

July 5, 1966

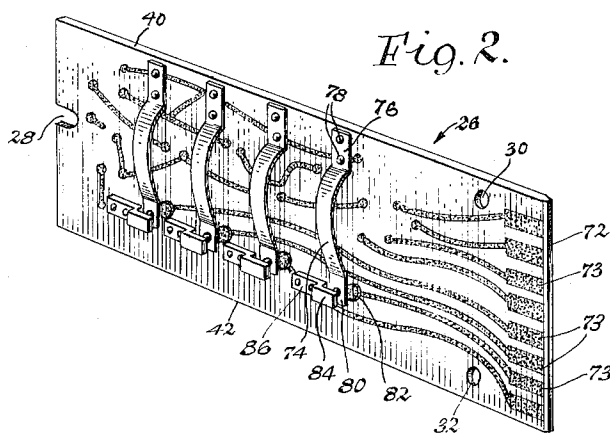
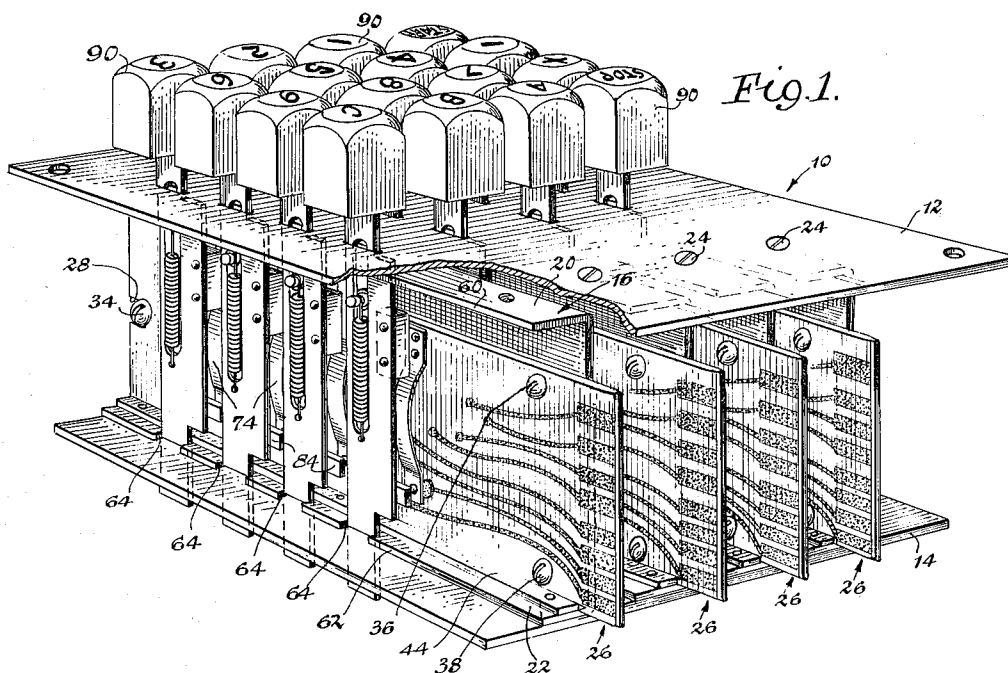
S. D. REED

3,259,806

TRANSLATING KEYBOARD FOR DATA HANDLING SYSTEMS

Filed Oct. 21, 1963

2 Sheets-Sheet 1



INVENTOR.
SPENCER D. REED

BY
Beau, Brooks, Buckley & Beau
ATTORNEYS

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2 Sheets-Sheet 2

Fig. 3.

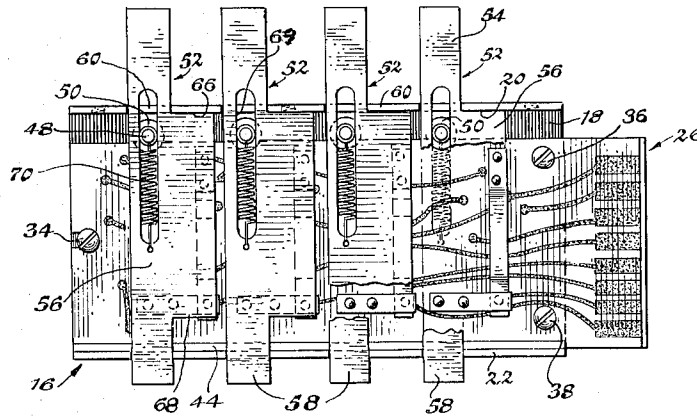
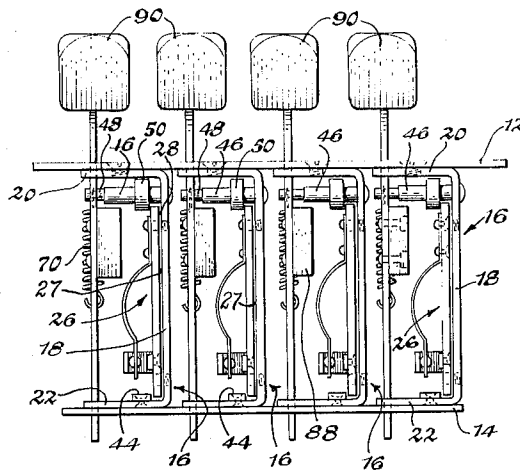


Fig. 4.



INVENTOR.
SPENCER D. REED

BY

Beau. Brooks, Buckley & Beau
ATTORNEYS

1

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TRANSLATING KEYBOARD FOR DATA HANDLING SYSTEMS

Spencer D. Reed, Endicott, N.Y., assignor to Sensing Devices, Inc., Endicott, N.Y.
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This invention relates to keyboard assemblies in general and pertains, more particularly, to a self-contained unit or package comprising a desired array or matrix of individually operable key members, the requisite mounting means therefor and the associated circuitry desired to be operated in conjunction with the keys, all being contained in the unit so as to be compatible and usable in conjunction with the data processing equipment and the like, either directly in association therewith or physically removed therefrom.

In data processing and similar endeavors, a keyboard having individual keys or tabs arranged in a convenient array or matrix is required in order to translate various symbols or characters into discrete electrical signals corresponding to the particular character or symbol involved; and such electrical signals must be in a form compatible with the equipment controlled by the keyboard. Thus, the keyboard assembly is characterized by having physically movable keys or tabs which, when operated, activate associated circuitry to produce the requisite electrical signal. As can be appreciated, many different arrays, arrangements or matrices of keys may be desirable for various and different applications and in conjunction with various and different types of processing or similar machines. As a result, keyboard assemblies tend to become a one-of-a-kind type of arrangement and for that reason, their manufacture is not particularly economical. It is therefore of primary concern in connection with the present invention to provide a standard subassembly arrangement for keyboard assemblies whereby repetitive subassemblies may be arranged in different and desired patterns to produce a required array or matrix.

Another object of this invention resides in the provision of an assembly as set forth in which the component parts thereof are interrelated in such fashion that they individually serve, in many instances, multiple functions so as to reduce cost, effect economy of weight, size and space; and wherein their use permits a reduction in cabling and cable connecting cost normally associated with tying into a keyboard unit.

Another object of this invention concerns the concept of a basic component of each subassembly which comprises a printed circuit member which operates not only to provide a compact and self contained circuit arrangement which allows substantial reduction in cabling, but which also serves as a mounting and positioning means for key-controlled electrical contact members. Ancillary to this object is the fact that an arrangement such as is described permits the use of actuator keys which require but a minimum of effort to operate so that the factor of human fatigue is greatly mitigated even when the keyboard is operated over extended period of time.

It is a further object of this invention to provide an improved keyboard assembly embodying novel subassemblies wherein each subassembly is essentially self-contained and includes the requisite circuitry associated with that particular subassembly. In this manner, both assembly and maintenance of the equipment is greatly simplified. For example, in contrast to an arrangement wherein the electrical circuitry is located remote from the actual keyboard construction, operating trouble in association with the present invention can be quickly isolated to a particular subassembly circuitry and does not involve time consuming circuit tracing to isolate the source of trouble.

2

A further object of this invention is to provide an improved keyboard assembly having the characteristics as above described and wherein the number of parts is maintained at a practical minimum and wherein each subassembly of the general arrangement or overall assembly is essentially self-contained and is, moreover, so constructed and arranged that the component parts thereof, while being easily assembled, are nevertheless so joined together that each subassembly can be handled separately for arrangement with other similar subassemblies without danger of the component parts becoming displaced or misaligned in such fashion as renders the final assembly either tedious or difficult.

Other objects and advantages of the invention will appear from the description hereinbelow and the accompanying drawing wherein:

FIG. 1 is a perspective view, partly broken away, showing a keyboard assembly and associated circuitry constructed in accordance with the principles of the present invention;

FIG. 2 is a perspective view of one of the printed circuit boards associated with each subassembly;

FIG. 3 is a side view, partly broken away, showing the details of the one subassembly within the keyboard and circuit assembly; and

FIG. 4 is a view of the assembly shown in FIG. 1 and illustrating certain other details associated with the invention.

Referring now more particularly to FIG. 1, an assembly representative of the principles of this invention is shown therein and designated by the reference character 10; which assembly will be seen to include the top and bottom mounting plates 12 and 14 which are provided with a plurality of subassemblies, such as the subassembly generally designated by reference character 16, disposed therebetween. The several subassemblies are similarly formed and each represents a self-contained and separate unit which cooperates with the top and bottom plates 12 and 14 to form an integral, coordinated and rigid unit 10. It will be appreciated that the reason for using two mounting plates 12 and 14 stems essentially from the desire to join the various subassemblies in a rigid unit; it being possible to eliminate one of these plates if so desired, as will be described hereinafter.

With reference now to FIG. 4, it will be seen that each subassembly 16 comprises a channel member having a web 18 and laterally directed legs 20 and 22, the latter of which are positioned adjacent and secured to the top and bottom plates 12 and 14 by any suitable fastening means such as the screwthread members 24 as is shown in FIG. 1. Each subassembly further includes a printed circuit board indicated generally by the reference character 26, see particularly FIG. 3, which is secured to the inner face of each of the webs 18, preferably with an intervening insulating sheet 27 disposed therebetween, see particularly FIG. 4. For the purpose of its attachment to the web 18, each circuit board 26 is provided with a notch 28 at one end thereof, see particularly FIG. 2, and with openings 30 and 32 at opposite sides of the board adjacent the opposite end thereof. Fastener elements 34, 36 and 38 engaged with each web 18 are utilized for securing each corresponding circuit board 26 in place.

It will be clear from a study of FIG. 1 that by loosening a fastener 34 and by removing fasteners 36 and 38, an associated circuit board 26 will be free for endwise withdrawal from its corresponding channel member. In this fashion, any desired circuit board may be quickly and easily removed and replaced as may be desired or necessary.

For the purpose of guiding the circuit boards 26 so as to assure their proper disposition within the subassemblies, guideways are provided on the channel members

for receiving the upper and lower edges 40 and 42 of each circuit board 26. The guideway for the lower edge 42 of each circuit board may take the form of a strip of material 44, see particularly FIGS. 1 and 4, secured to the lower channel leg 22 in each case parallel to but spaced from a corresponding web 18 so that, as shown, the aforementioned lower edge 42 of each circuit board 26 is properly guided thereby. It will of course be appreciated that the use of a separate strip 44 is not essential in the formation of the lower guideway. For example, the lower leg 22 may be provided with an integrally formed groove or guideway such as to receive and guide the lower edge 42 of the circuit board. Along the upper edge of each web 18, adjacent to the upper leg 20 of each channel, are a series or rows of anchor stud members 46 which are rigid with the web 18 and which project laterally therefrom, substantially coextensive with the legs 20 and 22, the anchoring studs 46 preferably terminating in reduced end portions 48 the purpose of which will be presently apparent. The height of each circuit board 26 is such that the lower edge 42 thereof, being received in the lower guideway such as may be provided by the members 44, positions the upper edge 40 thereof, in each case, closely adjacent the rows or anchoring studs 46. The anchoring studs 46 are provided with shoulder portions 50 spaced laterally from the corresponding web 18 so that each row of anchoring studs and their corresponding shoulder portions 50 constitute and form an upper guideway for receiving and guidably positioning the upper edge 40 of each circuit board 26. As stated above, the exact construction of the lower guideway as is shown in the drawings need not be strictly followed. For example, the lower guideway could as well be formed by the provision of a step or rib on the lower leg 22 of each channel member 16, obviating the necessity for a separate strip of material 44 as is specifically shown and described hereinabove.

To complete each subassembly, a row of key stems is associated therewith, as can be seen more particularly in FIG. 3. In FIG. 3, each of the key stems is designated by the reference character 52 and each will be seen to include an upper portion 54, an intermediate portion 56 and a lower end portion 58. Furthermore, it will be apparent from this figure and also from FIG. 1 that the free edge portions 60 and 62 of the upper and lower legs 20 and 22 of each channel member 16 are provided with notches 64 for receiving the upper and lower portions 54 and 58 of each key stem 52. However, it will be noted that should it be desirable to eliminate the bottom plate 14, the lower leg 22 of each channel member may then be provided with an opening rather than a notch. The intermediate portion 56 of each key stem is, on the other hand, wider than the upper and lower portions 54 and 58 thereof so that the upper and lower shoulders 66 and 68 presented by each intermediate portion 56 provide stops cooperable with a corresponding upper or lower leg 20 or 22 to limit reciprocatory motion of each key stem relative to its channel member. Each key stem is provided with an elongate slot 69 which receives the aforementioned reduced end portion 48 of each anchoring stud 46 in the manner best shown in FIGS. 1, 3 and 4 and a suitable tension spring member 70 has its opposite ends connected respectively to the anchoring member in each case and a portion of the key stem adjacent the lower end of the slot 69. The spring 70 in each case is assembled under slight tension so that each key stem is urged, normally, upwardly as is shown in FIG. 3 so that the upper shoulder 66 of each intermediate portion 56 engages the underside of the upper leg 20 of each associated channel member.

From the above description of the subassemblies, it can be appreciated that each constitutes and forms an integral and complete unit in and of itself which may be readily assembled or disassembled with a minimum of effort. Each circuit board 26 may be of any desired cir-

cuitry configuration, corresponding to the particular problem to be encountered and conventional printed circuit techniques may be employed in the manufacture thereof. It will also be understood that the circuit board 26 in each case constitutes and forms a complete circuit arrangement, inclusive of circuit components so that the projecting edge 72 of each board need provide merely the terminal portions 73 to which suitable conductor elements are applied for completing the circuitry extending to the associated data processing machine or the like. Although, for simplicity, the circuit boards shown in the drawings do not illustrate all of the circuit components which may be associated therewith, the various switch means, or at least one form thereof, which may be actuated in response to reciprocation of the key stems is shown. Referring to FIG. 2, the switch means particularly shown therein will be seen to consist of a flexible switch arm 74 having a base portion 76 rigidly affixed to the circuit boards, as by rivets 78 with the free end portion 80 of each switch arm being free to move, under the influence of suitable actuating means, into electrical engagement with either the contact land portion 82 or the contact arm 84 shown. The contact arm 84 is provided with a base portion 86 secured to the board 26 in a similar fashion to the base portion 76 of the movable switch arm 74 and, in each case, as will be well understood by those skilled in the art, electrical connection is made by these base portions 76 and 86 to appropriate land portions of the printed circuit board. In addition to the components constituted by the various switch means, additional components such as diodes and the like may be associated with each circuit board. In this case, it will be understood that such additional circuit components will be secured to the same face on the circuit board as are the switch means so that the rear face or side of the circuit board 26 opposite to that shown in FIG. 2, will be free and unencumbered by laterally projecting circuit components and will contain only the conventional land portions necessary to constitute and form the proper electrical connections within the circuitry itself. It will be further understood that the number of switch means as are shown in FIG. 2 correspond in number to the number of key stems associated with the subassembly and, as will be clear from FIG. 4, the key stem in each case may carry an actuator means such as the insulating block 88 which is aligned so as to engage the movable contact arm 74 when the key stem is pushed downwardly to move the switch arm from a position in contact with the contact member 84 into contact with the land portion 82 to produce the electrical signal at the corresponding terminal or terminals 73. The switches themselves are of course of such type as may be required to perform the desired circuit closing or breaking actions and, to this end, may be either single or multiple pole and either single or multiple throw.

It will be further appreciated that each subassembly, when assembled, presents all its parts in properly positioned and oriented relationship so that the orientation or positioning of such parts is entirely proper and will be retained despite reasonable handling of the subassemblies. This is particularly true as regards the various key stems 52 in view of the fact that the upper and lower portions 54 and 58 thereof are received within the notches 64, the tension springs 70 providing sufficient frictional engagement between the key stems and the channel members to hold the key stems properly in position so that each of the subassemblies may be subjected to reasonable handling without incurring misalignment and/or accidental loss of the key stems. Further, the channel shaped configuration of the members 16 conveniently provides for the requisite lateral offset between the webs 18 and the associated key stems 52 so that the circuit boards 26 may be slid endwise through the channel members as aforesaid while, at the same time, providing sufficient lateral

clearance for the circuit components carried by the circuit boards to permit this interengagement of parts. Obviously, the number of key stems associated with each channel member may be varied at will, the circuit board of course requiring modification or extension to accommodate for the particular number of switch means in the circuitry involved. The top and bottom plates 12 and 14 are provided with rectangular openings arranged in parallel rows for accommodating and receiving the upper and lower portions 54 and 58 of the key stems 52 and when a complete unit is to be assembled, it will be manifest that each of the subassemblies will be engaged with the lower plate 14 such that the lower portions 58 of the associated key stems 52 thereof are received in a corresponding row of openings in the bottom plate 14. Thereafter, the top plate 12 is positioned to receive the rows of upper portions 54 of the various key stems and, lastly, the button portions 90, bearing suitable indicia as shown, are engaged with the upper end portions 54 of the various key stems. Obviously, other and different switch means than are specifically described and shown may be employed without departing from the spirit and scope of the present invention.

I claim:

1. A keyboard and circuit assembly, comprising a pair of mounting plates and a plurality of channel members extending between said mounting plates, each channel member having a pair of legs and a web joining such legs, and said channel members being oriented such that the webs thereof extend normal to said mounting plates and in spaced, parallel relation to each other, one leg of each channel member being secured to one mounting plate and the other leg of each channel being secured to the other mounting plate, said mounting plates having a plurality of rows of aligned openings therein with such rows corresponding in number to and being arranged parallel to the direction of said webs, a key stem reciprocally received in each pair of said aligned openings, a circuit board releasably secured to the inner face of each web, and each circuit board having a plurality of switch members thereon, one opposite each key stem and operable in response to reciprocation of the associated key stem, and means on said channel members for guiding each circuit board for withdrawal and replacement endwise of an associated channel member.
2. A keyboard and circuit assembly, comprising a mounting plate and a plurality of channel members fixed thereto, each channel member having a pair of legs and a web joining such legs, and said channel members being oriented such that the webs thereof extend normal to said mounting plate and in spaced, parallel relation to each other, said mounting plate having a plurality of rows of openings therein with such rows corresponding in number to and being arranged parallel to the direction of said webs, a key stem reciprocally received in each of said openings, a circuit board releasably secured to the inner face of each web, and each circuit board having a plurality of switch members thereon, one opposite each key stem and operable in response to reciprocation of the associated key stem, means for guiding each circuit board for withdrawal and replacement endwise of an associated channel member, and a row of anchor studs projecting laterally from each web adjacent one of said legs, each key stem having a slot clearing the free end of an associated stud, spring means acting between each stud and its

associated key stem urging the key stem normally to one extremity of its reciprocable movement, said means for guiding each circuit board comprising a guideway at the other leg of each channel member and shoulder portions on at least a plurality of studs in each row thereof.

3. A subassembly for translating keyboard assemblies, comprising

a channel member having a web provided with laterally projecting legs along the opposite side edges thereof, a plurality of anchoring studs secured to said web along a line parallel and adjacent to one of said legs, a plurality of key stems, each having an intermediate portion and opposite end portions, in which the intermediate portion is wider than the end portions, and each intermediate portion being of a length less than the spacing between the channel legs, said end portions of the key stems being guidably received in said legs and each key stem having an elongate slot receiving and clearing the free end of one of said anchoring studs, spring means acting between each anchoring stud and an associated key stem urging the intermediate portion of the latter into engagement with said one leg of the channel member, a circuit board having a width substantially equal to the spacing between said anchoring studs and the other leg of said channel member, means on said anchoring studs and said other leg of the channel member providing guideways for the opposite side edges of said circuit board whereby such board is guided for endwise removal and replacement relative to said channel member from and to a position laterally parallel to said key stems, circuit components on one side face of said circuit board including switch means associated with each key stem, and actuator means on each key stem for altering the condition of an associated switch means in response to axial displacement of the key stem.

4. A translating keyboard assembly, comprising a pair of plates disposed in spaced, parallel relation, means extending between and joining said plates, each plate having a plurality of rows of openings therein, with the rows of one plate being aligned with corresponding rows of the other plate and with corresponding openings in corresponding rows also being aligned, a key stem received in each pair of corresponding openings and each stem being of such length relative to the spacing between plates as to permit axial reciprocation of each stem while the so-reciprocated stem remains within the confines of and is guided by its associated corresponding pair of openings, said means comprising a plurality of webs lying in a plane between and normal to said plates, and in laterally spaced parallelism with a corresponding row of key stems, a circuit board mounted in face-to-face opposition to each web and on that side thereof facing a corresponding row of key stems, each circuit board including circuit components mounted on and projecting laterally from that side of the board facing its corresponding row of key stems, at least some of which circuit components comprise switch means operable in response to reciprocation of the keys of said corresponding row thereof, said means including guideways adjacent opposite edges of said webs receiving the opposite edges of said circuit board to permit removal and replacement of individual circuit boards by endwise movement thereof within said guideways.

5. A translating keyboard and circuit assembly, comprising

- a top plate and a bottom plate disposed in spaced, parallel relation, and a plurality of spaced channel members extending between said top and bottom plates,
- each channel member having top and bottom legs contiguous with said top and bottom plates respectively and joined thereto to interconnect said plates, and having a web extending between said legs,
- said top and bottom plates being provided with aligned rows of openings wherein each row is disposed in spaced, parallel relation to one of said webs adjacent the free edges of the legs associated therewith,
- a reciprocable key stem received in each aligned pair of such openings, and each stem having an intermediate portion having an inner face opposed to but spaced from the inner face of a respective web,
- a circuit board received in each channel member adjacent the inner face of each web and each board having circuit components mounted on that side thereof facing said inner faces of the associated key stems, the spacing between said inner faces of the key stems and their associated webs being such as to clear said components whereby said circuit boards may be removed and replaced endwise through said channel member,
- said components including a switch means associated with each key stem,
- and means on each key stem for actuating an associated switch means in response to reciprocation of the associated key stem.

6. A keyboard and circuit assembly, comprising
- a pair of mounting plates disposed in spaced, parallel relation, and a plurality of channel members disposed between said mounting plates and fixed thereto to maintain the stated spaced, parallel relation,
 - each channel member having a pair of legs and a web joining such legs, and said channel members being oriented such that the webs thereof extend between and normal to said mounting plates and in spaced, parallel relation to each other,
 - each plate having a plurality of rows of openings therein with such rows corresponding in number to and being arranged parallel to the direction of said webs, and the openings of corresponding rows being aligned,
 - a key stem reciprocally received in each pair of aligned openings,
 - a circuit board releasably secured to the inner face of each web, and each circuit board having a plurality of switch members thereon, one opposite each key stem and operable in response to reciprocation of the associated key stem,
 - and means for guiding each circuit board for withdrawal and replacement endwise of an associated channel member.

7. A keyboard and circuit assembly, comprising
- a pair of mounting plates disposed in spaced, parallel relation, and a plurality of channel members disposed between said mounting plates and fixed thereto to maintain the stated spaced, parallel relation,
 - each channel member having a pair of legs and a web joining such legs, and said channel members being oriented such that the webs thereof extend between and normal to said mounting plates and in spaced, parallel relation to each other,
 - each plate having a plurality of rows of openings therein with such rows corresponding in number to and being arranged parallel to the direction of said webs, and the openings of corresponding rows being aligned,
 - a key stem reciprocally received in each pair of aligned openings,

- a circuit board releasably secured to the inner face of each web, and each circuit board having a plurality of switch members thereon, one opposite each key stem and operable in response to reciprocation of the associated key stem,

means for guiding each circuit board for withdrawal and replacement endwise of an associated channel member,

- and a row of anchor studs projecting laterally from each web adjacent one of said legs, each key stem having a slot clearing the free end of an associated stud, spring means acting between each stud and its associated key stem urging the key stem normally to one extremity of its reciprocable movement,
- said means for guiding each circuit board comprising a guideway at the other leg of each channel member and shoulder portions on at least a plurality of studs in each row thereof.

8. A subassembly for translating keyboard assemblies, comprising

- a channel member having a web provided with laterally projecting legs along the opposite side edges thereof, the free edges of said legs having spaced notches therealong in which the notches of the two legs are in alignment,
- a plurality of anchoring studs secured to said web along a line parallel and adjacent to one of said legs,
- a plurality of key stems, each having an intermediate portion and opposite end portions, in which the intermediate portion is wider than the end portions and said end portions are substantially coextensive in width with said notches, each intermediate portion being of a length less than the spacing between the channel legs,

said end portions of the key stems being received in aligned pairs of said notches, and each key stem having an elongate slot receiving and clearing the free end of one of said anchoring studs,

spring means acting between each anchoring stud and an associated key stem urging the intermediate portion of the latter into engagement with said one leg of the channel member,

- a circuit board having a width substantially equal to the spacing between said anchoring studs and the other leg of said channel member,

means on said anchoring studs and said other leg of the channel member providing guideways for the opposite side edges of said circuit board whereby such board is guided for endwise removal and replacement relative to said channel member from and to a position laterally parallel to said key stems, circuit components on one side face of said circuit board including switch means associated with each key stem,

and actuator means on each key stem for altering the condition of an associated switch means in response to axial displacement of the key stem.

9. A subassembly for translating keyboard assemblies, comprising

- a channel member having a web provided with laterally projecting legs along the opposite side edges thereof,
- a plurality of key stems, each having an intermediate portion and opposite end portions, in which the intermediate portion is wider than the end portions and each intermediate portion being of a length less than the spacing between said channel legs, each intermediate portion having an elongate slot therein, the legs of each channel member having aligned openings therein receiving the end portions of respective key stems,

an anchor member for each key stem and each anchor member being secured to the channel member and having a terminal portion extending into the slot of respective key stems,

9

a spring for each key stem and engagement with one end thereof with said key stem and at the other end thereof with a corresponding anchor member,
 a circuit board secured in face-to-face relationship with that face of the web facing said key stems,
 guide means for guiding said circuit board for endwise removal and replacement relative to said channel member,
 circuit components on one side face of said circuit board including switch means associated with each key stem,
 and actuator means on each key stem for altering the condition of an associated switch means in response to axial displacement of the key stem.

5

10

10

10. The subassembly as defined in claim 9 wherein said guide means is formed in part by said anchor members.

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ROBERT K. SCHAEFER, *Primary Examiner.*

KATHLEEN H. CLAFFY, *Examiner.*

H. J. RICHMAN, *Assistant Examiner.*