

Sept. 8, 1931.

C. G. OLSON

1,822,600

METHOD OF MAKING LOCK WASHERS

Filed Feb. 28, 1928

2 Sheets-Sheet 1

Fig. 1.

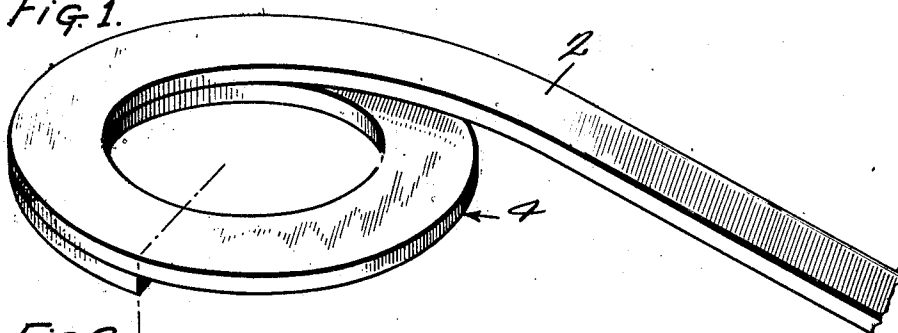


Fig. 2.

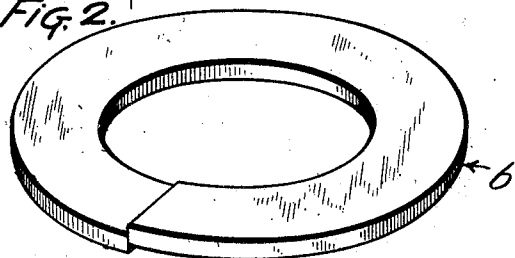


Fig. 6.

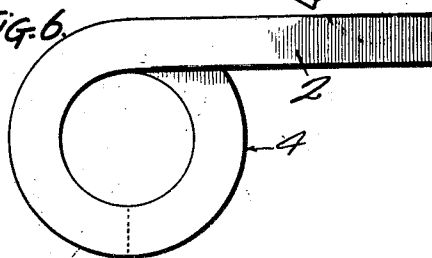


Fig. 3.

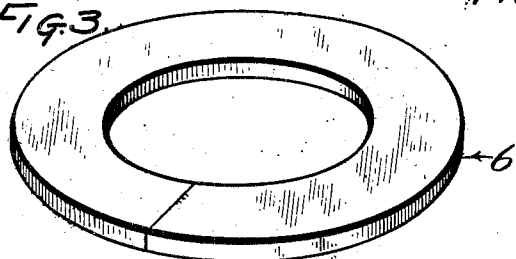


Fig. 7.



Fig. 8.

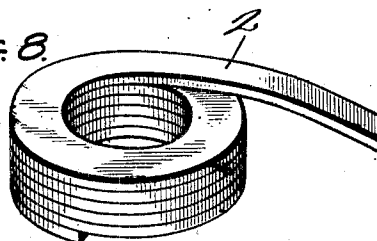


Fig. 4.

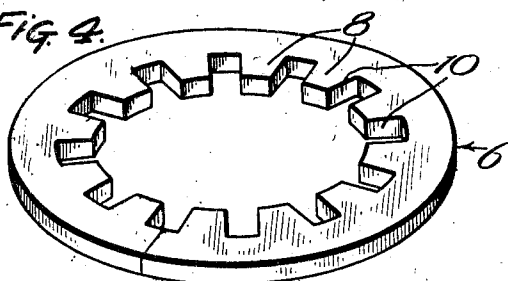


Fig. 9.

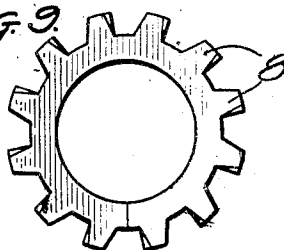
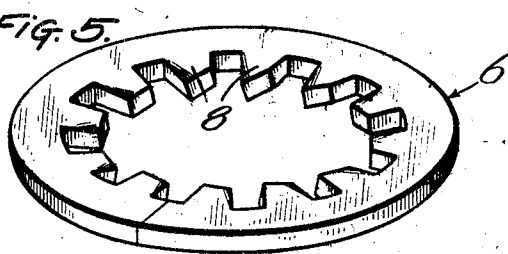


Fig. 5.



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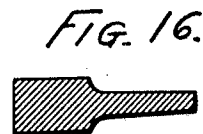
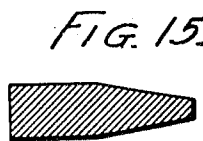
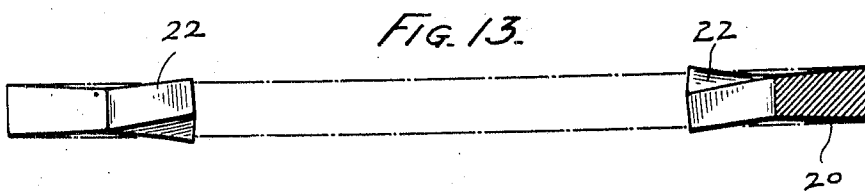
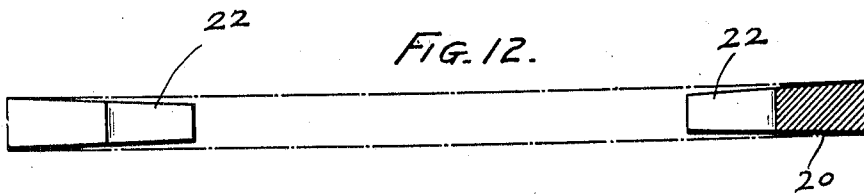
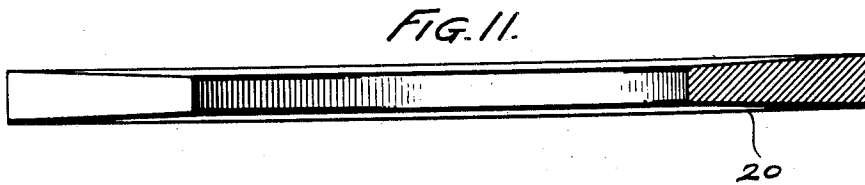
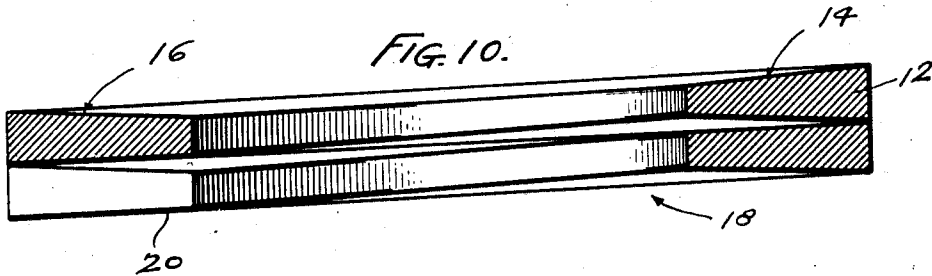
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METHOD OF MAKING LOCK WASHERS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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METHOD OF MAKING LOCK WASHERS

Application filed February 28, 1928. Serial No. 257,560.

My invention relates to methods of making lock washers and the like, and particularly to methods of producing lock washers of the type formed with a plurality of marginal prongs.

It has heretofore been common practice in the manufacture of annular members, such as washers or lock washers, to punch such members from flat stock. In following this practice a considerable portion of the stock must necessarily be discarded as scrap material, and it is a primary object of my invention to provide a method of producing lock washers and the like whereby the above mentioned losses occasioned as a result of the formation of scrap material, are reduced to a minimum.

It is a further object of my present invention to provide an economical and practical method whereby annular members such as lock washers may be expeditiously produced from a continuous strip of flat stock, said stock being coiled with the flat surfaces thereof perpendicular to the axes of the coil and subsequently severed and punched so as to present a plurality of marginal prongs.

My invention further contemplates the provision of a method of producing lock washers wherein a continuous strip of flat stock is coiled with the flat surface thereof perpendicular to the coil axis and previously to the coiling thereof said stock is pretensioned for the purpose of setting up a tension within the formed coil, which tension will serve to cause the extremities of the individual convolutions subsequently severed from the coil to be moved into substantial alignment.

It is a further object of my invention to provide a method of producing lock washers and articles of like nature from a strip of stock wherein the strip is coiled edgewise into more than one complete helical convolution, and then one convolution is cut off from the coil, and prongs or notches of desired shape are formed along one edge of the severed convolution.

In addition to the above mentioned features, it is an object of my invention to provide a method of forming washers from a continuous strip of material by coiling the

material edgewise, severing individual convolutions thereof, straightening the severed convolution, forming prongs along one of the margins thereof, and then twisting the resulting prongs to project out of the plane of the washer.

A further object of my invention is to provide a method of producing lock washers and the like whereby a wedge-shaped or tapered strip of metal of the width of a washer measured from the inner to the outer rim thereof is coiled, a convolution thereof severed and warped teeth formed along the thinnest marginal portion of the severed convolution, thereby producing a lock washer having teeth which will always remain at a slight angle of twist with respect to the surface of the work with which it may be associated, even though a screw or nut be tightened thereagainst to full compression.

My invention further contemplates the provision of a method of producing lock washers from a flat strip of material which consists in coiling the material edgewise, thereby reducing the thickness of the outer margin of the coil convolutions so that when an individual convolution is severed and formed with twisted external marginal teeth, these teeth will never be completely untwisted when compressed by a screw or nut, thereby always maintaining the teeth in position to bite into an associated surface regardless of the degree of compression to which the washer may be subjected.

These, and other objects will be more apparent from the following detailed description when considered in connection with the accompanying drawings in which:

Figure 1 is a perspective view of a strip of material in the process of being initially coiled edgewise into more than one complete helical convolution;

Figure 2 discloses one of the helical convolutions which has been severed from the coil disclosed in Figure 1;

Figure 3 shows the convolution or washer disclosed in Figure 2, after said washer has been subjected to a straightening operation;

Figure 4 discloses the washer formed with a plurality of internal marginal prongs;

Figure 5 discloses the washer after the prongs thereof have been subjected to a twisting operation;

Figure 6 is a plan view of the coil disclosed in Figure 1;

Figure 7 is a front elevational view of Figure 6, which serves to indicate the manner in which the strip material is pretensioned previous to the coiling of the material;

Figure 8 is a view similar to the view shown in Figure 1 disclosing a multiplicity of helical convolutions;

Figure 9 is a detail view of a lock washer formed with a plurality of twisted external prongs, which presents an alternative or modified form of the lock washer disclosed in Figure 5;

Figure 10 is a transverse sectional view of a coil formed from a strip of wedge-shaped or tapered strip material, said coil simulating in form the coil shown in Figure 1 and representing a transverse sectional view of such a coil taken substantially along the horizontal dot and dash line of Figure 1 and looking to the left of said figure;

Figure 11 is a transverse sectional view of the lowermost convolution of the coil disclosed in Figure 10 after said convolution has been severed from said coil;

Figure 12 is a transverse sectional view of the severed convolution disclosed in Figure 11 with internal marginal teeth formed therein;

Figure 13 is a transverse sectional view similar to Figure 12, with the teeth thereof twisted out of the plane of the washer; and

Figures 14 to 16 inclusive disclose cross sections of different forms of strip material having one margin thereof reduced, all of said material being adapted for use in connection with the production of lock washers in the manner disclosed in Figures 10 to 13 inclusive.

Referring now to the drawings, wherein like numerals have been employed to designate similar parts throughout the various figures, it will be seen that my improved method contemplates the use of a continuous strip or band of material 2 from which lock washers may be made. This strip 2 may comprise suitable materials such as spring steel which may be hardened and tempered subsequent to the forming of said strip into washers, or it may be comprised of hard rolled material such as spring bronze. However, the matter of the material to be used will be largely dependent upon the uses to which the washers formed therefrom are to be subjected. This strip 2 disclosed in Figures 1 to 8 inclusive, is rectangular in cross section but it will be clear from the description which is to follow of Figures 10 to 16 inclusive, that strips or bands which are wedge-shaped in cross section may, in certain instances, be very effectively employed. As

shown in Figure 1, the strip 2 is initially formed into a coil indicated generally by the numeral 4, and this coiling operation may be performed by hand or by means of a conventional type of coiling machine (not shown), and in this connection it is to be observed that the strip 2 just previous to the coiling thereof, is flexed laterally, as clearly shown in Figures 1 and 7. By laterally flexing the strip material in this manner, said material is pretensioned and this pretensioning serves to set up a tension within the individual convolutions of the formed coil 4. This tension which is set up within the coil 4 causes the adjacent convolutions thereof to bear against one another or, in other words, the tendency of the upper convolution of the coil 4, shown in Figure 1, experiences a tendency to spring downwardly against the upper adjacent surface of the lowermost convolution. Thus it will be understood that when an individual convolution or washer 6, Figure 2, is severed from the coil 4 as for example by shearing along the dot and dash line disclosed in Figure 1, the above mentioned tension which has been super-imposed upon this severed convolution in response to the flexing of the strip 2 as the strip is being formed into the coil, serves to cause the abutting or adjacent extremities of the severed convolutions to be sprung into substantial alignment as disclosed in Figure 2. It has been found in practice in many instances that the pretensioning of the strip 2 is sufficient to cause the extremities of the washer 6 to be carried into actual or accurate alignment as shown in Figure 3, but in the event that the washer extremities are not sprung into accurate alignment it is only necessary to apply a compressive force to the washer shown in Figure 2 to cause the straightening thereof.

After the washer 6 has been flattened or straightened so as to assume the form disclosed in Figure 3, a plurality of marginal prongs 8, Figure 4, may be formed by punching out sections so as to present marginal spaces 10. These prongs 8 are then subjected to a twisting operation by any suitable means (not shown) so that their outer extremities will not lie entirely in the plane of the body of the washer 6, as indicated in Figure 5. When the washer 6 is used in connection with a nut (not shown), the prongs thereof are adapted to lock and securely hold said nut when tightened against a surface such as a plate or part of a machine frame, and for a more detailed explanation of the operativeness and effectiveness of the type of washer disclosed in Figure 5 reference is made to the patent to R. T. Hosking, No. 1,419,564, dated June 13, 1922.

The method just described in connection with the forming of a washer having twisted prongs or teeth formed along the inner rim

thereof, has a very practical application in the production of lock washers having similar prongs or teeth formed along the external rim thereof as shown in Figure 9. From the foregoing description it will be understood that when the flat strip 2, which is normally rectangular in cross section, is formed into the coil 4 of Figure 1, the stock along the inner rim of the coil will be subjected to compression and the portion of the stock along the outer rim thereof will be subjected to tension. The compression will obviously cause the thickness of the stock to be increased along the inner rim and proportionately reduced along the outer rim. The advantages resulting from these changes in the marginal thickness of the inner and outer rims of an individual severed convolution will be readily appreciated in connection with the forming of a washer of the type disclosed in Figure 9 having external marginal prongs or teeth formed therein. In such instances the outer extremities of the twisted prongs will be thinner than the bases thereof and hence, when a washer provided with teeth of such a design is clamped between two objects such for example as a machine surface and the surface of a tightening nut (not shown), said teeth will never be completely untwisted regardless of the compressive forces to which they may be subjected. By not taking all of the twist out of the tooth the engaging edges thereof are always maintained in position to bite into the work even though the washer is tightened down to full compression. The advantages incident to washers of this type are specifically pointed out in the patent to R. T. Hosking, No. 1,592,525, dated July 13, 1926.

Referring now to Figures 10 to 13 inclusive, it will be observed that wedge-shaped or tapered strip material indicated by the numeral 12 may be coiled and pretensioned in a manner similar to the described method of coiling and pretensioning the strip 2 in Figure 1. Thus it will be understood that the strip 12 is initially pretensioned by laterally flexing said strip and subsequently formed into a coil with the reduced margin of the strip forming the inner rim of the coil. Immediately previous to the edgewise coiling or bending of the strip 12, the cross sectional area thereof will correspond to the area indicated by the numeral 14, Figure 10, and as the bending or coiling of the strip 12 continues, the cross sectional area thereof will correspond to the section indicated by the numeral 16, Figure 10. In comparing the cross sectional areas 14 and 16, it will be observed that the inner rim of the coil in the process of being formed increases in thickness, the thickness of the inner portion of the cross sectional area 16 being greater than the thickness of the inner portion of the section 14. However, the increase in thickness experi-

enced by the inner rim, together with the relative decrease in the thickness of the outer rim in response to the coiling of the strip, is not sufficient to effect the equalization of the inner and outer rim thicknesses. In other words, the convolutions of the completed coil which I have indicated generally by the numeral 18, Figure 10, will have an inner rim which is thinner than the outer rim. The advantages of forming the convolutions in this manner will be more apparent as the description progresses.

Subsequent to the formation of the coil 18, an individual convolution 20 may be severed in the manner described in connection with the severing of the convolution 6, Figure 2 from the coil 4, Figure 1. The pretensioning of the strip 12 during the coiling thereof will serve in this instance to effect a substantial alignment of extremities of the severed convolution 20. Internal teeth or prongs 22 are now formed in any suitable manner along the inner rim of the convolution 20 and it will be observed that the outer extremities of these teeth will be thinner than the bases thereof. The teeth 22 are then twisted out of the plane of the convolution or washer 20 so as to present teeth twisted similarly to the teeth 8 of Figure 5. When a lock washer of the type disclosed in Figure 13 is clamped in position between a suitable surface and a clamping nut, there will be a tendency to cause the teeth 22 to be untwisted. By reason of the fact that these teeth are thinner than the body of the washer, said teeth can never be completely untwisted in response to compression exerted by the above mentioned clamping nut. Thus by having the tooth thinner than the body portion of the washer, said tooth will always remain at a slight angle of twist with respect to the surface of the work with which it is associated, even though a clamping nut be tightened down to full compression as hereinbefore described in connection with the lock washer described in Figure 9. Obviously various forms of wedge-shaped or tapered strip material may be employed in practicing my improved method without departing from the spirit and scope of my invention. Cross sections of various strips which might be employed with equal effectiveness are disclosed in Figures 14 to 16 inclusive. The shape of the material to be used in forming lock washers in accordance with my invention will be dependent, to a certain extent, upon the particular type of washer teeth which may be desired and although I have disclosed radially formed teeth, it is to be understood that various other forms of teeth may be produced in practicing the described method.

It is to be understood that my invention is not limited to the severing of a single helical convolution from a coil as hereinbe-

fore described, but further contemplates pretensioning the strip material 2 and subsequently forming said strip into a multiplicity of convolutions, as clearly shown in Figure 8.

5 In this instance one or more of the individual convolutions, thus presented may be severed from the coil.

From the foregoing it will be understood that my invention provides a method whereby
10 by annular members such as the lock washers 6 may be formed with a minimum amount of loss from scrap material. This will be apparent when it is understood that the only scrap material resulting from the practice of
15 my improved method is the portion of the stock which is punched out to form the spaces 10. This represents a decided saving over methods heretofore employed wherein the washers were blanked or punched from flat
20 stock material. By pretensioning the strip material previous to the coiling thereof, I have been able to greatly facilitate the severing of the individual convolutions, said tension serving in each instance to cause a sub-
25 stantial alignment of the severed extremities of the formed washer. It will be apparent that if a coil of strip material is formed in accordance with the teachings of my invention as shown in Figure 1, wherein only one
30 and one-half convolutions are formed prior to the severing operation, said severing operation may be performed without any interference from other convolutions. Thus it will be understood that by employing my im-
35 proved method, annular members such as lock washers may be successively formed from a continuous strip of material in a very economical and expeditious manner.

For the purpose of illustrating the practical application of my invention, I have here-
40 in described the practice of my improved method in connection with the production of a particular type of lock washer provided with twisted marginal prongs. However, it
45 is to be understood that my invention is not limited to methods of producing any particular type of lock washer, but is capable of producing washers and annular members of like nature of varied designs and therefore the in-
50 vention should be limited only by the scope of the appended claim.

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

55 The method of forming pronged lock washers from a strip of flat spring stock, the thickness of which equals the thickness of the washer to be produced and the width conforms to the width of the washer when meas-
60 ured from the inner to the outer rim thereof, said method consisting in coiling said flat strip edgewise, subjecting said strip to a lateral deflection just previous to the coiling thereof and thereby charging the convolu-
65 tions of the coil so that said convolutions

will automatically spring together with the lateral surfaces in contact with each other, severing a complete convolution from said charged coil, the charging of said coil serving
70 in this instance to effect the self-alinement of the severed extremities thereof, and then forming marginal locking teeth in said severed convolution.

In witness whereof, I have hereunto subscribed my name.

CARL G. OLSON.

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