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MANUFACTURE OF POINTED TUBULAR METAL ARTICLES

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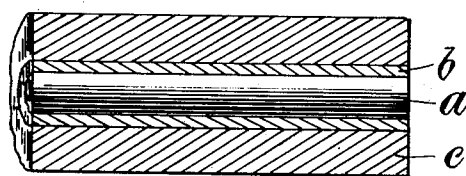


Fig. 1

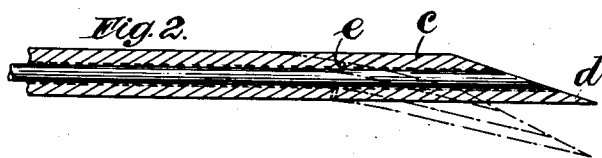


Fig. 2.

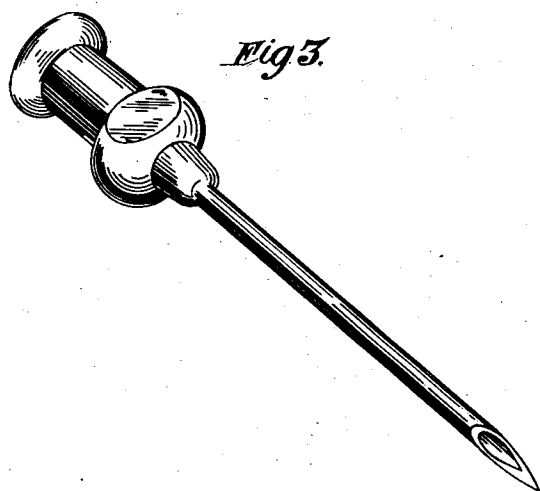


Fig. 3.

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MANUFACTURE OF POINTED TUBULAR METAL ARTICLES

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This invention comprises improvements in the manufacture of pointed tubular metal articles and particularly hypodermic syringe needles.

5 According to the specification of my United States Patent No. 1,568,369, tubing for such needles is produced by reduction to small gauge of a tubular billet containing a core of metal capable of extreme elongation
10 and retention of tensile strength. For some purposes, steel needles with a lining of incorrodible metal are desired, and this was accomplished by enclosing the core in a tube of lining metal before inserting it into the
15 tubular billet. After rolling, swaging or drawing the composite billet down to the required tube gauge, the tube was subjected to heat treatment, for annealing the core, the rolling, swaging or drawing operation and
20 the heat treatment causing the lining to be welded, soldered, or intimately allied with the interior of the steel tube.

According to the present invention the cored tube is subjected to a heat treatment or
25 heat treatments so controlled as to anneal the core and temper the tube whilst on the core. Thus with tubes of certain alloys which are used in the hard drawn state, the heating of the composite wire, is controlled so that a
30 softening or annealing of the core and a tempering of the tube is effected but is stopped short at the point at which the tube itself is correctly tempered. Or where the composite wire is heated to a temperature
35 sufficient for causing a lining to be united or welded to the inside of the tube and for softening or annealing the cone, the heat treatment is followed by a quenching and reheating, for the purpose of hardening and tempering the tube metal, whilst the tube is on
40 the core. The grinding and finishing of the needle point are advantageously performed whilst the tube is still on the core. In this way the point may be produced without the
45 disadvantageous burr which results when the point is produced after the removal of the tube from the core. The polishing, cutting of a screw thread, and the plating of the exterior of the tube may also be performed
50 whilst the tube is on the core.

In the drawing, illustrating one suitable method for carrying out the invention;

Fig. 1 is a longitudinal section of a core, lining metal and a tubular billet;

Fig. 2 is an enlarged view of a finished
55 tube prior to its removal from the core; and

Fig. 3 is an enlarged perspective view of a hypodermic syringe needle made from tubing, such as seen in Fig. 2.

In Fig. 1 the core *a* is immediately sur-
60 rounded by a tube of lining metal *b* which in turn is surrounded by a tubular billet *c* of steel or the like. The composite object is elongated to produce a tube of the desired
65 gauge. The cored tube is then subjected to a controlled heat treatment or treatments as will be hereinafter described so as to anneal the core *a* and temper the tube *c* while the
70 latter remains on the core. The grinding and finishing of the needle point *d* is performed while the tube still remains on the core. A cut is made at *e* at the exact point
75 of division for a needle length, the tube is cracked at this point but not the core, and the tempered and finished needle is drawn off the core.

In carrying the invention into effect with a tube of alloy sold commercially under the registered trade-mark "Nichrome" and a
80 core of brass, the heating of the heat treatment is carried up to 620 degrees centigrade for two minutes and is then terminated. The brass core is softened or annealed by this treatment and the nickel chrome alloy of the tube is tempered but otherwise remains un-
85 affected.

The invention is also applicable when tubular articles of carbon steel and stainless steel alloy are produced. For example, when
90 producing tubular articles of austenitic steel, such as Firth's Staybrite steel (the composition of which may vary, for practical purposes, from about 17% nickel, 8% chromium and the rest iron to about 12% chromium,
95 12% nickel, with the rest iron) the composite wire may be hardened by drawing, and heated to about 600° C. The core is thus softened and may be removable from the tube as described for example in the specification of my prior 100

patent aforesaid, and the tube is tempered and remains in the tempered condition.

With tubes of carbon steel an incorrodible metal lining may be united to the tubes. The core is enclosed in the metal lining before inserting it into the tube. The lining is partly allied or welded with the tube by the working of the composite wire and by the flux or solder which may have been interposed. The composite wire is then heated to about 950° C. for annealing the core and for completing the alliance of the lining to the outer tube. The composite wire is then reheated to about 780° C. and quenched to harden the outer tube. Finally, the composite wire is reheated to about 300° C. for the purpose of tempering the tube metal and the core is removable as described in the specification of my prior patent aforesaid, after being pointed and polished.

With tubes of Firth's steel sold commercially under the registered trade-mark F. H. Steel, the composite wire is heated to between 850° C. to 1050° C. for annealing the core and for completing the alliance of the tube with a metal lining. The wire is next quenched to harden the outer tube and is then reheated to a temperature between 150° C. to 250° C. for tempering the outer tube. This variation in the tempering temperature may actually be encountered in practice. It may be possible to accomplish the heating in one operation. Thus the composite wire may be heated to a temperature between 850° C. and 1050° C. and the rate of cooling adjusted to the temperature selected. The temperature selected may be 950° C. with an oil quench or 1000° C. with air cooling or 900° C. with a water quench. The lower the temperature selected, the faster-working must be the quench, and the above temperatures must only be taken as approximate as they may vary with a particular set of circumstances, but the principle remains the same.

The core or mandril metal may be selected for its expansion characteristics and so that the expansion of the core metal during the heat treatment is greater than the expansion of the tube metal. This expansion further promotes the welding or closer alliance of the lining metal with the tube metal and facilitates the ultimate separation of the tube lengths or needles from the core when cold.

This latter effect is obtained, of course, with equal advantage when the lining is dispensed with, as when certain hard alloys are used for making the needles. For example, an alloy containing nickel, iron, chromium, molybdenum and tungsten (known as contractid) may be subjected to a heat treatment at a low temperature of 600° C. to 720° C. This treatment, whilst annealing the core and tempering the tube produces such a degree of expansion of the core, which may be of nickel-silver or brass that the contraction of the core when cooled, facilitates the separation of the

tube from the core. This heat treatment can be successfully adapted to any steel or alloy which work-hardens, but which tempers and does not fully soften by a heat treatment at a temperature below 750° C. High carbon steels with or without other alloying elements, and steels such as stainless steels of varying composition may also be subjected to a similar heat treatment.

The grinding of points on the tube lengths in the production of the finished needles is frequently a difficult and troublesome operation, particularly in the case of lined stainless steel needles and certain others, notably nickel alloy needles. The reason for this is that a burr is formed within the point and as the presence of such burr is highly objectionable and even dangerous, it is important that it should be removed so that the finished needle shall have a perfectly clean point. These improvements avoid the difficulty and the defects above noted and effect an important economy by producing a finished cannula needle whilst still on the core. Thus, when the composite billet has been reduced to the appropriate gauge and the needle lengths or double needle lengths have been produced, the point or points is or are formed, as by grinding, whilst the bore is still occupied by the core. In this way a perfect point is produced containing no dangerous burr. Furthermore, there is the assurance that such a point can contain no foreign matter such as grinding swarf, dirt, or unsterilized matter. This is also very important in the polishing because a very much cheaper method known as scouring can be adopted without danger of spoiling the needles through filling up the bore. In practice, when the tube and core have been reduced to the proper gauge, and the heat treatment has been performed, the exterior is polished, the point is ground, any necessary screw thread is cut and the tube may be plated with nickel for example, whilst the tube is on the core. A cut is marked at the exact point of division for a needle length, the tube is cracked at the said point but not the core and the finished needle is drawn off the core. Naturally, the method is applicable whether a single needle is produced each time, or whether a double needle length is produced and two finished needles are pulled from off the single core length.

I claim:—

1. In the manufacture of hypodermic syringe needles, reducing to a small gauge a composite wire comprising a hard metal outer tube containing a core of metal capable of extreme elongation and retention of tensile strength, heating said wire to a temperature sufficient for annealing the core, controlling such heat so as to temper the tube whilst the tube remains on the core, grinding and finishing a needle point on the tube whilst still on the core, severing a needle length of said

tube and withdrawing the tempered and finished needle length from the core.

2. In the manufacture of pointed tubular metal articles such as hypodermic syringe needles, reducing to a small gauge a composite wire comprising a hard metal outer tube, an incorrodible metal lining for said tube and a core of metal capable of extreme elongation and retention of tensile strength, heating the composite wire to a temperature sufficient for softening the core and for uniting the lining to the tube, quenching the composite wire to harden the tube, and reheating the composite wire to temper the tube metal and withdrawing the tempered tube from the annealed core.

3. In the manufacture of pointed tubular metal articles such as hypodermic syringe needles, reducing to a small gauge a composite wire comprising a hard metal tube, an incorrodible metal lining for said tube and a core of metal capable of extreme elongation and retention of tensile strength, heating the composite wire, controlling such heating so as to anneal the core and temper the tube metal whilst the tube remains on the core, grinding and finishing a needle point on the tube whilst still on the core, severing a needle length of said tube, and withdrawing the tempered and finished needle from the annealed core.

4. In the manufacture of hypodermic syringe needles, reducing to a small gauge a composite wire comprising a hard metal outer tube containing a core of metal capable of extreme elongation and retention of tensile strength, heating the composite wire, controlling such heating so as to anneal the core and temper the tube metal whilst the tube remains on the core, grinding and finishing a needle point on the tube and polishing the exterior of the tube whilst said tube is still on the core, severing a needle length of said tube, and withdrawing the tempered and finished needle from the annealed core.

5. In the manufacture of hypodermic syringe needles, reducing to a small gauge a composite wire comprising a hard metal outer tube, a metal lining for said tube, and a core of metal capable of extreme elongation and retention of tensile strength, heating the composite wire to a temperature sufficient for softening the core and for uniting the tube to said lining, quenching the composite wire to harden the tube, reheating the composite wire to the tempering temperature of the tube metal, grinding and finishing a needle point on the tube whilst said tube remains on the core, severing a needle length of said tube, and withdrawing the tempered and finished needle length from the annealed core.

6. In the manufacture of tubular metal articles such as hypodermic syringe needles, reducing to a small gauge a composite wire comprising a hard metal outer tube contain-

ing a core of metal capable of extreme elongation and retention of tensile strength, heating said wire to a temperature sufficient for annealing the core, controlling such heating so as to temper the tube whilst the tube remains on the core, polishing and screw-threading the tube whilst still on the core, severing a length of such tube and withdrawing the severed length as a finished article from the core.

7. In the manufacture of tubular metal articles such as hypodermic syringe needles, reducing to a small gauge a composite wire comprising a hard metal outer tube containing a core of metal capable of extreme elongation and retention of tensile strength, heating said wire to a temperature sufficient for annealing the core, controlling such heating so as to temper the tube whilst the tube remains on the core, polishing, screw-threading and plating the tube whilst still on the core, severing a length of such tube and withdrawing the severed length as a finished article from the core.

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