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AIR JET COMMUTATOR

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Fig. 1

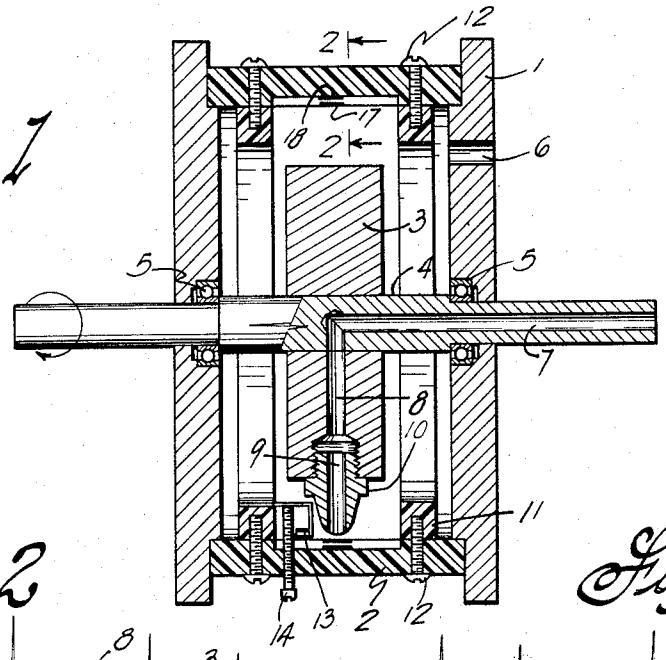


Fig. 2

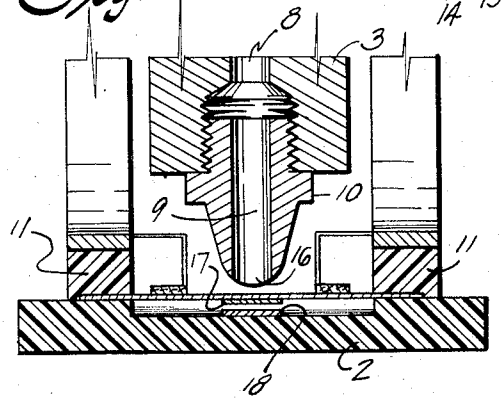
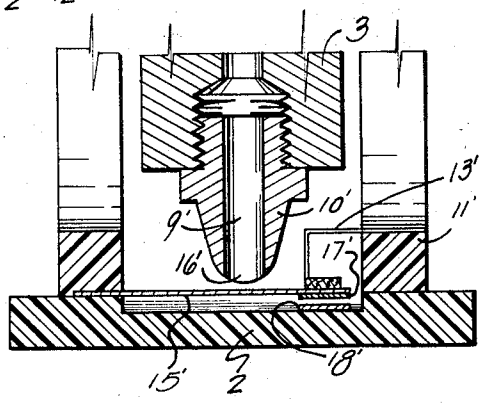


Fig. 3



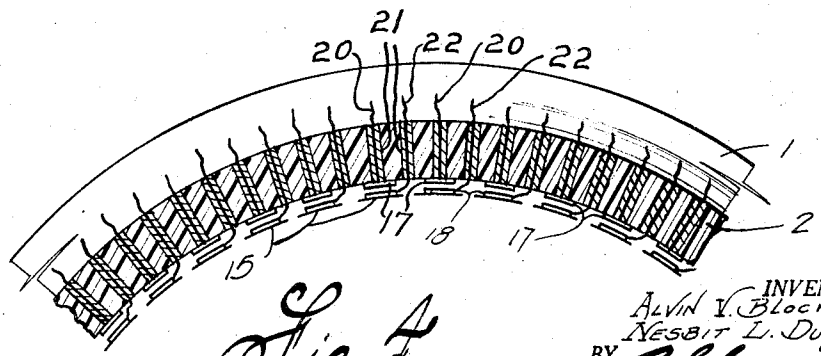


Fig. 4

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AIR JET COMMUTATOR

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5 Claims. (Cl. 200—81.9)

This invention relates to mechanical commutation devices and the like.

In the field of mechanical commutation, the desirable characteristics of an ideal commutator are long life, reliability of operation, high scan speeds with direct current operation, and large segment selection. No commutator exists, however, which is ideal with respect to each of these features. For example, if the speed of commutation is high, the life of the equipment is correspondingly low. Ordinarily the life of a commutator has been limited by contact and rotor wear to only a few million operations.

The subject of this invention provides a fluid jet commutator which solves the above problems by having no rubbing contact between the rotor and contact arm and by having only impact contact between the contact arms.

The object of this invention, therefore, is to provide a commutator of a simple design but which will give long life, reliability of operation, and can be used at high scan speeds.

A further object of this invention is the elimination of rubbing contact in commutator devices and substituting therefor only impact contact.

The accompanying drawings disclose illustratory concrete embodiments capable of carrying out the underlying principles of my invention.

Figure 1 shows the fluid jet commutator in its application environment;

Figure 2 shows the fluid jet and ribbon type commutator in a blown-up view;

Figure 3 shows a detail view similar to Figure 2 but depicting a cantilever type commutator.

Figure 4 is a view along section lines 2—2 in Figure 1.

In prior art devices of commutators, the maximum scan rate was approximately 30 c. p. s. These commutators are rotating wafer switches, motor type commutators with either rotating brushes or rotating segments, or distributor type commutators operating on the cam principle. The above commutators are limited by a short life at high speeds due to excessive wear of either the rotor elements or the contact arms. Their designs also inherently introduce poor frequency response.

With the air jet commutator, it is expected that the life of such commutator should be in excess of 1,000 hours with scan rates of 200 c. p. s. and switching rates in excess of 50,000 operations/second. In addition, the air jet commutator has a flat frequency spectrum from direct current into the megacycle/second region.

Referring to Figures 1 and 2, circular end plates **1** are mounted on each side of a tubular sleeve **2**. Plates **1** are fixed or mounted to any convenient support. Mounted in tube **2** is a flywheel **3** which is secured to the central shaft **4**. The shaft is rotatably supported in the end plates by means of ball bearings **5**. Any convenient means may be used to drive shaft **4** at the desired rate of speed to obtain the proper scan speed of the air jet.

Bore **7** is drilled longitudinally of the shaft to slightly past its mid-point position. Bore **8** is drilled radially of the flywheel and central shaft to intersect the longitudinal bore **7**. Screwed into flywheel **3** is the nipple **10** having a central bore **9** therethrough. The nipple is mounted within the flywheel **3** so that the two bores **8** and **9** are in alignment.

Ribbon **15** is mounted opposite the outlet **16** in nipple **10** between fixed rings **11**. The ring or posts **11** are secured to the tube **2** by means of fasteners **12**.

While Figure 1 shows only several of the ribbon like elements for simplicity's sake, actually a plurality of such ribbon elements are arranged in an annular array as shown in Figure 4.

A dampening device **13** is placed adjacent the ribbon to prevent the ribbon from bouncing and giving false operation. The dampener **13** may take on several forms. For example, in Figure 1, the dampener consists of curved heavy spring element with leather, felt or some other absorbent material adhered to the side facing the contact ribbon. The adjustment of the dampener may be made by screw means **14**. In this type of dampener, the absorbent pad dampens the contact arm as it swings back after closure. The heavy spring does not deflect appreciably but only serves to bear against the adjustment screw.

A second type of dampener which may be used is shown in Figures 2 and 3. The construction is similar to that of Figure 1 but the spring material and spacing of the absorbent material from the ribbon is such as to obtain an action wherein the fundamental oscillation of the contact ribbon is only broken and the ribbon is allowed to operate only at harmonics which are small and of such a nature as to prohibit contact recurrence.

Either type dampener, of course, may be used with either type of ribbon (Fig. 1 or Fig. 3).

Figure 3 shows a modification of the air jet commutator; instead of the ribbon type contact mechanism, a cantilever system is substituted therefor. Thus, a cantilever element **15'** is mounted from a post **11'** having contacts **17'**, **18'** at one end of the cantilever. The air jet nipple **10'** is placed adjacent a portion of the cantilever as in the modification of Figures 1 and 2. Dampening mechanism **13'** is also used as in the prior structure of Figures 1 and 2.

Obviously, each of the fixed contacts (**17** and **17'**) has a means by which electrical contact may be made with it, such as separate lead **20** which may be separately brought through the tubular sleeve **2**, as shown in Figure 4. The lead **20** is, of course, insulated from sleeve **2**, as shown at **21**, when necessary. Likewise, each of the movable contacts (**18** and **18'**) are similarly accommodated, as with leads **22**.

The operation of the two modifications is identical. Referring to Figures 1 and 2, compressed air is pumped through bore **7** from any convenient source. The air passes through bores **7**, **8**, **9**, out exhaust jet **16** and impinges against the ribbon **15** or cantilever **15'** (Figure 3). The force of impingement causes a momentary closure of contacts **17**, **18** (or **17'**, **18'** in Figure 3).

Shaft **4**, meanwhile, is being rotated at the desired rate of speed. Nipple **10** is likewise rotated at the same rate of speed, causing successive impingement of the air jet on the successive ribbons or cantilevers mounted in tube **2**. A port **6** is provided in one of the end plates **1** to prevent a build-up of air pressure within the enclosure.

Damping mechanism **13** is regulated to obtain optimum results with respect to bouncing of the cantilever or ribbon elements. This may have to be readjusted at different scan speeds.

In the actual construction of the unit, the end plates were made of aluminum, the flywheel of brass, the damper of leather and the tube of phenolic. It is understood however that numerous substitutions of materials may be made without departing from the scope of my invention.

The nipple, in turn, had an outlet port of 0.055" diameter with the outlet spaced 0.008" from the ribbon or cantilever elements. Numerous other port sizes and spaced outlets may be used by a judicial selection of combinations.

It is thus evident that only insignificant wear occurs with my improved commutation device, and such wear occurs only at the point of contact since the air jet has a negligible effect on the ribbon or cantilever elements. Furthermore, it is relatively simple to compensate for any wear at the point of contact with the air jet commutation system. With a conservative design of ribbon or cantilever elements, the stress in the elements may be held at such a low value that many hundred millions of operations can be obtained.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In a commutation device, a stationary hollow member having a cylindrical inner surface; a plurality of fixed, spaced electrical contacts mounted annularly on the cylindrical surface of said member; a plurality of movable annularly spaced, electrical contacts resiliently mounted in said fixed member and disposed radially inward and

opposite said fixed contacts for yielding engagement therewith, a fluid pressure nozzle having its opening directed at said movable contact mounted in said fixed member for rotation in a peripheral plane that includes said contacts to sequentially close a movable contact on a fixed contact under fluid pressure from said nozzle during rotation of said nozzle.

2. The device of claim 1 in which said fluid pressure is compressed air and said hollow stationary member is provided with an aperture for exhausting the air from within it to prevent a pressure build-up in the device.

3. The device of claim 2 wherein each said movable contact includes a ribbon-like element mounted between two fixed supports, and the air pressure impinges against said ribbon-like elements.

4. The device of claim 2 in which said movable contacts include cantilever elements and the air impinges on the cantilever element to actuate the contacts.

5. The device of claim 2 further including damping means mounted in said stationary member adjacent the movable contacts to prevent bouncing of said contacts.

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