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APPARATUS FOR MAKING REFLECTOR SURFACES

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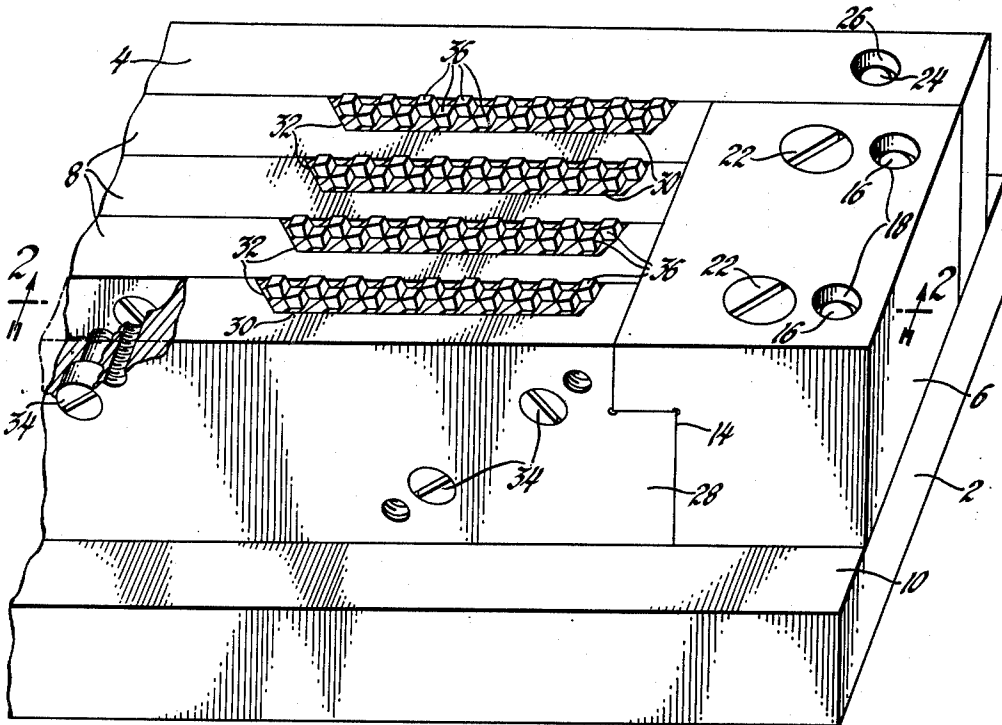


Fig. 1

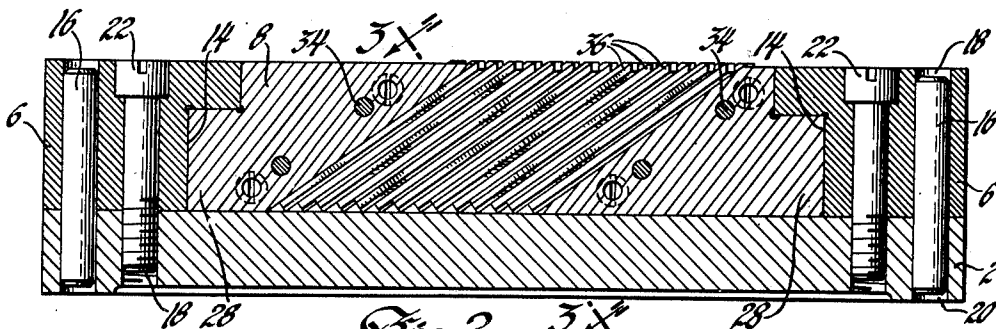


Fig. 2

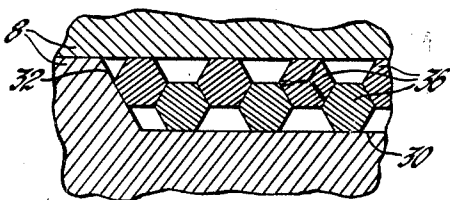


Fig. 3

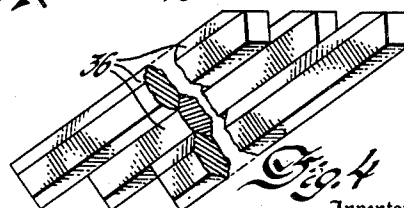


Fig. 4

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APPARATUS FOR MAKING REFLECTOR SURFACES

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1

The present invention relates generally to means for forming plane surfaces on elements and more particularly to a fixture adapted to receive a plurality of die forming elements for the simultaneous forming of plane surfaces on each of the elements by a grinding and lapping operation.

In the reflector art there are a number of geometric configurations which when incorporated in the surface of a glass blank form an efficient light reflecting surface. A configuration commonly employed in such surfaces is that of the cube corner comprising the three trihedral rhombic surfaces. With a multiplicity of cube corners impressed in the surface of a glass or plastic material so that the plane surfaces are at right angles to each other, a reflecting surface is formed which is extensively used in vehicle reflectors. Such a reflector is illustrated in Patent 2,086,356 granted to Falge et al., July 6, 1937.

In constructing the die matrix for the molding of multi-surfaced cube cornered glass and plastic reflectors it has been a common practice to form the die of a plurality of elements of hexagonal cross section, the molding ends of which have been shaped usually by grinding and a subsequent lapping operation to provide a plurality of contiguous plane surfaces each being in extremely accurate angular relationship not only with each other but with the locating faces of the elements as well. As a considerable number of elements are employed in the forming of the die matrix, it is desirable to employ means which are adapted to accurately shape the ends of a large number of elements simultaneously. Heretofore, this has been accomplished by providing a holding fixture for the elements in which a plurality of elements are grouped with a locating face of each of the peripheral elements in engagement with the fixture. A fixture providing such an arrangement of elements for grinding and lapping of the molding surfaces is not entirely satisfactory as errors in alignment of the elements centrally located in the group are apt to be introduced when the elements are rotated for the forming of a contiguous surface. Such errors may result from the adherence of particles of the surfacing materials to the locating faces of the elements even though extreme care is exercised in the cleaning of the fixture and elements between subsequent surfacing operation. Such errors also may be introduced by elements with improperly aligned locating faces. In the grouping or clustering of

2

elements for the surfacing operation such errors may become cumulative toward the center of the group resulting in the rejection of considerable numbers of the elements as unsatisfactory for the die matrix.

It is therefore an object of the present invention to provide improved means for supporting a plurality of die forming elements for accurately forming the molding surfaces thereon.

It is another object to provide an improved means for supporting a plurality of die forming elements for forming the molding surfaces thereon whereby at least one locating face of each element is in engagement with the supporting means.

These and other objects are attained in accordance with the present invention by providing a holding fixture having a plurality of spaced parallel pockets, each pocket being adapted to hold a plurality of die forming elements in a row with adjacent elements in staggered relationship and at least one of the locating faces of each element in engagement with the side walls of the fixture.

For a better understanding of my invention, reference may be had to the accompanying drawing in which:

Figure 1 is an enlarged fragmentary view in perspective of a holding fixture embodying the present invention. Figure 2 is a side view taken along the line 2-2 of Figure 1. Figure 3 is an enlarged fragmentary view taken along the line 3-3 of Figure 2 and Figure 4 is an enlarged view illustrating the angular position of the staggered elements in the holding fixture.

Referring now to the drawing and particularly to Figures 1 and 2 there is illustrated a fixture embodying the present invention which is adapted to hold a plurality of elements of hexagonal cross section to form equiangular trihedral surfaces thereon by a grinding and lapping operation.

The fixture comprises a supporting base 2 upon which there are detachably mounted a side positioning member 4, a pair of guide and clamping members 6 and a plurality of element spacing members 8. The supporting base 2 is in the form of a rectangular plate of considerable mass with parallel plane surfaces 10 and 12 which are preferably treated to resist wear. The guide and clamping members are in the form of generally rectangular solid blocks with one side undercut to form a right angle recess 14 extending lengthwise of the members. They are positioned on the base adjacent its ends with the undercut sides op-

3

positely disposed and are held in position by a pair of dowel pins 16 which cooperate with cylindrical recesses 18 and 20 respectively located adjacent the marginal edges of the guide members 6 and the supporting base 2. The guide members 6 are clamped in position on the supporting base by threaded screws 22. The positioning member is in the form of a rectangular bar and is disposed lengthwise of the support in abutting relationship with the end faces of the oppositely disposed guide members 6. The positioning member 4 is held in abutting relationship with the guide member 6 by dowel pins 24 which cooperate with cylindrical recesses 26 located adjacent the ends of the positioning member and corresponding recesses (not shown) located adjacent the lengthwise marginal edge of the supporting base 2. The element spacing members 8 are substantially similar to each other in form with side faces in parallel planes and with right angle extending sections 28 which are adapted to cooperate with the recess 14 in the guide members 6 to provide means for positioning and clamping the spacing members on the support base. Each of the spacing members 8 is provided with a groove diagonally disposed across the spacing member with its side wall 30 in a plane parallel to the planes of the side faces and its end walls 32 converging toward the side wall 30 at an angle of 60 degrees. Adjacent spacing members are connected together by threaded screws 34 to define a pocket between the adjacent members having the end walls 32, side wall 30 and the side face of the adjoining spacing member as boundaries. They are aligned on the supporting base 2 between the guide members 6 with the spacing member adjacent the positioning member 4 attached to it by a screw threaded member (not shown) similar to the threaded member 34. Each of the successively aligned spacing members is thereafter attached to its contiguous spacing member by the threaded screws 34.

With a fixture such as described a plurality of elements 36 may be disposed in spaced pockets across the fixture with at least one locating face of each element in engagement with a side wall of the rigidly mounted spacing members. To position the elements the positioning member 4 and guide members 6 are located on the supporting base 2 so that their cylindrical recesses coincide with the corresponding cylindrical recesses in the supporting base 2. The dowel pins 16 and 24 are then inserted in the coinciding recesses to prevent the positioning member 4 and guide members 6 from sliding on the surface 10 of the supporting base. A spacing member 8 is then placed between the guide members 6 with its groove adjoining the side face of the positioning member 4. A plurality of the hexagonal elements 36 are disposed in a row in the pocket formed by the positioning member 4 and the spacing member 8 with adjacent elements in staggered relationship and with their bottom ends in contact with the surface 10 and at least one locating face of each element in engagement with a side wall of the pocket. For positioning the hexagonal elements in the manner described the width of the grooves in the spacing elements 8 should be substantially one and one-half times the dimension between parallel faces of the hexagonal elements. The angle at which the recesses are diagonally disposed across the spacing members should be such as to position the elements with respect to the supporting base 2 to obtain contiguous plane surfaces which are at right angles to each other; this being considered

4

critical to the total reflection of light from a reflector formed of a multiplicity of trihedral surfaces.

With the elements 36 disposed in the pocket in this manner the spacing member 8 is clamped to the side positioning member 4 by threaded screws similar to 34 to apply clamping pressures to the elements in a plurality of directions. Successive rows of elements are positioned in the same manner with the successively aligned spacing members being clamped to each other instead of to the positioning member 4. With each spacing member 8 in position on the supporting base 2 the guide members 6 are clamped to the supporting base 2 by the threaded screws 22 to rigidly hold the spacing members 8 and elements 36 in position on the supporting base.

With the elements rigidly clamped in the fixture the exposed ends are subjected to a rough grinding operation and thereafter to a lapping operation including successively finer abrasives to form a highly polished plane surface. After forming the first surface the clamping screws are removed and the fixture is disassembled and thoroughly cleaned. It is then reassembled with the elements rotated in the pockets 120 degrees for the forming of a contiguous surface. With elements of hexagonal cross-section the surfacing operation is repeated three times to form a cube corner comprising three trihedral rhombic surfaces.

The particular advantage of a holding fixture embodying the present invention is the manner in which the hexagonal elements are arranged to provide an engaging contact between the element and the fixture for at least one locating face of the hexagonal element. With this manner of arrangement the pins have a rigid and fixed guide surface which substantially eliminates any misalignment of the pins and the subsequent forming of molding surfaces which do not have a proper angular relationship with the longitudinal axis of the pins and with each other.

While the embodiment of the present invention as herein disclosed constitutes a preferred form it is to be understood that other forms might be adopted all coming within the scope of the claims which follow.

What we claim as new and desire to obtain by Letters Patent of the United States is:

1. An apparatus for simultaneously forming plane surfaces on the ends of a plurality of elements of hexagonal cross section adapted to be assembled in mutual engagement to present a multi-surfaced die matrix comprising a supporting plate having opposite parallel plane supporting surfaces, a pair of oppositely disposed guiding and clamping members detachably mounted on one of said surfaces, said guiding members having one face undercut to provide in cooperation with said supporting plate guiding and clamping recesses, a positioning member detachably mounted on said supporting member with its end portions in abutting relationship with the ends of said guiding members and a plurality of spacing members connectible to each other and as a connected unit of spacers to said positioning member between said guiding members, said spacing members having reduced end portions extending into said guiding and clamping recesses and a recess in one side having a side wall parallel with the side of said spacer and converging end walls inclined to the supporting surface of said supporting plate to provide a plurality of inclined pockets between adjacent spacing

5

members for clamping a plurality of said elements in a staggered row with each element having at least one locating face in engagement with a spacer wall and a locating face of an adjacent element.

2. An apparatus for holding a plurality of elements adapted to be assembled in mutual engagement to present a multi-surfaced die matrix, said apparatus comprising a plurality of connectable members, having oppositely disposed flat side walls, one of said members having an inclined recess in one of said oppositely disposed side walls cooperable with a flat side wall of an adjacent connectable member to provide an inclined pocket for clamping a plurality of said elements in a staggered row and means for securing said members together to clamp said elements in said pocket.

3. An apparatus for holding a plurality of elements adapted to be assembled in mutual engagement to present a multi-surfaced die matrix, said apparatus comprising a plurality of connectable members with opposite parallel walls, one of said members having a recess in one wall thereof cooperable with the wall of an adjacent member to provide a pocket for clamping a plurality of said elements in a staggered row, said recess having one wall parallel with said parallel walls and converging end walls disposed at an inclination across said member and means for connecting said adjacent members to apply clamping pressure in a plurality of directions to the elements in said row.

4. An apparatus for holding a plurality of elements adapted to be assembled in mutual engagement to present a multi-surfaced die matrix, said apparatus comprising a plurality of connectable members, said members being provided with a recess in one side having a side wall parallel with the side of said members and converging end walls disposed at an inclination across said members to provide a plurality of inclined pockets between adjacent members for clamping a plurality of said elements in a staggered row and means for securing adjacent members to apply clamping pressure in a plurality of directions to the elements in said row.

5. An apparatus for holding a plurality of elements adapted to be assembled in mutual engagement to present a multi-surfaced die matrix, said apparatus comprising a pair of connectable members with opposite parallel walls, one of said members being provided with an inclined recess having one wall parallel with said parallel walls and in one wall thereof, said recess being cooperable with a wall of the other of said members to form an inclined pocket for clamping a plurality of said elements in a staggered row and means for securing said members to clamp said elements in said pocket.

6. An apparatus for holding a plurality of elements adapted to be assembled in mutual engagement to present a multi-surfaced die matrix, said apparatus comprising a support, a positioning member detachably mounted on said support, a plurality of element clamping members mounted on said support and connectable to each other and as a unit of clamping members to said positioning member, each of said clamping members having a recess in one side provided with a side wall parallel with the side of said clamping members and converging end walls inclined to said support to provide a plurality of inclined pockets between adjacent connectable clamping and positioning members for clamping a plurality

6

of said elements in a plurality of staggered rows and means for securing said connectable members to clamp said units in said pockets.

7. An apparatus for holding a plurality of elements adapted to be assembled in mutual engagement to present a multi-surfaced die matrix, said apparatus comprising a support, a pair of oppositely disposed guiding and clamping members detachably mounted on said support, a plurality of connectable spacing members disposed on said support between said guiding and clamping members, said spacing members having one flat wall and an oppositely disposed wall having an inclined recess therein cooperable with the flat wall of an adjacent spacing member to provide pockets inclined to said support for clamping a plurality of said elements in a staggered row and means on said guiding and clamping members for clamping said spacing members on said support.

8. An apparatus for holding a plurality of elements adapted to be assembled in mutual engagement to present a multi-surfaced die matrix, said apparatus comprising a support, a pair of oppositely disposed guiding and clamping members detachably mounted on said support, a plurality of connectable spacing members disposed on said support between said guiding and clamping members, said spacing members being provided with a recess in one side having a side wall parallel with the side of said spacing members and end walls converging toward said side wall at an angle of 60° and inclined to said support to provide a plurality of inclined pockets between adjacent spacing members for clamping a plurality of said elements in a plurality of staggered rows.

9. An apparatus for holding a plurality of elements adapted to be assembled in mutual engagement to present a multi-surfaced die matrix, said apparatus comprising a support, a pair of oppositely disposed guiding and clamping members detachably mounted on said support, a positioning member detachably mounted on said support to engage said guiding and clamping members, a plurality of spacing members connectable to each other and as a unit to said positioning member between said guiding and clamping members, each of said spacing members being provided with an inclined flat sided recess in one wall to form pockets between adjacent spacing members inclined to said support for clamping a plurality of said elements in a staggered row, and means on said guiding and clamping members for clamping said spacing members to said support.

10. An apparatus for holding a plurality of elements adapted to be assembled in mutual engagement to present a multi-surfaced die matrix, said apparatus comprising a support, a pair of oppositely disposed guiding and clamping members detachably mounted on said support, a positioning member detachably mounted on said support to engage said guiding and clamping members, a plurality of spacing members connectable to each other and as a unit to said positioning member between said guiding and clamping members, said spacing members being provided with a recess in one side having a side wall parallel with the side of said spacer and end walls converging toward said side wall at an angle of 60° and inclined to the supporting surface of said support to provide a plurality of inclined pockets between adjacent spacing members for clamping a plurality of said elements in a stag-

gered row and means on said guiding and clamping members for clamping said spacing members to said support.

11. An apparatus for holding a plurality of elements of hexagonal cross section adapted to be assembled in mutual engagement to present a multi-surfaced die matrix comprising a supporting plate having opposite parallel plane supporting surfaces, a pair of oppositely disposed guiding and clamping members detachably mounted on one of said surfaces, a positioning member detachably mounted on said supporting member with its end portions in abutting relationship with said guiding members, and a plurality of spacing members connectable to each other and as a connected unit of spacers to said positioning member between said guiding members, each of said spacing members having an inclined recess in one side thereof having a side wall parallel with the side wall of said spacer and converging end walls to provide a plurality of inclined pockets between adjacent spacing

members for clamping a plurality of said elements in a staggered row with each element having at least one locating face in engagement with a spacer wall.

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