

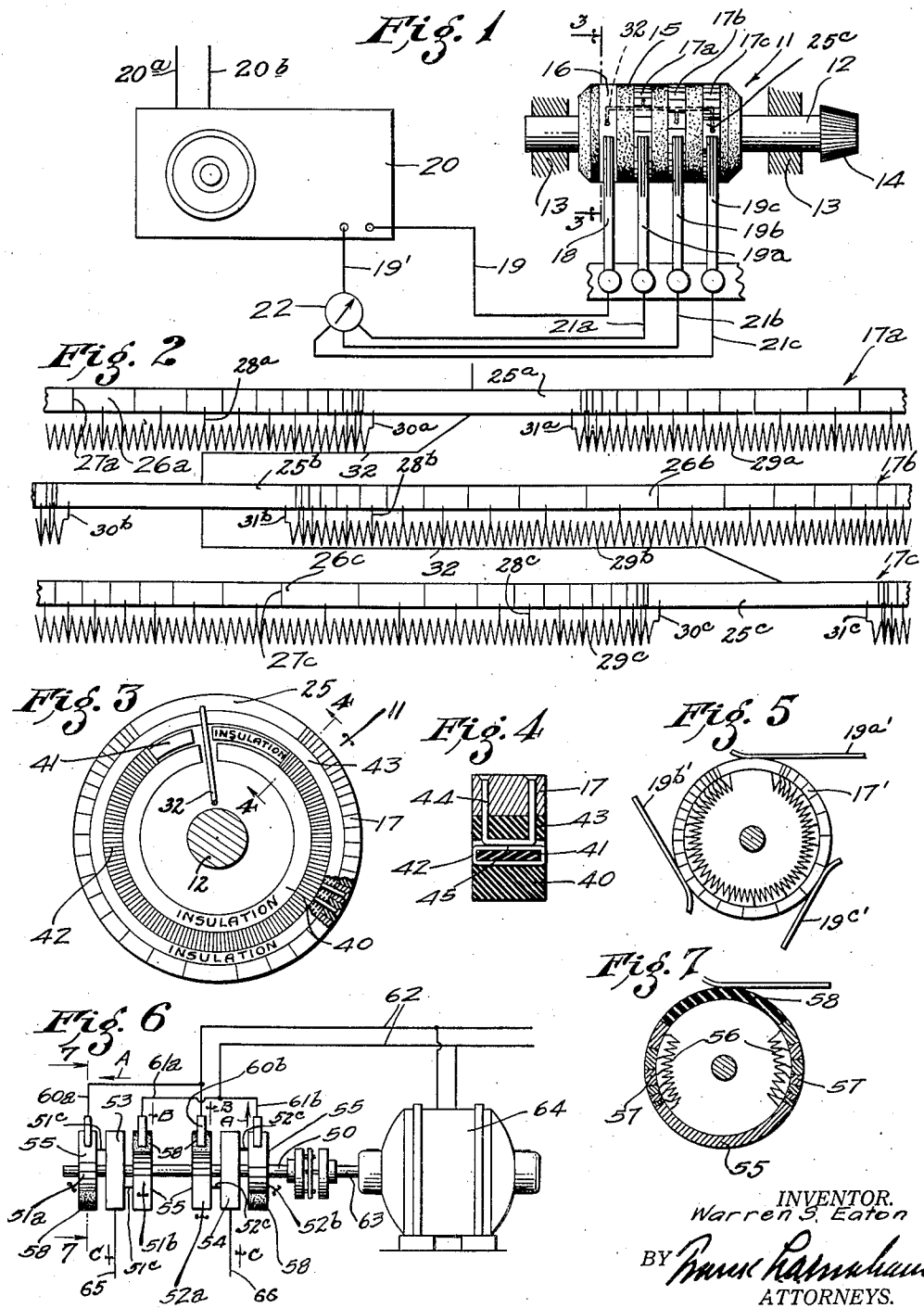
Jan. 19, 1932.

W. S. EATON

1,842,340

COMMUTATOR CONSTRUCTION

Filed Nov. 28, 1928



UNITED STATES PATENT OFFICE

WARREN S. EATON, OF LOS ANGELES, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO EATON RADIO INSTRUMENT CORPORATION, OF LOS ANGELES, CALIFORNIA, A CORPORATION

COMMUTATOR CONSTRUCTION

Application filed November 28, 1928. Serial No. 322,337.

This invention relates to an improved form of segmental commutator which has been produced primarily for use in combination with an inductance commutator such as is disclosed in my co-pending application, Serial No. 322,338 and has as a primary object the segregation of a plurality of electrical excitations which are traveling in a single circuit and in which it is desirable to eliminate the sparking which commonly occurs in an ordinary contact commutator in which there is a definite make and break of the circuit during the rotation of the commutator.

The general construction of the commutator which forms the subject matter of this application embodies a rotatable commutator shaft which carries a plurality of conducting rings. Under ordinary circumstances in which it would be desirable to conduct current first through one of the rings and then through another one of the rings, the rings would be formed in segments the ends of which would be completely separated by insulating material. During the rotation of such a commutator a plurality of brushes being in contact with the rings, an electric circuit would be closed between each of the rings during the period that the conducting section was in contact with a brush and would be immediately broken when the brush was brought into contact with the insulating material.

In the use of an organization of this character in connection with a radio circuit, it will be apparent to those familiar with the art that this construction would be attended by two undesirable features; first that the sparking which would occur at the brushes would be picked up by the input of the radio set and would be amplified through the set, causing a disturbing action on the plate of the output tube which would materially affect the audibility of the incoming signal and in the event the device was being used in combination with a radio direction indicator, this sparkling action would have a very undesirable effect upon the so called radio compass.

Second, the commutator of the type described above in which the circuit is broken

sharply at the end of the contact member has the further undesirable feature of producing an "inductive kickback" against the plates of the tubes in a radio set which materially decreases the sensitivity and the life of the tubes.

It is therefore an object of this invention to produce a commutator organization of the character described in which the circuits between the various conducting elements of the organization are gradually opened and closed, this being effected by means of a progressively increasing and decreasing resistance which is introduced into and removed from circuits which include each of the conducting rings during each revolution of the commutator.

It will be apparent that the use of a commutator of this nature is not necessarily confined to radio energy but that it may be advantageously used for rectifying or converting alternating current to direct current.

It will be understood therefore that it is a further object of this invention to develop a contact resistance commutating organization which may be employed in connection with a source of alternating current for the purpose of converting the alternating current to direct current.

It is a further object of the invention to develop a commutator which may be used for converting a single alternating current to a plurality of pulsating alternating currents and which may also be employed for converting a plurality of direct or alternating currents into a resultant current, the characteristics of which are the average of those of the original currents.

Other objects attending the production of this invention will be better understood from the following description of the accompanying drawings which are more or less diagrammatic in form, having been chosen for illustrative purposes only and in which

Fig. 1 is a diagrammatic elevational view showing one embodiment of my invention as being used in connection with a radio.

Fig. 2 is a diagrammatic view illustrating the development of the commutator conduct-

ing strips and the manner in which the resistance is connected to these strips.

Fig. 3 is a diagrammatic sectional elevation which may be considered as having been taken substantially in a plane represented by the line 3—3 in Fig. 1.

Fig. 4 is a sectional view illustrating a preferred manner in which the conducting rings and resistance members may be arranged relative to each other and may be considered as having been taken substantially in a plane represented by the line 4—4 in Fig. 3.

Fig. 5 is a diagrammatic view illustrating a modified form of commutator in which a plurality of brushes are used in combination with a single commutator element.

Fig. 6 is an elevation view illustrating the manner in which a plurality of commutator elements may be used in combination with a synchronous motor for the production of a direct current from alternating current.

Fig. 7 is a diagrammatic sectional view which may be considered as having been taken substantially in a plane represented by the line 7—7 in Fig. 6 and illustrates the manner in which the commutator elements used in this form of the invention are constructed.

More particularly describing the invention as herein illustrated, reference numeral 11 indicates a commutator element which is mounted upon a rotatable shaft 12 supported by bearings 13 and adapted to receive rotation from any suitable source of power (not shown) which may be applied to a friction cone, or other transmitting means indicated at 14.

The commutator element 11 comprises an insulating body 15, a master conducting ring 16 and segmental conducting rings indicated at 17a, 17b and 17c respectively.

The conducting rings are adapted to contact with a plurality of brushes indicated at 18, 19a, 19b and 19c respectively.

It will be noted that the single brush 18 which is in contact with the master ring 16, is connected directly through a conductor 19 with a source of electric energy such as the radio set indicated by reference numeral 20; the radio set being supplied with input energy through conductors 20a and 20b connected to a source of energy (not shown).

The conducting brushes 19a, 19b and 19c are connected through conductors 21a, 21b and 21c with any suitable instrument such as a radio compass 22 (the details of which form the subject matter of another application) the compass in turn being connected with a conductor 19' leading to the opposite side of the radio set output.

It will now be understood that, if for instance, three separate sources of excitation, such as the receiving antenna of a radio direction indicator, are passing current through the radio set 20 in alternate relation with each other, and if the main segments indi-

cated at 25a, 25b and 25c on the segmental rings 17a, 17b and 17c respectively, are disposed at substantially 120° with each other, that by rotating the shaft 12 in synchronism with the flow of current from the three mentioned sources of excitation, each of the segments 25a, 25b and 25c, will be effective to close a circuit for the transmission of the current from one of the mentioned sources of excitation.

In order that these three currents may be gradually cut out and into the circuit for the purpose of eliminating the sparking effect, and the kickback on the tubes as mentioned above, the segmental conducting rings 17a, 17b and 17c respectively are provided with a plurality of symmetrical segments indicated by reference numerals 26a, 26b and 26c respectively. These segments are separated from each other by non-conducting strips 27a, 27b and 27c and are arranged as is best illustrated in Fig. 2 in a manner such that the radial width of each strip gradually increases away from the two outer edges of the main segments 25a, 25b and 25c respectively.

These so-called auxiliary segments 26a, 26b and 26c are independently connected by means of conductors 28a, 28b and 28c with resistance segments 29a, 29b and 29c, the opposite ends 30a, 30b, 30c and 31a, 31b and 31c, being directly connected with the main segments 25a, 25b and 25c. It will be understood therefore from this construction, that as the brush which is in contact with the commutator ring, leaves the main segment, resistance is gradually introduced into the circuit, reducing the current gradually to a negligible value. As a means of collecting the currents from the separate rings, the rings are connected to the master ring 16 by means of a common conductor 32 which is directly connected with the main segments 25a, 25b, and 25c, of the rings 17a, 17b, and 17c, respectively, said conductor 32 running longitudinally of the commutator 11 and rotating therewith. The point at which the resistance is a maximum is diametrically opposite to the center of the main segment (25a, 25b and 25c) and during the continued rotation of the commutator from this point on, the resistance is gradually decreased so that an increased current is gradually admitted to the main segment, there being no sharp break at any point.

It will be understood that this construction gives a smooth flow of current, obviates sparking in the commutator, and reduces the kick back against the plates of the tubes, to a minimum.

Figs. 3 and 4 more clearly illustrate a preferred manner of constructing a commutator of this nature. In these views, it will be noted that the commutator element 11 comprises a central insulating section 40 which is surrounded by a second insulating section

41 which carries the resistance coil 42, the resistance member in turn being circumscribed by the segmental conducting ring 17.

The conducting segments are connected with the resistance coil by means comprising a stirrup 44 which extends through the conducting segment 17 and the insulating segment 43, the inner surface 45 of the stirrup being in direct contact with the resistance coil 42. It will be understood that although this is a preferred form in which the resistance elements may be built, many other constructions are possible, the important feature being that the construction provides a commutator through which the value of the current never falls completely to zero and in which the flow of current is held constant for a given width of segment.

Fig. 5 illustrates the manner in which a single commutator ring 17' of the type shown in Fig. 3 may be employed in connection with three brushes, 19a', 19b' and 19c' to obtain an effect similar to that which is obtained with the three separate rings shown in Fig. 1.

Figs. 6 and 7 illustrate a construction which is adapted to convert an alternating current to a direct current. This embodiment of the invention comprises a commutator shaft 50 which carries four segmental commutators 51a and 51b, and 52a and 52b. These segmental commutators may be described as being "AC" segments and the conducting portions of these rings are directly connected with conducting slip rings by means of conductors 51c and 52c, such rings being indicated at 53 and 54.

Fig. 7 illustrates the manner in which the conducting rings 51a and 51b and 52a and 52b are constructed and it will be noted from this illustration that these commutator rings embody a master conducting segment 55, the opposite ends of which are connected through resistance 56 with a plurality of auxiliary segments 57. These commutators rings differ from those described in connection with Fig. 1 in that an insulating segment 58 is provided in the ring opposite to the conducting segment 55.

Referring again to Fig. 6, it will be noted that the commutator rings are arranged with the insulating segments 58 disposed oppositely with the master conducting segments 55 and that each pair of the two parallel sets of rings 51a and 51b and 52a and 52b are arranged at substantially 180° with each other, the rings 51a and 52a being parallel and the rings 51b and 52b being parallel. It will thus be apparent that if alternating current is delivered to brushes 60a, 60b and 61a and 61b from conductors generally indicated at 62, that this current will flow to the commutator rings 51a and 52a during one-half of each revolution and will flow to the commutators 51b and 52b during the other half of the revolution.

The shaft 50 is illustrated as being directly connected with the rotor shaft 63 of a synchronous motor 64 and it will be understood that when this shaft is rotated in synchronism with the currents supplied to the motor 64 and to the brushes 60a and 60b and 61a and 61b, that the same current will be flowing through the commutator in one direction during one-half of the revolutions of the shaft and in the opposite direction during the other half (assuming the motor 64 to be a two-pole motor).

It will now be apparent from the foregoing description of the arrangement of the commutator segments, that during the rotation of the shaft 50, a current will be flowing in the direction of the arrow "A" while the brushes 60a and 61b are in contact with the conducting segments 55 on the commutator rings 51a and 52b and that during the other half of the revolution of the shaft 50, current will be flowing in the direction of the arrow B but during this part of the revolution, the brushes 61a and 60b are in contact with the conducting segments on the commutator rings 51b and 52a and the resultant flow of current from the conducting slip rings 53 and 54 will always be in the same direction, such direction being indicated by the arrow C. By providing the resistance members and the segmental conducting members in the commutators shown in this converter, a direct current which is non-pulsating is obtained from the conductors 65 and 66.

It will be understood that while I have herein described this invention in connection with a radio circuit and a rectifying device, that it is not necessarily restricted to the specific applications illustrated, but that it includes within its scope any construction which fairly comes within the spirit of the appended claims.

I claim as my invention:

1. A contact commutator for gradually opening and closing a circuit between a rotating conductor and a fixed conductor embodying a rotatable insulating member; a main conducting segment in said insulating member; and a plurality of resistance segments in said insulating member adapted to introduce a gradually increasing resistance and a gradually decreasing resistance into said circuit during a complete revolution of said commutator, said resistances being connected to form a continuous circuit.

2. A resistance commutator construction embodying: a rotating shaft; a central insulating section concentric with said shaft and fixed thereon; a resistance section surrounding said central insulating section; an insulating ring support surrounding said resistance section; a segmental conducting ring surrounding said insulating ring support; and conducting means connecting each of said segments with said resistance.

3. A resistance commutator construction for gradually opening and closing a circuit between a rotating conductor and a fixed conductor embodying: a rotating shaft; a central insulating section concentric with said shaft and fixed thereon; a resistance segment surrounding said insulating section; a conducting ring in insulated relation with said resistance segment, said conducting ring comprising a main segment and a plurality of auxiliary segments insulated relative to each other; conducting means connecting said main segment with said rotating conductor; conducting means connecting the two ends of said resistance with said main segment; and conducting means connecting each of said auxiliary segments with said resistance.

4. A resistance commutator construction for gradually opening and closing a circuit between a rotating conductor and a fixed conductor embodying: a rotating shaft; a central insulating section concentric with said shaft and fixed thereon; a resistance segment surrounding said insulating section; a conducting ring in insulated relation with said resistance segment said conducting ring comprising a main segment and a plurality of auxiliary segments in insulated relation with each other, conducting means connecting said main segment with said rotating conductor; conducting means connecting the two ends of said resistance with said main segment; and conducting means connecting each of said auxiliary segments with said resistance, said auxiliary segments being arranged symmetrically relative to said main segment.

5. A resistance commutator construction for gradually opening and closing a circuit between a rotating conductor and a fixed conductor embodying: a rotating shaft; a central insulating section concentric with said shaft and fixed thereon; a resistance segment surrounding said insulating section; a conducting ring in insulated relation with said resistance segment, said conducting ring comprising a main segment and a plurality of auxiliary segments in insulated relation with each other; conducting means connecting said main segment with said rotating conductor; conducting means connecting the two ends of said resistance with said main segment; and conducting means connecting each of said auxiliary segments with said resistance, said auxiliary segments being arranged symmetrically relative to said main segment and the radial width of each segment being gradually increased from the two opposite radial edges of a main segment to a point diametrically opposite with the center of said main segment.

6. A contact commutator for gradually opening and closing a circuit between a rotating conductor and a fixed conductor embodying: a rotatable segmental conducting member; a continuous resistance element;

and means for connecting said fixed conductor and the segments of said conducting member to said resistance element to introduce a gradually increasing and decreasing resistance into said circuit upon rotation of said segmental conducting member.

In testimony whereof I have hereunto set my hand at Los Angeles, California, this 10th day of November, 1928.

WARREN S. EATON.

70

75

93

100

103

110

115

120

121