Aug. 13, 1957 G. E. ADAMS, SR., ET AL 2,802,916

INTERNAL COMMUTATOR

Filed April 5, 1954

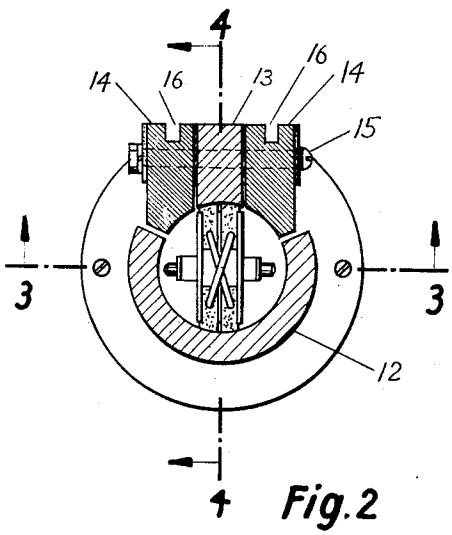


Fig. 2

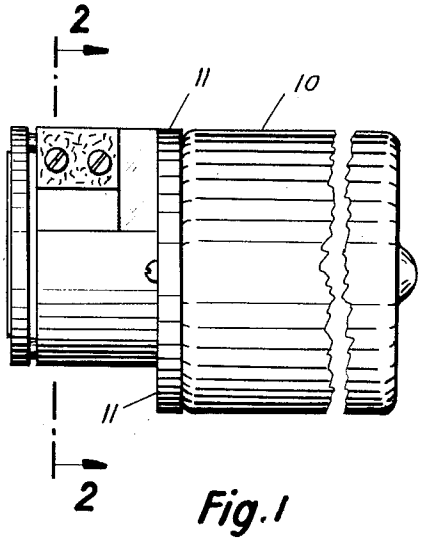


Fig. 1

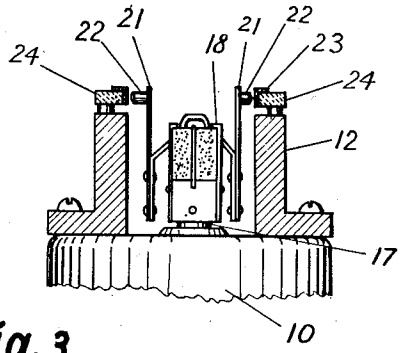


Fig. 3

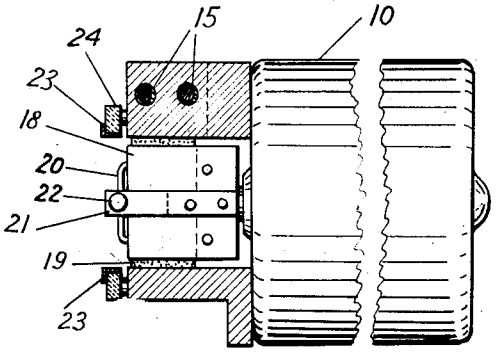


Fig. 4

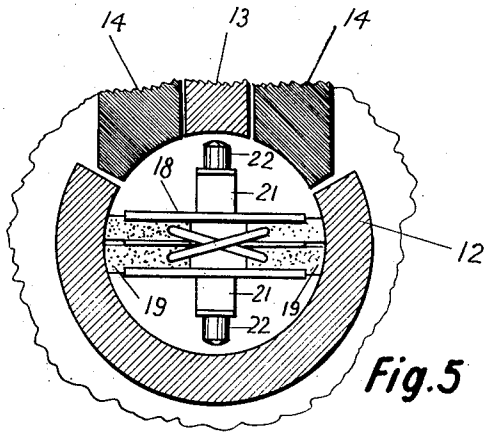


Fig. 5

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INTERNAL COMMUTATOR

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Application April 5, 1954, Serial No. 421,052

2 Claims. (Cl. 200—80)

This invention relates to improvements in internal commutators as used in power supplies for electronic equipment, and specifically it relates to an improved commutator of the type where the commutator segments are stationary and with internal rotating brushes driven by a suitable motor for the purpose of producing pulses of a desired frequency.

The present invention is used in circuits such as described in our co-pending patent application, Serial No. 417,596, filed March 22, 1954.

The main object of our invention is to produce a commutator or reversing rotary switch which may be used to chop a D. C. current into pulses of a given frequency.

Another object of our invention is to produce a commutator of compact design and high efficiency capable of handling large D. C. currents.

A further object of our invention is to provide an internal commutator with stationary commutator segments and with rotating internal brushes having a minimum of friction.

An ancillary object of our invention is to produce an internal commutator having rotating brushes held against the internal face of the commutator by centrifugal force and acting as a speed governor as well.

Still another object of our invention is to provide an internal commutator having motor driven rotating brushes in combination with a centrifugal switch which will close a circuit at a pre-determined speed of said brushes.

Other objects and advantages of our invention will be apparent during the following description and claims:

In the accompanying drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 represents a side elevation of an internal commutator embodying our invention,

Figure 2 represents a section taken along the line **2—2** in Figure 1,

Figure 3 represents a partial section taken along line **3—3** in Figure 2,

Figure 4 represents a partial section taken along lines **4—4** in Figure 2, and

Figure 5 represents an enlarged partial section, same as shown in Figure 2 except that the brushes are in a different position.

In the drawings wherein for the purpose of illustration is shown a perfect embodiment of our invention, the numeral **10** designates a small D. C. motor having its shaft extending on one end. The internal commutator having a flange **11** is mounted on the shaft end of the motor **10**. The flange **11** is integral with the two segments **12** and **13** which form a common or ground segment of the commutator. A pair of similar, but opposite live segments **14** are mounted by means of through poles **15** to the segment **13** and are electrically insulated from same, see Figures 1 and 2.

The segments **14** may be furnished with a slot **16** into which the leads are soldered or may otherwise be supplied

with heavy lugs for the same purpose. The common wire may be bolted or pressed to the flange **11** or to the large common segment **12**, as designed.

The shaft **17** carries a dual brush holder **18** which is pinned on the end of said shaft. The brush holder **18** is preferably made from sheet metal and holds a double set of brushes which are in parallel with two brushes making contacts at each side of the internal face of the commutator, see Figures 2, 3, 4 and 5. The brushes **19** are inter-connected by means of wires **20** and are held in the brush holder **18** in such position that they are free to press against the internal face of the commutator in accordance with the centrifugal force exerted as soon as the brushes are rotated. The brushes have the function of making electrical contact between the common segment **12** and the live segments **14**. Thus if we look at the brushes in the position shown in Figure 2 and if the rotation in that view is clockwise, then the brushes will first make contact with the right hand live elements **14** and then after rotating about 135°, contact will be made between the left hand segments **14** and the common segment **12**. Thus making and breaking will be repeated twice on each rotation, thus producing two complete cycles as will be described hereinafter.

It is obvious to one skilled in the art that if desired the commutator could be made with twice or three times as many cycles per revolution. This is important in cases where an A. C. output is desired, such as airplanes, where the power supplies usually supply 400 cycles A. C. In all D. C. power supplies, however, it is sufficient to use two live segments as shown in the drawings and described above.

In addition to the brushes, the brush holder **18** also carries two centrifugal switches **21** which are facing one on each side of said brush holder **18**. These switches consist of a contact button **22** mounted on the end of a spring **21** which is flexible and which will bend outwardly due to the weight of the button **22** and the weight of the spring when rotated at the high speed. A shorting ring **23** mounted on the insulating ring **24** forms one part of the circuit. This switch is used as a time delay switch to operate a relay which closes the main circuit as described in our co-pending application, mentioned above. This switch is simple and reliable and has an important function in connection with the safe and efficient operation of power supplies of the type mentioned.

The operation of our invention has been described in some detail above. In general it may be said that the brushes act together with the live segments **14** and has a constant speed reversing switch which breaks or pulses the direct current, thereby producing an alternating current which can be transformed in a transformer. The brushes have the unique feature of being held against the commutator inside of same by the centrifugal forces which take effect immediately as soon as the motor **10** is started. It is thus not necessary to have any springs between the brushes such as is common on all other type of commutator equipment. Furthermore, due to this feature, the brushes will be pressed against the inside face of the commutator by a force which varies in accordance with the square of the R. P. M. of the motor. Thus immediately when the motor exceeds its speed normally, the brushes will be pressed much harder against the stationary commutator thus inserting an increased braking effect. Similarly if the motor slows down the pressure will be much less and the motor will therefore have a tendency to hold a constant speed. In other words, the centrifugal force on the brushes will act as a speed governor and will help to stabilize the speed of the motor which otherwise would have a tendency to fluctuate. This will also be helped to some extent by the centrif-

ugal switch **21**, the buttons **22** which will rub against the inside face of the ring **23** thereby adding another stabilizing factor.

The ring **23** is mounted on the insulating ring **24** which is again supported on the common segments **12** or **13**. Electrical connecting lugs may be provided on ring **23** for connection to the circuit. The other side of the control circuit for the centrifugal switch **21** is connected to the common segments **12** or **13**. It is also obvious that lugs or heavy braced connections may be made to the flange **11** or to the said common segments **12** or **13** for the main circuit which is usually of low voltage D. C. and heavy currents.

It is to be understood that the form of our invention, herewith shown and described, is to be taken as a perfect example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of our invention or the scope of the sub-joined claims.

Having thus described our invention, we claim:

1. An internal commutator comprising an electric motor; a commutator body mounted on said motor, said body having a semi-cylindrical extension co-axial with the shaft of said motor and forming the largest part of the circumference of said commutator; a plurality of segments electrically insulated from said body forming the remaining part of the circumference; a brush holder mounted on the shaft of said motor inside said commutator; a pair of brushes held in said holder rotatable by said motor; a centrifugal switch mounted on the side of said brush holder, and a connecting element electrically insulated from said commutator co-acting with said centrifugal switch.

2. An internal commutator comprising an electric motor; a commutator body mounted on said motor, said body having a semi-cylindrical extension co-axial with the shaft of said motor and forming the largest part of the circumference of said commutator; a plurality of segments electrically insulated from said body forming the remaining part of the circumference; a brush holder mounted on the shaft of said motor inside said commutator; a pair of brushes held in said holder rotatable by said motor; a metallic ring insulated from said commutator but mounted concentric with same, and a pair of flat springs mounted on the sides of said brush holder, said springs having contact buttons at their free ends whereby same may act as a centrifugal switch in making connection to said concentric ring.

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