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Dead Front Display with Adjustable Cover-Glass Gap

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ABSTRACT

A dead front display is a type of display that disappears, e.g., blends with the background, when turned off. A tradeoff exists between the sharpness of the display in the ON state and the effectiveness of hiding the black state of the display behind the diffuser in the OFF state. The closer the display is to the diffuser, the sharper the ON state but the more visible the black in the OFF state. This disclosure describes a mechanism to dynamically adjust the air gap between the top diffuser layer and the display of a dead front display for different display states. When the display is turned on, the gap is reduced, producing a sharper image. When the display is turned off, the gap between the top diffuser layer and the display is increased, causing the display to be better hidden.

KEYWORDS

- Dead front display
- Air gap
- Cover glass
- Display sharpness
- Polymer-dispersed liquid crystal (PDLC)
- Switchable PDLC

BACKGROUND

A dead front display is a type of display that disappears, e.g., blends with the background, when turned off. When off, the display effectively looks like it is not there. Another type of dead front display is a diffused white display where the display is hidden behind a white diffuser

layer. In the ON state, the display is visible, and in the OFF state it looks like a white surface (LCDs and OLEDs are black in the OFF state.)

A tradeoff exists between the sharpness of the display in the ON state and the effectiveness of hiding the black state of the display behind the diffuser in the OFF state. The closer the display is to the diffuser, the sharper the ON state but the more visible the black in the OFF state. Conversely, the farther the display is from the diffuser, the blurrier the display in the ON state but the less visible the black (e.g., the closer its appearance to a blank surface) in the OFF state.

DESCRIPTION

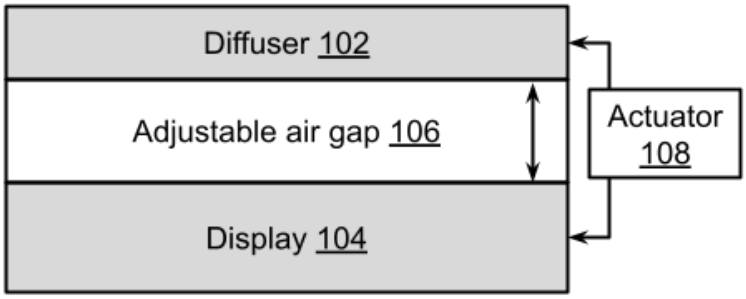

Fig. 1: Dead front display with an adjustable cover-glass gap (side view)

This disclosure describes a mechanism that enables dead front displays to dynamically adjust the air gap between the top diffuser layer and the display for different display states. Fig. 1 illustrates a side view of an example dead front display with an adjustable cover-glass air gap. The air gap (106) between the diffuser (102) and the display (104) can be changed by an actuator (108) based on the display state (ON or OFF).

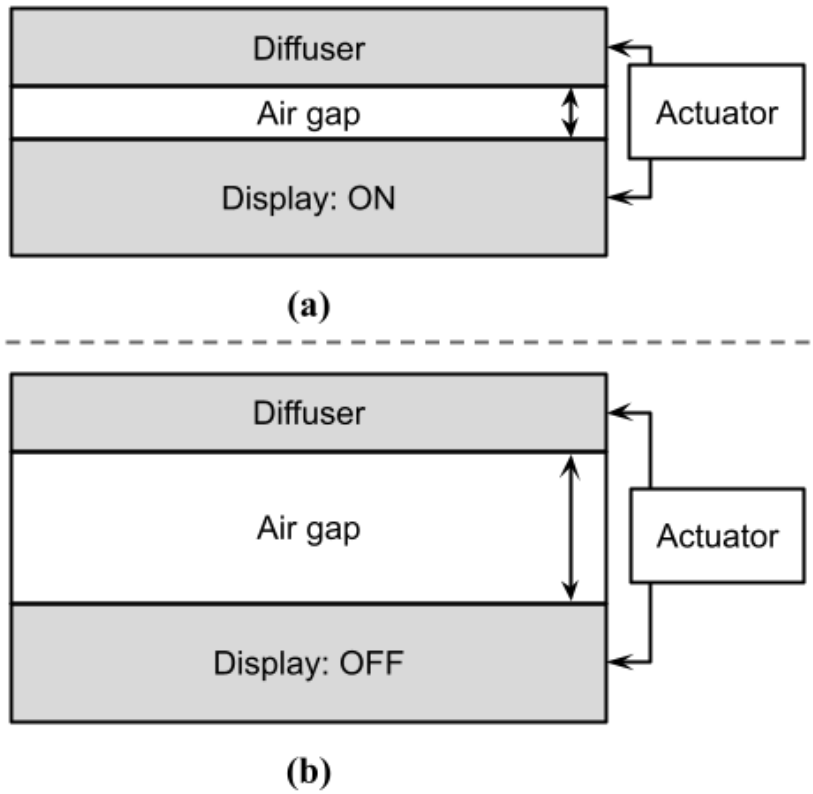

Fig. 2: Air gap between the diffuser and the display depends on the state of the display. (a) The air gap is relatively small when the display is in its ON state. (b) The air gap is relatively large when the display is in its OFF state

As illustrated in Fig. 2, when the display is turned ON (Fig. 2a), the air gap is reduced, producing a sharper image. When the display is turned OFF (Fig. 2b), the air gap is increased, causing the display to be better hidden.

Dead front displays can be utilized in devices where blending the display is important, e.g., smart home devices such as thermostats. The described techniques enable the display to retain quality while providing better blending.

CONCLUSION

This disclosure describes a mechanism to dynamically adjust the gap in a dead front display between the top diffuser layer and the display for different display states. When the display is turned on, the gap is reduced, producing a sharper image. When the display is turned off, the gap between the top diffuser layer and the display is increased, causing the display to be better hidden.