(No Model.)

E. THOMSON.

ELECTRIC COMMUTATOR OR SWITCH.

No. 283,167. Patented Aug. 14, 1883.

Fig. 1.

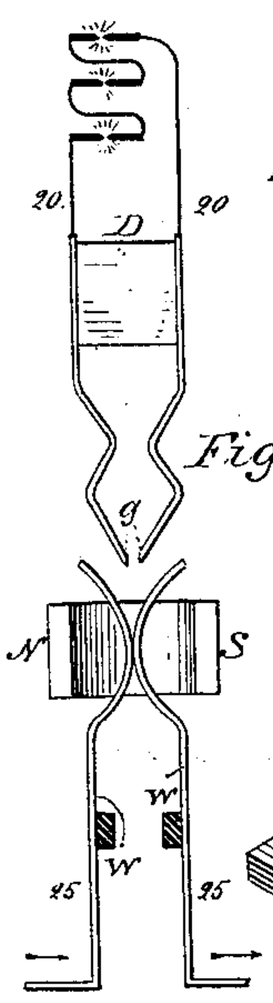


Fig. 6.

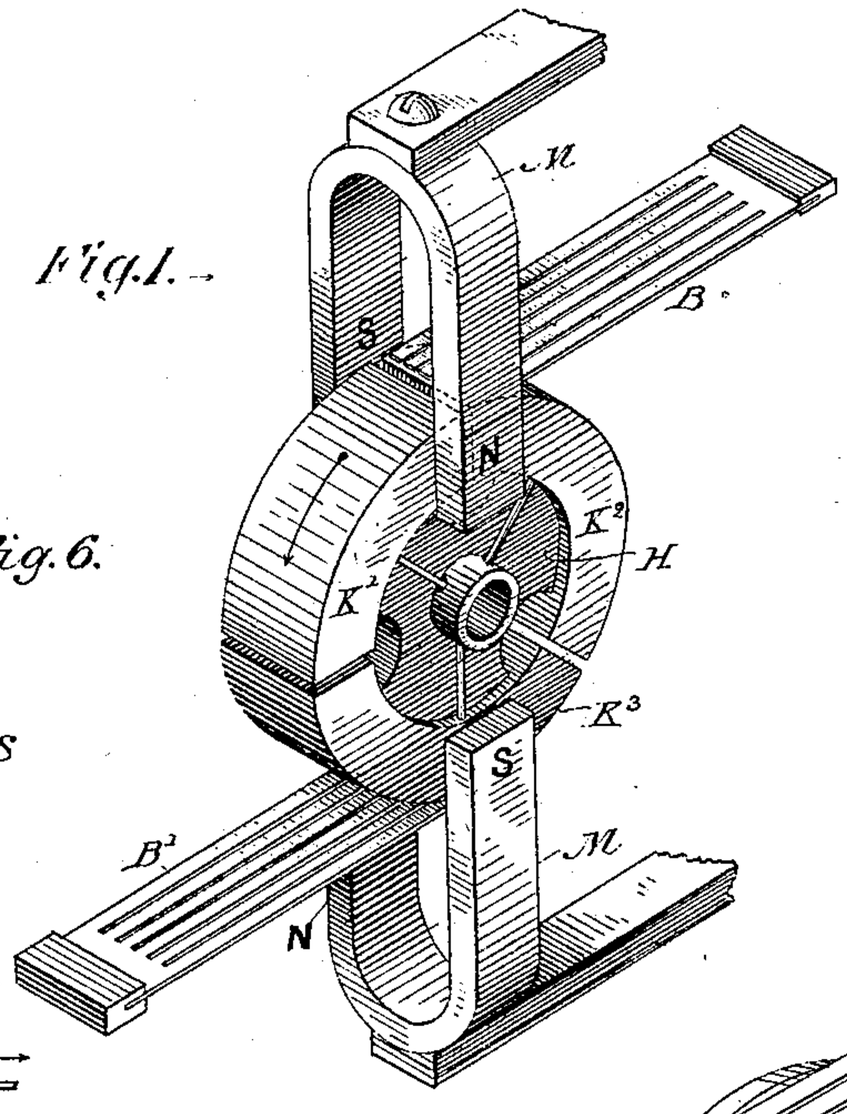


Fig. 2.

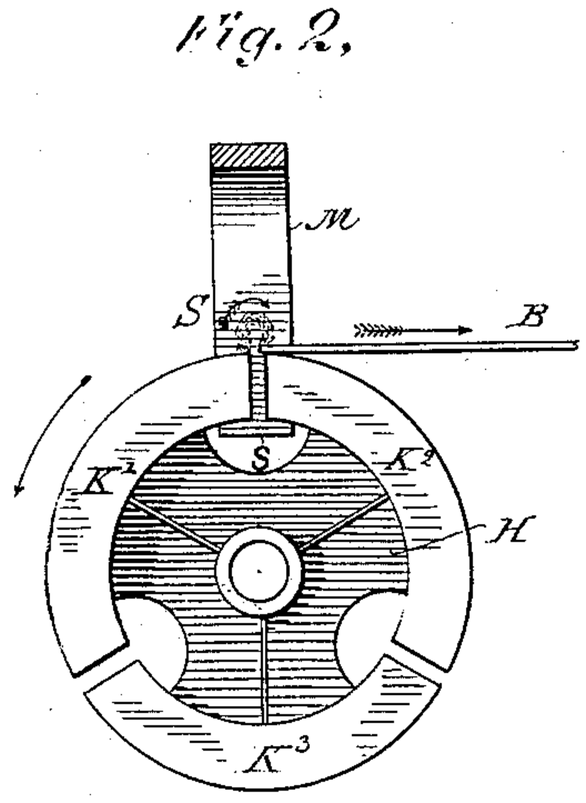


Fig. 3.

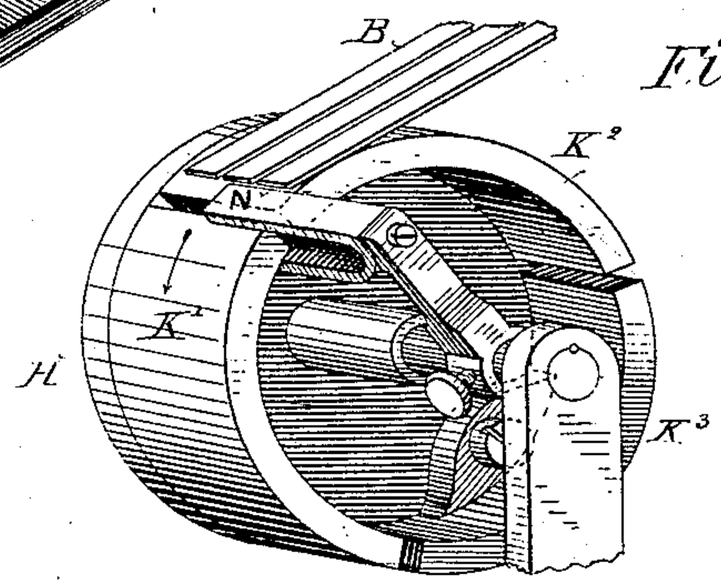
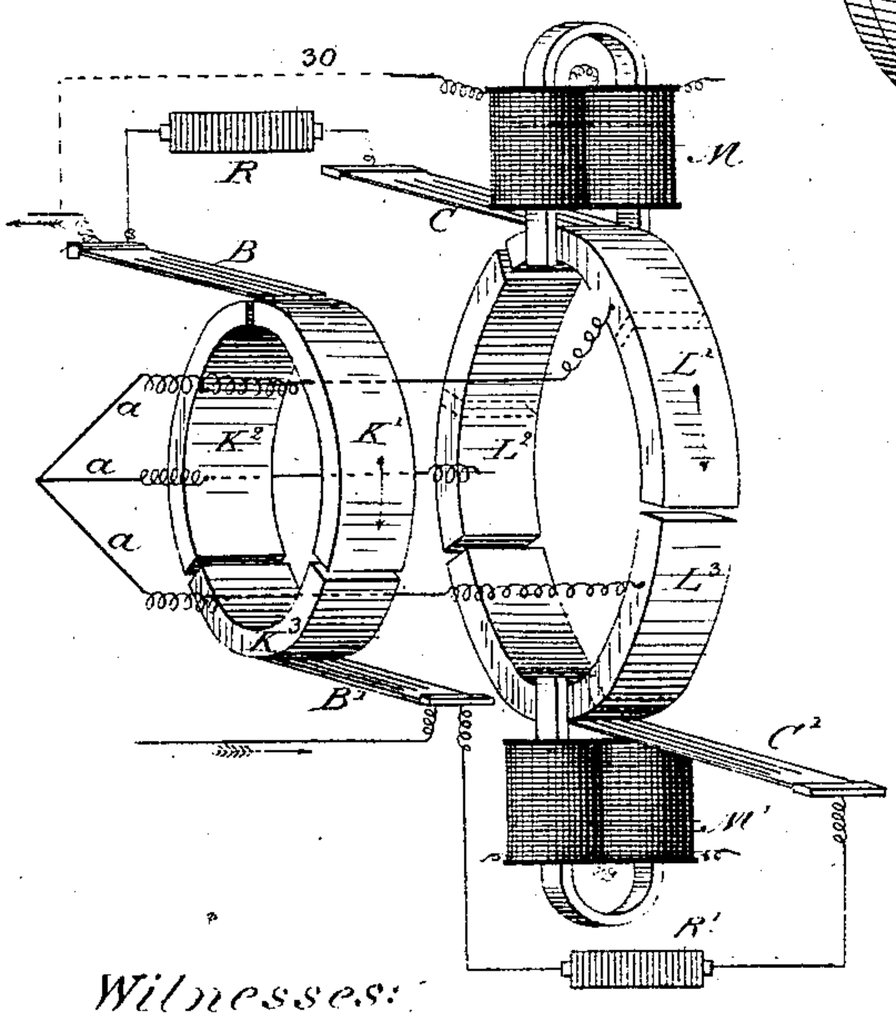


Fig. 4.



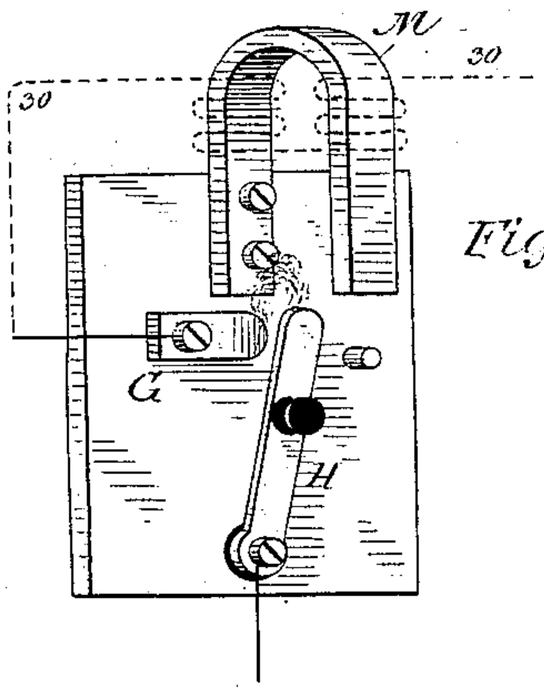


Fig. 5.

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By his Attorney: W. C. Townsend

UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF NEW BRITAIN, CONNECTICUT, ASSIGNOR TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF BOSTON, MASS.

ELECTRIC COMMUTATOR OR SWITCH.

SPECIFICATION forming part of Letters Patent No. 283,167, dated August 14, 1883.

Application filed April 26, 1883. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, and a resident of New Britain, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Electric Commutators or Switches, of which the following is a specification.

My invention relates to switch or commutator devices for breaking, changing, or shifting electric circuits, and more particularly to switches or commutators designed for use in connection with electric-lighting systems, although it is not confined to devices used in such connection, but is intended to include electric switches or commutators generally when used in combination with circuits designed to carry currents of considerable electro-motive force or of sufficient electro-motive force to cause a tendency to the formation of electric arcs across the switch-contacts on breaking circuit, or when used in connection with any other apparatus such that there is a tendency to the formation of arcs or sparks at the switch or commutator surfaces.

The object of my invention is to increase the durability of electric switches or commutators and to prevent damage thereto from the causes mentioned. More specifically, my invention is designed to prevent damage to the commutator brushes and segments by the formation of arcs or sparks at the commutators of dynamo-electric machines, and likewise to lessen the tendency to short-circuiting of the armature-coils by the residuary spark of rupture.

To these ends my invention consists in combining with the contact surfaces or points for an electric switch or commutator suitable means for producing a magnetic field in proximity to the contact-surfaces—such, for instance, as a magnet whose poles are placed near to the said contact surfaces or points, so as to break, displace, or disperse any electric spark or arc that may form or tend to form at such contacts, said magnet acting for this purpose by virtue of the tendency of an arc or heated conductor to move out of or into a magnetic field, according to its direction.

My invention consists, also, in the combination, with the commutator for a dynamo-electric machine, of a magnet or magnets, or their equivalent, a conductor conveying an electric current, placed in suitable proximity to said commutator at points immediately following those at which a commutator-segment leaves a commutator-brush, so as to prevent, by the diffusing or displacing action of the magnetic field thus brought to bear, any electric arc or flash or spark at the instant of rupture of circuit between the brush and segment.

My invention also consists of certain specific combinations that will be recited in detail at the end of this description.

The magnet may be either a permanent or electro magnet. In the latter case it may be charged from any source. If used in connection with a dynamo-machine, it might be charged by the current or a portion of the current generated by the machine. Any desired form or construction of electro-magnet may be employed, and said magnet may be applied in any desired way, provided it be suitably arranged to bring the attractive or repulsive action of a magnetic field to bear upon any spark, arc, or electric current that may pass or tend to pass at the time of breaking or commutation, so as to diffuse or displace the same. I have herein shown a magnet for producing or bringing a magnetic field to bear; but other means for producing or bringing to bear the desired magnetic influence may be employed—such, for instance, as a conductor forming the path of an electric current.

In the accompanying drawings, Figure 1 illustrates one construction of my improved commutator for dynamo-electric machines. Fig. 2 illustrates the action of the magnet on a spark forming when the brush of the commutator leaves a commutator-segment. Fig. 3 shows another way of applying the magnet to a commutator. Fig. 4 shows the combination, with the main or principal commutator, of an accessory commutator, to which latter the magnets are applied. Fig. 5 shows the combination of the magnet with an ordinary circuit-breaking switch. Fig. 6 shows the magnet combined with a plug-switch for an electric-lighting system.

In Fig. 1, K' K^2 K^3 indicate the segments of a three-segment commutator—such, for instance, as that used with the three-coil dy-

namo-electric machine described in United States Letters Patent No. 223,557—while B B′ indicate the positive and negative commutator-brushes. The segments are mounted or supported in any desired manner.

M M are permanent or electro magnets, between whose poles the commutator-segments pass, and which are supported in any suitable manner just beyond the ends of the commutator-brushes, so as to bring the magnetic field to bear upon the rear ends of the segments at or near the point where they leave the brushes.

Fig. 2 illustrates the action of a magnet, placed as shown, in displacing or dispersing the electric arc or flash, if any occur, which takes place when the segment leaves the brush. As here indicated, the spark is thrown inward between the legs of the magnet. If the magnet were reversed or the direction of the current were the opposite, the spark or arc would be thrown away from the magnet toward the axis of the commutator.

In Fig. 3 magnet-poles include the inner and outer surfaces of the commutator at one edge, and are applied at or near the point where the rearmost end of the slot leaves the brush and breaks contact. The action is the same as in the case just described, the magnetic field existing at this point serving to divert or disperse any heated conducting-stream.

In Fig. 4 is shown an accessory commutator, whose segments L′ L^2 L^3 are connected, respectively, with the segments K′ K^2 K^3 of the main or principal commutator, while its brushes C C′ are connected, respectively, with the brushes B B′ of the main commutator, and are applied to the accessory commutator in the same manner as the brushes B B′ to the main commutator K′ K^2 K^3. Both commutators are connected to or mounted on the same shaft in any suitable manner, so as to revolve together; but the two commutators have a slight angular displacement with relation to one another, so that the slots of the main commutator pass the brushes B B′ just before the slots of the accessory commutator pass the brushes C C′. The magnets are applied to the accessory commutator as in the first instance, so as to be opposite the slots at the moment that a segment leaves a brush.

The object of using the accessory commutator and of making its divisions follow those of the main commutator is to locate the spark of rupture definitely. The accessory commutator is made narrow, and preferably of large diameter, so as to allow its divisions to be made more accurately.

I sometimes divide the accessory commutator into twice the number of segments of the main commutator, the main commutator-segments being in such case connected to the alternate segments of the accessory commutator, as indicated, so that every other segment of the latter is an idle segment, and said segments alternate with the active segments. The connections are such that the segments of the main commutator, and therefore the armature terminals, break connections with the brushes B B′ at the moment before they break connection with brushes C C′. When the accessory commutator is thus divided, the corresponding brushes of the main and accessory commutator, as B C and B′ C′, are connected through coarse wire coils R R′ wound around a bundle of iron wires or other core possessing powerful inductive action on its surrounding coil. The effect of this arrangement is to greatly increase the efficiency of the whole device. The coils R R′ act to prevent sudden reversals of current in the conductor joining the corresponding brushes B C or B′ C′ by the magnetic inertia of their cores. Such sudden reversal occurs when a flash passes across the slot between two segments of a commutator that are at the instant connected to opposite brushes. When the brush C leaves an active segment, it produces a slight spark of rupture, due to the fact that the armature-coil, the terminal of which is attached to said segment, has very nearly become neutral. This spark is diverted by the magnet M and prevented from bridging the slot by an inverse spark forming in its place when the coil has just passed the neutral point; but where the brush C passes to an idle segment in crossing said slot such inverse discharge, to occur at all, must pass from the armature terminal over the slot to the brush C, then through the coil R to the brush B, to the succeeding armature terminals, or to the general circuit taken from B; but the coil R requires time to take up such inverse current and develops a very powerful counter extra current, or, rather, a counter electro-motive force opposing any such action. The combination shown in Fig. 4 is therefore a valuable addition to the effectiveness. The coils R R′, as disposed above with the double-segment commutator, alone form an excellent means of partially controlling any "short-circuiting" tendency or tendency to "flash." No claim is herein made to such disposition of coils and commutator-brushes, and the method of avoiding spark contained in such arrangement will be made the subject of a separate application for patent.

In Fig. 5, G indicates the fixed contact plate or surface of a switch, and H the movable portion. The magnet M is set over the contact, so as to divert and disturb any arc or discharge across the switch-surfaces or breaking-circuit. A plug-switch may have a magnet applied to its plug to prevent arcs over its two surfaces when used to insert lights into a closed circuit.

In Fig. 6, W W indicate normally-closed spring-contacts of any ordinary construction, which may be forced apart by a switch-plug, D, for the purpose of introducing the light-circuit 20 into the generator-circuit 25. When the plug is inserted, an arc may form across the two surfaces of D at *g*. This arc will be broken by a magnet, whose poles N S are placed as shown.

As before stated, the magnet may be charged from the circuit controlled by the switch or

commutator. This arrangement is indicated in Figs. 4 and 5 by the dotted line 30, connecting the coils on M with the circuit of the switch or commutator.

It is plain that my invention is not limited to any particular form or construction of commutator or switch, and that it can be applied in obvious manner to commutators for dynamo machines or motors having a greater or a less number of segments than three.

What I claim as my invention is—

1. The combination, with an electric switch or commutator, of a magnet placed in proximity to the switch-contacts or to surfaces between which a spark or flash is liable to occur, substantially as and for the purpose set forth.

2. The combination, with the commutator for a dynamo-electric machine, of a magnet placed in proximity to the commutator-cylinder at a point immediately succeeding the commutator-brush, as and for the purpose set forth.

3. The combination, with a dynamo-electric machine commutator, of an accessory commutator set so that the spaces between its segments will pass its brushes immediately after the corresponding spaces of the main commutator pass its brushes, and magnets placed in proximity to the accessory commutator, as and for the purpose described.

4. The combination, with the contact points or surfaces in an electric switch or commutator, of suitable means for producing a magnetic field in proximity thereto, which field shall act by its attractive or repulsive influence to diffuse or displace any electric arc or current that may pass or tend to pass at the instant of break or commutation.

Signed at New Britain, in the county of Hartford and State of Connecticut, this 23d day of April, A. D. 1883.

ELIHU THOMSON.

Witnesses:
E. WILBUR RICE,
G. E. EMMONS.