

[54] **FORK NEEDLE**

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[52] U.S. Cl..... **28/4 N**

[51] Int. Cl..... **D04h 18/00**

[58] Field of Search..... **28/4 N, 72.2**

[56] **References Cited**

UNITED STATES PATENTS

3,022,813	2/1962	Glover	28/4 N
3,579,763	5/1971	Sommer	28/72.2

3,727,276 4/1973 Foster..... 28/4 N

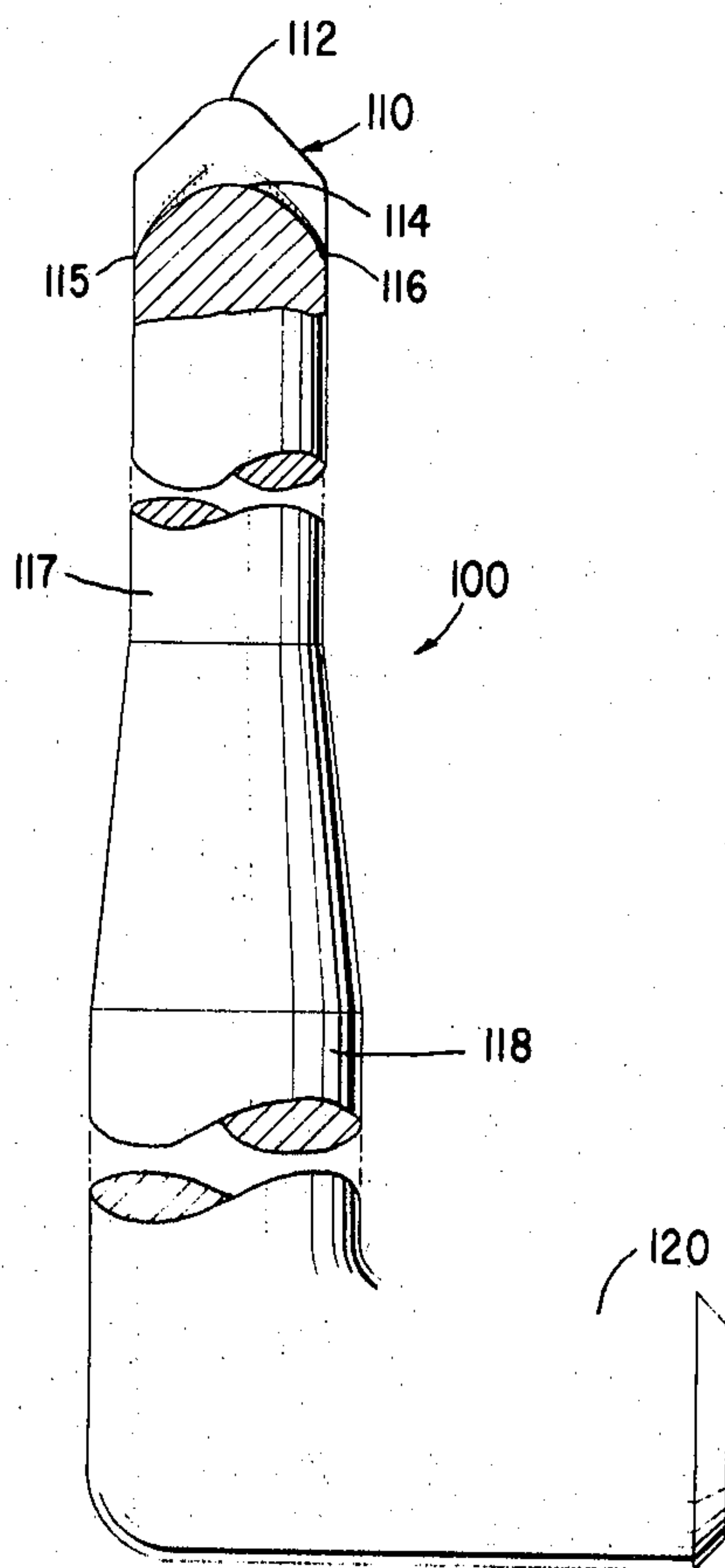
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A. Williams, Jr.; Alan Ruderman

[57] **ABSTRACT**

A fork needle for punching out fibres from a pre-compacted fibre web to form a tufted loop pile structure on one surface of the web. The needle includes at least a pair of spaced tines having the cross section of the crotch therebetween arcuately curved, and preferably circular, across the entire width of each tine. Also disclosed is a fork needle having one tine substantially longer than the other tine. Further disclosed is a fork needle in which the length of the tines are substantially greater than the spacing between the tines.

9 Claims, 7 Drawing Figures



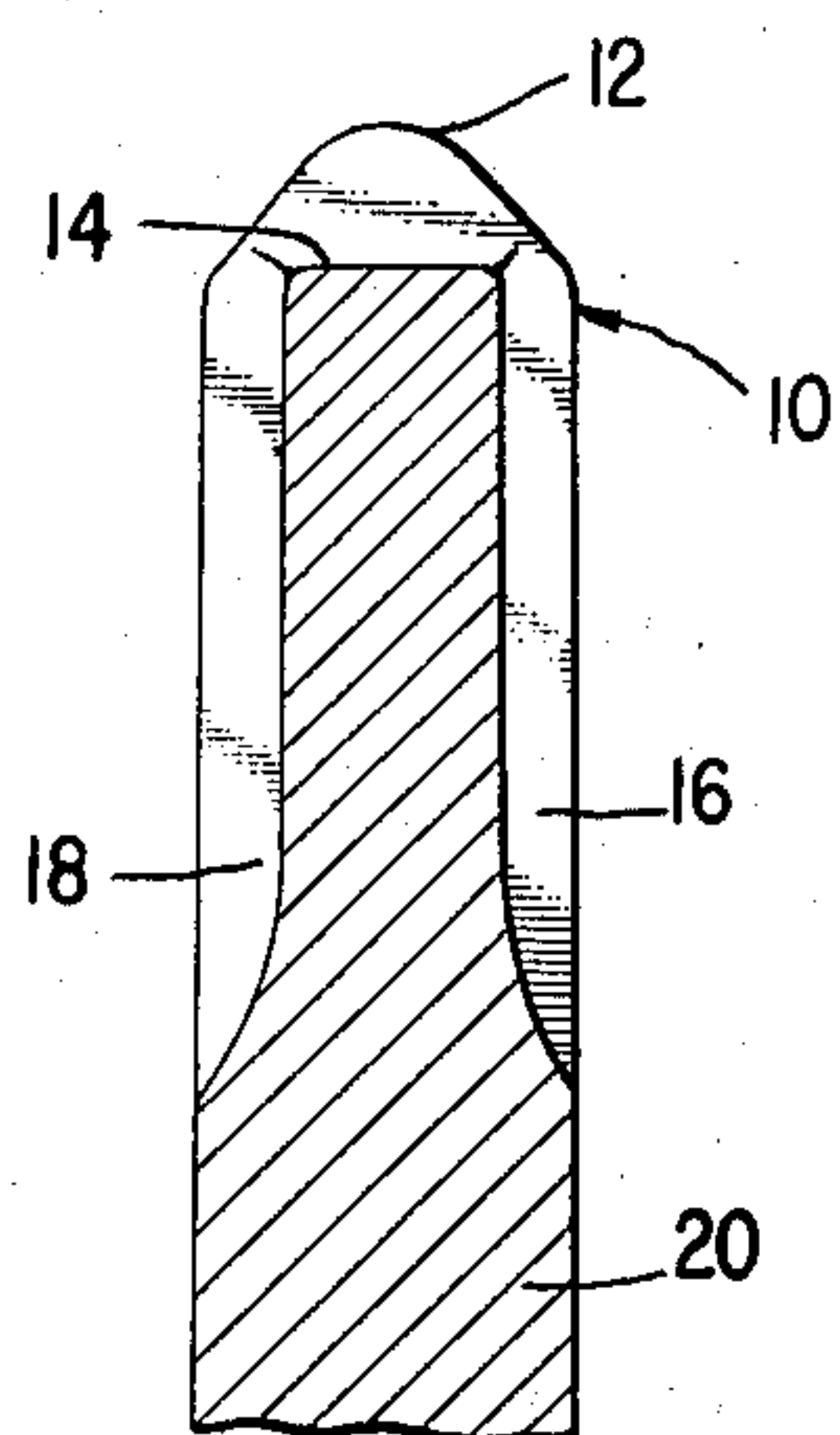


Fig. 1 (PRIOR ART)

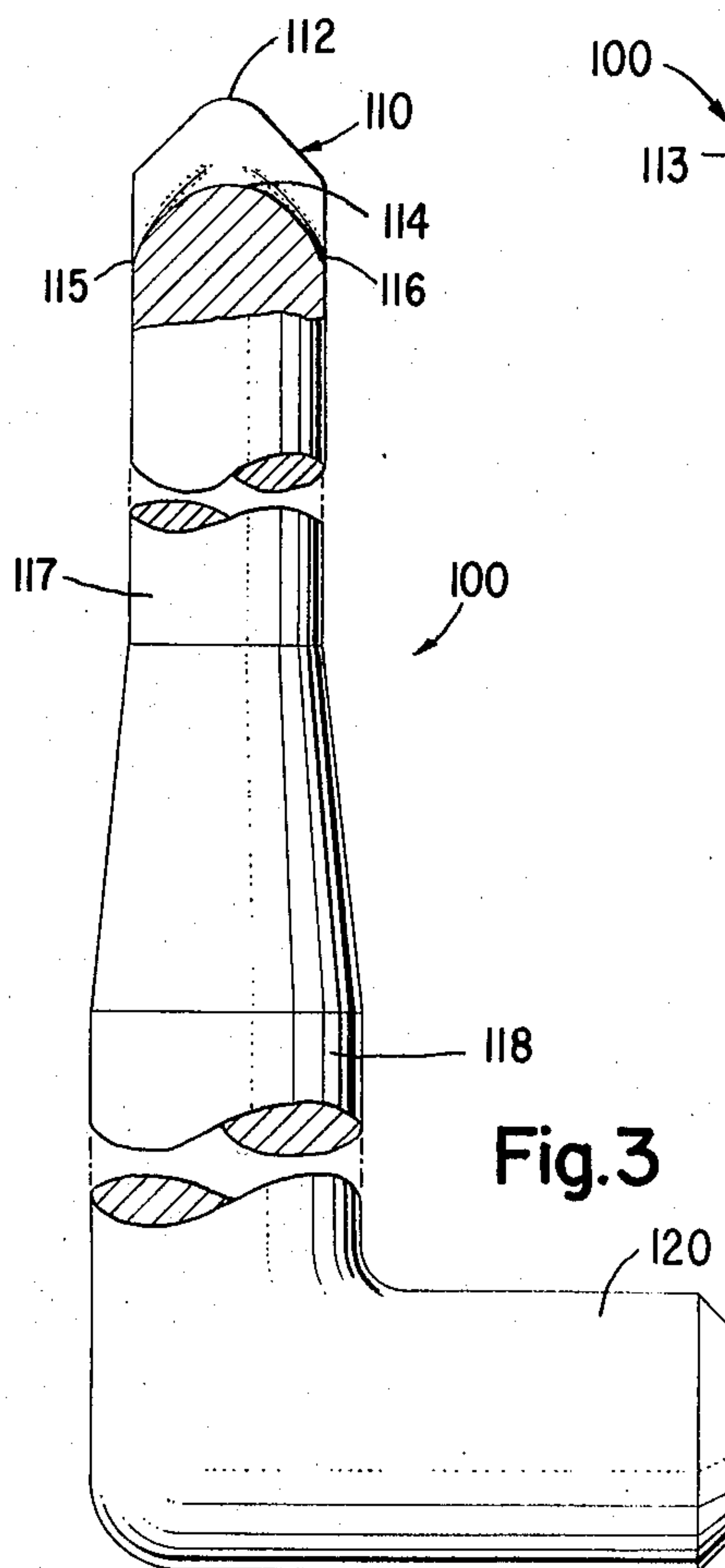


Fig. 3

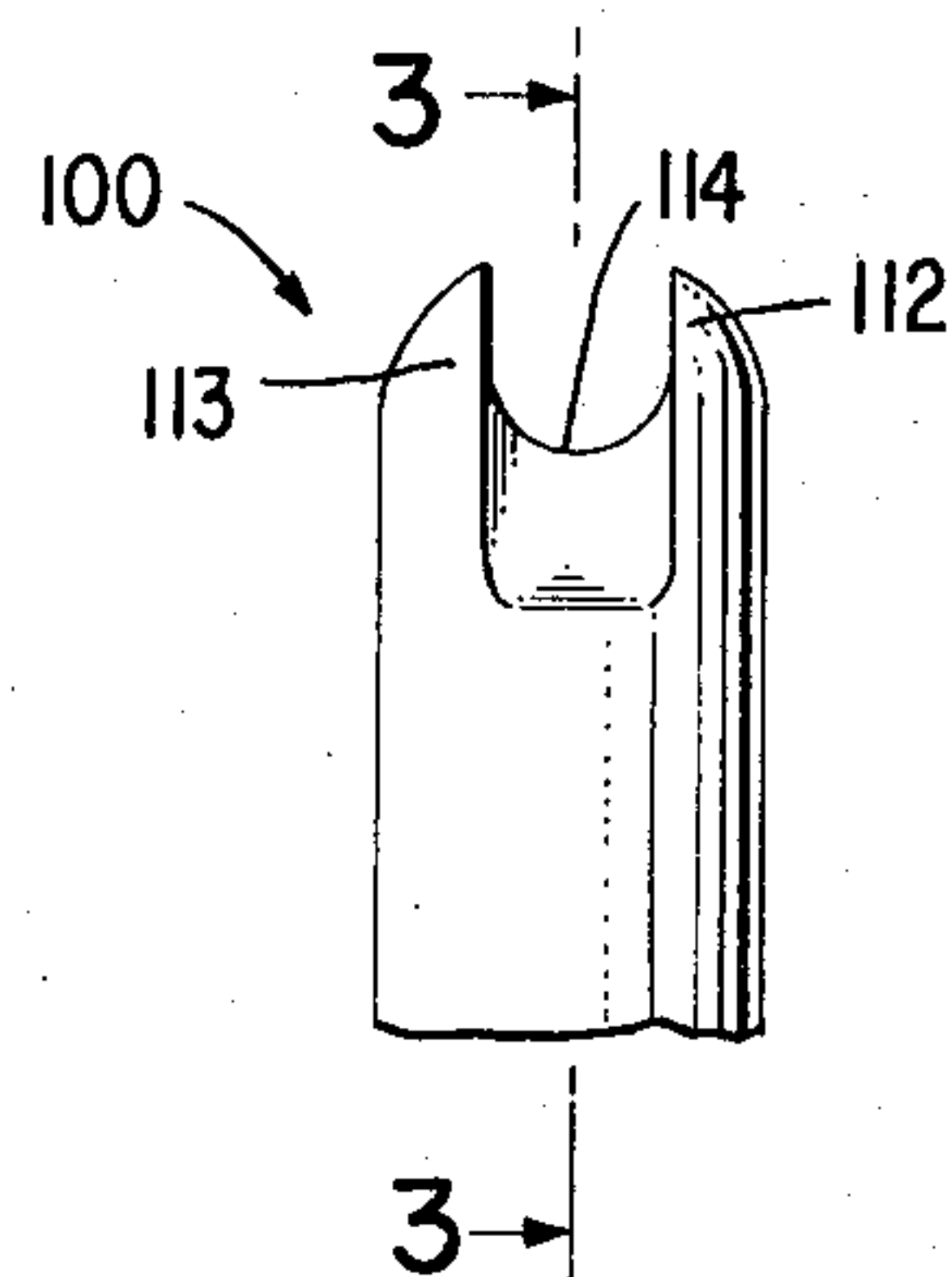


Fig. 2

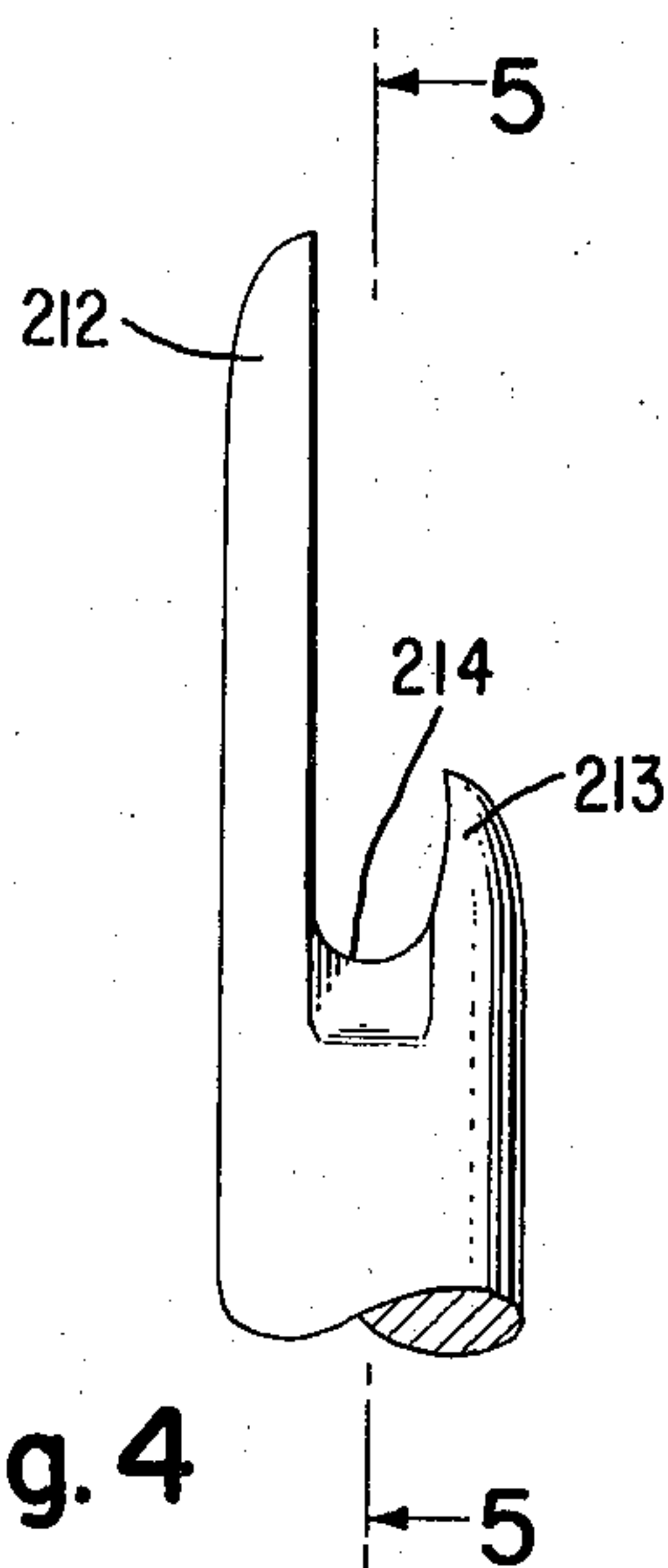


Fig. 4

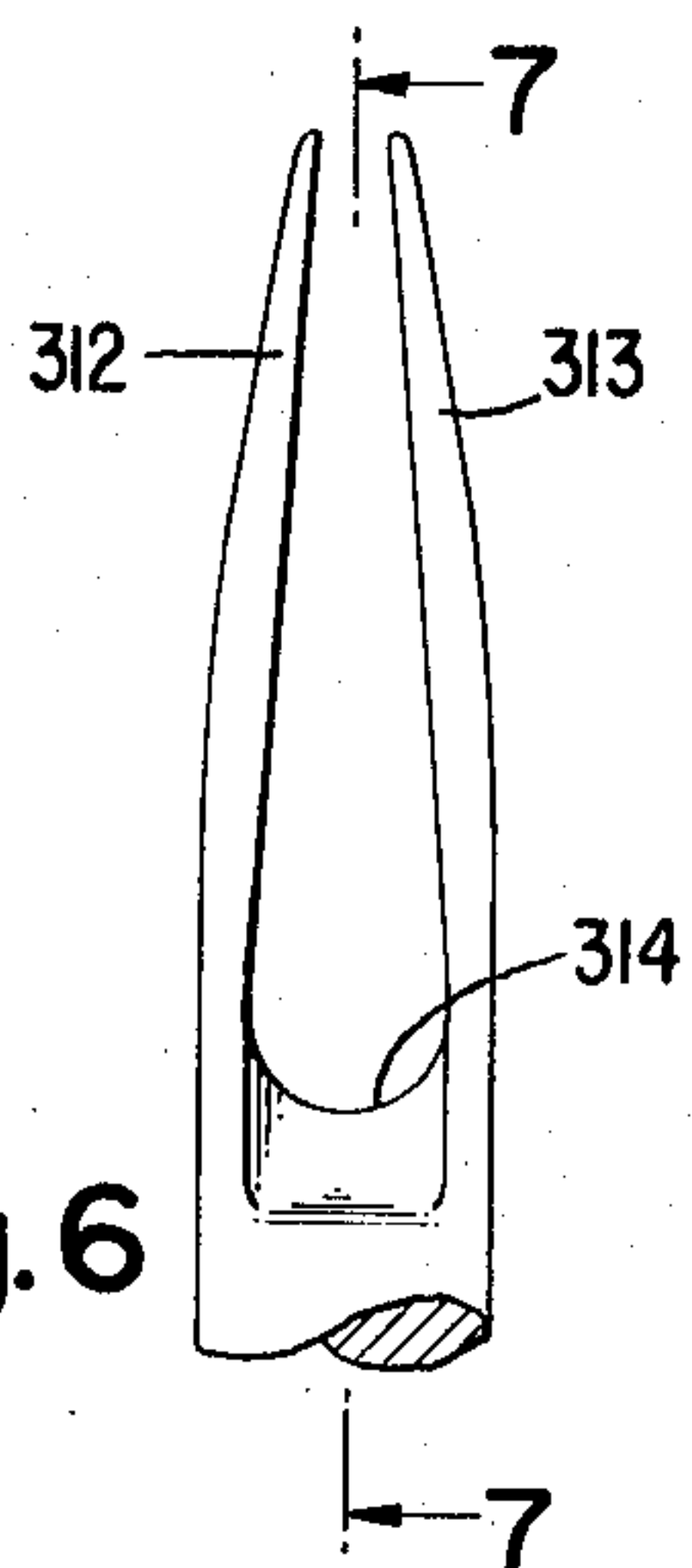


Fig. 6

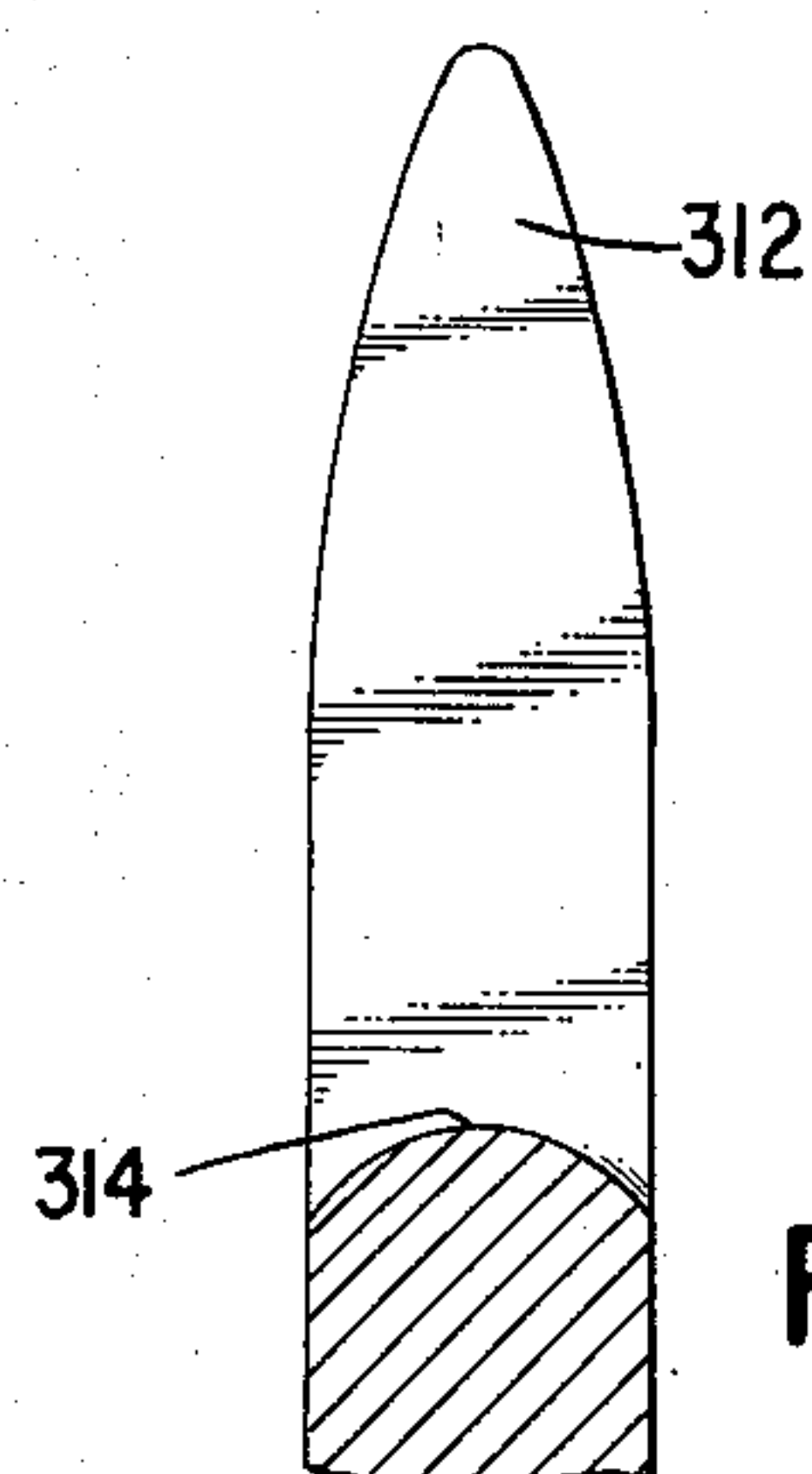


Fig. 7

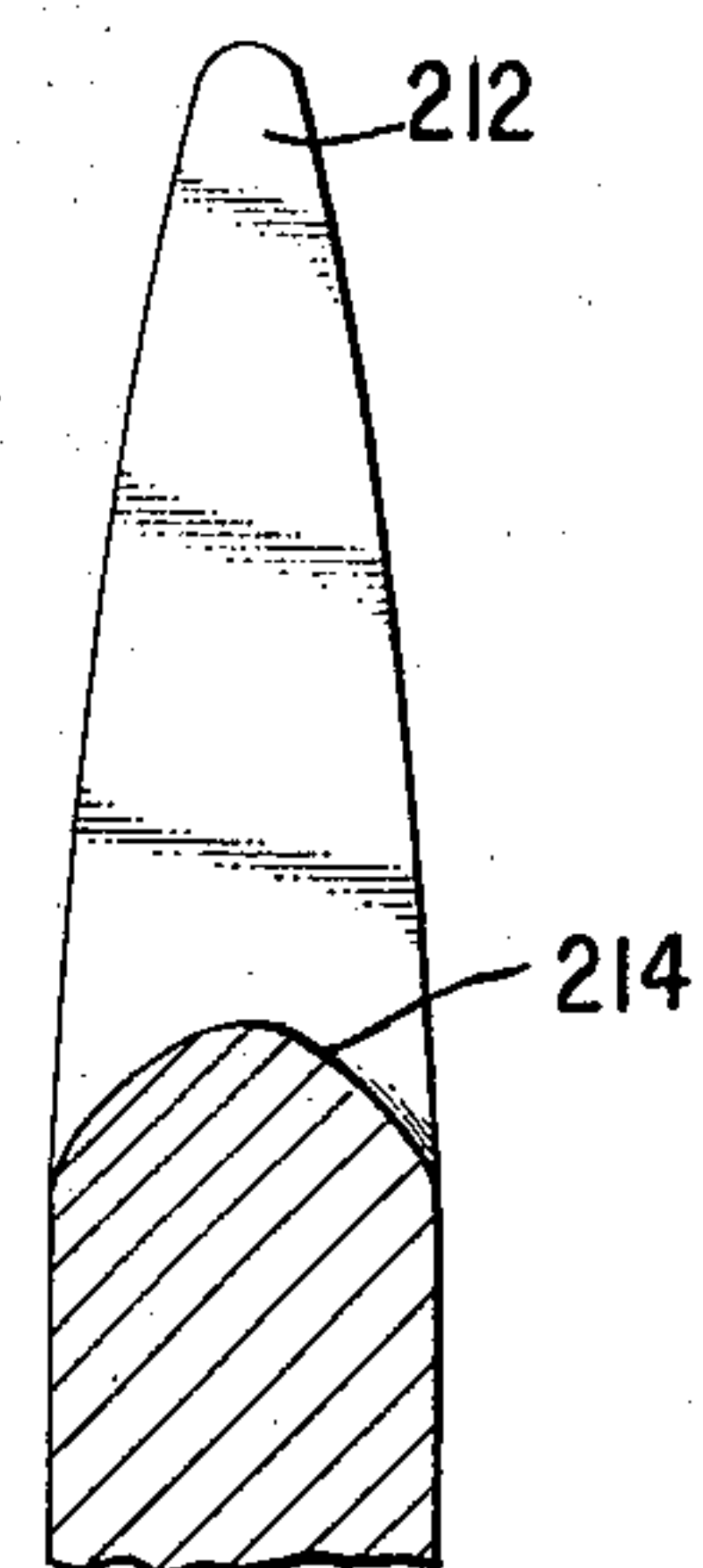


Fig. 5

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FORK NEEDLE

BACKGROUND OF THE INVENTION

This invention relates to needles and more particularly to a needle for producing non-woven fabrics having a tufted loop pile structure on one of its surfaces.

A relatively recent process for forming non-woven fabrics is that of driving the fibres of a pre-compacted web through the web itself to cause them to protrude as loops from one of the faces of the web. This process, which for example is shown in U.S. Pat. No. 3,579,763, produces a product approaching the qualities of tufted fabrics, but at a substantially reduced cost. As disclosed in the aforesaid United States patent, the needles used during this process have at least two terminal points separated by a recess or crotch. These needles, which are known in the art as fork needles, are presently of a design in which the basic shape of the fork represents the blade half of the eye of a sewing machine needle. The conventional grooves required by sewing machine needles have been incorporated into these prior art fork needles. The die used for pressing the fork is more or less the same as that used for sewing machine needle production. This conventional fork needle, however, has been found to have certain deficiencies for producing a satisfactory fabric during the high production runs. One of the problems encountered is fibre distortion created during the forming of the loops. Another problem is the excessive needle breakage encountered due to the high forces which these relatively thin walled needles must encounter.

SUMMARY OF THE INVENTION

The present invention overcomes these deficiencies of the prior art needles by providing a fork needle in which the conventional grooves have been eliminated and in which the cross section of the crotch between the fork tines has been arcuately curved. Preferably the arcuately curved cross section of the crotch is an arc of a circle.

It is therefore a primary object of the present invention to provide a fork needle which will reduce the amount of fibre distortion during loop forming.

A further object is to provide a fork needle having increased strength at the crotch between the tines and which is therefore less likely to break at that location.

Another object of this invention is to provide a fork needle which reduces the fibre distortion and which reduces needle breakage by distributing the forces over different portions of the needle during the penetration and loop forming stages.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and features of the invention will appear more fully from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a cross section taken through the crotch and substantially parallel to the tines of a portion of a prior art needle;

FIG. 2 is an elevational view of a portion of one embodiment of a needle incorporating the present invention;

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FIG. 3 is a view of the needle shown in FIG. 2 but turned substantially at right angles thereto, and partially broken away and cross sectioned along line 3—3 of FIG. 2;

FIG. 4 is an elevational view of a portion of a needle illustrating a second aspect of the invention;

FIG. 5 is a cross sectional view of the needle shown in FIG. 4 taken along line 5—5 of FIG. 4;

FIG. 6 is an elevational view of a portion of a needle illustrating a third aspect of the invention; and

FIG. 7 is a cross sectional view of the needle shown in FIG. 6 taken along line 7—7.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, FIG. 1 illustrates a typical prior art fork needle of the type used in the aforesaid U.S. Pat. No. 3,579,763 to draw fibres out of a pre-compacted fibre web by needle punching to form a loop pile structure on the undersurface thereof. The fork of the needle is formed by a pair of tines, of which 12 is illustrative. As can be seen in FIG. 1 the crotch 14 between the tines of the prior art needles is substantially flat. Thus, distortion of the fibres occurs as the loops are formed during the process. Moreover, the prior art needles include grooves 16 and 18 extending from the crotch between the tines on opposite sides thereof for a small distance down the blade 20 of the needle. These grooves in effect reduce the cross sectional area of the needle and increase the tendency to break during penetration of a needle into the web.

The present invention, as embodied in the needle shown in FIGS. 2 and 3 and designated generally as 100, includes at the pointed end 110 a pair of spaced tines 112 and 113. The tines are joined at a crotch 114 which as seen in FIG. 3 is arcuate in cross sectional configuration. Preferably this cross sectional configuration is circular and extends entirely across the maximum width of the tines from 115 to 116. Furthermore, the crotch preferably smoothly merges with the tines in the direction of the tip, as shown by the circular shape of the crotch 114 in FIG. 2. A fork needle having this cross sectional configuration of the crotch, smoothly rather than abruptly forces the fibres through the web to form loops. Thus, loop distortion is reduced and the stress concentration in the crotch is reduced. Moreover, because the cross sectional configuration of the crotch extends across the entire width of the tines from 115 to 116 the longitudinal grooves of the prior art needle are eliminated. Thus, the needle is strengthened and its resistance to breakage due to the penetration forces that occur during the needling process is increased. The remainder of the needle shown in FIGS. 2 and 3 are conventional and includes a blade portion 117 extending to a shank 118 and a crank portion 120 which is conventionally mounted in a needle board. The needles shown in FIGS. 2 and 3 may be manufactured easily by a die pressing process.

The needle shown in FIGS. 4 and 5 disclose a further aspect of the present invention in that tines 212 and 213 are of a different lengths. This reduces the shock on the needle as the tines separately penetrate the web as compared to the shock when tines of equal length are together driven through the web. Thus, in the needle of FIGS. 4 and 5 an initial penetration force occurs when the tine 212 penetrates the web and a second penetration force occurs when the tines 213 penetrates

the web. Since each of these penetration forces is smaller than the simultaneous force occurring on the needle of FIGS. 2 and 3, the overall impact forces on the needle is reduced. The maximum load of course occurs when the crotch 214 forces the fibres into a loop formation, but since the cross sectional area of the crotch is the same as the needle in FIGS. 2 and 3 the stress concentration and loop distortion as compared to the prior art needles are greatly enhanced.

A third aspect of the present invention is disclosed in FIGS. 6 and 7 wherein the tines 312 and 313 are greatly elongated. In this instance the initial shock of impact of the points of the tines 312 and 313 into the web is greatly dissipated relative to a short tine needle by the time the crotch 314 acts on the fibres to force them through the web. Furthermore, the tines 312 and 313 may be longitudinally tapered toward each other in this embodiment to reduce further the initial penetration force. This long tine configuration also features the possibility of manually opening or closing the space between the tines to allow capture of more or less fibres, thereby to extend the range of use of a given needle. The cross sectional configuration of this needle at the crotch is of course the same as that of the other needles of the present invention.

Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to a preferred embodiment of the invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the

scope of the appended claims.

Having thus described the invention what I claim is:

1. A fork needle for punching a pre-compacted fiber web to form a loop pile structure protruding from a face thereof, said fork needle having a point end comprising at least a pair of substantially pointed tines, the crotch between said tines having an arcuate cross section in a plane substantially parallel to said tines, said crotch further including a concave surface smoothly merging into said tines in the direction of the point end.

2. A fork needle as defined in claim 1 wherein said concave surface is a sector of a circle.

3. A fork needle as defined in claim 1 wherein said arcuate cross section is a sector of a circle.

4. A fork needle as defined in claim 3 wherein said cross section is midway between said tines.

5. A fork needle as defined in claim 3 wherein the arc of said sector extends across the maximum width of said tines.

6. A fork needle as defined in claim 1 wherein said arcuate cross section extends entirely across the maximum width of said tines.

7. A fork needle as defined in claim 6 wherein the tines of each spaced pair are of different lengths.

8. A fork needle as defined in claim 1 wherein the length of said tines from the crotch to the free ends thereof are substantially greater than the spacing between said tines.

9. A fork needle as recited in claim 8 wherein the spacing between the tines at the crotch is greater than the spacing between the tines at the free ends.

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