

UNITED STATES PATENT OFFICE

2,432,294

ELECTRIC SWITCH

Robert P. Dimmer, Chicago, Ill., assignor to
Automatic Electric Laboratories, Inc., Chicago,
Ill., a corporation of Delaware

Application September 11, 1943, Serial No. 501,927

6 Claims. (Cl. 200—27)

1

This invention relates to electric switches, and more particularly to a motor driven switch suitable for use in an electric circuit such as a direction finder.

In direction finders it has been proposed to reverse the connections to the antenna and concomitantly reverse the connections to an indicating meter. Various methods have been suggested and employed to provide such reversal of connections, including vacuum tube switches and mechanical switches. For portable instruments subject to shock it is believed that mechanical switching arrangements might be preferable to vacuum tube switching arrangements. Mechanical switching, however, requires consideration of various problems such as a fairly high speed of operation, such as 600 or more reversals of the connections per minute. The switching between the antenna and a direction finder receiver requires a balanced construction so that each connection has the same inductive and capacitive effects. It also is necessary to hold down to a minimum the transfer of energy due to capacitive effects between the switch parts. The make and break of the switch must be positive at all times and there must be no mechanical vibration of the switch contact after the switch has been opened. In accordance with the present invention a switching arrangement has been provided which has taken into consideration the above factors and which is used with a spaced loop antenna arrangement to provide, in effect, a double pole double throw switching arrangement between the antenna and a direction finder receiver. In addition the switch also concomitantly reverses the connections to an indicating instrument, and this reversal makes and breaks the circuits subsequent to and prior to the make and break of the double pole double throw switching arrangement.

Therefore, it is an object of the present invention to provide an improved switch particularly suited for switching radio circuits.

Still another object of this invention is to provide an improved motor driven switch which is positive in action in making and breaking circuits and which has no vibratory action of the switch contacts.

The features of this invention are set forth with particularity in the appended claims. Other and further objects of this invention will subsequently become apparent by reference to the following description taken in connection with the accompanying drawing wherein Fig. 1 is a front view, partially broken away, of a switch embodying the present invention; Fig. 2 is a sec-

2

tional view of the switch shown in Fig. 1 along the lines 2—2; and Fig. 3 is a schematic arrangement showing the connections between the switch contacts and the relation between the switch cams together with their application to a direction finder circuit.

Referring to Figs. 1 and 2 of the drawing, there is shown a switch contained in a housing having a frame 11, a front panel 12, and a top cover 13. The front panel 12 may be secured to the frame 11 by suitable means such as screws 14. The front panel supports all of the switch contact elements. The ends of the frame 11 are provided with suitable bearing members 15 which support a cam shaft 16 having thereon a plurality of adjustably positioned cams 17 to 22, inclusive. The latter two cams 21 and 22 differ in construction from the other cams and are separated by a shield 23 from the other cams. The cams each operate a cam follower 24 supported adjacent the free end of a flat steel spring 25 mounted in an insulating block assembly 26 which is secured to the front panel 12 by suitable fastening means such as screws 27. Each steel spring 25 is arranged to actuate by means of an insulating spacer 28 a nickel silver spring 29 having at an intermediate point thereon a platinum iridium contact 31. The lower extremity of the nickel silver spring 29 is also supported within the insulating block assembly 26 and is arranged in physical contact with an electrical contact member 32 extending through an insulating bushing 33 to the exterior of the switch cabinet. A stationary adjustable contact 34 of platinum iridium is supported at the end of a threaded screw member 36 mounted in an insulating block or bushing 37 extending through the front panel 12. This construction reduces to a minimum the capacity effect between the spring 29 and the screw member 36. Adjacent the insulating block 37 there is provided a connecting lug 38 retained in position by the lock nut 39 which also retains in position the adjusted screw member 36. The insulating members 37, 33 and 26 are preferably of a material such as polystyrene which has suitable electrical insulating and power factor characteristics so that a switch may be used in radio frequency circuits.

The shaft 16 is arranged to be connected to an electric motor which, in one application, is operated at a speed of 600 R. P. M. In order to provide a minimum of friction between the cam 18 and the spring 25 to be actuated thereby, it has been found desirable to provide a cam follower 24 in the form of a miniature roller bearing. The

elimination of friction reduces the possibility of introducing into the action of the spring 25 certain undesirable mechanical vibrations. Furthermore, the roller bearing reduces the generation of heat which otherwise would affect the operation of the steel spring 25. In order that the make and break of the contacts 31 and 34 be sharply defined, the movable contact 31 is located at an intermediate point on the cantilever portion of the nickel silver spring member 29. Furthermore, to insure simultaneous operation of a plurality of such contacts, the cooperating contact 34 is arranged to be adjustable. This permits an accurate determination of the making and breaking of each individual contact.

By referring to Fig. 3 it will be seen that the cams 17 to 20 are arranged to control make and break switch contacts 41 to 44, respectively, and that the contacts 41 and 42 are open when the contacts 43 and 44 are closed. These contacts are arranged in a circuit between a pair of spaced loop antennas 45 and 46 and a direction finder receiver 47. The switch contacts 41 to 44 are arranged to operate in the manner of a double pole double throw switch. In order that there be no interaction between the radio frequency circuit connected to the switch contacts 41 to 44 and the switch contacts 48 and 49 operated by the cams 21 and 22, there is provided the shield 23. The contacts 48 and 49 are connected between one terminal of the output circuit of the receiver 47 and an indicating circuit which includes a meter 51. The meter 51 is connected across a pair of capacitors 52 and 53, the common juncture of which is grounded.

In the position shown in Fig. 3 it will be seen that the receiver 47 is connected to the loop antennas 45 and 46. It may now be assumed that the cam shaft is operating to rotate all of the cams in a clockwise direction. It will be noted that the next contact operation to occur will be the opening of the contact 49. Subsequent thereto the contacts 43 and 44 will be opened and thereupon the contacts 41 and 42 will be closed so that the antennas 45 and 46 are reversed with respect to the input circuit of the receiver 47. After the contacts 42 and 41 have been closed the contact 48 will be closed. Prior to the opening of the contacts 41 and 42 the contact 48 again will be opened. Thus it is seen that the cams 21 and 22 operate to make and break the associated switch contacts 48 and 49 subsequent to and prior to the operation of contacts associated with the cams 17 to 20. By having the cams 21 and 22 operate the associated switch contacts 48 and 49 in the manner described, the meter 51 is assured of proper indication in accordance with the energy received from the directional antennas. The capacitors 52 and 53 will each time be charged to a potential and a current flow will be established through the indicator tending to equalize the charges on these capacitors if either one of the capacitors receives a higher potential than the other. The meter 51 is a zero center instrument which will be deflected to the right or to the left to indicate as to whether the transmitting station has a bearing to the right or to the left of the position indicated by the directional antennas. The amount by which the indicator of the meter is deflected in any case is dependent upon the amount of deviation of the directional antenna from the bearing of the transmitting station.

While the cams 17 to 22 have been shown as having a particular coordination as indicated in

Fig. 3 it, of course, is to be understood that when desired this relation may be changed since each of the cams is arranged to be adjustably positioned upon the cam shaft 16. Thus by adjustment of the cams upon the cam shaft 16 together with the adjustment permitted by the stationary switch contact, it becomes apparent that great accuracy may be obtained in the determination as to when the switch is to be operated.

It furthermore will be appreciated that while the present invention has been disclosed as applied to a direction finding receiving system, the switch is susceptible to applications in other fields where similar requirements must be met. The invention therefore which has been shown in a particular embodiment is not to be limited thereby since obviously variations may be made therein commensurate with the scope of the invention set forth in the appended claims.

What is claimed is:

1. An electric switch adapted to be motor driven comprising a container, a cam shaft housed therein and having a plurality of cams, said cams being arranged to actuate a plurality of switch contacts, each set of switch contacts comprising a flat cantilever steel spring supporting adjacent the free end thereof a ball bearing cam follower, a movable cantilever spring insulated from and arranged parallel to said first spring member to be actuated thereby and having at an intermediate point thereon a switch contact, and an adjustable stationary contact supported by a member extending substantially perpendicular to the spring supporting said movable switch contact.

2. An electric switch adapted to be driven by a motor comprising a housing supporting therein a cam shaft having a plurality of cams, a pair of switch contacts for each cam including a flat steel spring member fixed at one end and provided adjacent the free end thereof with a ball bearing cam follower, another flat spring member having one end fixed at a point spaced from the fixed end of said steel spring member arranged parallel to said first spring member, said other spring member carrying an insulating member arranged for continuous contact with said first spring member and supporting at an intermediate point thereon a movable switch contact, an adjustable stationary switch contact supported from said housing by a member arranged substantially at right angles to said spring members, and means for retaining said adjustable contact in adjusted position.

3. A shielded electric switch adapted to be driven by a motor comprising a shielded housing having a cam shaft, a plurality of cams for said shaft adapted to be adjustably positioned thereon, a circuit maker and breaker for each cam including a flat cantilever steel spring mounted upon a radio frequency insulator and arranged in a plane parallel to the longitudinal plane of said cam shaft, a roller bearing cam follower mounted adjacent the free end of said spring, a flat cantilever spring electric conductor mounted upon a radio frequency insulator and arranged parallel to said first spring, insulating means mounted between the free ends of said springs to transmit movement from one spring to the other, an electric contact mounted at an intermediate point on said second spring, a radio frequency insulator supported by said housing parallel to said springs, a threaded electric conductor mounted in said latter radio frequency insulator substantially perpendicular to the plane

of said electric conductor spring, and a contact mounted on the end of said electrical conductor for cooperation with the contact carried by said electrical conductor spring.

4. A shielded electric switch adapted to be driven by a motor comprising a shielded housing having a cam shaft, a plurality of cams mounted on said shaft, a circuit maker and breaker for each cam including a flat steel spring cantilever mounted upon a radio frequency insulator and arranged in a plane parallel to the longitudinal plane of said cam shaft, a roller bearing cam follower mounted adjacent the free end of said spring cantilever, a flat spring electric conductor cantilever mounted upon a radio frequency insulator and arranged parallel to said first spring cantilever, insulating means interposed between the free ends of said spring whereby a cam may impart simultaneous movement thereto, an electric contact mounted at an intermediate point on said second spring cantilever, an electric terminal connected to said second spring cantilever and extending through a radio frequency insulator to the exterior of said shielded housing, a radio frequency insulator supported by said housing parallel to said springs, a threaded electric conductor mounted in said latter radio frequency insulator substantially perpendicular to the plane of said spring cantilevers, a contact mounted on the end of said threaded electric conductor for cooperation with the contact carried by said electric conductor cantilever, and an electric terminal connected to said threaded electric conductor at the exterior of said housing.

5. A shielded electric switch adapted to be driven by a motor comprising a shielded housing having a cam shaft, a plurality of cams mounted on said shaft, a circuit maker and breaker for each cam including a flat steel spring cantilever mounted upon a radio frequency insulator and arranged in a plane parallel to the longitudinal plane of said cam shaft, a roller bearing cam follower mounted adjacent the free end of said spring cantilever, a flat spring electric conductor cantilever mounted upon a radio frequency insulator and arranged parallel to said first spring cantilever, insulating means interposed between the free ends of said spring whereby a cam may impart simultaneous movement thereto, an electric contact mounted at an intermediate point

on said second spring cantilever, an electric terminal connected to said second spring cantilever and extending through a radio frequency insulator to the exterior of said shielded housing, a radio frequency insulator supported by said housing parallel to said springs, a threaded electric conductor mounted in said latter radio frequency insulator substantially perpendicular to the plane of said spring cantilevers, a contact mounted on the end of said threaded electric conductor for cooperation with the contact carried by said electric conductor cantilever, and an electric terminal connected to said threaded electric conductor at the exterior of said housing, said cams being arranged in groups each individual to a different electric circuit, and shielded means mounted within said housing to separate said groups of cams.

6. A motor driven switch comprising, a shaft, a cam mounted on said shaft, an insulating block assembly, a cantilever steel spring secured in said block assembly and extending in the plane of said cam, a roller bearing follower mounted on the free end of said spring and bearing continuously on said cam, a second cantilever spring having one end secured in said block assembly and spaced from the fixed end of said first named spring, said second spring extending parallel to said first named spring, an insulating member secured to the free end of one of said springs and bearing continuously on the free end of the other spring, a movable contact secured to an intermediate part of said second named spring, and a stationary contact mounted opposite said movable contact.

ROBERT P. DIMMER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,121,996	Gassman	Dec. 22, 1914
2,246,922	Macchioni	June 24, 1941
1,993,957	Coberly	Mar. 12, 1935
816,083	Farwell	Mar. 27, 1906
2,094,337	Williams	Sept. 28, 1937
912,447	Coffee	Feb. 16, 1909
1,036,700	Pfanstiehl	Aug. 27, 1912