No. 647,291. Patented Apr. 10, 1900.

# W. M. CHAPMAN.

## POLE CHANGER.

(Application filed Aug. 10, 1899.)

(No Model.)

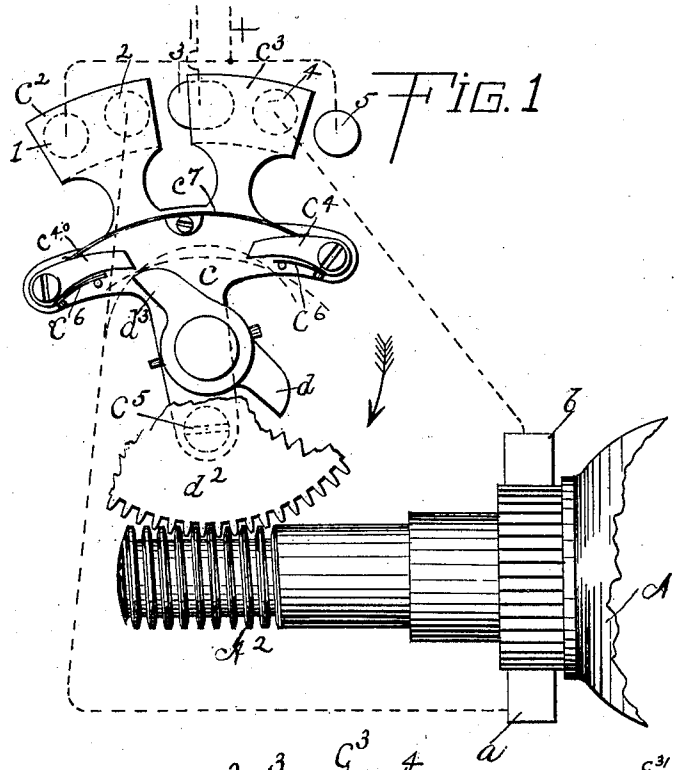


FIG. 1

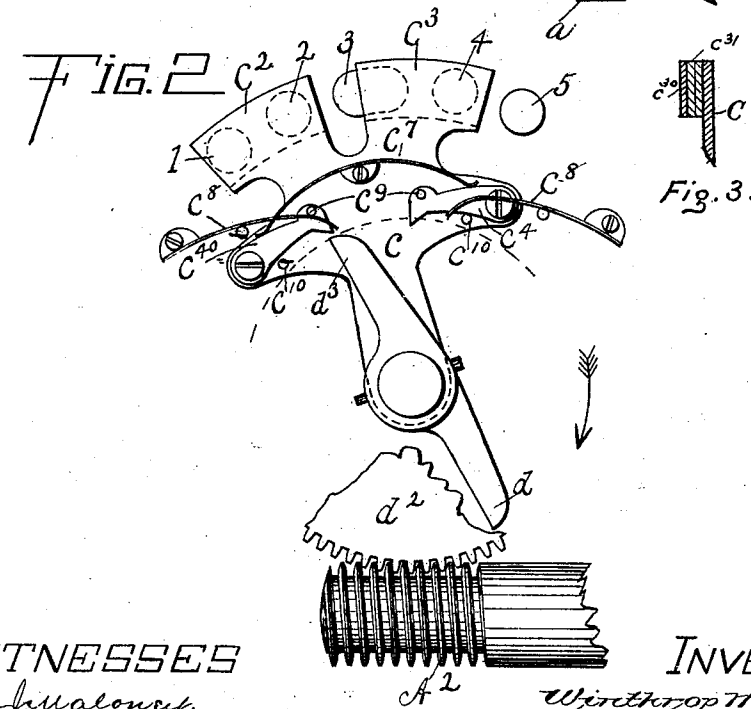


FIG. 2



Fig. 3.

WITNESSES

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# UNITED STATES PATENT OFFICE.

WINTHROP M. CHAPMAN, OF NEEDHAM, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO CHARLES W. RICHARDS, OF SAME PLACE.

## POLE-CHANGER.

SPECIFICATION forming part of Letters Patent No. 647,291, dated April 10, 1900.

Application filed August 10, 1899. Serial No. 726,785. (No model.)

*To all whom it may concern:*

Be it known that I, WINTHROP M. CHAPMAN, of Needham, county of Norfolk, and State of Massachusetts, have invented an Improvement in Pole-Changers, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

The present invention relates to a pole-changing device for dynamo-electric machines, said device being adapted to be used in cases where it is necessary to obtain a current always flowing in the same direction from a dynamo-electric machine which may be driven in either direction.

The device is especially adapted for those car-lighting systems in which a dynamo is driven by the rotation of the car-axle, so that the armature is liable to be rotated in one direction as often as in the other. It is to be understood, however, that the invention is not limited to such specific use, since pole-changing devices embodying the invention may be used for various purposes.

The device embodying the invention comprises a switch member adapted to be shifted from one set of contacts to another, so that no matter which way the armature of the dynamo is traveling the positive brush will be connected with the positive line-terminal and the negative brush with the negative line-terminal, so that the polarity of the dynamo-brushes may be shifted without varying the direction of current in the line-circuit. To shift the said switch member from one position to the other in response to a change in direction of rotation of the dynamo-armature, the said armature is arranged to coöperate with an actuating device which will travel in one direction or the other, according to the direction of travel of the armature, and the said actuating device is provided with engaging portions, one of which will engage the switch member when the actuator is traveling in one direction and the other of which will engage the switch member when the actuator is traveling in the opposite direction. The actuator and switch member are so arranged with relation to each other that as soon as the actuator has pushed the said switch member a sufficient distance to bridge the proper contacts it will become disengaged therefrom and will not produce any further operation. The switch member is then left in a position to be operated upon by the other engaging portion of the actuator if the direction of travel of the dynamo-armature is changed.

It may not in some cases be essential to employ more than one engaging portion for each member, since such a pole-changer might be utilized in cases where the automatic changing of the poles need be accomplished only when the direction of rotation of the armature has been once changed. When the device is used for the purpose above named, however—that is to say, in car-lighting systems—it is desirable that it should be completely automatic, the parts therefore being duplicated, so that the device will operate in response to every change in the direction of rotation of the armature.

Figure 1 is a side elevation of a sufficient portion of a device embodying the invention to illustrate the construction and operation thereof. Fig. 2 is a similar view illustrating a modification, and Fig. 3 is a sectional detail showing a portion of one of the switch-arms and its bridging-contact.

As herein shown, the brushes *a* and *b* of the armature A, either of which brushes may be positive or negative, according to the direction of rotation of said armature, are connected, respectively, with the contact-pieces 2 and 4 of a line of contact-pieces 1, 2, 3, 4, and 5, which are adapted to be bridged by the switch member *c*, which is shown as having bridging projections $c^2$ and $c^3$, each of which projections is provided with a contact-piece, Fig. 3, adapted to bridge two of the said contacts and separated from the switch member by a suitable insulating material.

The negative line-terminal is shown as connected with the contact 3, and the positive line-terminal is shown as connected with the contacts 1 and 5, the switch being shown in such a position that the positive line-terminal is connected with the brush *a* and the negative line-terminal with the brush *b*. The circuit in this case is from brush *a* to contact

2, across the switch member $c^2$ to contact 1, and thence to the positive terminal of the line, around the line-circuit, (not shown,) and back through the negative terminal to contact 3, across switch member $c^3$ to contact 4, and thence to the brush $b$. If, therefore, the direction of rotation of the armature is changed so that the brush $b$ becomes the positive brush and the brush $a$ the negative brush, it is necessary to shift the switch member $c$ to the right, the circuit then being from brush $b$ to contacts 4 and 5, which are then connected by the switch member $c^3$, and thence to the positive terminal of the line, around the line-circuit, and back through the negative terminal to contact 3, thence through the switch member $c^2$, which then bridges the contacts 3 and 2, to said contact 2, and from said contact 2 to brush $a$. In order to effect these changes, it is necessary that the switch member $c$ should be shifted from one position to the other each time the direction of rotation of the armature is changed and then left stationary so long as the armature continues traveling in the same direction. To this end the switch member is arranged to coöperate with a traveling actuator $d$, herein shown as an arm carried by a worm-gear $d^2$, coöperating with a worm $A^2$ on the shaft of the armature A, it being obvious, therefore, that the direction of rotation of said gear will be changed when that of the armature is changed. The said actuator $d$ is arranged, when the switch member is in the position shown and the worm-gear is traveling in the direction of the arrow, to engage and move the switch member $c$, which is shown as provided with a pawl $c^4$, adapted to be positively engaged as the actuator travels with the arrow. As shown in Fig. 1, the switch member $c$ is pivotally supported at $c^5$ on an axis eccentric to the axis of the actuator $d$, it being obvious, therefore, that the actuator $d$ and pawl $c^4$ will remain in engagement only until the point of the said pawl has reached the position at which its path of travel crosses the path of travel of the said actuator, the said paths of travel being indicated in dotted lines.

The parts are so arranged that during the time the actuator is in engagement with the pawl $c^4$ the switch member $c$ will be moved far enough to shift the contacts and change the circuits, as above described. It is further obvious that as soon as the switch member $c$ has been thus shifted the pawl $c^4$ will remain out of the path of the actuator $d$, so that no further movement will take place while the actuator $d$ is traveling in the direction of the arrow.

In order that the shifting may take place automatically in either direction, the actuator is shown as provided with a second projection $d^3$, adapted to coöperate with a pawl $c^{40}$, symmetrically arranged with the pawl $c^4$ and arranged to travel along the same curved path. Assuming, therefore, that the actuator $d$ is traveling in the opposite direction from that indicated by the arrow and that the switch member is in the other position from that shown, it will be seen that the pawl $c^{40}$ will be engaged by the projection $d^3$, as has already been described with relation to the projection $d$, and will carry the switch member $c$ to the position shown.

The pawls described are duplicates of each other, both operating in exactly the same way in order to render the device completely automatic, it being obvious that one of said pawls might be omitted without departing from the invention—as, for example, if it were desired to cause the pole-changer to operate automatically in one direction only. When two pawls are employed, as shown, the only object in duplicating the engaging portion of the actuator is to afford means for causing the member which engages a pawl at each rotation to slide past with the least possible friction, the two projections being offset and each provided with an inclined surface at one side and an abrupt shoulder at the other. As shown in the drawings, for example, the member $d$ cooperates with the pawl $c^4$ only, being out of alinement with the pawl $c^{40}$, and if the actuator is traveling in the direction opposite to that indicated by the arrow the inclined surface of the member $d$ will engage the pawl $c^4$, so as to lift said pawl with the least possible friction. With the pawls in alinement it is obvious that one engaging projection would do the work, but neither surface could be inclined or beveled and more friction would be encountered in lifting the pawl.

It is desirable that the pawl which has been positively engaged should be moved after such engagement completely out of the path of the actuator, so as to be wholly out of contact therewith during the further rotation of the actuator in the same direction. To this end each pawl is provided with a spring $c^6$, the tendency of which is to move the said pawl somewhat out of its normal path, (indicated by the dotted line,) the end of the pawl being so shaped with relation to the engaging shoulder of the actuator that the said shoulder when in positive engagement with the pawl will wedge the same down close against its spring $c^6$, which spring when its pawl is released by the actuator will raise said pawl out of the path of travel of the actuator. Thus after the pole-changer is once shifted the only engagement between it and the actuator is between the under inclined surface of one of the pawls and the actuating arm or arms, so that the pawl easily yields without any material wear. The said pawls are held in their normal position by means of a spring $c^7$, having a tension somewhat slighter than that of the springs $c^6$, so as to keep the pawls in their normal position without interfering with the function of the springs $c^6$.

It is obviously not essential that the actu-

ating members and the pawls should travel in different paths, since other means may be devised for disengaging the parts after the switch member has been moved a sufficient distance. As shown in Fig. 2, for example, the switch member $c$ and the actuator $d^{10}$ are mounted on a common axis and the pawls $c^4$ and $c^{40}$ are arranged to coöperate with disengaging members $c^8$, having inclined surfaces arranged to engage pins or projections $c^9$ upon the pawls, the said inclined surfaces being stationary with relation to the actuating device. Assuming, therefore, that the direction of the armature has just been changed and that the actuator $d^{10}$, Fig. 2, is traveling in the direction of the arrow, it will be seen that the said actuator will engage the pawl $c^4$ and shift the member $c$ until the projection $c^9$ rides along the inclined surface $c^8$, thus lifting the said pawl out of engagement with the shoulder. To carry the said pawl entirely out of engagement with said shoulder, as above described, the inclined surface $c^8$ is formed upon a spring the tension of which is such that the spring will yield slightly before forcing the pawl out of engagement with the shoulder, the said pawl moving after it is actually disengaged to the position of the pawl $c^{40}$. The downward movement of the pawls in this instance is limited by stops $c^{10}$ when the said pawls are not controlled by the inclined surfaces $c^8$.

It will be seen from the foregoing description that if the direction of movement of the armature is changed the poles will be correspondingly changed at the end of a very small interval of time.

The device is simple and positive in its operation and is therefore especially adapted for car-lighting systems, where the direction of rotation of the armature may be frequently changed or may remain unchanged for a considerable period of time.

It is not intended to limit the invention to the specific construction shown and described, since modifications may be made without departing from the invention.

I claim—

1. A pole-changer comprising a traveling switch member to coöperate with suitable contacts; a traveling actuator coöperating with the armature of the dynamo to be controlled and arranged to change its direction of travel when the direction of travel of the said armature is changed; an engaging member traveling with said actuator and arranged to engage and move the said switch member; and means for disengaging said actuator from said switch member after the latter has been moved a predetermined distance, as set forth.

2. The combination with a pole-changing switch; of a rotating actuator coöperating therewith; a pawl carried by said switch and lying in the path of said actuator and adapted to be positively engaged thereby during its movement in one direction but to yield before the same during its movement in the other direction; and means for disengaging the said pawl from said actuator after it has been moved thereby a predetermined distance, as set forth.

3. The combination with a pivotally-supported pole-changing switch; of a pair of pawls carried by said switch, the said pawls pointing in opposite directions; a rotating actuator adapted to positively engage one of said pawls when the actuator is traveling in one direction and the other pawl when the actuator is traveling in the opposite direction; and means for disengaging the pawl from the actuator when the switch member has been moved a predetermined distance, as set forth.

4. The combination with a pivotally-supported pole-changing switch; of a pair of pawls carried by said switch; the said pawls pointing in opposite directions; a rotating actuator provided with engaging surfaces to cooperate respectively with said pawls, one of said surfaces being adapted to positively engage one of said pawls when the actuator is traveling in one direction and the other surface being adapted to positively engage the other pawl when the actuator is traveling in the opposite direction; and means for disengaging the pawl from the actuator when the switch member has been moved a predetermined distance, as set forth.

5. The herein-described means for changing the brush connections of a dynamo-electric machine from one line-terminal to the other in response to a change in the direction of travel of the armature, which comprise an actuator adapted to travel continuously in one direction or the other according to the direction of travel of the armature, and a switch member having connected therewith a latching projection or pawl whereby said member will be moved by said actuator in one direction but not in the other.

6. The herein-described means for changing the brush connections of a dynamo-electric machine from one line-terminal to the other in response to a change in the direction of travel of the armature, which comprise a continuously-traveling actuator adapted to change its direction in response to a change in the direction of rotation of the armature, and a switch member having a latching projection to coöperate with said actuator to move the switch member when the direction of movement of said actuator has been changed.

7. The combination with the actuator, of the switch member, the engaging portion of the switch member whereby said member is moved by the actuator, said engaging portions being adapted to move out of engagement with each other at the end of a predetermined movement of the switch member, and means for producing a further movement of one of said parts whereby an open space

is left between them during the subsequent movement of the actuator.

8. The combination with the actuator $d$; of the switch member $c$; the pawl $c^4$ connected with said switch member; and the spring $c^6$ or its equivalent, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WINTHROP M. CHAPMAN.

Witnesses:

HENRY J. LIVERMORE,

JAS. J. MALONEY.