Jan. 19, 1943. R. VERMEULEN 2,308,795

SUPPORTING ARM FOR SOUND BOXES AND SOUND RECORDERS

Filed June 24, 1939

Fig. 1.

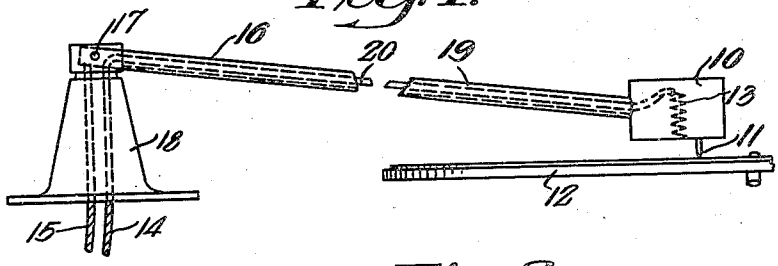


Fig. 2.

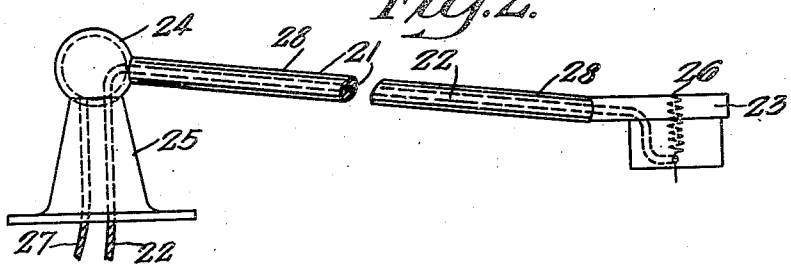


Fig. 3.

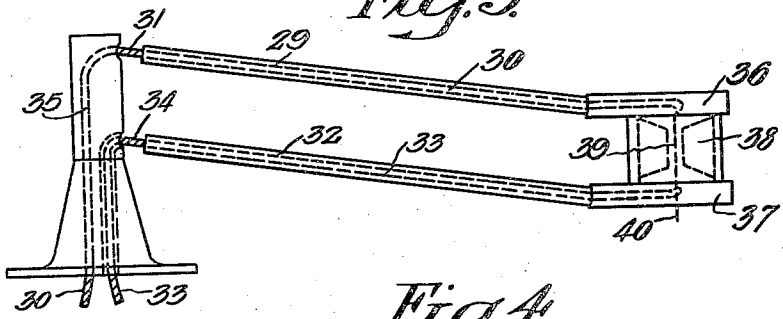
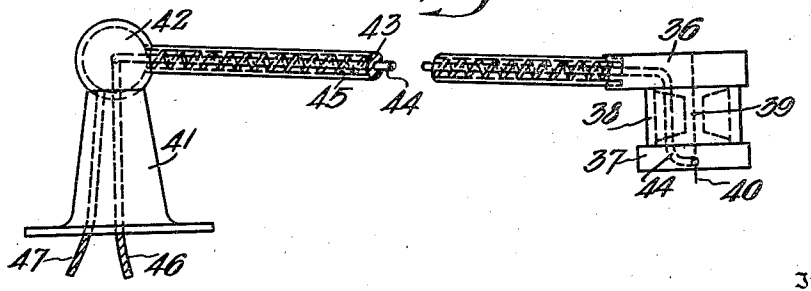


Fig. 4.



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SUPPORTING ARM FOR SOUND BOXES AND SOUND RECORDERS

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Application June 24, 1939, Serial No. 280,949
In Germany August 5, 1938

3 Claims. (Cl. 179—100.41)

With mechanical sound-recording and sound reproducing devices, it has been sought to make the supporting arm for the sound recorders and the sound boxes so as to be as simple as possible and nevertheless sufficiently stiff and free from resonance. The usual forms of construction are constituted by a hollow body of metal or synthetic resin, in the internal part of which extend the supply conductors for the speech coil.

According to this invention, the voluminous and heavy construction is abandoned, since the supporting arm itself is only constituted by a plurality of supply conductors which have together a sufficient stiffness and a very low ohmic resistance.

It is one of the marked advantages of this construction that the cross-section of the supporting arm need not exceed the size necessitated by mechanical requirements with a view to bringing about only an inappreciable loss of energy in the supply conductors even with sound boxes and sound recorders having a low internal resistance, say, of the order of magnitude of 0.01 ohm. With the usual forms of construction, in which the supply conductors extend in the internal part of the supporting arm, it may be the case that the cross-section of all of the supply conductors necessitates a larger diameter of the supporting arm than would be necessary for reasons of mechanical strength.

Even if this condition were not imposed, the known supporting arms are always given such a size that their mechanical impedance maintains the movements of the arm due to the resonance vibrations below a definite limit judged to be admissible. However, if the arm according to the present invention is only constituted by a plurality of supply conductors, the cross-section of which is only determined by the maximum admissible electric resistance, then the mechanical impedance of the arm may frequently not suffice to avoid resonance vibrations.

In order to render these vibrations harmless, however, at least one of the supply conductors by which the arm is constituted is preferably so formed that it has the required stiffness against bending and torsion, while the other supply conductors are in mechanical contact with the former and increase the internal friction of the arm. They thus exert a damping action upon vibrations, if any, of the former supply conductor.

Further features and advantages of the invention will be more fully explained by reference to a few forms of construction shown in the accompanying drawing, wherein

Fig. 1 represents one embodiment in which the supporting arm is constituted by a stiff and a flexible aperiodic supply conductor,

Fig. 2 shows one form of construction in which both supply conductors extend concentrically with respect to one another,

Fig. 3 shows a supporting arm of four supply conductors parallel-connected in pairs, and

Fig. 4 shows a modified form of supporting arm for a pickup device of the type shown in Fig. 3.

Referring to Fig. 1, 10 is the sound box or pickup device whose scanning needle 11 may scan the sound grooves of a sound record 12. The vibrations of the needle 11 produce, in the armature coil 13, A. C. voltages which are conducted through supply conductors 14 and 15 to an amplifying device which is not shown in the drawing. The supporting arm 16 is pivotally journalled in a joint 17 of the supporting body 18.

The supporting arm 16 is constituted by a stiff supply conductor 19 of copper or aluminum having an U-shaped cross-section. Owing to this U-shaped cross-section, the conductor 19 has a sufficient stiffness to act as a supporting arm for the sound box. The second supply conductor is laid as an insulated copper cord 20 in the U-shaped opening of the conductor 19. One end of the armature coil 13 is connected to the supply conductor 15 through the housing of the sound box 10 and the external supply conductor 19 fixed therein. The other end of the coil 13 is directly connected to the cord 20 which, in turn, is connected to the supply conductor 14.

In the form of construction according to Fig. 2, the external supply conductor 21 is constituted by an aluminum tube the internal diameter of which is completely filled up by an insulated copper conductor 22. One end of the tube 21 is stiffly secured to the housing 23 of the sound box or pickup device, its other end carrying the ball joint 24 by means of which it bears in a movable manner on the supporting body 25. One end of the armature coil 26 is directly connected to the adjacent end of the copper conductor 22, and the other end thereof is connected to the housing 23, the tubular conductor 21, and the ball joint 24. A conductor 27 establishes the electrical connection of the ball 24 with the amplifying device which follows.

The aluminum tube 21 has a sufficient stiffness to serve as a supporting arm. For damping the natural resonance of this tube, its internal diameter is completely filled up by the compound

copper cord 22 having an insulating envelope. In fact, the compound cord 22 has substantially no resonance and has a great internal friction so that vibrations which may occur in the tube 21 are thus greatly damped. For further damping, this tube 22 may, if desired, also be provided with a lacquer layer 28. A similar construction may, of course, be used in connection with the modification of Figure 1.

In the form of construction according to Fig. 3, the supporting arm is formed by four supply conductors which are parallel-connected in pairs. One supply conductor is constituted by an aluminum tube 29 in which the non-insulated copper cord 30 is enclosed almost throughout its length. The second supply conductor is, according to the same construction, constituted by an aluminum tube 32 which is separated from the former and in which is enclosed the copper cord 33 which is likewise not insulated. Only in the vicinity of bearing points 31 and 34 are the cords 30 and 33 not surrounded by the tubes 29 and 32 but form, themselves, the flexible suspension points. They are then led, insulated from each other, to the amplifying device through the supporting body 35.

The other ends of the supply conductor 29 and 32 are connected, respectively, to the covers 36 and 37 of the housing 38 of a pickup device. The armature 39 of this pickup device is constituted by a single supply conductor vibrating in a magnetic field in a rod-like manner and stretched between the covers 36 and 37. One end of the armature 39 is connected to outside through the cover 37 and carries a hard pin 40 as a scanning needle. Such sound boxes have been described in detail and claimed in the U. S. patent application Ser. No. 214,608 of R. Vermeulen et al., now Patent No. 2,240,918, granted May 6, 1941. The resistance of the armature is in general rather low (i. e., approximately 0.01 ohm) so that it is necessary that the supply- and carrying-off conductors should have a lower resistance. At the same time, this sound box has, however, in itself, a very low weight (i. e., lower than 30 grams, viz, approximately 16 grams), and also the pressure of the needle 40 in the sound groove must be less than 30 grams so that it is also necessary to maintain that part of the weight of the supporting arm, which presses upon the sound box, as low as possible. This condition is particularly important since such sound boxes have a non-interchangeable needle. In order to increase the life of the needle as much as possible, the pressure of the sound box on the sound record is maintained very low (viz., below 30 grams) and the directive force of the armature also is low (viz., less than 20 grams) at a normal amplitude of 0.1 mm.

Fig. 4 shows another embodiment of a supporting arm for the same sound box. The supporting body 41 carries a ball joint 42 having a hollow ball into which lead two concentric tubes 43 and 44 which form together the supporting arm. The external tube 43 is electrically connected in a mechanically rigid manner both in the ball 42 and in the cover 36 of the sound box. This tube forms one supply conductor and is in itself sufficiently stiff against bending and torsion to serve as a supporting arm. Inside this tube and concentrically thereto at some distance from the inner wall of the first tube, there is a second tube 44 which is led in through the sound box to the second cover 37 and serves as a second supply conductor. The distance between both tubes 43 and 44 is maintained in such manner that a helically wound yarn thread 45 is laid between the tubes. This yarn thread causes a great friction between the external and the internal tube, thus damping vibrations, if any, of the external tube. It serves also as an insulating body between the supply conductors. The supply- and carrying-off conductors 46 and 47 serve for the connection to the amplifying device. The cord 46 is connected to the internal tube 44 and the cord 47 to the ball 42. For further increasing the internal friction of the supporting arm, the intermediate space, may, if desired, still be filled up with wax.

I claim as my invention:

1. In electrical signal translating apparatus, the combination of an electromechanical translating device adapted to cooperate with a phonograph record and including a conductive casing and signal voltage generating means within said casing, a conductive member of substantially U-shaped cross section electrically connected to said casing, said member having sufficient stiffness to support said device and constituting the sole supporting means therefor, said casing having electrical connection with said voltage generating means, a second conductive member electrically connected to said voltage generating means, said second-named member being located between the sides of said U, and means for maintaining said conductive members equally spaced from each other throughout their common lengths.

2. In electrical signal translating apparatus, the combination of an electromechanical translating device adapted to cooperate with a phonograph record and including a conductive casing and signal voltage generating means within said casing, a conductive member of substantially U-shaped cross section electrically connected to said casing, said member having sufficient stiffness to support said device and constituting the sole supporting means therefor, said casing having electrical connection with said voltage generating means, a second conductive member electrically connected to said voltage generating means, said second-named member being located between the sides of said U, and means electrically insulating said members from each other and maintaining said conductive members equally spaced from each other throughout their common lengths.

3. The invention set forth in claim 1 characterized by the addition of damping means between said conductive members, said damping means being of a character which exhibits appreciable internal friction.

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