Aug. 4, 1970 K. VOGEL 3,523,184

OPERATIONAL KEYBOARD SYSTEM

Filed Dec. 6, 1968

FIG. 1

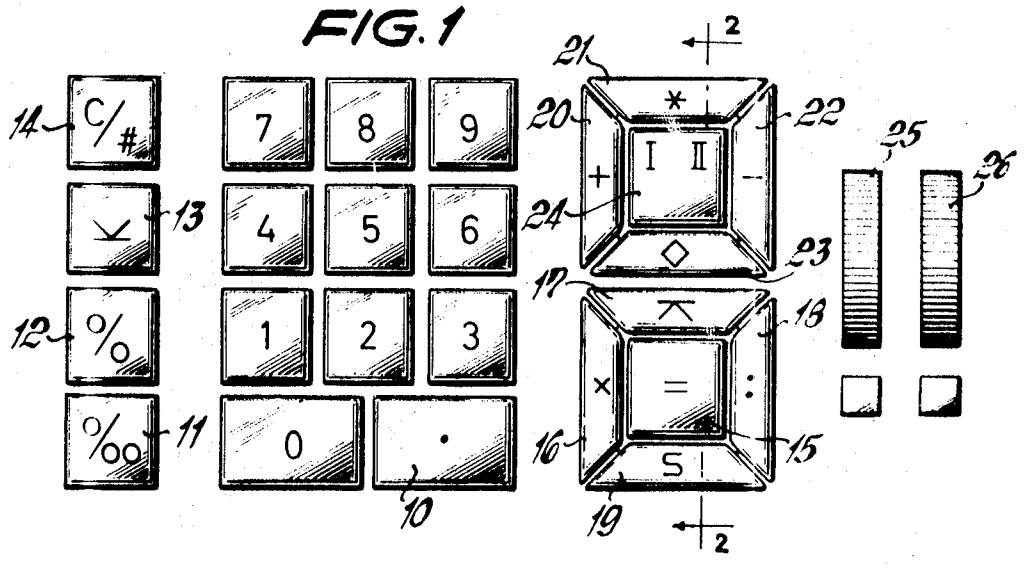


FIG. 2

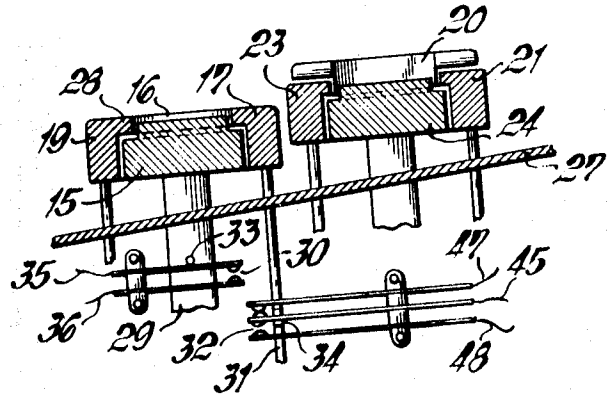
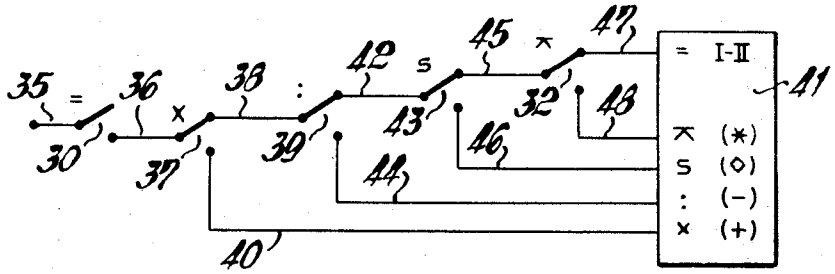


FIG. 3



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OPERATIONAL KEYBOARD SYSTEM

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U.S. Cl. 235—145 11 Claims

ABSTRACT OF THE DISCLOSURE

Operational keyboard system for calculators in which at least one group of operational keys is arranged in a block constituting a main key and function keys surroundingly arranged with respect thereto. The function keys are operable only together with the main key. Each of the keys is connected via switching means to an associated control circuit for performing a calculating function; only the main key being capable of being individually depressed to initiate the calculating function of its associated control circuit via its switching means. All other calculating function control circuits are initiated when both the main key and the associated function key are depressed.

BACKGROUND OF THE INVENTION

The present invention relates to the operational keyboard of calculators and other data-processing equipment, wherein a block-shaped keyboard is provided having at least one centrally located key which can be operated by one finger either individually or in conjunction with an adjacent key.

Germany Pat. No. 975,661 discloses an operational keyboard in which the keys are so arranged that at least one of a plurality of erase keys can be operated together with a carriage advance key. It is further known to operate two keys in unison in order to initiate certain functions, such as for example division. In this approach when the one key is depressed, the other key is automatically taken along.

Germany Utility Pat. No. 1,955,187 further discloses an arrangement wherein one key in the operational keyboard is combined into an operating block or unit with other keys adjacent thereto and is centrally disposed in such block so that it can be operated by one finger either alone or together with one of the adjacent keys.

It has now developed, however, as can also be seen in German Utility Pats. No. 1,891,642 and No. 1,948,195, that in machines, which can handle more than four basic forms of arithmetic, the operational keyboard becomes not only very large so that it is likely to occupy a much greater space than the conventional ten-key keyboard, but that it is also relatively more complicated and difficult to operate due to the number of adjacently arranged keys.

SUMMARY OF THE INVENTION

It is therefore the object of the present invention to provide an operational keyboard which is relatively more compact and is so simple to operate that no special training for the operator is necessary and the operator can operate the machine quickly and safely without any special concentration being necessary.

According to the present invention, a main key is provided around which additional function keys are arranged in a ring or frame, respectively. Moreover, each function key in the ring or frame can be operated together with the main key and each key is provided with switching means which control a function circuit before the main key actuates the function. Each of the function keys adjacent to the main key is provided with a ledge or the like which extends over the main key and moves the main key, when the respective function key is depressed, particularly, after the switching interval required to actuate its respective switching means. The individually operable main key can be rectangularly-shaped, for example, as a square, and the function keys can be bar-shaped. Each one of the bar-shaped function keys can be associated with one of the four sides of the main key. In the same manner, the main key can be circular and the function keys can be surroundingly arranged in the form of annular segments.

This arrangement and coupling of the function keys with respect to the main key permits the main key to have such an area that it can be operated without the danger of inadvertently depressing an adjacent function key at the same time. Moreover, this arrangement makes it also possible to dimension each one of the four or more function keys disposed around the main key in such a way that it can be depressed safely together with the main key.

The way in which particular function keys are associated with the main key, for purposes of striking, (e.g. the multiplication and division keys with a main key, which, itself, is a result key, and associating the plus, minus, subtotal and total control keys with a second main key which, itself, is a memory selection key and which initiates the operation) makes the operation of a calculator or computer provided with this type of operational keyboard very easy.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified plan view of the operational keyboard of a calculator arranged according to the present invention.

FIG. 2 is a sectional view of the operational keyboard according to FIG. 1 taken along the lines 2—2 of FIG. 1.

FIG. 3 is a control circuit diagram for the individual keys of the operational keyboard according to FIGS. 1 and 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, the operational keyboard according to the present invention is shown therein. The keyboard includes, in addition to the ten number keys with the numerals 0 to 9, a decimal point setting key **10**, a row of keys arranged to the left of the number keys containing the conventional per mille key **11**, a percent key **12**, a repeat key **13** and an erase or don't count key **14**. On the right of the group or block of ten number keys and decimal setting key **10**, two operational key blocks are provided of which the lower one is provided with a centered, square, main key **15** in the form of a result key. Around the result key **15**, there is a frame of function keys, a multiplication key **16**, a repeat key **17**, a division key **18** and a memory key **19**. In the same manner, a plus key **20**, a sum total key **21**, a minus key **22** and a subtotal key **23**, surround a centered square, main key **24**, which is in the form of a memory-selecting key. As already mentioned, the two main keys **15** and **24** could also be constructed to be circular and the associated function keys **16** to **19** or **20** to **23**, respectively, could be in the form of annular segments. In addition to the blocks of function keys there is also provided a knurled decimal point preselection disc **25** and a knurled setting disc **26** to preselect the digit to be rounded off.

As can be seen, in FIG. 2, the two operational key blocks **15** to **19** and **20** to **24** are disposed in a keyboard base plate **27** in a stepped arrangement with respect to each other. The plus key **20** is disposed some-

what higher than the other function keys and is also distinguished from the other keys by its color. Thus, for example, the main keys **15** and **24** are mostly white, the plus key is red and all other function keys **16** to **19** and **21** to **23** are black. The function keys **15** to **24** are mounted for vertical displacement in the base plate **27** by means of key shafts.

The two main keys **15** and **24** are locked against each other in a known manner by means of a blocking cam (not shown) or other blocking element so that only one of the main keys **15** or **24** can be depressed at a time. The other functional keys **16** to **19** and **20** to **23** extend over at least a part of the edge of their respective main key **15** or **24** with an overhang element, such as ledge **28** at function key **19**. Thus, the outer function keys **16** to **19** or **20** to **23**, respectively, can only be depressed together with their respective main key **15** or **24**. Moreover, the keys in each group are also blocked against the keys of the other group, via the main key **15** or **24**, respectively. Thus, it is not possible, for example, to intentionally or inadvertently depress function keys of both blocks **15** to **19** and **20** to **24** at the same time.

The control of the calculating functions occurs via key shafts of the above-mentioned function key blocks **15** to **19** and **20** to **24**. These key shafts are disposed for vertical displacement in the keyboard base plate **27** and actuate, via mechanical or electrical switching members, the responsive means for accomplishment of the function. In the present example, closable or switchable sets of contacts are provided through the key shafts. Thus, the circuit closing or actuating contact **30** can be operated through key shaft **29** of main key **15** and a switching contact **32** can be operated via a key shaft **31** of the repeat key **17**. In the same manner, all the key shafts of the remaining function keys **16** and **18** to **23** have respectively associated switching contacts and a closing contact is associated with main key **24**. The contacts are constructed mainly as microswitches which are closed or switched, respectively, by lateral pins **33** or flaps **34** of key shaft **29** or **31**, respectively, when the associated key **15** or **17**, respectively, is depressed or tilted, respectively.

Referring to FIG. 3, this illustrates the electric switching and control circuits together with the two, above-mentioned, closing or switching contacts, respectively. A line **35** brings voltage to the contact **30** of the main key **15** (=). From this contact a line **36** leads to the switching contact of a switch **37** (×). The outputs of switch **37** are connected to a line **38** which leads to the next switch **39** (:) and to a line **40** which leads to a function control center **41**. In the same way, from switch **39** an output line **42** leads to the next switch **43** (S) and an output line **44** to control center **41**. The outputs of switch **43** are connected, in turn, to an output line **45** which leads to switch **32** (K) and another output line **46** which leads to the center **41**. From the last-mentioned switch, **32**, both output lines **47** and **48** lead to the control center, which is constructed, for example, as a coding network.

As indicated by the respective symbols and evident from the control circuit diagram of FIG. 3, discussed above, the result function (=) of center **41** receives its potential via lines **35**, **36**, **38**, **42**, **45** and **47** when only switch **30** is closed, i.e. when only main key **15** (FIG. 2) is depressed, since switches **37**, **39**, **43** and **32** are all in their initial switch-through state. If, in addition to switch **30**, switch **37** is also actuated, i.e. if function key **16** is depressed together with main key **15**, the multiplication function (×) of center **41** receives the potential via line **40**. The symbols associated with switches **30**, **37**, **39**, **43** and **32** show which function of center **41** is actuated. The circuit diagram of FIG. 3, however, also shows why no malfunction (interference) occurs when, together with the positively actuated main key **15** or its contact **30**, respectively, more than one additional switching contact

is actuated. If, for example, the switching contacts **37** and **39** are fully actuated together with contact **30**, the switch **39** remains ineffective.

The control circuit of the second block or groups of function keys **20** to **24** (FIG. 1) fully corresponds in its electrical construction and operation to that of the function key block **15** to **19**. The only difference is that other functions, as indicated in FIG. 3 by the parenthetical symbols in the control center **41**, are actuated by the control circuit.

It will be understood that the above description of the present application is susceptible to various modifications, changes and adaptations.

What is claimed is:

1. Operational keyboard system for calculators comprising, in combination:

(a) at least one group of operational keys arranged in a block and having:

(1) a centrally disposed main key,

(2) function keys surrounding said main key,

(3) means for individually operating said main key and for operating said function keys only together with said main key;

(b) switching means associated with each key in said block for connecting the same to an associated control circuit to initiate a given calculating function.

2. Operational keyboard system as defined in claim **1** wherein said switching means includes a portion associated with each of said function keys and a portion associated with said main key, said main key portion being actuated to form a connection with its associated control circuit when said main key is individually operated and means for actuating the function key portions, when the associated function key is operated, to first form a connection with its associated control circuit before said main key portion actuates its associated control circuit.

3. Operational keyboard system as defined in claim **2** wherein said means for individually operating said main key and for operating said function keys only together with said main key includes an overhang element for each of said function keys which extends over a portion of said main key and each of said function keys is arranged with respect to its associated switching means portion in such a manner that, when said key is operated, it serves to operate said main key via said overhang element after said switching means portion associated with the surrounding key is actuated.

4. Operational keyboard system as defined in claim **3** wherein the individually operable main key is rectangularly shaped and said function keys are bar-shaped and associated at a respective one of the four sides of said main key.

5. Operational keyboard system as defined in claim **4** wherein said main key is square-shaped.

6. Operational keyboard system as defined in claim **3** wherein a plurality of said blocks is combined together to form an operational unit, said blocks being arranged adjacently and in stepped-fashion with respect to each other.

7. Operational keyboard system as defined in claim **6** wherein the main key switching means portion is an actuating contact and the switching means portion associated with each of said function keys is a switching contact, said actuating contact and all of the contacts at said function keys being connected in series in such a manner that, when only the main key is operated, the calculating function control circuit associated with said main key is initiated to perform its function and, when said main key is operated together with one of the function keys in the same block, the calculating function control circuit associated with said one function key is initiated to perform its function.

8. Operational keyboard system as defined in claim **7** wherein the main key of one of said blocks is a result

key, the function keys associated therewith including a multiplication key and a division key; and the main key of another of said blocks is a memory switching key, the function keys associated therewith including an addition key, a subtraction key, a subtotal key and a total key.

9. Operational keyboard system as defined in claim 7 wherein the addition key is provided with indicating means for readily distinguishing this key from the other function keys in its particular block.

10. Operational keyboard system as defined in claim 8 wherein said indicating means is provided by arranging said addition key to have its top at a higher level than the other of said function keys.

11. Operational keyboard system as defined in claim 8 wherein said indicating means is provided by arranging said addition key to be of a different color than the other surrounding keys.

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