Oct. 25, 1932. A. A. W. TAYLOR 1,884,375

RADIOPHONE LOUD SPEAKER

Filed July 12, 1930

FIG.3.

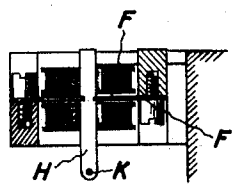


FIG.2.

FIG.1.

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UNITED STATES PATENT OFFICE

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RADIOPHONE LOUD SPEAKER

Application filed July 12, 1930, Serial No. 467,590, and in Australia July 26, 1929.

In known loud speakers such as are used in connection with radio receivers, the armature is connected to a vibratable diaphragm either directly or through a lever. In either case the freedom of the armature movements is affected by its connection to the diaphragm, as the diaphragm momentum, more particularly if the diaphragm has a pronounced vibrational period of its own, constrains the armature to follow it, with the result that the diaphragm movements are not truly in correspondence with the variations in the current by which the armature is driven.

Given an appropriate diaphragm, it is not at all necessary that it should be moved through the range through which the armature moves. The necessary amplitude of diaphragm displacement is relatively low and may be as low as one fifteenth the range of the armature's movement. By coupling the armature to the diaphragm through a lever which reduces the amplitude of the transmitted movement, a better control of the diaphragm is obtained as the diaphragm is then less able to limit the freedom of the armature to be moved responsively to the variations in the energizing current. Stated in another way, the armature is better enabled to enforce its movement on the diaphragm, whilst the diaphragm is less able to interfere with the movements applied to it by the armature.

It is the object of this invention to more fully liberate the armature from interference by the diaphragm vibrations and to procure still better interpretation of the armature movements by the diaphragm. With that object in view, the fulcrum of the coupling lever is carried by a floating member which has appropriate inertia, and is not held rigidly on a fixed member. The inertia of the floating member will oppose vibrational movements of that member proportionately to their frequency; the damping effect which opposes reversal of direction of the movement of said member augments with rise in frequency. Armature movements to which the diaphragm does not respond freely are thus passed out or absorbed through the floating member and they are also taken up in the cushion mounting of the head of the armature arm on the soundboard or diaphragm. Improved interpretation of the current modulation is thus obtained from the diaphragm, as the armature is less constrained in moving responsively to variations in the energizing current than when it acts on a diaphragm through a member which has no lost motion as in conventional arrangements.

The floating member which carries the armature lever fulcrum is a small mass of metal or other ponderous substance supported on a resilient cushion of a sponge rubber held in a fixed support. Its weight should be adjustable, as for instance by means of shot filled into a pocket in the desired quantity, or maybe by attaching weights to it or removing weights from it. This member is at liberty to oscillate but is operative by its inertia to absorb movements applied to it via the coupling lever. Its mass is sufficient to provide the necessary reaction for the functioning of the armature lever in transmitting armature movements to the diaphragm. In practice the weight of the floating member varies between 5 oz. and 20 oz. according to the diaphragm inertia and the relative length of the lever arms.

This arrangement has been used with very notable success for the direct coupling of loud speaker "units" to the soundboards of pianos, utilizing the soundboards functioning as diaphragms. In this case a coupling link from the work end of the armature lever is attached to one of the cross ribs on the back of the soundboard, usually about mid-length of the rib; the place of attachment should be determined with regard to the desired characteristics of the reproduction; thus when the attachment is located near the treble end of the soundboard, high tone and very clear articulation are obtained; when it is located in the bass area of the soundboard, lower tone and greater fullness are obtained with some diminution in sharpness.

The floating weight must be so supported that it is rotatable with respect to the plane and direction of the lever movement, and will be maintained in true centre position so that

such weight will not constrain or load the armature or the diaphragm.

The attachment of the driving link to the soundboard (or diaphragm) is buffered in a manner which permits of certain adjustment to obtain modification in the tonal qualities of the reproduction. The buffering consists of rubber pads in front of and behind a cap on the end of the coupling link. By screwing up the assembly so as to increase or diminish the compression on one or other or both pads, variations are obtained in the characteristics of the note delivered from the soundboard or diaphragm.

In the accompanying drawing:—

Fig. 1 is a back elevational view of a reproducer unit such as is commonly used in loud speakers;

Fig. 2 is a longitudinal vertical section through the unit and the link attachment for a soundboard diaphragm; and

Fig. 3 is a detail sectional view of the coil in the electro-magnet.

It will be understood that the invention is usable with electro-magnetic reproducer units of the moving coil type or of other types.

A is a frame member which may be mounted on any fixture as by means of a stud to which it is locked by a pinching screw B. The magnet C is clamped to this frame member as for instance by a dog plate D and screws E. The armature F which may be of the moving coil or the bar type is located in the gap between the magnet pole pieces. The electric current connections are conveniently brought through insulated binding posts G fixed on the frame A, from which thin flexible wires are brought to the magnet or armature coils. The armature carrying arm H is connected to the end of the lever J, the coupling link K being light but rigid and so fitted that its transverse stiffness does not impede freedom of movement of the armature. The other end of the lever J is carried by a flexible tongue L. This tongue is permanently fixed at its butt in a slot M in the inertia block N. The block N is located on a vertical stud O on the head of the frame A, and it is provided with a stud piece P on which weights Q may be fixed on it and secured by a nut. R is a liner of sponge rubber in the stud hole in the block N, and S are thick washers of sponge rubber above and below the block N. The inertia of the block N may be slightly varied by altering the pressure of the nut T on the weights Q and in a greater degree varied by adding or removing loading weights Q.

The lever J is connected by a stiff link U to the stem V′ of a disc V. W is a compressible disc of rubber or fibre or such material behind it and W′ a washer of like compressible material in front of it. Y is a cover plate embracing the assembly W′ V W and secured by screws Z′ to a piano sounding board frame batten Z or to another member associated with a vibratable diaphragm suitable for reproduction of sound vibrations. It is convenient to fix the link U to the disc stem V′ by a spot of solder X after the parts have been set up and adjusted.

The point at which the link U is connected to the lever J is relatively close to the tongue L which functions as the lever fulcrum. The amplitude of movement at this point is small in relation to the amplitude of movement of the armature link K coming from the armature.

Displacement of the lever J by the armature movement produces stresses on the coupler link U and on the block N, tending to move them in opposite directions. The inertia of the block N is sufficient to hold the fulcrum of the lever with sufficient resistance to cause the coupler link U to move the diaphragm in correspondence with the armature movements but in diminished amplitude and with a cushioned effect. By varying the loading on the block N or the pressure applied by the nut T the cushioning effect is varied and the characteristics of the reproduction are modified.

What I claim as my invention and desire to secure by Letters Patent is:—

1. An electro-magnetic loud speaker unit comprising an armature, a diaphragm, a fulcrumed lever connecting said armature with said diaphragm, and a fulcrum member being held in operative relation with respect to said lever by the inertia of said member.

2. An electro-magnetic loud speaker unit, comprising an armature, a diaphragm, a fulcrumed lever connecting said armature with said diaphrgam, and a fulcrum block for said lever, said block being free to move transversely with respect to the plane of the diaphragm.

3. An electro-magnetic loud speaker unit, comprising an armature, a diaphragm, a fulcrumed lever connecting said armature with said diaphragm, and a fulcrum member of limited mass supporting said lever, said member being so supported that the fulcrum of said lever is restrained from movement responsively to stresses applied to said diaphragm through the lever by the inertia of said fulcrum member.

4. An electro-magnetic loud speaker unit according to claim 1 in which the fulcrum member is rotatably supported and variable in weight.

5. An electro-magnetic loud speaker unit according to claim 2 in which the fulcrum block has variable inertia and is held in yielding supports.

6. An electro-magnetic loud speaker unit, comprising an armature, a diaphragm, a lever and link coupling between the armature and

the diaphragm, a ponderous fulcrum block for the lever yieldingly supported between resilient cushions and adapted to be altered in weight to vary its inertia.

7. An electro-magnetic loud speaker according to claim 6 in which the lever and link coupling embodies a lever coupling link and a cap at one end of said link connected to said diaphragm through a buffering member including resilient cushion pads in front and behind said cap.

In testimony whereof I affix my signature.

ALVIN ALFRED WHEATLEY TAYLOR.