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|--|-----------|---------|--------------|---------|
| [54] PRISMATIC DISPLAY WINDOW FOR A CALCULATOR | 2,761,056 | 8/1956 | Lazo | 240/2.1 |
| | 2,835,440 | 5/1958 | Koch..... | 235/1 A |
| [75] Inventor: Lee Glen Kitchens, Richardson, Tex. | 3,030,017 | 4/1962 | Crooke | 235/1 A |
| | 3,217,819 | 11/1965 | Allen | 177/177 |
| [73] Assignee: Texas Instruments Incorporated, Dallas, Tex. | 3,803,834 | 4/1974 | Reese | 58/50 R |

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Primary Examiner—Stephen J. Tomsky
Attorney, Agent, or Firm—Harold Levine; Rene E. Grossman; Thomas G. Devine

[52] **U.S. Cl.**..... 235/1 D; 58/50 R; 177/177;
 340/380; D26/5 C

[51] **Int. Cl.**..... G06c 5/02; G06m 1/22

[58] **Field of Search**..... 235/1 D, 1 A;
 177/177-178, 182; 58/50 R; 116/DIG. 36;
 340/365 R, 337, 380; D52/2, 3; D26/5 C

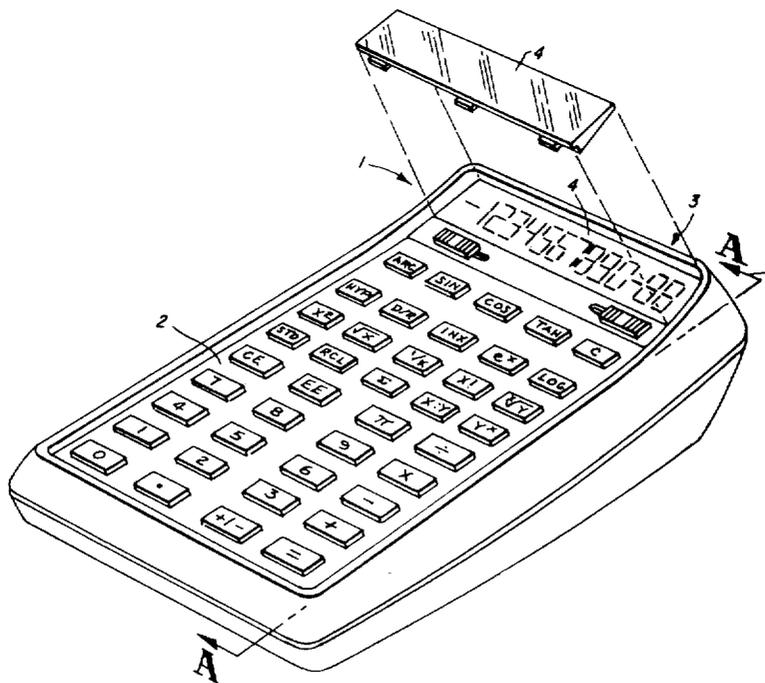
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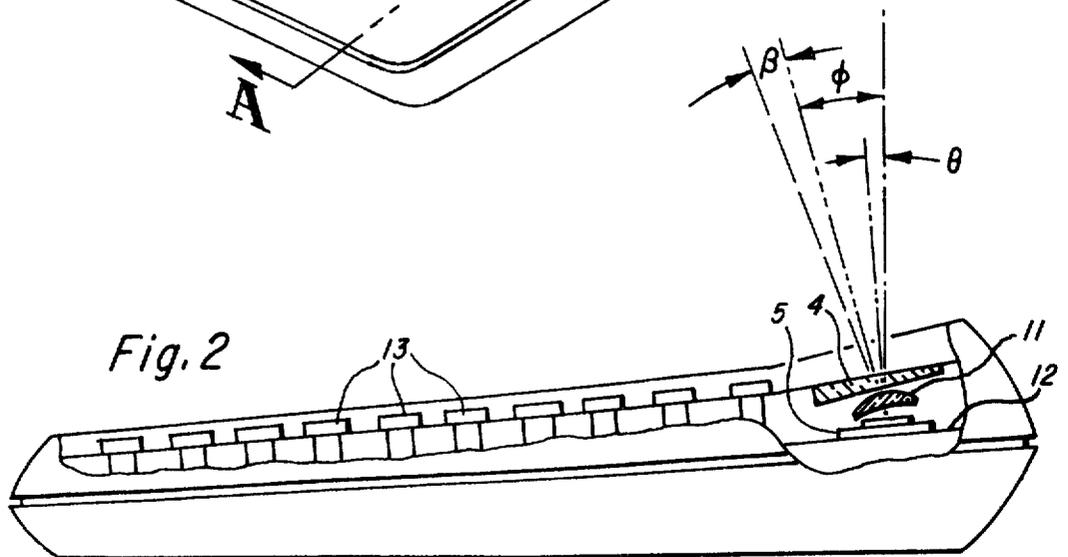
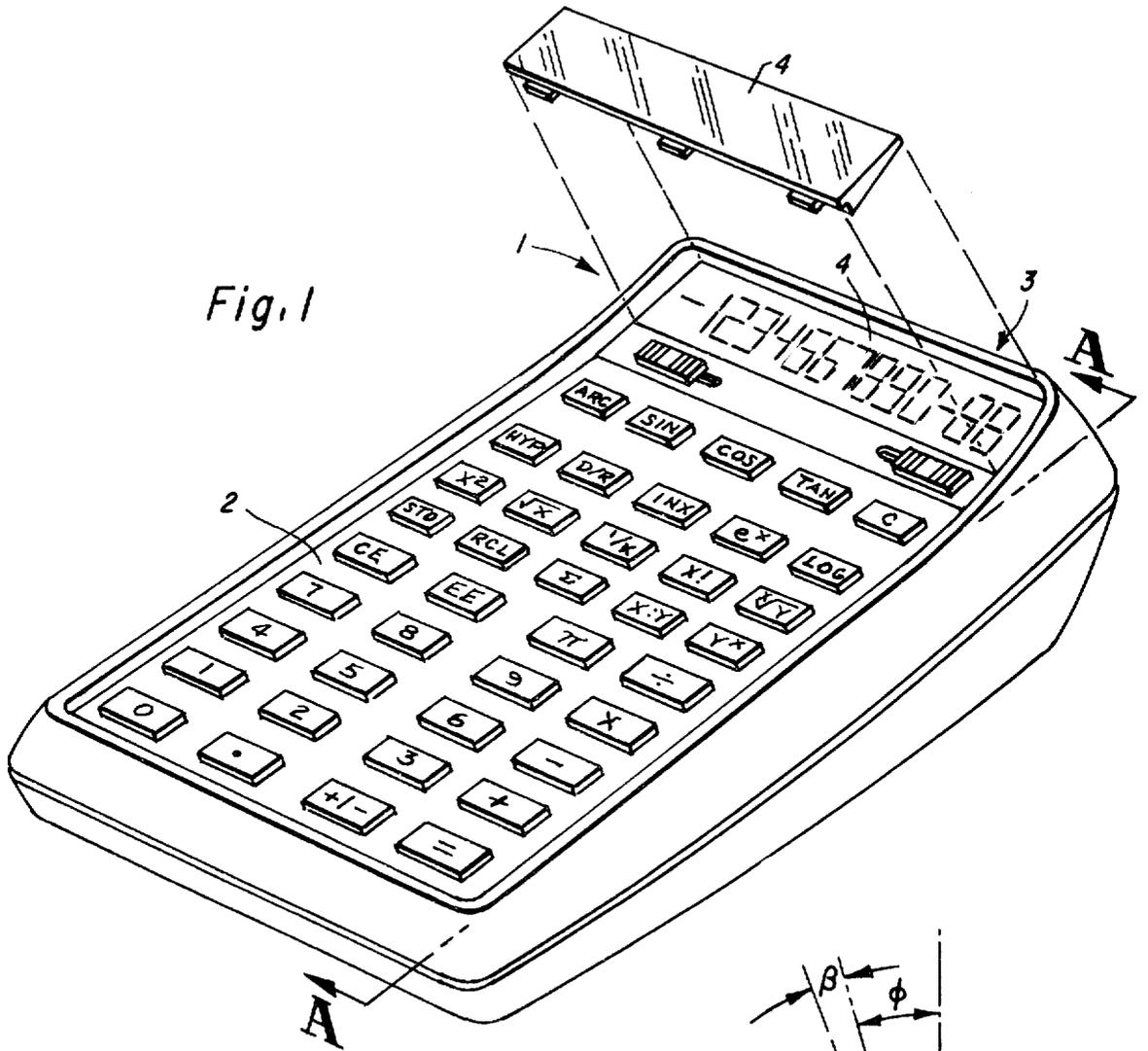
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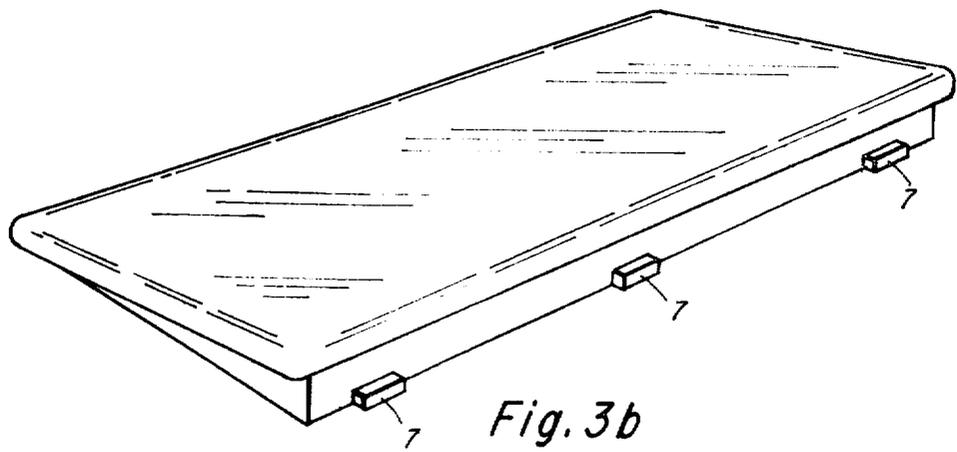
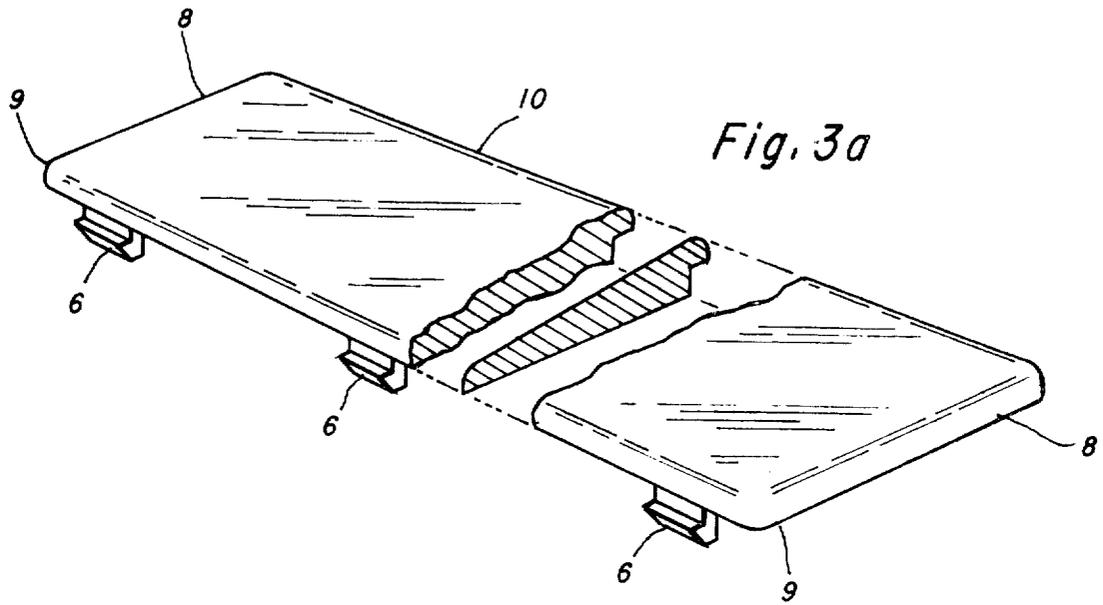
[57] **ABSTRACT**

Disclosed is a calculator casing having a prism display window for shifting the angle of light transmission therethrough to provide a more desirable viewing angle. A low profile calculator having a liquid crystal, light emitting diode, or gas discharge tube display has interposed between the viewer and the display elements a prism window for shifting the viewing angle and filtering undesirable ambient light.

6 Claims, 4 Drawing Figures







PRISMATIC DISPLAY WINDOW FOR A CALCULATOR

This invention relates to calculator casing in general and more specifically to calculator casing having a prism lens overlying the display source for shifting the viewing angle thereof.

BACKGROUND OF THE INVENTION

With the arrival of the calculator age, there have been provided calculators suitable for nearly any and all tasks. The more complex the task, the more complex the calculator which is required, and such complex calculators have been implemented as bulky non-portable desk-top models. Less sophisticated machines are presently provided in smaller desk-top models which are easily transported. Still less sophisticated machines are provided in portable hand-held casings which may even be of the pocket size variety yet which are still convenient to operate. Two such hand-held calculators are described in detail in copending patent application "Variable Function Programmed Calculator," Ser. No. 163,565, now abandoned and replaced by Ser. No. 420,999, filed Dec. 3, 1973 and "Multi-Chip Calculator System," Ser. No. 397,060, filed Sept. 13, 1973, both of which are assigned to the assignee of this application. A casing preferably utilized with the calculator system described in Ser. No. 420,999 is disclosed in U.S. Design Pat. No. 226,922 entitled "Calculator Casing," filed in June 9, 1972. In such a calculator casing having a relatively high profile, it is observed that the display surface of surface source lies at a relatively elevated angle to the plane of the keyboard for providing a pleasant viewing angle to the plane of the keyboard for providing a pleasant viewing angle for the user. Such elevation, however, requires increased height dimensions of the calculator casing and as such is not suitable for a low profile design.

A calculator display panel for use on a hand-held calculator of the low profile type is set forth in U.S. Design Pat. No. 227,261. It is there observed that the display window and the keyboard lie substantially in the same plane. Such a relationship between the plane of the display and the plane of the keyboard requires a near perpendicular viewing angle by the user which is inconvenient and generally undesirable. Other calculator systems are available for magnifying smaller display sources, but fail to alter the angle of light transmission.

It is therefore an object of the present invention to provide a calculator casing having a prism for shifting the angle of transmission of the display. It is another object of the present invention to provide a calculator system of the type having a visible display output contained in a casing which features a prism overlying the display figures to alter the angle of light transmission of the figures and thereby provide an improved viewing angle. It is still another object of the present invention to provide such a prism in a calculator system overlying visual representations formed by light emitting diodes, liquid crystals, or gas discharge tubes. It is still another object of the present invention to provide a calculator with light sources of a display lying substantially in the plane of the keyboard having an overlying prismatic window which has only surface thereof lying flush with the calculator casing for altering the transmission through the window of the display images.

Briefly and in accordance with the present invention, the display of a calculator system includes a prism overlying the display output source for altering the angle of transmission of the display representations and thereby providing an improved viewing angle for the user. In the preferred embodiment, the prism is trapezoidal in shape and overlies a display source comprised of liquid crystals, light emitting diodes, or gas discharge tubes lying substantially in the plane of the keyboard. The prism further provides an optical filter having a visual band pass centered about the characteristic frequency of the display source. To provide an attractive low profile version, the back end of the top surface of the prism is flush with the keyboard casing, with the front end elevated to form a small angle within the keyboard and display source which lie in a common plane. The angle of transmission of the output data characters, however, is at an increased angle bent towards the viewer.

The novel features believed to be characteristic of this invention are set forth in the appended claims. The invention itself, however, as well as other objects and advantages thereof, may best be understood by reference to the following detailed description when read in conjunction with the accompanied drawings wherein:

FIG. 1 pictorially depicts a calculator system featuring a prism display window;

FIG. 2 depicts a profile view of the calculator and display shown in FIG. 1; and

FIGS. 3a and 3b depict a preferred embodiment of the prism of this invention.

DETAILED DESCRIPTION

Referring now to FIG. 1, there is shown an electronic calculator featuring a prismatic display window according to this invention. The calculator 1 is one of low profile and preferably of the hand-held version. The electronics of the calculator in FIG. 1 is explained in detail in copending patent application Ser. No. 397,060, filed Sept. 13, 1973 and assigned to the assignee of this invention. The calculator has a keyboard 2 for entering data and instructions into the calculator for effecting manipulations thereof. The results are displayed on the display 3 through the prismatic window 4 of this invention which is also shown as removed. The window 4 is attached to the casing of the calculator via a series of tabs or protrusions which will be described subsequently. The display 3 may be of the visible light emitting diode type, or of the gas discharge tube type, or of the liquid crystal type. The prismatic window 4, depending on the specific display type, is constructed so as to provide an appropriate filter having an optical band pass centered around the respective light source. For example, when conventional VLEDs are utilized, then a red filter is provided and when gas discharged tubes are utilized, an orange filter is provided. When the utilizing liquid crystals, the prismatic window is clear and a filter is not utilized. Constructing the window 4 of various translucent acrylic plastics so as to provide the above described filters is generally well known.

Referring now to FIG. 2, there is shown a silhouette and partial sectional of view A—A of the calculator in FIG. 1. A printed circuit board 12 has both the keyboard with keys 13 and the display source 5 mounted thereon. The plane of the keyboard lies substantially at an angle θ with the bottom of the casing of the calculator which is the horizontal ground reference. The angle

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θ may be designed according to preference, but to achieve the low profile effect, the angle θ preferably is less than 10° , and preferably is 4° . Overlying the display source 5 is a magnifying lens 11 for virtually enlarging the output data images. The upper surface of the prismatic window lies in the surface of the keyboard housing with the normal thereto forming the angle Φ with the vertical. The angle Φ may be designed having magnitude according to preference, but to achieve the low profile effect, only a minimum elevation or minimum Φ may be utilized. In this embodiment Φ is approximately 9° . The angle of the prism is denoted β and is approximately 9.5° in this embodiment. The total angle of transmission of the output display is $(\Phi + \beta)$ or approximately 13.5° from the vertical. Conventional non-prismatic windows would provide an angle of Φ or 4° , which is insufficient. As long as an optical quality lens is utilized and the angles are small, the angle at which the light passes through the window is determined principally by the angles and the index of refraction is not critical.

Shown in FIG. 3a is a detailed magnified view of the back of the display window. Tabs 6 project downwardly for hooking beneath the case of the calculator for holding the window securely. From the end view of the window, it is seen that the window is generally of a trapezoidal configuration, whereby the lower surface of the window lies at the angle β with the upper surface as above described.

Shown in FIG. 3b is the front view of the window shown in FIG. 3a as viewed from the keyboard. Nodes 7 extend therefrom for insertion into the calculator casing which in combination with tabs 6 hold the window 4 securely in place.

The dimensions of the window 4 depend generally upon the dimensions of the calculator, but in one embodiment the rear of the window as measured between points 9 is approximately 2.6 inches and sides 8 extend from points 9 at an angle of 4 degrees outward. Side 10 of the display is substantially 0.445 inches from the back side of the window 4 defined between points 9. The thickness at the back edge is approximately 0.05 inches. The angle β is approximately 9.5 degrees which defines the height at the front of the window to be approximately 0.125 inches.

Preferably the window 4 is comprised of the plastic Lexan, but any similar translucent acrylic plastic may be utilized. The plastic is preferably of optical quality, and as long as the angles are small, the particular index of refraction is not a critical feature. To implement the

filter as above described, the translucent acrylic plastic is constructed of the appropriate color so as to pass substantially only the color characteristic of the display source lying beneath the window. The lens 4 is preferably constructed utilizing injection molding processes keeping the mold surfaces of optical quality. These processes are now well known in the art.

It is thus evident that a prismatic display window is provided which is advantageously utilized in a calculator system. The prismatic display window allows a low profile calculator without an extremely elevated keyboard angle by altering the angle of light transmission from the display source lying beneath the window. By providing a filter in the display window, background light which may hinder viewing of the display is substantially eliminated. By utilizing the prismatic window of this invention, a viewing angle of approximately 13.5° from the vertical is achieved while the keyboard and the display source lies at an angle of less than 5° with the horizontal.

While a specific embodiment of a prismatic window for a calculator system has been described in detail herein, it will be apparent to those skilled in the art that various changes of shape, composition, and dimensions may be made without departing from the spirit or scope of this invention.

I claim:

1. In a calculator system having a keyboard and having a visible output display contained in a casing for displaying visual data representations, the improvement comprising:

- a. a display source, disposed substantially in the same plane as the keyboard; and
- b. a prism attached to the casing for altering the angle of transmission of the visual data representations the transmission angle being acute with respect to the vertical plane.

2. The calculator system according to claim 1 wherein said prism is shaped as a trapezoid.

3. The calculator system according to claim 2 further comprising a magnifying lens overlying the display source.

4. The calculator system according to claim 3 wherein the transmission angle with respect to the vertical plane is less than 20° .

5. The calculator system according to claim 4 wherein said prism is comprised of plastic.

6. The calculator system according to claim 1 wherein said prism further provides an optical filter.

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