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2,743,348

ENGRAVING STYLUS

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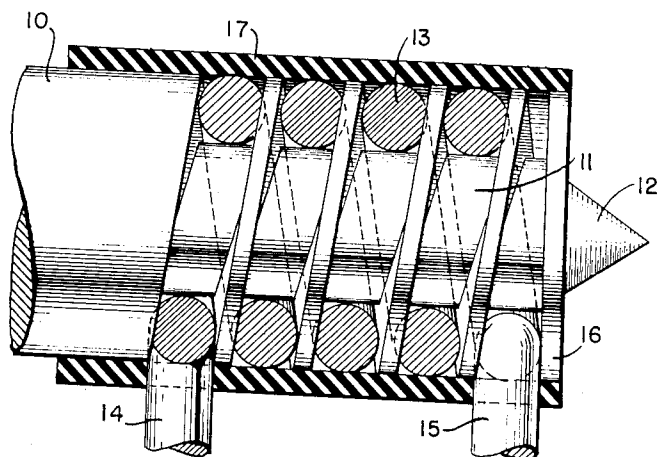


FIG. 1

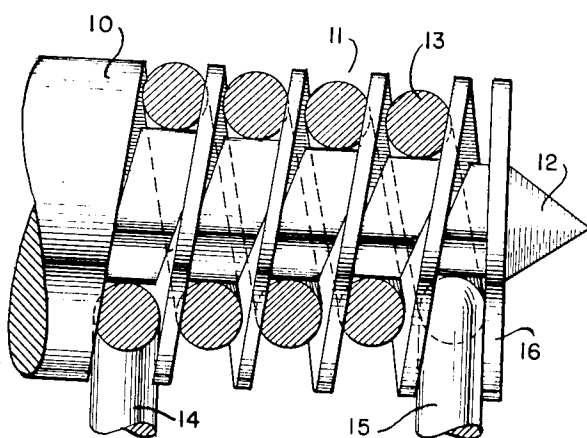


FIG. 2

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ENGRAVING STYLUS

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4 Claims. (Cl. 219—21)

This invention relates to engraving styli and, while it is of general application, it is particularly suitable for embodiment in styli for engraving image-reproducing plates by the apparatus described and claimed in applicant's prior Patent No. 2,575,546 entitled "Machine for Producing Screened Relief Pattern Plates."

In the engraving of plates of thermally decomposable material, such as cellulose-nitrate, by a machine of the type described in the above patent, it is desirable to maintain the temperature of the tip of the engraving stylus at a relatively high and approximately uniform temperature under all operating conditions, that is, both when forming relatively shallow deformations, corresponding to darker shades of an image, and deep deformations, corresponding to high-lights of the image. In order to achieve such a result, it is necessary to establish a relatively free flow of heat from the electric heating coil conventionally used with such an engraving stylus to the tip of the stylus so that the flow of heat to the tip will increase or decrease with the "load" on the stylus, that is, the amount of deformation or decomposition which it effects.

Another problem encountered in the operation of such an engraving machine is the tendency of heat radiated from the stylus heating coil to soften the engraving plate in the vicinity of the elementary area being engraved or to swell and buckle away from the surface of the supporting cylinder, or both. Such effects may act cumulatively to impair the sharpness of the resulting deformations and the quality of the image reproduced by the plate.

It is an object of the present invention, therefore, to provide a new and improved engraving stylus which obviates one or more of the foregoing disadvantages of engraving styli heretofore proposed.

It is another object of the invention to provide a new and improved engraving stylus characterized by relatively free heat flow from the heating coil to the engraving tip of the stylus.

It is a further object of the invention to provide a new and improved engraving stylus including provisions for shielding a plate being engraved from direct radiation from the heater coil while engraving.

In accordance with the invention, a heatable stylus for engraving a plate of thermally deformable material and designed for oscillation at a frequency of at least a few hundred cycles per second comprises a metallic shaft having a diameter not exceeding a few tenths of an inch and having a substantially helical channel extending along its periphery substantially to the end thereof and terminating at said end in a deforming tip and an electric heating coil disposed in the channel and adapted for operation at a temperature at least of the order of 1800° F. so that heat is transferred to the stylus by radiation and conduction.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection

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with the accompanying drawing, while its scope will be pointed out in the appended claims.

Fig. 1 of the drawing is a longitudinal view, partly in section, of an engraving stylus embodying the invention; while

Fig. 2 is a similar view of a modified form of engraving stylus embodying the invention in which the heating coil is in the form of a tapered helix.

Referring now to Fig. 1 of the drawing, there is illustrated a heatable stylus for engraving a plate of thermally deformable material comprising a cylindrical metallic shaft 10 having a substantially helical channel 11 extending along its periphery and terminating in a tapered or conical plate-deforming or engraving tip 12. The channel 11 is of a depth preferably of the order of one-half the radius of the shaft and has an approximately square cross section, while the tip has a maximum diameter not exceeding, and preferably somewhat less than, the root diameter of the shaft 10. The tip 12 is preferably conical or pyramidal having an apex angle between 60° and 90° and preferably of the order of 75°.

The stylus of Fig. 1 also includes means for heating the tip 12, the heating means preferably being in the form of an electric heating coil 13 disposed in the channel 11 and provided with lead conductors 14 and 15. The electric heating coil 13 is of a material capable of operating at high temperatures so that it is adapted for operation at a temperature such that a substantial portion of the heat is transferred to the stylus by radiation as well as by conduction. At the operating temperature, the surface of the wire of coil 13 oxidizes sufficiently to insulate it electrically from the shaft 10 at the low voltages normally utilized. The coil 13 is formed of a wire having a cross-sectional area substantially equal to that of the channel 11.

The stylus of Fig. 1 further includes means for shielding a plate being engraved from direct radiation from the heating coil 13, principally from the end turn thereof. To this end, the channel 11 terminates in a radially extending fin or baffle 16 surrounding the end of the shaft. It will be understood that the channel 11, the baffle 16, and the tip 12 are formed integrally from homogeneous stock, as by milling, grinding, casting, or the like. If desired, the portion of the shaft 10 including the channel 11 and the baffle 16 may be enclosed in a heat insulating shield or jacket 17 surrounding the coil 13.

With a construction of the type described above, a substantial portion of the heat is transferred from the coil 13 to the shaft 10 by radiation and the rest by conduction. For this purpose, the wire should operate at a temperature in the range of 1800° F. to 1900° F., which is of a bright cherry red color. Radiation takes place radially outward from the surface of the wire of the coil 13 in all directions and, with the wire inserted in the channel and substantially filling the channel, as indicated, the greater portion of the radiated heat is intercepted by the shaft 10 and the walls separating adjacent turns of the helical channel 11. This is in addition to the heat transferred by direct contact through the oxide coating. Heat then flows through the core of the shaft 10 to the tip 12. Actually it is believed that the greater portion of heat for the tip 12 is derived from the end turn of the coil 13 and that the remaining turns of the coil merely establish a proper heat gradient.

With the construction described and with the reduced diameter, large angle tip, the distance from the end turn of the coil 13 to the tip is a minimum, resulting in an improved heat flow by conduction and a minimum radiation by the tip itself. In operation the tip 12 maintains a cherry red color even to its engraving point, while in prior styli the tip darkens perceptibly for an appreciable distance back from the engraving point. With the en-

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graving point of the stylus maintained at this higher temperature, the stylus is capable of forming a greater number of deformations per second and thus of imparting a higher engraving speed to a machine to which it is applied. At the same time, the end fin or baffle 16 shields the plastic plate during engraving from direct radiation from the coil 13, particularly the end turn thereof, to prevent softening and buckling of the plate. The heat-insulating shield 17 serves to conserve the heat developed by the coil 13 and thus further improve the efficiency of the stylus.

While the parameters of the stylus of Fig. 1 may be varied in accordance with particular applications, one satisfactory design has the following specifications:

Shaft 10:

A refractory alloy comprising essentially 44% cobalt, 33% chromium, 17% tungsten, and 2¼% carbon and commercially available under the trademark "Rexalloy" from the Crucible Steel Co.

Channel 11:

Cross section—0.040 inch square.

Tip 12:

0.30 inch outer diameter.

Apex angle 75°.

Operating temperature approximately 1700° F.

Coil 13:

80% nickel—20% chromium alloy.

6 turns of 0.040 wire having a specific resistivity of 650 ohms/circular mil foot.

Operating temperature 1800° F. to 1900° F.

From the foregoing specifications it is seen that the diameter of the shaft 10 does not exceed a few tenths of an inch so that it has a small inertia such that it can be readily oscillated at frequencies of a few hundred cycles per second or more required for making screened relief pattern plates, for example at 350 cycles per second specified in applicant's prior Patent 2,575,546 referred to above.

In Fig. 2 is illustrated a modified form of the invention in which corresponding elements are given similar reference numerals. The essential difference in the stylus of Fig. 2 is that the channel 11 is in the form of a tapered helix and the coil 13 has a similar configuration. With this construction, the end turn of the coil 13, which is primarily effective in the transfer of heat to the tip 12, is disposed somewhat closer to the tip so that the path of heat flow by conduction through the shaft 10 is somewhat shortened. The heat-insulating shield 17 is shown as omitted from the stylus of Fig. 2, but this may, of course, be added if desired. The principles of operation of the stylus of Fig. 2 are in all respects similar to those of Fig. 1 described above.

While there have been described what are at present considered to be the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A heatable stylus for engraving a plate of thermally

deformable material and designed for oscillation at a frequency of at least a few hundred cycles per second and comprising: a metallic shaft having a diameter not exceeding a few tenths of an inch and having a substantially helical channel extending along its periphery substantially to one end thereof and terminating at said end in a deforming tip; and an electric heating coil disposed in said channel and adapted for operation at a temperature at least of the order of 1800° F. so that a substantial portion of the heat is transferred to the stylus by radiation, said coil being formed of a wire having a cross-sectional area substantially equal to that of said channel.

2. A heatable stylus for engraving a plate of thermally deformable material and designed for oscillation at a frequency of at least a few hundred cycles per second and comprising: a metallic shaft having a diameter not exceeding a few tenths of an inch and having a substantially helical channel extending along its periphery substantially to one end thereof and terminating at said end in a tapered deforming tip, the apex angle of said tip being not substantially less than 60°; and an electric heating coil disposed in said channel and adapted for operation at a temperature at least of the order of 1800° F. so that a substantial portion of the heat is transferred to the stylus by radiation.

3. A heatable stylus for engraving a plate of thermally deformable material and designed for oscillation at a frequency of at least a few hundred cycles per second and comprising: a metallic shaft having a diameter not exceeding a few tenths of an inch and having a substantially helical channel extending along its periphery substantially to one end thereof and terminating at said end in a deforming tip; an electric heating coil disposed in said channel and adapted for operation at a temperature at least of the order of 1800° F. so that a substantial portion of the heat is transferred to the stylus by radiation; and means for shielding a plate being engraved from direct radiation from said coil.

4. A heatable stylus for engraving a plate of thermally deformable material and designed for oscillation at a frequency of at least a few hundred cycles per second and comprising: a metallic shaft having a diameter not exceeding a few tenths of an inch and having a substantially helical channel extending along its periphery substantially to one end thereof and terminating at said end in a deforming tip, said channel terminating in a radially extending baffle surrounding the end of the shaft; and an electric heating coil disposed in said channel and adapted for operation at a temperature at least of the order of 1800° F. so that a substantial portion of the heat is transferred to the stylus by radiation.

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