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- (73) Patenthaver: **ASSA ABLOY France SAS, 106 Avenue Marx Dormoy, 92120 Montrouge, Frankrig**
- (72) Opfinder: **JULIEN, Hervé, 80 chaussée de Sellières, 10100 ROMILLY SUR SEINE, Frankrig**
GOSSIAUX, Alexandre, 13 bis route de Maison Blanche, 10800 BUCHERES, Frankrig
Robin, Hervé, 4 rue Jules Bodie, 10420 LES NOES PRES TROYES, Frankrig
- (74) Fuldmægtig i Danmark: **RWS Group, Europa House, Chiltern Park, Chiltern Hill, Chalfont St Peter, Bucks SL9 9FG, Storbritannien**
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Description

The invention relates to a lock controlled by magnets, and more particularly to a lock controlled by magnets having a cylinder with a barrel and plug that are secured in the absence of a key, and having a key with magnets for unblocking the plug. The invention also relates to the key for a lock controlled by magnets.

Document EP 1 482 108 describes a flat key with a notched profile, having a magnet for attracting a pin, which is not urged by a spring, into one of the notches of the profile.

Document EP 2 492 421 describes a flat key, at the end of which there is disposed a flat magnet able to part, in the plug, two magnets which attract one another while holding a pin in the key passage. One of the two magnets parted by the key is secured to the pin and its movement frees up the key passage. To part the two magnets of the plug, the key has only one insertion direction.

Document EP 0 571 311 describes a flat key which bears a magnet on each of its two lateral faces. Irrespective of the direction of introduction of the key, one of the magnets is in a position to repel a magnet which is housed in the plug, and which in turn pushes back a pin, which is urged by a spring, out of the plug. The positioning of the magnets on the lateral faces of the key is difficult, taking into account their polarity which forces them to be offset.

Documents KR 2002 0050057, CN 201 972 462 U and US 3 942 345 describe locks controlled by magnets, the shank of the key containing two fixed magnets whose facing faces have the same polarity.

One of the objects of the invention is to propose a lock controlled by magnets which does not have the drawbacks mentioned.

One subject of the invention is a lock controlled by magnets, having a cylinder with a barrel and plug that are secured by means of pins in the absence of a key, and a key with magnets for unblocking the plug, wherein the key bears, in its shank, a set of two magnets that are aligned with the same axis perpendicular to the axis of the shank of the key, the facing faces of the two magnets having the same polarity, wherein, in a first housing having an axis perpendicular to the axis of the plug, the cylinder has a means for blocking the plug in the absence of a key, said blocking means being movable, upon the introduction of the key, by the magnets of the key shank, wherein the axis of the plug and the axis of the first housing of the cylinder define a first reference plane, the axis of the key shank and the axis of the magnets of the key shank define a second reference plane, and the two reference planes coincide after the key has been introduced into the cylinder, wherein the key shank is round and the coincidence of the reference planes of the cylinder and of the key shank is ensured by means of a fixed pin of the plug, characterized in that the key shank has a guide profile in the form of a wave in order, during the progression of the key shank in the cylinder, by sliding of the guide profile along the fixed pin of the plug, to make the reference planes of the cylinder and of the key shank coincide.

Preferably, the key shank has at least one indentation for receiving at least one pin of the cylinder ensuring that, after introduction of the key shank into the cylinder, the key shank and the plug are secured in order to allow the plug to be manipulated by means of the key.

According to one embodiment, the key shank has a housing in which a capsule containing the magnets is inserted.

Advantageously, along the axis of the first housing, the cylinder has a second housing containing a pin which is urged by a spring and which releases the plug when it is opposite the capsule containing the magnets.

According to one embodiment, the capsule has an annular groove receiving a fixed pin.

5 According to one embodiment, the capsule has a lateral indentation ensuring a relative displacement with respect to a fixed pin.

Preferably, the capsule has oblique faces on either side of its indentation.

10

Advantageously, with the lower edge of its indentation bearing against the fixed pin, the capsule ensures the position of the lower pin in the plug and the position of the upper magnet in the barrel, thus allowing the rotation of the plug.

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Preferably, the plug has, at its end, a polygonal housing, and the key shank has a polygonal end able to be inserted in the polygonal housing of the plug irrespective of the direction of introduction of the key shank into the cylinder.

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Preferably, the means for blocking the plug in the absence of a key is a magnet, the face of which facing the axis of the plug has the same polarity as the outer faces of the magnets of the key shank.

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Advantageously, the first housing has a vertical axis, and the magnet in said housing is subjected only to gravity and is repelled by the magnets of the key shank.

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According to one embodiment, the first housing has an axis with an orientation that differs from the vertical, and the magnet in said housing is urged by a spring.

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According to one embodiment, the means for blocking the plug in the absence of a key is a ferromagnetic pin which is urged by a spring and which is attracted, counter to the action of the spring, by the magnets of the key shank.

Another subject of the invention is a key for a lock controlled by magnets, having a key shank that has an axis and a reference plane, characterized in that it has a housing having an axis comprised in the reference plane and perpendicular to the axis
5 of the key shank, and, in the housing, a capsule containing two magnets that are aligned with the axis of the housing, the facing faces of the two magnets having the same polarity.

According to one embodiment, the capsule is movable in
10 translation in the housing.

According to one embodiment, the key is reversible.

According to one embodiment, the key shank is flat.
15

According to one embodiment, the key shank is round and has a guide profile that is symmetrical with respect to its reference plane.

20 **Brief description of the drawings**

The invention is described below with reference to the attached drawings, in which:

25 [Fig. 1] is a partial perspective view of a key according to a first embodiment of the invention;

[Fig. 2] is a partial perspective view of a key according to a second embodiment of the invention;

30 [Fig. 3] is a perspective view in partial cross section of the set of magnets borne by the key;

[Fig. 4] is a view in partial cross section of the key shank in
35 a plane comprising the axis of the key shank and the axis of the magnets;

[Fig. 5] is a perspective view of the cylinder of the lock according to the invention, sectioned along the plane comprising the axis of the cylinder and the axis of the magnets housed in the cylinder;

5

[Fig. 6] is a view similar to Figure 5, with the key in position in the plug;

[Fig. 7] is an end view of the cylinder, with the reversible key in one of its two possible positions;

10

[Fig. 8] is a view similar to Figure 7 in the other position of the key;

[Fig. 9] is a partial perspective view of the plug on the key entry side;

15

[Fig. 10] is a view in partial cross section of the plug with the round key in position after guidance by the pin;

20

[Fig. 11] is a view in vertical cross section of an exemplary embodiment of the set of magnets borne by the key, after introduction of the key into the lock.

25 **Description of embodiment(s)**

Figure 1 depicts a key shank 1 of rectangular cross section having, in the vicinity of its end, a housing 2 receiving magnets 3, 4. The magnets 3, 4 are housed in a non-magnetic capsule 5 made of plastics material, for example, which has an annular groove 7 in the gap between the magnets 3 and 4 (**Figure 3**). The magnets 3, 4 preferably have the same geometrical axis. They are cylindrical, by way of example, but may have any other form.

30

The facing faces of the magnets 3, 4 have the same polarity, for example south (S).

35

The other faces of the magnets 3, 4, or outer faces, also have the same polarity, for example north (N).

In the key shank 1, the housing 2 is a cylindrical passage in which the capsule 5 containing the two magnets 3, 4 is inserted. To hold the capsule 5 in the housing 2, a pin 6 is introduced into a passage 8 having an axis perpendicular to the axis of the housing 2, and offset with respect to the axis of the housing 2, such that the pin 6 cooperates with the annular groove 7 to hold the capsule 5 in the shank 1 of the key. This holding action is considered to be a retaining action, and not to be a blocking action blocking the capsule 5 in the housing 2 (**Figure 4**), the assembly made up of the capsule 5 and the two magnets 3, 4 being provided with a certain degree of mobility in the housing 2 (**Figure 11**).

Figure 2 depicts a round key shank 11 having, in the vicinity of its end, a cylindrical housing 2, having an axis perpendicular to the axis of the key shank 11, able to receive a capsule 5 containing two magnets 3, 4, their facing faces having the same polarity, S for example. The capsule 5 is retained in the housing 2 by means of a pin 6 inserted in the passage 8 having an axis perpendicular to the axis of the housing 2, and offset with respect to the axis of the housing 2, the pin 6 cooperating with the annular groove 7 of the capsule 5.

The axis of the key shank 11 and the axis of the housing 2 define a reference plane for the key. The magnets 3, 4 are aligned with the axis of the housing 2. This reference plane is a plane of symmetry for the key shank with the exception of the end 9 of the key shank, said end having a polygonal shape in the exemplary embodiment of **Figure 2**.

The round key shank 11 has to have a well-defined position in the plug at the end of the introduction operation in order to be able to perform its role of entraining the plug. However, the round key shank 11 may be introduced into the plug with any orientation. To ensure the correct positioning for operation of

the key, the plug 10 bears a fixed pin 12 for orientation of the round key shank 11 (**Figures 9, 10**). For its part, the key shank 11 has a guide profile 13, 14 in the form of a wave that is disposed symmetrically with respect to the reference plane of the key shank 11.

This guide profile is also symmetrical with respect to the plane perpendicular to the reference plane of the key shank 11. Thus, irrespective of the orientation of the key during its introduction into the lock, as soon as the guide profile 13, 14 touches the orientation pin 12, the sliding of the guide profile along the orientation pin rotates the key such that the key is in the correct operating position at the end of the introduction path. Since the guide profile is symmetrical with respect to two perpendicular planes, the rotation of the key is at most a quarter turn, and the key is reversible. The key does not have a forced orientation upon introduction into the plug of the lock.

The plug 10 is housed in a barrel or dummy barrel 15, to which it is secured in the absence of a key (**Figure 5**). In the vicinity of its inner end, and along an axis perpendicular to the longitudinal axis of the plug, there are disposed, in the upper portion, a magnet 16 in a first housing 18, and, in the lower portion, a pin 17 in a second housing 19. The upper magnet 16 is situated in the first housing 18 that is common to the barrel 15 and to the plug 10. This first housing 18 does not lead into the central space of the plug 10. Accordingly, the upper magnet 16 rests on the bottom of the first housing 18 by gravity. In this rest position, the upper magnet 16 fills that portion of the first housing 18 which is situated in the plug 10 and partially fills that portion of the first housing 18 which is situated in the barrel 15. In this rest position, the upper magnet 16 prevents any rotation of the plug 10 with respect to the barrel 15.

According to one embodiment variant, the magnet 16 is not subjected only to gravity, but is urged by a spring towards the bottom of the housing 18.

This embodiment variant makes it possible to dispose the housing 18 with an axis with an orientation that differs from the vertical.

5

The lower pin 17 is situated in a second housing 19 that is common to the barrel 15 and to the plug 10. This second housing 19 leads into the central space of the plug 10, along the axis of the first housing 18.

10

Located in the second housing 19 is a conventional stack comprising a spring 20, which is covered by a cylindrical sleeve playing the part of a barrel pin 21, and the pin 17 serving as a plug pin. When the key is introduced into the plug 10, it pushes the lower pin 17 back. When the key is in the correct position, the capsule 5 containing the two magnets 3 and 4 is opposite the pin 17, the tip of which comes into contact with one of the magnets 3, 4. The entire pin 17 is then in the plug and the entire barrel pin 21 is then in the barrel, and the plug can rotate.

20

According to the embodiment of **Figure 11**, the capsule 5 containing the two magnets 3 and 4 is provided not with an annular groove 7, but with a lateral indentation 27 of a certain height, ensuring a relative displacement thereof with respect to the fixed pin 6. The capsule 5 is movable in translation along the axis of the housing 2. Thus, as long as the key is not in the lock, the capsule 5 protrudes from its housing 2, the upper edge of its indentation 27 bearing against the fixed pin 6. In order for the key to be able to be introduced without difficulty into the lock, the capsule 5 has oblique faces 28 on either side of its indentation 27, ensuring its retraction into the key shank.

25

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When the key reaches its final position corresponding to **Figure 11**, the capsule is placed on the lower pin 17 which urges said capsule upwards under the action of its spring 20. In order to allow the capsule 5 to protrude above the key shank, the plug

35

10 is provided with a recess under the housing 18 of the upper magnet 16.

5 The lower pin 17 pushes the capsule 5 back until the lower edge of the indentation 27 bears against the fixed pin 6. The magnet 3 is then close enough to the upper magnet 16 to repel it, possibly by compressing its spring. In this position bearing against the fixed pin 6, the capsule 5 performs two functions. On the one hand, it holds the lower pin 17 entirely in the plug 10, and, on the other hand, it holds the upper magnet 16 entirely in the barrel 15. It thus controls two security points for allowing the rotation of the plug.

15 Near its access opening (**Figure 5**), the plug 10 has a third housing 25 receiving a pin 22 for securing the plug 10 and the key shank 1 or 11. This pin 22 is urged by a spring 24 and protrudes into the central space of the plug 10. The spring 24, like the spring 20 of the lower pin 17, is covered by a cylindrical sleeve constituting a barrel pin, which blocks the plug 10 with respect to the barrel 15 in the absence of a key. 20 The key shank 1 or 11 has two symmetrical indentations 23, which are each able to receive the pin 22 in a position that allows the rotation of the plug 10 in the barrel 15, and that secures the key and the plug in order to perform this rotation (**Figure 6**). 25

Preferably, between the third housing 25 of the pin 22 and the first housing 18 of the magnet 16, the plug 10 has a plurality of housings that each receive one pin, and the key shank has an equal number of indentations for receiving the tips of the pins. 30

At its lower end (**Figure 5**), the plug 10 has a polygonal, for example hexagonal, housing 26 able to receive the polygonal end 9 of a round key, for example (**Figure 7**). Since the key is reversible, the polygonal housing 26 also receives the polygonal end 9 of the key in its reversed position (**Figure 8**). 35

Operation of the lock is permitted when the key is in position, and when the magnets and pins are also in position, for release of the plug. According to the invention, the two magnets 3 and 4 of the key are mounted on the same geometrical axis, with their facing faces having the same polarity (S for example) and their outer faces having the other polarity (N for example). In the vicinity of the inner end of the plug 10, the face of the upper magnet 16 facing the key shank has the same polarity as the outer faces of the magnets of the plug (N for example).

10

Thus, when the key shank penetrates the plug, the upper magnet 16 of the cylinder is repelled by one of the magnets 3, 4 of the plug, and the plug 10 is disengaged from the barrel 15.

15 In the absence of a key introduced into the plug, or in the presence of a key not provided with the magnetic function described, or of a key provided with a magnetic function that is not correctly polarized, or with an inadequate air gap, the upper magnet 16 is not positioned so as to allow free rotation of the plug, and the cylinder remains locked.

20

To the extent that the plane defined by the axis of the plug 10 and the axis of the upper magnet 16 and of the lower pin 17, or first reference plane, is vertical, the upper magnet 16 may be free in its housing 18 and be subjected merely to gravity.

25

According to another embodiment of the invention, the first housing 18 receives a means for blocking the plug in the absence of a key, said blocking means being, instead of a magnet such as 16, a ferromagnetic pin which is urged by a spring towards the barrel. When the key is introduced, the magnets 3, 4 come opposite the ferromagnetic pin and attract it, by compressing its spring, into a release position of the plug.

30

35 The pin 12 for orientation of the round key will ensure the correct positioning of the key by making the second reference plane, which is defined by the axis of the key shank and the

axis of the magnets of the key, coincide with the first reference plane of the plug.

5 The introduction of the key into the lock is controlled by the coincidence between the indentation 23 of the key shank and the pin 22 for securing the plug to the key.

10 The matching of the profile between the indentation 23 and the pin 22 ensures that the pin 22 is satisfactorily positioned and frees up the shear line between the plug and the barrel, allowing the rotation of the plug. This matching also ensures the mechanical connection between the key and the plug for the rotation of the plug. This matching applies to all of the plug pins and all of the corresponding indentations of the key shank
15 which are provided between the housings 25 and 18.

Patentkrav

1. Lås styret af magneter, der indbefatter en cylinder med stator og rotor, der er fastgjort ved hjælp af stifter i mangel af en nøgle, og en nøgle med magneter til oplåsning af rotoren, hvor nøglen i sit skaft (1, 11) bærer en sæt af to magneter (3, 4), der er rettet ind på en samme akse vinkelret på akse af nøglens skaft, hvor overfladerne af de to magneter, der vender mod hinanden, har den samme polaritet, hvor cylinderen i et første hus (18) af akse, der er vinkelret på rotorens akse (10), indbefatter et middel til at låse rotoren i mangel af en nøgle, der kan bevæges, når nøglen indføres, af magneterne (3, 4) af nøgleskaftet, hvor rotorens akse og akse af cylinderens første hus (18) definerer et første referenceplan, akse for nøgleskaftet (1, 11) og akse for magneterne (3, 4) for nøgleskaftet definerer et andet referenceplan, og efter at nøglen er indført i cylinderen, falder de to referenceplaner sammen, hvor nøgleskaftet er rundt, og sammenfaldet mellem cylinderens og nøgleskaftets referenceplaner sikres ved hjælp af en fast stift (12) af rotoren, kendetegnet ved, at nøgleskaftet indbefatter et bølgeformet styreprofil (13, 14) for at skabe sammenfaldet mellem referenceplanerne for cylinderen og nøgleskaftet under nøgleskaftets fremadskriden i cylinderen, ved at skubbe styreprofilen på rotorens faste stift (12).
2. Lås ifølge krav 1, kendetegnet ved, at nøgleskaftet indbefatter i det mindste en fordybning (23) til modtagelse af i det mindste en stift (22) på cylinderen, hvilket sikrer, efter at nøgleskaftet er indført i cylinderen, fastgørelsen af nøgleskaftet og af rotoren for at tillade manøvrering af rotoren ved hjælp af nøglen.
3. Lås ifølge et af kravene 1 og 2, kendetegnet ved, at nøgleskaftet indbefatter et hus (2), hvori en kapsel (5), der indeholder magneterne (3, 4), er indsat.
4. Lås ifølge et af kravene 1 til 3, kendetegnet ved, at cylinderen i akse af et første hus (18) indbefatter et andet

hus (19), som indeholder en stift (17), som er belastet af en fjeder (20), og sikrer frigivelse af rotoren (10), når den vender mod kapslen (5), der indeholder magneterne (3, 4).

5 5. Lås ifølge krav 3, kendetegnet ved, at kapslen (5) har en ringformet fordybning (7), som modtager den faste stift (6).

6. Lås ifølge krav 3, kendetegnet ved, at kapslen (5) har en lateral fordybning (27), der sikrer en relativ bevægelse i
10 forhold til en fast stift (6).

7. Lås ifølge krav 6, kendetegnet ved, at kapslen (5) indbefatter skrå flader (28) på hver side af sin fordybning (27).

15 8. Lås ifølge krav 6, kendetegnet ved, at med den nedre kant af dens fordybning (27), der hviler på den faste stift (6), sikrer positionen af den nedre stift (17) i rotoren (10) og positionen af den øvre magnet (16) i statoren (15), hvilket muliggør rotation af rotoren (10).

20 9. Lås ifølge et af kravene 1 til 8, kendetegnet ved, at rotoren ved dens ende indbefatter et polygonformet hus (26), og nøgleskaftet (11) indbefatter en polygonal ende (9), der kan indsættes i det polygonformede hus (26) af rotoren uanset
25 retningen for indføring af nøgleskaftet ind i cylinderen.

10. Lås ifølge krav 1, kendetegnet ved, at midlet til at låse rotoren i mangel af en nøgle er en magnet (16), hvis overflade, der vender mod rotorens akse, har den samme polaritet som de
30 udvendige overflader af magneterne (3, 4) på nøgleskaftet.

11. Lås ifølge krav 10, kendetegnet ved, at det første hus (18) har en vertikal akse, og magneten (16) i huset (18) er kun udsat for tyngdekraften og frastødes af magneterne (3, 4) af
35 nøgleskaftet.

12. Lås ifølge krav 10, kendetegnet ved, at det første hus (18) har en akse med en anden orientering end vertikalt, og magneten

(16) og huset (18) er belastet af en fjeder.

13. Lås ifølge krav 1, kendetegnet ved, at midlet til at låse rotoren i mangel af en nøgle er en ferromagnetisk stift, som er belastet af en fjeder og tiltrukket af fjederens påvirkning af magneterne (3, 4) af nøgleskaftet.

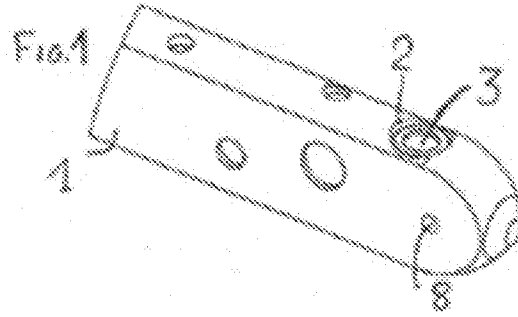
14. Nøgle til en lås, der er styret af magneter, ifølge et af kravene 1 til 13, der indbefatter et nøgleskaft (1, 11) med en akse og et referenceplan, således at det indbefatter et hus (2) med en akse, som er indeholdt i referenceplanet og vinkelret på nøgleskaftets (1, 11) akse, kendetegnet ved, at en kapsel (5) i huset (2) indeholder to magneter (3, 4), der er rettet ind efter husets (2) akse, hvor overfladerne af de to magneter (3, 4), der vender mod hinanden, har samme polaritet.

15. Nøgle ifølge krav 14, kendetegnet ved, at den er reversibel.

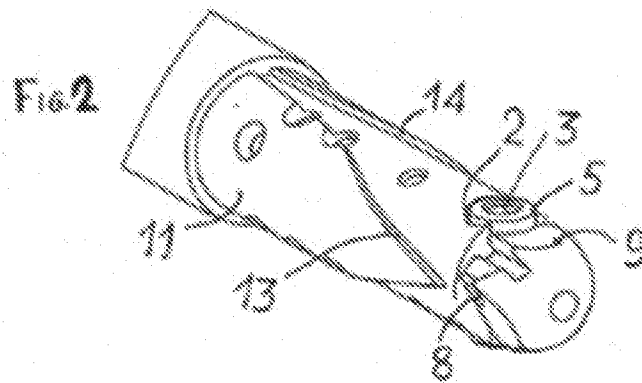
16. Nøgle ifølge krav 14, kendetegnet ved, at dens skaft (1) er fladt.

17. Nøgle ifølge krav 14, kendetegnet ved, at dens skaft (11) er rundt og indbefatter et styreprofil (13, 14), som er symmetrisk i forhold til sit referenceplan.

(Fig. 1)



(Fig. 2)



(Fig. 3)

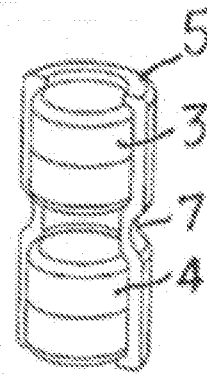
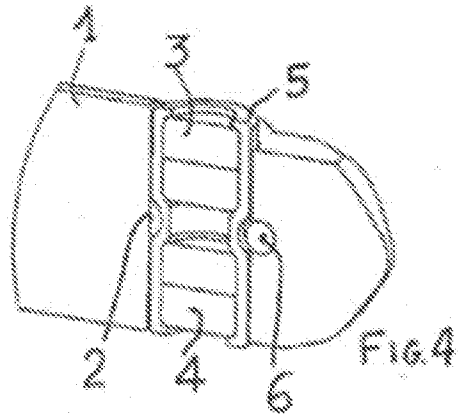
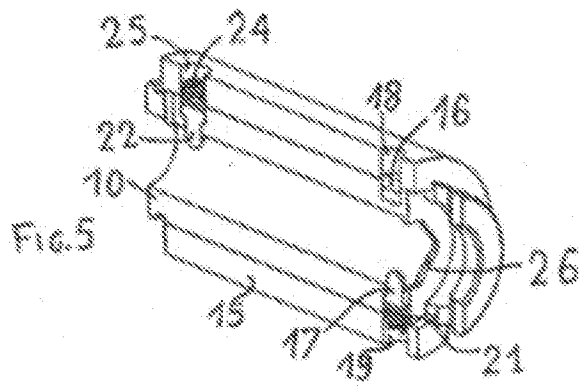


Fig. 3

[Fig. 4]



[Fig. 5]



[Fig. 6]

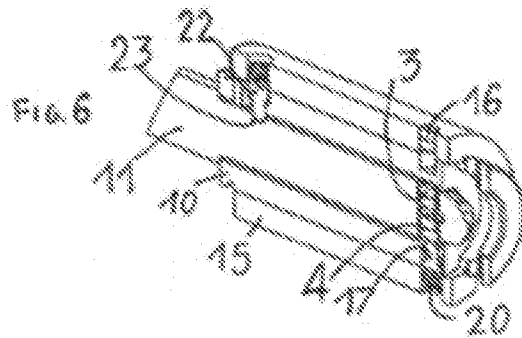


Fig. 7

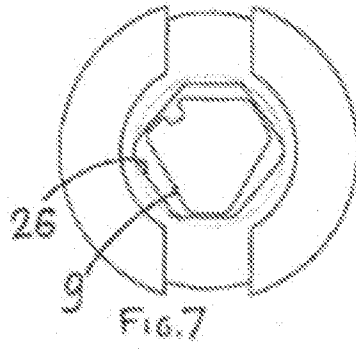


Fig. 8

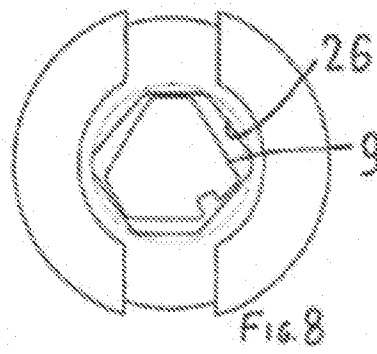


Fig. 9

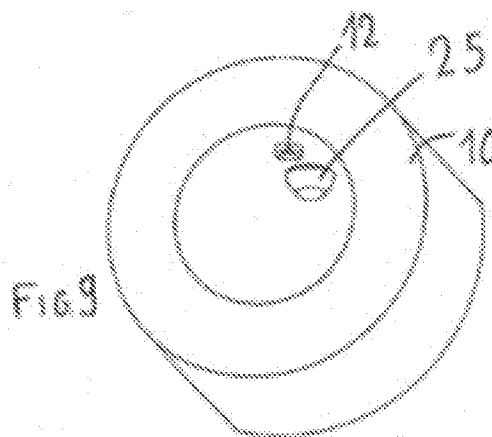


Fig. 10

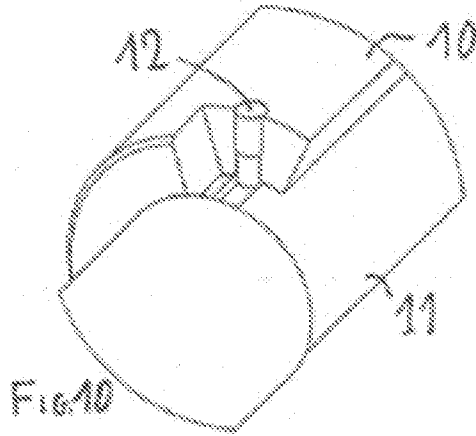


Fig. 11

