carbon based elastomer can have optical refraction index as low as 1.40, and a heavy flint glass with 71% lead has an index of refraction as high as 1.805. With such a combination, the evanescent decay length is roughly 1.6 micron, which is still within reach of the surface wave displacement. The compliant transparent elastomer ideally should have a thickness that is many times the decay length of the evanescent wave field to ensure that the laser light can not tunnel out.

[0127] FIG. **29** illustrates such an arrangement. Pixels are addressed row by row by sending a pulse or a wave train **203** of surface acoustic wave in the direction of increasing or decreasing row numbers. The arrival of the surface acoustic wave pulse **203** at a row location displaces the boundary between the piezoelectric material **201** and the compliant elastomer **204** inward, compressing the elastomer **204**. The compression increases the optical density of the elastomer **204** which increases the optical index of refraction of the latter. The inward movement of the elastomer-piezoelectric substrate boundary, as well as the increase in the index of refraction also narrows the evanescent gap to allow the laser light to tunnel through.

[0128] Since the surface acoustic wave travels at a speed which is much higher than what is required for row scanning, a strobe technique is used which sends the SAW pulses at a high repetition rate and modulate the laser diodes at a strobe frequency which is marginally greater than the pulse frequency of the surface acoustic wave. For example, if the display screen is 50 inches in height, then the linear row scanning speed is 50 in times 60 Hz=76.2 m/s. This is roughly 20 times slower than the propagation speed of the surface acoustic wave. This can be compensated by sending the surface acoustic wave pulse at a repetition rate of 1200 Hz and set the strobe frequency of the laser diodes exactly 60 Hz faster at 1260 Hz to give the apparent scanning frequency of 60 Hz. To avoid smearing of the pixels, the duty cycle of the laser diodes has to be 1/20, or 5%. The low duty cycle is not a problem for laser diodes which have very high peak light output; hence the averaged light output won't suffer from the low duty cycle. If higher light output is desired, it can be accomplished simply by increasing the frame rate to 1200 Hz for a maximum duty cycle of 100% by repeating a frame 20 times with the aid of a frame grabber which stores an entire frame. Other duty cycles are possible either by adjusting the duty cycle within one pixel period, or by skipping rows during a frame sweep with the aid of a scan converter working in concert with a frame grabber.

[0129] Another issue with the SAW addressing scheme is the attenuation and pulse distortion of the surface acoustic wave pulse as it travels. The piezoelectric medium typically has a high Q to permit the SAW pulse to travel relatively un-attenuated within a modest distance. However, the compliant elastomer layer to which the surface acoustic wave is coupled is significantly more lossy, which necessitates the use of SAW repeaters at specific intervals to amplify/regenerate the SAW pulse before any significant attenuation occurs.

[0130] FIG. **30** is a schematic exemplar embodiment of the SAW repeater **213**. Inter-digitated electrodes **200** are used to drive the piezoelectric thin film **201** at periodic distances. The distance between any two inter-digitated clusters **220** should be small enough to ensure little attenuation of the surface acoustic wave amplitude between the two. The inter-digitated electrodes **200** also serve as voltage sensors since as SAW propagates within the piezoelectric medium **201**; it compresses and expands, causing the piezoelectric medium **201** to generate a voltage in response to such mechanical stress. Within an inter-digitated cluster **220**, two sets of inter-digitated electrodes **200** sense the voltage difference between two closely spaced locations. The voltage difference is fed to a gain controlled signal amplifier **211** through a set of unity gain differential amplifiers **212**. A fixed gain pre-amplifier **214** can also be introduced to improve the signal-to-noise ratio. The amplification gain of the gain controlled amplifier **211** is determined by the amplitude square (or the power) of the surface acoustic wave at that location. The amplified differential signal **216** is then used to drive, or actuate, the piezoelectric substrate **201** at a small distance downstream from where the SAW pulse amplitude is sensed. The actuation of the SAW medium is in-phase with the freely propagating SAW pulse for best efficiency. The actuation should be just sufficient to replenish the energy lost due to propagation attenuation. The actuation is through another set of inter-digitated electrodes **217** which preferentially actuates SAW signal within a narrow range of wavelength through the use of an inverter **214**. Such wavelength selective amplification and actuation facilitates signal amplification. When the power as measured by the power meter **215** is smaller than a threshold value provided by the voltage reference **210**, the gain of the amplifier **211** is greater than one, causing the surface wave to be amplified. Once the power of the surface acoustic wave exceeds the threshold value, the amplification gain becomes less than unity. This ensures that the SAW pulse is maintained at a constant peak value. To further guarantee that small random noises do not get amplified, another lower threshold reference can be introduced to reduce the small amplitude gain to less than unity. The lower threshold reference voltage is chosen such that it is at least one standard deviation higher than the RMS (root mean square) noise level, but not much higher. This will suppress noise while the desired SAW pulses will be amplified to their proper heights.

[0131] FIG. **31** is an view of the inter-digitated electrode cluster **220** with two sensing inter-digitated electrodes **200** forming a differential pair and an actuating inter-digitated electrode **217**. The spacing between two adjacent fingers of opposing inter-digitated electrodes **200**, **217** is equal to the wavelength of the surface acoustic wave.

[0132] The use of inter-digitated electrodes **217** for actuation has one disadvantage, namely, it tends to stimulate SAW signals going both ways. This is because inter-digitated electrodes **217** only have two phases which are 180° apart. Thus it is impossible to distinguish a forward going SAW pulse and a backward going one. The generation of backward going SAW pulses can be suppressed by the selective nature of the sensing and amplification stages. If the amplitude of the backward SAW pulse is smaller than the lower amplification threshold, it would also be attenuated by the amplifier. One approach, however, is to employ a 3-phase inter-digitated drive technique to actuate only forward propagating SAW pulse. Such a technique is a subset of the phased antenna approach widely used in telecommunications. In this case, the 3-phase antenna array **230** has a very large front-to-back antenna gain ratio (the ratio between forward propagation and backward propagation), hence the