Nov. 2, 1948. H. C. HARRISON 2,452,568

SWITCHING DEVICE

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FIG. 1

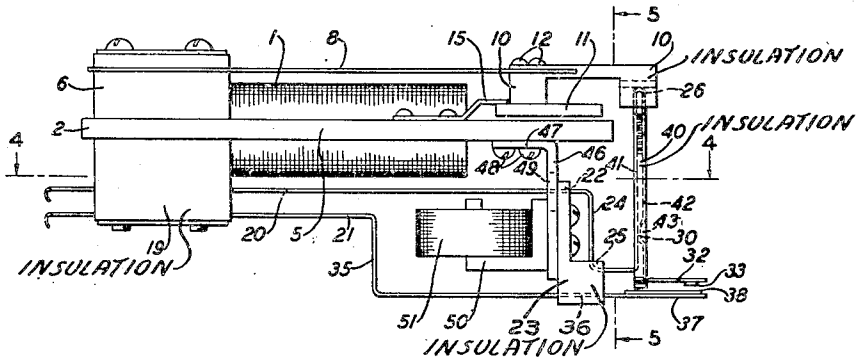

FIG. 2

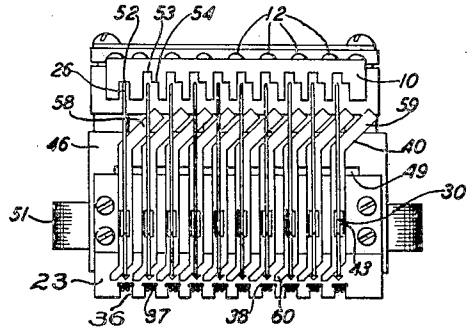

FIG. 3

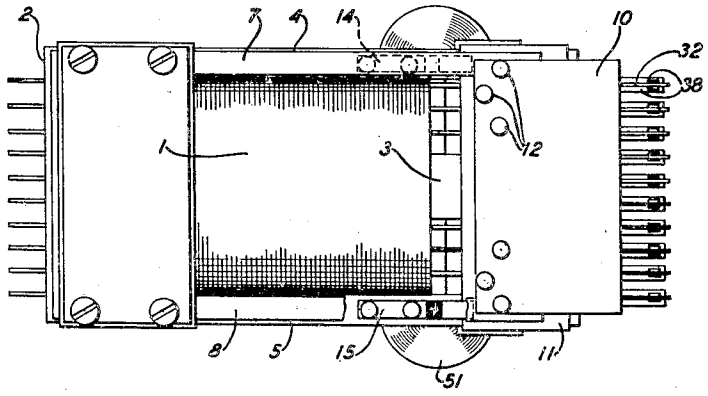

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FIG. 4

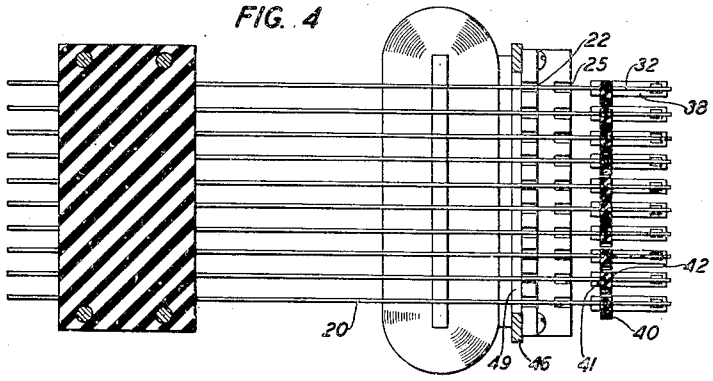


FIG. 5

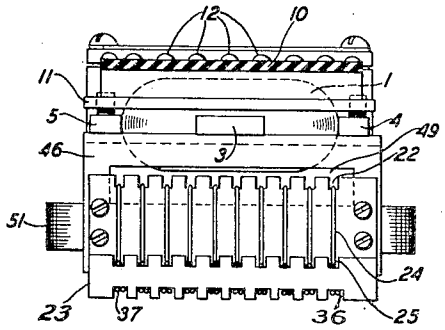


FIG. 6

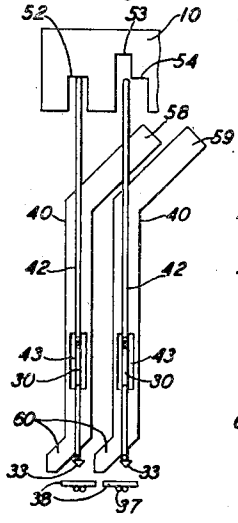


FIG. 7

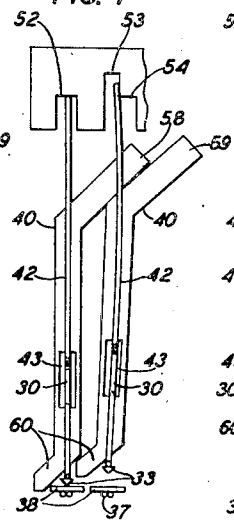


FIG. 8

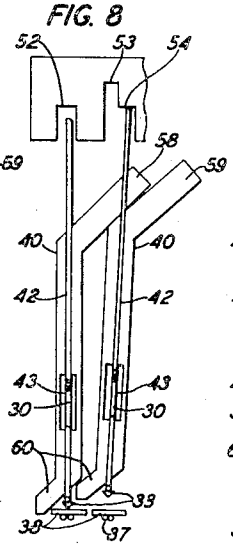
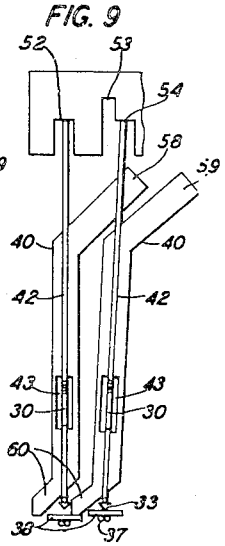


FIG. 9



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UNITED STATES PATENT OFFICE

2,452,568

SWITCHING DEVICE

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Application October 1, 1943, Serial No. 504,582

9 Claims. (Cl. 177—353)

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This invention relates to switching devices and particularly to such devices for establishing succeeding electrical connections.

An object is to simplify the construction and increase the capacity of such switches with the addition of simple and inexpensive parts.

Another object is to increase the utility by minor inexpensive changes in the mechanism.

Heretofore sequence contact arrangements have been employed, in which succeeding electrical connections were established by the aid of step-by-step means including pawl and ratchet mechanisms and rotating cam devices operating on spring contacts.

The present invention which relates in general to such sequence contact arrangements dispenses entirely with such prior step-by-step means and a feature thereof is an arrangement comprising a coil and an armature therefor, sets of contact springs and a member connected to each set of contact springs for causing a succeeding set to operate each time the armature is attracted.

Another feature is an arrangement of this kind in which by a simple structural change on these members, a preceding connection at a set of contact springs may either be allowed to remain or be altered by a succeeding member on its operation.

Another feature is the arrangement of another coil in connection with this mechanism whereby the preceding connections are maintained locked in their actuated positions as long as the coil is energized, that is, a series of connections established in sequence may be released simultaneously. This mechanism may therefore be employed not only to establish succeeding electrical connections but also to establish combinations of connections for code signaling or other purposes.

The invention has been illustrated in the accompanying drawings in which Fig. 1 shows a side view of a structure in accordance with the applicant's invention.

Fig. 2 is a front view of a switch shown in Fig. 1;

Fig. 3 is a top view of the switch shown in Fig. 1;

Fig. 4 is a cross-section taken on line 4—4 of Fig. 1;

Fig. 5 is a cross-section taken on line 5—5 of Fig. 1; and

Figs. 6 to 9 illustrate different positions of the operating members for the spring contact sets.

The mechanism consists essentially of a coil 1, a core 2 having an inner core member 3 inside the coil 1 and the two return pole-pieces 4 and 5 outside the coil extending towards the front or right-hand side looking at Figs. 1 and 3. To the

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connecting block 6, mounted at the rear of the core 2, are connected two light springs 7 and 8, to the opposite ends of which is connected an insulation block 10 and to this block is connected an armature plate 11 by means of a series of rivets 12. The armature 11 is restricted in its upward movement by means of backstops 14 and 15 attached to the pole-pieces 4 and 5, respectively. At the rear of core 2 on the under side thereof are also connected by means of an insulation block 19 two rows of springs, an upper row is marked 20 and a lower row is marked 21. The upper row 20 consists of ten separate wires tensioned to normally rest in individual slots 22 in an insulation block 23 and as they leave this block they are bent downwardly at 24 to rest in individual slots 25 in block 23 and then bent forwardly and upwardly and then down back over themselves to form a loop 26 and further down into a loop 30 and downwardly again and forwardly at 32 where they are provided with contacts 33. The lower row of springs 21 consists of ten pairs of wires bent downwardly at 35 and then forwardly and tensioned to normally rest in slots 36 in block 23 and at 37 each pair is provided with a separate contact plate such as 38, each contact plate 38 being opposite a corresponding spring in the group 20. To each spring in the group 20 there is connected in the loop 26 an insulation member 40 to be held tightly between the two members of this loop 26 resting in opposite slots 41 and 42 in the member 40 and held from shifting lengthwise by means of the loop 30 entering into a transverse aperture 43 in the members 40. The block 23 is secured to a bracket 46 which in turn is connected at 47 to the return pole-pieces 4 and 5 and by means of screws 48. This bracket 46 is provided with a longitudinal aperture or opening 49 for the passage of the springs 20. At the left-hand side of this bracket 46 is connected a U-shaped yoke piece 50 on one side member of which is mounted a locking coil 51, the yoke piece being wide enough to pass across and below the ten springs 20 for the magnetic holding of these springs as they are lowered toward the yoke piece one by one and the coil 51 is energized as will be described hereinafter. The upper ends of loops 26 are normally arranged in slots in the block 10, the loop of the first spring 20 towards the left looking at Fig. 2, is located in slot 52 and engages the bottom thereof while the remaining loops are located in the corresponding succeeding slots which are shaped differently from slot 52. The left-hand side of these slots is deeper than the right-hand side, as

shown, for example, at 53 and 54 of the second slot. The succeeding loops 26 while normally located in the left-hand section of the slots extend only in these sections to a depth almost even with the bottoms of the right-hand sections. The purpose of this shape of the succeeding slots will be described hereinafter.

The operation of this mechanism is as follows: When the coil 1 is energized, the armature 11 is attracted by the members 3, 4 and 5 of the core and pulled downwardly thereby. This shifts the block 10 downwardly and the slot 52 which, as stated, engages the first spring of group 20, causes this spring to be lowered and make contact with the associated springs of the group 21. As this first spring is lowered the coil 51 may be energized to attract and hold it in locked position. The normal position of the first spring and second spring are shown in Fig. 6 and the lowered position of this first spring is shown in Fig. 7. It will be noted that in this case the first card with its upper oblique extension 58 has engaged a corresponding extension 59 of the second card and causes this card to shift or turn slightly towards the right as shown in Fig. 7 by the cam action between these extensions 58 and 59 with the slot 25 for the second spring serving as the pivotal point. The second spring will, however, not be lowered by the block 10 due to the deep section 53 therein but will be free to enter this section and engage the right-hand side of this section. On the other hand, this second spring due to the shifting of the associated card, will bend slightly as shown at 60 toward the left. Then when the armature 11 is released by the coil 1 and the block 10 is raised to its normal position, the second spring will slip out of the section 53 and enter the section 54 and restore to its straight normal condition, as shown in Fig. 8. Thus on the subsequent lowering of the block 10, the second spring will be engaged by the bottom surfaces of section 54 and be lowered to make a connection with the associated pair of contacts in the group 21. As this second spring is lowered, as shown in Fig. 9, its associated card will engage with its extension 59 the corresponding extension as the next succeeding card of the third spring and shift this third card the same as it was itself shifted by the first card. In this manner succeeding connections are established for each operation and release of the armature and the block 10, and as each connection is made the corresponding spring will be locked by the coil 51 in actuated position. However, the arrangement is such that on the closing of each succeeding connection between a spring of the group 20 and a spring of the group 21, the operation of a succeeding spring in the group 20 will cause the opening of the preceding connection. This arrangement has also been illustrated in Figs. 6 to 9. It will be observed that each card is provided at its lower end with an oblique projection extending toward the left so that when, for example, the second card, as shown in Fig. 9 is lowered, the associated projection 60 will engage the contact 38 on the spring of the group with which the preceding group of the spring 20 is engaged and lower it to disengage it from this preceding spring of group 20. Projections, such as 60, need not, of course, be provided on all of the cards and if desired they may be entirely eliminated so that some succeeding connections or all of them may remain as established and lock to the end of the series. In any event, when all ten connections have been made the locked

springs of the group 20 may be released simultaneously by the deenergization of the holding magnet 51. Thus various combinations of connections may be established by the succeeding operations and releases of the armature. These contact making arrangements may be used for various purposes for example, to establish succeeding connections over a series of contacts or a succeeding closing and opening of a connection arranged in code formations. Furthermore, besides the spring groups 20, 21 other springs may be added below the group 21 to establish other combinations of connections on each operation of a spring 20 to connect a spring 21 so that the capacity of the switches may be increased without any extensive changes being made.

What is claimed is:

1. A switch comprising a coil, an armature, sets of contact springs directly operable by said armature and a member connected to each set of contacts for causing a succeeding set of contacts to be directly operated by said armature and a preceding set of contacts to be released each time the armature is actuated to establish succeeding temporary electrical connections.

2. A switch comprising a coil, an armature therefor, sets of contact springs directly operable by said armature, a member connected to one contact spring of each set for causing said one contact spring of a succeeding set to be directly operated by said armature to connect with another contact spring of said succeeding set and for causing said other contact spring on the preceding set to be released from the associated contact spring to which it was connected each time the armature is operated.

3. A switch comprising a coil, an armature therefor, sets of contact springs, a member connected to one contact spring of each set for causing said one contact spring of a succeeding set to be operated to connect with another contact spring of said succeeding set each time said armature is operated, means for holding said one contact spring in its actuated position during the succeeding releases and operations of the armature, and a projection on each of said members so arranged that the projection on a succeeding member when operated moves said other contact spring of a preceding set out of contact with the associated one contact spring.

4. A switch comprising a coil, an armature therefor, sets of contact springs, a member connected to one contact spring of each set for causing said one contact spring of a succeeding set to be operated to connect with another contact spring of said succeeding set each time said armature is operated, a projection on each of said members so arranged that the projection on a succeeding member when operated moves said other contact spring of a preceding set out of contact with the associated contact spring.

5. A switch comprising a coil, an armature therefor, sets of contact springs, an insulation member attached to one contact spring of each set each of said members having a projection operative on a succeeding member of a succeeding set on the operation of the armature for shifting said succeeding member into a position so that said one contact spring carrying said succeeding insulation member will be engaged and moved by the armature on its succeeding operation to connect with another contact spring of said succeeding set and another projection on each of said insulation members so arranged that when the associated contact spring is moved by the arma-

ture, said other projection will engage and move said other spring in the preceding set to disconnect it from the associated spring carrying the insulation member.

6. A switch comprising a coil, an armature operated by said coil when energized, sets of contact springs one of the springs of each set being directly operable by said armature to establish a connection with a companion spring in the corresponding set, an insulation member attached to said one armature operable spring in each set, said insulation members having cooperating cam surfaces so arranged that when one of said insulation member-carrying springs is operated by the armature a cam surface on said insulation member cooperates with a cam surface on the next succeeding insulation member to place the attached spring in condition to be operated upon the next operation of the armature for establishing a connection with the companion spring.

7. A switch comprising a coil, an armature operated by said coil when energized, sets of contact springs one of the springs of each set being directly operable by said armature to establish a connection with a companion spring in the corresponding set, an insulation member attached to each said armature operable spring, said members having cooperating cam projections so arranged that when the armature operates on one such spring a cam projection on said spring acts on a cam projection on a succeeding insulation member to shift the attached spring into condition to be operated upon by the armature when it is again operated and so that on said operation of said first-mentioned member carrying spring another cam projection of said associated member acts on the companion spring of the preceding set to separate it from its associated actuated spring.

8. In a magnetic counting device including a pole structure and means for transmitting a series of magnetizing impulses thereto, armatures associated with said pole structure and corresponding respectively to said impulses, each armature being movable to count its corresponding impulse responsive to the resulting impulse of magnetic force emanating from said pole structure, means normally preventing each armature except the first from moving to count any said impulse of force, and means including spring means effectively tensioned responsive to each said force impulse preceding the last, and released responsive simply to the termination thereof, for nullifying said preventing means with respect to the next succeeding armature.

9. In a magnetic counting device including a pole structure and means for transmitting a series of magnetizing impulses thereto, armatures associated with said pole structure and corresponding respectively to said impulses, each armature being movable to count its corresponding impulse responsive to the resulting impulse of magnetic force emanating from said pole structure, means normally preventing each armature except the first from moving to count any said impulse of force, and means including spring means effectively tensioned responsive to the counting movement of each armature preceding the last, and released responsive simply to the termination thereof, for nullifying said preventing means with respect to the next succeeding armature.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
752,150	Gehrung	Feb. 16, 1904
1,972,941	Lewis	Sept. 11, 1934
2,116,173	Judge	May 3, 1938
2,172,322	Blomberg	Aug. 16, 1938
2,241,156	Powell	May 6, 1941
2,292,489	Stibitz	Aug. 11, 1942
2,305,450	Stibitz	Dec. 15, 1942
2,307,868	Stibitz	Jan. 12, 1943