Jan. 19, 1965 B. E. SHLESINGER, JR 3,166,645

MULTIPLE CONTACT SWITCH WITH ELASTIC OPERATOR

Filed March 27, 1963 2 Sheets-Sheet 1

Fig. 1

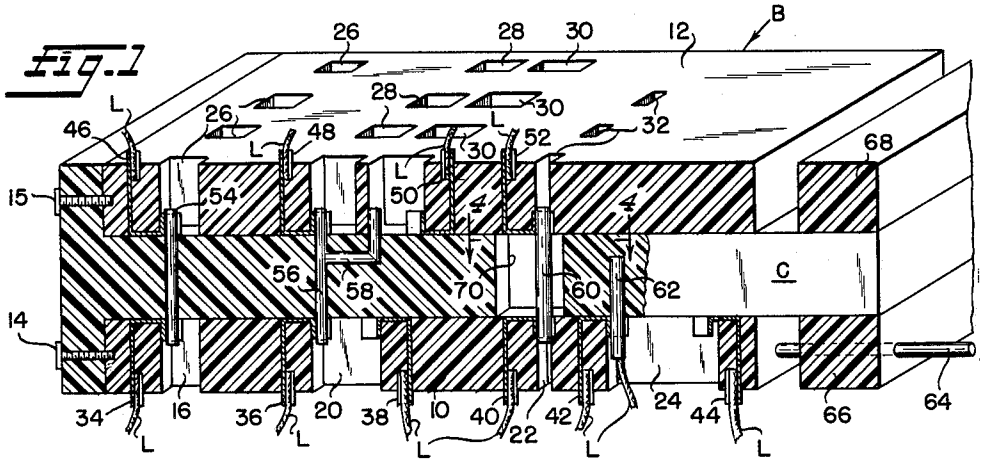


Fig. 2

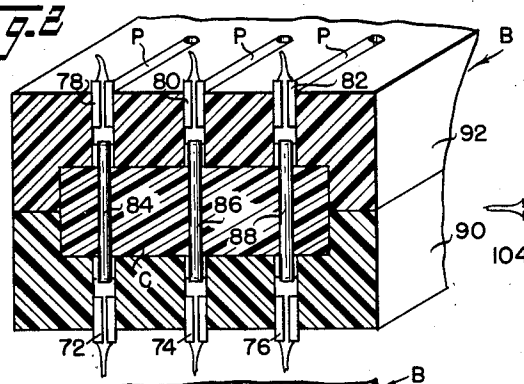


Fig. 3

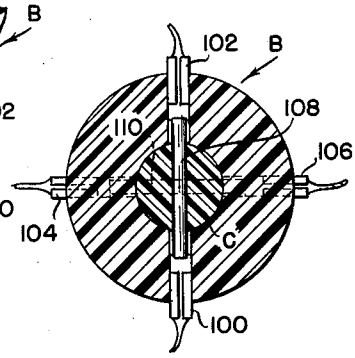


Fig. 4

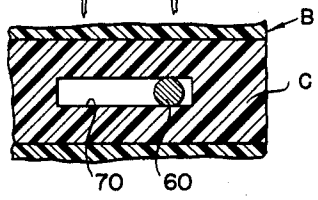
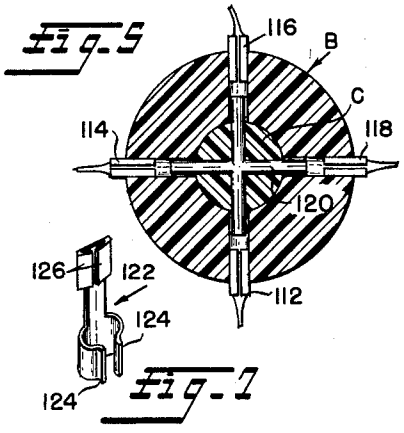


Fig. 5



Expandable Cable Extended This Way

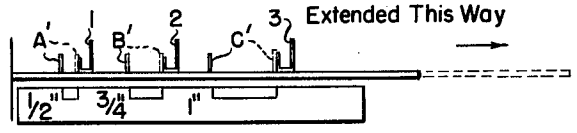


Fig. 6

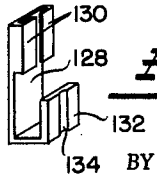


Fig. 8

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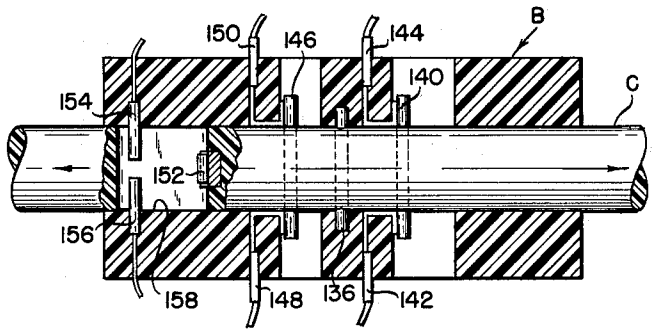
ATTORNEYS

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MULTIPLE CONTACT SWITCH WITH ELASTIC OPERATOR

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Fig. 9



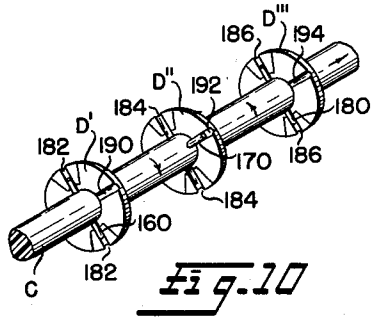


Fig. 10

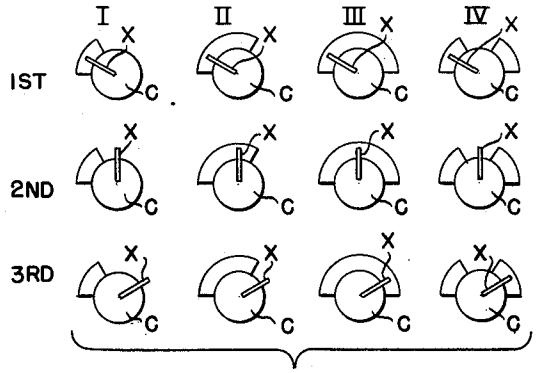


Fig. 11

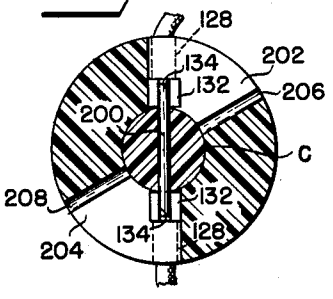
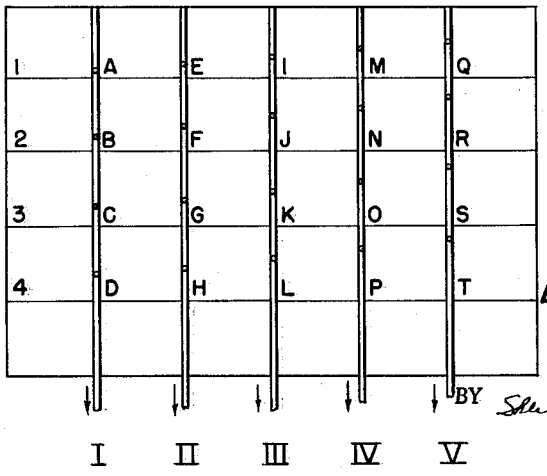


Fig. 12

Fig. 13



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3,166,645

MULTIPLE CONTACT SWITCH WITH ELASTIC OPERATOR

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Filed Mar. 27, 1963, Ser. No. 268,321
19 Claims. (Cl. 200—16)

This invention pertains to multiple contact switches for programming and the like.

Most programming switches in the past have been designed to operate sequentially. With the development of the programming art, a need for sequential as well as random selection has occurred. The incorporation of random and sequential selection in a single switching system has required complex as well as expensive equipment.

It is an object of this invention, therefore, to provide a multiple contact switch that is simple in construction and inexpensive to manufacture and one which will provide both random and sequential selection.

It is a further object of this invention to provide a multiple contact switch that may be used in programming systems, telemetering, telephony, and the like.

Yet another object of this invention is to provide a multiple contact switch that will provide a large number of different connections.

Still another object of this invention is to provide a multiple contact switch which will have a minimum number of parts and a maximum of efficiency of operation.

A further object of this invention is to provide a contact switch which is operable by any type of motor mechanism.

Other objects and various features of this invention will be pointed out or will occur to those skilled in the art from reading of the following specification in conjunction with the accompanying drawings, in which:

FIGURE 1 is an isometric view of a switch as taught by this invention a portion being shown in section;

FIGURE 2 is a fragmentary isometric view a portion of which is in cross section illustrating a modification of this invention;

FIGURE 3 is a sectional view of another modification of this invention;

FIGURE 4 is an enlarged fragmentary section taken along the lines 4—4 in FIGURE 1 and viewed in the direction of the arrows;

FIGURE 5 is a sectional view showing another modification of this invention;

FIGURE 6 is a schematic showing the relaxed and extended positions of the cable under switch operating conditions;

FIGURES 7 and 8 show two different types of contact bars;

FIGURE 9 shows a further modification of this invention a portion of which is shown in section;

FIGURE 10 is an isometric view showing a portion of the switch broken away from the housing or casing and illustrating the relationship of the contact pins with respect to the conductor plates under various operating conditions;

FIGURE 11 shows diagrammatically various contact arrangements capable of one embodiment of this invention;

FIGURE 12 is a sectional view of a further modification of this invention;

FIGURE 13 is a graphic illustration of a particular sequential programming system as taught by this invention.

Generally indicated in the drawings by the letter B is a switch block housing. The switch block housing B is constructed of some non-conductive material and

preferably is secured to some support (not shown). The means for securing block B to a support may be any conventional means such as screws, bolts, clamps, adhesives, or the like.

FIGURE 1 shows the block B as having a generally rectangular configuration. The block B is comprised of a lower contact support member **10** and an upper contact support member **12**. Between the support members **10** and **12**, is a resilient, yieldable cable or elastic member generally indicated in the drawings by C. In FIGURE 1, the cable C is secured to one end of the block B by screw members as for example **14** and **15**. It is to be noted that in FIGURE 1, the cable C has a T-shape. The arms of the T are bolted to the block B as illustrated. It is obvious that other means can be provided for securing the cable C to the block B. It is, however, important that the cable be secured to the block B in such a manner as to permit movement of the cable C with respect to the block B. The opening between the base **10** and the top **12** for receipt of the cable C should be reasonably snug when the cable C is placed therein but not so snug as to bind the cable C from movement therein.

The cable C is constructed of non-conductive material of an elastic nature such as natural and synthetic rubbers. It may be of the same material as the base **10** and the top **12**.

Within the block B are a series of recesses generally indicated as **16, 20, 22, 24, 26, 28, 30** and **32**. As noted in FIGURE 1, certain successive recesses are of increased length for reasons as will be obvious from reading the section (infra) entitled Sequential Operation. Set into the block B are a series of contact members **34, 36, 38, 40, 42, 44, 46, 48, 50** and **52**. The contact members are generally L-shaped. The members may be set in the block at the time of formation of the block or may be later set therein.

The cable C has a series of conductor pins **54, 56, 58, 60** and **62** set therein. With the exception of pins **58** and **62**, they are shown in FIGURE 1 as extending through the cable C. The aforementioned pins **58** and **62** extend only a portion of the way through the cable C.

Contact members **34** through **52** are normally in the relaxed position of cable C as shown in FIGURE 1 in contact or out of contact as the case might be. Cable C is further connected to block B by a guide bar **64** or bars (not shown). The cable C is laminated to bottom holding member **66** and top holding member **68**. Guide bar **64** extends through holding member **66** to maintain a cable member C in position at all times with respect to the block member B. Additional guide members **64** may be provided to extend through the upper holding member **68** into the top member **12** of the block B to limit any play in conjunction therewith during extension or contraction of the cable C. The guide member **64** is slidable on the holder **66**. It is to be noted that the contacts **34** through **52** and the conductor member **62** are provided with leads L connected to circuits (not shown).

Operation of FIGURE 1 system

It will now be obvious that when the cable C is pulled to the right in FIGURE 1 with the block B remaining stationary, the conductor pin **54** which connects the contact **34** with contact **46**, is moved to the right and out of engagement with the contact members to thereby break the circuit. Subsequently, conductor member **56** which is connected to member **58** will break the circuit between contact **36** and contact **48** and make the circuit between contact **38** and contact **50** through conductors **58** and **56**.

The recess **70** in the block C is a by-pass system which

allows conductor 60 to maintain the circuit from contact 40 through contact 52 while cable C is being extended. The slot 70 in the cable C permits the cable C to be extended without interference with the conductor 60.

Upon further extension of the cable C, the conductor 62, to which is secured a lead, breaks contact with the contact member 42 and makes contact with the contact member 44.

It will be obvious that printed circuits can be utilized in or on the block B as required. The block shown in FIGURE 1 illustrates a series of recesses 26, 28 and 30 on the top member thereof, all of which operate individual circuits (not shown specifically).

FIGURE 2 shows the side by side relationship of contact 72, 74, 76, 78, 80 and 82 and conductors 84, 86 and 88 in a typical type of block B. Printed circuits P are shown. The block B is generally composed of two channel shaped members 90 and 92 which may be cemented together after the cable C has been laid therebetween to form the sandwich. Operation is similar to that shown in FIGURE 1.

FIGURE 3 illustrates another embodiment of this invention in which the cable C is cylindrical and moves in a block B which is also cylindrical. Pairs of contacts 100 and 102 and 104 and 106 are at right angles to each other. Contacts 100 and 102 are connected by a conductor 108, and contacts 104 and 106 are connected by a conductor 110. The conductors and pairs of contacts are spaced axially from each other for sequential operation.

FIGURE 5 shows a slightly different modification in which all four contacts 112, 114, 116 and 118 are connected or disconnected by a conductor member 120 which is cruciform and makes contact with all four simultaneously as shown, or in pairs as desired (not shown), if the contacts are spaced axially as desired and the slots provided are similar to slots 16, 20, 22, 24, 26, 28 and 30 and are of a reasonable length.

FIGURES 7 and 8 show the contact members in detail. In FIGURE 7, the contact member 122 is provided with resilient gripper fingers 124 and is crimped to the lead wire by clamps 126. Similarly, contact member 128 in FIGURE 8, which is crimped to the wire by clamps 130, is provided with an L-shaped configuration of which the upwardly projecting base leg 132 is provided with a recess 134 into which the conductors slip as will here and after be pointed out.

Sequential operation

In FIGURE 6, the sequential operation is shown schematically. The Rule is shown with increments of one half inch, three quarter inch, and one inch. The cable C has therein conductors A', B' and C'. Upon pulling of the cable C to the right it will stretch, since the cable is secured on the left side to the block B. The conductors A', B' and C' are imbedded in the cable C as illustrated in FIGURE 1. As the cable C is stretched to the right, conductor A' will come into engagement with contact 1. It will be obvious that all of the conductors A', B', and C' have moved one half inch. Conductor A' will be the only one in engagement with one of the contacts and that, of course, will be in engagement with contact 1. Upon further stretching of the cable another quarter of an inch, conductor A' will still maintain its engagement with contact 1 and, subsequently, conductor B' will come into engagement with contact 2. Conductor C' will still be one quarter of an inch away from engagement with contact 3. Upon further extension of the cable to the right, conductor C' will engage contact 3. Contacts 1 and 2 will be in engagement with conductors A' and B when conductor C' is in engagement with contact 3. The reverse operation will take place upon slackening of the cable in that conductor C' will move away from contact 3 first; then conductor B away from contact 2; and finally conductor A' will move away from contact 1 and the cable will then be back in its original position.

FIGURE 9 illustrates how the cable C may be fixed in the block B centrally thereof as by a pin 136. With the arrangement as illustrated, the cable C may be stretched from both sides of the pin 136 at different time intervals or simultaneously as desired. The conductor 140, for example, can be moved away from contacts 142 and 144 subsequent to or prior to engagement of conductor 146 with contacts 148 and 150. It is obvious that any number of contacts, such as previously illustrated, and arrangements may be worked out as desired. In FIGURE 9 the conductor 152 may be short and not projecting beyond the surface of the elastic member. Contacts 154 and 156 will then project beyond the surface of block B and into the recess or slot 158 of the elastic member C. In this instance when the elastic member is stretched the conductor 152 will move into engagement with the two projecting contacts 154 and 156.

Random or sequential selection

In FIGURE 10, the break away illustrates how this invention can be used to provide random selection of contacts rather than sequential. In FIGURE 10, let us assume that the disks D', D'' and D''' are imbedded in a block such as previously described. Let us also assume that there is clearance for rotation of the conductors 160, 170 and 180. Let us consider that the areas 182, 184 and 186 on the disks D', D'', and D''' have a recess therein and that the disks also have non-conductive areas recessed as at 190, 192 and 194. Let us assume that the stretch on the cable C is to the right. Let us also assume that the conductors 160, 170, and 180 engage sequentially the disks D', D'' and D''' in that order. Let us then suppose that it is our intention to illuminate conduction of the conductor 170 with the conductive areas 184. In the first instance, all of the conductors are aligned up in normal engagement with their various conductive areas 182, 184 and 186. The cable is then stretched until the conductor 160 engages the recess in a conductive surface 182 of the disk D'. Conductors 184 and 186 are yet not engaged with their respective discs D'' and D'''. The cable is then rotated to the right as indicated by the arrow. The recess in the conductive area 182 prevents the conductor 160 from jumping therefrom as the cable is rotated to the right, The conductor 170 then positions in the recess 192 in the non-conductive area upon further extension of the cable. Conduction is made through conductor 160 but not through conductor 170. Let us assume that it is our intension to have conduction through conductor 180. Conductor 180 is still out of engagement with the disc D''', therefor by rotation to the left as indicated by the arrow it will then be aligned with the conductive area 186 and can be positioned in the recess in the conductive area 186. Since conductor 170 is locked in the recess 192, it can not swing to the left upon twisting of the cable in same manner as previously described with conductor 160. It will now be obvious that any series of contacts can be eliminated upon the expansion and stretching of the cable so long as there is a means for locking a portion of the cable against rotation. The means of course, in this instance, are the recesses in the disc D', D'' and D''', which lock the conductors 160, 170 and 180 against further rotative movement upon stretching of the cable and rotating of the cable. So long as the conductor is in any one of the recesses, and so long as tension is maintained on the cable, the conductor will maintain that portion of the cable in twisted relation with respect to any other portion as desired. This arrangement permits the operator of the programming system to select those contacts in a sequence which he desires to by-pass and those circuits which he wishes to connect in advance of the stretching of the cable C. With this arrangement, for example, the operator could by-pass the first three contacts by initially rotating the cable to the non-conductive position and by locking the conductors in the non-conductive position as illustrated and subsequently by

rotating the remainder of the cable to the conductive position for the next contact in series, and so on.

FIGURE 12 more clearly illustrates one method of handling the system just described. In FIGURE 12, contacts similar to that shown in FIGURE 8 are provided. A conductor **200** is shown in the cable C resting in slots **134** of the contact **128**. The block B has slotted areas **202** and **204** in which recesses **206** and **208** are provided. Upon rotation of the cable C in a clockwise direction, the conductor **200**, if not positioned in the slot **134**, by tension on the cable C will rotate with the cable C in a clockwise direction until it reaches the end of the slot **202**. Upon further expansion of the cable, the conductor **200** will position itself in the slots **206** and **208** respectively. If there is a slack of the cable C, the conductor **200** will withdraw itself from the slots **206** and **208**, and upon rotation counter clockwise of the cable C, the conductor will position itself above the slots of the contact members **128**. Upon applying tension on the cable C, the conductor **200** will then position itself in the recesses **134**, in the contact legs **132** of the contact member **128**.

FIGURE 11 explanation

FIGURE 11 illustrates various types of contact areas which can be utilized in the cylindrical type switch as heretofore described. The numerals I through IV illustrate a contact area of approximately 45°, of approximately 100°, of approximately 180°, and split contact areas of approximately 45° each, respectively. In the first row, the conductor X is in contact in all the various types of contact areas. In the second row, the cable C has been rotated and the conductor X is out of contact in the columns of I and IV and in contact in the columns of II and III. In the third row, the cable has been further rotated and the conductor X is now out of contact with the conductive areas in the columns under I and II and in contact in columns of III and IV.

FIGURE 13 description

In FIGURE 13, cables I through V are mounted in a block B. Conductors **1**, **2**, **3**, and **4** extend transversely of the path of travel of the cables and across the block B. Conductors A through T are mounted in cables I through V respectively. Upon actuation of all of the cables I through V simultaneously in the direction indicated by the arrows, a sequential operation will occur in which conductors A, E, I, M, and Q will contact the conductor **1** in that sequence and so on.

It is obvious that the sequence as set out in FIGURE 13 may be varied as desired and the one shown illustrates one typical arrangement.

While the invention has been described in connection with different embodiments thereof, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains, and as may be applied to the essential features hereinbefore set forth and as fall within the scope of the invention or the limits of the appended claims.

Having thus described my invention what I claim is:

1. A multiple contact switch comprising a pair of members one of which is non-elastic and the other of which is elastic, said elastic member having a portion fixed and a portion movable, said non-elastic member having a set of substantially in line serially spaced contacts, said elastic member having a set of substantially in line serially spaced contacts mounted on said movable portion, each set cooperating with each other to successively operate a series of circuits when the elastic member is stretched, means for linearly stretching said elastic member, and means for sequentially limiting the stretching of said elastic member in successive increments beginning with one increment and continuing in sequence with the succeeding increments in the direction away from said one increment and preventing movement of said contacts on said elastic member when said circuits are successively operated.

2. A multiple contact switch as in claim 1 and wherein said sequential limiting means includes a series of serially spaced stops.

3. A multiple contact switch as in claim 1 and wherein said sequential limiting means includes a set of serially spaced slots.

4. A multiple contact switch as in claim 1 and wherein said sequential limiting means includes a set of serially spaced slots of successively increasing length beginning with the one adjacent said fixed portion and continuing in sequence in the direction away from said fixed portion.

5. A multiple contact switch as in claim 1 and wherein said sequential limiting means includes a set of serially spaced slots of successively increasing length beginning with the one adjacent said fixed portion and continuing in sequence in the direction away from said fixed portion, said non-elastic and elastic member contacts projecting into said slots.

6. A multiple contact switch as in claim 1 and wherein said elastic member fixed portion is the end of said elastic member.

7. A multiple contact switch as in claim 1 and wherein said means for limiting the sequential stretching includes said contacts.

8. A multiple contact switch as in claim 1 and wherein one of said members is rotatable with respect to the other.

9. A multiple contact switch as in claim 1 and wherein said elastic member is rotatable.

10. A multiple contact switch as in claim 1 and wherein said elastic member is rotatable to move any one of its spaced contacts from a conductive position to a non-conductive position, and wherein said sequential limiting means includes a set of serially spaced slots of successively increasing length beginning with the one adjacent said fixed portion and continuing in sequence in the direction away from said fixed portion, said slots having a conductive area and a non-conductive area whereby when one of said members is rotated, said switch contacts are moved from conductive to non-conductive position and vice versa.

11. A multiple contact switch as in claim 1 and wherein said elastic member is rotatable to move any one of its spaced contacts from a conductive position to a non-conductive position, and wherein said sequential limiting means includes a set of serially spaced slots of successively increasing length beginning with the one adjacent said fixed portion and continuing in sequence in the direction away from said fixed portion, said slots having a conductive area and a non-conductive area whereby when one of said members is rotated, said switch contacts are moved from conductive to non-conductive position and vice versa, said non-conductive and conductive areas having means for retaining said contacts in said non-conductive and conductive positions.

12. A multiple contact switch comprising at least one stationary member and a plurality of movable elastic members, each of said elastic members having a portion fixed and a portion movable, said stationary member having a set of substantially in line serially spaced contacts, said elastic members each having a set of serially substantially in line spaced contacts mounted on said movable portion and cooperating serially with said stationary member contacts to successively operate a series of circuits when said elastic member is stretched, means for linearly stretching said elastic member, and means for sequentially limiting the stretching of said elastic member in successive increments in the direction away from said fixed portion and preventing movement of said contacts on said elastic members when said circuits are successively operated.

13. A multiple contact switch as in claim 12 and wherein said stationary member has at least two sets of said

serially spaced contacts, and each of said sets has one of said elastic members slidably mounted in said stationary member.

14. A multiple contact switch as in claim 13 and wherein said elastic members are substantially flat cables.

15. A multiple contact switch as in claim 1 and wherein said elastic member is in sliding contact with said non-elastic member.

16. A multiple contact switch as in claim 1 and wherein said non-elastic member includes a block having a passageway extending therethrough, said elastic member including a movable resilient portion mounted in said passageway, and said resilient portion projecting from one end of said passageway.

17. A multiple contact switch as in claim 1, and having a second pair of members, contacts and means operating in the direction opposite to said first mentioned pair.

18. A multiple contact switch as in claim 1, and having said fixed portion of said elastic member secured to said non-elastic member centrally with respect to said elastic and non-elastic members, and means for stretching said elastic member operating on either side of said fixed portion in opposite directions.

19. A multiple contact switch as in claim 1, and wherein said elastic member includes a by-pass slot cooperating with a contact on said non-elastic member to by-pass said contact when said elastic member is stretched.

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