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(54) **Method and system for a pre-selector in a tap changer**

(57) The present invention relates to a method and a system for a pre-selector with contacts in a tap changer of a transformer. The system comprises a moveable part (2) being connected to one of the contacts of the pre-selector and being arranged to be pivotally moveable around a pivot point (3) between a first and a second end

position. The system further comprises a first and a second spring (4,5) arranged to act on the said moveable part.

When the moveable part is pivotally moved past a first knee position, the force from the first spring is acting in the same direction as the started pivotal movement towards the second end position.

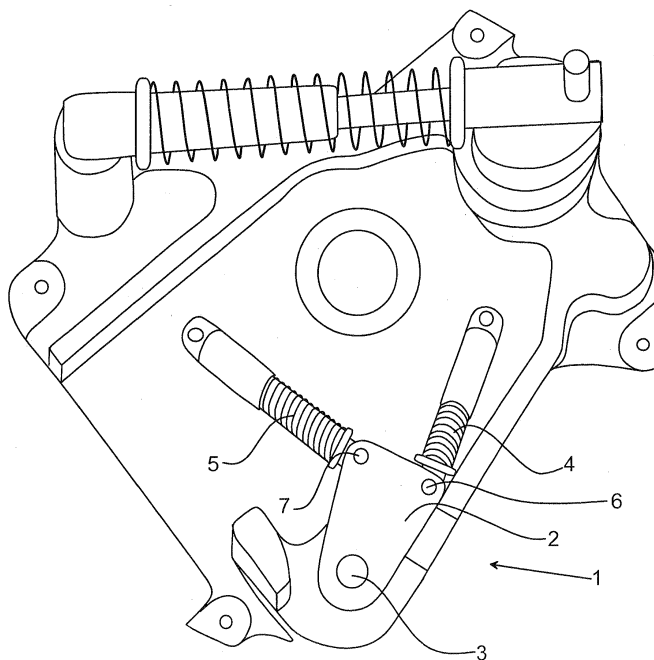


Fig. 1

Description

Technical Field

[0001] The present invention relates generally to tap changers for transformers, and in particular to a method and a system for a pre-selector of a tap changer of a transformer.

Background

[0002] In power transformers, on-load tap changers (OLTC) are used to change tapping connections of transformer windings while the transformer is energised. Since the transformer is in use, arcing will occur when the tapping connections are changed. Pre-selectors are used in on-load tap changers to enable connecting or disconnecting turns of the transformer winding. Pre-selectors may also be used to connect a whole part of a winding. Also in the contacts of the pre-selector, arcing will occur when the contacts are moved. If arcing is not restrained, increased wear of the contacts occur as well as a risk of damage to the transformer windings with shortened duty operational time for both the tap changer and the transformer as a result. In a worst case scenario, an arc in the pre-selector will turn out to be a short-circuit, causing serious damages to the transformer.

[0003] To limit arcing in the contacts of the pre-selector, so called tie-in-resistors are used. Instead of causing an arc, the energy stored when breaking the contacts of the pre-selector is released in the form of a controlled current through the tie-in-resistor. Although serving as a good working solution, there are some drawbacks with the tie-in-resistors. They are expensive and bulky and are preferably only installed if there are specific circumstances requiring such installation. A risk is that the conditions at site are not fully known, or are changed, with damages to the transformer being a result if tie-in-resistors are not installed. Further, if tie-in-resistors are installed, the energy will still be present in the form of heat in the resistor.

[0004] Further, to secure proper functionality it is of importance that the pre-selector is securely locked when positioned in the appropriate position. There are known systems where the locking function of the pre-selector is achieved by two surfaces being in contact with each other by high friction. However, since the locking function is caused by the two surfaces being in contact, high friction between the surfaces is also caused when it is not wanted, i.e. when the pre-selector contacts are to be separated. If the contacts are not separated quickly, more arcing will occur during separation leading to unnecessary wear of the contacts and risk of damaging the transformer winding.

Summary of invention

[0005] It is an object of the invention to provide a meth-

od and a system for a pre-selector on a tap changer for a transformer without the drawbacks described above.

[0006] This object is achieved by providing a method for operating a system for a pre-selector with contacts in a tap changer for a transformer. The system comprises a moveable part being connected to one of the contacts of the pre-selector. The moveable part is arranged to be pivotally moveable around a pivot point between a first and a second end position. The system further comprises a first and a second spring arranged to act on the moveable part. A force is applied to said moveable part overcoming the forces from the first and the second spring. The springs are arranged to keep the moveable part in its first end position. The applied force is pivotally moving the moveable part from the first end position in direction towards the second end position. The force from the first spring is, when said moveable part is pivotally moved past a first knee position, acting in the same direction as the started pivotal movement towards the second end position.

[0007] The force applied by the first pressure spring thus contributes to the movement whereby quick contact separation of the contacts in the pre-selector is achieved. Quick contact separation is advantageous since the occurring arc can be extinguished faster which leads to less contact wear. Further, the faster the arc is extinguished, the less heat is generated. Still further, with enough quick separation of the contacts, there is no need for expensive and bulky tie-in-resistors to handle the arcs.

[0008] In a preferred embodiment, the force from the second spring, when the moveable part is further pivotally moved past a second knee position, is acting in the same direction as the started pivotal movement towards the second end position.

[0009] In a preferred embodiment, the forces from the first and the second spring are acting to keep the moveable part in position when positioned in either of the endpoints.

[0010] In a preferred embodiment, the forces from the first and the second spring are equal and acting to keep said moveable part in position when positioned in an equilibrium position between the endpoints.

[0011] The invention further relates to a system for operating a pre-selector with contacts in a tap changer for a transformer comprising a moveable part being connected to one of the contacts of the pre-selector and being arranged to be pivotally moveable around a pivot point between a first and a second end position. The system further comprises a first and a second spring arranged to act on the moveable part. The first and the second spring is arranged to keep the moveable part in its first end position. The first spring, when the moveable part is pivotally moved past a first knee position, is arranged to apply a force on the moveable part acting in the same direction as the started pivotal movement towards the second end position.

[0012] In a preferred embodiment are the first and the second springs arranged to apply a force on the move-

able part, by which force the moveable part is locked in respective position when positioned in respective first and second end position.

[0013] In a preferred embodiment can the moveable part be positioned in an equilibrium position between the first and the second end position.

[0014] In a preferred embodiment is the moveable part kept in the said equilibrium position by that the forces of the first and the second springs are symmetrically applied on the moveable part and equal to each other.

[0015] In a preferred embodiment are both the first spring and the second spring arranged to apply forces keeping the said moveable part locked in respective first and second end position.

[0016] In a preferred embodiment are the first and the second springs pressure springs.

Brief Description of the Drawings

[0017]

Figure 1 illustrates the system where the driver is positioned in a first locking position.

Figure 2 illustrates the system where the driver has been moved slightly to a first knee position.

Figure 3 illustrates the system where the driver has been further moved to an equilibrium position.

Figure 4 illustrates the system where the driver has been further moved to a second knee position.

Figure 5 illustrates the system in a second locking position.

Detailed Description

[0018] Figure 1 illustrates a system 1 for locking a pre-selector on a tap changer for a transformer according to the present invention. A moveable part 2, hereinafter named as the driver, is connected to the contact of the pre-selector.

[0019] The driver 2 is arranged to be moved by a motor drive (not shown) between a first and a second position with an intermediate equilibrium position. A first and a second pressure spring 4, 5 are arranged to act on the said moveable part 2. The first and second springs are attached to the moveable part 2 in a first and a second attachment point 6, 7. In Figure 2, the driver 2 is positioned in a first locking position. Both the first and the second spring 4, 5 keep the driver 2 locked in the position. The attachment points 6, 7 are chosen to achieve that both the first spring 4 and the second spring 5 apply spring pressure forces keeping the driver 2 locked in each of the first and the second position as shown in Figure 1 and 5, respectively.

[0020] During operation, the system 1 works as fol-

lows. In a first locked position as shown in Figure 2, both springs 4, 5 applies pressing forces acting in directions keeping the driver locked in position as described above. As shown in Figure 3 the moveable part 2 is moved from its first locked position by a motor drive (not shown) overcoming the pressure forces of the first and the second spring 4, 5. When the driver is moved to a first specific position, a first knee-point, the attachment point of the first spring have been moved to a position where the pressure force from the first spring instead of locking the driver 2 in its first position acts on the driver helping the started pivotal movement in the other direction away from the first locked position. The force applied by the first pressure spring 4 thus contributes to achieve quick contact separation of the contacts in the pre-selector. Quick contact separation is preferred since the occurring arc can be extinguished faster which leads to less contact wear.

[0021] With reference to Figure 4, both pressure springs 4, 5 are arranged to act with equal forces on the driver 2 when the driver is positioned in an intermediate equilibrium position, thereby keeping the driver 2 in the intermediate position.

[0022] In the equilibrium position shown in Figure 4, the driver stops from moving to long in an uncontrolled way. In this intermediate position, the two pressure springs 4, 5 acts with equal forces symmetrically applied to the driver, thereby keeping the driver in the position.

[0023] The driver is then moved towards the next toggle point by the motor drive as shown in Figure 5. When the driver is moved to a second specific position, a second knee-point, the attachment point of the second spring have been moved to a position where the pressure force from the second spring instead of keeping the driver 2 in its intermediate position acts on the driver helping the started pivotal movement in the direction towards the second locked position.

[0024] Both springs 4, 5 applies pressure forces contributing to the movement of the driver 2 to the locked position, resulting in a distinct entering of the contact. In the second locked position, shown in Figure 5, both springs 4, 5 are applying pressure forces keeping the driver 2 locked in the second position similar to the locking in the first position as described above.

[0025] The invention has mainly been described above with reference to a few embodiments. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended patent claims.

Claims

1. A method for operating a system for a pre-selector with contacts in a tap changer for a transformer, said system comprising a moveable part (2) being connected to one of the contacts of said pre-selector and being arranged to be pivotally moveable around

a pivot point (3) between a first and a second end position,
and at least a first and a second spring (4, 5) arranged to act on the said moveable part (2),
said method comprising

- applying a force to said moveable part (2) overcoming the forces from said first and said second spring (4, 5) being arranged to keep the moveable part in its first end position, and pivotally moving said moveable part (2) from the first end position in direction towards the second end position,

characterised in that,

the force from the first spring (4), when said moveable part (2) is pivotally moved past a first knee position, is acting in a direction contributing to the started pivotal movement towards the second end position.

2. A method according to claim 1, wherein the force from said second spring (5), when said moveable part (2) is further pivotally moved past a second knee position, is acting in a direction contributing to the started pivotal movement towards the second end position.

3. A method according to claim 1 or 2, wherein the forces from said first and said second spring (4, 5) are acting to keep said moveable part (2) in position when positioned in either of said endpoints.

4. A method according to claim 1, 2 or 3, wherein the forces from said first and said second spring (4, 5) are equal and acting to keep said moveable part (2) in position when positioned in an equilibrium position between said endpoints.

5. A system (1) for operating a pre-selector with contacts in a tap changer for a transformer, comprising a moveable part (2) being connected to one of the contacts of said pre-selector and being arranged to be pivotally moveable around a pivot point (3) between a first and a second end position, and at least a first and a second spring (4, 5) arranged to act on the said moveable part (2), said first and said second spring (4, 5) being arranged to keep the moveable part in its first end position,

characterised in that,

said first spring (4), when said moveable part (2) is pivotally moved past a first knee position, is arranged to apply a force on said moveable part (2) acting in a direction contributing to the started pivotal movement towards the second end position.

6. A system (1) according to claim 5, wherein said first and said second springs (4, 5) are arranged

to apply a force on the said moveable part, by which force the said moveable part is locked in respective position when positioned in respective first and second end position.

7. A system according to claim 6, wherein said moveable part (2) can be positioned in an equilibrium position between said first and said second end position.

8. A system according to claim 7, wherein said moveable part (2) is kept in the said equilibrium position by that the forces of the first and the second springs (4, 5) are symmetrically applied on the said moveable part (2) and equal to each other.

9. A system according to any of claims 5-8, wherein both said first spring (4) and said second spring (5) is arranged to apply forces keeping the said moveable part locked in respective first and second end position.

10. A system according to any of claims 5-9, wherein said first and second springs (4, 5) are pressure springs.

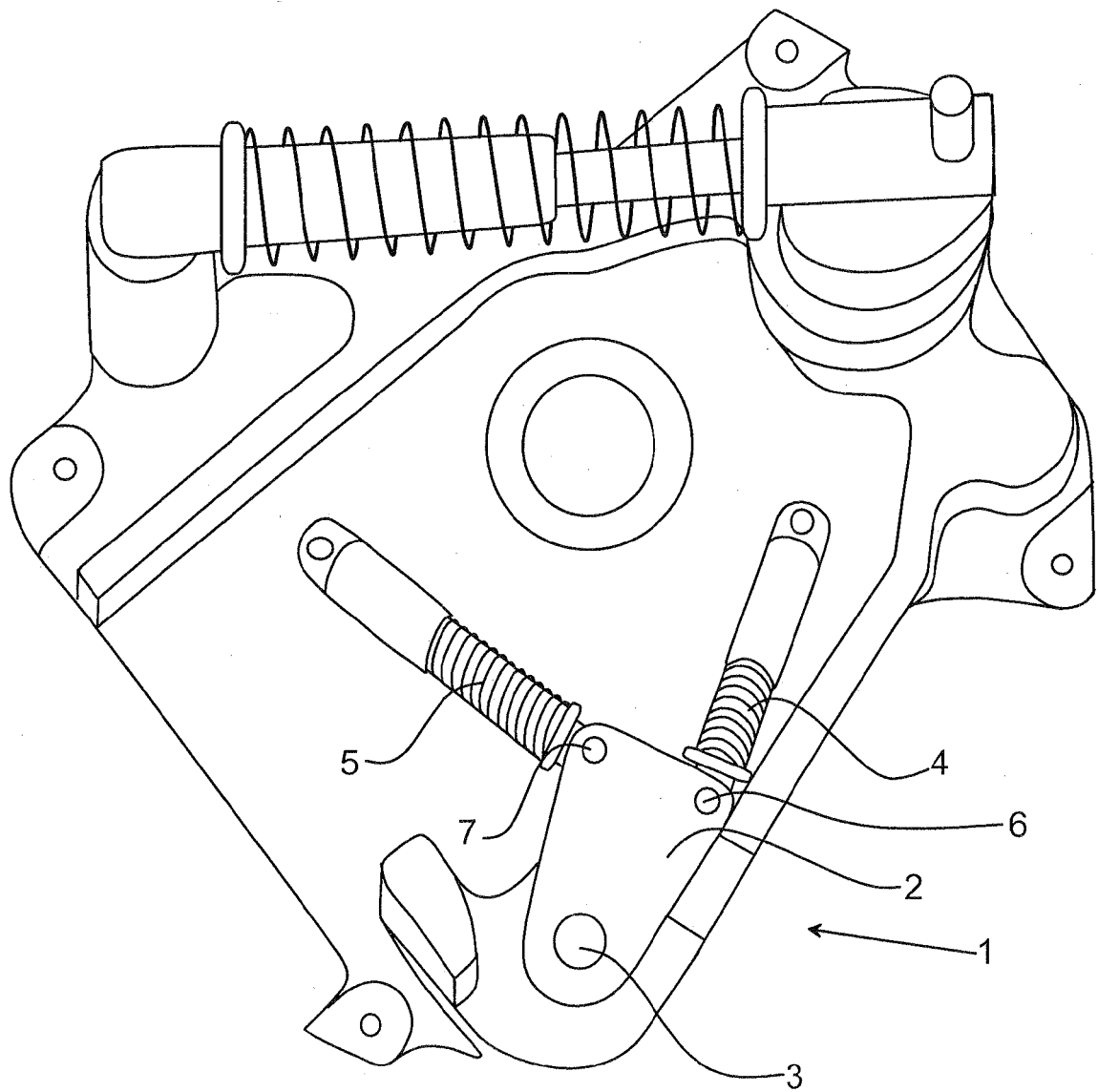


Fig. 1

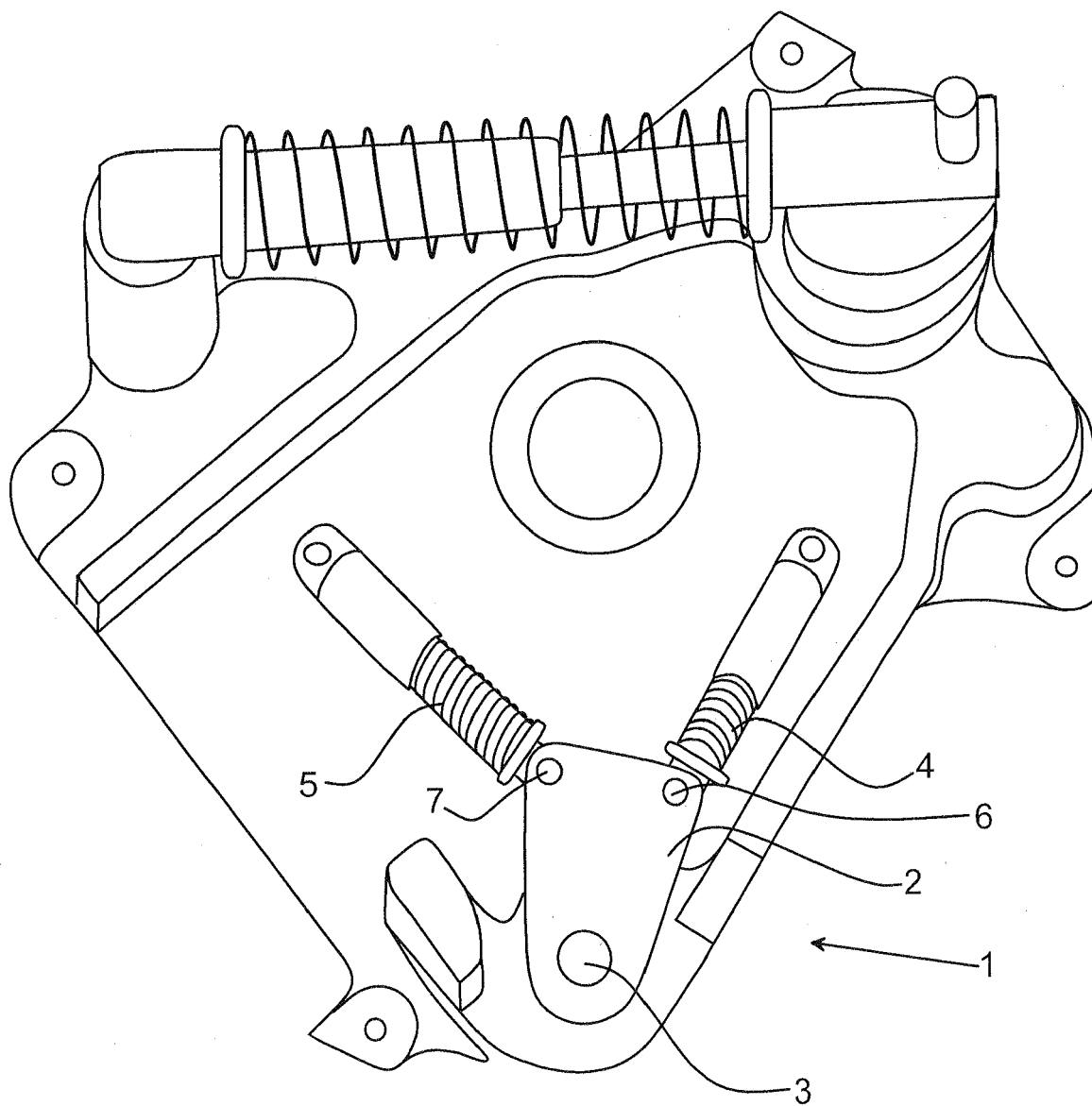


Fig. 2

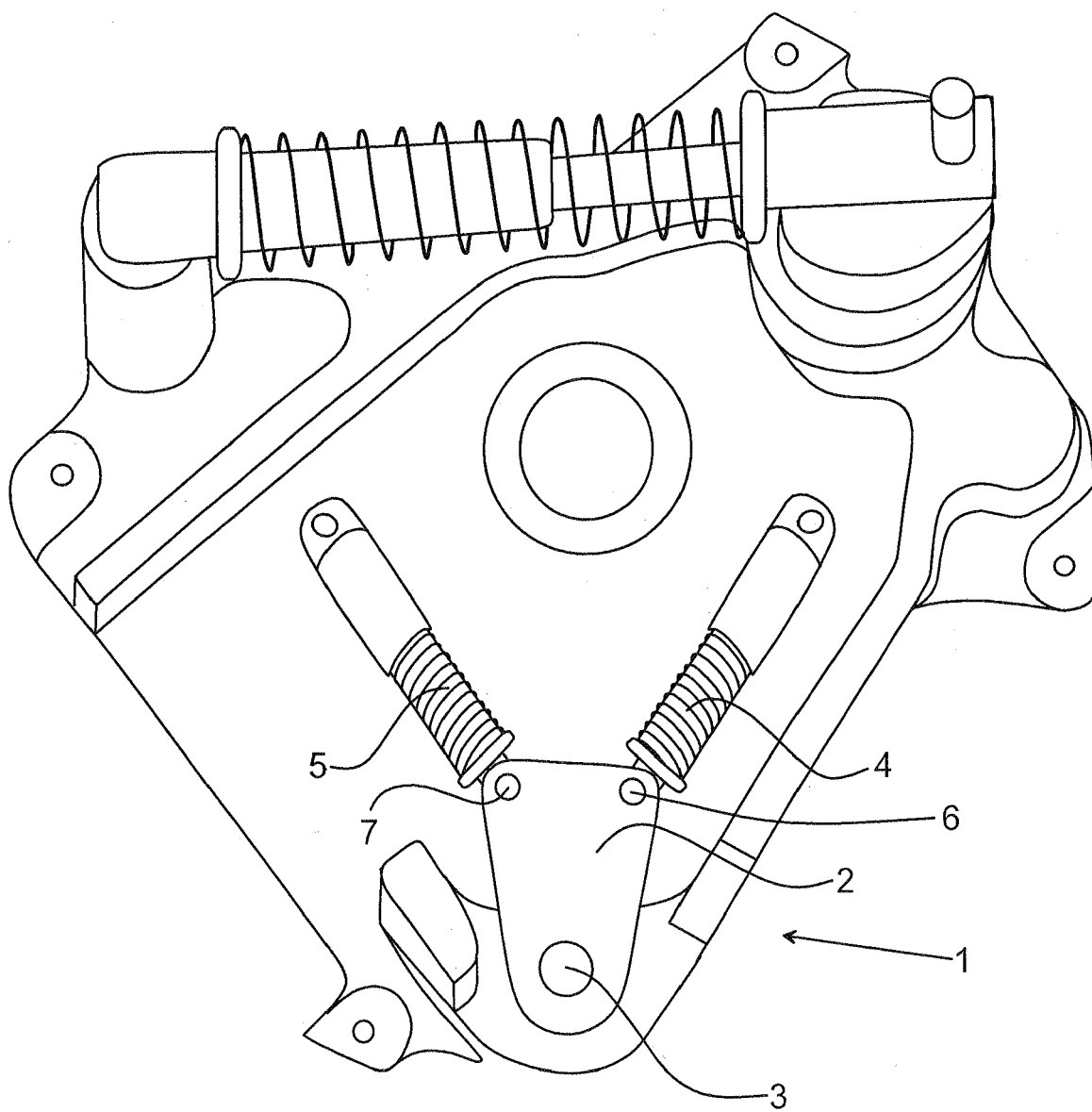


Fig. 3

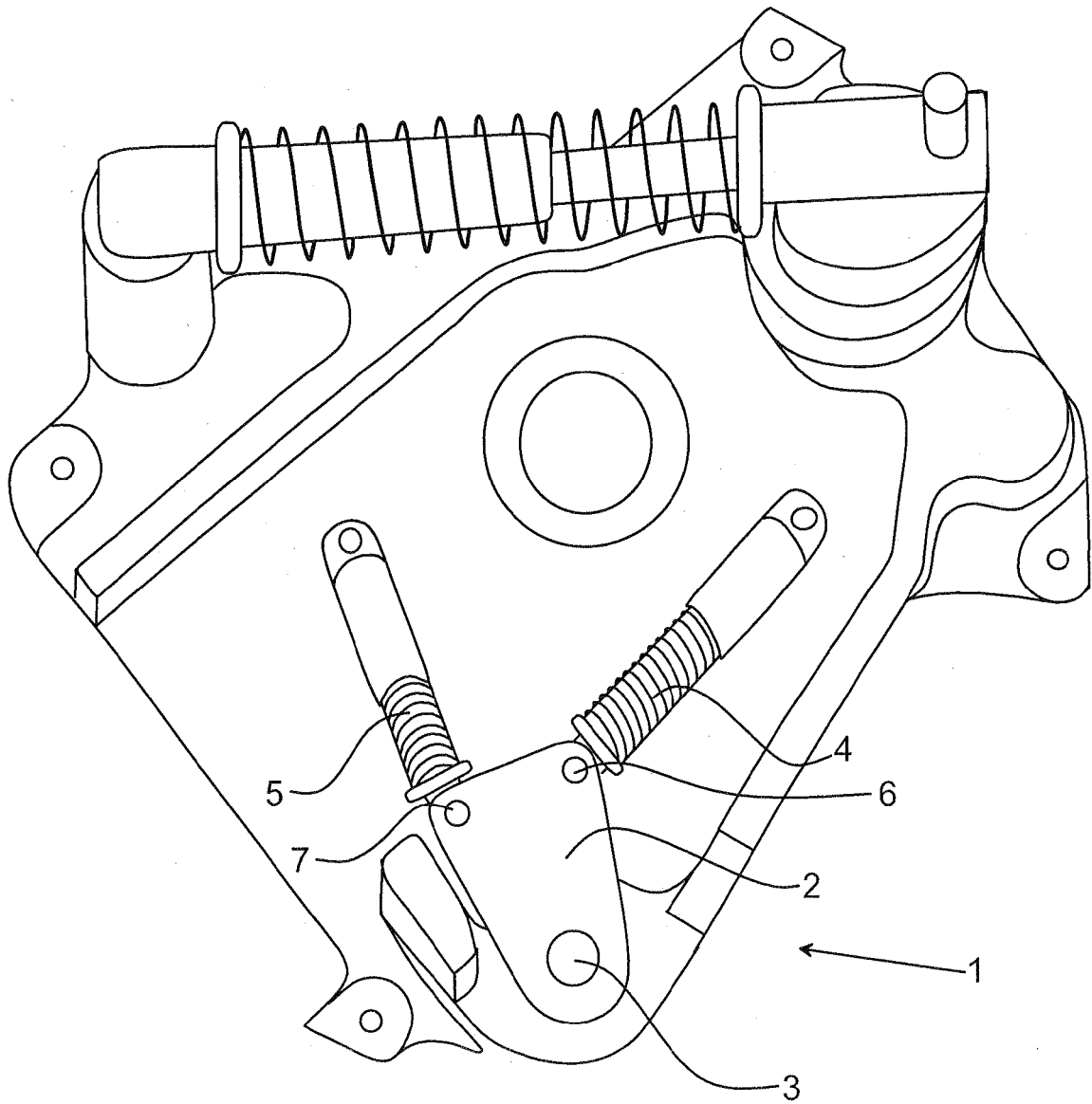


Fig. 4

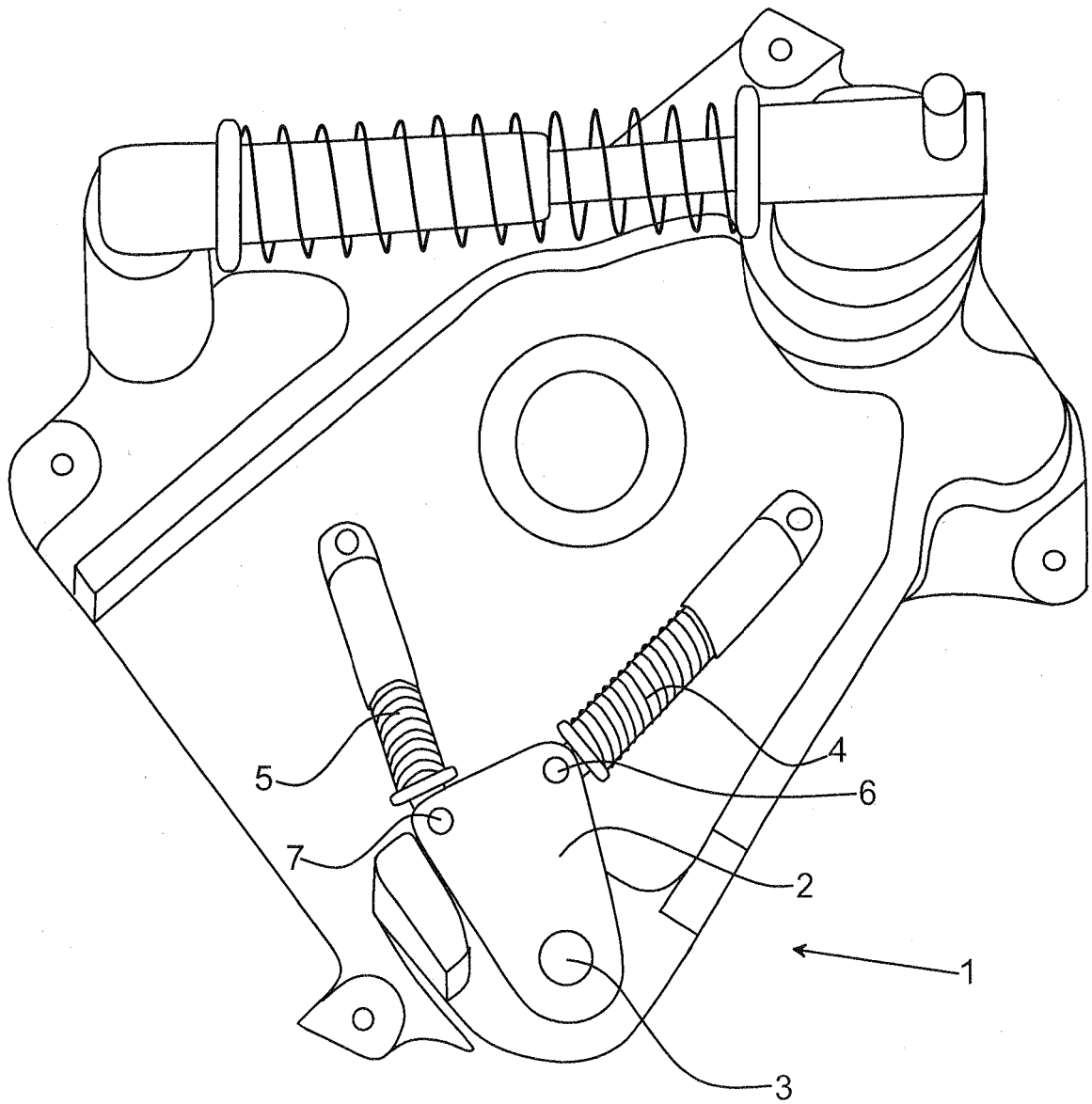


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 09 16 1052

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2 947 838 A (UREDA BENON F) 2 August 1960 (1960-08-02) * column 2, line 40 - column 4, line 50; figures 5-9 *	1-10	INV. H01H9/00
A	US 2 177 109 A (HILL LELAND H) 24 October 1939 (1939-10-24) * the whole document *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		12 October 2009	Simonini, Stefano
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			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 16 1052

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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12-10-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2947838	A	02-08-1960	NONE
US 2177109	A	24-10-1939	NONE