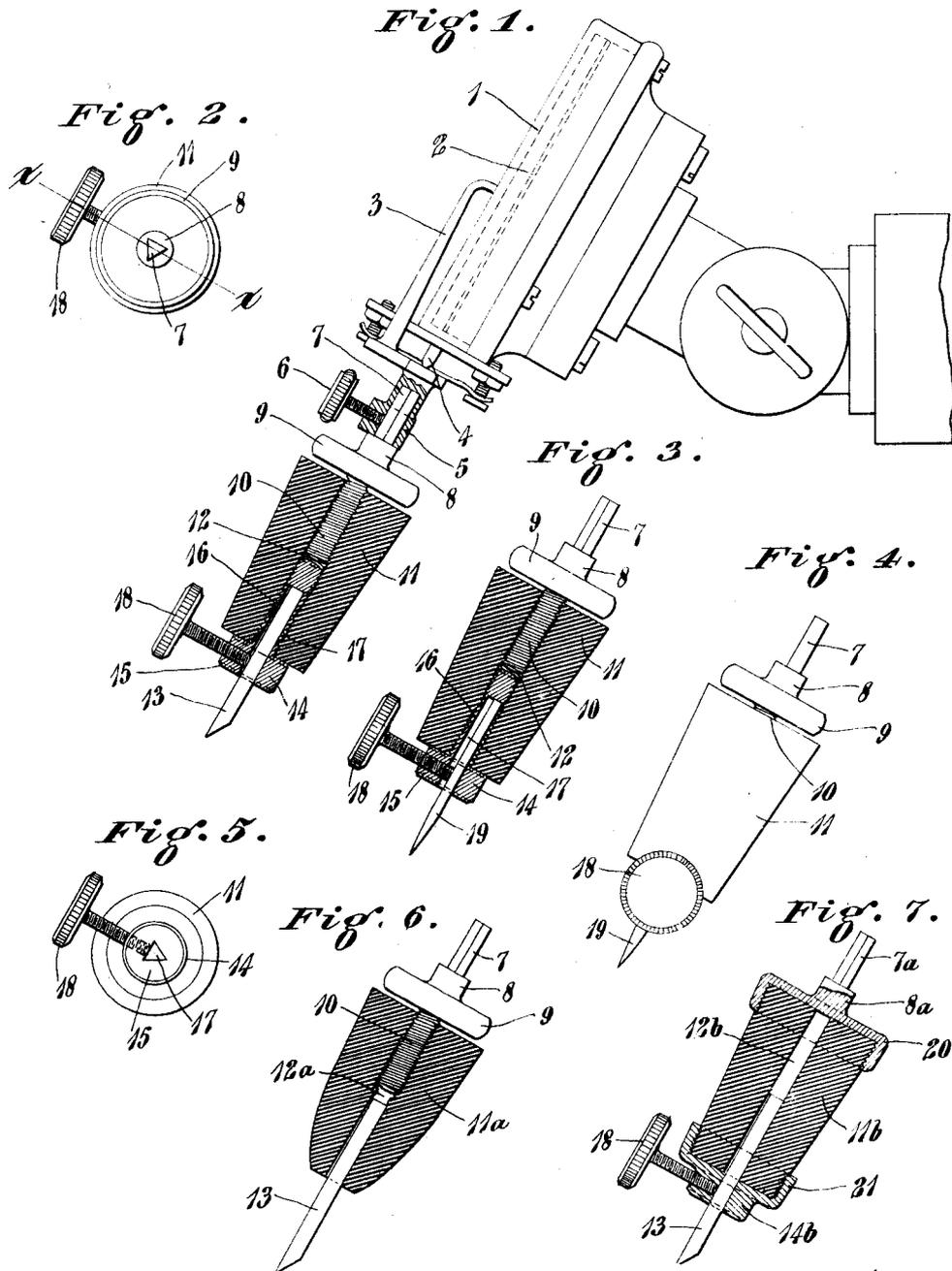


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ACOUSTIC NEEDLE MOUNTING.  
APPLICATION FILED OCT. 15, 1914.

1,194,573.

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# UNITED STATES PATENT OFFICE.

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ACOUSTIC-NEEDLE MOUNTING.

1,194,573.

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*To all whom it may concern:*

Be it known that I, WILLIAM A. TANGEMAN, a citizen of the United States, and a resident of Wyoming, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Acoustic-Needle Mountings, of which the following is a specification.

My invention relates to sound recording and reproducing machines; and its object is the provision of means for improving the quality of the sound reproduced by such instruments.

My invention consists in the parts and in the details of construction and arrangement of parts as will hereinafter be more fully described and claimed.

In the drawing: Figure 1 is a side elevation of a sound box with a needle mounted thereon by means of my invention, parts involved in my invention being shown in vertical section on a line corresponding to the line  $x-x$  of Fig. 2, the needle shown being one of triangular cross section, such as is usually made of bamboo or some such vegetable fiber; Fig. 2 is a detail plan view of the mounting shown in Fig. 1; Fig. 3 is a sectional view similar to that shown in Fig. 1, but showing the mounting carrying a needle of circular cross section, such as is usually made of metal; Fig. 4 is an elevation of the mounting, taken at right angles to that of Figs. 1 and 3, or looking along the line  $x-x$  of Fig. 2; Fig. 5 is an inverted plan view of the mounting with the needle removed; Fig. 6 is a sectional view corresponding to that shown in Figs. 1 and 3, but illustrating a modification of my invention in which the needle is carried directly in the cushioning material; and Fig. 7 is a vertical section similar to those of the preceding figures, but showing another modification in which the base and holder extend out around the respective ends of the cushioning body.

For the purpose of illustrating the use of my invention, I have shown, in the drawing, a sound box 1 with a diaphragm 2 to which is attached one end of the stylus lever 3, pivoted upon lugs 4 on the side of the sound box, and having in its opposite end a socket 5 into which enters a set screw 6, which

socket usually directly receives the stylus or needle that is to engage with the record.

The form of mechanism here shown is specifically intended for use with records having lateral undulations, but as will be discerned from the following description, my invention is applicable also in connection with records having vertical undulations or those of other forms, and may be applied to reproducing mechanisms of varying constructions and types, the one herein shown being selected merely to illustrate the principle of the invention.

Reproduction of a sound originally recorded, ordinarily makes manifest some imperfections in the record itself, and also a mechanical action upon the diaphragm caused by friction of the stylus or needle against the record, due largely to the inelasticity of the needle or stylus mounting. Indeed, such friction of the needle or stylus against the material of the record is manifest aside from the sounds produced by the diaphragm, and becomes most objectionable during the more quiet periods of the rendition of the record.

Indiscriminately muffling the sound of the instrument muffles the harmonic or musical sound vibrations which are intended to result exactly from and to reproduce exactly the undulations of the sound groove, as well as the undesirable or inharmonic sounds. The substitution of soft materials, such as fiber, for the purpose of absorbing sounds has, owing to inelasticity, failed to reproduce the true undulations of the record when it has been made so absorbent of sound as to materially modify the objectionable noises transmitted from the record as above described.

For reproducing all classes of sounds, including desired faint ones, overtones and high notes, it is highly desirable, in many instances, that a stylus or needle be used which will have very little sound absorbent properties, of such material as steel or sapphire.

Attempts have been made to prevent the objectionable noises by interposing a cushioning body between the stylus or needle and the stylus lever. Such efforts heretofore have failed to accomplish the object sought by the present invention either in be-

ing too inelastic and too absorbent of the sound, with the same objectionable results as are frequently experienced with the sound-absorbent needle or stylus; or in being not sufficiently absorbent to the sound, with the result that most of the objectionable sounds are transmitted.

In my invention I have provided a cushioning material between the needle or stylus and the stylus lever, of such properties and so disposed that I am enabled to successfully prevent the production of the noises without detracting from the desirable effects of the reproduction.

So far as I am able to determine, the success of my invention is due to the use of cushioning material, highly elastic, yet readily responsive to the undulations of the record, in combination with a proper disposition of such material to enable it to properly perform its function by virtue of the inherent properties of the material.

A material answering to the above description, and most readily suggested, is rubber. The degree of vulcanization of the rubber may be varied to suit the requirements, but such variation will ordinarily be within a range such that the degree of vulcanization may be described as resembling that of rubber ordinarily used for pencil erasers. The possibility of accurately governing the degree of hardness and elasticity of rubber enables me to provide a cushioning material to be used under any conditions which may be required to be met, as shown by experience with different sounds to be reproduced, or with records of different properties, or with different reproducing instruments.

Not only do I employ material having the descriptive properties above set forth, but I preferably provide the body of cushioning material of bulk that is large relative to that of the needle or stylus, as well as to that of the stylus lever and other moving parts between the needle and the diaphragm. I also while giving the cushioning body ample bulk, preferably leave it free exteriorly from any casing or other surrounding part of the mounting, associating with the cushioning material only such parts as are required to attach the material to the stylus or needle at one end and to the stylus lever at the other end, and preferably attaching these parts by extending them into the interior of the cushioning body rather than extending them around the exterior thereof. Thus, as shown in Figs. 1 to 5, inclusive, a shank 7 of cross section to fit the socket 5 has a hub 8 providing a shoulder abutting the end of the stylus lever 3 outside the socket 5, succeeded by a flange 9 of considerable diameter, past which is a threaded stud 10. The cushioning body 11, of material of the nature here-

inbefore described, is, as here shown, preferably of elongated moderately frusto-conical shape, and has an opening 12 of circular cross section through its inside from one end to the other. This opening 12 receives the threaded stud 10, so that the larger end of the body 11 is presented up toward the stylus lever 3, the threaded stud 10 cutting threads in the walls of the opening 12 so that the body 11 is screwed onto the described base in which the stud 10 is comprised, and may be brought up as far thereon as may be desired. The flange 9, with its considerable diameter, affords means for holding the base while screwing the body 11 thereon.

The stylus or needle 13 is held in a holder 14 comprising a lower enlarged head 15 and a threaded stud 16 which enters the lower end of the opening 12, cutting threads in the walls of the opening 12, and which may thus be drawn as far up in the body 11 as may be desired. Extending longitudinally of this holder 14 through the head 15 and some distance up in the interior of the stud 16 is a socket 17, which is made triangular in cross section to receive needles like the needle 13, and a set screw 18 projects through one side of the head into this socket to clamp the needle. Such a socket will also hold needles of circular cross section, such as the needle 19 shown in Figs. 3 and 4.

The behavior of the cushioning body 11 will be largely influenced by the extent to which the studs 10 and 16 of the base and holder, respectively, are inserted into the central opening 12. If they are inserted so far that they meet, the action of the mounting will be more like the solid metallic mounting that would be provided by inserting the needle 13 directly into the stylus lever 3, although of course still greatly influenced by the material of the cushioning body 11, because this body is instrumental in holding the two studs together and thereby makes up part of the connection, even though the studs make metallic contact. As the studs 10 and 16 are separated by screwing one or the other or both of them out of the cushioning body, the relative influence of the material of the cushioning body will increase. From the foregoing it will be seen that I add this ability of making mechanical adjustment to that of governing the hardness of the rubber or other material which may be found suitable.

The provision of means to refine the reproduction of sounds is far more greatly a matter of practice than of theory. So much is it a matter of that nature that apparent similarity of materials are more often deceptive than not, and the least variation of hardness or elasticity may be very significant, as may also the least variation of disposition of the material in the structure of

the mounting. Therefore, by providing some material susceptible of great variation in its properties, and at the same time liberally disposing of such material, I am enabled to adjust the hereinbefore described details with great precision and secure accordingly accurate results.

In the modification shown in Fig. 6, the base is like that shown in the preceding figures and above described, but the body of cushioning material 11<sup>a</sup> has the lower part of its frusto-conical formation of increased taper, which taper is preferably somewhat curved, and the needle or stylus 13 is inserted directly into the lower part of the central opening 12<sup>a</sup> of the body 11<sup>a</sup>, the threaded stud 10 of the base being screwed into the upper part of this opening as was done in the preceding example. The diameter of the opening 12<sup>a</sup> relative to the dimensions of the needle 13 may be varied so that the needle may be made to fit the opening more or less tightly, this detail also having a bearing upon the behavior of the mounting. Also the needle 13 may be inserted to a greater or less distance into the body 11<sup>a</sup> or may be made to make contact with the lower end of the stud 10, with results similar to, but less marked, than those of the contact of the studs 10 and 16 in the preceding example. It will also be understood that the lower part of the opening 12<sup>a</sup> may be made of proper diameter to receive a needle of small circular cross section, such as that shown in Figs. 3 and 4. The additional tapering of the lower part of the body 11<sup>a</sup>, where the needle or stylus is directly inserted, compensates to some extent for the reduction of bulk by the elimination of the holder 14, making the lower end of the cushioning body 11<sup>a</sup> more responsive to vibration of the needle than were it not reduced.

In the modification shown in Fig. 7, the base has the shank 7<sup>a</sup> and the hub 8<sup>a</sup>, but the flange 9 and threaded stud 10 are replaced

by a cup 20 into which is screwed the upper end of the cushioning body 11<sup>b</sup> and the holder 14<sup>b</sup> has, instead of the threaded stud 16, a cup 21 that screws onto the lower end of the cushioning body 11<sup>b</sup>. The body 11<sup>b</sup> has a central opening 12<sup>b</sup>, but it merely serves to permit the extension of the needle or stylus 13 up from the body of the holder 14<sup>b</sup>. I consider this construction less desirable than those shown in Figs. 1 to 6, inclusive, but it embodies my invention, in that the cushioning material enters into the connection of the needle or stylus with the stylus lever and is unconfined throughout a substantial extent of its length exteriorly, allowing the cushioning body to perform its function without undue influence of any surrounding metal or other material more non-absorbent of sound. When the cushioning body is too much confined by a metal casing or similar arrangement, I find that the behavior of the mounting is so much like that of the material of the casing that satisfactory results are not attained.

From the foregoing it will be understood that my invention is capable of considerable modification without departure from the scope and spirit of the following claim:

In an acoustic needle mounting, in combination with a diaphragm and the vibratory lever connected thereto, and a needle or stylus, a hollow cushioning body composed of flexible rubber making up a connection between the lever inserted in one end of said body and the needle or stylus inserted in the other end thereof, said body being tapered toward its free end and being unconfined throughout its length, and its upper end also being unconfined and spaced apart from its mounting and free to yield naturally, substantially as set forth and for the purposes specified.

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