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 [21] Appl. No. **4,691**
 [22] Filed **Jan. 21, 1970**
 [45] Patented **Jan. 11, 1972**
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1,675,300 6/1928 Dawson..... 72/132
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[54] **MAKING CORRUGATED ELASTIC SHIMS**
 7 Claims, 11 Drawing Figs.

[52] U.S. Cl..... **72/131,**
72/132, 72/427
 [51] Int. Cl..... **B21f 11/00,**
B21d 45/00
 [50] Field of Search..... **72/131, 132**

[56] **References Cited**
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 2,855,974 10/1958 Heckethorn..... 72/131

ABSTRACT: Into a cylindrical bending chamber, free from rotating parts, a corrugated strip is fed tangentially between the interior wall of the bending chamber and a semicylindrical anvil whose curved side follows in spaced relation the opposite curved side of the bending chamber from that at which the stock enters. The end of the stock after making one and a half turns abuts against the radial straight side of the semicylindrical anvil. The stock is sheared generally radially by a shear blade acting against the corner of the semicylindrical anvil. Completed corrugated elastic shims are ejected axially. In the preferred embodiment the strip is gripped or engaged only at the edges.

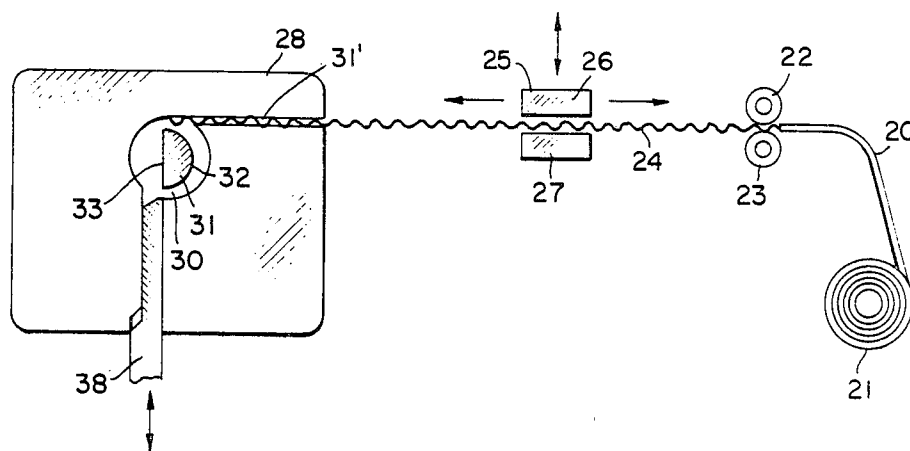


FIG. 1

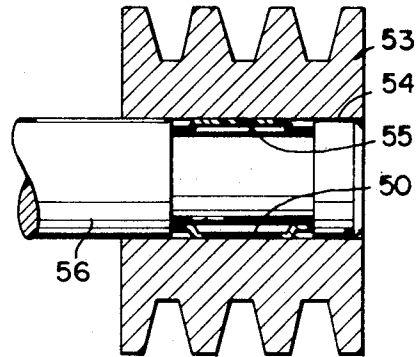
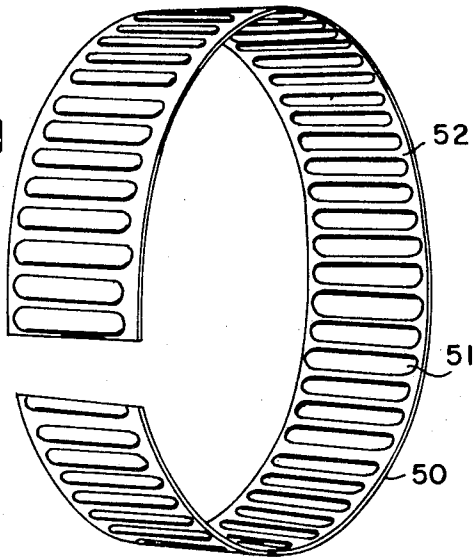


FIG. 2

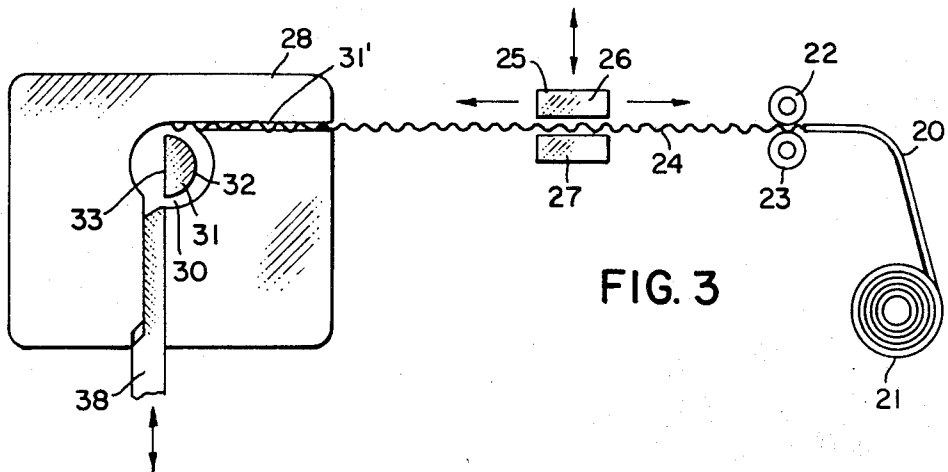


FIG. 3

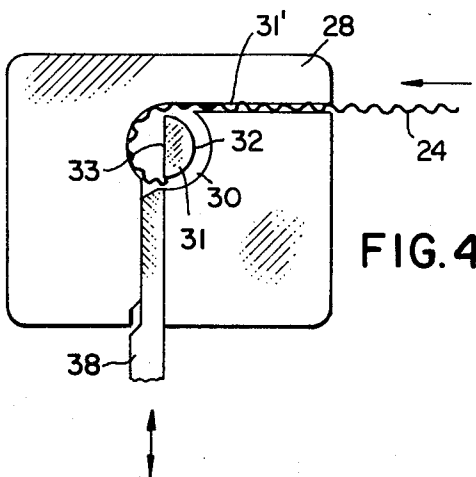


FIG. 4

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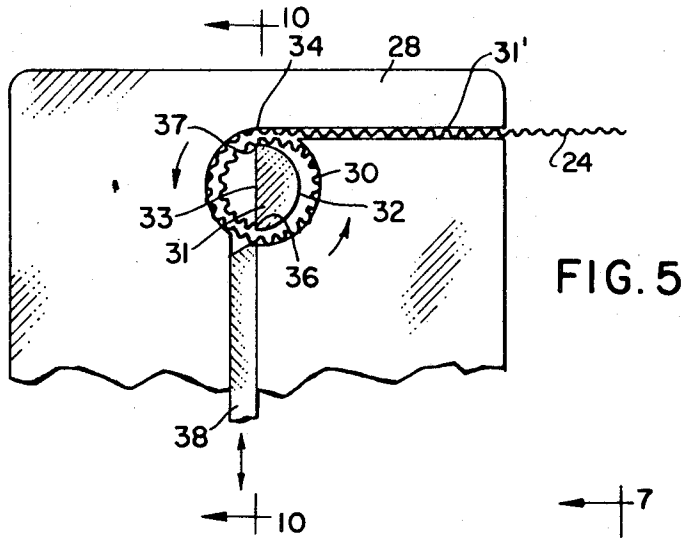


FIG. 5

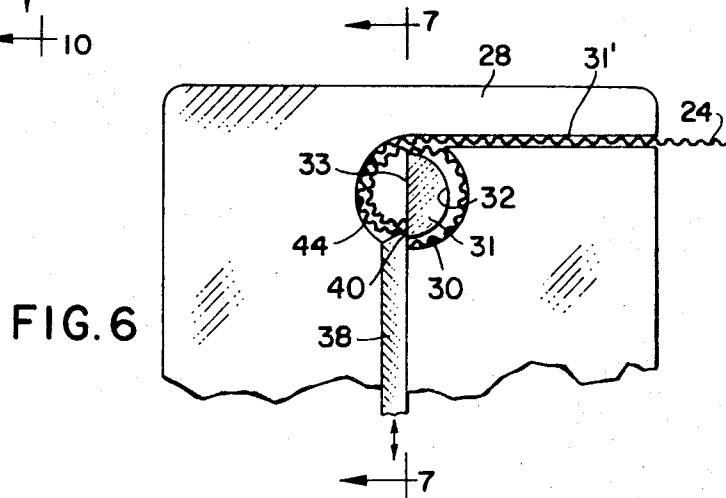


FIG. 6

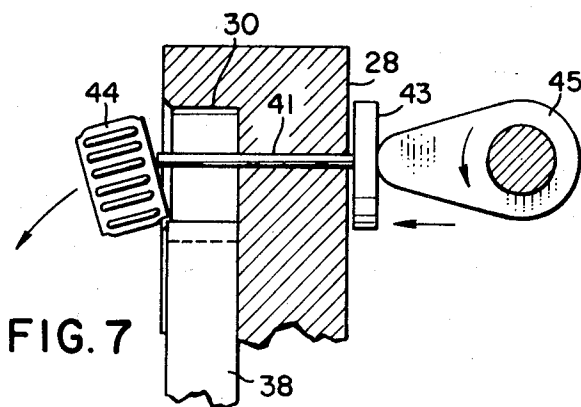


FIG. 7

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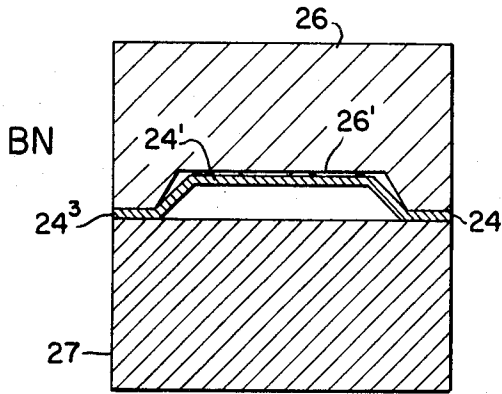


FIG. 8

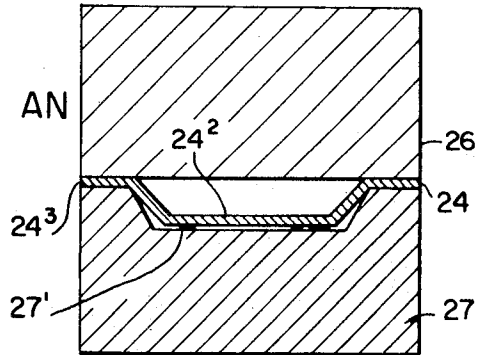


FIG. 9

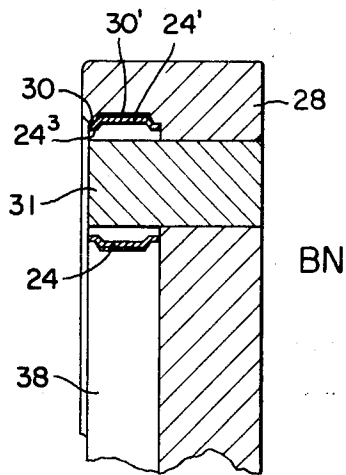


FIG. 10

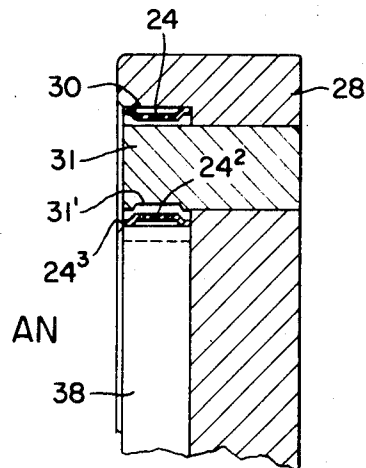


FIG. 11

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MAKING CORRUGATED ELASTIC SHIMS

The present invention relates to the making of corrugated elastic shims from corrugated strip by bending them into generally curved, circular or multisided shape.

Corrugated elastic shims as explained in Dix and Wehr U.S. Pat. No. 3,061,386, granted Oct. 30, 1962 for Tolerance Rings and Hulck and Schultes U.S. Pat. No. 3,142,887, granted Aug. 4, 1964 for Method of Making a Split Annular Tolerance Ring, are intended for securing rotating parts such as bearings, pulleys, sheaves, gears, sprockets, levers and the like, to shafts. As shown in Roller Bearing Co. of America catalogs on Star Tolerance Rings (1961, 1962, and 1965), corrugated elastic shims are of two types, one intended for insertion first into a hole, into which the shaft is later pressed (type AN) and the other intended first for insertion around a shaft (in many cases within a circumferential recess around the shaft), and then the shaft and corrugated elastic shim to be pressed into the interior opening of a rotating part surrounding the same (type BN).

One way of making corrugated elastic shims in the past has been to roll corrugated strip between a rigid circular mandrel and an elastic wheel. This method has been subject to difficulty because of variation in the elasticity of the elastic wheel, rapid wear of the elastic wheel, and difficulty in maintaining adjustment which will produce corrugated elastic shims of precise dimensions without necessity for resizing or rejecting a substantial number which were not according to size. One difficulty has been that there is a tendency if excessive pressure is applied to deform the corrugations so that the corrugated elastic shims no longer grip properly.

Another method of making corrugated elastic shims in the past has been to feed strip tangentially against an idling wheel which is capable of rotating and which forms part of the circumference of a cylindrical bending chamber containing a semicylindrical anvil and a cooperating shear blade. This method has also given rise to difficulties through need for constant readjustment of the idling wheel, and danger of producing corrugated elastic shims which will no longer conform to the required gage dimensions. One purpose of the present invention is to eliminate the difficulties due to wear in the idling wheel and avoid the need for constant readjustment.

A further purpose of the invention is to obtain corrugated elastic shims which are not subject to deformation of the corrugations which has made it necessary to resize after bending.

A further purpose is to simplify the operation of bending corrugated elastic shims.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate a few only of the numerous embodiments in which the invention may appear, selecting the forms shown from the standpoints of convenience in illustration, satisfactory operation, and clear demonstration of the principles involved.

FIG. 1 is a perspective of a corrugated elastic shim produced according to the invention.

FIG. 2 is an axial section showing a corrugated elastic shim installed to hold a pulley on a shaft.

FIGS. 3 to 6 are stepwise end elevations of the bending mechanism, the illustrations being diagrammatic.

FIG. 3 is an end elevation of the start of the bending operation with the strip entering the inlet to the bending chamber.

FIG. 4 illustrates the further advance of the strip into the bending chamber, and shows the position at which a new cycle will start.

FIG. 5 is slightly enlarged and shows the feed fully advanced to place one and a half turns of corrugated strip in the bending chamber.

FIG. 6 is slightly enlarged and illustrates the shearing operation.

FIG. 7 is a section on the line 7-7 of FIG. 6 showing the ejection, and omitting the remaining strip.

FIG. 8 is a transverse section through the gripping jaws of FIG. 3, designed for use on corrugated elastic shims of BN type.

FIG. 9 is a transverse section through the gripping jaws of FIG. 3 intended for use on corrugated elastic shims of AN type.

FIG. 10 is a fragmentary enlarged section of FIG. 5 on the line 10-10, showing the bending block and shear blade designed for bending BN-type corrugated elastic shims.

FIG. 11 is a fragmentary enlarged section of FIG. 5 on the line 10-10, showing the bending block and semicylindrical anvil for bending AN-type corrugated elastic shims.

Referring to the drawings, metallic strip 20 in FIG. 3 is taken off a reel 21 and passes through corrugating rolls 22 and 23 suitably intergeared (not shown) to form corrugations extending transversely along the length of the strip through the middle portion, not extending fully to the edges in the preferred embodiment.

The corrugated strip 24 thus produced is fed by feed mechanism 25, which as suggested by FIG. 3, involves an upper feed jaw 26 and a lower feed jaw 27. The jaws are capable as indicated by the arrows of gripping the corrugated strip so as not to crush the corrugations, feeding the strip forward for one increment which corresponds to the material required to make one corrugated elastic shim, then releasing the grip and retracting backward. On the next cycle the jaws grip again and advance as previously explained.

In order to permit gripping the corrugated elastic strip, it is corrugated over only part of its width, suitably at the middle. Depending upon the type of corrugations, the upper feed jaw, 26 is relieved at 26' to avoid crushing BN-type corrugations 24' (FIG. 8) or the lower feed jaw 27 is relieved at 27' to avoid crushing AN-type corrugations 24² (FIG. 9). In either case the feed jaws 26 and 27 engage one or both edges 24³ of the corrugated strip as shown.

The strip advances to a bending block 28 which has a curved or preferably cylindrical bending chamber 30 disposed with its axis at right angles to the direction of progression of the strip. Strip enters the bending chamber through a tangential inlet opening 31 and impinges against the wholly stationary preferably cylindrical interior wall.

As the strip progresses around the interior wall as shown in FIG. 4, it first introduces one-half turn of strip into the chamber as there shown.

As illustrated in FIG. 5, further forward feed of the corrugated strip makes it follow around the interior preferably cylindrical wall of the bending chamber 30 radially outside a curved or suitably semicylindrical anvil 31 which has a curved preferably cylindrical wall 32 generally conforming to the inner wall of the bending chamber 30 and a straight generally radial wall 33 which acts as both a stop and a shear anvil to be described.

As the feed progresses in FIG. 5, the forward end of the strip encounters the inside of an outer turn of strip at 34 and continues along the inside of the strip until it abuts against the straight generally radial surface of the suitably semicylindrical anvil at 36. Because of the need to use the portion 36 of the semicylindrical anvil as a stop, the clearance between the semicylindrical anvil and the inside of the bending chamber at this point is limited to allow only one layer of corrugated strip to enter this space. At the opposite end of the semicylindrical anvil at 37, there is room provided for two turns of corrugated strip between the inner wall of the cylindrical bending chamber 30 and the semicylindrical anvil. Therefore, as shown in FIG. 5, the anvil is placed slightly offcenter in the preferably cylindrical bending chamber to allow for this difference in clearance.

The forward end of the entering strip having been stopped by the radial surface of the semicylindrical anvil at 36, forward feed ceases, and the strip is held while it is sheared as shown in FIG. 6. For this purpose a shear blade 38 is capable of moving between a radially outer position not in contact with the strip and a radially inner position at which it has encountered the outermost layer of corrugated strip and sheared it off at 40.

In the next operation as shown in FIG. 7, ejector pins 41 are brought in parallel to the axis in suitable openings by a follower 43 to engage the formed corrugated elastic shim 44 and

push it out of the bending chamber 30 while retaining in the bending chamber one-half turn of corrugated strip which will be there at the time of the next cycle. The follower 43 is advanced by a suitable rotating cam 45 and the follower 43 is biased by spring means not shown to follow the cam.

In order to prevent crushing the corrugations, the bending chamber and the anvil engage the corrugated elastic strip at its edges. Thus as shown in FIG. 10, the wall of the bending chamber 30 has an annular recess 30' intermediate its ends, which receives the corrugations 24' of BN-type corrugated elastic shims 24. In the case of AN-type corrugated elastic shims as shown in FIG. 11, the semicylindrical anvil 31 has a recess 31' for corrugations 24² in the midlength area on the side adjoining shear blade 38. The edge portions 24³ of the corrugated elastic shim engage the wall of the bending chamber 30 in both BN and AN types as shown in FIGS. 10 and 11.

The material of the strip may be carbon steel such as AISI 1070 or 1074, hardened by heat treatment usually after bending, or stainless steel type 301, which is cold worked usually before bending.

Other compositions of which corrugated elastic shims can be made are beryllium copper (subsequently heat treated), phosphor bronze cold worked to spring properties, or Monel cold worked to spring properties and containing:

Nickel	67% by weight
Copper	30%
Manganese	1%
Iron	1.5%

It will be evident that one of the virtues of the present invention is that the corrugated elastic shims are not rolled in bending and therefore are not likely to have their corrugations crushed or distorted. Resizing, therefore, is not necessary.

It will be further evident according to the present invention that wear on the bending mechanism has been greatly reduced.

Since rolling is not required, the speed of production can be greatly increased, and I find that the production can be speeded up to three or four times the prior rate.

The equipment is not likely to get out of adjustment, and therefore it is possible to operate for long periods without adjustment.

In operation of the mechanism and process of the invention, it will be evident that the initial start of the repeat cycle will be the position shown in FIG. 4, and the end of the cycle, the position shown in FIG. 7, and it is merely necessary to advance the corrugated strip by the feed mechanism the required amount and operate the shear blade and the ejection mechanism to make one corrugated elastic shim on each cycle.

As shown in FIG. 1, I there illustrate a generally circular corrugated elastic shim 50 having corrugations 51 extending transversely of its length and a rim 52 at each side which is free from corrugations.

In FIG. 2, I show a pulley 53 which has a hole 54 in the interior and is fastened to a shaft 56 by a corrugated elastic shim 50 in an annular recess 55.

In view of my invention and disclosure, variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention with copying the structure and method shown, and I therefore claim all such insofar as they fall within the reasonable spirit and scope of my claims.

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

1. In mechanism for bending corrugated strip to make a corrugated elastic shim, walls forming a curved internal bending chamber free from rotating parts, a tangential inlet passage to the bending chamber, an interior anvil in the bending chamber on the side opposite that which the strip first contacts on entering, spaced from the walls of the bending chamber and having a shear edge, a movable shear blade having a position at the outside of the bending chamber and movable generally radially inwardly along the shear edge of the anvil, and feed means for advancing corrugated strip into the tangential inlet passage so that the strip will bend into conformity with the interior of the cylindrical bending chamber around a circular path, the clearance between the anvil and the bending chamber along the path of the movable shear blade being just sufficient to allow one layer of corrugated strip to pass, the surface of the anvil acting as a stop for the end of the strip.

2. Mechanism of claim 1, having feeding means which introduces one and one half turns of strip into the bending chamber.

3. In mechanism for bending corrugated strip to make a corrugated elastic shim, walls forming a curved internal bending chamber free from rotating parts, a tangential inlet passage to the bending chamber, an interior anvil in the bending chamber on the side opposite that which the strip first contacts on entering, spaced from the walls of the bending chamber and having a shear edge, a movable shear blade having a position at the outside of the bending chamber and movable generally radially inwardly along the shear edge of the anvil and feed means for advancing corrugated strip into the tangential inlet passage so that the strip will bend into conformity with the interior of the cylindrical bending chamber around a circular path, in which the bending chamber has an annular recess to receive the corrugations of the strip.

4. In mechanism for bending corrugated strip to make a corrugated elastic shim, walls forming a curved internal bending chamber free from rotating parts, a tangential inlet passage to the bending chamber, an interior anvil in the bending chamber on the side opposite that which the strip first contacts on entering, spaced from the walls of the bending chamber and having a shear edge, a movable shear blade having a position at the outside of the bending chamber and movable generally radially inwardly along the shear edge of the anvil, and feed means for advancing corrugated strip into the tangential inlet passage so that the strip will bend into conformity with the interior of the cylindrical bending chamber around a circular path, in which the anvil has a recess to receive the corrugations of the strip.

5. A method of bending corrugated strip in a cylindrical bending chamber free from rotating parts having an anvil with clearance from the walls of the bending chamber, which comprises feeding corrugated strip tangentially into the bending chamber and between the anvil and the bending chamber wall until one end of the strip abuts against the anvil, bending the strip into a curved shape, shearing the strip generally radially against the anvil and removing the strip axially from the bending chamber.

6. A method of claim 5, which comprises feeding one and one half turns of corrugated strip into the bending chamber before shearing, removing one turn of the sheared strip by ejecting axially and retaining one half turn of strip in the bending chamber to form the next tolerance ring.

7. A method of claim 5, which comprises engaging the strip with the chamber wall only at the edges of the strip.

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