Sept. 15, 1942. E. JORDAN 2,295,583

APPARATUS AND METHOD FOR PRODUCING LOCK WASHERS

Filed July 6, 1940

Fig. 1.

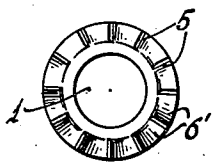


Fig. 2.

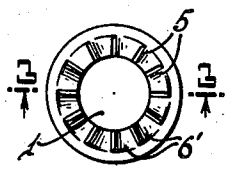


Fig. 4.

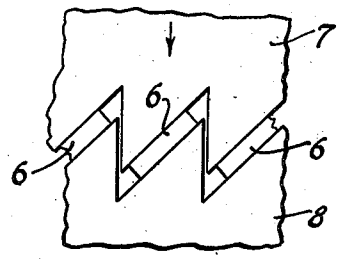


Fig. 3.

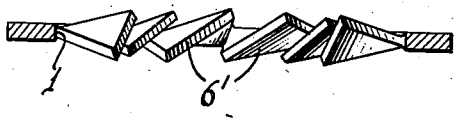


Fig. 5.

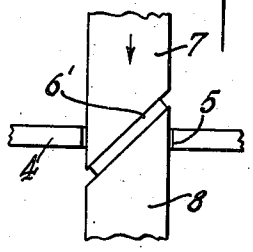


Fig. 6.

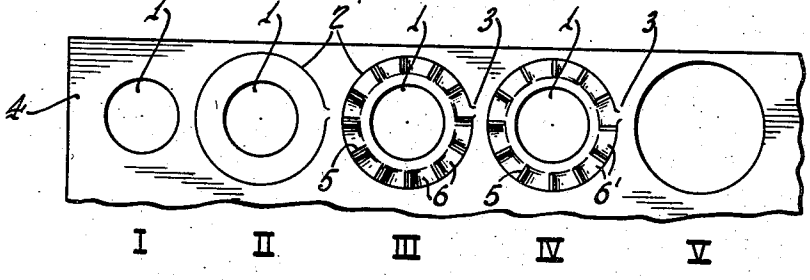
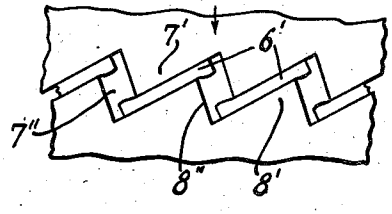


Fig. 7.



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APPARATUS AND METHOD FOR PRODUCING LOCK WASHERS

Ernst Jordan, Hamburg, Germany; vested in the Alien Property Custodian

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4 Claims. (Cl. 10—73)

The present invention relates to a lock washer with locking flaps overlapping in fan shape, and to a method and apparatus for the production thereof. For locking machine parts, especially nuts and the like, the so-called "fan washers" are used; these are washers with radial incisions, the flaps thus formed being mutually twisted so that they overlap in fan fashion.

To attain this, the fan-like overlapping of the flaps located between the radial incisions was hitherto effected by reducing the original diameter of the lock washer or by subsequently subjecting the flaps to a squeezing pressure which detrimentally affects the material.

The first mentioned method is open to the objection that it is necessary to first punch an individual ring and then to reduce the diameter of the washer. Consequently, series production is not possible. The other methods, which consist in subsequently squeezing the flaps, are objectionable as they always cause a disadvantageous weakening of the material at the point where the squeezing takes place.

The present invention avoids these objections and allows the continuous production of as many lock washers as required and consists substantially in that the flaps formed by the radial incisions are first twisted by two counter operating dies with faces inclined in opposite directions and are then spread uniformly on their entire width by increasing the pressure exerted by the dies. The flaps thus produced have at no point unfavorable cross-sections caused by maltreating the material, but are absolutely uniform so that a premature fracture of the flaps is impossible. Fan washers are known, in which the flaps are arranged either on the outer edge or are directed inwardly. In the case of washers of the latter type this method can be applied very easily because the washers are held in the band until the finished locking device is punched out. In the case of washers with outwardly directed teeth, the washer is preferably connected with the sheet metal band at a single point only so that it is possible to punch out the finished washer without leaving any burr.

Further and other objects of the present invention will be hereinafter set forth in the accompanying specification and claims and shown in the drawing which, by way of illustration, shows what I now consider to be preferred embodiments of my invention.

Both the lock washer itself and also the method for its production are illustrated in the accompanying drawing, in which:

Fig. 1 shows in plan view a fan washer with outwardly directed flaps;

Fig. 2 is a plan view of a fan washer with inwardly directed flaps;

Fig. 3 is a cross-sectional large scale view of the washer illustrated in Fig. 2;

Fig. 4 diagrammatically illustrates the two counter-movable dies in position for twisting a flap;

Fig. 5 diagrammatically illustrates the counter-movable dies in position for widening a flap;

Fig. 6 shows a work piece and the production phases of an individual lock washer with outwardly directed flaps;

Fig. 7 shows a modified die for producing lock washers according to the invention.

Like parts are designated by like numerals in all figures of the drawing.

Referring more particularly to Fig. 6 of the drawing the hole 1 of the washer is punched, operation I, whereupon the periphery 2 of the washer is punched out except at the point 3, production step II. The sheet metal work material 4 is then fed into a die arrangement which cuts the radial incisions 5 and at the same time twists the flaps 6 thus formed, production step III. This is effected by means of pairs of dies 7 and 8 (Fig. 4). The operative faces of these dies are inclined in such a manner, that, when the radial incisions 5 have been produced, the flaps 6 are twisted. If the pressure exerted by the dies is now increased in production step IV the twisted flap 6 is widened on its entire width to form a flap 6' (Fig. 5), so that these flaps 6' partly overlap one another.

The finished lock washer, as it is only connected to the sheet metal band 4 at the point 3 can then be easily and conveniently ejected, operation V.

The method described, unlike the conventional methods described in the opening paragraphs, does not require two pair of dies, namely one pair for producing the radial incisions and the other pair for producing the flaps, but the production of the finished overlapping flaps is effected in the manner described with a single pair of dies. Owing to the uniform widening according to the new method this widening may amount to 40% of the original width of the flaps. This method also permits carrying out the previous twisting of the flaps to such an extent that the best possible degree of efficiency of the locking means is insured.

For broadening out the flaps in the step IV illustrated in Fig. 5 I may use dies 7' and 8'

shown in Fig. 7 having smaller operating faces than the dies used for cutting and twisting the flaps by means of step III according to Figure 4. With such dies there is a space between the edges 7'' and 8'' which space permits better flow of the material and better adjustability of the extent of the broadening out operation. With this alternate method, during the last phase thereof, only part of a segment portion of the washer is compressed and the material flows freely into the aforementioned spaces.

The cutting faces of the pair of dies 7, 8 are brought together as far as the thickness of the work material for producing the radial incisions 5. The faces of the dies are inclined by an angle of 45° to 55° with respect to the vertical, so that the flaps, after being twisted, cover about ⅔ of the inclined faces. If the pressure exerted by the dies is now increased, the flaps 6' can be widened by almost 50% (Fig. 5) of their former width. In addition to this extraordinary extent of overlapping there is the great advantage of the absolute uniformity of the overlapping configuration.

Furthermore, the great simplification attained by the combination of the cutting and squeezing dies results in very considerable reduction in price not only of the lock washers but above all of the tools.

Finally, it must be pointed out that in view of the manner in which lock washers according to the invention operate a so-called bolt lengthening must be considered. The bolt stretches in the course of time especially when it is subjected to vibratory and similar movements. This lengthening of the bolt can only be compensated by lock washers of the type the present invention is concerned with, where maximum inclination, that is twist of the flaps, and uniform widening can be attained so that flaps 6' insure the greatest possible resiliency for permanently producing the desired locking effect.

While I believe the above described embodiments of my invention to be preferred embodiments, I wish it to be understood that I do not desire to be limited to the exact details of design, method and construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:

1. The method of producing a fan type lock washer having overlapping flaps of substantially uniform thickness comprising the steps of sheering radial cuts into a disc shaped work piece to form segment portions projecting from a solid ring portion of the work piece, at the same time and also subsequently further twisting the segments produced by the radial cuts, subsequently uniformly compressing said sgment portions in a direction normal to said work piece and thereby uniformly reducing the thickness of and broadening the individual segments to overlap one another in fanlike manner, and carrying out all said steps in one continuous motion truly perpendicular to the work material and axial to the disc shaped work piece.

2. The method of producing a fan type lock washer having overlapping flaps of substantially uniform thickness comprising the steps of sheering radial cuts into a disc shaped work piece to form segment portions projecting from a solid ring portion of the work piece, at the same time and subsequently further twisting the segments produced by the radial cuts into a position inclined by 45° to 55° with respect to radial planes disposed at right angles to the work piece, subsequently uniformly compressing said segment portions in a direction normal to said work piece and thereby uniformly reducing the thickness of and broadening the individual segments to overlap one another in fanlike manner, and carrying out all said steps in one continuous motion truly perpendicular to the work material and axial to the disc shaped work piece.

3. The method of producing a fan type lock washer having overlapping flaps comprising the steps of sheering radial cuts into a disc shaped work piece to form segment portions projecting from a solid ring portion of the work piece, at the same time and subsequently further twisting the segments produced by the radial cuts, subsequently uniformly compressing said segment portions in a direction normal to said work piece and thereby uniformly reducing the thickness of and broadening the individual segments, continuing the step of compressing the segments on only a part thereof and uniformly over the extension of said part and thereby further thinning and broadening the individual segments to overlap one another in fanlike manner, and carrying out said steps in a motion perpendicular to the work material and axially to the disc shaped work piece.

4. A device for producing, from sheet like work material, a fan type lock washer having overlapping flaps of substantially uniform thickness, said device comprising a pair of substantially cylindrical dies adapted to be moved towards one another and having a plurality of annularly disposed corresponding inclined segment like plane operating faces interconnected by substantially radially disposed surfaces extending substantially at right angles to the work material, the annular extension of said inclined operating faces being larger than the distance between said second mention surfaces in a plane perpendicular to the the longitudinal axis of said dies and said inclined faces being wider than said flaps.

ERNST JORDAN.