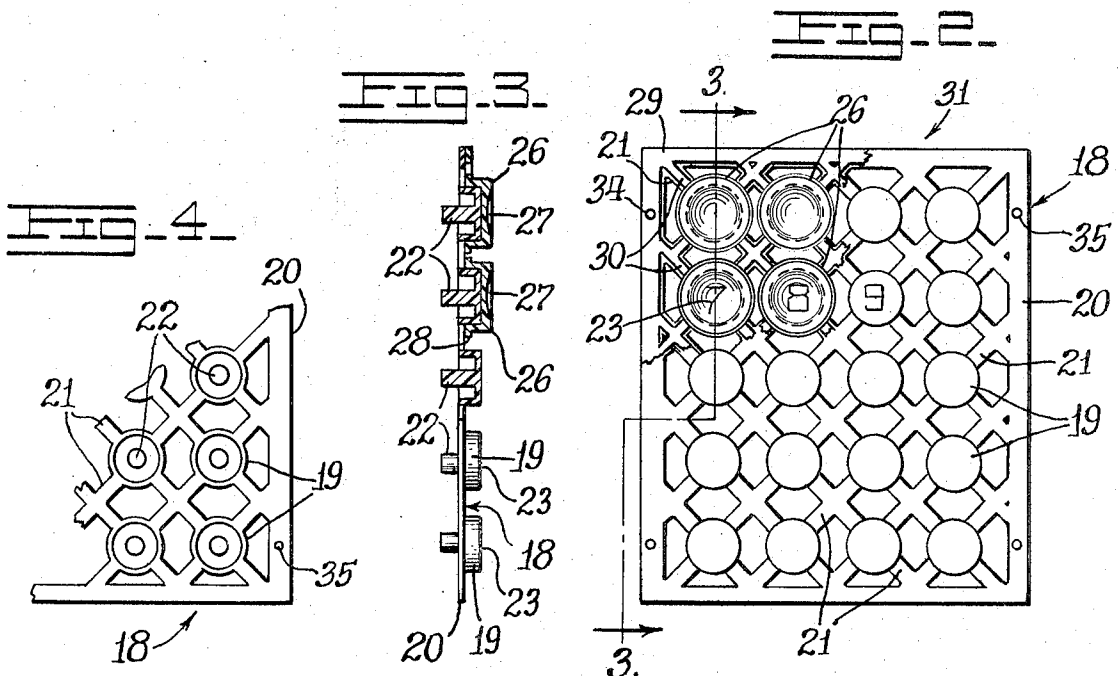
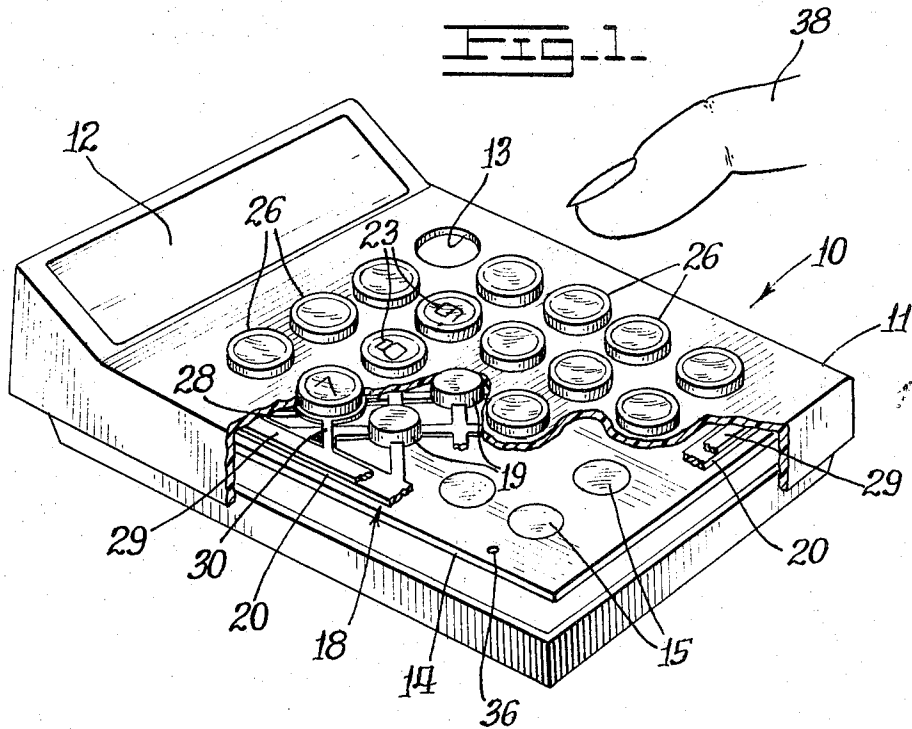


MULTIPLE KEY ASSEMBLY FOR CALCULATORS AND THE LIKE

BACKGROUND AND SUMMARY OF THE INVENTION

It is conventional with small electronic calculators to use a printed circuit board having the desired number of electrical switches as an integral part thereof. As a matter of fact, some calculator manufacturers purchase these boards as a finished unit from a common manufacturer. Plastic keys are positioned within the case and aligned over respective switches. Depending upon the functions that the calculator is to have, the keys will bear identifying indicia to tell the user what action takes place if a particular key is pressed. Different manufacturers build different functions into their calculators and therefore, while some of the keys of various calculators will have the same indicia, there are likely to be some keys which have a different indicia.

Another reason that various manufacturers will have keys made to their specific specifications is that each manufacturer wants his machine to look distinctive and not have the same appearance as all the competitive machines. One area in which this can be accomplished is the appearance of the keyboard.

Another factor that enters into the manufacture of the keys of the keyboard is the requirement that the indicia should not wear away as a result of extended use. The present practice to prevent this from occurring is to mold the indicia into the key. That is, a two-color injection molding process is employed to form the keys, one color being the overall appearance of the key and the other color being that of the indicia. This means that there must be a separate injection mold for the key for each indicia. These molds are expensive. Unless a manufacturer is willing to use "stock" keys for his keyboard (which he is usually not for the reasons discussed above) he has quite an investment in molds.

One of the principal objects of the present invention is to avoid this investment problem, to permit different manufacturers to have distinctive keyboards at a relatively low cost and to increase the ease of coming out with a different model.

Another problem which is greatly ameliorated by the present invention is that of cost of assembly along with the elimination of assembly error. Under the present practice the assembly of each keyboard is performed by an individual worker. While there are several different procedures that may be followed, each essentially involves the worker selecting, for example, twenty individual keys from twenty different containers, each of which holds a respective key, and then positioning those keys in the required arrangement on a particular part of the calculator (e.g. inserting them into the openings in the outer case). It is readily apparent that this is a tiresome, time consuming operation and one in which there is great possibility of error. When the error is later discovered it may be cheaper to throw away an assembly than to attempt to take it apart and correct the error.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view, partially broken away, of a small calculator embodying the present invention;

FIG. 2 is a plan view, partially broken away, of the front of the keyboard embodiment employed in FIG. 1;

FIG. 3 is a section taken at line 3—3 of FIG. 2; and

FIG. 4 is a fragmentary rear view of the keyboard of FIGS. 2 and 3.

DESCRIPTION OF SPECIFIC EMBODIMENT

The following disclosure is offered for public dissemination in return for the grant of a patent. Although it is detailed to ensure adequacy and aid understanding, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how others may later disguise it by variations in form or additions or further improvements.

The embodiment described herein is employed in a small electronic calculator, generally 10; however, it will be readily apparent to those skilled in the art that it could be used in other devices having a keyboard with a plurality of keys to operate electric switches or the like. The calculator has a case 11 which contains the electronic components. The case has a window 12 at which is displayed the results of the calculations. The remainder of the top face of the case is occupied by a keyboard comprising a plurality of individual keys positioned in a particular pattern. To this end the case has such a pattern of openings 13 through each of which a respective key projects. In the illustrated embodiment the top right hand key has been removed to facilitate the illustration of the key opening 13. The keys are employed to operate a corresponding number of electric switches positioned in the same pattern. These switches are a part of a printed circuit board 14. Each switch has its own actuator 15. As thus far described, the structure is conventional.

In the present invention there is a matrix, generally 18, comprising a plurality of bosses 19 which are within a frame 20 and are secured to the frame and to each other by a plurality of webs 21 which function as a membrane means. Extending downwardly from the underside of each boss is a projection 22. The bosses and their projections are arranged in a pattern such that each is centered over a respective switch actuator 15. This matrix 18 is injection molded of a suitable plastic such as polypropylene. The webs 21 are flexible so that the individual bosses can be moved vertically to actuate the respective switch without disturbing any of the remaining bosses. However, the webs and frame hold the entire matrix in the predetermined pattern in which it is molded (primarily for the purpose of assembly as hereinafter described). The indicia 23 for identifying the respective keys is printed or painted on the tops of the respective bosses after the matrix is molded.

Over and frictionally engaging each boss is a respective cap 26. These caps are of molded plastic and are transparent so that the indicia 23 therebelow can be viewed by the user of the calculator. The top of the cap has a depression 27 (see particularly FIG. 3). The cap has a flange 28 at the bottom edge thereof. The main part of the cap is of a diameter just slightly smaller than the diameter of opening 13 so that it will enter the opening and move freely up and down with respect to the case 11. The flange 28 projects beyond the diameter of opening 13 so that the cap is securely retained within the case. While these caps can be individual

pieces, in the illustrated embodiment they are a part of an overall unit, generally 31, which additionally includes a frame 29 and a plurality of webs 30. Thus, this whole unit is injection molded at one time as a complete assembly.

A manufacturer of a calculator would, for example, have one department that made the circuit boards 14, or these might be purchased from a manufacturer of such items. In the assembly department there would be a supply of these circuit boards along with the molded matrix 18 and the molded cap units 31, together with such other parts as are required to complete the calculator. The bosses 19 of the matrixes 18 would have the required indicia 23 printed thereon. An assembler would position the circuit board 14 on the bottom half of the case 11. Over this would be placed the matrix 18 and the caps 26 of the unit 31 would be slipped over the top of the bosses 19. Screws, not shown, would then be inserted through openings 34 in unit 31, openings 35 in matrix 18 and openings 36 in circuit board 14. The screws would be threaded into suitable mountings in the case. In some embodiments these openings might be irregularly positioned so that the parts could be assembled in only one orientation with respect to each other thereby preventing any possibility of mispositioning the switches and keyboard in the case 11. After the keyboard and switch assembly, thus formed, was mounted in the bottom half of the case 11 (and other required components put in the case) the top half of the case would be dropped over the keyboard and suitably fastened to the bottom half of the case.

Because of the indicia being printed on the bosses of the matrix 18 in a single operation there is no possibility of a key having a particular indicia marking being mispositioned with respect to the remaining keys. The caps 26 protect the indicia and prevent its being worn away as a result of the continued manipulation of the keys by a person's finger 38 during the use of the calculator. The assembly of the keyboard as a unit rather than putting the keys in place individually greatly speeds the operation and thereby reduces its cost. As a matter of fact, the operation becomes ideally suited for automatic assembly by machine as distinguished from a manual assembly operation. If a manufacturer desires to change the functions incorporated into the calculator, it is not necessary to employ a new set of expensive molds for the revised keys. The same plastic molds can be employed, but the printing operation

changed to apply the new indicia where required. This is a relatively inexpensive and quickly achievable change.

I claim:

1. In a keyboard assembly for an electronic calculator or the like, which assembly includes a plurality of actuating elements arranged in a predetermined pattern, a corresponding number of key devices with each device being associated with a respective element so that when the device is pushed by an operator's finger the respective element will be actuated, each device having an identifying indicia thereon, the improvement wherein said devices comprise:

a matrix formed of a plurality of bosses interconnected by flexible membrane means, there being a boss for each of said elements with the boss being centered over the respective element, each boss having an underside adjacent the respective element and an outer side, said indicia being on the outer side of the bosses, said membrane means positioning said bosses in an orientation corresponding to said pattern of the elements while permitting each individual boss to move in the direction of its respective element for actuating the respective element; and

a corresponding number of caps with each cap covering and protecting the outer side of a respective boss, said caps being transparent so that said indicia on said outer side can be seen.

2. In an assembly as set forth in claim 1, wherein said matrix is molded of plastic and said membrane means comprises a plurality of individual webs.

3. In an assembly as set forth in claim 2, wherein said calculator includes a case within which is said elements and has openings through which the devices respectively project, the improvement comprising:

said membrane means includes an integral border to which some of said webs connect, each boss having a projection extending from its underside toward the respective element, said caps being molded of plastic separate from said matrix, each cap having a projection adjacent its lower side to prevent it from coming out through the respective opening.

4. In an assembly as set forth in claim 3, wherein said caps are part of a unit molded of plastic, said unit including webs interconnecting the caps.

* * * * *

50

55

60

65