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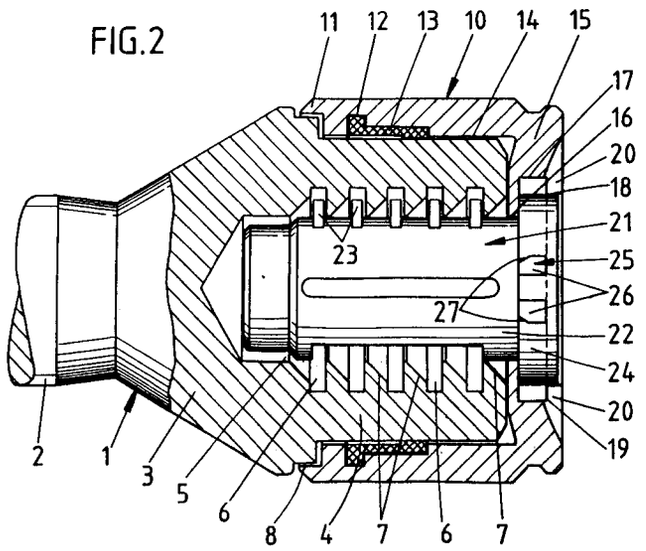
## (54) Anti-theft device for motor vehicle wheels.

(57) An anti-theft device for motor vehicle wheels comprises a casing (10) covering the polygonal head (4) of a wheel nut or bolt (1) in which there is rotatably arranged a lock cylinder (21) the tumblers (23) of which project beyond the surface of the lock cylinder (21) and enter annular grooves (6) on the internal wall of the polygonal head in the anti-theft position. The tumblers (23) can be adjusted into a position retracted from the annular grooves by insertion of the key (30), the key (30) having a projection (33) which lies in the plane of the key channel (28) and passes behind an annular shoulder (19) at the end face of the casing (10) when the key is inserted and turned from the basic position, this casing (10) trapping the key (30) against withdrawal and forming a transverse slot (20) for the passage of the projection (33). At least one projecting catch (25) is shaped on the lock cylinder (21) and passes behind the annular shoulder (19) covering an annular groove (17) of the casing (10) into which the projection (33) of the key (30) projects.

FIG.2

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The invention relates to an anti-theft device for motor vehicle wheels.

An anti-theft device for motor vehicle wheels comprising a casing covering the polygonal head of a wheel nut or bolt in which there is rotatably arranged a lock cylinder of which the tumblers projecting beyond the surface of the lock cylinder and entering annular grooves on the internal wall of the polygonal head in the anti-theft position can be adjusted into a position retracted from the annular grooves by insertion of the key is known from DE 30 17 630 A1. The key has a projection which lies in the plane of the key channel and passes behind an annular shoulder at the end face of the casing when the key is inserted and turned from the basic position, this casing trapping the key against withdrawal and forming a transverse slot for the passage of the projection. The annular shoulder on the end face of the casing is formed by a spring washer which is clipped in an annular groove of the casing and forms the transverse slot for the passage of the projection. This spring washer is also used to surround the larger diameter collar of the lock cylinder and to prevent it from being withdrawn from the casing.

It is an object of the invention to provide a device of this type in a technically simple manner, avoiding the need for additional components for holding the lock cylinder in the casing.

The present invention provides an anti-theft device for motor vehicle wheels which device comprises a casing covering the polygonal head of a wheel nut or bolt in which there is rotatably arranged a lock cylinder the tumblers of which project beyond the surface of the lock cylinder and enter annular grooves on the internal wall of the polygonal head in the anti-theft position, and can be adjusted into a position retracted from the annular grooves by insertion of the key, the key having a projection which lies in the plane of the key channel and passes behind an annular shoulder at the end face of the casing when the key is inserted and turned from the basic position, this casing trapping the key against withdrawal and forming a transverse slot for the passage of the projection, characterised in that at least one projecting catch is shaped on the lock cylinder and passes behind the annular shoulder covering an annular groove of the casing into which the projection of the key projects.

The projecting catch is preferably guided through the transverse slot into its engagement position, and is more preferably formed by two fork-shaped wings which are radial to the lock cylinder and after being inserted through the transverse slot are spread apart in the circumferential direction owing to their elastic restoring force into the engagement position of the shoulder and project into the annular groove.

This construction results in an anti-theft device for motor vehicle wheels which can be produced at low cost and is simple to manage. No additional components are required for holding the lock cylinder when inserted in the casing. However, the rotatability of the lock cylinder relative to the casing is ensured. The transverse slot of the annular shoulder on the end face of the casing serves not only for the passage of the key projection but also for the guidance of at least one projecting catch moulded to the lock cylinder. After the projecting catch has passed through the transverse slot, which takes place as the casing and lock cylinder are assembled, the projecting catch passes behind the annular shoulder into the annular groove covered thereby. A backward shift of the lock cylinder is no longer possible, creating an irreversible connection between the casing and the lock cylinder in the axial direction, this connection nevertheless allowing relative rotation of the two parts. The position in which the key channel is not aligned with the transverse slot of the annular shoulder can arise when the casing is placed onto the polygonal head of a wheel nut or bolt and the key is removed. The lock cylinder can then be turned by the key tip such that orientation of the key channel coincides with the transverse slot, in which position the projection can travel through the transverse slot during continued insertion of the key in order to engage with the annular shoulder after a certain closing turn. In this position, the tumblers of the lock cylinder are shifted into their release position so that the casing, together with the lock cylinder, can be removed by means of the key. The removing force of the key is transmitted via the projection onto the casing. Removal forces acting upon the key can never be used, therefore, to release the engagement between lock cylinder and casing, even if the transverse slot and projecting catch are aligned. Engagement is always ensured as the key is being inserted. If its projection is aligned with the transverse slot, the projecting catch is in the engagement position relative to the shoulder. If the situation of the projecting catch coincides with that of the transverse slot, the projection assumes its engagement position, as mentioned hereinbefore. For achieving sufficiently great engagement of the order of 0.1 millimetre, the projecting catch comprises two fork-shaped wings extending radially to the lock cylinder. The wings can, to a certain extent, yield during insertion and, after travelling through the slot, are spread apart in the circumferential direction owing to their elastic restoring force into the engagement position of the shoulder and project into the annular groove and remain therein. When the lock cylinder and casing are assembled, the ramps of the wings provide assis-

tance so that, as the wings are inserted through the transverse slot, they are continuously squeezed together. Deformation of the wings is therefore substantially avoided. It is particularly advisable to provide two diametrically opposed pairs of wings orientated transversely to the key channel and two appropriately opposing slots on the end face of the casing. In this way, removal forces exerted on the lock cylinder are distributed uniformly between the lock cylinder and the casing. Handling is also simplified in this way. Therefore, a rotated lock cylinder need never be rotated through more than 90° by means of the key. Handling is further simplified by the saw-tooth cross section of the annular zones on their internal wall. As a result, the annular zones preceding the annular grooves form ramps for the tumblers of the lock cylinder. It is therefore possible, without a key, to apply the casing with lock cylinder onto the corresponding wheel bolt or nut, the tumblers which project radially beyond the lock cylinder loading the saw-tooth slope flanks and therefore being controlled in the inwards direction during this application process. On completion of application, the outwardly spring-loaded tumblers can enter the spaces between the saw-teeth, i.e. the annular grooves, to secure the axial situation of the lock cylinder with the casing, this position still allowing rotation of the casing. However, as the casing embraces the polygonal head, it is not possible to apply a spanner etc. It can only be applied after appropriate removal of the casing.

An embodiment of the invention is described below with reference to the drawings.

Figure 1 shows a wheel bolt, a casing containing the lock cylinder and the associated key side by side.

Figure 2 is a greatly enlarged view of a longitudinal central section through the assembled device.

Figure 3 is a view corresponding to Figure 2 but with the key inserted into the key channel of the lock cylinder, the tumblers being pulled back into a release position relative to the annular grooves of the wheel bolt.

Figure 4 shows a front view of the casing corresponding to the position in Figure 2 but with the key indicated in dot dash lines.

Figure 5 shows the section along the line V-V in Figure 3, with the difference from this figure that the lock cylinder is rotated through about 90° by the key.

Figure 6 is a greatly enlarged view of the section along the line VI-VI, illustrating the engagement position of two fork-shaped wings forming a projecting catch.

The anti-theft device for motor vehicle wheels has a wheel bolt 1 of which the threaded shank 2 passes into a clamping zone 3. A hexagonal polygonal head 4 is attached thereto. From the free face end of the polygonal head 4 there is provided a blind bore 5 in which five parallel, equally spaced annular grooves 6 are formed. These annular grooves are preceded by annular zones with saw-tooth cross sections such that the saw-tooth slope flanks 7 expanding toward the face end of the polygonal head extend at an angle of about 45°.

An annular collar 8 extends between the polygonal head 4 and the clamping zone 3. The adjacent polygonal head 4 is provided with rounded corners 9. A casing 10 serves to cover and to protect the polygonal head 4. It is equipped, on the application side, with a rim 11 which can rest on the annular collar 8 when the casing is applied. The rim 11 is followed by a stepped internal annular groove 12 for receiving a sealing ring 13. When the casing 10 is located on the polygonal head 4, the sealing ring 13 positively surrounds the polygonal head such that the sealing ring 13 remains stationary as the casing 10 rotates. The above-mentioned internal annular groove 12 is formed in a bore 14 of the casing 10, the bore being sufficiently large to receive the polygonal head 4 which, with its rounded corners 9, also rotatably supports the casing 10.

The bore 14 extends to a casing base 15 at the end face of the casing 10. The bore 14 is followed directly stepwise by a smaller diameter bore portion 16 which, in turn, passes into a larger diameter annular groove 17. This annular groove 17 ends at a short distance in front of the end face of the casing 10 and passes into a smaller diameter bore portion 18 which is, however, larger in diameter than the bore portion 16. An annular shoulder 19 preceding the annular groove 17 is formed in this way. Two diametrally opposed transverse slots 20 which leave a passage to the annular groove 17 are located in the shoulder 19.

The casing base 15 is used to mount a lock cylinder 21. The lock cylinder has a smaller cross section cylindrical portion 22, the external diameter of which corresponds to the internal diameter of the bore portion 16, and which is rotatably mounted therein. Plate-like tumblers 23 directed transverse to the longitudinal axis of the lock cylinder are guided in the cylindrical portion 22 and are arranged with equal spacing, and in an equal number, to the annular grooves 6 of the wheel bolt 1. Springs (not illustrated) outwardly load the tumblers 23 so that the tumblers 23 dip with one end into the annular grooves 6 when the casing 10 is applied to the wheel bolt 1 in accordance with Figure 2. Consequently, the casing 10 cannot be removed from the polygonal head 4 of the wheel bolt 1, but can only be rotated relative to the polygonal head.

Figure 2 also shows that the outer ends of the tumblers 23 are closer to the centre line of the wheel bolt than the beginning of the saw-tooth

slope flanks 7.

The larger cross section collar 24 which is adapted to the diameter of the bore portion 18, is rotatably mounted therein and is adjacent to the smaller cross section portion 22 also serves to support the lock cylinder 21. At a short distance from the free face end of the collar 24, two diametrally opposed projecting catches 25 are shaped thereon. Each of these projecting catches 25 is formed by two fork-shaped wings 26 which are radial to the lock cylinder and extend at the level of the annular groove 17 of the casing base 15. The two wings 26 form a pair of wings. The outer rear regions of the wings 26 are constructed as ramps 27.

As shown, in particular, in Figures 5 and 6, the width of this pair of wings is greater than the width of the transverse slots 20. Figure 6 also shows that the ramps 27 are spaced more closely at the run-on end than the width of the transverse slots 20

The assembly of casing 10 and lock cylinder 21 to form a structural unit is shown in Figure 6. Using an auxiliary tool (not shown) the tumblers 23 are pulled back sufficiently far for the lock cylinder 21 to be inserted until the projecting catches 25 oriented relative to the transverse slots 20 first limit the insertion process. As the insertion process continues in the direction of the arrow in Figure 6, the ramps 27 of the wings 26 travel agains the lateral edges 20' of the transverse slots 20, the wings 26 being squeezed together to the clear opening of the transverse slots 20. After passing through the transverse slots 20, the wings 26 of the projecting catches 25 enter the annular groove 17 so that the wings engage behind the shoulder 19 owing to their elastic restoring force. An irreversible plug-in connection is thus produced between the lock cylinder and the casing. The lock cylinder 21 can be rotated relative to the casing 10 but cannot be axially withdrawn from it.

A longitudinal key channel 28 for receiving the key shank 29 of a key 30 is located in the lock cylinder 21. Lock notches 31 cut to different depths are worked in the key shank 29. A projection 33 which is arranged between key shank 29 and key handle 32 extends behind the last lock notch 31, the projection 33 projecting radially beyond the collar 24 and dipping into the annular groove 17 when the key 30 is inserted into the key channel 28 of the lock cylinder 21.

If the casing 10 applied to the wheel bolt 1 is to be removed to release the wheel bolt, the key 30 should be introduced into the key channel 28 of the lock cylinder 21 for this purpose. The lock cylinder 21 should be rotated with the key tip so that the key channel 28 is aligned with one of the transverse slots 20. Only then can the key 30 be completely inserted with retraction of the tumblers 23 into the position illustrated in Figure 3. The casing 10 can now be gripped by hand and be removed. However, it is also possible to remove it merely by using the key 30. For this purpose, the lock cylinder 21 should be rotated so that the projection 33 of the key 30 engages behind the annular shoulder 19 at the end face of the casing 10. During this rotation of the lock cylinder, the casing 10 is not entrained as the sealing ring 13 produces greater friction between polygonal head 4 and casing 10. By subsequent pulling of the key 30, the casing 10 can be removed from the polygonal head 4 via the projection 33 of the key 30 loading the shoulder 19 of the casing 10.

The casing 10 can be applied to the wheel bolt 1 either with a key inserted or without a key. If the key is not inserted, the radially outwardly spring-loaded tumblers 23 load the saw-tooth slope flanks 7 representing the ramps with an inwardly directed displacement of the tumblers 23 during the application movement. When the movement for applying the casing 10 is completed, the tumblers 23 are aligned with the annular grooves 6 of the wheel bolt 1 following the saw-tooth slope flanks 7 and, with spring loading, can advance into the position according to Figure 2, producing the security position which allows rotation of the casing 10 but not removal thereof.

Even if a rotational position in which the projecting catches 25 are aligned with the transverse slots 20 is selected during removal of the casing 10 by means of the key 30, the removal forces act only between projection 33 of the key 30 and shoulder 19 of the casing 10. The projecting catches 25 are not loaded on withdrawal from the transverse slots 20.

## Claims

**1.** An anti-theft device for motor vehicle wheels which device comprises a casing (10) covering the polygonal head (4) of a wheel nut or bolt (1) in which there is rotatably arranged a lock cylinder (21) the tumblers (23) of which project beyond the surface of the lock cylinder (21) and enter annular grooves (6) on the internal wall of the polygonal head in the anti-theft position, and can be adjusted into a position retracted from the annular grooves by insertion of the key (30), the key (30) having a projection (33) which lies in the plane of the key channel (28) and passes behind an annular shoulder (19) at the end face of the casing (10) when the key is inserted and turned from the basic position, this casing (10) trapping the key (30) against withdrawal and forming a transverse slot (20) for the passage of the projection (33), characterised in that at least one

projecting catch (25) is shaped on the lock cylinder (21) and passes behind the annular shoulder (19) covering an annular groove (17) of the casing (10) into which the projection (33) of the key (30) projects.

**2.** Anti-theft device according to claim 1, characterised in that the projecting catch (25) is guided through the transverse slot (20) into its engagement position.

**3.** Anti-theft device according to claim 1 or claim 2, characterised in that the projecting catch (25) is formed by two fork-shaped wings (26) which are radial to the lock cylinder (21) and, after being inserted through the transverse slot (20), are spread apart in the circumferential direction owing to their elastic restoring force into the engagement position of the shoulder (19) and project into the annular groove (17).

**4.** Anti-theft device, according to any of claims 1 to 3, characterised in that the outer rear regions of the wings (26) are constructed as ramps (27).

**5.** Anti-theft device, according to any of the claims 1 to 4, characterised in that two diametrically opposed pairs of wings are arranged transverse to the key channel (28) and two correspondingly opposed transverse slots (20) are arranged in the end face of the casing (10).

**6.** Anti-theft device, according to any of the claims 1 to 5, characterised in that the annular grooves (6) are preceded by annular zones with a saw-tooth cross section such that the saw-tooth slope flanks (7) serve as ramps for the tumblers (23).

FIG.1

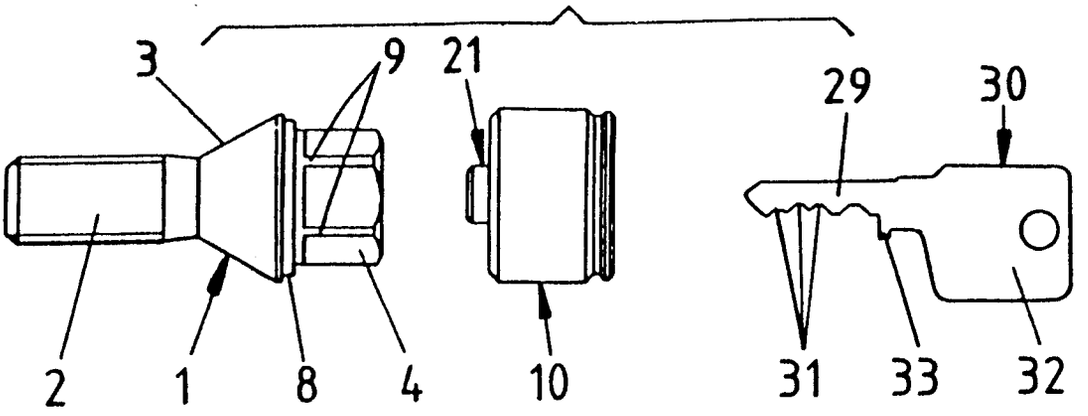
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FIG.2

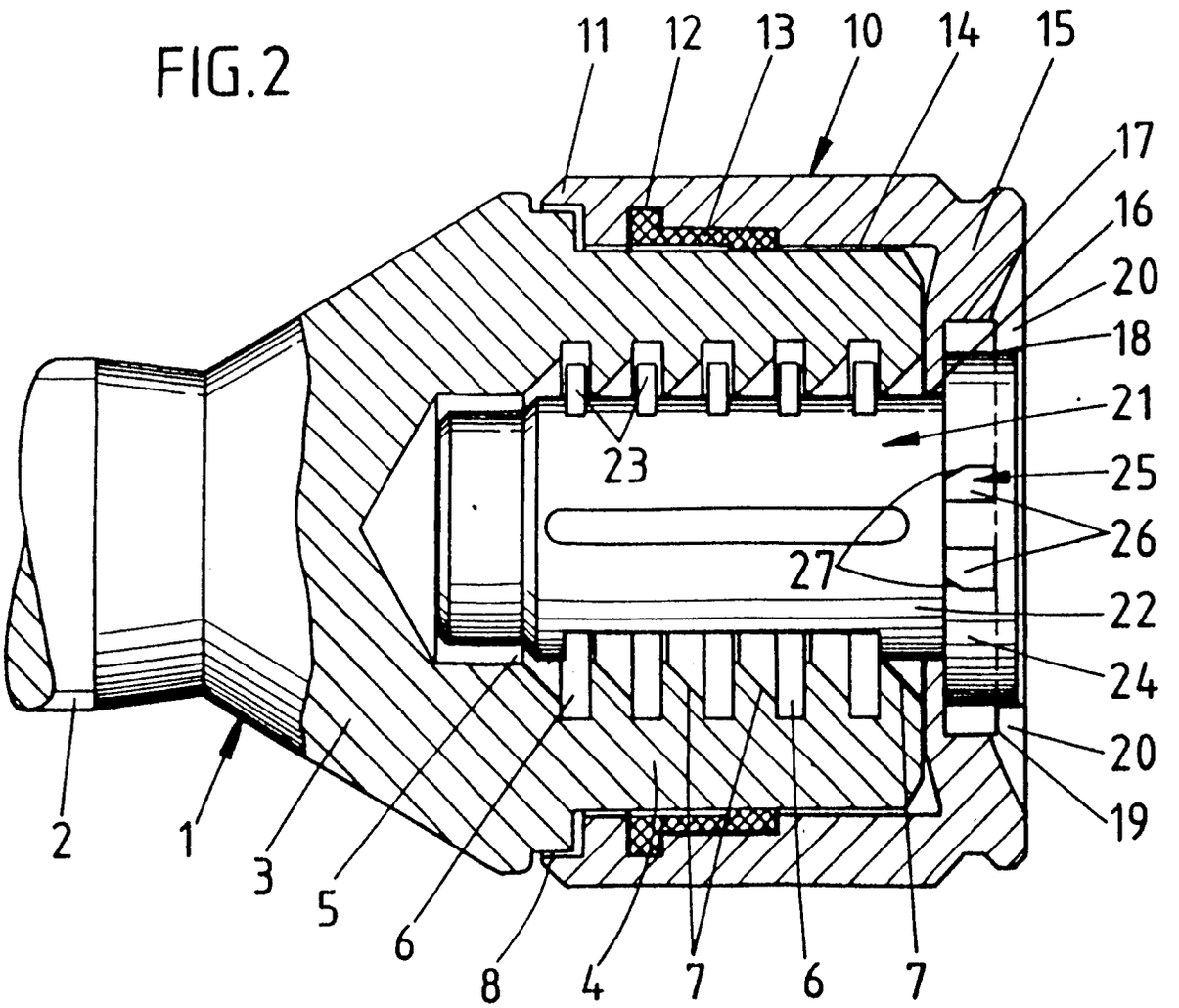
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FIG.3

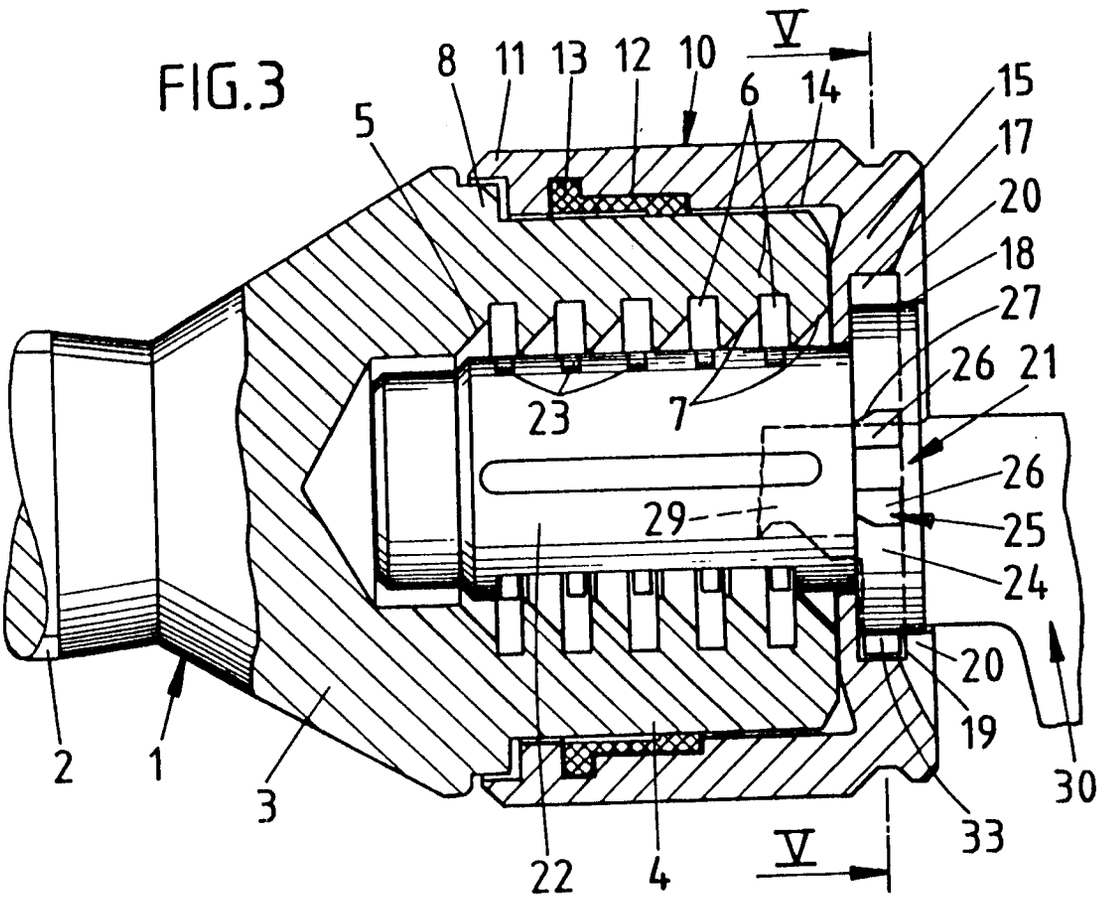
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FIG.4

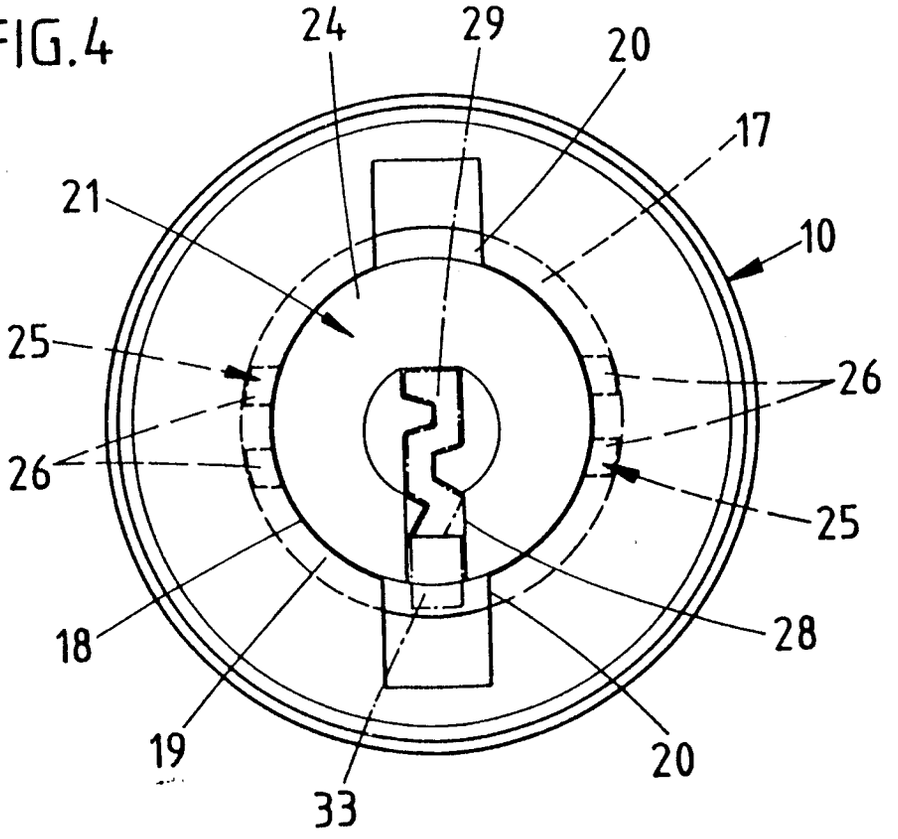
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FIG.5

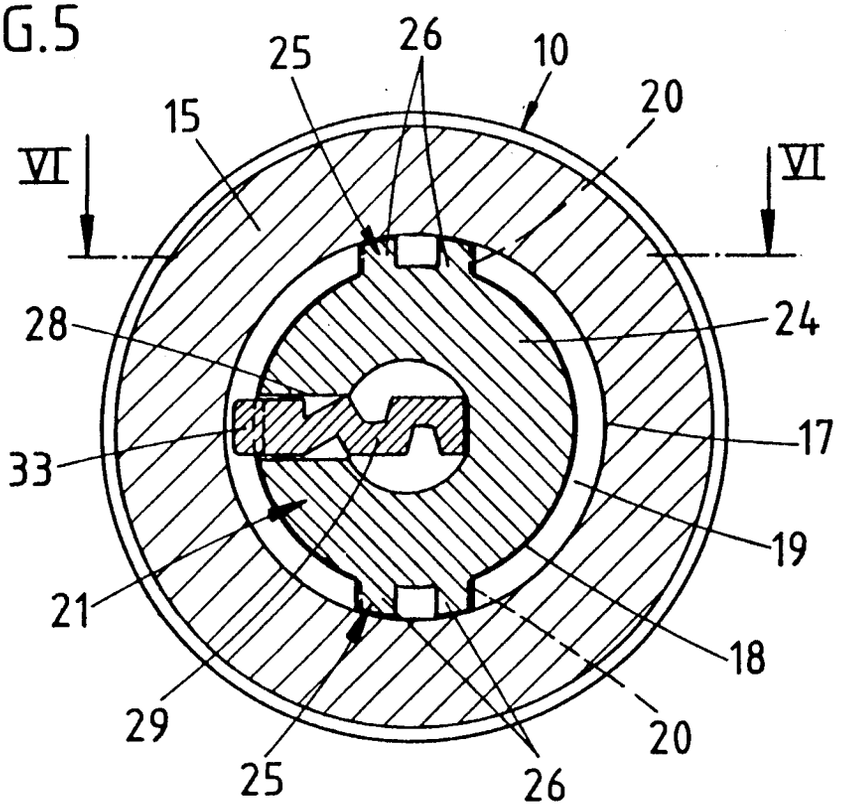
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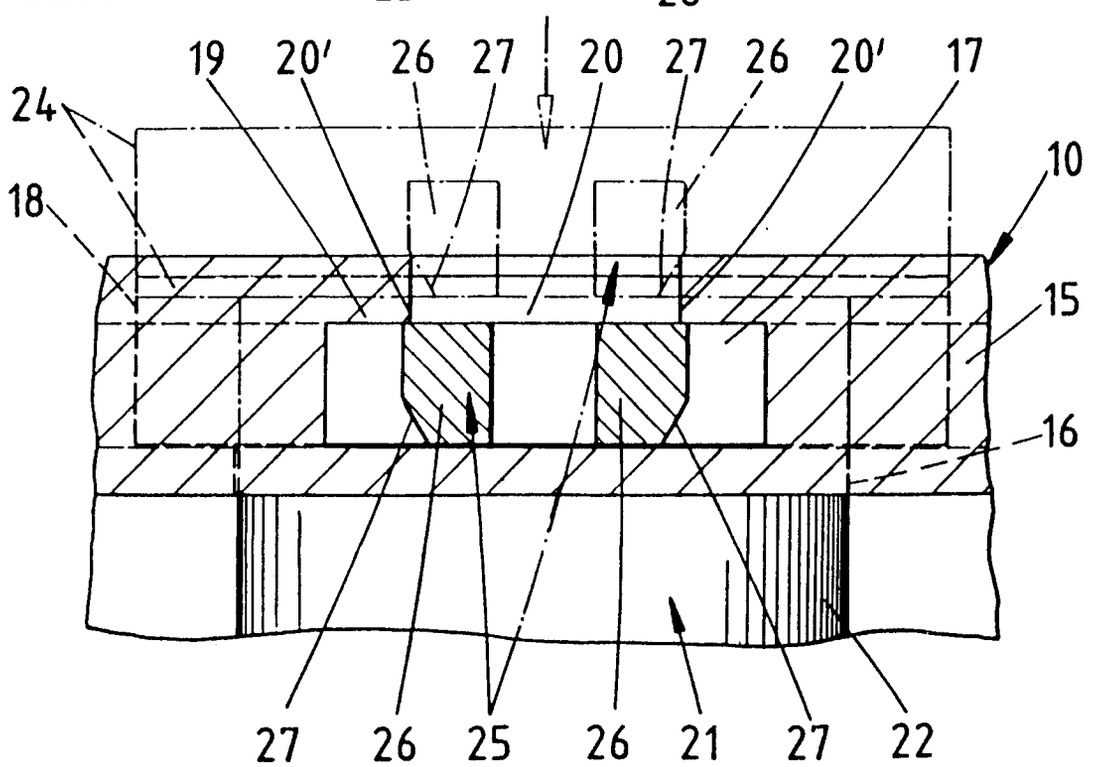
FIG.6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