United States Patent [19]

Zocher

[11] **3,929,082**

[45] **Dec. 30, 1975**

[54] **NEEDLES FOR TUFTING OR THE LIKE**

[75] Inventor: **Josef Zocher,** Haaren, Aachen, Germany

[73] Assignee: **The Singer Company,** New York, N.Y.

[22] Filed: **Apr. 16, 1975**

[21] Appl. No.: **569,323**

[52] **U.S. Cl.** **112/222**

[51] **Int. Cl.²** **D05B 85/00**

[58] **Field of Search** 112/224, 222, 225, 227; 223/102

[56] **References Cited**

UNITED STATES PATENTS

568,946	10/1896	Hanna	112/222
3,469,548	9/1969	Zocher	112/222
3,862,611	1/1975	Kuromegawa	112/222

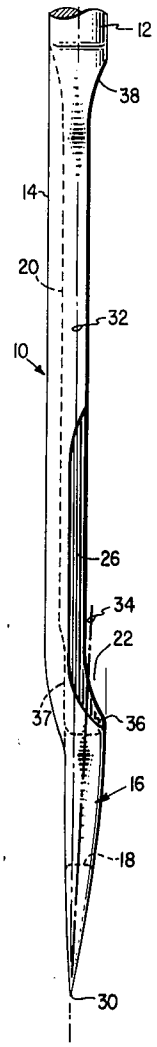
Primary Examiner—H. Hampton Hunter

Attorney, Agent, or Firm—Edward L. Bell; Robert E. Smith; Alan Ruderman

[57] **ABSTRACT**

A tufting needle construction in which the axis of the eye and point portion of the needle is skewed relative to the axis of the needle so that the blade of the needle just above the needle eye is angularly offset relative to the eye and point portion to form the clearance above the eye portion of the needle. The axis of the eye and point portion passes into the clearance above the eye. In one form illustrated the axis of the entire blade is coincident with the axis of the needle while in a second embodiment the axis of the blade at the clearance above the eye is offset from the axis of the needle. The construction is such that the cross section of the needle at the eye is less than that of known needles of similar gauge and the clearance above the eye may be equal to or greater than that of such known needles.

9 Claims, 25 Drawing Figures



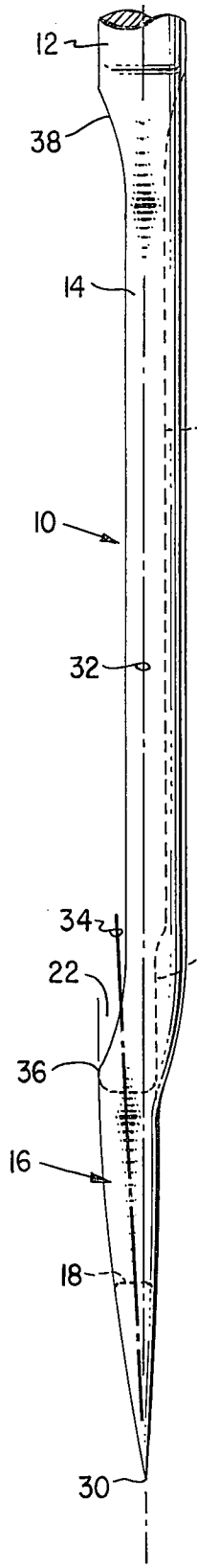


Fig. 1.

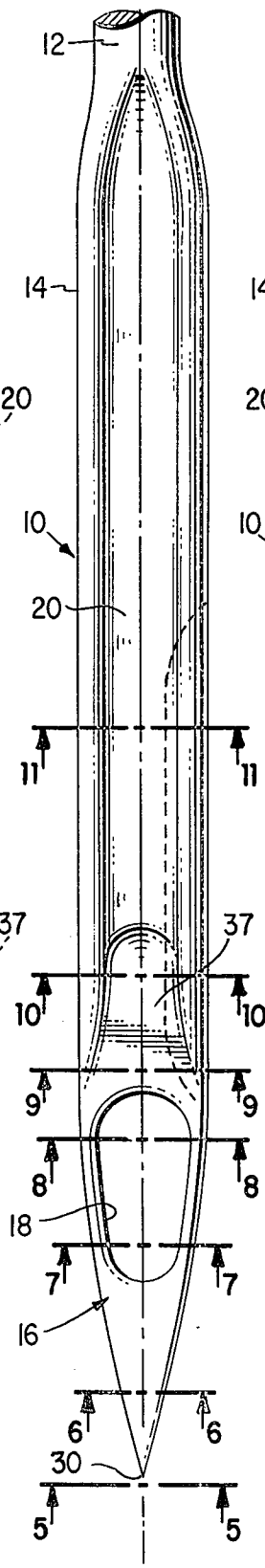


Fig. 2.

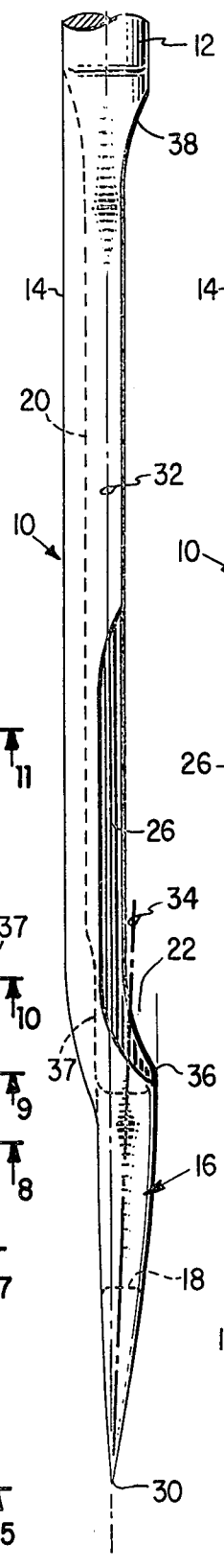


Fig. 3.

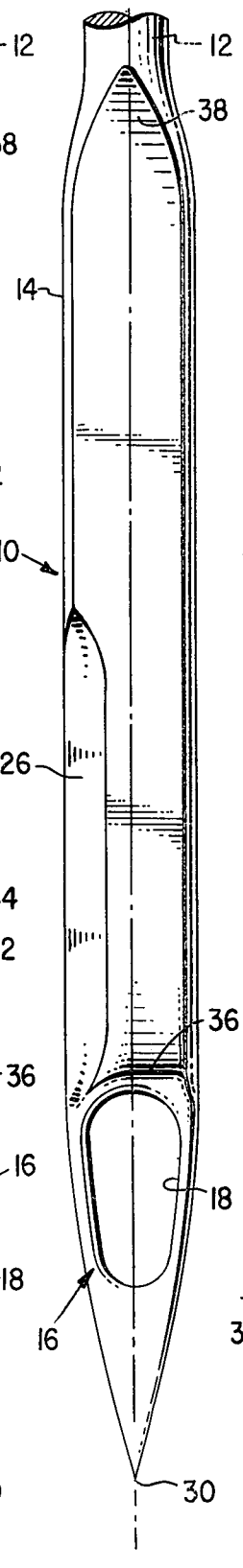


Fig. 4.

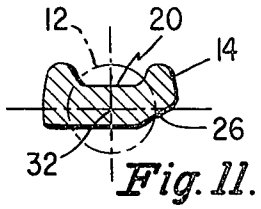


Fig. 11.

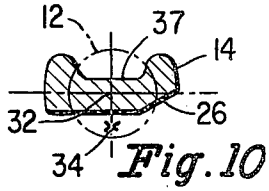


Fig. 10

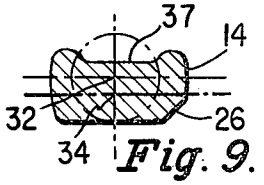


Fig. 9.

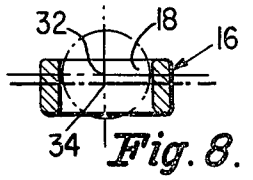


Fig. 8.

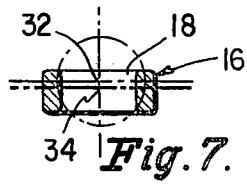


Fig. 7.

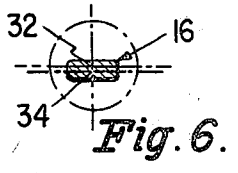


Fig. 6.

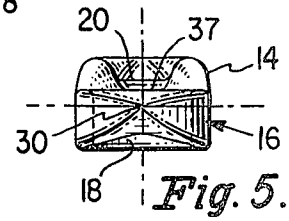
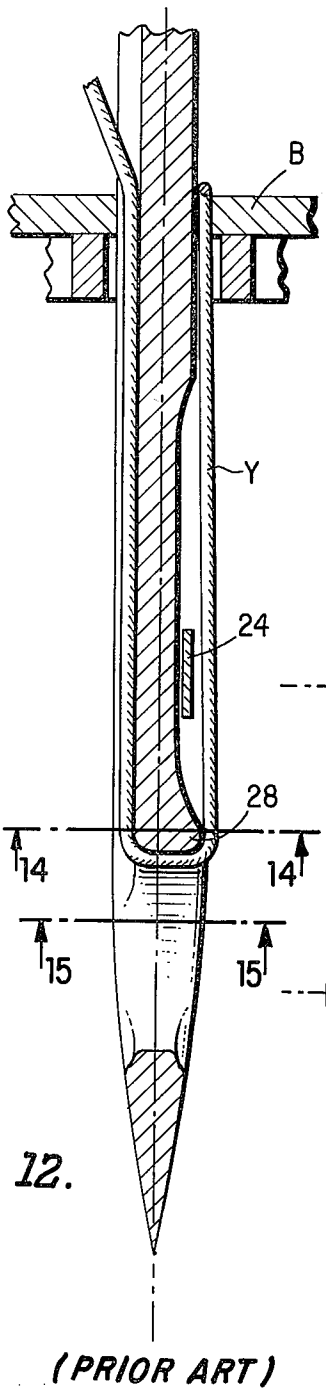


Fig. 5.



(PRIOR ART)

Fig. 12.

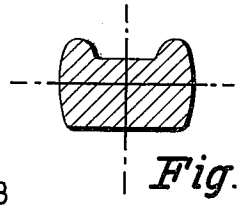


Fig. 14.

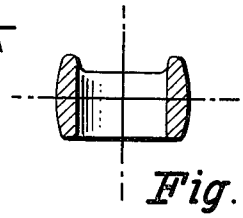


Fig. 15.

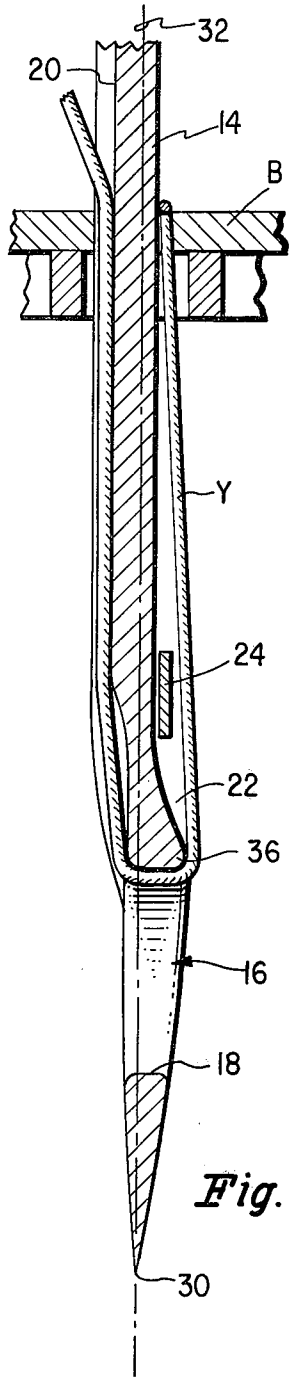


Fig. 13.

Fig. 17.

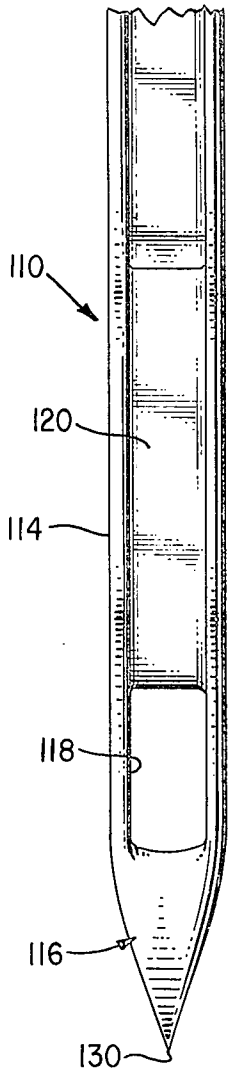
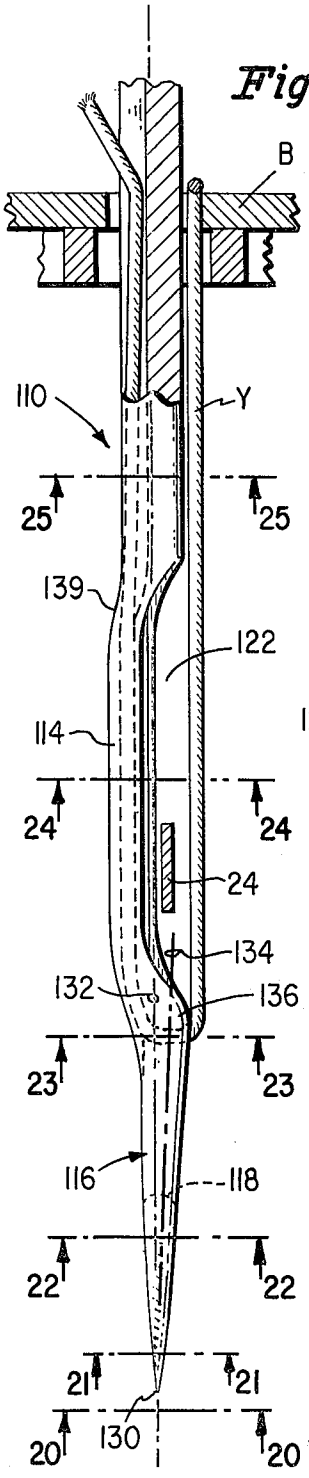


Fig. 18.



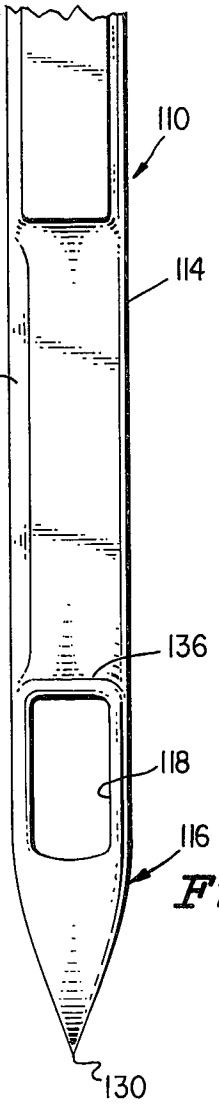


Fig. 19.

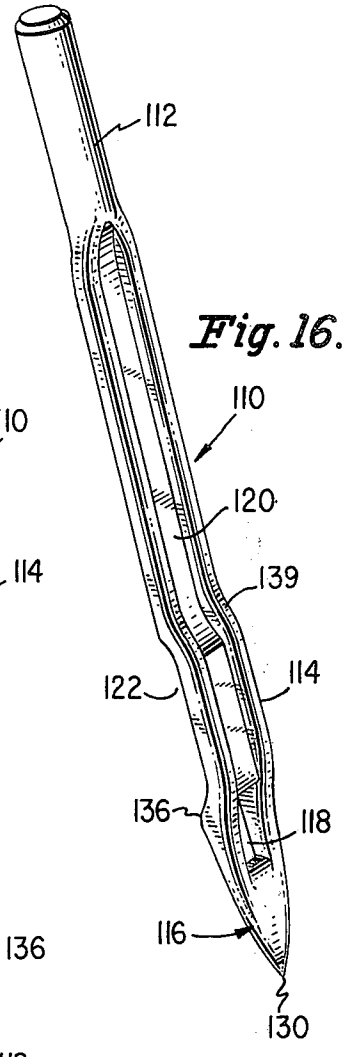


Fig. 16.

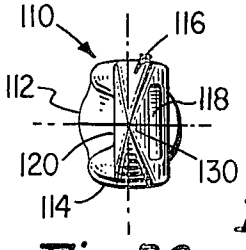


Fig. 20.

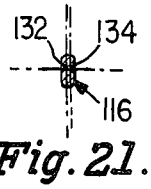


Fig. 21.

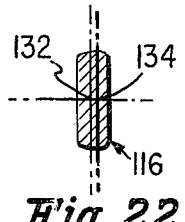


Fig. 22.

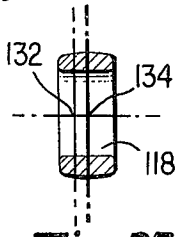


Fig. 23.

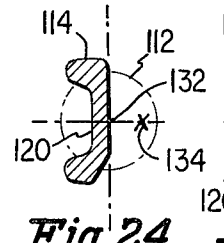


Fig. 24.

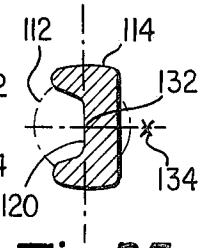


Fig. 25.

NEEDLES FOR TUFTING OR THE LIKE

BACKGROUND OF THE INVENTION

This invention relates to tufting needles and more particularly to improved needles of this type in which the cross section at the eye is reduced while the looper receiving clearance above the eye is maintained sufficiently large for safe loop seizure.

The art of tufting incorporates needles for piercing a backing fabric to insert loops of yarn into the backing. The penetration forces require to pass the needle through the backing is an important factor in limiting the working speed of the tufting machine due to the vibration effects and the influence on wear life of the parts of the machine and the needles themselves. It is desirable to use tufting needles having relatively large needle eye openings due to the use of heavy yarns and also since the yarns vary in bulkiness and the practice of connecting yarn from the plurality of yarn cones together. However, the penetration force of the needles is related to the cross section of the needle at the eye which determines the size of the penetration hole made in the backing fabric. The individual hole size and the needle spacing or gauge moreover determines the reduction in tensile strength of the backing material. Furthermore, the needle cross section affects the machine gauge since each needle requires a defined space to penetrate through the needle plate fingers.

The requirement of a large needle eye with a small cross section has not been satisfactorily attained with the known prior art needles. One thing that has prevented this is that normally the looper must pick up a loop of yarn when the yarn is under tension, i.e., the looper picks up a loop while the needle is on the down stroke. This is a necessity if continuous filament yarn is being tufted, especially for gauges below five thirty-seconds inch. For this reason tufting needles are designed with a clearance above the eye (C.A.E.) within which the looper passes to pick up a loop. In certain limited instances when using some spun yarn, the yarn is allowed to bloom to form a loop which is picked up on a needle up stroke. However, even in these limited instances the blooming is minimal and a clearance is required. The prior art needles, in order to realize the required clearance, increase the needle thickness at the eye to provide a kick-out or step at the web between the eye and the blade. This results in a clearance space between the needle and the adjacent yarn leg within which the looper passes. The depth of the kick-out and the clearance above the eye determines the thickness of the needle side wall at the eye, and thus, the cross section of the penetration hole.

SUMMARY OF THE INVENTION

Essentially the invention provides a tufting needle in which the axis of the eye and point portion is angularly offset or skewed relative to the axis of the needle so that the clearance above the eye portion of the blade is angularly offset relative to the eye and point portion, and the eye and point portion is of a reduced thickness than that of conventional needles of like gauge. By angularly offsetting or "cranking" the clearance above the eye portion of the blade relative to the eye and point portion, the C.A.E. can be large while keeping the point and eye relatively thin. Thus, the cross section of the needle at the eye can be reduced to provide reductions in the penetration forces.

Accordingly, it is the primary object of the present invention to provide a tufting needle having a reduced cross section at the eye while maintaining or improving the ability of the needle to transfer a loop of yarn to a looper.

It is another object of this invention to provide a tufting needle wherein the penetration force through the backing fabric is reduced and the degree of distortion of the backing is also reduced.

It is a further object of this invention to provide a tufting needle wherein the penetration force through the backing fabric is reduced and which needle has improved yarn transfer capabilities.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of this invention will best be understood upon reading the following description of the invention together with the accompanying drawings in which:

FIG. **1** is partial side elevational view of one form of a needle constructed in accordance with the present invention;

FIG. **2** is a partial front elevational view of the needle illustrated in FIG. **1**;

FIG. **3** is a partial side elevational view of the needle illustrated in FIG. **1** viewed from the opposite side of that illustrated in FIG. **1**;

FIG. **4** is a rear elevational view of the needle illustrated in FIG. **1**;

FIG. **5** is an end elevational view of the needle illustrated in FIG. **1** viewed from the point;

FIG. **6** is a cross sectional view taken substantially along the line **6—6** of FIG. **2**;

FIG. **7** is a cross sectional view taken substantially along the line **7—7** of FIG. **2**;

FIG. **8** is a cross sectional view taken substantially along the line **8—8** of FIG. **2**;

FIG. **9** is a cross sectional view taken substantially along the line **9—9** of FIG. **2**;

FIG. **10** is a cross sectional view taken substantially along the line **10—10** of FIG. **2**;

FIG. **11** is a cross sectional view taken substantially along the line **11—11** of FIG. **2**;

FIG. **12** is a longitudinal sectional view through a prior art tufting needle carrying yarn through the eye and receiving a looper within the clearance above the eye;

FIG. **13** is a view similar to FIG. **12** but with the needle illustrated in FIGS. **1** through **11**;

FIG. **14** is a cross sectional view taken substantially along line **14—14** of the prior art needle illustrated in FIG. **12**;

FIG. **15** is a cross sectional view taken substantially along line **15–15** of FIG. **12**;

FIG. **16** is a perspective view of a needle constructed in accordance with a second embodiment of the present invention;

FIG. **17** is a partial front elevational view of the needle illustrated in FIG. **16**;

FIG. **18** is a partial side elevational view of the needle illustrated in FIG. **16** illustrated in the bottom of its stroke in a tufting machine showing the looper within the clearance above the eye;

FIG. **19** is a rear elevational view of the needle of FIG. **16**;

FIG. **20** is an end elevational view of the needle of FIG. **16** viewed from the point;

FIG. 21 is a cross sectional view taken substantially along line 21—21 of FIG. 18;

FIG. 22 is a cross sectional view taken substantially along line 22—22 of FIG. 18;

FIG. 23 is a cross sectional view taken substantially along line 23—23 of FIG. 18;

FIG. 24 is a cross sectional view taken substantially along line 24—24 of FIG. 18; and

FIG. 25 is a cross sectional view taken substantially along line 25—25 of FIG. 18.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 1 through 4 a needle 10 is illustrated embodying the first form of the present invention. The needle incorporates a shank 12 at the uppermost portion adapted to be mounted in a needle bar or the like of a tufting machine. A blade portion 14 is connected to the shank and to a point portion 16 at its lower end. A needle eye 18 is illustrated as being wholly within the tapered point portion of the needle but may be within the lower part of the blade above the tapered point portion. Thus, the portion of the needle having the point and eye will be referred to as the eye and point portion. The blade portion 14 on one side includes a yarn guide groove 20 extending from the shank and terminating at the eye. Yarn Y is guided within the guide groove 20 and protected within the confines of the needle as it travels from a supply to the eye. The blade portion of the needle, as hereafter described, is formed with a clearance 22 known in the art as a clearance above the eye or C.A.E. within which a tufting machine looper 24 may be received as illustrated in FIG. 13. A recess 26 is beveled on an edge of the C.A.E to provide additional clearance for the looper, which may actually contact the recess during the tufting process.

In accordance with the present invention the sides of the eye and point portion of the needle is constructed with very thin wall as viewed from the sides illustrated in FIGS. 1 and 3. This has not been attainable with prior art constructions because in order to provide a sufficient clearance above the eye, the eye and point portion of the needle had to be thickened to provide a kick-out or step from which the blade was then reduced. The sides of the eye and point portion was thereby made wider than the blade. This can be understood from FIG. 12 which shows a typical prior art needle illustrating the kick-out 28 at the web at the upper edge of the eye. By use of the thickened eye and point portion as illustrated in FIG. 16, a reduction in the blade thickness above the kick-out 28 provided the clearance. Since the blade could not be reduced in thickness to such an extent that it would fail after use for only a short period of time, the eye and point portion have to be made excessively thick.

In order to attain a needle with a thin eye and point portion and still provide the required C.A.E., the applicant has skewed or offset the eye and point portion of the needle relative to the path taken by the needle during the tufting process when viewed in the direction of backing fabric feed. This path is that of the longitudinal axis of the needle or a center line passing through the shank 12 and the tip 30 of a point portion 16 in the direction of the plane of the eye 18, i.e., when viewed from the side, as illustrated in FIGS. 1 and 3. Thus, the axis or center line 32 drawn through the shank 12 and the tip 30 of the point is skewed relative the axis or center line 34 of the eye and point portion 16. Otherwise stated, the axis or center line 34 of the eye and point portion is offset from the axis or center line 32. The direction of offset is away from the side on which the groove 20 is formed. Moreover since the needle eye is in the plane of its axis 34, and since the plane of the needle axis is in the direction of backing fabric feed, the plane of the eye is offset relative to the needle axis 32. Thus, in the web portion of the blade above the eye as the edge of the blade is bent back toward the needle axis 32 a shoulder 36 is formed on the side toward which axis 34 is skewed and the space above the shoulder is where the clearance is created. On the groove 20 side of the needle opposite the shoulder 36 the blade is deflected toward the longitudinal axis 32 to form a ramp 37 which merges into the eye and point portion to reduce friction between the needle and the backing. Of course, the blade must be undercut above the shoulder, which may as illustrated be adjacent the shank as at 38, but it is the offsetting of the eye and point portion which provides the required kick-out without conventional thickening of the eye and point portion that allows the clearance to be created without reducing the needle strength vis-a-vis conventional needles.

The degree of offset or skewing of the eye and point portion and the distribution of mass of the needle may be further understood from FIGS. 5 through 11, and particularly FIGS. 6 through 9. It can be clearly seen that that the axis or center line 34 of the eye and point portion 16 is offset relative to the axis or center line 32 of the needle. The offset is such that the axis 34 passes through the clearance 22. The majority of the needle mass from just above the shoulder 36 to the tip 30 is to one side of the axis 32 while in the C.A.E. it is to the opposite side of the axis 32. The cross sectional area of the needle at the eye as illustrated in FIGS. 7 and 8 when compared with the cross sectional area of a conventional needle of like gauge as illustrated in FIG. 15 can be seen to be substantially smaller. Thus, the penetration force of the new needle is substantially less. It has been found from initial test results that a reduction in penetration force of approximately 25 per cent relative to conventional needles is obtained with needles constructed in accordance with this embodiment of the invention. Since tufting machines incorporate a multiplicity of needles, e.g., 1,000 or more being typical, great reductions in machine loading can be realized with this new needle. Moreover it has been found that the pull-out force, that is the force required to pull a tuft out of the backing B, was increased by approximately 40 per cent when tested in Typar non-woven polypropylene. This pull out force is indicative of smaller penetration holes and less distortion of the backing material and, therefore, the residual strength of the backing material is increased.

Referring now to FIGS. 16 through 25 a second embodiment of the invention is illustrated in which the blade 114 of the needle 110 in the vicinity of the C.A.E. 122 is offset relative to the needle axis 132. The center line or axis 134 of the eye and point portion 116 is offset relative to the needle axis 132 as in the first embodiment to form a shoulder 136 adjacent the C.A.E., but the blade at the C.A.E. is also offset so that the axis of the blade in the C.A.E. is offset and parallel to the axis 132. Thus, a shoulder 139 is formed on the groove 120 side of the blade above the C.A.E. and the blade 114 in the region of the C.A.E. forms a throw-out or crank toward the groove side about the center line 132. The outer wall of the blade 114 except where it

bends relative to the axis **132** is parallel to the longitudinal axis **132.** Thus, in a manner similar to the first embodiment the eye and point portion can be reduced relative to conventional needles and the C.A.E. can be sufficiently large for good loop seizure by a looper.

Numerous alternations 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 nature of the invention, what we claim herein is:

1. A needle for tufting or the like including a shank having a longitudinal axis, a blade extending from said shank, an eye and point portion including a transverse eye connected to said blade and terminating in a tip, said blade having a longitudinal groove on one side terminating at the eye, said eye and point portion having an axis skewed relative to said longitudinal axis away from said groove side, and means defining a shoulder at the junction of the eye and point portion with the blade on the side toward which the axis is skewed to define a clearance above the eye.

2. A needle as recited in claim **1** wherein the axis of the eye and point portion passes through the clearance above the eye.

3. A needle as recited in claim **1** where said blade on the groove side adjacent said junction is deflected toward said longitudinal axis to define a ramp merging with the eye and point portion.

4. A needle as recited in claim **3** wherein the sides of said eye and point poortion is not wider than the sides of the blade.

5. A needle as recited in claim **3** wherein the sides of said eye and point portion is narrower than the sides of said blade.

6. A needle as recited in claim **4** wherein the sides of said blade at the clearance above the eye is narrower than the remainder of the blade.

7. A needle as recited in claim **3** wherein the axis of the blade in the clearance above the eye is coincident with said longitudinal axis.

8. A needle as recited in claim **3** wherein the axis of the blade in the clearance above the eye is offset from said longitudinal axis toward the groove side of said blade.

9. A needle as recited in claim **8** wherein said axis of the blade is parallel to the longitudinal axis.

* * * * *