June 12, 1934. C. G. OLSON 1,963,027

METHOD OF MAKING LOCK WASHERS

Filed Aug. 3, 1933

FIG. 1.

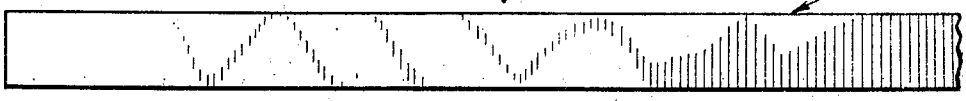


FIG. 2.



FIG. 3.



FIG. 4.

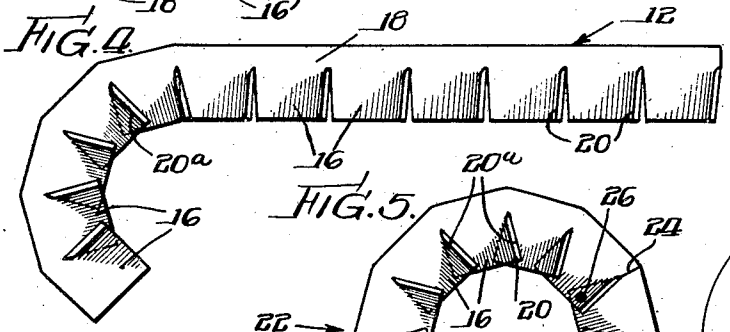


FIG. 5.

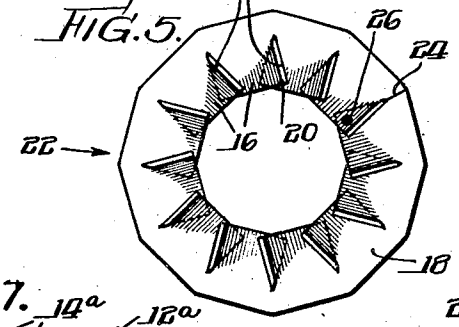


FIG. 6.

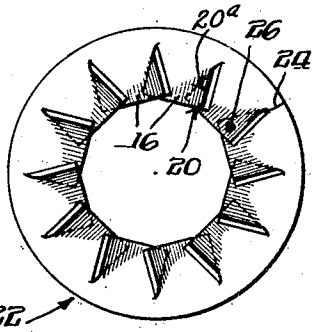


FIG. 7.

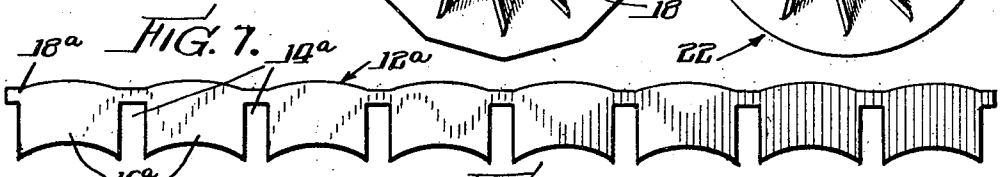


FIG. 8.



FIG. 9.

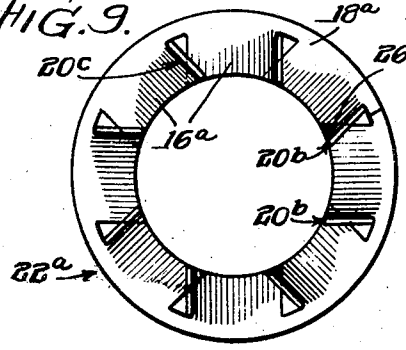


FIG. 10.

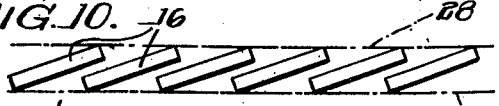
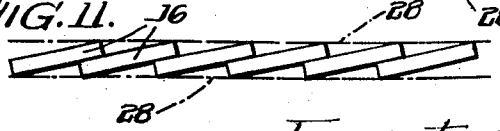


FIG. 11.



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METHOD OF MAKING LOCK WASHERS

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Application August 3, 1933, Serial No. 683,413

9 Claims. (Cl. 10—86)

My invention relates generally to methods of making lock washers, and particularly to methods of making lock washers of the overlapping prong type.

One of the important objects of my invention is to provide a simple and practical method of forming lock washers from a strip of resilient flat stock, and more particularly to provide a method whereby said stock may be edgewise formed so as to effect the overlapping of prongs along the inner margin thereof.

More specifically, my invention contemplates the provision of a method which includes the step of edgewise forming into an annular shape a strip of resilient metal having a plurality of prongs along the margin thereof in such a manner as to thereby effect the overlapping relationship of adjacent prongs.

Still more specifically, it is an object of my invention to provide along one margin of strip stock a plurality of adjacent prongs, and then warp said prongs so as to present work engaging corners on opposite sides of the stock, and thereafter coil or edgewise form said strip so as to effect overlapping relationship of said prongs in the completed washer.

A further object of my invention is to form a washer in the manner set forth above, and then secure the adjacent ends of the washer by any suitable means, such as by spot-welding the overlapping portions of the adjacent prongs at the abutting extremities of the washer stock.

The foregoing and numerous other objects and advantages will be more apparent from the following detailed description when considered in connection with the accompanying drawing, wherein—

Figure 1 discloses a strip of resilient flat stock, which may be employed in practicing my improved method of producing washers;

Figure 2 discloses the stock of Figure 1 after it has been split so as to present a plurality of adjacently positioned prongs along one margin of the stock;

Figure 3 is an edgewise view of the strip of Figure 2 after the prongs have been warped so as to present work engaging corners on opposite sides of the washer stock;

Figure 4 discloses the manner in which the strip of Figure 3 is coiled or formed edgewise so as to effect the overlapping of adjacent prongs;

Figure 5 is a plan view of a completed washer disclosing the overlapping portions of the prongs at the abutting ends of the washer secured together by spot-welding;

Figure 6 discloses the washer of Figure 5 after the outer multi-sided margin has been formed into a true circle;

Figure 7 is a strip of resilient flat stock having modified prongs;

Figure 8 is an edgewise view of the strip of Figure 7 after the prongs have been warped out of the plane of the stock;

Figure 9 is a plan view of the washer resulting from the edgewise bending or forming of the strip of Figure 8, disclosing how the curved edges along the inner and outer margin of the strip ultimately conform with a true inner and outer circle along the margin of the completed washer;

Figure 10 is a diagrammatic illustration of the manner in which the teeth or prongs of the washer are adapted to initially set up resilient resistance to the clamping action of the work; and

Figure 11 discloses the manner in which the prongs are finally clamped against each other as a result of the tightening of the work piece thereagainst.

Referring now to the drawing more in detail wherein like numerals have been employed to designate similar parts throughout the various figures, it will be seen that Figure 1 discloses a strip of resilient flat stock designated generally by the numeral 12. This material conforms to the required degree of resiliency and strength for the particular washer to be formed therefrom. One embodiment of my invention contemplates the slitting of one margin of the strip 12, as indicated in Figure 2. The slits 14 divide one margin of the strip 12 into a plurality of adjacently positioned prongs 16. These prongs are then warped in any suitable manner, such as by means of dies, out of the plane of the body portion 18 of the strip so as to present oppositely disposed work engaging corners 20 on opposite sides of the body 18. I prefer to so warp or flex the prongs 18 or portions thereof out of the plane of the stock so as to present not only the sharp work engaging corner 20, but also an elongated work engaging edge corner 20*a*. In some instances it may not be necessary to employ the elongated corner presented by the edge 20*a*, but merely the localized corner or point designated by the numeral 20. However, my invention contemplates the provision of prongs having either the edge 20*a* which extends out of the plane of and parallel with the body of the washer stock, as well as prongs in which only the portions 20 project on opposite sides of the stock.

After the prongs 16 have been warped, as in-

dicated in Figure 3, the stock is then edgewise bent, formed or coiled in any suitable manner, as indicated in Figure 4. The edgewise forming of the strip (as shown) causes adjacent portions of the prong to overlap each other. When the stock has been bent sufficiently so as to complete an annular body or washer 22, it is severed along the line 24, indicated in Figure 5, and the free edges of the body 18 are secured in abutting relation. In order to secure the free ends of the annularly formed washer together, I propose to spot-weld the adjacent overlapping prongs at 26. Obviously the invention is not limited to any particular means for securing the free ends of the washer body together. In some instances it may be desirable to change the multi-sided marginal effect shown in the washer of Figure 5 to a true circular form shown in Figure 6. This is accomplished by subjecting the margin of the body to a suitable swedging operation by means of a die. However, in causing the outer margin of the washer to conform with a true circle, no variation in the overlapping relationship of the prongs is occasioned.

In Figures 7 to 9, inclusive, I have shown a modified construction which is contemplated by the present invention. In Figure 7 a strip designated by the numeral 12*a* is shown, which includes a plurality of prongs 16*a* which are separated by notches or slots 14*a*. The prongs 16*a* are provided along one margin of a body portion 18*a*. The prongs 16*a*, as shown in Figure 8, are warped out of the plane of the body 18*a* so as to present work engaging corners 20*b*, and these corners continue in the form of edges 20*c*, which edges are preferably parallel to the plane of the body 18*a*. After the prongs 16*a* have been warped, as shown in Figure 8, the strip is edgewise formed in the manner shown in Figure 4 so as to present the washer 22*a* of Figure 9. The edgewise forming of the warped prongs 16*a* causes them to overlap and present a plurality of work engaging edges 20*c* projecting out of the plane of and in substantial parallelism with the body 18*a*, which terminate in the sharp work engaging corners 20*b*. By having the prongs 16*a* and the portion of the body 18*a* companion thereto preformed arcuately, as indicated in Figure 7, the resulting structure of Figure 9 will present inner and outer margins which conform with true circles. The adjacent free ends of the washer 22*a* are secured together by a spot-weld 26*a*.

In Figures 10 and 11 I have diagrammatically illustrated the manner in which a washer constructed in accordance with the teachings of my invention operate to lockingly engage a work piece. With the exception of the two prongs which are welded together, the overlapping relationship of the remaining prongs will conform with the unfolded disclosure of Figure 10. It will be seen that the prongs are axially spaced a sufficient distance so that, when the washer is initially clamped between a pair of work pieces indicated by the dot-and-dash lines 28, the locking corners of the prongs will resiliently oppose the clamping action. If the tightening force is sufficient to overcome the resiliency of the prongs, they will eventually be clamped against each other in the overlapping relationship shown in Figure 11. In this relationship each prong forms a bearing surface for the other, thereby forming a plurality of oppositely disposed work engaging corners, which rigidly imbed themselves within the work pieces. That is to say, the adjacent overlapping surfaces of the prongs cooperate to produce a rigid locking element, as distinguished from a resilient or yieldable locking element. However, the inherent characteristic of the prongs to spring axially in the event that either work piece tends to loosen, serves to materially increase the locking effectiveness of the washer.

As an example of the type of washer which may be produced by practicing my improved method, I make reference to the overlapping prong arrangement shown in the Murphy Patent 261,947 particularly Figure 3 thereof.

In the claims attached hereto reference is made to the disposition of prongs along the margin bearing such relation to the radius of the finished washer as to effect an overlapping relationship of adjacent prongs. Obviously when the prongs are actually spaced along the margin of the washer body, as shown in Figure 9, the overlapping of the prongs is dependent upon three factors, namely the width of the space between the prongs, the radial length of the prongs and the radius of the finished washer. When the prongs are formed as indicated in Figure 2 by providing a plurality of slits or severances, the slightest edgewise forming of the strip will cause an overlap of the prongs. Therefore, in order to define methods wherein the prongs are disposed along the margin either by the slits 14 of Figure 2 or notches 14*a* of Figure 7, all the claims include the above mentioned statement relating to the disposition of the prongs with relation to the radius of the finished washer. This also serves to clearly distinguish from prior methods of edgewise forming strip stock as shown in the patents to Hosking, 1,845,272 and 1,866,304.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The method of producing washers which includes the step of edgewise forming into an annular shape a strip of resilient metal having a plurality of prongs along the margin thereof, the disposition of the prongs along the margin bearing such a relation to the radius of the finished washer as to effect an overlapping relationship of adjacent prongs.

2. The method of producing washers which includes the step of edgewise forming into an annular shape a strip of resilient metal having a plurality of prongs along the margin warped out of the plane of the washer stock, the disposition of the prongs along the margin bearing such a relation to the radius of the finished washer as to effect an overlapping relationship of adjacent prongs.

3. The method of producing washers which includes the step of edgewise forming into an annular shape a strip of resilient metal having a plurality of prongs along the margin warped out of the plane of the washer stock, the disposition of the prongs along the margin bearing such a relation to the radius of the finished washer as to effect an overlapping relationship of adjacent prongs with oppositely disposed corners on each prong projecting on opposite sides of the plane of the washer body.

4. The method of producing washers which includes the step of edgewise forming into an annular shape a strip of resilient metal having a plurality of prongs along the margin warped out of the plane of the washer stock, the disposition of the prongs along the margin bearing such a relation to the radius of the finished

washer as to effect an overlapping relationship of adjacent prongs with oppositely disposed edges of each prong spaced from and in substantial parallelism with the plane of the washer body.

5. The method of producing washers which consists in forming along at least one margin of a strip of resilient flat stock a plurality of prongs, and then edgewise forming the strip into an annular shape with the prongs along the inner margin, the disposition of the prongs along the margin bearing such a relation to the radius of the finished washer as to cause said prongs to overlap during the edgewise forming.

6. The method of producing washers which consists in forming along at least one margin of a strip of resilient flat stock a plurality of prongs, then edgewise forming the strip into an annular shape with the prongs along the inner margin, the disposition of the prongs along the margin bearing such a relation to the radius of the finished washer as to cause said prongs to overlap during the edgewise forming, and securing together the free extremities of the annularly formed strip.

7. The method of producing washers which consists in severing at spaced intervals a margin of strip stock so as to present a plurality of adjacently positioned prongs, warping said prongs so as to position oppositely disposed corners of each prong out of the plane of the unsevered portion of the strip stock, and then edgewise forming into annular shape the pronged strip, the disposition of the prongs along the margin bearing such relation to the radius of the finished washer as to thereby effect an overlapping relationship of the adjacent prongs.

8. The method of producing washers which consists in severing at spaced intervals a margin of strip stock so as to present a plurality of adjacently positioned prongs, warping said prongs so as to position oppositely disposed corners of each prong out of the plane of the unsevered portion of the strip stock, edgewise forming into annular shape the pronged strip, the disposition of the prongs along the margin bearing such relation to the radius of the finished washer as to thereby effect an overlapping relationship of the adjacent prongs, severing the annularly formed strip from the main body of the strip, and then securing together the free extremities of said annular member.

9. The method of producing washers which consists in forming a plurality of prongs along the margin of a strip of resilient stock, warping said prongs so as to project oppositely disposed work engaging margins thereof out of the plane of the washer stock, and then forming the strip into annular shape, the disposition of the prongs along the margin bearing such a relation to the radius of the finished washer as to experience an overlapping relationship as a result of the annular forming of the strip.

CARL G. OLSON.