ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 1, January 2018

Advances in Lenticular Lens Array Technology

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Abstract:Lenticular focal point arrays are generally utilized in the printed display industry and in particular utilizations of electronic showcases. By and large, lenticular arrays can make from intertwined printed pictures such enhanced visualizations as 3-D, liveliness, flips, transform, zoom, or different blends. The utilization of these regularly barrel shaped arrays for this reason started in the late 1920's. The focal points involve a front surface having a circular cross-section also, a level back surface upon where the material to be shown is proximately found. The head constraint to the resultant picture quality for current innovation lenticular focal points is circular abnormality. This constraint causes the lenticular focal point arrays to be commonly thick (0.5 mm) and not effectively folded over such things as jars or jugs. The destinations of this exploration exertion were to build up a reasonable systematic model, to fundamentally improve the picture quality, to build up the tooling important to manufacture lenticular focal point exhibit expulsion chambers, and to create upgraded manufacture innovation for the expulsion chamber. It was established that the most feasible cross-sectional shape for the lenticular focal points is curved. This shape significantly improves the picture quality. The connection between the focal point span, conic steady, material refractive record, and thickness will be examined. A huge test was to create a precious stone cutting instrument having the best possible curved shape. Both genuine curved and pseudo-circular precious stone apparatuses were structured and manufactured. The plastic sheets expelled can be very slight (< 0.25 mm) and, thus, can be folded over jars and such. Manufacture of the lenticular engraved expulsion chamber required exceptional advancement thinking about the enormous physical size and weight of the chamber, and the tight mechanical resiliences related with the lenticular focal point molds cut into the chamber's surface. The improvement of the cutting device and the lenticular engraved expulsion chamber will be displayed notwithstanding an illustrative examination of current lenticular innovation and the new innovation. Three U.S. licenses have been given as an outcome of this exploration exertion.

Keywords: Lenticular lens, array technology, print industry, computer vision, elliptic, fabrication.

INTRODUCTION

Making stereoscopic (three-dimensional) 3D effect can be practiced a few different ways, with the two most well-known being lenticular and holographic imaging. In spite of the fact that they are not comparable by the way they show up as 3D [1]positions, they are on occasion confused with each other. Lenticular [2]pictures can be perceived by the plastic-furrowed round and hollow focal point covering the printed or photographic picture. Lenticular pictures, either printed or created photographically, will in general show up a lot more life-like than 3D images. Since holographic pictures are not printed, they appear to show up as dreamlike workmanship, or by one way or another counterfeit. Today, visualizations are utilized oftentimes on customer's Mastercards[3].

DESIGN OF LENTICULAR LENS

As referenced above, round and hollow lenticular focal point clusters are normally utilized with the end goal of forte printing to make a 3-D impact or to encode different pictures that are independently seen by humbly turning the print. Figure 1 outlines a side view and diagonal perspective on a commonplace lenticular focal point exhibit. From first standards of material science related with optics, it is promptly established that the connection between the good ways from the vertex of the focal point to the back surface (t), whereupon the shown data is printed, the range of the focal point (R), and the refractive record (N) is given by:

$$t = RN/(N-1)$$

This condition accept a perfect focal point and the separation t is additionally the central length "f." truly, the outside of the lenticular focal point[4] is roundabout in cross-segment and the anticipated picture endures huge abnormalities. These abnormalities corrupt the nature of the showed picture.

ISSN (Online) 2394-2320

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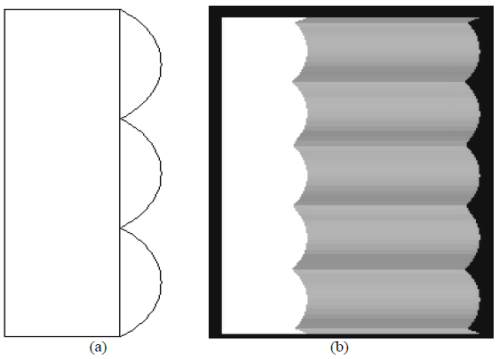

Figure 1: Side view and oblique view of generic lenticular array

Figure 2 shows the instigated deviations of circular on-hub and the expansion of unconsciousness off-pivot for a round and hollow focal point exhibit. When all is said in done, the light is going from the printed surface to the spectator; in any case, correspondence permits seeing the issue backward also. The episode light is from a removed point source that in this manner produces collimated beams[5]. A perfect focal point will concentrate such light to a typical purpose of core interest. As can be seen from Fig. 1, the light is spread over a critical region. This cutoff points goals and the quantity of interleaved pictures common of this printing innovation. It is moreover known by those talented in optics that the thickness t should be not as much as that referred to above so as to amplify the goals within the sight of distortions. This shortening can add up to maybe 20% of t. It can likewise be seen from Fig. 1 that the profundity of the focal point surface (good ways from focal point vertex to convergence of the lenticules) can arrive at R at the intersection of the nearby focal points. A result of this is the obstructing of light or the undesired reflection [6] of light.

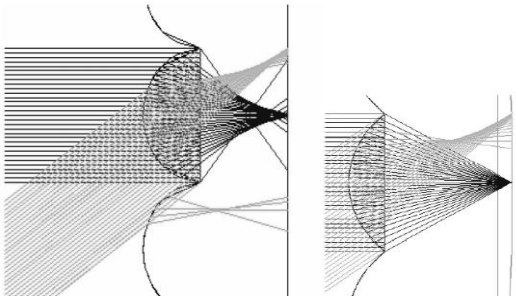

Figure 2: Cylindrical lens array on the left and elliptical lens array on the right

ANALYSIS OF LENTICULAR LENS

The raytrace[7] for a lenticular focal point having the equivalent spatial conveyance (pitch) of focal points and base sweep is shown in Figure 3. Notice that the hub picture is basically geometrically great and that the off-pivot picture is improved, concerning the tube shaped focal point, with trance like state being the predominant leftover distortion[8]. Further, it is obvious that the past obstructing of a portion of the light is never again a trouble, in this manner giving a more splendid furthermore, more clear picture. The profundity of the focal point intersection from the focal point vertex is about 60% of the previous case.

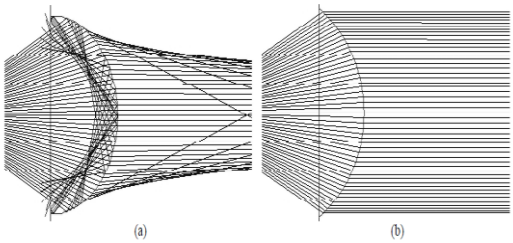

Figure 3: Conventional cylindrical lens with (a) total internal reflection, (b) well collimated rays

The utilization of a curved surface for the lenticular focal points fundamentally mitigates the previously mentioned issues with the barrel shaped focal point. The base pitch a given lenticular exhibit can have utilizing barrel shaped surfaces is 1/(2R). At the point when the pitch is expanded, the width of the component fundamentally diminishes. It is fascinating to take note of that the utilization of the curved surface can permit the utilization of lower pitch focal points as can be seen by looking at Figs. 2 and 3.

ZEMAX [9]was utilized to display the different lenticular focal point[10] designs. Figure 4(a) shows that with an ordinary barrel shaped focal point, absolute inward reflections can happen that breaking point the measure of opening which is helpful of the lenticule. This constraint makes the picture less "splendid" since less light can get in and out when contrasted with the circularly formed focal point showed in Fig. 4(b). Despite the fact that the lenticule limits are appeared, the source and the material in the middle the source and the lenticule have a similar refractive file as the lenticule[2]. The improvement is clear and is, to some extent, why the curved lenticule gives more splendid pictures having higher complexity.

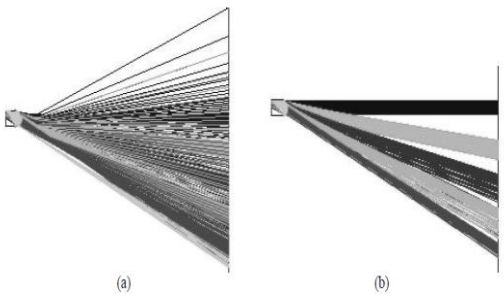

Figure 4: Half field beams for a cylindrical lens element

To assess the off-pivot execution of the distinctive lenticules, the level back surface of each lenticule was portioned into nine sections. Because of balance, just the middle and the four sections on one side should be inspected. A point source was situated at the focal point of each portion and enthusiasts of beams were then followed through the perspective. In a perfect world, one would watch five collimated shafts leaving the lenticule; in any case, abnormalities debase the collimation and detachment. The bar course θ is given by first-request optics to be tanθ = h/f where h is the good ways from the optical pivot to the source. Figure 4(a) show the leaving pillars for a barrel shaped lenticule and Figure 4(b) shows the shafts for a circular lenticule[11]. The improvement in bar partition is momentous and brings about watched pictures having less ghosting and crosstalk.

RESULTS AND CONCLUSION

Joining the previously mentioned referenced innovations can make new, never-seen printed lenticular configurations and structures including: whole external lenticular bundling improvements (box over wraps); portioned applied lenticular name inclusion to external bundling; pressure touchy, non-pressure delicate, self-glue, and non-self-cement lenticular mark items; multi-handle, multi-substrate strip open weight touchy and non-pressure touchy lenticular names; lenticular overlaid to paper board items; bundling in-packs and on-packs; drink cups having ornamental halfway or full lenticular cup wraps; video, dvd, or album circle spread lenticular medicines; regular postal mail; magazine embeds; paper embeds; or challenge and game sweepstakes segments that contain utilization of incomplete or full lenticular upgrades.

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