April 16, 1940. A. LODGE 2,196,998

METHOD OF MAKING WATCH DIALS

Original Filed May 15, 1935

Fig. 1.

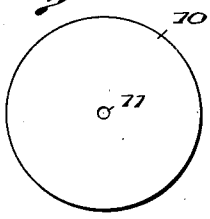


Fig. 1a.

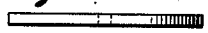


Fig. 2.

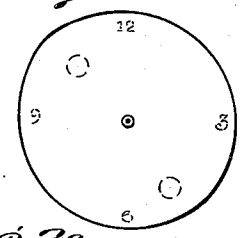


Fig. 2a.

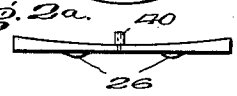


Fig. 3.

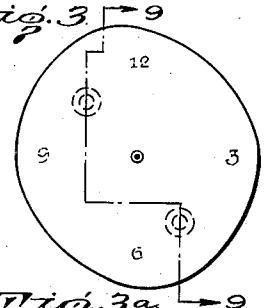


Fig. 3a.

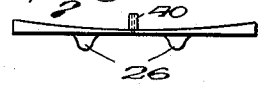


Fig. 4.

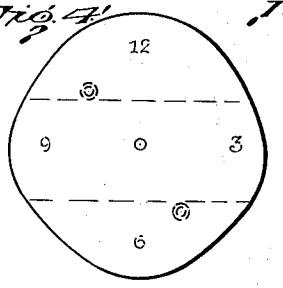


Fig. 4a.



Fig. 5.

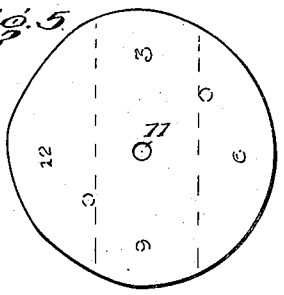


Fig. 5a.

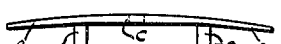


Fig. 6.

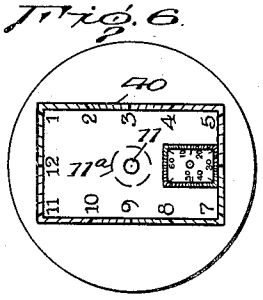


Fig. 6a.

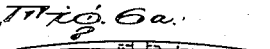


Fig. 7.

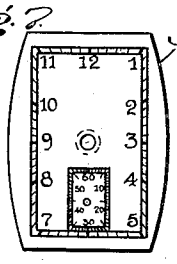


Fig. 8.

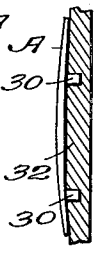


Fig. 8a.

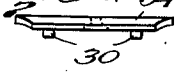


Fig. 12.

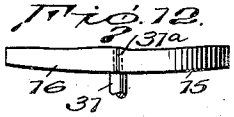


Fig. 9.

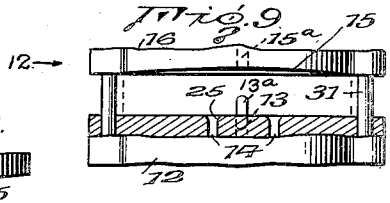


Fig. 13.

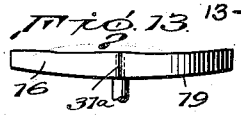


Fig. 10.

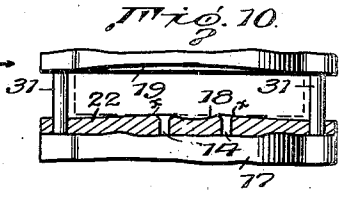


Fig. 11.

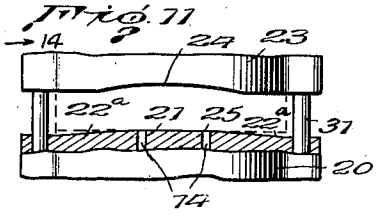
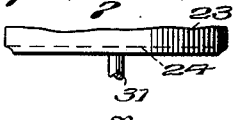


Fig. 14.



Inventor

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By

Attorney

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UNITED STATES PATENT OFFICE

2,196,998

METHOD OF MAKING WATCH DIALS

Alvin Lodge, Lancaster, Pa., assignor to Hamilton Watch Company, Lancaster, Pa., a corporation of Pennsylvania

Original application May 15, 1935, Serial No. 21,622. Divided and this application August 4, 1936, Serial No. 94,295

12 Claims. (Cl. 29—177)

The present invention relates to a method of cold working a blank or strip of metal so as to produce integral projections therefrom while, at the same time, providing a smooth unblemished surface on the opposite side of the strip or blank within the area from which said projections extend.

Heretofore projections or pin-like members have been extruded from the stock of metal blanks or strips such as by the method disclosed in the patent to Jeremiah McGrevey, No. 1,632,305, granted June 14, 1927, and assigned to the assignee of the present application, where is taught a process for putting so-called "feet" on watch dial numerals which are receivable in openings of very small diameter, disposed around the marginal or peripheral edge of the watch dial face. These projections of watch dials numerals are of less diameter than the thickness of the material from which they are extruded and, therefore, no blemishes appear on the outer face of the article formed and in the case of watch numerals whatever blemish, if any, that exists is so infinitesimal that it is not apparent to the naked eye.

An entirely different condition exists, however, when it is desired to extrude integral projections from a blank or strip of larger area, or where it is desirable and necessary to extrude projections from a portion of a blank or a strip which projections are to have a diameter, in the finished product, not less than the thickness of the area of the blank or strip from which they are extruded, because this results, among other disadvantages, in a blemished opposite surface of the blank or strip.

The present method, therefore, is essentially that of subjecting the metal blank or strip to pressure in such a manner as to cause it to flow transversely across the edge of an opening into which it is desired to have certain of the metal extend which forms the projections, this flowing of the metal resulting in projections being formed on one face of the blank while maintaining an unblemished homogenous surface on the opposite face of the blank and opposite the projections. The flowing or shifting of the metal may be accomplished in successive steps to produce projections of greater length or magnitude if desired.

The invention is of general application, but is herein shown and described particularly with respect to the manufacture of watch dials to which it is particularly applicable.

Watch dials are attached to a pillar plate by several spaced apart feet inserted in holes for the respective feet in the pillar plate and therein secured. It has always been in the practice, until the production of my invention about to be set forth, to provide separate feet or pins and attach them to the metal backing plate of the dial, usually by soldering the feet at one end in holes provided in that metal plate for the purpose. In itself, although so long persisted in, the procedure just described is subject to certain disadvantages: (1) the inability to obtain accurate alignment of the feet, (2) when the feet are applied to dials which are to be covered with a thin layer of enamel or other plating, the solder becomes dislodged and the feet become loose or lost; (3) when the dial is covered or plated with a suitable dial facing material, the heat of the solder frequently mars the dial face; (4) in curved dials the recesses or holes, provided for their positioning by drilling, frequently come through the opposite face of the dial due to the fact that these recesses must be drilled at a sloping angle with respect to the surface of the dial. Modern watches, furthermore have created problems of construction or manufacture which not only seriously increase the disadvantage of the just described hitherto followed practice but in some special cases make impossible such procedure. This is notably true in the so-called wrist or strap watches so universally worn.

The principal object of my invention has been the solution of the problems, thus created, in a way that will be wholly satisfactory from the standpoints of manufacture and the watch product itself. A particular object of my invention is to solve such problems in connection with the strap or wrist watch, especially with such a watch having a concave curvature on the side thereof next to the wrist of the wearer. In solving the problems, I have provided a method by which a metal plate or strip is formed with integral projections thereon of a diameter or thickness not less than the thickness of the area of the plate from which they extend, so that the plate and projection are an integral unit, the projections being composed of metal extruded from the plate and being of accurate dimensions and accurately positioned irrespective of the contour or shape of the plate in its final finished form for use, while at the same time the opposite surface of the plate is smooth, homogenous and unblemished at the areas thereof from which the projections are extruded.

The watch dial shown and described herein is not claimed in this application as it forms the subject matter of my application Serial No.

21,622, filed May 15, 1935, issuing into Patent Number 2,103,263 of which this application is a division. The above mentioned application is assigned to the assignee of my present application.

My invention consists in whatever is described by or is included within the terms or scope of the appended claims.

Inasmuch as my invention has been developed, as I have explained, in connection with the curved type of wrist or strap watch, it will facilitate illustration and description of my invention in its broad aspect as well as that particular application of it, to show in the drawing, illustrations of a watch dial of that description and the method or procedure in producing such a dial.

In the accompanying drawing:

Figs. 1 to 7 are, respectively, illustrations in plan view of the changing form from blank to completed dial; and

Figs. 1*a* to 6*a* are, respectively edge views thereof;

Fig. 8 is an edge view of the dial applied to the pillar plate shown in section;

Fig. 8*a* is an end view of such dial;

Figs. 9 to 11 are, respectively, views of upper and lower dies employed in producing the changes in the blank as shown in Figs. 2 to 5, portions of the lower die being in staggered section approximately along the 12 and 6 o'clock axis as shown by section line 9—9, Fig. 3 and through the holes into which the feet are extruded. The dies for performing the operations illustrated in Figs. 2 and 3 are substantially those shown in Fig. 9 and the blanks shown in Figs. 2, 2*a*, 3, 3*a*, 4 and 4*a*, are illustrated in the drawing in a position of about 90 degrees from that which they assume in the dies of Figs. 9 and 10, as shown in the drawing.

Figs. 12, 13 and 14 are, respectively, views of the upper dies shown in Figs. 9 to 11, seen from a point at right angles to such other figures, viewed from the direction indicated by the arrows in Figs. 9, 10 and 11.

Inasmuch as the embodiment of my invention, selected for illustration and description, is the dial for a curved wrist watch, a brief preliminary description appears desirable. The dial A, shown in Figs. 7, 8 and 8*a* of the drawing, is of an oblong form with the greater dimension or length in the line of the opposite dial numerals 6, 12, and the curvature being in that direction. Several of these dial positions or numerals are indicated on the blanks in Figs. 2, 3, 4, and 5 for the sake of clarity. The dial show is solid sterling silver or plated with silver, and the numerals are engraved or impressed in the outer surface of the plate. The curvature of the outer surface is convexly cylindrically curved from end to end, and the under surface, or the one next to the pillar plate, is concavely dished in the same direction, the plate being thinned down towards each end with the central or intermediate portion substantially thickened and the central or intermediate portion is flattened so that it will lie flat against the adjacent flat upper surface of the pillar plate (see Figs. 5*a*, 6*a* and 8). The integral feet are situated respectively near the ends, or 6 and 12 o'clock edges, and are located of necessity at or near the thinned edges of the plate for obtaining the greatest possible accuracy in the pisitioning of the dial. The location of the projections or feet of watch dials must be such as to insure accuracy in disposition on the watch movement, which in turn insures accuracy of time, and to avoid interference with other parts of the watch. Thus in the curved dial, shown in the drawing, the projections or feet are located at portions of the dial which, due to its shaping, are too thin for the attachment of separate feet or pins by soldering their ends in recesses drilled into one face of the dial.

The curvature of a dial for watches as well as other small instruments, is desirable for the sake of appearance and also for the practical reason of providing clearance for adjacent parts of the instrument.

Heretofore there were two methods commonly employed to provide such dials. One method was to bend or curve or shape the dial by the hands or by tools or dies so that the opposite sides or surfaces were curved, the thickness of the dial throughout remained approximately the same. The other method involved the addition or removal of material from either the face or the back of the dial to produce the necessary shape. By both of these procedures the thickness of the dial varies and feet may be applied either before or after either operation, but this results in inaccurate disposition of the feet due to displacement after bending, if applied prior thereto, but if applied after forming, the feet must be attached to sloping surfaces which cause the feet to extend at improper angles for reception in the openings provided therefor in the pillar plate of the watch; or, if the usual recess for attaching the feet is drilled in the thin dial to facilitate attachment of the feet to align with the pillar plate openings, the recess will be at such an angle with respect to the sloping surfaces of the dial that a portion of it will come through the opposite side of the plate, thus marring it and rendering attachment difficult.

In positioning the dial on the pillar plate, it is essential to the accuracy of the time keeping properties of the watch that the feet shall be parallel and so located as to fit nicely in the openings of the pillar plate so that set screws may be screwed into the feet or some other means provided for securing the dial to the pillar plate. Accordingly accuracy of alignment and positioning of the feet on the dial plate are essential. This accuracy is attainable by my method which forms the dial and the feet thereon simultaneously, or as parts of one continuous operation, with the feet or projections in proper position thereon, but is not possible by such methods as I have described involving bending or machining or by separate feet or pins soldered or otherwise attached to the dial plate.

The blank 10 to be transformed into the dial is a thin disc of metal of uniform thickness, either solid metal or with a thin plating, such as silver or the like, having a central hole 11. The dies, shown in Figs. 9 to 14, may be employed to fashion the blanks. Accordingly, the dies are conveniently made in the form of cylindrical blocks, each die being mounted on a suitable holder not necessary to show or describe.

The blank 10, in Fig. 1, is first subjected to operation of the dies 12 and 16 in Fig. 9, where it will be seen that the lower die 12 has a flat or plane upper face and extending downward therefrom is a central hole 13 and two feet forming holes 14, shown 180° apart in the particular case illustrated, for the flow of metal from the blank for the formation of the feet, while the lower and cooperating face 15 of the upper die 16 is cylindrically convexly curved. The action

of these dies on the blank gives the blank the form shown in Figs. 2 and 2*a*.

The first operation reduces the thickness of the blank through the center forcing the metal out to the sides of the blank, thus leaving the side marginal portions thicker than the center portion. As the metal is flowed or shifted from the center toward the sides, the flow forces the metal down into the openings **14** for providing the rudimentary projections **26** from which the feet **30** (Figs. 8 and 8*a*) are eventually formed.

The development of the blank, as shown in Figs. 3 and 3*a*, is produced by subjecting the blank, shown in Figs. 2 and 2*a*, to a further operation of dies similar in all respects to those in Fig. 9, except that the cooperating surface of the upper dies has a curvature on a greater radius in order to further force the metal toward the sides of the blank to additionally thin it in the center and to add metal to the rudimentary projections **26**, the openings **14** being enlarged for this purpose.

In Figure 10, lower die **17**, for producing the development of the blank, shown in Figs. 4 and 4*a*, has its upper operating face with a concavely cylindrical depression **18**, at the central portion thereof, the theoretical axis of the curvature being in the direction substantially at right angles to the axis of the curvature of the dies shown in Fig. 9, (and, in respect to the dial shown, in the direction of the 3 to 9 o'clock edges of the dial). Such curvature **18** may, but not necessarily, terminate at each side in line with one of the foot-forming holes **14** and, from that point outward to the periphery of the die **17**, the surface **22** inclines downward at a slight angle while the working face of the upper die has a cylindrically convex face **19** (similar to die **16**, Fig. 9), extending to the periphery of the face. The depression **18** is for the purpose of causing metal to flow toward the center of the blank from portions lying opposite the humps or raised portions *x* (provided on the die **17** by the depression **18** and surface **22**). This operation causes the metal to shift or flow and replaces certain of the metal squeezed in the preceding operations from the center of the blank to the side thereof.

To produce the development shown in Fig. 5, the dies in Fig. 11 are employed which may be such as are suitable for the shaping desired. For the dial herein disclosed, the lower die **20** has a central flat surface **21**, instead of the concave surface shown in Fig. 10, and the angle of the adjacent downwardly inclined surfaces **22***a* is somewhat greater than the surface **22** in Fig. 10; and the upper die **23**, shown in Figs. 11 and 14, has on its lower working face a cylindrically concavely curved depression **24**. The width of the depression **24**, extending from left to right in Fig. 11, corresponds to the length of the finished dial (from 12 to 6 o'clock members) while the axis of the depression, extending from left to right in Fig. 14 (taken at right angles to the view in Fig. 11), runs along the **3** to **9** numerals on the dial.

It will be observed that the holes **14** into which the metal flows, or is extruded during the swaging operations, have each at the entrance an enlargement with convexly rounded surfaces **25** which produces the fillet **26***a* at the junction of the foot **26** with the dial plate and that the radius of curvature of that convex surface is gradually diminished in the successive operation produced by the lower dies **12**, **17** and **20**, and that diminution of radius is carried to the next die (not shown in the drawing) for producing the track **40** and which backs up the dial when the next to the last operation is performed of impressing the track and numerals of the finished dial in the dial face. In the track impressing operation the diminution of radius causes additional pressure to be applied above the feet-forming holes to compensate for any possible inaccuracy in the dies.

At the same time the track and numerals are impressed upon the face of the dial, a circular depression **11***a* may be impressed into the underneath side of the dial for a purpose to be next described. The result of the dial impressing operation is the development shown in Figs. 6 and 6*a*, and in that stage, it is of circular or disc form with the perfectly formed and parallel integral feet **30**, and with a circular central depression **11***a* concentric with the central hole **11**, and with the thickened central portion *c* having tapering margins at the 6 and 12 o'clock edges *e* of the finished dial. The central hole **11** in the finished dial receives the hand arbors (not shown) which pass through the same, while the depression **11***a* in the underneath surfaces of the dial accommodates the usual collars on these arbors. The last operation is the trimming off of the marginal portions of the disc shown in Fig. 6, so that the final product is that shown in Fig. 7,—a dial of oblong form with the longer side edges slightly curved outward.

The central hole **11**, may or may not be provided in the blank **10**. The purpose of the hole is two fold; it may be used to center the blank, and also to reduce the pressure by permitting inward flow of the metal toward the center of the blank as pointed out below. Means other than a hole may be provided for centering the blank. When so provided it enables flow of the metal towards the center, where it is most desirable to remove metal and thereby reduces the pressure which tends to distort the dies that are used further along in the process after that effect from the provison of the hole takes place. The first die operation substantially closes the hole **11** and actually forms a burr or cylindrical projection **40** on the upper side of the dial blank as shown in Fig. 2*a* and also forces some of the metal which originally surrounded the hole into the die holes **14** provided also for allowing the metal to flow away. The burr is formed by the flow of the metal of the blank toward the center thereof and into the clearance space provided between the guide pin **13***a* and the opening **15***a* in the upper die **15** in Fig. 9. Subsequently, the burr is removed and hole **11** reopened as will be explained hereinafter. Every effort is made in the early stages of the process to remove metal from the center of the blank to avoid the building up of such a high pressure at that point in the later operations where distortion of dies due to uneven pressure is objectionable. When rudimentary feet are formed, the blank is centered by these feet and the centering pin is no longer necessary in the subsequent steps. After the central hole has been substantially closed by the pressure of the first dies, it is reopened to the desired diameter by drilling to remove the stock squeezed to the center. In Figs. 4 and 5, the center opening, after the swaging step, is shown as circular. However, in these steps the center opening, before being drilled, is not a true circle because the metal may flow slightly differently from one direction than from the others. Such

central hole is finally reopened by a die or drill to accommodate the hands-carrying arbors, such reopening being at the same time the blank as shown in Figs. 6 and 6*a*, is trimmed to provide the dial shown in Fig. 7.

The die face formations, shown in Figs. 9 and 10, were the result of problems that arose in the use of other formations, before those forms were produced, which resulted in deformations of the blank found to be chargeable to the elasticity of the metal from which the dies were made and which resulted in a higher pressure at certain points and with no direction for the metal under pressure to flow that would prevent that action on the dies, resulting in the dial being thicker at the central portion than at the 9 and 3 o'clock edges. By the preliminary operations which the dies, shown in Figs. 9 and 10, perform, the metal in the intermediate stages is flowed and shifted to positions where the pressure exerted in the final swaging operation will be almost equal over the surface of the dial and any distortion of the dies which may occur will be even and without any objectionable result because the contour of the finished dial, even though the entire surface may be depressed slightly, will nevertheless be satisfactory.

The radius of the convex face of the upper die shown in Figs. 9 and 12 is less than that of the upper die shown in Figs. 10 and 13, the curvature of greater radius tending to flow the metal to the side a little further than the curvature of less radius.

A pin 31 engaging aligning holes in the upper and lower dies situated at the 6 o'clock end of the dies secures and maintains the alinement of the dies during operation. The aligning holes in the upper die are slotted to the periphery of the same as shown at 31*a* in Figs. 12 and 13 in order to afford the aligning pin 31 a snug, slightly expanding fit.

The gradual evolution or development of the feet is shown beginning with the rudimentary form 26 shown in Figs. 2*a* through Fig. 8, the perfected form of foot appearing as 30 in Figs. 7 and 8.

It is very important that at least the central portion of the dial be not spaced on its underside from the pillar plate 32, (see Fig. 8) and should lie snugly thereagainst because of the danger of cracking or otherwise injuring the dial by pressure thereon from the hand removing tools when the hands are to be removed, such tool being thrust between the face of the dial and the hands at the center arbor.

The shape of the dies which are employed may vary to suit the part or parts which are to be made by the process of this invention, although for purposes of example there has been herein shown and described dies particularly useful for producing curved watch dials. The essential principle of the invention, intended to be broadly covered hereby, is that of flowing metal of a blank or strip transversely by pressure across the edge of an opening into which it is desired for the metal to flow in order to obtain a projection on one face of the blank while maintaining an unblemished, homogenous surface on the opposite face of the blank and opposite the projection. This may be accomplished by shifting or flowing portions of the metal from one part of the blank to another. If relatively small projections are desired, one shifting operation or step may suffice, but for projections of greater length and magnitude, successive steps of shifting or flowing metal should be resorted to. The successive steps of forming the rudimentary projections 26 to the final finished feet 30 of desired diameter and length depend upon the size and shape, of course, of the openings or projection forming matrix 14 and the pressure applied by the dies. The openings 14 in the dies extend through the thickness thereof, and at no time does the metal, which subsequently forms the feet, completely fill the openings.

Having thus described the invention and manner in which the same is to be performed, it is to be understood that the invention is not to be limited to the exact details of the description and disclosure in the drawing herewith, because the same may be modified and varied in numerous ways within the scope of the present invention, and it is desired that the invention is not to be limited beyond the scope of the appended claims.

What I claim is:

1. The method of making a curved watch dial which comprises the following steps, forming rudimentary feet on the back of the blank and simultaneously thinning the blank at its central portion, working the rudimentary feet and simultaneously thinning the blank at its 6 and 12 o'clock portions by effecting a flow of metal from these portions toward the central portion, further working the feet into the desired shape and simultaneously giving the front of the blank a convexly curved shape, impressing the track and numerals on the convexly curved front of the blank, and then trimming the blank into the desired shape.

2. The method of making a curved watch dial which comprises the following steps, forming rudimentary feet on the back of the blank and simultaneously thinning the blank at its central portion, working the rudimentary feet and simultaneously thinning the blank at its 6 and 12 o'clock portions by effecting a flow of metal from these portions toward the central portion, and further working the feet into the desired shape and simultaneously giving the front of the blank a convexly curved shape.

3. The method of producing a projection on a metal blank or strip which method includes subjecting a metal blank to a forming pressure and thereby extruding stock from the blank into a projection forming matrix and simultaneously shifting a portion of the stock transversely completely across the entrance to the projection forming matrix from one portion of the blank to another, for forming a projection on the blank.

4. The method of producing a projection on a metal blank or strip which method includes subjecting a metal blank to a forming pressure and thereby extruding stock from the blank into a projection forming matrix and simultaneously shifting some of the stock transversely completely across the entrance to the projection forming matrix from one portion of the blank to another, for forming a rudimentary projection on the blank, and subsequently working the rudimentary projection into the desired shape.

5. The method of producing a projection on a metal blank or strip which includes the steps of subjecting a metal blank to pressure thereby extruding stock from the blank into a projection forming matrix and simultaneously shifting stock transversely completely across the entrance to the projection forming matrix from one portion of the blank to another, for forming a rudimentary projection from the stock of a metal

blank, and subsequently subjecting the blank to a second pressing operation for completing the shape of the rudimentary projection.

6. A method of making curved watch dials that includes the acts of taking a metal plate blank and subjecting it on opposite sides to pressure surfaces thereby shaping the blank with a thickness that diminishes from the central portion to the opposite edges thereof, forming said blank into a convexo-concavo configuration, and extruding attaching feet therefrom.

7. A step in the method of making a watch dial, as set forth in claim 6, wherein the blank is subjected to a forming pressure thereby shifting the stock from the 6 and 12 o'clock areas toward the center, three, and nine axis, and also flowing metal into feet forming matrices.

8. In a method of producing a projection on a metal blank or strip which method includes the application of a series of forming pressures, centering a metal blank and subjecting it to an initial forming pressure thereby shifting some of the stock of the blank transversely completely across an opening in a projection forming matrix and simultaneously extruding a projection on the blank, then centering the blank by means of the projection thus formed and further working the blank by a second forming pressure.

9. The method of producing a projection on a thin dial by several pressure steps which method comprise applying one pressure step thereto thereby shifting metal from one portion to another to form comparatively thick and thin areas in said dial, applying a second pressure step to said dial near the thickened areas and shifting some of said stock in the thickened area completely across a projection forming matrix and also extruding certain of said metal into said matrix.

10. A method of forming a projection on a thin dial as set forth in claim 9 wherein the metal is further worked thereby extruding a sufficient quantity of metal to produce a substantial projection.

11. The method of forming projections on a thin blank which method comprises shifting a portion of the stock of the blank transversely completely across a projection forming matrix and simultaneously so extruding another portion of said stock from the one side of the blank into the projection forming matrix as to leave the other side of the blank smooth and free of indentations thereof.

12. The method of making a curved watch dial which comprises the following steps: shifting the metal from one area to another to form thick and thin portions, further shifting the metal from the comparatively thick portion of the dial to the thin portion and simultaneously forming rudimentary feet, and further shifting the metal in the dial to give the dial its completed shape and simultaneously completing the shaping of the feet.

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