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R. W. COOK

2,043,152

SPRING

Filed April 24, 1933

FIG. 1.

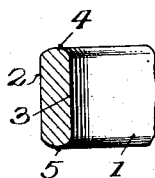


FIG. 2.

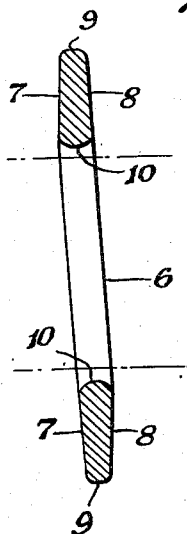


FIG. 3.

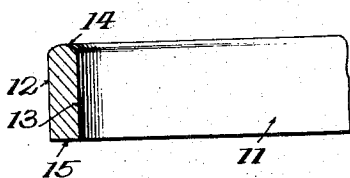


FIG. 4.

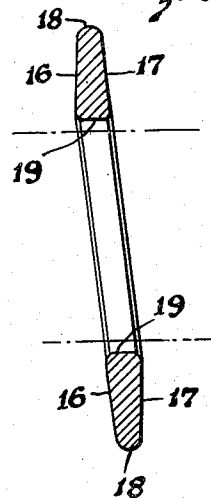
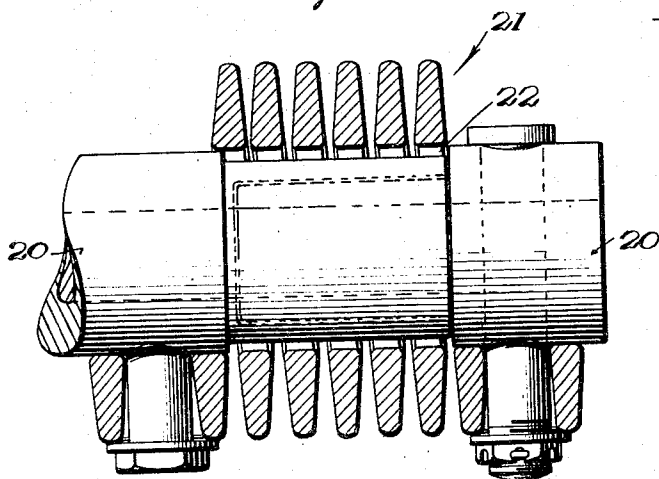


FIG. 5.



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SPRING

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2 Claims. (Cl. 267—1)

This invention relates to springs and, more particularly, is intended to provide a torsional coil spring of a new construction.

It has heretofore been proposed, and is now the usual practice, to form coil springs of the type used in the Bendix starter drive by coiling about a mandrel a length of metal stock. Such metal stock has heretofore been formed with two parallel faces forming the sides of the stock and two shorter convexed or outwardly-curved faces forming the other external faces of the stock. This stock is wound helically about the mandrel to form the spring coil. Certain disadvantages have been found in practice to reside in the manufacture of coil springs in this manner and from the material described, the principal disadvantage being that the stock, bearing as it does with a short convex face against the mandrel, tends to turn over or deform from a position at right angles to the mandrel to a position at an acute angle to the mandrel and in which the convolutions of the spring coil are unevenly spaced, whereby the coil is ruined for all practical purposes. Another disadvantage residing in a spring formed from stock of the type described above is due to the fact that, while the face of the spring which bears against the mandrel in the coiling operation is somewhat flattened during that operation, it still retains a curvature which, when the spring coil is placed in position about a shaft, causes excessive wear of the shaft when relative rotation between the spring and shaft occurs. To avoid these difficulties many solutions have been proposed and are well-known in the art. None of them have, however, completely solved the problem and the need for such a solution has long been apparent.

The invention therefore has for its object the provision of a torsional coil spring which will be so formed as to provide maximum bearing surface between the spring and a shaft about which the spring may be coiled, and which will also be formed with an outer peripheral portion having a curved surface, whereby the spring will have the maximum load capacity with a minimum fiber stress and, thereby, the maximum fatigue value.

By reason of this invention there is therefore provided a helically coiled spring the inner faces of the convolutions of which are relatively wide and extend substantially parallel to the axis of the coil throughout the greater part of their area, the outer faces of the convolutions being curved in order to give minimum fiber stress for a given load, these inner and outer faces being connected

by relative long, substantially flat faces which converge toward the outer faces of the convolutions.

Other objects and features of novelty of the invention will be apparent from the following description and the annexed drawing, it being expressly understood, however, that the invention is in no way limited by such description and drawing or otherwise than by the appended claims.

Referring now to the drawing wherein similar reference characters refer to like parts;

Fig. 1 is a view, partly in section, of stock from which springs have been made according to the prior art;

Fig. 2 is a view, partly in section, of one convolution of a spring coil after the spring has been coiled from the stock disclosed in Fig. 1;

Fig. 3 is a view, partly in section, of a piece of stock from which it is proposed to coil a spring according to the present invention;

Fig. 4 is a view, partly in section, of one convolution of a spring coil which has been formed from the stock shown in Fig. 3; and

Fig. 5 is a sectional view of a spring formed according to the present invention and shown in operative relation to other parts.

As stated hereinbefore, it has been the practice, in forming springs of the type used in the Bendix starter drive, to coil a length of stock about a mandrel. Such stock, as heretofore employed, has usually been formed with a cross-section as disclosed in Fig. 1 of the drawing, such stock, being generally designated by the numeral 1, having the parallel side faces 2 and 3 forming the longer sides of the cross section of the stock, and the outwardly-curved or convexed shorter faces 4, 5. During the operation of winding this stock about a mandrel to form a helical spring, the tension exerted on the stock causes a slight deformation of the stock, such that the cross-section of the wire forming the completed spring coil is like that illustrated in Fig. 2. Referring to this figure, it will be seen that the spring wire 6 comprises the longer, slanting faces 7, 8 which diverge toward the center-line of the spring coil, and the outwardly-curved or convexed shorter faces 9, 10. It will be seen that, while a certain deformation of the cross-section of the wire has taken place during the coiling operation, the inner face 10 of the finished spring wire retains a great amount of curvature.

It has been found that due to the curvature of the face 5 of the uncoiled stock, as disclosed in Fig. 1, the stock has a tendency to turn over or deform on the mandrel during the coiling opera-

tion, while due to the curvature of the face 10 of the completed spring, as disclosed in Fig. 2, such face, bearing as it does on the shaft about which the spring may be assembled in use, bears against such shaft and causes excessive wear thereof when relative rotation between the spring and shaft takes place.

According to the present invention, the spring coil is formed by winding about a mandrel a length of stock having a cross-section as disclosed in Fig. 3 of the drawing. This stock, designated generally by numeral 11, comprises the longer parallel faces 12, 13, a shorter, outwardly-curved face 14, which is similar in shape to the faces 4, 5 of Fig. 1, and a second shorter, flat face 15 which is oppositely-disposed from the face 14. Stock formed in this manner is adapted, according to the present invention, to be coiled about a mandrel in the usual manner but, due to the fact that the flat face 15 bears against the mandrel in the coiling operation, a firm and solid bearing between the mandrel and stock will be provided and all possibility of turning over or deformation of the spring wire during coiling will be obviated.

After completion of the coiling operation, the spring wire will have the cross-section illustrated in Fig. 4 and will comprise the two flat, slanting sides 16, 17 which diverge toward the axis of the spring coil, the outer, convex face 18, and the inner, flat face 19. The deformation of the spring stock of Fig. 3 during the coiling operation is such as to widen the inner face of the spring stock without affecting the outer curved face thereof. There will thus be provided a spring, each convolution of which will have a flat inner face providing maximum bearing surface on a shaft about which the spring may be coiled in use, while the outer surface of which will be curved so that minimum fiber stress will be caused during the coiling operation and when the spring is under a given load.

Due to the above described deformation of the spring wire during the coiling operation, the inner face of the spring will be broader than the similar face of a spring formed in the manner taught by the prior art, and will also be flat throughout substantially all of its area, as compared to the rounded configuration of the corresponding face of prior art springs. There is

thus provided a maximum bearing surface between the spring and the shaft on which it is assembled in use, as the shaft 20 of Fig. 5 upon which the spring 21, formed according to the present invention, is coiled. The flat faces 22 of the spring convolutions, bearing on the shaft over a maximum bearing area, reduce the wear on the shaft due to relative rotation between the spring and the shaft.

While one modification of my invention has been illustrated and described in the present application, it will be apparent to those skilled in the art that modifications and changes may be made therein without departing in any way from the spirit of the invention, for the limits of which reference must be had to the appended claims.

What is claimed is:

1. A torsional coil spring formed from a strip of wire having substantially the same cross-section throughout its length, the wire of the spring coil being of greater width than thickness, the sides of the wire being defined by elongated substantially flat faces which converge from the inner face of the wire toward the outer face thereof, the inner face of the wire being broader than the outer face and being flat throughout substantially all of its area to provide maximum bearing surface, the narrower outer face of the wire being curved to give minimum fiber stress under a given load.

2. A torsional coil spring for engine starters, said spring being formed from a strip of wire having substantially the same cross-section throughout its length, the wire of the spring coil being of greater width than thickness, the inner face of each convolution of the wire being flat throughout substantially its entire area to provide maximum bearing surface between the coil spring and a shaft on which the spring may be mounted, the outer face of each convolution being narrower than the inner face and being curved to give minimum fiber stress for a given load, the inner and outer faces being connected by elongated substantially flat faces which converge from the inner face toward the outer face, the end coils of said spring terminating in curved loops disposed on one side edge of the spring coil.

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