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Hatley et al.

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[54] **KEYBOARD SWITCH ASSEMBLY WITH IMPROVED MOVABLE CONTACT HAVING CANTILEVER SUPPORTED CENTRAL MEMBER WITH RADIALLY EXTENDING CONTACT FINGERS**

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[73] Assignee: **Donnelly Mirrors, Inc.**, Holland, Mich.

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[52] **U.S. Cl.**..... **200/5 A**, 200/159 B, 200/166 BH

[51] **Int. Cl.** **H01h 13/14**

[58] **Field of Search** ..... 200/5 R, 5 A, 159 B, 200/166 BH, 1 R, 159 A, 166 J

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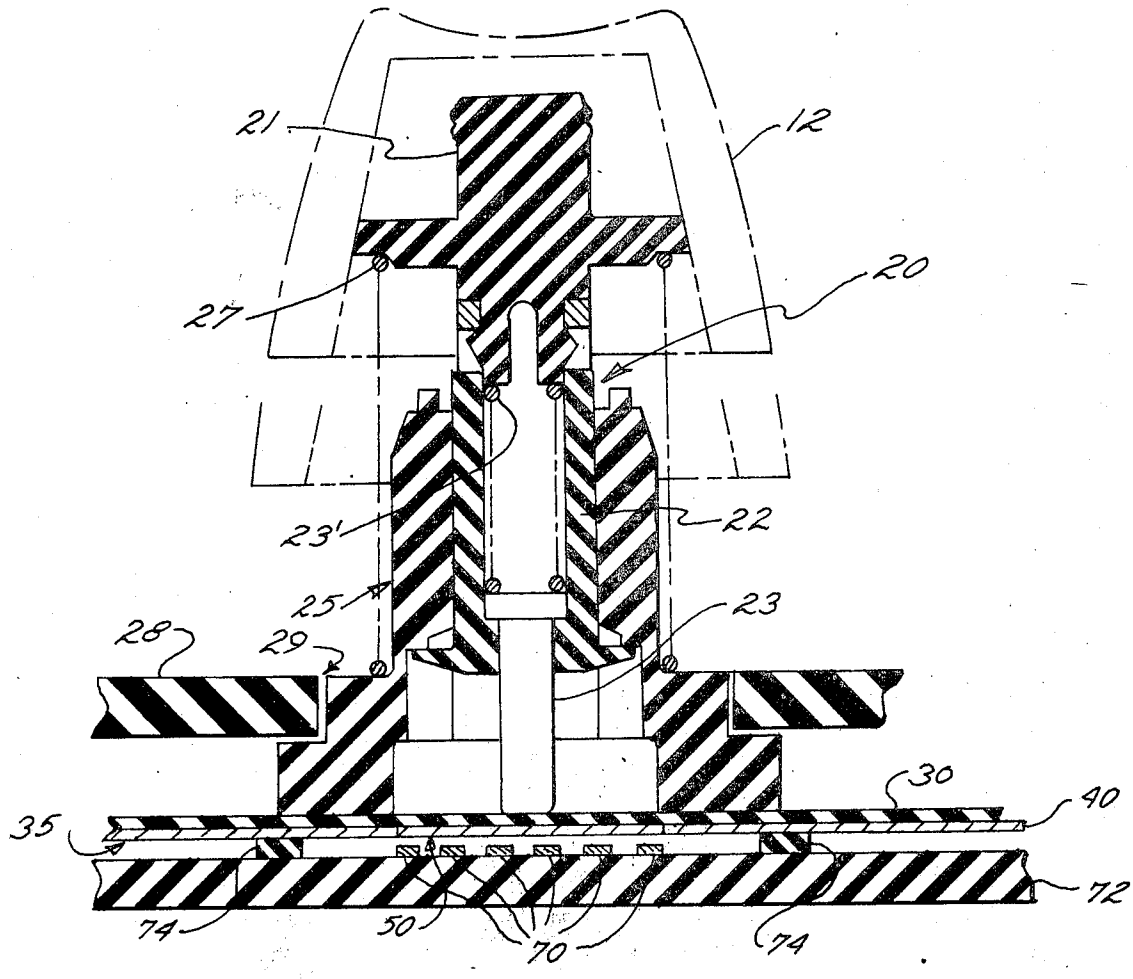
Primary Examiner—J. R. Scott

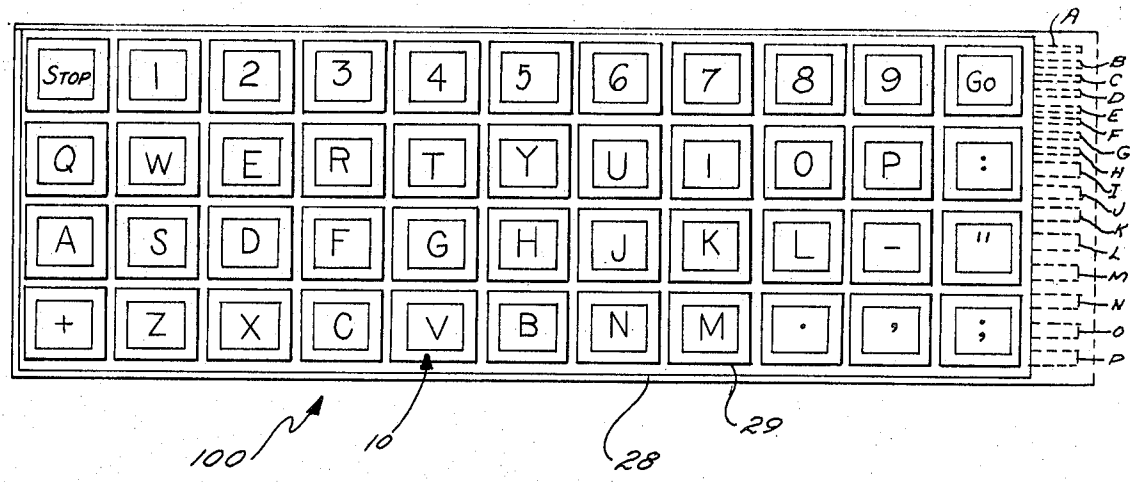
Attorney—Peter P. Price et al.

[57] **ABSTRACT**

A mechanically operated keyboard with key stations having a multiplicity of electrical switch contacts for providing an encoded electrical data output signal corresponding to and uniquely identifying individual key stations includes an array of movable contacts each corresponding to an individual key station and which are formed in a sheet of conducting material mounted above a corresponding array of fixed contacts to form multiple contact electrical switches for each key station of the keyboard. Each movable contact has a central member suspended to the sheet of conducting material in cantilevered fashion and includes a plurality of peripherally spaced contact fingers joined to the central member such that the contact fingers adjacent the junction of the central member to the conducting sheet will contact associated fixed contacts of a key station only after the remaining contact fingers have come into contact with their associated fixed contacts. An electrical circuit coupled to the contact fingers provides a strobe output signal only when all of the electrical switch contacts associated with a given key station have been actuated as indicated by the closure between the contact finger adjacent the junction of the central member to the conducting sheet and its associated fixed contact.

16 Claims, 8 Drawing Figures




STOP
1
2
3
4
5
6
7
8
9
Go
Q
W
E
R
T
Y
U
I
O
P
:
A
S
D
F
G
H
J
K
L
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"
+
Z
X
C
V
B
N
M
.
,
;
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
100
10
28
29

FIG. 1.

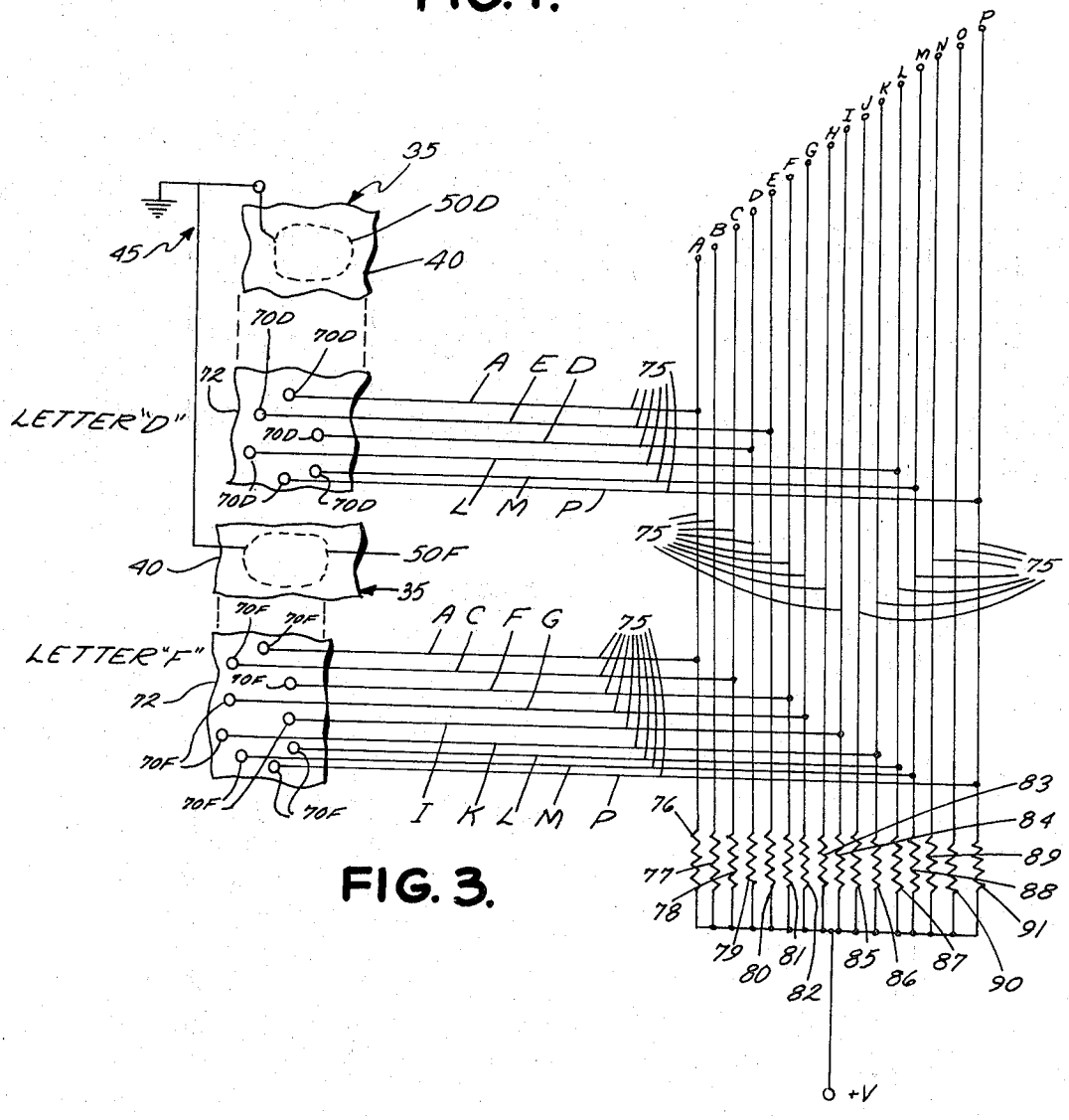
35
50D
40
45
70D
72
LETTER "D"
A E D
75
L M P
50F
LETTER "F"
A C F G
I K L M P
76
77
78
79
80
81
82
83
84
89
88
91
85
86
87
90
+V

FIG. 3.

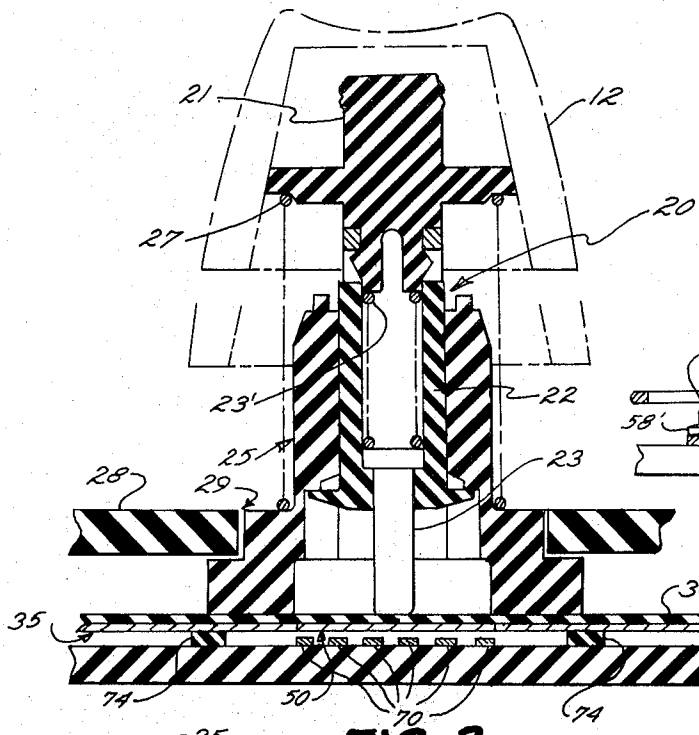

FIG. 2.

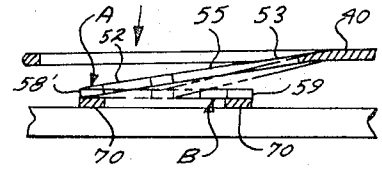

FIG. 6.

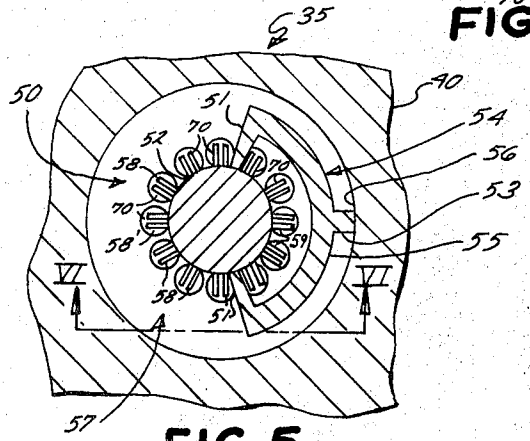

FIG. 5.

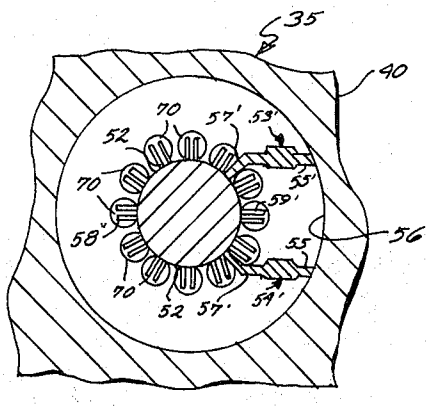

FIG. 7.

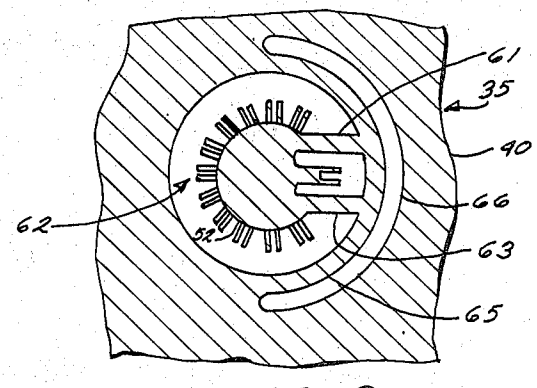

FIG. 8.

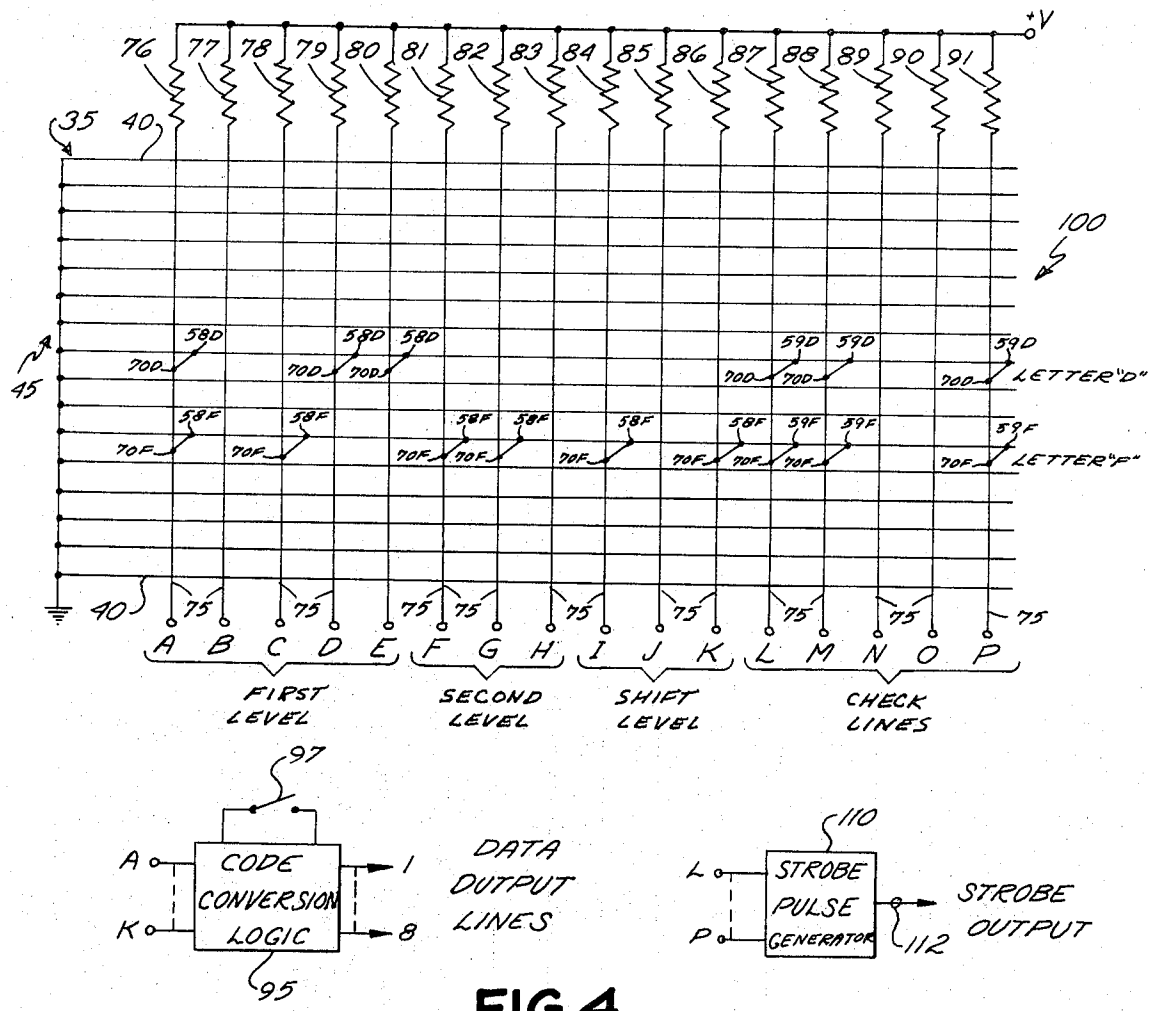
+V
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91
35 40
100
45
58D 59D LETTER "D"
58F 59F LETTER "F"
70D 70F
75
A B C D E F G H I J K L M N O P
FIRST LEVEL
SECOND LEVEL
SHIFT LEVEL
CHECK LINES
97
A
K
CODE CONVERSION LOGIC
1
8
95
DATA OUTPUT LINES
110
L
P
STROBE PULSE GENERATOR
112
STROBE OUTPUT

FIG. 4.

KEYBOARD SWITCH ASSEMBLY WITH IMPROVED MOVABLE CONTACT HAVING CANTILEVER SUPPORTED CENTRAL MEMBER WITH RADIALLY EXTENDING CONTACT FINGERS

BACKGROUND OF THE INVENTION

The present invention relates to an electrical-mechanical keyboard for producing data output signals, and particularly to the switch construction for providing data output and strobe signals when all of the switch contacts of an individual key station are closed.

Conventional keyboards are either electrical-mechanical or electrical in design. With the advent of computer applications whereby the output signals from a keyboard are coupled directly to various computer terminal equipment, it has become necessary to provide multiple bit data output signals from the keyboards which accurately and rapidly correspond to an actuated key station. Conventional electrical-mechanical keyboards are relatively unsuccessful in such applications partially because of contact bounce occurring with the electrical switches employed. Also, errors in the data output signals frequently are caused by timing differences between the closing of individual switches associated with each key station. Thus, computer inputs to which conventional keyboards are coupled, and which are relatively fast reading, interpret contact bounce and/or timing lags as an erroneous code or data signal. The keyboard of the present invention, however, employs a unique switch design which has a single movable electrical contact with a plurality of contact fingers which, together with a multiplicity of fixed contacts, form electrical switches. A digital control circuit is coupled to the keyboard and insures that no data output signals are read by the computer or interface equipment until all of the switch contacts are properly closed. This design overcomes the difficulties faced by conventional mechanical keyboards.

Electrical keyboards employing Hall-effect devices, reed switches, capacitive devices, or magnetic devices are frequently more reliable than many electrical-mechanical keyboards but are considerably more costly. The keyboard of the present invention, however, provides reliability equivalent to such electrical keyboards but at a greatly reduced cost.

An electrical-mechanical keyboard using a single movable contact with a plurality of contact fingers has employed a last-to-close contact finger associated with the switch contacts to provide a signal when all of the switch contacts have been made. The design however employs contact fingers which are bent at different angles relative to the remaining fingers and must be accurately formed to insure its operation. The design of the present switch eliminates the difficulties encountered with the manufacture and operation of such a switch.

SUMMARY OF THE INVENTION

A mechanically operated keyboard embodying the present invention comprises a plurality of individual key stations each having an electrical switch formed from a movable switch contact having a central member mounted in cantilevered fashion to a sheet of conducting material. A plurality of contact fingers are integrally formed with the central member and contact an array of corresponding fixed contacts associated with the key station when a key is actuated. Each of the fixed contacts is coupled to a source of operating power and to a keyboard output terminal to provide electrical data output signals therefrom when a key station is actuated. A strobe pulse generation circuit is coupled to at least the receivable contact adjacent the cantilever mounting point to generate a strobe signal only when this last-to-close contact is closed and thereby all of the remaining movable contact fingers have contacted associated fixed contacts. This assures that an accurate data output signal is present at the keyboard data output terminals when a strobe pulse is generated.

It is an object, therefore, of the present invention to provide a novel switch construction for use with a mechanically operated keyboard having a plurality of key stations each with a movable contact having a plurality of contact fingers associated with fixed contacts such that at least one switch contact will close only when all of the remaining switch contacts of a key station have been closed.

It is another object of the present invention to provide a movable contact mounted to a contact finger sheet in a cantilevered fashion such that as the movable contact is actuated, contact fingers attached thereto and adjacent the cantilevered mounting point are last-to-make.

It is still a further object of the present invention to provide an improved electrical-mechanical keyboard.

These and other objects of the present invention will become apparent upon reading the specification together with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a keyboard embodying the present invention;

FIG. 2 is a side elevation view in cross section of an individual key station employed in a keyboard embodying the present invention;

FIG. 3 is a wiring diagram showing the interconnection of the fixed key station contacts to the keyboard output terminals for the letters "D" and "F", and also showing the electrical and mechanical relationship of the movable contacts associated with the fixed contacts for the key stations "D" and "F".

FIG. 4 is an electrical circuit diagram partially in schematic and block diagram form showing one embodiment of a keyboard embodying the present invention;

FIG. 5 is an enlarged partial plan view of a movable contact sheet showing the detailed structure of one embodiment of the movable contact of one of the key stations of the keyboard;

FIG. 6 is a section view of the structure shown in FIG. 5 taken along the section lines VI—VI together with the associated fixed contacts;

FIG. 7 is an enlarged partial plan view of the movable contact sheet showing the detailed structure of one alternative embodiment of the movable contact of one of the key stations; and

FIG. 8 is an enlarged partial plan view of the movable contact sheet showing the detailed structure of another alternative embodiment of the movable contact of one of the key stations.

DETAILED DESCRIPTION OF THE FIGURES

Referring now in detail to FIGS. 1-3, there is shown a mechanically operated electrical keyboard 100 in-

cluding a plurality of key stations 10 for each symbol shown in FIG. 1. The keyboard 100 has a plurality of output terminals A–P for coupling electrical output signals from the keyboard to various circuits associated with the keyboard. The keyboard comprises a face plate 28 with an array of apertures 29 in which the key stations 10 are mounted. Each key station includes a key cap 12 (FIG. 2) which corresponds to an individual letter, number, or other symbol which is desired to be entered into a computer or other digital interface equipment in the form of an electrical data signal corresponding to and uniquely identifying the symbol. The cap 12 is coupled over a plunger assembly 20 that is moved downwardly when the key station is actuated by the operator. The plunger assembly 20 comprises an end portion 21 over which the cap 12 is mounted, a cylindrical sleeve 22 joined to the member 21; and a plunger 23 slidably mounted within the sleeve 22 which in turn is slidably mounted within a housing 25. A spring 23′ couples the plunger 23 to the member 21. A return spring 27 is coupled to the outer periphery of the housing 25 and extends upwardly to contact the end member 21 to return the key to its original position when released by the operator. The housing 25, which accommodates the sleeve 22, is fitted within an aperture 29 in face plate 28 of the keyboard to hold the individual key station 10 into position on the keyboard.

The plunger 23 contacts a flexible sheet 30 of insulating material such as rubber which spans the entire array of key stations forming the keyboard and which has adjacent its surface opposite the plunger 23, a sheet 35 of flexible conducting material 40 such as beryllium copper which is selectively etched away at the area immediately under each of the plungers 23 of each key station to form an array of movable electrical contacts 50. Each key station 10 includes a movable electrical contact shown in FIG. 5 which, as described in detail below, comprises a plurality of individual contact fingers formed around the periphery of a central portion of conducting material that is electrically and mechanically formed in the sheet 35 of conducting material 40 by means of a cantilevered attachment to the sheet 35. The specific movable contact structure of FIGS. 5–7 and their construction is discussed below.

Under the movable contact 50 of the key station 10 (FIG. 2) is an array of fixed contacts 70 which are mounted in alignment with the contact fingers of the movable contact on an insulated base material 72 which serves to rigidly hold the fixed contacts 70 in place. The flexible insulating material 30 and the conducting sheet 35 are supported above the base 72 by means of support members 74 which are spaced to allow the key plunger 23 to depress the movable contact sufficiently when the key station is actuated so as to cause physical and electrical contact between the movable contact 50 and the array of fixed contacts 70 on the base. Each of the individual contacts 70 forming the array of fixed contacts are electrically coupled to output terminals A–P (FIGS. 1 and 3) of the keyboard 100 by means of conductors 75 (FIG. 3) which, like the fixed contacts 70, can be deposited on the base member 72 as is well-known in the art. The fixed contacts 70 of each of the key stations 10 forming the keyboard can likewise be formed on a printed circuit board having a layer of conducting material that is selectively etched away to form the individual fixed contacts and their leads to the terminals A–P at the edge of the board.

The movable contact fingers of each key station are formed in the sheet 35 of conducting material 40 (FIG. 2) to form a finger sheet 45 which is electrically grounded as shown in FIGS. 3 and 4. The fixed contacts 70 for the individual key stations and their leads 75 coupling the fixed contacts to the keyboard output terminals are likewise shown schematically in FIGS. 3 and 4. A voltage source +V is coupled to each fixed contact of every key station through a plurality of voltage dropping resistors 76–91 to provide electrical operating power for the keyboard. As an individual key station is actuated, the contact fingers of the movable contact 50 on finger sheet 45 (FIGS. 3 and 4) contact the array of fixed contacts coupled to a predetermined number of resistors 76–91 such that a predetermined number of the output terminals A-P are grounded. The voltage at these output terminals thereby drops to zero providing a logic "0" output at the terminals where a movable contact finger has electrically contacted an associated fixed contact. The remaining outputs remain at the voltage of the +V source or a logic "1" level. Each key station will have an array of fixed contacts of a sufficient number to provide a data signal to uniquely identify that particular station and, if desired, check line signals. The output terminals A–K provide the data signals whereas terminals L–P provide check signals employed as explained below to insure proper closure of the contacts of a key station before a strobe pulse is generated.

The key stations for the letters D and F are shown in FIGS. 3 and 4. Letter D has fixed contacts 70D coupled to resistors 76, 79, 80, 87, 88 and 91 via conductors 75. Thus, when the key station corresponding to the letter D is actuated, output terminals A, D, E, L, M and P will have a logic "0" output since the fixed contact associated with these output terminals will be grounded on the opposite side of the voltage dropping resistors. The remaining output terminals will remain at the logic "1" state. Similarly, when the letter F key station is actuated by the operator, output terminals A, C, F, G, I, K, L, M and P will have a logic "0" signal due to the closure of movable contact 50F with fixed contacts 70F and the coupling of interconnecting conductors 75 of the key station.

The output terminals A–K which develop the data output signal uniquely identifying each key station as it is actuated are coupled to corresponding input terminals A–K of a code conversion logic circuit 95. Circuit 95 (FIG. 4) is a conventional circuit which detects the logic "1" and "0" states on lines A–K and converts these signals to standard 7-bit data signals employed with conventional computer equipment and which appear on data output lines 1–8 coupled to circuit 95. The code conversion logic circuit 95 includes a shift key 97 associated with the keyboard and electrically coupled thereto which serves to actuate circuit 95 to respond to provide a different data output signal for a key station when the shift key is actuated by the operator.

A strobe pulse generation circuit 110 has input terminals coupled to the check lines L–P to receive signals therefrom which actuates the circuit 110 to develop a strobe output pulse at terminal 112 when the switch contacts of a key station are actuated. In some embodiments, the strobe pulse generator 110 may include associated circuits which provide various features in con-

junction with the keyboard of the present invention such as two-key roll-over Such associated and included circuits are described in detail in a copending patent application entitled KEYBOARD AND DIGITAL CIRCUIT THEREFOR by Derek Hatley, filed concurrently herewith, assigned to the present assignee; and incorporated by reference herein. In its less complex embodiment, the circuit 110 receives a signal from one of the check lines coupled to the last-to-close switch contact for each key station and includes conventional pulse generating and shaping circuits which respond thereto to provide the desired strobe output signal when all of the switch contacts of a key station have been actuated. One switch contact signed to provide such a signal to the strobe pulse circuit is shown in detail in FIGS. 5 and 6.

Referring now in detail to FIG. 5, there is shown a movable contact structure 50 which comprises a central member 52 which is suspended in a cantilevered fashion to the flexible conducting material 40 and formed as an integral part thereof by means of a coupling means 54. Means 54 comprises a generally Y-shaped member having an arcuate segment 55 joining in a cantilevered fashion by means of member 53, the central member 52 to the edge 56 of a central aperture 57 formed in the conducting material 40. Aperture 57 is sufficiently large to accommodate the contact finger assembly 50 therein which is shaded in the figure for clarity. Member 55 has arms 51 at opposite ends which join the central member 52 to the arcuate segment 55 thereby electrically and mechanically coupling the member 52 to the sheet 40.

Around the periphery of the central member 52 is formed a plurality of contact finger pairs 58 and 59. 12 pairs of contact fingers are shown in the figure. It is understood that this number can be varied for different keyboard needs. The central member 52, the contact fingers 58, 59 and the assembly 54 are formed as an integral part of the contact finger sheet 40 by, for example, selectively etching away the material 40 to form the structure shown in FIG. 5. An array of such movable contacts is formed in the finger sheet 45 such that each key station of the keyboard has a movable contact.

In FIG. 4, the contact fingers 58, 59 and associated fixed contacts 70 for the letters D and F are identified as 58D, 70D and 58F, 70F respectively.

At least three of the contact fingers are formed on the central member 52 adjacent the arm 53 joining the arcuate segment 55 to the edge 56 of the sheet 40 and are indicated at 59 in the figure. As explained below, these contacts (59) will contact associated fixed contacts 70 after the remaining contact fingers 58 have contacted their associated fixed contacts. FIG. 6 illustrates the operation of the movable contact to insure this result.

For the sake of clarity, only two oppositely positioned fixed contacts 70 are shown in FIG. 6. These contacts are aligned with the movable contact 59 closest to arm 53 and the movable contact directly opposite the central member 52 and identified as 58′ in FIG. 5. Before a key station is actuated, the movable contact 50 is co-planar with the sheet 40 such that the plane of the central member 52 is substantially in the plane of the remaining portion of the sheet 40. Once the key is actuated and the plunger 23 (FIG. 2) contacts the central member 52 through the insulating sheet 30, and before the key is fully depressed, the movable contact is in a position illustrated at A in solid lines in FIG. 6. In this position, the plane of the central member 52 is approximately the same as the plane of the arcuate segment 55. Arm 53 is tilted at an angle with respect to the sheet 40 and the plane of the surface of the fixed contacts such that the contact finger 58′ is approximately first to contact its associated fixed contact 70. Up until this point, the movement of the plunger 23 has only caused the arm member 53 to bend thereby allowing the central member and contact fingers thereon to tilt downwardly as shown in position A.

As the plunger 23 continues its downward travel as indicated by the direction of the arrow shown in FIG. 6, the central member 52 and contact fingers 58 and 59 thereon pivot in a twisting fashion about the end connecting members 51 of the assembly 54 causing them to be positioned as shown in the phantom lines at position B in FIG. 6. The pivoting of the central member 52 about the end members 51 insures that the contact finger 59 closest the arm 53 will contact the associated fixed contact 70 last. The closure of this contact therefore can be employed to generate a strobe pulse indicating that all of the remaining contacts have been made. It is seen that the remaining contacts 59 which are also adjacent the arm 53 likewise tend to close last and the three contacts 59 closest the arm 53 can be used in combination to provide a strobe pulse only after all three have closed. In such an arrangement, the strobe pulse generator 110 (FIG. 4) includes a three input AND gate which provides an output pulse only after the three contacts which are coupled to the inputs of the AND gate have closed. In most circuits however, only the contact finger 59 closest the arm 53 is used.

FIG. 7 shows one alternative embodiment of the movable contact 50 in which the central member 52 is joined to the edge 56 of the conducting sheet 40 by means of a pair of arms 53′ and 54′ which replace the assembly 54 shown in FIG. 5. The operation of the movable contact finger shown in FIG. 7 is substantially the same as that shown in FIG. 6. As the plunger 23 (FIG. 2) is actuated and moves downwardly, the central member 52 will first bend about the narrowed portions 55′ of the arms 53′ and 54′ such that the movable contact assumes the position A shown in FIG. 6. After the contact finger 58″ which is opposite members 53′ and 54′ contacts an associated fixed contact, the central member 52 will pivot about the narrowed portions 57′ of arms 53′ and 54′ to the position shown in FIG. 6 at B thereby causing the contact finger 59 (FIG. 7) to contact its associated fixed contact last. This contact finger pair can therefore be used to generate a strobe pulse in the same manner as described above and insures that a strobe pulse is generated only after the remaining contact fingers 58″ and 58′ have contacted their associated fixed contacts.

Another embodiment of the movable contact is shown in FIG. 8. In this embodiment, the central member 52 is supported by the combination of a pair of arms 61 and 63 and arcuate arm 65. Each arm 61, 63 is coupled at one end to the central member 52 and at an opposite end to arcuate arm 65. Arm 65 extends approximately 180° around the central member 52 and is formed by etching out an arcuate slot 66 in the conducting material 40. The contact shown in FIG. 8 also includes twelve contact finger pairs 62 around the periphery thereof. The movable contact so formed oper-

ates in generally the same manner as illustrated in FIG. 6 by first flexing at the junction of arms 61 and 63 with arcuate arm 66 until some of the contact finger pairs have contacted their associated fixed contacts and then bending at the junction of the ends of arcuate arm 65 with the remaining portion of a contact finger sheet 40 until the last-to-make contact positioned between arms 61 and 63 contacts its associated fixed contact.

It is seen therefore that the embodiments shown in FIGS. 5, 7 and 8 provide movable contact fingers which are mounted in a cantilevered fashion to the contact sheet 40 and which provide last-to-close contacts. These contacts are used with the circuitry shown in FIG. 4 to generate a strobe output signal which is coupled to the interface equipment causing the interface equipment coupled to the keyboard to read the data output signal from the keyboard only when all of the switch contacts are properly actuated as indicated by the last-to-close contact being made. This insures that an accurate data signal is read by the interface equipment. As noted in the copending application identified above, various digital circuits for providing two-key roll-over and other features, can be employed with the movable contacts shown in FIGS. 5 and 7 to provide a more flexible keyboard with such additional features although the keyboard described herein is capable of providing accurate data output signals at a relatively low cost by virtue of the switch construction.

It will be apparent to those skilled in the art that the specific design of the movable contacts can be varied to provide the same desired effect such that when the cantilevered movable contact is actuated by the plunger, one of the contacts thereon will be last-to-make and thereby provide a strobe pulse generating signal. Also the contact finger pairs may include a single member instead of the two-pronged members illustrated. These and other modifications will however fall within the scope of the present invention as defined by the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows.

1. In a keyboard including a plurality of key stations for providing electrical data signals uniquely identifying each key station as it is actuated, an electrical switch for each key station comprising:

an insulated base member;

an array of fixed electrical contacts positioned in fixed relationship on said base member;

insulative spacing means on said base member adjacent said array of fixed electrical contacts;

a sheet of flexible conducting material supported on said spacing means in spaced relationship to said array of fixed electrical contacts and including an opening therein;

a movable electrical contact positioned within said opening of said sheet, said movable contact including a central member with a plurality of contact fingers positioned in alignment with associated fixed electrical contacts and means coupling said central member to an edge of said sheet adjacent said opening in a manner such that when the key station is actuated, said central member moves in a controlled manner to assure a predetermined contact finger will contact an associated fixed contact last in the sequence of engagement of said contact fingers to said fixed contacts.

2. The apparatus as defined in claim 1 wherein said coupling means comprises an arcuate segment of flexible conducting material having opposite ends coupled to said central member such that said segment circumscribes a portion of said central member, and

means for joining an edge of said segment remote from said central member to an edge of said sheet within said opening in a cantilevered fashion such that when the key station is actuated, said central member will initially bend about said joining means and subsequently pivot within said segment at the junction of said opposite ends of said segment to said central member such that the contact finger immediately adjacent said joining means is last-to-make.

3. The apparatus as defined in claim 2 wherein said joining means comprises an arm coupled between said segment and said edge of said sheet; and wherein said central member and contact fingers thereon, said segment, and said arm are integrally formed in said sheet and are substantially coplanar therewith when the key station is not actuated.

4. The apparatus as defined in claim 1 wherein said means for coupling said central member to said sheet is a substantially Y-shaped member having a pair of ends at one end thereof attached to said central member and circumscribing a portion of said member, and the remaining end attached to said sheet such that when the key station is actuated, said remaining end will initially bend and the central member will then pivot within said Y-shaped member at the junction of said ends of said member to said central member to insure that the contact finger immediately adjacent said remaining end is last-to-make.

5. The apparatus as defined in claim 4 wherein said central member and contact fingers thereon, said Y-shaped member, and said sheet are integrally formed and are substantially coplanar when the key station is not actuated.

6. The apparatus as defined in claim 1 wherein said coupling means comprises an arcuate segment of flexible conducting material positioned within said opening and having opposite ends coupled to said sheet at the edge of said opening, and a pair of spaced arms of flexible conductive material extending from said arcuate segment to said central member such that said arcuate segment circumscribes at least a portion of said central member and wherein said predetermined contact is positioned on said central member between said spaced arms.

7. The apparatus as defined in claim 1 wherein said coupling means comprises first and second arms of flexible conductive material each having one end joined to said central member in spaced relationship to the other arm and remote ends joined to the edge of said sheet within said opening and in spaced relationship such that when the key station is actuated, said arms will initially bend about said remote end and subsequently said central member will pivot at the junction of said one end of said arms to said central member such that a contact finger between said arms is last-to-make.

8. The apparatus as defined in claim 7 wherein said ends of said first and second arms are narrower than the middle of said arms thereby permitting the bending and twisting of said arm ends to provide the desired motion for said movable contacts.

9. The apparatus as defined in claim 8 in which said first and second arms are aligned in parallel relationship.

10. In a keyboard for developing electrical data signals uniquely identifying each of a plurality of key stations on said keyboard, an electrical switch for each key station including a movable contact for contacting an array of associated fixed electrical contacts coupled to a source of electrical power to provide an electrical data signal at an output terminal of said keyboard when a key station is actuated, said movable contact comprising:

a central member including a plurality of integrally formed contact fingers around the periphery of said central member, said central member formed in a sheet of flexible conducting material mounted in proximity to the array of fixed contacts associated with a key station and circumscribed by said sheet, said central member joined to said sheet by a joining member of flexible conducting material joining said central member to said sheet in a cantilevered fashion such that said central member and contact fingers thereon can be displaced relative to the plane of said sheet in a controlled manner to assure said contact fingers of said movable contact physically and electrically contact said associated array of fixed contacts whereby preselected contact fingers are last in the sequence of engagement to contact associated fixed contacts when the key station is actuated.

11. The movable contact as defined in claim 10 wherein said joining member comprises an arcuate member having one edge coupled to said sheet and a pair of ends coupled to said central member such that said central member is partially circumscribed by said arcuate member.

12. The movable contact as defined in claim 11 wherein said central member, said joining member, and said sheet are integrally formed in a single sheet of conducting material and in substantially the same plane.

13. The movable contact as defined in claim 10 wherein said joining member comprises a pair of arms coupled to said central member at spaced positions on either side of said central member by one end of each arm, said arms having ends remote from the central member joined in spaced relationship to said sheet.

14. The movable contact as defined in claim 13 wherein said central member and contact fingers thereon, said pair of arms, and said sheet are integrally formed in a single sheet of conducting material and in substantially the same plane.

15. The movable contact as defined in claim 14 wherein each end of each of said arms is narrowed to increase the flexibility of the arms at the junction of said arms to said central member and to said sheet.

16. In an electrical-mechanical keyboard for providing electrical data output signals which uniquely identify each key station of the keyboard, and wherein each key station comprises an array of fixed electrical switch contacts and a single movable electrical contact which is movable to electrically contact the array of fixed electrical contacts; a method of providing a signal indicating that each of the fixed contacts of the array of fixed contacts have been contacted by the movable contact comprising the steps of:

suspending the movable electrical contact in a cantilevered fashion above the array of associated fixed electrical contacts;

bending the movable contact toward the array of fixed contacts at an angle thereto until at least one fixed contact is contacted by the movable contact;

pivoting the movable contact such that it is parallel to the plane of the fixed contacts such that one of the remaining fixed contacts contacts an associated contact in the sequence of engagement; and

coupling the last-to-make electrical switch contact to an electrical circuit which responds thereto to provide a signal when the last-to-make contact is closed.

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