

[54] **KEYBOARD APPARATUS**

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Related U.S. Application Data

[60] Division of Ser. No. 598,558, Oct. 10, 1966, Pat. No. 3,588,875, which is a continuation-in-part of Ser. No. 496,031, Oct. 14, 1965, abandoned.

[52] U.S. Cl. **340/365, 178/17 C**

[51] Int. Cl. **G08c 9/00**

[58] Field of Search **340/365; 177/17 C; 235/145**

[56] **References Cited**

UNITED STATES PATENTS

2,814,031 11/1957 Davis 340/365
2,913,688 11/1959 Slebodnik 340/365

3,119,996 1/1964 Comstock 340/365

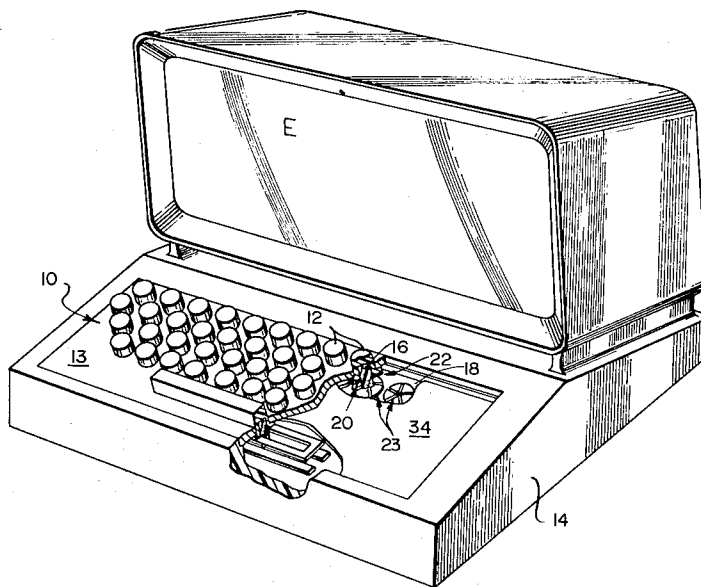
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[57] **ABSTRACT**

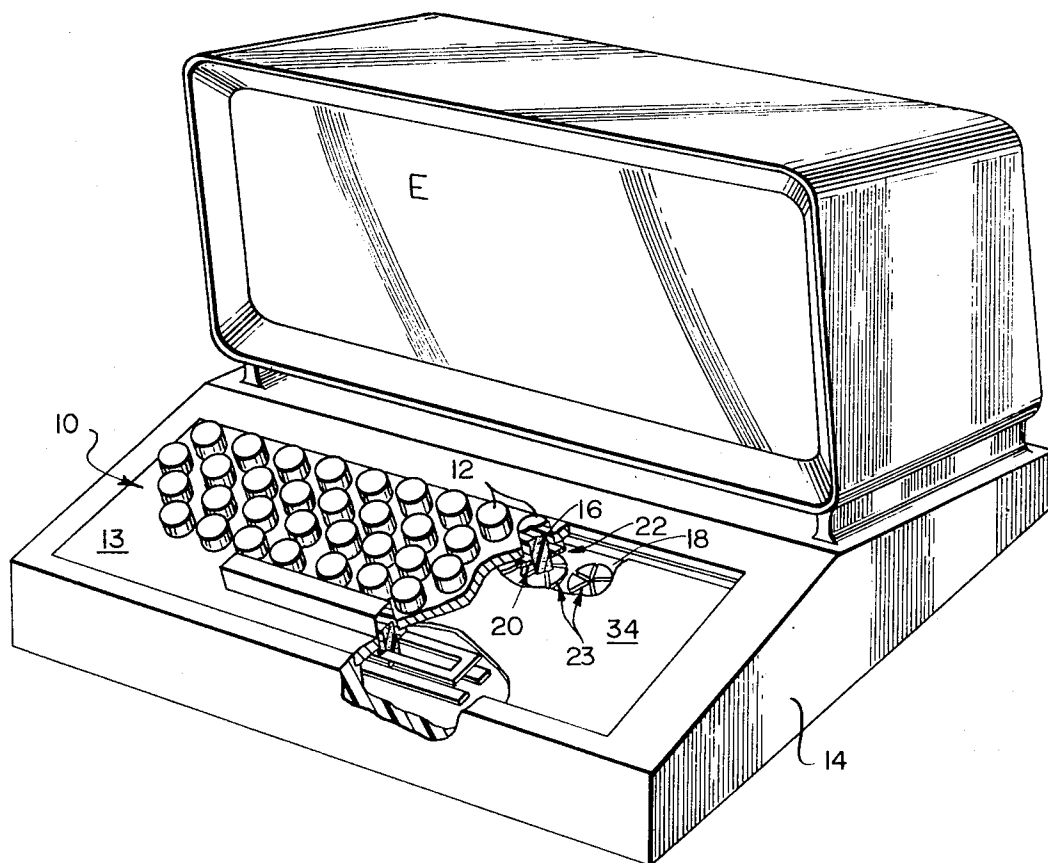
A keyboard encoder comprises a set of keys. Each key is in juxtaposition with one or more field-responsive elements associated with that key, the outputs of the field-responsive elements being conveyed to output terminals of the encoder. Actuation of a key alters the field to which the elements associated therewith respond. The number of elements associated with each key and the connections of these elements to the output terminals correspond to the output code for the character represented by the key. Consequently, the responses of the field-responsive elements to actuation of a key provide a directly encoded representation of the corresponding character at the output terminals. Also disclosed is an elongated switch bar in which contact is readily made even though the switch bar is depressed at either of the two ends thereof.

5 Claims, 1 Drawing Figure



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3,668,695



KEYBOARD APPARATUS

This application is a division of my co-pending application Ser. No. 598,558, filed Oct. 10, 1966 for Character Encoder, now U.S. Pat. No. 3,588,875, issued June 28, 1971, which in turn is a continuation-in-part of another application Ser. No. 496,031, filed Oct. 14, 1965 for Keyboard Encoder, now abandoned.

This invention relates to a compact keyboard encoder having no moving parts except for the keys themselves. Actuation of a key changes an electrical characteristic of one or more sensors according to the coded representation of a character associated with the key. Converters in the encoder transform these changes in the characteristic to digital signals identifying the character.

A digital encoder of the type having a keyboard input provides the link between a human operator and automatic data processing equipment. The keyboard appears similar to a typewriter keyboard and for each keyboard character selected by the operator, the encoder produces a series of electrical signals corresponding to the digits in a coded representation of the character. In an illustrative application, the operator uses the keyboard to type computer instructions and input data. The encoder converts the selected characters to their corresponding digital signals, which are then recorded on a magnetic tape or on a series of punched cards.

Many prior keyboard encoders employ keyboards having mechanical linkages similar to those in conventional office typewriters or teletype machines. High operating noise and relatively frequent maintenance, due to wear and maladjustment, restrict the performance of such mechanical encoders.

Electrical switches having moving contacts are also used in prior keyboard encoders. However, dirt on the contacts and contact oxidation and wear cause mechanical switches to have varying non-zero resistances between engaged contacts. As a result, encoders employing moving contacts have limited reliability and their performance often deteriorates with age as well as with use.

A further disadvantage of prior keyboard encoders is their relatively large size and high cost.

BRIEF SUMMARY OF INVENTION

Accordingly, it is an object of the present invention to provide a compact, high performance keyboard encoder characterized by relatively low cost.

Another object of the invention is to provide an encoder of the above type characterized by the absence of mechanical linkages and moving electrical contacts.

A further object of the invention is to provide an encoder of the above type characterized by high reliability. A more specific object of the invention is to provide a keyboard encoder whose output signals are relatively free from errors and which is capable of prolonged use with minimal maintenance.

A still further object of the invention is to provide a keyboard encoder characterized by simplicity of design and low-cost fabrication.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

Briefly, keyboard apparatus embodying the present invention includes a panel mounted on a frame with the panel having a plurality of holes passing between inner and outer surfaces thereof. A support board is also mounted to the frame inwardly from said panel inner surface and substantially parallel thereto. Also provided is a plurality of character buttons each of which has an inner end that is separated from an outer end and each of which is disposed in one of the holes through the panel. Each of the buttons is depressable at the panel outer surface from a normal position to an actuated position so as to move the inner end away from the panel and toward the support board. A resilient means is disposed between the buttons and the support board so as to urge each button into the normal position. When a button is depressed, the resilient means is compressed to a relatively small fraction of its width.

In one embodiment of the invention, a plurality of capacitor plates is disposed on the support board with at least two plates being operatively associated with each button. Each button then carries on its inner end a conductor means which overlaps the plates associated with each button. When a button is in its normal position, there is relatively little capacitive coupling between the associated capacitor plates. On the other hand, when a button is depressed, the capacitive coupling between the associated plates is increased appreciatively.

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawings like reference characters denote like components, and:

The FIGURE is a pictorial representation, partly broken away, of an electronic display unit incorporating a keyboard encoder embodying the invention.

DESCRIPTION OF PREFERRED EMBODIMENT

For a detailed description of the keyboard apparatus embodying the present invention, reference is made to the aforementioned U.S. Pat. No. 3,588,875, which patent is incorporated herein by reference. In particular, the keyboard apparatus embodying the invention is shown in FIGS. 1 through 14 and described in detail beginning at Column 3 Line 61 and continuing through Column 15 Line 4.

What is claimed is:

1. A multiple character keyboard comprising in combination
 - A. frame means,
 - B. a panel having opposed inner and outer surfaces and being mounted to said frame means,
 - C. a support board mounted to said frame means inwardly from said panel inner surface,
 - D. a plurality of character-designating buttons, each of which
 1. has inner and outer ends,
 2. passes through said panel and is depressible at the panel outer surface from a normal position to an actuated position to move said inner end toward said support board,
 - E. insulating cushion means
 1. disposed between said buttons and said board,
 2. urging each button into said normal position, and
 3. being compressed under a depressed button to a relatively small fraction of its width when the button is in the normal position, and
 - F. stop means limiting the movement of each button away from said support board beyond said normal position.
2. A keyboard according to claim 1 in which
 - A. each button has means at the inner end thereof forming a recess facing said board, and
 - B. a separate cushion means is associated with each button, each separate cushion means being seated in said recess in the associated button and engaging said support board.
3. A multiple character keyboard comprising in combination
 - A. a frame,
 - B. a panel mounted on said frame and having inner and outeropposed surfaces,
 - C. a plurality of character buttons, each of which has an inner end that is spaced from an outer end, each button
 1. having a flange adjacent said inner end,
 2. being disposed in a hole through said panel and having a normal position where said flange engages said panel inner surface,
 3. being depressible from said normal position to move said inner end away from said panel,
 4. having electrical conductor means adjacent said inner end,
 - D. a dielectric board mounted on said frame substantially parallel to said panel and disposed inwardly therefrom,

- E. resilient means disposed between said buttons and said dielectric board and urging the buttons into said normal position,
- F. a plurality of capacitor plates on said board,
1. at least two plates being operatively associated with each button and disposed opposite said conductor means on the associated button,
 2. said plates associated with each button being substantially co-planar with each other and having a relatively small capacitive coupling between them when the associated button is in said normal position,
 3. said plates associated with each button being so overlapped by said conductor means on the button that when said button is depressed, thereby moving said conductor means thereon toward said plates, the capacitive coupling between each associated plate and at least one other associated plate increased capacitive coupling of the plates with the associated conductor means, and
- G. means forming an insulator between said plates and said associated conductor means.
4. A keyboard according to claim 3 in which
- A. each button has means forming a central recess in the

- surface thereof at said inner end so that said recess faces said dielectric board,
- B. said conductor means has a substantially planar metal surface covering the unrecessed bottom surface of the button,
- C. said insulating means includes a layer of dielectric material covering said capacitor plates, and
- D. said resilient means consists of a plurality of insulating spongelike cushions, each cushion being
1. disposed in a recess and engaging said layer of dielectric material to urge the button into said normal position, and
 2. compressible to such an extent that the button associated therewith is readily depressible to engage said metal surface thereon against said layer of dielectric material.
5. A keyboard according to claim 3 in which
- A. said insulating means includes a layer of dielectric material covering said capacitor plates, and
- B. said conductor means on each button bottoms on said layer when the button is depressed.
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