April 29, 1930. J. E. KIERNAN 1,756,201

LOUD SPEAKER

Filed Dec. 9, 1927

Fig. 1.

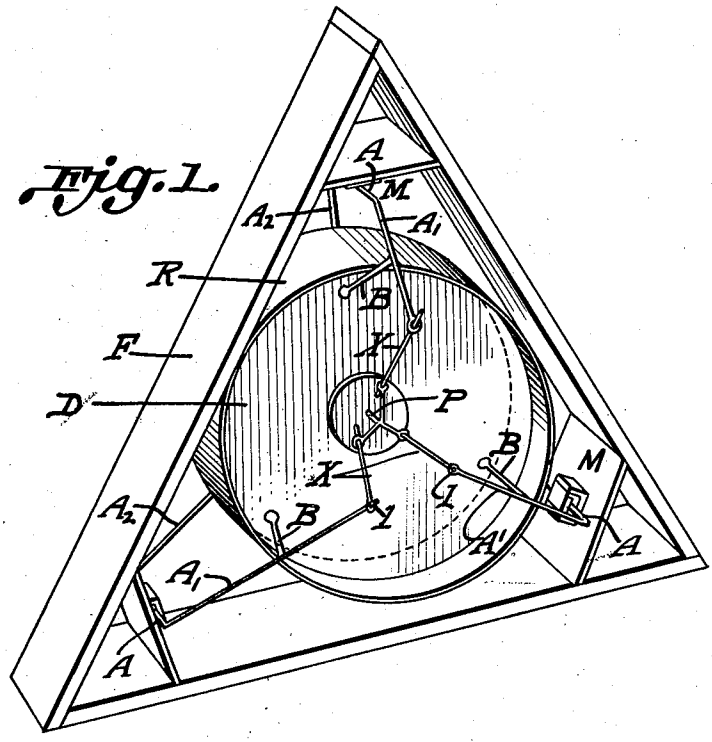
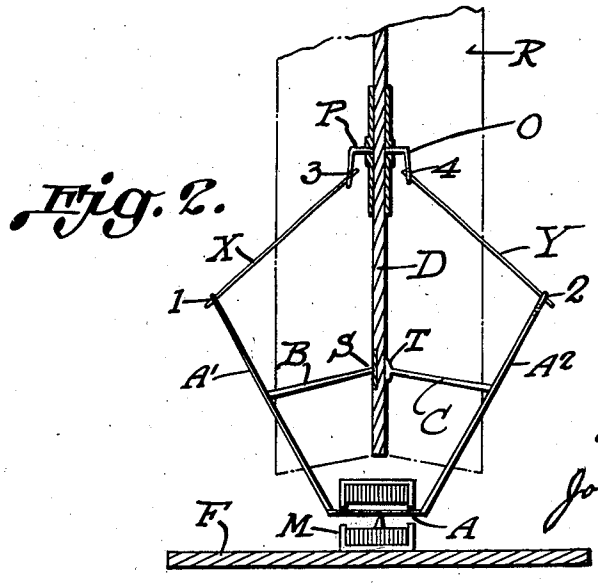


Fig. 2.



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UNITED STATES PATENT OFFICE

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LOUD-SPEAKER

Application filed December 9, 1927. Serial No. 238,732.

The invention relates to sound reproduction devices used in connection with radio receiving sets and known as loud speakers, which are also applicable to electrically operated phonographs and public amplifiers and in connection with talking motion pictures; and the object of the invention is to provide a strong, substantial device that will give a loud and natural reproduction of sound waves.

Referring to the drawings:

Fig. 1 is a view in perspective of one form of the device, showing a diaphragm balanced between three electromagnets mounted in a triangular frame.

Fig. 2 is a side view of one of the electromagnets attached to the diaphragm.

In Fig. 1 three electromagnets are shown spaced at approximately equal intervals from one another, but any number, from two up, may be used, supported in a frame of appropriate shape.

By electromagnet I mean a speaker unit or telephone receiver, of the two-pole type or of the four-pole and polarized armature type. In any case, the armature is supported at its middle point on a sharp pivot.

The invention involved a study of the principle known in physics as the parallelogram of forces. A force being completely specified by (*a*) its magnitude, (*b*) its point of application, and (*c*) its direction, it became necessary for me to determine, more exactly than has heretofore been done, the means by which a diaphragm could be made to vibrate perpendicularly to its plane with a minimum of transverse vibrations and with sufficient magnitude to convey its vibrations to the air at a distance.

F is a frame to support the device.

M is an electromagnet; A, its armature extending on both sides of M. To increase the effect of the vibrations of the armature A in each case, I have lengthened it beyond the electromagnets M by adding angular extensions A^1 and A^2. The extensions form an angle with the armature proper A for the purpose of changing the direction of the vibrations and having the force of same strike against the diaphragm D at a reduced angle.

Points 1 and 2 are sockets in which X and Y move freely. X and Y are rods or wires attached from the armature sockets 1 and 2 to similar sockets 3 and 4 in the actuating pin flanges O. X and Y are preferably tangential to the vibrations of the armature at points 1 and 2.

B is a subsidiary actuating pin to make the actuation of the diaphragm D more uniform over its entire area, and rests against a plate S made of some hard material for re-inforcing the said diaphragm at that point.

C is a similar pin on the opposite side of the diaphragm D, and rests against a rubber pad T to stabilize the diaphragm at that point and at the same time allow the vibrations of the armature extensions A^1 and A^2 to be communicated to the pin P without being unduly absorbed by pins B and C.

The diaphragm D is balanced between the electromagnets, and the plane of said diaphragm is at right angles to the armatures A of the said electromagnets. All the A^1 extensions of the various armatures are constantly in the same phase of vibration, and all the A^2 extensions on the opposite side of the diaphragm D are as a unit in the opposite phase with respect to the A^1 extensions. The resultant of these vibrations lies in a direction perpendicular to the diaphragm D.

As to variations:

The diaphragm may be of wood, bakelite, glass, hard rubber, compressed paper, etc., and if of wood should be composed of a number of sectors with the grain running in different directions to give the greatest possible inflexibility to the diaphragm.

The actuating pin P may be attached to the diaphragm D by any suitable method, or instead of a single actuating pin in the centre, a plurality may be used for attaching the several armature connectors X and Y in pairs to the diaphragm, the central portion of which is then strongly reinforced, as shown in the figures. The use of one pin P, however, is preferable.

A^1 and A^2 may be extended upward to meet an elongated pin P, the X and Y connectors being eliminated and points 1 and 3, 2 and 4

being connected to make simple free-moving joints.

Again, A^1 and A^2 may be dropped at an angle below A, in which case the pin P should be still more elongated to form the proper angle with the X and Y connectors; pins B and C being eliminated, for the movement of X and Y is in the direction of their length, and at a considerable angle to the plane of D.

As shown in Figure 2, the armature A is between the diaphragm D and the pivot N; and the connectors X and Y are properly rods; but if the pivot N is placed between the armature A and the diaphragm D, then X and Y may be of light wire or string.

R is merely a band, enclosing the armature D, and is made of any suitable material; it serves to give direction to the sound waves; and is either attached to the edge of diaphragm D or in close proximity thereto.

Claims:

1. In a loud speaker, a diaphragm, a plurality of electromagnets arranged around said diaphragm, armatures for said electromagnets, and angular extensions at each end of said armatures for communicating vibrations to said diaphragm.

2. In a loud speaker, a diaphragm, a plurality of electromagnets arranged around said diaphragm, armatures for said electromagnets, connections from said armatures on each side of said diaphragm to a central actuating pin and additional actuating pins from said armature to various points of said diaphragm.

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