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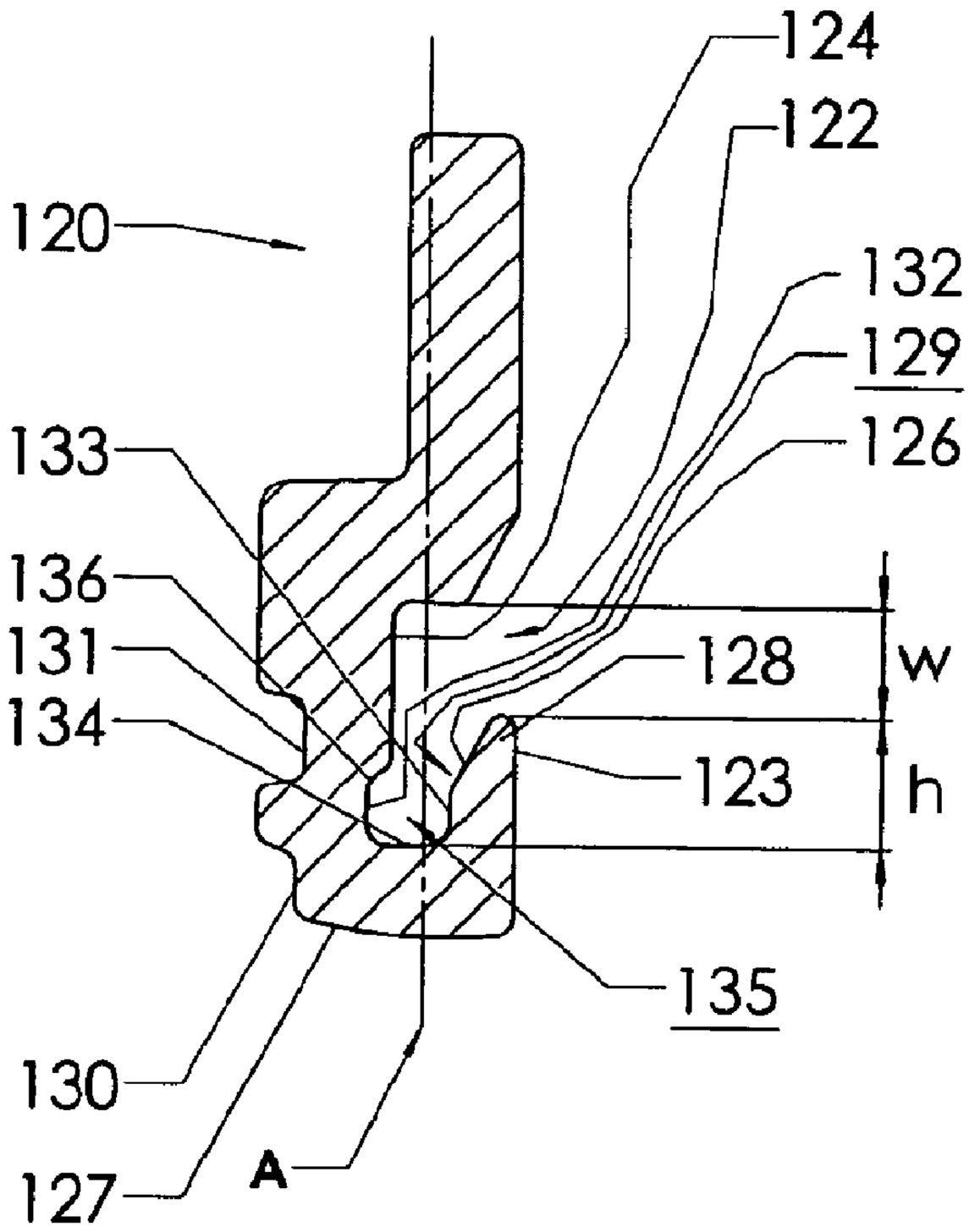

(57) Abrégé/Abstract:
A key for use in a cylinder lock with a rotatable key plug having a profiled keyway. The key comprises an elongated, substantially flay key blade (120; 120') having a longitudinal profile groove (122; 122') extending along at least a portion of the length of the key

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(57) Abrégé(suite)/Abstract(continued):
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 and the inside of which comprises a side wall portion (126; 126') being inclined and facing the bottom wall (124; 124') of the groove. The undercut portion (129; 129') of the groove is expanded, at its innermost part adjacent to said inclined side wall portion (126; 126'), into a longitudinally extending pocket (135; 135').

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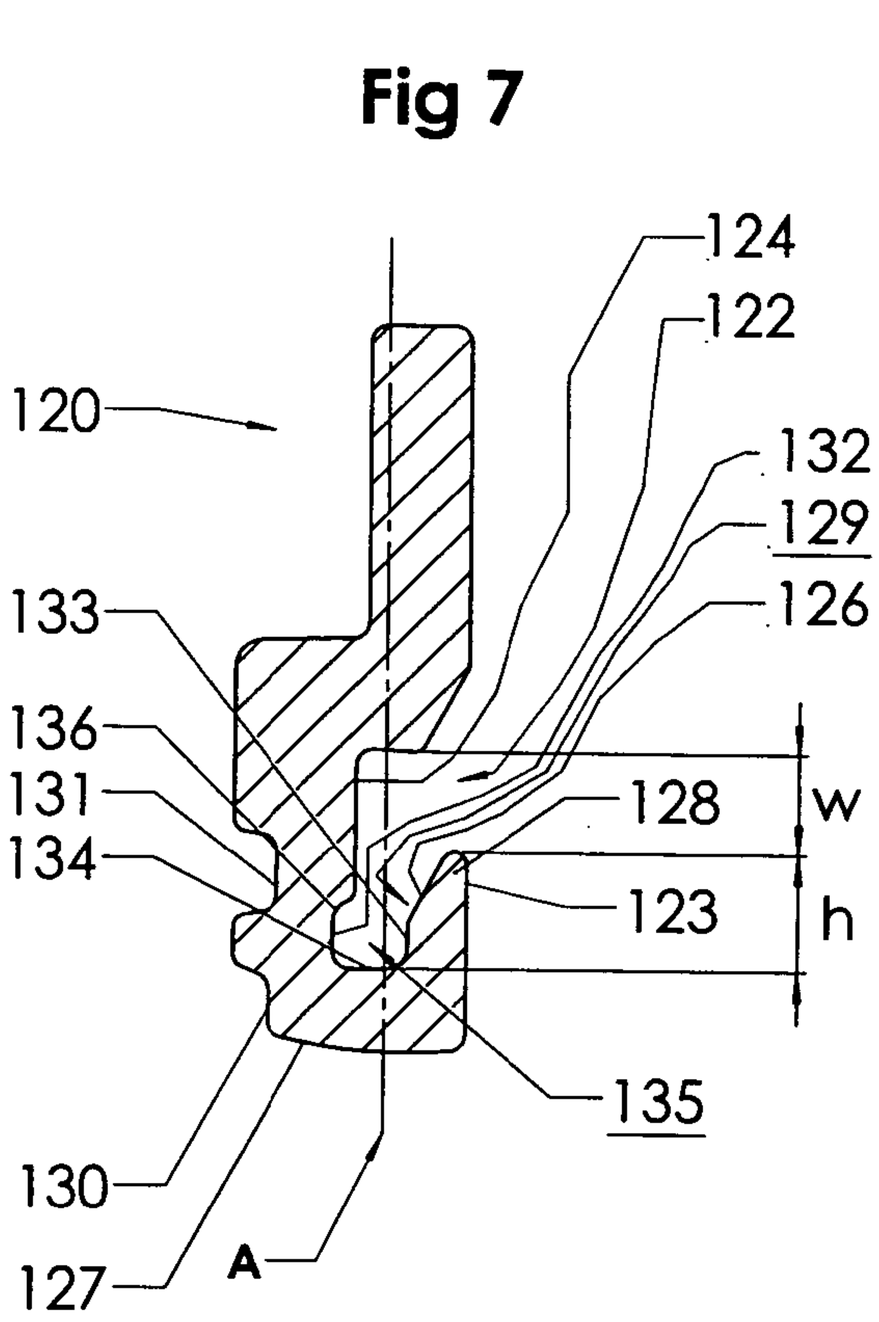
[Continued on next page]

(54) Title: PROFILED KEY FOR CYLINDER LOCKS

(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 and the inside of which comprises a side wall portion (126; 126') being inclined and facing the bottom wall (124; 124') of the groove. The undercut portion (129; 129') of the groove is expanded, at its innermost part adjacent to said inclined side wall portion (126; 126'), into a longitudinally extending pocket (135; 135').

Fig 7



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PROFILED KEY FOR CYLINDER LOCKS

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 a bottom 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 a ridge portion, the outside of which forms part of a side surface of the key blade and the inside of which comprises a side wall portion being inclined and facing said bottom wall of said groove.

Such a key with an undercut groove is previously known, e.g. from US patent 5,715,717 (Widén) or US patent 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, a key according to the present invention is provided with an undercut groove, a portion of which is expanded, at its innermost part adjacent to an inclined side wall portion, into a longitudinally extending pocket, said pocket comprising opposite lateral walls and an end wall, so as to form an extension of said longitudinal profile groove, said extension being oriented substantially in a direction which is parallel to said side surface of said key blade, and one of these opposite lateral walls of the pocket forming an extended inside wall of a ridge portion. This extended 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 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.

Figure 1 and Figure 2 illustrates a prior art lock and key combination;

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

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

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

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

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

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

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

Figures 10 - 20 are cross-sectional views of some additional embodiments of the profiled key according to the invention.

Brief description of some preferred embodiments

Figures 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 US patent 5,715,717 (Widén). The lock 10 is of the kind having a housing 11 with 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 Figure 3, the key also has a grip portion 24.

The operation of the lock is more readily understood from the cross-sectional view in Figure 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 Figure 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 Figure 5, as disclosed e.g. in the above-mentioned US patent 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 Figure 5, the central plane of the key blade is denoted "A". The longitudinal groove 22 has a bottom wall 24 and opposite side walls 25 and 26. One of these opposite walls, in particular the 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 wall or surface 24. This lower side wall 26 of the undercut groove 22 forms an inside wall 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 Figures 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 Figure 5).

The undercut portion 29 of the longitudinal groove 22 has many advantages, as explained in the above-mentioned US patent specification 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 Figure 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 (Figure 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 Figure 5, although they have been supplemented with the digit "1" before the number given in Figure 5.

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 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 innermost lateral wall 132 of the pocket-like extension 135 adjoins with the bottom 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 ridge portion 128 is somewhat longer, measured in parallel to the central plane A of the key blade, than the prior art structure (Figure 5). More particularly, the ridge portion 128 has a vertical dimension h, which is more than half of the smallest width w of the undercut groove 122, this smallest width w being measured as a perpendicular projection onto the bottom wall 124 of the longitudinal groove 122. 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 Figures 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 Figures 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 Figure 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. Other tools also have to be used. Accordingly it will be difficult for others than specialized manufacturers to produce such key blanks;
- 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 Figure 1 - 5, it is possible to provide many vertical levels of code recesses in this material region, see Figure 6. Of course, this will also facilitate lock and key systems having a very high number of code combinations.

In Figures 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 arrange-

ment is similar to those disclosed in the US patents 4,756,177 (Widén) and 5,715,717 (Widén).

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

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 Figure 6), in this case in the ridge portion 128 (see Figure 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 (Figure 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 Figure 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 (see Figures 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 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 Figure 10, there is shown an embodiment where the bottom wall 124 of the longitudinal profile groove 122 merges smoothly with the adjoining lateral wall 132 of the pocket-like configuration 135, without any step (136 in Figure 7).

In Figure 11, the pocket-like configuration 135 is similar to the one in Figure 7, but the lowermost end wall 134′ is rounded or curved.

The embodiment shown in Figure 12 is similar to the one in Figure 10, but the lowermost end wall 134'' is slanted or inclined at an angle corresponding to the inclined surface 126. Thus, the slanted lowermost end wall 134'' faces the adjoining lateral wall 132 which adjoins the bottom wall 124.

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

The embodiment shown in Figure 14 is like the one shown in Figure 10, but the lateral wall 132 adjoining the bottom wall 124 is provided with a longitudinal recess 132a, which is rectangular in cross-section.

The embodiment of Figure 15 is similar to the one of Figure 14, but there is also a longitudinal recess 133a in the lateral wall 133 opposite to the longitudinal recess 132a.

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

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

In the embodiments shown in Figures 18 and 19, the key blade 120′ has a relatively wide lower portion 140′ and a relatively narrow upper portion 141′, there being a shelf or step surface 142′ in the transition region between the wider lower portion 140′ and the narrow upper portion 141′. In both embodiments, the longitudinal profile groove 122′ is located adjacent to this shelf surface 142′. Like in the other embodiments shown in Figures 10 - 17, the longitudinal undercut groove 122′ is extended, adjacent to its inclined side wall portion 126′, into a pocket-like configuration 135′. In the shown embodiments, these pocket-like configurations are substantially rectangular, but they may preferably be formed with irregularities or any desired shape, e.g. as illustrated in the previous embodiments. In Figure 18, the lateral wall 132′ merges smoothly with the bottom wall 124′ of the undercut groove 122′, and the latter adjoins the associated side wall 143′ of the upper, relatively narrow portion 141′ of the key blade via a step 144′. In Figure 19, on the other hand, there is no such step 144′, and the lateral wall 132′, the bottom wall 124′ and the side wall 143′ all merge smoothly into a common side surface.

Finally, the key blade 120″ shown in Figure 20 is composed of a lower part 150″, which is identical or similar to the lower parts 140, 140′ of the key blades shown in Figures 10 - 19, 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 Figure 20 or turned upside down (the profile is then exactly the same because of the symmetry of the lower and upper parts).

In all embodiments described above, and in the appended claims, it is assumed that the bottom 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 123, 123′, 123″ thereof. Within this definition, the bottom wall may be oriented at a small angle to said central plane A, this angle being normally no more than 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.

1. A key for use in a cylinder lock with a rotatable key plug having a profiled keyway, said key comprising:

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

said longitudinal profile groove (122) having an undercut portion (129) adjacent to and inside a ridge portion (128) of the key blade, the outside of said ridge portion forming a part of said side surface (123) 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 a side surface of the key blade at an upper part thereof, above said longitudinal groove, and

- the inside of said adjacent ridge portion (128) facing said inner wall (124) of said groove, wherein

- said longitudinal profile groove (122) has only one undercut portion (129), as seen in a cross-sectional view transverse to the longitudinal direction of the key blade, said one undercut portion (129) of said longitudinal profile groove (122), at its innermost part inside said adjacent ridge portion (128), is extended, substantially in a vertical direction (A) parallel to said upper and lower side surfaces (123) of the key blade (120), into a longitudinal, substantially uniformly wide pocket (135) having opposite lateral wall portions (132, 133) and a lowermost transverse end wall (134), which is substantially flat or slightly curved, and which is substantially parallel to a lower edge portion (127) of

the key blade and faces upwardly in said vertical direction (A), and

- said extended pocket (135) being so deep in said vertical direction (A) that the vertical dimension (h) of said adjacent ridge portion (128), measured in said plane of said lower and upper side surface (123) of the key blade (120), is more than half of the smallest width (w) of said longitudinal profile groove (122) adjacent to said side surface (123), said smallest width (w) being measured as a perpendicular projection onto said inner wall (124) of said longitudinal profile groove (122).

2. The key as defined in claim 1, wherein said vertical dimension (h) of said ridge portion (128) is equal to or greater than said smallest width (w).

3. The key as defined in claim 1, wherein the vertical dimension (h) of said ridge portion (128) is greater than the distance (d) between said end wall (134) and said lower edge surface (127).

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

5. The key as defined in claim 1, wherein at least one of said opposite lateral wall portions (132, 133) is curved.

6. The key as defined in claim 1, wherein said opposite lateral wall portions (132, 133) of said pocket (135) are substantially parallel to said upper and lower side surfaces (123) of the flat key blade (120).

7. The key as defined in claim 1, 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).

8. The key as defined in claim 1, wherein at least one of said opposite lateral wall portions (132) and said lowermost transverse end wall (134) is provided with an irregular surface portion (132c, 134c).

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

10. The key as defined in claim 1, constituting a key blank with a continuous upper edge portion configured so as to permit coded recesses to be cut therein.

11. 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 key blade, said side code recesses being configured to cooperate with at least one side tumbler (105) in an associated lock.

12. The key as defined in claim 11, wherein said side code recesses (102a ... 102e) forming a side code constitute a wave-like, longitudinal code pattern.

13. The key as defined in claim 11, 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 surface

(123) of said ridge portion (128) into said longitudinal pocket (135) of the undercut profile groove (122).

14. The key as defined in claim 11, 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 lowermost part of said longitudinally extending pocket (135).

15. The key as defined in claim 11, wherein said side code recesses (102a ... 102e) form concavities with lower bottom portions located at a number of different levels, each representing a code.

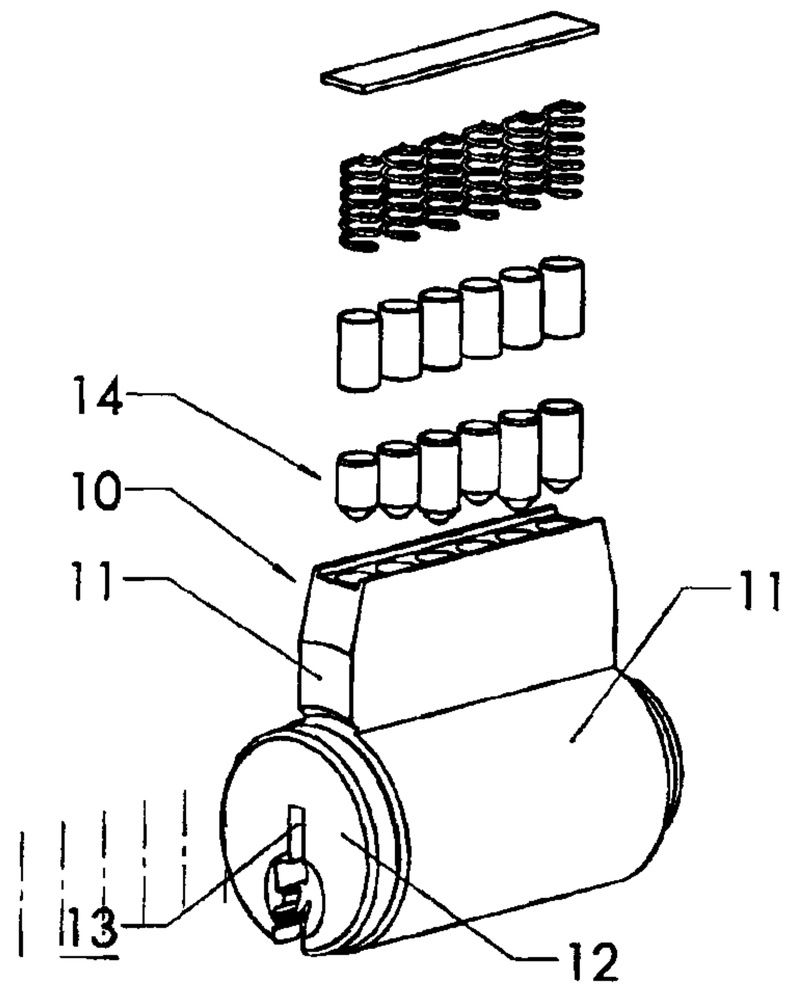
16. The key as defined in claim 14, wherein said different levels also include an uppermost level at the upper edge (102f) of said ridge portion (128).

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

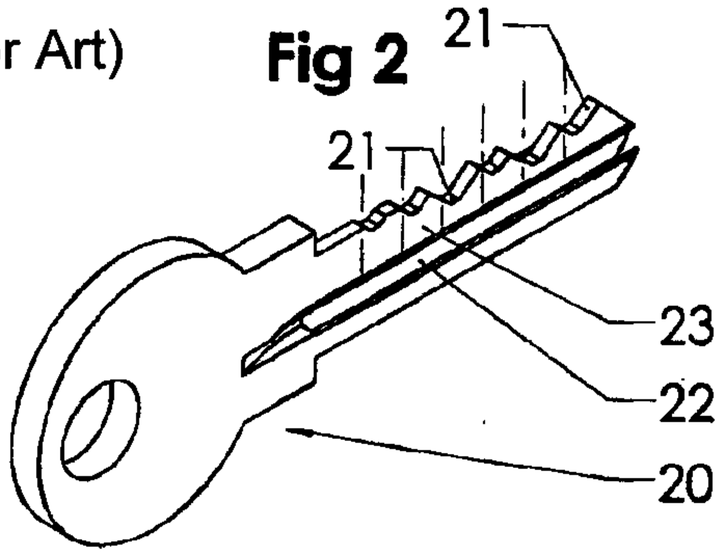
18. The key as defined in claim 1, wherein the inner wall (124) of said longitudinal profile groove and the adjoining longitudinal pocket (135) are located at a depth from said side surface (123) of the key blade (120) which is greater than half the thickness of said key blade.

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

Fig 1 (Prior Art)



(Prior Art) **Fig 2**



(Prior Art) **Fig 3**

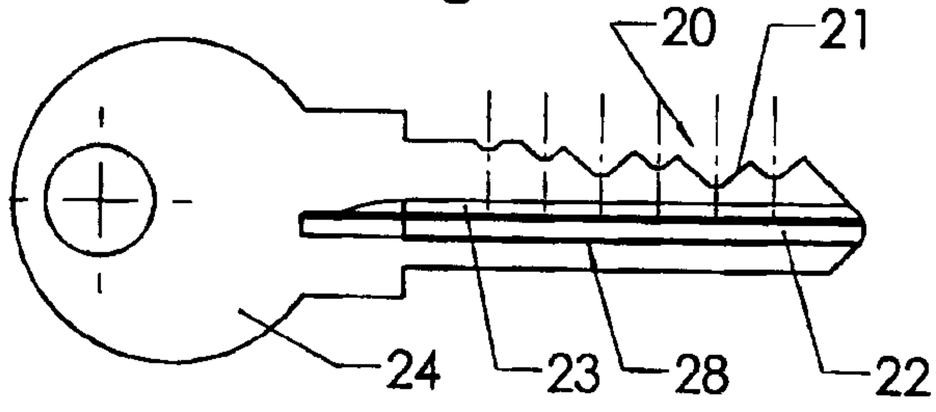


Fig 4 (Prior Art)

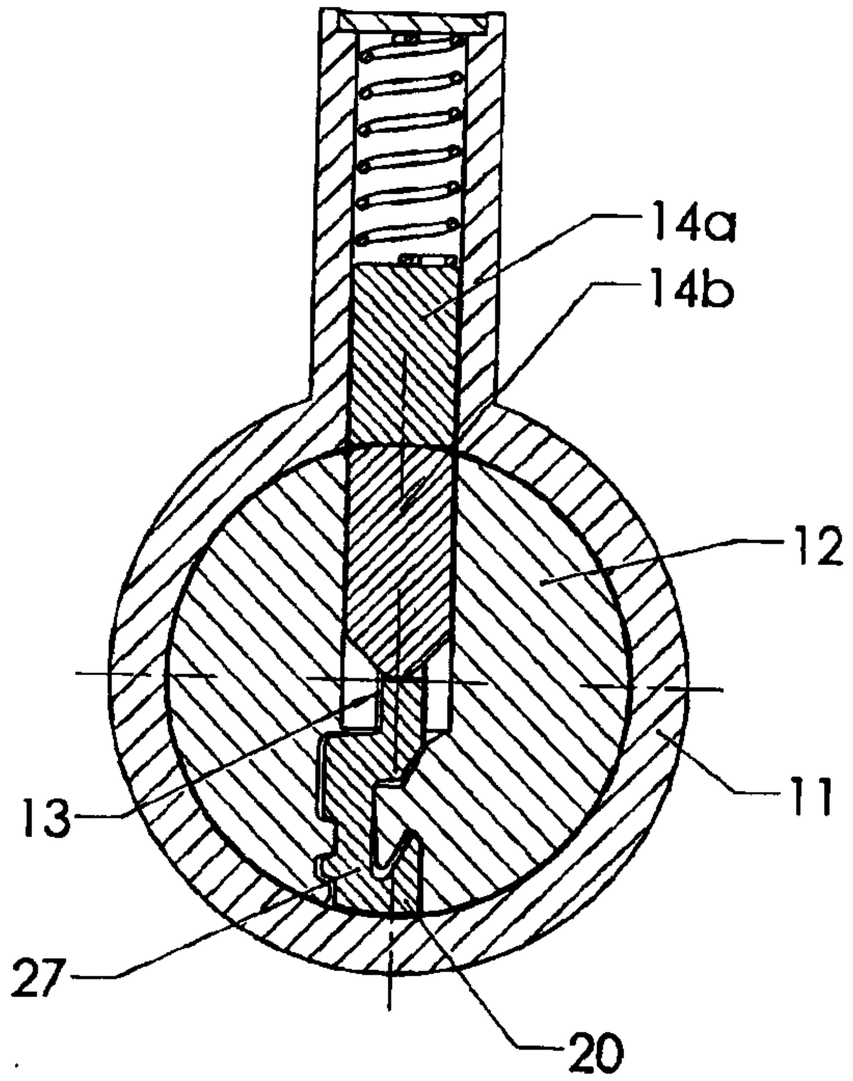


Fig 5 (Prior Art)

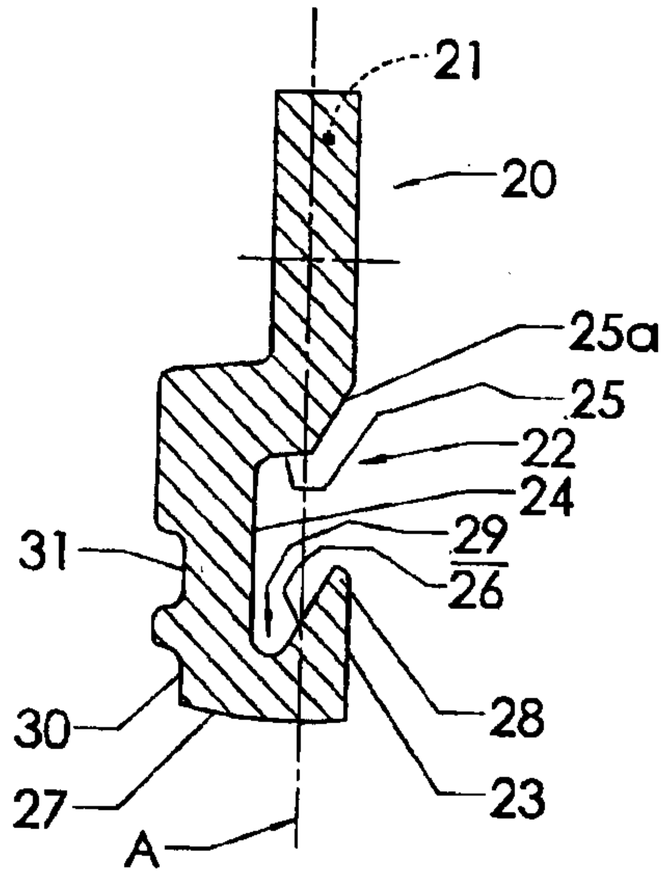


Fig 6

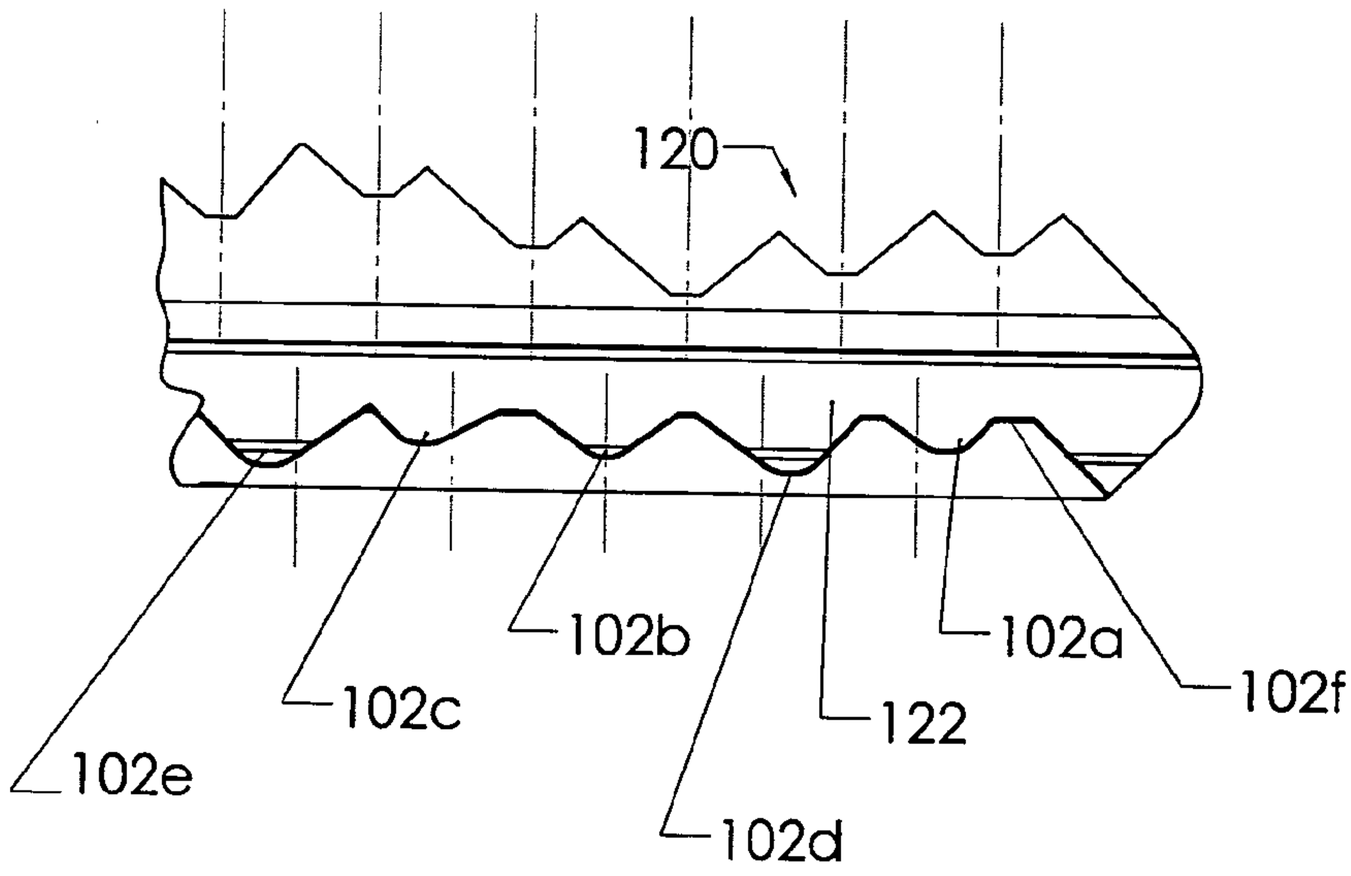

120
102b
102a
102f
102c
122
102e
102d

Fig 7

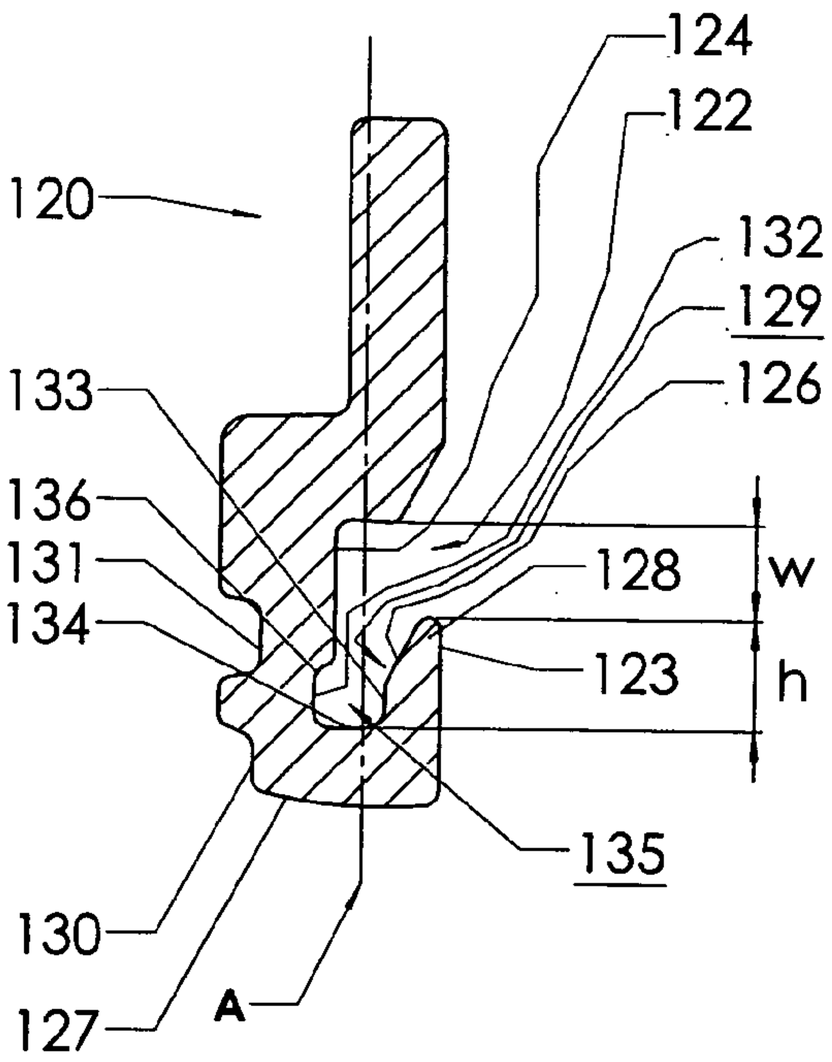

124
122
120
132
129
133
126
136
131
128
w
134
123
h
135
130
127
A

Fig 8

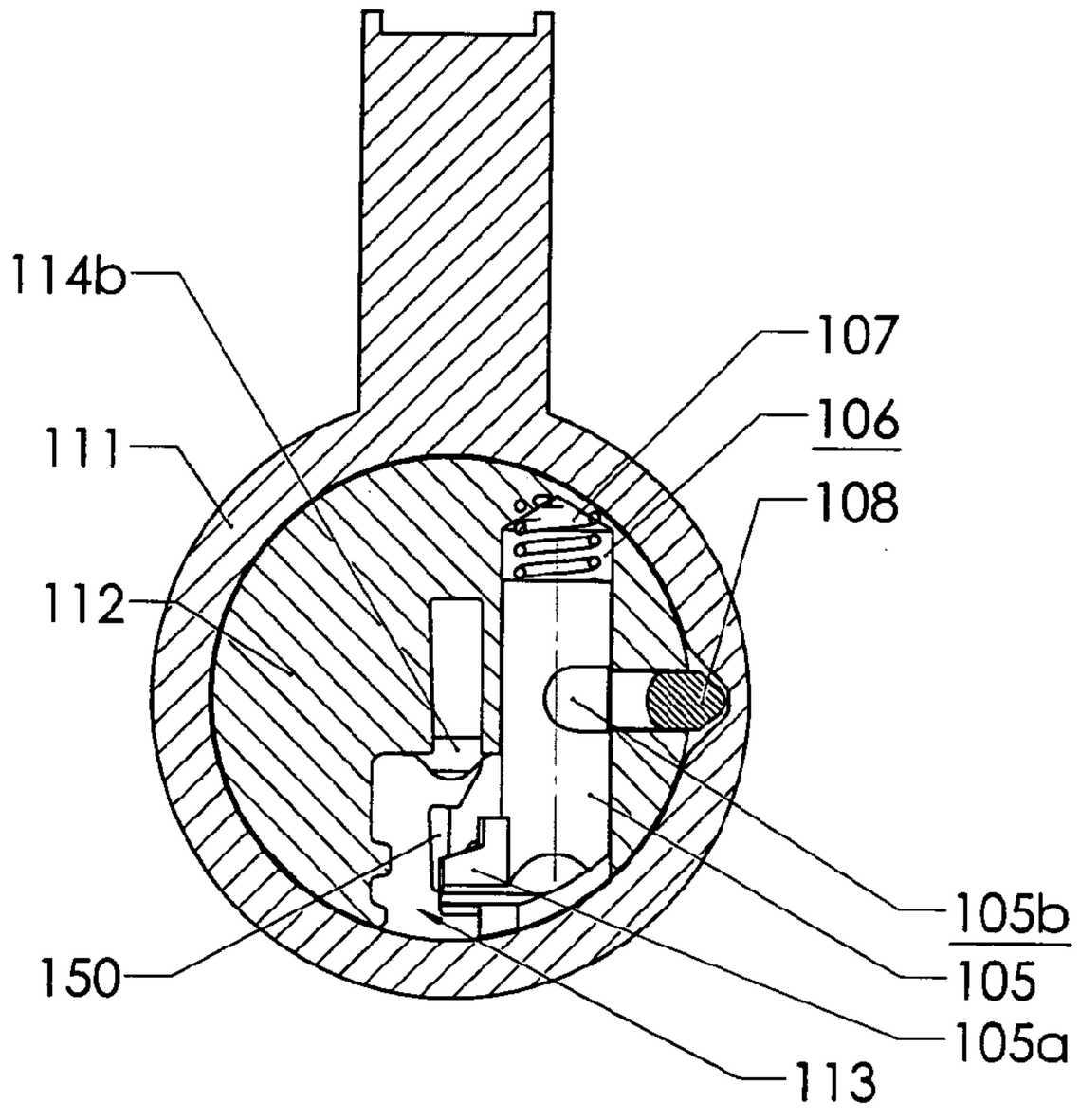

114b
107
106
111
108
112
105b
105
150
105a
113

Fig 9

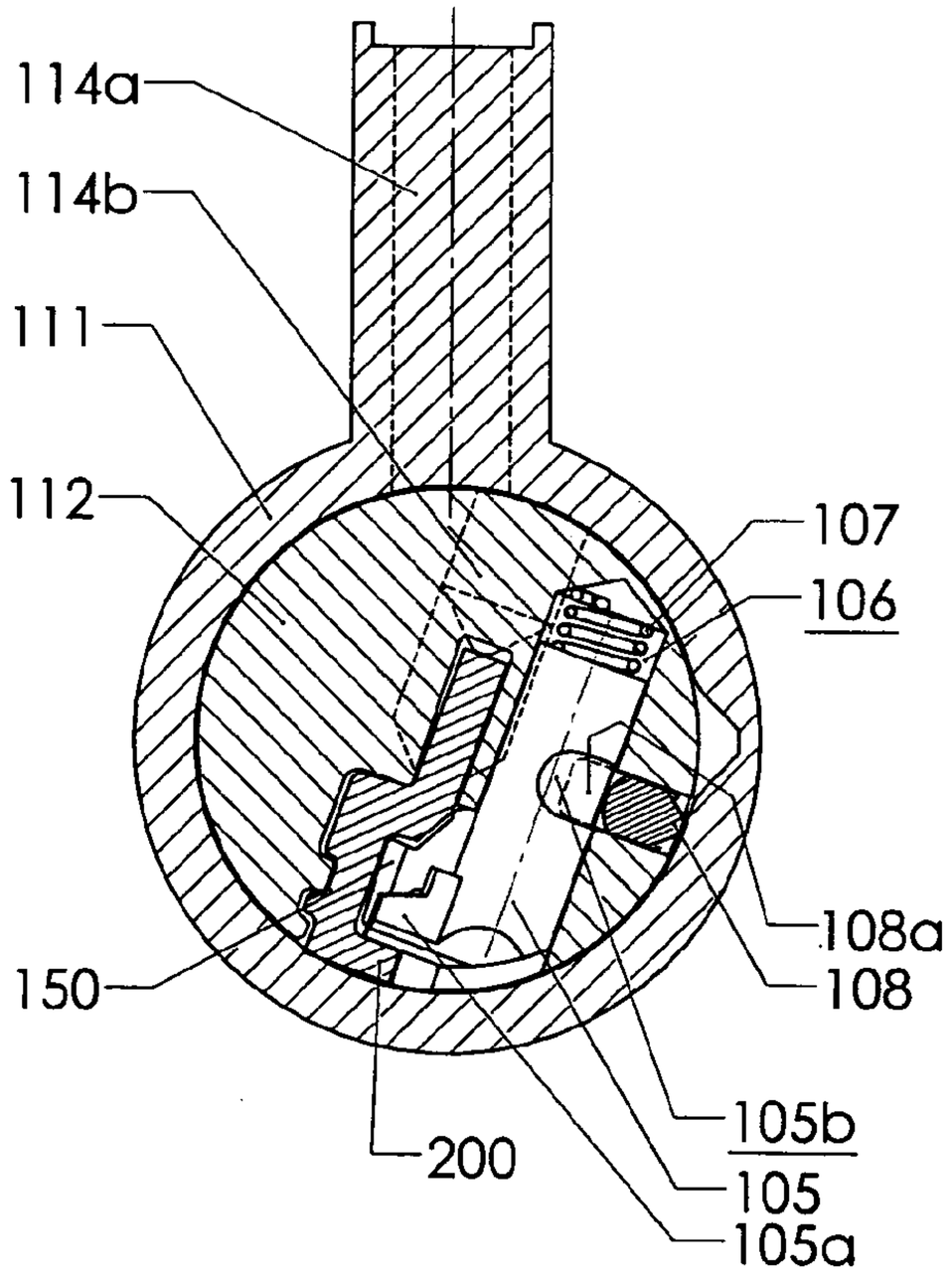

114a
114b
111
112
107
106
108a
108
150
200
105b
105
105a

Fig 10

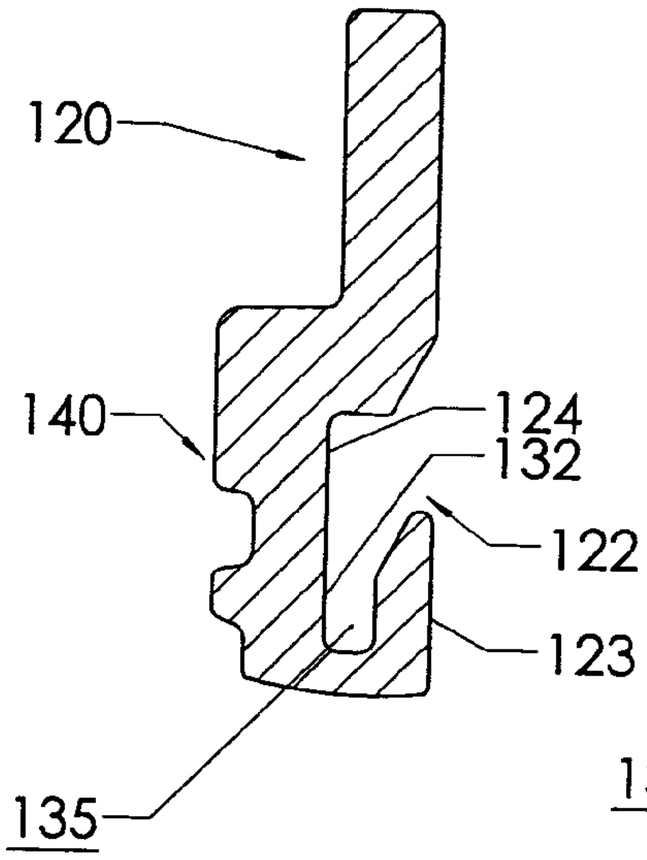


Fig 11

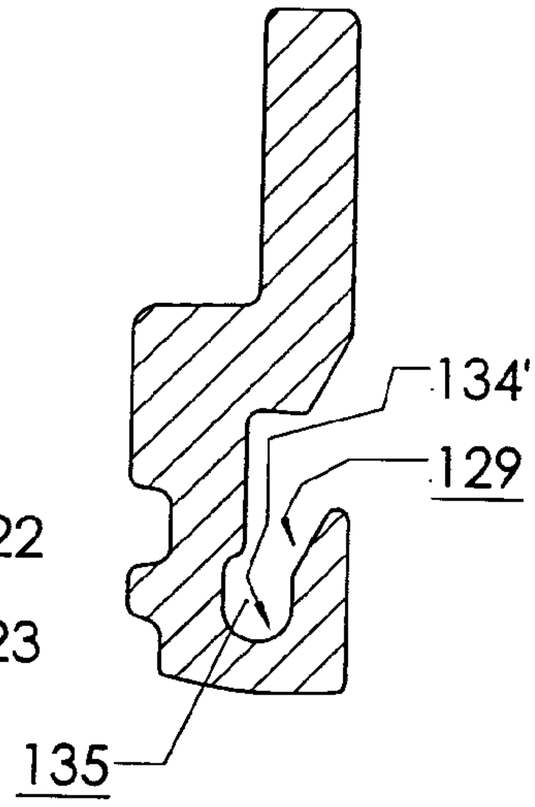


Fig 12

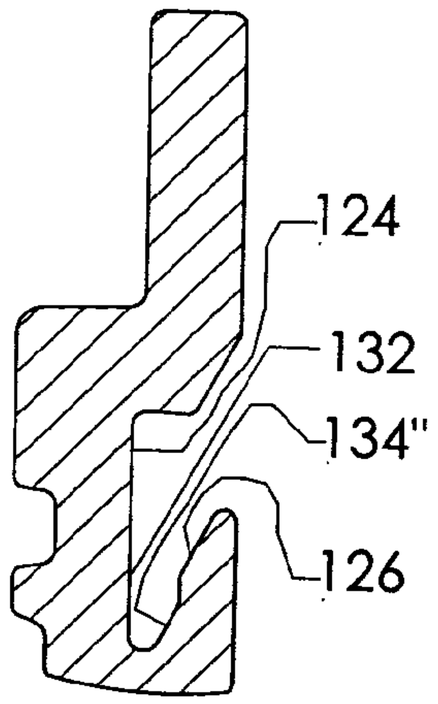


Fig 13

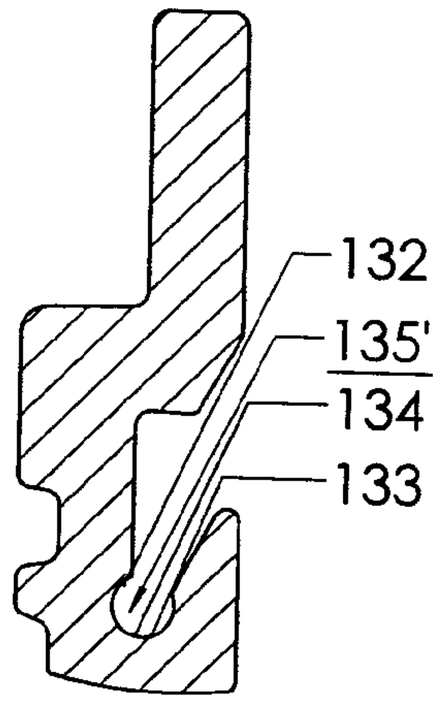


Fig 14

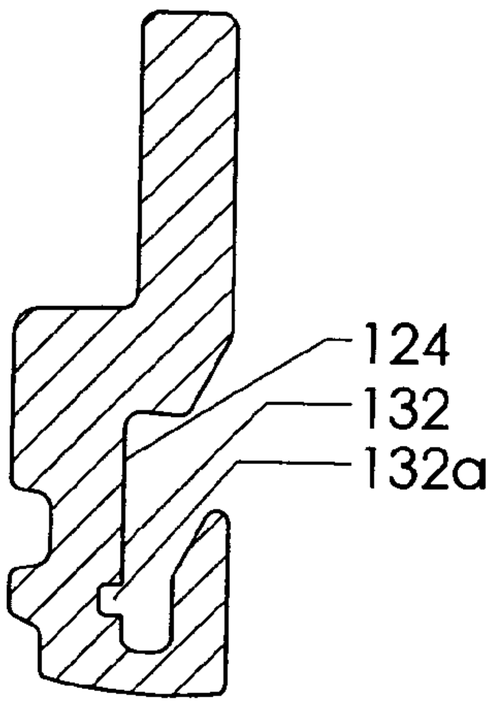


Fig 15

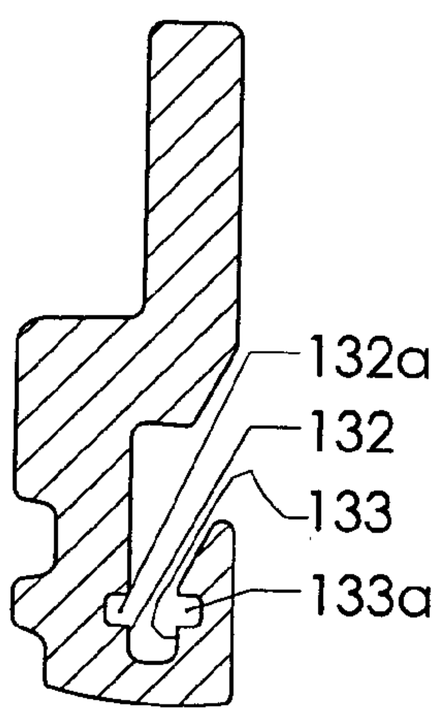


Fig 16

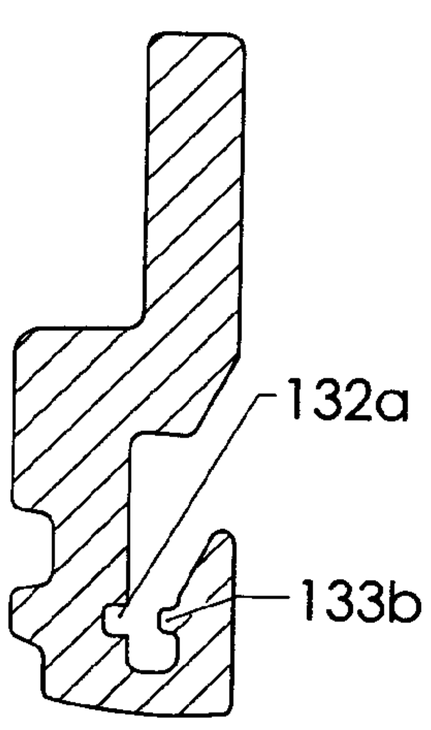


Fig 17

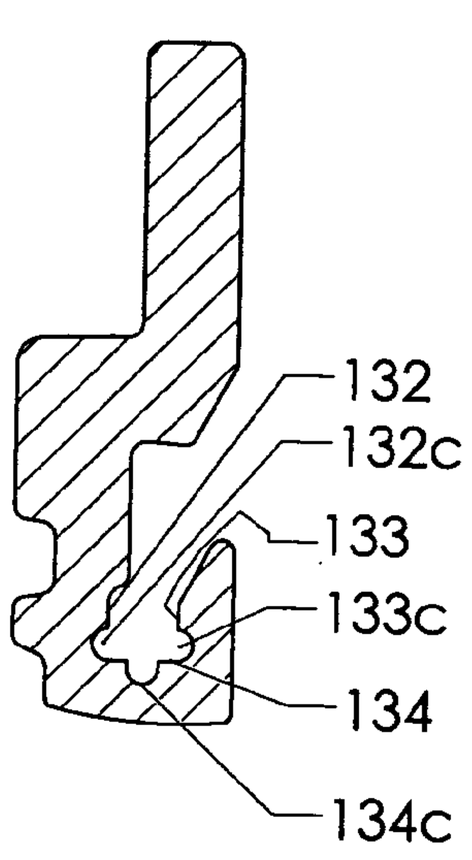


Fig 18

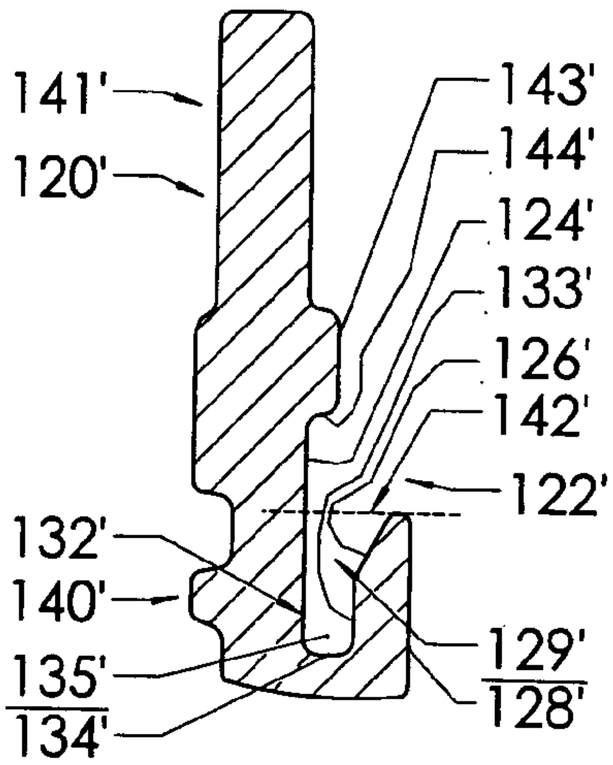


Fig 19

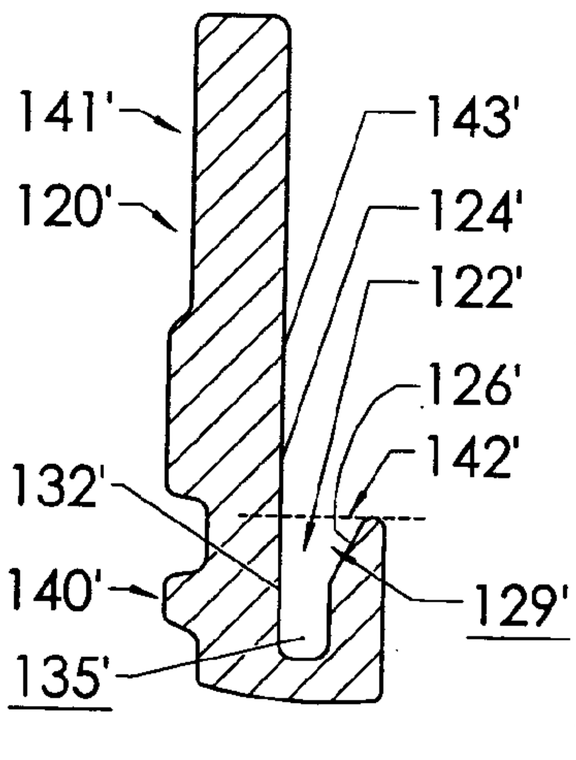
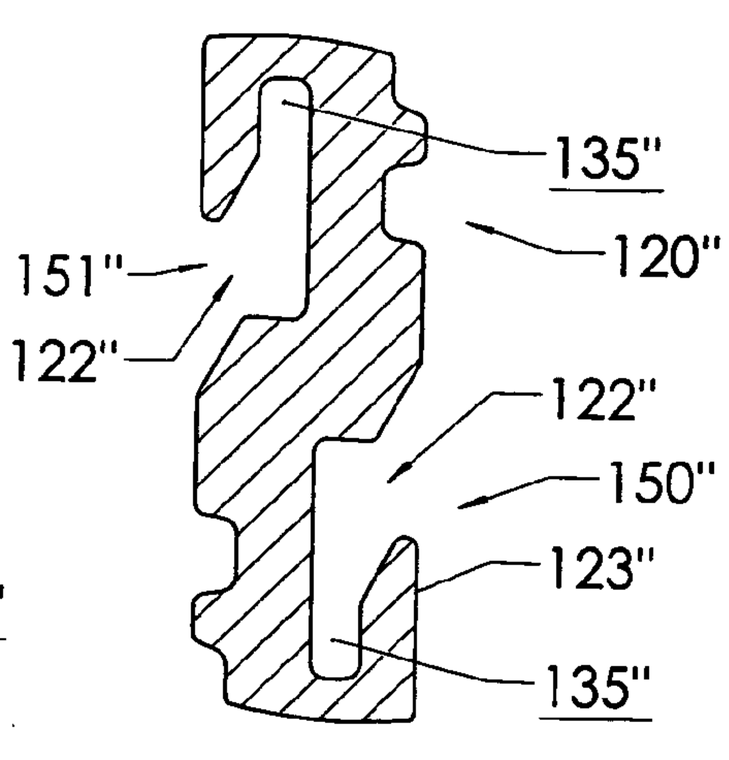
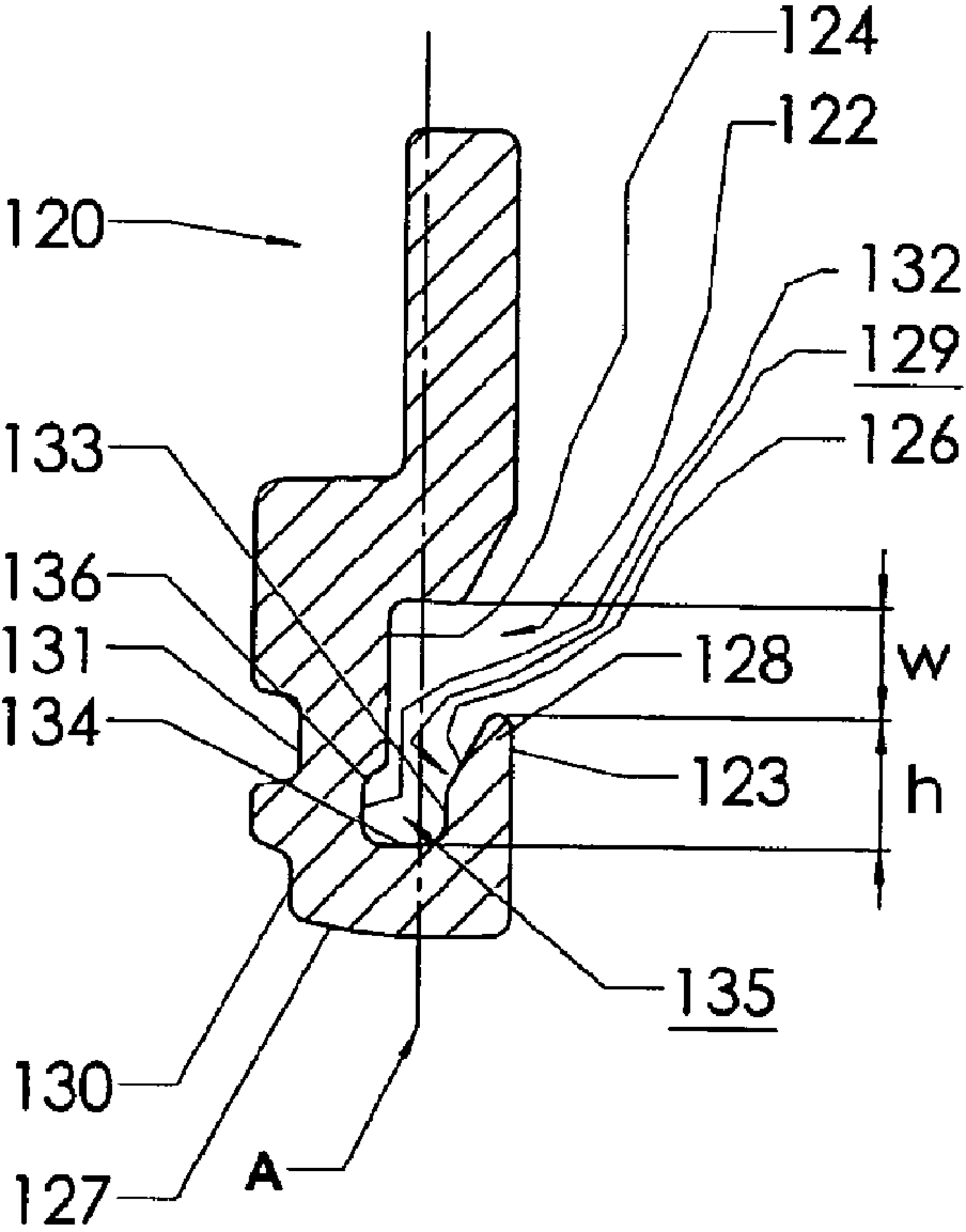


Fig 20




120
124
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A