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Research Article

THE USE OF CIRCULAR SPRINGS IN PATTERN DESIGN BETWEEN SQUARE CORSETS IN TRADITIONAL TURKISH TILE DECORATIVE ART

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Abstract

Both in classical Turkish decorative arts and works produced today, compositions of geometric patterns have also been used as well as various floral motifs. The compositions of these geometric forms were also used in wall tiles which have a considerable place in Turkish decorative arts. The use of circular curves in decorating tile surfaces is too common but there aren't significant details regarding the passage of circular curves between the diagonal of squares in series on tile surfaces. In this study, the creation of circular curves between the diagonals of squares on a square tile surface is formulated and applied. The main methodology is based on to calculate the radius of the circular curve and the frontal angle of circular curve depending on the length of the frame. In addition, according to the given radius of the circular curve to be passed, the edge angle of the square and the center angle of the circular curve were calculated. It is explained how the circular curves between the square diagonal will be applied on the surface of a tile with simple measuring tools. Necessary practices are experimented and obtained findings and considerations are explained.

Keywords: Tile Patterns, Circular Arc Forming, Application of Circular Arcs

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Araştırma Makalesi

GELENEKSEL TÜRK ÇINI SÜSLEME SANATINDA KARE KÖŞEGENLERI ARASINDA GEÇIRILEN DAIRESEL EĞRILERIN DESEN TASARIMNINDA KULLANILMASI

Özet

Gerek klasik Türk süsleme sanatlarında gerekse günümüzde üretilen eserlerde, çok çeşitli bitkisel motiflerin yanısıra geometrik desenlerden oluşan kompozisyonlar da kullanılmıştır. Türk süsleme sanatlarının en önemlilerinden biri olan duvar çinilerinde de bu geometrik şekillerden oluşan kompozisyonlar çokça kullanılmıştır. Uygulamada çini yüzeylerinin süslenmesinde dairesel eğrilerin kullanıldığı görülmüş, ancak çini yüzeylerinde dizi halindeki karelerin köşegenleri arasında dairesel eğrilerin geçirilmesi ile ilgili çok belirgin detaylar gözlenmemiştir. Bu çalışmada; kare biçimli bir çini yüzeyinde dizi halinde oluşturulan karelerin köşegenleri arasında dairesel eğrilerin geçirilmesi ve bunun aplikasyonu tasarlanmıştır. Bununla ilgili olarak bir çini yüzeyinde dizi halinde oluşturulan karelerin, dikkate alınan kenar uzunluğuna bağlı olarak geçirilecek dairesel eğrinin yarıçapı ile bu dairesel eğriyi merkezden gören açısı hesaplanmıştır. Ayrıca geçirilecek dairesel eğrinin verilen yarıçapına uygun olarak, karenin kenar uzunluğu ve dairesel eğrinin merkez açısı hesaplanmıştır. Dizi halindeki karelerin köşegenleri arasında geçirilecek dairesel eğrilerin bir çini yüzeyinde basit ölçü aletleriyle ile nasıl aplike edileceği açıklanmıştır. Konuyla ilgili uygulamalar yapılmış elde edilen bulgular ve kanaatler belirtilmiştir.

Anahtar Kelimeler: Çini Desenleri, Dairesel Yay Oluşturma, Dairesel Yayların Uygulanması

1. INTRODUCTION

In art, composition is a combination of elements in order to create a work of art. With the experience of centuries, motifs in Turkish decorative arts have been perfected and compositions have reached a rich variety and superior maturity. The motifs of the compositions exhibiting incredible diversity and intricacies in Turkish art works are in fact composed of very simple elements or units with many different combinations. The proportions and balance are very important in composition arrangements. In these designs, perfect balances are established both in the overall composition and in the proportions of the parts.

The compositions of Turkish decorative arts are dominated by curves and curves seen in nature. In composition arrangements, the area to be decorated is generally separated by smaller proportional units. This distinction is made in the form of geometric forms such as straight, broken, hypothetical lines and square rectangles and triangles, or with borders, dendans, separation rumi and clouds. The main compositions in these schemes develop with curves and curves.

The spiral curves, which come together in a harmonious and mathematical order from each other, cover the area in a balanced manner. The motifs are always placed in the same direction with respect to the direction of travel of the pattern. In Turkish ornamentations, compositions can be freed or more symmetrical (Özkeçeci, 2008). Tile means tiles, and means all ceramics painted on a composite white body, including tiles. Tile artifacts are usually painted in two stages. First the design is painted in black with charcoal. The next step is called painting. (Glassie, 2002)

The roots of Turkish art history are rooted in pre-Islamic periods and Central Asian, the homeland of Turks. These civilizations are the source of form and motifs used in our classical arts (Özkeçeci, 2008). In Turkish art, architecture, writing, book arts, literature, music and ornament arts are seen as prominent. The ornament arts, which developed in a perfect style, have been a great example in every period as a complement to the writings and structures in Turkish art. The art of ornamentation has been the main link between the various forms of Turkish art and at the same time alleviated the impact of the architecture in architecture.

Prepared compositions such as stone, metal, ceramics, wood, fabric, plaster, leather, glass, paper and all kinds of materials, such as carving, engraving, painting, casting, inlay, etc. on all kinds of goods and structures applied with different techniques (Özkeçeci, 2008).

The curves of nature are dominant in the compositions of Turkish decorative arts. In composition arrangements, the area to be decorated is generally divided into smaller proportional units. This distinction can be made in the form of geometric forms such as straight, broken, curved lines, square rectangles and triangles. In addition, this is done with borders, dendan*, separation with Rumi** and clouds. (*Dendan; As the term of tile decoration, the title, the entrance and return places, the individual and tooth-like shapes are the name given. **Rumi; the meaning of the dictionary belongs to Anatolia. It is a very common form of Turkish ornament, which consists of stylized forms of wings, legs and bodies of animals, which are based on Central Asia. Separation of the small parts of the rumi is made with smaller pieces of the shape is called rûmî. The shape that occurs with the passing of rûmî's is called Rumi).

The main compositions in these schemes develop with curves. The spiral curves, which come together in a harmonious and mathematical order from each other, cover the area in a balanced manner. The motifs are always placed in the same direction with respect to the direction of the pattern, the intersection points of the branches are covered with motifs.
In Turkish ornamentations, compositions can be freed and more symmetrical (Özkeçeci, 2008). Classy Turkish patterns and motifs are widely used; one of the Turkish decorative arts is the tile. Tile, produced from a special ceramic paste, decorated with traditional colors and motifs, is a name given to a piece of glazed ceramic. Turkish tile art has a very old history extending to the Uighurs.

After Karahanlılar and Gazneliler, the use and development of the tile in architecture has started with the Great Seljuks who created the first tile works in Iran. During the 13th century, the main big and bright development of the art of tile was seen in Anatolian Turkish art. In the early works, it appears as a very rich motif with a technical maturity that cannot be measured with Iran. These are the motifs that come from the Great Seljuks and spread to all the decorative arts (Aslanapa, 2003).

Wall tiles (large slab tiles) are usually of hexagonal, square or other shape, and are more often used in interior and flat surfaces of structures. The tiles decorated with geometric or floral motifs and inscriptions are used for covering desired surfaces in desired sizes. Turkish decorative arts, circles, triangles squares, etc. a wide variety of geometric shapes and great compositions were obtained. These compositions have been widely used in wall tiles. Circle arcs were used in the decoration of tile surfaces in many works (Figures 1-3). It is obvious that these applications are based on a mathematical and technical basis. The idea of designing a tile surface by passing the circular curves between the diagonal of the squares in series gives the opportunity to design with an innovative understanding and technical knowledge.

This study is useful in terms of presenting the original works of Turkish tile artists by bringing innovations to traditional Turkish ornaments and creating original works. In this study; on the surface of a square tile, the circular curve between the diagonal of the frames installed in the application and application of the circular curve is designed.

In this respect, an array is formed based on one side of the squares formed on the surface of a tile; The radius of the circular arc to be passed between the diagonals of a square, the angle of the curve is seen from the center of the curve or the edge length of the square and the circular arc angle of the square in accordance with the radius of the circular arc to be passed.

Glazed tiles on large wall surfaces at palaces, large exhibition halls, subway stations often form simple geometric patterns (diamonds, diagonal grids, squares and double y shapes) on the visible side and form fills in unglazed bricks (Meinecke, 1976). Various shapes are used as a pattern on today's tiles. In practice, it was seen that circular arc was used to decorate tile surfaces (Figures 1-4). However, it was observed that circular arc was not passed between the diagonal of squares in series on a tile surface. In this study; the application of the circular arc between the diagonals of the frames formed on the surface of a tile and their application is designed. Accordingly, based on an edge of the squares formed in series on a tile surface;

The radius of the circular arc to be passed as tangent to the diagonal of the square and the angle of one square of this square is seen from the center of the circular arc. In addition, if the circular arc radius is tangent to the diagonal of the square, then the edge length and the circular arc angle of the respective square are calculated.

Figure 1. Example of circular design in a tile (Wall tiles on the wall next to the altar of Mesih Mehmet Pasha Mosque (16th century), located near Hırka-i Şerif Mosque in Fatih district of Istanbul, URL_1)

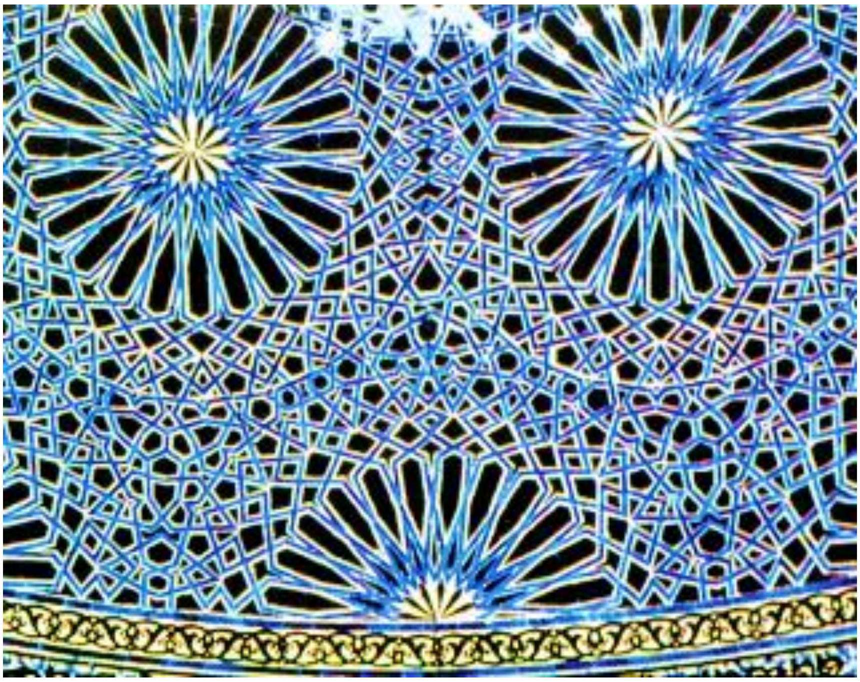

Figure 2. Example of circular design in a tile (Tile decoration on the dome and pendant of the Karatay Madrasa - Konya, URL_2)

Figure 3. Example of circular design in a tile (T.C. Ministry of National Education SVET (Strengthening Vocational Education and Training System Project). Ceramic and Glass Technology, Preparing Ulama Pattern, Ankara 2008, URL_3)

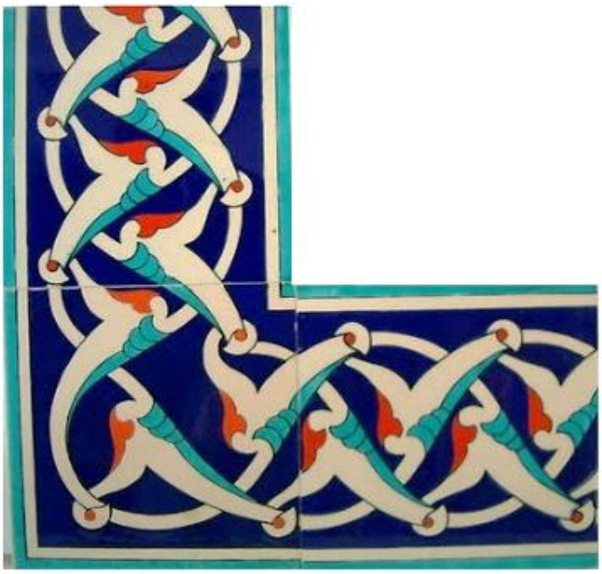

Figure 4. Example of a tile border design (URL_4)

In practice, it is explained how the circular arcs formed between diagonals in series of squares can be applied with simple measurement tools on a tile surface. Practices related to the subject and the findings and opinions obtained are stated.

2. MATERIALS AND METHODS

2.1. CALCULATION OF THE ELEMENTS OF THE CIRCLE PUBLICATION BETWEEN THE DIAMETERS OF A SQUARE

An infinite number of circular arcs can be passed from the corners A and D through the ABCD shaped a-side frame (Figure 5). However, if the circle arc to be passed through the corner points A and D in Figure 5 is considered to be tangential to the AC and DB diagonal of the square, in this case, only a circle arc passes from points A and D. In this case, Δ deviation angle, t tangent length and radius R in the center of the circle to be passed are obtained from the following relations (Bannister et al., 1998; Kavanagh, 2009; Wilfred S., 2001; Wolf, and Ghilani, 2008):

$$\Delta=2\alpha=100^{g} \quad (1)$$

$$t=EA=ED=\frac{a}{2cos50} \quad (2)$$

$$R=\frac{a}{2sin50}=t \quad (3)$$

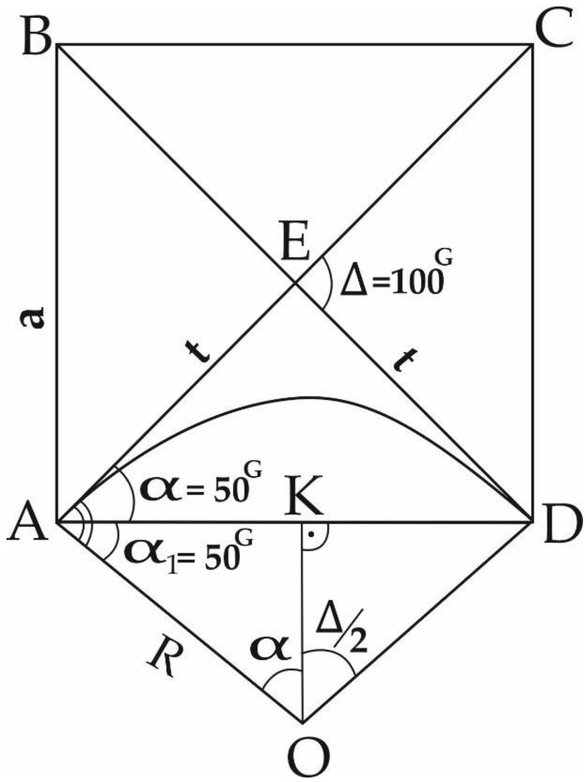

Figure 5. Circle arc in tangent position to the diagonal of the square

When the radius R of the circle that is tangent to the diagonal of the square is given the radius R, the edge a of the square is obtained by using the (3) correlation.

$a=2R\ \sin 50^g$ (4)

After calculating the square radius of the circular arc of the circular arc, which is tangent to the diagonal of the square, taking into account the edge length, the application elements of the circular broadcast center (AK, AO, KO) are calculated. In Figure 5, if the edge of the square (a) is given in the ABCD frame, α_1 is obtained;

$\alpha=\alpha_1=50^g$ (5)

If the edge of the tile tablet is known, the AK, AO and KO application elements are obtained from the following equations;

$AK=\frac{a}{2}$ (6)

$AO=\frac{a}{2cos\alpha_1}$ (7)

$KO=AK*\tan\alpha_1 = AK$ (8)

2.2. CALCULATING THE RADIUS FOR DRAWING A CIRCULAR PARALLEL TO THE CIRCLE BETWEEN THE DIAGONAL AND THE CIRCLES IN A FRAME

Circumcision in a square in a square to pass through a circle parallel to the circle can be drawn. In such a case, the width of the belt to be passed in parallel is needed. If the width of the belt to be passed (b) is known, then in this case, the circular arc (R’) parallel to the AD spring passing through the points A’ and D’ is obtained from the following relation (Figure 6).

$$R' = R + b \qquad (9)$$

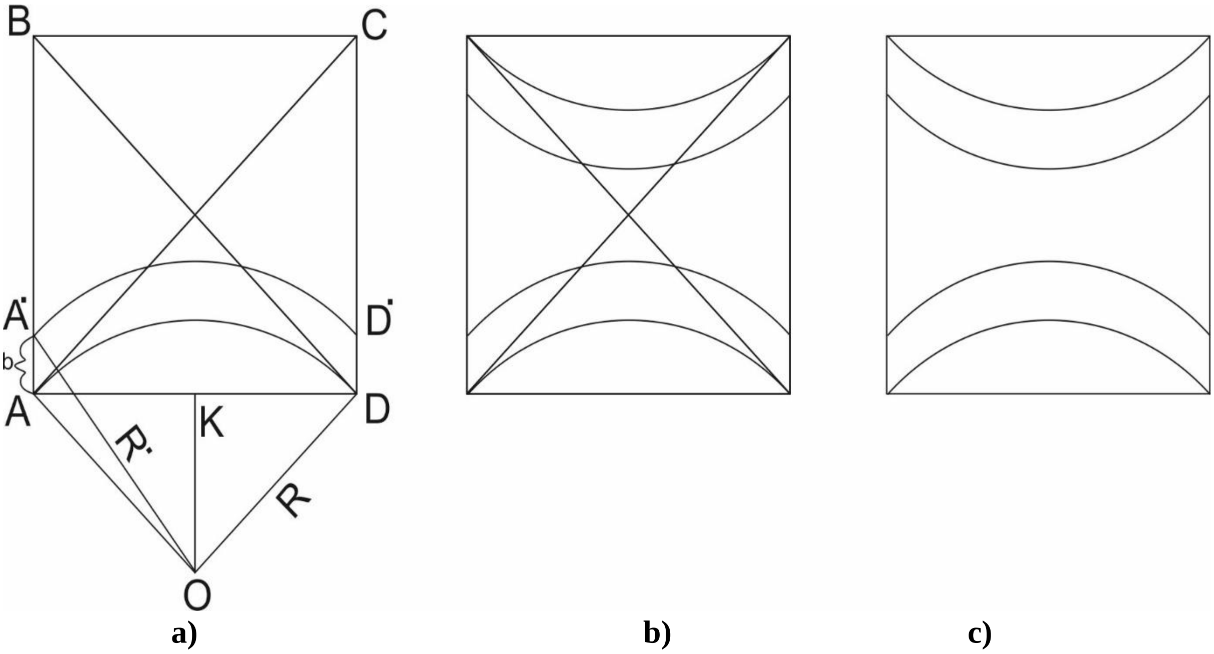

Figure 6. Drawing stages of the belt parallel to the circular arcs passed between AC and DB diagonals in a frame; a) Drawing of circular arc A’D’ parallel to AD circular arc, b) Drawing the circular arcs parallel to the circular springs drawn tangentially to their corners on the entire surface of the square, c) Clearing the diagonals in the square and making the belt visible

2.3. FORMING TILE TILES IN SEQUENCE

After a tile tablet is fixed on a surface, the AK is calculated from the correlation (6), taking into account the edge length of the tablet. The point K is the midpoint of the edge of the tablet. Point O is marked in the upright direction from the K point by taking the AK = KO length. The drawing of the circular arcs between the diagonal of the square created in series on a china tablet is done with the help of a precision compass, a ruler with a mm section and double squares. For the circular spring application, the pin point is dipped into the center of the compass, with the other end of the compass brought to the radius length calculated from the correlation (3), the circular arc is drawn between the corner points of the square.

Similar operation is made on the other side of the frame parallel to the edge of the process. In this way, the circle springs are tangent to the diagonal on the tile surface. Tile tiles arranged in this way are combined to form a series (Figure 7).

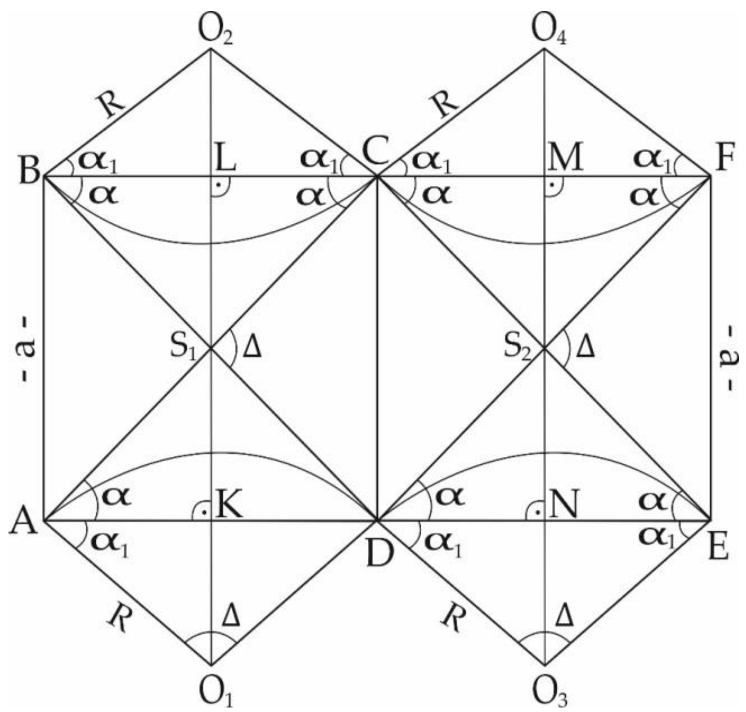

Figure 7. Creating squares in series and application of circle arcs between diagonal of them

If a tile is to be drawn in a position parallel to the arc of circles drawn in a tangent position on a tile surface. Taking into account the width of the belt, R' is calculated from the relation (9). On the surface of the tile to the center of the curve to plunge the sharp point of the compass.

A circular arc is drawn between the other ends of the compass which is brought to the radius of R' and the perpendicular edges of the square to the base (Figure 6a). Similar operation is made on the other side of the frame parallel to the edge of the process (Figure 6b). By erasing the diagonals of the square, the formed belts are made more prominent. In this way, the belt is obtained in the parallel position with the circle springs in the tangent position on the tile surface (Figure 6c).

3. RESULTS AND DISCUSSION

3.1. APPLICATIONS

3.1.1. *Application 1*

A 20 cm*20 cm china tablet was chosen as the application site. Four tiles were assembled in a position adjacent to each other to form a square frame of 40cm. With respect to the square array, the calculations of the elements mentioned in F. 5 are shown below;

$\Delta=2\alpha=100^{g}$

$t=EA=ED=\frac{a}{2cos50}=14.14cm$

$R=\frac{a}{2sin50}=t=14.14\ cm$

$AK=\frac{a}{2}=10cm$

$AO=\frac{a}{2cos\alpha_1}=14.14cm$

$KO=AK=10cm$

A tile tile is fixed on a flat surface. By applying the application elements calculated by the above correlations, the center point (K) of the tile edge and the center (O) point of the circle arc that will pass through the corners are marked. As described in *Calculating the Radius for Drawing a Circular Parallel to the Circle between the Diagonal and the Circles in a Frame* section, the circle arc is drawn between the diagonals (Figure 8). The pattern designed on these springs was applied (Figure 9) and the drawn pattern design was colored (Figure 10).

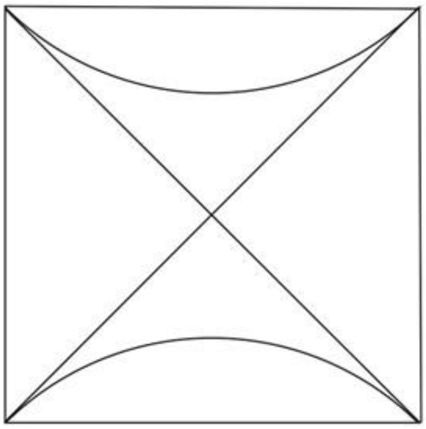

Figure 8. Drawing of circular arc between diagonals in frame

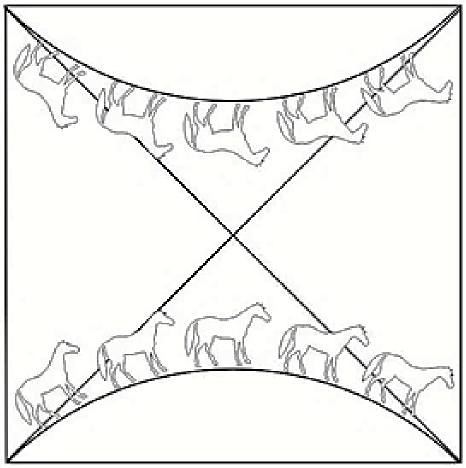

Figure 9. Pattern design on the drawn circular springs

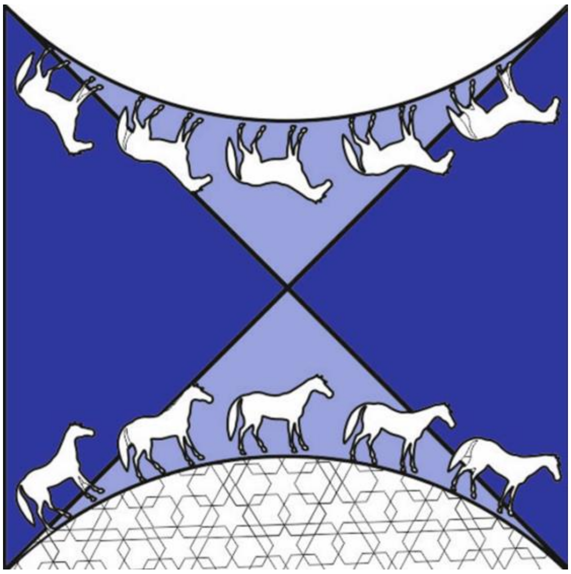

Figure 10. Coloring of the drawn pattern design

This figure is created in the computer environment with the help of a corel draw drawing program (Bain, 2003), the circle is shown in the design of the tile is colored (Figure 10). This design has been completed with the mirror method, next to each other (Figure 11). In the final form, four 20cmx20cm tile patterns are ready (Figure 11). This pattern, the same size of four tiles on the tiles with tile processing techniques has been finished by the application (Figure 12).

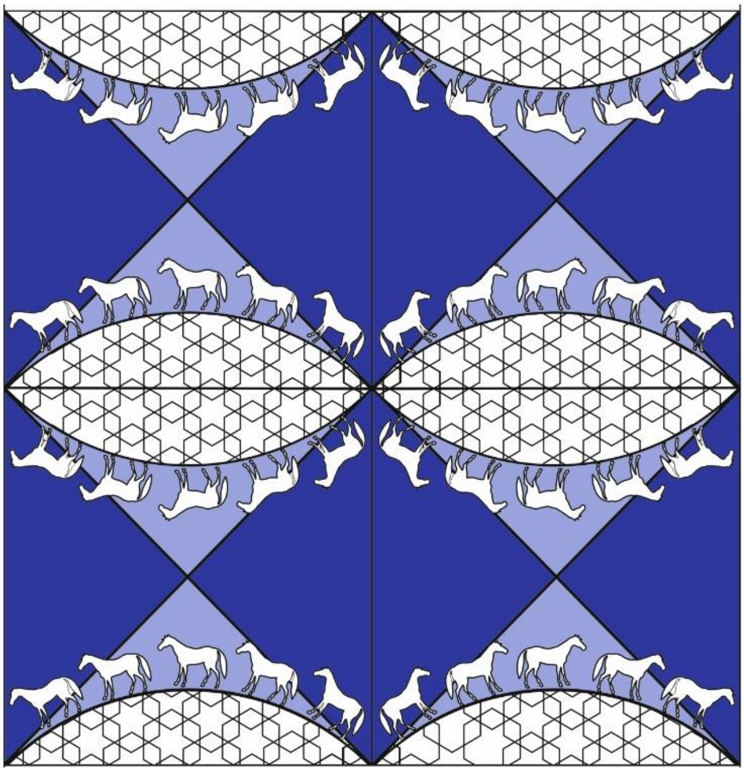

Figure 11. Array of the drawn and colored pattern design

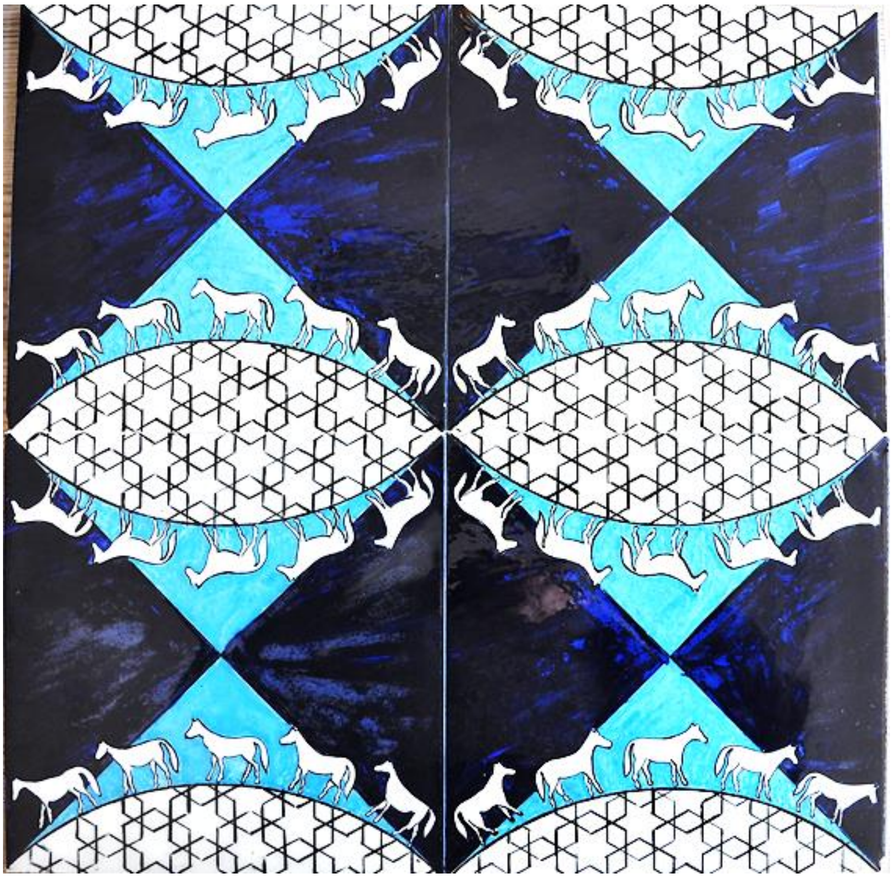

Figure 12. The finished form of the tiles, which have been prepared, is processed and baked with tile processing techniques

3.1.2. *Application 2*

A 20 cm*20 cm china tablet was chosen as the application site. Four tiles were assembled in a position adjacent to each other to form a square frame of 40cm. For the frame sequence, the calculations of the elements mentioned in F. 5 are made in before section. As a result of the calculation made above, R = 14.14 cm was obtained. The belt width (b) was chosen 4 cm to provide an aesthetic appearance in the considered square zone. Accordingly; R'= R + 4 = 18.14 cm. was obtained. As stated in before section, the center of the circular arc that will pass through the diagonal of the square of the square is marked and the circle arc is perforated.

At the center of the arc of the circle, the point of the compass was dipped, and the compass range was calculated by taking the calculated R'. And the circle was drawn between the vertical edges of the square perpendicular to the horizontal edge, parallel to the drawn circle arc. Similar operation was performed at the other square edge parallel to the square edge of the process. The generations that emerged in the square are fitted with a classic Turkish tile pattern (Figure 13).

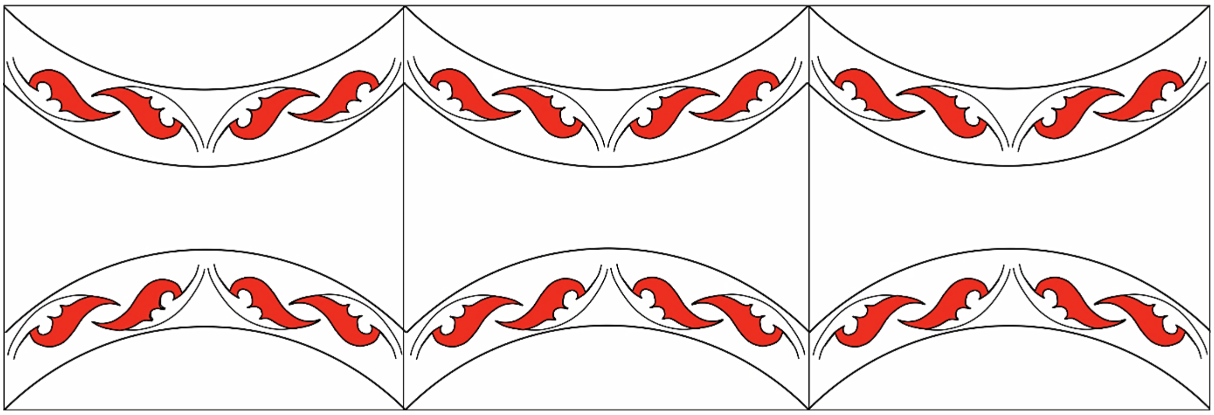

Figure 13 Tile border design made with a belt formed parallel to the circular springs between the diagonal of the squares

4. CONCLUSIONS AND RECOMMENDATIONS

- In a tile design, the application of the circular springs to be drawn in a square to the diagonal in the tangent position can be done by means of compasses, two miters and a ruler with mm sections.
- Circular springs can be drawn in the tangential position to the diagonal of the square of the desired size with the help of drawing supported sub-programs (such as Corel draw) by taking into account the required application elements.
- With the circular springs between the diagonals of the squares can be drawn very smooth and beautiful tile patterns.
- In the surfaces of the series of tiles in the diagonal of the circular springs by passing the multiple-tile tile or border pattern can be drawn.
- Among the diagonal of the squares, very modern patterns can be designed using circular springs and classical Turkish tile designs.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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