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COMMUTATOR.

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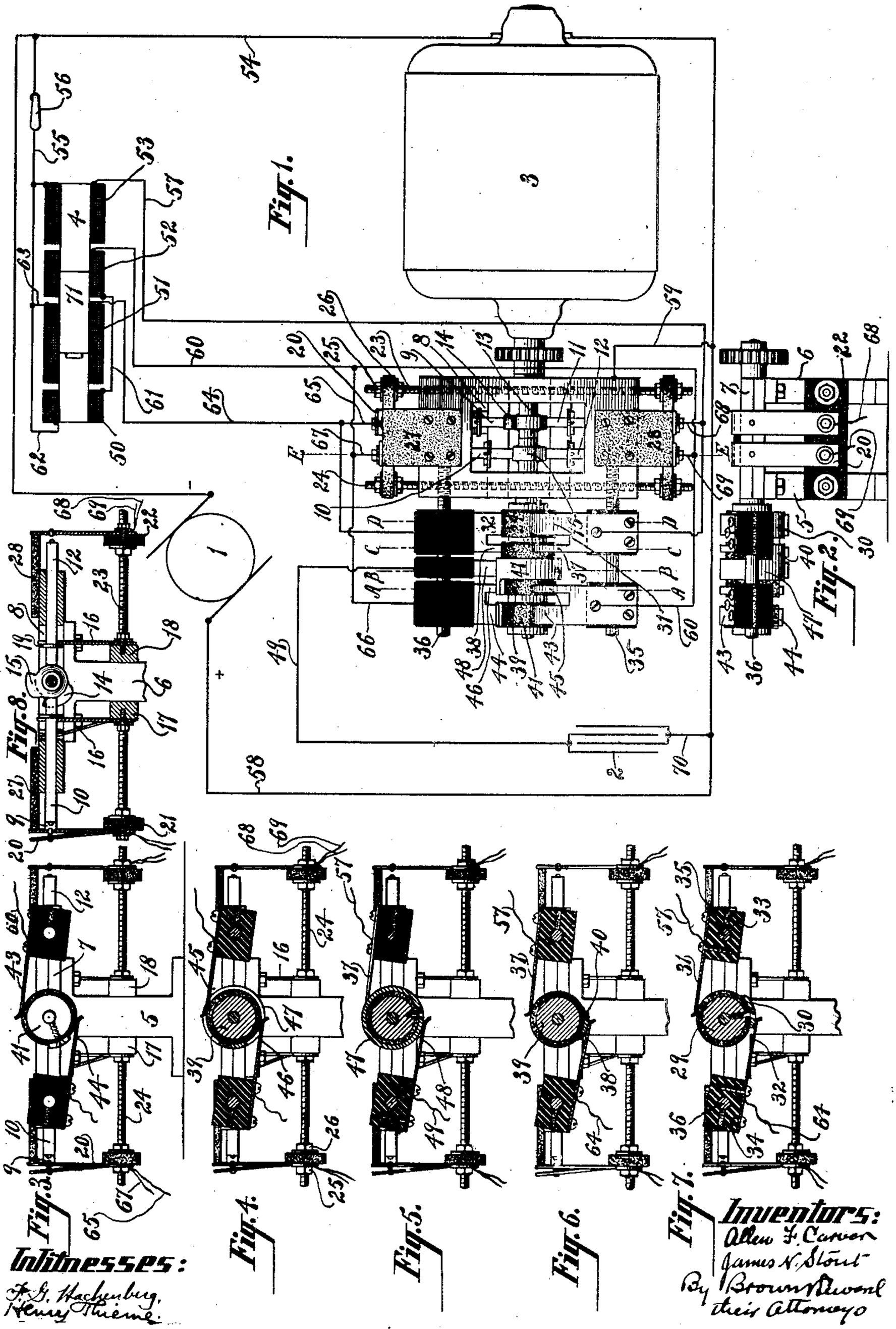

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UNITED STATES PATENT OFFICE.

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COMMUTATOR.

No. 842,624. Specification of Letters Patent. Patented Jan. 29, 1907.

Application filed November 25, 1905. Serial No. 289,061.

To all whom it may concern:

Be it known that we, ALLEN F. CARVER and JAMES N. STOUT, citizens of the United States, and residents of the borough of Manhattan, in the city and State of New York, have invented a new and useful Commutator, of which the following is a specification.

Our invention relates to commutators, and more particularly to a commutator in which the make and break of the controlling-circuit is effected by the separation of the contact-points in a line directly toward and away from each other, the object being to secure a prompt make and break and prevent burning out of the contact-points by sparking.

A practical embodiment of our invention is represented in the accompanying drawings, in which—

Figure 1 is a plan view of the commutator, showing it connected up to a translating device, the latter, as well as the generator, motor, and condenser, being shown conventionally. Fig. 2 is a view in side elevation. Fig. 3 is an end view. Fig. 4 is a vertical section in the plane of the line A A, Fig. 1. Fig. 5 is a vertical section in the plane of the line B B, Fig. 1. Fig. 6 is a vertical section in the plane of the line C C, Fig. 1. Fig. 7 is a vertical section in the plane of the line D D, Fig. 1; and Fig. 8 is a vertical section in the plane of the line E E, Fig. 1.

The generator is shown conventionally at 1, a condenser at 2, a motor at 3, and a translating device, in the present instance a series of coils suitable for the operation of an electric tool-driver, at 4.

The commutator is supported upon a suitable frame, in the present instance a pair of legs 5 and 6, surmounted by a table 7, which may be made in superposed half-sections for convenience in drilling half-sockets in the adjacent faces of the sections for the mounting of the contact making and breaking plungers to be hereinafter explained. The table 7 is provided with a central opening 8, and in the opposite ends of the table there are mounted contact making and breaking plungers, in the present instance two plungers in each end, the plungers in one end being denoted by 9 and 10 and those in the opposite end by 11 and 12. These plungers are mounted in pairs upon the opposite sides of a cam-shaft 13, mounted in suitable bearings carried by the table 7, the said shaft being actuated by the motor 3. The cams carried by the shaft 13 for actuating the plungers are in the nature of mutilated snail-cams, the eccentric portion of the cam beginning upon quite an abrupt slant from the concentric portion of the cam and terminating by an abrupt offset, as is common with snail-cams. The cam for operating the plungers 9 and 11 is denoted by 14, and the cam for operating the plungers 10 and 12 is denoted by 15. These cams are each carried by the shaft 13, and their abrupt faces are located a quadrant's distance apart, so that each will operate a contact-plunger twice during its revolution—*i. e.*, the cam 14 will operate the plunger 9 and at the next half-revolution will operate the plunger 11, while the cam 15 will operate the plunger 10 a quarter-revolution after the operation of the plunger 9 by the cam 14, and after the cam 15 has completed a half-revolution it will operate the plunger 12, which will be operated a quarter-revolution after the plunger 11 has been operated by the cam 14.

The plungers 9 10 11 12 are each held yieldingly in contact with its operating-cam and disk by means of bar-springs 16, (see Fig. 8,) the said springs being fixed at their lower ends to bars 17 18, secured to the legs 5 and 6, while their upper ends partially embrace the plungers and engage abutments 19 on the plungers. The springs for the several plungers are quite similar in their construction and arrangement, and we have indicated by symbol one only, 16, (shown in Fig. 8,) as sprung back by the action of the cam 14 to force the plunger 9 into engagement with its contact-piece. The several plungers are provided with platinum tips for immediate contact with their contact-piece, and the contact-pieces which coact with the plungers are in the nature of flat spring-arms 20, arranged in pairs with their free ends opposite the outer ends of the several plungers, two such spring-arms being located on each side of the commutator and secured at their lower ends to bars 21 22 of suitable insulating material—as, for example, vegetable fiber. The said bars 21 and 22 are conveniently held in position by means of screws 23 24, which extend through the legs 5 and bars 17 18, as is clearly indicated in Fig. 1, and have on their outer ends adjusting-nuts 25 26, two for each end of each of the bars 21 22, for the purpose of adjusting the

bars 21 22, and hence the spring arm-contacts 20 carried thereby, to the exact position required with respect to the ends of the contact-plungers 9 10, &c.

To make the breaking of the contact more abrupt and instantaneous than it would be by the gradual withdrawal of the end of the plunger from the spring-arm while the latter was permitted to follow it back to its normal position, we provide stops 27 28, which may be thin sheets of vegetable fiber made fast to the top of the table 7 at its opposite ends and projecting over the ends of the table to points slightly in advance of the positions which the spring-arms 20 would normally assume and in the path of the free ends of the arms, so that the free end of the arm 20 as it recedes when the plunger is allowed to drop off the abrupt face of the cam will under its own spring tension follow the plunger up to the point where the end of the arm 20 strikes the stop, at which moment it will be instantaneously arrested and will be under such velocity that the plunger will have its contact-points separated from the spring-arm at that instant very quickly and sharply, doing away with any dwell whatsoever, and thus obviating, as far as may be, tendency to sparking. Provision is also made for reducing the spark by connecting the contact-pieces 20 with a condenser shown conventionally at 2, and which is brought into electrical communication at a suitable interval before the break between the plunger and the contact-piece 20 actually takes place.

The operation of the condenser is coupled with means for commutating the current controlled by the plungers—*i. e.*, in order to relieve the contact at the end of the plunger from carrying the entire body of the current for operating the translating device, whatever it may be, save only for a short interval, just before the current is to be broken, we provide commutator drums or disks capable of receiving broad brushes, and these are so timed with respect to the cams for operating the plungers that they will close contact through the coils of the translating device, and so provide for the free flow of current up to a point just before the circuit is to be broken, when the commutator drums or disks will be thrown out of use, throwing the whole current through the plunger and the yielding contact-piece 20 to be broken by the drop of the plunger. To accomplish the above, the shaft 13, which carries the cams 14 and 15 for operating the plungers, is extended, a commutator disk or drum 29, provided with conducting material 30, occupying a small portion of its periphery, (see Fig. 7,) the remaining portion of its periphery being of insulated material. The disk or drum 29 has bearing thereon brushes 31 32, fixed to suitable blocks of insulating material 33 34, respectively, the latter held in position by bars 35 36, set in the edge of the table 7. These brushes 31 32 are bifurcated, the branches 37 38 (see Fig. 3) engaging the periphery of a drum or disk 39, mounted to rotate with the disk 29 and serving by the contact therewith of a plate 40 of conducting material on the disk to throw the condenser into circuit and hold it in electrical communication after the brushes 31 and 32 have left the conducting section of the drum or disk and have become insulated.

The drum or disk commutator composed of the sections 29 and 39, with their brushes, is intended to coact with the plungers 9 and 11 and the circuit controlled thereby, while a similar commutator composed of the drum or disk section 41 and the drum or disk section 39, the former engaged by brushes 43 and 44 (see Fig. 3) and the latter by branches 45 46, (see Fig. 4,) coacts with the plungers 10 and 12.

The disk 39, in addition to its conducting-plates for coacting with the branches 45 and 46, has also a ring 47 of conducting material which is preferably integral with the plates, the said ring being engaged by a brush 48 in constant electrical connection with the condenser 2 through a wire 49.

To illustrate the operation of the commutator, we have chosen a series of coils which have been found desirable to use in connection with an electric tool-driver, and this we have noted hereinabove as the translating device 4. We have indicated in the space surrounded by these coils a driver in the position which it would assume when the parts of the commutator are in the position shown in the several figures. For purposes of explanation the coils of the translating device are denoted by 50, 51, 52, and 53. The wire leading from the generator 1 to the motor is denoted by 54. The branch wire leading from the wire 54 to one pole of the coil 53 is denoted by 55, and in this branch wire there is indicated a switch 56 for the purpose of throwing the translating device into and out of operation. The opposite pole of the coil 53 is connected by a wire 57 with the brush 31, which when the conducting-plate 30 is in contact with the brush transmits current to the shaft 13, and hence to the frame of the machine. A wire 58 leads from the opposite pole of the generator 1 to the opposite pole of the motor 3, and a branch wire 59 leads to the frame of the machine to complete the circuit through the brush 31 and coil 53. A wire 60 connects one pole of the coil 52 with the brush 43, the opposite pole of the said coil being connected with the coil 50 by a wire 61, and from the coil 50 a wire 62 leads to the wire 55, thence to one pole of the generator 1, while the opposite pole of the generator, as before, is connected with the frame of the commutator to complete the circuit through the brush. A wire 63 connects one pole of the coil 51 with the wire 55, the opposite

pole of the coil 51 being connected by a branch wire 64 with the brush 32 and with the spring-contact 20 by a branch 65. The wire 60 is connected with the brush 44 by a branch wire 66, the latter being connected by a branch wire 67 with the contact-piece which coacts with the plunger 10. In like manner the brushes 31 and 43 are connected with the spring-arms which coact with the plungers 11 and 12 by means of branch wires 68 and 69, respectively. One pole of the condenser 2 is connected by a wire 70 with the wire 58, leading to the generator, and also by means of the branch wire 59 is at all times in electrical contact with the frame of the machine. The opposite pole of the condenser 2 is connected by a wire 49 with the brush 48 in contact with the conducting-ring 47. It is to be here noted that connection with the several yielding arms 9 10 11 12 is made through the same wires by both the branches of the bifurcated brushes when the respective branches are in contact with the conducting-plates on the drums or disks.

Assuming the motor 3 to be in operation, the switch closed, and the driver (denoted by 71) in the position indicated within the coils, the cam 14 has at this moment pressed the plunger 9 into engagement with the contact-piece 20, thus completing the circuit through the coil 51 and forcing the driver to the left to deliver its blow. As the shaft 13 continues to rotate, the plunger 9 will suddenly drop off the abrupt face of the cam 14, making the quick break between its outer end and the contact-piece 20, and the spark will be reduced by the contact of the brush 38 with the conducting material 40 on the drum or disk 39, which has electrical connection with the condenser until after the break has been made. Shortly after the drop of the plunger 9 the plunger 10 will be operated by the cam 15, and connection will be made through the coil 52 and branch wire 61 with the demagnetizing-coil 50, simultaneously releasing the driver, and by means of the coil 52 starting its return movement. This will quickly be followed by the action of the cam 14 on the plunger 11, which will in turn energize the coil 53 and complete the return movement of the driver, and momentarily after the circuit is broken through the coil 53 by the drop of the plunger 11 over the face of the cam 14 the cam 15 will engage the plunger 12 and energize again the coil 52 for starting the driver on its advance movement, and this will be followed by the action of the cam 14 on the plunger 9, completing circuit through the driving-coil 51 for moving the driver toward its work. The action of the brushes 31 and 32 will conform closely to the action of the cam 14; but these brushes will slide off the conducting material on the disk 29 just before the break occurs by the falling of the plunger off the abrupt face of the cam 14, thus throwing the entire current at and just before the break is made through the yielding contact-piece and the plunger. In the same manner the brushes 43 and 44 coact with the cam 15 and the plungers 10 and 12 operated thereby to help carry the current up to the moment just before the break is to be made.

It is noted that the condenser 2, having one pole at all times in electrical connection with a ring on the shaft 13, is brought into action by a branch of the current-carrying brush and retained in electrical connection with the yielding contact-arm until after the break has been made, thereby reducing the spark on each of the circuit makers and breakers as the circuit is broken.

What we claim is—

1. In a commutator, the combination with a yielding contact-piece and a circuit maker and breaker arranged to move toward and away from the contact-piece, of means for actuating the circuit maker and breaker and a stop for arresting the yielding contact-piece on its return movement.

2. In a commutator, a supporting plate or table, plungers mounted in the plate or table to reciprocate longitudinally, a rotary cam mounted between the adjacent ends of the plungers for operating the plungers in one direction, springs for operating the plungers in the opposite direction and yielding contact-pieces in position to engage the opposite ends of the plungers when the plungers are forced outwardly by the cam.

3. In a commutator, a supporting plate or table having a hollow center, plungers mounted in the plate with their adjacent ends projecting into the hollow space at the center of the plate or table, a rotary cam mounted in the said hollow space between the adjacent ends of the plungers for operating the plungers in one direction, springs for operating the plungers in the opposite direction, yielding contact-pieces in position to engage the opposite ends of the plungers and stops for arresting the yielding contact-pieces on their return movements.

4. The combination with a translating device including an electromagnetic coil, of a commutator comprising a contact-piece in circuit with the coil, a reciprocating circuit maker and breaker for engaging the contact-piece, means for operating the circuit maker and breaker, a condenser electrically connected with the contact-piece and means for establishing communication with the condenser to reduce the spark at the moment of breaking circuit through the electromagnetic coil.

5. The combination with a translating device including several electromagnetic coils, of a commutator comprising several contact-pieces in circuit with the coils, reciprocating circuit makers and breakers for engaging the

contact-pieces and means for operating the circuit makers and breakers, a condenser electrically connected with the several contact-pieces and means for establishing communication with the condenser to reduce the spark at the moment of breaking circuit through the several coils.

6. The combination with a translating device including several coils, of a commutator comprising contact-pieces in circuit with the coils, means for making and breaking circuit through the contact-pieces, and auxiliary circuit makers and breakers in circuit with the contact-pieces and coils, for assisting in carrying the current through the coils.

7. The combination with a translating device including several coils, of a commutator comprising contact-pieces in circuit with the coils, reciprocating circuit making and breaking devices arranged to coact with the contact-pieces, means for operating the said circuit makers and breakers and rotary commutators in circuit with the coils and contact-pieces for assisting in carrying the current through the coils, the relation between the rotary commutators and the contact-pieces with their reciprocating circuit-makers and breakers being such that a circuit will be broken by the rotary commutator prior to the breaking of the circuit by the contact-piece and its coacting circuit maker and breaker.

8. The combination with a rotary disk or drum provided with conducting material, on a portion of its periphery, and a companion disk or drum provided with conducting material on a portion of its periphery, of a bifurcated brush, one branch of which is in engagement with one of the disks or drums and another branch with the other disk or drum, a condenser in electrical communication with one of said disks and a translating device in circuit with the other of said disks and means for rotating the disks.

9. The combination with a commutator including a rotary shaft, companion disks mounted on the shaft and provided with conducting material on a part of their periphery, brushes common to the companion disks, a disk or drum provided with conducting material throughout its entire periphery and a brush in engagement with said disk, of a condenser in electrical communication with said last-named brush and with one of the companion disks and a translating device in circuit with the other of said companion disks.

In testimony that we claim the foregoing as our invention we have signed our names, in presence of two witnesses, this 21st day of November, 1905.

ALLEN F. CARVER.
JAMES N. STOUT.

Witnesses:
FREDK. HAYNES,
HENRY THIEME.