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(54) **CONTROL SYSTEM FOR HIGH-VOLTAGE ELECTRICAL DEVICES**

(57) The invention relates to a control system comprising a drive (4) allowing the transmission of at least three switching positions of an electrical device (6) depending on the movement of an actuator (8) having two

functional positions (A, B) and depending on the position of at least one blocking means (1) for blocking at least two positions (C, D) which is integrated in a transmission part (5, 5', 5'').

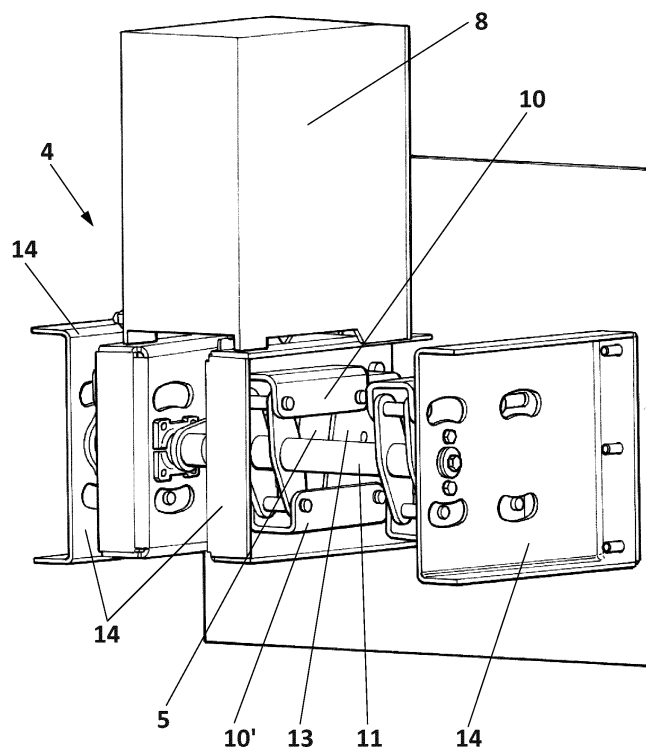


FIG. 1

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Description

Object of the Invention

[0001] The present invention relates to a control system for high-voltage electrical devices, said electrical devices being used for obtaining desired power distribution, preventing consumers from being without power, assuring the protection of people and electrical equipment, such as transformers, for example, and therefore being applied in high-voltage power distribution networks. The object of the invention is to provide a drive capable of transmitting the movement of an actuator to at least one high-voltage electrical device having several switching positions which can be incorporated in any electrical equipment, specifically for the transmission of at least three switching positions, i.e., making, breaking and/or disconnecting and grounding.

Background of the Invention

[0002] Electrical equipment used in power distribution networks can comprise electrical switching devices performing installation making, breaking and/or disconnecting and grounding functions. In this manner, in cases in which there is, for example, a fault in the distribution line, a power outage due to construction work, maintenance or load distribution optimization, such electrical devices can be operated to obtain the desired power distribution, preventing consumers from being without power or assuring the protection of people and electrical equipment, such as transformers, for example.

[0003] These high-voltage electrical devices can consist of circuit breakers, load break switches, etc., provided with a moving contact and a fixed contact, including a contact for grounding those electrical devices having three or more switching positions. To perform these switching functions, a driving force produced by an actuator, such as a mechanical or magnetic actuator, for example, is transmitted to the moving contact of the high-voltage electrical device. The intervention of the actuator can be both voluntary, ordered by an operator regardless of the current value, and due to the action of a device sensitive to specific current values directly or indirectly ordering that the circuit be opened.

[0004] The transfer of the driving force between the actuator and the moving contact of the electrical device is performed through a control system located between both.

[0005] There are control systems for high-voltage electrical devices in which more than one actuator must be used since actuators usually comprise only two functional positions, and for a third switching position, specifically for grounding, the action of a second actuator is required. In other cases, several electrical devices are used to thus be able to perform the making and breaking and/or disconnecting switching functions by means of an electrical device, and the grounding switching function by means

of another electrical device. In both cases, one or more locking mechanisms must be used to prevent simultaneous switching of the actuators or electrical devices, which is a drawback since very complex locking mechanisms must be used which may at times lead to operating errors, and furthermore putting them into practice entails a greater cost due to their complexity and the large number of elements required for manufacturing them.

[0006] There are solutions in which only one actuator is used for the drive of the making, breaking and/or disconnecting and grounding switching functions of an electrical device. Control systems located between the actuator and the electrical device are used to that end, these control systems being responsible for transmitting the driving force produced by the actuator and for selecting the switching function in which said force must be applied.

[0007] Patent document US6603087B2 can be mentioned in this sense, in which an actuator and a control system are defined. The control system is a spring transmission system comprising one or more springs, and where said springs are compressed due to the movement of the actuator having two positions to then use their energy when opening or closing the contacts of the electrical device to carry out two switching positions, specifically the making and breaking and/or disconnecting switching functions. The third switching position, from the disconnecting position to the grounding position and vice versa, is carried out manually and by means of a lever acting on the actuating shaft of the contacts of the electrical device. Therefore, the control system transmits the force generated by the actuator to carry out only two switching functions, the making and breaking and/or disconnecting functions. The actuator is not involved in switching to take the electrical device from being isolated to being grounded, nor is it involved in the reverse switching. In summary, the making and breaking and/or disconnecting switching functions are carried out by means of the actuator comprising two functional positions, whereas the grounding switching function is carried out manually by means of a lever.

[0008] Likewise, there are control systems for high-voltage electrical devices in which the movement of the actuator is transmitted to the moving contact of the high-voltage electrical device through a rotational actuating shaft, so the moving contact of the high-voltage electrical device describes a circular path, thereby hindering the guidance of said moving contact.

Description of the Invention

[0009] The invention relates to a control system for high-voltage electrical devices, such as, for example, load break switches, circuit breakers, etc., with at least three switching positions, a first making position, a second breaking and/or disconnecting position and a third grounding position, which can be applied in high-voltage power distribution networks, and comprising at least one fixed contact and one moving contact, the moving contact

being attached with at least one drive of the system of the present invention.

[0010] The control system of the present invention comprises at least one drive for the transmission of at least three switching positions (making, breaking and/or disconnecting and grounding) from an actuator, such as a mechanical or magnetic actuator, for example, comprising a first and a second functional position. To that end, the drive comprises at least one transmission part for the transmission of said at least three switching positions of at least one electrical device, which can be incorporated in electrical equipment, such as, for example, a switchgear, a transformer, etc. This transmission part can be moved in one direction or the other depending on the movement of the actuator (depending on the functional position of the actuator) and depending on the position of at least one blocking means for blocking at least two positions which is integrated in said transmission part. The blocking means can slide in at least one first slot comprised in the transmission part, being able to move between a first position and a second position, either manually or in a motorized manner.

[0011] By keeping the blocking means in its first position, such blocking means blocks the transmission part, such that the movement of the actuator from its first functional position to the second position makes said transmission part move in a forward direction towards the making position and such transmission part moves the moving contact of the electrical device to the making switching position. Starting from this making position, by keeping the blocking means in its first position and moving the actuator to its first functional position, the transmission part moves in a backward direction towards the breaking and/or disconnecting position, and therefore the moving contact of the electrical device goes to the breaking and/or disconnecting switching position.

[0012] On the other hand, by keeping the blocking means in its second position, such blocking means blocks the transmission part, such that the movement of the actuator from its first functional position to the second position causes the transmission part to move in a forward direction towards the grounding position and such transmission part moves the moving contact of the electrical device to the grounding switching position. Likewise, starting from this grounding position, by keeping the blocking means in its second position and moving the actuator to its first functional position, the transmission part moves in a backward direction towards the breaking and/or disconnecting position, and therefore the moving contact of the electrical device goes to the breaking and/or disconnecting switching position.

[0013] Therefore, by means of a single actuator and one drive, the desired power distribution can be obtained by means of an electrical device having at least three switching positions, comprising the making, breaking and/or disconnecting and grounding switching functions, avoiding the use of complex locking mechanisms which may at times lead to operating errors, and thereby reduc-

ing the manufacturing cost thereof.

[0014] The transmission part for the transmission of the drive of the present invention is attached to the moving contact of the electrical device by means of at least one removable mechanical fixing element, such as a pin element, for example.

[0015] The transmission part is preferably attached to the actuator by means of at least one connecting rod and at least one actuating shaft, said at least one connecting rod being responsible for attaching the transmission part to the actuating shaft and such actuating shaft being responsible for attaching said at least one connecting rod to the actuator. The moving contact of the high-voltage electrical device is thereby prevented from describing a circular path, and said moving contact can describe a straight path, thereby making the guiding thereof easier and improving the general behavior of the high-voltage electrical device. Likewise, the drive comprises at least one support of the actuating shaft. The transmission part comprises at least one second slot where said at least one connecting rod can slide. Finally, the transmission part can comprise at least one cover closing said at least one first and one second slot.

[0016] The possibility of the transmission part being attached to the actuator only by means of at least one actuating shaft has been contemplated.

[0017] The control system of the present invention can comprise one drive for each of the phases of the electrical device or one drive for the three phases of the electrical device.

Description of the Drawings

[0018]

Figure 1 shows a perspective view of the control system of the present invention according to a first preferred embodiment.

Figure 2 shows a side view of the drive comprising the actuator and the transmission part, as well as the connecting rods and the actuating shaft which allow associating said actuator with the transmission part according to the embodiment of Figure 1.

Figure 3 shows a side view of the transmission part with the blocking means according to the embodiment of Figure 1.

Figure 4 shows a perspective view of the control system of the present invention according to a second preferred embodiment.

Figure 5 shows a side view of the drive comprising the actuator and the transmission part, as well as the actuating shaft which allows associating said actuator with the transmission part according to the embodiment of Figure 4.

Figure 6 shows a perspective view of the transmission part with the blocking means according to the embodiment of Figure 4.

Figure 7 shows a perspective view of the control sys-

tem of the present invention according to a third preferred embodiment.

Figure 8 shows a side view of the drive comprising the actuator and the transmission part, as well as the connecting rods and the actuating shaft which allow associating said transmission part with the moving contact of the electrical device according to the embodiment of Figure 7.

Figure 9 shows a side view of the transmission part with the blocking means according to the embodiment of Figure 7.

Figure 10 shows a block diagram of the control system of the invention in which the electrical device is in the grounding position.

Figure 11 shows a block diagram of the control system of the invention in which the electrical device is in the breaking and/or disconnecting position, having started from the grounding position.

Figure 12 shows a block diagram of the control system of the invention in which the electrical device is in the making position.

Figure 13 shows a block diagram of the control system of the invention in which the electrical device is in the breaking and/or disconnecting position, having started from the making position.

Preferred Embodiment of the Invention

[0019] Several preferred embodiments are described below in reference to the aforementioned drawings, without this limiting or reducing the scope of protection of the present invention.

[0020] Figures 10-13 show block diagrams reflecting the control system object of the present invention for at least one high-voltage electrical device (6) of at least three switching positions, such as, for example, an circuit breaker, a load break switch, etc. Specifically, each of Figures 10-13 depicts each of the switching positions of the high-voltage electrical device (6), specifically the making, breaking and/or disconnecting and grounding switching positions.

[0021] The control system comprises at least one drive (4) for the transmission of said at least three switching positions. This drive (4) is attached to at least one moving contact (3) of at least one electrical device (6) through at least one removable mechanical fixing element (9), such as a pin element, for example, as shown in Figures 2, 5, 6, 8 and 10-13. Likewise, as shown in Figures 1-9, the drive (4) comprises at least one blocking means (1) for blocking at least two positions, a first position (C) and a second position (D), and which is integrated in at least one part (5, 5', 5'') of transmission of said at least three switching positions of at least one electrical device (6). The blocking means (1) can be moved from the first position (C) to the second position (D) and vice versa manually or in a motorized manner. The drive (4) also comprises at least one actuator (8) having two positions, such as a mechanical or magnetic actuator, for example, and

comprising a first functional position (A) and a second functional position (B).

[0022] As shown in Figure 12, by keeping the blocking means (1) in its first position (C), such blocking means (1) blocks the transmission part (5, 5', 5''), such that the movement of the actuator (8) from its first functional position (A) to the second position (B) makes said transmission part (5, 5', 5'') move in a forward direction towards the making position and such transmission part (5, 5', 5'') moves the moving contact (3) of the electrical device (6) to the making switching position.

[0023] As shown in Figure 13 and starting from the making position, by keeping the blocking means (1) in the first position (C) and moving the actuator (8) to its first functional position (A), the transmission part (5, 5', 5'') moves in a backward direction towards the breaking and/or disconnecting position, and therefore the moving contact (3) of the electrical device (6) goes to the breaking and/or disconnecting switching position.

[0024] Going from the breaking and/or disconnecting position to the grounding position, as shown in Figure 10, is carried out by moving the blocking means (1) to the second position (D), where such blocking means (1) blocks the transmission part (5, 5', 5''). The movement of the actuator (8) to the second position (B) thereby causes the transmission part (5, 5', 5'') to move in a forward direction towards the grounding position and such transmission part (5, 5', 5'') moves the moving contact (3) of the electrical device (6) to the grounding switching position.

[0025] Switching from the grounding position to the breaking and/or disconnecting position, as shown in Figure 11, is carried out by keeping the blocking means (1) in the second position (D) and moving the actuator (8) to its first functional position (A), so the transmission part (5, 5', 5'') moves in a backward direction towards the breaking and/or disconnecting position, and therefore the moving contact (3) of the electrical device (6) goes to the breaking and/or disconnecting switching position.

[0026] According to a first preferred embodiment, the transmission part (5) is attached to the actuator (8) by means of at least one connecting rod (10, 10') and at least one actuating shaft (11), said at least one connecting rod (10, 10') being responsible for attaching the transmission part (5) to the actuating shaft (11) and such actuating shaft (11) being responsible for attaching said at least one connecting rod (10, 10') to the actuator (8) as shown in Figures 1 and 2. The transmission part (5) comprises at least one first slot (7) where the blocking means (1) can be moved between its first position (C) and its second position (D), as shown in Figure 3, and at least one second slot (12, 12') where said at least one connecting rod (10, 10') can slide when it is not blocked by the blocking means (1). Figure 3 shows how the blocking means (1) is blocking the slot (12') since it is in its second position (D). On the other hand, the drive (4) comprises at least one support (14) of the actuating shaft (11) as shown in Figure 1. Finally, the possibility of the transmis-

sion part (5) being able to comprise at least one cover (13) closing said at least one first slot (7) and one second slot (12, 12') as shown in Figures 1 and 2 has been contemplated.

[0027] As shown in Figures 4-6, according to a second preferred embodiment the transmission part (5') can be attached directly to the actuator (8) by means of at least one actuating shaft (11). The transmission part (5') comprises at least one slot (7') where the blocking means (1) can be moved to its first position (C) or to its second position (D), as shown in Figure 6. Figure 6 specifically shows how the blocking means (1) is in its first position (C). The movement of the blocking means (1) from its first position (C) to its second position (D) and vice versa can be carried out manually or in a motorized manner, the latter manner being depicted in Figure 6, where the blocking means (1) is operated by an actuator (15) such as a coil, for example. Likewise, the drive (4) comprises at least one support (14) of the actuating shaft (11) as shown in Figure 4.

[0028] Figures 7-9 show a third preferred embodiment of the transmission part (5''), which is attached to the moving contact (3) by means of at least one connecting rod (10'') and at least one actuating shaft (11). The transmission part (5'') comprises at least one second slot (12'') where said at least one connecting rod (10'') can slide, and at least one first slot (7'') where the blocking means (1) can be moved to its first position (C) or to its second position (D). The movement of the blocking means (1) from its first position (C) to its second position (D) and vice versa can be carried out manually or in a motorized manner. As shown in Figures 7 and 8, the part (5'') is attached to the actuator (8) by means of at least one fixed or removable mechanical attachment (15). As shown in Figure 7, the drive (4) comprises at least one support (14) of the actuating shaft (11).

Claims

1. Control system for high-voltage electrical devices comprising at least one fixed contact (2) and one moving contact (3), for being applied in high-voltage power distribution networks, where the system comprises a drive (4) which can be coupled to a moving contact (3) of a high-voltage electrical device (6) for the transmission of at least three switching positions, **characterized in that** the drive (4) comprises at least one blocking means (1) for blocking at least two positions integrated in at least one transmission part (5, 5', 5'') for the transmission of the at least three switching positions of the electrical device (6).
2. Control system according to claim 1, **characterized in that** the drive (4) comprises at least one actuator (8) moving the transmission part (5, 5', 5'') for the transmission of the at least three switching positions of the electrical device (6).
3. Control system according to claim 2, **characterized in that** the actuator (8) comprises a first functional position (A) and a second functional position (B).
4. Control system according to any of the preceding claims, **characterized in that** the part (5, 5', 5'') comprises at least one first slot (7, 7', 7'') where the blocking means (1) slide between a first position (C) and a second position (D).
5. Control system according to claim 4, **characterized in that** the blocking means (1) can be moved from the first position (C) to the second position (D) and vice versa manually or in a motorized manner.
6. Control system according to claims 1-5, **characterized in that** in its first position (C) the blocking means (1) blocks the part (5, 5', 5''), such that the movement of the actuator (8) to its second position (B) causes the part (5, 5', 5'') to move and said part (5, 5', 5'') moves the moving contact (3) of the electrical device (6) to a making switching position.
7. Control system according to claims 1-5, **characterized in that** in its second position (D) the blocking means (1) blocks the part (5, 5', 5''), such that the movement of the actuator (8) to its second position (B) causes the part (5, 5', 5'') to move and said part (5, 5', 5'') moves the moving contact (3) of the electrical device (6) to a grounding switching position.
8. Control system according to any of the preceding claims, **characterized in that** the movement of the actuator (8) to its first position (A) causes the part (5, 5', 5'') to move and said part (5, 5', 5'') moves the moving contact (3) of the electrical device (6) to a breaking and/or disconnecting switching position.
9. Control system according to any of claims 1-8, **characterized in that** the part (5, 5', 5'') is attached to the moving contact (3) by means of at least one removable mechanical fixing element (9).
10. Control system according to claim 9, **characterized in that** the part (5) is attached to the actuator (8) by means of at least one connecting rod (10, 10') and at least one actuating shaft (11).
11. Control system according to claim 10, **characterized in that** the part (5) comprises at least one second slot (12, 12') where said at least one connecting rod (10, 10') can slide.
12. Control system according to claim 11, **characterized in that** the part (5) comprises at least one cover (13).
13. Control system according to claim 9, **characterized**

in that the part (5') is attached to the actuator (8) by means of at least one actuating shaft (11).

14. Control system according to any of claims 1-8, **characterized in that** the part (5") is attached to the moving contact (3) by means of at least one connecting rod (10") and at least one actuating shaft (11). 5
15. Control system according to claim 14, **characterized in that** the part (5") is attached to the actuator (8) by means of at least one fixed or removable mechanical attachment (15). 10
16. Control system according to claim 15, **characterized in that** the part (5") comprises at least one second slot (12") where said at least one connecting rod (10") can slide. 15
17. Control system according to any of claims 1-13, **characterized in that** it comprises one drive (4) for each of the phases of the electrical device (6) or one drive (4) for the three phases of the electrical device (6). 20
18. Control system according to any of the preceding claims, **characterized in that** the drive (4) comprises at least one support (14) of the actuating shaft (11). 25

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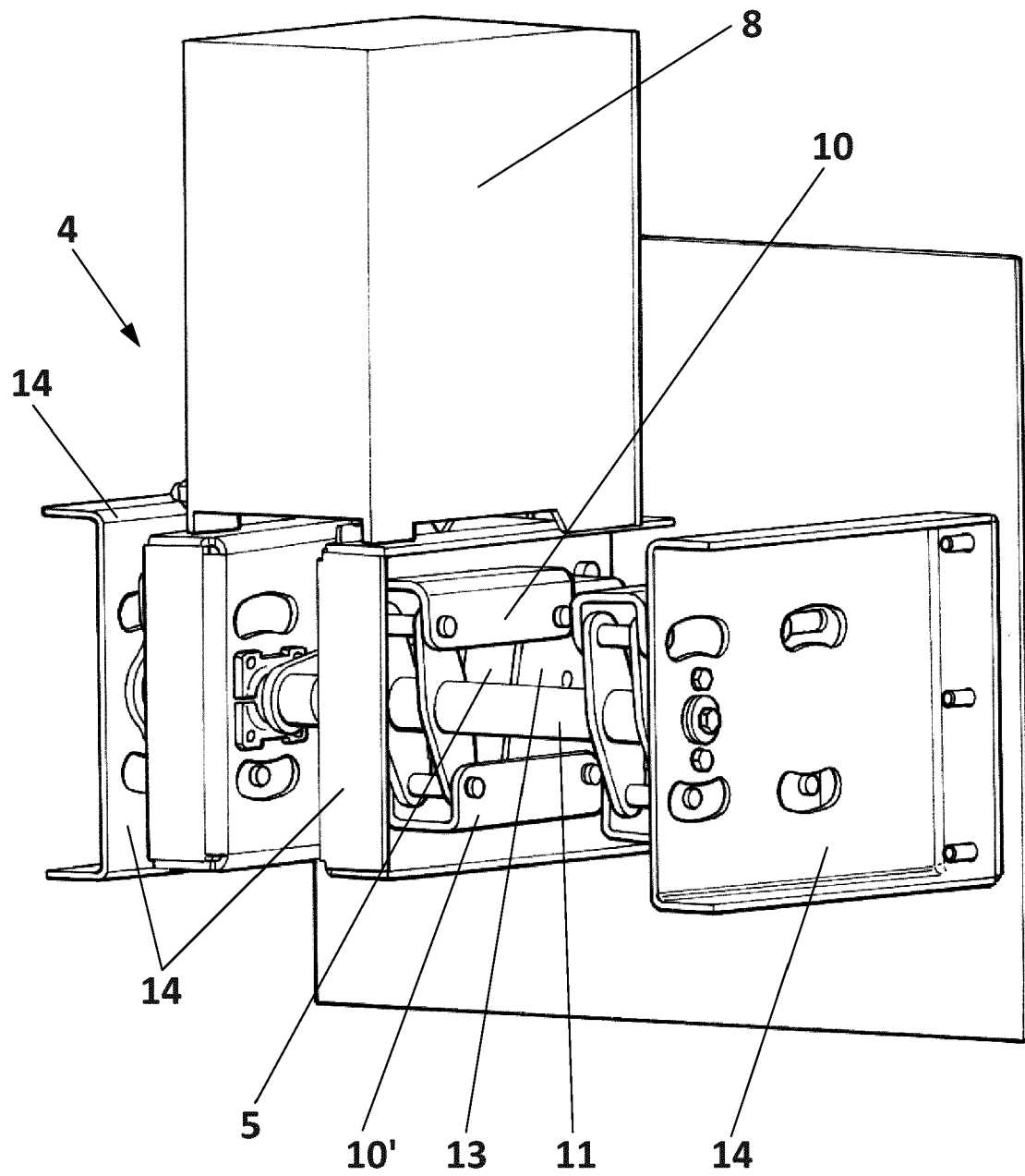


FIG. 1

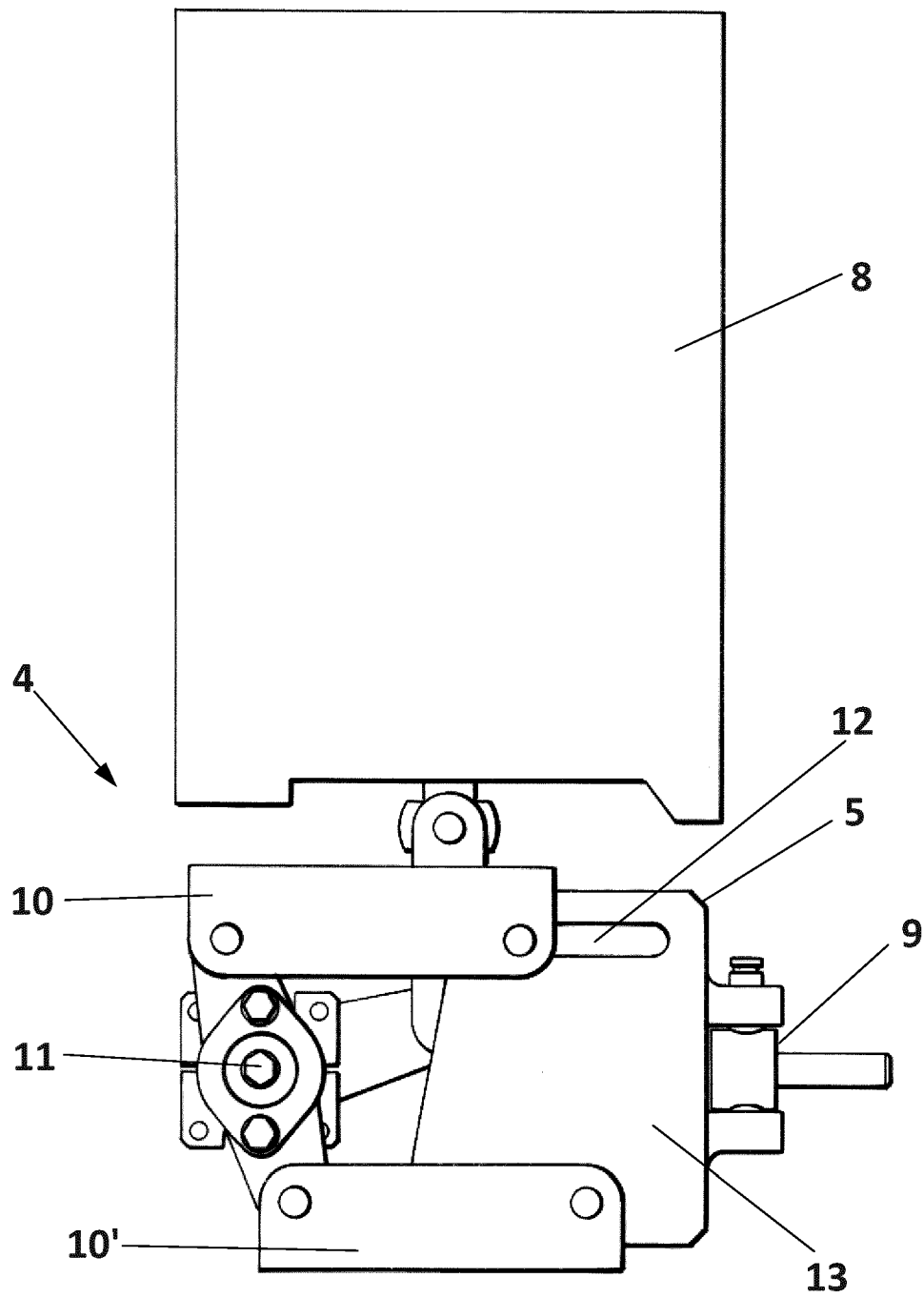


FIG. 2

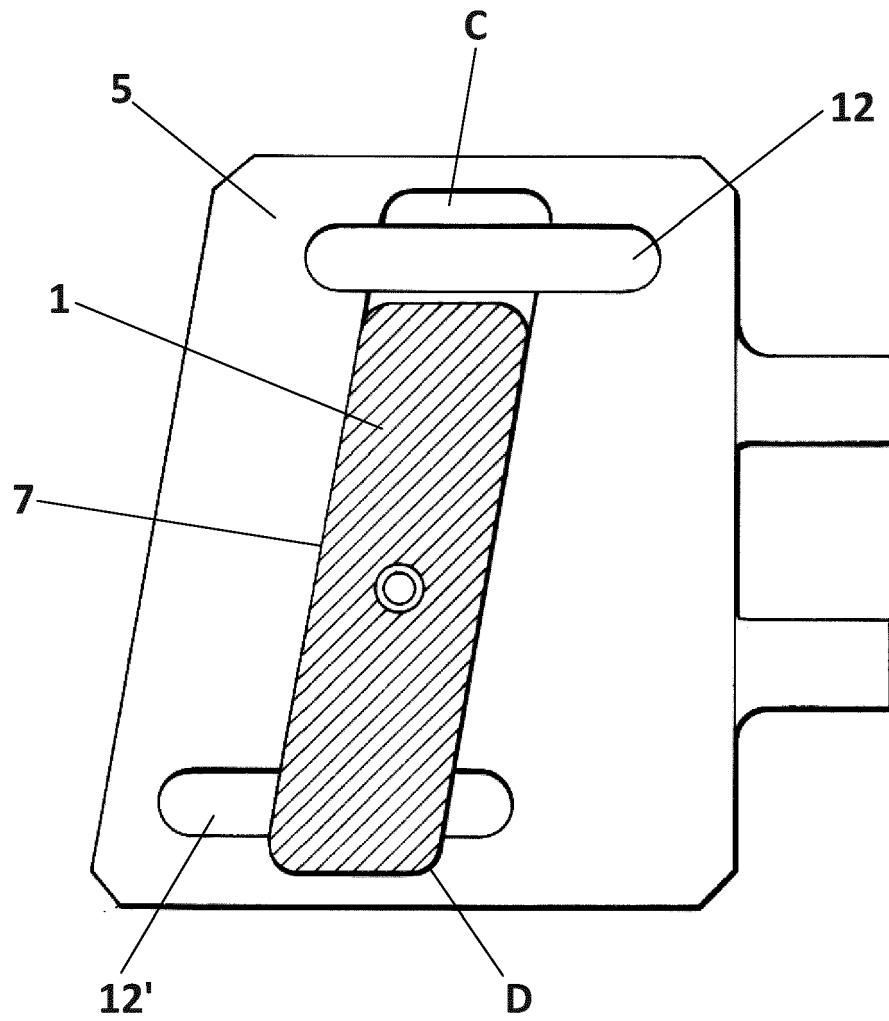


FIG. 3

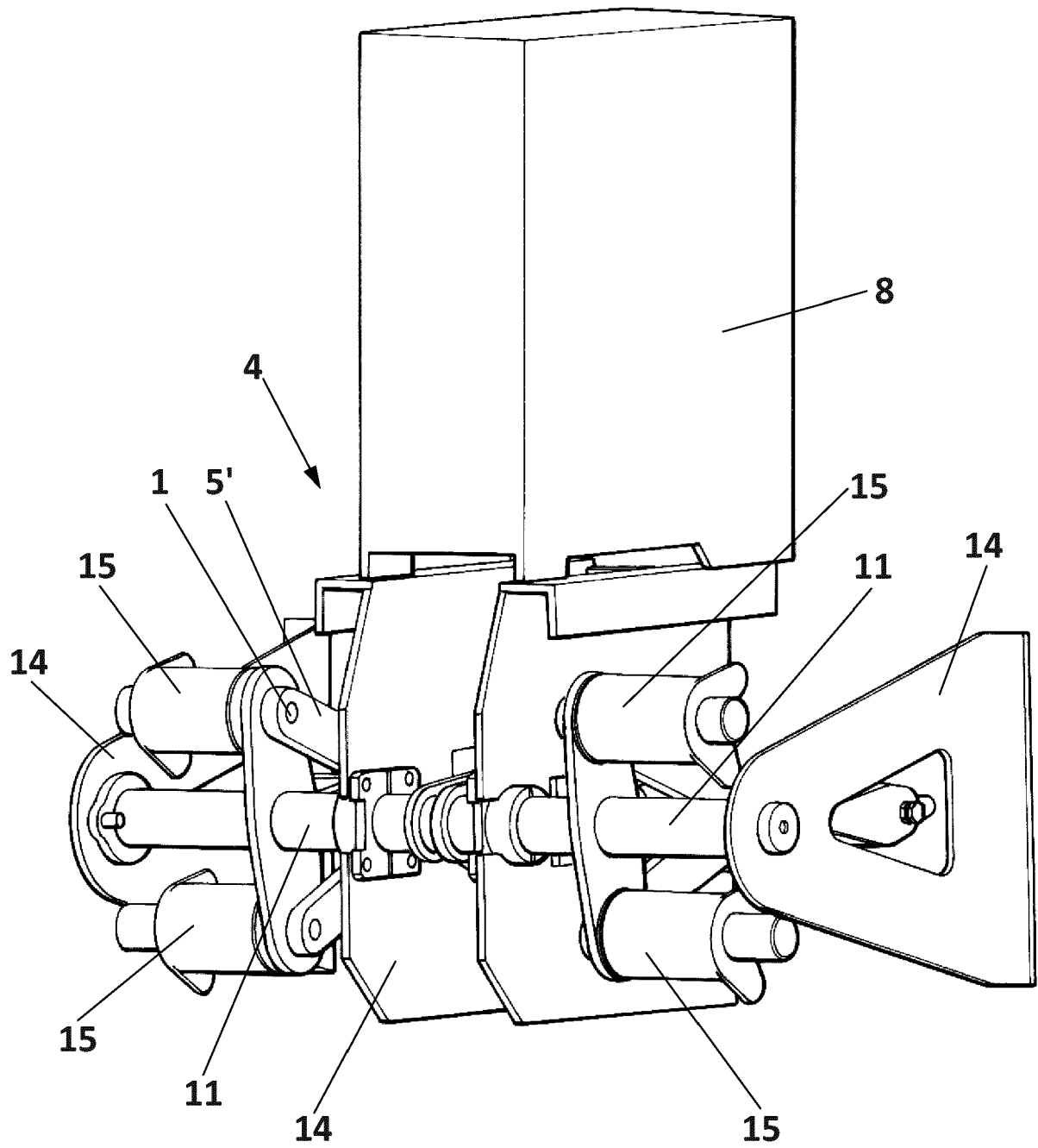


FIG. 4

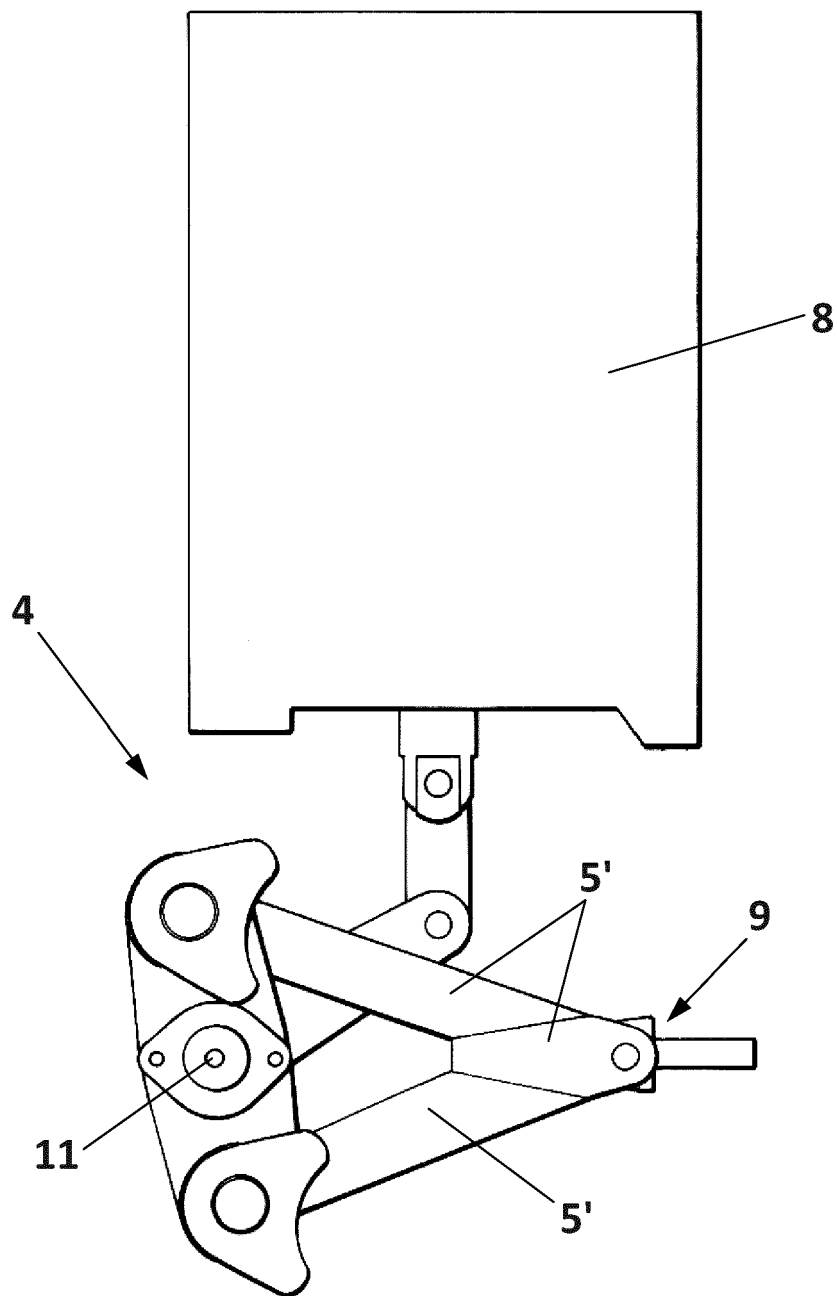


FIG. 5

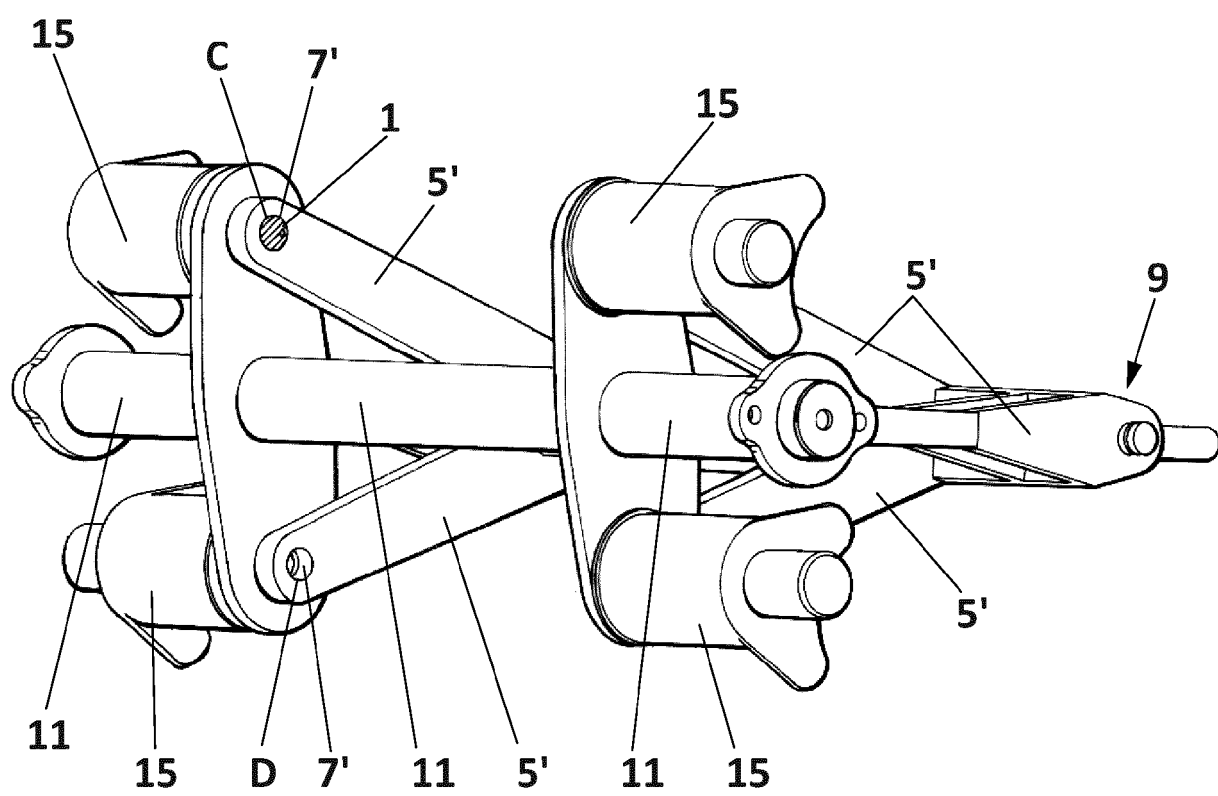


FIG. 6

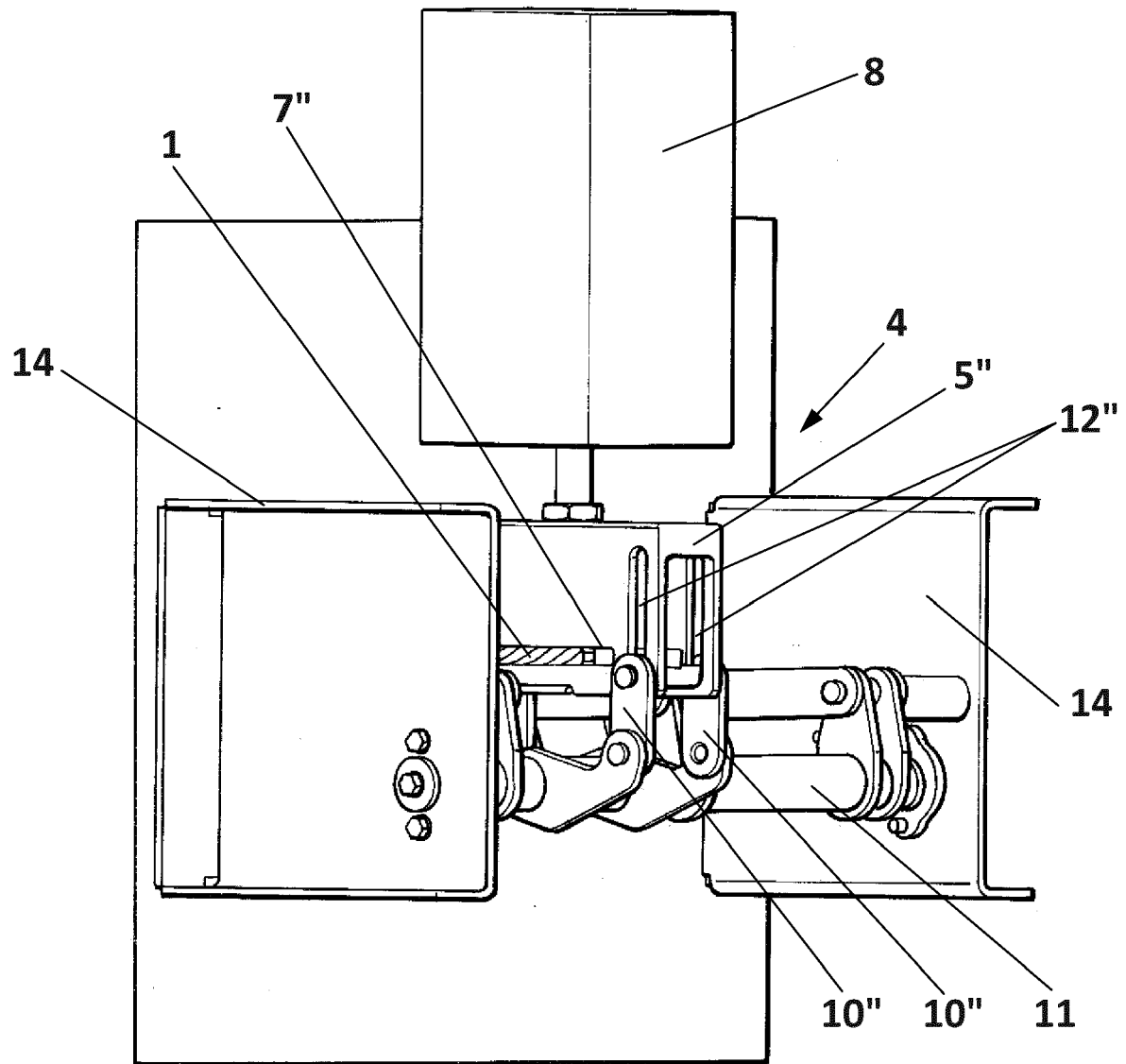


FIG. 7

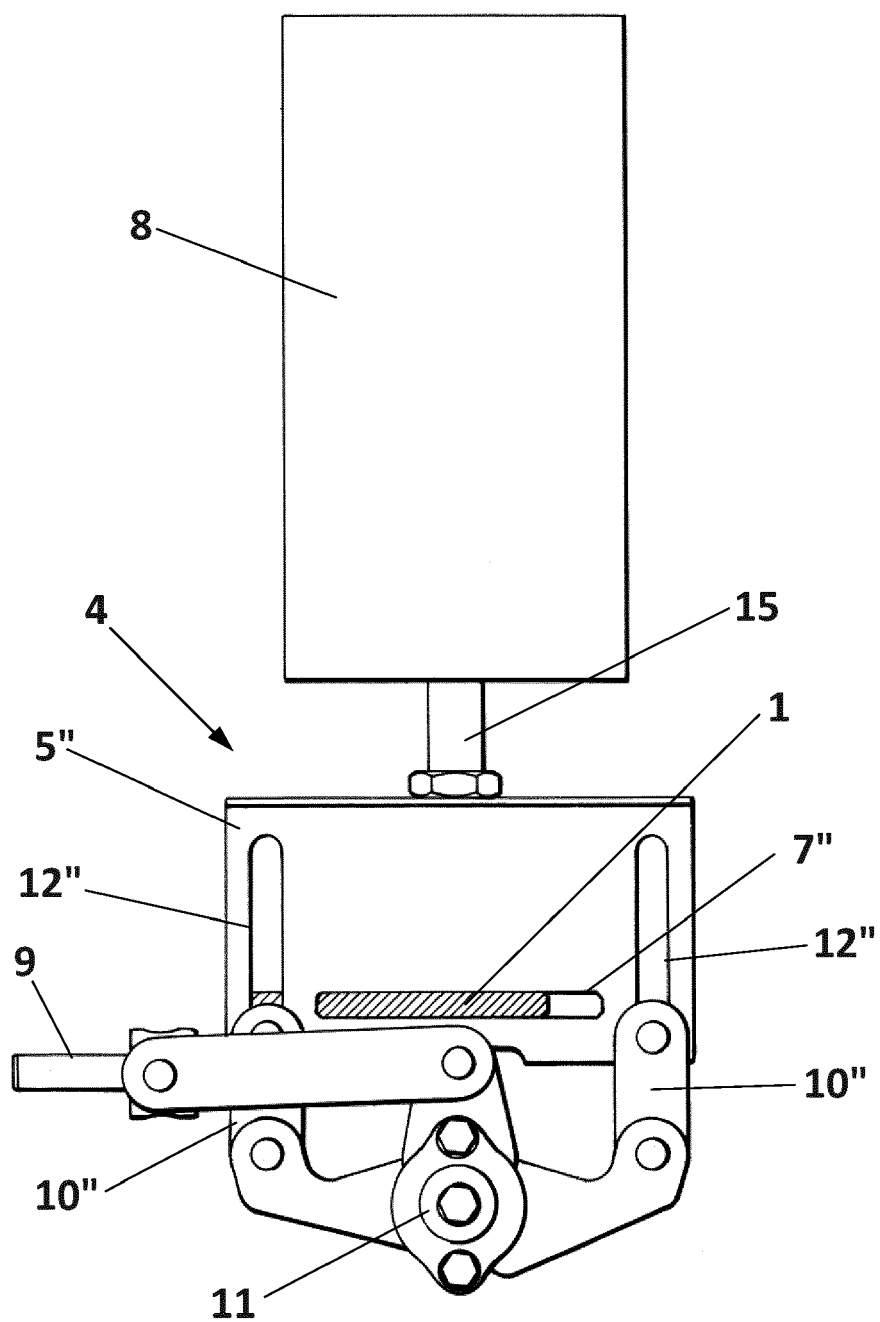


FIG. 8

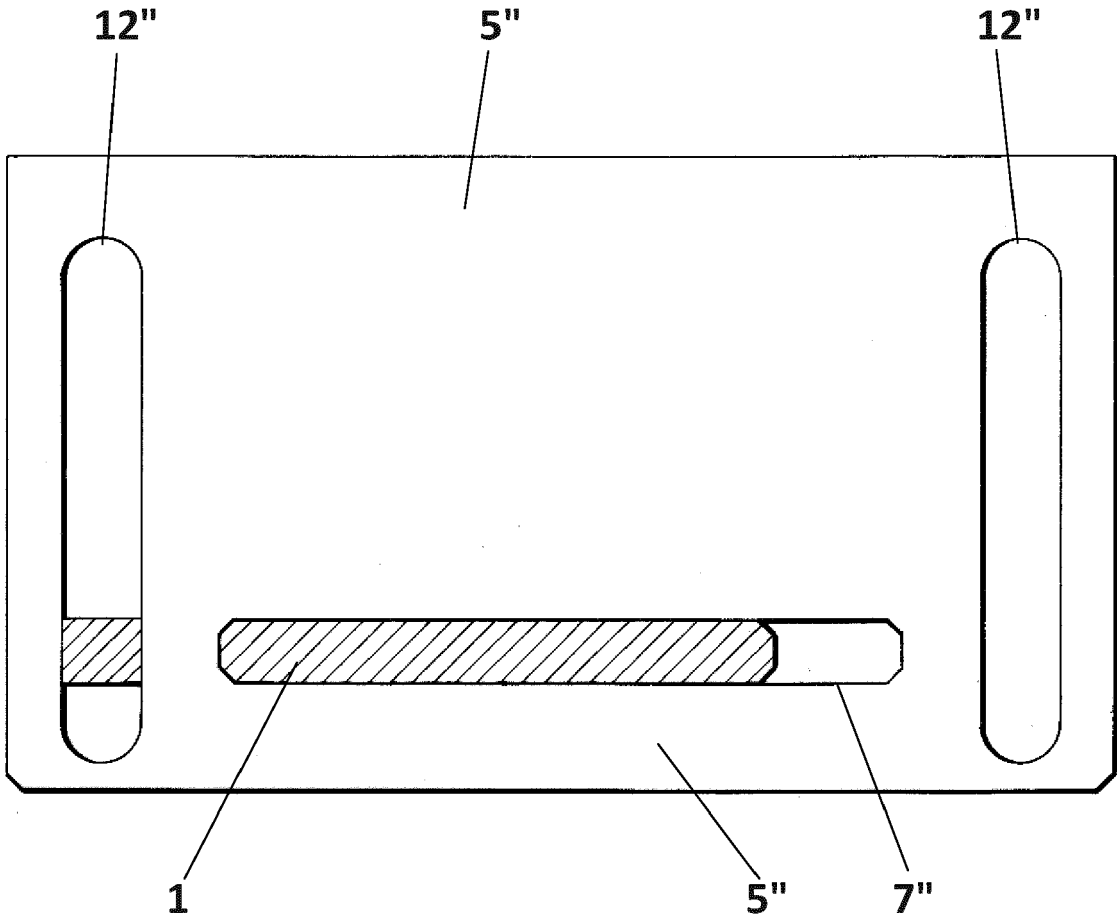
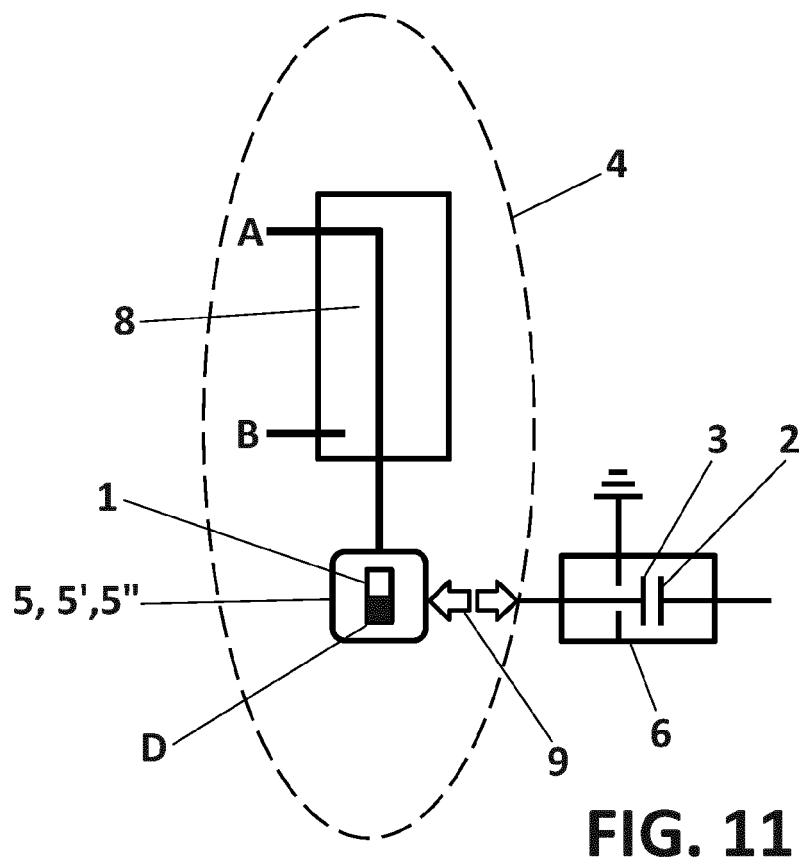
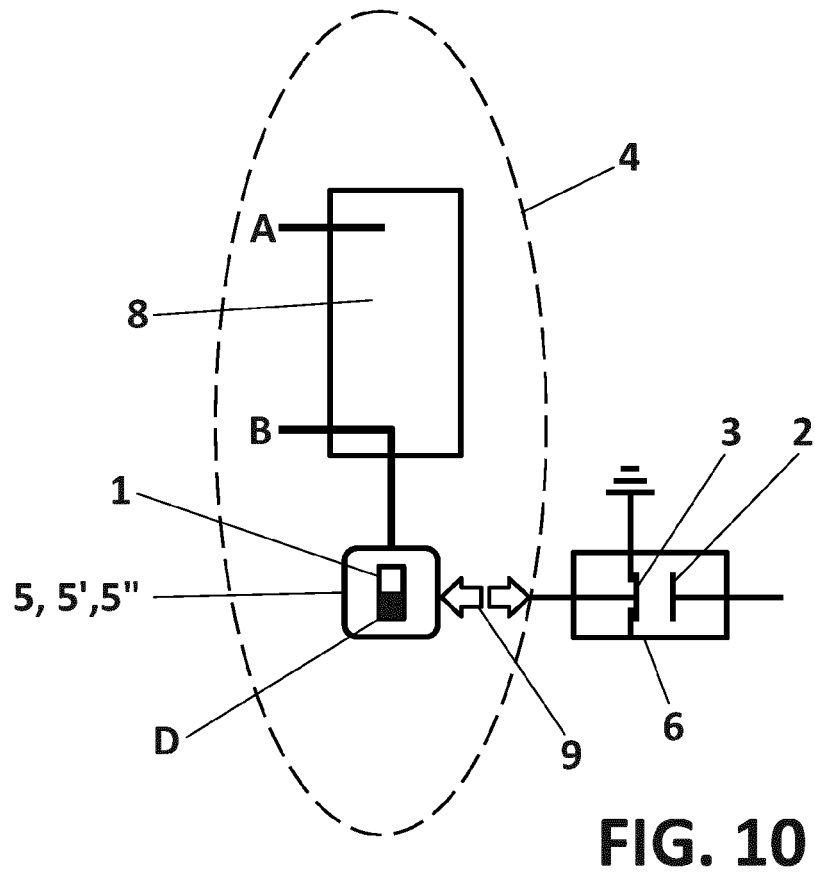
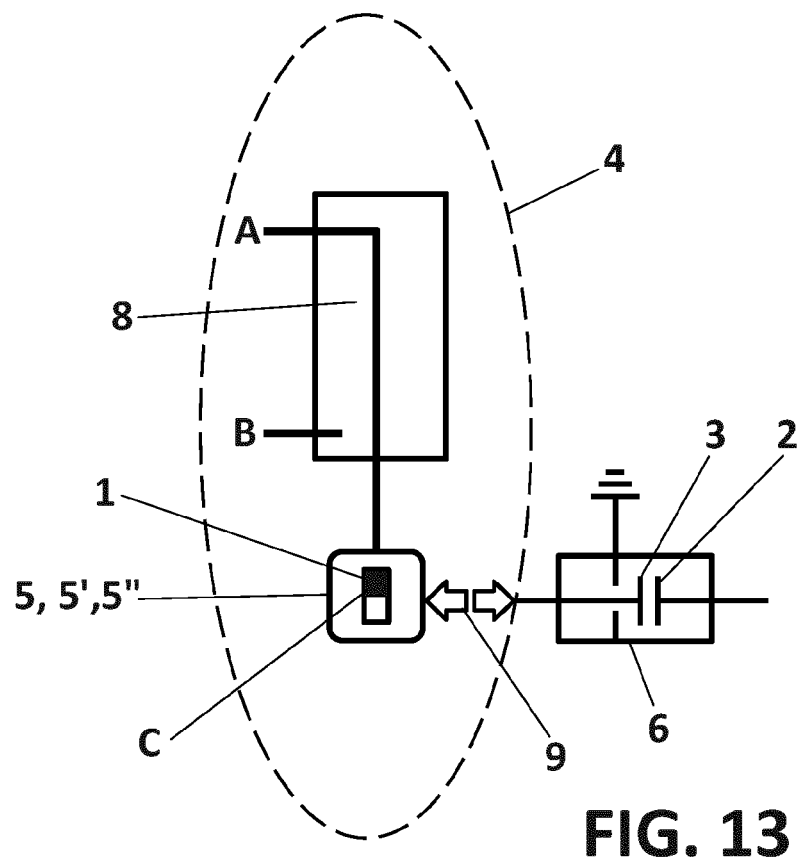
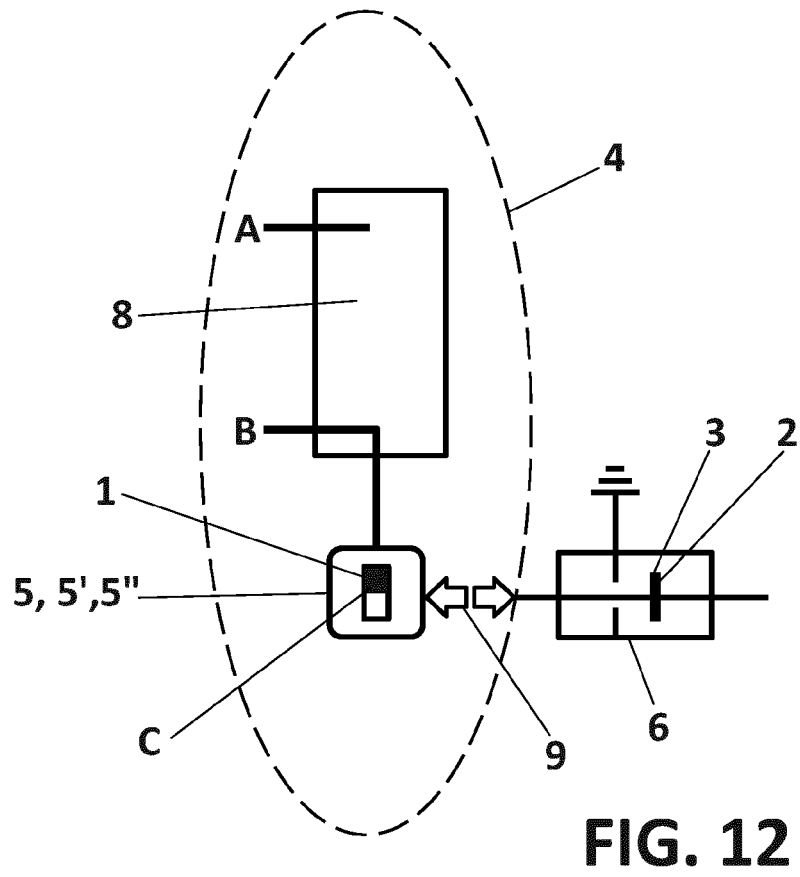


FIG. 9







EUROPEAN SEARCH REPORT

Application Number
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			H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 February 2017	Examiner Bilard, Stéphane
CATEGORY OF CITED DOCUMENTS		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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 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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07-02-2017

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