suspension therefor in the form of a rim, the thickness of said rim being less than the thickness of said diaphragm, and secured to said diaphragm at the periphery thereof, and having circular corrugations embossed therein.

Signed at Rochester, in the county of Monroe and State of New York, this 6th day of November, A. D. 1929.

IGOR S. BOBROVSKY.