Feb. 11, 1947. W. S. BACHMAN 2,415,403

VIBRATION TRANSLATING DEVICE

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Fig. 1.

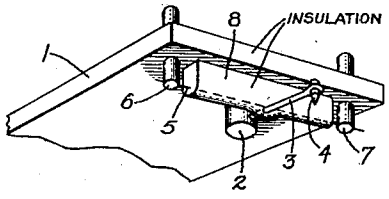


Fig. 3.

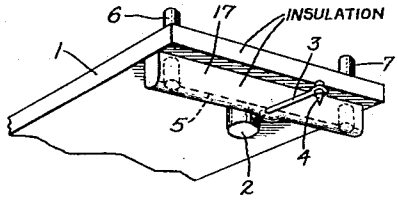
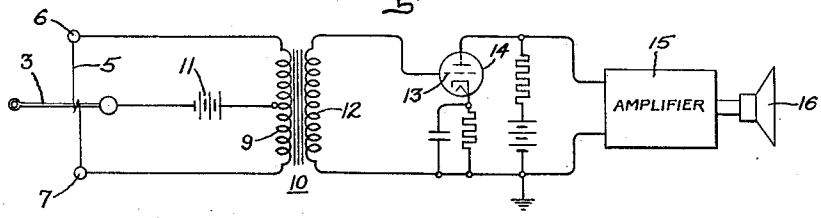


Fig. 2.



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UNITED STATES PATENT OFFICE

2,415,403

VIBRATION TRANSLATING DEVICE

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Application December 29, 1945, Serial No. 638,380

5 Claims. (Cl. 179—100.41)

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My invention relates to vibration translating devices, such as phonograph pickups, and more particularly to such devices for translating mechanical vibrations into electrical variations. This application is a continuation in part of my copending application Serial No. 565,357, filed November 28, 1944, and assigned to the assignee as the present invention.

In my above mentioned application there are described various forms of phonograph pickups employing high resistance wires which are strained in accordance with the vibrations of a sound track to produce electrical variations corresponding to the sound. Such pickups may be constructed with very light, moving parts so that the stylus may be made to follow the grooves of a sound record accurately over a wide range of frequencies of the recorded sounds. It is an object of my invention to provide a vibration translating device employing a high resistance wire for translating vibrations into electrical variations and in which the wire may be mounted in a normally unstressed condition.

The novel features 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 organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing in which Fig. 1 is a perspective view of a portion of a phonograph pickup head embodying my invention; Fig. 2 is a diagram of the electric circuit connections employed with the pickup of Fig. 1; and Fig. 3 is a view similar to Fig. 1 showing a modified form of my invention.

Referring now to the drawing, the pickup illustrated in Fig. 1 comprises a head 1 comprising a block of insulating material having a conducting post 2 rigidly mounted in the block 1 and having a stylus member or element 3 secured thereto. The member 3 comprises an arm of steel or other suitable resilient material and a permanent stylus point 4 mounted at the end of the arm remote from the post 2. During operation of the head, the stylus point 4 travels in the groove or sound track of the record and the member 3, acting as a cantilever beam, vibrates in accordance with the sound to be reproduced. In order to translate the vibrations into electrical variations suitable for amplification and reproduction, a fine resistance wire 5 is secured to the stylus member 3 at a short distance from

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the post 2 and the ends of the wire are rigidly held in good conducting relation with two conducting posts 6 and 7 rigidly mounted in the block 1 on either side of the post 2. The wire 5 may be made of nichrome or other suitable material and should be selected to have uniform elasticity throughout its length. The diameter of the wire may be of the order of one one-thousandth of an inch. The dynamic mass of the cantilever beam or stylus arm 3 may be made very small. The small dynamic mass enables the point 4 to follow the sound track readily with minimum possibility of damage, and the tone arm or supporting device (not shown) to which the head is secured may be balanced so that the unbalanced weight on the stylus point is, say, one-half ounce or less. The wire 5 may be secured to the stylus member 3 by wrapping it around the member so that the member and the wire are in good electrical conducting relationship. The wire 5 and the portion of the member 3 to which it is secured are embedded in a body of resilient insulating material 8, which has been illustrated as cemented or otherwise secured to the underside of the head 1. Any suitable flexible insulating material which may be made to closely embed the wire and restrict its lateral movement may be employed. One material suitable for this purpose is the cellulose nitrate plastic sold under the trade name "Pyralin."

The body of insulating material 8 terminates short of the posts 6 and 7. When the member 3 is vibrated by displacement of the point 4 as it moves along the sound track of a record, the resistance of the portions of the wire 5 embedded in the material 8 on either side of the member 3 are varied in proportion to the intensity of the vibrations. The material 8 restricts the lateral movement of the embedded wire and, although the wire constitutes a long slender column which would bend readily upon application of a compressive force, the insulating material restricts this bending under high velocity stresses and as a result the wire is strained both in compression and in tension. Thus for any one displacement of the stylus member the portion on one portion of the member is strained in compression while that on the other side is strained in tension, and as the member vibrates this alternate and opposite straining of the two portions of the wire produces proportionate alternate and opposite variations of the electrical resistances of the two portions.

The pickup shown in Fig. 1 may be connected

in an electrical circuit as indicated in Fig. 2 in order to reproduce the recorded sound. The wire 5 is connected in a balanced electrical circuit, the terminals 6 and 7 being connected to the primary winding 9 of a transformer 10. The midpoint of the wire 5 is connected through the member to one terminal of a battery 11, the other terminal of which is connected to a midpoint tap on the primary winding 9.

When the member 3 is in repose the tension on each of the portions of the wire 5 is the same and the electrical circuit is balanced so that the same amount of current flows in the two halves of the primary winding 9; however, as soon as the member 3 is displaced by vibrations of the point 5 the resistances on the two sides of the wire 5 vary oppositely and the current flowing through the winding 9 increases in one direction or the other depending upon the direction of unbalance of the resistances of the two portions of the wire 5. Any variations in current in the primary winding 9 produce corresponding voltage changes in the secondary winding 12 of the transformer. The voltage changes in the secondary 12 are impressed on a control electrode 13 of an electron discharge device 14 which amplifies the voltage variations; these variations or signals are then further amplified by a power amplifier 15 connected to drive a loudspeaker 16. The circuit arrangement of Fig. 2 is conventional and has been employed heretofore to amplify oppositely varying electrical quantities.

The pickup head illustrated in Fig. 3 is similar to that shown in Fig. 1 and corresponding parts have been designated by the same numerals. The body of resilient insulating material employed in Fig. 3 and indicated at 17 not only surrounds the portions of the wire 5 adjacent the stylus member 3 in the manner of the material 8 in Fig. 1, but also surrounds the lower ends of the posts 6 and 7. This construction provides a more durable structure and prevents damage to the ends of the wire between the resilient material and the posts 6 and 7. The posts 6 and 7 also help to retain the insulating material 17 in position on the pickup head. The operation of the pickup of Fig. 3 is the same as that of the pickup of Fig. 1.

From the foregoing it will readily be apparent that I have provided a pickup including a simple and effective arrangement for utilizing a high resistance wire which is normally unstressed so that linear variations of resistance on both the tension and compression characteristic curves of the wire may be employed. The pickup is simple and effective in operation and requires a minimum number of moving parts.

While I have disclosed my invention as applied to a particular form of pickup head, other applications will readily be apparent to those skilled in the art. I do not, therefore, desire my invention to be limited to the specific constructions illustrated and described and I intend by the appended claims to cover all modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A vibration translating device comprising a support, a vibratory element mounted on said support, an electrical resistance wire connected to said element and extending laterally therefrom, and a body of resilient insulating material embedding said wire and said element adjacent said wire whereby said wire is strained in tension and in compression in accordance with the vibrations of said element.

2. A vibration translating device comprising a support, a vibratory member mounted on said support, two portions of electrical resistance wire connected between said member and said support one on either side of said member, and a body of resilient insulating material embedding said wire portions on both sides of said support and said element adjacent said wire portions whereby said wire portions are strained alternately in tension and in compression in accordance with the vibrations of said member.

3. A phonograph pickup comprising a supporting head, a stylus member supported at one end on said head and having a stylus point near its other end adapted to be displaced laterally upon movement along a record sound track, an electrical resistance wire supported on said head and connected to said member and having a straight portion extending laterally of said member, and a body of resilient insulating material embedding said straight portion of said wire and the adjoining portion of said member whereby said wire is strained in tension and in compression in accordance with relatively high frequency vibrations of said member produced by movement of said stylus point along a sound track, the electrical resistance of said wire being thereby varied in proportion to such vibrations.

4. A phonograph pickup comprising a supporting head, a stylus member supported at one end on said head and having a stylus point near its other end adapted to be vibrated upon movement along a record sound track, an electrical resistance wire having its ends connected to said head and its midportion connected to said member to provide straight portions of said wire on either side of said member, and a body of resilient insulating material embedding said straight portions and the adjoining portion of said member whereby vibrations produced by movement of said stylus point along a sound track produce strains in compression and tension in said straight portions so that the electrical resistances of said portions are varied oppositely in proportion to the vibrations of said member.

5. A phonograph pickup comprising a supporting head of insulating material, a conducting stylus member supported at one end on said head and having a stylus point near its other end adapted to be displaced laterally upon movement along a record sound track, a post of conducting material mounted in said head, an electrical resistance wire connected to said member and to said post, and a body of resilient insulating material embedding said wire and adjacent portions of said post and said member whereby said wire is normally unstressed and is strained in tension and in compression in accordance with relatively high frequency vibrations of said member produced by movement of said stylus point along a sound track to vary the electrical resistance of said wire in proportion to such vibrations.

WILLIAM S. BACHMAN.