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MACHINING OF SMALL BORE METAL TUBING

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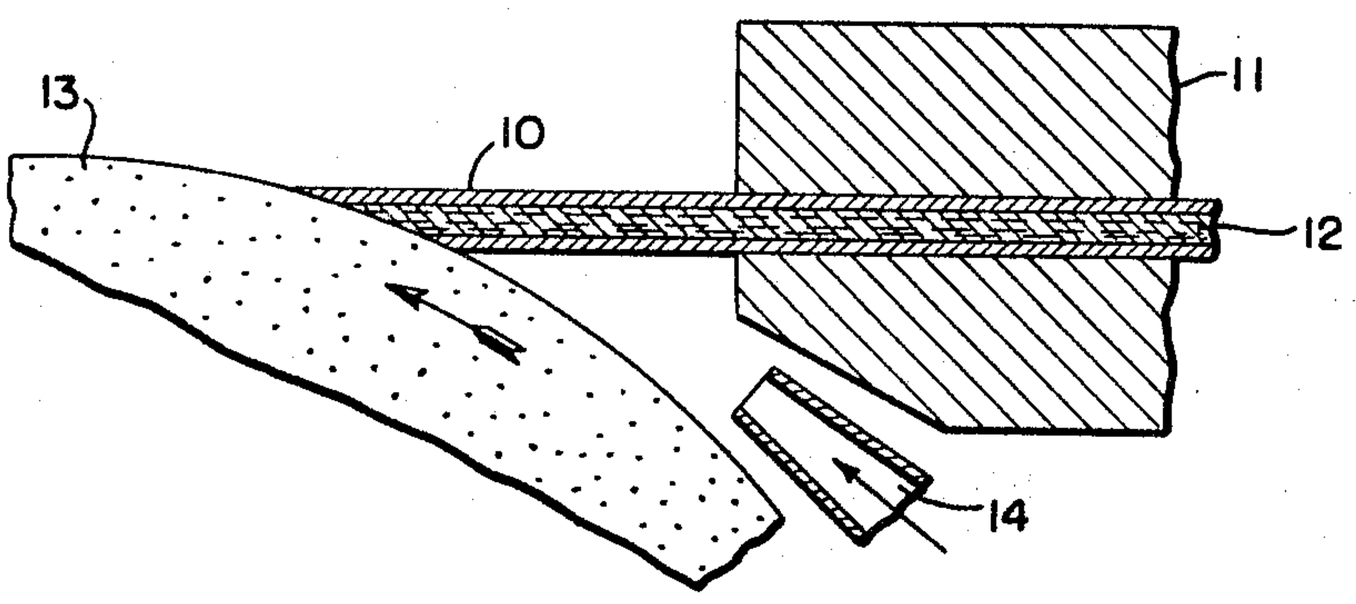

INVENTOR.
PETER M. F. WATSON
BY Philip Colman &
Orton J. Bradley
His Attorneys

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MACHINING OF SMALL BORE METAL TUBING

Peter M. F. Watson, Wokingham, Berkshire, England, assignor to The Gillette Company, Boston, Mass., a corporation of Delaware

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ABSTRACT OF THE DISCLOSURE

Method of forming the point of a surgical needle by grinding the end of a metal tube while the tube is filled with a core of ice to avoid the formation of burrs.

This invention relates to the machining by grinding of capillary or other small bore metal tubing. In particular, the invention is applicable to the formation of the points of tubular surgical needles, such as are used for the injection of medicaments or the withdrawal of body fluids, by obliquely grinding away the end of a steel tube of appropriate dimensions.

If the walls of the tube are left unsupported during the grinding operation, extensive burring of the metal takes place. The burrs thus formed have to be removed by subsequent operations, since if left in place they would (in the case of a surgical needle) obstruct the bore or lumen of the needle, cause pain to the patient when the needle was used, and might break off within the body. In the case of tubes used for other purposes, burrs formed by grinding can obstruct the bore of the tube and if they subsequently break away they can interfere with proper operation of the apparatus in which the tube is used.

De-burring of the ground point of a tubular surgical needle is usually effected by directing onto the point a stream of fluid loaded with abrasive particles, and/or by the use of steel brushes. Such abrasive de-burring operations inevitably cause some rounding off of the sharp cutting edges of the needle as formed by the grinding operation, thus blunting the needle.

Burr formation can be prevented or reduced by effecting the grinding operation while the bore of the tube is filled with a core of metal, such as aluminium or brass This metal core serves to support the wall of the tube against the action of the grinding wheel, allowing the metal of the wall to be cut cleanly away without forming burrs. However, this expedient suffers from the disadvantages that the core metal which is ground away tends to clog the grinding wheel and that the necessary operation of removing the portion of the core which remains within the bore of the tube after grinding is difficult to perform and may result in damage to the ground edges.

In accordance with the present invention the formation of burrs is prevented or reduced to within acceptable limits by effecting the grinding operation while the bore of the tube is filled with a core of ice. Surprisingly, it has been found that a hard ice core is extremely effective for the purpose in question, while the ice chips or melted water produced from the core during grinding are without effect on the grinding wheel and subsequent removal of the residual core from the tube presents no difficulties.

The figure of the drawing is an elevational view partly in section.

In one way of practising the invention, in its application to the manufacture of tubular needles as illustrated in the drawing, a length of stainless steel tubing **10**, of the dimensions required to form the desired needle, is secured in a work-holding clip **11** with the end of the tube which is to be sharpened projecting from the clip. Water under pressure is forced into a clamped tube to fill its bore completely, the water being retained within the tube by capillary attraction. The water used may be distilled water, or it may contain additives such as those employed in the coolant used in the subsequent grinding operation, but preferably the amount of any additions is limited so that the freezing point will not be depressed by more than a few degrees. The clip containing the water-filled tube is immersed in solid carbon dioxide at a temperature of —75° C. for about one minute, or for any longer convenient period, to freeze the water into a hard core **12** within the tubes. Very much lower temperatures, such as those obtainable with liquid air or nitrogen, may be used if desired to increase the resistance of the core to melting, but it has been found that the temperature specified is sufficient, provided that the grinding operation is carried out promptly after the withdrawal of the clip from the refrigerant and with proper precautions to prevent premature melting of the core.

Grinding is effected by engaging the exposed end of the clamped tube with a grinding wheel **13**, the relative disposition of the tube and the grinding wheel being chosen to give the desired point configuration. It is usually preferred to supply coolant liquid through a nozzle **14** to the zone where the tube contacts the grinding wheel. The coolant liquid employed may be at room temperature, but the flow of coolant may need to be limited to restrict conduction of heat to the tube and avoid premature melting of the ice core. It is possible to employ a copious flow of refrigerated coolant, for example at a temperature of —5° C. The grinding operation must, of course, be carried out sufficiently promptly after removal of the tube from the refrigerant, sufficiently rapidly and otherwise under such conditions that the ice core in the tube remains unmelted until the grinding of the tube has been completed.

The pointed tube may then, if desired, be subjected to further grinding operations to form a bevelled facet on one or both sides of the point. The bore of the tube may be filled wih an ice core during these bevel grinding operations also, but this appears to be unnecessary, the tendency to burr formation being small.

The pointed needle obtained by the operations described is so free from burrs that no abrasive de-burring operation is necessary to render it suitable for use; any small adherent particles of metal resulting from the grinding operation which may be present are readily removed by the conventional cleaning operations in liquid baths to which the needle is subjected after grinding. The cutting edges of the needle accordingly remain in their sharp, as-ground condition.

I claim:

1. A method of machining a small bore metal tube having an end comprising the steps of filling the tube with water, freezing the water within the tube into a hard core, and grinding the end of the tube to a desired configuration.

2. A method according to claim 1, in which coolant liquid at a temperature below 0° C. is supplied to the end of the tube during grinding.

3. A method according to claim 1 wherein the tube is of capillary size and the water is retained therein during the freezing step by capillary attraction.

4. A method according to claim 1 including the step of forcing water under pressure into the tube to fill the bore completely prior to freezing the water within the tube.

References Cited

UNITED STATES PATENTS

2,031,052	2/1936	Lewis et al.	51—322 X
2,761,250	9/1956	Molinari	51—8
1,891,304	12/1932	Everett	29—423
2,586,532	2/1952	Granfield	51—322
2,760,314	8/1956	Heibel et al.	51—283
2,436,819	3/1948	Neidorf	51—283
3,063,141	11/1962	Scholl	51—281 X
3,081,586	3/1963	Gersbach	51—277 X
3,176,387	4/1965	Argueso et al.	29—423
3,216,154	11/1965	Christen et al.	51—283
3,247,589	4/1966	Burns	29—424

FOREIGN PATENTS

891,110	3/1962	Great Britain.

LESTER M. SWINGLE, *Primary Examiner.*

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51—323