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METHOD OF AND APPARATUS FOR FLAME
FORMING CORUNDUM STYLES
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Fig. 1.

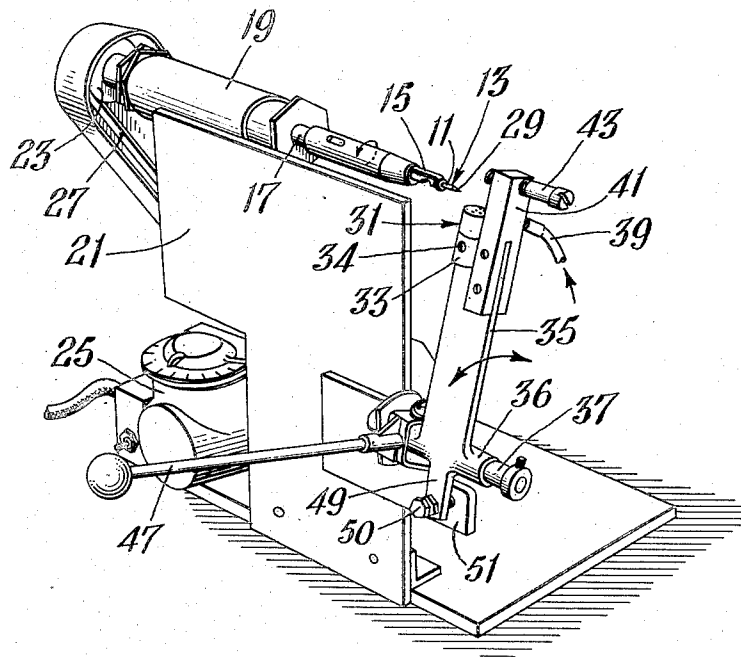
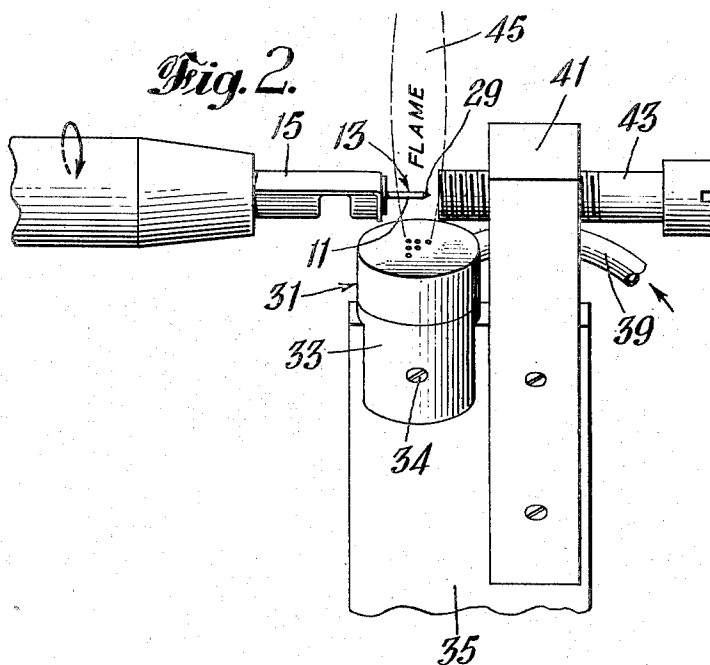


Fig. 2.



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METHOD OF AND APPARATUS FOR FLAME FORMING CORUNDUM STYLES

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9 Claims. (Cl. 49—58)

1

This invention relates to a novel method of and apparatus for thermally shaping the apex of a unicrystalline corundum style, and more particularly relates to flame-rounding the apex of a corundum phonograph needle.

For some time there has been available a procedure for rounding and simultaneously glossing the apex of a relatively thick corundum phonograph style or needle, having a diameter of about $\frac{1}{16}$ inch, by grinding one end to a cone including an angle of 30 degrees, truncating the point of the cone slightly by grinding to form a blunt apex, and then directing on oxy-natural gas flame against the needle while it rotates, to cause the material at and adjacent its apex to melt and assume a curvature of small radius. This procedure has been satisfactory for such needles, but when attempts were made to flame-round relatively thin corundum needles having a diameter of only about .030 inch and having a relatively blunt cone including an angle of about 45 degrees, it was difficult to control the flame intensity and size accurately enough both to flame gloss the needle shank and to form the same radius on the apex of each needle being treated. Control of the shaping operation also was adversely affected by atmospheric drafts which caused flickering of the flame. Since such thin corundum needles having 45 degree cones are employed as inserts in the ends of metal or plastic shanks, and since most corundum phonograph needles are of this insert type, it is evident that a flame-rounding procedure could not be adopted widely in the phonograph needle industry until the radius could be controlled more exactly.

The principal object of the present invention is to provide a novel method of and apparatus for reproducing thermally the same radius of curvature on the apex of each of a series of thin corundum styles regardless of variation in such factors as heating intensity and size of the flame, and regardless of atmospheric drafts. Another object is to eliminate the need for new flame adjustment when forming each successive corundum style.

The above and other objects will become apparent from the following description, having reference to the accompanying drawing, wherein:

Fig. 1 is a perspective view showing an arrangement of apparatus for flame-rounding the apex of a corundum style; and

Fig. 2 is an enlarged side elevational view of a part of the apparatus shown in Fig. 1.

2

In accordance with the present invention a relatively thin corundum style having one end ground conically to a cone of about 45 degrees having a blunt apex is rotated about its longitudinal axis while a flame is applied transversely to the style adjacent its apex, as in the former procedure. Exact and reproduceable control of the radius of curvature is assured by maintaining a heat conductive body of metal as a heat leak directly in the flame opposite and close to the apex of the style to control the input of heat from the flame to the style by conducting heat away from the flame and acting as a stabilizer to compensate for variations in the heating effect of the flame. The metal heat conductor also produces a steep temperature gradient from the apex of the style back to its shank, thus causing the surface of the style to become flame-glossed from the apex to the shank without overheating the apex. The heat leak must have sufficient mass and conductivity to provide an equilibrium temperature which is cool relative to the flame, and advantageously is of an oxidation-resistant metal such as stainless steel or Monel metal.

The method described briefly above can be performed by apparatus of the type shown in Figs. 1 and 2 wherein the shank 11 of a corundum style 13 is carried in a conventional chuck 15 mounted on one end of a shaft 17 which rotates in a journal 19 carried on an upright supporting bracket 21. For rotating shaft 17, a sheave 23 fixed on the opposite end of the shaft is rotated by an electric motor 25 acting through a driving belt 27.

For flame-rounding the apex 29 of style 13 a multijet burner 31 having a bifurcated lower end 33 is mounted by a set screw 34 on the top of an upright tongue 35 having a sleeve 36 on its lower end pivotally journalled on a horizontal pivot 37 which projects from bracket 21 below and parallel to the longitudinal axis of chuck 15. A combustible gas mixture such as an oxy-propane mixture is supplied to the burner 31 from any suitable source through a hose line 39. Tongue 35 is positioned so that burner 31 is normally at one side of the chuck axis but can be moved at will into heating position in a direction across the chuck axis.

Also mounted by set screws on the top of tongue 35 on that side of burner 31 remote from chuck 15 is an upright bifurcated support 41 projecting above the burner. Support 41 has a horizontal bore near its upper end into which is threaded a metal bolt 43 projecting above the burner 31 in position to be maintained in the flame 45 dur-

3

ing a flame-rounding operation. Bolt 43 is approximately parallel to chuck 15 and is adjustable at will in support 41 toward and away from the chuck to vary the extent of the bolt into the flame.

A handle 47 projects laterally from sleeve 36 so that an operator can raise the burner 31 and the bolt 43 in unison in a direction across the longitudinal axis of the chuck into position for heating a style 13. A second tongue 49 projects down from sleeve 36 and carries an adjustable stop bolt 50 which is adapted to strike an abutment 51 projecting horizontally from the bracket 21 so that the proper heating position can be set initially by the operator and thereafter assumed automatically each time a new style is to be flame-rounded.

When the burner 31 and the bolt 43 are in their operating positions, the burner is directly below the style 13 and the end of the bolt is positioned directly in the flame opposite and close to the apex of the style as in Fig. 2. Generally the distance between the apex of the style and the end of bolt 43 is of the order of .01 to .05 inch. Bolt 43 absorbs heat from the flame so as to compensate for variations in the heating effect of the flame due to small variations in the gas flow and flickering of the flame due to atmospheric drafts.

There also seems to be a flame deflecting action of the heat leak 43. When the flame tends to flicker over to the apex of the needle, the heat leak deflects it back to an approximation of its original position.

The described method and apparatus have operated successfully on very thin corundum phonograph needles having a diameter of only .030 inch, an apex radius of only 0.0015 inch, and a cone angle of 45 degrees. Twenty-two well-shaped needles were formed in succession, using a $\frac{3}{8}$ inch diameter bolt 43 having its end about 0.05 inch from the apex of each corundum needle 13. Of course, when a considerable number of corundum needles are to be flame-rounded, the proper positioning of the heat-conductive bolt 43 is established by trial on the first few needles, and is thereafter maintained constant for the rest of the needles. If the bolt is too close to the needle the rounded apex will not have a smooth, glossy surface, while if the bolt is too distant from the needle, the apex will be overheated by the flame and an undesirable ball shape will be obtained instead of the desired shape wherein the conical surface is tangent to and merges smoothly with the rounded apex.

One specific embodiment of apparatus embodying the principles of the invention has been described solely by way of illustration. It is to be understood that the claims are not limited to the specific embodiment described and shown, but are to be interpreted as including variations in the construction and relative arrangement of parts which can be adopted within the scope of the invention.

What is claimed is:

1. A method of flame-rounding the apex of a thin corundum style which comprises applying flame transversely to said style at said apex while rotating said style about its longitudinal axis; and maintaining in said flame opposite and close to said apex a body of metal which absorbs heat from said flame and acts as a stabilizer to compensate for variations in the heating effect of said flame.

2. A method of flame-rounding the apex of a thin corundum style which comprises rotating

4

said style about its longitudinal axis; heating the apex of said style in close proximity to a body of metal by moving in unison a heating flame and a heat-conductive body of metal in said flame from a first position spaced from said style into such a second position that said flame impinges transversely against the apex of said rotating style and said body of metal is opposite and close to said apex, said body of metal acting as a stabilizer to compensate for variations in the heating effect of said flame; and after said apex is rounded by said flame, moving said flame and body of metal in unison back to said first position.

3. Apparatus for flame-rounding a corundum style comprising, a rotatable chuck adapted to receive said style; means for rotating said chuck about its longitudinal axis; a burner so constructed and arranged as to direct flame across such axis just in front of said chuck when in heating position; and a heat-conductive body of metal so positioned as to extend into such flame opposite said chuck when said burner is in heating position, said body of metal acting as a stabilizer to compensate for variations in the heating effect of said flame.

4. Apparatus in accordance with claim 3, wherein said heat-conductive body of metal is adjustable toward and away from said chuck to vary the extent of said body into such flame.

5. Apparatus in accordance with claim 4 wherein said heat-conductive body of metal is a bolt, said apparatus also comprising a support for said bolt, and said bolt being threaded therein and adjustable approximately parallel to said longitudinal axis of said chuck.

6. Apparatus in accordance with claim 3 wherein said burner is normally positioned at one side of said longitudinal axis and is movable in a direction across such axis into heating position.

7. Apparatus in accordance with claim 6 also comprising a common support for said burner and said heat conductive body, said body also being normally positioned at one side of said longitudinal axis and being movable with said burner into position opposite said chuck.

8. Apparatus in accordance with claim 7 wherein said common support is a tongue carrying both said burner and said heat conductive body at one end thereof, and pivoted at the opposite end thereof about a second axis approximately parallel to said chuck.

9. Apparatus in accordance with claim 3, also comprising a support for said heat conductive body having a bifurcation, said burner also having a bifurcation, both of said bifurcations fitting over the top of said tongue and being secured thereto.

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