

July 29, 1941.

A. LODGE

2,250,542

MACHINE AND METHOD FOR FORMING PROJECTIONS ON METAL STOCK

Filed Sept. 23, 1937

2 Sheets-Sheet 1

FIG. 1.

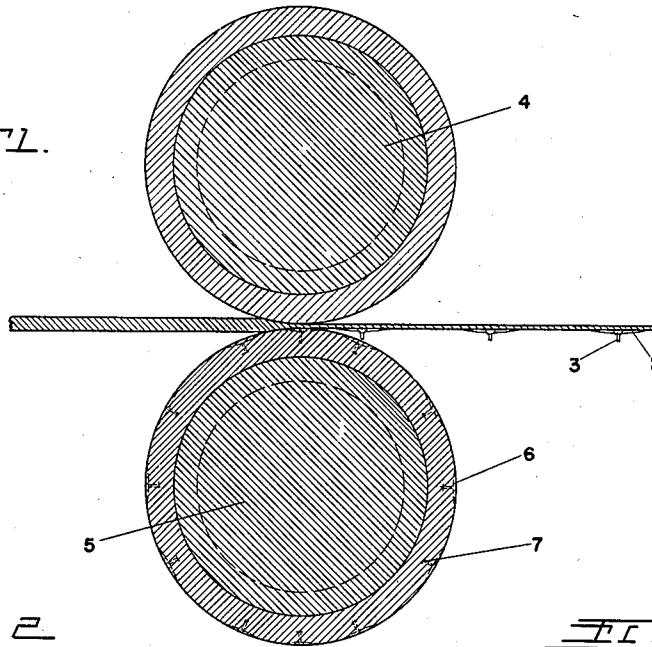


FIG. 2.

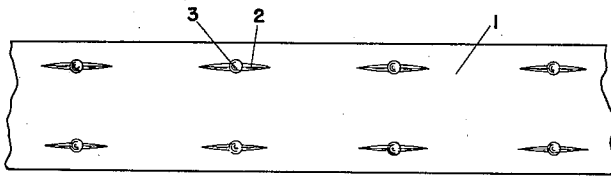


FIG. 4.

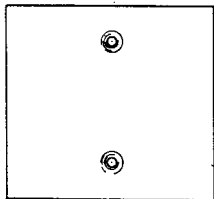
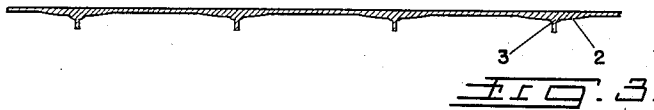
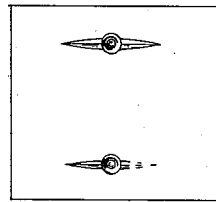


FIG. 5.

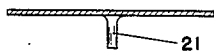


FIG. 6.

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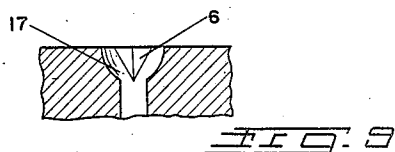
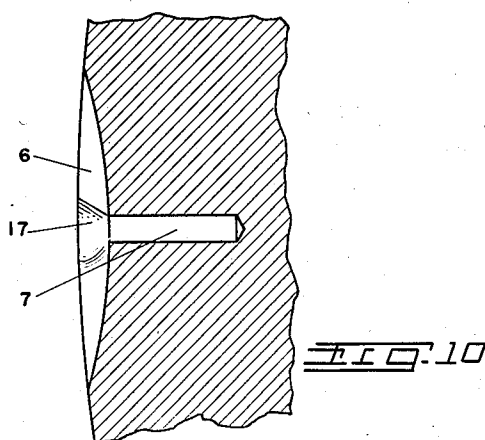
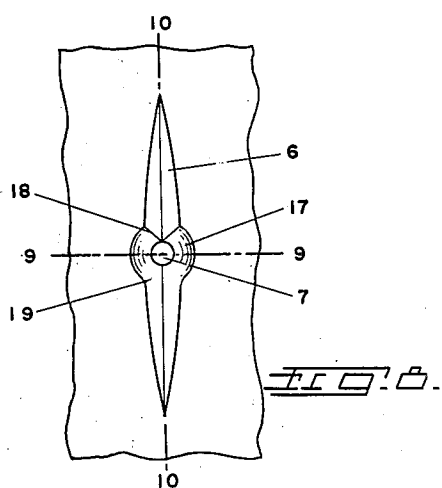
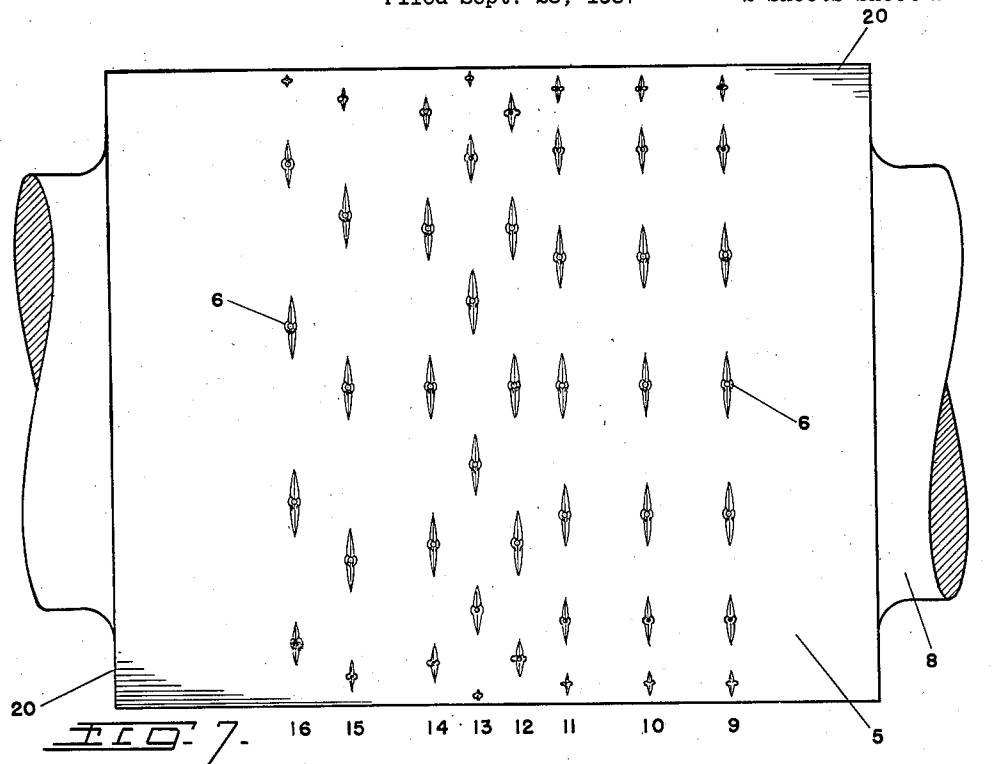
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2,250,542

MACHINE AND METHOD FOR FORMING PROJECTIONS ON METAL STOCK

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

2,250,542

MACHINE AND METHOD FOR FORMING  
PROJECTIONS ON METAL STOCKAlvin Lodge, Lancaster, Pa., assignor to Hamilton  
Watch Company, Lancaster, Pa.

Application September 23, 1937, Serial No. 165,330

6 Claims. (Cl. 29—1)

This invention is directed to a machine for a method of making projections on metal stock. Specifically the invention is directed to a machine for rolling and method of forming feet on metal stock used in making watch dials.

The prior methods of producing feet consisted of soldering individual feet to the dial, or of subjecting the metal blank to a multiplicity of swaging operations with an annealing process between each swaging operation. The series of swaging operations were necessary in order to produce feet long enough and of a diameter thick enough so that holding screws might be inserted into the feet and hold the blank to the base, or specifically to hold a watch dial to the pillar plate which houses the operating watch mechanism.

These swaging operations are long and tedious as each blank must be individually placed beneath the die. Rudimentary feet are formed by the first operations, and the final finished shape by the subsequent operations. After each die operation the blanks must be annealed to restore ductility to the metal and relieve the stress and strain existing between the molecules of the blank by reason of the previous die operations. Four or five separate swaging and annealing operations are necessary before the blank can have sufficient metal flowed into the matrix of the die to form feet large enough so that the dial may be firmly held against the pillar plate of the watch.

Further, the thinness of the stock which can be worked by these swaging operations and flowed back and forth across, and consequently into, the matrices is limited because if the stock or blank is exceptionally thin there will appear depressions or indentations directly opposite the feet where metal has flowed into the feet.

After much experimentation and research to obviate the above drawbacks of the manufacture of dials made entirely by swaging process, the following machine and method were invented. This invention accomplishes in one fast rolling and one finishing swaging operation what formerly required four or five swaging operations. The rolling machine gives quantity production and speed which is necessary in any industry, while swaging, although slow, produces accuracy which is necessary to any precision industry. The swaging operation is necessary to give the feet their finished shape.

Rolling previously consisted merely of a compression of the stock. This invention is directed to a machine and method which greatly reduces

the basic thickness thereof, while leaving certain small portions of said stock of substantially the original thickness or sometimes of even greater thickness.

5 In the drawings accompanying and forming a part of this specification:

Figure 1 is a view of the rolls in operation, showing a bar of metal passing therethrough.

Figure 2 is a plan view of the underside of the bar after passing through the rolls.

Figure 3 is a cross-sectional view of the bar shown in Figure 2.

Figure 4 is a plan view of the stock after being cut into individual blanks, on a slightly larger scale.

Figure 5 is a plan view of the blank after a final swaging operation has been performed.

Figure 6 is a cross-sectional view of Figure 5.

Figure 7 is a view of the lower roll.

Figure 8 is a detail view of one of the matrices.

Figure 9 is a transverse cross-sectional view of the matrix on line 9—9 of Figure 8.

Figure 10 is a longitudinal cross-sectional view of the matrix on line 10—10 of Figure 8.

The rolling die consists of an upper roll 4 and a lower roll 5. The upper roll 4 is smooth with the exception of very fine horizontal parallel lines for a purpose hereinafter described. The lower roll 5, in addition to these extremely fine horizontal lines 20, has formed therein a series of matrices 6 or feet forming apertures.

As can be seen in Figure 7, these matrices 6 are arranged in columns 9, 10, 11, 12, 13, 14, 15 and 16 extending over the entire circumference of the lower roll. By shifting the guides (not shown) the stock may be directed over any portion of the rolls having the proper distance between the feet forming matrices and the feet will be properly spaced so as to fit into the pillar plate of the particular size watch for which the finished dial is intended. This obviates the necessity of changing the roll for dials having feet spaced apart different distances.

The stock for the most popular size dial is cold fed to the matrices indicated by column 10 and either to column 9 or column 11. Column 9 and column 11 are spaced equal distances from column 10. The purpose of the extra row is in case the matrices indicated by the column 9 become worn, operation may continue by using columns 10 and 11.

Columns 12, 13 and 14 are used to form another size dial. In this case, however, all three

matrices are used at one time. Columns 15 and 16 are used for a different size dial.

The outer portion of the matrices proper 7 merge into circular cone-like structures 17 on two opposite sides. On the remaining two sides the matrices proper merge into circumferentially extending grooves 6. These grooves become shallower and narrower as they extend further from the matrix proper. Where the forward groove merges with the circular cone-like portion 17, the corners 19 are rounded so that when the teat 3 leaves the matrix it is enabled to force some of the surrounding metal past the curved corner 19 into the forward groove. This formation thereby makes it possible for a larger teat to leave the matrix than would otherwise be possible. The rear corners 18 are shown as being sharp, however, for certain purposes better results may be obtained if these corners are also rounded.

The stock 1 is fed to the rolls 4 and 5, where by means of the fine grooves or lines 20 on the rolls the metal is drawn through and may emerge exceedingly thin. Stock as thin as .010 inch and thinner, having feet as high as .050 inch, may be produced this way, but stock of similar thickness can not be swaged because of the before-mentioned depressions appearing opposite the feet. If raw material of sufficient thickness to produce proper feet is used in flat swaging dies the pressures required are destructive to the dies. As is plainly apparent comparatively thick stock of the order of .028 inch can be formed to shape by the slow swaging process, but by this rolling process either thick or thin stock may be worked. The stock may be compressed only slightly from its original shape, but ordinarily the main body of the stock is compressed to  $\frac{1}{4}$  or  $\frac{1}{5}$  of its original shape, so as to form feet of sufficient height. The metal received in the matrices proper 7 is subjected to no compression and forms the teat 3. The lines on the roll also provide small spaces in which lubricant may be applied and lodged, and the thickness of the finished stock thereby controlled. The lines further provide means for keeping the stock in a straight line and assist the stock in spreading in a lateral direction toward the matrices.

The metal received in the circular cone-like portions and the grooves is subjected to varying degrees of pressure, depending upon its distance from the matrix proper. These portions of the matrices form the enlargements 2. By means of the tapered enlargement and pointed teat, the stock may be accurately and speedily centered in the swaging die.

The grooves 6 and circular cone-like portions 17 have several very important functions. One is that they provide a quantity of metal 2 adjacent the teat or foot proper 3 and reinforce the foot as it leaves the matrix proper 7. This quantity of metal is also, in a later operation, flowed into the matrices of the swaging die and leaves no depressions on the side of the blank opposite the feet. The second important function of these elements, and more especially the groove, is to provide a runway or pass through which the teat may leave the matrix proper without being broken off or being badly distorted. However, as the teat leaves the matrix proper the end is brushed back slightly. Thus the end is formed into a more pointed projection and provides an exact pin point for the finishing operation. The stock leaves the rolls approximately  $3\frac{1}{2}$  times as fast as it enters and by means of

the grooves, the circular cone-like portion and more especially the rounded corner 19 therebetween, which permits free flow, the stress in the metal is considerably reduced and the subsequent breaking off of the foot is prevented. Due to the tremendous reduction necessary and the heat generated by the friction due to this reduction, the speed of the rolls is much lower than that encountered in ordinary rolling practices. This speed is about  $2\frac{1}{2}$  or three revolutions per minute. The size of the rolls for best results for stock to produce dials of wrist watch thickness has been determined to be approximately five inches. At that size the embryonic feet may leave the matrix with little, if any, distortion.

After leaving the rolling dies the stock is cut transversely into individual blanks having two projections on each blank. Some of the dials, however, may have more than two projections thereon.

The blanks are then placed under a swaging die which flows the metal 2 around the teat 3 into the swaging die to form the final, finished, accurate shape of the feet 21.

I claim:

1. The method of making watch dials which comprises subjecting thin metal stock to a rolling operation which forms rudimentary projections and reinforcing areas, cutting the stock into individual blanks, and subjecting the blanks to a swaging operation which forms the projections into feet.

2. A machine for rolling feet on watch dials comprising an upper roll, a lower roll having feet forming matrices therein, said feet forming matrices comprising deep center holes, circular cone-like apertures and circumferentially extending grooves, said apertures and grooves providing a flaring mouth for said center hole, and said grooves becoming gradually smaller as they extend away from the center hole.

3. The method of forming projections on watch dials which comprises subjecting metal stock to the action of rolling dies to form main projecting portions and contiguous strengthening and feeding portions to reinforce the projecting portion when leaving the dies and to provide excess material for subsequent operations, cutting the stock into individual blanks and subjecting the blanks to a swaging operation to form the projections into their final shape, by flowing the stock from the strengthening portion into and around the projections.

4. The method of forming projections on watch dials which comprises subjecting stock to a cold rolling operation which leaves portions of said stock of substantially the original thickness and thereafter positioning said stock by said portions and subjecting said stock to a cold swaging operation which finishes said portions.

5. The method of forming large projections on thin metal stock which consists in forcing metal stock into projection forming matrices and also into runways extending laterally of the matrices and associated with the matrices so that said stock in said runways will reinforce and support said stock in said projection forming matrices as said stock in said projection forming matrices leave said matrices with little or no distortion by passing through a portion of the runways, and subsequently subjecting said stock to a cutting operation and thereafter to a pressing operation to form said projections into their final finished form.

6. The method of forming feet on dials for instruments which comprises subjecting thin metal stock to rolling dies, one of which has a central foot forming matrix and a feeder channel leading into the main portion of the matrix so that rudimentary projections and thick-  
ened surrounding areas are formed on the metal blank, and thereafter positioning said stock by said projections and subjecting said stock to a cold swaging operation which finishes said projections.

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