June 10, 1958 D. H. O. HIDER 2,838,694

ROTATABLE ELECTRICAL CONNECTIONS

Filed Feb. 3, 1955

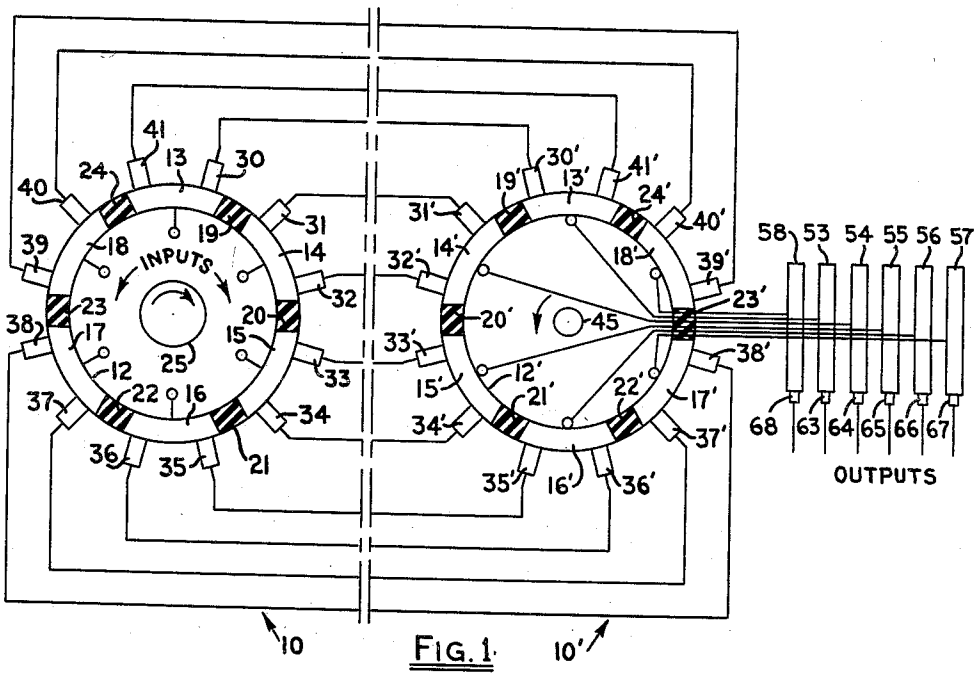


FIG. 1

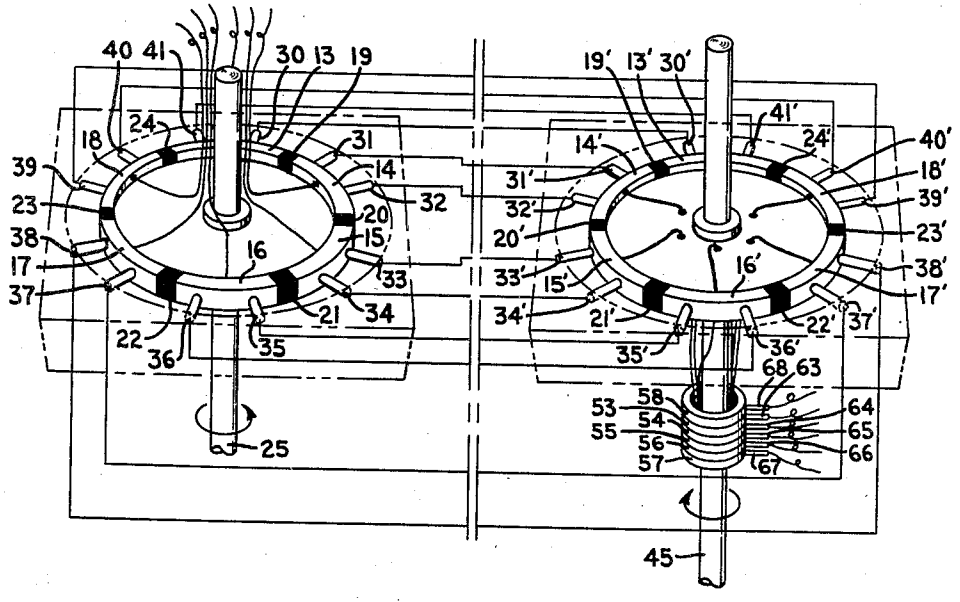


FIG. 2

INVENTOR.
DENIS HAROLD OWEN HIDER
BY G. D. O'Brien
T. L. Styner
ATTYS.

United States Patent Office 2,838,694 Patented June 10, 1958

2,838,694

ROTATABLE ELECTRICAL CONNECTIONS

Denis H. O. Hider, Fareham, England, assignor to the Commissioners for executing the office of Lord High Admiral of the United Kingdom of Great Britain and Northern Ireland

Application February 3, 1955, Serial No. 485,908

6 Claims. (Cl. 307—145)

This invention relates to rotary electrical connections and more particularly to rotary contact means for coupling a plurality of electrical circuits between relatively rotatable parts.

It has been a general practice to utilize continuous slip rings and brushes to conduct several separate circuits between relative rotatable bodies, these continuous slip rings usually being in stacked relation on the relatively rotatable bodies. Stacking of continuous slip rings on a rotatable body requires considerable space which is often at a premium on defense equipment as gun turrets, rotatable antennas, sight units, or the like.

In the present invention the equivalent of several continuous slip ring and brush connections is provided in much less space than that normally occupied. Continuous electrical connections between relatively rotatable parts are made without the need of the usual plurality of continuous slip rings at the rotatable body. The rotary electrical connection embodies at least one pair of corresponding commutators or segmented slip rings, each segment of one segmented slip ring being fixedly connected to one of the rotating parts to which electrical connections are to be made. Corresponding segments of the two segmented slip rings are interconnected by brushes bearing on corresponding segments so that as the two segmented slip rings or commutators rotate in synchronism continuous electrical connection is maintained between the corresponding segments of the two segmented slip rings, thus giving the effect of several continuous slip ring and brush arrangements. The interconnection leads of the brushes may be of any length so that one of the two segmented slip ring assemblies may be located remotely from the segmented slip ring on the rotatable body where more space is available. A stack of continuous slip rings may be used at the remote point to continue the circuits from the remote segmented slip rings to their various points of coupling. In this manner only a small rotary contactor device is needed at the rotatable body and the bulk of the contactor can be placed at a remote point where space is not at a premium. It is therefore a general object of this invention to provide a rotatable electrical connection device utilizing a pair or pairs of segmented slip rings each carrying a plurality of circuits wherein only one of the pairs is required on a rotatable body to connect electric circuits between relatively rotatable bodies.

These and other objects, advantages, features and uses will become more apparent as the description proceeds when taken in consideration of the accompanying drawing, in which:

Fig. 1 is a schematic diagram of a rotatable connector; and

Fig. 2 is an isometric illustration of the mechanical means for carrying out the rotatable connector function.

Referring more particularly to Fig. 1, there are represented two rotatable segmented slip ring components represented in general by the reference characters **10** and **10'**. The segmented slip ring component **10** rotates with

a rotatable body (not shown) to which electrical circuits are to be established and the segmented slip ring **10'** rotates in synchronism in the opposite rotative direction to the component **10**. The component **10** may be referred to as a master interchanger and the component **10'** the remote interchanger.

The component **10** consists of a slip ring **12** having segments **13** to **18** of electrical conductive material and segments **19** to **24** of electrical insulating material. The slip ring **12** is mechanically associated with a shaft **25** which is rotatable to operate a body as an antenna, gun, or the like, as desired. Each electrical segment is engaged by two electrical brushes, the segment **14** being engaged by brushes **31** and **32**, the segment **15** being engaged by brushes **33** and **34**, and so on around the segmented slip ring, the segment **13** being engaged by brushes **41** and **30**. The insulation segments **19** through **24** are each of circumferential extent slightly greater than the brush width so that no brush can span two electrical conductive segments.

The component **10'** has a similar segmented slip ring **12'** with the corresponding portions and parts having corresponding reference characters as the component **10** with a prime (') thereon to distinguish the parts. Brushes **30** to **41** of component **10** are connected to corresponding brushes **30'** to **41'** of component **10'**. The component **10'** is fixed to a shaft **45** which shaft is coupled to rotate in any suitable manner in opposite synchronous relation to the shaft **25** as will later appear necessary.

Each electrically conductive segment **13'** to **18'**, inclusive, is electrically connected to a corresponding continuous slip ring **53** to **58**, respectively, all of which are preferably rotatable with the shaft **45**. Slip ring brushes **63** to **68**, respectively, engage corresponding slip rings. Circuits are therefore completed from the inputs to the segments **13** through **18** on the master interchanger component **10** to the outputs at the brushes **63** through **68** in the remote interchanger component **10'**.

The arrangement illustrated is based on the fact that in the normal method of making electrical connection to a rotating part by a simple continuous slip ring and brush, only a small portion of the periphery of the slip ring is contacted by the brush or brushes at any one instant and the rest of the surface of the slip ring is inactive. By segmenting the slip ring like a commutator and providing a pair of brushes for contacting each segment, which eliminates the inactive portions of the normal continuous slip ring, and collecting all the active segments together in a single segmented slip ring, it is possible to provide continuous electrical connections of a plurality of circuits without the need of separate continuous slip rings and brushes. While the illustration herein discloses six such circuits, it is to be understood that more or less circuits may be established by increasing or decreasing the number of electrical conductive segments. The segmented slip rings may be stacked where a large number of circuits are to be established. Inputs and outputs are legended on the drawing and described for the purpose of illustrating the invention but it is to be understood that the circuits can be oriented in either or both directions.

Referring more particularly to Fig. 2 like parts are given like reference characters to those of Fig. 1. The shaft **25** is operative to rotate a rotatable body, as an antenna, gun, or the like (not shown), by its own power source or controlling means (not shown). The segmented slip ring is preferably fixed to this shaft to rotate therewith and the brushes are supported about the segmented slip ring in any suitable stationary manner as by the stationary part of the rotatable device. The shaft **45** may be journaled in any remote place where space is not essential. The two shafts **25** and **45** are associated

in any suitable manner to rotate in synchronism in opposite angular directions although they may be made to rotate in synchronism in the same rotative direction where the brush couplings are rearranged in reverse order. This synchronism may be accomplished in any suitable manner by using a mechanical, electrical or fluid coupling. Slip rings 53 through 58 are preferably fixed to the shaft 45 to conduct the output of the electrical circuits through brushes 63 to 68, inclusive.

In the operation of the rotatable connection device of this invention reference is made to Fig. 1 keeping in mind the mechanical relationship illustrated in Fig. 2. As presently viewed in Fig. 1, a circuit is established between the input segment 13 through brushes 30 and 41 to brushes 30' and 41', through the segment 13' to continuous slip ring 53, and to brush output 63. Similar circuits are established from inputs 14, 15, 16, 17 and 18 to outputs 64, 65, 66, 67 and 68. Assuming that the master interchanger component 10 rotates clockwise and the remote interchanger component 10' rotates counter-clockwise in synchronism, then as segment 13 leaves brush 41 and segment 13' leaves brush 41' the connection is still maintained by brushes 30 and 30'. As rotation continues brushes 30 and 31 will engage segment 13 while at the same time brushes 30' and 31' will engage segment 13'. Still further rotation brings brushes 31 and 32 into contact with segment 13 while brushes 31' and 32' are simultaneouly brought into contact with segment 13'. This operative procedure may be followed for each segment and for either direction of rotation and the continuity of the several circuits through the rotary contactor is maintained thereby for all rotative positions.

The plurality of circuits that can be continuously transmitted through the single segmented master interchanger component provides a very compact structure for putting the appropriate elements of a rotatable device in the circuit. Although a stack of the segmented slip rings may be required to supply the requisite number of circuits to the rotatable device, the number of segmented slip rings are reduced in proportion to the number of circuits established in a single segmented slip ring.

While I have illustrated and described a preferred embodiment of my invention it is to be understood that many modifications and changes may be made in the constructional details and illustrated features without departing from the spirit and scope of the invention and I desire to be limited only by the scope of the appended claims.

I claim:

1. A rotatable contactor device comprising; slip ring and brush means arranged in pairs, one of a pair for following rotative movements of a rotatable element and the other of the pair remote from said one for synchronously following the movements of said one, each slip ring means being divided into electrically conductive segments; and conductors coupling corresponding brushes cooperative with corresponding conductive segments whereby a plurality of circuits are established continuously through said pairs of slip ring and brush means.

2. A rotatable contactor device comprising; a pair of slip rings one of which is mounted to rotate with a rotatable body and the other of which is remotely mounted to rotate in synchronism with said one slip ring, each slip ring having corresponding electrical conductive segments therein; electrical brushes contacting each segment; and conductors coupling the brushes of said one slip ring with corresponding brushes of said other slip ring whereby there is continuity of the several circuits established through said pair of slip rings.

3. A rotatable contactor device comprising, a pair of slip rings each having electrical conductive segments peripherally thereof separated by electrical insulating segments, at least two brushes for each electrically conductive segment only one of which is separated from said conductive segment by said insulating segment at any one time, electrical conductors coupling brushes of corresponding electrical segments producing a plurality of separate electrical circuits, and means coupling said slip ring to rotate in synchronism whereby a plurality of circuits may be established through corresponding segments of said slip rings.

4. A rotatable contactor device comprising; slip ring and brush means arranged in pairs, one of each pair for following rotative movements of a rotatable element and the other of each pair remote from said one for synchronously following the rotative movements of said one, each slip ring means being divided into electrically conductive segments separated by insulating segments; conductors coupling corresponding brushes cooperative with corresponding conductive segments of each pair; and a continuous slip ring and brush means coupling each conductive segment of the other of each pair whereby a plurality of separate circuits are established between the segments of said one slip ring and brush of each pair and the brushes of said continuous slip ring and brush means continuously in all rotative positions of said slip ring and brush means.

5. A rotatable contactor device comprising; a pair of slip rings each having electrical conductive segments therein separated by electrical insulating segments; at least two electrical brushes adapted to lie within contact of each conductive segment of each of said pair of slip rings, only one of which is adapted to be electrically separated from said conductive segments when lying in contact with said insulating segments at any one time; electrical conductors coupling brushes of corresponding conductive segments producing a plurality of electrically continuous couplings between the conductive segments of said pair of slip rings in all synchronous rotative positions of said slip rings; and a plurality of continuous slip ring and brush means associated with one of said slip rings of said pair corresponding in number to the conductive segments of said slip rings of said pair with one each continuous slip ring being electrically coupled with one each of said conductive segments of said one slip ring of said pair whereby a plurality of circuits may be established to the conductive segments of the other slip ring of said pair from the brushes of said continuous slip ring and brush means in all synchronous rotative positions of said pair of slip rings.

6. A rotatable contactor device comprising; slip ring and brush means arranged in pairs of two remote groups, each slip ring having a plurality of electrical conductive segments separated by electrical insulating segments; at least two electrical brushes adapted to lie within contact of each conductive segment of said slip rings, only one of which is adapted to be electrically separated from said segments when lying in contact with said insulating segment at any one time; electrical conductors coupling brushes of corresponding conductive segments of each pair of slip rings producing a plurality of separate continuously conducting circuits in each pair of slip ring and brush means for all synchronous rotative positions of said slip ring and brush means; a plurality of continuous slip rings associated to rotate with one of said groups, said continuous slip rings corresponding in number to the number of conductive segments of said one group with each conductive segment thereof electrically coupled to one each of said continuous slip rings; and a brush for each continuous slip ring whereby a plurality of isolated circuits may be established between the conductive segments of said slip rings in the other of said continuous slip rings for all synchronized rotative positions of said groups of slip rings.

No references cited.