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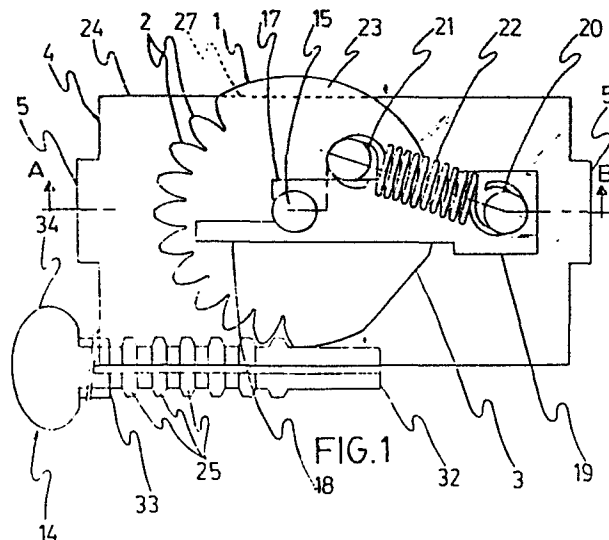
71 Applicant: **Ochoa, Sinesio Barquin**
Corazon de Maria 2
E-28002 Madrid(ES)

72 Inventor: **Ochoa, Sinesio Barquin**
Corazon de Maria 2
E-28002 Madrid(ES)

74 Representative: **Prutton, Roger et al,**
Marks & Clerk Alpha Tower Suffolk Street Queensway
Birmingham B1 1TT(GB)

54 Improvements in rack and pinion system for activating lock cylinder units.

57 A rack and pinion activated lock cylinder unit includes a plurality of discs 1 which have pinion teeth 2 for engagement by rack teeth 25 on a corresponding key 14. The discs 1 are pivotally mounted on radial plates 4 which extend radially of the lock cylinder. Each of the discs 1 has a circular peripheral portion 23 which projects beyond the radial plate 4 into a corresponding groove 28 in the lock housing 35, to prevent the cylinder turning. Insertion of the appropriate key turns the discs to a position such that flats 3 on the discs face outwardly and turning of the cylinder is permitted.



IMPROVEMENTS IN RACK AND PINION
SYSTEM FOR ACTIVATING LOCK CYLINDER UNITS

The present invention refers to improvements in a rack and pinion system for activating lock cylinder units.

This invention enables the lock cylinder unit to be retained against rotating movement by a plurality of discs oscillating about its shaft and provided with a toothed section, a segmented area of each of them being housed in openings at corresponding points of a fixed sleeve of the cylinder unit. The said discs are disposed in plates radial to the cylinder unit shaft, secured at their axial ends to circular supports.

The release position of the lock cylinder unit, so that it can rotate freely, is obtained by inserting, axially to the cylinder unit, the corresponding key provided with a plurality of racks disposed longitudinally at at least one of the faces of its polygonal profile, which racks are capable of meshing with the corresponding teeth of the discs; causing them to rotate to a maximum penetration position of the key at which segmented offsets of the discs coincide with the openings of the fixed sleeve. At this position there are no means for retaining the cylinder unit against rotation.

Each of the discs is impelled by a spring which maintains it in an angular position fixed by a butt, in order to enable insertion of the key and so that the initial tooth of each of its racks impinges correctly on the first tooth of the disc, without causing any obstruction or blocking between teeth.

The wide range of lock cylinder units and corresponding keys is achieved by varying the number of teeth of at least one of the key racks, since this has a bearing on the final position adopted by the corresponding disc, and therefore its segmented offset, enabling the cylinder unit to rotate freely, should be placed at a different position. According to the invention, and to highly increase the different combinations of lock cylinder units and keys, the pitch of at least one of the rack and pinion gears must differ from that of the rest. Further, the teeth of at least one of the key racks can be disposed in a lineally offset position from those of the rest.

According to the invention, the discs provided with a toothed area are preferably placed at both sides of the radial plates, oscillating about a common shaft which passes through them, the said discs being angularly positioned so that the first tooth, on which the key impinges, is firmly positioned by the said butt, close to the shaft of the lock cylinder unit and coinciding therefore with that of the operating key. In accordance with this arrangement of the discs, the racks of the key will be positioned in pairs, their teeth having the same or a different pitch, as well as also slightly offset, as already indicated.

The disc support plates are preferably arranged according to two perpendicular planes, so that their inner edges are close to the shaft, emerging from the discs, wherefore the key will adopt a general square section and will be provided with four longitudinal

notches constituting the guiding means for the insertion thereof, since the longitudinal edges of the said support plates slide therealong.

5 For a better understanding of the invention, a set of drawings is accompanied in which, by way of illustration and not limiting, the following is represented:

Figure 1 is an elevational view of one of the support plates of the partially toothed discs, corresponding to a position at which the lock cylinder unit is retained against rotation, and also showing the key of the actuating system of the invention.

Figure 2 is a section on line A-B of figure 1.

15 Figure 3 is a fragmentary perspective view showing the fastening of the radial support plates of the discs to end circular supports, thereby determining the solid frame of the lock cylinder unit.

Figure 4 is a cross-section of the lock cylinder unit of figure 3, including the discs and the fixed sleeve of the cylinder unit.

Figure 5 is a partial section of the operating key of the invention.

25 Figure 6 is a section on line C-D of figure 5.

Figure 7 is a perspective view of the fixed sleeve of the lock cylinder unit, illustrating the openings constituting the means for retaining the cylinder unit against rotation.

Referring to these drawings, it can be seen that the rack and pinion system for activating lock cylinder units is comprised of a plurality of discs 1 provided at a partial area of their periphery with teeth 2, each one of which has a segmented offset defining a straight line 3 at a relative position with respect to the teeth 2, some discs differing from others. The discs 1 are preferably disposed in pairs and are rotatably supported at both sides of a plurality of support plates 4 disposed radially to the shaft of the lock cylinder unit, which plates are fixed at their ends 5 to axially-holed circular supports 6. According to a preferred embodiment of the invention, there are four radial support plates 4 disposed according to two perpendicular planes, although any other arrangement having a higher or lesser number of support plates and preferably arranged in a uniform angular position could be adopted.

Referring to figure 3, the support plates 4 are fixed to the circular supports 6 provided with the axial hole 7, the assembly being secured by screws 8 passing through holes 9 of a member 10 placed in a backed relation with the outer face of the inner circular support 6, and through corresponding holes 11 of said circular supports 6, the end of said screws 8 engaging in threaded holes of another end member 12 placed in a backed relation with the outermost circular support 6 and provided with the axial hole 13 for inserting the key 14.

The assembly of elements through which the

screws 8 pass, forms a compact assembly constituting the rotary frame of the lock cylinder unit.

According to figures 1 and 2, each support plate 4 includes two discs 1 backed to their faces and oscillating about a common shaft 15 which passes through the support plate 4. The shaft 15 is retained against axial movement since its ends are provided with annular slots 16 into which the end lugs 17 and 18 of one of the ends of abutting members 19 are introduced, the opposite end of which is secured to the support plate 4 by means of a pin 20.

Each abutting member 19 therefore has the dual purpose of, on the one hand, preventing the common shaft 15, for turning two discs 1, from emerging and, on the other hand, fixing the angular position of the teeth 2 of the disc 1, when the pivot 21 emerging from the outer face of the disc 1, since it is aided by a spring 22, contacts its edge radially furthestmost from the shaft of the cylinder unit.

According to figure 1, each disc 1 has an area in the form of a circular segment 23 which emerges from the radially furthestmost longitudinal edge 24 of the support plate 4. Upon insertion of the key 14 through the opening of the end member 12 of the lock cylinder unit, the first tooth 25 of the corresponding rack 26, provided longitudinally in the key 14 and capable of meshing with the teeth 2 of the corresponding disc 1, impinges on the first tooth 2 thereof, causing an angular displacement of the disc in which, at the position corresponding to that of maximum penetration

of the key 14, the segmented offset 3 of the disc 1 occupies the position shown at 27 in figure 1, at which it is joined to the upper edge 24 of the support plate 4.

As can be seen from figures 4 and 7, as long
5 as the lock is not activated by the corresponding key, the discs 1 present a circular segment 23, emerging from its support plate 4, this circular segment 23 being housed in the corresponding housing 28 made in the direction of the generators of a sleeve 29 of the cylinder unit
10 frame, which remains fixed and therefore stationary with respect to the cylinder unit, thereby constituting the blocking means for the lock.

The housings 28 of the fixed sleeve 29 are formed of rectangular windows uniformly arranged on the
15 circular periphery of the sleeve. In the embodiment shown in the figures, they are arranged in pairs, therefore forming, between each two consecutive pairs, a small stiffening partition 30 which insures the entire stable position and a maximum resistance against a possible fraudulent action due to the rotation of the cylinder unit.
20

Referring to figure 4, the eight discs 1 are partially housed in the corresponding housings 28 of the sleeve 29, the cylinder unit therefore being re-
25 tained against rotation or being encountered at a blocking position. Figure 4 also illustrates that the free edge 24 of the support plate 4 is positioned close to the inner surface of the sleeve 29, whereas its innermost edge is very close to the lock cylinder unit.

According to figures 5 and 6 illustrating the key, it can be seen that the profile has a polygonal shape, adapted to the number of support plates 4 of the cylinder unit shaft, said profile having a like number of notches 31 defining guiding means for the insertion of the key, since the innermost edge of the support plates 4 is housed in said notches 31 (see figures 1 and 4). At the maximum insertion position of the key 14, that is when the front end 32 thereof butts against the end member 10 of the lock cylinder unit, all the segments 3 or offsets of the discs 1 are positioned according to the dotted line 27 of figure 1, prolonging from the upper edge 24 of the support plates 4, whereby the housings 28 of the sleeve 29 of the cylinder unit are free from the disc 1, thereby eliminating the blocking means for the lock cylinder unit to turn freely.

Each of the racks 26 disposed in the key 14 has a different number of teeth 25, so that, until the maximum insertion position of the key is reached, a different angular displacement will be produced in each one of the discs, or at least in some of them, wherefore the segmented offset 3 of each of the discs 1 is made at a relative position in accordance with the angular magnitude of the rotation. Apart from the different number of teeth of the racks 26 of the key 14, the pitch of the rack and pinion gear of some of the discs 1 and their respective rack 26 can also vary, and further, although all the racks have the same pitch, the teeth of some of them can be offset from the teeth

of others, enabling the number of possible combinations in the formation of the range of locks to be highly increased and preventing the same manufactured unit from being repeated.

5 Since the teeth of the racks 26 intervening in the rotation of the respective discs 1 are those positioned close to the end 32 for the insertion of the key, the said racks can depart from the same front surface 33 close to the widening 34 for securing the key, since
10 this arrangement is not related to the functioning.

 As can be seen from figure 4, the fixed sleeve 29 of the lock cylinder unit is, in turn, covered with another steel sleeve 35 which conceals the housings 25 of the former, to prevent access to the discs
15 1 as well as a fraudulent action.

 Upon extraction of the key 14, all the discs 1 recover their original position to enable the key 14 to be re-inserted by means of springs 22.

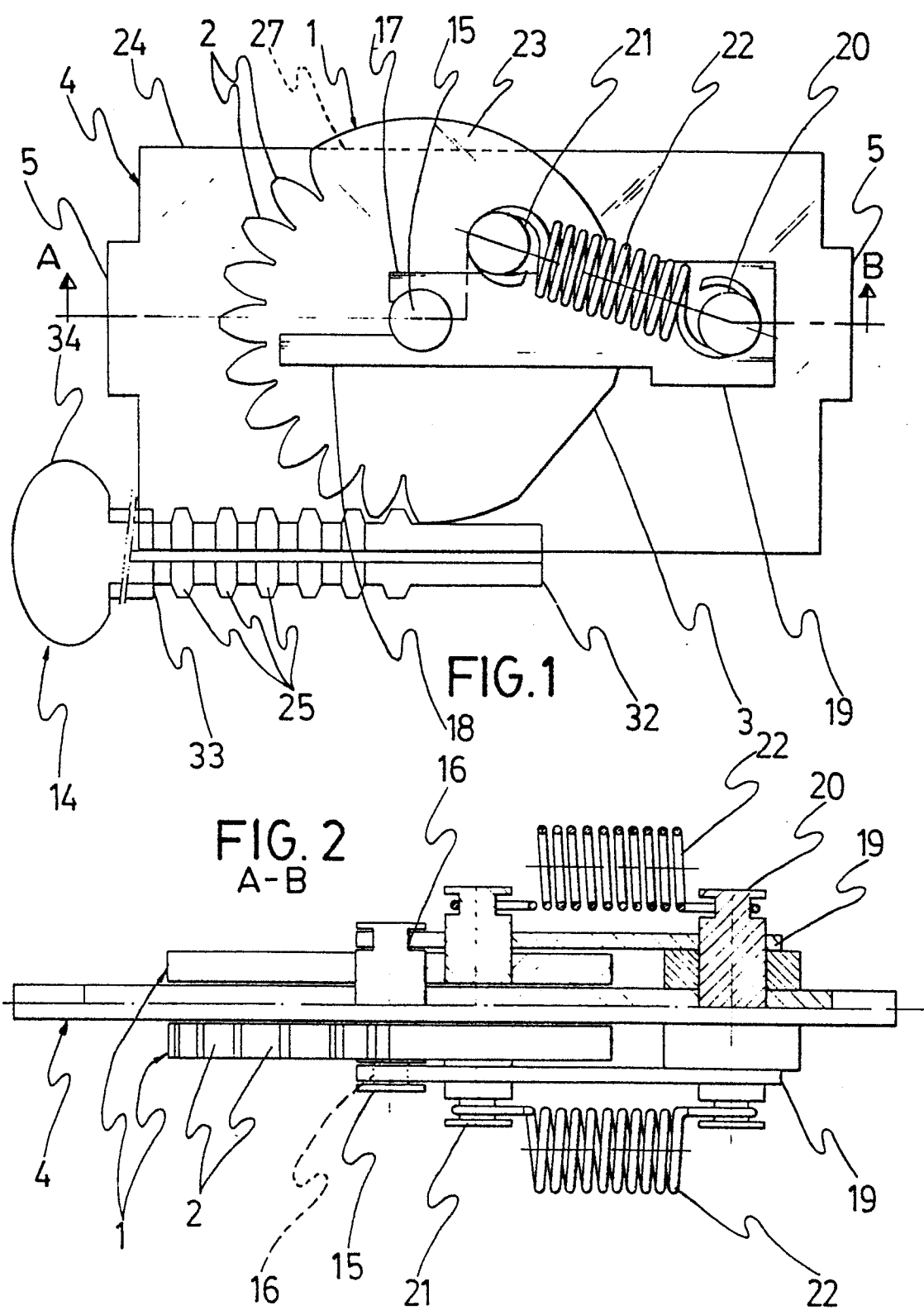
 If a key 14 differing from that corresponding to the cylinder unit, because it has a different
20 gear pitch or an offset arrangement of the racks, is inserted, the assembly will normally be blocked because of jamming, and it will not be possible to completely insert the key or to extract it thereafter, if insertion has been forced. In the case of a very simple ar-
25 rangement of racks and partially toothed discs, even though the key could be completely inserted, one area of each of the discs will always be housed in the corresponding housing of the fixed sleeve, therefore pre-

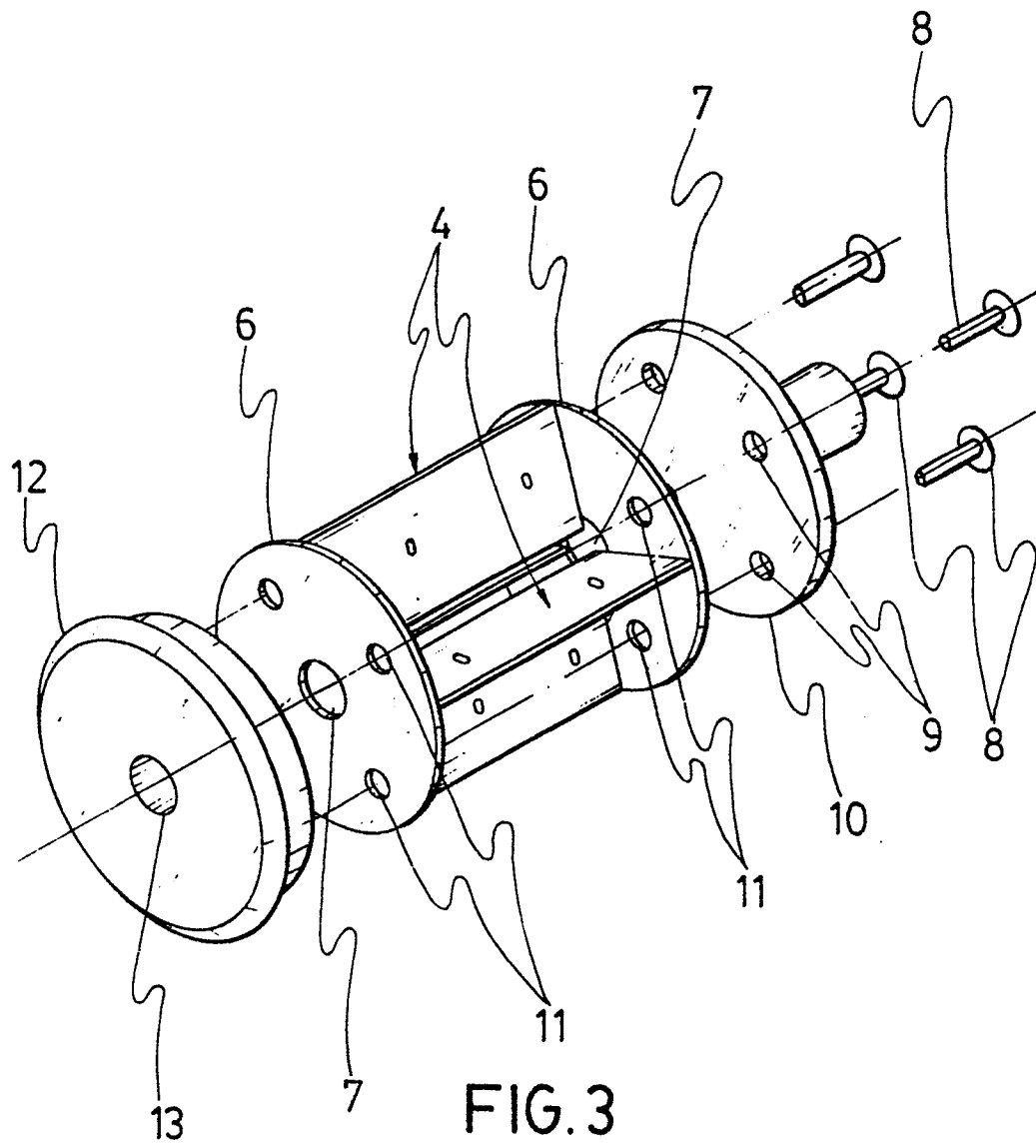
venting the cylinder unit from rotating freely, which effect is achieved only when the corresponding key is inserted and all the discs rotate in the adequate angular magnitude.

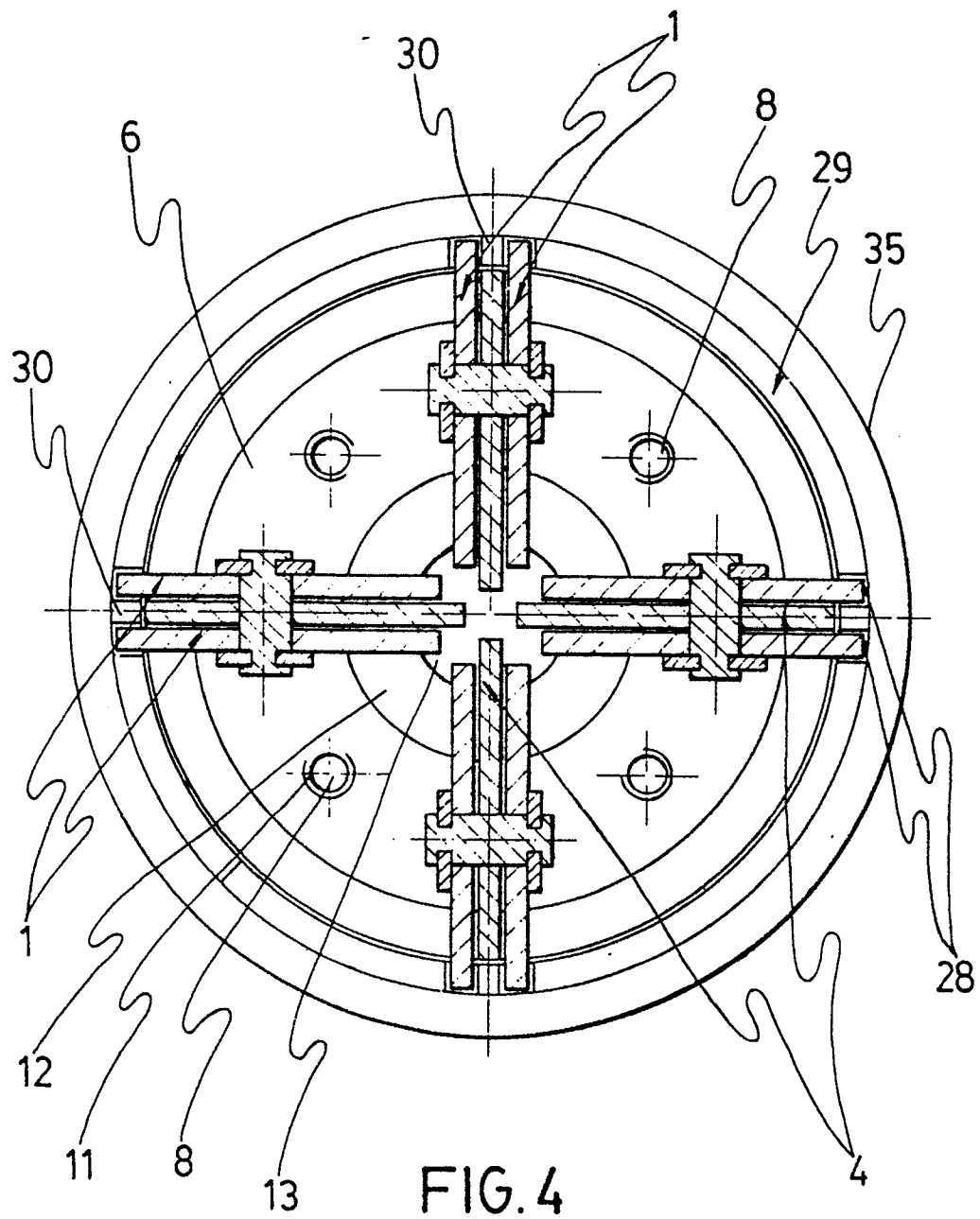
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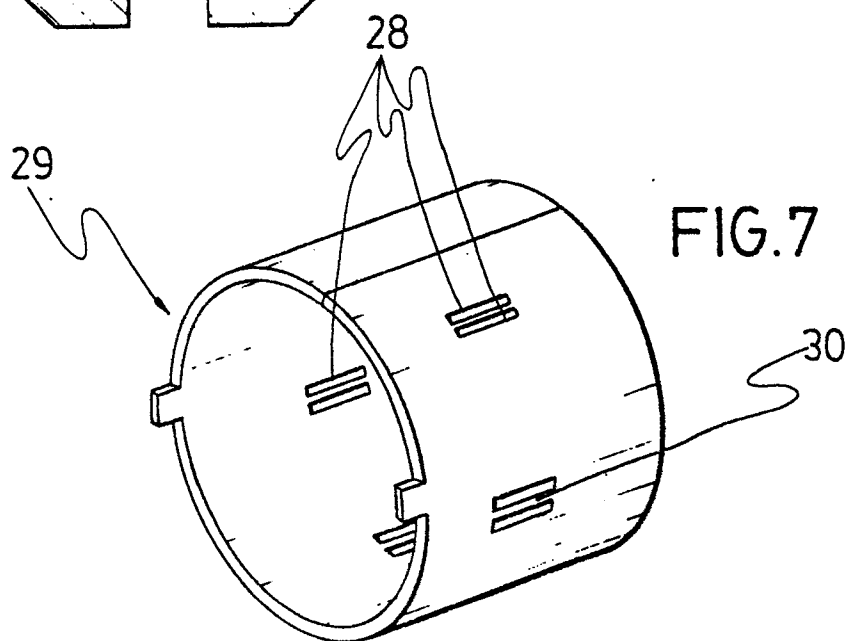
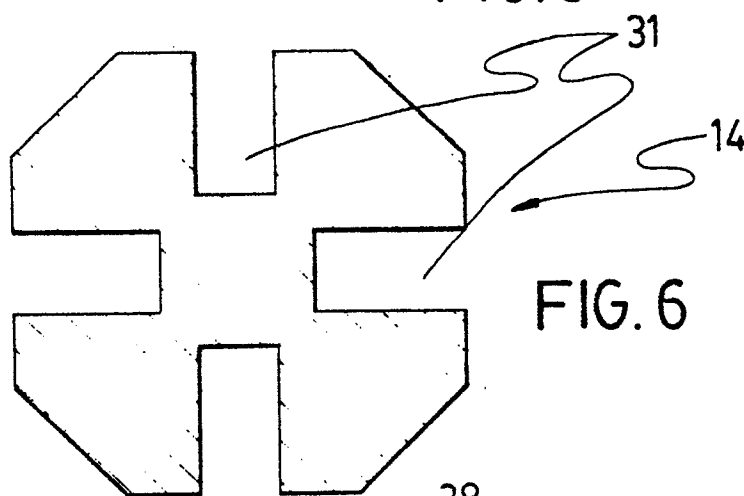
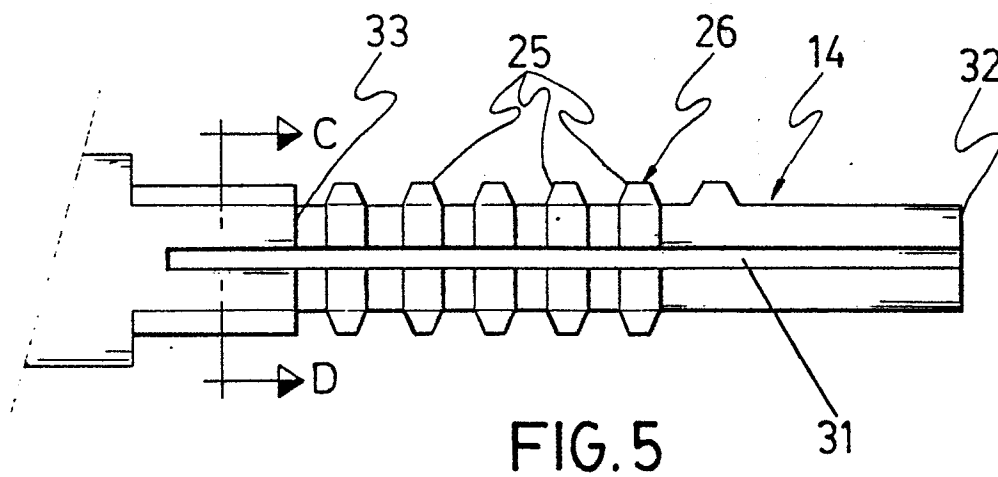
1. Improvements in rack and pinion system
for activating lock cylinder units, characterised in that
the key has a plurality of racks placed longitudinally
5 on at least one of the faces of its polygonal profile;
said racks are capable of meshing with the corresponding
teeth provided on a partial area of the periphery of
discs oscillating about a shaft fixed in respective
radial plates secured at their ends between two supports
10 perpendicular to the cylinder unit; each of the discs
being impelled by a spring which maintains it in an
angular position fixed by a butt, and a circular segment
of all the discs being housed in the corresponding groove
made in the generators of a fixed sleeve of the lock
15 assembly, preventing the cylinder unit from rotating,
until a release position, upon insertion of its key, is
reached enabling the discs to turn, at which the off-
sets thereof coincide with the openings in the fixed
sleeve.

20 2. Improvements in rack and pinion system
for activating lock cylinder units according to claim 1,
in which the number of teeth of the key racks can vary,
the teeth can be in a lineally offset position with res-
pect to those of some of the others, and the pitch of
25 at least one of the rack gears can also vary.











DOCUMENTS CONSIDERED TO BE RELEVANT			EP 86301139.1
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	DE - A1 - 2 941 703 (GEBR. GRUND-MANN G.M.B.H.) * Fig. 3-4 *	1	E 05 B 63/00
A	GB - A - 1 596 146 (FICHTE-BAUCHE) * Fig. 1-4 *	1,2	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			E 05 B
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 22-04-1986	Examiner CZASTKA
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			