

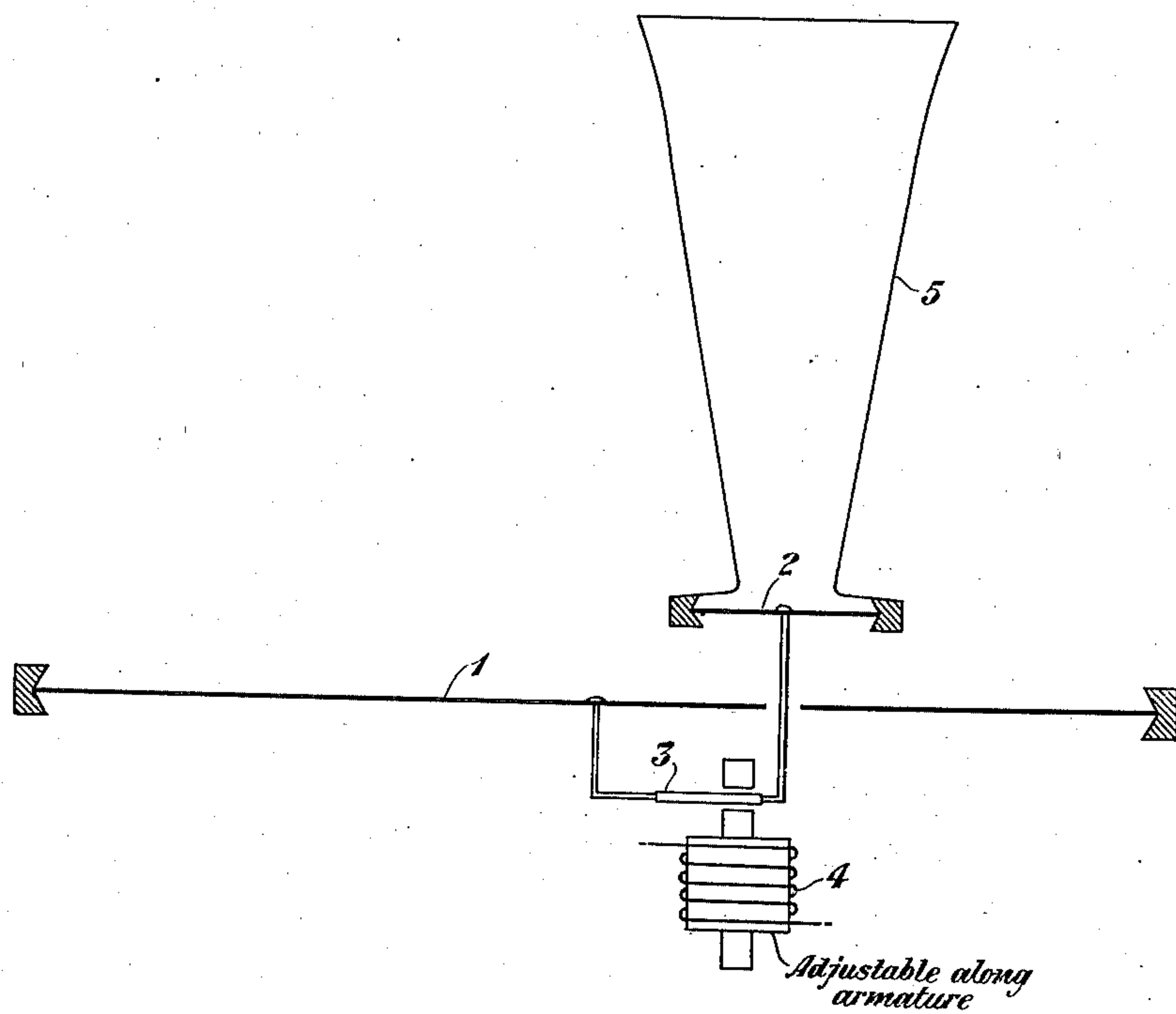
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SOUND REPRODUCER

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SOUND REPRODUCER.

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To all whom it may concern:

Be it known that I, BRUNSON S. McCUTCHEN, residing at North Plainfield, in the county of Somerset and State of New Jersey, have invented certain Improvements in Sound Reproducers, of which the following is a specification.

This invention relates to sound reproducers and more particularly to sound reproducers of the type known as loud speakers.

An object of the invention is to provide a loud speaker which will effectively transmit a wide range of frequencies without undue distortion. This object and other objects of the invention are attained by providing a doubly resonant arrangement comprising two diaphragms of different dimensions and different degrees of stiffness. One of these diaphragms may have a natural period corresponding to a low telephonic frequency and the other may have a natural period corresponding to a high telephonic frequency. The two diaphragms are mechanically connected to be operated by a suitable magnetic arrangement.

Further details of the invention will be clear from the following description when read in connection with the accompanying drawing, the figure of which is a simplified illustration of a preferred embodiment of the invention.

Referring to the drawing, 1 represents a large diaphragm and 2 a small diaphragm. 3 designates a light but rigid armature actuated by some form of magnetic system, such as 4. The armature 3 is suitably connected, as indicated, to the midpoints of the two diaphragms. The small diaphragm 2 is shown in front of the large diaphragm 1, connection between the small diaphragm and the armature being effected through a small opening in the large diaphragm. A horn 5 is provided to give efficient coupling between the small diaphragm and the air.

It will be readily understood that the small diaphragm, due to its minute mass and relatively great stiffness, can be given a high natural resonance while the large diaphragm, having much greater mass and less stiffness, will have a low natural frequency.

It will be noted that the driving force is applied to the common armature 3. Let us now consider what happens when the armature is actuated by a low frequency driving

force. The small diaphragm, due to its great stiffness and high natural period, presents a large mechanical impedance to the motion of the armature while the large diaphragm presents a relatively small one. The result will be that the end of the armature connected to the small diaphragm will remain practically stationary while the end connected to the large diaphragm will vibrate vigorously. On the other hand, when a high frequency driving force actuates the armature, the end attached to the large diaphragm will, in effect, form a fulcrum, due to the great mass of the diaphragm, and the small diaphragm will vibrate.

An efficient doubly resonant loud speaker possesses many advantages which are well known and which need not be referred to at this time. The particular structure above described, however, has an inherent advantage residing in the fact that the actuating energy is automatically delivered to that diaphragm which will most efficiently convert energy of that particular frequency into sound. Another advantage consists in a very simple form of adjustment, viz, sliding the magnetic device 4 along the armature 3 and thus changing the relative mechanical advantage of the driving arm with respect to the two diaphragms. By means of this adjustment slight changes in the quality can be readily effected.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a sound reproducer, a diaphragm having a high natural period, a diaphragm having a low natural period, and means to apply a driving force to said diaphragms, said means being so related to the diaphragms that when a low frequency driving force is applied to the system the diaphragm having a high period will offer a large mechanical impedance to the driving force so that the driving force will be most effective upon the diaphragm of low frequency.

2. In a sound reproducer, a diaphragm having a high natural period, a diaphragm having a low natural period, and means to apply a driving force to said diaphragms, said means being so related to the dia-

phragms that when a low frequency driving force is applied to the system the diaphragm having a high period will offer a large mechanical impedance to the driving force so that the driving force will be most effective upon the diaphragm of low frequency, and when a high frequency driving force is applied to the system the low frequency diaphragm will offer a large impedance to the driving force so that it will be most effective upon the high frequency diaphragm.

3. In a sound reproducer, a small diaphragm having small mass and relatively great stiffness so that its natural period will be high, a large diaphragm having a greater mass and less stiffness so that its natural period will be low, and means to apply a driving force to said diaphragms, said means being so related to the diaphragms that when a low frequency driving force is applied to the system the diaphragm having a high period will offer a large mechanical impedance to the driving force so that the driving force will be most effective upon the diaphragm of low frequency.

4. In a sound reproducer, a small diaphragm having small mass and relatively great stiffness so that its natural period will be high, a large diaphragm having a greater mass and less stiffness so that its natural period will be low, and means to apply a driving force to said diaphragms, said means being so related to the diaphragms that when a low frequency driving force is applied to the system the diaphragm having a high period will offer a large mechanical impedance to the driving force so that the driving force will be most effective upon the diaphragm of low frequency and when a high frequency driving force is applied to the system the low frequency diaphragm will offer a large impedance to the driving force so that it will be most effective upon the high frequency diaphragm.

5. In a sound reproducer, a small diaphragm having small mass and relatively great stiffness so that its natural period will be high, a large diaphragm having a greater mass and less stiffness so that its natural period will be low, means to produce a driving force, and a lever arrangement for applying said force to the diaphragms, said lever arrangement being so related to the diaphragms that when a low frequency driving force is applied to the system the small diaphragm presents a large mechanical impedance and the driving force will be principally applied to the large diaphragm.

6. In a sound reproducer, a small diaphragm having small mass and relatively great stiffness so that its natural period will be high, a large diaphragm having a greater mass and less stiffness so that its natural period will be low, means to produce a driv-

ing force, and a lever arrangement for applying said force to the diaphragms, said lever arrangement being so related to the diaphragms that when a low frequency driving force is applied to the system the small diaphragm presents a large mechanical impedance and the driving force will be principally applied to the large diaphragm, and when a high frequency driving force is applied to the system the large diaphragm will present a large mechanical impedance so that the driving force will be principally applied to the small diaphragm.

7. In a sound reproducer, a small diaphragm having small mass and relatively great stiffness so that its natural period will be high, a large diaphragm having a greater mass and less stiffness so that its natural period will be low, means to produce a driving force, a lever operated by said means, said lever being connected to the two diaphragms so that it may be, in effect, fulcrumed about its point of connection with either diaphragm, and the driving force being so applied to the lever that when it is actuated by a low frequency driving force the small diaphragm presents a large mechanical impedance and the lever applies the energy to the large diaphragm.

8. In a sound reproducer, a small diaphragm having small mass and relatively great stiffness so that its natural period will be high, a large diaphragm having a greater mass and less stiffness so that its natural period will be low, means to produce a driving force, a lever operated by said means, said lever being connected to the two diaphragms so that it may be, in effect, fulcrumed about its point of connection with either diaphragm, and the driving force being so applied to the lever that when it is actuated by a low frequency driving force the small diaphragm presents a large mechanical impedance and the lever applies the energy to the large diaphragm, while the application of a high frequency driving force to the lever permits the large diaphragm to offer a relatively large mechanical impedance so that the force is effectively applied to the small diaphragm.

9. In a sound reproducer, a small diaphragm having small mass and relatively great stiffness so that its natural period will be high, a large diaphragm having a greater mass and less stiffness so that its natural period will be low, means to produce a driving force, a lever operated by said means, said lever being connected to the two diaphragms so that it may be, in effect, fulcrumed about its point of connection with either diaphragm, the driving force being so applied to the lever that when it is actuated by a low frequency driving force the small diaphragm presents a large mechanical impedance, and the lever applies the energy to the

large diaphragm, while the application of a high frequency driving force to the lever permits the large diaphragm to offer a relatively large mechanical impedance to the
5 large diaphragm, while the application of a high frequency driving force to the lever permits the large diaphragm to offer a relatively large mechanical impedance so that the force is effectively applied to the small diaphragm, and means to adjust the point at 10 which the driving force is applied to the lever with respect to its two effective fulcrums.

In testimony whereof, I have signed my name to this specification this 31st day of 15 March 1924.

BRUNSON S. McCUTCHEN.