

Oct. 30, 1962

R. G. FOWLER ET AL
MULTIPLE-POINT SWITCHES

3,061,692

Original Filed Oct. 4, 1956

2 Sheets-Sheet 1

FIG. 1

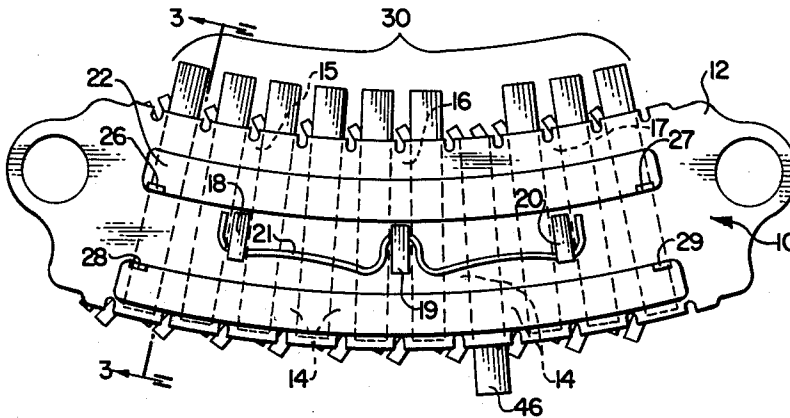


FIG. 2

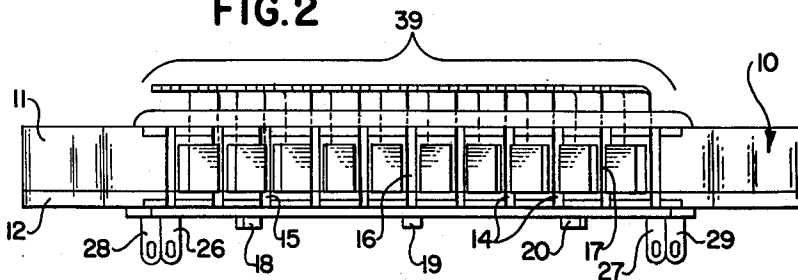
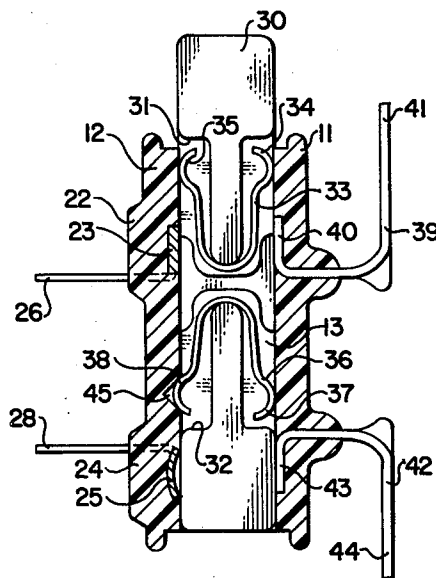


FIG. 3



INVENTORS
ROLAND G. FOWLER
OSCAR F. LARSEN
PAUL A. DALE &
MARK J. GARVEY

BY *Ronald A. Kline*
Wilbert Hawk, Jr.
THEIR ATTORNEYS

1

3,061,692

MULTIPLE-POINT SWITCHES

Roland G. Fowler, Newfield, and Oscar F. Larsen, Paul A. Dale, and Mark J. Garvey, Ithaca, N.Y., assignors to The National Cash Register Company, Dayton, Ohio, a corporation of Maryland
Original application Oct. 4, 1956, Ser. No. 614,005, now Patent No. 2,985,364, dated May 23, 1961. Divided and this application Nov. 19, 1959, Ser. No. 854,066
2 Claims. (Cl. 200—16)

This invention relates to a switching unit of the type which may be adapted for use on calculators, adding machines, accounting machines, and similar mechanisms having a plurality of electrical circuits to be connected in different combinations. One particular use of the invention relates to calculating machines adapted to control tape recording, as described and claimed in pending application, Serial No. 614,005, filed by Roland G. Fowler et al., on October 4, 1956, now Patent No. 2,985,364, to which reference is herein made, and from which this is a divisional application.

In the one particular embodiment of the invention as herein shown and described, a portion of a calculator, in the form of a differentially settable member selectively positioned during a machine operation, actuates a switching unit as herein disclosed in accordance with the value of a depressed amount key. Other like switching units may be set in accordance with the type of machine operation—such as add, subtract, sub-total, total, etc., and means may be provided for resetting the switches to normal at either the beginning or end of a machine operation.

The primary object of the invention is to provide a relatively simple switching unit, yet one which is of the positive action type and extremely durable in operation. The invention includes certain novel features of construction and combinations of parts, a preferred form or embodiment of which is hereinafter described with reference to the accompanying drawings forming a part of the specification.

In the drawings:

FIG. 1 is a view in side elevation of a switching unit embodying the invention;

FIG. 2 is a view in top plan of the unit shown in FIG. 1;

FIG. 3 is a view in section on line 3—3 in FIG. 1, on an enlarged scale;

FIG. 4 is a view in side elevation of the invention mounted on a calculator, showing a portion of the calculator differentially settable member, and means for actuating the member when selectively positioned during a machine operation; and

FIG. 5 is a view in side elevation of means for resetting the switching unit during the beginning of a machine operation.

Referring to FIGS. 1—3, a switching unit, generally designated by the numeral 10, consists of an insulating body 11 and an insulating cap-piece 12, both being preferably molded of a dielectric material such as wear-resistant nylon. The body 11 is molded with a plurality of radial channels 13, each being separated by a partition wall 14 extending toward the cap-piece 12 and flush with it. In the form of the invention herein shown, there are ten such channels 13 to correspond with the digits "1 to 9" and "0," as provided in the usual calculating machine, although a different number may be employed as required for other uses of the invention.

As shown in FIG. 1, partition walls 15, 16, and 17, have outwardly extending tenons 18, 19, and 20, respectively, which extend into and through mortise holes in the cap-piece 12. The undersides of the tenons 18, 20, and the upperside of the intervening tenon 19 are notched

2

for receiving a retaining spring 21 to hold the body 11 and cap-piece 12 firmly together.

On the inside of the cap-piece 12, opposite an arcuate reinforcing formation 22 on the outside thereof, is an electric bus conductor 23, FIG. 3, having a flat arcuate surface which opens into an upper zone of all of the radial channels 13. A second external reinforcing formation 24, like arcuate formation 22, has molded integrally with it a dished electric bus conductor 25, also of arcuate shape, and opening into the bottom zones of all of the radial channels 13, as seen in FIG. 3. The conductor 23 has extending therefrom at both ends and directed to the outside of the cap-piece 12, like terminals 26 and 27, and likewise, the conductor 25 is equipped with a pair of externally extending terminals 28 29, FIG. 2.

For each radial channel 13 there is provided a plunger 30, made of an insulating material such as nylon, and being shown collectively by a bracket in FIG. 1. A particular one of these plungers 30 is shown in FIG. 3, as it appears from the section 3—3 in FIG. 1, riding in its channel in the "up" position. Each side of each plunger 30, adjacent each end thereof, is relieved to provide an upper U-shaped recess 31 and a lower U-shaped recess 32. In upper recess 31 is positioned a modified U-shaped conductor 33, of spring material, having arcuate contact portions 34 and 35, portion 34 slidably engaging the inside wall of the insulating body 11, and portion 35 slidably engaging the inside wall of cap-piece 12. In the lower U-shaped recess 32 is a similar modified U-shaped electric conductor 36, having an arcuate contact portion 37 slidably engaging the inside wall of body 11, and an arcuate contact portion 38 slidably engaging the inside wall of cap-piece 12.

In the form of the invention herein shown, there are ten terminal contacts like contact 39 molded integrally with the switch body 11, there being one such switch contact 39 for each channel 13, having an internal contact portion 40 facing its associated channel, and an external portion 41 for making connections thereto. These contacts 39 are shown collectively by the bracket in FIG. 2, all having the same reference numeral.

At this point it may be said that the modified U-shaped conductors 33 and 36 are duplicated on the opposite side of each plunger 30, the internal contact portion 40 of terminal contact 39 being wide enough so that if a plunger 30 is depressed, the two upper contact portions 34 of U-shaped conductors 33 will make pressure contact with that portion 40.

Cooperating with the lower U-shaped conductors 36 is a series of terminal contacts 42 molded integrally with the body portion 11, there being one terminal contact 42 for each channel 13 with an internal contact portion 43 directed therewithin, and an external portion 44 for making connections thereto. As with the upper U-shaped conductors 33, the lower U-shaped conductors 36 are duplicated on both sides of each plunger 30. The portions 43 of the terminal contacts 42 are also wide enough to accommodate the U-shaped conductors 36 on both sides of the plunger. Therefore, if the plunger 30 is in its "up" position, no connection exists between the upper bus conductor 23 and the terminal contact 39, or between the lower bus conductor 25 and the terminal contact 42.

In the upper position of the plunger 30, as shown in FIG. 3, the arcuate contact 38 of lower U-shaped conductor 36 engages a groove 45 on the inside surface of cap-piece 12, whereas in the lower position of the plunger that contact 38 engages the dished surface of bus conductor 25 so that the plunger 30 is yieldingly retained either in the "open" position shown in FIG. 3, or in the "closed" condition, in which the plunger is depressed.

For one particular use of the invention, as set out in

detail in pending application, Serial No. 614,005, as depressed plunger 46, FIG. 1, represents a value, such as "6," and indicates that the "6" key of an associated denominational key bank (not herein shown) has been depressed and the machine caused to perform an entry cycle of operation. Prior to such machine operation, a differentially settable member is positioned in accordance with the value of the depressed key, such as the "6" key, and is then actuated to set the switching unit 10 accordingly. Then at the beginning of the next machine cycle the switching unit is restored to normal "up" condition by means such as that to be hereinafter described.

As shown in FIG. 4, secured to an ear 50 extending from the rear end of a downwardly extending arm of each of the diverging levers 51, one such lever being provided for each denominational key bank and set in accordance to the key depressed therein, is a bracket 52 holding a downwardly extending pin 53. A sleeve 54 slidably fits over pin 53 and has a circumferential groove 55 slidably fitting within an associated slot 56 in a guide and actuating member 57. In this instance, the length of the slot 56 is equivalent to the movement of the pin 53 when moved by the diverging lever 51 from one position, such as "home," to the extreme position under control of the highest order key, such as the "9" key, in the denominational key bank. Therefore, the ten plungers 30 provided in this one instance represent positions from "zero" to "9," and are each controlled in accordance with the movement of the diverging lever 51 under control of the amount keys. A complete description of the key bank and its associated diverging lever is adequately set out in the pending application herein referred to, however, such a complete showing and description are not deemed essential for the purposes of this invention and its mode of operation.

The actuating member 57 is supported by a slotted bracket 58, FIG. 4, which rides on a pair of spaced-apart pins 59 and 60 carried in a machine frame plate 61. A forked lever 62 engages a pin 63 carried on the lowermost end of the bracket 58, this lever 62 herein shown as being pinned to a machine drive shaft 64 which is supported by a second frame plate 65. During each machine operation, shaft 64 is rocked first counter-clockwise and then returned clockwise to its initial position prior to the end of the operation. Thus, in view of the interconnection between the lever 62 and the bracket 58, the guide and actuating member 57 is moved first in the direction of the arrow 66, and then returned to its starting position in the direction of the arrow 67, during each machine operation. In such movement the sleeve 54, as moved along the guide slot 56 by the diverging lever 51, actuates the switch in accordance to the corresponding key depressed in the denominational key bank. As shown in FIG. 4, the switching unit 10 is fixedly carried on spaced apart rods 78 and 79 carried by frame plate 61.

Although the actuating member 57 and the sleeve 54 are returned to their initial, upper positions during each machine operation, as set out above, the switching unit 10, being of the positive action type, remains "closed" until reset by returning the depressed plunger 30 back to its initial "open" position. Journaled in machine frame 65, FIG. 5, is a shaft 68, operable by first being rocked counterclockwise and then clockwise during the beginning of each machine operation. An arm 69, pinned to the shaft 68, carries a rocker arm 70 aligned with and extending under the various plungers 30 of the switching unit 10. A plurality of spaced apart teeth 71 are carried by the arm 70, one tooth for each plunger and located radially in line therewith. As the shaft 68 rocks first counter-clockwise, the arm 69 swings its rocker arm 70 up against the bottom edge of the switch unit to restore to the upper position any plunger which has been depressed in a preceding machine operation. The shaft 68 then rocks clockwise and the rocker arm 70 is restored to normal, ineffective position. This readies the switch-

ing unit 10 for the next entry of data, according to the key depressed in the denominational key bank, as above described.

Because there are two of the U-shaped conductors 33, FIG. 3, between each terminal contact 39 and common conductor 23, there is a double safety factor in that the contact portion 40 is wide enough so that both may brush across it. The same is true regarding the U-shaped conductors 36 and their contact members 25 and 42, and if it is desired to run the common conductors 23 and 25 in parallel, there would be a safety factor of four rather than two in making the connection, it being assumed that terminal contacts 39 and 42 for a given plunger 30 are connected together.

Although the switching unit herein disclosed is described in relation to one particular function of a calculating machine, it is obvious that such a switch construction has utility in many other organizations of parts and modes of operations. It is also apparent that such a unit may be actuated manually by one's fingers or any other means desirable. Therefore, it is seen that we have provided a rather unique and simplified construction, and yet one which is extremely effective and reliable for the purposes intended, and while we have described the invention in the one particular form, it is obvious that structural changes will be made without departing from the spirit of the invention, and we, therefore, desire not to be limited to that precise form beyond the limitations which may be imposed by the following claims.

What is claimed is:

1. An electrical switching unit including, in combination, an electrical insulating body having at spaced intervals therealong open-sided channels cut therein; an upper contact extending through the switch body at each channel, said contacts each having a wiping surface opening into its channel; a lower contact extending through the body at each channel, said lower contacts each having a wiping surface opening into its channel; an insulating cap-piece secured to the body and closing the sides of the channels; there being secured to the cap-piece on the side facing the channels an upper bus conductor common to all the upper contacts and a lower bus conductor common to all the lower contacts, said lower bus conductor being dished longitudinally; and there being a detent groove in the cap-piece between the two bus conductors and extending parallel to them; an insulating plunger for each channel and movable lengthwise therein, each plunger having, on each of the side surfaces thereof located at right angles to the plane of the bus conductors and contacts, an upper U-shaped recess and a lower U-shaped recess; a U-shaped bridging conductor located in each U-shaped recess, said bridging conductors being thus disposed in upper and lower pairs and being of spring material with the legs of each urged outwardly against the channel side surfaces having the contacts and bus conductors; said plungers each having an unoperated position in which the legs of the lower pair of bridging conductors which cooperate with the cap-piece engage the detent groove, and an operated position in which the legs of the lower pair of bridging conductors which cooperated with the cap-piece engage the dished surface of the lower bus conductor, the bus conductors and contacts being so positioned that in the upper position of the plunger it is resiliently held so that its upper and lower pairs of U-shaped bridging conductors do not make a circuit from the bus conductors to the associated contacts, whereas, in the lower position of a plunger it is resiliently held so a circuit is made between the bus conductors and their associated contacts.

2. The structure of claim 1 in which said channels are spaced along said body to include each possible position of a differentially settable switch actuator; said actuator is moved to various positions to represent different items of data to be entered into a calculating mechanism; and

means is provided to reset any plunger depressed by said actuator after said data is entered into the mechanism.

References Cited in the file of this patent

UNITED STATES PATENTS

1,640,755	Deale	Aug. 30, 1927
1,809,778	Evans	June 9, 1931
1,961,871	Caskey	June 5, 1934
2,506,987	Becwar	May 9, 1950

5

2,521,561
2,594,644
2,791,647
2,870,274
2,899,676
2,927,985

603,924

Batcheller	Sept. 5, 1950
Hanson	Apr. 29, 1952
Newcomb	May 7, 1957
Thias	Jan. 20, 1959
Rivers et al.	Aug. 11, 1959
Rivers	Mar. 8, 1960

FOREIGN PATENTS

Great Britain	June 25, 1948
---------------	---------------