Jan. 15, 1957 D. E. HOOKER 2,777,907

ROTARY SWITCH WITH SPIRAL OVERTRAVEL

Filed Jan. 2, 1953

Fig. 1

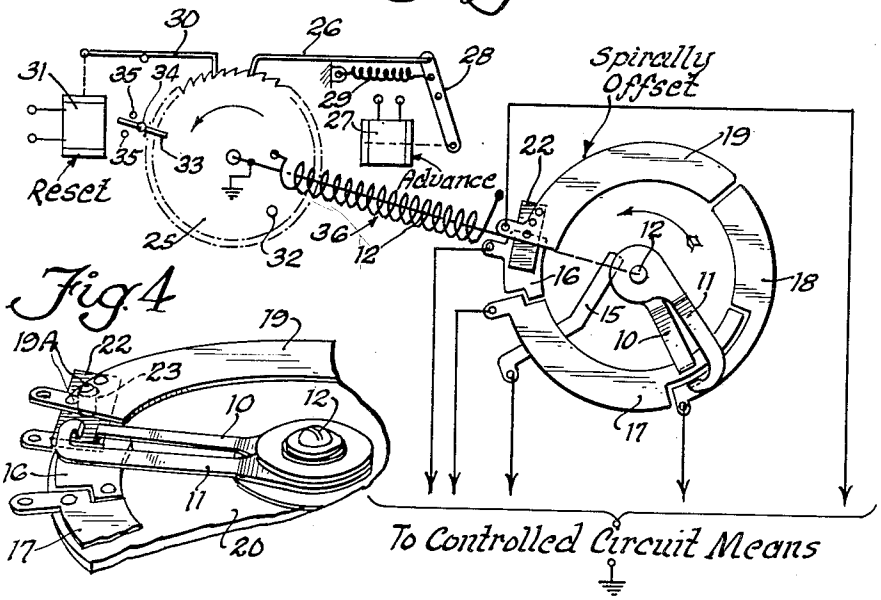


Fig. 4

Fig. 2

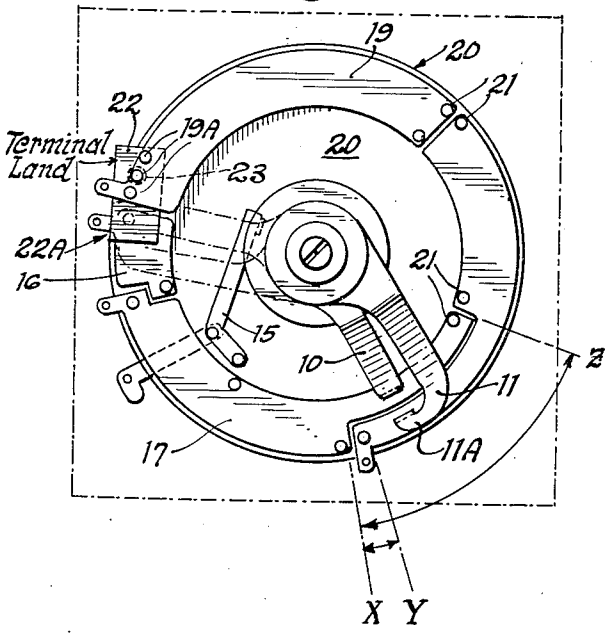
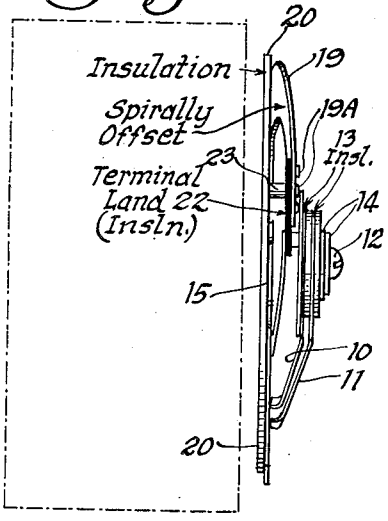


Fig. 3



INVENTOR.
Donald E. Hooker
BY
Atty

United States Patent Office 2,777,907
Patented Jan. 15, 1957

2,777,907

ROTARY SWITCH WITH SPIRAL OVERTRAVEL

Donald E. Hooker, Skokie, Ill., assignor to Raymond T. Moloney, Chicago, Ill.

Application January 2, 1953, Serial No. 329,244

3 Claims. (Cl. 200—11)

This invention has as its principal object the provision of improvements in a rotary type electrical switch, and means utilizing a spiral contact path to extend the rotational range of a rotatable contact of fixed radius to a full 360° or beyond, and to provide a zero or dead position at a point at least 360° away from the starting position.

The invention is particularly applicable to rotary switches of the step-by-step variety which are intended to reach an open-circuit or dead position near the end of their normal range of travel.

One of the popular arrangements heretofore used for this purpose has been the positioning of an auxiliary switch device near the end of the arc of travel of the rotary switch arm, to be engaged and operated by the latter as it reaches the terminal position.

Such an arrangement increases the cost of the switching unit insofar as it requires a separate switch, additional assembly operations, and special wiring and attaching connections. Moreover, several degrees of travel of the rotary switch contact must usually be sacrificed near the end of the travel in order to allow for actuation of the supervisory switch appendage.

Another expediency heretofore commonly resorted to for these purposes has been the provision of one or more extra contact segments operative near the end of the travel of the main rotary contact (or an auxiliary rotary wiper contact) to open the main circuit or operate a relay for the same purpose. Such arrangements also require extra contact means and connections, and generally involve a sacrifice of several degrees of travel of the main rotary contact.

According to the present improvements, the stationary contact means is extended into a spiraling plane which is followed by a spring contact arm of fixed radius, so that at the end of one full revolution of travel the arm will rest upon a special contact or an insulated area which overlies the starting position for the contact of a full 360° away from the terminal position.

The detailed functional and structural characteristics of the new switch will become more apparent as the following description proceeds in view of the annexed drawing in which:

Fig. 1 is a rudimentary schematic diagram of the switch components shown partly in plan and partly in perspective relation;

Fig. 2 is a front elevational view of the spiral switch component;

Fig. 3 is a side elevational view of the spiral switch component;

Fig. 4 is a fragmentary perspective detail, to enlarged scale, of the terminal region of the spiral contact element of the switch.

Referring to Fig. 1, the spiral contact component of the switch includes a pair of rotatable flexible contact fingers **10** and **11** fixed upon a shaft **12** to rotate with the latter.

As viewed in Fig. 3, the two contact fingers or arms are insulated from each other by suitable insulating washers **13**; however, the outer and longer contact arm **11** is grounded to the shaft **12** by means of metal washers **14**.

As in Fig. 1, a stationary wiper arm **15** rides against the hub portion of the shorter or inner contact arm **10** to establish an electrical connection with the latter.

Any suitable means may be employed for rotating the shaft **12** and its traveling contact arms **10** and **11**. In the illustrative embodiment of Fig. 1, the device is intended for step-by-step operation through only one revolution; and to this end, the shaft **12** is connected to a conventional ratchet wheel **25** adapted to be advanced from a starting position by reciprocal action of a stepping or driving pawl **26**, moved in a retractive direction by a solenoid **27** and associated linkage **28**, and returned in the opposite direction by spring means **29**.

A releasable holding pawl **30** holds the gain of the ratchet wheel in the usual manner, and can be released by a reset solenoid **31**. Such a stepping and resetting ratchet means **25—31** is conventional and does not form per se a part of the invention.

The starting and terminal positions of travel for the ratchet means, and hence for the switch shaft **12**, are determined preferably by stop means including a pin **32** on the ratchet disc which abuts a stop lug **33**, pivoted at **34** to move slightly between stop pins **35**, so that at least a full 360° range is permitted the ratchet and switch shaft **12** in this embodiment.

A long coil spring **36** is employed to urge the ratchet wheel and shaft to a normal starting position.

The stationary, spirally-offset contact means is preferably, but not necessarily, in the form of arcuate metal strips **16**, **17**, **18**, and **19**, such as shown in Figs. 1 and 2, and all mounted on a flat base disc **20** of insulating material (Fig. 3), it being important to observe in the latter view that the contact arc or segment **19** is in part spirally offset or elevated from the plane of the base disc and the other contact elements, especially the initial contact member **16** (as depicted in Fig. 4).

Riveted, as at **19A**, to the terminal part of the spirally raised contact member **19** is an extension or terminal land in the form of a small wafer **22** of stiff insulating material, the middle one of the rivets **19A** passing through a tubular stud **23** (Figs. 3 and 4) and headed into the base disc **20**, by which means the end portion of contact strip **19** is raised from the plane of the disc **20** and the other contact arcs, as aforesaid.

The metal strip material, of which the contact **19** in particular is constructed, is chosen to have sufficient thickness and stiffness to support the pressure of the rotary or moving contacts **10** and **11**, the latter being of spring copper or bronze to flex as they travel from the lower contact level (as over contacts **17**, **18**) onto the higher, offset level toward the land **22**.

In Fig. 2, it will be observed that the terminal land member or extension **22** partly overlies the first, short contact strip **16**, and the ends of the two moving contact fingers **10** and **11**, in their dotted-line starting position, lie beneath the member **22** and part of the spirally offset end region of stationary contact strip **19**.

However, when the two rotary contacts **10** and **11** have traveled through a full revolution (as in Fig. 4) they rest wholly on the insulated terminal land member **22**, a full 360° away from their initial or home position on lower contact **16**.

In Fig. 2 the contact **11** is seen to have its wiping end **11A** offset to align radially with the end of the companion contact **10**; this makes possible a shorter extension of the exposed portion **22A** of the terminal wafer beyond the end of the spirally offset contact **19**, in order to ac-

commodate the two contacts 10 and 11. Also, for the particular stationary contact arrangement 16—19 shown, this offsetting achieves economy of the arcuate range available, as for example in bridging the two contact segments included between the radii X and Y (Fig. 2).

However, it will be understood by those skilled in the art that the terminal land portion 22A (or the length of contact 19) may be extended into the spiraling plane as much as desired, if the stop pin means 32 is removed to permit the rotary contacts to continue the desired amount beyond 360° in the event that greater range is required.

The particular angular overlapping configuration of the various stationary contacts 16, 17, 18, as along the arc between the radii X and Z, in Fig. 2, for one example, achieves a cross-connecting function for the intended application of the particular form of the switch illustrated; which function is augmented by the offset arrangement of contact part 11A for economy of angular space, as previously mentioned.

Desired circuit connections are extended from the several contact means 10, 11, 16, 17, 18, 19, wiper 15, and the grounded shaft 12 (for contact 11) to any desired instrumentality to be controlled.

It will be apparent that when the two moving contact fingers 10 and 11 have completed their permitted range of angular travel and lodge upon the terminal land 22, any circuit path across these fingers will be broken by reason of the insulating nature of the member 22; yet a full switching or connecting range of at least 360° will have been afforded by reason of the spiral offsetting and overhang of the end parts of contact 19.

In the operation of the form of switch shown in Fig. 1, energization of reset solenoid 31 will withdraw the holding pawl 30 from the ratchet teeth and permit spring 36 to restore the shaft 12 and contact fingers 10 and 11 to their dotted-line starting position (Fig. 2).

Impulsing of the advancing solenoid 27 will cause the pawl and spring mechanism 26, 28, 29, to step the ratchet wheel and move the contact fingers over the several stationary contact elements 16, 17, 18; and continued stepping will cause the contacts 10 and 11 to traverse the contact 19 and ultimately lodge upon the insulated land extension 22 (as in Fig. 4), whereupon, any existing circuit across said contacts 10 and 11 will be broken.

The latter open-circuit condition of the device will persist until such time as the switch is reset, as by energizing reset solenoid 31, to cause the spring 36 to turn the contact shaft 12 through a full retrograde movement back to the starting position, in which the wiper ends of contacts 10 and 11 will lie beneath the elevated or offset portion of the terminal stationary contact parts.

It will be apparent that the offset member 19 may be of insulating material throughout its length if it is desired to permit full 360° travel to the contact arms without any switching function in the terminal range of travel, in which case the terminal extension 22 may be omitted as a separate appendage.

Moreover, the arcuate lengths and shapes of the several contact elements 16 to 19 are not limiting, but may be altered to meet various switching requirements.

I claim:

1. In a rotary switch, rotatable contact means including a first radial contact arm of predetermined radial length; a second radial contact arm angularly displaced from said first arm and of greater radial length than the latter and having a returned end portion projecting angularly back to a position of radial alignment substantially opposite the end of said first contact arm; and arcuate stationary contact means positioned to be traversed by said rotatable contact means and including at least two electrically separated arcuate portions concentric to the rotative axis of said rotatable contact means and each lying at a radial distance therefrom to be contacted by one of said radially-aligned end portions of the rotatable contact arms, whereby said aligned end portions occupy a predetermined angular area and substantial radial portions of said contact arms are angularly offset and do not overlie each other.

2. A construction according to claim 1 in which said stationary contact means includes a part located in a plane normal to the rotative axis of said rotatable contact means, and a further portion extending spirally out of said plane, and said angularly-offset radial arm portions of the rotatable contact means are yieldable in an axial direction and can be displaced to follow said spirally-extending portion out of said plane without contacting each other.

3. In a rotary type switch, a rotatable member carrying a first radially-extensive contact arm and a second contact arm extending at one side of the first arm in a direction which is approximately parallel to and beyond said first contact arm both said arms being yieldable to spring in an axial sense, the second contact arm having an offset portion near its outer end projecting in a chordal sense back toward and terminating in a contactor portion which is substantially opposite the free contactor end of said first contact arm and spaced outwardly and radially away from the latter; together with stationary contact means arranged in circumambient relation to the rotative axis of said contact arm and having radially-spaced portions each respectively underlying the path of movement of one of said free contactor end portions of said arms, whereby said contactor portions engage the stationary contact means along the same radial line and may yield at least a limited amount in an axial sense without touching one another.

References Cited in the file of this patent

UNITED STATES PATENTS

1,752,149	Clurman	Mar. 25, 1930

FOREIGN PATENTS

870,160	France	Dec. 5, 1941
905,841	France	Dec. 14, 1945