Hearts and Arrows: Formation of the H&A pattern

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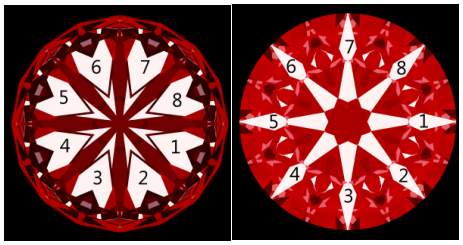
Every polisher knows that polishing Hearts and Arrows by HRD Antwerp is not easy. Some knowledge about the optical formation of both the hearts and the arrows can ease the job. This article reveals the exact interaction between the facets and the hearts and arrows pattern. The polishing sequence of the facets used in this article is not exclusive. There are other polishing schemes possible to create a Hearts and Arrows brilliant. The sequence demonstrates the exact number of facets needed to



form one heart and one arrow. Pavilion main facets are coded as P_m(index), pavilion halve facets as P_h(index). Crown main facets are coded as C_m(index) and star facets as C_s(index). The numbering of the hearts is illustrated in the two images above.

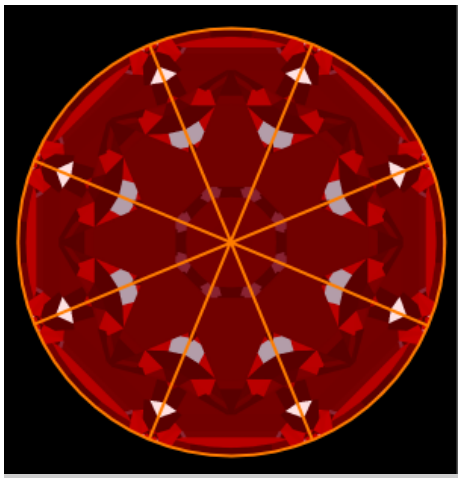


Figure 1: 8 bezels, 8 pavilion main facets

Forming the hearts

Each heart is formed by several facets. The light is entering the diamond and the facet reflections start to interact with each other creating optical effects. The slightest faceting deviation in depth, angle or azimuth can lead to deformed heart patterns. The heart patterns are created mainly by the pavilion main and half facets.

Let's take a detailed look at the formation of the heart patterns. First the

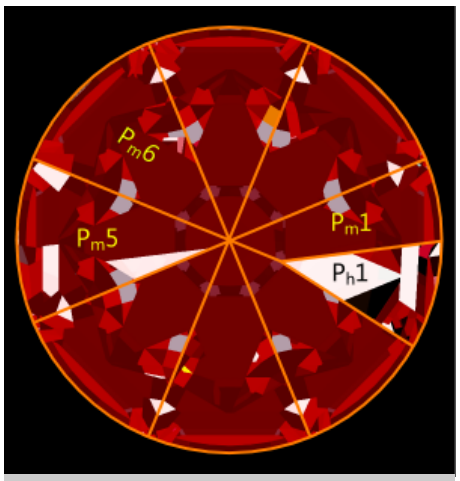


Figure 2: first pavilion half

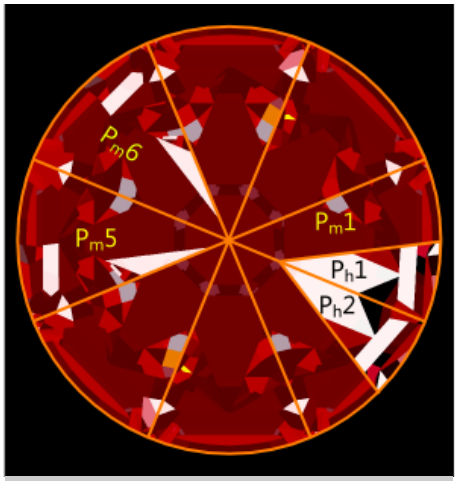


Figure 3: second pavilion half

creation of perfect symmetrical hearts is explained. In a next article some examples of common polishing errors together with their influence on the heart patterns will be given.

A perfectly blocked diamond, 8 main crown facets and 8 main pavilion facets, shows no hearts nor arrows (figure 1). A perfect round girdle is assumed. The first pavilion half, P_h1, gives birth to one of the two lobs of the first heart. The result of this first step, when viewed

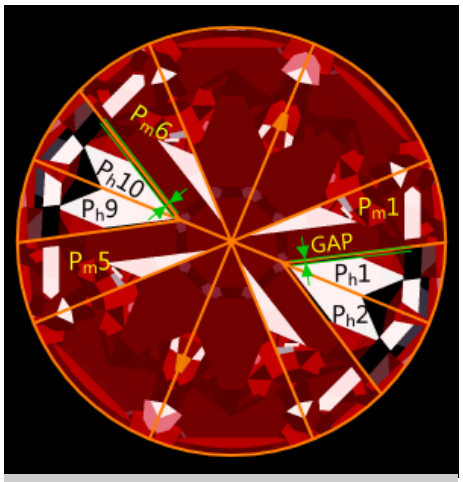


Figure 4: Opposite pavilion halves

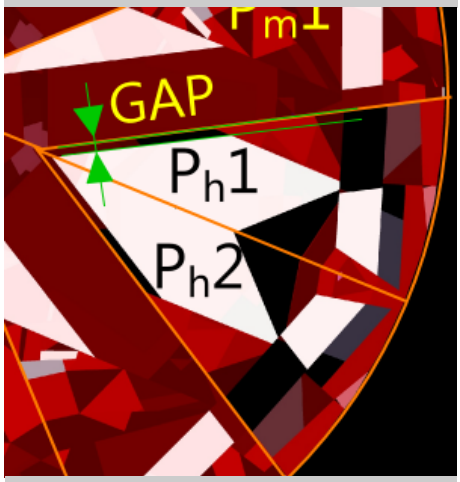


Figure 5: effect of opposite pavilion halves

through a H&A viewer, is illustrated in figure 2.

On the opposite side the white triangular shaped polygon forms a half of the v-shape of the fourth heart. The formation proceeds with the following pavilion half, P_h2, resulting in Figure 3.

The second lob of the first heart is getting shaped. As in step 1, polishing this facet, P_h2, gives rise to the other part of the v-shape of the sixth heart. To complete the first heart, the opposite halves P_h9 and P_h10 need to be polished.

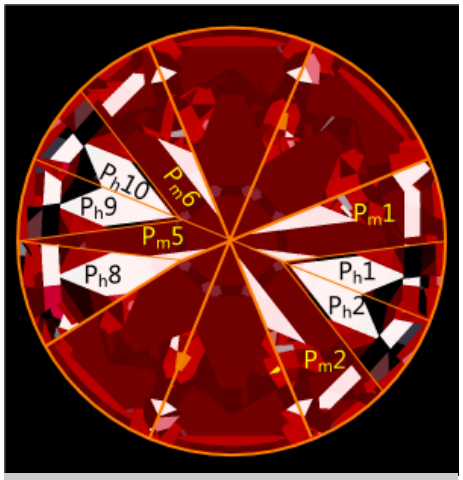


Figure 6: fifth half

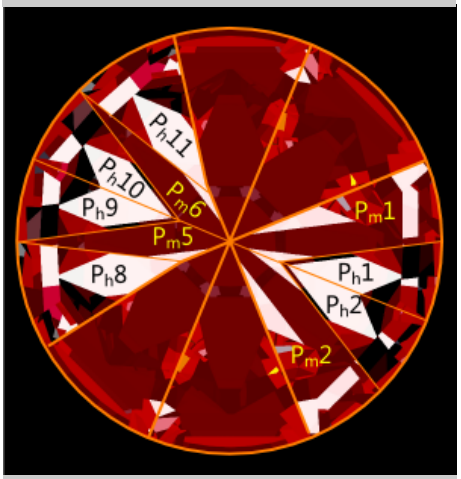


Figure 7: sixth half

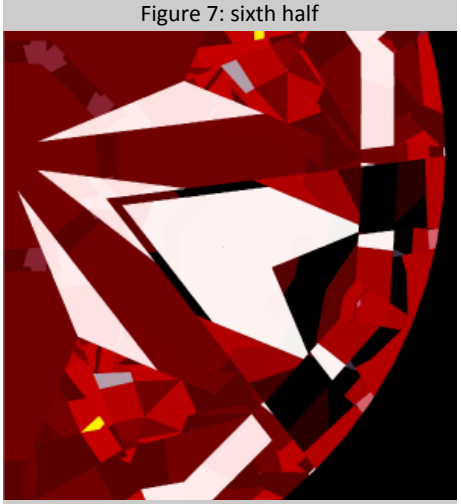


Figure 8: without star facets

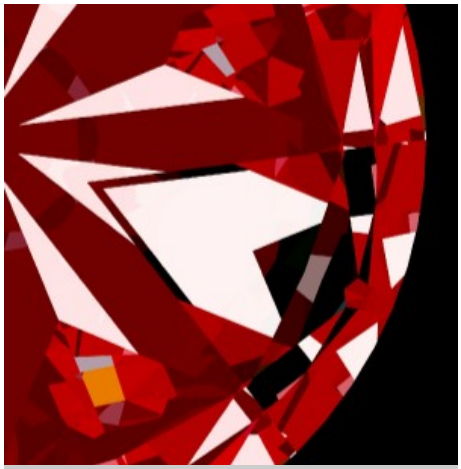


Figure 9: With star facets

Remember that the goal of this article is to describe the formation of one heart and not to start a discussion on the optimal polishing sequence. Besides creating the basic shape of the fourth heart, P_h9 and P_h10 reveal a subtle effect on the shape of the opposite heart. A small gap is created between the hearts and the edge between the halves and the pavilions (Figure 5).

The next stage in the process is the formation of the v-shape on the first heart. To achieve this two more halves, P_h8 and P_h11 are polished. At this stage the heart pattern is almost complete (figure 6 and 7). To flatten the shoulders of the heart (figure 8) the star facets are being polished. The result of this action is illustrated in figure 9.

It is amazing but it requires **FOUR pavilion main facets, SIX pavilion half facets** and **TWO crown facets** to create **one complete heart pattern**. The two crown facets, the table and the star facet **opposite** to the heart, form the shoulders of the heart. The pictures show that while polishing the necessary facets to create the first heart also several parts of the other hearts are created. This makes it extremely difficult to correct or adjust the heart shape of a finished diamond.

Forming the arrows

Similar to the creation of the hearts, also, each arrow is formed by several facets. Exactly how many facets are needed to form at least one complete arrow? Let's investigate the formation of an arrow. In figure 10 the initial state

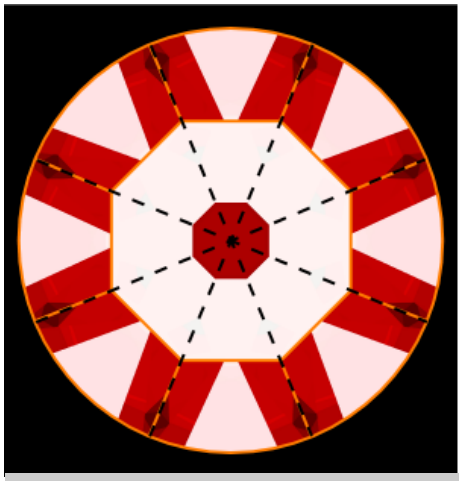


Figure 10: 8 bezels, 8 pavilion main facets

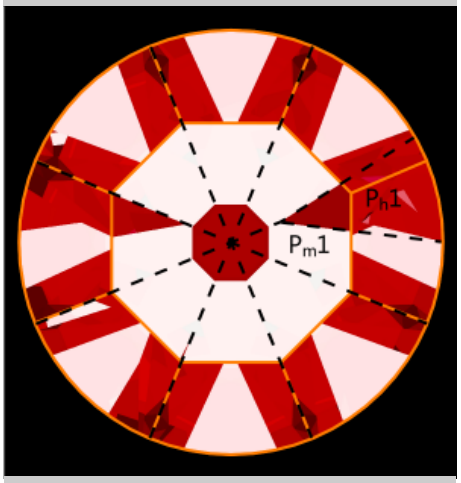


Figure 11: first pavilion half

with 8 bezels and 8 pavilion main facets is shown, when looking perpendicular through the table. Again the assumption is made that the girdle is perfectly round. We start with polishing the first pavilion half facet, P_h1. The result of this action is visualized in figure 11. Each pavilion half facet creates, together with the neighboring pavilion main facet, part of the first arrow reflection. At the same time the opposite reflection of the first arrow, the fifth arrow, is formed. Figure 12 shows the effect of polishing the next half, P_h2. This creates the biggest part of the arrow head and the rough shape of the arrow shaft. In figure 13 and 14 the opposite halves, P_h9 and P_h10 are polished.

The result of this action is a reshaped, smaller, arrow shaft.

Finalizing the first arrow requires the polishing of the crown star facets. Figure 15 illustrates the effect of the creation of the first star facet, C_s1. The star facets cut off the arrow point from the shaft and start forming the star shaped

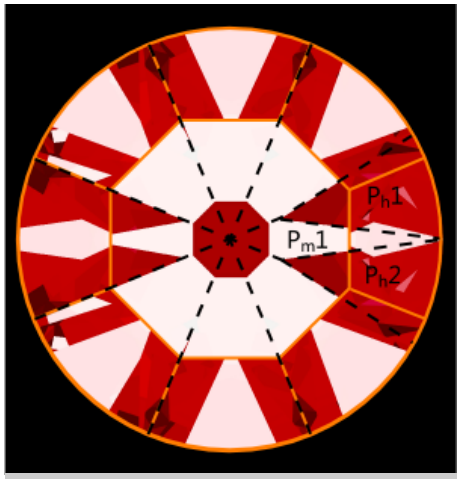


Figure 12: second pavilion half

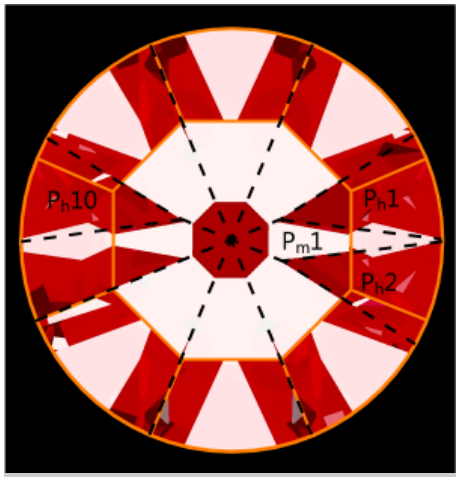


Figure 13: third pavilion half

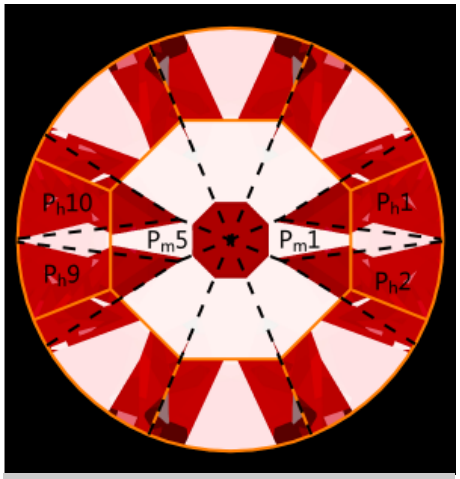


Figure 14: fourth pavilion half

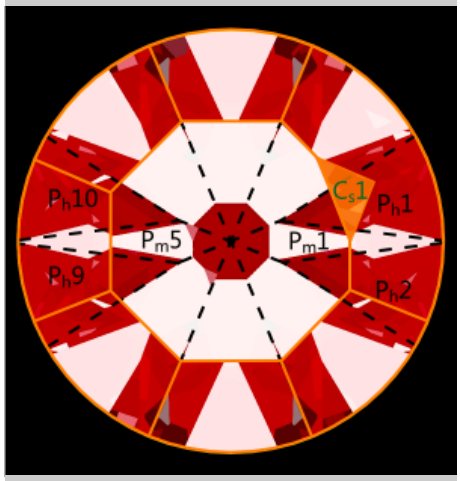


Figure 15: first star facet

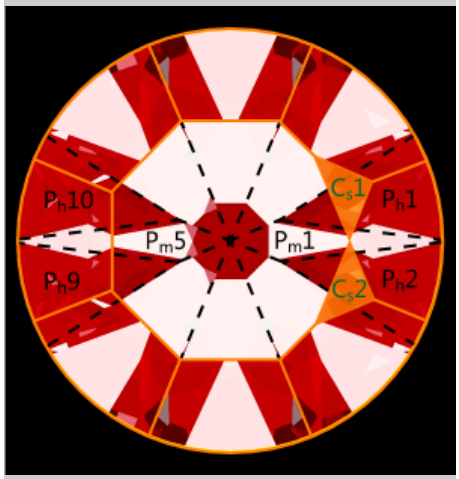


Figure 16: second star facet

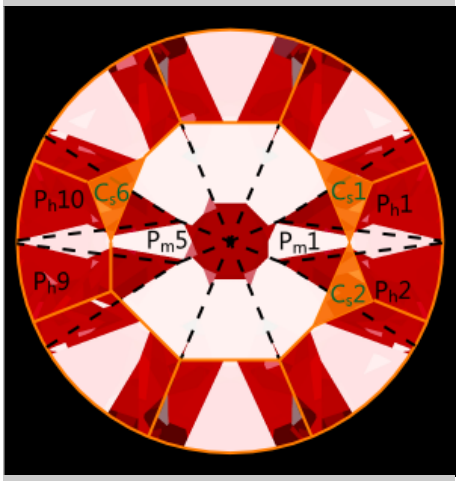


Figure 17: third star facet

inner pattern round the center of the diamond. Figure 16 shows the effect of the next star facet, C_s2, being polished. The first and the second arrow are formed. It is impossible to create one complete arrow pattern without creating the opposite at the same time. Completing the third and fourth star facets, C_s5 and C_s6 creates the first two complete arrows, shown in figure 17 and 18.

SIX pavilion facets and SIX crown facets (table, bezel, four star facets) were required to create one complete arrow. At the same time the opposite arrow is also completed. The tricky part in polishing a true H&A is that the same facets are involved in both the creation of the heart pattern and the arrow pattern. Every error influences several H&A patterns at the same time.

Conclusion

Each H&A pattern is created by several facets. In descending order of importance, the most important facets are:

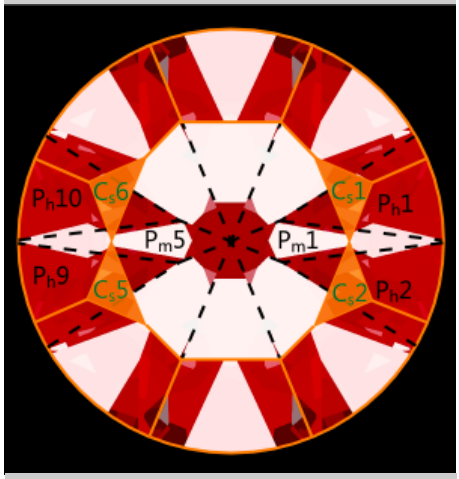


Figure 18: fourth star facet

- The pavilion main facets
- The pavilion halve facets
- The table
- The crown main facets
- The star facets

The crown half facets have no effect on the hearts and arrows patterns. They only influence the reflection patterns in the neighbourhood of the girdle. The correct proportions are discussed in a previous article: “Hearts and Arrows by HRD Antwerp - Relationship with the cut parameters”. A future article will give more information on the influence of facet position and orientation errors on the hearts and arrows patterns.

All images are created with the aid of DiamCalc Pro from Octonus Software Ltd.