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(54) Tufting needle

Tuftingnadel

Aiguille à touffeter

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Description

[0001] The invention concerns a tufting needle as an individual needle and as an element of a needle module incorporating several such needles, with an eye provided in the area of its tip and a thread-guiding groove on one side of the needle, starting from the eye and running along the needle stem, together with a module for such needles.

[0002] In the conventional system, the yarn is at an angle to the axis of the needle prior to entry into the backing. As the needle penetrates the backing, the angle of the yarn to the needle axis increases in proportion to the depth of penetration. The yarn tension will tend to increase with the increase in this angle. The effects of this are as follows:

1. Friction between the yarn and the backing fabric causes an increase in yarn tension which in turn causes the yarn to stretch temporarily changing its physical nature, i.e. it may flatten, be drawn down, loosely bound short fibres, effect materials such as neps, or fibre ends may become loosened or protrude from the yarn structure, and the chances of yarn breakage at weak points or joints may be increased.

2. The increased yarn tension also resists the needle insertion process, increasing the load on the drive motor which in turn draws higher current and increases running costs. Increased motor load also affects the power factor which in some countries incurs extra penalty charges.

3. Increased yarn tension also often causes "robbing back" of pile yarn from the previous tuft. In the case of loop pile carpets this results in an uneven surface. In the case of cut pile carpets this results in different lengths of the two legs of the tuft, or "J-tufting" as it is commonly called.

4. Friction between the yarn and the backing changes the surfaces of the yarn. Loosened fibre ends are brushed out of the surface resulting in an unwanted hairy appearance. This problem will be more pronounced for staple yarns.

5. Loosened short fibres are released as "fly" which may contaminate the carpet surface and become a safety hazard as they collect around the machine. In extreme cases the count of the yarn could be changed. Loosened effect material can detract from the appearance of the carpet. If the effect material is loosened to the extent that they drop out of the structure the desired appearance of the carpet will not be achieved.

6. The friction between the yarn and the backing fabric, combined with the increased yarn tension will cause the insertion hole to elongate which can promote distortion of the tuft lines. It may also result in difficulties in obtaining acceptable tuft anchorage.

[0003] Furthermore, one of the funtions of the thread groove, which is also called the yarn protection groove, is to protect the yarn in its passage through the backing. However, in conventional tufting this function is not realised on both strokes of the needle, only on the upward stroke. On the downward stroke the yarn has to pass between the backing fabric and the cheeks of the groove before entering the groove. The relatively sharp contours of the cheeks, compared to the smooth circular shape of the rear of the needle, create increased resistance to the yarn passage.

[0004] EP-A-0187925 and UK-A-1601812 disclose a tufting needle having a stem and a upper eye as well. The UK patent is directed to a needle for throwing two loops of two pile yarns at a single penetration of the backing fabric by the needle. For feeding the yarn or the yarns to the upper eye, it is necessary for them to be delivered at a considerable angle against the axis of the stem so that it is unavoidable for the yarns to be deflected and thus to undergo friction forces which in turn lead to considerable loads to be taken by the needles. Such forces and loads, however, may easily lead to breaks of the yarns and of the needles and thus to interruptions of the tufting procedure. Moreover, the forces and loads caused by the deflection of the yarns lead to differences in the lengths of the loops which result in an uneven surface of the tufting product.

[0005] US-A-3442233 discloses a tufting needle having a straight shank and a lower eye. A groove is running upwards from the eye. No upper eye is provided. A guiding element is located close to the upper portion of the shank for guiding the thread into the groove of the needle. The guiding element may cause friction to the thread.

[0006] DE-A-19528152 discloses a tufting needle having its stem offset with respect to its shank. With this needle, however, only one eye is provided being located close to the needle tip.

[0007] The object of the present invention is to attain a substantial reduction in the stated loads on tufting needles in particular.

[0008] In order to attain this objective, the invention provides for a tufting needle of the type mentioned at the beginning of this description to be allocated a thread-feeding element in the upper area of the stem of the thread-guiding groove, to introduce the thread into this groove.

[0009] According to the invention the yarn is guided into the thread guiding groove near the top of the needle with the result that the contact between the yarn and the backing fabric is greatly reduced. The primary effects of this ar as follows:

1. After initial penetration of the needle into the back-

ing fabric the contact area will be different for different yarns, but for one particular yarn will be essentially constant throughout both the downward and upward stroke as will the frictional effects between the yarn and the backing fabric.

2. After initial penetration a slight increase in yarn tension will occur after which it will become constant. Changes in the physical nature of the yarn due to stretching will be reduced.

3. Increased load on the drive motor during the time the needle is penetrating the backing fabric will be constant and minimal resulting in energy savings. Up to 30 % reduction in energy demands have been measured. Power factor changes are also minimised.

4. Needle insertion forces are greatly reduced, up to 70 % reductions have been measured depending on yarn count.

5. The lower yarn tension, coupled with the fact that a significant area of the surface of the yarn is in contact with the smooth surface of the thread guiding groove (especially for finer count yarns), means that the yarn flows easily from the supply creel/beam through the needle throughout the stroke rather than "robbing back" from the previous stitch creating a more even surface with greater tuft shape regularity.

6. Yarn hairiness effects are minimised.

7. Fly at the needles is reduced and effect material is less likely to be loosened.

8. Elongation of the (needle) insertion hole due to yarn tension and yarn feed angle are eliminated resulting in more regular tuft lines and less likelihood of problems with tuft anchorage.

[0010] Particularly expedient embodiments of the object of this invention are specified in the sub-claims and in the following description:

Fig. 1a shows a front view of an initial embodiment of a tufting needle;
Fig. 1 b shows a side view (sectional) of the needle in accordance with Fig. 1 a;
Fig. 1 c shows a rear view of the needle in accordance with Fig. 1 a;
Fig. 2a shows a front view of a further embodiment of a tufting needle;
Fig. 2b shows a side view (sectional) of the needle in accordance with Fig. 2a;
Fig. 2c shows a rear view of the needle in accordance with Fig. 2a;
Fig. 3a shows a front view of an embodiment of a tufting needle in accordance with the prior art;
Fig. 3b shows a side view (sectional) of the needle in accordance with Fig. 3a;
Fig. 3c shows a rear view of the needle in accordance with Fig. 3a;
Fig. 4a shows a rear view of an embodiment of a tufting needle in accordance with the present invention;
Fig. 4b shows a side view (sectional) of the needle in accordance with Fig. 4a;
Fig. 4c shows a front view of the needle in accordance with Fig. 4a;
Fig. 5a shows a front view of a further embodiment of a tufting needle in accordance with the present invention;
Fig. 5b shows a side view (sectional) of the needle in accordance with Fig. 5a;
Fig. 5c shows a rear view of the needle in accordance with Fig. 5a;
Fig. 6a shows a rear view of a further embodiment of a tufting needle in accordance with the present invention;
Fig. 6b shows a side view of the needle in accordance with Fig. 6a;
Fig. 6c shows a front view of the needle in accordance with Fig. 6a;
Fig. 7a shows a frontal view of a needle module with tufting needles and mounted perforated plate;
Fig. 7b shows a side view of the needle module in accordance with Fig. 7a;
Fig. 8a shows a frontal view of a further embodiment of the needle module in accordance with the present invention with tufting needles and spring-loaded perforated plate;
Fig. 8b shows a side view of the needle module in accordance with Fig. 8a;
Fig. 9a shows a further embodiment of the module, whereby the tufting needles are inserted directly in a needle bar which is connected to the perforated plate;
Fig. 9b shows a side view of the configuration according to Fig. 9a;
Fig. 10a shows a front view of a further embodiment of a tufting needle in accordance with the present invention;
Fig. 10b shows a side view of the needle in accordance with Fig. 10a, and
Fig. 10c shows a rear view of the needle in accordance with Fig. 10a

[0011] Figs. 1, 2 show a tufting needle with a shank, 1, a stem, 2, a tip, 3, and an eye, 4, located close to the tip, 3. The shank, 1, can be fitted separately in the needle bar of a tufting machine. Alternatively, it can also be embedded in a module body, which holds several identical needles and can then be assigned as a unit to a needle

bar.

[0012] The stem, 2, incorporates a thread-guiding groove, 5, which has a flat base, 6. Two cheeks, 7, 8, run along the sides of the thread-guiding groove, 5. As shown in Figs. 1 b, 2b, one of these cheeks is provided with a hook-shaped element, 9, which forms a thread support which is open in the direction of the shank, 1. The thread support, 10, extends into the area of the thread-guiding groove, 5, and may extend to the latter's base, 6 (Fig. 2).

[0013] The rear view of the tufting needle corresponds to an established configuration, as shown in Figs. 1c, 2c.

[0014] In the case of the needle in accordance with.Fig. 1, therefore, the thread is not supplied to the eye, 4, at an angle to the needle's axis, but is inserted via the thread support, 10, directly into the thread-guiding groove, in which it is guided up to the eye, 4. This principle means that the thread is supplied to the needle in the vicinity of the shank, 1, and, subsequently, close to the point at which the tufting needle is mounted on the equipment concerned, that is, at a point at which the occurring forces can be easily discharged into the needle bar.

[0015] The embodiment of the invention in accordance with Fig. 3 also has a shank, 1, a stem, 2, a tip, 3, and an eye, 4. As Fig. 2b shows, in this embodiment the stem, 2, is joined to the shank, 1, via a transitional segment, 11. Shank, 1, and stem, 2, are offset in parallel with one another. An opening, 12, leads into the upper area of the thread-guiding groove, 5, forming a thread-feeding element. The stem, 2, possesses a thickened area, 13, around the opening, 12, which runs transversely to the longitudinal direction of the row of needles when the tufting needle is installed in a needle bar, i.e. it does not intrude into the space between neighbouring needles.

[0016] The embodiment of the invention in accordance with Fig. 10 also has a shank, 1, a stem, 2, a tip, 3, and an eye, 4. The stem, 2, is joined to the shank, 1, via a forwardly extending (i.e. away from the needle bar) transitional segment, 90. Shank, 1, and stem, 2, are offset in parallel with one another. In the transitional segment, 90, an upwardly and/or forwardly extending opening, 91, is provided which leads into the upper area of the thread guiding groove, 5.

[0017] This embodiment has the advantage that the yarn directly enters the yarn guiding groove = yarn protecting groove with minimal bending. As the yarn does not have to pass between the needles, the upper needle guide can be relatively large (i.e. the width of the needle or larger). Threading is also easier because the yarn can be pushed or pulled down through the upper needle guide into the needle groove toward the needle eye from the relatively clear space above the upper needle guide. Effectively the upper needle guide of this embodiment incorporates the last guide bar on the tufting machine in a similar orientation, but located directly at the top of the yarn protection groove. Accordingly all of the same space considerations and hole size considerations that apply to the guide bar also apply to the upper needle guide.

[0018] The embodiment of the tufting needle in accordance with the present invention shown in Fig. 4 differs from the previously described embodiments in that a transitional segment, 14, is provided between the shank, 1, and the stem, 2, with an opening, 15, which serves as a thread-feeding element. Here again, the shank, 1, and stem, 2, are offset in parallel with one another. The opening, 15, is followed by the thread-guiding groove, 5, on the stem, 2, whereby the straight continuation of the thread-guiding groove, 5, is aligned with the opening, 15.

[0019] In the embodiment of the tufting needle in accordance with the present invention which is shown in Fig. 5, shank, 1, and stem, 2, are coaxially aligned. Between these two segments of the needle there is a bend, 20, which lies on a plane parallel with the base, 6, of the thread-guiding groove. When this tufting needle is installed in a bar, this bend protrudes transversely to the row of needles, which means that it does not require any additional space between neighbouring tufting needles in the needle row.

[0020] The bend, 20, incorporates an opening, 21, which serves as a thread-feeding element. In relation to the longitudinal axis of the needle, the opening, 21, is twisted at an angle of 90° to the eye, 4. The upper end, 22, of the thread-guiding groove, 5, extends up to the opening, 21, in the area of the bend. After passing through the opening, 21, a thread which is fed in through the opening, 21, is thus positioned against a cheek, 23, of the thread-guiding groove, 5, at the upper end of which it continuously takes on the straight course of the thread-guiding groove, 5.

[0021] In the embodiment of the present invention shown in Fig. 6, the shank, 1, and stem, 2, are offset in parallel with one another. Between these segments there is a transitional segment, 30, incorporating an opening, 31, which serves as a thread-feeding element. This feeding element is flat, as a result of which the opening is inclined forwards when the row of needles is in installed state, thus simplifying the introduction and course of a thread in this opening. The opening, 31, is followed directly by a thread-guiding groove, 5, on the stem, 2.

[0022] Fig. 7 shows an embodiment of the invention in which the thread-feeding elements are provided not directly on a tufting needle, but in a perforated plate which closely adjoins the needle or needles. The tufting needles, 55, are firmly embedded in a row in a module body, 56, which, in turn, can be fixed to a needle bar (not shown).

[0023] Attached to the module body, 56, is a plate-type element, 57, the bottom part of which takes the form of a perforated plate, 58. This perforated plate, 58, is provided with openings, 59, which serve as thread-feeding elements, whereby one opening, 59, is provided for each tufting needle, 55, and a thread can be passed through these holes and thus conveyed into position in the direct vicinity of the upper area of the thread-guiding groove of the tufting needle concerned.

[0024] The perforated plate, 58, may also constitute a homogeneous element of the module body, 56.

[0025] The embodiment in accordance with Fig. 8 differs from that shown in Fig. 7 first of all in that a plate-type element, 65, is provided on the module body, 56, whereby the bottom part of this element takes the form of a perforated plate, 66. In Fig. 7b, the openings in this perforated plate are open to the bottom left (67), to facilitate the introduction of a thread. The plate-type element, 65, can be swivelled around a pin, 68. A spring, 69, presses it against the module body and consequently into the desired position in relation to the row of needles. The spring, 69, is stayed by a counterplate, 70, which is fixed to the module body, 56.

[0026] In the embodiment shown in Fig. 9, tufting needles, 75, are fixed individually in a needle bar, 76. Connected to the needle bar, 76, is a perforated plate, 77, each hole, 78, of which is positioned in relation to the thread-guiding groove of a tufting needle, 75, in such a manner as to enable a thread to be fed directly into this groove.

[0027] The thread guideways and guide elements are smoothed and rounded in all embodiments.

[0028] The tufting needles can be designed in accordance with previously common configurations in the area of the tip. The same applies with regard to the side of the needles facing the thread-guiding groove, which is referred to above as the rear side.

Claims

1. Tufting needle as an individual needle and as an element of a needle module incorporating several such needles, comprising a shank (1) and a stem (2) with a lower eye (4) provided in the area of the tip (3) of the stem (2) and a thread-guiding groove (5) on one side of the needle, starting from the eye (4) and running along the needle stem (2), wherein the thread-guiding groove (5) is provided with a thread-feeding upper opening (15, 21, 31, 91) **characterized in that** the upper opening (15, 21, 31, 91) is located in an upper transitional segment (14, 20, 30, 90) of the shank (1) to introduce the thread into this groove, the transitional segment (14) being located between the stem (2) and the shank (1) and the stem (2) being offset with respect to the shank (1).

2. Tufting needle in accordance with Claim 1, **characterised in that** the distances between the thickened area and the needle tip (3) differ for the needles provided with a thickened area in the plane of the thread-guiding groove (5) for the purpose of accommodating a thread-feeding element.

3. Tufting needle in accordance with Claim 1, **characterised in that** it operates in conjunction with a perforated plate (58, 66, 77) fixed to the needle bar of a tufting machine, said plate possessing holes corresponding to the upper end of the thread-guiding-groove (5) of each needle.

4. Needle module with tufting needle in accordance with Claim 1, **characterised in that** the thread-feeding elements of the module's needles take the form of the holes of a perforated plate (58, 66, 77) which is located closely above the needles and each hole of which corresponds to the upper end of a thread-guiding groove (5).

5. Needle module in accordance with Claim 4, **characterised in that** the perforated plate is fixed to a module body.

6. Needle module in accordance with Claim 4, **characterised in that** the perforated plate on the module body is mounted in such a manner that it can be swung away from the needles.

7. Needle module in accordance with one of Claims 4 to 6, **characterised in that** the holes of the perforated plate are provided with slits to facilitate introduction of the thread.

Patentansprüche

1. Tuftingnadel in Form einer einzelnen Nadel als ein Element eines Nadelmoduls, das mehrere solcher Nadeln aufweist, mit einem Schenkel (1) und einem Schaft (2) mit einem unteren Öhr (4), das im Bereich der Spitze (3) des Schafts (2) angeordnet ist, und mit einer an einer Seite der Nadel angeordneten, an dem Öhr (4) beginnenden und entlang des Schafts (2) verlaufenden Fadenführungsrinne (5), wobei die Fadenführungsrinne (5) mit einer fadenführenden oberen Öffnung (15, 21, 31, 91) versehen ist, die in einem oberen Übergangsabschnitt (14, 20, 30, 90) des Schenkels (1) angeordnet ist, um den Faden in diese Rinne einzuführen, wobei der Übergangsabschnitt (14) zwischen dem Schaft (2) und dem Schenkel (1) angeordnet ist und wobei der Schaft (2) gegen den Schenkel (1) versetzt angeordnet ist.

2. Tuftingnadel nach Anspruch 1, **dadurch gekennzeichnet, dass** die Abstände zwischen dem verdickten Bereich und der Nadelspitze (3) bei den Nadeln abweicht, die mit einem in der Ebene der Fadenführungsrinne (5) angeordneten verdickten Bereich versehen sind, um ein Fadenzuführelement aufzunehmen.

3. Tuftingnadel nach Anspruch 1, **dadurch gekennzeichnet, dass** sie in Verbindung mit einer perforierten Platte (58, 66, 77) arbeitet, die an der Nadelbarre einer Tuftingmaschine befestigt ist, wobei die Platte Löcher aufweist, die dem oberen Ende der Fadenführungsrinne (5) jeder Nadel zugeordnet

sind.

4. Nadelmodul mit Tuftingnadel gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Fadenzuführelemente der Nadeln des Moduls die Form von Löchern in einer perforierten Platte (58, 66, 77) haben, die dicht oberhalb der Nadeln angeordnet ist, wobei jedes Loch dem jeweiligen oberen Ende einer Fadenführungsrinne (5) zugeordnet ist.

5. Nadelmodul nach Anspruch 4, **dadurch gekennzeichnet, dass** die perforierte Platte an einem Modulkörper fixiert ist.

6. Nadelmodul nach Anspruch 4, **dadurch gekennzeichnet, dass** die perforierte Platte an dem Modulkörper in einer solchen Weise montiert ist, dass sie von den Nadeln weg geschwenkt werden kann.

7. Nadelmodul nach einem der Ansprüche 4 bis 6, **dadurch gekennzeichnet, dass** die Löcher der perforierten Platte mit Schlitzen versehen sind, um das Einführen des Fadens zu erleichtern.

Revendications

1. Aiguille à touffeter en tant qu'aiguille individuelle et en tant qu'élément d'un module d'aiguilles englobant plusieurs aiguilles de ce type, comprenant un talon (1) et une tige (2) avec un chas inférieur (4) prévu dans la région de la pointe (3) de la tige (2) et une rainure de guidage (5) du fil sur un côté de l'aiguille, commençant au niveau du chas (4) et courant le long de la tige (2) de l'aiguille, dans laquelle la rainure de guidage (5) du fil est pourvue d'une ouverture supérieure (15, 21, 31, 91) d'alimentation en fil, **caractérisée en ce que** l'ouverture supérieure (15, 21, 31, 91) est située dans un segment supérieur de transition (14, 20, 30, 90) du talon (1) pour introduire le fil dans cette rainure, le segment de transition (14) étant situé entre la tige (2) et le talon (1) et la tige (2) étant décalée par rapport au talon (1).

2. Aiguille à touffeter selon la revendication 1, **caractérisée en ce que** les distances entre la région épaissie et la pointe (3) de l'aiguille diffèrent pour les aiguilles pourvues d'une région épaissie dans le plan de la rainure de guidage (5) du fil dans le but de loger un élément d'alimentation en fil.

3. Aiguille à touffeter selon la revendication 1, **caractérisée en ce qu'**elle fonctionne conjointement avec une plaque perforée (58, 66, 77) fixée à la barre d'aiguille d'une machine à touffeter, ladite plaque possédant des trous correspondant à l'extrémité supérieure de la rainure de guidage (5) du fil de chaque aiguille.

4. Module d'aiguilles avec aiguille à touffeter selon la revendication 1, **caractérisé en ce que** les éléments d'alimentation en fil des aiguilles du module prennent la forme des trous d'une plaque perforée (58, 66, 77) qui est située juste au-dessus des aiguilles et dont chaque trou correspond à l'extrémité supérieure d'une rainure de guidage (5) du fil.

5. Module d'aiguilles selon la revendication 4, **caractérisé en ce que** la plaque perforée est fixée à un corps de module.

6. Module d'aiguilles selon la revendication 4, **caractérisé en ce que** la plaque perforée sur le corps de module est montée de telle manière qu'elle puisse être écartée des aiguilles.

7. Module d'aiguilles selon une des revendications 4 à 6, **caractérisé en ce que** les trous de la plaque perforée sont pourvus de fentes pour faciliter l'introduction du fil.

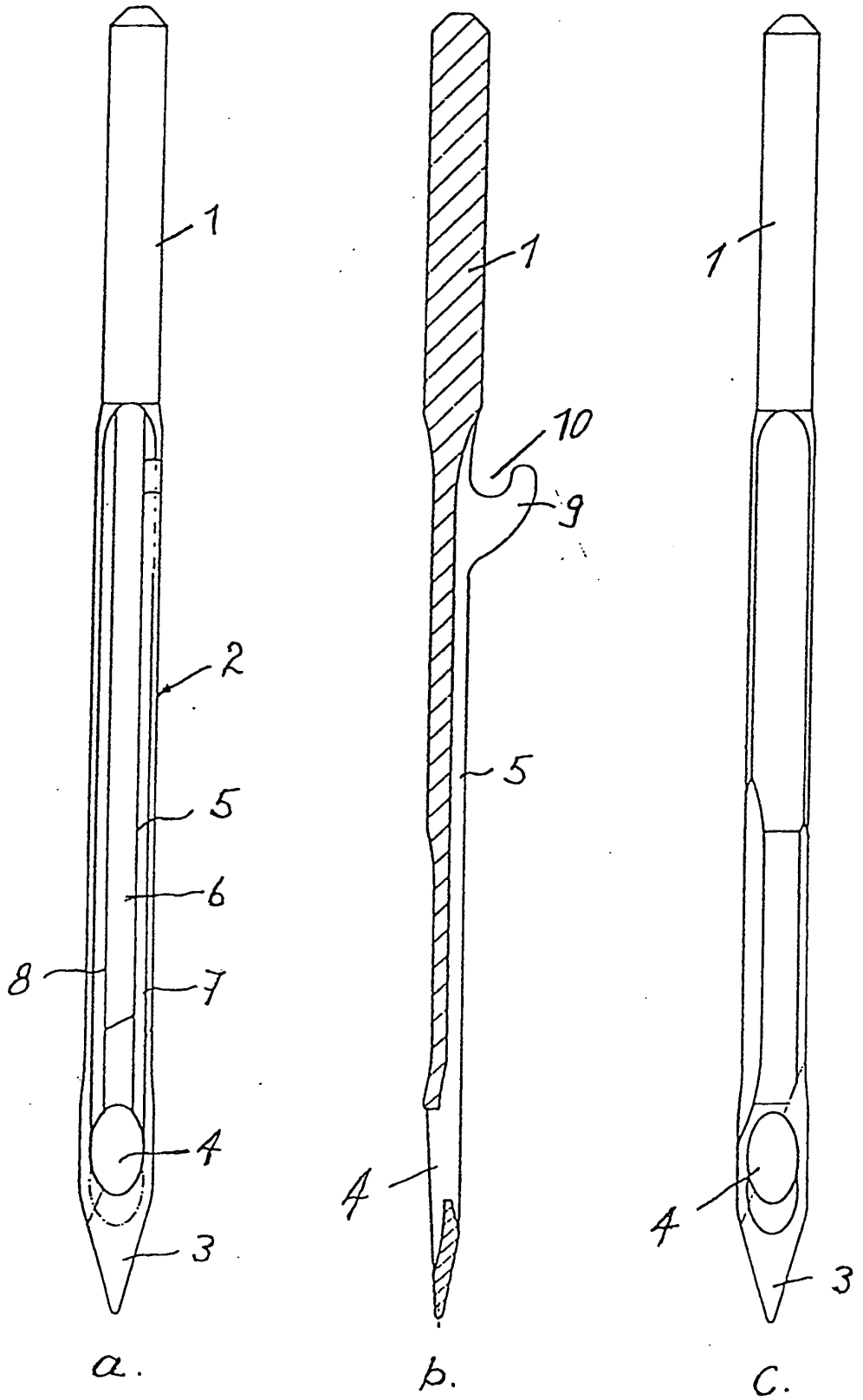

Fig. 1

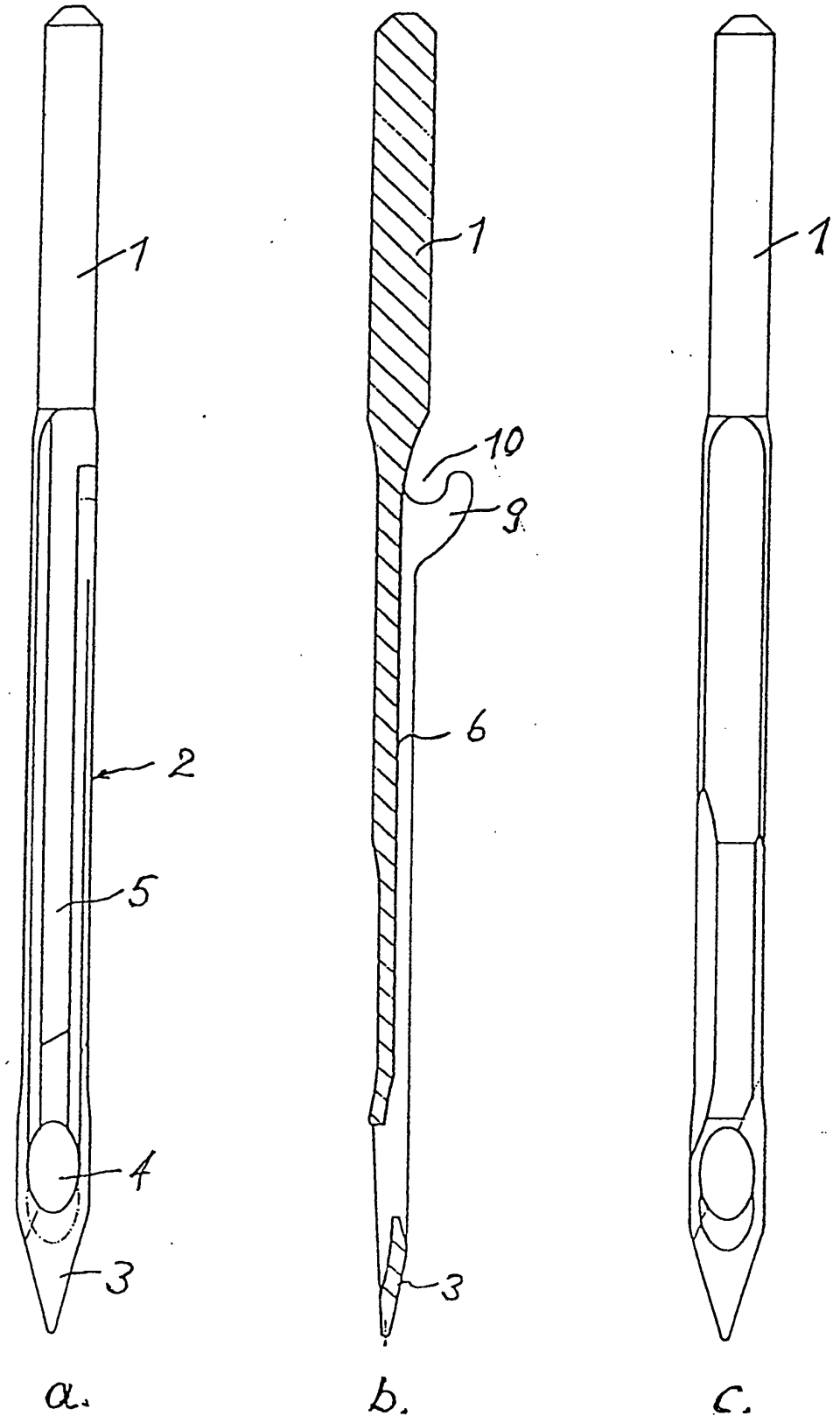

Fig. 2

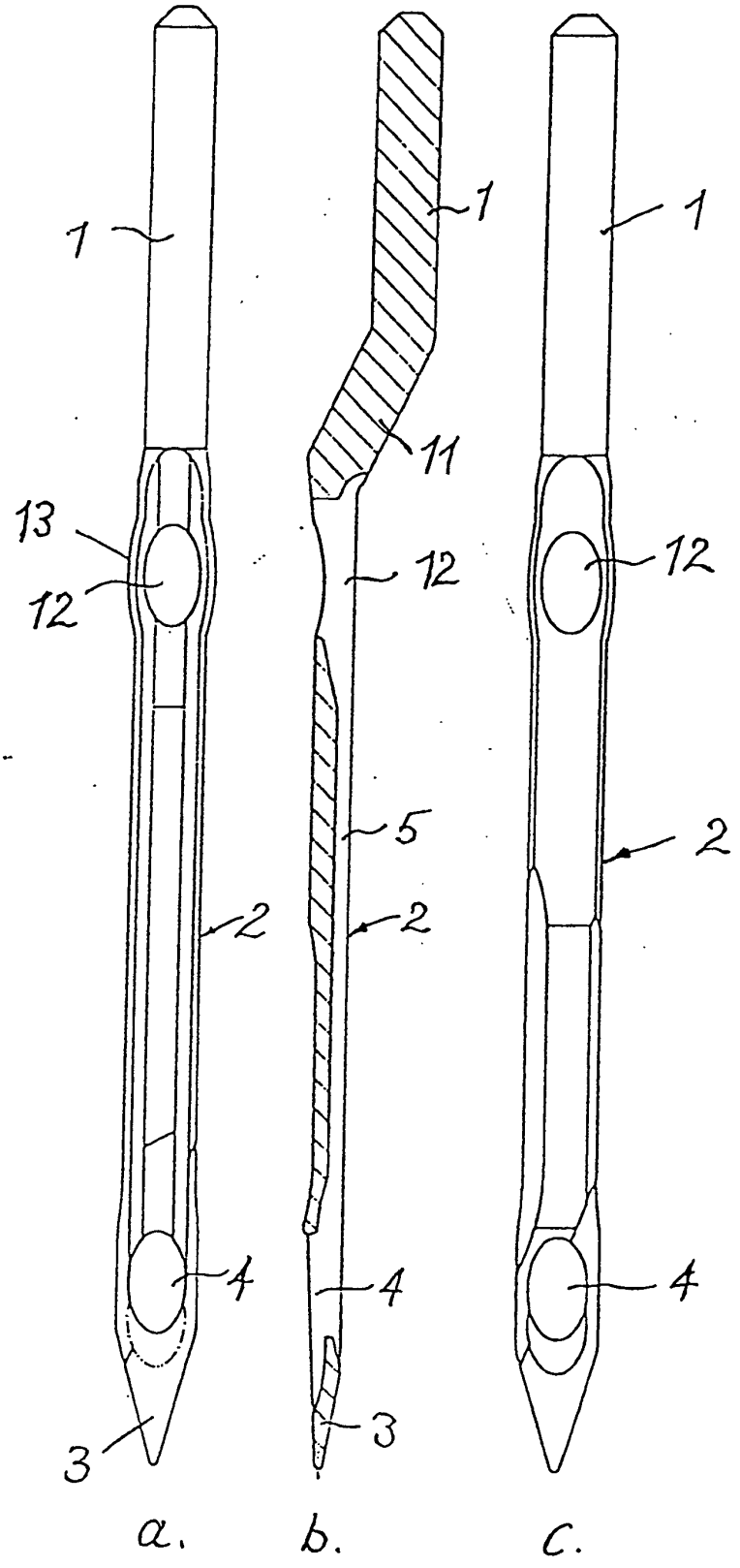

Fig. 3

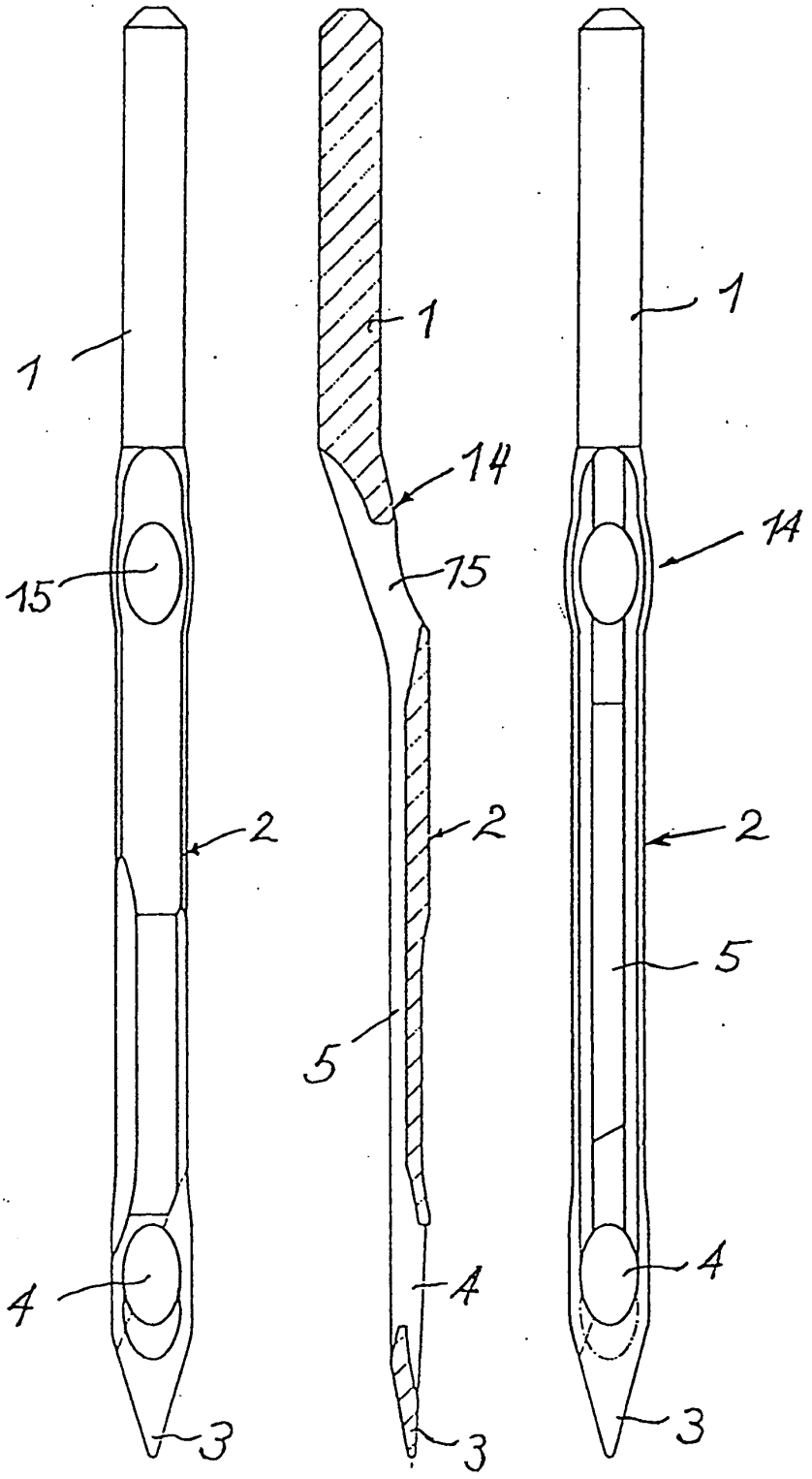

Fig. 4

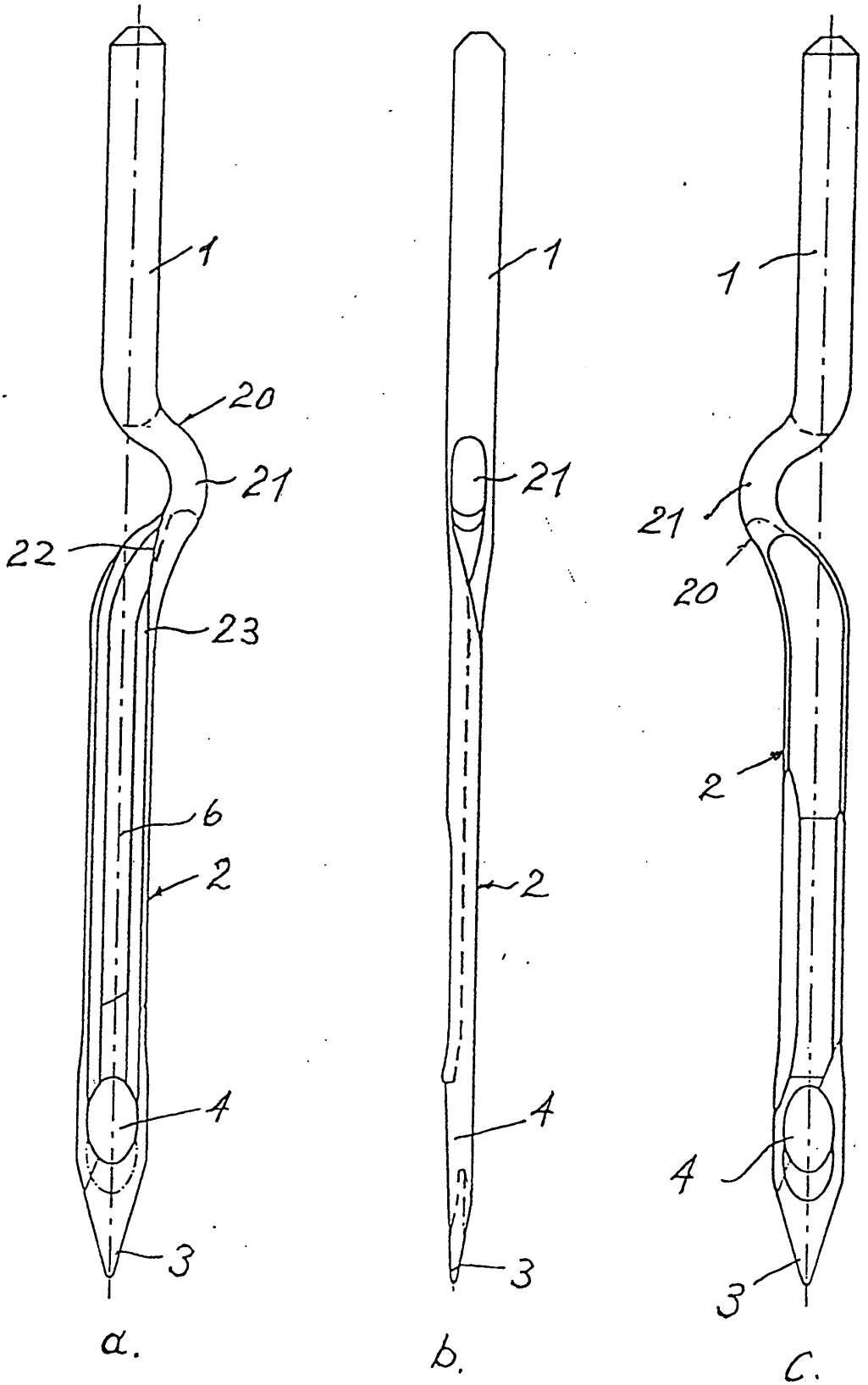

Fig. 5

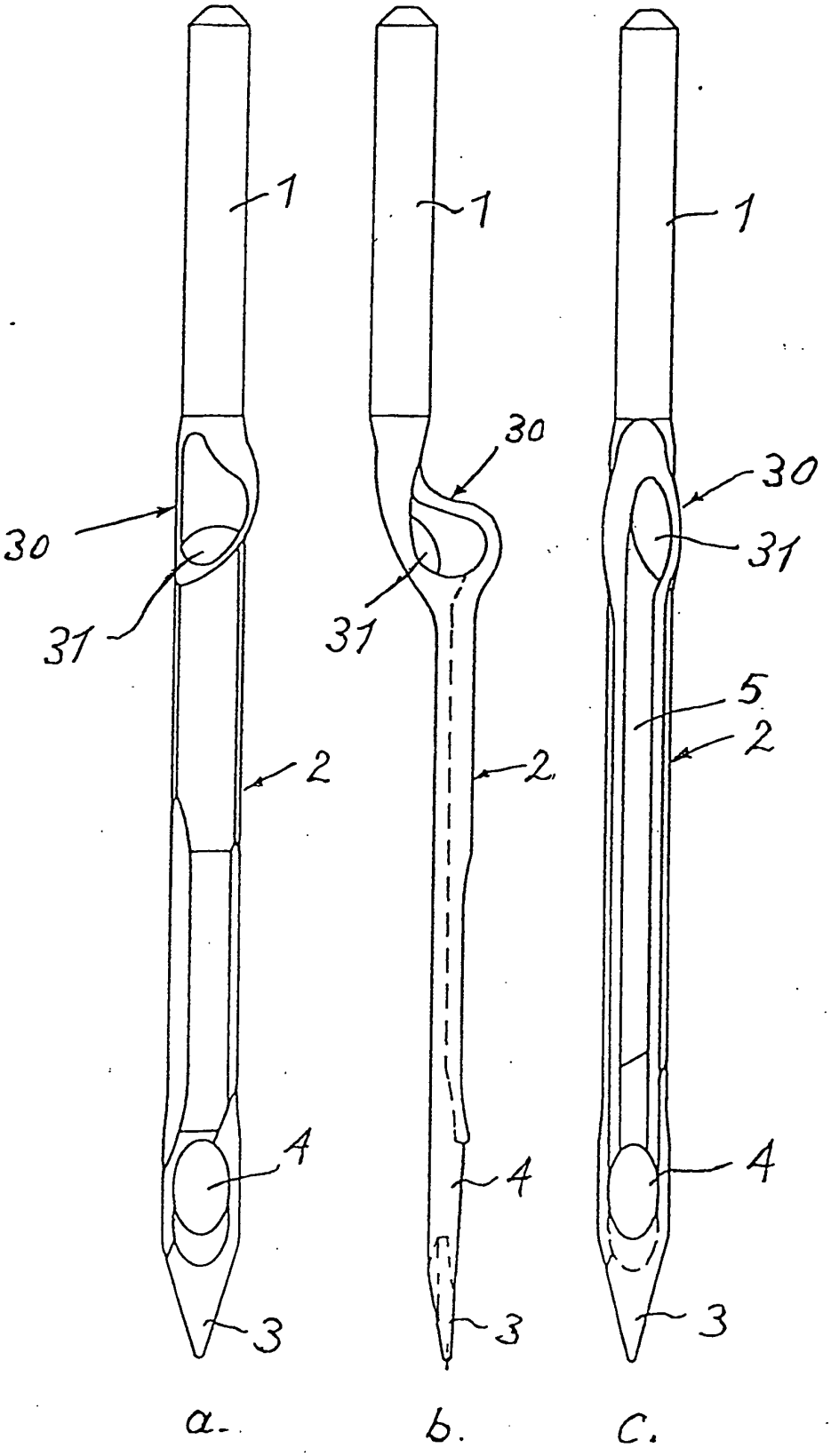

Fig. 6

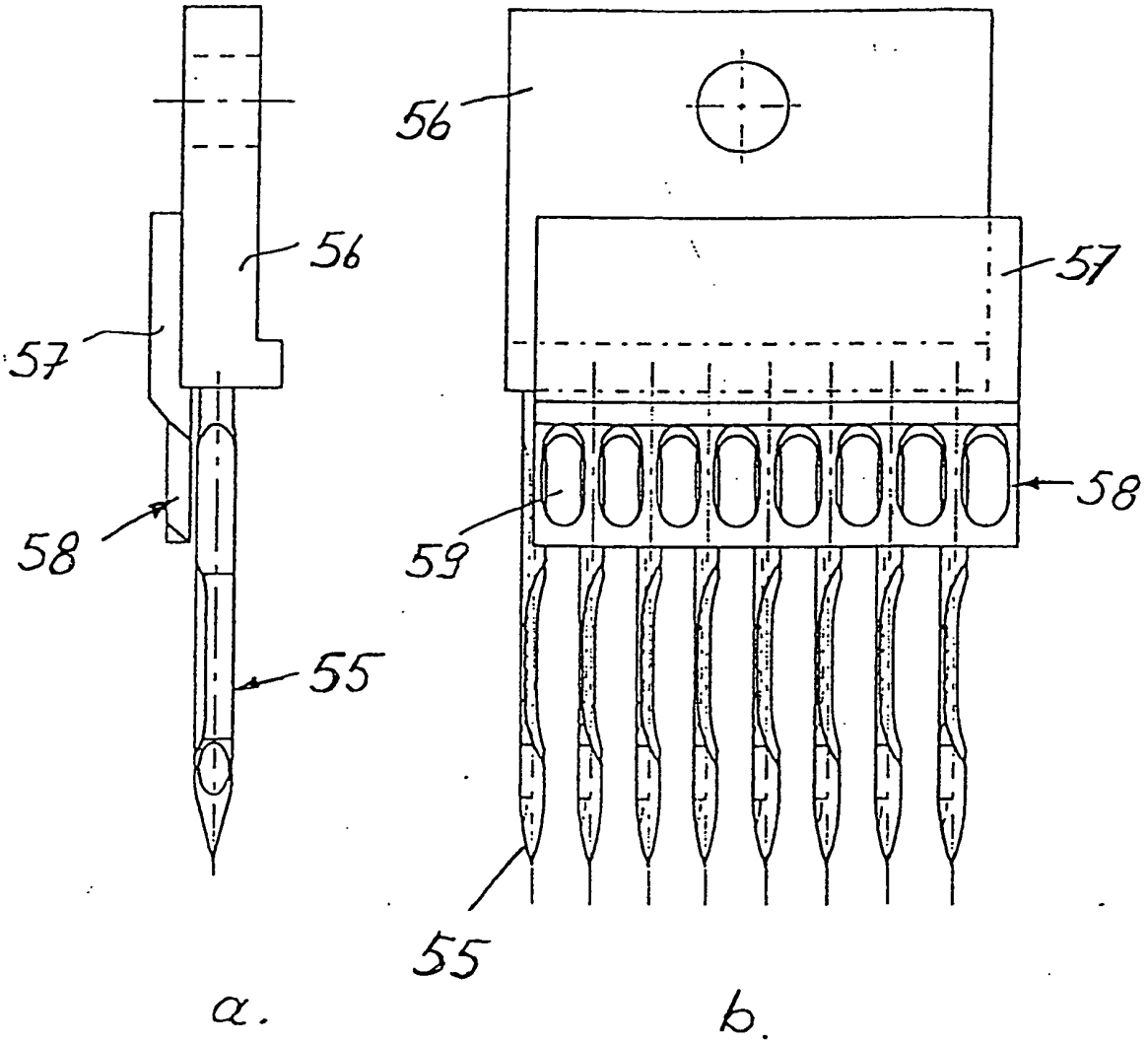

Fig. 7

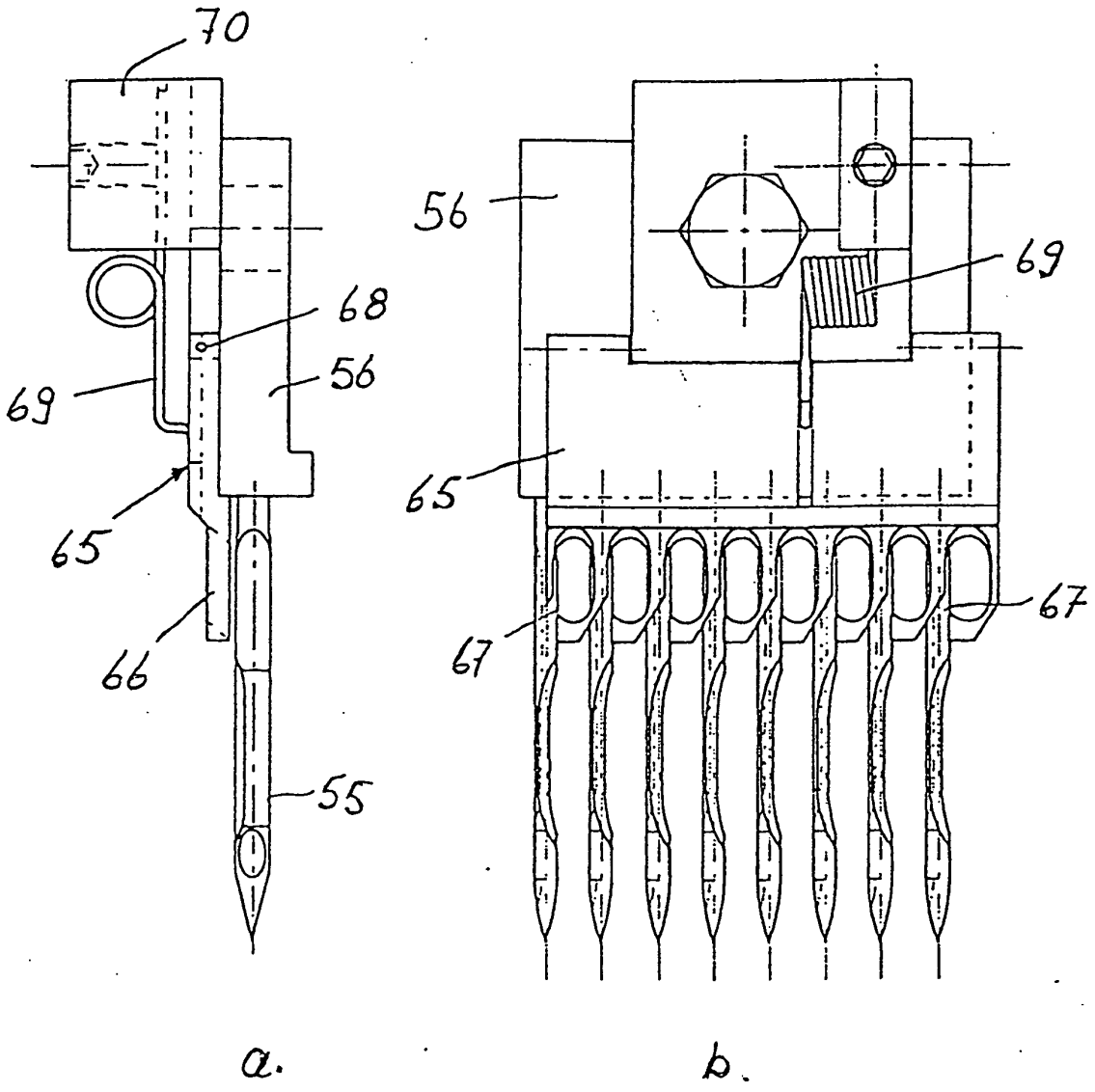

Fig. 8

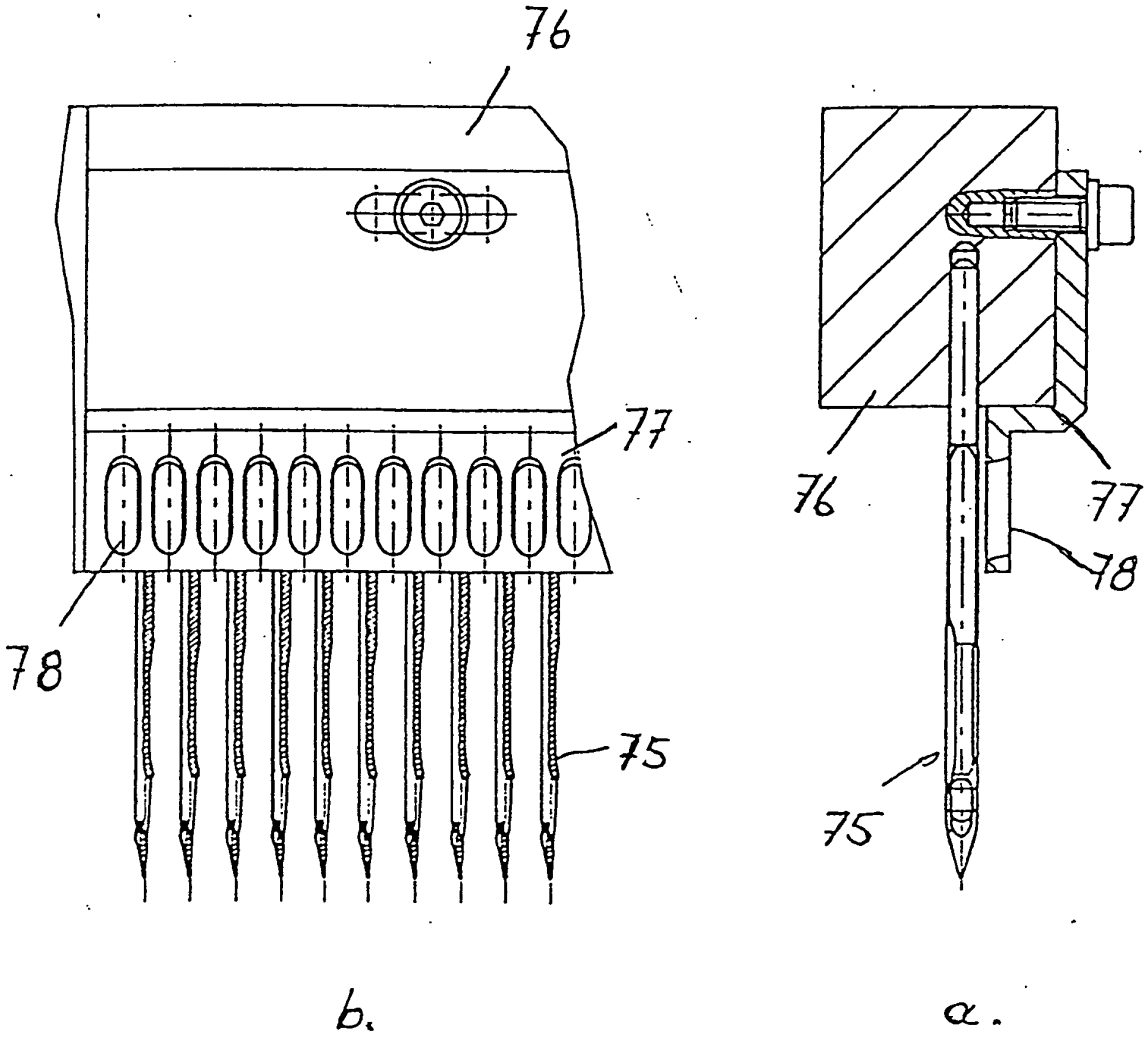

Fig. 9

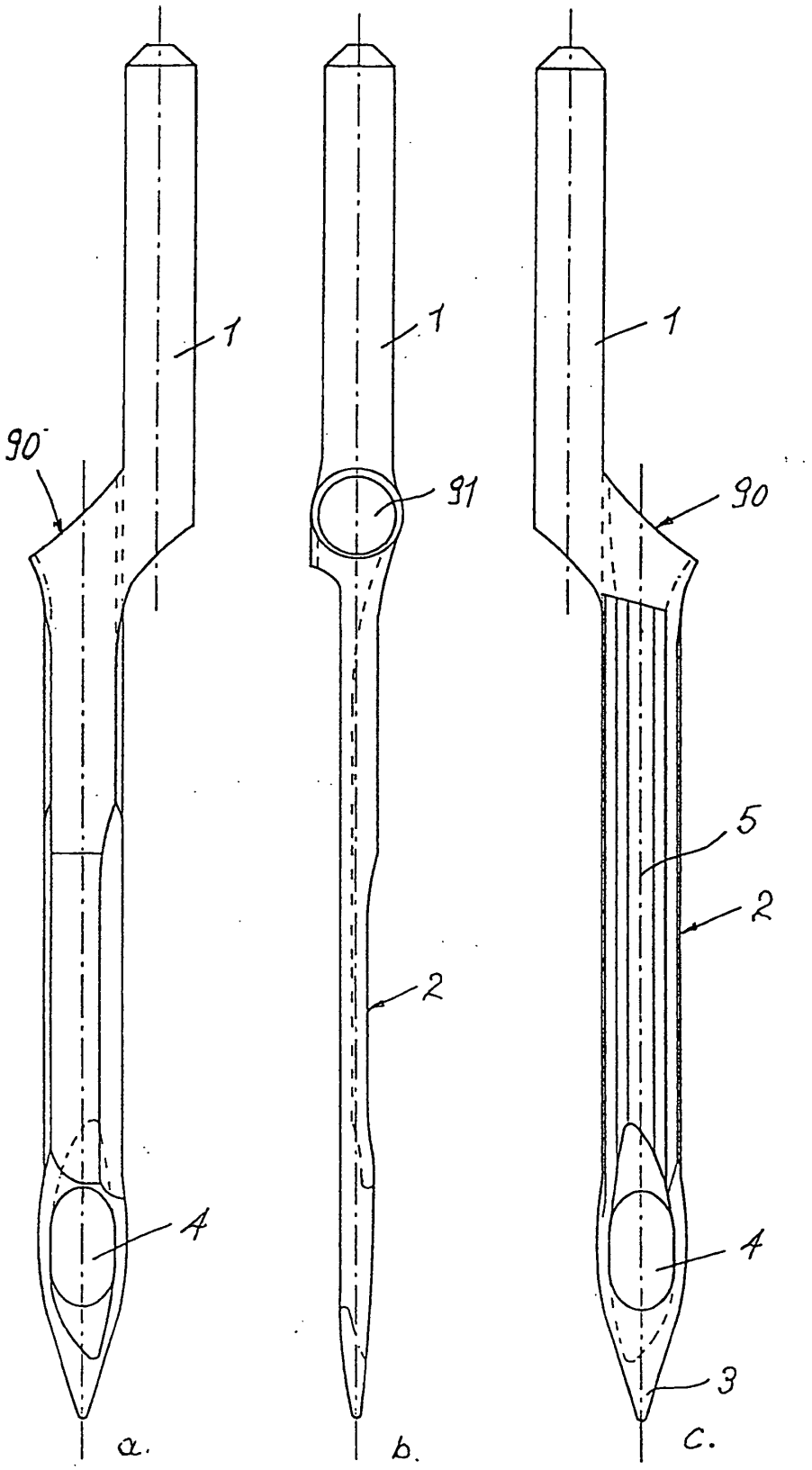

Fig. 10