METHOD OF MAKING EXPANDER STEEL

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The object of this invention is to provide a novel method for corrugating spring steel strips into various contours desirable to render them effective as piston ring expanders.

A feature of the improved method is to cause the formed steel to inherently and permanently assume and retain a curved contour.

These ring expanders are made of relatively thin spring steel and the operation of corrugating the steel strips is carried on without heating the strips, hence, it is a cold method.

The method of my invention preferably involves means for forming corrugations, of whatever form desired, and after the corrugations are formed, the method involves a separate operation on the strip, as formed, with a view of causing the formed strip to assume a curved contour, and in the present case, this latter feature is carried out by slightly altering one set of corrugated integers.

It is a feature of my improved method to hold one set of corrugated integers, without changing the form thereof, while the form of the other set of integers is being changed.

The invention will be more fully described in connection with the accompanying drawings and will be more particularly pointed out in and by the appended claims.

In the drawings:

Fig. 1, is a view in side elevation of a machine for carrying out the improved method and illustrating the shaping means while the latter is being retracted from the formed strip.

Fig. 2, is a view similar to Fig. 1, showing the shaping means functioning to shape an integer of one set thereof.

Fig. 3, is a sectional view on line 3—3 of Fig. 2, with the forming wheels in elevation.

Fig. 4, is a sectional view on line 4—4 of Fig. 3, showing the shaping means in a functioning position.

Fig. 5, is an enlarged plan view of a portion of the formed strip, which may be of indefinite length, and showing the same before it is reshaped.

Fig. 6, is an edge view thereof.

Fig. 7, is an edge view of the strip showing an integer of one set of sections thereof shaped to cause the strip to assume and retain a curved contour.

Like characters of reference designate similar parts throughout the different figures of the drawings.

In the following description, and as shown in the drawings, the method referred to will be that designed to make substantially the type of corrugation shown in my U.S. Patent No. 1,534,400, issued April 21, 1925. Further, this application is divided out from my pending application filed Mar. 18, 1927, Serial No. 176,562. However, by merely changing the shape of the forming means and the shaping means, the invention is equally adapted for the manufacture of expander steel of other shapes than that shown.

I have shown a frame which may consist of side walls 1, having suitable journals 2, in which a power driven shaft 3, bears, only one wall and journal being shown. On shaft 3 is suitably mounted any form of crank which may be a disc 4, as shown, the same being concentrically mounted on said shaft. A crank pin 5, is eccentically mounted on disc 4 and I connect thereto, one end of a forming wheel actuating pawl 6, as shown at 7. A guiding stud 8, guides said pawl 6, in a manner to intermittently actuate the forming wheels, to be later described. I have shown a presser head arm 9, pivoted to the frame 1, at 10, and having a presser or shaper head 11, to be later described. Said arm 9, is actuated to be moved upwardly and downwardly by power link 12, the lower end of which is pivoted at 13, to said arm, and the upper end of which is connected to pin 5.

Reference will next be made to the forming means.

The forming means, as shown, involves a set of wheels 14 and 15, which are rotatable on studs 16 and 17, respectively, and which studs are mounted on frame 1. Said wheels have intermeshing teeth 18 and 19, respectively, which are strip forming portions or elements, the spaces 20 and 21, respectively, between said teeth being also forming elements. This mesh relation of the wheels...
14 and 15, insures their rotating in unison, one being driven from the other. As shown the right hand end of pawl 6, engages the uppermost teeth of wheel 4, and every time the disc 4, makes a half revolution, in a clockwise direction, viewing Fig. 1, the wheels 14 and 15 will be rotated to the extent of one tooth and will form one corrugated integer of the strip.

On the remainder of the revolution of disc 4, the pawl 6 will be retracted to the position shown at Fig. 1. The stud 8, is so located that when the wheel 14 has been rotated to the extent of one tooth thereof, the pawl 6, will be raised out of engagement with the wheel. The strip, in blank, is indicated in edge elevation at 22, and passes through any suitable guide 23, secured to the frame 1.

I will next describe the form of expander shown in Fig. 6. This expander is formed with alternately and oppositely disposed bearing sections, and intermediate supporting sections. I will term those sections which are disposed radially outwardly as the outer or piston ring engaging sections and will indicate them at 24, each comprising one integer of the formed strip. It will be noted that sections 24, are convexly formed so that when tensioned against the piston ring, they will more or less flatten by reason of the fact that they are arched on a less radius than the radius of the piston ring with which they coact. Likewise, when the inner sections 25, leave the forming rolls 14 and 15, they are convexly arched radially inwardly toward the base of the piston ring groove, which they are designed to engage. I will designate the intermediate supporting sections at 26, and it will be seen that these sections are disposed sufficiently radially so that they will support or stiffen the sections 24 and 25. The teeth of the wheels 14 and 15, are shaped to form a strip having these elongated outer and inner sections 24 and 25, and the intermediate supporting sections 26, and I will refer to each bend or section as an integer of the formed strip.

If the formed strip, as shown in Fig. 6, was in no way treated after leaving wheels 14 and 15, it would maintain itself straight, or in a straight condition, and it would be necessary to manually bend a cut portion thereof around a piston groove. This is considered such a defect that specially bent and previously cut expander steel is now being sold. Besides this defect, it is usually found best to roll the formed steel on a spool in order to get it into convenient and compact shape for the market and shipment. Thus, when a mechanic gets ready to use it, and releases the roll of spring steel, the latter instantly seeks to straighten out, much after the manner of a clock-spring when the latter is released from a tensioned condition.

Now it is the object of my invention to make a completely formed corrugated strip of piston ring expanding spring steel in such a manner that the finished steel will take a curved contour so that when a length is cut off for a piston groove, this length will fit or "hang" the groove. Thus the mechanic's hands will be free to spread the ring over the piston without having to hold the steel into the groove.

I will next refer to that portion of the mechanism for carrying out this phase of the method.

An anvil is designated at 27, and is removably secured to frame 1, by screws 28. This anvil 27, has what I will term a holding portion 29, which, as will be seen from Fig. 2, is shaped to correspond and receive one integer 24, and a part of integer 25, together with an intermediate integer 26. Of course this holding portion may be extended to receive more of the formed strip than is herein shown, but the important thing is that the holding portion 29, is shaped to receive the strip without changing the shape of the strip portion held thereby.

In other words, the portion 29, functions solely as a holding portion. Contiguous with this holding portion 29, is a shaping portion 30, and the latter is so positioned that when the integers 24 to 26 are disposed upon the holding portion 29, the next endmost adjacent integer 25, will engage the shaping portion 30, as in accordance with this specific form of the invention, I concentrate the shaping operation only on sections 25, which are the inner sections. Now it will be seen that the inner sections 25, when the formed strip leaves the wheels 14 and 15, are convexly formed radially inwardly, as will be seen from Fig. 6. This shaping portion 30, is convex, with a view of changing the shape of sections 25, from the inwardly convex form shown in Fig. 6, to the outwardly convex form shown in Fig. 7. The coating or companion element of the shaping means is the presser head 11, which is provided with holding portion 31, complementary to the holding portion 29 of the anvil, to securely hold a portion of the strip while the latter is being reshaped. The head 11, is also provided with a shaping portion 32, which coacts with shaping portion 30.

From the foregoing, it will now be clear that by reversing the convexity of one of the sets of sections, which in this disclosure, comprises sections 25, I cause the strip to assume a curved form when it leaves the shaping means, as generally indicated in Fig. 2. The extent and character of the reshaping may be varied as desired, either as regards the form of the strip shown, or as regards other forms of strips. In the present instance, the reverse convexity of sections 25, is made on a radius greater than the radius of the piston ring groove so that the inner sections will, if neces-
sary, flex into full length engagement with the base of the groove, and in most cases, will form a saddle for engagement with such groove.

While the sections 25 are shaped toward the "round" of the surface with which they coact, it is clear that they will have a much longer area of engagement therewith than if these sections were curved the reverse of the "round" they engage. Now it will be clear that the strip is not acted upon, in the performance of this operation as a whole, but it is acted upon as regards individual sections thereof, and in the present case, this individual action is consecutively performed as the several sections come into working range of the shaping means.

It will now be clear that while the disc 4 is rotating clockwise, viewing Fig. 1, it is lifting the presser head 11, away from the anvil and is about to advance the wheels 14 and 15, the distance of one tooth thereof, or any desired distance dependent upon the location of the anvil and presser head and the length of the sections formed in the strip. After the wheels have been actuated, then, friction holds them in the position from which they have been released. As pin 5, begins its downward movement, the presser head 11, is moved downwardly toward the anvil, as shown in Fig. 2, until it comes into pressure engagement therewith. As pin 5, passes over the lower dead center, the final and maximum pressure is applied, firmly holding certain sections of the strip, and being the remaining section. Thus, the forming means is idle when the shaping means is functioning and the shaping means is idle when the forming means is functioning.

It is believed that the improved method will be fully understood from the foregoing and I do not wish to be limited thereby except for such limitations as the claims may import.

I claim:

1. The herein-described method of making expander steel, which consists, in corrugating a spring steel strip to form alternately and oppositely disposed outer and inner bearing sections, and in bending the formed inner sections outwardly to cause the finished strip to assume a curved contour.

2. The herein-described method of making expander steel, which consists, in bending a spring steel strip to form alternately disposed outer and inner elongated bearing sections, and in bending the inner bearing sections convexly outwardly to substantially fit the base of the piston groove.

3. The herein-described method of making expander steel, which consists, in bending a spring steel strip to form alternately disposed outer and inner elongated bearing sections and immediately disposed supporting sections, and in shaping the inner sections outwardly to cause the finished strip to assume a curved contour.

In witness whereof I have hereunto affixed my signature.

GEORGE C. BECK.