Title: KEYBOARD FORMED OF SEPARATE KEYBUTTON ROWS

Abstract: A keyboard device includes a plurality of discrete keyboard row elements, each including a plurality of keyswitches, and a backbone device configured to provide a plurality of positions of the keyboard row elements, the plurality of positions including at least one use position, the keyswitches arranged to accept data entry in the at least one use position. A keyboard device includes a plurality of row elements, each corresponding to a row of key elements, each row element including a top area and a side area, each row element laterally expandable between an expanded position and a contracted position, and an elastomer strip provided on each row element, a width of the elastomer strip selected so that, in the expanded position of the row element, the elastomer strip covering the top area and at least a portion of the side area. A method includes selectively logically and electrically connecting a plurality of row elements to a backbone device to form an operative keyboard device, each row element including a plurality of keybuttons, and entering data via the keybuttons after the connecting step.
KEYBOARD FORMED OF SEPARATE KEYBUTTON ROWS

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit of U.S. Provisional Patent Application No. 60/409,878, filed on September 10, 2002, and U.S. Provisional Patent Application No. 60/409,954, filed on September 10, 2002, each of which is expressly incorporated herein in its entirety by reference thereto.


FIELD OF THE INVENTION

The present invention relates to the formation of a portable keyboard using separate keybutton rows. As with other keyboards, the desired character is signaled by depressing that keybutton with a fingertip.

The present invention relates, generally, to ensembles of keybuttons and, e.g., rows of keybuttons, e.g., five. The keyboard layout is usually named for the assembly of characters which begins the "d" row, second from the top, and is thus called "QWERTY" after the leftmost first six characters.
BACKGROUND INFORMATION

Some 140 years after Christopher Scholes invented the typewriter and assigned the keybar names in the so-called "QWERTY" layout, the QWERTY layout has become the dominant keyboard layout for information handling equipment.

Thus, most people who learn to "touch type" do so using a QWERTY layout. When fully learned, touch typing provides a method for data input that is almost entirely unconscious, relegating the component tasks to spinal reflex arcs and muscles, when fed information from the conscious brain.

In the last two decades, several major trends ensure the popularity of touch typing. First, office workers no longer feel that it is a demeaning activity to type, in fact, it is now considered natural. Gone are the days when people drafted letters on yellow pads, forwarded the pad to a typist, retrieved the typed rough draft, corrected it, sent it back to the typist, and reviewed the final typed output. Now the author does the typing, and in many cases, the material is not put on paper, but is sent electronically to the intended recipient(s).

Second, the rapid growth in popularity of the internet has encouraged many people to learn to touch type, or to improve nascent skills so that they can produce text quickly.

Third, typed homework materials are now expected by school teachers, and a handwritten paper may mean a lower grade. Further, more and more schools are using "computer labs" as part of the school day, so that students are expected to touch type with some skill.

Fourth, young children are learning their "A-B-Cs" on a computer keyboard, using special software designed to attract and teach them. Their typing computer keyboard is usually formed in a QWERTY layout, and while the young students only use "hunt and peck" keybutton typing systems, it is not long before they begin to learn QWERTY touch typing. In that regard, U.S. Patent No. 4,902,231 to Clare Freer is believed to describe some Learn to type via mnemonic devices as educational devices for teaching touch typing. The proposed
device includes a chart to be placed in the view of the young student and a series of overlays to be used on the individual student keyboards. The chart and overlays give the student the visual and mental impressions necessary to remember the location of individual keys without having to look at the keys.

Now that portable data handling devices, such as laptop computers, smart cellphones or PDAs are routinely capable of handling and displaying text messages, there is a desire by the users of such portable equipment to readily produce text messages using touch typing.

Presently, only a few devices other than laptops are made that allow typed input. Even the very tiny keyboards, such as that on the Research-In-Motion ("RIM") Blackberry model PDA use a miniature keyboard laid out in QWERTY format. Targus is believed to offer the "Think Outside" 3-part folding keyboard for attachment to PDAs, and Palm is believed to offer a two-part folding keyboard for their better PDA models.

While stylus input, or machine-translation of handwritten symbols is offered, character input using a stylus or pen may be not as "transparent to the user" as is touch typing, so that it is not uncommon for the user of a portable device to wait until they are at a full size desktop keyboard to do significant text communication.

Thus, there is a latent desire to easily perform touch typing when the user is NOT near their desktop full size keyboard. Since the portable data devices that are smaller than a laptop computer often do fit in large pockets, the offered "touch typing" device must also be of similar size. If the touch typing keyboard is integrated into a smart cell phone or small PDA, it must be of a size that does not make the cell phone or PDA seem overly bulky.

U.S. Patent No. 6,068,417 to Butler is believed to describe a system which allows lateral movement of keybuttons between a compressed state to an open "typing use" state. A system of "lazy tong" linkages is used to achieve easy
expansion and notched side keybuttons allows good size compression when stored.

U.S. Patent No. 6,563,434 to Olodort et al. and U.S. Patent No. 6,331,850 to Olodort et al. are believed to describe some of the underlying technology for the "Think Outside" folding keyboard. These two patents are believed to deal with the electrical and mechanical methods of achieving a collapsible keyboard whose transport size is thus minimized.

Note that the present invention may use several individual keybutton rows to form a keyboard, in contrast to U.S. Patent No. 4,349,286 to Blaser et al., entitled "Keyboard Assembled from Individual Keys". The device described by Blaser et al. provides individual "plug-in" keybuttons so that rearranging of the keyboard layout is made easier, whereas the present invention utilizes a pre-manufactured QWERTY layout. In Europe, some rearrangement, such as AZERTY is used, but that rearrangement is done at the time of manufacture and may not be changed by the user.

SUMMARY

Accordingly, it is an aspect of the present invention to provide a keyboard system in which mechanically separate keybuttons rows may be combined to provide a full keyboard.

More particularly, it is an aspect of the present invention to provide a full keyboard whose keybuttons, when depressed, may act to signal a logic device as to that depression and further yield a data output which may represent a selected character or symbol to an associated information handling device.

A more specific aspect of the present invention is to provide a keyboard in which the individual keybutton rows may be, if desired, carried as separate units, as in a storage bag or other housing. An associated backbone joining unit may also be carried with the individual keybutton rows.

A further aspect of the present invention is to provide an individual keybutton row with an arrangement for physical expansion or contraction, so as to provide at least two
operating keybutton row width modes, narrow for storage and wide for touch typing. A third compact but operating mode is an option.

A further aspect of the present invention is to provide a support system for the keyboard, whether contracted or expanded, so that the typist user may readily depress keys on a stable keyboard unit.

An example embodiment of the present invention may provide two major types of elements, (1) an individual keybutton row, with or without an arrangement for lateral expansion and (2) a backbone connector unit which may electrically join the individual keybutton row electronic strips and may provide a signal route to the contained logic devices, such as microprocessor.

Additionally, the backbone unit may provide an exit route for logic decoded messages, e.g., character codes. Secondarily, the backbone unit may physically join and support at least one end of the keybutton row.

For some constructions of keyboards, the plugs and receptacles may be omitted and the keybutton rows may be "hard wired" to the backbone. In this case, the backbone housing may be indented between keybutton row positions so as to allow the backbone to be curved along with the keybutton rows into a compact storage bundle.

An individual keybutton row may constitute a separate mechanical assembly. For the greatest storage compactness, it may be desirable to provide a keybutton row that may expand from a compact storage size to a full 10-3/8 inch wide size for touch typing.

The expansion mechanism may take many forms, e.g., rail sets which slide within each other. For a keybutton row that expands twice the storage size (e.g., 5-3/16 long in storage to 10-3/8 in touch typing mode), a three part rail system may be provided. The left and right ends slide within a middle section, so that a two-to-one expansion may be possible.
It may also be possible to use an elastomeric rubber for the molded keytop surface. The uppermost surface of the keybuttons may expand to twice its storage length.

It is a further aspect of the present invention to provide a wide lap over of the elastomeric rubber top surface, so as to avoid the possible edge gaps or visual neckdown that may otherwise occur in the center portion of the narrowing elastomeric strip when the keybutton row is fully extended. By lapping the elastomer over the rail edge and extending it down over the full height of the side rails, the inevitable necking may only occur over the side rail edges and may not compromise the actual typing surface provided on the top of the rails. Since the necking curve of the elastomer when stretched may only occur on the side of the rails, it may be out of sight of the user, so that a continuous visual appearance of the stretched out elastomer may be preserved.

Standard elastomeric dimples mounted beneath the rails may provide suitable touch typing feel for the typist's fingers. A suitable electrical connection may use a thin, flexible polyamide strip. When the keyrow is compressed to its storage length, the polyamide strip may festoon upwardly between keybutton positions. When the keyrow is expanded out to touch typing length, the festoon or upward bulge in the polyamide may almost disappear. The remaining bulge between the keybutton positions may allow the polyamide strip to festoon upwardly at the bulge points.

Thin membrane switches may be placed at each keybutton location, directly under the elastomeric dimple. When the dimple everts, a central nib presses down on the membrane switch. The membrane switches are wired into copper traces which extend along the polyamide strip in each keybutton row. One end of the polyamide strip (here, the left end) is then mated to a plug. Alternately, the copper traces may be permanently connected to the backbone circuitry, if it is not required to handle the keyboard rows separately from the backbone unit.
In an example embodiment of the present invention, a keyboard device includes a plurality of discrete keyboard row elements, each including a plurality of keyswitches, a backbone device configured to provide a plurality of positions of the keyboard row elements, the plurality of positions including at least one use position, the keyswitches arranged to accept data entry in the at least one use position.

The row elements may be electrically and logically detachably attachable to the backbone device.

The row elements may be electrically and logically attached to the backbone device in the at least one use position.

The backbone may include electrical and logical connection elements, each connection element corresponding to a respective row element, and the row elements may be electrically and logically attachable to the backbone device via the connection elements.

Each connection element may be uniquely configured relative to other connection elements.

Each row element may include a complementary electrical and logical connection element configured to connect to a respective connection element of the backbone.

The plurality of positions may include a rolled storage position and an unrolled use position.

The keyboard device may include a storage bag configured to receive the backbone and the row elements.

Each row element may be laterally expandable and contractible.

The row elements may be attached to an arrangement adapted to vertically stack the row elements.

The row elements may be attached to an arrangement adapted to adjust an inter-row spacing between row elements, and the arrangement may include a mechanical linkage.

The connection elements may be color coded.

Each row element may include a laterally expandable elastomer strip, and the elastomer strip may extend along a side portion of the row element.
In accordance with an example embodiment of the present invention, a method includes selectively logically and electrically connecting a plurality of row elements to a backbone device to form an operative keyboard device, each row element including a plurality of keybuttons, and entering data via the keybuttons after the connecting step.

The method may further include selectively logically and electrically disconnecting the row elements from the backbone device after the data entry step.

In an example embodiment of the present invention, a keyboard device may include a plurality of row elements, each corresponding to a row of key elements, each row element including a top area and a side area, each row element laterally expandable between an expanded position and a contracted position; and an elastomer strip provided on each row element, a width of the elastomer strip selected so that, in the expanded position of the row element, the elastomer strip covering the top area and at least a portion of the side area.

The keyboard device may include a plurality of keyswitch elements, each corresponding to a respective one of the key elements. The keyswitch elements may be provided in an interior portion of the row element below the elastomer strip.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows an individual row of keybuttons.

Figure 2 shows a size particularization of an individual row of keybuttons.

Figure 3 shows a particularization of a keyboard row by adding keybutton labels to each keybutton position.

Figure 4 shows five individual rows of keybuttons, joined to a backbone unit which contains a logic processor and an arrangement for communicating with an external information handling device.

Figure 5 shows a placement of five separate keybutton rows along with a backbone unit in a protective bag, e.g., for transport or storage of the keyboard.
Figure 6 shows an indented structure for the backbone unit, so that the backbone unit may be curved at hinge points for storage.

Figure 7 shows the indented backbone rolled into a pentagonal shape (Figure 7A) and placed within a protective bag (Figure 7B). The individual keybutton rows may be left attached to the backbone, and may thus also be in the protective bag.

Figure 8 presents a U channel assembly which may allow the keybutton row to expand laterally from a compact storage position.

Figure 9 shows a cross section of a U channel onto which an elastomeric cover has been placed. The elastomeric cover is molded to serve as individual keybuttons, and the pressure of a typist's finger will deflect the elastomeric cover downwards. This pressure is transmitted to an elastomeric dimple. The dimple may collapse under mild pressure, and the tip may close the underlying switch capsule, signaling the logic microprocessor that a particular keybutton has been pressed down.

Figure 10 shows an elastomeric row cover. In Figures 10A and 10B, the unstretched and then stretched out geometry of an elastomeric strip is shown. The undesirable neckdown is compensated by forming a deep side lap on the elastomer strip. Figure 10C shows the side lap elastomer unstretched, and Figure 10D shows the side lap elastomer strip when stretched out.

Figure 11 shows one method of linking several individual keybutton rows together. The vertical stack of keybutton rows of 11A will then change to the "bleacher seat" configuration shown in Figure 11B. If the keybutton rows are positioned to be adjacent to each other and represent an essentially flat surface, the keyboard shape shown in Figure 11C may be obtained. If the keybutton rows are then expanded laterally, the full size keyboard of Figure 11E may be obtained.

Figure 12 illustrates the vertical expansion of closely packed keybutton rows, as in a compact storage, e.g., in
Figure 12A. When the keybutton rows are expanded vertically, to obtain the optimum center to center spacing (3/4 inch), the resulting keyboard is shown in Figure 12B. Note that the use of flexible connectors may allow the keybutton rows to open vertically without losing electrical linkage from the keybutton rows to the logic microprocessor inside the backbone unit.

Figure 13 illustrates a latch stabilization system that provides a flexible base when the keyboard is carried. When a solid base is desired for typing support, the finger latches engage to stabilize the flexible base. Figures 13A and 13B show views of the backbone segments used on the left side of the keyboard, Figure 13C shows a top view of the individual keyboard rows, and Figures 13D and 13E show the thin end bar used on the right side of the keyboard.

Figure 13F shows an enlarged view of the bottom of the backbone unit, with details of a slide bar that moves through a side strap. Figure 13G shows the left side ensemble of slide bars and straps, both in the disengaged and engaged positions. Figure 13H shows the right side ensemble of slide bars and straps, both in the disengaged and engaged positions.

LIST OF REFERENCE NUMERALS UTILIZED IN THE DRAWINGS

10 individual keybuttons
12 space bar (wide key)
20 keybutton labels
30 keybutton row, general
40 keybutton row, particularized (compressed)
45 keybutton row, particularized (expanded)
50 keybutton row, with labels
70 interconnecting plug
100 expansion rails
120 receptacle (electronic)
125 connector ribbon (used instead of 70 plug and 120 receptacle)
130 backbone unit
132 indented backbone unit
134 indent notches
136 flexible or hinged base
138 indented backbone segments
140 matrix decoder logic
150 decoded information output
160 carry bag
162 second carry bag
180 basic U channel shape
185 left U channel
190 U center channel
192 side area of U channel 190
195 U right channel
200 elastomer strip top
210 elastomer strip side lap (left)
212 elastomer strip side lap (right)
215 engager point
220 molded character zone
240 dimple
250 pressure tip
260 membrane switch pad
270 polyamide strip
280 polyamide strip festoon (at rear)
300 unstretched elastomeric keyboard row
   cover strip (individual keybuttons 10
   molded into the strip 300)
310 stretched elastomeric strip
315 full depth lapover of elastomer
   keybutton row cover 300
320 neckdown region of elastomer
   keybutton row cover
330 individual molded characters
   zone
340 vertical stacking of keybutton
   rows 40
360 left telescoping linkage (pivot mounted to
keybutton rows 40 or 45)
370  right telescoping linkage (pivot mounted to
keybutton rows 40 or 45)
380  pivot (attaches keybutton row 40 or 45 to
  telescoping linkage 360 or 370)
400  slide bar
410  finger operation portion of slide bar
420  side strap
430  fold points of backbone and end bar
440  end bar

DETAILED DESCRIPTION

Figure 1 shows a set of individual keybuttons 10, laterally providing a keybutton row 30. The electrical connections to the individual switches for each keybutton emerge at the left end, here shown as interconnecting plug 70. In the non-particularized row, all keybuttons are of equal size (this also represents the top row E of a standard 5 row keyboard).

Figure 2 shows a lateral set of keybuttons 10 which have been particularized into keybutton row 40 so that the individual keybuttons may be wider, as required. Here, row A of a standard 5 row keyboard is shown, with the very wide "space bar" at the center.

Figure 3 shows a lateral set of keybuttons 10 which have been particularized by adding "keybutton name" labels 20 to each key. Additionally shown are the lateral expansion rails 100 at the top side and bottom side of the labeled keybutton row 50.

In Figure 4, five particularized keybutton rows 50 have been placed vertically adjacent to each other so as to form a full keyboard. Each keybutton row 50 has an interconnecting plug 70 at the left end. These plugs 70 mate with receptacle 120 mounted on the backbone unit 130. The backbone unit 130 also includes a matrix decoder chip 140, such as a microprocessor. Once a keybutton switch closure is made, the matrix chip 140 produces an output signal to the associated
data handling device, and this signal may appear at output 150. Note that this may be a wired output, a wireless signal output, etc.

Mechanically separate individual keybutton rows 50 may be assembled into a full keyboard by hand, e.g., by joining a plug 70 on each keybutton row to a mating receptacle 120 on a backbone unit 130. Color coding of the plugs and receptacles may be used to avoid mistakes in choosing just which plug and receptacle to use, and this may be less expensive than using five mechanically different plug and receptacle sets.

In Figure 5, the individual keybutton rows 60 have been placed into two vertical stacks, along with the backbone unit 130. The end view shows the resulting stack, placed within a protective carry bag 160.

Figure 6 shows a version of the backbone 130, but with four indent notches 134 so as to form indented backbone 132.

Figure 6A shows the resulting indented backbone 132 from the top, and Figure 6B shows the indented backbone 132 from the bottom. A flexible or hinged base 136 joins the five portions of the indented back bone 132 housing. A data output port, here a connector, is shown as 150. As previously noted, this connector may not be used if the communication between the logic microprocessor within the indented backbone 132 were to be wireless.

Figure 7 shows the indented backbone 132 rolled into a pentagon shape in Figure 7A. If the individual keybutton rows 50 were plugged in, they may also form a pentagon shape, which may be convenient for compact transport. In Figure 7B, the pentagonal shape is placed in a protective carry bag 162.

In Figure 8, a basic U channel shape 180 is shown. This U channel shape 180 is one arrangement for achieving an expandable "carrier" for keybutton row 50. To allow lateral expandability, Figure 8B shows left, center and right U channels. The left U channel 185 may be placed within the end of center U channel 190, and the right U channel 195 may be placed within the other end of center U channel 190.
In Figure 8C, the left U channel 185 and the right U channel 195 are moved laterally out from center U channel 190.

Figure 9 shows a cross-sectional end view of a typical U channel with an elastomer top strip in place. The elastomer strip top 200 may be made from a metal-catalyzed room-temperature curing synthetic rubber which may have stretchout properties of at least two-to-one.

The elastomer top strip 200 is placed over the telescoping U channels, here 185 and 190. A polyamide strip 270 with copper traces is used for interconnecting the keybutton switches to the logic processor 140. The elastomer strip top 200 has a central "molded character" zone 220 atop the strip. This molded zone 220 may identify particular keybuttons to the typist.

A membrane switch pad 260 is placed atop the polyamide strip 270. An elastomeric dimple 240 is placed directly atop the membrane switch pad 260. When the typist user presses a finger down on the molded character zone 220 of the elastomer strip top 200, the central portion 220 will deflect downwardly. This downward motion passes through the engager point 215 and may collapse the dimple 240. When the dimple 240 collapses under finger pressure, the pressure tip 250 may descend and make pressure contact with the center of membrane switch pad 260. This pressure causes electrical closure of the membrane switch pad 260, and a closure signal is carried by the polyamide strip 270 to the logic processor 140.

Note that the elastomer strip top 200 provides long side laps at left (elastomer strip side lap 210) and at right (elastomer strip side lap 212). The function of these long side laps 210 and 212 will be shown in Figure 10.

In Figure 10A (at the top), a strip of unstretched elastomer is shown. When this strip is pulled laterally, Figure 10B shows the result. A severe "neckdown" 320 will appear as a result of stretching.

In order to ensure that a neckdown 320 may not harm the mechanical aspect of the elastomer strip when used for a keybutton row 50, Figure 10C shows a full depth lapover on the
unstretched elastomer row cover 300. This lapover 315 occurs on both sides of the U channel.

When the U-channels 185, 190 and 195 move to form a wider structure, the elastomer cover 310 may be stretched out. But, because a lap over 315 was provided on both sides of the U channels, the neckdown of the elastomeric row cover 320 may occur only in the side area 192. Thus, the top portion of the elastomeric strip cover for the row 310 may not be affected, for example, in the molded character zone 330.

Figure 11 shows a system for expanding a five row keybutton set (rows 40) which originates in a vertically stacked configuration 340, shown in Figure 11A.

Figure 11B shows the stack of five keybutton rows 40 slid out in a "bleacher seat" configuration. The individual keybutton rows 40 are held to telescoping linkages 360 by pivots 380. Once the "bleacher seat" configuration of 11B is pulled out, the individual keybutton rows 40 may be further pivoted using pivots 380 into an essentially flat configuration, as shown in Figure 11C. Here, the electrical connection between the individual keybutton rows 40 to the backbone 130 is made using connectors 125, such as pieces of polyamide strip with copper traces atop. It may be provided to mechanically protect these connectors 125 with, for example, a coating of elastomer on both sides.

In Figure 11D, all keybutton rows 40 are expanded out laterally from their storage width to a touch typing width, e.g., 10-3/8 inches. The laterally expanded keyrow would now be labeled "45".

In Figure 11E, five of the expanded rows 45 are used to assemble a full sized keyboard, suitable for touch typing.

In Figure 12, the possible need to expand the individual keybutton row center-to-center distance is presented. In Figure 12A, the keyboard rows are vertically thinner than 3/4", so they may be compressed vertically to save storage or transport space. In Figure 12A, a set of ribbon connectors 125 is used to provide an electrical pathway between the individual keybutton rows and the backbone 130 which contains
the logic processor 140. The keyboard rows are held by pivots 380 onto the left side telescoping rail 360 and the right side telescoping rail 370. The telescoping rails 360 and 370 allow the relative vertical movement of the keybutton rows 45 to achieve the desired 3/4 inch center-to-center spacing, as shown in Figure 12B.

This spacing represents the standard spacing provided on full-size desktop keyboards, and this is a "training dimension" for anyone learning to touch type. If the center-to-center keybutton row spacing is not close to 3/4 inch, the keyboard will "feel wrong" to the typist user, and typing mistakes may occur.

In Figure 13, a latch stabilization system is illustrated which may allow the user to utilize the keyboard in either a flexible mode for carrying or an essentially rigid mode for typing use. Figure 13C shows the top view of five individual keyboard elements 50, in this case connected to a left side indented backbone 138. When viewed from the left, as in Figure 13A, the individual segments 138 are seen as trapezoids mounted on flexible or hinged base 136. If viewed from the bottom, the backbone would appear as in Figure 13A, with the four fold points 430 as shown.

The right side of the keyboard may be stabilized using end bar 440, which has the segmented shape of the backbone, but is much thinner. It is shown attached to the right ends of the individual keyboard elements 50, and a bottom view is shown in Figure 13E.

In Figure 13F, an enlarged bottom view of the backbone base 136 is shown, with fold points 430 shown. A slide bar 400 is shown, having a "half tee" shape, with a finger-operated tab 410 at top left of the slide bar 400. The slide bar operated is side strap 420, which is mounted directly on the base 136 of the backbone unit 138 or the corresponding bottom of the end bar 440.

In Figure 12G, the topmost view of the left side latch system shows the slide bars 400 leftward, and thus are in the "disengaged" position. The bottom most view of Figure 12G
shows the slide bars 400 moved to the right under finger tip action of the tab 410 inside side strap 420, so as to cross over the width of the fold lines 430. This bridging action across the fold lines may stabilize the base of the keyboard on the left side.

In Figure 13H, the right side latch system is shown. In the topmost view, the slide bars 400 are leftward, i.e., disengaged. In the bottom most view of Figure 13H, the slide bars 400 are moved to the right under finger tip action of the slide tab 410, so as to bridge the fold lines 430. This bridging action of the slide bars 400 may act to stabilize the right side of the keyboard.

In accordance with an example embodiment of the present invention, mechanically separate individual keybutton rows (e.g., five) may be used to assemble a working keyboard. The mechanically separate nature of the individual keybutton rows may make possible some efficient storage modalities, but may allow re-configuration into a working keyboard.

In accordance with an example embodiment of the present invention, mechanically separate individual keybutton rows may be assembled into a full keyboard by hand, e.g., by joining a plug on each keybutton row to a mating receptacle on a backbone unit. Color coding may be used to avoid mistakes in choosing just which plug and receptacle to use.

In accordance with an example embodiment of the present invention, mechanical linkages may be used to join the individual keybutton rows, and these mechanical linkages may facilitate the transition between a close-packed storage mode to a "spread out" use mode. The linkages may also facilitate the transition between a laterally compressed keyboard (e.g., for storage) out to an expanded width keyboard to be used for touch typing.

In accordance with an example embodiment of the present invention, the relative vertical mechanical movement between individual keybutton rows may permit close packed vertical storage to the optimized (3/4 inch center-to-center) inter spacing for the individual keybutton rows.
In accordance with an example embodiment of the present invention, an elastomer strip may be used to form keybutton rows which may expand laterally. When such an elastomer strip is stretched out, both the lateral center-to-center distance between keybuttons is expanded (e.g., to the optimum 3/4 inch space), and the lateral width of the keybutton may also be increased.

In accordance with an example embodiment of the present invention, the unwanted neckdown aspect of stretched elastomer strips may compensated for by using a deep side lap construction.

It should be understood that each of the elements described above, or two or more together, may also find application in types of equipment other than keyboards. And, while the description has been illustrated and described as embodied for keybutton depression sensing in a keyboard, it is not intended to be limited to the details shown, since it should be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and its operation may be made by those skilled in the art without departing in any way from the spirit and scope of the present invention.

What is claimed as new and desired to be protected by Letters Patent is set for in the appended claims.
WHAT IS CLAIMED IS:

1. A keyboard device, comprising:
   a plurality of discrete keyboard row elements, each
   including a plurality of keyswitches; and
   a backbone device configured to provide a plurality of
   positions of the keyboard row elements, the plurality of
   positions including at least one use position, the keyswitches
   arranged to accept data entry in the at least one use
   position.

2. The keyboard device according to claim 1, wherein the
   row elements are electrically and logically detachably
   attachable to the backbone device.

3. The keyboard device according to claim 2, wherein the
   row elements are electrically and logically attached to the
   backbone device in the at least one use position.

4. The keyboard device according to claim 1, wherein the
   backbone includes electrical and logical connection elements,
   each connection element corresponding to a respective row
   element, the row elements electrically and logically
   attachable to the backbone device via the connection elements.

5. The keyboard device according to claim 4, wherein
   each connection element is uniquely configured relative to
   other connection elements.

6. The keyboard device according to claim 4, wherein
   each row element includes a complementary electrical and
   logical connection element configured to connect to a
   respective connection element of the backbone.

7. The keyboard device according to claim 1, wherein the
   plurality of positions includes a rolled storage position and
   an unrolled use position.
8. The keyboard device according to claim 1, further comprising a storage bag configured to receive the backbone and the row elements.

9. The keyboard device according to claim 1, wherein each row element is laterally expandable and contractible.

10. The keyboard device according to claim 1, wherein the row elements are attached to an arrangement adapted to vertically stack the row elements.

11. The keyboard device according to claim 1, wherein the row elements are attached to an arrangement adapted to adjust an inter-row spacing between row elements.

12. The keyboard device according to claim 1, wherein the arrangement includes a mechanical linkage.

13. The keyboard device according to claim 4, wherein the connection elements are color coded.

14. The keyboard device according to claim 1, wherein each row element includes a laterally expandable elastomer strip.

15. The keyboard device according to claim 14, wherein the elastomer strip extends along a side portion of the row element.

16. The keyboard device according to claim 1, wherein the arrangement includes a device system configured to mechanically stabilize the keyboard during translation from a portable use position to a typing use position.

17. A method, comprising:
   selectively logically and electrically connecting a plurality of row elements to a backbone device to form an
operative keyboard device, each row element including a plurality of keybuttons; and entering data via the keybuttons after the connecting step.

18. The method according to claim 17, further comprising selectively logically and electrically disconnecting the row elements from the backbone device after the data entry step.

19. A keyboard device, comprising:

a plurality of row elements, each corresponding to a row of key elements, each row element including a top area and a side area, each row element laterally expandable between an expanded position and a contracted position; and

an elastomer strip provided on each row element, a width of the elastomer strip selected so that, in the expanded position of the row element, the elastomer strip covering the top area and at least a portion of the side area.

20. The keyboard device according to claim 19, further comprising a plurality of keyswitch elements, each corresponding to a respective one of the key elements.

21. The keyboard device according to claim 20, wherein the keyswitch elements are provided in an interior portion of the row element below the elastomer strip.
Figure One - Individual row of keybuttons

Figure Two - Individual row of keybuttons, size particularized

Figure Three - Individual row of keybuttons secondarily particularized with characters with added expansion rail system

Figure Four - Individual rows of character and size-particularized keybuttons combined into keyboard

"backbone" (connectors and logic)
Matrix Decoder Chip 140 (Inside)
decoded character information output 150 (to associated data device)
**Figure Five** - Individual keybutton rows and backbone in storage bag

- output plug 150
- backbone unit 130 (end view)
- recessed connector 120
- end view, carry bag 160
- individual keybutton row 50
- interconnecting plug 70

**Figure Six** - Indented backbone 132 (allows curving for storage)

- indent notches 134
- indented backbone segments 138
- data output connector 150
- flexible or hinged base 136
- recessed receptacles 120 (to individual keyrows 50)

**Figure Seven** - Indented backbone rolled into pentagon shape (individual keyrows plugged into backbone)

- 7A = rolled ensemble
- (end view)
- flexible or hinged base 136
- indented backbone segments 138
- individual keyrows 50

**7B = in protective bag**

- nominal 2-1/2 inches
Figure 8 = U channel assembly

8A = basic U channel shape 180

8B = left, center and right U channels

left U channel 185

center U channel 190

right U channel 195

8C = left and right U channels slide within center U channel

right U channel 195

center U channel 190

left U channel 185
Figure Nine = cross sectional end view of U channels with elastomer top strip in place.
Figure 10 = Full lap of Elastomer Row Cover

10A Unstretched elastomer strip 300

10B Stretched elastomer strip 310

note neckdown 320 (in center)

10C Full lapover on sides of elastomer strip

note full depth lapover 315 (of elastomer row cover 300)

side area 192 (of U channel 190)

10D When row is stretched out, Neckdown of elastomer strip only on sides of U channel

neckdown of elastomer row cover 310 only occurs on side areas

side area 192 (of U channel 190)
Figure 11  "Bleacher Seat stacking"

11A = vertical stack 340

11B = slide out to "bleacher seating"

pivot 380

telescoping linkage 360

11C = adjust so all keyrows lie flat (in same plane)

backbone 130

connectors 125

11D = expand all keyrows 40

11E = full size touch typing keyboard
Figure Twelve  Increasing Keybutton row pitch to 3/4 inch center to center

12A = keyboard rows expanded to full 10-3/8" width, but are closer than 3/4" center to center

12B = keyboard rows moved out to provide 3/4" center to center

connectors 125 (flexible strips maintain connection during inter row movement)
Figure Thirteen  
Latch Stabilization System

13A LEFT BOTTOM VIEW  13A LEFT SIDE VIEW  13C TOP VIEW  13D RIGHT SIDE BOTTOM VIEW  13E RIGHT VIEW

13 F
finger-operated slide tab 410
slide bar 400
side strap 420
fold line 430

13 G Left Side Latches
400 420 disengaged
136
400 420 engaged
136

13 H Right Side Latches
400 disengaged
440
400 engaged
440
slide bar 400 movement