(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 May 2007 (18.05.2007)

PCT

(10) International Publication Number
WO 2007/054038 A1

(51) International Patent Classification:
B61L 5/10 (2006.01)

(21) International Application Number:
PCT/CZ2006/000075

(22) International Filing Date:
2 November 2006 (02.11.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PUV2005-17152 8 November 2005 (08.11.2005) CZ

(71) Applicant *(for all designated States except US)*: **DT VYHYBKÁRNA A MOSTÁRNA A.S.** [CZ/CZ]; Dolní 100, 797 11 Prostejov (CZ).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **ZAK, Michal** [CZ/CZ]; Pod Kosirem 1, 796 01 Prostejov (CZ).

(74) Agent: **HOLASOVA, Hana**; Krizova 4, 603 00 Brno (CZ).

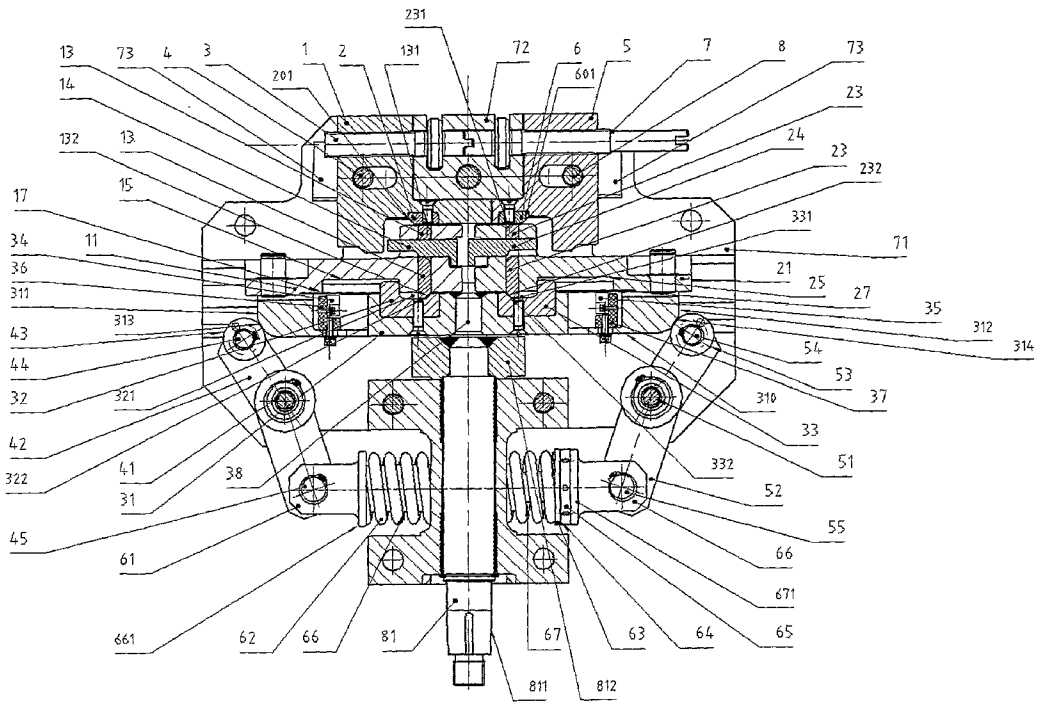
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** LOCK MECHANISM



(57) **Abstract:** Lock mechanism for adjusting cases, including stators, pulls, latch equipped with hook segments and its matching two-arm levers, in which each of the pulls (11, 21) contains a pushing latch (13, 23), while each latch (13, 23) contains a pushing balance latch (14, 24) and each pull (11, 21) contains a recession (15, 25) for the hook segment (32, 33) placed on the latch (31).

WO 2007/054038 A1

Lock Mechanism

Technical Field

The invention concerns the lock mechanism of adjusting cases for re-setting of tongues of tram and railway switches, locking of the adjacent tongue of switch and facilitation of safe passage for rail vehicles.

Background Art

The hitherto known and used mechanisms of locks of the tongues of tram and railway switches can be classified according to the way of locking as simple self-locking and non-self-locking with under-latching.

Self-locking locks use the principle of self-locking of the snap and counter-pieces functional areas, keeping the mechanism in locked position only by friction, supported by possible spring pressure. Samples of realisation include various lever and gate-type mechanisms. In case of manual or mechanised re-setting, the mechanism is usually completed with an ejecting mechanism of snaps.

The disadvantage of simple self-locking locks is their limited reliability in case of multiple cuts with consequent change of friction angle due to wear and tear of function areas of the lock. Cutting features of some self-locking locks are improved by use of revolving pulleys in the place of latching contact.

Some older mechanisms allow only destructive cutting.

The non-self-locking under-latched locks of other mechanisms used eliminate the above stated disadvantages by using non-self-locking friction angles of function latching areas. Due to safety reasons, the solution must be completed with the mechanism of under-latching, ideally in combination with gradual running of the tongues of switch for reaching high-quality and multiple cut of the lock. The disadvantages of this solution include much more complicated, larger and financially more demanding structures.

The disadvantage of sliding locks with latching is the complicated setting of rise dimension, in case of switches for the 1 000 mm gauge it is complicated construction layout of individual parts of the case equipment, in consideration of large width of blocking systems.

Other used lock mechanisms for adjusting cases of switches for tram transport allow the tongues securing using a different principle of friction lock with partial expansion of the pressure spring. The tongues are interconnected by a pull, the adjacent travelling tongue is not fixed in terminal position, but it holds on the basis of power of the partially expanded spring, completed with the friction power of the mechanism of swinging non-self-locking latches with counter-pieces with inclined planes. The power for cutting is adequate to the power of the pressure spring.

The disadvantage of the lock mechanisms is the fact that the cutting power of the adjacent and remote tongue is limited by the friction power extent. The manual (emergency) re-setting is performed – in case of this type – with very high resetting power, as during resetting the spring is packed and the latches prevent by significant friction any free movements of the pull.

Disclosure of Invention

The above stated problems are to the large extent eliminated by the lock mechanism for adjusting (setting) cases, including stators, pulls, latched equipped with hook segment and related two-armed lever, in compliance with this invention, with its base consisting mainly of the fact that each of the pulls is contains a push latch and each of the latches contains a push tension latch and each pull contains a recession for the hook segment placed on the latch.

From the function point of view it seems advantageous for the latch to be connected by detachable joint with the position sensors.

From the function point of view it also seems advantageous that the latch is in touch – through pivots with roller bearings – with one of the ends of two-arm levers placed on pivots, while the other ends of two-arm levers are connected through the pivots with the telescopic pull with the pressure spring.

From the point of view of low friction powers it seems advantageous for the pulls and the latch to contain grooves for bearing balls, located in matching grooves on the base plate and cover, while the grooves are parallel.

Other advantages of the lock mechanism include locking of the adjacent tongue by sub-latching, multiple non-destructive cuts (based on the principle of initial pushing of the distant tongue from the terminal position), while keeping full functionality and reliability of the lock. The lock is designed as a low one, designed for use in low adjustment cases of tram switches, with integrated function of adjacent tongue locking control and reaching the terminal position of the distant tongue, while the setting of sensors is constant for the whole range of rise. The rise adjustment using the adjustment (setting) screw is very fast.

Another undisputed advantage includes very low friction power, even thanks to the pushing spring, preventing wear and tear of contact surfaces of latches and related more frequent adjustments for the latch test.

Brief Description of Drawings

The technical solution will be explained using drawings, showing the view of the

lock mechanism in fig. 1, section of the locking mechanism in fig. 2. and details of individual stages of the lock mechanism re-setting when moving to the left – fig. 3 the co-running of pulls, fig. 4 the insertion of the left balance latch and de-blocking of the left latch, fig. 5 shows extension of the left latch and sub-latching, and individual stages of the lock mechanism re-setting when moving to the right, fig. 6 de-latching using the latch, fig. 7 de-latching using the cut (non-destructive) and fig. 8 the co-running of pulls to the right.

Samples of invention

The lock mechanism according to fig. 1. and fig. 2 with straight movement includes stators 1, 5, pulls 11, 21, latch 31 equipped with hook segments 32, 33 and two-arm levers 42, 52 matching the latch 31. Each of the pulls 11, 21 contains a pushing latch 13, 23, while each latch 13, 23 contains a pushing balance latch 14, 24 in a hole that is not shown. Each of the pulls 11, 21 contains the recession 15, 25 for the hook segment 32, 33 placed on the latch 31 and each hook segment 32, 33 placed on the latch 31 is equipped with recession 321, 331 for the latch 13, 23. The latch 31 is connected by detachable joint with position sensors 34, 35 through holders 36, 37. The pulls 11, 21 are equipped with a shaped edge 17, 27 for sensing their position.

The pulls 11, 21 and the latch 31 contain – in compliance with fig. 2 - grooves 16, 26, 39 for bearing balls 77 placed in matching grooves 74, 78 on the base plate 71 and cover 75, while the grooves 16, 26, 39, 74, 78 are parallel, which allows straight parallel motion of the pulls 11, 21 and the latch 31.

The stators 1, 5 according to fig. 1 are placed in parallel with the latch 31 and pulls 11, 21 on the bed 73 symmetrically in relation to the backstop 72, while their position is adjustable using adjusting (setting) screws 3, 7 organised on the backstop 72. The rise of the lock mechanism adjusted by the screws 3, 7 is fixed in defined position using tightening bolts 4, 8 fastened to the base plate 71 according to fig. 2. Stators 1, 5 are equipped with shape segments 2, 6 facing the latches 13, 23 on pulls 11, 21. The latches 13, 23 are equipped with inclined function areas 131, 132, 231, 232 for matching inclined

function areas 201, 601, 322, 332 of shape segments 2, 6 and recessions 321, 331 of hook segments 32, 33.

The latch 31 is in touch – through pivots 44, 54 with roller bearings 43, 53 – with one of the ends of two-arm levers 42, 52 placed on pivots 41, 51, while the other ends of two-arm levers 42, 52 are connected through pivots 45, 55 with the telescopic pull 61. The telescopic pull 61 consists of the case 66 with boss 661 containing pushing shaft 67 with boss 671, while the telescopic pull 61 is spring-loaded using the pressure spring 62 placed among the bosses 661, 671. The strength of the pushing spring 62 is set by the setting nut 65, axial bearing 64 and mat 63 placed on the shaft 67.

The linear straight motion of the latch 31 is arranged from the swinging motion of the driving shaft by known gate-type mechanism 81, while fig. 1 shows the shaft 811 with the gate piece 812, not shown stone and main pivot of the latch 38.

The mechanic according to fig. 2 is arranged on the base plate 71 and covered with the cover 75, placed on pivots 41, 51 with not shown recess for the cover 75 and secured to the base plate 71 by tightening bolts 76 in such a way so as the bearing balls 77 are placed in grooves 16, 26, 39, 74, 78 arranged on the base plate 71 and on the cover 75, pulls 11, 21 and latch 31. So as to arrange balanced arrangement of bearing balls 77, the grooves 16, 26 are equipped with a partition element.

Fig. 1 and 3 show the status when the lock mechanism is in its central indifferent position, when the left latch 13 is fixed in the position by the left balance latch 14 and the right latch 23 is free without any pre-tension. The right pull 21 is movement – coupled with the segment 33 of the latch 31 and the recession 25, while he right latch 23 is inserted into the recession 331 of the right hook segment 32 of the latch 31. The left latch 13 with its inclined function area 132 leans on the inclined function area 322 of the recession 321 of the left hook segment 32, while the right latch 23 with its inclined function area 232 leans on the inclined function area 332 of the recession 331 of the right hook segment 33. The latch 31 is kept in indifferent poison by the pivots 44, 54 with roller bearings 43, 53, touching the transition areas 313, 314 of the latch 31. The

transition areas 313, 314 connect the front 310 of the latch 31 with its side areas 311, 312.

Fig. 4 shows the status of the lock mechanism with the left balance latch 14 touching the left stator 1 and inserted in the left pull 11, which de-blocks the left latch 13 and it may freely move from the recession 321 of the left hook segment 32 of the latch 31 to the space delimited by the left stator 1 and its shape segment 2 in the direction perpendicular to the direction of the latch 31 movement. The left pull 11 is in limit left position and the right pull 21 is movement - – coupled with the segment 33 of the latch 31 and the recession 25, while he right latch 23 is freely inserted into the recession 331 of the right hook segment 32 of the latch 31.

Fig. 5 shows the status of the lock mechanism with the latch 31, left and right pulls 11, 21 in their limit left positions. The left pull 11 touches the left stator 1 together with the left balance latch 14. The left latch 13 is pushed out of the recession 321 of the hook segment 32 of the latch to the area delimited by the left stator 1 and its shape segment 2, and the latch 31 locks it. The left position sensor 34 located on the latch 31 indicates the shape edge 17 of the left pull 11 and it is connected to the „switch on" status. The right pull 21 touches the left pull 11, and the left balance latch 14 touches the right balance latch 24, which puts the right latch 23 to working position, with its end placed in the recession 331 of the right hook segment 33 of the latch 31. The latch 31 is hold in limit left position by the pivot 44 with roller bearings 43, touching the front 310 of the latch 31 and the pivot 54 with roller bearings 53, touching the side area 312 of the latch 31, or – in case of low setting of the mechanism rise (in concrete terms - fig. 5) – the side part of the transition area 314.

In case of the latch 31 movement from the right to the left, the left pull 11 is taken from its initial position according to fig. 3 by the left latch 13 placed in the recession 321 of the left hook segment 32 of the latch 31 by straight movement to the left side. The left latch 13 is fixed in that position by the left balance latch 14. The right pull 21 is simultaneously carried by the right hook segment 33 of the latch 31 placed in the recession 25 of the right pull 21, while the right latch 23 is free, i.e. without any pre-tension and the right balance latch 24 is carried together with the right pull 21.

During the next movement of the latch 31 to the left according to fig. 4 with simultaneous movement of the pulls 11, 21 there sits on at first the left balance latch 14 to the left stator 1 and the next movement to the left inserts the left balance latch 14 to the left pull 11 with simultaneous de-blocking of the left latch 13. The right pull 21 is simultaneously carried by the latch 31 through the right hook segment 33 of the latch 31 placed in the recession 35 of the right pull 21.

During the next movement of the latch 31 to the left, the left pull 11 does not move any further. The left latch 13 is pushed – based on the next movement of the latch 31 through its inclined function area 131 via the inclined function area 322 from the recession 321 of the hook segment 32 of the latch 31 and so its inclined function area 131 slides on the inclined function area 21 of the shape segment 2 and it is inserted to the area delimited by the left stator 1 and its shape segment 2. In the course of the next stage, the left latch 13 is fully pushed out of the recession 321 of the hook segment 32 of the latch 31 and under-passage of the latch 31 under the left latch 13, which locks the left pull 11 through the left latch 13. The holder 36 with left position sensor 34 switches to the „switch on" status by touching the shape edge 16 of the left pull 11. The movement of the latch 31 according to fig. 5 is stopped in the position, when the pulls 11, 21 touch each other, which delimits the terminal position of the right pull 21. In this stage, there is extended the right balance latch 24 to its operation position, in which it sets the right latch 23 to new working position, when the right latch 23 is placed in the recession 321 of the right hook segment 32 of the latch 31. The sensing of the status of sub-latching is differential and it is set by the difference position of the latch 31 and the left pull 11.

The movement of the left and right pull 11, 21 from indifferent position to the left is completed with a different geometric position of two-arm levers 42, 52 and consequent difference power effect to the latch 31 through the roller bearings 43, 53. The latch 31 moves from its indifferent position according to fig. 1, when the roller bearings 43, 53 touch the latch 31 on transition areas 313, 314, to its limit left position according to fig. 5, when the roller bearings 43 touch the front 310 of the latch 31 and the roller bearings 53 touch the side part of the transition area 314 of the latch 31, and in case of higher rises even the side area 312 of the latch 31, while the roller bearings 43, 53 reached this

position through the transition areas 313, 314 with simultaneous partial rotation of two-arm levers 42, 52.

When the latch 31 moves from the left limit position to the right according to fig. 6, i.e. during de-latching when the latch 31 moves to the right, the right pull 21 is carried by using the fixed right latch 23 secured by the right balance latch 24 in the recession 331 of the right hook segment 33 of the latch 31. Simultaneously, the left pull 11 is de-blocked from its locked position and it remains still, while the left position sensor 34 ceases to indicate the shape edge 17 of the left pull 11 and the left position sensor 34 disconnects to the status „switched off".

Fig. 7 shows de-latching using non-destructive cut by pushing off the non-shown distant tongue, when – while the right pull 21 moves from the left limit position to the right – the latch 31 is carried by the right hook segment 32 placed in the recession 25 of the right pull 21. Similarly as in fig. 6, the left pull 11 is de-blocked from locked position and it remains still, while the left position sensor 34 ceases to indicate the shape edge 17 of the left pull 11 and the left position sensor 34 disconnects to the status „switched off".

The next movement of the latch 31 to the right according to fig. 8 inserts the left latch 13 using the left shaped segment 2 of the left stator 1 to the area of recession 321 of the hook segment 32 of the latch 31, which makes possible the next simultaneous movement of the latch 31 and pulls 11, 21 by constant speed.

Industrial applicability

The lock mechanism can be advantageously used for adjusting cases for re-setting of tongues of tram and railway switches into both limit positions.

CLAIMS

1. Lock mechanism for adjusting cases, including stators, pulls, latch equipped with hook segments and its matching two-arm levers, **characterised by the fact, that** each of the pulls (11, 21) contains a pushing latch (13, 23), while each latch (13, 23) contains a pushing balance latch (14, 24) and each pull (11, 21) contains a recession (15, 25) for the hook segment (32, 33) placed on the latch (31).

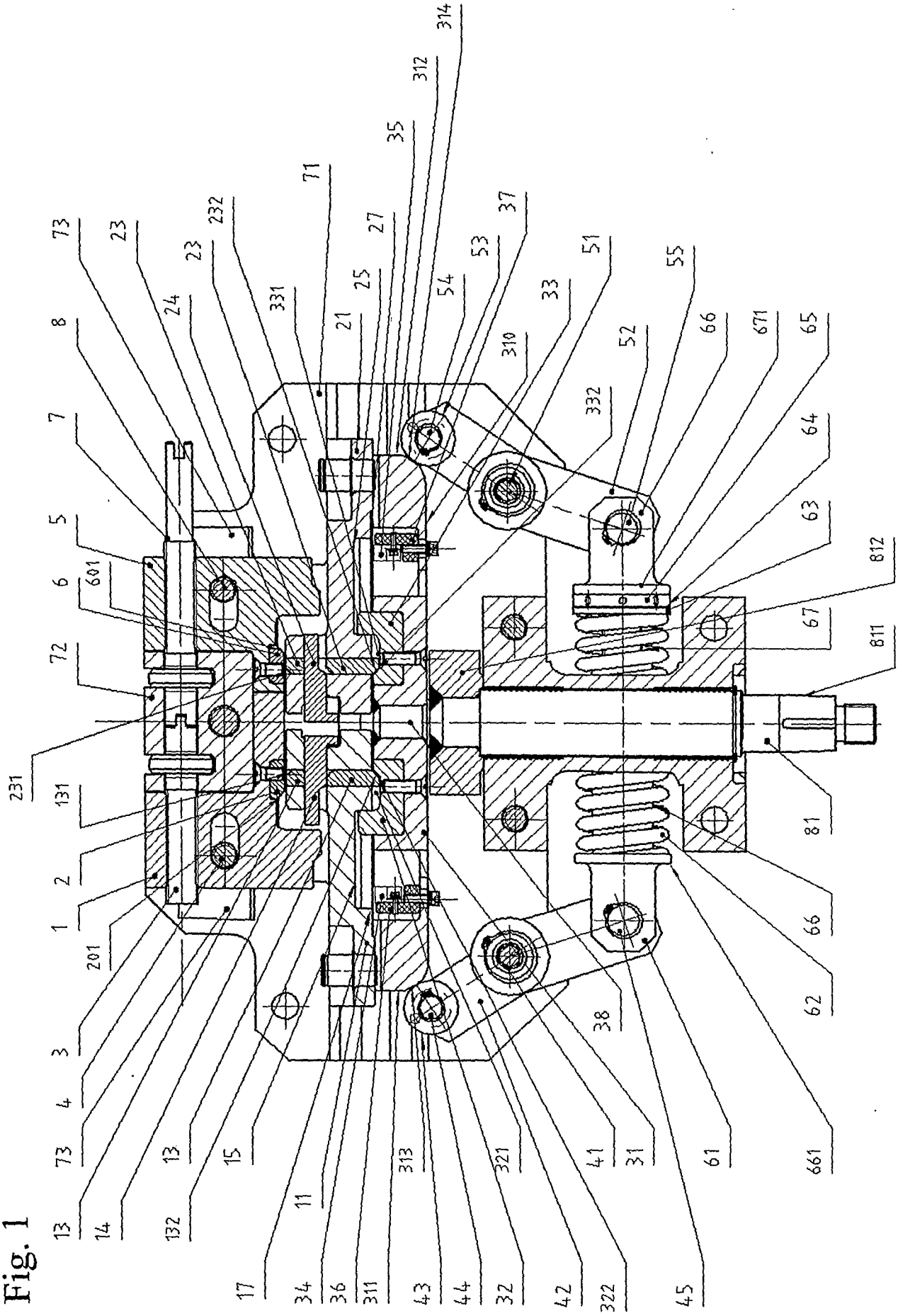
2. Lock mechanism according to claim 1, **characterised by the fact, that** the latch (31) is connected by detachable joint with position sensors (34, 35).

3. Lock mechanism according to claims 1 or 2, **characterised by the fact, that** the latch (31) is in touch through pivots (44, 54) with roller bearings (43, 53) by one of the ends of two-arm levers (42, 52) placed on pivots (41, 51), while the other ends of two-arm levers (42, 52) are connected through pivots (45, 55) with telescopic pull (61) with the pressure spring (62).

4. Lock mechanism according to claims 1, 2 or 3, **characterised by the fact, that** the pulls (11, 21) and the latch (31) contain grooves (16, 26, 39) for bearing balls (77) located in matching grooves (74, 78) on the base plate (71) and the cover (75).

5. Lock mechanism according to claim 4, **characterised by the fact, that** grooves (16, 26, 39, 74, 78) are parallel.

Fig. 1


1
2
3
4
5
6
7
8
11
13
14
15
17
21
23
24
25
27
31
32
33
34
35
36
37
38
41
42
43
44
45
51
52
53
54
55
61
62
63
64
65
66
67
71
72
73
81
131
132
201
231
232
310
311
312
313
314
321
322
331
332
601
661
671
811
812

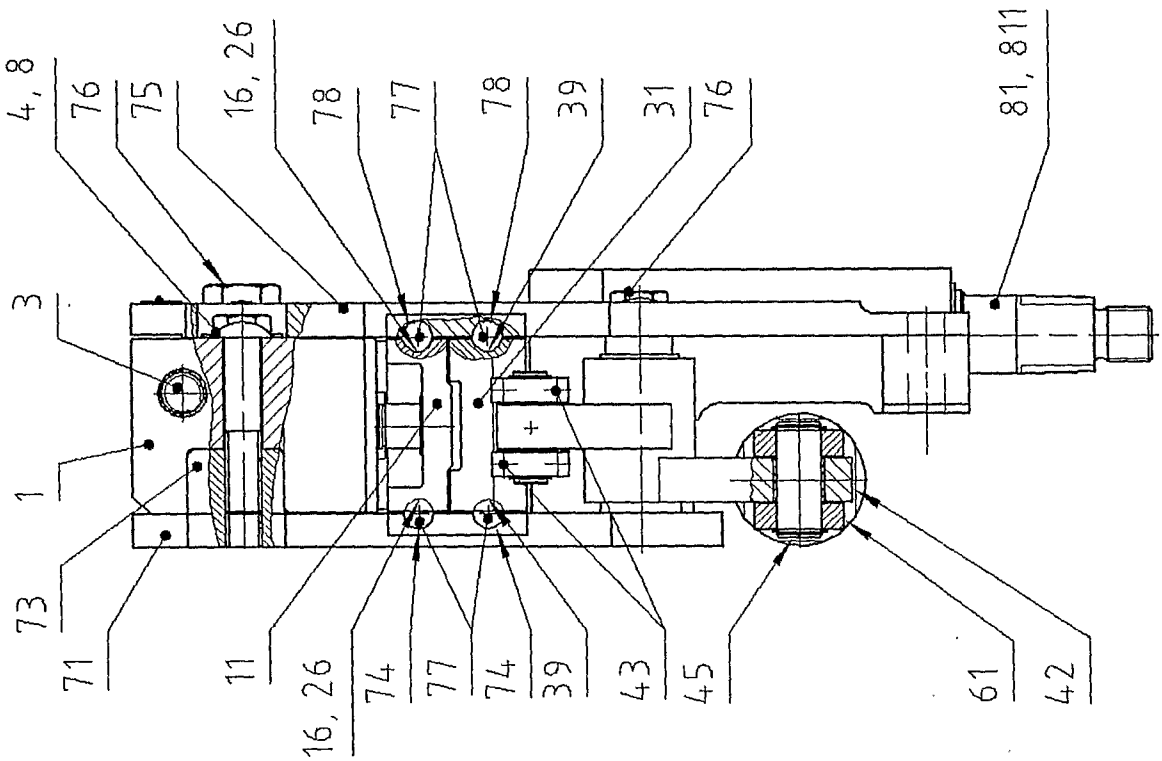

4, 8
76
75
16, 26
78
77
78
39
31
76
81, 811
3
1
73
71
11
16, 26
74
77
74
39
43
45
61
42

Fig. 2

Fig. 3

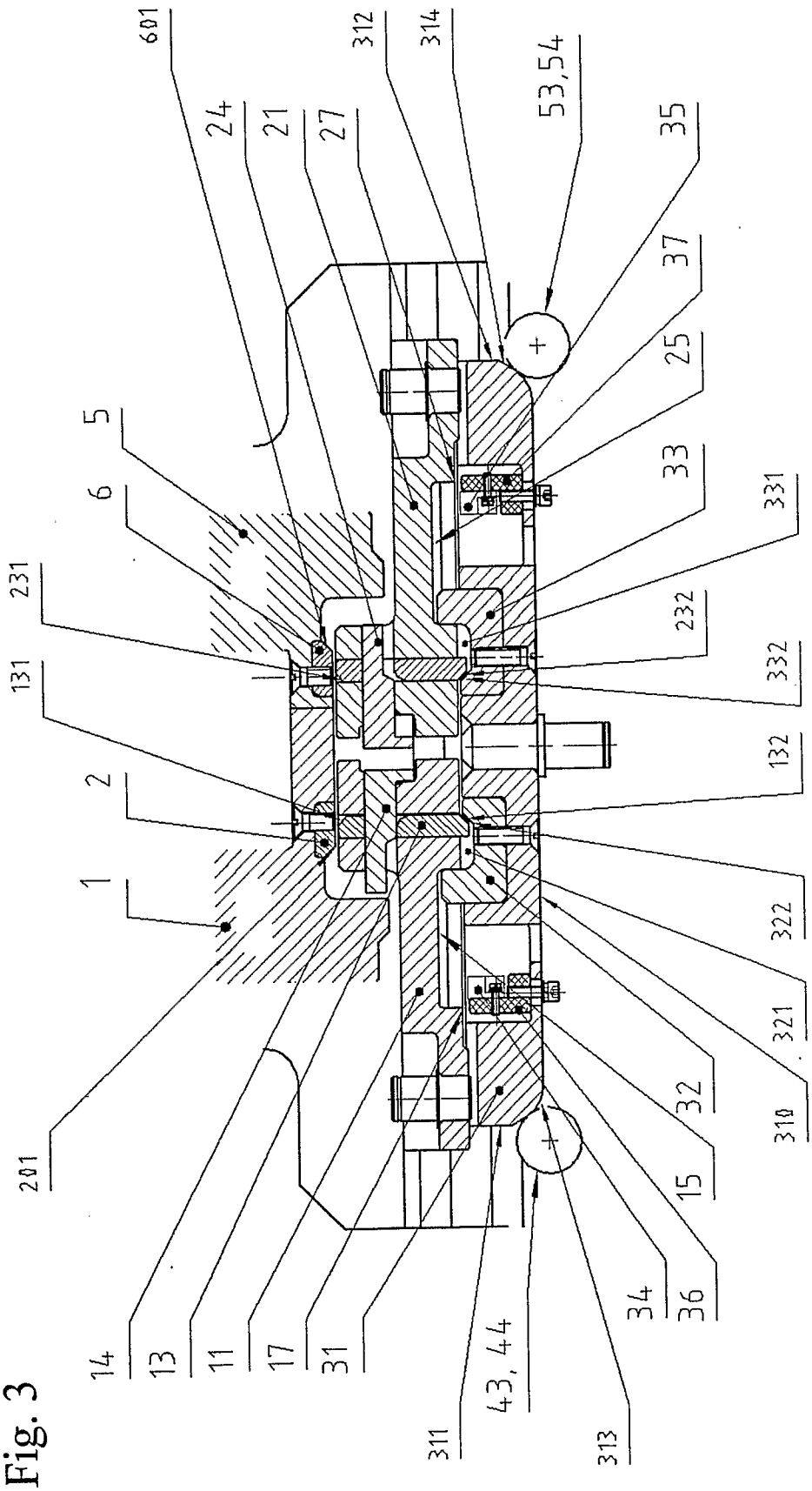
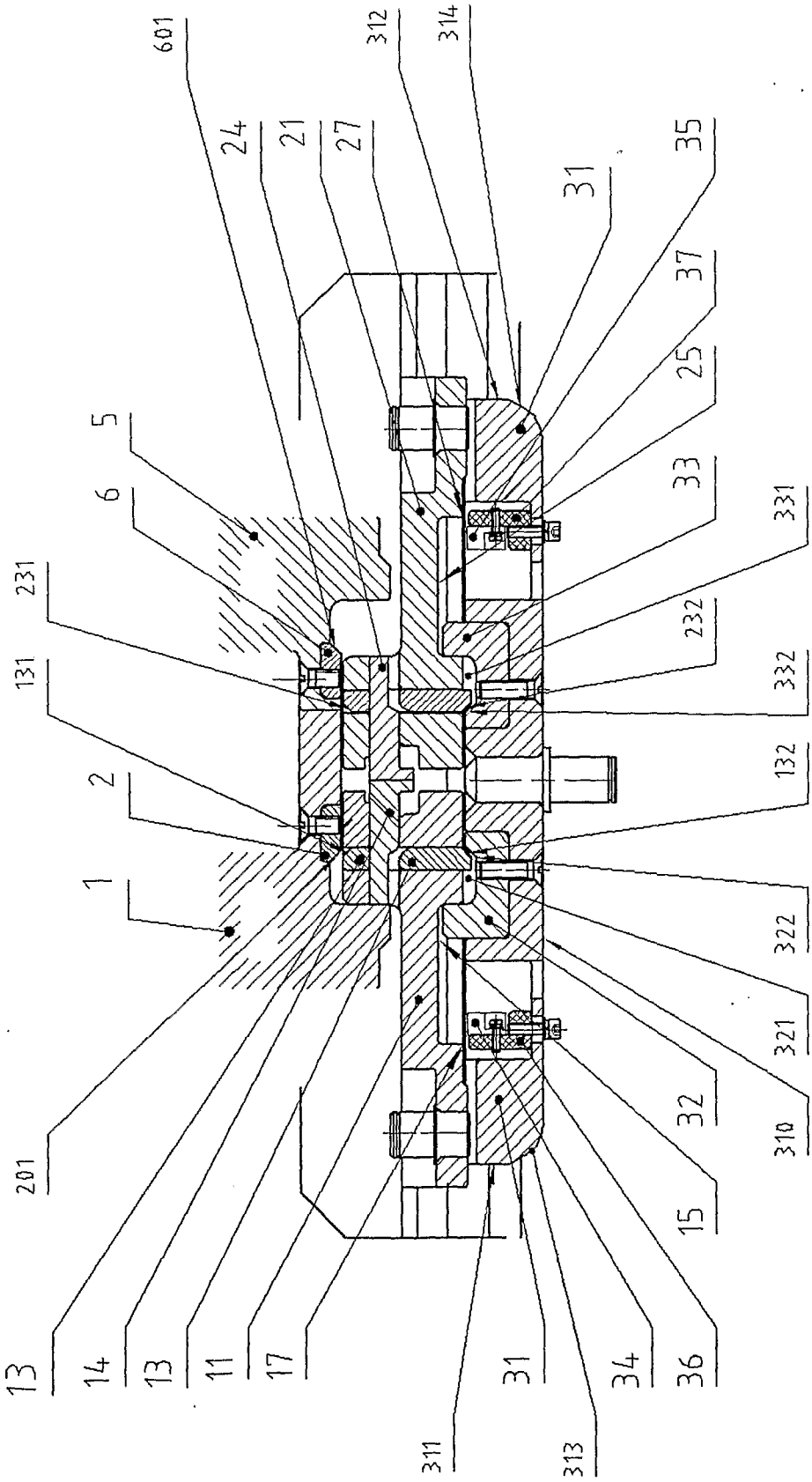

601
24
21
27
312
314
53,54
35
37
25
33
331
232
332
132
322
321
310
32
15
36
34
313
311
43, 44
31
17
11
13
14
201
1
2
131
231
6
5

Fig. 4


601
312
314
24
21
27
31
35
37
25
5
6
33
331
231
232
131
332
2
132
1
322
321
310
32
15
201
13
14
13
11
17
31
34
36
311
313

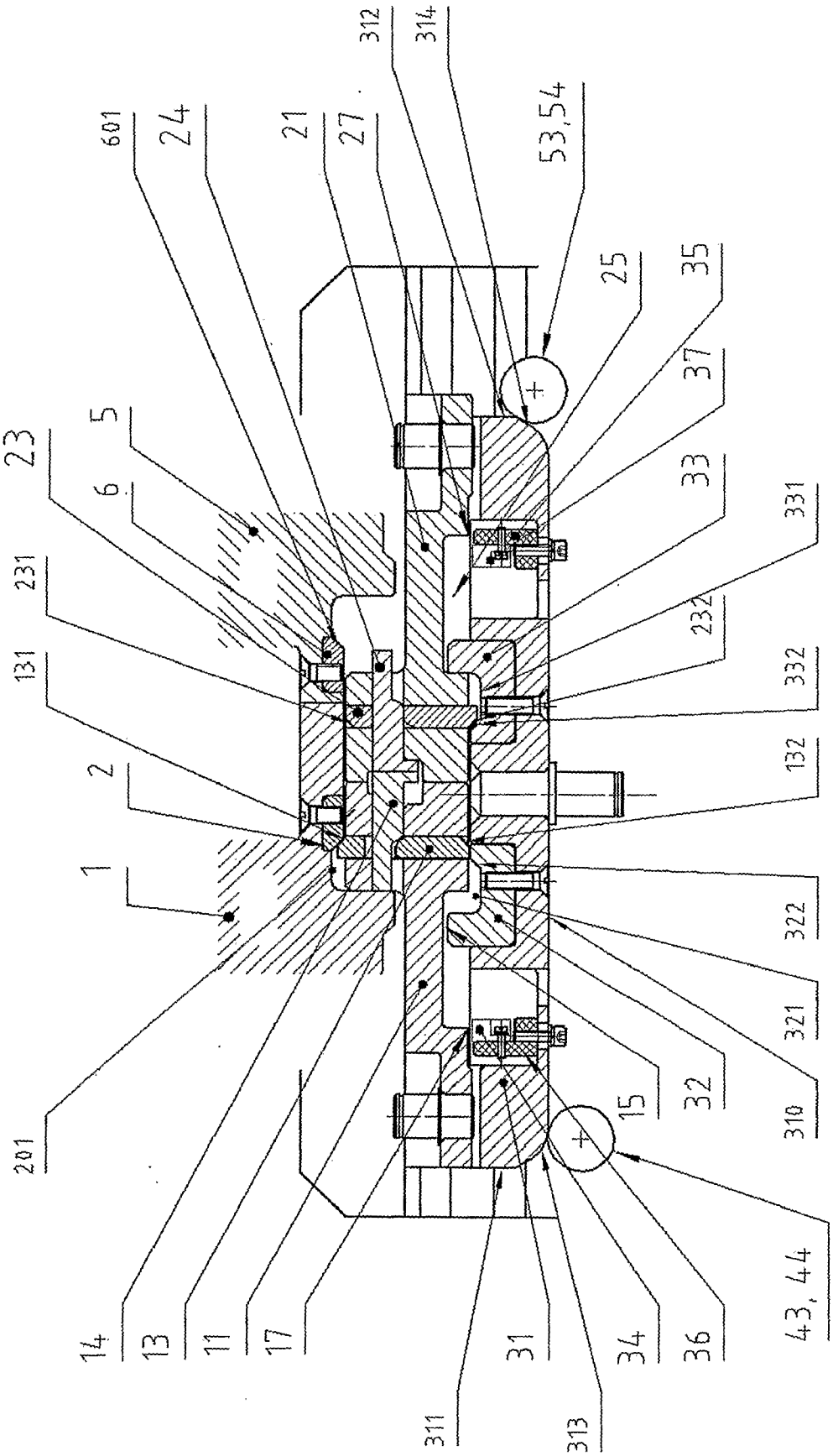
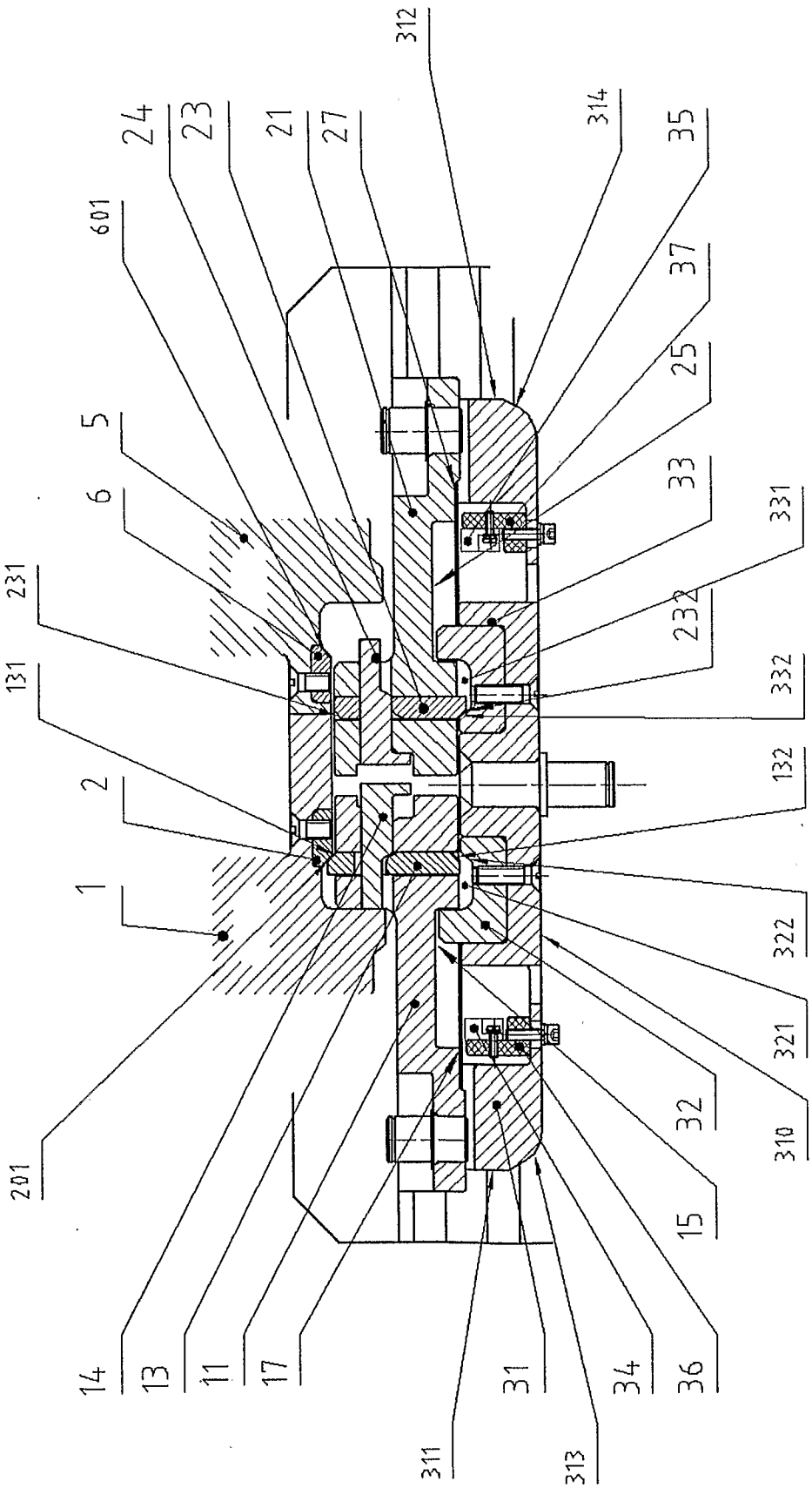

201
1
2
131
231
23
6
5
601
24
21
27
312
314
53,54
25
35
37
33
331
232
332
132
322
321
310
32
15
14
13
11
17
311
31
313
34
36
43, 44

Fig. 6


312
24
23
21
27
314
35
601
37
5
25
6
33
331
231
232
131
332
2
132
1
322
321
310
32
15
201
14
13
11
17
311
31
313
34
36

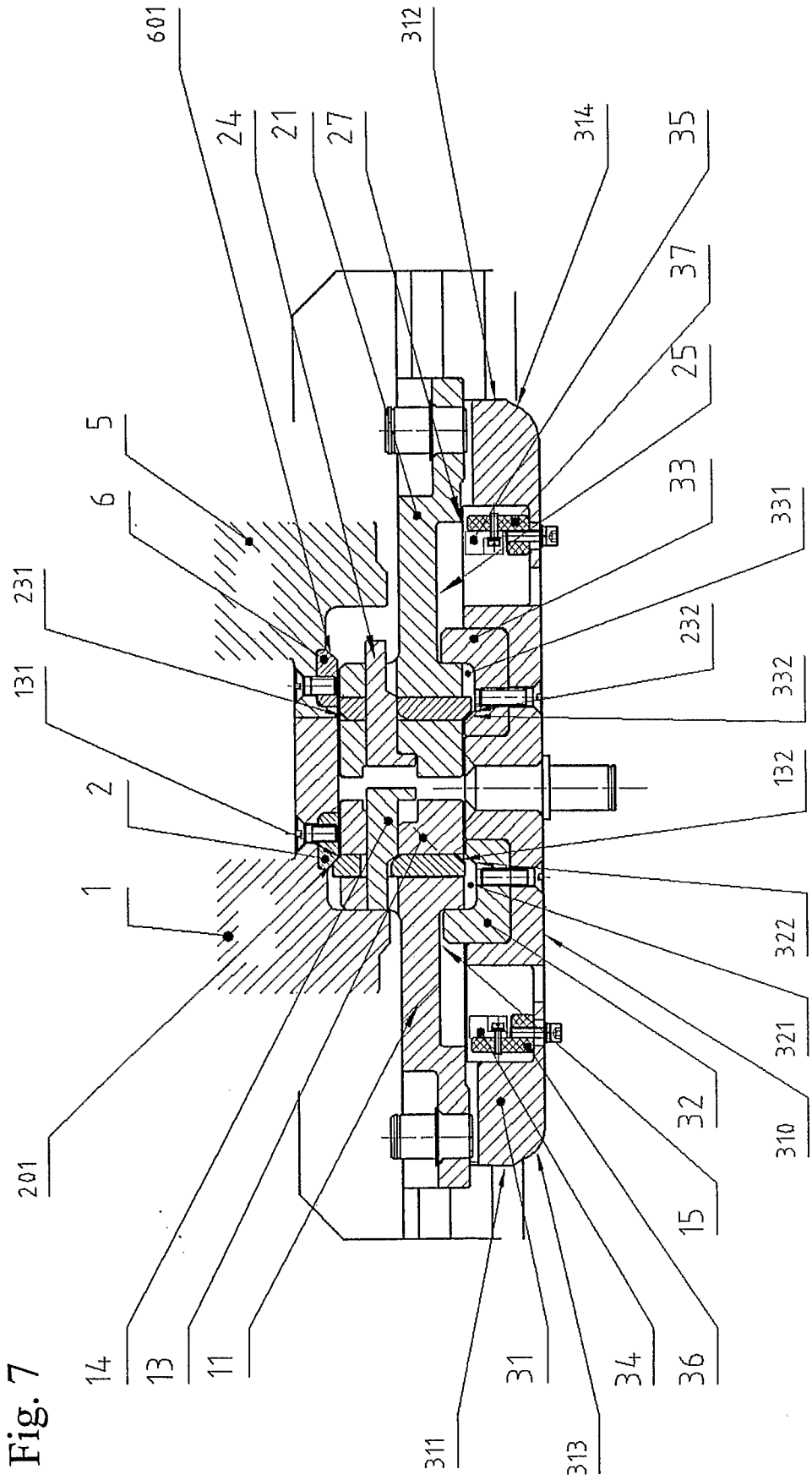

601
312
24
21
27
314
35
37
25
5
6
33
331
231
232
131
332
132
2
1
322
321
310
32
15
201
14
13
11
31
34
36
311
313

Fig. 7

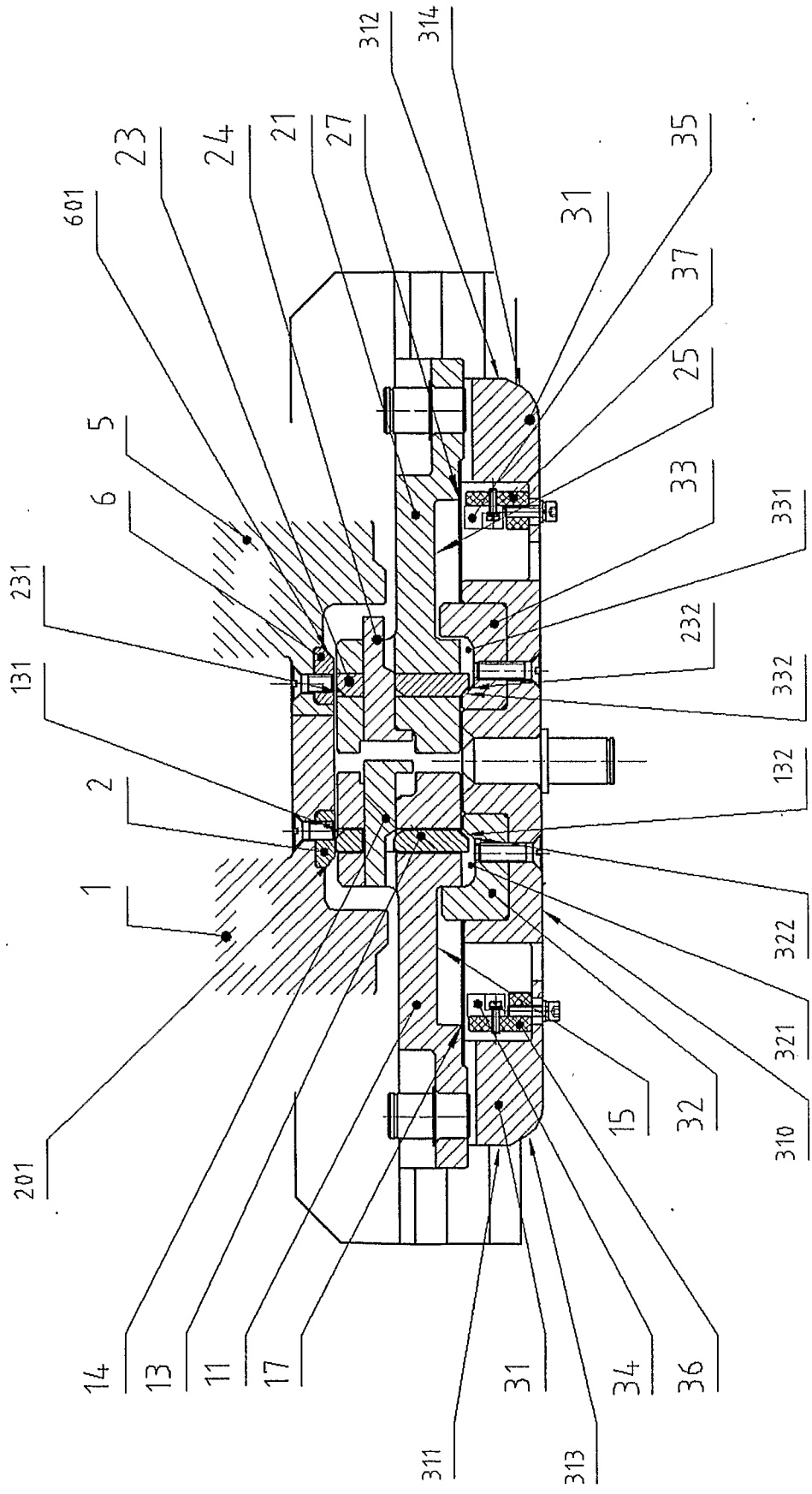

312
314
23
24
21
27
35
601
31
37
5
25
6
33
331
231
232
131
332
132
2
1
322
321
310
15
32
201
14
13
11
17
31
34
36
311
313

Fig. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2006/000075

A. CLASSIFICATION OF SUBJECT MATTER
INV. B61L5/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002/148932 A1 (BIAGIOTTI MAURIZIO [IT]) 17 October 2002 (2002-10-17) abstract; figures 1-8	1-5
A	WO 2005/049402 A (GE TRANSP SYSTEMS S P A [IT]; BIAGIOTTI MAURIZIO [IT]) 2 June 2005 (2005-06-02) abstract; figures 2,3	1-5
A	EP 0 467 865 A1 (SILIANI ANGIOLO SPA [IT]) 22 January 1992 (1992-01-22) abstract; figures 1,3-8,10	1-5
A	EP 1 470 983 A (VIALIS NMA RAILWAY SIGNALLING [NL]) 27 October 2004 (2004-10-27) abstract; figures 1-3	1-5

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 February 2007	07/03/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Janhsen, Axel

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/CZ2006/000075

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002148932 A1	17-10-2002	CA 2378806 A1	27-09-2002
		EP 1245469 A1	02-10-2002
		IT FI20010028 U1	27-09-2002
		MX PA02003240 A	12-08-2004
WO 2005049402 A	02-06-2005	AU 2004291347 A1	02-06-2005
		BR PI0416750 A	16-01-2007
		CA 2487669 A1	19-05-2005
		CA 2546436 A1	02-06-2005
		CN 1882467 A	20-12-2006
		EP 1694548 A1	30-08-2006
		US 2005116119 A1	02-06-2005
EP 0467865 A1	22-01-1992	AT 112528 T	15-10-1994
		DE 69104431 D1	10-11-1994
		DE 69104431 T2	20-04-1995
		DK 467865 T3	31-10-1994
		ES 2062745 T3	16-12-1994
EP 1470983 A	27-10-2004	NL 1023064 C2	01-10-2004