Jan. 12, 1954 F. KOPPELMANN 2,666,102

MECHANICAL RECTIFIER

Filed April 13, 1950

FIG. 3

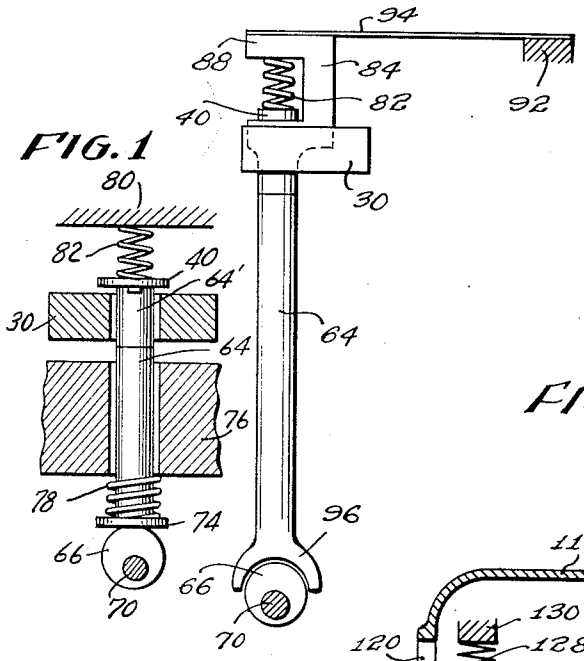


FIG. 1

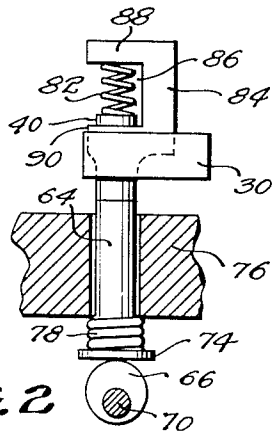


FIG. 2

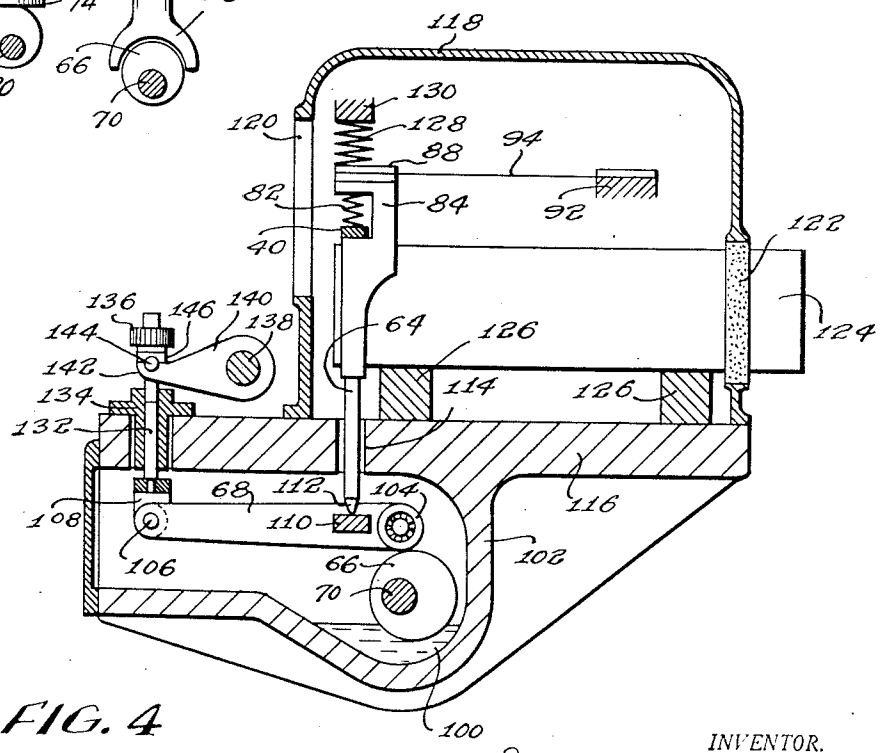


FIG. 4

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Patented Jan. 12, 1954

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UNITED STATES PATENT OFFICE

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MECHANICAL RECTIFIER

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Application April 13, 1950, Serial No. 155,585

Claims priority, application Germany November 4, 1949

16 Claims. (Cl. 200—30)

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The present invention relates to a contact arrangement for mechanical current converters.

It is an object of the present invention to provide an arrangement, the parts of which can be easily adjusted to varying conditions.

A contact arrangement for mechanical current converters according to the present invention comprises in combination a stationary contact member, a movable contact member, resilient means for urging the movable contact member against the stationary contact member, means driven synchronously with the current to be converted for separating the movable contact member from the stationary contact member, and a movable bearing for the resilient means, the bearing moving synchronously with the contact separating means so that the stroke of the resilient means is constant during the opening of the contact members. Preferably a contact arrangement according to the present invention comprises a crank adapted to be driven synchronously with the current to be converted, a rod driven by the crank for separating the movable contact member from the stationary contact member, the rod performing a small rotational movement in addition to the translatory motion for separating the contact members, and a bearing for the resilient means, the bearing moving synchronously with the rod so that the stroke of the resilient means is constant during the opening of the contact members.

Another embodiment comprises an eccentric adapted to be driven synchronously with the current to be converted, a rod having a recessed end engaging the eccentric, guide means for guiding the rod so that the end of the rod engaging the eccentric performs an oscillating motion, the rod being connected to the movable contact member so as to separate the contact members during the stroke of the rod. Preferably a recess is arranged at the other end of the rod, and a compression spring arranged in the recess and urging the movable contact member against the stationary contact member whereby the stroke of the compression spring is constant during the opening of the contact members.

A preferred embodiment of the present invention comprises in combination a frame, two stationary contact members arranged in the frame, a movable contact member arranged in the frame and adapted to bridge in one end position thereof the stationary contact members, a shaft penetrating into the frame and adapted to be driven synchronously with the current to be converted, an eccentric arranged on the shaft, a pivoted

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lever engaging the eccentric, means for adjusting the pivot of the lever with respect to the frame, a rod having one end thereof engaging the lever, the rod being guided in a substantially linear direction in a hole of the frame, a recess forming the other end of the rod and accommodating the movable contact member so that it is separated from the stationary contact members when the rod reaches substantially the one end position thereof under the action of the eccentric and the lever, and a compression spring arranged in the recess and urging the movable contact member against the stationary contact members, whereby the stroke of the compression spring is constant during the opening of the contact members.

Preferably a leaf spring connects the recess forming the other end of the rod to the frame and a compression spring is arranged between the other end of the rod and the frame.

A preferred embodiment of the present invention comprises in combination a frame having a substantially horizontal wall and an upper and a lower chamber arranged, respectively, above and below the horizontal wall, two stationary contact members arranged in the upper chamber, a movable contact member arranged in the upper chamber and adapted to bridge in one end position thereof the stationary contact members, a shaft penetrating into the lower chamber and driven synchronously with the current to be converted, an eccentric arranged on the shaft in the lower chamber, a pivoted lever arranged in the lower chamber and engaging the eccentric, a substantially vertical pin arranged in an aperture of the horizontal wall and forming at the lower end thereof the pivot of the lever, means for adjusting the pin with respect to the aperture in the horizontal wall, a substantially vertical rod having a lower end arranged in the lower chamber and engaging the lever, the rod being guided in a substantially vertical direction in a hole of the horizontal wall, a recess forming the upper end of the rod in the upper chamber and accommodating the movable contact member so that it is lifted from the stationary contact members when the rod reaches substantially the upper end position under the action of the eccentric and the lever, and a compression spring arranged in the recess and urging the movable contact member against the stationary contact members, whereby the stroke of the compression spring is constant during the opening of the contact members. In a preferred embodiment a second shaft is adapted for angular adjustment and an arm rigidly secured to said second shaft is con-

nected to the pin so as to adjust it with respect to the horizontal wall, and screw means are connected to the pin and adapted to adjust the pin with respect to the horizontal wall.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings in which:

Fig. 1 shows a contact arrangement according to the invention.

Figs. 2 and 3 show two embodiments of contact arrangement according to the invention; and

Fig. 4 shows a practical embodiment of a contact arrangement.

In Fig. 1 movable contact bridge 40 bridges in its lowermost position stationary contacts 30 and 30*a*. The bridge 40 is moved upwards by the insulating head 64' of a rod 64 the other end of which is acted upon by an eccentric 66 secured to a shaft 70 which is driven synchronously with the alternating current to be rectified. The rod 64 carries at its lower end a plate 74 abutting against the eccentric 66. A guide member 76 guides the rod 64 in a straight line vertical motion and a helical spring 78 arranged between the end plate 74 and the guide member 76 keeps the plate 74 in engagement with the eccentric 66. The eccentric 66 is so shaped that the bridge 40 makes contact with the contacts 30 and 30*a* for a period equivalent to 60° of the cycle of the alternating current and is out of contact for 120° during each half cycle of the current. A stationary member 80 is arranged above the bridge 40 and a helical spring 82 is arranged between the bridge 40 and the stationary member 80, the spring 82 supplying the contact pressure of the bridge 40. Spring 82 has a stroke which is the larger the smaller the time period is during which the bridge 40 makes contact with the stationary contact members 30 and 30*a*. Thus the alternating strain on spring 82 is the higher the larger the distance is by which the bridge 40 is separated from the stationary contacts 30 and 30*a*. Since in a six-phase connection the contact time is only half as long as in a three-phase connection, namely theoretically 60° instead of 120°, the stroke of spring 82 will be approximately twice as large in the six-phase connection as in the three-phase connection, which leads to difficulties in practical design.

The invention overcomes these difficulties by making the member against which the spring 82 abuts movable together with the rod 64. An embodiment of such a device is shown in Fig. 2 which differs from the embodiment shown in Fig. 1 by the shape of the upper part of rod 64. In Fig. 2 the stationary contacts 30 and 30*a* are shown displaced through 90° against the position in which they are shown in Fig. 1, and are situated laterally of the head 84 of the rod 64. The head 84 is preferably made of insulating material for instance a hard fabric and has a recess 86 for the reception of the bridge 40 and the spring 82 abutting against the upper leg 88 of the head 84 which serves as a movable bearing for the spring 82. The other parts are similar to those shown in Fig. 1.

If the device is in the position shown in Fig. 2 in which the rod 64 has its uppermost position and spring 78 is compressed, the bridge 40 is lifted from contact pieces 30 and 30*a*. Spring 82 is in its most expanded position and presses the bridge 40 against the lower leg 90 of the head 84. The lower leg 90 is in this position at a slightly higher level than the contact pieces 30 and 30*a* so that it keeps the bridge 40 out of contact with the latter. When the shaft 70 rotates and moves the eccentric 66 toward the lowermost position, the rod 64 is moved correspondingly downward, spring 78 keeping the end plate 74 in contact with the eccentric 66. During this movement the head 84 is moved downward and at a certain moment, the bridge 40 comes into contact with stationary contacts 30 and 30*a*, the spring 82 preventing any rebound of the bridge 40. When the eccentric 66 moves further toward its lowermost position the spring 82 exerts a sufficient pressure for pressing the bridge 40 firmly against the contacts 30 and 30*a*. When the eccentric 66 passes its lowermost position and moves on, the bridge 40 is lifted once more from the stationary contacts 30 and 30*a*, the spring 82 keeping the bridge 40 in contact during the first part of the upward movement of rod 64. Thus the lifting and lowering of the bridge 40 is achieved smoothly and without any shock. The stroke of the spring 82 is independent of the movement of the rod 64 since it is carried within the recess 86 of the head 84 of the rod 64.

The embodiment shown in Fig. 3 differs from that shown in Fig. 2 in some minor features among which is an improvement which allows to dispense with the guiding member 76 which in continuous operation needs lubricating with oil. In the design shown in Fig. 3 the lower end 96 of the rod 64 is curved and engages the eccentric 66. In consequence thereof the rod 64 carries out a small rotary movement in addition to its vertical movement because the lower end 96 of the rod 64 moves toward the left and the right by an amount corresponding to the eccentricity ϵ of the eccentric. The upper leg 88 of the head 84 is linked to a stationary part 92 by means of a leaf spring 94 so that if the rod 64 is sufficiently long the bridge 40 does not carry out any lateral movement. Practical tests have shown that the arrangement shown in Fig. 3 operates permanently even at a high contact pressure up to 100 kg.

The operation of the device shown in Fig. 3 is essentially the same as that of the device shown in Fig. 2.

Referring now to Fig. 4 showing a practical embodiment of the contact arrangement according to Fig. 3 the shaft 70 carrying the eccentric 66 is driven by a synchronous motor and is arranged horizontally in a bottom recess 100 of a frame 102. The bottom recess 100 is filled with oil into which the lower side of the shaft 70 and the eccentric 66 dip. It is to be understood that the frame 102 accommodates twelve eccentrics which are keyed to a common shaft 70.

The eccentric 66 is engaged by a roller 104 attached to one end of a lever 68 pivoted at 106 to a movable part 108 the position of which can be adjusted in the manner described hereinafter. The lever 68 carries a bearing 110 near its end carrying the roller 104. The bearing 110 is engaged by the tapered lower end 112 of the rod 64 which is provided with an insulating head 84. The rod 64 passes through a boring 114 of the upper wall 116 of the frame 102 so that the head 84 is above the wall 116 inside a casing 118 provided with a window 120 for the observation of the bridge 40 and the spring 82 and with a

rubber packing 122 for leading in the bus bars 124 taking the part of the stationary contacts 30 and 30a. The bus bars 124 are carried by insulating blocks 126. The casing 118 is preferably designed as a hood which can be removed from the top wall 116 of the frame 102. The upper end of the insulating head 84 is connected by a leaf spring 94 to a stationary part 92 so that the head 84 is restricted to movements essentially in the direction of the axis of the rod 64. It must be understood, however, that the rod 64 carries out very small lateral movement since the lever 68 rotates about the movable part 108 so that the bearing 110 carries out a motion along a circular arc about the pivot 106. A compression spring 128 is arranged between the upper leg 88 of the head 84 and a stationary part 130 and serves for pressing the lower end 112 of the rod 64 against the bearing 110. The spring 128 has a larger stroke than the spring 82 which, however, makes no difficulties in practice since the spring 128 need not be a light spring. The spring 82, however, should be as light as possible in order to avoid a rebounding when the bridge 40 engages the bus bars 124. Thus the spring 82 should be made of high grade steel.

The roller 104 can be replaced by a ball bearing or the like which may also be arranged on the shaft 70, the right end of lever 68 abutting against the outer shell of the ball bearing.

The operation of the device shown in Fig. 4 as far as it has been described is substantially the same as that of the device shown in Fig. 2 and need not be repeated.

In order to adjust the contact time, i. e., the time during which the bridge 40 is in contact with the bus bars 124, the pivot 106 of the lever 68 is made adjustable by arranging the movable part 108 on the lower end of a vertical pin 132 passing through a sleeve 134 screwed into the upper wall 116 of the frame 102. The pin 132 can be lifted or lowered by means of an adjusting screw 136, a lowering of the part 108 increasing the contact time and a lifting of part 108 decreasing the contact time. The screw 136 allows each pivot 106 to be adjusted individually. All the twelve pivots 106 can be adjusted simultaneously by the rotation of a shaft 138 to which twelve arms such as 140 are keyed. Each arm 140 carries with its outer end 142 a horizontal pin 144 supporting a member 146 in which the vertical pin 132 is suspended. Thus it will be seen that by rotating the shaft 138 all pivots are adjusted simultaneously whereas by the rotation of the screw 136 each pivot can be adjusted individually.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of arrangement for converting alternating current into direct current differing from the types described above.

While I have illustrated and described the invention as embodied in an arrangement for mechanically converting three-phase current into direct current, I do not intend to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of my invention.

Without further analysis, the foregoing will so fully reveal the gist of my invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What I claim as new and desire to secure by Letters Patent is:

1. A contact arrangement for mechanical current converters, comprising in combination, a stationary contact member; a movable contact member; an eccentric adapted to be driven synchronously with the current to be converted; a pivoted lever engaging said eccentric; a rod engaging with one end thereof said lever; guide means for guiding said rod in a substantially linear direction; a recess arranged at the other end of said rod; and a compression spring arranged in said recess and urging said movable contact member against said stationary contact member whereby the stroke of said compression spring is constant during the opening of said contact members.

2. A contact arrangement for mechanical current converters, comprising in combination, a stationary contact member; a movable contact member; an eccentric adapted to be driven synchronously with the current to be converted; a pivoted lever engaging said eccentric; means for adjusting the pivot of said lever; a rod engaging with one end thereof said lever; guide means for guiding said rod in a substantially linear direction; a recess arranged at the other end of said rod; and a compression spring arranged in said recess and urging said movable contact member against said stationary contact member whereby the stroke of said compression spring is constant during the opening of said contact members.

3. A contact arrangement for mechanical current converters, comprising in combination, a frame; two stationary contact members arranged in said frame; a movable contact member arranged in said frame and adapted to bridge in one end position thereof said stationary contact members; a shaft penetrating into said frame and adapted to be driven synchronously with the current to be converted; an eccentric arranged on said shaft; a pivoted lever engaging said eccentric; means for adjusting the pivot of said lever with respect to said frame; a rod having a one end thereof engaging said lever, said rod being guided in a sustantially linear direction in a hole of said frame; a recess forming the other end of said rod and accommodating said movable contact member so that it is separated from said stationary contact members when said rod reaches substantially the one end position thereof under the action of said eccentric and said lever; and a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members.

4. A contact arrangement for mechanical current converters, comprising in combination, a frame; two stationary contact members arranged in said frame; a movable contact member arranged in said frame and adapted to bridge in one end position thereof said stationary contact members; a shaft penetrating into said frame and adapted to be driven synchronously with the current to be converted; an eccentric arranged on said shaft; a pivoted lever engaging said eccentric; means for adjusting the pivot of said

lever with respect to said frame; a rod having a one end thereof engaging said lever, said rod being guided in a substantially linear direction in a hole of said frame; a recess forming the other end of said rod and accommodating said movable contact member so that it is separated from said stationary contact members when said rod reaches substantially the one end position thereof under the action of said eccentric and said lever; a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members; and a leaf spring connecting said recess forming the other end of said rod to said frame.

5. A contact arrangement for mechanical current converters, comprising in combination, a frame; two stationary contact members arranged in said frame; a movable contact member arranged in said frame and adapted to bridge in one end position thereof said stationary contact members; a shaft penetrating into said frame and adapted to be driven synchronously with the current to be converted; an eccentric arranged on said shaft; a pivoted lever engaging said eccentric; means for adjusting the pivot of said lever with respect to said frame; a rod having a one end thereof engaging said lever, said rod being guided in a substantially linear direction in a hole of said frame; a recess forming the other end of said rod and accommodating said movable contact member so that it is separated from said stationary contact members when said rod reaches substantially the one end position thereof under the action of said eccentric and said lever; a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members; and a compression spring arranged between the other end of said rod and said frame.

6. A contact arrangement for mechanical current converters, comprising in combination, a frame; two stationary contact members arranged in said frame; a movable contact member arranged in said frame and adapted to bridge in one end position thereof said stationary contact members; a shaft penetrating into said frame and adapted to be driven synchronously with the current to be converted; an eccentric arranged on said shaft; a pivoted lever engaging said eccentric; means for adjusting the pivot of said lever with respect to said frame; a rod having a one end thereof engaging said lever, said rod being guided in a substantially linear direction in a hole of said frame; a recess forming the other end of said rod and accommodating said movable contact member so that it is separated from said stationary contact members when said rod reaches substantially the one end position thereof under the action of said eccentric and said lever; a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members; a leaf spring connecting said recess forming the other end of said rod to said frame; and a compression spring arranged between the other end of said rod and said frame.

7. A contact arrangement for mechanical current converters, comprising in combination, a frame having a substantially horizontal wall and an upper and a lower chamber arranged, respectively, above and below said horizontal wall; two stationary contact members arranged in said upper chamber; a movable contact member arranged in said upper chamber and adapted to bridge in one end position thereof said stationary contact members; a shaft penetrating into said lower chamber and driven synchronously with the current to be converted; an eccentric arranged on said shaft in said lower chamber; a pivoted lever arranged in said lower chamber and engaging said eccentric; a substantially vertical pin arranged in an aperture of said horizontal wall and forming at the lower end thereof the pivot of said lever; means for adjusting said pin with respect to the aperture in said horizontal wall; a substantially vertical rod having a lower end arranged in said lower chamber and engaging said lever, said rod being guided in a substantially vertical direction in a hole of said horizontal wall; a recess forming the upper end of said rod in said upper chamber and accommodating said movable contact member so that it is lifted from said stationary contact members when said rod reaches substantially the upper end position under the action of said eccentric and said lever; and a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members.

8. A contact arrangement for mechanical current converters, comprising in combination, a frame having a substantially horizontal wall and an upper and a lower chamber arranged, respectively, above and below said horizontal wall; two stationary contact members arranged in said upper chamber; a movable contact member arranged in said upper chamber and adapted to bridge in one end position thereof said stationary contact members; a shaft penetrating into said lower chamber and driven synchronously with the current to be converted; an eccentric arranged on said shaft in said lower chamber; a pivoted lever arranged in said lower chamber and engaging said eccentric; a substantially vertical pin arranged in an aperture of said horizontal wall and forming at the lower end thereof the pivot of said lever; means for adjusting said pin with respect to the aperture in said horizontal wall; a substantially vertical rod having a lower end arranged in said lower chamber and engaging said lever, said rod being guided in a substantially vertical direction in a hole of said horizontal wall; a recess forming the upper end of said rod in said upper chamber and accommodating said movable contact member so that it is lifted from said stationary contact members when said rod reaches substantially the upper end position under the action of said eccentric and said lever; a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members; and a leaf spring connecting said recess forming the upper end of said rod to said frame.

9. A contact arrangement for mechanical current converters, comprising in combination, a frame having a substantially horizontal wall and an upper and a lower chamber arranged, respectively, above and below said horizontal wall; two stationary contact members arranged in said upper chamber; a movable contact member ar-

ranged in said upper chamber and adapted to bridge in one end position thereof said stationary contact members; a shaft penetrating into said lower chamber and driven synchronously with the current to be converted; an eccentric arranged on said shaft in said lower chamber; a pivoted lever arranged in said lower chamber and engaging said eccentric; a substantially vertical pin arranged in an aperture of said horizontal wall and forming at the lower end thereof the pivot of said lever; means for adjusting said pin with respect to the aperture in said horizontal wall; a substantially vertical rod having a lower end arranged in said lower chamber and engaging said lever, said rod being guided in a substantially vertical direction in a hole of said horizontal wall; a recess forming the upper end of said rod in said upper chamber and accommodating said movable contact member so that it is lifted from said stationary contact members when said rod reaches substantially the upper end position under the action of said eccentric and said lever; a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members; and a compression spring arranged between the upper end of said rod and said frame.

10. A contact arrangement for mechanical current converters, comprising in combination, a frame having a substantially horizontal wall and an upper and a lower chamber arranged, respectively, above and below said horizontal wall; two stationary contact members arranged in said upper chamber; a movable contact member arranged in said upper chamber and adapted to bridge in one end position thereof said stationary contact members; a shaft penetrating into said lower chamber and driven synchronously with the current to be converted; an eccentric arranged on said shaft in said lower chamber; a pivoted lever arranged in said lower chamber and engaging said eccentric; a substantially vertical pin arranged in an aperture of said horizontal wall and forming at the lower end thereof the pivot of said lever; means for adjusting said pin with respect to the aperture in said horizontal wall; a substantially vertical rod having a lower end arranged in said lower chamber and engaging said lever, said rod being guided in a substantially vertical direction in a hole of said horizontal wall; a recess forming the upper end of said rod in said upper chamber and accommodating said movable contact member so that it is lifted from said stationary contact members when said rod reaches substantially the upper end position under the action of said eccentric and said lever; a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members; a leaf spring connecting said recess forming the upper end of said rod to said frame; and a compression spring arranged between the upper end of said rod and said frame.

11. A contact arrangement for mechanical current converters, comprising in combination, a frame having a substantially horizontal wall and an upper and a lower chamber arranged, respectively, above and below said horizontal wall; two stationary contact members arranged in said upper chamber; a movable contact member arranged in said upper chamber and adapted to bridge in one end position thereof said stationary contact members; a first shaft penetrating into said lower chamber and driven synchronously with the current to be converted; an eccentric arranged on said first shaft in said lower chamber; a pivoted lever arranged in said lower chamber and engaging said eccentric; a substantially vertical pin arranged in an aperture of said horizontal wall and forming at the lower end thereof the pivot of said lever; a second shaft adapted for angular adjustment; an arm rigidly secured to said second shaft and connected to said pin so as to adjust it with respect to said horizontal wall; screw means connected to said pin and adapted to adjust said pin with respect to said horizontal wall; a substantially vertical rod having a lower end arranged in said lower chamber and engaging said lever, said rod being guided in a substantially vertical direction in a hole of said horizontal wall; a recess forming the upper end of said rod in said upper chamber and accommodating said movable contact member so that it is lifted from said stationary contact members when said rod reaches substantially the upper end position under the action of said eccentric and said lever; and a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members.

12. A contact arrangement for mechanical current converters, comprising in combination, a frame having a substantially horizontal wall and an upper and a lower chamber arranged, respectively, above and below said horizontal wall; two stationary contact members arranged in said upper chamber; a movable contact member arranged in said upper chamber and adapted to bridge in one end position thereof said stationary contact members; a first shaft penetrating into said lower chamber and driven synchronously with the current to be converted; an eccentric arranged on said first shaft in said lower chamber; a pivoted lever arranged in said lower chamber and engaging said eccentric; a substantially vertical pin arranged in an aperture of said horizontal wall and forming at the lower end thereof the pivot of said lever; a second shaft adapted for angular adjustment; an arm rigidly secured to said second shaft and connected to said pin so as to adjust it with respect to said horizontal wall; screw means connected to said pin and adapted to adjust said pin with respect to said horizontal wall; a substantially vertical rod having a lower end arranged in said lower chamber and engaging said lever, said rod being guided in a substantially vertical direction in a hole of said horizontal wall; a recess forming the upper end of said rod in said upper chamber and accommodating said movable contact member so that it is lifted from said stationary contact members when said rod reaches substantially the upper end position under the action of said eccentric and said lever; a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members; and a leaf spring connecting said recess forming the upper end of said rod to said frame.

13. A contact arrangement for mechanical current converters, comprising in combination, a frame having a substantially horizontal wall

and an upper and a lower chamber arranged, respectively, above and below said horizontal wall; two stationary contact members arranged in said upper chamber; a movable contact member arranged in said upper chamber and adapted to bridge in one end position thereof said stationary contact members; a first shaft penetrating into said lower chamber and driven synchronously with the current to be converted; an eccentric arranged on said first shaft in said lower chamber; a pivoted lever arranged in said lower chamber and engaging said eccentric; a substantially vertical pin arranged in an aperture of said horizontal wall and forming at the lower end thereof the pivot of said lever; a second shaft adapted for angular adjustment; an arm rigidly secured to said second shaft and connected to said pin so as to adjust it with respect to said horizontal wall; screw means connected to said pin and adapted to adjust said pin with respect to said horizontal wall; a substantially vertical rod having a lower end arranged in said lower chamber and engaging said lever, said rod being guided in a substantially vertical direction in a hole of said horizontal wall; a recess forming the upper end of said rod in said upper chamber and accommodating said movable contact member so that it is lifted from said stationary contact members when said rod reaches substantially the upper end position under the action of said eccentric and said lever; a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members; and a compression spring arranged between the upper end of said rod and said frame.

14. A contact arrangement for mechanical current converters, comprising in combination, a frame having a substantially horizontal wall and an upper and a lower chamber arranged, respectively, above and below said horizontal wall; two stationary contact members arranged in said upper chamber; a movable contact member arranged in said upper chamber and adapted to bridge in one end position thereof said stationary contact members; a first shaft penetrating into said lower chamber and driven synchronously with the current to be converted; an eccentric arranged on said first shaft in said lower chamber; a pivoted lever arranged in said lower chamber and engaging said eccentric; a substantially vertical pin arranged in an aperture of said horizontal wall and forming at the lower end thereof the pivot of said lever; a second shaft adapted for angular adjustment; an arm rigidly secured to said second shaft and connected to said pin so as to adjust it with respect to said horizontal wall; screw means connected to said pin and adapted to adjust said pin with respect to said horizontal wall; a substantially vertical rod having a lower end arranged in said lower chamber and engaging said lever, said rod being guided in a substantially vertical direction in a hole of said horizontal wall; a recess forming the upper end of said rod in said upper chamber and accommodating said movable contact member so that it is lifted from said stationary contact members when said rod reaches substantially the upper end position under the action of said eccentric and said lever; a compression spring arranged in said recess and urging said movable contact member against said stationary contact members, whereby the stroke of said compression spring is constant during the opening of said contact members; a leaf spring connecting said recess forming the upper end of said rod to said frame; and a compression spring arranged between the upper end of said rod and said frame.

15. A contact arrangement for mechanical current converters, comprising, in combination, an eccentric adapted to be driven synchronous with the current to be converted; a movable member engaging said eccentric and synchronously moving with the same; a rod having one end thereof connected with said movable member so as to move synchronous with said eccentric, said rod having a recessed portion at the other end thereof; spring means urging said rod in one direction toward said eccentric; a compression spring located in said recessed portion and having one end secured to the other end of said rod and moving with the same; a movable contact member located in said recessed portion and being secured to the other end of said compression spring and urged by the same to move in said one direction to an end position abutting against said recessed portion; and a stationary contact located adjacent said recessed portion and being engaged and closed by said movable contact during movement of said rod in said one direction toward said eccentric.

16. A contact arrangement for mechanical current converters, comprising, in combination, an eccentric adapted to be driven synchronous with the current to be converted; a movable recessed member engaging said eccentric and synchronously moving with the same; a rod having one end thereof secured to said movable member so as to move synchronous with said eccentric in a small rotational movement, said rod having a recessed portion at the other end thereof; leaf spring means engaging the other end of said rod and urging said rod in one direction toward said eccentric; a compression spring located in said recessed portion and having one end secured to the other end of said rod and moving with the same; a movable contact member located in said recessed portion and being secured to the other end of said compression spring and urged by the same to move in said one direction to an end position abutting against said recessed portion; and a stationary contact located adjacent said recessed portion and being engaged and closed by said movable contact during movement of said rod in said one direction toward said eccentric.

FLORIS KOPPELMANN.

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