(19) Japan Patent Office (12) **Utility Model Publication** (U) (11) Initial Publication
File Number: 1993-45651
(43) Publication Date: 18 June 1993

(51) Int. Cl.[5]	Identification Code	Internal Reference Number	FI	Basis for IPC Application
G02F 1/1335	530	7724-2K		

Request for examination Not Requested
Number of claims: 1 (Total 3 pages)

(21) Application Number 1991-104603

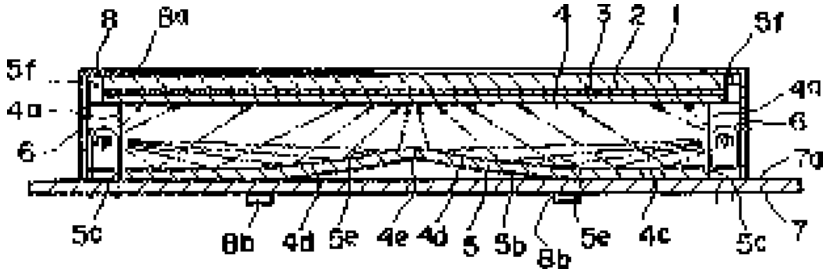
(22) Application Date 25 Nov 1991

(71) Applicant 000101732
Alpine Electronics, Inc.
8-1-1 Nishigotanda
Shinbagawa-ku,
Tokyo

(72) Inventor Fumiyasu Niizuma
Alpine Electronics, Inc.
8-1-1 Nishigotanda
Shinbagawa-ku,
Tokyo

(54) [Title of the Invention] Liquid Crystal Display Device

(57) [Abstract]
[Aim] To provide a liquid crystal display device equipped with a means of illumination that is able to sufficiently illuminate an LCD, even a large-scale LCD, without any light and dark irregularities.
[Structure] The back surface (4c) of a light conductor (4) is provided with a pair of sloped surfaces (4d, 4d) which slope from both ends towards the middle, and a ridge (4e) is formed where this pair of sloped surfaces (4d, 4d) intersect. This light conductor (4) is inserted and locked into the recess (5a) of a holder (5), and an LCD (1) is attached to the front of the light conductor (4). The four corners of the holder 95) are provided with extruding pieces (5f), and these extruding pieces (5f) control the movement of the LCD (1) in the direction of both ends. In addition, the ridge (4e) of the light conductor (4) is positioned so as not to overlap with the display segment (1a) of the LCD (1) when viewed front-on. Light is then guided into the light conductor (4) by lamps (6, 6, …) provided at both ends of the light conductor (4).



[Scope of Claims for Utility Model Application]

[Claim 1]

A liquid crystal display device featuring a liquid crystal display device equipped with a liquid crystal display element with multiple display segments, a light conductor provided on the back surface of the aforementioned liquid crystal display element, and light sources to illuminate the aforementioned liquid crystal display element via the aforementioned light conductor; where the aforementioned light sources are fixed at either end of the aforementioned light conductor, and two sloped surfaces are formed on the back surface of the aforementioned light conductor that slope from both ends towards the middle where the aforementioned light conductor is the thinnest; and it is also provided with a holder which has locking parts to lock both the aforementioned liquid crystal display element and the aforementioned light conductor [in place]; and where the ridge formed at the intersection of the pair of sloped surfaces of the aforementioned light conductor is positioned so as to not overlap with the display segments of the aforementioned liquid crystal display element when viewed front on.

[Brief Description of the Drawings]

[Figure 1] An exploded view of the liquid crystal display device of the example of the invention.

[Figure 2] A front view of the liquid crystal display device of the example of the invention.

[Figure 3] A cross-section at A-A in Figure 2.

[Figure 4] A front view of the liquid crystal display device of another example of the invention.

[Figure 5] A summarized cross-section of a conventional liquid crystal display device.

[Figure 6] A summarized cross-section of a conventional liquid crystal display device.

[Description of the Symbols]

1, 9	Liquid Crystal Display Element (LCD)
1a, 9a	Segments
4	Light Conductor
4c	Back Surface
4d	Sloped Surface
4e	Ridge
5	Holder
5a	Recess
6	Lamp
10	Liquid Crystal Display Device

Figure 1

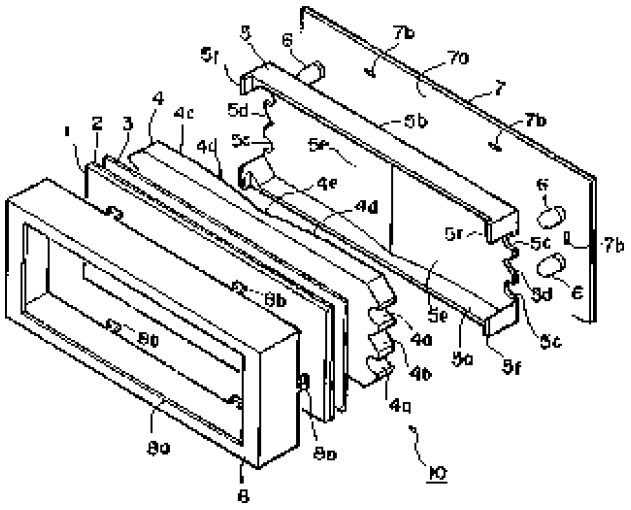


Figure 2

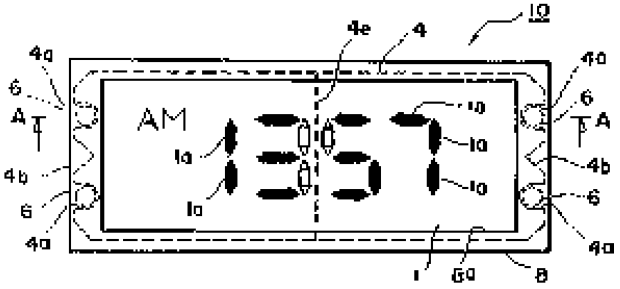


Figure 3

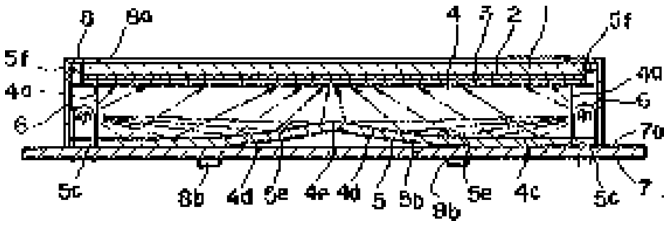


Figure 4

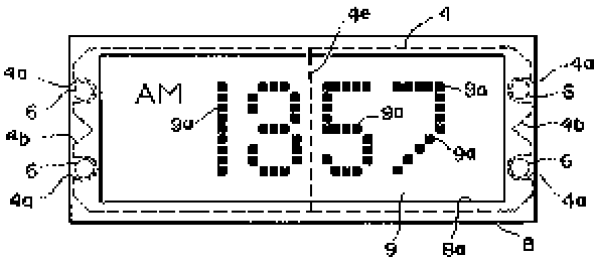
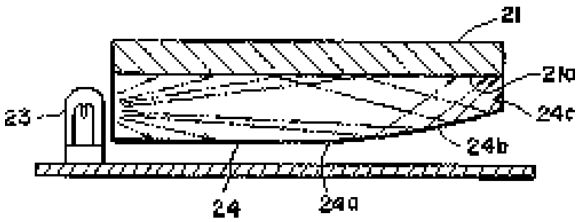


Figure 5

Figure 6



[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The invention is related to a liquid crystal display device for use in all types of electronic equipment, and is particularly related to the illumination structure within liquid crystal display devices.

[0002]

[Prior Art]

Liquid crystal display devices are widely used in all types of electronic equipment, including the display screens of audio equipment, to display the time, radio frequency or other items. These liquid crystal display devices are generally composed of liquid crystal display elements (hereinafter referred to as LCD) and a light source referred to as a backlight fixed to the back of the LCD. The light from the light source passes through or is intercepted by polarizers set inside the LCD and light and dark states are triggered in display pattern segments, and numbers, letters and symbols etc. are displayed via the separation of these light and dark states.

[0003]

With the type of liquid crystal display devices described above, it is necessary to uniformly illuminate the back of the LCD with the light from the light source to eliminate inconsistent light and dark states on the display. To this end, a light conductor (22) comprised of a flat panel of clear resin is attached to the back (21a) of the LCD (21) and a lamp (23) is set at one end (22a) of the light conductor (22), as shown in Figure 5. The light emitted from this lamp (23) is reflected in a diffused pattern inside the light conductor (22) and dispersed, and this reflected light is then guided to the LCD (21) side. However, there exists a problem where the light guided to one end (22a) of the light conductor (22) from the lamp leaks to the outside of the light conductor (22) during the process of diffuse reflection inside the light conductor (22) as it progresses to the other end (22b) and this light is lost, resulting in a darker display from the LCD (21) corresponding to the other end (22b) of the light conductor (22).

[0004]

Figure 6 shows the means used to solve this problem. It is proposed that the thickness of the light conductor (24) is gradually reduced as the distance to the lamp (23) becomes greater, turning the back (24a) of the light conductor (24) into a sloped surface (24b). This structure allows the sloped surface (24b) to forcibly reflect light that reaches the other end (24c) of the light conductor (24) onto the LCD (21), and is a means of guiding a large amount of light to the other end of the LCD (21) when compared with the [example] shown in Figure 5 using a flat panel light conductor (22). As such, the problem where the display of the LCD (21) corresponding to the other end (24c) of the light conductor (24) becomes darker no longer occurs.

[0005]

[Problems to be Solved by the Invention]

Recent advances in LCD production technology have led to the availability of LCDs of a much larger scale than before; however, this necessitates a greatly increased amount of light to illuminate the LCD.

The conventional structure of liquid crystal display devices described above naturally limits the amount of light guided to the LCD side by the light conductor as the light conductor is only illuminated at one end, making it difficult to obtain the amount of light necessary to illuminate a large-scale LCD.

The invention was born from this issue, and aims to provide a liquid crystal display device equipped with a means of illumination that is able to sufficiently illuminate the LCD, even when mounted onto a large-scale LCD.

[0006]

[Means of Solving the Problems]

In order to solve the problem disclosed above, the invention is comprised of a liquid crystal display device comprising of liquid crystal display elements having multiple display segments, a light conductor set on the back of these liquid crystal display elements, and a light source which illuminates the liquid crystal display elements through the light conductor, light sources which are fixed at both ends of the light conductor, a pair of sloped surfaces that are formed on the back of the light conductor which slope from the two ends towards the middle where the light conductor is the thinnest, and a holder having a locking part that is set to lock both the aforementioned liquid crystal display elements and the light conductor individually, where the ridge that is formed where the pair of sloped surfaces of the aforementioned light conductor intersect is positioned where it will not overlap with liquid crystal display element display segments when viewed straight-on.

[0007]

[Operation]

With the means disclosed above, having light sources which are fixed at both ends of the light conductor and a pair of sloped surfaces that are formed on the back of the light conductor which slope from the two ends towards the middle where the light conductor is the thinnest means that light can be guided from both ends of the light conductor, and that the light guided into the light conductor can be forcibly led to each liquid crystal display element by the pair of sloped surfaces, greatly increasing the amount of light led to the liquid crystal display elements when compared to existing means of guiding light from only one end of the light conductor, and making it possible to sufficiently illuminate the liquid crystal display elements even when mounted onto a large-scale liquid crystal display element.

[0008]

In addition, by setting a holder having a locking part to lock both the aforementioned liquid crystal display elements and the light conductor individually, and by positioning the ridge formed where the pair of sloped surfaces of the aforementioned light conductor intersect where it will not overlap with liquid crystal display element display segments when viewed straight-on, it is possible to prevent light and dark irregularities on the display caused by a shift of the relative positions of the liquid crystal display elements and the light conductor due to vibration etc. that results in the liquid crystal display element display segments overlapping with the ridge of the light conductor. In addition, even if the brightness of the light sources at each end differ, brightness irregularities in single display segments are prevented as each display segment is only illuminated by the light from one light source. Furthermore, the locking part of the holder fixes both the liquid crystal display and the light conductor in place, increasing the assembly performance of the device.

[0009]

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.