SEATTLE FACETOR DESIGN November 1987

FINDING ANGLES FOR OPTIMAL BRILLIANCE BY CALCULATION

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I was not satisfied with the stories about optimal brilliance of faceted stones, so I looked for a sound basis to find things out for myself. I decided that I needed at least a calculating method for light paths inside the stone, to simulate viewing when the stone was illuminated with a lamp. Of course I used a computer to facilitate and speed up these calculations. In the beginning I used a small handheld computer and applied it to a simplified two-dimensional model of a brilliant. As for results I rapidly found out that the size of the table is rather important for the brilliance and the appearance of fish eyes. The influence of the table size is not the same for different refractive indices. The results could be confirmed by cutting stones with various table sizes and various angles.

After this preliminary study I used a larger computer, again on the simplified two-dimensional model, to study the scintillation behavior. I consider scintillation performance to be most important if one looks at a moving stone from a distance in the light of a few lamps. Then it is not important whether the light flashes come out of the table or out of other crown facets. Also fish eyes can hardly be noticed from a distance, certainly so for small stones set around a cabochon or a larger faceted gem. This time a large number of ray paths were used in the calculations. The investigations showed that best scintillation would be obtained with other sets of angles than advised normally for optimal brilliance. In fact low pavilion angles, well below the critical angle, would make a nicely scintillating gem! Of course these stones do show a "fish eye". If observed from above in the light of one lamp the brilliance of the table is considered of most importance. But this is not important at all for scintillation in the way I have defined the property. To verify all this, again stones were cut: indeed in large lines the results could be confirmed. I was preparing an article on this, but considered in the meantime how to use a three-dimensional model. I could at last realize that, I had to use a faster computer to calculate the ray paths inside the stone. In this article the computer program itself will be discussed very globally only but the results obtained up to now will be shown.

As mentioned before, the computer program can calculate the ray paths in and outside a faceted gem, just as they are in reality. Also any cut, even very complicated ones, can be handled. The program can further calculate the average brightnesses of the table, stars, mains, etc. The relative position of the observer, stone and lighting lamp are shown in Fig. 1. As the observer automatically will hold the stone in such a position that the table is most bright, the program was made to take care of that and it therefore finds the "best" lamp position for the viewing angle "w" chosen.

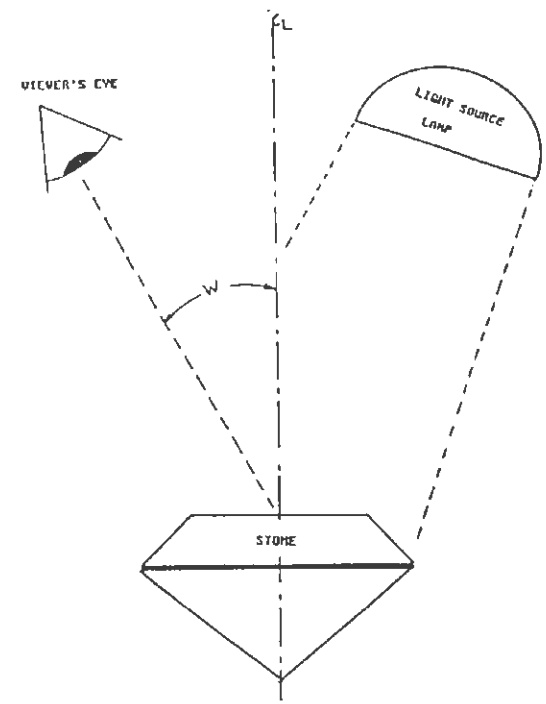

Figure 1 Relative position of observer, stone, and lighting lamp