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(54) Shunt breaking system

(57) The present invention provides for a vacuum circuit interrupter device for a medium voltage switching apparatus such that the device is designed to generate a parallel or secondary circuit within the said apparatus where the operating linkage included in the said device allows the vacuum interrupter to be placed at any desirable position based on the available space within the said switching device.

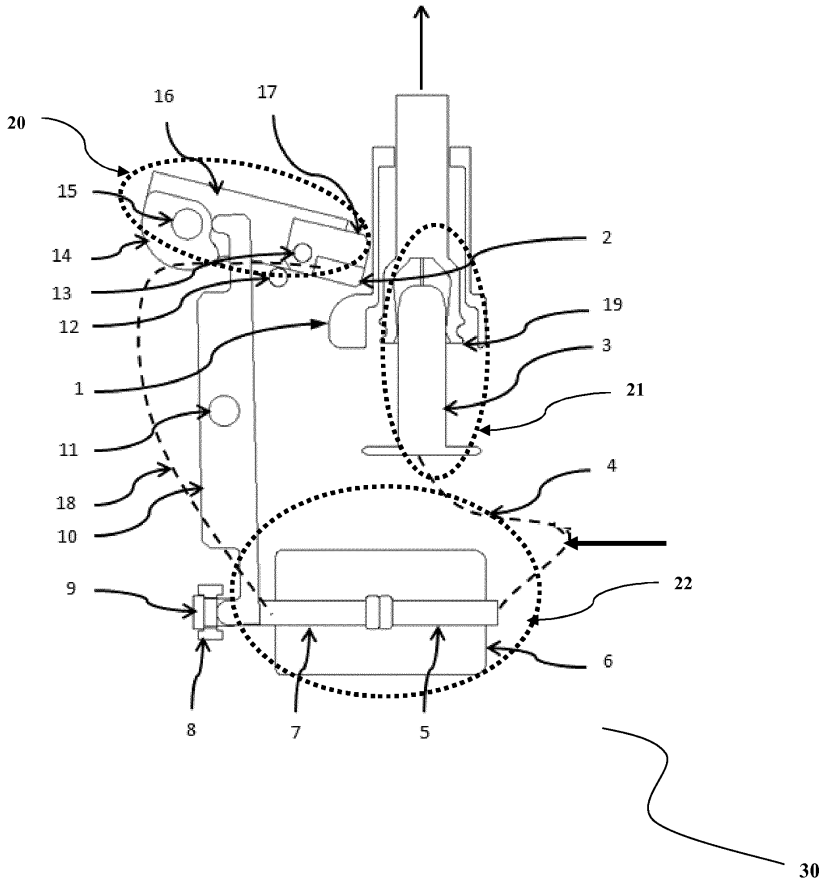

FIGURE 6

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Description

[0001] **Technical field:** The present invention relates to a vacuum interrupter device designed to break an electrical circuit in a medium voltage switch disconnector, incorporating such a device.

[0002] **Background and prior art: Background and prior art:** Generally an electrical switch disconnector is designed to provide a making or breaking of specified currents. As already known it mainly comprises a sealed enclosure filled with a high dielectric strength gas, in which a pair of main contacts are arranged, one stationary contact and the other movable, connected to an operating drive. A pair of arcing contact arc sometimes electrically connected in parallel to the main contacts, such as to open the arcing contacts after the main contacts during breaking, and to close the arcing contacts before the main contacts during making.

[0003] There are various methods to achieve the required breaking capacity in a switch disconnector. To handle the arcing during breaking operation, some designs use arc splitters as that in FBX Ring Main Unit, some use the puffer systems as that in RM6 Ring Main Units. Prior arts such as EP2182536 and EP2479769 disclose parallel switching which has a primary circuit **and** a secondary circuit containing a vacuum interrupter. The primary circuit is used during the normal working of the switch disconnector. During the opening operation of the switch disconnector, current is transferred from primary circuit to secondary circuit by the moving contact and the current breaking is made to happen in a vacuum environment.

[0004] EP2182536 describes an application for **a** switch disconnector with rotary motion of the contacts. The linkage operating the vacuum interrupter (**Figure 1**) has a sliding joint **10** between the lever 7 and the moving contact **5** of the vacuum interrupter. The end positions and movement (velocity) of moving contact of vacuum interrupter depends on the length of ratios of lever **7** i.e. distance between the pivot **11** and its free end **9** to the distance between the pivot **11** to the sliding joint **10.**

[0005] EP2479769 discloses an application for a switch disconnector having moving contacts with rotary and sliding or linear motion. As seen **in figure 2,** the lever **18,** interacting with the main moving contact, is pivoted at two positions **11** and **21.** This lever articulates/rotates about different pivots during opening and closing of the switch disconnecter. During opening, the lever **18** rotates about pivot **21.** This lever has an oblong slot which allows it to rotate about pivot **11** during closing of switch disconnecter. The linkage operating the vacuum interrupter has a lever **18** which is pivoted about the pin **21.** This lever is connected to the moving contact of vacuum interrupter by a hinge **11**. The end positions and movement (velocity) of moving contact of vacuum interrupter depends upon the length ratios of the lever **18** i.e. distance between the pivot **11** and its free end to the distance between pivot **11** to the pivot pin **21.**

[0006] On applying the above teachings to the existing switch disconnector **(figure 3)**; it was found that the linkage designs of the above mentioned prior arts require the vacuum interrupter to be placed close to the moving contact of the switch disconnector. Therefore the placement of vacuum interrupter, linkage pivot and linkage length provide very little flexibility. Further, adopting these designs in the existing switch disconnector require inure space and shall demand increase in the size of the enclosure. Moreover, the placement of vacuum interrupter and its operating mechanism will leave very little space in terms of dielectric withstand between the live vacuum interrupter **21** and the earthed tank **20**, considering the application at medium voltage levels (Rated voltage 240(and impulse level of 25 kV of the product being designed). **Figure 4** shows the dielectric criticality of such arrangement of vacuum interrupter when simulated in the Flux 2D analysis. It is known that stroke and velocity of the moving contact of a switch disconnector is dependent on its operating drive. As the secondary circuit is mechanically driven by the moving contact of the switch disconnector, any changes in its movement shall require most of the linkages to he modified to get the desired contact movement of the vacuum interrupter.

[0007] Prior art DE10047032 relates to an application for a switch disconnector having moving contacts with rotary motion **(figure 5)**. Secondary circuit (vacuum interrupter and its operating linkages) are mounted on the moving contact of the switch disconnector. Cam **12** operates a pin 11 which is rigidly connected to the moving contact of the vacuum interrupter. However, here, the secondary circuit along with the vacuum interrupter are mounted on the moving contact which increases the mass of the moving contact and shall demand more energy to move the contacts of switch disconnector.

[0008] Hence there was felt a pressing requirement for an alternate position of vacuum interrupter and a suitable linkage which can be accommodated in available space.

[0009] **Summary of the Invention:** The present invention provides for a vacuum circuit interrupter device for a medium voltage switching apparatus such that the device is designed to generate a parallel or secondary circuit within the said apparatus where the operating linkages included in the said device allows the vacuum interrupter to be placed at any desirable position based on the available space within the said switching device.

[0010] **Brief Description of the Drawings:** A full understanding of the invention can be gained from the following description of the preferred embodiments when read in conjunction with the accompanying drawings in which:

Figure 1 describes the parallel switching mechanism existing in prior art EP2182536

Figure 2 describes the parallel switching mechanism existing in prior art EP2479769

Figure 3 illustrates the impractical positioning of vacuum interrupter of prior art solutions in present switch disconnector

Figure 4 shows dielectric criticality of arrangement of figure 3 in Flux2D analysis

Figure 5 describes the parallel switching mechanism in prior art DE10047032 where secondary circuit are mounted on the moving contact of the switch disconnector

Figure 6 and 7 depict the vacuum circuit interrupter device of the present invention wherein the contacts move in a linear motion

Figure 8 denotes the exploded view of the profiled cam of the device of present invention

Figure 9 denotes the exploded view of the contoured regions created during interaction of moving contact deflector with pallet contact of the device of the present invention.

Figure 10 and 16 depicts the position P2 of the device of present invention

Figure 11 and 17 illustrates position P3 of the device of present invention

Figure 12, 13 and 18 denote position P4 of the device of present invention

Figure 15 and 28 illustrate position P1 of the device of present invention

Figure 14 illustrates an alternate embodiment of the present invention in which the contacts move in a rotary motion

Figure 19 is an illustration of calculation of ratio of displacement on profiled cam and moving contact of the vacuum interrupter through lever (10) in present invention

Figures 20 depict exploded view of profiled cam of device of present invention

Figures 21-23 depict different possible orientations of the cam in the present invention

Figures 24-27 depict exploded view different profiles of lever (10) of device of present invention

[0011] **Detailed Description of the Invention:** The present invention is intended to function as a parallel or secondary circuit for an existing switch disconnector. Considering the size of existing enclosures, vacuum interrupter has to be positioned in location such that the new operating linkage is rendered suitable to transfer the motion to the vacuum interrupter in less space or rather available space.

[0012] The detailed description provided herein after is for an embodiment where the stationary contact (3) is connected to the incoming busbar and the moving contact **(19)** is connected to the outgoing busbar. An embodiment where the stationary contact is connected to the outgoing busbar and moving contact is connected to incoming bus bar is also envisaged by the present invention. Referring to **figure 6**, there is depicted a vacuum circuit interrupter device **(30)** of the present invention and comprising a primary circuit **(21)** consisting of stationary contact (3) and moving contact **(19)** and a moving contact deflector **(1)** rigidly connected thereto; a secondary circuit **(22)** consisting of a vacuum interrupter (6) electrically connected to the stationary contact **(3)** on terminal (5) by a flexible connection **(4)** and a moving contact **(7)** connected to moving contact deflector **(1)** through a pallet contact (2) and a flexible connection **(18)** and an operating linkage comprising of lever (10) and a profiled cam **(14)** for moving the vacuum interrupter **(6)** between a closed circuit position in electric communication with the stationary contact (3) and an open circuit position. The linkage is defined by the transfer of movement of moving contact (19) to the vacuum interrupter (6) with required amount of displacement and velocity. The lever **(10)** is rotatable at pivot **(11)** preferably around the middle of its length for connecting the cam **(14)** at lever first end (23) and connected to guide (8) at lever second end (33) (figure 7). A collar (9) is connected to guide (8) at collar first end and the moving contact (7) of vacuum interrupter (6) at collar second end. The guide (8) in conjunction with the collar (9) is configured to travel a linear path defining a travel path for moving contact (7).

[0013] The pallet contact (2) is rigidly mounted on first end of pallet base (17) configured to be engaged with moving contact deflector (1). A pallet lever (16) is rotatably connected at its one end at pivot (13) with pallet base and second end configured to rigidly connect with cam **(14)** on its other end. The pallet base (17) is biased by a torsion spring placed at pivot (13) against the pallet lever **(16).** The assembly **(20)** of pallet lever **(16)** cam **(14)** pallet base (17) and pallet contact **(2)** is pivoted around pivot **(15)**. The assembly (20) is biased by a torsion spring placed at pivot **(15)** against stopper pin **(12)** configured to prevent the pallet lever (16) from clockwise rotation during closing of vacuum interrupter (6). Referring to **figure** 9, the moving contact deflector **(1)** has a special feature, having specific contour-for example in region (e) which interacts with the pallet contact (2) with specific radius as in region **(d)**. The pull force in vacuum interrupter **(6)** due to its vacuum helps to keep a positive contact between the collar **(9)** and the guide **(8)**, guide (8) and the transfer lever (10) and also between the transfer lever (10) and the cam profile **(14)**.

[0014] The present invention further discloses that the

said linkage is defined by the transfer of movement of moving contact (19) to the vacuum interrupter **(6)** with required amount of displacement and velocity. Referring to figure **8,** the profiled cam **(14)** is defined for regions (a) and **(c)** of uniform radius and region **(b)** with varying radius with respect to pivot **(15)** for providing stroke and velocity of movement to vacuum interrupter **(6).** The ratio of displacement on profiled cam **(14)** and the moving contact (7) of vacuum interrupter **(6)** is dependent on ratio of distance between pivot **(11)** and point of interaction with cam **(14)** (**L1**) to the distance between the pivot **(11)** and point of interaction between the lever (10) and guide **(8) (L2).**

[0015] The vacuum circuit interrupter device of the present invention is of a medium voltage type suitable for placement in a medium voltage switching apparatus where the switch contact movement is either a linear or a rotary. The profile of the lever **(10)** of the operating linkage is dependent on position of vacuum interrupter **(6)** in said switching apparatus. Whereas orientation of cam **(14)** is a factor of direction of placement of vacuum interrupter **(6)** and resultant profile of lever **(10).**

[0016] The device **(30)** of the present invention is designed to generate a parallel or secondary circuit in the said switch apparatus. The operating drive of the present invention is designed to actuate the moving contact (19) takes four positions of opening position **(P1)**, separating position **(P2)**, disconnecting position **(P3)** and closing position **(P4).** Referring to **figure 6** and 14 which shows the close position of the switch, the current flows from the stationary contact (3) to the moving contact (19) through the primary circuit. The secondary circuit is inactive in this position. The vacuum interrupter **(6)** is closed. The opening position **(P1)** is a position for connection between the moving contact deflector **(1)** and the pallet contact (2) when the moving contact **(19)** is electrically connected to the stationary contact (3) allow current to flow from stationary contact (3) to moving contact **(19)** through primary circuit **(21)** (3-19) and through the secondary circuit **(22)** (3-4-57-18-2-1-19). As seen in **figure 28** which shows linear contact motion, the lever **(10)** interacts with region (a) of the cam **(14)** transferring no movement to the vacuum interrupter **(6)** resulting in vacuum interrupter being in closed position. In an alternate embodiment of P1 position shown in figure 15 where the contacts are seen to have rotary motion.

[0017] Referring to figure **10** and 16, the separating position (P2) is a position in which the moving contact (19) leaves the stationary contact (3) up to a distance for achieving a sufficient dielectric distance causing the primary circuit (21) (3-19) to become inactive and current to flow only through the secondary circuit (22) (3-4-57-18-2-1-19). After this position the lever **(10)** is articulated with region **(b)** of the cam **(14)** operating the vacuum interrupter **(6)** for breaking the current there within **(figure 16)**. During this phase, the current starts breaking in secondary circuit, i.e. inside the vacuum interrupter **(6)**, instead of in the insulating medium of primary circuit. The region **(b)** is articulated to achieve the desired stroke and velocity of the moving contact (7) of vacuum interrupter (6).

[0018] Referring to **figures 11** and 17, the disconnecting position (P3) is a position in which the lever **(10)** engages with cam portion (c) of constant radius preventing any further motion to be transferred to vacuum interrupter (6). Engagement between pallet contact **(2)** and moving deflector **(1)** configured to keep vacuum interrupter **(6)** open. This helps to ensure, that there is healthy current interruption in the vacuum interrupter **(6)** contacts.

[0019] Referring to **figures 12**, and 18, the closing position **(P4)** is a position in which the moving contact deflector **(1)** releasing the pallet contact (2), moving contact deflector continues to move upward and pallet contact moves downward with the help of assembly (20) and torsion spring at pivot 15. This renders the primary circuit (21) and secondary circuit (22) inactive. The lever **(10)** passes from region **(c)** to **(b)** and finally to **(a)** closing the vacuum interrupter **(6)**. Referring to figure 13, during closing of the switch disconnector, on its, downward trajectory, the moving contact deflector (1) engages with pallet base (17) causing the base (17) along with pallet contact (2) to rotate clockwise along pivot (13). The moving contact deflector (1) on its downward movement causes moving contact (19) to engage with the stationary contact (3) closing the primary circuit (21).

[0020] Advantageously, the switch disconnector in RM6 Ring Main Unit has a linear contact movement and the new design for the secondary or parallel circuit is suitable considering its enclosure size. Other breaker and switch disconnectors like Flusarc also have the potential to implement the above design. The cam linkage can also be made suitable for a switch disconnector with rotary contacts as shown in figures 14-18. By changing only the cam profile we can adapt to the future modification in vacuum interrupters in terms of ratings, stroke and the velocity requirement for its contact opening. With the change in specification or ratings s of vacuum interrupter, we can expect the size to change, its moving contact velocity to change, or its contact displacement to be changed. All these can be achieved by using one or more features of the cam or transfer lever design parameters.

[0021] Further advantages include that with the addition of a cam in the linkage, the input motion can be transferred in any direction by appropriately arranging the cam orientation and the transfer lever. This provides the advantage of placing the vacuum interrupter as per space availability in a given switch disconnector. For a given design, change in stroke at the vacuum interrupter is possible by changing the pivot position to change the ratio of L1 to L2 of the transfer lever, or by changing the cam profile. For a given design, change in contact velocity of vacuum interrupter is possible by changing only the cam profile. Change in size of vacuum interrupter can be easily accommodated into the design. The tulip fingers in moving contact of the existing switch disconnector is covered by a deflector to improve the dielectric behavior by

hiding the sharp corners of the tulip fingers. In this new design, additional feature with a specific profile has been added to the deflector. The moving contact of the switch disconnector interacts with the secondary circuit through this feature of the deflector. This avoided any change in the contact system of the switch disconnector.

[0022] For a given design of transfer lever, the gradient (g) of the profile of cam will define the velocity whereas rise (m) of the cam will define the amount of displacement of the moving contact of vacuum interrupter whereas (figure 20). For a given design of transfer lever and the cam profile, the orientation of the cam profile will depend on the direction in which the vacuum interrupter is placed and the profile of the transfer lever (see figures 21-23). For a given design of cam (profile and orientation) and to have 1:1 ratio of displacement on cam profile and the moving contact of vacuum interrupter, in transfer lever, the ratio of distance between the pivot and the point of interaction with cam (L1) to the distance between the pivot and the point of interaction between the transfer lever and the vacuum interrupter (L2) is also 1:1. This ratio can be changed if different ratio is required (see figure 19). For a given design of cam, the profile of the transfer lever will depend on the position of the vacuum interrupter, (see figures 24-27). For example, the vacuum interrupter of the present invention is designed to open at an average speed greater than 0.8m/s for the first 4mm and not more than 1.6m/s. Further, the vacuum interrupter remains open for at least 16ms during each breaking operation.

[0023] In an alternate embodiment, additional torsional springs can be added at the pivot 11 to avoid the bounces at the interactions between the lever **(10)** and the cam (14), and between the lever **(10)** and the collar (9). To avoid the jamming and sticky movements at the pivots **(11)** and during the return of moving contact (7) of the vacuum interrupter, the interacting surface between cam **(14)** and lever **(10)** can be modified to have a connection like a groove-pin connection. The contoured groove with the same profile of the cam (14) rigidly connected to pallet lever (16) and pin connected to the transfer lever (10). Further the interaction between the lever **(10)** and guide (8) can be eliminated and replaced by a slot -pin connection. The slot being provided in lever **(10)** and pin connected to the guide (8). In an alternate embodiment, the switch disconnector of the present invention can have a rotary contact motion. In yet another alternate embodiment, the special feature on the moving contact deflector may be a part of one of the moving contact fingers with appropriate interaction with the pallet contact of the secondary circuit. The present invention is added as a subassembly to the existing switch disconnector.

[0024] While specific embodiments of the invention have been described in detail, it will be appreciated by those skilled in the art that various modifications and alternatives to those details could be developed in light of the overall teachings of the disclosure. Accordingly, the particular arrangements disclosed are meant to be illustrative only and not limiting as to the scope of the invention which is to be given the full breadth of the appended claims and any and all equivalents thereof.

Claims

1. A vacuum circuit interrupter device **(30)** comprising-

(a) a primary circuit **(21)** consisting of stationary contact **(3)** and moving contact **(19)** and a moving contact deflector **(1)** rigidly connected thereto, said stationary contact **(3)** being connected to incoming busbar and said moving contact **(19)** being connected to outgoing busbar;
(b) a secondary circuit **(22)** consisting of a vacuum interrupter **(6)** electrically connected to the stationary contact **(3)** on terminal **(5)** by a flexible connection **(4)** and a moving contact **(7)** connected to moving contact deflector **(1)** through a pallet contact **(2)** and a flexible connection **(18)**;
(c) an operating linkage consisting of lever **(10)** and a profiled cam **(14)** for moving the vacuum interrupter **(6)** between a closed circuit position in electric communication with the stationary contact **(3)** and an open circuit position.

2. The vacuum circuit interrupter device as claimed in claim 1, wherein the operating linkage is defined by the transfer of movement of moving contact **(19)** to the vacuum interrupter **(6)** with required amount of displacement and velocity.

3. The vacuum circuit interrupter device **(30)** as claimed in claim 1 wherein the lever **(10)** is rotatable at pivot **(11)** preferably around the middle of its length for connecting the cam **(14)** at lever first end **(23)** and connected to guide **(8)** at lever second end **(33)**, the profile of the lever **(10)** is dependent on position of vacuum interrupter **(6)** in said switching apparatus.

4. The vacuum circuit interrupter device **(30)** as claimed in any of the preceding claims wherein collar **(9)** is connected to guide **(8)** at collar first end and the moving contact **(7)** of vacuum interrupter **(6)** at collar second end, said guide **(8)** being in conjunction with collar **(9)** is configured to travel a linear path defining a travel path for said moving contact **(7).**

5. The vacuum circuit interrupter device **(30)** as claimed in any of the preceding claims wherein pallet contact **(2)** is rigidly mounted on first end of pallet base **(17)** configured to be engaged with moving contact deflector **(1).**

6. The vacuum circuit interrupter device **(30)** as claimed in any of the preceding claims wherein a pallet lever

(16) is rotatably connected at its one end at pivot **(13)** with pallet base **(17)** and second end configured to rigidly connect with cam **(14)** on its other end, said pallet base **(17)** being biased by a torsion spring against the pallet lever **(16).**

7. The vacuum circuit interrupter device **(30)** as claimed in any of the preceding claims wherein the assembly **(20)** of pallet lever **(16)**, cam **(14)**, pallet base **(17)** and pallet contact **(2)** is pivoted around pivot **(15)**, said assembly **(20)** being biased by a torsion spring placed at the pivot **(15)** against stopper pin **(12)** configured to prevent pallet lever **(16)** from clockwise rotation during closing of vacuum interrupter **(6)**.

8. The vacuum circuit interrupter device **(30)** as claimed in any of the preceding claims wherein the profiled cam **(14)** is defined for regions **(a)** and **(c)** of uniform radius and region **(b)** with varying radius with respect to pivot **(15)** for increasing stroke and velocity of movement of vacuum interrupter **(6)**, the orientation of said cam **(14)** being a factor of direction of placement of vacuum interrupter **(6)** and resultant profile of lever **(10)**.

9. The vacuum circuit interrupter device **(30)** as claimed in any of the preceding claims wherein the ratio of displacement on profiled cam **(14)** and the moving contact **(17)** of vacuum interrupter **(6)** is dependent on ratio of distance **(L1)** between pivot **(11)** and point of interaction with cam **(14)** to the distance **(L2)** between the pivot **(11)** and point of interaction between the lever **(10)** and guide **(8).**

10. The vacuum circuit interrupter device **(30)** as claimed in any of the preceding claims wherein it takes four positions of opening position **(P1)**, disconnecting position **(P2)**, separating position **(P3)** and closing position **(P4).**

11. The vacuum circuit interrupter device **(30)** as claimed in claim 10 wherein the opening position **(P1)** is a position for connection between the moving contact deflector **(1)** and the pallet contact **(2)** when the moving contact **(19)** is electrically connected to the stationary contact **(3)** to allow current to flow from stationary contact **(3)** to moving contact **(19)** through primary circuit **(21) (3-19)** and through the secondary circuit **(22) (3-4-5-7-18-2-1-19)** and the lever **(10)** interacting with region **(a)** of the cam **(14)** transferring no movement to the vacuum interrupter **(6)** resulting in vacuum interrupter being in closed position.

12. The vacuum circuit interrupter device (30) as claimed in claim 10 wherein separating position **(P2)** is a position in which the moving contact **(19)** leaves the stationary contact **(3)** up to a distance for achieving a sufficient dielectric distance causing the primary circuit **(21) (3-19)** to become inactive and current to flow only through the secondary circuit **(22) (3-4-5-7-18-2-1-19)**, the lever **(10)** being articulated with region **(b)** of the cam **(14)** for operating the vacuum interrupter **(6)** for breaking the current therewithin, said region **(b)** being articulated to achieve the desired stoke and velocity of the moving contact **(7)** of vacuum interrupter **(6).**

13. The vacuum circuit interrupter device **(30)** as claimed in claim 10 wherein the disconnecting position **(P3)** being a position in which the lever **(10)** engages cam portion **(c)** of constant radius preventing any further motion to be transferred to vacuum interrupter **(6)** causing engagement between pallet contact **(2)** and moving deflector **(1)** to keep vacuum interrupter **(6)** open to get healthy current interruption.

14. The vacuum circuit interrupter device **(30)** as claimed in claim 10 wherein closing position **(P4)** is a position in which the moving contact deflector **(1)** releasing the pallet contact **(2)** renders the primary circuit **(21)** and secondary circuit **(22)** inactive, saidmoving contact deflector continuing to move upward,pallet contact moving downward with the help of assembly **(20)** and torsion spring at pivot **(15)**, said lever **(10)** passing from region **(c)** to **(b)** and finally to (**a**) closing the vacuum interrupter **(6).**

15. The vacuum circuit interrupter device **(30)** as claimed in claim 14 wherein on its downward trajectory, the moving contact deflector **(1)** engages pallet base **(17)** causing the base **(17)** along with pallet contact **(2)** to rotate clockwise along pivot **(13)**, said moving contact deflector **(1)** causing moving contact **(19)** to engage with the stationary contact **(3)** closing the primary circuit **(21)**.

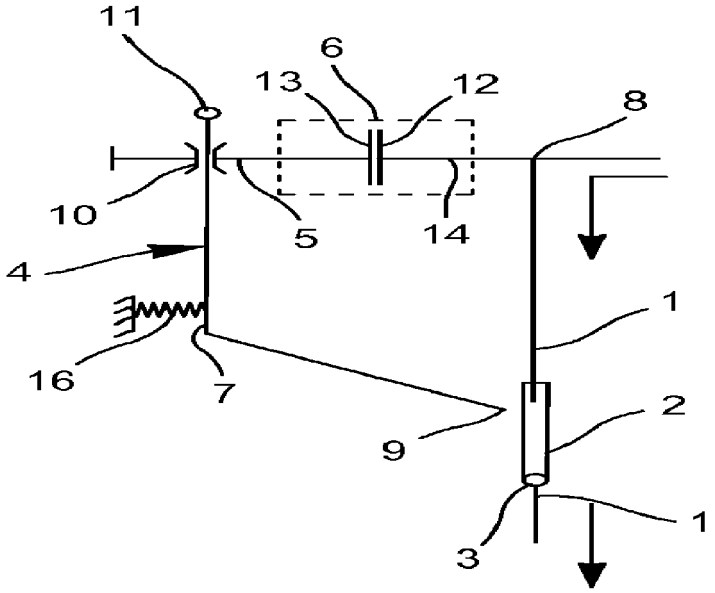


FIGURE 1 (PRIOR ART)

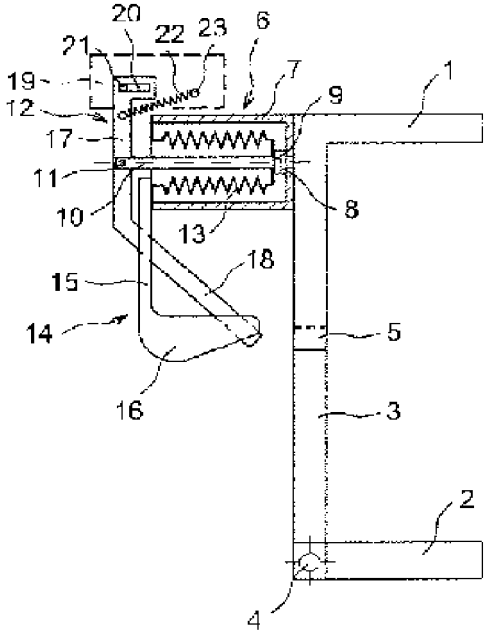


FIGURE 2 (PRIOR ART)

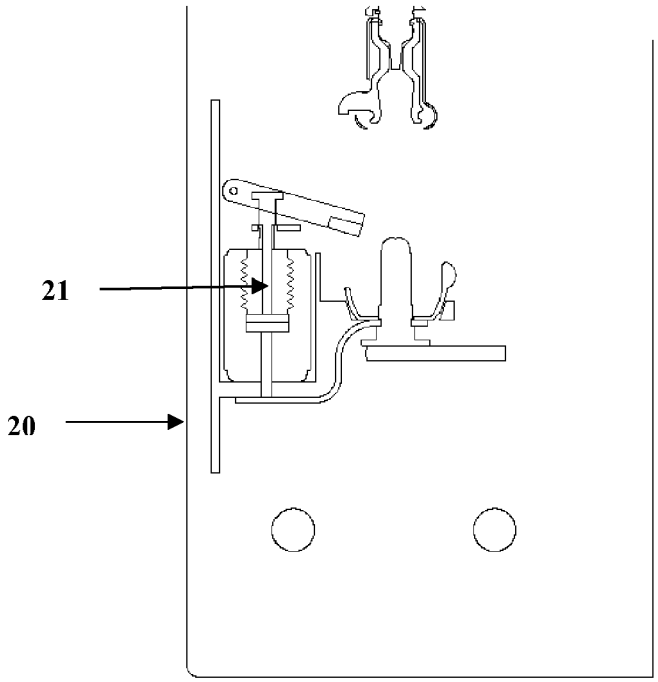


FIGURE 3

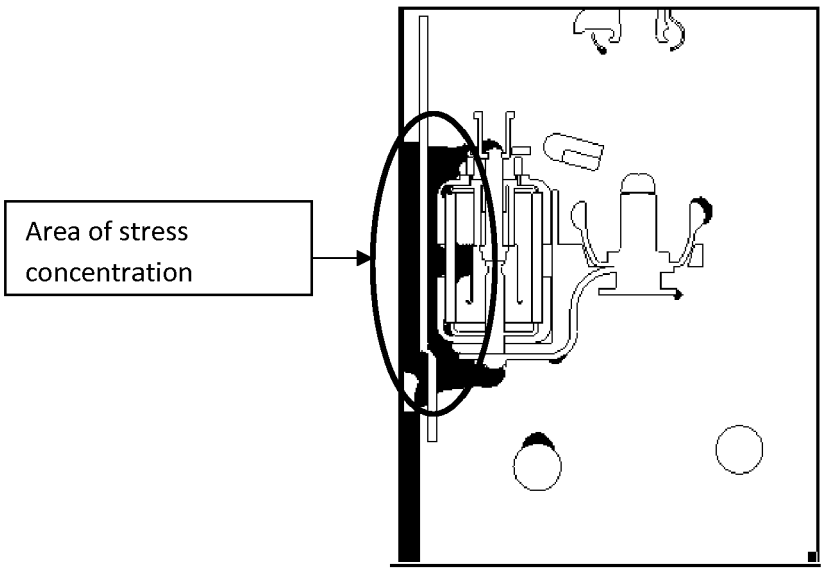


FIGURE 4

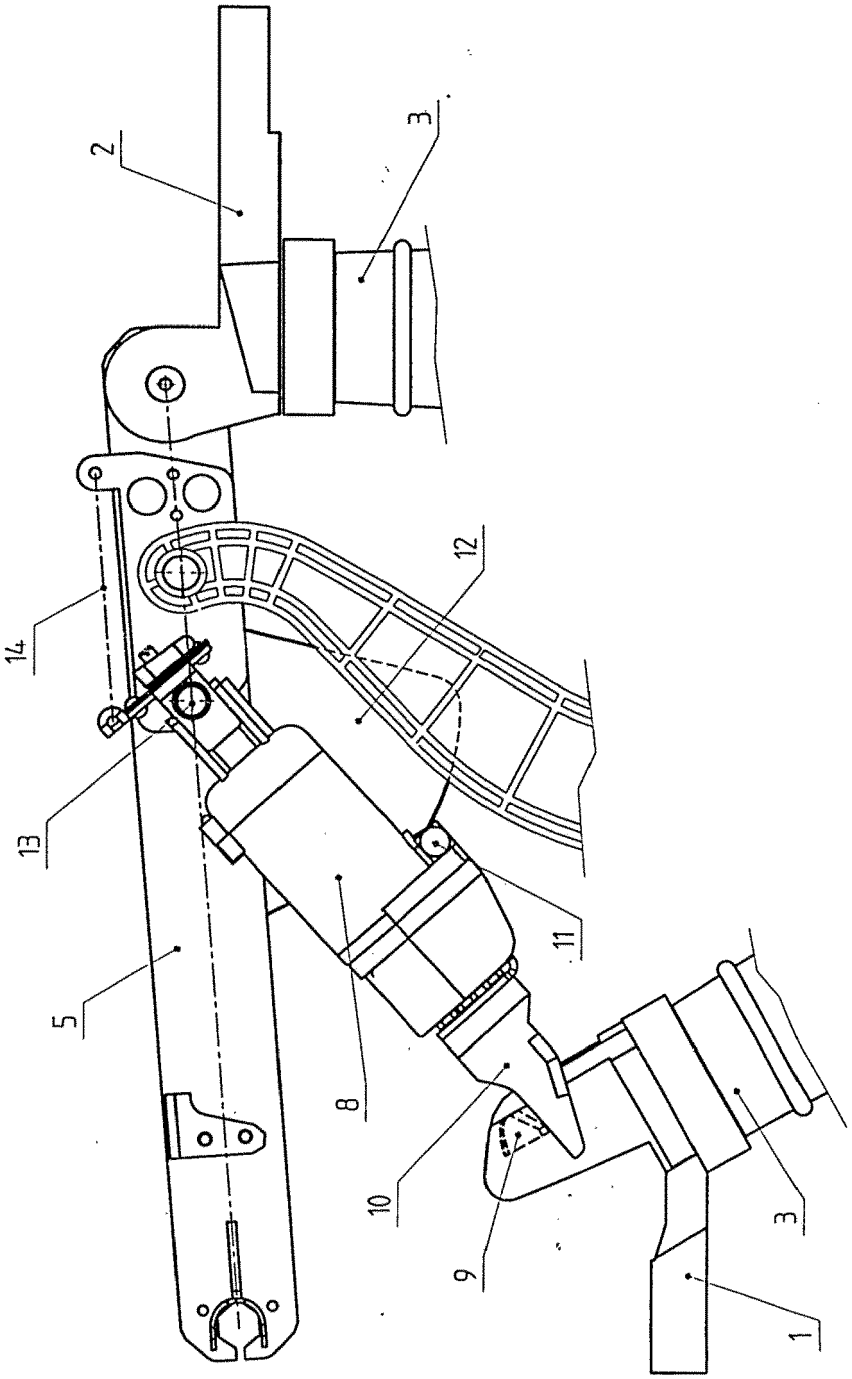


FIGURE 5

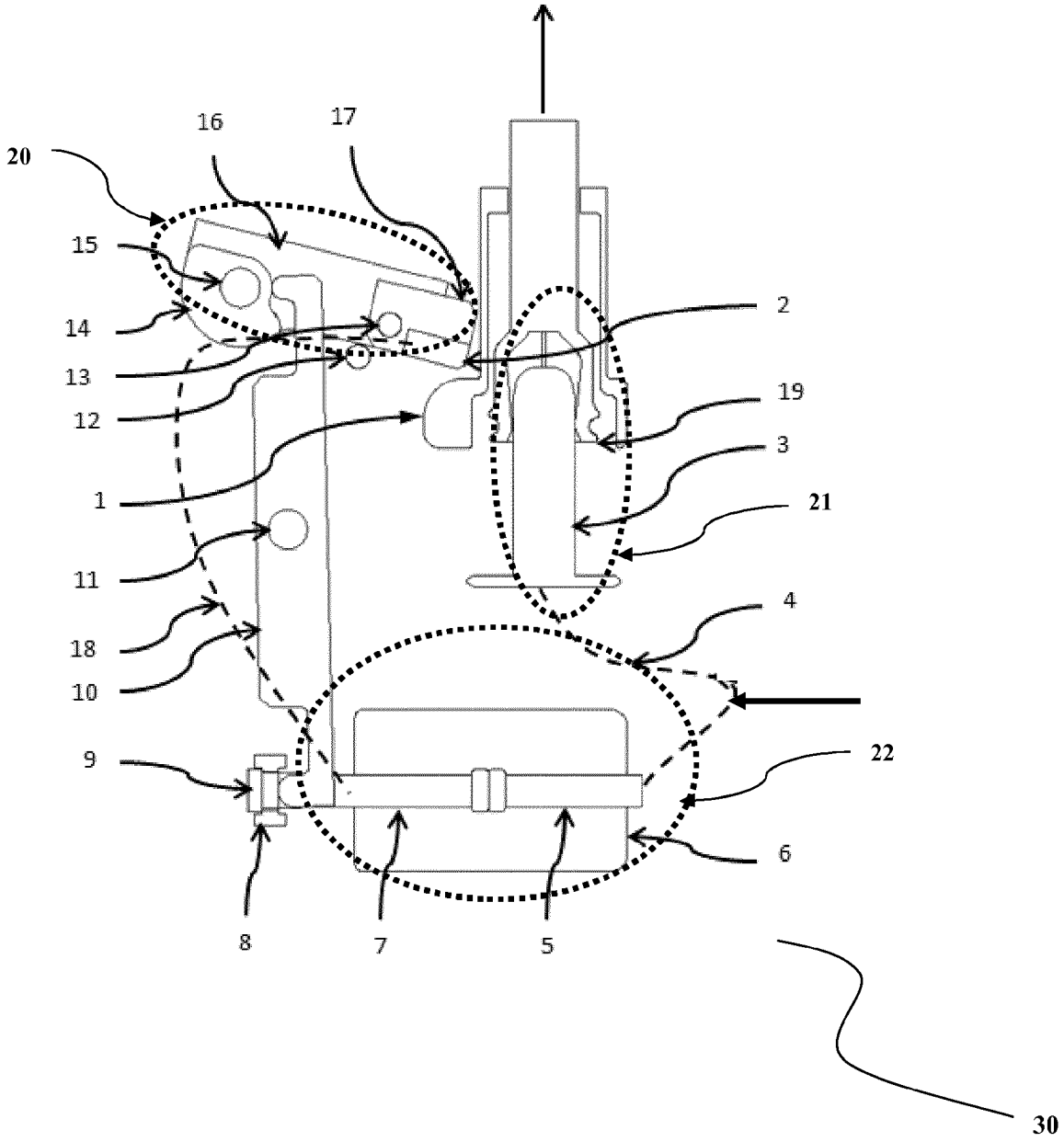


FIGURE 6

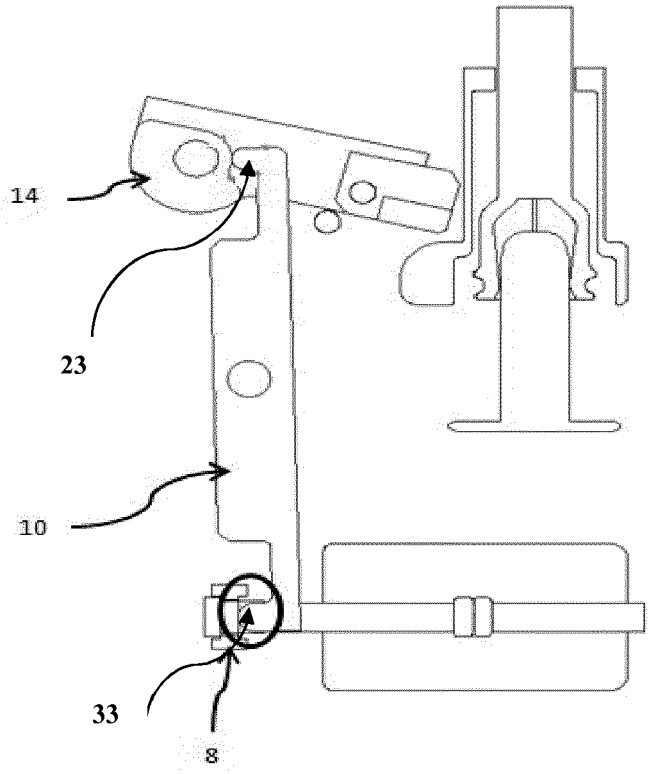


FIGURE 7

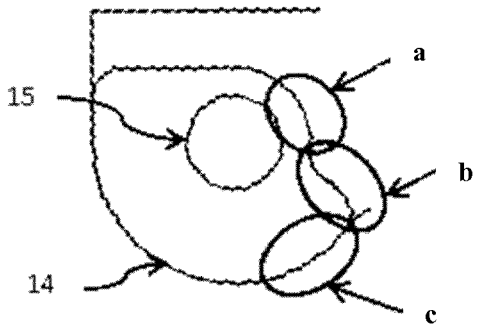


FIGURE 8

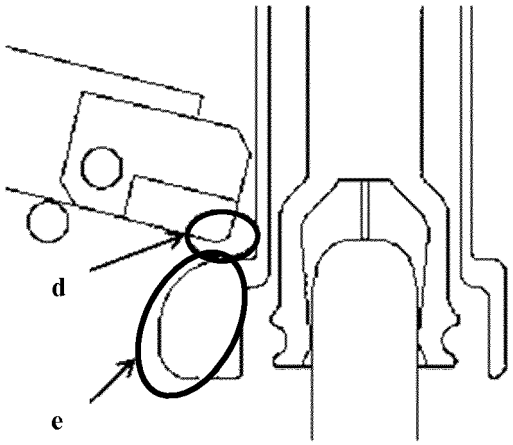


FIGURE 9

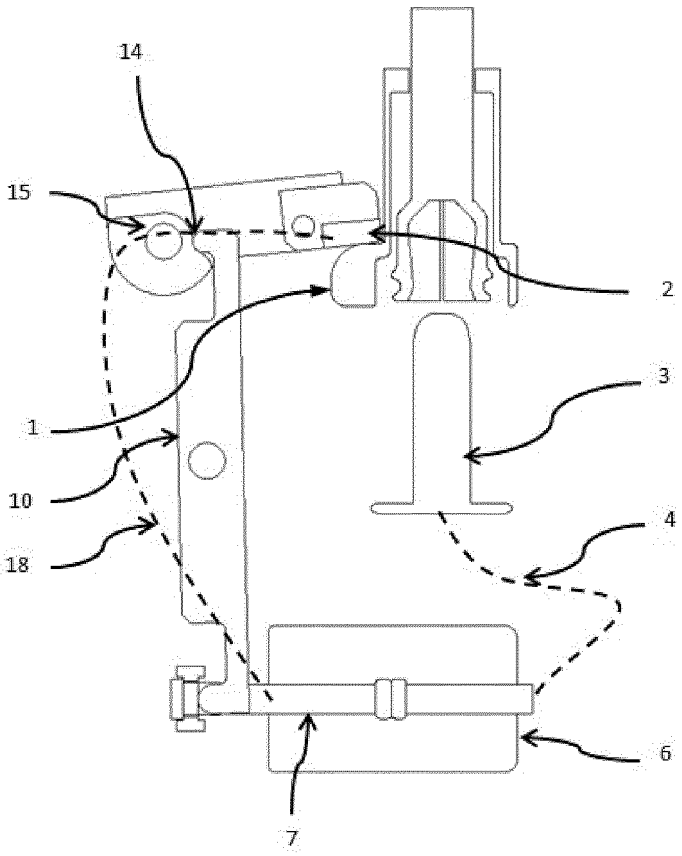


FIGURE 10

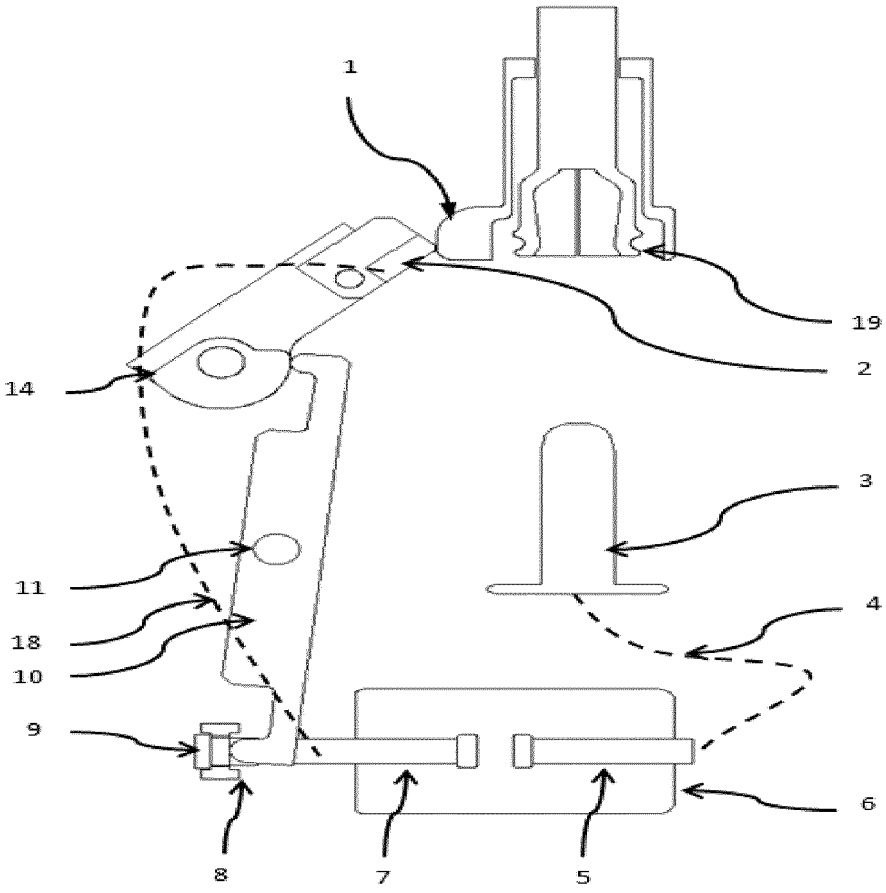
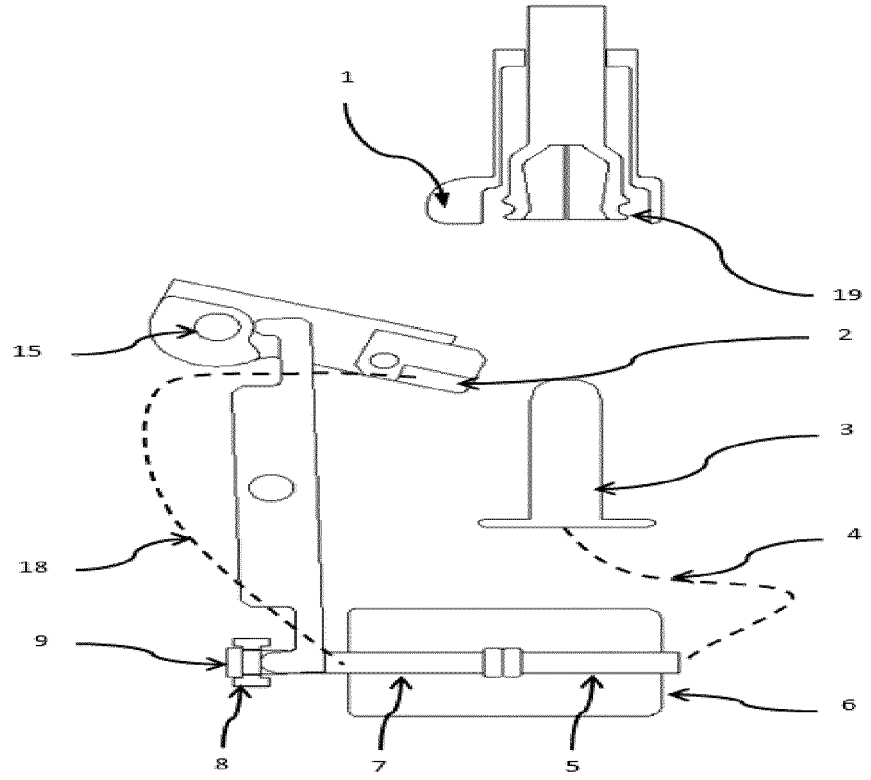


FIGURE 11



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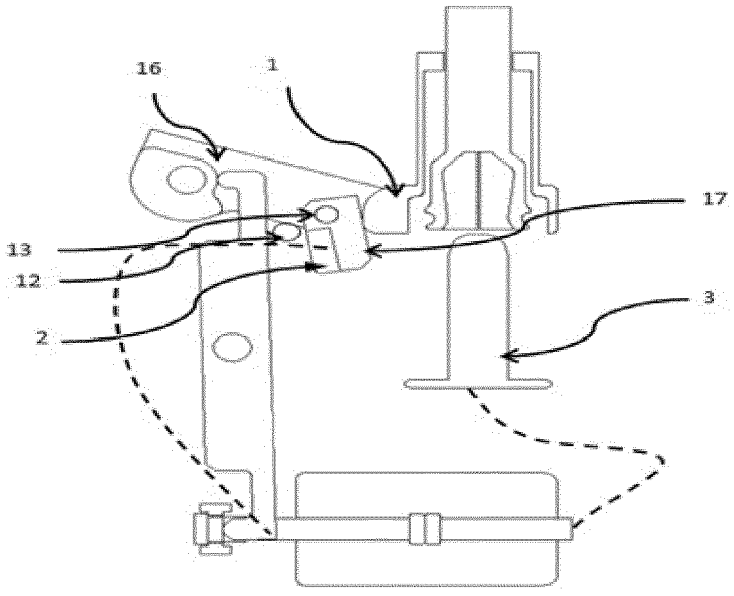


FIGURE 13

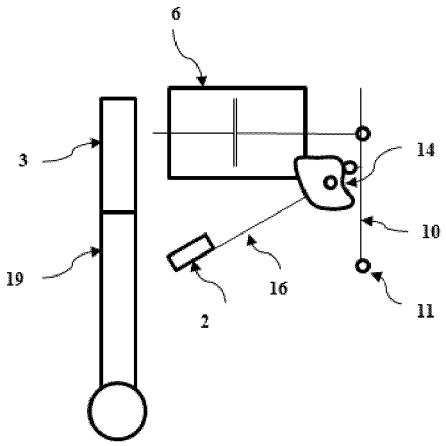
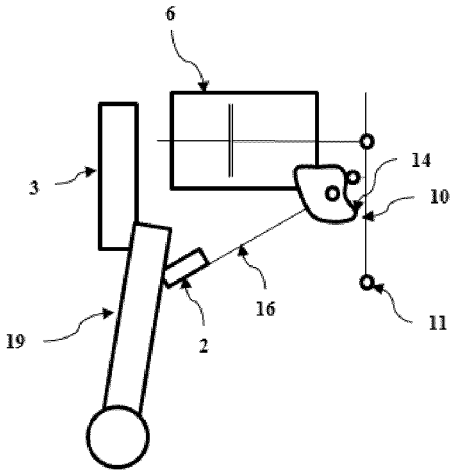


FIGURE 14



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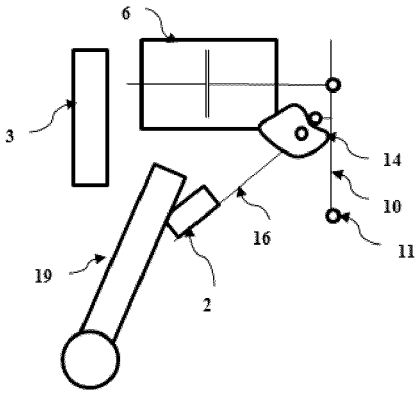

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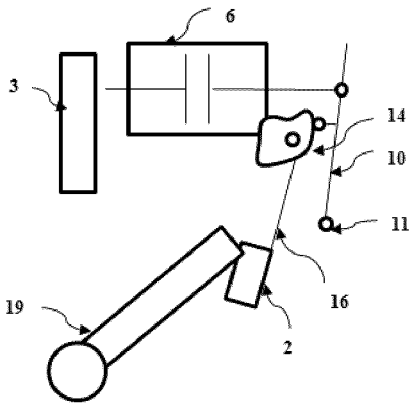

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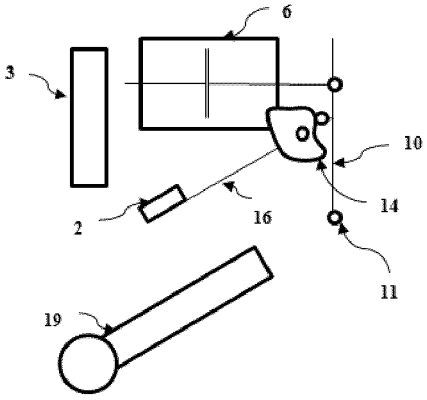

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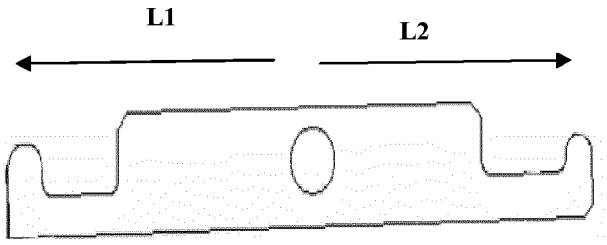

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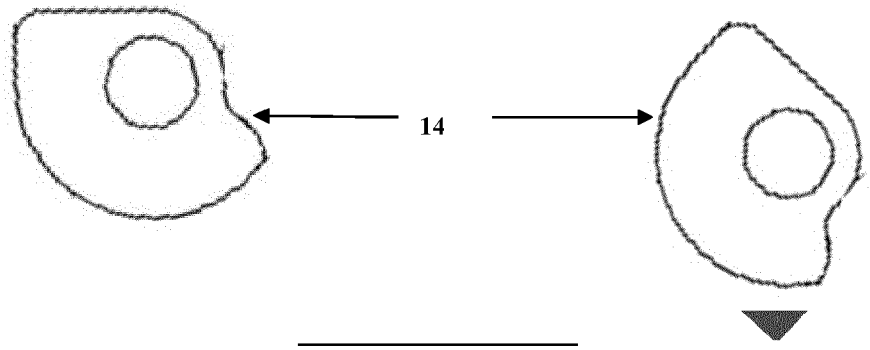

FIGURE 21

FIGURE 22

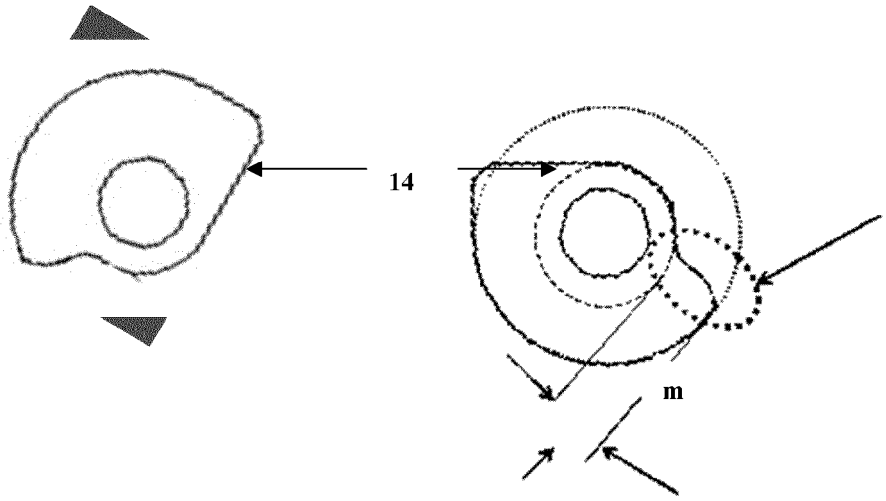

FIGURE 23

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FIGURE 20

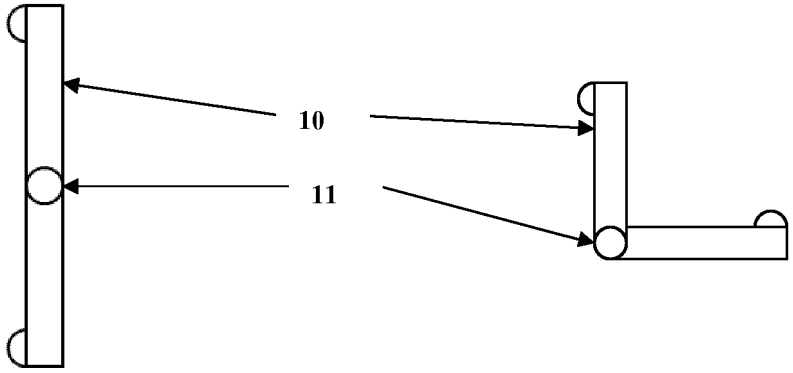

FIGURE 24

FIGURE 25

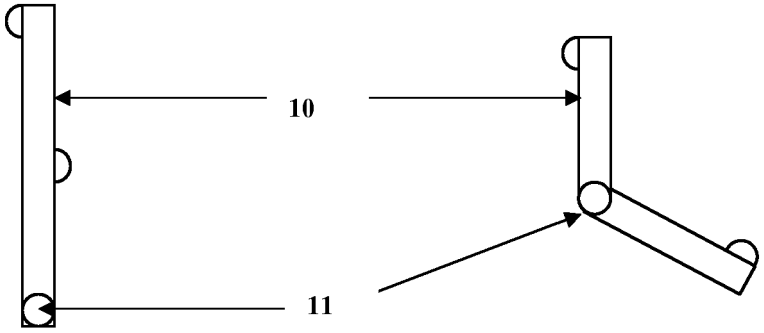

FIGURE 26

FIGURE 27

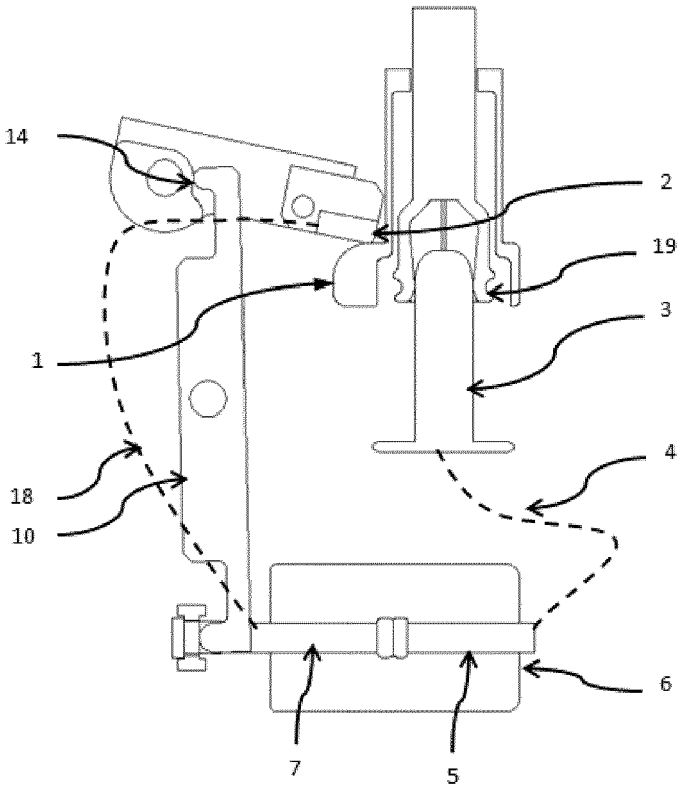

Figure 28

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EUROPEAN SEARCH REPORT

Application Number
EP 15 30 5034

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 June 2015	Ernst, Uwe

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