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(54) **SWITCH FOR A SWITCHGEAR**

(57) The present invention relates to a switch (1) for a switchgear, the switch comprising: a cylinder (20); a piston (30); a contact (50); a pin (60); and a stored energy unit (100). The piston is configured to move within the cylinder from a standby position to a released position along an axis of the cylinder. When in the standby position the piston is spaced from the contact and electrically isolated from the contact. When in the standby position the cylinder is electrically isolated from the contact. When in the released position the piston is in electrical connection with the contact. When in the released position the piston is in electrical connection with the cylinder. Movement of the piston from the standby position to the released position is configured to move the pin within a bore (53) of the contact from a standby position to a released position. Movement of the pin from the standby position to the released position is configured to indicate that the piston has moved from the standby position to the released position. The stored energy unit is located within or associated with the switch such that activation of the stored energy unit is configured to move the piston from the standby position to the released position.

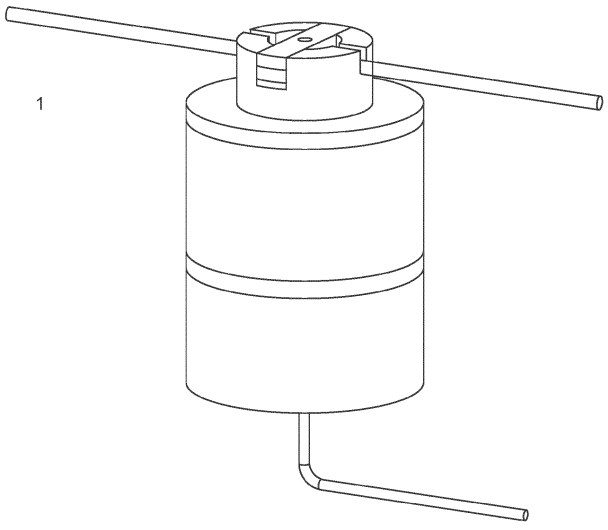

Figure 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a switch for a switchgear, such as an air-insulated switchgear or a gas-insulated switchgear for low, medium and high voltage applications.

BACKGROUND OF THE INVENTION

[0002] For the limitation of the effects of a fault arc inside a switchgear panel, it is desirable to quickly establish a stable current path from the conductor to ground, so that the fault arc is short-circuited and so quenched. To address this fast earthing systems are used. These use stored energy, for example from springs or micro gas generators, and are triggered by a control device depending on for example the magnitude of the current, the rate of rise of the current and/or the light emitted by the fault arc.

[0003] Such fast closing devices or earthing devices (also called switches) can be used in switchgears to quickly and reliably connect busbars to ground in case of an electrical failure, for example an electrical arc between the three phases. Also, such fast closing switches can be utilized for example for the short-circuiting of non-performing single cells in a series of cells of an HVDC converter. Vacuum chambers can be used for this switching function for a compact design, reliable insulation and switching function and for a sealed operation, so that gases or sparks from the switching operation cannot escape.

[0004] Because the effects of an electrical arc/short-circuit can be so severe, further protection actions are frequently undertaken in addition to the activation of the switch because it is not known if the switch has correctly functioned. However, activation of the further protective actions when the switch has correctly functioned incurs extra cost.

[0005] There is a need to address this issue.

SUMMARY OF THE INVENTION

[0006] Therefore, it would be advantageous to have an improved earthing switch for a switchgear or a short-circuiting switch for a defective cell of a HVDC switch. Hereafter, reference is made to a switch for a switchgear, but it is to be noted that the switch finds utility for more than just a switchgear as discussed above.

[0007] The object of the present invention is solved with the subject matter of the independent claims, wherein further embodiments are incorporated in the dependent claims.

[0008] In a first aspect, there is provided switch for a switchgear, the switch comprising:

- a cylinder;
- a piston;
- a contact;
- a pin; and
- a stored energy unit.

[0009] The piston is configured to move within the cylinder from a standby position to a released position along an axis of the cylinder. When in the standby position the piston is spaced from the contact and electrically isolated from the contact. The contact is also referred to as a conductive top. When in the standby position the cylinder is electrically isolated from the contact. When in the released position the piston is in electrical connection with the contact. When in the released position the piston is in electrical connection with the cylinder. Movement of the piston from the standby position to the released position is configured to move the pin within a bore of the contact from a standby position to a released position. Movement of the pin from the standby position to the released position is configured to indicate that the piston has moved from the standby position to the released position. The stored energy unit is located within or associated with the switch such that activation of the stored energy unit is configured to move the piston from the standby position to the released position.

[0010] Thus, means are provided to indicate that a switch such as an ultra fast earthing switch (UFES) has been released. This enables the closing of the switch to be detected and for it to be confirmed that the switch has been released. In this way, further mitigating means relating to utilization of further protection circuits can be omitted.

[0011] In an example, the cylinder is configured to connect to a part of a switchgear at earth potential.

[0012] In an example, the contact is configured to make electrical connection with at least one current carrying part of the switchgear.

[0013] In an example, movement of the pin from the standby position to the released position is configured to cut through a communication cable to indicate that the piston has moved from the standby position to the released position.

[0014] In an example, the communication cable is an optical fibre.

[0015] Thus, a galvanic free detection means is provided, where for example a signal that normally passes through the optical fibre is interrupted when the fibre is broken as the switch closes, and it can be detected that the switch has closed in going from the standby position to the released position.

[0016] In an example, when in the standby position the switch is configured such that at least one region inside the switch between piston and the contact is configured to be under vacuum.

[0017] In an example, when in the standby position a barrier is configured to form a first region inside the switch between piston and the barrier configured to be under vacuum and the barrier is configured to form a second

region inside the switch between barrier and the piston configured to be under vacuum.

[0018] In an example, movement of the piston from the standby position to the released position is configured to break the barrier with the piston.

[0019] In an example, the switch comprises a bellows. A first end of the bellows in connected to the pin and a second end of the bellows is connected to the contact. A vacuum tight seal is formed around the bore of the contact by the bellows.

[0020] Thus, a vacuum can be provided within the switch enabling the piston to move rapidly towards the contact upon activation as there is no air resistance and further electrical isolation is provided between the cylinder and the contact in the standby position due to the intervening vacuum.

[0021] In an example, the switch comprises at least one insulator wall section between the cylinder and the contact.

[0022] In an example, when in the standby position the piston is held in position by a lid connected to the piston and connected to the cylinder.

[0023] In an example, when in the standby position the piston is held in position by a lid connected to the piston and connected to at least one insulator wall section between the cylinder and the contact.

[0024] In an example, the lid comprises a predetermined breaking area configured to break when the piston moves from the standby position to the released position.

[0025] In an example, gas from the stored energy unit is configured to move the piston from the standby position to the released position upon activation of the stored energy unit.

[0026] In an example, the stored energy unit comprises a micro gas generator or a pressurized gas container.

[0027] In a second aspect, there is provided a switchgear with one or more switches according to the first aspect.

[0028] The above aspects and examples will become apparent from and be elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Exemplary embodiments will be described in the following with reference to the following drawings:

Fig. 1 shows an example of a switch;

Fig. 2 and 3 show sectional views of an example of a switch in standby and released positions; and

Figs. 4 and 5 show sectional views of an example of a switch in standby and released positions.

DETAILED DESCRIPTION OF EMBODIMENTS

[0030] Figs. 1-5 relate to switches for a switchgear, such as a low, medium or high voltage switch gear.

[0031] In an example, a switch 1 comprises a cylinder 20, a piston 30, a contact 50, a pin 60, and a stored energy unit 100. The piston is configured to move within the cylinder from a standby position to a released position along an axis of the cylinder. When in the standby position the piston is spaced from the contact and electrically isolated from the contact. When in the standby position the cylinder is electrically isolated from the contact. When in the released position the piston is in electrical connection with the contact. When in the released position the piston is in electrical connection with the cylinder. Movement of the piston from the standby position to the released position is configured to move the pin within a bore 53 of the contact from a standby position to a released position. Movement of the pin from the standby position to the released position is configured to indicate that the piston has moved from the standby position to the released position. The stored energy unit is located within or associated with the switch such that activation of the stored energy unit is configured to move the piston from the standby position to the released position.

[0032] According to an example, the cylinder is configured to connect to a part of a switchgear at earth potential.

[0033] According to an example, the contact is configured to make electrical connection with at least one current carrying part of the switchgear.

[0034] According to an example, movement of the pin from the standby position to the released position is configured to cut through a communication cable 80 to indicate that the piston has moved from the standby position to the released position.

[0035] According to an example, the communication cable is an optical fibre.

[0036] According to an example, when in the standby position the switch is configured such that at least one region inside the switch between piston and the contact is configured to be under vacuum.

[0037] According to an example, when in the standby position a barrier 110 is configured to form a first region inside the switch between piston and the barrier configured to be under vacuum and the barrier is configured to form a second region inside the switch between barrier and the piston configured to be under vacuum.

[0038] In an example, the barrier 110 is a conductive barrier.

[0039] According to an example, movement of the piston from the standby position to the released position is configured to break the barrier with the piston.

[0040] According to an example, the switch comprises a bellows 70. A first end of the bellows in connected to the pin and a second end of the bellows is connected to the contact. A vacuum tight seal is formed around the bore of the contact.

[0041] According to an example, the switch comprises at least one insulator wall section 10 between the cylinder and the contact.

[0042] According to an example, when in the standby

position the piston is held in position by a lid 40 connected to the piston and connected to the cylinder. Alternatively, when in the standby position the piston is held in position by a lid 40 connected to the piston and connected to at least one insulator wall 10 section between the cylinder and the contact.

[0043] According to an example, the lid comprises a predetermined breaking area 42 configured to break when the piston moves from the standby position to the released position.

[0044] According to an example, gas from the stored energy unit is configured to move the piston from the standby position to the released position upon activation of the stored energy unit.

[0045] According to an example, the stored energy unit comprises a micro gas generator or a pressurized gas container.

[0046] In an example, the stored energy unit comprises one or more springs. Expansion of the one or springs is configured to move the piston from the standby position to the released position upon activation of the stored energy unit.

[0047] In an example the piston comprises an electrical contact 33 that is configured to slide along an inner surface of the cylinder and make electrical connection between the piston and the cylinder.

[0048] In an example the electrical contact is configured to make electrical connection between the piston and the cylinder when the piston has moved to the released position.

[0049] In an example the piston and contact are configured such that in the released position a portion of an outer surface 31 of the piston is in contact with a portion of an inner surface 51 of the contact.

[0050] In an example the portion of the outer surface of the piston and the portion of the inner surface of the contact are shaped such that in moving from the standby position to the released position the piston is locked in the released position.

[0051] In an example the portion of the outer surface of the piston is conically shaped and the portion of the inner surface of the contact is conically shaped.

[0052] A switchgear can comprise one or more switches as described above

[0053] Continuing with the figures, several embodiments are now described in detail.

Fig. 1 shows an outside view of a switch 1. Fig. 2 shows a sectional view of an exemplar switch 1 in standby position. Fig. 3 shows a sectional view of the switch of Fig. 2 in released position. Fig. 4 shows a sectional view of an exemplar switch 1 - with two independent gaps - in standby position. Fig. 5 shows a sectional view of the switch 1 of Fig. 4 in released position.

[0054] The fast closing or earthing switch 1 generally works as follows. An insulator 10, a piston 30, a lid 40 and a conductive top 50 define a sealed, evacuated volume. The volume can be manufactured, evacuated and sealed by 1) brazing and 2) evacuating (using a small tube that is closed after wards), or in a common process inside of a furnace. A conductive cylinder and a micro gas generator can then be added in an assembly process.

[0055] In an application of the fast closing switch 1, electrical terminals can be attached to the lower surface 22 (or to the corresponding outer cylindrical surface 25) and to the upper surface 52 (or to the corresponding outer cylindrical surface 55) to connect the fast closing switch to any electrical circuit. As long as the switch is required to stay open, the micro gas generator 100 is left without electrical feeding, the piston 30 stays in its lower position as shown in Fig. 2 and no current can flow from the lower terminal (from the cylinder 20 and the piston 30) to the upper terminal (to the contact or conductive top 50).

[0056] In the situation when the fast closing switch 1 is required to close, the micro gas generator 100 can be fired. Due to the pressure of the evolving gases, the piston 30 will be pushed upwards with high force. The predetermined breaking area 42 of the lid 40 will break and the piston 30 will run upwards with high speed until the piston 30 hits the lower end of the conductive top 50. The conical area 31 of the piston and the conical area 51 of the contact or conductive top 50 are formed such that the piston 30 will be clamped inside of the conductive top 50 so that a solid and reliable electrical connection between the piston 30 and contact or conductive top 50 will be established.

[0057] The piston 30 further comprises means of electrical contacting 33 to the inner surface of the conductive cylinder 20. The means 33 can be an integral part of the piston 30, but they can also be a separate part or parts like a spiral contact or a multi-contact system. In this closed status in the released position, current can flow from the lower surface 22 of the conductive cylinder 20 over the piston 30 to the upper surface 52 of the contact or conductive top 50 and the fast closing switch 1 is mechanically and electrically closed in a solid and reliable way.

[0058] The switch has means to cut an optical fibre 80 for the detection of a successful operation of the fast closing switch 1 from the outside of the switch. Further, this detection is galvanically free, so that no further constraints have to be considered in a high voltage environment.

[0059] This is achieved as now described. An upward motion of piston 30 and its tip 32 hits the pin 60 and pushes it upwards through a bore 53 in the contact or conductive top 50. The pin 60 is for example made of stainless steel. The pin 60 is guided by the bore 53 in the conductive top 50.

[0060] The pin 60 is brazed to the upper end of a bellows 70, for example made of stainless steel. The lower end of the bellows 70 is brazed to the contact or conductive top 50 so that the vacuum inside of the switch 1 is sealed in the standby or opened position of the fast closing switch 1.

[0061] As the pin 60 is pushed by the piston 30 the

upper end 61 of pin 60 is pushing against an optical fibre 80. For a safe cutting function, the upper side of the optical fibre 80 can be fixed with a bridge 90, that can for example be screwed onto a groove in the contact or conductive top 50, so that flat conductors can still be screwed onto the surface 52 of the contact or conductive top 50, not disturbed by the bridge 90 or its fixation screws. The bridge 90 comprises a hole 91 so that the upper end 61 of the pin 60 can punch a piece 81 of the optical fibre 80 through the hole 91 for a reliable interruption of the glass fibre - this is clearly shown in Figs. 3 and 5. The hole 91 may be designed in a way that is serves as a reservoir for the cut piece 81 when for example a flat conductor is screwed onto the surface 52. The bridge 90 is for example made of steel or stainless steel. Alternatively, the function of the bridge 90 can also be integrated in the flat conductor or in any other conductor fixed at the contact or conductive top 50. However, the bridge 90 with a hole 91 is not required, because the movement of the pin 60 has been found to cut the optical fibre 80, but the bridge 90 with a hole 91 can help ensure such a cutting action.

[0062] If it is required for a more precise guiding of the pin 60, a bridge 95 for guiding the upper end 61 of the pin 60 in a hole 96 in the bridge 95 can optionally be added at the upper end of the pin 60, outside of the vacuum compartment, by fixing the bridge 95 to the upper surface 52 of the contact or conductive top 50, for example in a groove, at a position above the bellows 70 and below the optical (glass) fibre 80.

[0063] It is to be noted that the guidance of a pin made of stainless steel in a hole of a conductive top, for example made of copper or a bridge, for example made of steel or stainless steel is usually not a recommended practice, as it can result in high frictional forces and even griping after several operations, and where at least lubrication would normally be required. However, it has to be considered that in the present situation the fast closing switch 1 can be a one-shot device for emergency use with a single operation. Therefore, excessive friction and griping will not occur here also with no lubrication. However, lubrication with an appropriate vacuum compatible oil can be utilized if necessary, however it is considered not to be required.

[0064] The above description is generally shown in Figs. 2 and 3.

[0065] The fast closing switch with release detection 1 may be equipped with two independent vacuum chambers in series and therefore two independent vacuum gaps in series as shown in Figs. 4 and 5. This can be done for an improved reliability of the insulation in vacuum to mitigate spurious breakdowns of a single gap. Here, two insulators 10 are arranged in series, separated by a conductive barrier 110. In the standby position, two independent vacuum gaps in series are established. In operation, the moving piston 30 will open the conductive barrier 110 due to the radially predefined breaking areas 112 in a way that no part of 110 will be between the piston 30 and the contact or conductive top 50. After the operation, in the released position, the piston 30 will be firmly connected to the conductive top 50 so that a solid and reliable electrical connection through the fast connecting switch will be established.

Reference Numerals

[0066]

1 Fast connecting switch with release detection
10 Insulator
20 Conductive cylinder
22 Lower surface of 20
25 Outer cylindrical surface of 20
30 Piston
31 Conical area of 30
32 Tip of 30
33 Means of electrical contacting
40 Lid
42 Predetermined breaking area of 40
50 Conductive top
51 Conical area of 50
52 Upper surface of 50
53 Bore in 50
55 Outer cylindrical surface of 50
60 Pin
61 Upper end of 60
70 Bellows
80 Optical fibre
81 Piece cut from 80
90 Bridge for punching
91 Hole in 90
95 Bridge for guidance
96 Hole in 95
100 Micro gas generator
101 Cable of 100
110 Barrier
112 Radial predetermined breaking area of 110

[0067] While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive. The invention is not limited to the disclosed embodiments. Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing a claimed invention, from a study of the drawings, the disclosure, and the dependent claims.

Claims

1. A switch (1) for a switchgear, the switch comprising:

- a cylinder (20);
- a piston (30);
- a contact (50);
- a pin (60); and

- a stored energy unit (100);

wherein the piston is configured to move within the cylinder from a standby position to a released position along an axis of the cylinder;
wherein when in the standby position the piston is spaced from the contact and electrically isolated from the contact;
wherein when in the standby position the cylinder is electrically isolated from the contact;
wherein when in the released position the piston is in electrical connection with the contact;
wherein when in the released position the piston is in electrical connection with the cylinder;
wherein movement of the piston from the standby position to the released position is configured to move the pin within a bore (53) of the contact from a standby position to a released position;
wherein movement of the pin from the standby position to the released position is configured to indicate that the piston has moved from the standby position to the released position; and
wherein, the stored energy unit is located within or associated with the switch such that activation of the stored energy unit is configured to move the piston from the standby position to the released position.

2. Switch according to claim 1, wherein the cylinder is configured to connect to a part of a switchgear at earth potential.

3. Switch according to any of claims 1-2, wherein the contact is configured to make electrical connection with at least one current carrying part of the switchgear.

4. Switch according to any of claims 1-3, wherein movement of the pin from the standby position to the released position is configured to cut through a communication cable (80) to indicate that the piston has moved from the standby position to the released position.

5. Switch according to claim 4, wherein the communication cable is an optical fibre.

6. Switch according to any of claims 1-5, wherein when in the standby position the switch is configured such that at least one region inside the switch between piston and the contact is configured to be under vacuum.

7. Switch according to claim 6, wherein when in the standby position a barrier (110) is configured to form a first region inside the switch between piston and the barrier configured to be under vacuum and the barrier is configured to form a second region inside the switch between barrier and the piston configured to be under vacuum.

8. Switch according to claim 7, wherein movement of the piston from the standby position to the released position is configured to break the barrier with the piston.

9. Switch according to any of claims 6-8, wherein the switch comprises a bellows (70), wherein a first end of the bellows is connected to the pin and wherein a second end of the bellows is connected to the contact, wherein a vacuum tight seal is formed around the bore of the contact.

10. Switch according to any of claims 1-9, wherein the switch comprises at least one insulator wall section (10) between the cylinder and the contact.

11. Switch according to any of claims 1-10, wherein when in the standby position the piston is held in position by a lid (40) connected to the piston and connected to the cylinder or when in the standby position the piston is held in position by a lid (40) connected to the piston and connected to at least one insulator wall section between the cylinder and the contact.

12. Switch according to claim 11, wherein the lid comprises a predetermined breaking area (42) configured to break when the piston moves from the standby position to the released position.

13. Switch according to any of claims 1-10, wherein gas from the stored energy unit is configured to move the piston from the standby position to the released position upon activation of the stored energy unit.

14. Switch according to claim 13, wherein the stored energy unit comprises a micro gas generator or a pressurized gas container.

15. A switchgear comprising one or more switches according to any of claims 1-14.

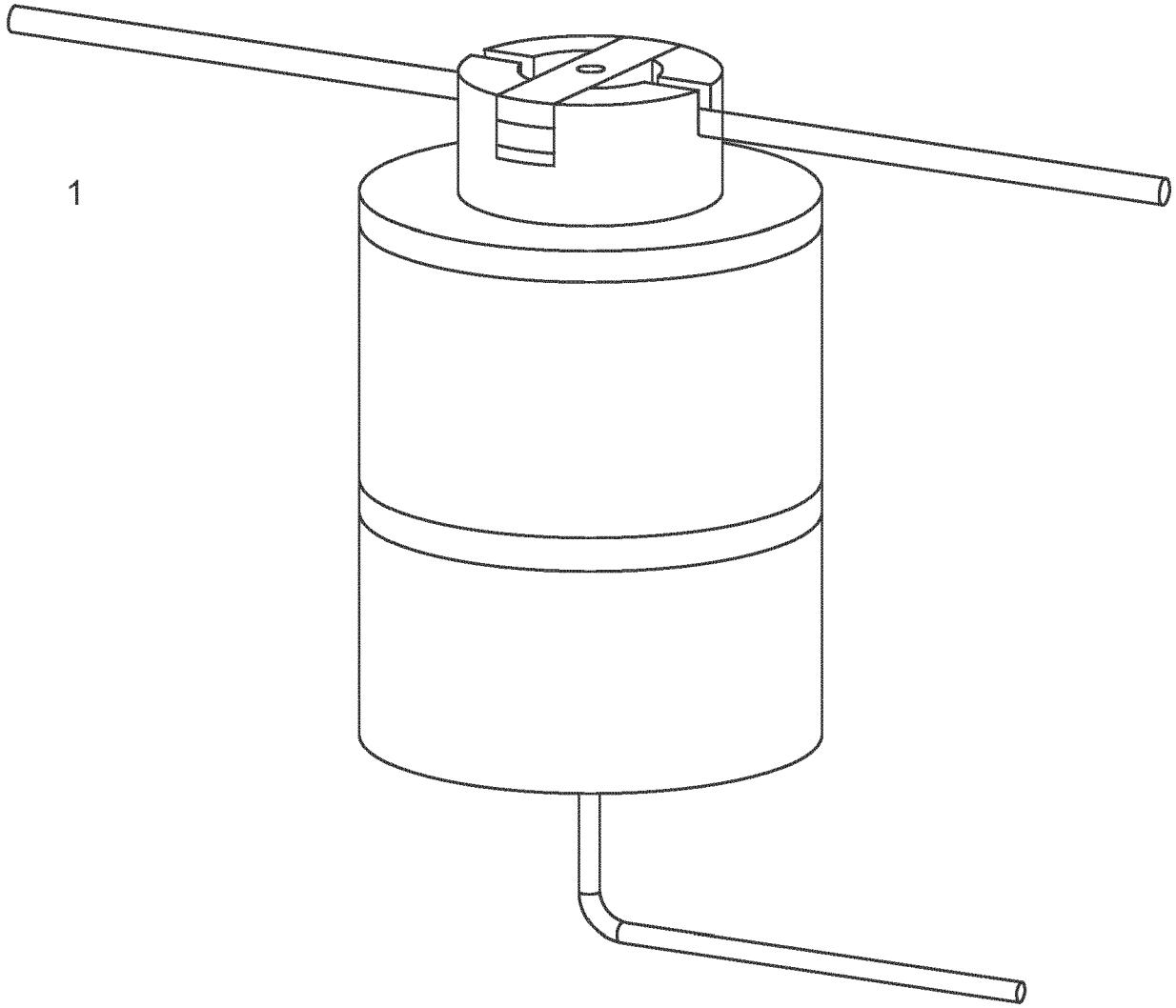

Figure 1

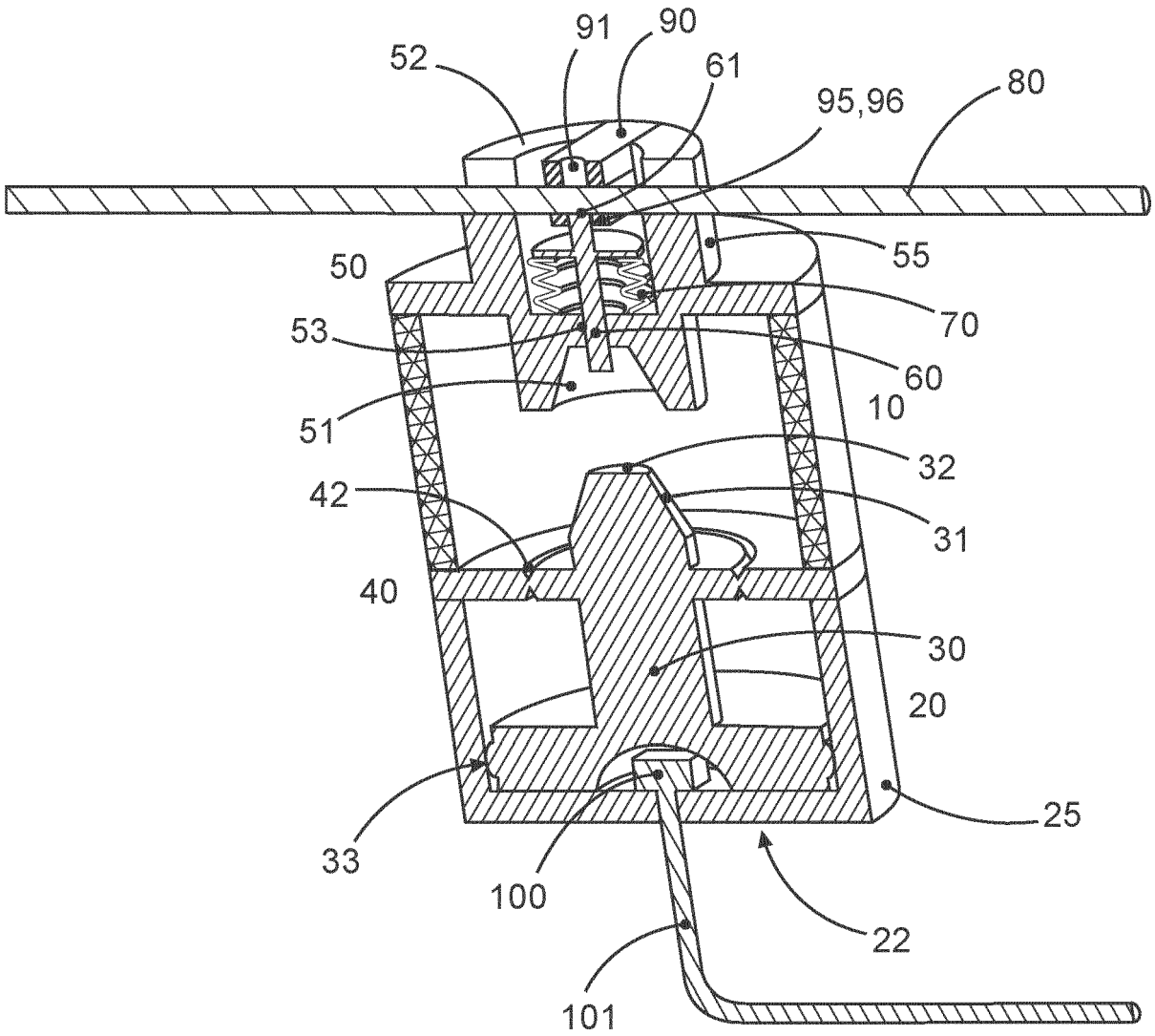
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Figure 2

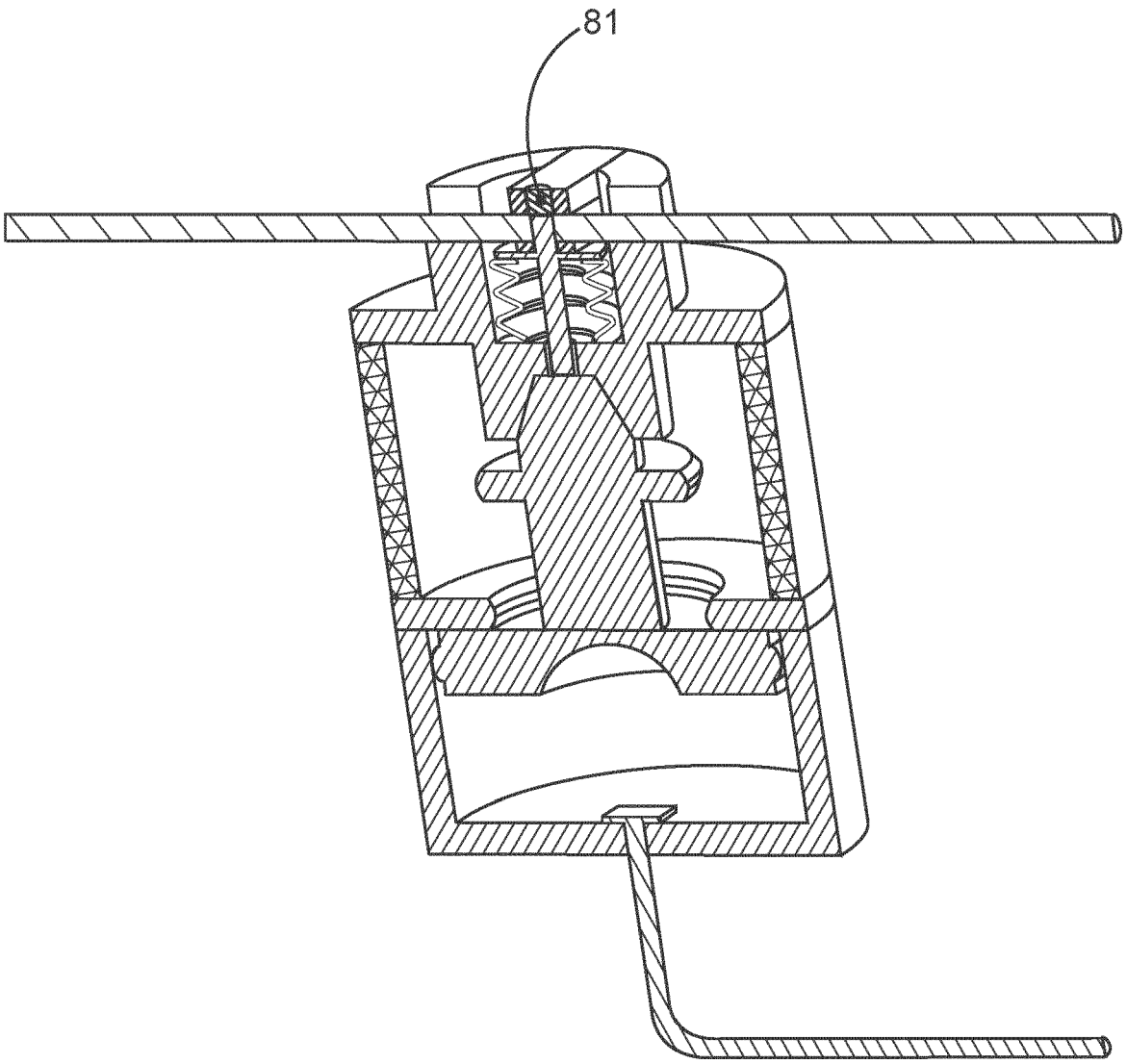

Figure 3

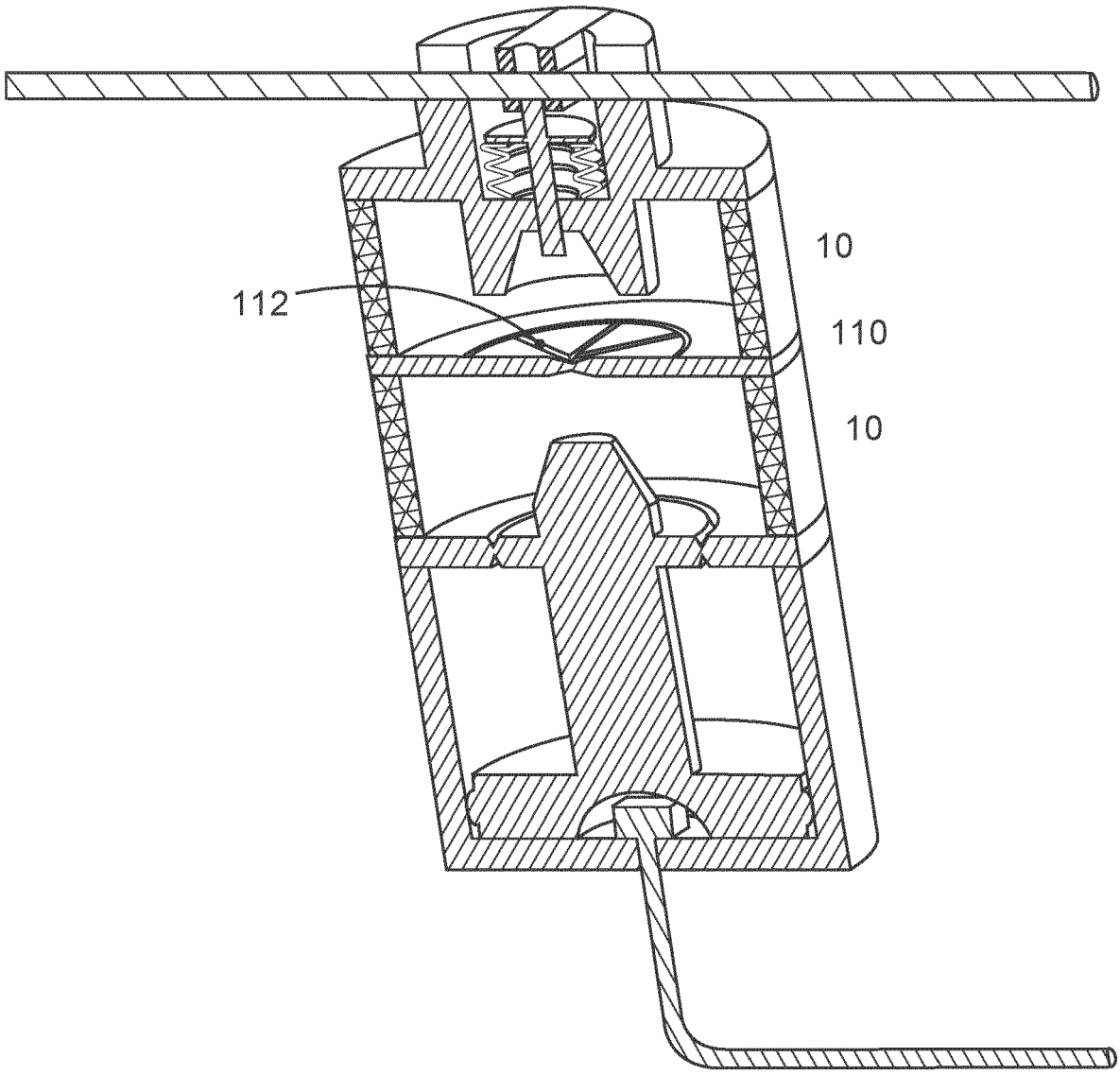

Figure 4

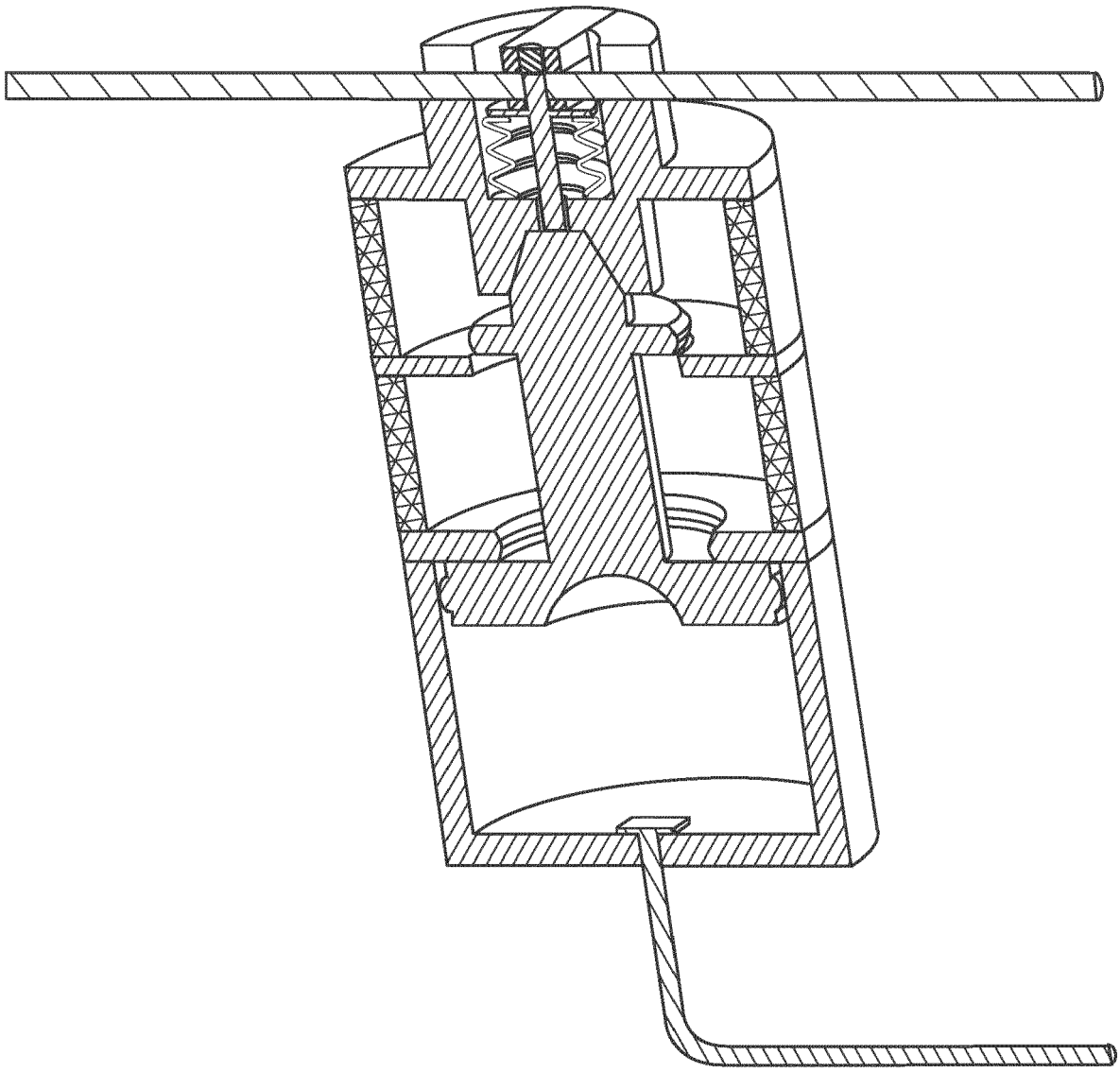

Figure 5

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 6771

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 034 503 A1 (ABB TECHNOLOGY AG [CH]) 11 March 2009 (2009-03-11) * paragraphs [0029] - [0033] * * figure 1 *	1-15	INV. H01H79/00 H01H39/00 H01H9/16
A	Dietmar Gentsch ET AL: "S3 - Speed, safety and savings", ABB review 2|10, 9 September 2010 (2010-09-09), pages 84-86, XP055207472, Retrieved from the Internet: URL:https://library.e.abb.com/public/0e511a63c9eef5ebc12577990036b369/ABB%20Review%202-2010_72dpi.pdf [retrieved on 2015-08-12] * page 86; figure 2 *	1-15	ADD. H01H31/00 H01H33/666
A	EP 2 159 813 A1 (ABB TECHNOLOGY AG [CH]) 3 March 2010 (2010-03-03) * paragraphs [0024] - [0026] * * figure *	1-15	
A	DE 20 2006 020737 U1 (DEHN & SOEHNE [DE]) 24 September 2009 (2009-09-24) * paragraphs [0066] - [0070] * * paragraphs [0080] - [0083], [0120] * * figures 1,2,4 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) H01H
A	US 2013/033796 A1 (SHEA JOHN J [US]) 7 February 2013 (2013-02-07) * paragraphs [0057] - [0062], [0075] * * figures 1,2,5 *	1-15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 November 2022	Glaman, C

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 17 6771

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2034503 A1	11-03-2009	BR PI0816387 A2	03-03-2015
		CN 101796604 A	04-08-2010
		EP 2034503 A1	11-03-2009
		EP 2198444 A1	23-06-2010
		ES 2529049 T3	16-02-2015
		JP 5254340 B2	07-08-2013
		JP 2010538431 A	09-12-2010
		KR 20100051844 A	18-05-2010
		RU 2010112698 A	10-10-2011
		UA 100027 C2	12-11-2012
		US 2010219162 A1	02-09-2010
		WO 2009030443 A1	12-03-2009
EP 2159813 A1	03-03-2010	AT 497246 T	15-02-2011
		AU 2009287023 A1	04-03-2010
		BR PI0918286 A2	22-12-2015
		CN 102138194 A	27-07-2011
		EG 26245 A	20-05-2013
		EP 2159813 A1	03-03-2010
		ES 2359755 T3	26-05-2011
		JP 5279910 B2	04-09-2013
		JP 2012501514 A	19-01-2012
		KR 20110053976 A	24-05-2011
		PL 2159813 T3	29-07-2011
		PT 2159813 E	18-04-2011
		RU 2464664 C1	20-10-2012
		UA 100437 C2	25-12-2012
		US 2011163070 A1	07-07-2011
		WO 2010022938 A1	04-03-2010
		ZA 201101505 B	26-10-2011
DE 202006020737 U1	24-09-2009	AT 433602 T	15-06-2009
		AT 463833 T	15-04-2010
		CN 101278369 A	01-10-2008
		DE 102005048003 A1	19-04-2007
		DE 202006020737 U1	24-09-2009
		EP 1911059 A1	16-04-2008
		EP 2051275 A1	22-04-2009
		PL 2051275 T3	30-09-2010
		WO 2007014816 A1	08-02-2007
US 2013033796 A1	07-02-2013	US 2013033796 A1	07-02-2013
		WO 2013022572 A1	14-02-2013

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82