Aug. 22, 1950 E. L. MACK 2,519,488

SOUND REPRODUCING STYLUS

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FIG. 1.

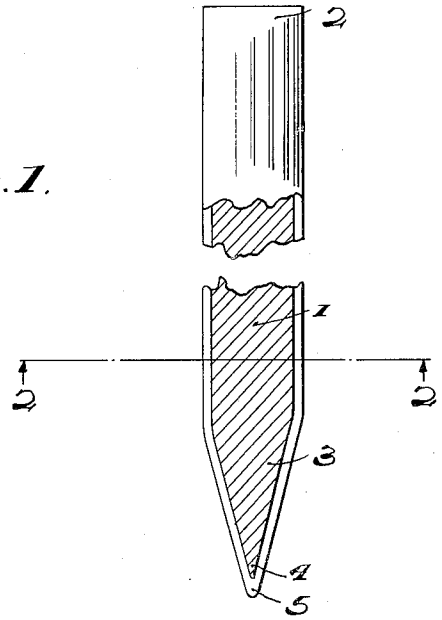
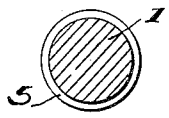


FIG. 2.



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SOUND REPRODUCING STYLUS

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2 Claims. (Cl. 274—38)

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This invention relates to sound reproducing styluses adapted for use in connection with tablet-and-stylus sound reproducing devices.

An object of my invention is to provide a sound reproducing stylus wherein at least the surface of the tablet-engaging end is of a hardness substantially greater than that of the basic material of the stylus.

A further object of my invention is to provide a sound reproducing stylus of aluminum wherein at least the surface of the tablet-engaging end is composed of an oxidation product of aluminum.

A further object of my invention is to provide a sound reproducing stylus basically made of relatively soft metal and having a hard, wear-resistant surface developed by chemical means on at least the tablet-engaging end.

A further object of my invention is to provide a sound reproducing stylus basically made of relatively soft metal and having a hard wearing surface developed by electro-chemical means on at least the tablet-engaging end.

A further object of my invention is to provide methods by which styluses having the described characteristics may be made.

With these objects in view, together with such other objects as may appear herein, I declare the following to be a full, clear and complete description of my invention, such as will enable any one skilled in the art to practice the same.

For use in the stylus-and-tablet type of sound reproducing device, it is desirable that the stylus be somewhat rounded on the end which makes contact with the tablet (the said end being sometimes herein referred to as the "tablet-engaging end"), a conventional radius of curvature commonly in use being .0025", and that the rounded surface be smooth and of extreme hardness in order to minimize change in the conformation thereof due to wear by frictional contact with the moving tablet. Styluses have most commonly been made of steel but the tablet-engaging end of such styluses deteriorates rapidly through wear in contact with the tablet and the usual practice is to discard them after reproducing a single tablet or, at most, a few tablets. Other styluses of a so-called "semi-permanent" character have been made and used, in which styluses a material harder than steel was used for either the entire stylus or for the tablet-engaging end which was frequently attached to or inserted in the tapered portion of the stylus. Material such as sapphire or other jewels, rare metal carbides such as tungsten carbide, and

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other hard substances have been used in the tablet-engaging end of such semi-permanent styluses. The results have been reasonably satisfactory so far as concerns resistance to wear but such styluses in many cases are fragile as well as expensive to manufacture due to the fact that the tablet-engaging end must usually be formed from a baroque shape and attached in some manner to the stylus. By my invention I have provided a semi-permanent stylus which can be made at a cost comparing favorably with that of the ordinary steel stylus but capable of reproducing the sound from many more tablets before wear necessitates its replacement. In fact, the number of reproductions obtained from styluses made according to my invention compares favorably with that from semi-permanent styluses tipped with the hard materials hereinabove mentioned.

In its simplest form my invention provides a stylus of aluminum or of an alloy of high aluminum content, both of which are herein referred to and included within the term "aluminum," on at least the tablet-engaging end of which stylus I cause to be formed an adherent surface layer of the oxidation product of aluminum. In order to bring about the formation of the adherent surface layer of the oxidation product of aluminum, I subject at least the tablet-engaging end of the stylus to oxidation by chemical means or preferably by electrolytic means such as anodic oxidation, all according to procedures described in many reference books on electro-chemistry and on metallurgy. I thus produce a stylus basically made of aluminum but having an authigenic adherent surface layer of oxidized aluminum or aluminum oxide, a substance which in the form thus obtained possesses great hardness and little ductility.

Even styluses of the semi-permanent type are considered worn out and normally are discarded when they have undergone sufficient wear to alter the contour of the tablet-engaging end very slightly from its original value, but this small amount of wear is ordinarily less than the thickness of the oxidized aluminum layer which I apply to styluses made according to my invention. In fact since the surface layer of aluminum oxidation product obtained as above described may tend to increase in hardness with increasing depth from the outer surface, I may remove, as by polishing, the outer layers thereof in order to expose the harder layers lying at a depth somewhat removed from the outer surface.

In the figures, Fig. 1 represents diagrammati-

cally a partial cross-sectional view of a stylus embodying my invention; and

Fig. 2 represents a cross-sectional view taken along the line 2—2 of Fig. 1.

As shown, the stylus 1 is composed of a shank portion 2, a tapered end portion 3 terminating in a rounded tablet-engaging end 4, the surface of the stylus or at least the tablet-engaging end thereof being covered with an adherent layer of aluminum oxidation product or aluminum oxide 5.

It will be seen that one of the advantages of my invention is that the general contour of the tapered portion of the stylus 3 as well as that of the rounded tablet-engaging end 4 may be formed from the relatively soft metal aluminum, thus adapting the production of the stylus to modern manufacturing practices which may include turret lathe or multiple-spindle lathe production, cold upsetting, or the like. The surface layer of aluminum oxidation product may subsequently be formed in place by anodic electrolytic treatment of the formed styluses in large quantities, in a single lot. If preferred, however, less than the entire surface of the stylus can be subjected to said treatment; for example, only the tapered portion or only the pointed tip of the stylus may be subjected to the oxidizing treatment. If it is desired to remove the outer layers of the oxidized aluminum layer as hereinabove described, this may be accomplished by barrel tumbling of a quantity of the otherwise completed styluses either alone or with a finely divided abrasive, such as corundum, silicon carbide, boron carbide, or diamond.

I thus use the extremely hard form of oxidized aluminum produced as herein specified to serve as the tablet-engaging end of my stylus in the form of a surface layer perhaps no more than .001" thick but supported and reinforced by more ductile, less brittle aluminum backing. As the basic material for my stylus I prefer to use one of the hard alloys of aluminum, such as the alloy commonly known as Duralumin (but herein included in the term "aluminum" as above explained), and if a heat-treatable material is used, it is preferable to have it in its hardened condition. I use the selected metal in the form of a wire or rod of any appropriate dimension, as for example a rod approximately $\frac{5}{8}$" long and on the order of $\frac{1}{16}$" in diameter, or if preferred other diameters may be used. The taper of the tapered end of the stylus is not critical but the rounded tablet-engaging end will ordinarily have a radius of about .0025", although lesser and greater radii may be used with success. The

thickness of the layer of aluminum oxidation product necessary to attain the objects of my invention may be varied within wide limits but, in general, one one-thousandth of an inch is sufficient although less may be used and a greater thickness brings no appreciable disadvantage.

While I have hereinbefore assumed an aluminum blank or core material in explaining my invention, it is to be expressly understood that the stylus may be provided with a body or core of any other suitable metal that has aluminum appropriately attached thereto where the tablet-engaging end of oxidized aluminum is to be produced in conformity with the present invention. Thus the stylus may be formed of steel and subsequently coated with aluminum by any one of many known processes including aluminizing and finally subjected to formation of the oxidized aluminum layer as herein previously described.

What is claimed is:

1. A sound reproducing stylus of the semi-permanent type having at least its tablet engaging end provided with an aluminum surface that has at least its tablet engaging portion formed of authigenic anodic oxidized aluminum.

2. The method of making a sound reproducing stylus which includes forming a stylus with at least its tablet engaging end providing an aluminum surface, subjecting at least the tip end of said aluminum surface to anodic oxidation and exposing a harder layer beneath the surface in said oxidized portion.

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