Oct. 2, 1962 G. L. GOUGH, JR 3,056,874

SWITCH MECHANISM

Filed Dec. 18, 1959 2 Sheets-Sheet 1

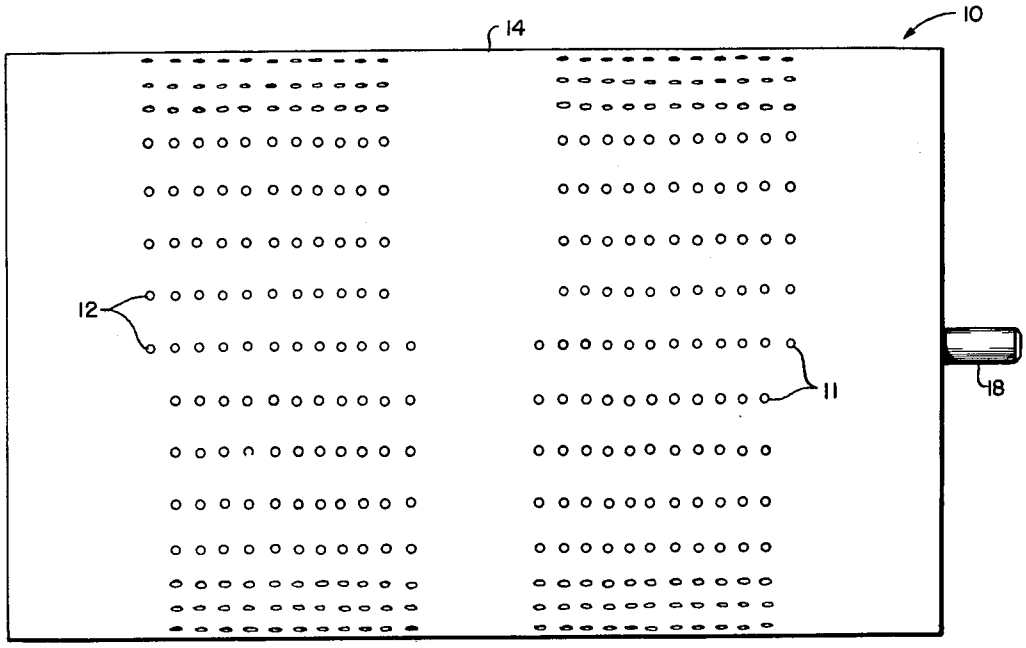


FIG. 1

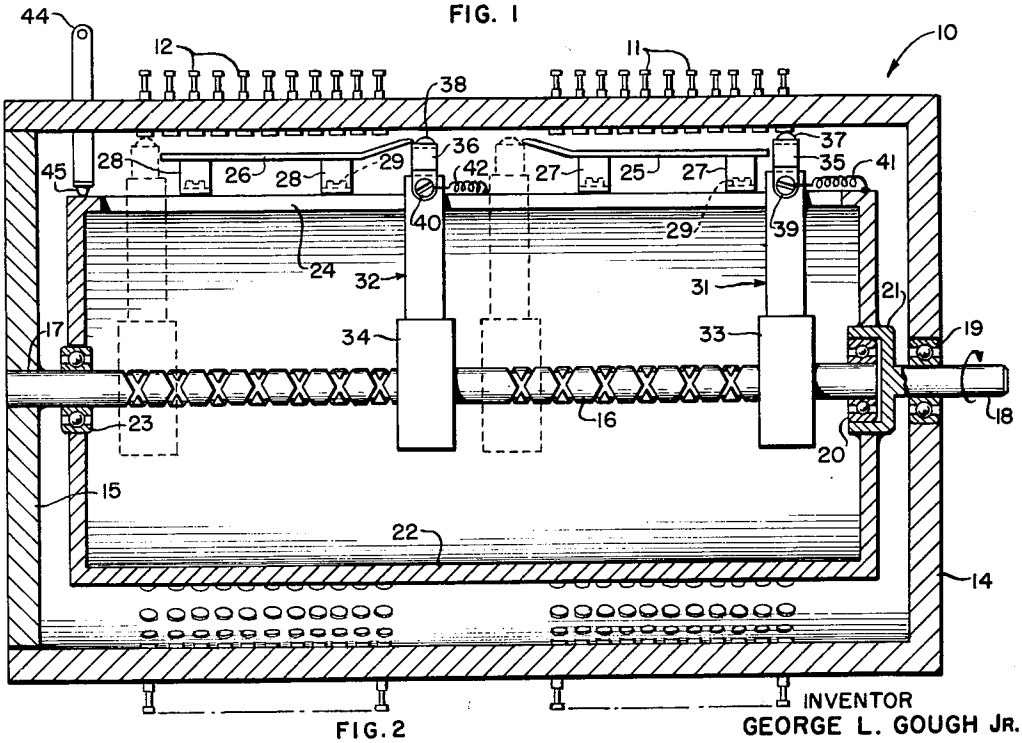


FIG. 2

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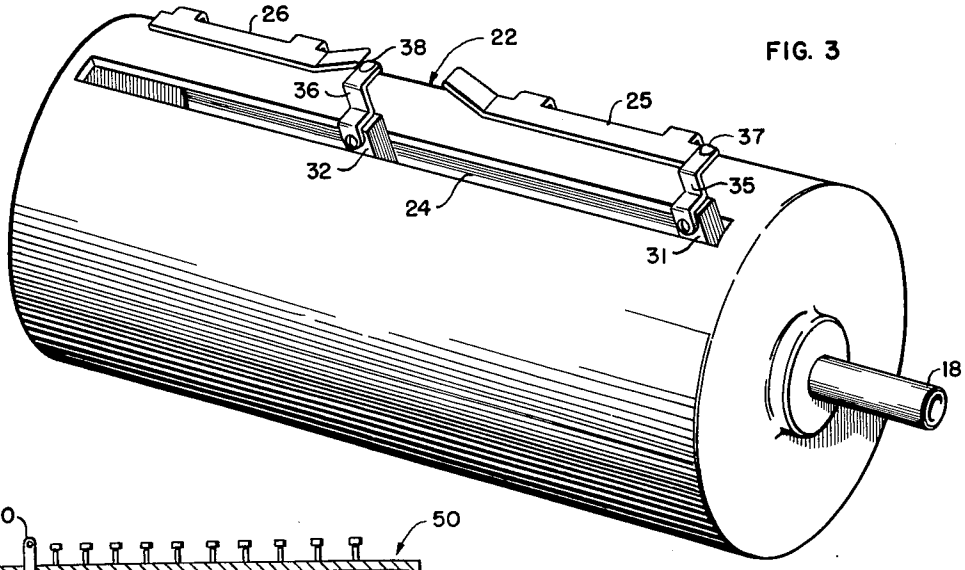
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SWITCH MECHANISM

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FIG. 3



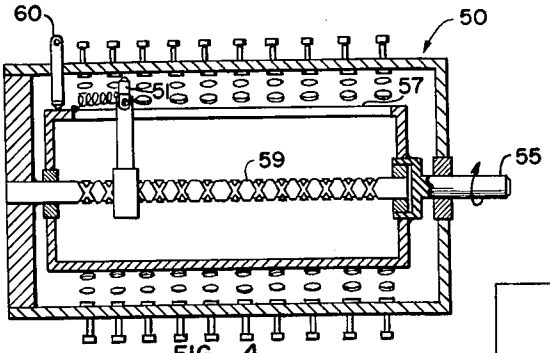


FIG. 4

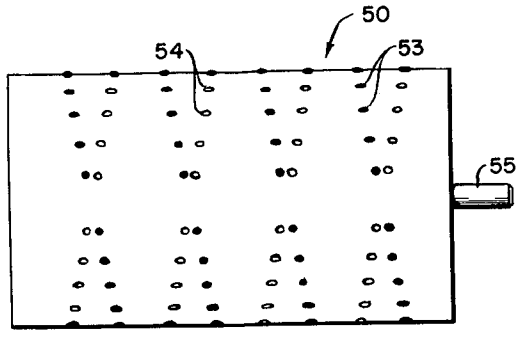


FIG. 5

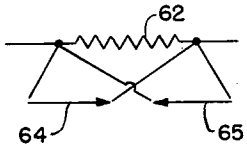


FIG. 6

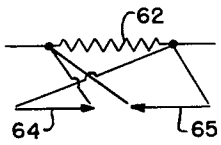


FIG. 7

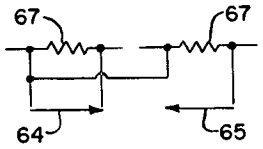


FIG. 8

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SWITCH MECHANISM

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Filed Dec. 18, 1959, Ser. No. 860,395
9 Claims. (Cl. 200—158)

This invention relates to multi-contact switches and more particularly to a multi-contact switch for providing continuously variable read-out information through rotation of a switch wiper shaft in but one direction.

At present, most physical contact switches have their contacts arranged in circular fashion in one plane and within 360 degrees. Hand-operated rotary wafer switches and conventional rotary steppin switches are examples of this type of design. With increased emphasis being placed on automation and integrated data processing systems, the need for greater information density than correspondingly greater contact density than can be provided by the aforementioned examples has become quite acute. Accordingly, it is an object of the present device to provide means wherein "read-out" intelligence may be secured from more contacts than is physically possible to place in one plane and within 360 degrees.

Another object is to provide a rotary switch capable of providing continuously variable read-out information through rotation of the switch shaft in but one direction.

A further object of the invention is to provide a multi-contact switch capable, upon the completion of a cycle of operation, of presenting the read-out information in either the same sequence as before or in the reverse of the sequence presented before without reversal of the direction of operation.

A feature of the invention includes a multi-contact switch having two sets of contacts with each set of contacts arranged in a helical path opposite to that of the other set.

Another feature of the invention is a pair of contact wipers, each wiper being associated with a set of helically arranged contacts, adapted to alternately engage the helically arranged sets of contacts.

Another feature is a pair of wiper re-actuation rails, each rail being associated with a wiper, adapted to permit the wipers to alternately engage their associated helically arranged contacts.

A more complete understanding may be obtained from the following detailed description of a specific embodiment of the invention when read in conjunction with the appended drawings, in which:

FIG. 1 is an outside view of a cylindrically shaped multi-contact switch having two sets of contacts, each set being arranged in a helix opposite to the other;

FIG. 2 is a cross-sectional view of the multi-contact switch showing the internal components of the switch and the contacts shown in FIG. 1;

FIG. 3 is a perspective view of the wiper driving cylinder;

FIG. 4 is a sectional view of an alternate embodiment of the present invention which utilizes only one contact wiper;

FIG. 5 is a view of the cylindrical housing of the alternate embodiment showing two sets of helically arranged contacts superposed on one another; and

FIGS, 6, 7 and 8 are schematic illustrations of some of the possible connections of the two sets of helically arranged contacts with which each embodiment is provided.

Referring now to FIGS. 1 and 2, there is shown a switch **10** which includes two sets of contacts, **11** and **12**, embedded in the wall of a cylindrically shaped stationary housing **14**. It will be noted that contacts **11** are

arranged in a right-hand helix while contacts **12** are arranged in a left-hand helix. The reason for this arrangement will become evident in the following description and explanation. The cylindrically shaped stationary housing **14** is provided with an end cap **15** and disposed centrally within the housing **14**, is a double helix lead screw **16** secured fixedly to the end cap **15** at **17**. A rotatable shaft **18**, supported by a bearing **19** in the housing **14**, receives the free end of the lead screw **16** and supports the free end of the screw in a bearing **20**; the shaft **18** is adapted to be rotated by any suitable source of rotative power (not shown). Fixedly secured, as for example by welding, to the enlarged portion **21** of the shaft **18**, is one end of a cylindrically shaped wiper driving cylinder **22** made of a suitable electrically conductive material such as copper or brass. The opposite end of the wiper driving cylinder **22** is rotatably supported by a bearing **23** which is supported by the lead screw shaft **16**. Thus it is seen that rotation imparted to the shaft **18** causes the wiper driving cylinder **22** to be rotated about the lead screw **16** within the stationary housing **14**.

It will be understood that the driving arrangement shown is merely illustrative of one of many suitable arrangements, e.g., the well known planetary gear arrangement could also be utilized to operate the driving cylinder.

The wiper driving cylinder **22**, as may be seen in FIGS. 2 and 3, is provided with an elongated slot **24** machined in the surface of the holder and fixedly secured to the outer surface of the wiper drive holder **22** adjacent to the elongated slot **24**, are deactivation rails **25** and **26** supported by integrally formed blocks **27** and **28**, respectively. Blocks **27** and **28** are secured to the cylinder **22**, as by threaded fasteners **29**. Wiper assemblies or rotors **31** and **32** are positioned for longitudinal movement within the slot **24** and are supported for longitudinal movement by blocks **33** and **34**, which encircle the lead screw **16**. The blocks **33** and **34** are provided with drive pins (not shown) which ride in the grooves of the double helix lead screw **16**. Resilient contact wipers **35** and **36**, having integrally formed contacts **37** and **38**, respectively, are fixedly secured to the wiper assemblies **31** and **32** by threaded fasteners **39** and **40**, respectively; the wipers are connected electrically to the wiper driving cylinder **22** by leads **41** and **42**, respectively.

A fixed read-out wiper **44**, extending through the stationary housing **14**, is provided with a resilient member **45** which engages electrically the wiper driving cylinder **22**, thereby furnishing, through the holder, a common connection to the wipers **35** and **36**.

To facilitate a better understanding of the present device, a brief description of its operation will be set forth. With the wiper assemblies **31** and **32** in their rightward, or initial position, as shown in FIG. 2, rotation of the shaft **18** in the direction of the arrow will rotate the wiper driving cylinder **22** and the wiper assemblies **31** and **32**, residing within slot **24**, in a like direction. Since the assemblies **31** and **32** are provided with blocks **33** and **34** having drive pins (not shown) which ride in the grooves of the double helix lead screw **16**, leftward longitudinal movement is imparted to the assemblies as they rotate about the lead screw. When the assemblies **31** and **32** have reached their extreme leftward position, as shown in dashed outline, the double helix lead screw is effective to reverse the longitudinal movement of the assemblies as continued rotation is imparted to the holder **22**.

As the wiper assembly **32** begins to move to the left, the de-activation rail **26** will depress the resilient wiper **36** thereby moving the contact **38** out of electrical engagement with the left-hand helically arranged contacts repre-

sented by terminal 12. At this time, resiliently mounted contact 37 of wiper 35 remains in electrical engagement with the right-hand helically arranged contacts, as represented by contact 11. During the entire leftward movement of the wiper assemblies or rotors 31 and 32, the wiper 35 will remain in electrical engagement with the contacts 11 and the wiper 36 will be held out of contact with the contacts 12 by the de-activation rail 26. When the wiper bodies 31 and 32 have reached their extreme leftward position, as shown by the dashed lines in FIG. 2, it will be seen that the de-activation rail 26 no longer depresses the wiper 36 whereupon the resilient wiper 36 returns to its normal position and engages the left-hand helically arranged contacts 12. Due to the double helix on the lead screw 16, continued rotation of the shaft 18 in the clockwise direction, causes the wiper assemblies 31 and 32 to now be moved to the right. As the wiper assemblies move to the right, de-activation rail 25 depresses the wiper 35, moving the contact 37 out of electrical connection with the right-hand helically arranged contacts 11. Since the de-activation rail 26 no longer depresses the wiper 36, wiper 36 remains in electrical engagement with the left-hand helically arranged contacts 12 during the entire rightward movement of the wipers.

The read-out wiper 44 remains in constant electrical engagement with the wiper driving cylinder 22 and is placed in electrical engagement alternately with circuits or electrical apparatus which may be connected to the terminals 11 and 12. It will be noted that due to the use of the double helix lead screw 16, continued rotation of the shaft 18 in one direction permits the wipers 37 and 38 to traverse all of the contacts, to return to their initial position, and to establish contact with any predetermined contact by entering upon another terminal-traversing cycle, without having to stop the movement of the wipers and reverse the direction of rotation of the shaft 18.

FIGS. 4 and 5 illustrate an alternate embodiment which may be utilized to practice the present invention. The switch 50, shown in FIG. 4, is similar in structure, component parts and operation to switch 10 shown in FIG. 2, with two major exceptions, viz., switch 50 has only one contact wiper 51 and has the right-hand helically arranged contacts 53 superposed on the left-hand helically arranged contacts 54 as may be seen in FIG. 5. Thus when rotation is imparted to the shaft 55 from a suitable source of rotative power (not shown), the wiper drive holder 57 and double helix lead screw cooperatively impart alternately right-hand and left-hand helical movement to wiper 51. During the left-hand helical movement, wiper 51 traverses and successively engages the contacts 54 and in the reverse direction, the wiper traverses and successively engages the contacts 53. It will be noted that due to the superposed arrangement of the contacts 53 and 54, the wiper 51 engages only one set of contacts during each direction of helical movement, accordingly, each set of contacts is alternately placed in electrical engagement with the stationary or read-out wiper 60.

It will be understood that any electrical element capable of bearing intelligence can be connected to the contacts externally of the switches 10 and 50, e.g., capacitors for the storage of energy which is indicative of information, resistances of varying values which can be indicative of information or potentials of varying magnitudes which can also be intelligence bearing. Further, it will be noted that the contacts could be replaced with a single multi-turn helical resistance wire and a potentiometer of great versatility would be provided.

FIGS. 6, 7 and 8 illustrate, schematically, the versatility of the possible connections the two sets of helically arranged contacts are able to provide. Resistance 62 represents, schematically, intelligence bearing resistances which can be connected to the contacts 11 and 12 or 53 and 54 externally of the switches 10 and 50, respectively, and the arrows 64 and 65 represent the directional movement of the wipers 35 and 36 or 51. Fig. 6 demonstrates that it is possible to connect resistance values to each set of contacts such that the values are presented in a predetermined sequence in one direction of wiper movement and in the reverse order of the sequence in the opposite direction of wiper movement. FIG. 7 is illustrative of the fact that the intelligence bearing resistances can be connected to the sets of contacts 11 and 12 or 53 and 54, such that the intelligence or read-out information is presented in the same sequence during each direction of wiper movement. FIG. 8 illustrates that by connecting different resistance values, represented by resistances 67 and 68, to each set of contacts, the switch is capable of providing an extremely large amount of variable information and it will be recalled that in each set of contact connections continuously variable read-out information is provided through continued rotation of the wiper or wipers in but one direction. Thus the great utility of the switch, for example, in integrated data processing systems, is seen as no time will be lost stopping and reversing the direction of the rotation of the wipers when it is desired to return to a contact element which has been contacted previously. And, due to the connections available as shown in FIGS. 6 and 7, once the program of any data processing system is determined, the contact connections can be selected which will shorten the amount of time required to go from the last contact connection of one series of contact selections to the first contact connection of a second series of contact selections of the most frequently repeated sequence of series contact selections.

It is manifest that many variations may be made in the specific embodiments shown and described without departing from the spirit and scope of the present invention.

What is claimed is:

1. In a multi-contact switch, a housing, a first set of contacts mounted in the housing and arranged in a right-hand helix and a second set of contacts mounted in the housing and arranged in a left-hand helix, a double helix lead screw mounted fixedly in the center of the housing, contact engageable means mounted on the lead screw and having driving pin portions engaging the threads of the lead screw, means to rotate said contact engageable means, said rotating means and said double helix lead screw cooperatively adapted to impart alternately right-hand and left-hand helical movement to said contact engageable means to cause said contact engageable means to alternately traverse and successively engage the contacts of each set of helically arranged contacts.

2. In a multi-contact switch, a cylindrically shaped housing, a first set of contacts mounted in the housing and arranged in a right-hand helix and a second set of contacts mounted in the housing and arranged in a left-hand helix, a double helix lead screw centrally disposed and fixedly mounted within the housing, contact engageable means mounted on the lead screw and having driving pin portions engaging the threads of the lead screw, a contact engageable means drive holder disposed within the housing for rotation around the lead screw and adapted to impart rotation to said contact engageable means, means to rotate said drive holder, said drive holder and said double helix lead screw cooperatively effective to impart alternately right-hand and left-hand helical movement to said contact engageable means to cause said contact engageable means to alternately traverse and successively engage the contacts of each set of helically arranged contacts.

3. In a multi-contact switch, a housing, two sets of contacts mounted in the housing with each set of contacts arranged in a helical path opposite to that of the other set, a wiper associated with each set of contacts and normally urged into contact therewith, means for imparting simultaneously rotational and reversible longitudinal movement to the wipers to cause one wiper to trace the helical path of its associated set of contacts in one direction of longitudinal movement and to cause the other wiper to trace the helical path of its associated set of contacts in

the reverse direction of longitudinal movement, and means for restraining each wiper from engaging its associated set of contacts except at such time as each wiper is tracing the helical path of its associated set of contacts.

4. In a multi-contact switch, a housing, two sets of contacts mounted in the housing with each set arranged in a helical path, a double helix lead screw centrally disposed within the housing, a pair of contact wipers mounted on the lead screw and having driving portions engaging the threads of the lead screw, each wiper associated and urged into engagement with one set of contacts, a rotatable member disposed within the housing and adapted to impart rotational movement to the wipers, means to rotate said rotatable member, said double helix lead screw effective to impart reversible longitudinal movement to the wipers when said wipers are rotated, said wipers positoned on the lead screw in relation to one another so as to trace alternately the helical path of their associated contacts and successively engage the contacts therein, and a de-activating member associated with and mounted adjacent to each wiper for rotation therewith and said de-activating member adapted to restrain the wiper from engaging its associated contacts at such time the wiper is tracing a path other than the path of its associated contacts.

5. In a multi-contact switch, a cylindrically shaped housing, one set of contacts embedded in the wall of the housing and arranged in a right-hand helical path, a second set of contacts embedded in the wall of the housing and arranged in a left-hand helical path, a double-helix lead screw centrally disposed and fixedly mounted within the housing, a pair of contact wipers mounted on the lead screw and having driving pin portions engaging the threads of the lead screw, each wiper associated and urged into engagement with the contacts of one of said two sets of contacts, a wiper drive holder disposed concentrically within the housing for rotation around the lead screw and having a portion thereof engaging said wipers to impart rotation thereto, means to rotate said wiper drive holder, said wiper drive holder and said double helix lead screw cooperatively adapted to impart alternately right-hand and left-hand helical movement simultaneously to the wipers through continued rotation of the wipers in but one direction to cause the wipers to alternately follow the paths of and engage their associated contacts, and a de-activation rail mounted on said wiper drive holder adjacent each wiper and adapted to restrain the wiper from engaging its associated contacts except at such time the wiper is tracing the helical path of its associated contacts.

6. In a multi-contact switch, a cylindricallly shaped housing, two sets of contacts embedded in the wall of the housing with each set arranged in a helical path, a double helix lead screw mounted fixedly in the center of the housing, a pair of contact wipers mounted on the lead screw and having driving portions engaging the threads of the lead screw, each wiper associated with and urged into engagement with the contacts of one of the two sets of contacts, a wiper drive holder disposed within the housing for rotation around the lead screw and having a portion thereof engaging said wipers to impart rotation thereto, means to rotate said wiper drive holder, said wiper drive holder and said double helix lead screw cooperatively effective to impart alternate right-hand and left-hand helical movement to each wiper through continued rotation of the wipers in but one direction, said wipers so positioned on said lead screw such that when one wiper is following the helical path of its associated wipers the other wiper is following a helical path opposite to the path of its associated contacts, and a de-activation rail mounted on said wiper drive holder adjacent each wiper and adapted to withhold each wiper from engagement with its associated contacts when each wiper is following a helical path opposite to that of its associated contacts.

7. In a multi-contact switch, a cylindrically shaped housing, one set of contacts embedded in the wall of the housing and arranged in a right-hand helical path, a second set of contacts embedded in the wall of the housing and arranged in a left-hand helical path, a double helix lead screw centrally disposed and fixedly mounted within the housing, a contact wiper assembly associated with each set of terminals and mounted on said lead screw, said assemblies including a resilient contact wiper portion normally urged into engagement with its associated contacts and a driving pin portion engaging the threads of the lead screw, a rotatable cylindrical wiper assembly drive holder centrally disposed within the housing surrounding the lead screw and having an elongated slot formed in the wall thereof adapted to receive and guide said wiper assemblies and permit said holder to impart rotation to the assemblies, said wiper drive holder and said double helix lead screw, upon continued rotation of said wiper assembly drive holder in but one direction, cooperatively adapted to simultaneously impart alternate right-hand and left-hand helical movement to the wiper assemblies to cause the assembly associated with the right-hand helically arranged contacts to follow the path of and successively engage the contacts of said right-hand associated set of contacts during said right hand helical movement and to cause said assembly associated with the left-hand helically arranged contacts to follow the path of and successively engage the contacts of said left-hand associated set of contacts during said left-hand helical movement, and a deactivation rail associated with each wiper assembly and mounted on said wiper drive holder adjacent said slot along the lateral path of said associated wiper relative to said drive holder, each deactivation rail having an inclined portion on one extremity thereof adapted to engage and depress said associated resilient wiper to maintain said wiper out of engagement with its associated contacts while said wiper is not tracing the helical path of its associated contacts, said deactivation rail of a predetermined length so as to release said depressed resilient wiper and allow said wiper to re-engage its associated contacts and remain in engagement therewith while said wiper is tracing the helical path of its associated contacts.

8. In a multi-contact electrical switch, a cylindrical housing, a first set of contacts embedded in the wall of said housing and arranged in a right-hand helical path, a second set of contacts embedded in the wall of said housing arranged in a left-hand helical path and superposed on said first set of contacts, a double helix lead screw centrally disposed and fixedly mounted within said housing, a contact wiper urged into cooperative engagement with said contacts and having driving pin portions engaging the threads of said screw, a rotatable member disposed within said housing and adapted to impart rotational movement to said contact wiper, means to rotate said rotatable member, said rotatable member and lead screw cooperatively effective to impart alternately right-hand and left-hand helical movement to said wiper to cause said wiper to traverse and successively engage the contacts of said right-hand helically arranged set of contacts during said right-hand helical movement and to traverse and successively engage the contacts of said left-hand helically arranged contacts during said left-hand helical movement.

9. In a multi-contact electrical switch, a cylindrical housing, a first set of contacts embedded in said housing and arranged in a right-hand helical path, a second set of contacts embedded in said housing arranged in a left-hand helix and superposed on said first set of contacts, a double helix lead screw mounted fixedly concentrically of said housing, a contact wiper mounted on said lead screw for rotational and reversible longitudinal movement, a rotatable wiper drive holder disposed concentrically within said cylindrical housing surrounding said lead screw and adapted to impart rotation to said wiper, means to rotate said wiper drive holder, said wiper drive

holder and said lead screw cooperatively adapted to impart uni-directional rotational and reversible longitudinal movement to said wiper to cause said wiper to traverse and successively engage the right-hand set of helically arranged contacts in one direction of longitudinal movement and traverse and successively engage the left-hand helically arranged set of contacts in the reverse direction of longitudinal movement.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,056,874 October 2, 1962

George L. Gough, Jr.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 15, for "steppin" read -- stepping --; line 43, for "re-actuation" read -- de-actuation --.

Signed and sealed this 16th day of April 1963.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents