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(54) **PROFILED KEY FOR CYLINDER LOCKS**

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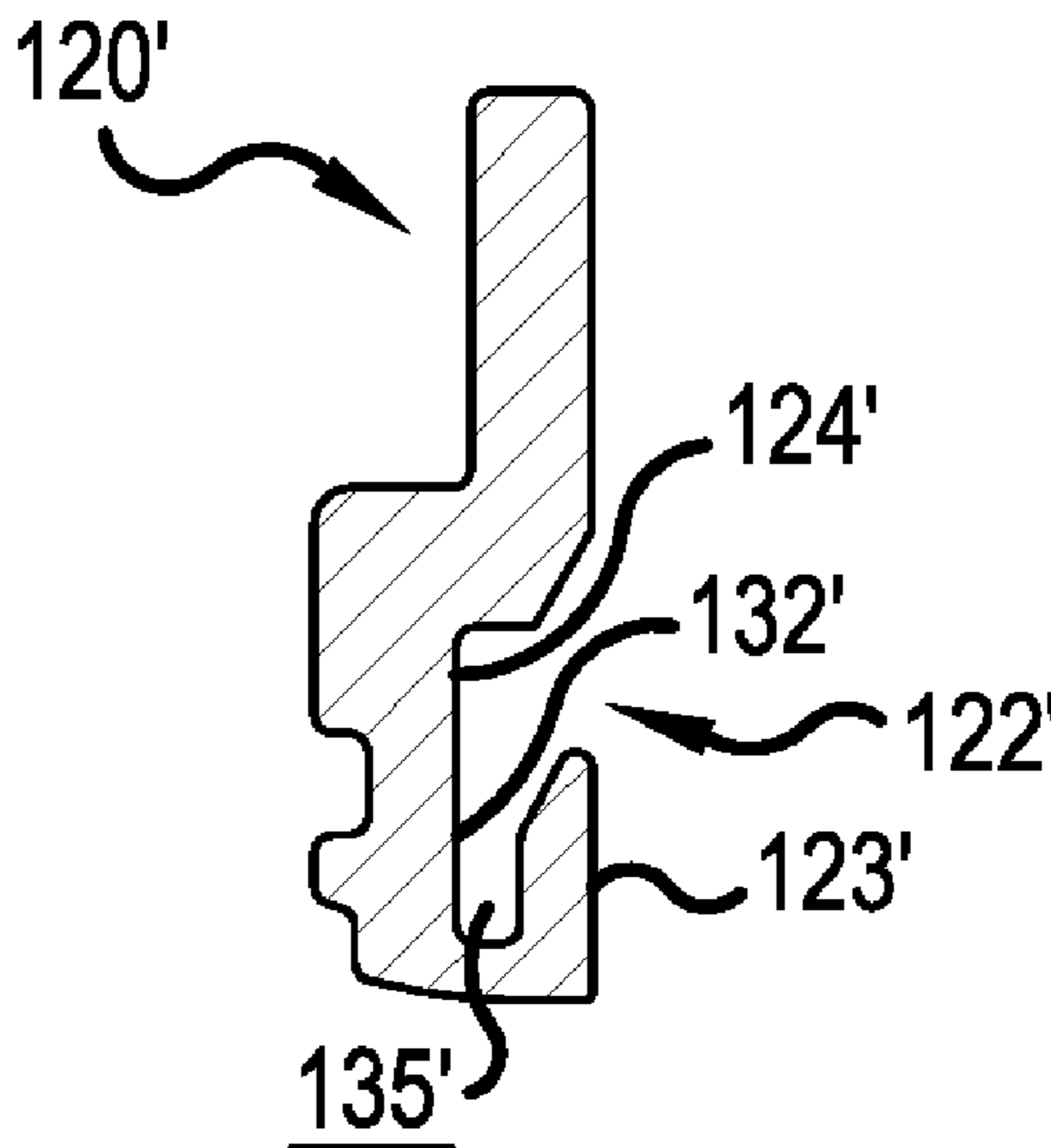
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(57) **ABSTRACT**

A key for use in a cylinder lock with a rotatable key plug having a profiled keyway. The key comprises an elongated, substantially flay key blade (120; 120') having a longitudinal profile groove (122; 122') extending along at least a portion of the length of the key blade. The groove has an undercut portion (129) adjacent to a ridge portion (128, 128'), the outside of which forms part of a side surface (123; 123') of the key blade. The undercut portion (129; 129') of the groove is expanded, at its innermost part adjacent to and inside said ridge portion, into a longitudinally extending pocket (135; 135').

48 Claims, 6 Drawing Sheets



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(58) **Field of Classification Search**
USPC 70/493, 405, 406, 409
See application file for complete search history.

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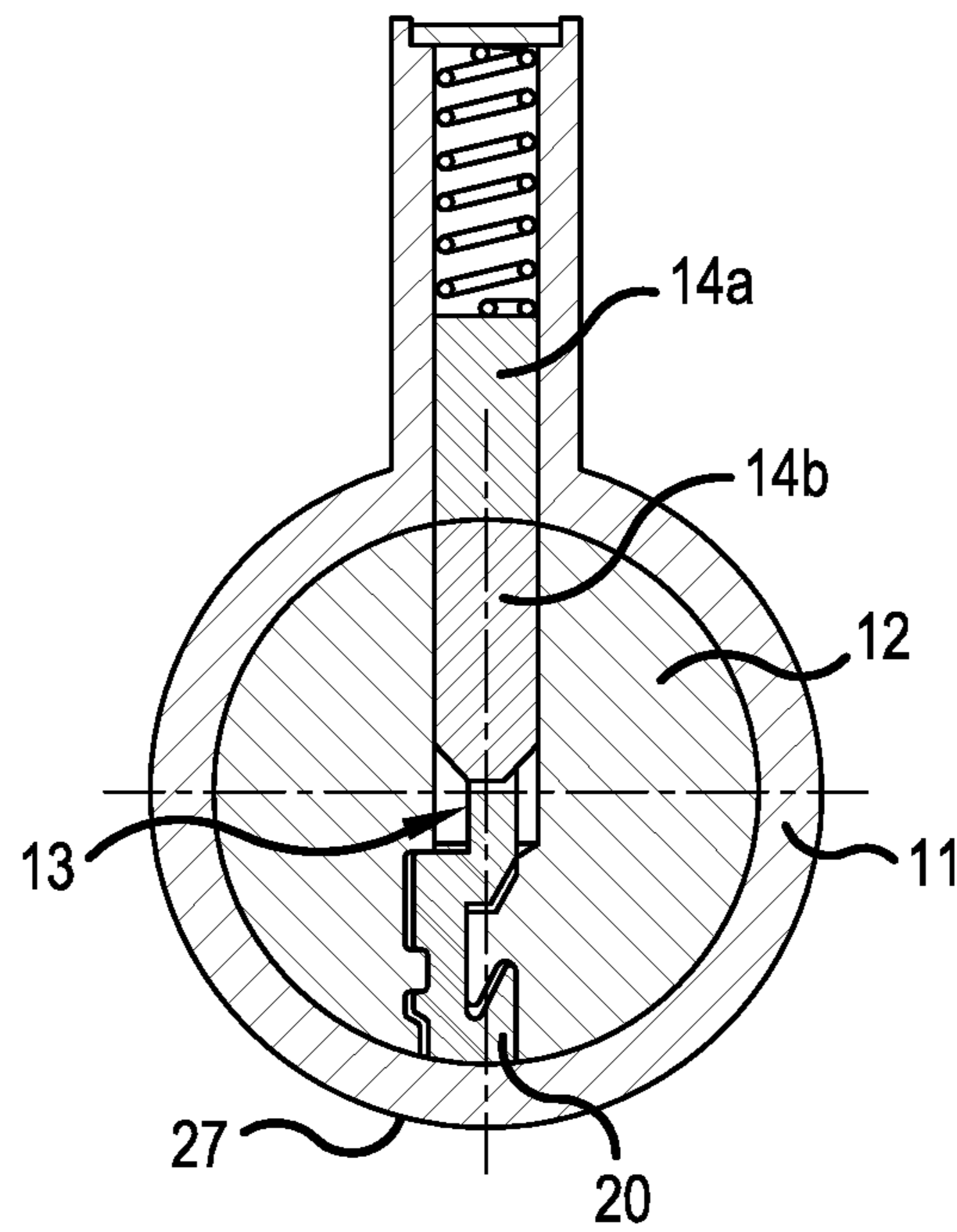


FIG. 4
PRIOR ART

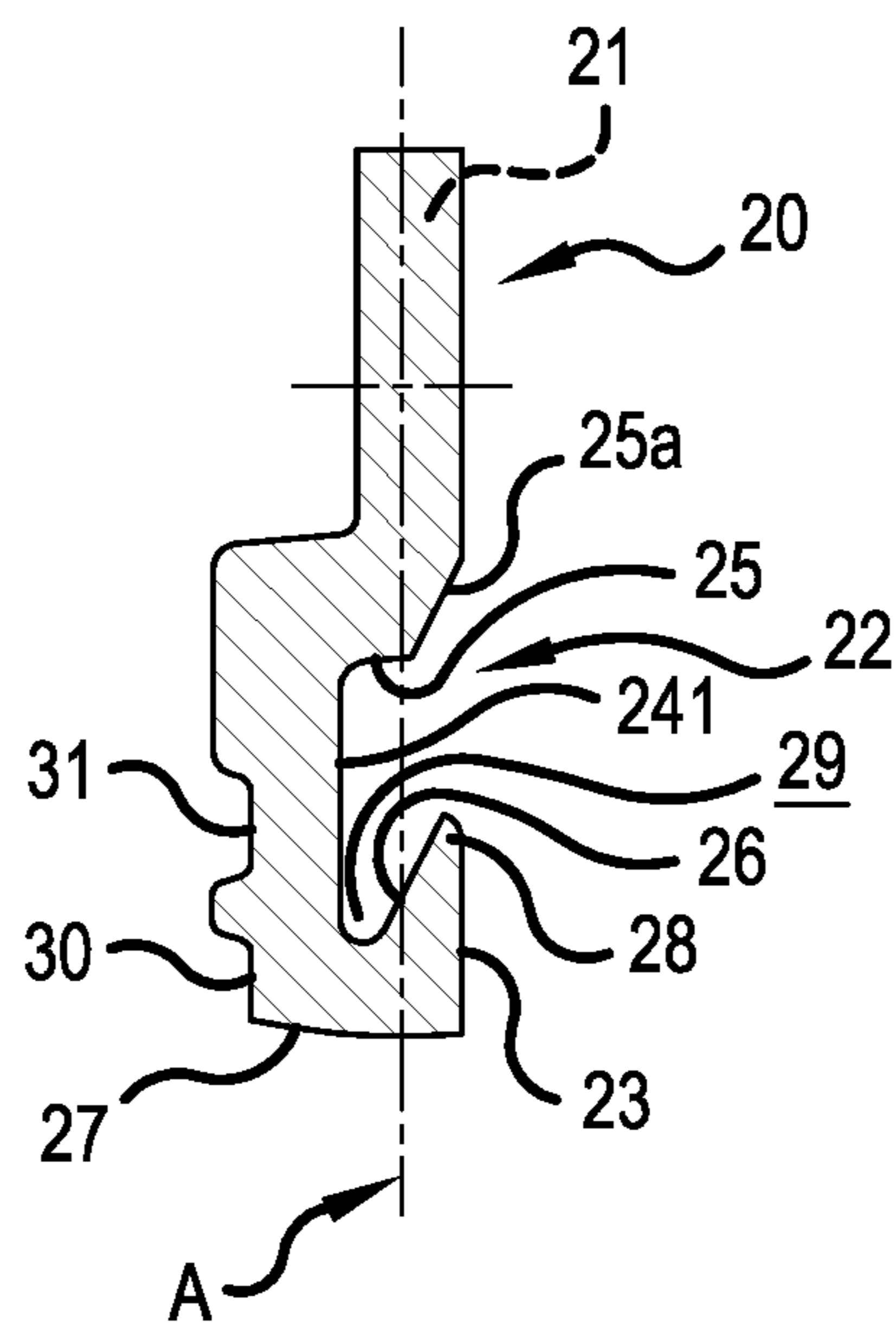


FIG. 5
PRIOR ART

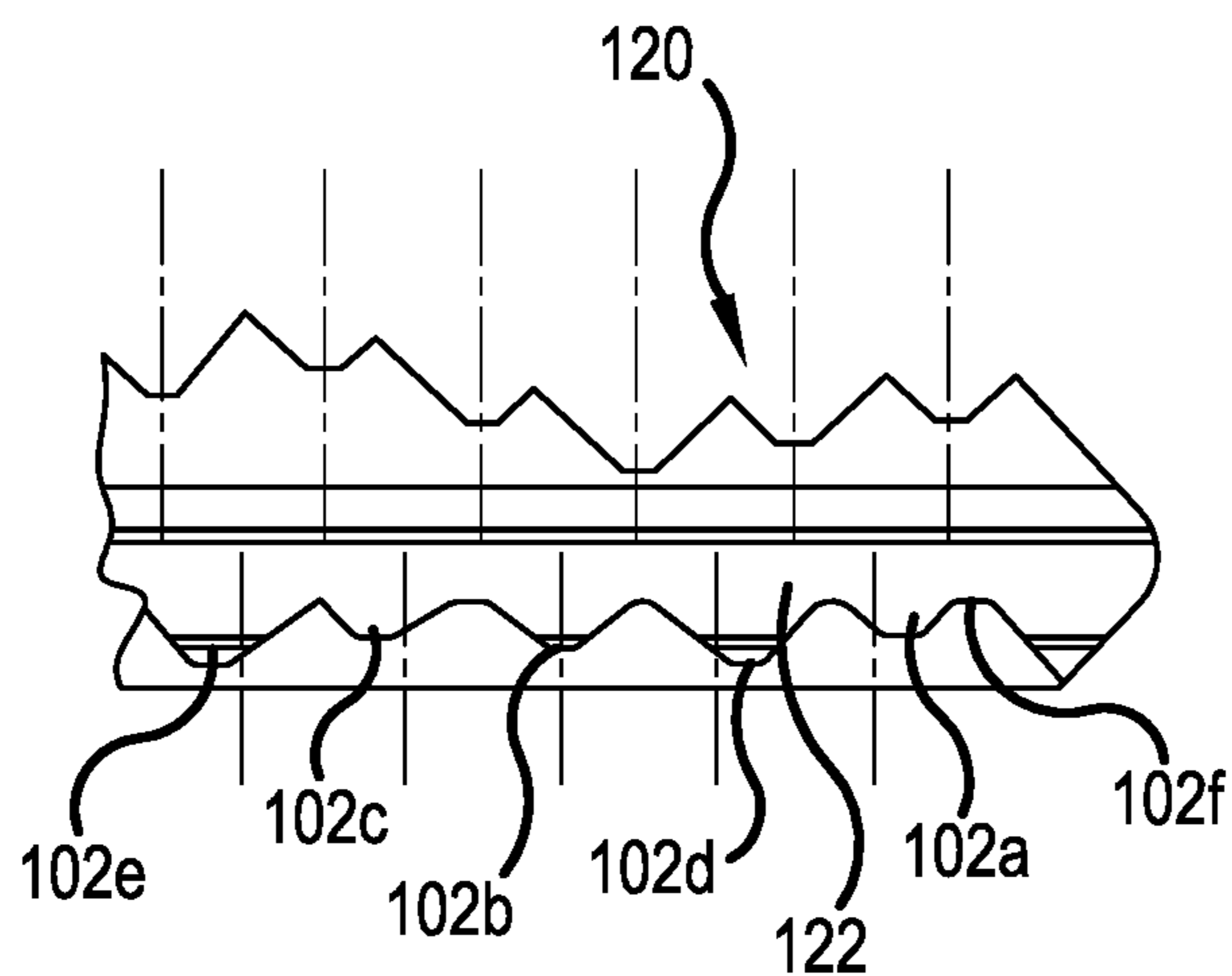


FIG. 6

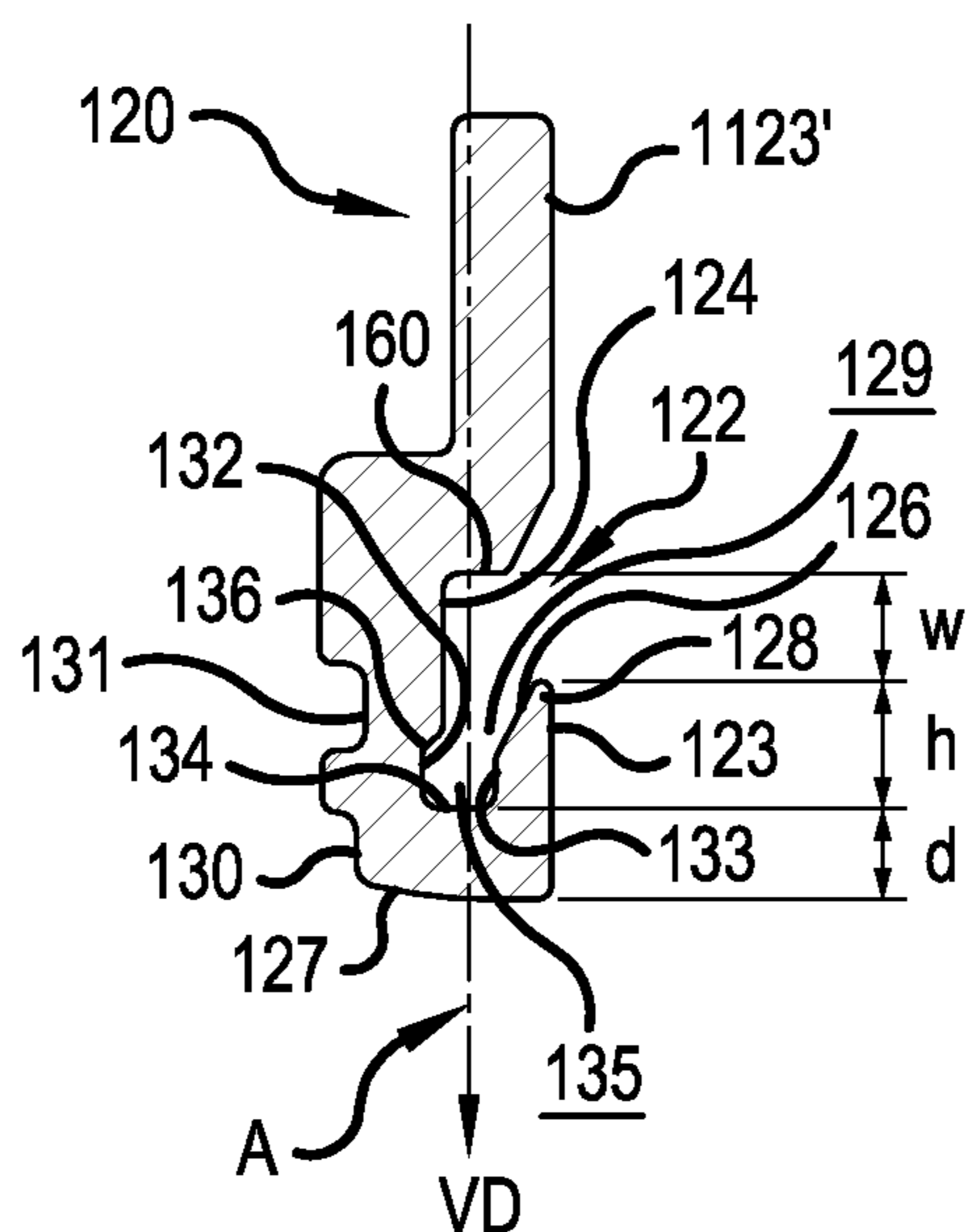


FIG. 7

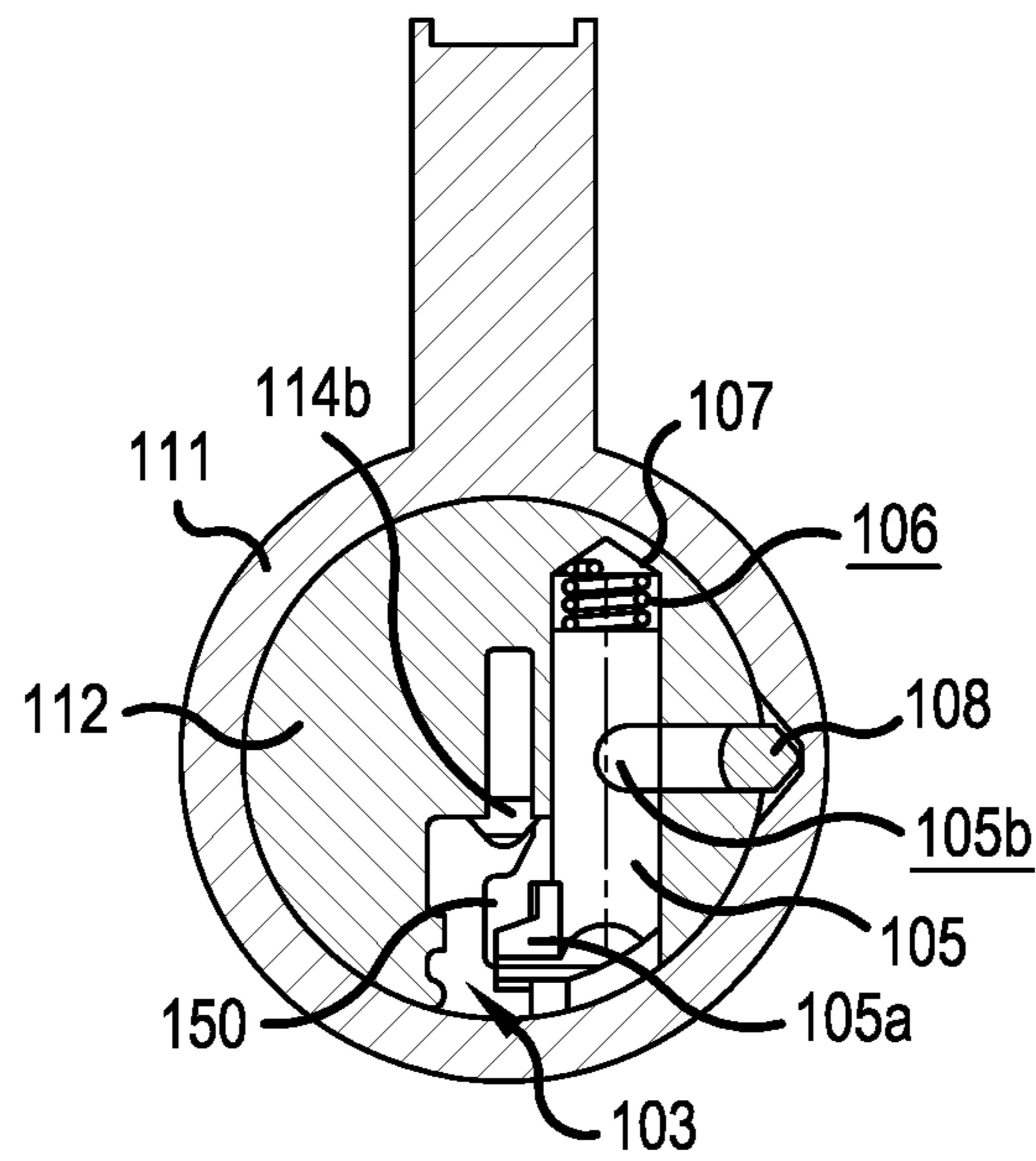


FIG. 8

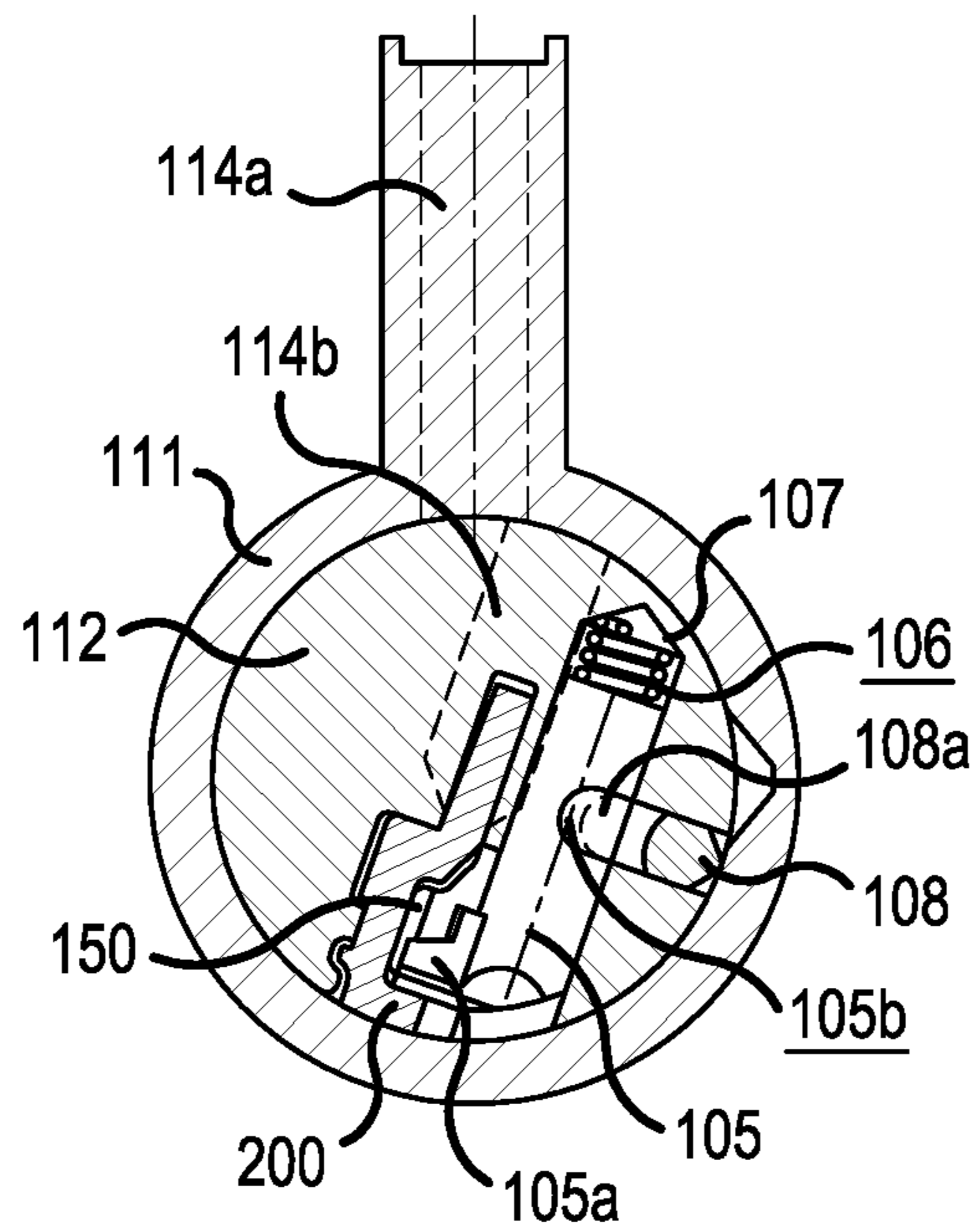


FIG. 9

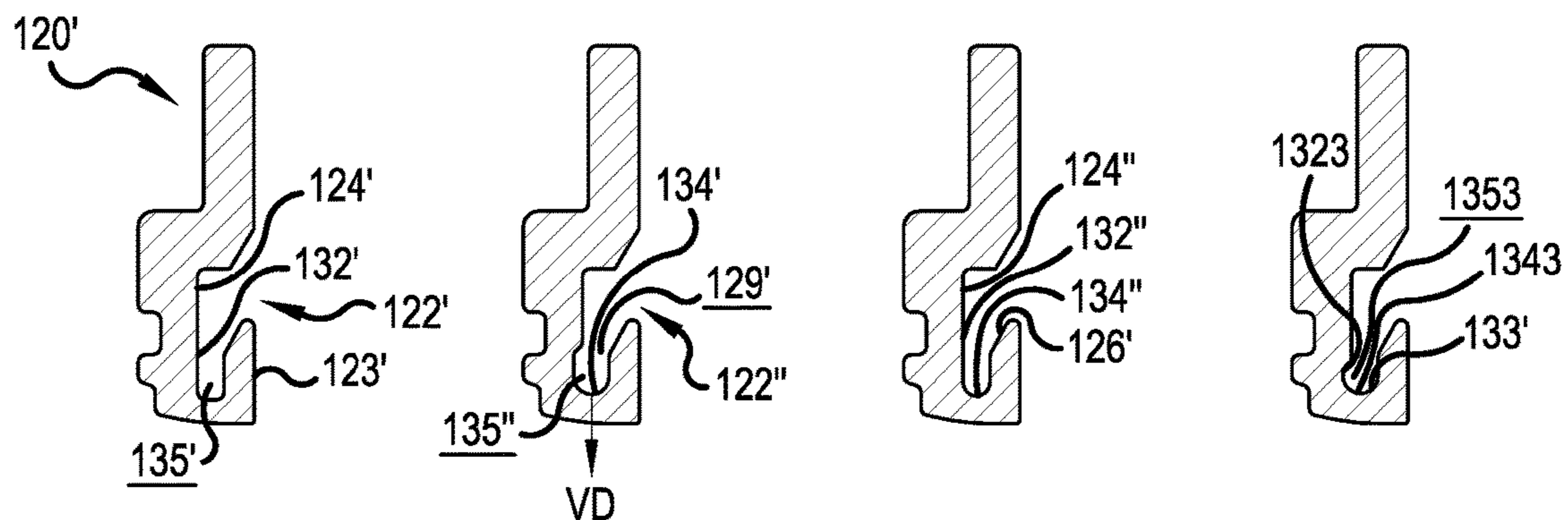


FIG.10

FIG.11

FIG.12

FIG.13

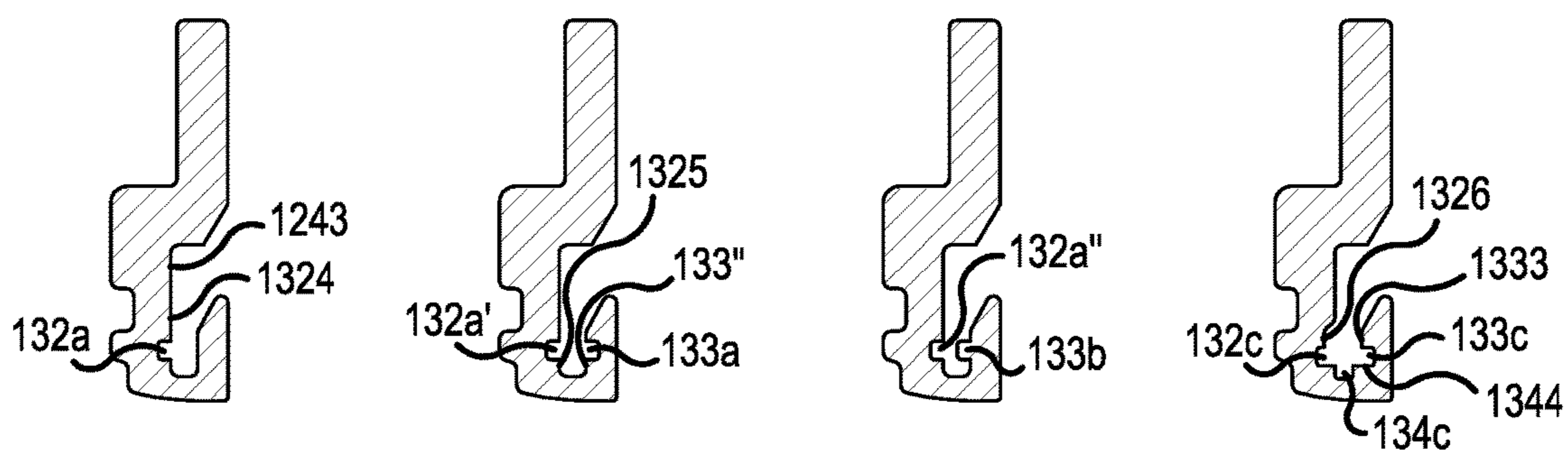


FIG.14

FIG.15

FIG.16

FIG.17

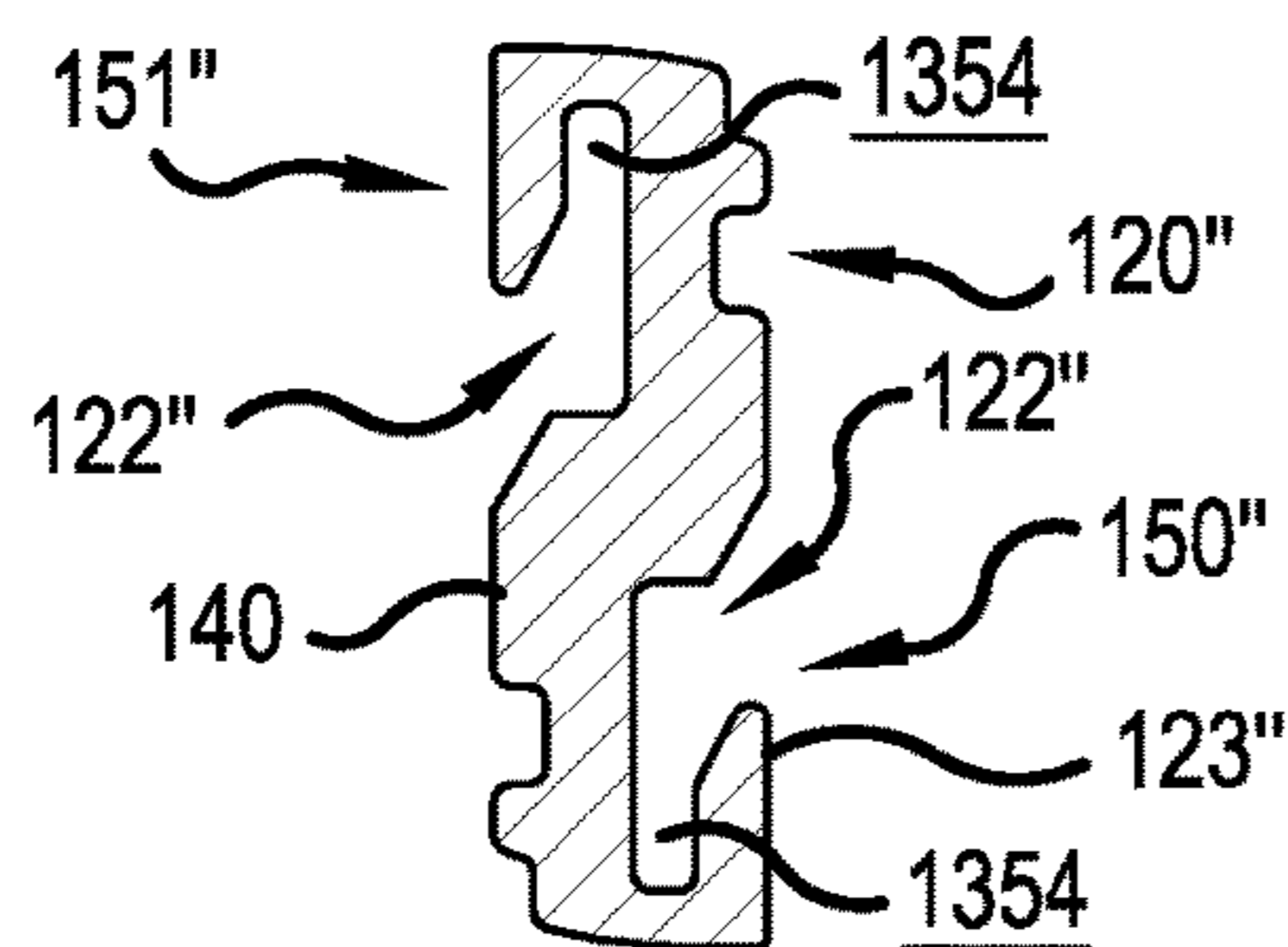


FIG.18

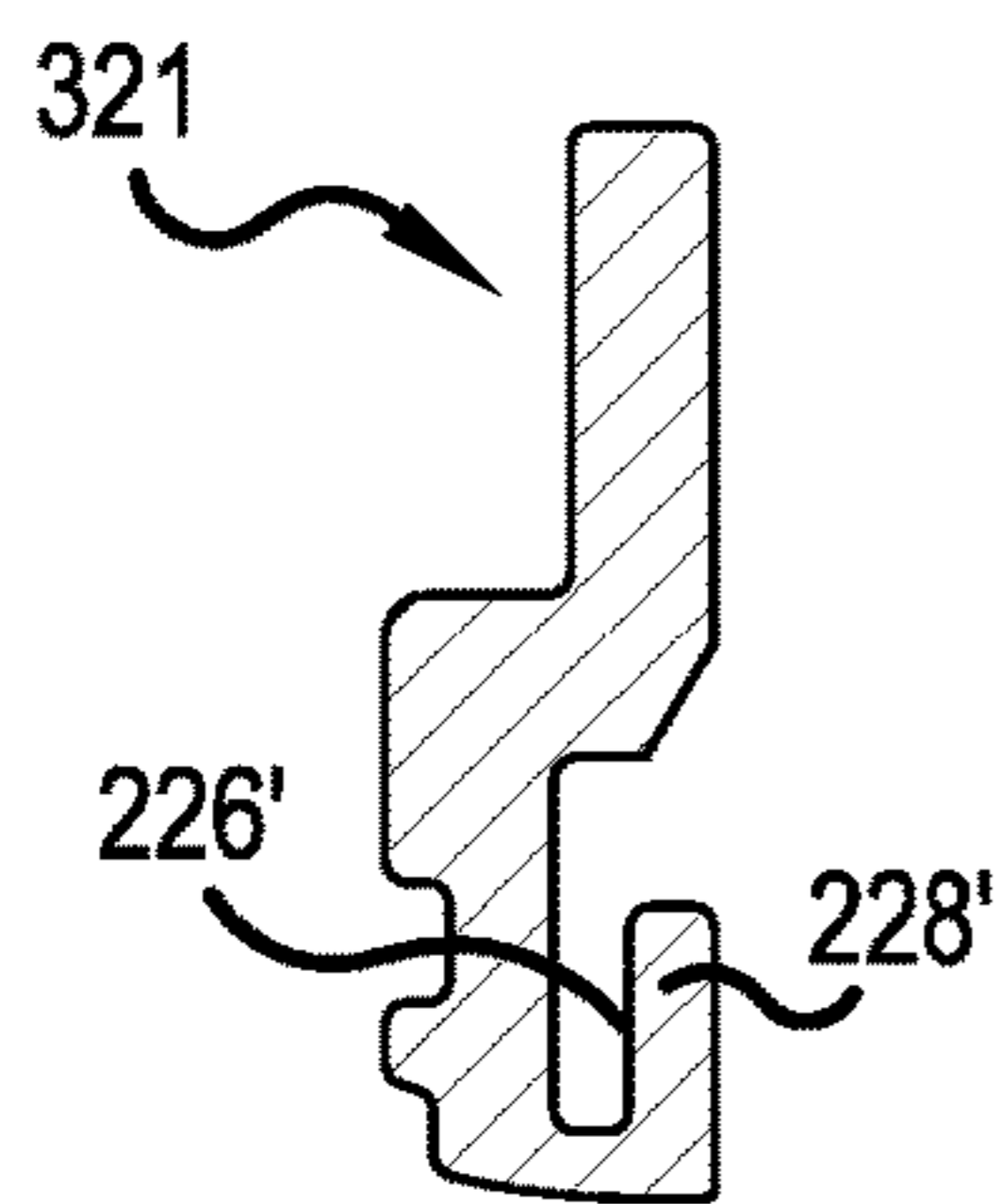


FIG. 19

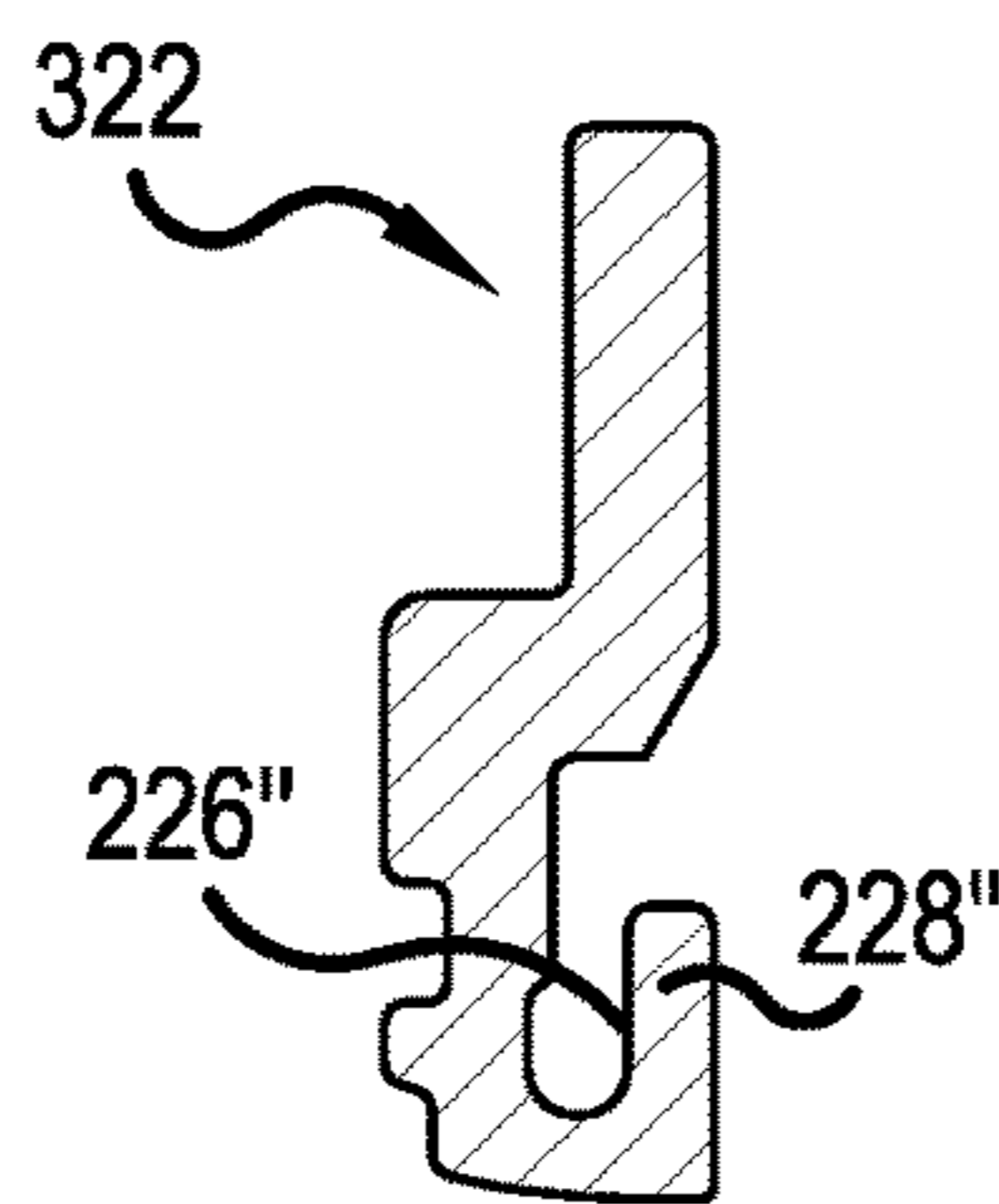


FIG. 20

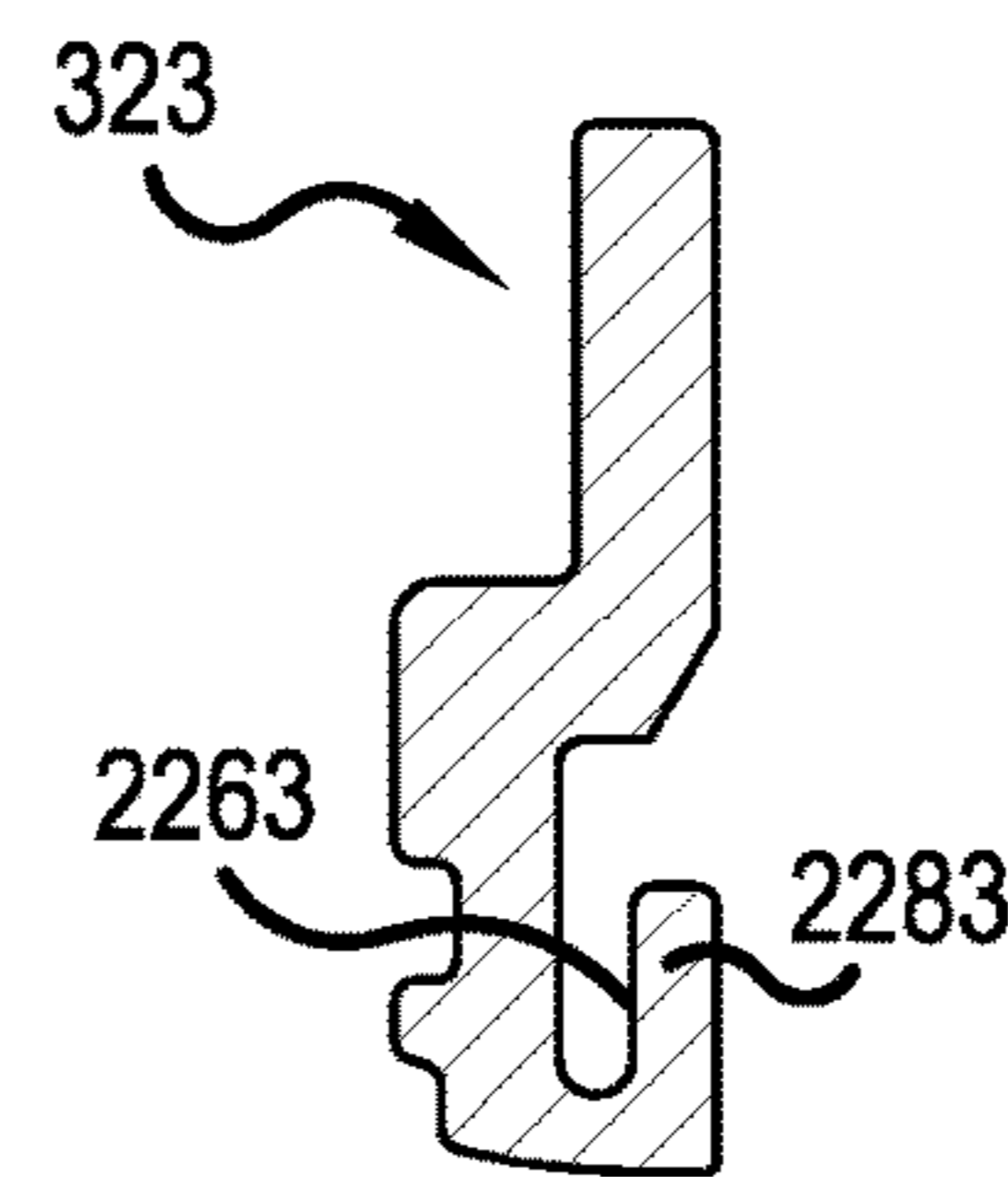


FIG. 21

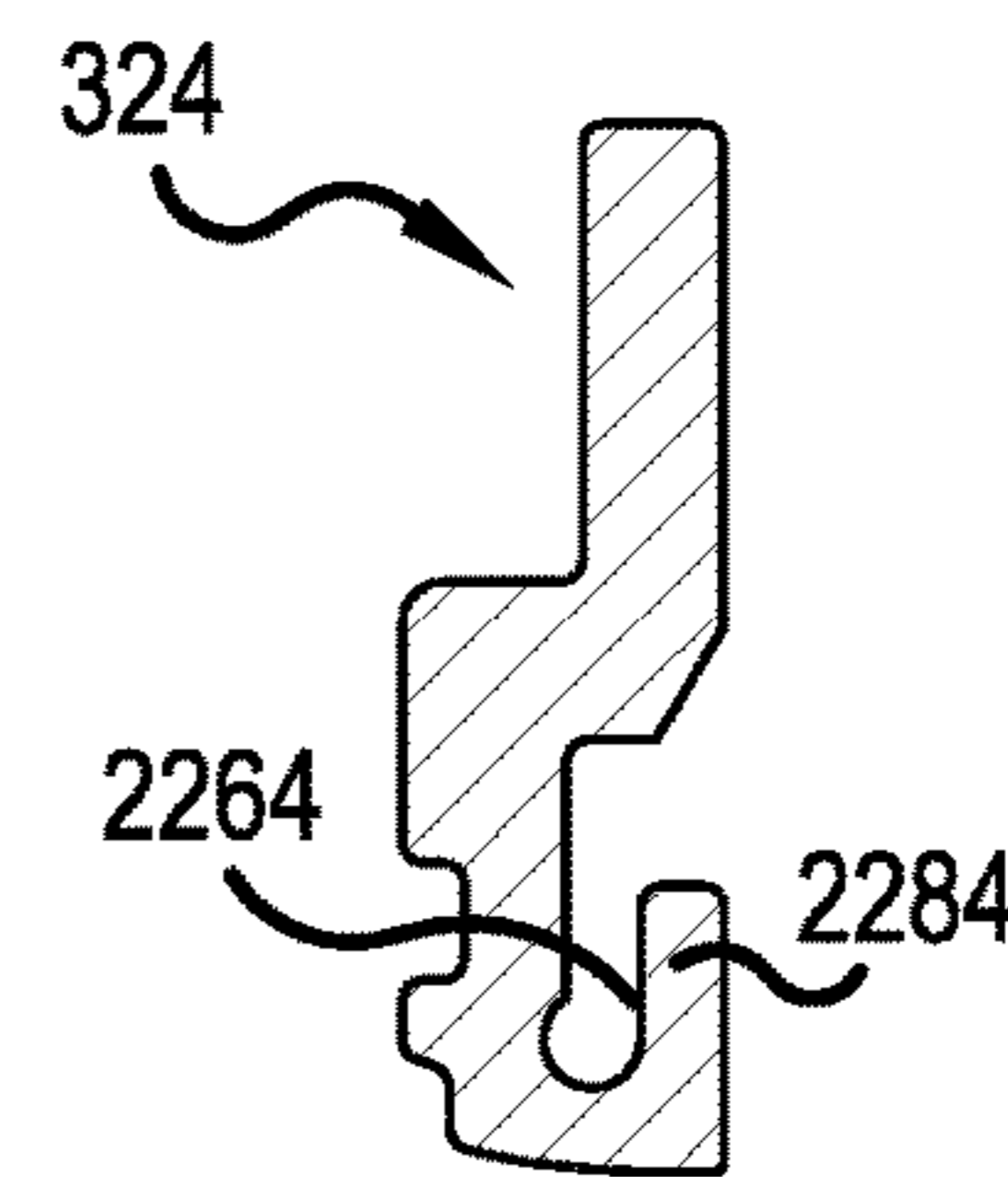


FIG. 22

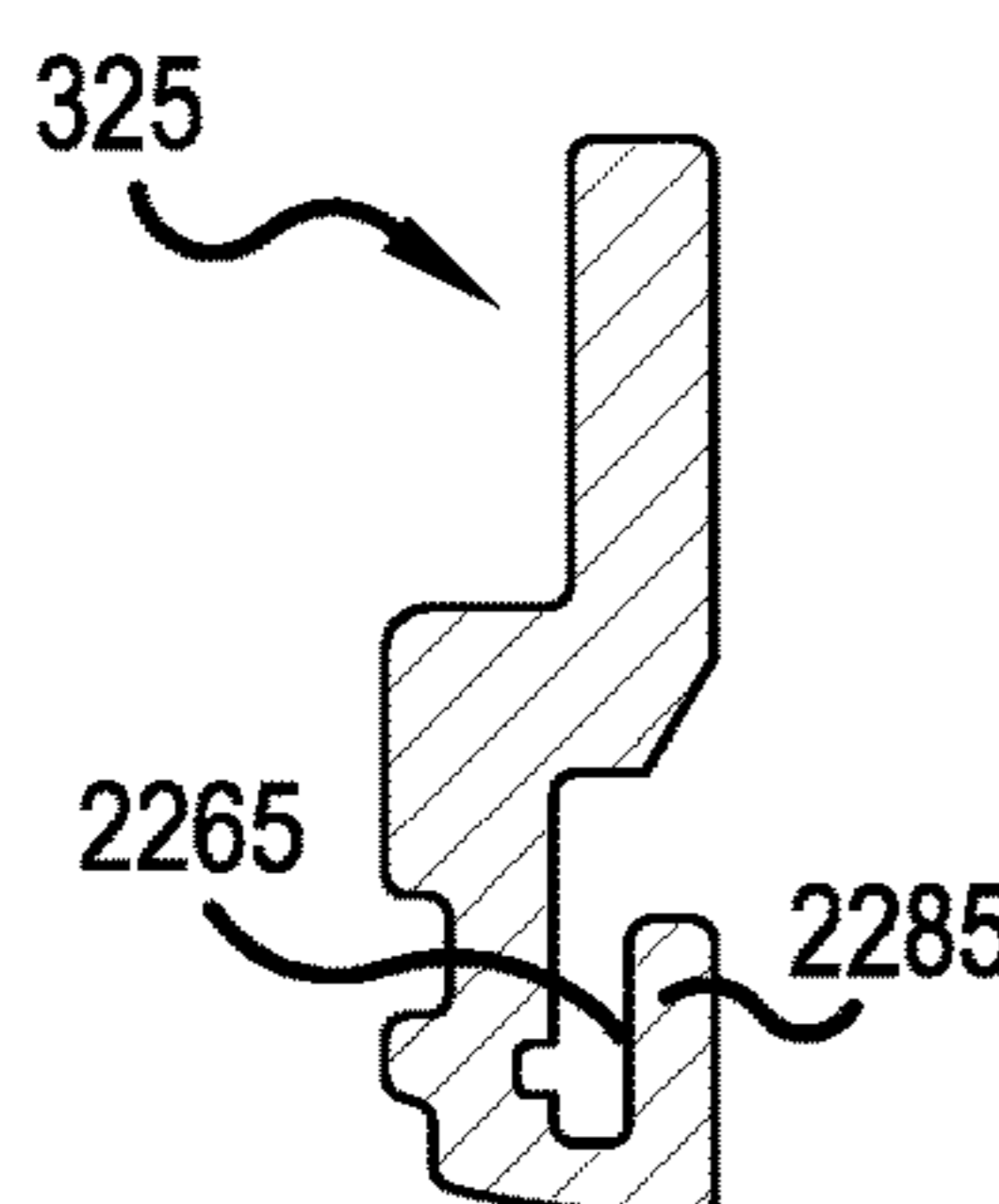


FIG. 23

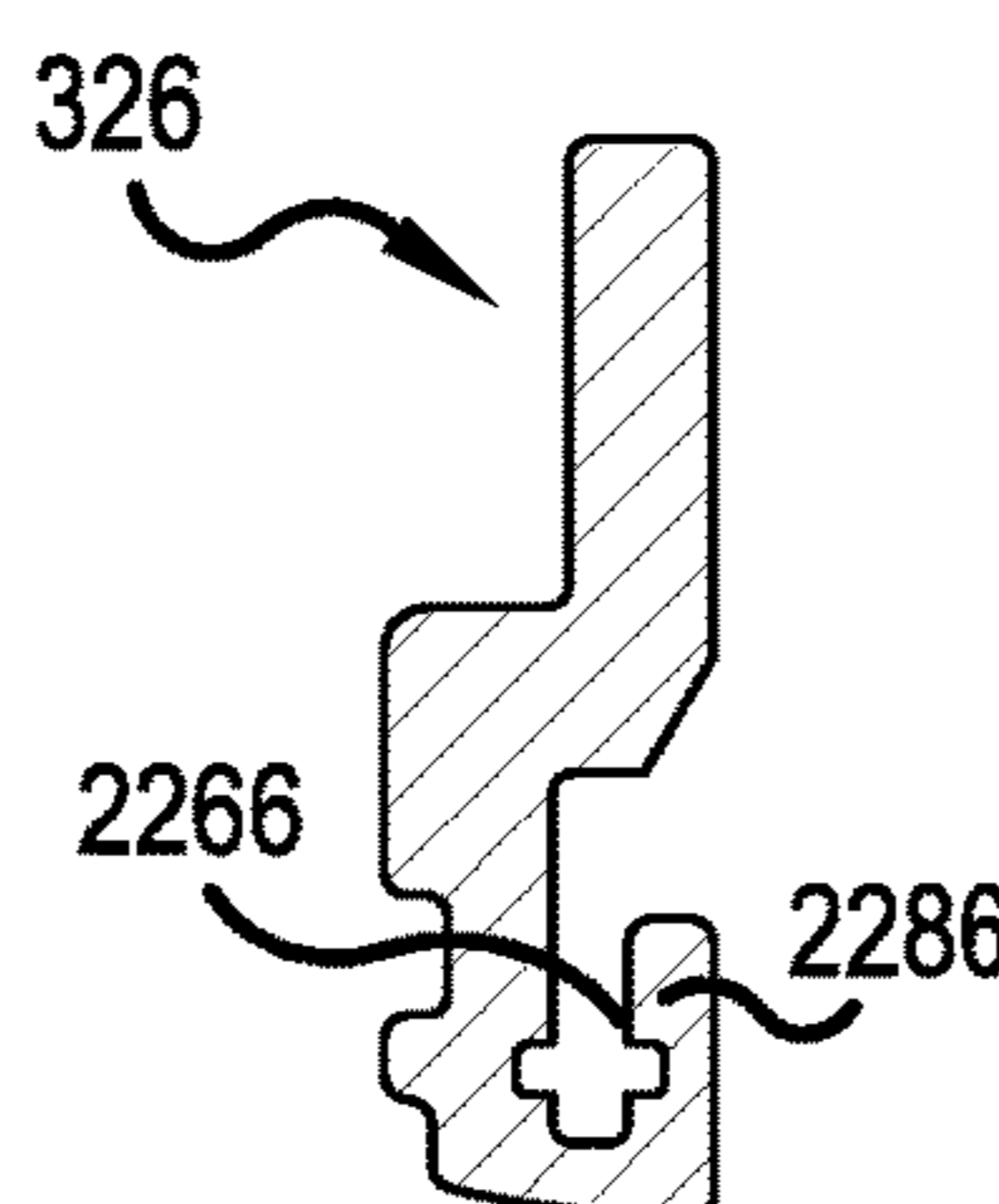


FIG. 24

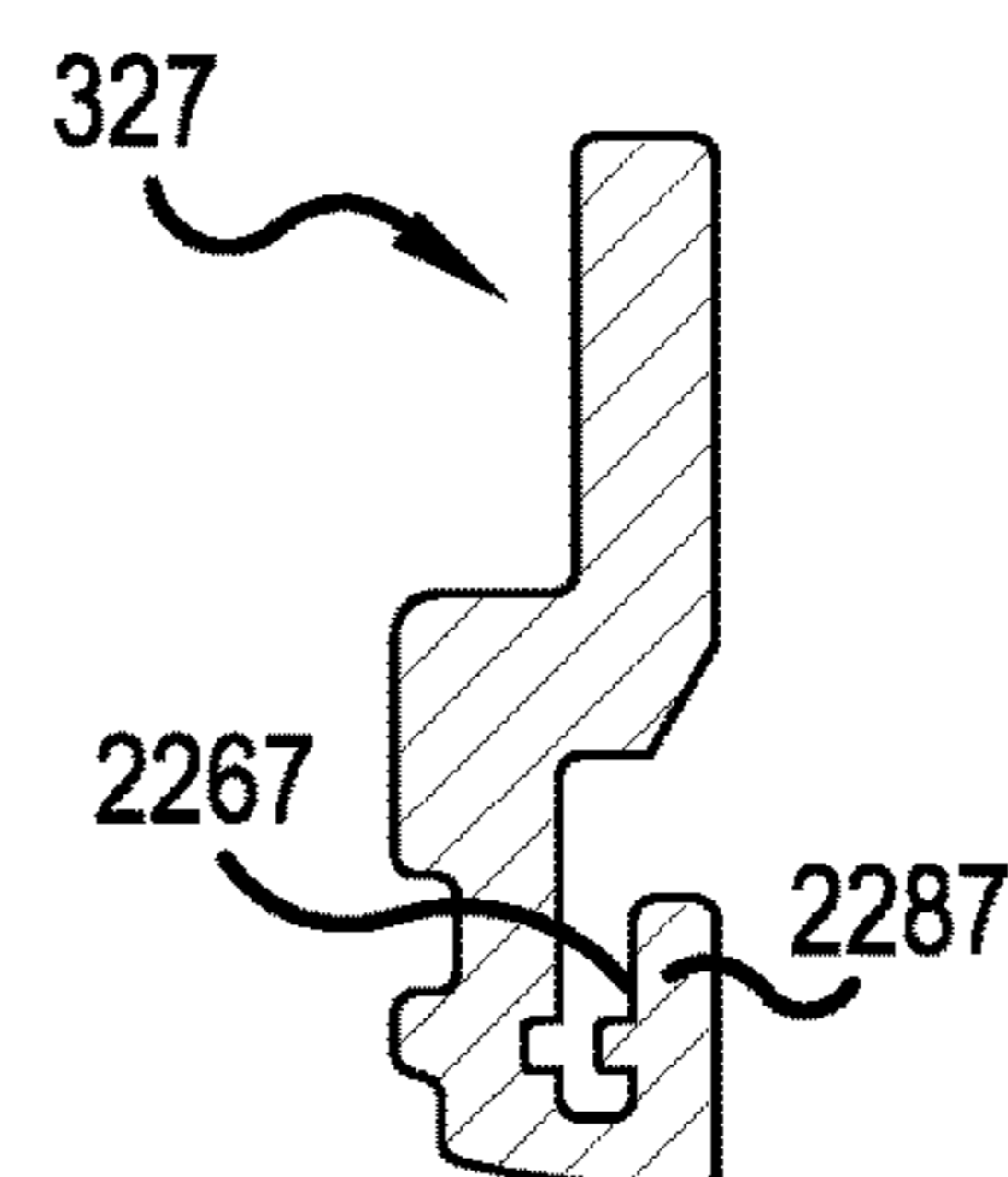


FIG. 25

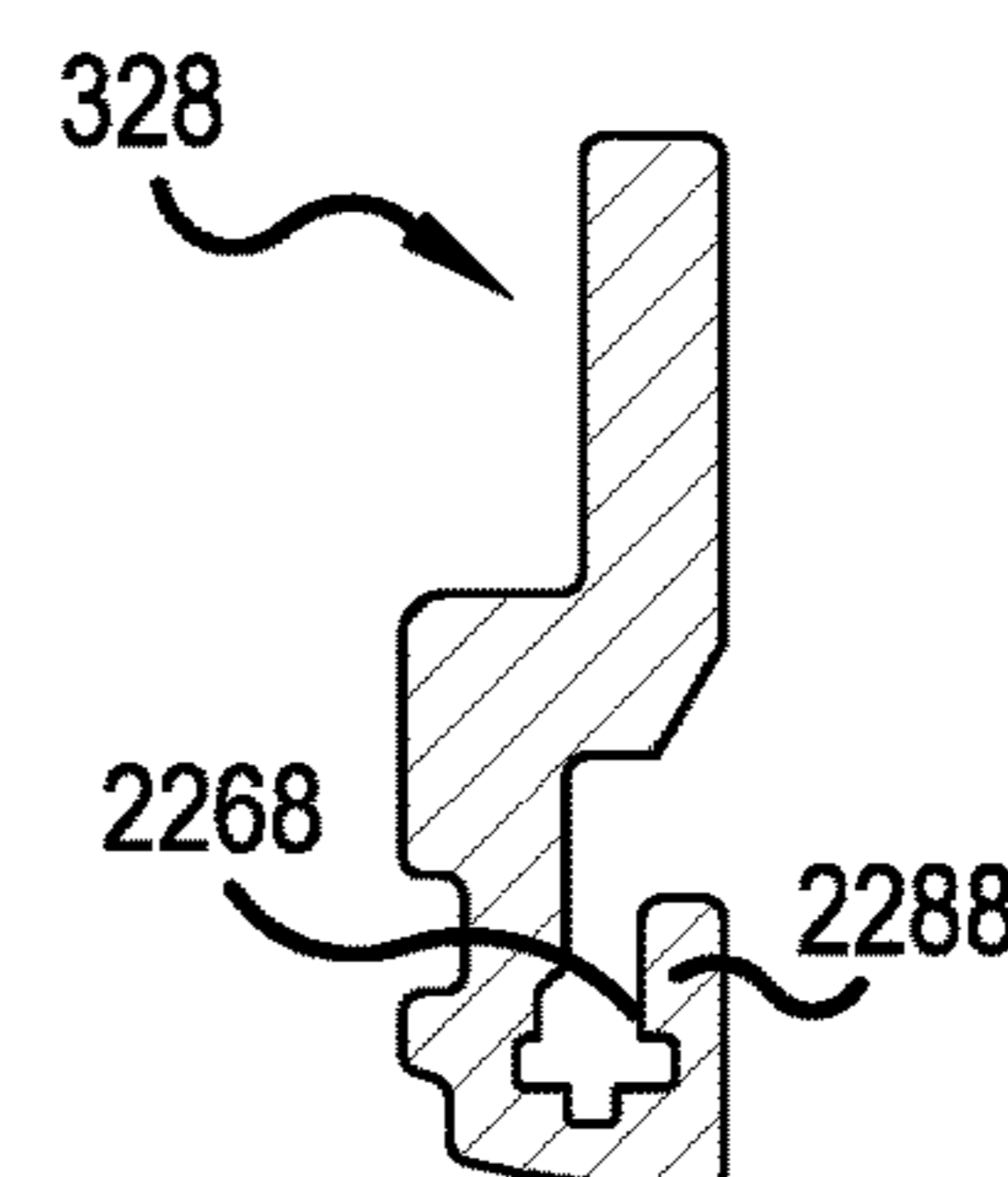


FIG. 26

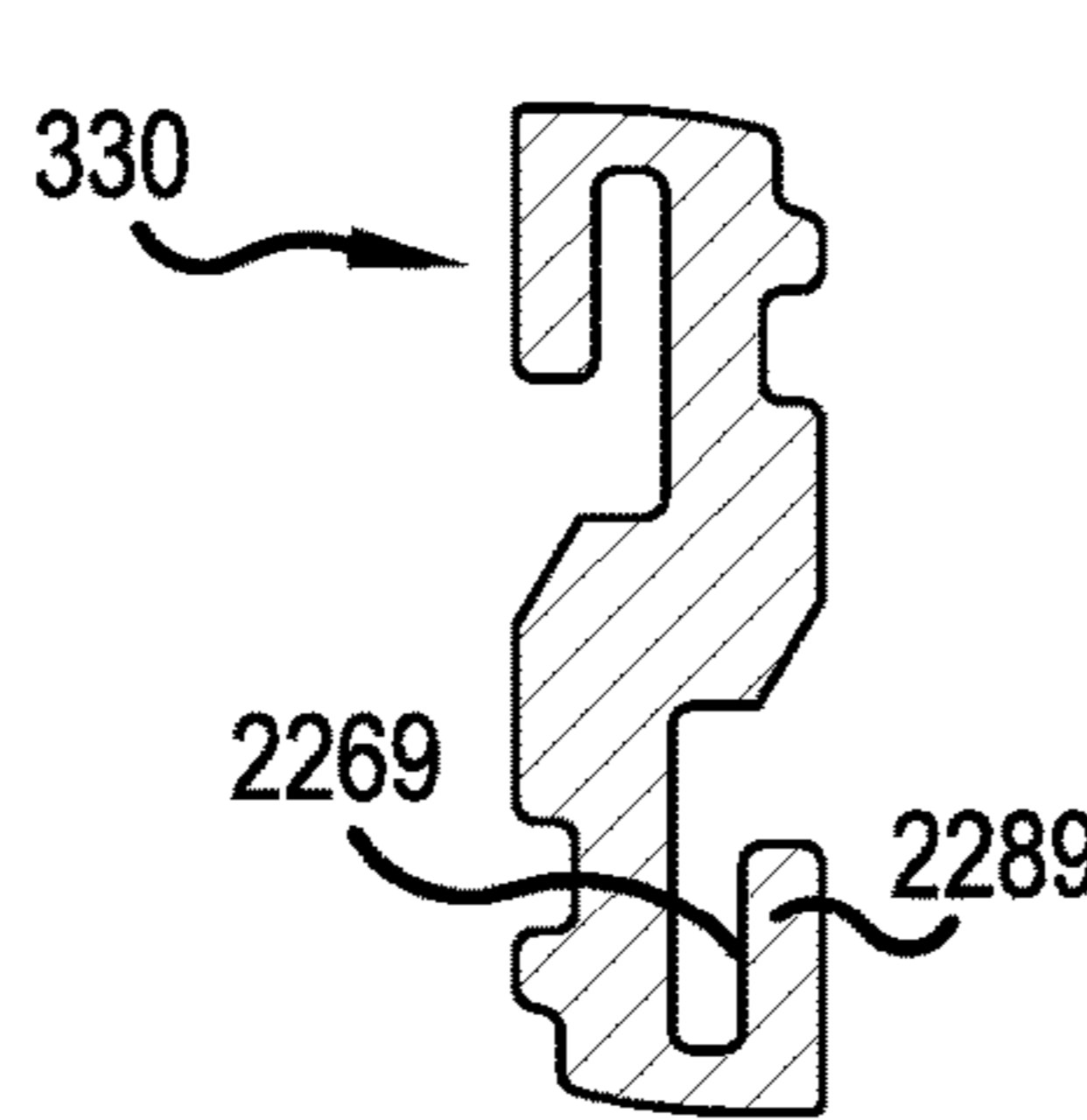


FIG. 27

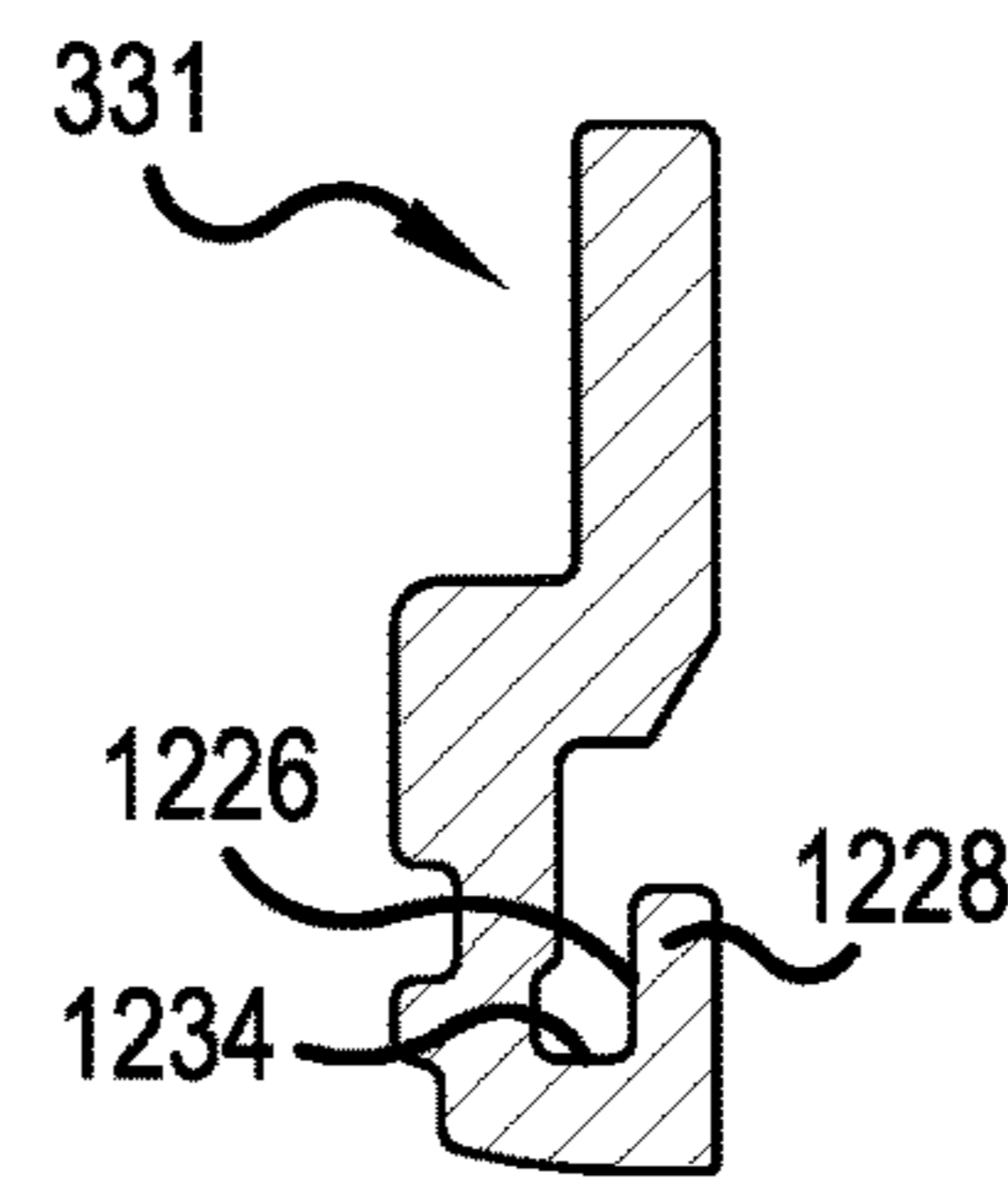


FIG. 28

PROFILED KEY FOR CYLINDER LOCKS

Matter enclosed in heavy brackets [] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a reissue of U.S. application Ser. No. 12/866,204 filed on Aug. 4, 2010 now U.S. Pat. No. 8,210,009 B2 issued on Jul. 3, 2012, which is a National Phase of PCT Patent Application No. PCT/SE2010/050189 filed on Feb. 18, 2010, which claims priority to Swedish Patent Application No. 0900207-2 filed on Feb. 18, 2009 and PCT Patent Application No. PCT/SE2010/050006 filed on Jan. 4, 2010.

FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to a key for use in a cylinder lock with a rotatable key plug having a profiled key hole or keyway, said key comprising:

an elongated, substantially flat key blade having a longitudinal profile groove extending along at least a portion of the length of the key blade, with an inner wall of said groove being substantially parallel to a side surface of said flat key blade,

said longitudinal profile groove having an undercut portion adjacent to and inside a ridge portion of the key blade, the outside of said ridge portion forming a lower side surface of the key blade, at a lower part thereof, said side surface at the lower part of said key blade lying substantially in the same plane as an upper side surface of the key blade at an upper part thereof, above said longitudinal profile groove, and

the inside of said ridge portion facing said inner wall of said groove.

Such a key with an undercut groove is previously known, e.g. from U.S. Pat. No. 5,715,717 (Widén) or U.S. Pat. No. 5,640,865 (Widén). Such keys have proven to be very useful in that they provide an improved security. The key profile is quite distinguished from conventional keys, and it is rather difficult to copy such keys. Moreover, they permit a great variation of the cross-sectional profile, which is a great advantage.

OBJECT OF THE INVENTION

However, over time, there is a constant need for further distinguishing profiles and many more possible variations thereof.

A further object of the invention is to make it even more difficult to copy such profiled keys with ordinary lock smith tools.

SUMMARY OF THE INVENTION

In order to achieve these objects, the undercut longitudinal profile groove, at its innermost part inside said ridge portion, is expanded into a longitudinal pocket having opposite lateral walls and a lowermost transverse end wall,

which is substantially flat or slightly curved, and one of said opposite lateral wall portions of said pocket forms an inside wall of said ridge portion, wherein the vertical dimension of said ridge portion, measured in a plane of said side surface of the key blade, is more than half of the smallest width of said undercut groove adjacent to said side surface, said smallest width being measured as a perpendicular projection onto said inner wall of said longitudinal groove. The inside wall of the ridge portion may be substantially parallel to a side surface of the key blade, so that the ridge portion forms a massive and strong material portion extending in parallel to the side surface of the key blade. The pocket inside the ridge portion may have a substantially rectangular cross-section, a substantially circular cross-section, with a relatively large curvature, or some other configuration.

In this way, the material of the key blade is used in an optimum way, and a new kind of profile is obtained, and it will be very difficult to copy such keys, especially if they are produced by stamping and milling. A cutting disc is normally not enough. Rather, it will be necessary to use broaching tools and a well-controlled use of such tools in order to secure exact dimensions of the pocket-like extension of the groove. This is of great importance for key control and high security to the end user of the key.

With such a configuration of the undercut groove, many advantages are obtained at the same time, as will be explained further below.

Other preferable features are stated in the dependent claims and will appear from the detailed description below.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described more fully below with reference to the appended drawings.

FIG. 1 and FIG. 2 illustrates a prior art lock and key combination;

FIG. 3 shows a side view of the key illustrated in FIG. 2;

FIG. 4 is a cross-section through the prior art lock with an inserted key;

FIG. 5 is a cross-sectional view of the prior art key blade;

FIG. 6 shows a side view of a profiled key according to the present invention for an embodiment with a wave-like code pattern;

FIG. 7 is a cross-section through the key of FIG. 6;

FIG. 8 is a cross-section through an associated lock with a key plug and a side tumbler;

FIG. 9 is a similar view of a lock and an inventive key inserted into the lock;

FIGS. 10-18 are cross-sectional views of some additional embodiments of the profiled key according to the invention, and

FIGS. 19-28 are similar cross-sectional views of some further modified embodiments of the profiled key according to the invention.

BRIEF DESCRIPTION OF SOME PREFERRED EMBODIMENTS

FIGS. 1 through 5 show a prior art lock and key system with a key blade having an undercut profile groove in a side surface thereof, such as the system disclosed in U.S. Pat. No. 5,715,717 (Widén). The lock 10 is of the kind having a housing 11 with locking pins 14 in an upper portion thereof and a rotatable key plug 12 accommodated in a cylindrical bore of the housing. In the key plug 12, there is a central longitudinal keyway or key hole 13 having a sectional profile corresponding to an associated key 20 provided with

conventional recesses 21 at the upper edge thereof and a profile groove 22 at a side surface 23 of the key blade. As appears from FIG. 3, the key also has a grip portion 24.

The operation of the lock is more readily understood from the cross-sectional view in FIG. 4. The key plug 12 is rotatable within the housing 11 and can be locked against rotation by means of a longitudinal row of upper and lower locking pins 14a, 14b. Each pair of such locking pins can be positioned with their abutting end surfaces at the shear line between the key plug 12 and the housing 11. In this position, as shown in FIG. 4, the key plug 12 is rotatable. Here, as is well-known in the art, the locking pins are positioned so as to release the lock by means of a properly cut key 20.

The full profile of the key 20 (of prior art design) is illustrated in FIG. 5, as disclosed e.g. in the above-mentioned U.S. Pat. No. 5,715,717 (Widén). Accordingly, this prior art key has a longitudinal profile groove 22 extending longitudinally along the key blade at a depth which is slightly greater than half the thickness of the key blade. In FIG. 5, [the central] a plane of the key blade is denoted by the letter "A". The longitudinal groove 22 has an inner wall [24] surface 241 and [opposite walls] upper wall surface 25 and lower side wall surface 26. An inclined portion 25a extends upwardly from the upper wall surface 25. One of [these opposite walls] the wall surfaces, in particular the lower side wall [or] surface 26 located closest to the base edge 27 of the key blade is undercut and extends in a plane being inclined so as to face inwardly towards [the bottom] inner wall [or] surface [24] 241. This lower side wall surface 26 of the undercut groove 22 forms an inside wall surface of a ridge portion 28, the outside of which forms part of the above mentioned side surface 23 of the key blade.

The prior art key blade shown in FIGS. 2, 3, 4 and 5 also has two further longitudinal grooves 30 and 31 on the other side of the key (to the left in FIG. 5).

The undercut portion 29 of the longitudinal groove 22 has many advantages, as explained in the above-mentioned U.S. Pat. No. 5,715,717 (Widén), especially with regard to increasing the number of possible profile variations, improved resistance against picking the lock and high security against unauthorized key copying.

According to the present invention and as illustrated in FIGS. 6 through 9, a further improvement resides in a modification of the undercut groove. This modification comprises an expansion or extension of the innermost part of the undercut portion of the groove 122 (FIG. 7) so as to form a longitudinal pocket-like configuration 135. [In these Figures, all reference numerals relating to the key correspond to those shown in FIG. 5, although they have been supplemented with the digit "1" before the number given in FIG. 5.]

[The] As illustrated in FIG. 7, the downwardly extended pocket-like configuration 135 of the modified undercut groove 122, is (in this particular embodiment) substantially rectangular in cross-section, with opposite lateral walls 132 and 133 being parallel to each other, and a lowermost transverse end wall 134, being parallel to the lower edge surface 127 of the key blade and facing upwardly in the direction of the [central] plane A of the key blade. The flat key blade 120 has an external side wall surface 123 at the lower part of the flat one piece key blade 120 lying substantially in the same plane as an upper side surface 1123' of the flat one piece key blade 120 at an upper part thereof, above said longitudinal profile groove 122.

The innermost lateral wall 132 of the pocket-like extension 135 adjoins with the inner wall 124 of the undercut groove, but is slightly displaced inwardly (away from the

groove opening) so as to form a step 136, whereas the opposite lateral wall 133 forms the inside wall of the ridge portion 128, in parallel to the external side surface 123 of the key blade.

Thus, the surfaces 123, 133 and 132 are substantially parallel to each other. *The key blade 120 is a flat one piece key blade with an undercut portion 129 of the longitudinal profile groove 122 which, at an innermost part, is extended further substantially in the same direction as the vertical direction (VD) into a longitudinal, substantially uniformly wide pocket (135) having a uniform width with opposite inner and outer substantially parallel lateral wall surface portions (132, 133). The undercut portion or longitudinal profile groove 122 is defined at an upper part thereof by a smallest opening width (w), as seen perpendicularly to the external side wall surface 123 of the lower portion of said flat one piece key blade 120 between an upper wall 160 and the ridge portion 128. The vertical dimension (h) of the ridge portion 128 is equal to or greater than half of said smallest opening width (w). The inner wall surface 124 of said longitudinal profile groove 122 is located at a distance from the external side wall surface 123 of the flat one piece key blade 120 which is greater than half the thickness of the flat one piece key blade 120.*

According to a first aspect of the invention, the undercut portion 129 of the longitudinal profile groove extends downwardly substantially in a vertical direction (VD) in parallel to the upper side wall surface 1123' and the external side wall surface 123 of the flat one piece key blade 120. The undercut portion 129 of the longitudinal profile groove 122, at an innermost part, is extended further, substantially in the same direction as the vertical direction (VD) into a longitudinal, substantially uniformly wide pocket 135 having a uniform width with opposite inner and outer substantially parallel lateral wall surface portions 132, 133 wherein the inner wall surface 124 of the longitudinal profile groove 122 adjoins the inner lateral wall surface portion 132 of the pocket 135 and the inner lateral wall surface 132 of the pocket 135 extends downwardly to a lowermost transverse end wall surface 134, which is substantially flat or slightly curved, and which is substantially parallel to a lowermost edge wall surface 127 of the key blade and which faces upwardly in a direction opposite to the vertical direction (VD) towards the upper wall surface of the longitudinal profile groove 122 with the opposite lateral wall surface portions 132, 133 of the pocket 135 being substantially parallel to the upper side wall surface 1123' and the external side wall surface 123 of the flat one piece key blade 120.

According to a second aspect of the invention, the undercut portion 129 of the longitudinal profile groove extends downwardly substantially in a vertical direction (VD) in parallel to the upper side wall surface 1123' and the external side wall surface 123 of the flat one piece key blade 120. The undercut portion 129 of the longitudinal profile groove 122, at an innermost part, is extended further, substantially in the same direction as the vertical direction (VD) into a longitudinal, widened pocket 135 having a larger lateral width than the narrowest part of the undercut portion 129 of the longitudinal profile groove 122, said widened pocket 135 being formed by opposite inner and outer lateral wall surface portions 132, 133, and said inner wall surface 124 of said longitudinal profile groove 122 adjoins, by way of a continuously downwardly extending wall surface portion 136, said inner lateral wall surface portion 132 of the pocket 135 and the inner lateral wall surface portion 132 of the pocket 135 extends continuously further downwardly to a

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lowest transverse end wall surface 134, wherein the highest point of said inner lateral wall surface portion 132 is located below the lowest point of said inner wall surface 124 of said longitudinal profile groove 122, and the lowermost transverse end wall surface 134 which faces upwardly in a direction opposite to the vertical direction (VD) towards the upper wall surface of the longitudinal profile groove 122.

According to a third aspect of the invention, the undercut portion 129 of the longitudinal profile groove extends downwardly substantially in a vertical direction (VD) in parallel to the upper side wall surface 1123' and the external side wall surface 123 of the flat one piece key blade 120. The undercut portion 129 of the longitudinal profile groove 122, at an innermost part, is extended further, substantially in the same direction as the vertical direction (VD) into a longitudinal pocket being interrupted by at least one longitudinal recess 132a formed in at least one of opposite inner and outer lateral wall surface portions 132, 133 wherein the inner wall surface 1243 of the longitudinal profile groove 122 adjoins the inner lateral wall surface portion 132a, located opposite to the ridge portion and the inner lateral wall surface portion 132a extends downwardly to a lowermost transverse end wall surface 134, the lowermost transverse end wall surface 134 being substantially flat or slightly curved and being substantially parallel to a lowermost edge wall surface 127 of the key blade and which faces upwardly in a direction opposite to the vertical direction (VD) towards the upper wall surface of the longitudinal profile groove 122 with the opposite lateral wall surface portions 132, 133 of the pocket 135 being substantially parallel to the upper side wall surface 1123" and the external side wall surfaces 123 of the flat one piece key blade 120.

The ridge portion 128 is somewhat longer, measured in parallel to the [central] plane A of the key blade, than the prior art structure (FIG. 5). More particularly, the ridge portion 128 has a vertical dimension h, which is more than half of the smallest opening width w of the undercut groove 122, this smallest opening width w being measured as a perpendicular projection onto the [bottom] inner wall 124 of the longitudinal groove 122. Also, preferably, the vertical dimension h of the ridge portion 128 is greater than the distance d between the lowermost transverse end wall 134 and the lower edge surface 127 of the key blade. In this embodiment, the vertical dimension h of the ridge portion 128 is equal to or greater than the smallest opening width w. This structure is advantageous for several reasons:

by varying the width, depth (in the plane A) and longitudinal extension of the pocket-like configuration, the profile shape can be varied considerably;

because of the opposite lateral wall portions 132, 133 the total width of the undercut portion of the profile groove 122 can be accommodated in a limited region laterally, so that the total width of the key blade can be kept rather small. It appears from FIGS. 5 and 7 that the total width of the new key blade is about the same;

the corresponding tongue portion, which may form a part of a longitudinal rib 150 at a side wall of the key way (see FIGS. 8 and 9), will be stronger and does not have to have a pointed or sharp end portion, as in the prior art structure (compare FIG. 4);

the pocket-like extension 135 of the undercut portion of the groove 122 will make it much more difficult to make copies of such keys, since it is not sufficient to use only a cutter disk. Normally, other tools also have to be used. Accordingly it will be difficult for others than specialized manufacturers to produce such key blanks;

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the relatively long vertical extension of the ridge portion 128, in parallel to the [central] plane A of the key blade, will make it possible to cut rather deep recesses in the ridge portion. Accordingly, just like in the prior art embodiment of FIGS. 1-5, it is possible to provide many vertical levels of code recesses in this material region, see FIG. 6. Of course, this will also facilitate lock and key systems having a very high number of code combinations.

In FIGS. 8 and 9 there is shown an embodiment with a side locking tumbler 105, which is guided in a cylindrical cavity 106 in the rotatable key plug 112. In principle, the arrangement is similar to those disclosed in the U.S. Pat. Nos. 4,756,177 (Widén) and 5,715,717 (Widén).

The parts that correspond to the previous, prior art embodiment ([FIG. 5] FIGS. 1-5) have been given the same reference numerals, with the digit "1" added before the numbers shown in FIG. [5] 4.

Accordingly, the side tumbler 105 is rotatable around its cylindrical axis, so that a transversally projecting finger 105a will pivot back and forth when the projecting finger 105a follows a wave-like coded surface on the side of the key blade (see FIG. 6), in this case in the ridge portion 128 (see FIG. 7). When the side tumbler 105 is correctly positioned, a recess 105b in its cylindrical surface will register with corresponding projections 108a on a side bar 108 (FIG. 9). In this way, the side bar may move radially inwards so as to permit rotation of the key plug 112.

The projecting finger 105a on the side tumbler 105 will contact the wave-like code pattern on the side of the key blade 120, as shown in FIG. 6, while pivoting back and forth and also moving vertically up and down. When the key blade is fully inserted, the various side tumbler projections 105a will be located in the concavities 102a, 102b, 102c, 102d, 102e and possibly also (or alternatively) onto an upper code surface portion 102f at an uppermost extra code level. Such an upper, extra code level is disclosed in the published international patent application WO2005/028789 (Winloc et al).

It would be possible to provide an even deeper pocket-like extension 135 of the undercut portion of the profile groove, in parallel to the [central] vertical plane A of the key blade. Then, the number of possible code levels in the ridge portion [133] 128 (see FIGS. 6 and 7) would be larger than in prior art structures.

It should be noted that the new configuration of the undercut groove 122, with the pocket-like extension 135, is useful even without having a side tumbler 105. Then, the ridge portion is basically continuous and does not have any cuts or codes.

Also, if at least one side tumbler is used, it does not have to be rotatable, but can be guided for elevational movement only. Furthermore, the side tumbler does not have to operate as a locking means for locking the key plug against rotation. Alternatively, it may serve only as a blocking element, which prevents incorrectly cut keys from being fully inserted into the key way 13 of the lock 10. Such a blocking element is disclosed in a patent application being filed by the same applicant on the same day as the earliest priority date of this application.

The exact configuration or shape of the longitudinally extending pocket may be modified in various ways within the scope of the present invention. In FIG. 10, there is shown an embodiment where the inner wall [124] surface 124' of the longitudinal profile groove [122] 122' of the key blade 120' merges smoothly with the adjoining inner lateral wall [132] surface 132' of the vertically oriented pocket-like

configuration **[135]** 135' which is uniformly wide, without any lateral step (136 in FIG. 7).

In FIG. 11, the pocket-like configuration **[135]** 135" is similar to the one in FIG. 7, but the lowermost transverse end wall surface 134' is rounded or curved. In addition, FIG. 11 illustrates the undercut portion 129'.

The embodiment shown in FIG. 12 includes a lower side wall 126' and is similar to the [one] embodiment in FIG. 11, but the lowermost transverse end wall surface 134" is shorter (but still curved), and the inner wall **[124]** surface 124" of the groove merges smoothly with the adjoining inner lateral wall **[132]** surface 132" (as in FIG. 10). In FIGS. 11 and 12 the lowermost transverse end wall surfaces 134', 134" of the pocket 135 are curved.

In FIG. 13, the pocket-like configuration **[135']** 1353 is modified into a circular cross-section. Accordingly, in this embodiment, the lateral **[walls 132, 133]** wall surfaces 1323, 133' and the lowermost end wall **[134]** surface 1343 are all formed as circular arcs merging with each other.

The embodiment shown in FIG. 14 is like the one shown in FIG. 10, but the inner lateral wall **[132]** surface 1324 adjoining the inner wall **[124]** surface 1243 is provided with a longitudinal recess 132a, which is rectangular in cross-section.

The embodiment of FIG. 15 is similar to the one of FIG. 14, but there is also a longitudinal recess 133a in the outer lateral wall **[133]** 133" opposite to the longitudinal recess **[132a]** 132a' in the lateral wall 1325.

The embodiment in FIG. 16 is similar to the one in FIG. 15, but there is a longitudinal rib 133b (instead of a recess 133a) opposite to the longitudinal recess **[132a]** 132a".

The modified embodiment shown in FIG. 17 comprises relatively small longitudinal recesses 132c, 133c, 134c with **[part cylindrical]** part-cylindrical cross-sections in the lateral **[walls 133]** wall surfaces 1333 and **[132]** 1326 and the lowermost end wall **[134]** surface 1344, respectively. Except for these part-circular recesses, this embodiment corresponds to the one shown in FIG. 7.

The embodiments of FIGS. 14 through 17 are included to illustrate that the opposite lateral wall surface portions and the lowermost transverse end wall surface of the longitudinal pocket may be provided with irregular surface portions.

The key blade 120" shown in FIG. 18 is composed of a lower part 150", which is identical or similar to the lower parts of the key blades shown in FIGS. 10-17, and an upper part 151", which is identical to the lower part 150", but turned upside down. In this way the key blade 150", 151" can be inserted either way into an associated key hole, either as shown in FIG. 18 or turned upside down (the profile is then exactly the same because of the symmetry of the lower and upper parts). The key blade 120" includes a wall surface 140 and an upper and lower pocket-like extension 1354.

Finally, FIGS. 19 through **[27]** 26 show modified embodiments similar to those shown in FIGS. 10 through 17. Thus, the keys 321 through **[329]** 328 each have a cross-sectional profile corresponding to those shown in FIGS. 10 through 17, respectively, except that the upper part of the ridge **[portion 228 is]** portions 228', 228", 2283, 2284, 2285, 2286, 2287 and 2288 are uniformly thick, and the inside **[226]** 226', 226", 2263, 2264, 2265, 2266, 2267 and 2268 thereof **[is]** are parallel to the **[central]** plane of the key blade.

FIG. 27 includes a key 330 and corresponds to FIG. 18, and FIG. 28 includes a key 331 and corresponds to FIGS. 11 and 20, except that the lowermost transverse end wall **[234]** surface 1234 is flat. In addition, in FIG. 27 the ridge portion

is identified by 2289 and the inside by 2269. Further, in FIG. 28, the ridge portion is identified by 1228 and the inside by 1226.

In all embodiments described above, and in the appended claims, it is assumed that the inner wall 124 of the longitudinal undercut groove 122, 122', 122" is substantially parallel to the **[central]** plane A of the key blade and **[a side surface]** the external side wall surfaces 123, 123', 123" thereof. Within this definition, the inner wall may be oriented at a small angle to said **[central]** plane A, this angle being normally no more than **[15]** 15°, in some cases (such as a relatively thick key blade) somewhat larger.

The longitudinally extending pocket may be shorter than the length of key blade and extend along only a portion thereof.

Also, the longitudinal profile rib at the key plug may be interrupted or formed as one or more separate elements mounted in the key plug.

The invention claimed is:

- [The]** A key for use in a cylinder lock with a rotatable key plug having a profiled key way, said key comprising: an elongated, substantially flat one piece key blade (120) having a longitudinal profile groove (122) extending along at least a portion of the length of the flat one piece key blade (120), with an inner wall surface (124) of said groove being substantially parallel to **[a]** an external side wall surface (123) **[of said flat key blade]**, said longitudinal profile groove (122) having, at a lower part thereof, an undercut portion (129) adjacent to and inside a ridge portion (128) of the flat one piece key blade (120), the outside of said ridge portion (128) forming a part of said external side wall surface (123) of the flat one piece key blade (120), said external side wall surface (123) at **[the]** a lower part of said flat one piece key blade (120) lying substantially in the same plane as **[a]** an upper side wall surface (1123') of the flat one piece key blade (120) at an upper part thereof, above said longitudinal profile groove (122), said longitudinal profile groove (122) defining, at an upper part thereof, a smallest opening width (w), as seen perpendicularly to said external side wall surface (123) of said lower portion of said flat one piece key blade (120), between an upper wall surface (160) and said ridge portion (128), and **[the inside of]** said ridge portion **[facing]** (128) being opposite said inner wall surface (124) of said longitudinal profile groove (122), wherein: said undercut portion (129) of said longitudinal profile groove extends downwardly substantially in a vertical direction (VD) in parallel to the upper side wall surface (1123') and the external side wall surface (123) of the flat one piece key blade (120), said undercut portion (129) of said longitudinal profile groove (122), at **[its]** an innermost part **[inside said ridge portion (128)]**, is extended further, substantially in **[a]** the same direction as said vertical direction **[in parallel to said upper and lower side surfaces (123) of the key blade (120),]** (VD) into a longitudinal, substantially uniformly wide pocket (135) having a uniform width with opposite inner and outer substantially parallel lateral wall surface portions (132, 133) **[and]** wherein said inner wall surface (124) of said longitudinal profile groove (122) adjoins the inner lateral wall surface portion (132) of said pocket (135) and said inner lateral wall surface (132) of said pocket (135) extends downwardly to a lowermost transverse end wall

surface (134), which is substantially flat or slightly curved, and which is substantially parallel to a [lower] lowermost edge [portion] wall surface (127) of the key blade and which faces upwardly in a direction [in a central plane (A) of the key blade] opposite to said vertical direction (VD) towards said upper wall surface of said longitudinal profile groove (122) with said opposite lateral wall surface portions (132, 133) of said pocket (135) being substantially parallel to said upper side wall surface (1123') and [lower] the external side [surfaces] wall surface (123) of the flat one piece key blade (120).

2. The key as defined in claim 1, wherein [the] a vertical dimension (h) of said ridge portion (128) is greater than the distance (d) between said lowermost transverse end wall surface (134) and said [lower] lowermost edge wall surface (127) of the flat one piece key blade (120).

[3. The key as defined in claim 1, wherein said pocket (135) has a substantially rectangular cross-section.]

4. The key as defined in claim 1, wherein said inner wall [(124)] surface (124') of said longitudinal profile groove [(122)] (122') merges with one of said opposite lateral [walls] wall surface portions [(132, 133)] (132') of said pocket.

5. The key as defined in claim 1, wherein [the] a vertical dimension (h) of said ridge portion (128), measured in said plane of said [lower] external side wall surface (123) and upper side wall surface [(123)] (1123') of the flat one piece key blade (120), is more than half of [the] said smallest opening width (w) of said longitudinal profile groove (122) adjacent to said external side wall surface (123), said smallest opening width (w) being measured as a perpendicular projection onto said inner wall surface (124) of said longitudinal profile groove (122).

6. The key as defined in claim 5, wherein said vertical dimension (h) of said ridge portion (128) is equal to or greater than said smallest opening width (w).

7. The key as defined in claim 1, [constituting] wherein the flat one piece key blade (120) is formed from a key blank with a continuous upper edge portion configured so as to permit coded recesses to be cut therein.

8. The key as defined in claim 1, having coded recesses (102a . . . 102e) cut into said ridge portion (128), so as to form a side code on the flat one piece key blade (120), said side code recesses being configured to cooperate with at least one side tumbler (105) in an associated lock.

9. The key as defined in claim 8, wherein said side code recesses (102a . . . 102e) forming a side code constitute a wave-like, longitudinal code pattern.

10. The key as defined in claim 8, wherein said side code recesses (102a . . . 102e) are cut into the whole material thickness of said ridge portion (128), so that the side code recesses reach all the way from the [outside] external side wall surface (123) of said ridge portion (128) into said longitudinal pocket (135) of the undercut profile groove (122).

11. The key as defined in claim 8, wherein said side code recesses (102a . . . 102e) are cut from an upper edge of the ridge portion (128) down to various levels between said upper edge and [the] a lowermost part of said longitudinally extending pocket (135).

12. The key as defined in claim 8, wherein said side code recesses (102a . . . 102e) form concavities with lower bottom portions located at a number of different levels, each representing a code.

13. The key as defined in claim 11, wherein said different levels also include an uppermost level at the upper edge (1021) of said ridge portion (128).

14. The key as defined in claim 11, wherein the number of different levels is at least three.

15. The key as defined in claim 1, wherein the inner wall surface (124) of said longitudinal profile groove [and the adjoining longitudinal pocket (135) are] is located at a [depth] distance from said external side wall surface (123) of the flat one piece key blade (120) which is greater than half the thickness of said flat one piece key blade (120).

16. The key as defined in claim 1, wherein said substantially flat one piece key blade (120) has an upper [and lower portions (151", 150"), each] portion (151") having an undercut groove (122") portion with [said] an innermost longitudinal pocket [(135")] (1354), such that the key is symmetrical and can be inserted either way into an associated keyway of said cylinder lock.

17. [The] A key for use in a cylinder lock with a rotatable key plug having a profiled key way, said key comprising:

an elongated, substantially flat one piece key blade (120) having a longitudinal profile groove (122) extending along at least a portion of the length of the flat one piece key blade (120), with an inner wall surface (124) of said longitudinal profile groove (122) being substantially parallel [to a] to an external side wall surface (123) [of said flat key blade],

said longitudinal profile groove (122) having, at a lower part thereof, an undercut portion (129) adjacent to and inside a ridge portion (128) of the flat one piece key blade (120), the outside of said ridge portion forming a part of said external side wall surface (123) of the flat one piece key blade (120),

said external side wall surface (123) at [the] a lower part of said flat one piece key blade (120) lying substantially in the same plane as [a side] an upper sidewall surface (1123') of the flat one piece key blade (120) at an upper part thereof, above said longitudinal profile groove (122),

said longitudinal profile groove (122) defining, at an upper part thereof, a smallest opening width (w) as seen perpendicularly to said external side wall surface (123) of said lower portion of said flat one piece key blade (120), between an upper wall surface (160) and said ridge portion (128), and

[the inside of] said ridge portion [facing] (128) being opposite said inner wall surface (124) of said longitudinal profile groove (122), wherein:

said undercut portion (129) of said longitudinal profile groove extends downwardly substantially in a vertical direction (VD) in parallel to the upper side wall surface (1123') and the external side wall surface (123) of the flat one piece key blade (120),

said undercut portion (129) of said longitudinal profile groove (122), at [its] an innermost part [inside said ridge portion (128)], is extended further, substantially in [a] the same direction as said vertical direction [in parallel to said upper and lower side surfaces (123) of the key blade (120),] (VD) into a [longitudinal, substantially bulbous wide] longitudinal widened pocket (135) having a larger lateral width [relative to] than a narrowest part of the [longitudinal] undercut portion (129) of the profile groove (122), said [bulbous wide] widened pocket (135) being formed by opposite inner and outer lateral wall surface portions (132, 133), and said inner wall surface (124) of said longitudinal profile groove (122) adjoins, by way of a continuously

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downwardly extending wall surface portion (136), said inner lateral wall surface portion (132) of the pocket (135) and the inner lateral wall surface portion (132) of the pocket (135) extends continuously further downwardly to a lowermost transverse end wall surface (134), wherein the highest point of said inner lateral wall surface portion (132) is located below the lowest point of said inner wall surface (124) of said longitudinally profile groove (122), and [a] the lowermost transverse end wall surface (134) [which is slightly curved and] faces upwardly in a direction [in a central plane (A) of the key blade] opposite to said vertical direction (VD) towards said upper wall surface of said longitudinal profile groove (122).

18. The key as defined in claim 17, wherein [the] a vertical dimension (h) of said ridge portion (128) is greater than the distance (d) between said lowermost transverse end wall surface (134) and [said lower] a lowermost edge wall surface (127) of the flat one piece key blade (120).

19. The key as defined in claim 17, wherein at least one of said opposite lateral wall surface portions (132, 133) is curved.

20. The key as defined in claim 17, wherein said lowermost transverse end wall (134', 134") of said pocket (135) is curved with a radius being more than half of the width of said pocket, said width being measured transversely to said side surface (123) of said key blade (120).]

21. The key as defined in claim 17, wherein said inner wall [(124)] surface of said longitudinal profile groove [(122)] merges with one of said opposite lateral [walls] wall surface portions [(132, 133)] (1323) of said pocket.

22. The key as defined in claim 17, wherein [the] a vertical dimension (h) of said ridge portion (128), measured in said plane of said [lower] external side wall surface (123) and said upper side wall surface [(123)] (1123') of the flat one piece key blade (120), is more than half of [the] said smallest opening width (w) of said longitudinal profile groove (122) adjacent to said external side wall surface (123), said smallest opening width (w) being measured as a perpendicular projection onto said inner wall surface (124) of said longitudinal profile groove (122).

23. The key as defined in claim [15] 17, wherein [said] a vertical dimension (h) of said ridge portion (128) is equal to or greater than said smallest opening width (w).

24. The key as defined in claim 17, [constituting] wherein the flat one piece key blade (120) is formed from a key blank with a continuous upper edge portion configured so as to permit coded recesses to be cut therein.

25. The key as defined in claim 17, having coded recesses (102a . . . 102e) cut into said ridge portion (128), so as to form a side code on the flat one piece key blade (120), said side code recesses being configured to cooperate with at least one side tumbler (105) in an associated lock.

26. The key as defined in claim 25, wherein said side code recesses (102a . . . 102e) forming a side code constitute a wave-like, longitudinal code pattern.

27. The key as defined in claim 25, wherein said side code recesses (102a . . . 102e) are cut into the whole material thickness of said ridge portion (128), so that the side code recesses reach all the way from the [outside] external side wall surface (123) of said ridge portion (128) into said longitudinal pocket (135) of the undercut profile groove (122).

28. The key as defined in claim 25, wherein said side code recesses (102a . . . 102e) are cut from an upper edge of the

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ridge portion (128) down to various levels between said upper edge and [the] a lowermost part of said longitudinally extending pocket (135).

29. The key as defined in claim 25, wherein said side code recesses (102a . . . 102e) form concavities with lower bottom portions located at a number of different levels, each representing a code.

30. The key as defined in claim 28, wherein said different levels also include an uppermost level at the upper edge (102f) of said ridge portion (128).

31. The key as defined in claim 28, wherein the number of different levels is at least three.

32. The key as defined in claim 17, wherein the inner wall surface (124) of said longitudinal profile groove [and the adjoining longitudinal pocket (135) are] is located at a [depth] distance from said external side wall surface (123) of the flat one piece key blade (120) which is greater than half the thickness of said flat one piece key blade (120).

33. The key as defined in claim 17, wherein said substantially flat one piece key blade (120") has an upper [and lower portions (151", 150"), each] portion (151") having an undercut groove (122") with said innermost longitudinal pocket [(135")] (1354), such that the key is symmetrical and can be inserted either way into an associated keyway of said cylinder lock.

34. [The] A key for use in a cylinder lock with a rotatable key plug having a profiled key way, said key comprising:

an elongated, substantially flat one piece key blade (120) having a longitudinal profile groove (122) extending along at least a portion of the length of the flat one piece key blade (120), with an inner wall surface (124) of said groove being substantially parallel to a external side wall surface (123) [of said flat key blade],

said longitudinal profile groove (122) having, at a lower part thereof, an undercut portion (129) adjacent to and inside a ridge portion (128) of the flat one piece key blade (120), the outside of said ridge portion forming a part of said external side wall surface (123) of the flat one piece key blade (120),

said external side wall surface (123) at the lower part of said flat one piece key blade (120) lying substantially in the same plane as [a] an upper side wall surface (1123') of the flat one piece key blade (120) at an upper part thereof, above said longitudinal profile groove (122), said longitudinal profile groove (122) defining, at an upper part thereof, a smallest opening width (w), as seen perpendicularly to said external side wall surface (123) of said lower portion of said flat one piece key blade (120), between an upper wall surface (160) and said ridge portion (128), and

[the inside of] said ridge portion [facing] (128) being opposite said inner wall surface (124) of said longitudinal profile groove (122), wherein:

said undercut portion (129) of said longitudinal profile groove extends downwardly substantially in a vertical direction (VD) in parallel to the upper side wall surface (1123') and the external side wall surface (123) of the flat one piece key blade (120),

said undercut portion (129) of said longitudinal profile groove (122), at [its] an innermost part [inside said ridge portion (128)], is extended further, substantially in [a] the same direction as said vertical direction [in parallel to said upper and lower side surfaces (123) of the key blade (120),] (VD) into a longitudinal[, substantially uniformly wide] pocket [(135) having] being interrupted by at least one longitudinal recess (132a) formed in at least one of opposite inner and outer

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lateral wall *surface* portions (132, 133) [and] wherein said inner wall *surface* (1243) of said longitudinal profile groove (122) adjoins the inner lateral wall *surface* portion (1324), located opposite to said ridge portion and said inner lateral wall *surface* portion (1324) extends downwardly to a lowermost transverse end wall *surface* (134), said lowermost transverse end wall *surface* (134) being substantially flat or slightly curved and being substantially parallel to a [lower] lowermost edge [portion] wall *surface* (127) of the key blade and which faces upwardly in a direction [being parallel to a central plane (A) of the key blade] opposite to said vertical direction (VD) towards said upper wall *surface* of said longitudinal profile groove (122) with said opposite lateral wall *surface* portions (132, 133) of said pocket (135) being substantially parallel to said upper side wall *surface* (1123") and [lower] the external side wall *surfaces* (123) of the flat one piece key blade (120).

35. The key as defined in claim 34, wherein [the] a vertical dimension (h) of said ridge portion (128) is greater than the distance (d) between said lowermost transverse end wall *surface* (134) and said [lower] lowermost edge wall *surface* (127) of the flat one piece key blade (120).

[36. The key as defined in claim 34, wherein at least one of said opposite lateral wall portions (132, 133) is curved.]

37. The key as defined in claim 34, wherein said lowermost transverse end wall *surface* (134', 134") of said pocket (135) is curved with a radius being more than half of the width of said pocket, said width being measured transversely to said external side wall *surface* (123) of said flat one piece key blade (120).

38. The key as defined in claim 34, wherein at least one of said longitudinal [recess] recesses formed in at least one of the opposite lateral wall *surface* portions (132) and said lowermost transverse end wall *surface* (134) is provided with an irregular surface portion (132c, 134c).

39. The key as defined in claim 34, wherein said inner wall [(124)] *surface* (1243) of said longitudinal profile groove [(122)] merges with one of said opposite lateral [walls] wall *surface* portions [(132, 133)] (1324) of said pocket.

40. The key as defined in claim 34, wherein [the] a vertical dimension (h) of said ridge portion (128), measured in said plane of said [lower] external side wall *surface* (123) and the upper side wall *surface* [(123)] (1123') of the flat one piece key blade (120), is more than half of [the] said smallest opening width (w) of said longitudinal profile groove (122) adjacent to said external side wall *surface* (123), said smallest opening width (w) being measured as a perpendicular projection onto said inner wall *surface* (124) of said longitudinal profile groove (122).

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41. The key as defined in claim 40, wherein said vertical dimension (h) of said ridge portion (128) is equal to or greater than said smallest opening width (w).

42. The key as defined in claim 34, [constituting] wherein the flat one piece key blade (120) is formed from a key blank with a continuous upper edge portion configured so as to permit coded recesses to be cut therein.

43. The key as defined in claim 34, having coded recesses (102a . . . 102e) cut into said ridge portion (128), so as to form a side code on the flat one piece key blade (120), said side code recesses being configured to cooperate with at least one side tumbler (105) in an associated lock.

44. The key as defined in claim 43, wherein said side code recesses (102a . . . 102e) forming a side code constitute a wave-like, longitudinal code pattern.

45. The key as defined in claim 43, wherein said side code recesses (102a . . . 102e) are cut into the whole material thickness of said ridge portion (128), so that the side code recesses reach all the way from the [outside] external side wall *surface* (123) of said ridge portion (128) into said longitudinal pocket (135) of the undercut profile groove (122).

46. The key as defined in claim 43, wherein said side code recesses (102a . . . 102e) are cut from an upper edge of the ridge portion (128) down to various levels between said upper edge and [the] a lowermost part of said longitudinally extending pocket (135).

47. The key as defined in claim 43, wherein said side code recesses (102a . . . 102e) form concavities with lower bottom portions located at a number of different levels, each representing a code.

48. The key as defined in claim 46, wherein said different levels also include an uppermost level at the upper edge (102f) of said ridge portion (128).

49. The key as defined in claim 46, wherein the number of different levels is at least three.

50. The key as defined in claim 34, wherein the inner wall *surface* (124) of said longitudinal profile groove [and the adjoining longitudinal pocket (135) are] is located at a [depth] distance from said external side wall *surface* (123) of the flat one piece key blade (120) which is greater than half the thickness of said flat one piece key blade (120).

51. The key as defined in claim 34, wherein said substantially flat one piece key blade (120") has an upper [and lower portions (151", 150"), each] portion (151") having an undercut groove (122") with said innermost longitudinal pocket [(135")] (1354), such that the key is symmetrical and can be inserted either way into an associated keyway of said cylinder lock.

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