Jan. 12, 1932. E. F. WESTON 1,841,269

ELECTRIC SWITCH

Filed June 24, 1925 2 Sheets-Sheet 1

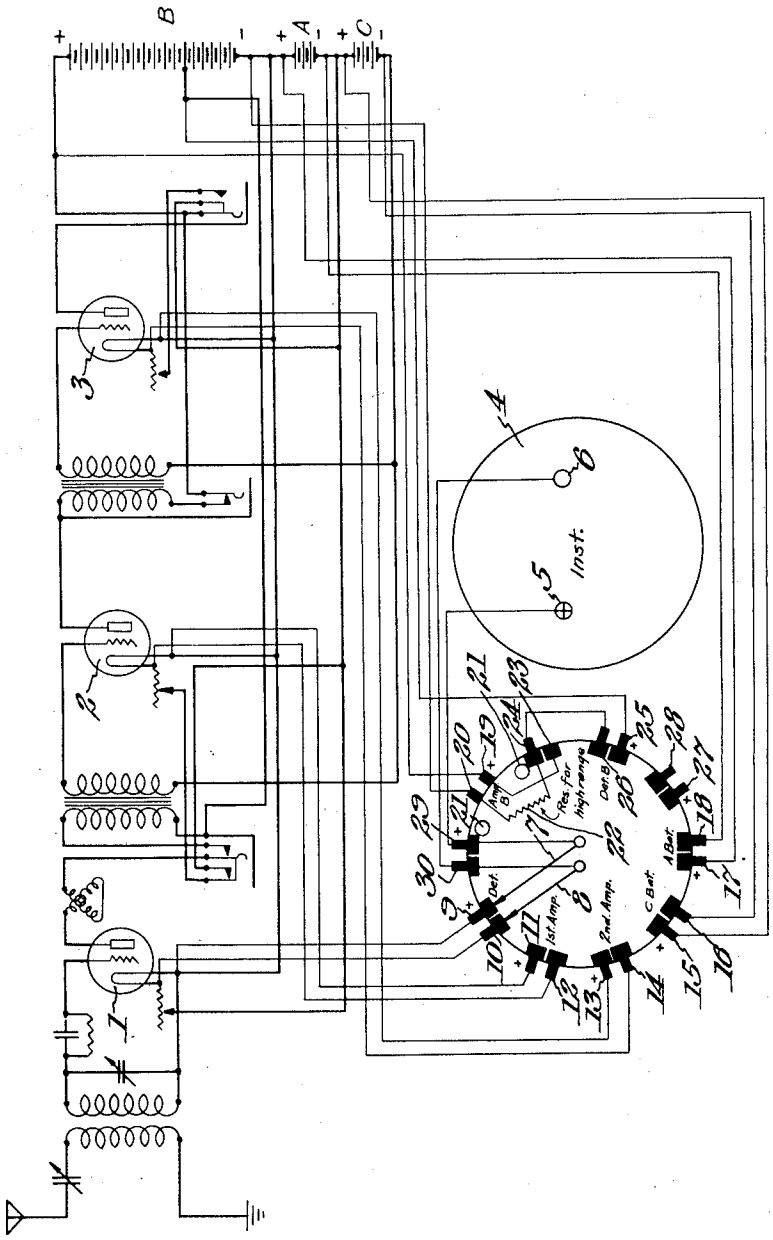


Fig. 1.

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Fig. 2.

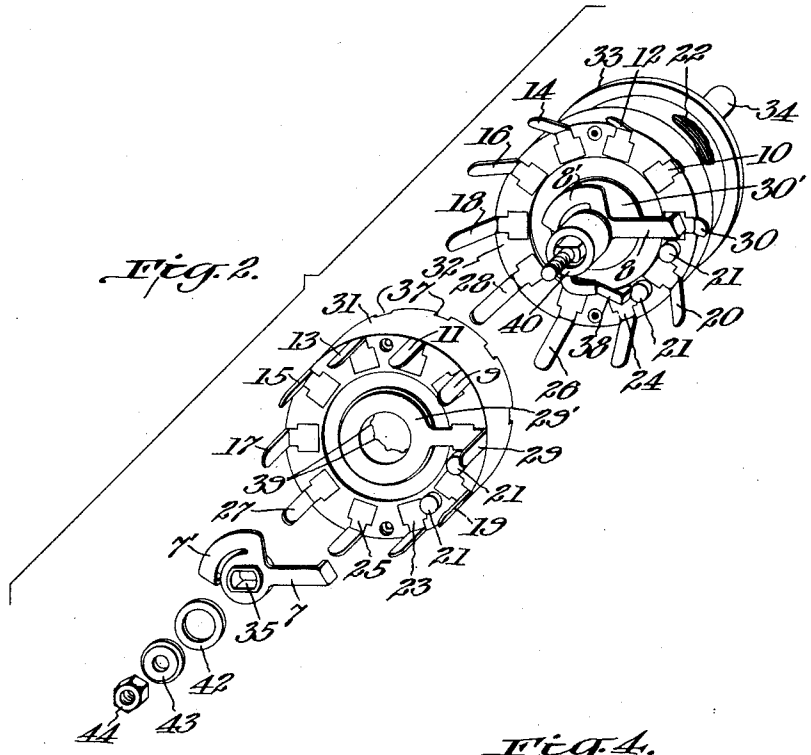


Fig. 4.

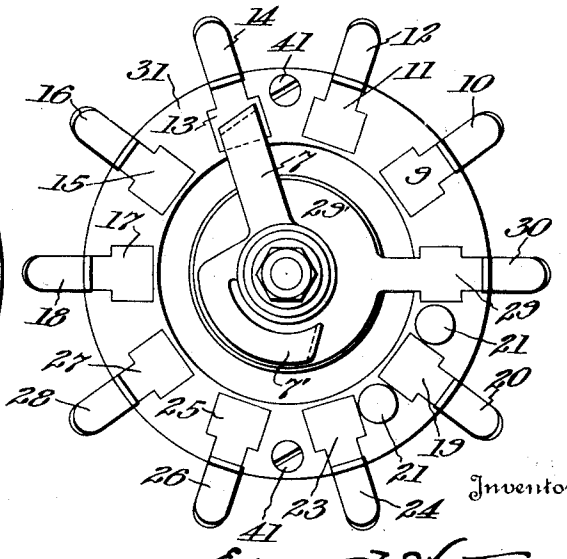
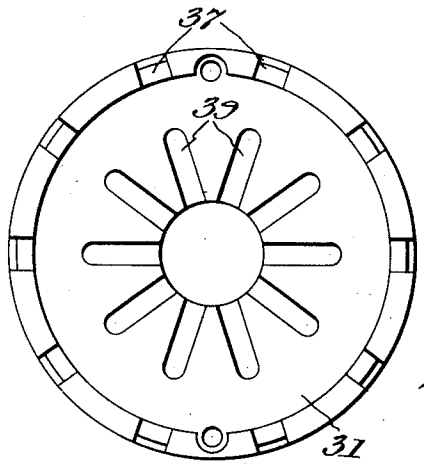


Fig. 3.



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UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH

Application filed June 24, 1925. Serial No. 39,361.

This invention relates to electrical switches and more particularly to multi-pole, multi-throw switches of the rotary type.

An object of the invention is to provide a compact multi-pole switch consisting of separable sections, each carrying one switch arm with its cooperating contacts.

Another object is to provide two insulating blocks for rigid attachment, with a single operating shaft passing therethrough, for operating the two switch arms.

Another object is to provide a switch arm provided with an indexing detent to indicate the "on" positions.

Another object is to improve generally the construction and operation of rotary switches.

Further specific objects of the invention relate to improvements in the construction of rotary switches, and particularly multipole switches which may be employed in an electrical testing circuit.

These and other objects of the invention may be attained by the embodiment illustrated in the accompanying drawings, in which:

Fig. 1 is a circuit diagram of the testing apparatus incorporated in a typical radio circuit;

Fig. 2 is an exploded view, in perspective, of the combined switch and multiplier unit;

Fig. 3 is an elevation of the inner end of the outer base member; and

Fig. 4 is an end view of the switch.

As shown diagrammatically in Fig. 1, the invention may be used in connection with radio apparatus for measuring an electrical property of any one of the various circuits which make up the network of a multistage amplifier. The radio receiver may include an audion detector 1 and audion amplifiers 2, 3 which are connected in any suitable manner to each other and to the usual A, B and C batteries. So far as the present invention is concerned, the particular radio circuit employed is immaterial and detailed description of the same is unnecessary.

The testing or indicating instrument 4 has a single set of terminals 5, 6 which are electrically connected to the pivoted arms 7, 8, respectively, of a double-pole multipoint switch. The arms are arranged for simultaneous movement and the switch contacts engaged thereby are so positioned that the switch arms simultaneously engage the separate contacts of a pair of contacts which are electrically connected to a particular circuit. With such a construction it is possible to measure a given property of any one of several circuits, whether or not the several circuits are electrically connected, since the two terminals of the instrument may be connected across or between any two points of a given circuit.

Suitable leads extend from the terminals of the filaments of the detector tube 1 and amplifying tubes 2 and 3 to the respective contacts 9 and 10, 11 and 12, and 13 and 14, thus enabling the operator to determine the potential drop across any one of the tubes. Similarly the C battery and A battery terminals are electrically connected, respectively, to the contacts 15, 16 and 17, 18. In standard practice, the voltages of the A and C batteries and the voltages impressed upon the filaments are all of the same order of magnitude, and the switch arms are adapted to connect the voltmeter directly across the battery or tube terminals. The B battery voltages are of a different order of magnitude, and a multiplier resistance is automatically placed in series with the voltmeter when such voltages are to be measured. As described in my copending application, the switch is provided with a pair of terminals 19, 20, which are similar in construction and arrangement to the previously described contact points, but which are positioned between a pair of stops 21, and cannot therefore be engaged by the switch arms. The negative terminal 20 is connected to the negative terminal of the B battery and to one terminal of a multiplier coil 22, which preferably forms a part of the switch assembly, the opposite terminal of the multiplier coil being connected to the negative contacts of the pairs of contacts 23, 24 and 25, 26. The positive contacts 23, 25 of these pairs are electrically connected to the B battery at the taps which are employed for impressing a positive voltage upon the plates of the detector and amplifier tubes, respectively.

As indicated in Fig. 1, the switch is pro-

vided with an extra pair of contacts 27, 28, which may be electrically connected to any desired circuit. While it is not essential, the connection between the switch arms and the instrument terminals is preferably secured through terminals 29, 30, which are formed in the same general manner as the switch contacts.

In Figs. 2, 3 and 4, I have illustrated one practical embodiment of a switch mechanism adapted to connect an electrical instrument across or between points in any one of a number of electrical circuits. The construction is similar to that described in my said copending application, Serial No. 39,360, filed June 24, 1925, now Patent No. 1,714,651, but includes two base sections 31 and 32 which carry the respective sets of positive and negative contacts and terminals. The contacts may be stamped from sheet metal to provide a flat contact portion which is flush with the supporting base and a soldering lug extending upwardly therefrom. The base sections are conveniently formed from a phenolic resin in which the contacts are embedded by known molding operations. The base section 32 carries the multiplier coil 22, attaching plate 33, a shaft 34 and the set of negative contacts 10, 12, etc., which have been described in connection with Fig. 1. The shaft 34 is provided with a non-circular portion for receiving the switch arms 7 and 8, the latter being provided with insulating bushings 35 which have passages therethrough of such size and shape as to fit snugly upon the non-circular portion of the shaft.

The inner face of the section 31 which carries the positive terminals 9, 11, etc., has a peripheral flange 36 for spacing the sections apart to provide a chamber within which the negative switch arm 8 operates, the flange being notched at 37 to clear the outwardly flaring soldering terminals which are integral with the switch contacts.

The switch arms 7, 8 have integral spring extensions 7′, 8′, respectively, in engagement with the contact plates 29′, 30′ which are integral with the terminals 29, 30, to which the voltmeter terminals are to be connected. An index arm 38 is mounted on the non-circular portion of the shaft 34 and has a flexible end riding over the radial notches 39 which are formed in the inner face of the base section 31. The central portion of the index arm is spaced from the section 31 by the bushing 40 and the free end of the arm can spring into and out of the notches as the shaft 34 is rotated.

The base sections 31, 32 are united by screws 41 and the outer switch arm 7 is held to the shaft 34 by washers 42, 43 and nut 44, the washer 42 being of insulating material. The switch arms are fixed on the shaft in radial alignment, and, as shown in Fig. 4, the two contacts of each pair are also aligned in radial planes.

The soldering lugs of the outer set of contacts preferably extend parallel to the axis of the shaft, but the lugs of the inner set flare outwardly to facilitate the making of connections thereto. As shown in Fig. 1, the circuit or circuits upon which is impressed a voltage higher than that which may be impressed across the terminals of the voltmeter has one side thereof connected to a terminal of the switch which lies between the stops 21. This terminal is connected to the contact which the switch arm can engage through the multiplier coil 22, which reduces the voltage which can be impressed across the instrument to a value falling within the normal range of the instrument.

While I have described the apparatus as associated with a radio receiver, it will be apparent that the apparatus may be used in connection with other electrical circuits where the measurement of an electrical property of any one of several circuits or parts thereof is best attained by connecting the instrument into only the particular section under investigation. When used with circuits which are not conductively connected, or which if conductively connected, are so arranged that it may be inconvenient or it is impossible to ground one side of the instrument to the circuits, properties of different orders of magnitude may be readily indicated upon a single range instrument merely by the suitable adjustment of the double-pole switch as the multiplier coil is automatically inserted in those testing circuits where its presence is necessary.

It will be apparent that the testing circuits illustrated in Fig. 1 may be established by switch structures and by combined switch and multiplier structures which are not identical with the particular embodiment of my invention which is illustrated in Figs. 2 to 4. Many changes in the several parts of the apparatus, their relative size, shape and location may be made without departing from the spirit of my invention as set forth in the following claims.

I claim:

1. A rotary switch comprising an inner base section carrying a plurality of contacts, a shaft, a switch arm on said shaft and movable over said contacts, an outer base section rigidly attached to said inner base section and spaced therefrom to clear said switch arm, and indexing means comprising a yielding arm fixed to said shaft adjacent said outer base section, and a series of recesses in the inner face of said outer base section, the recesses being so spaced that the yielding arm moves into a recess as the switch arm moves into engagement with a switch contact, the outer base section being cup-shaped to enclose said switch arm and its contacts.

2. A double-pole rotary switch comprising an inner base section, contacts thereon, a shaft, a switch arm on said shaft and movable over said contacts, an outer base section having a peripheral flange projecting from the inner face thereof said flange engaging the outer face of said inner base section, contacts on said outer base section, a second switch arm on said shaft movable over the contacts of said outer base section, a yielding index arm on said shaft, and a series of radial grooves on one of said base sections engageable by said index arm.

3. A double-pole switch comprising a rotatable shaft, a pair of axially aligned switch arms carried thereby, a pair of bases, a set of switch contacts carried by each of said bases for engagement by the respective switch arms, the contacts of said sets being arranged in axially-aligned pairs, whereby said arms simultaneously engage the respective contacts of a pair, one of said bases being cup-shaped whereby to provide a closed housing for one switch arm and its set of contacts.

4. A switch comprising an insulating base, contacts arranged circumferentially thereon, a conducting ring secured to the base, one of said contacts being electrically connected to said ring, and a rotary switch arm arranged to successively engage said contacts, the said switch arm comprising a central portion for mounting the same upon a shaft, an arm extending radially from said central portion for engagement with said contacts, and an arcuate arm having one end connected to said central portion by a radial extension, the opposite end of said arcuate arm engaging said ring.

5. A double-pole switch comprising a supporting structure, a shaft carried thereby, a pair of switch arms fixed to and insulated from said shaft, sets of contacts for engagement by the respective switch arms, the contacts of said sets being arranged in pairs whereby said arms simultaneously engage the respective contacts of a pair of contacts, and stop means preventing said arms from engaging one of said pairs of contacts.

6. A multi-pole switch comprising a rotary shaft, a plurality of connected bases, each of said bases having a surface normal to the said shaft, a set of circumferentially arranged contacts on each of the said surfaces and switch arms on said shaft for engagement with the contacts of the respective sets, one of said bases being cup-shaped to form a closed housing for one switch arm and its set of contacts, said switch contacts having attaching lugs extending in the direction of said shaft and at an angle to the surface carrying the respective contacts.

7. The invention as claimed in claim 6, wherein said connected bases comprise an inner and an outer base, the attaching lugs of the contacts carried by the inner base being flared outwardly to space the same from the outer base.

In testimony whereof, I affix my signature.

EDWARD F. WESTON.