

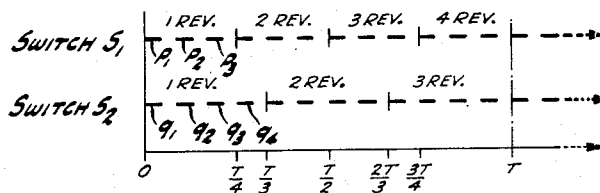
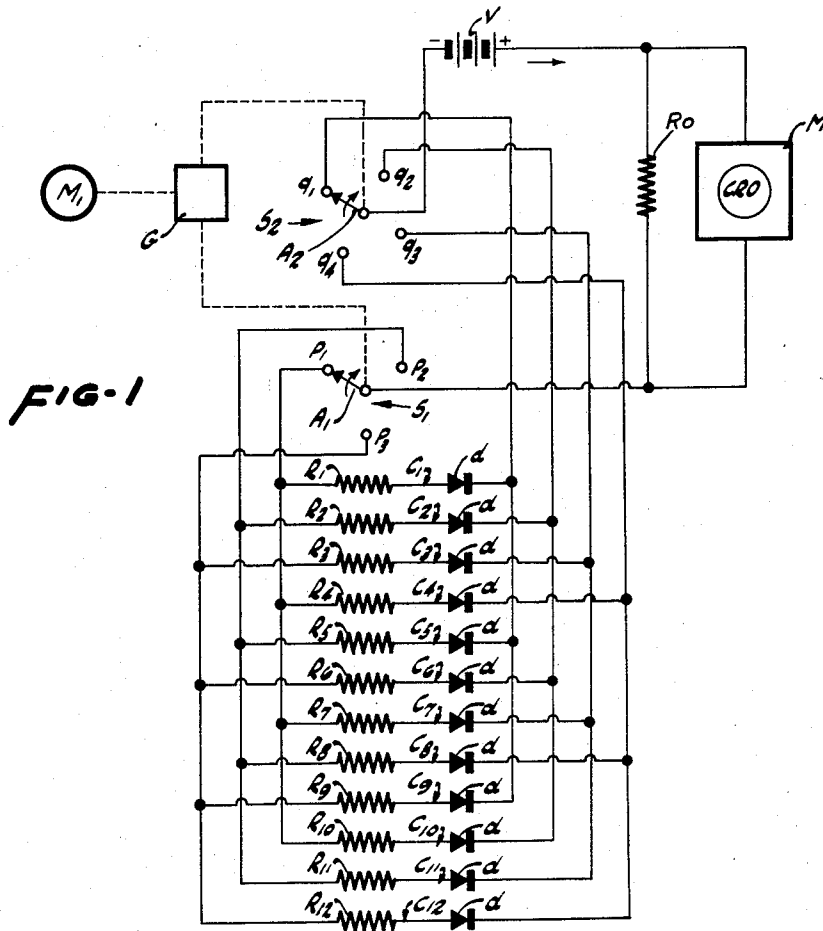
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MULTIPLE ROTARY SWITCH CIRCUIT

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MULTIPLE ROTARY SWITCH CIRCUIT

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This invention relates to and in general has for its object the provision of a multiple rotary switch circuit whereby the value of a plurality of resistors or functions thereof inserted in the circuit can be successively sampled.

More specifically, the object of this invention is the provision of a circuit of the character above described wherein the m contact points of the stator of a first rotary switch are connected with the n contact points of the stator of a second rotary switch through mn unique circuits; wherein each of said mn circuits includes a resistor to be sampled in series with a rectifier such as a diode; wherein a source of voltage and a current measuring device are connected in series across the two rotary switching arms of the first and second rotary switches; and wherein means is provided for rotating said switching arms at speeds in the inverse ratio of $n:m$ whereby said rotary switches serve successively to close each of said mn unique circuits, and each of the resistors in said circuits can be sampled once during each cycle of operation of the multiple rotary switch circuit.

Still another object of this invention is the provision of a switching system for successively closing mn unique circuits across a first rotary switch provided with m contact points and a second rotary switch provided with n contact points, and which can be substituted for a single rotary switch having mn contact points.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description where that form of the invention which has been selected for illustration in the drawings accompanying and forming a part of the present specification, is outlined in full. In said drawings, one form of the invention is shown, but it is to be understood that it is not limited to such form, since the invention as set forth in the claims may be embodied in other forms.

Referring to the drawings,

Fig. 1 is a schematic diagram of a circuit or system embodying the objects of my invention.

Fig. 2 is a time diagram of the circuit or system illustrated in Fig. 1 showing the differential commutating action of the two rotary switches of my system.

As illustrated in Fig. 1, the objects of my invention have been embodied in a circuit or system including a first rotary switch S_1 and a second rotary switch S_2 . Included in the switch S_1 is a conventional ring of three equally spaced contact points p_1, p_2, p_3 and a first coaxial switching arm A_1 arranged to sweep over said contacts 1, 2, and 3.

Similarly, the second switch S_2 includes a stator provided with a ring of four equally spaced contact points q_1, q_2, q_3 , and q_4 and a second coaxial switching arm A_2 .

Connected in series across the first and second switch arms A_1 and A_2 is a source of voltage V , and a current measuring device M , including a resistor R_0 in parallelism with a cathode ray oscilloscope CRO.

Connected across the three contact points p_1, p_2 , and p_3 and the four contact points q_1, q_2, q_3 , and q_4 are

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twelve unique circuits C_1-C_{12} , respectively including one of the resistors R_1-R_{12} to be sampled and each including a rectifier here shown in the form of a diode d . Here it should be noted that twelve circuits are involved for the reason that the three contact points of the first switch can be combined with the four contact points of the second switch in twelve different and distinct ways. More generally stated, m different objects or contact points can be combined with n different objects or contact points mn different ways or circuits.

Operatively associated with each of the rotary switching arms A_1 and A_2 , through a gear reduction box G , is a motor M_1 for respectively driving the switching arms A_1 and A_2 in the inverse ratio of 4:3, or more generally stated, in the inverse ratio of n/m where m represents the number of contact points of switch S_1 and n represents the number of contact points of switch S_2 .

As a result of this system, and with the switching arm A_1 and A_2 initially set so that A_1 is in contact with contact point p_1 , and A_2 is in contact with q_1 , the two switches will serve to sequentially close the circuits C_1-C_{12} , each of which, as shown in Fig. 1, includes the source of voltage V and the current measuring device M . This then makes it possible to sequentially sample each of the twelve resistors R_1-R_{12} , or in the more general case, the mn resistances.

The specific manner in which the two switches S_1 and S_2 cooperate with each other so successively close the twelve unique circuits C_1-C_{12} is diagrammatically indicated in Fig. 2. From this figure it will be noted that when switch S_1 has completed one revolution, switch S_2 has completed only three-fourths of a revolution, and that when S_1 has completed four revolutions S_2 has completed three revolutions, and the system has one complete cycle of operation in T seconds and is in a position to repeat the cycle of operation.

The function of the rectifiers or diodes d is of course to provide for only unidirectional travel of the current passing through the circuits C_1-C_{12} and to thus provide for twelve unique sampling circuits.

The system here illustrated can be extended to a pair of rotary switches each having any number of contact points m and n , respectively, but here it should be noted that mn unique circuits can be obtained only provided that m and n have no common factor other than the number one. If m and n do have a common factor k , then the number of unique circuits per cycle of operation is reduced to mn/k . One way of insuring that m and n have no common factor is to let $n=m+1$.

If S_1 has 100 contact points and S_2 has 101 contact points, and the cycle time is 1/100 minute (or the cyclic rate is 100 cycles per minute), then S_1 runs at $101 \times 100 = 10,100$ r.p.m. and S_2 runs at 10,000 r.p.m., and the total number of resistances R sampled is 10,100. The output of CRO looks like the output of a 10,100 contact switch running at 100 r.p.m.

The resistors R can of course be replaced by other circuit elements or by voltage or current sources without changing the operation of the system, and for this reason the term resistor is here used in a generic sense to cover all such elements.

Finally, it should be noted that the switching arms of the two rotary switches can be driven from a single motor provided with power take-offs of the proper gear ratios as above described.

I claim:

1. A multiple rotary switch system comprising: a first rotary switch having a first ring of m equally spaced contacts and provided with a first coaxial switch arm arranged to sweep over said first ring of m contacts; a second rotary switch having a second ring of n equally spaced contacts and provided with a second coaxial switch

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arm arranged to sweep over said second ring of n contacts; mn separate circuits connecting said m contacts with said n contacts, each of said mn circuits including a rectifier; and means for simultaneously rotating said first and second switch arms respectively at speeds in the ratio of $n:m$.

2. A multiple rotary switch system of the character defined in claim 1 wherein n and m have no common factor.

3. A multiple rotary switch system comprising: a first rotary switch having a first ring of m equally spaced contacts and provided with a first coaxial switch arm arranged to sweep over said first ring of m contacts; a second rotary switch having a second ring of n equally spaced contacts and provided with a second coaxial switch arm arranged to sweep over said second ring of n contacts; mn unique circuits connecting the m contacts of

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said first switch with the n contacts of said second switch, each of said circuits including a rectifier and a resistor; a source of voltage and a current measuring device connected in series across said first and second switch arms; and means for simultaneously rotating said first and second switch arms respectively at speeds in the ratio of $n:m$.

4. A multiple rotary switch system such as defined in claim 3 wherein m and n have no common factor.

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