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(54) Title:

**IMAGE ENCODING METHOD, IMAGE ENCODING DEVICE,
IMAGE DECODING METHOD, IMAGE DECODING DEVICE,
AND IMAGE ENCODING/DECODING DEVICE**

Description

Title of the invention: FLAT KEY FOR A LOCKING CYLINDER AND LOCKING CYLINDER

Technical field

[0001] The present invention relates to a flat key for a locking cylinder, in particular of locking installations, having substantially planar and approximately parallel flat key sides, a key back and a key bit which is opposite the back and which is toothed on the end face for positioning retention pins which are divided into core and housing pins and which are resiliently loaded in corresponding key channels of cylinder cores against the end face of the key bit in the direction towards the key back, grooves which are cut in the flat sides of the flat key being provided as variation profile elements and as guiding profile elements, at least two grooves of a side of the flat key overlapping, the insertion direction of which is different so that the intersection of the two grooves produces an edge which can be scanned in the direction perpendicular with respect to the longitudinal centre plane of the flat key. The invention further relates to a locking cylinder for such a flat key.

Prior Art

[0002] The protection of life, the private domain and property are of primary importance. Therefore, a lock and key assume particular significance. Access regions are defined in locking installations and produced by the association of each installation key with one or more

locks. This association or the exclusion of the key and lock with regard to the locking function is achieved in locking installations on the basis of locking cylinders having flat keys, *inter alia*, by the cross-section profile of the keys and the cross-section of the key channel. Only when the contour of a key channel cross-section corresponds to a flat key cross-section or surrounds it does the key fit the lock. As soon as the contour of the flat key cross-section intersects with that of the key channel cross-section, the key has no locking authorisation with respect to the above-mentioned locking cylinder.

[0003] Obviously, this association between the key and locking cylinder via the profile - that is to say, the cross-section of the key, in particular flat keys, and key channel of the locking cylinder - also applies to the individual cylinder and the individual key, which is not directly part of a locking installation.

[0004] Safety requirements are complied with when a key cannot be readily copied. Using security documents and stringent identity checks, a replacement key can be obtained from the original manufacturer by an authorised person. As long as key blanks are commercially available, a key service using a copying milling device can produce a replacement key without any problems by producing a tooth arrangement on the key bit. As long as a copying milling device is further capable of also scanning a cross-section profile on the flat sides of an original key and appropriate milling tools are available, a replacement key can also be produced from a metal plate by means of cutting. If, owing to the limitation of free commercial accessibility, it was thus previously not possible to

produce replacement keys for blocked key profiles owing to the lack of an appropriate blank, the technical possibilities are nowadays available for key services to produce copies of a key both with regard to the tooth arrangement and with regard to the profile. The scanning of a key profile is carried out mechanically or optically from the side. The result of this lateral scanning is followed by the cutting in or the feeding of one or more milling cutters in order to produce U-shaped, V-shaped or rectangular grooves. Using oblique positioning of the key blank, grooves may also be produced in an oblique manner with respect to the centre line of the profile cross-section, for example, as undercut grooves.

[0005] It is problematic in this instance that the key services normally make the cross-section of the key slightly "smaller", that is to say, construct all the grooves to be slightly wider and deeper so that the key can be inserted certainly into the key channel. It is thereby repeatedly the case that a key can also be inserted into locks for which it is not provided at all (so-called transverse lockings). An entire locking installation is thereby often invalidated.

[0006] EP 1362153 B proposed a profile system for cross-section formation of flat keys with substantially planar and approximately parallel flat sides and corresponding key channels in locking cylinders, which made impossible a processing of the profile in one operating step with a former key profile milling device which could be used by key services. This was achieved with flat keys having substantially planar and approximately parallel flat sides and corresponding key channels in that, from at least one

groove, in particular of the guiding profile, at least one other groove extends as a branching groove and in that the insertion directions of the groove and branching groove were different and diverged, for example, by 60° . Owing to the lateral scanning of the profile grooves of an original key during copying, the branching groove was not detected or only detected incompletely. It would have had to be produced by means of re-clamping the blank and repeated scanning of the original. The re-clamping for an angular position of the centre line of the profile groove, which position deviates from the original insertion direction of a profile groove, inevitably leads to lateral displacements so that a branching groove or another groove which extends laterally from a groove could not be produced either in a dimensionally and operationally accurate manner or in a cost-effective manner.

[0007] A cost-effective and precise production was in practice only possible in the lock factory, which had profile broaching machines and large milling centres, wherein re-clamping errors did not occur since separate operations which cause errors were not necessary with repeated measurement of a starting position.

[0008] However, it is possible in principle (even if connected with a high level of complexity) to copy such keys as long as only the grooves are constructed to be considerably larger (wider and deeper). According to EP 1362153 B there is provision for other grooves to be provided in the immediate vicinity so that, in case of to an excessively generous operation for milling removal, the key loses its stability, that is to say, the copying service cannot simply mill such a large groove that this

groove of the copied key surrounds the groove and branch groove of the original key. However, the copying service can arrange the groove and branch groove in a slightly enlarged manner without the key losing its stability or its locking ability.

[0009] From AT 500638 B, it is known to provide in the lock a scanning pin which determines in the case of the undercut groove whether it is actually undercut or whether it has simply been replaced by a correspondingly wider V-like groove. In this scanning pin, it was disadvantageous that it operated in only one direction. That is to say, if the lock was incorrectly installed, then it would be possible to open it with an illegally copied key, but not to lock it again afterwards. Even in the case of correct assembly, however, it was problematic if the illegally copied key was used by authorised persons; they could lock themselves in and were unable to open the room or dwelling again afterwards.

[0010] Furthermore, the gain in terms of security was also low since only the presence of the undercut was scanned, but not the precise construction of the groove and branching groove.

Statement of invention

[0011] An object of the present invention is to provide a flat key with which copying is even more difficult than with the keys according to EP 1362153 B or AT 500638 B.

[0012] According to the invention, this is achieved in that both of the two overlapping grooves are undercut in

opposing directions, and in that, in at least one groove, the centre of the groove base - when viewed in the direction perpendicular relative to the longitudinal centre plane of the key - is covered by these undercut portions and in that, in at least one groove, the transition from the groove flank to the groove base - when viewed in the direction perpendicular relative to the longitudinal centre plane of the key - is also covered by the undercut portion.

[0013] The notion behind this is as follows: if the groove base is at least partially covered, it is particularly difficult to establish the precise data of the groove (depth, width, angle, position). The edge which is produced by the intersection of the two grooves can be scanned in the lock. However, this edge cannot be produced directly by the key service, but instead is produced by the intersection of the two grooves. When the data of at least one groove cannot be determined in a precise manner, this edge is not located at the provided location and the key does not lock.

[0014] Owing to this edge which can be scanned, it is not possible to simply arrange a trapezoidal groove which surrounds both grooves of the original key during a copying milling operation. Owing to the scanning of the edge in the lock, it is absolutely necessary for both grooves to be constructed correctly so that the key locks.

[0015] It is particularly advantageous for the two undercut angles to be different. In this instance, a subsequent milling operation with a trapezoidal milling cutter also brings about another construction of at least one groove flank. Furthermore, from the angle of one groove, it is not

thereby possible to draw conclusions relating to the angle of the other groove, which would facilitate the measurement of the original key.

[0016] With regard to a guarantee that the embodiment according to the invention is in any case, even in locking installations, always present for security reasons (that is to say, with all keys, even with the most minor keys), it is advantageous for the two grooves to be provided as guiding profile elements. The guiding profile is constructed within a locking installation for each key so that the desired security is consequently provided in any case.

[0017] It is advantageous for at least one of the two grooves to overlap with a guiding profile groove at the opposing side of the flat key. This is known to make the introduction of lock picking tools more difficult.

[0018] Finally, it is advantageous when at least one trough-like groove is provided between the overlapping grooves and the key bit, the groove flank of the trough-like groove defining an angle α less than 90° , preferably between 30° and 45° , with the centre plane of the flat key and the other lateral flank of the trough-like groove defining an angle β between 93° and 97° with the centre plane of the flat key. Owing to the features known from AT 500638 B, sharp edges are prevented on the key.

[0019] A locking cylinder for a flat key of the type described above is provided with a cylinder housing and at least one cylinder core which is rotatably arranged in a hole of the cylinder housing and which has a profiled key

channel, and with retention pins which are divided into core and housing pins and which are resiliently loaded in holes of the cylinder housing and the cylinder core against the end face of the key bit in the direction towards the back of the key. The construction of the key channel is inverted to the key: the profiling of the key channel has two ribs which diverge in a V-shaped manner and which extend from a common root at a key channel flank and each have acute external angles with respect to the key channel flank and which complement the two overlapping grooves of the flat key. According to the invention, there is further provided in at least one cylinder core a scanning element which scans the edge which is produced by the intersection of the two grooves of the flat key and which may also be constructed as a flattened portion and which blocks the locking cylinder when the edge or flattened portion is excessively low.

[0020] Consequently, a key locks neither when the edge is excessively high, nor when the edge is excessively low; if the edge is too high, the key does not fit into the key channel; if it is too low, the lock is blocked by the scanning element.

[0021] There is preferably further provided a scanning element which scans for the presence of the undercut portion of a groove and, when the undercut portion is missing, blocks the locking cylinder. Consequently, an undercut groove is prevented from being replaced by a correspondingly larger, V-shaped groove.

[0022] The respective scanning elements can be displaced in a substantially radial manner within the cylinder core or

can also be rotated and abut the shoulder of the undercut portion of the key groove or the edge or flattened portion between the grooves which diverge in a V-shaped manner in the key. When the key is correct, a region of the scanning element is located in such a position that it fills the recess in the cylinder core at the covering face and a housing pin can slide thereover via the filled recess during the locking operation. An incorrect key either does not fit at all in the key channel or the housing pin, in the plane in which the scanning element is located, snaps into the recess in the cylinder core that is then open so that it cannot be rotated further (but can certainly be rotated back).

Brief description of the drawings

[0023] Embodiments relating to the subject-matter of the invention are illustrated in the drawings, in which: Figure 1 shows a key from the side; Figure 2 shows the contour of a section along the line II-II in Figure 1 with a first profile according to the invention; Figure 3 shows the contour of a section similar to Figure 2 having another profile according to the invention; Figure 4 shows a cylinder core having an inserted key according to Figures 1 and 2; and Figures 5 and 6 show sections along the planes V and VI in Figure 4, respectively.

Embodiment(s) of the invention

[0024] A key 1 (flat key) of a locking installation has in cross-section a profile, in particular a guiding profile, having grooves 2, 3. A guiding profile performs the function of positioning the key in the key channel. The two

grooves 2, 3 overlap (cover) each other. The insertion direction X for producing the groove 2 and the insertion direction X_1 for producing the groove 3 are different. Consequently, it is not possible to draw from one insertion direction a conclusion regarding the other insertion direction, which would facilitate a measurement of the key.

[0025] It is significant in this instance that the grooves 2, 3 are undercut, in opposing directions. (That is to say, when the angles X and X_1 between the insertion direction and the longitudinal centre plane of the key are drawn in such a manner that they are less than 90° , the angle X is then measured in the direction towards the key back, whereas the angle X_1 is measured in the direction towards the key bit.) The centre 4 of the groove 2 (and consequently the depth thereof) cannot thereby be determined by means of scanning in a direction perpendicular to the longitudinal centre plane 6 of the key, which makes it significantly more difficult to determine the precise data of the groove 2 (that is to say, width, depth, position and angle X). In this instance, not even the transition region 4' from the flank to the groove base can be detected.

[0026] Owing to the imprecision which is produced thereby, during a subsequent measurement it is almost impossible that with a copy of the key, the edge 5 which is produced by the intersection of the two grooves 2, 3 and cannot be milled directly, has the correct spacing d from the flank 7 of the key 1.

[0027] In Figure 2, trough-like grooves 40 and 41 are illustrated with broken lines between the overlapping

grooves 2, 3 and the toothed key bit. These grooves form part of a variation profile which is produced by leaving or removing individual grooves in the system or illustrated grid of all these trough-like grooves 40, 41 which can overlap optionally. Owing to the angle formation of the groove flanks already mentioned, a surface structure without disruptive sharp edges can be achieved. Figure 2 further shows the guiding profile groove 42, whose groove base overlaps with the groove base of the groove 2 so that the key channel, with a conforming complementary construction, prevents the insertion of a plate for scanning purposes. In this instance, this overlapping means exceeding a tangential plane which is parallel with the longitudinal centre plane 6 on a groove 2 with another opposing groove 42.

[0028] Figure 3 shows a key 1' which in addition to the grooves 2 and 3 also has grooves 2' and 3', which have similar geometric properties to the grooves 2 and 3. The edge is flattened within the grooves 2' and 3' to form an abutment face 5'.

[0029] In Figure 4, the corresponding cylinder core 9 is illustrated with a key 1 according to Figures 1 and 2 or 3, resp. The significant aspects in this instance are the two scanning elements 11 and 12 which can be seen more clearly in Figures 5 and 6.

[0030] The two scanning elements 11 and 12 are guided in a corresponding recess of the cylinder core 9 in such a manner that, although they can be displaced perpendicularly with respect to the longitudinal centre plane of the key 1, they cannot tilt significantly. With both scanning elements

11 and 12, one end is free (the lower end, as seen in Figures 5 and 6) and the other end is in abutment against the key 1; the scanning element 11 abuts the edge 5 (support face 5') and the scanning element 12 abuts the undercut portion 8. In the region of these scanning elements 11 and 12, there are milled externally on the cylinder core recesses 21, 22, 31, 32 which become slowly deeper from the outer sides of the scanning elements 11, 12 and terminate in the central region of the scanning elements 11, 12 in a step 21', 22', 31', 32'. These recesses are located in parallel cross-sectional planes, in which pin retention members are provided in the cylinder housing.

[0031] If the cylinder core is rotated so far that the housing pins reach the region of these recesses, then they slide with the correct key on the scanning elements 11 or 12 beyond the respective step 21', 22', 31' and 32'. When the key is not correct, that is to say, when the edge 5 or the support face 5' is too deep or the undercut portion 8 is not present, the scanning elements 11, 12 release the recesses. The springs of the housing pins press the housing pins into the respective recess 21, 22, 31 or 32 so that the housing pins are in abutment with the respective step 21', 22', 31' or 32' and the cylinder core 9 can no longer be rotated. However, since the recesses become shallower in the opposite direction, the cylinder core 9 can be rotated back and the key which does not fit can be removed. This functions in both directions, that is to say, even with dual locking cylinders which are installed in a transposed manner.

[0032] A particular advantage of this type of scanning is that the cylinder housing does not have to be changed, all the necessary features can be produced on the cylinder core 9.

[0033] If the grooves 2, 3 in a key copy are constructed to be excessively weak, that is to say, too narrow or not deep enough, then the key cannot be introduced at all into the key channel owing to collision with the corresponding ribs in the key channel of the cylinder core 9.

[0034] It should be noted that it is not necessary in practice to carry out the additional scanning with the scanning elements 11 and 12 with all locks of a locking installation since the key service cannot know whether these are provided or not. A key service operator does not copy keys when he does not know whether the key locks or not. A replacement key which is nonetheless produced could perhaps lock one door or the other in installations, but not main entrances, for example. Consequently, such a "copy" is useless.

Patent Claims

1. Flat key (1, 1') for a locking cylinder, in particular of locking installations, having substantially planar and approximately parallel flat key sides, a key back and a key bit which is opposite the back and which is toothed on the end face for positioning retention pins which are divided into core and housing pins and which are resiliently loaded in corresponding key channels of cylinder cores against the end face of the key bit in the direction towards the key back, grooves which are cut in the flat sides of the flat key being provided as variation profile elements and as guiding profile elements, at least two grooves (2, 3) of a side of the flat key overlapping, the insertion direction (X, X₁) of which is different so that the intersection of the two grooves (2, 3) produces an edge (5) which can be scanned in the direction perpendicular with respect to the longitudinal centre plane (6) of the flat key (1), both of the two overlapping grooves (2, 3) further being undercut in opposing directions, and in at least one groove (2), the centre (4) of the groove base - when viewed in the direction perpendicular relative to the longitudinal centre plane (6) of the key - being covered by these undercut portions (8), characterised in that, in at least one groove (2), the transition (4') from the groove flank to the groove base - when viewed in the direction perpendicular relative to the longitudinal centre plane of the key (1, 1') - is also covered by the undercut portion (8).

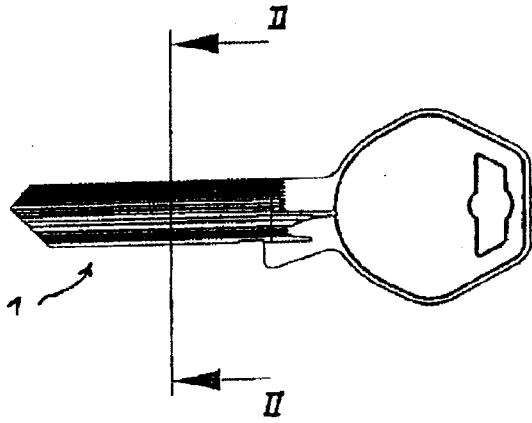
2. Flat key according to claim 1, characterised in that the two undercut angles (X , X_1) are of different sizes.
3. Flat key (1) according to any one of claims 1 to 2, characterised in that the two grooves (2, 3) are provided as guiding profile elements.
4. Flat key according to claim 3, characterised in that at least one of the two grooves (2, 3) overlaps with a guiding profile groove (42) at the opposing side of the flat key (1, 1').
5. Flat key according to any one of claims 1 to 4, characterised in that at least one trough-like groove (40, 41) is provided between the grooves (2, 3) and the key bit, the groove flank of the trough-like groove (40, 41) defining an angle α less than 90° , preferably between 30° and 45° , with the centre plane of the flat key (1) and the other lateral flank of the trough-like groove (40, 41) defining an angle β between 93° and 97° with the centre plane of the flat key (1).
6. Locking cylinder for a flat key according to any one of claims 1 to 5, having a cylinder housing and at least one cylinder core which is rotatably arranged in a hole of the cylinder housing and which has a profiled key channel, and having retention pins which are divided into core and housing pins and which are resiliently loaded in holes of the cylinder housing and the cylinder core against the end face of the key bit in the direction towards the back of the key,

characterised in that the profiling of the key channel has two ribs which diverge in a V-shaped manner and which extend from a common root at a key channel flank and each have acute external angles with respect to the key channel flank which complement the two overlapping grooves (2, 2, 2', 3') of the flat key (1, 1').

7. Locking cylinder according to claim 6, characterised in that there is provided in at least one cylinder core a scanning element (11) which scans the edge (5) which is produced by the intersection of the two grooves (2, 3, 2', 3') of the flat key (1, 1') and which may also be constructed as a flattened portion (5') and, when the edge (5) or flattened portion (5') is excessively low, blocks the locking cylinder.
8. Locking cylinder according to claim 6 or claim 7, characterised in that that there is provided in at least one cylinder core a scanning element (12) which scans for the presence of the undercut portion (8) of a groove (2) and, when the undercut portion (8) is missing, blocks the locking cylinder.

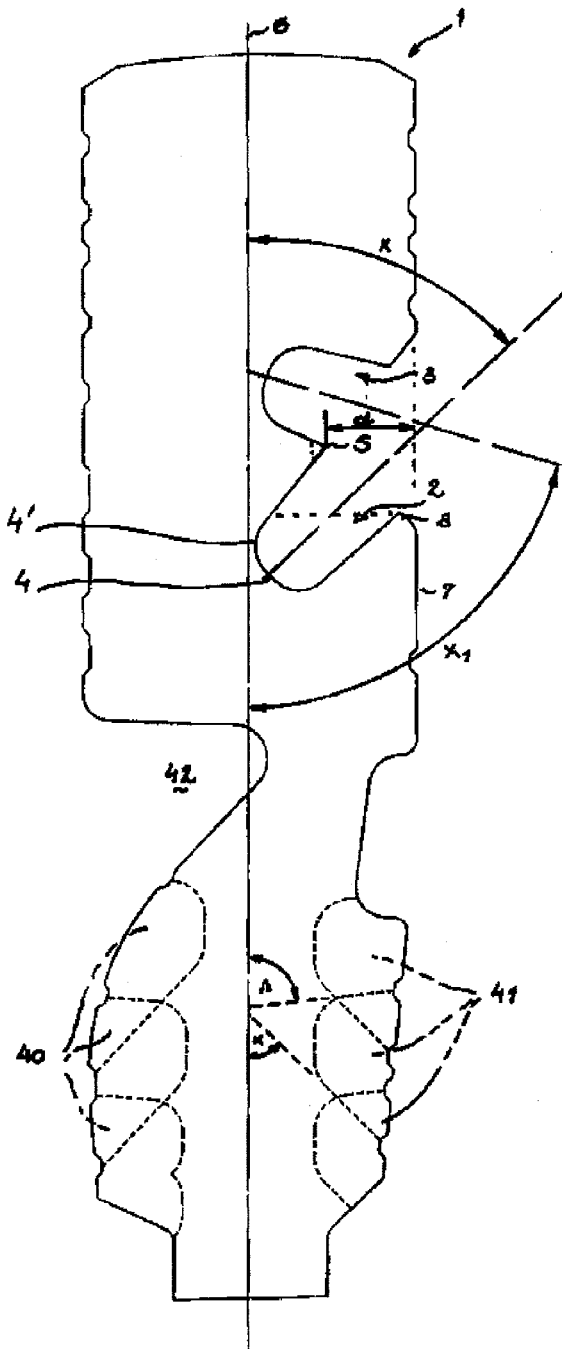
[Fig.]

Fig. 1



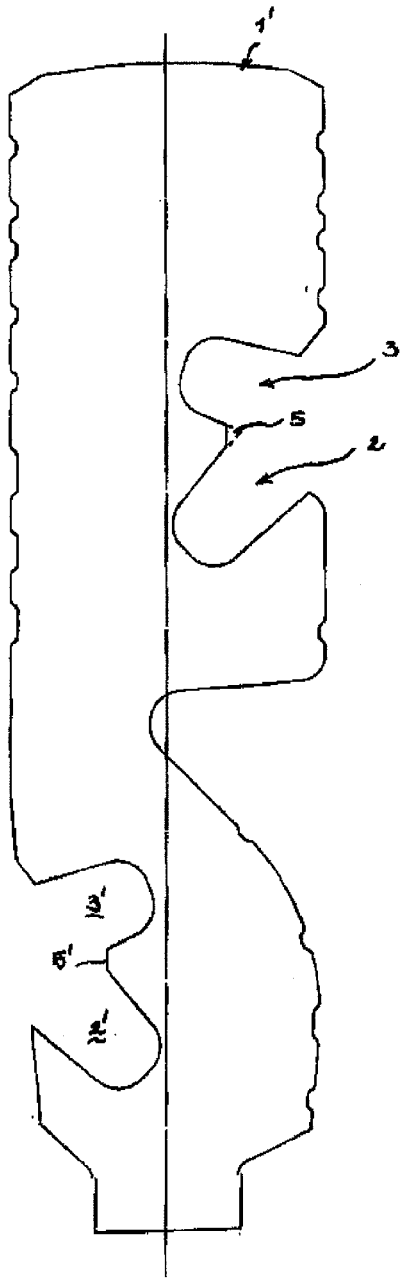
[Fig.]

Fig. 2



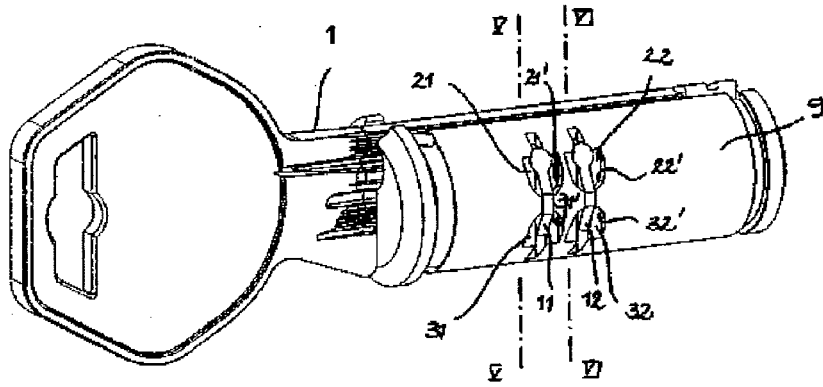
[Fig.]

Fig. 3



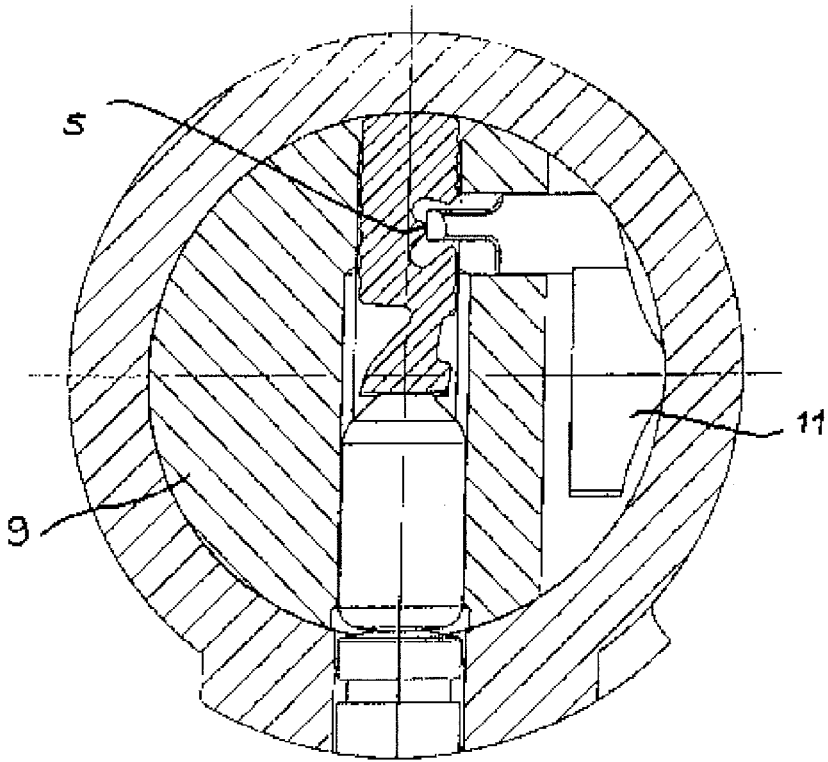
[Fig.]

Fig. 4



[Fig.]

Fig. 5



[Fig.]

Fig. 6

