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(54) Computer overlay keyboard

(57) A keyboard for a computing device comprises magnetic overlay means (12) and a housing (11). The magnetic overlay means has at least two interchangeable keypads, composed of pressure sensitive keys. The housing includes ferromagnetic coupling means (15) for removably coupling thereto the magnetic overlay means, pressure activated switch means (18), means (17) for registering the magnetic overlay means with the switch means, and microprocessor means (16) for receiving the switch signals and for generating and transmitting output signals correlatable with the switch signals to the computing device. The keyboard enables a single microcomputer to be used alternately as two different dedicated microcomputers, such as a cash register and a general purpose microcomputer. The keyboard is thought to be less expensive and more user-friendly than known multi-purpose tailored keyboards.

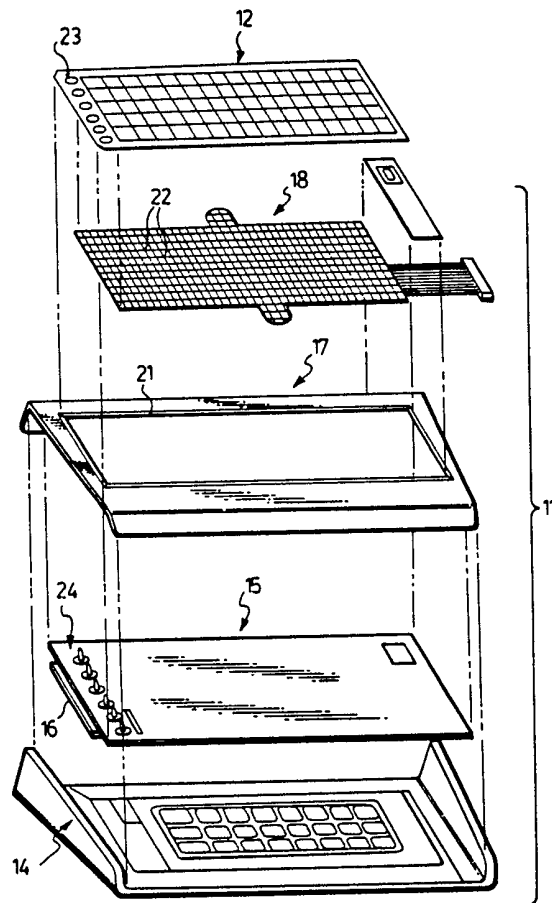
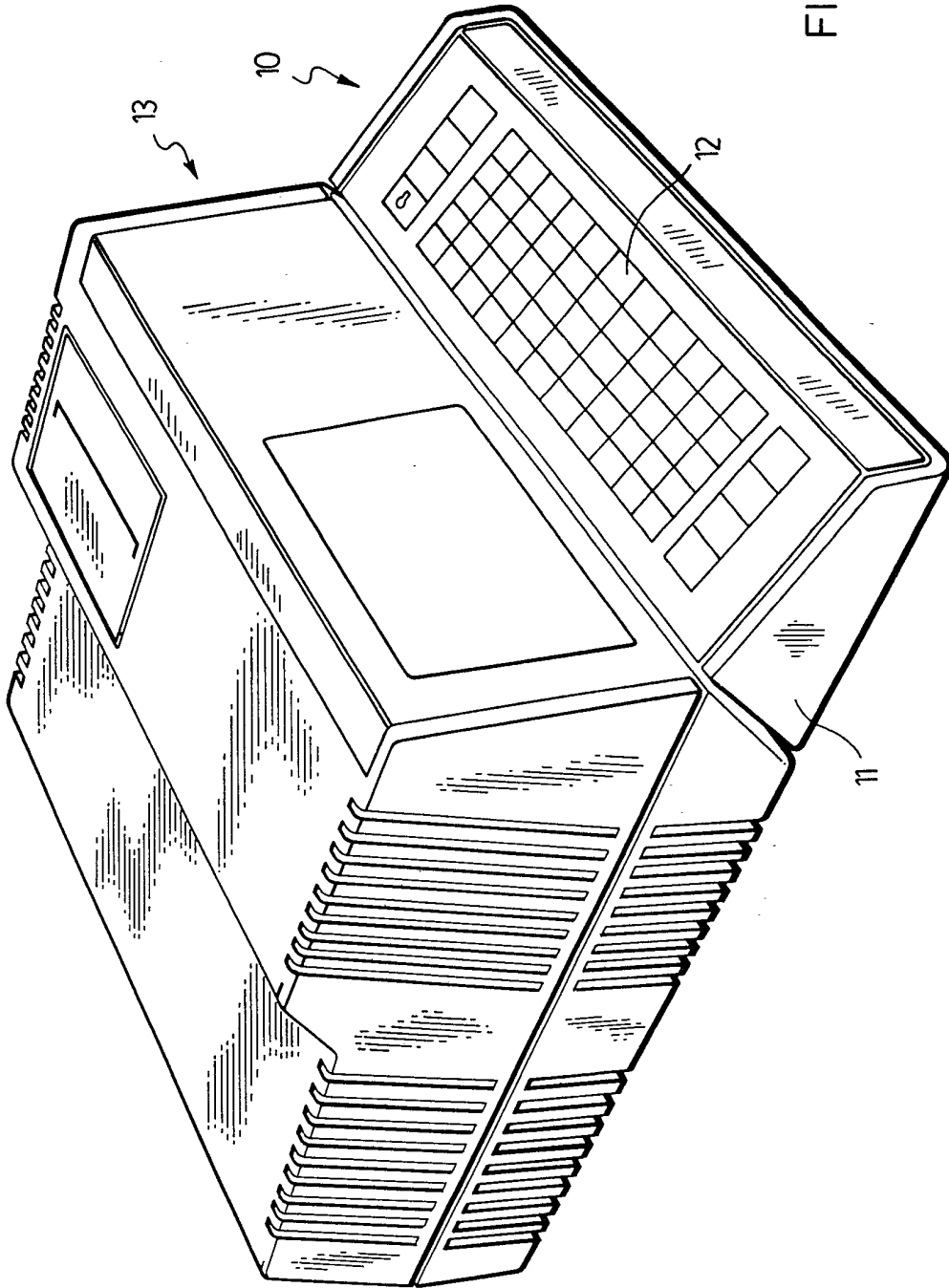


FIG. 2.

FIG. 1.



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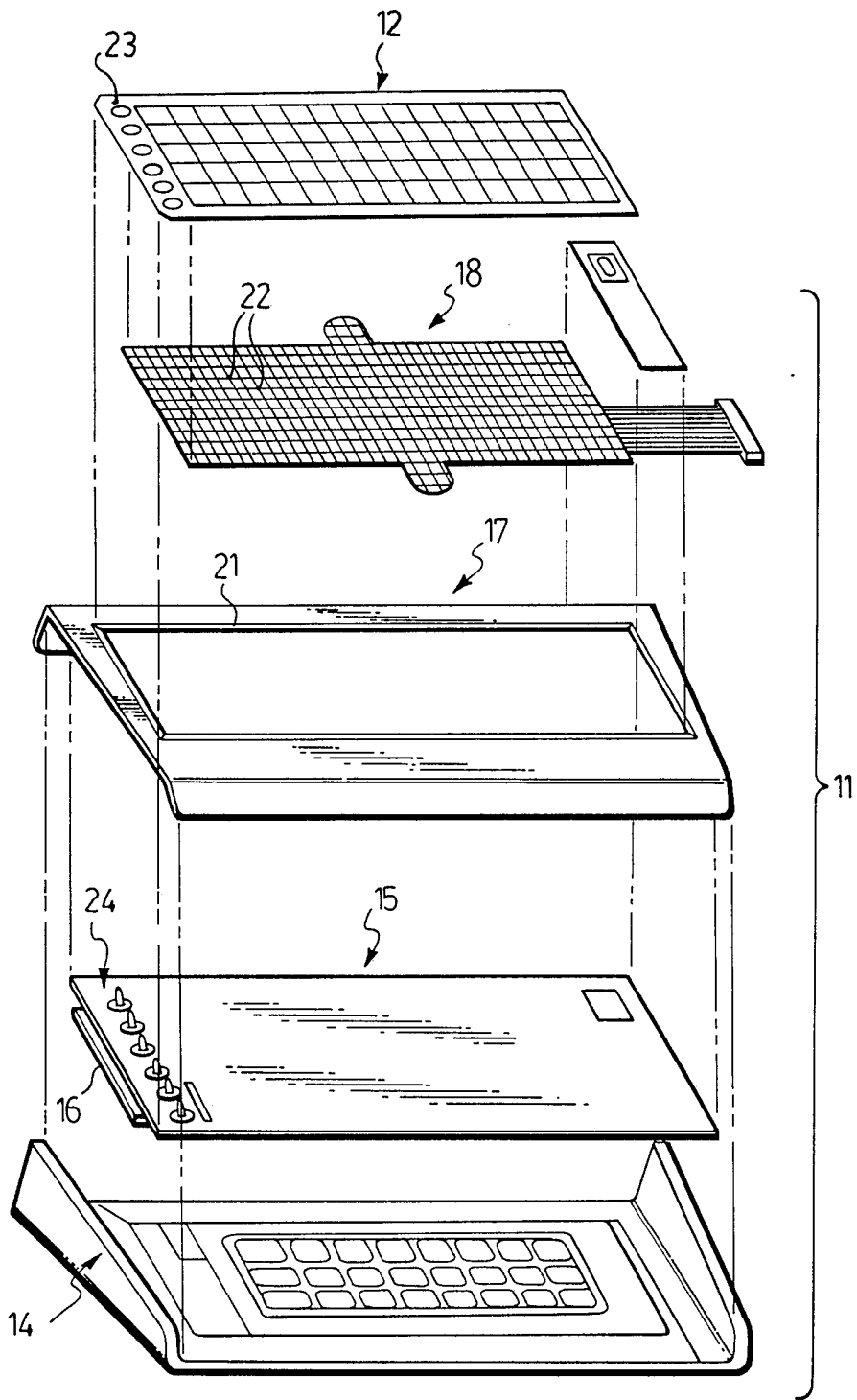


FIG. 2.

FIG. 3a.

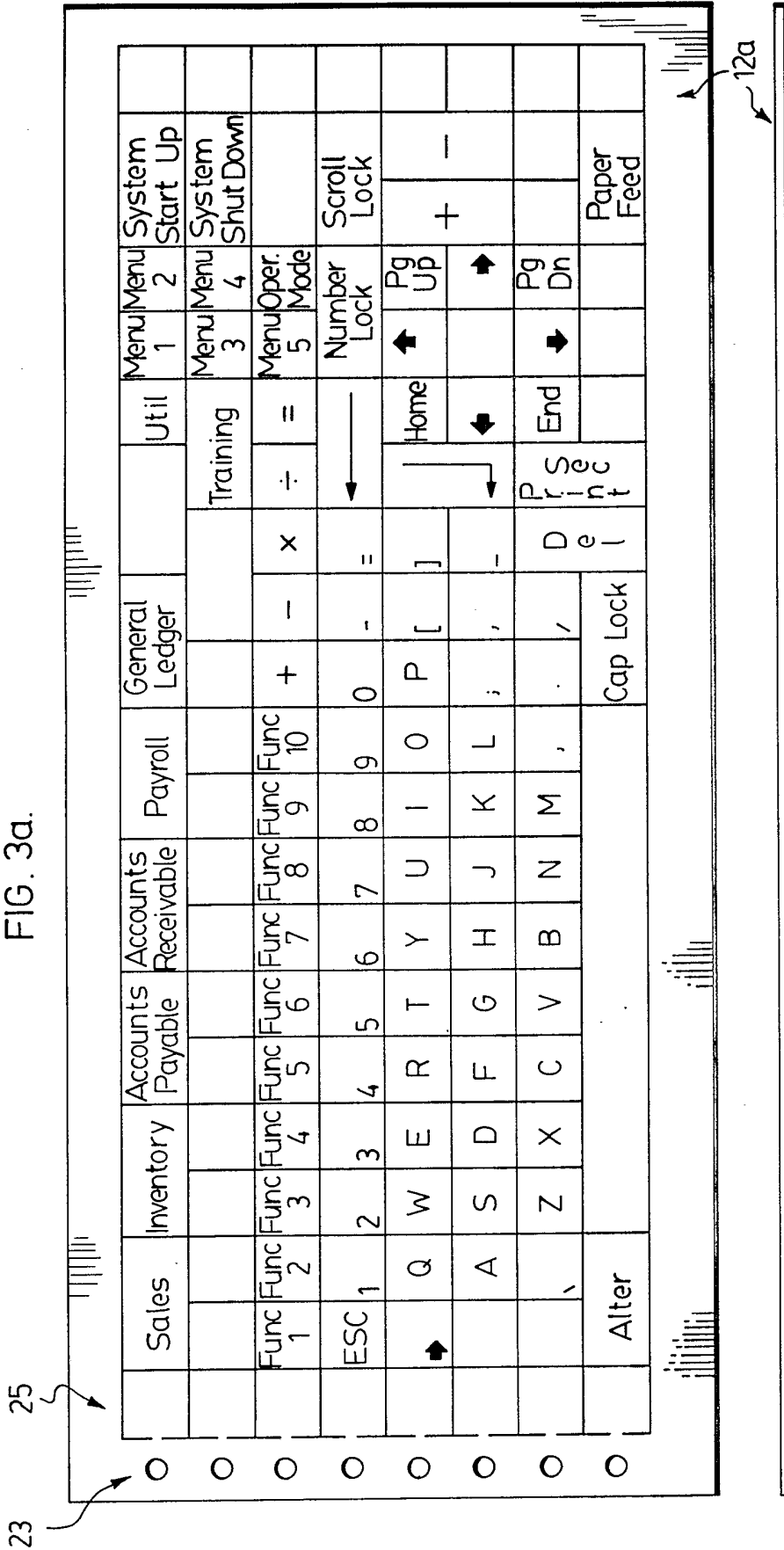


FIG. 3b.

FIG. 3c.

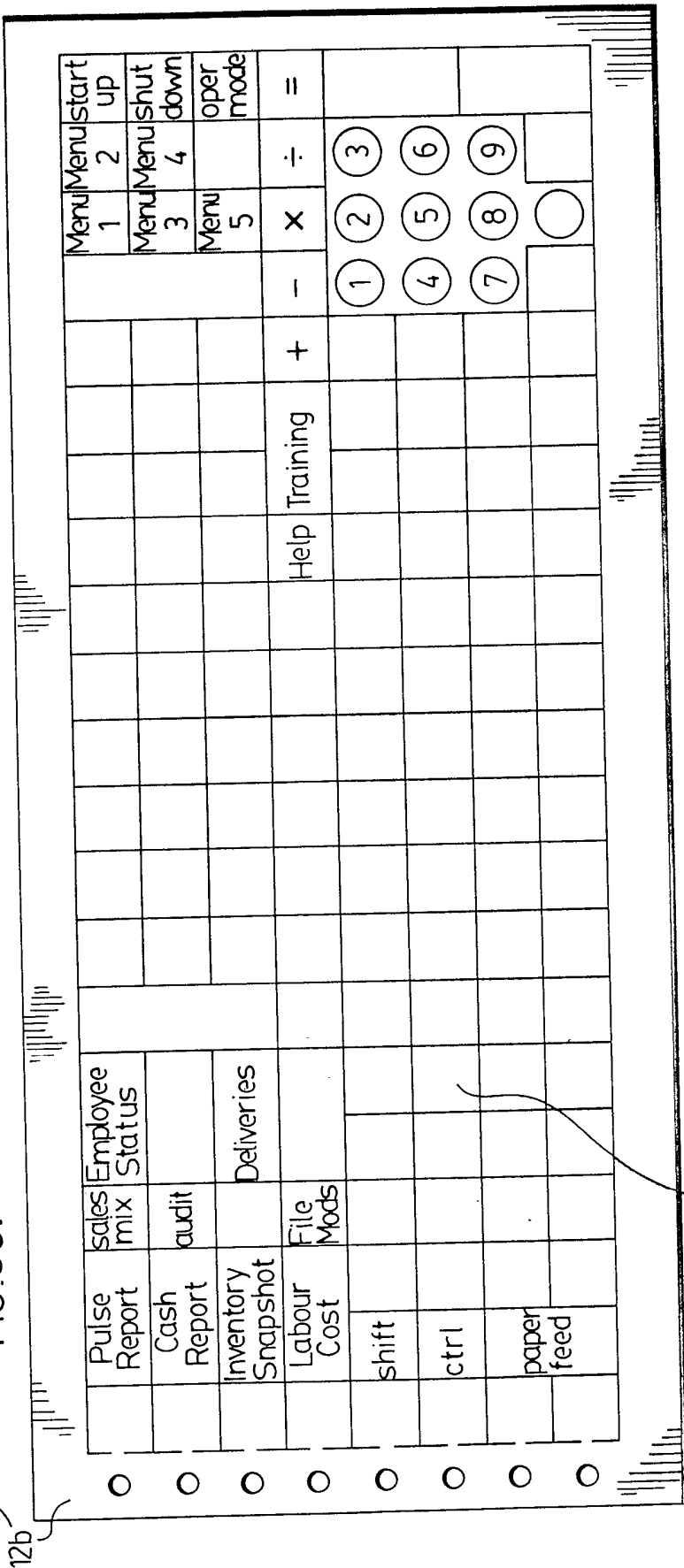


FIG. 3d.

20

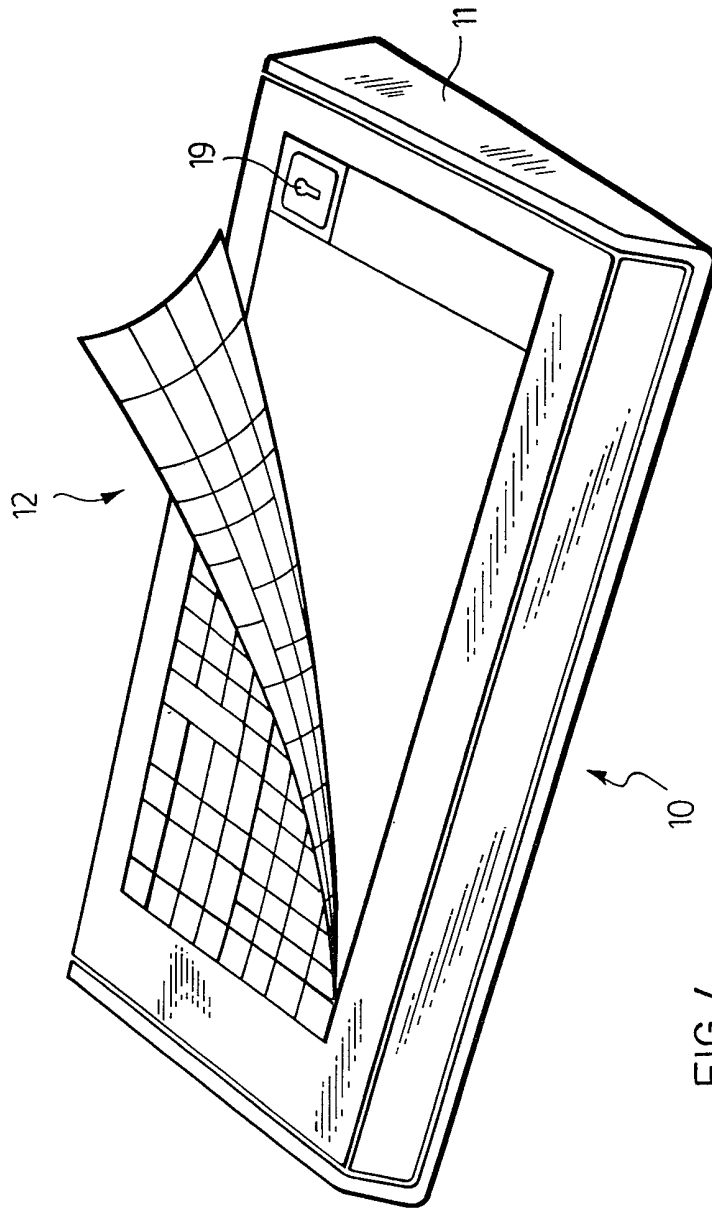


FIG. 4.

## SPECIFICATION

**Computer overlay keyboard**

5 This invention relates to keyboards for computers, and more particularly, to keyboards for dedicated microcomputers such as computerized cash registers.

10 There is an increasing need to have computer keyboards tailored to perform a particular task, such as word processing, so as to effect the task in a more efficient manner. As a result, dedicated microcomputers such as word processors or computerized cash registers tend to have specialized or tailored keyboards. For example, the keyboards of some cash registers used in fast food and other restaurants include keys which identify a particular product (e.g. a regular hamburger or a large orange soft drink), enabling the recordal of a particular food selection by means of a single keystroke. The use of a tailored keyboard tends to increase the efficiency of the input operation since the number of keystrokes is reduced and often a greater amount of information per keystroke is entered.

15 This need for a tailored or application-specific keyboard, however, tends to conflict with the need of a user for a single microcomputer which accomplishes a plurality of tasks in a cost-effective and user-friendly manner. A particular user may, for example, wish to have his microcomputer function as both a specialized calculator and a word processor. Of course, a single keyboard will generally do the job, but not usually at optimum efficiency, since the inconvenience and time involved in performing one or the other of the tasks tends to be higher than it might otherwise be if an application-specific keyboard had been utilized. A single keyboard becomes even more unsuitable if more than two different tasks are required of the device, or if one or more of the tasks involves a great number of different keystrokes, since there is a practical limit to the number of keys on a keyboard. Some keyboards have keys which are each identified by two or three labels, and which perform different functions depending upon whether or not a separate shift or control key or other switch is operated, but these keyboards tend to be cluttered and confusing.

20 A number of attempts have been made to solve the problem of designing a single microcomputer to accomplish more than one dedicated task in an inexpensive and non-confusing fashion. United States Patent No. 4,330,776 to Dennison, Jr. et al. dated May 18, 1982, discloses a single pivotally mounted rotatable keyboard housing with a keypad located on the top and bottom thereof. United States Patent No. 4,066,850 to Heys, Jr. dated January 3, 1978 discloses a cash register keyboard having keys whose indicia can be changed by inserting into a slot in the

70 keyboard one of a plurality of indicia sheets, once a latch is operated and the keyboard assembly partially dismantled. United States Patent No. 4,326,193 to Markley et al. dated April 20, 1982, discloses a computer terminal whose keyboard can be tailored to different applications by swinging a retainer frame upward and replacing the keyboard overlay with another having a different arrangement of keys and key symbols. However, each of these keyboards is believed by the applicants to be overly complicated and expensive and/or awkward to convert from one application to another.

75 The present invention marries the concept of a dedicated keyboard with the concept of a multiple use keyboard in a particularly elegant fashion, by means of a magnetic overlay which may have discrete keypads on each of its two flat surfaces. Such a keyboard allows a single microcomputer to be used alternately as a computerized cash register and general purpose microprocessor, in a convenient and user-friendly fashion, although it will be appreciated that the keyboard of the present invention will have many other applications. It is believed by the applicants that the use of a magnetic overlay allows for less awkward and less time-consuming conversion of a microcomputer from one application-specific configuration to another, more convenient storage of the keypad not currently in use, and additional protection against electrostatic discharge.

80 Accordingly, the present invention is directed towards a keyboard for a computing device, comprising magnetic overlay means and a housing. The magnetic overlay means has at least two interchangeable keypads, each being composed of a plurality of pressure sensitive keys. The housing includes ferro-magnetic coupling means for removably coupling thereto the magnetic overlay means, pressure activated switch means for generating switch signals when pressure is applied to the keys, positioning means for registering the magnetic overlay means with the switch means, and microprocessor means for receiving the switch signals and for generating and transmitting output signals correlatable with the switch signals to the computing device.

85 In the Preferred embodiment of the invention, the magnetic overlay means comprises a single overlay containing two discrete keypads, one on each side, so that keypad conversion may be accomplished by merely turning the overlay over. In the process, the keypad not currently in use is conveniently stored upside down on the keyboard housing—out of sight but not out of reach.

90 Alternatively, the magnetic overlay means may comprise at least two interchangeable magnetic overlays, each comprising a sheet of magnetic material having a keypad on one side. The overlays are preferably composed of

a flexible sheet of material impregnated with a permanent magnetic material such as barium ferrite.

The present invention and the advantages thereof will be better understood in light of the following detailed description of the preferred and alternative embodiments, which are illustrated, by way of example only, in the accompanying drawings, in which:

Figure 1 is a perspective view of the keyboard of the present invention shown coupled to a remote computing device.

Figure 2 is an exploded perspective view of the keyboard.

Figures 3a-3d illustrate the preferred embodiment of the overlay means, Figure 3a being a top plan view, Figures 3b and 3c being side elevational views, and Figure 3d being a bottom plan view.

Figure 4 is a perspective view of the keyboard, showing the overlay in the process of being turned over.

The keyboard of the present invention will now be described in its preferred embodiment as a keyboard for a computerized cash register, which enables the cash register to be used alternately as point of sale restaurant cash register and a management analysis microcomputer. However, it will be readily apparent that the preferred embodiment of the present invention can be suitably modified so that a single computing device can be used to conveniently perform in a user-friendly fashion a variety of similar or even disparate tasks, such as word processing and specialized calculations, or seat selection in a theatre and bookkeeping, or record keeping in a restaurant and tavern, or some combination of the above, or a myriad of other applications.

Referring now to Figure 1, the keyboard of the present invention shown generally as 10 comprises housing 11 and magnetic overlay means 12. Keyboard 10 is shown adjacent but separate from computing device 13, which in this case is a computerized cash register, although the keyboard and computing device could of course be made as a single unit. Cash register 13 may include a central microprocessor such as a 16 bit Intel (trade mark) 8088 microprocessor with 384 kilobytes of random access memory, an IBM PC (trade mark) bus, 2 floppy disk drives for accepting 5-1/4 inch double-sided double density floppy disks, an optional Winchester hard disk drive, a built-in cathode ray tube, a 40-column thermal printer, a customer display facing the rear of the unit, and a speaker. The cash register drawer may be mounted under the counter on which the unit rests. It will be appreciated that while it is described in a preferred embodiment as a cash register keyboard, the keyboard of the present invention can be set up to act as an input device for virtually any computing device. The term "computing device" as used herein is a broad term encom-

passing microcomputers, minicomputers, main frame computers, dedicated microcomputers, computer terminals and so forth.

Referring now to figure 2, housing 11 comprises a base 14, a plate 15 mounted in base 14 at a forwardly inclined angle, an electronics card 16 attached to the underside of plate 15, a frame 17 which fits over the periphery of plate 15, and a membrane switch matrix 18 which is secured to the top surface of plate 15 by adhesive. Magnetic overlay means 12 is placed by the user over switch matrix 18 and is removably securable to plate 15. Frame 17 registers overlay means 12 with switch matrix 18.

Plate 15 is ferro-magnetic and acts to removably receive and couple the magnetic overlay means to the rest of the keyboard. Plate 15 in the preferred embodiment is a flat plate of steel, although other ferro-magnetic coupling means could be used. By "ferro-magnetic" is meant a material, such as iron or an iron alloy, to which a magnet or magnetic material is attracted.

Magnetic overlay means 12 is preferably constructed of a thin, flexible, pressure sensitive sheet of permanent magnetic material. This material may be a rubber-like vinyl-coated mat impregnated with a magnetic material such as barium ferrite. Koroseal (trade mark) extruded flexible magnetic strip has been found to be suitable. It will be appreciated that the overlay, or at least the key areas thereof, must be pressure sensitive, that is, at least the key areas must respond to keystroke finger pressure, so that the keystroke is transmitted through the overlay and received by the switch means.

Membrane switch matrix 18 preferably comprises sheets of mylar printed with conductive paint. Membrane switch matrix 18 may have an adhesive backing to facilitate its securement to plate 15. Membrane switch technology is well known in the art and need not be described herein in detail.

The dimensions and composition of the plate 15, switch matrix 18, and overlay means 12 must be selected so that there exists sufficient magnetic attraction between the plate 15 and overlay means 12 when the switch matrix 18 is glued to plate 15 and magnetic overlay means 12 is placed over the switch matrix 18. In the case of the combination of a simple steel plate, an overlay means made of Koroseal, and a mylar switch matrix, it has been found that sufficient magnetic attraction between the overlay means and plate exists even as the dimensions of the switch matrix approach those of the steel plate, leaving little of the plate surface exposed. Of course, many variations of the preferred embodiment configuration are possible—for example, the dimensions of the switch matrix could be reduced to expose strips of steel facing the overlay on two or more sides of the matrix if



additional magnetic force was needed to effectively secure the magnetic overlay to the plate. Alternatively, the magnetic capacity of overlay means 12 could be increased. Of course, plate 15 need not be homogeneously ferro-magnetic.

The top surface of membrane switch matrix 18 is preferably printed with conductive EMI (electro-magnetic interference) shielding. The membrane switch contact area may be hermetically sealed if desired, to protect against spillage of liquids. Each individual membrane switch preferably comprises a tactile feedback mechanism 22, in the form of a flexible metal or plastic dome which abruptly collapses when subjected to a certain pressure threshold, in a fashion easily detectable by the user.

Protection against electrostatic discharge is provided in a number of ways. The switch matrix EMI shielding is grounded to the plate, the inside of the housing is coated with conductive paint, and additionally, the magnetic overlay means provides static protection because its impregnated magnetic material is metallic.

Frame 17 includes lip 21 which extends around the inside edge of the frame to define an opening slightly larger than the perimeter of overlay means 12, in order to register the overlay means with the array of membrane switches. Of course, other positioning means such as a borderline printed on the top surface of plate 15 could be utilized, and are within the scope of this invention.

The electronics card 16 includes microprocessing means which has a number of functions. The microprocessing means receives the switch signals and generates output signals correlatable with the switch signals for transmission to the computing device by means of a suitable interface and cable. It signals the computing device to load new software, which software redefines the meanings of the keys, in response to a user command. It provides the usual sort of local keyboard processing functions such as scanning the switch matrix to see if a switch has been closed, debouncing the keys, and providing for N-key rollover. In addition, the microprocessing means activates the LEDs (light emitting diodes) and beeper which are described below.

The preferred embodiment includes means for providing an audible signal to the user when a key is depressed, in the form of a beeper operatively coupled to the microprocessor means. If desired, the beeper can also function as a means for providing a different signal when an invalid keystroke is made.

Base 14 and frame 17 of housing 11 are preferably made of structural foam or other plastic material coated on the inside with conductive paint, although other materials such as various metals could be used.

It has been found that the "flat" keypad of

the present invention, in which the keys are merely spaces marked on a pad, as opposed to an array of individually operable keys, is more than adequately convenient for most operations not requiring an overly high rate of typing. If desired, a greater degree of key discrimination can be provided by embossing the gridlines defining the keys or the keys themselves.

Figures 3a-3d illustrate the reversible magnetic overlay 12 of the preferred embodiment, carrying keypad 12a on one side and interchangeable keypad 12b on the other side. The keys of keypads 12a and 12b are preferably defined by a grid consisting of two intersecting series of spaced, parallel lines, the line spacing corresponding to the membrane switch spacing, the keys being the spaces between the lines. For present applications, it is preferable that some of the keys be dimensioned to be double the usual height or width, so that they cover two switches. A single key could also cover more than two switches, such as in the case of a "tab" key on a typewriter keypad. The grid may be marked on the surfaces of the overlay by means of silkscreening, dry transfer printing, or otherwise. The keys may be permanently labelled by dry transfer printing, silkscreening, or hand-applied adhesive labels.

Referring now to Figures 2 and 3a, overlay means 12 could also contain a column of apertures 23 along one side for accepting light emitting diodes (LEDs) 24 mounted on plate 15. An adjacent column of keys 25 (which need not overlay any portion of the switch matrix 18) could be provided to identify the meanings of LEDs 24. LEDs 24 function to indicate to the user which mode the unit is in, so that the operator will know which keypad should be in use.

As shown in Figures 3a-3d, keypad 12a is a management analysis keypad, whereas keypad 12b is a point of sale restaurant cash register keypad. Point of sale keypad 12b may include a standard number pad located at the bottom right hand corner, standard on-line, real time report keys provided in the top left hand corner of the keypad, standard function keys such as "start up", "shut down", "void", "total" and the like, and a number of "soft" or programmable keys, such as key 20 shown in Figure 3. These "soft" keys may be programmed to take on a variety of meanings, and labelled accordingly. For example, such keys may identify food menu items, modifiers, payment methods, price modifiers or possibly server names. For example, the key identified as 20 on keypad 12b may mean "ham and eggs" depending upon the software currently loaded into the computing device. The meanings of the soft keys may be shown pictorially (e. g. diagram of milk shake) or otherwise by means of adhesive labels or other labelling means.

Keypad 12a is set up for management analysis, and includes a standard typewriter keyboard as well as the usual types of keys found on most microcomputer keyboards (e. g. cursor keys), and a number of special function keys tailored to provide management analysis of such activities as accounts payable, accounts receivable, inventory, general ledger and the like, in single key strokes where possible. The keypad layout may be similar in part to that of an IBM PC keypad which is becoming the industry standard for microcomputers.

Referring now to Figure 4, in order to convert keyboard 10 from management mode to point of sale operations mode, or vice versa, overlay means 12 is reversed by turning it over and by implementing an appropriate mode change procedure, once the computing device is activated and the operating system is loaded. If security means such as an intelligent security key system are provided, the user would have to insert an identification key into slot 19 of keyboard 10, or take other appropriate action, before the system is made operational.

To select the particular mode required, the user may be required to enter a pre-selected combination of keystrokes or a keystroke sequence, such as the shift/control key and the "management mode" key. The requirement for a control key depression in conjunction with the mode key depression to change modes reduces the chance of unwanted mode changing through inadvertent keystrokes. Of course, numerous other techniques for changing modes are possible and are within the scope of this invention. Performing the mode select procedure activates various software files and enables point of sale values or management analysis values obtained from the translation table, which is part of the software of the computing device, to be assigned to the switch matrix signals, depending upon the mode selected. Operation of one of the above combinations of mode select keys may result in the illumination of an appropriate LED identifying the mode currently in use, to avoid user confusion.

It may be desirable to provide within a single mode, such as point of sale operations mode, a series of sub-modes which in effect redefine some of the keys. This capability is provided in the preferred embodiment by means of "menu" keys located at the upper right hand corner of each keypad. Each keypad of the preferred embodiment includes five separate menu keys, providing for five different sub-modes. To reduce user confusion, a separate keypad should normally be used for each sub-mode or menu level, but the keys could be double-labelled to reduce the number of additional overlays required. Menu 1 of the point of sale keypad could, for example, represent the breakfast food menu, and all of

the soft keys could be dedicated to breakfast items, and menu 2 could be dedicated to the lunch food menu, and all of the soft keys on a separate keypad could be dedicated to lunch items. To go from the breakfast menu sub-mode to the lunch menu submode, the user presses the appropriate menu key, and (unless the keys are double-labelled) replaces the breakfast keypad with the lunch keypad, by interchanging overlays or by turning the overlay over if the lunch and breakfast keypads are marked on opposite sides of the same overlay. Similarly, it is possible to have management sub-modes and more than one management mode overlay.

In an alternative embodiment of the invention, the magnetic overlay means comprises at least two interchangeable magnetic overlays having a keypad on only one side, although it will be recognized that this alternative is less convenient from a storage point of view, and more costly, since a greater number of overlays will usually be involved. Overlays not currently in use may be stored by securing them to any convenient ferromagnetic surface.

It will be appreciated that the above description is illustrative only and not limiting, and that variations, of the embodiments described are possible. For example, it is conceivable that switch means other than an array of membrane switches, such as a plurality of short-throw microswitches, could be used. The keyboard could be a "smart" keyboard with its own ROM (Read Only Memory) or EPROM (Erasable Programmable Read Only Memory) in which is stored the translation table for the keys and other software. The overlay need not be entirely flexible—it could have a rigid frame, or have a rigid latticework, as long as key areas themselves were flexible enough to be sensitive to finger pressure.

Those skilled in the art will therefore appreciate that, while the present invention has been described and illustrated with respect to the preferred embodiments, numerous variations of the preferred embodiments may be made without departing from the scope of the present invention, which is defined in the appended claims.

## CLAIMS

1. A keyboard for a computing device, comprising magnetic overlay means having at least two interchangeable keypads, each keypad comprising a plurality of pressure sensitive keys; and a housing, including ferro-magnetic coupling means for removably coupling thereto the magnetic overlay means, pressure activated switch means for generating switch signals when pressure is applied to the keys, positioning means for registering the magnetic overlay means with the switch means, and microprocessor means for receiving the switch signals and for generating output signals correlatable with the switch signals for transmis-

sion to the computing device.

2. A keyboard according to claim 1, wherein the magnetic overlay means comprises at least one reversible magnetic overlay, the reversible magnetic overlay comprising a sheet of magnetic material having a keypad on both sides.

3. A keyboard according to claim 1, wherein the magnetic overlay means comprises at least two interchangeable magnetic overlays, the interchangeable magnetic overlays each comprising a sheet of magnetic material having a keypad on one side.

4. A keyboard according to claim 2 or 3, wherein the magnetic overlay is a flexible magnetic overlay comprising a flexible sheet of material impregnated with a permanent magnetic material.

5. A keyboard according to claim 4, wherein the magnetic material is Koroseal extruded flexible magnetic sheet.

6. A keyboard according to any preceding claim, wherein the ferro-magnetic coupling means comprises a ferro-magnetic plate having a substantially flat top surface for accepting the switch means and the magnetic overlay means.

7. A keyboard according to claim 6, wherein the ferro-magnetic plate is steel.

8. A keyboard according to any preceding claim, wherein the pressure activated switch means comprises an array of membrane switches carried by the top surface of the coupling means, the array being located underneath the overlay means when the overlay means is coupled to the ferro-magnetic coupling means.

9. A keyboard according to any preceding claim, wherein the positioning means comprises a frame defining an opening slightly larger than the perimeter of the magnetic overlay means.

10. A keyboard according to any preceding claim, comprising indicator means operably coupled to and controlled by the microprocessor means for providing the user with a visible indication of which of the two or more keypads should be in use.

11. A keyboard according to claim 10, wherein the indicator means comprises a column of light emitting diodes, and the overlay means includes a column of apertures for receiving the diodes and a column of adjacent keys not overlaying any part of the pressure activated switch means when the overlay means is secured to the coupling means for identifying the meaning of the light emitting diodes when illuminated.

12. A keyboard according to any preceding claim, wherein the magnetic overlay means comprises at least one reversible, magnetic overlay having a point of sale operations mode keypad on one side and a management mode keypad on the other side, so that the computing device may be used alternately as

a cash register and management analysis microcomputer.

13. A keyboard according to any preceding claim, wherein the magnetic overlay means comprises at least two different cash register point of sale keypads, the keys of each keypad being capable of being identified to correspond to two different sets of key meanings contained in a translation table stored in the computing device.

14. A keyboard according to any preceding claim, wherein the switch means comprises tactile feedback means to provide the user with a tactile sensation when finger pressure is applied to a key.

15. A keyboard according to any preceding claim, comprising audible feedback means operably coupled to the microprocessor means for providing the user with an audible signal when finger pressure is applied to a key.

16. A keyboard according to any preceding claim, wherein the keys of each keypad are defined by a grid marked on the overlay means, the keys being the spaces between the lines of the grid.

17. A keyboard according to any preceding claim, comprising indicia means for identifying the meaning of the keys of each keypad, comprising a plurality of adhesive labels which may be applied over the keys.

18. A keyboard for a multi-purpose microcomputer capable of being alternately used as a cash register and a general purpose microcomputer, comprising: at least one reversible magnetic overlay comprising a thin flexible rectangular sheet of material impregnated with a permanent magnetic material and having a keypad on both sides, the keypad comprising a plurality of keys sensitive to finger pressure and capable of being labelled by labelling means; and a housing comprising a base portion, a substantially flat ferro-magnetic coupling plate mounted in the base portion, an array of membrane switches carried by the top surface of the coupling plate for generating switch signals when finger pressure is applied to the keys of the magnetic overlay, a rectangular frame surrounding the perimeter of the coupling plate having an interior edge defining an opening slightly larger than the perimeter of the magnetic overlay for registering the overlay with the array of membrane switches so that keys of the keypad may be located directly above switches of the array, and microprocessor means for receiving the switch signals and for generating output signals correlatable with the switch signals for transmission to the microcomputer.

19. A keyboard for a computing device substantially as hereinbefore described with reference to the accompanying drawings.

20. Any novel feature or combination of features described herein.

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