July 12, 1938. E. J. PODANY 2,123,798

APPARATUS FOR FORMING AND TREATING SINUOUS SPRINGS

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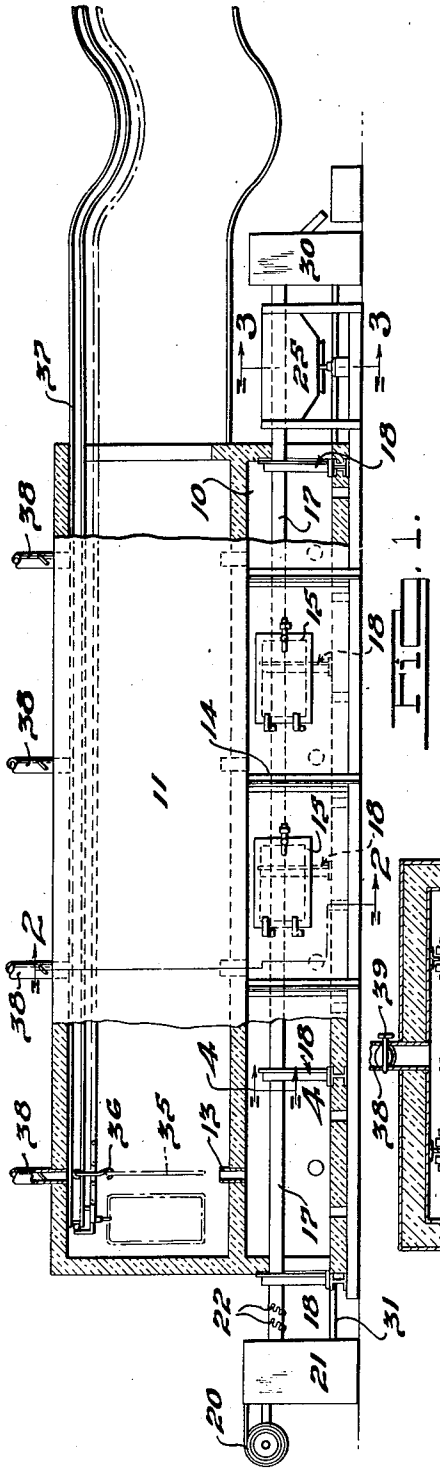

Fig. 1.

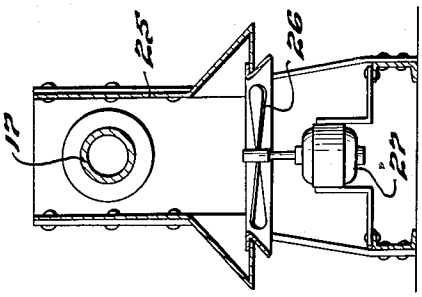

Fig. 3.

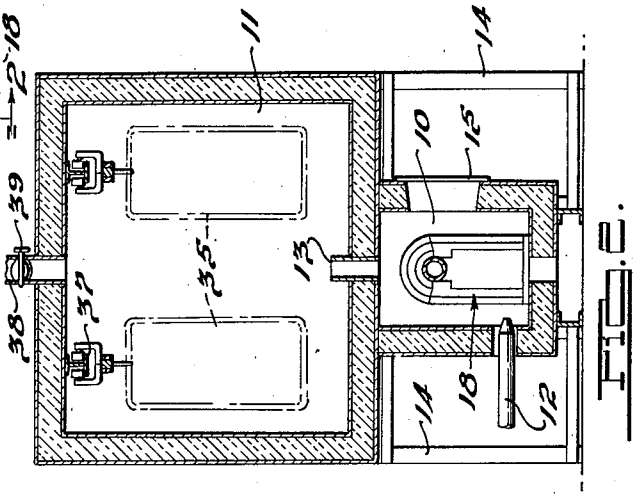

Fig. 2.

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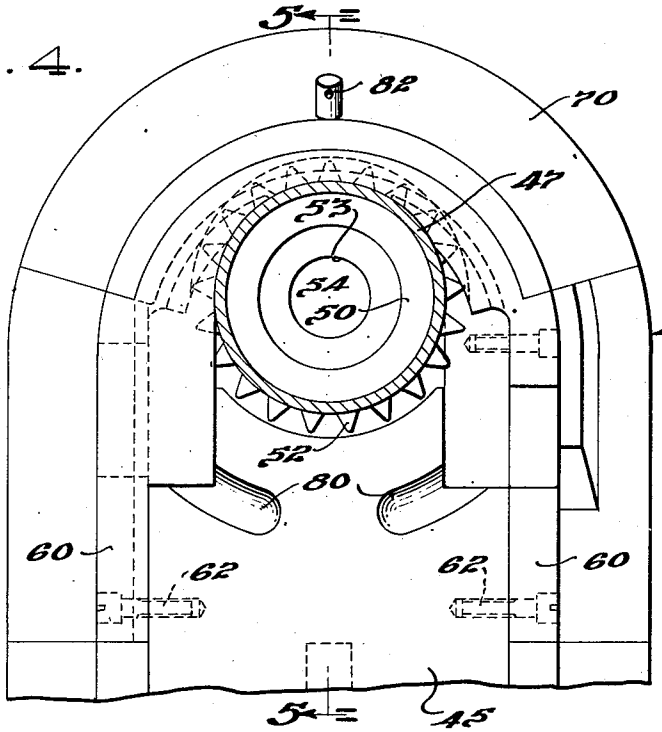
Fig. 4.



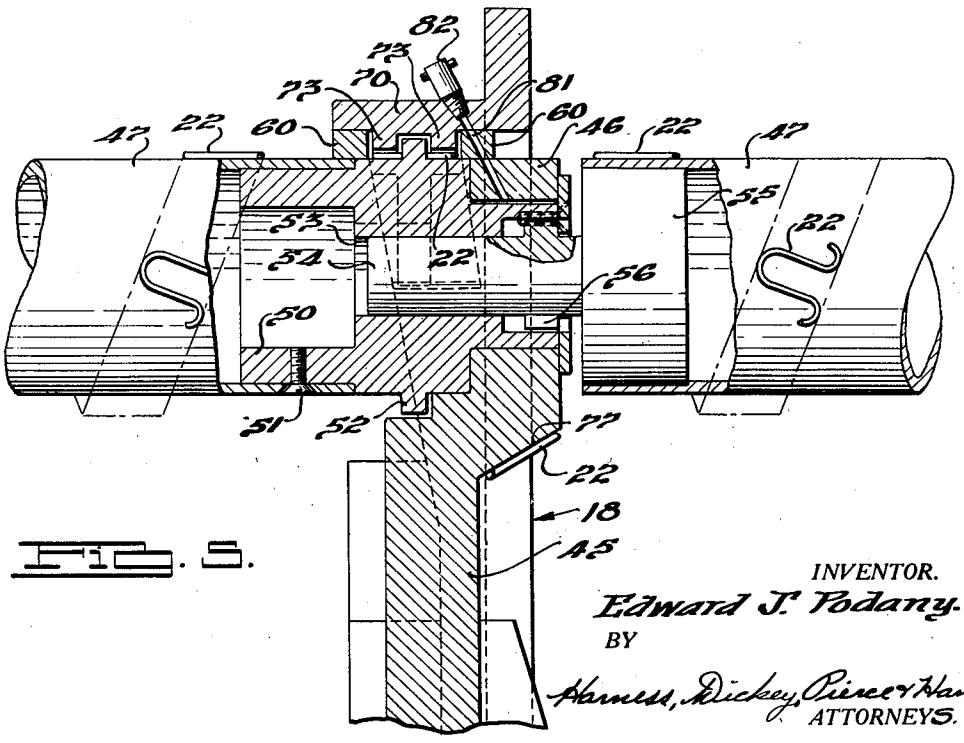


Fig. 5.

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Fig. 6.

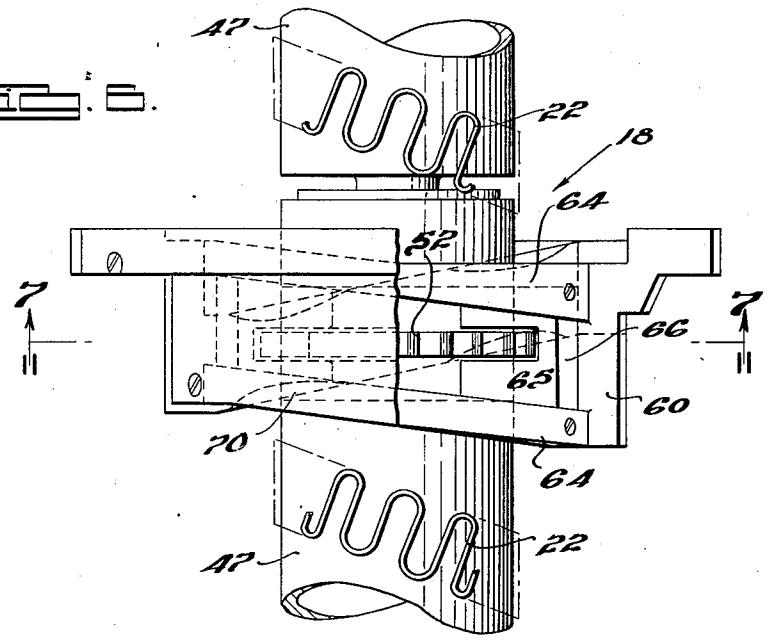
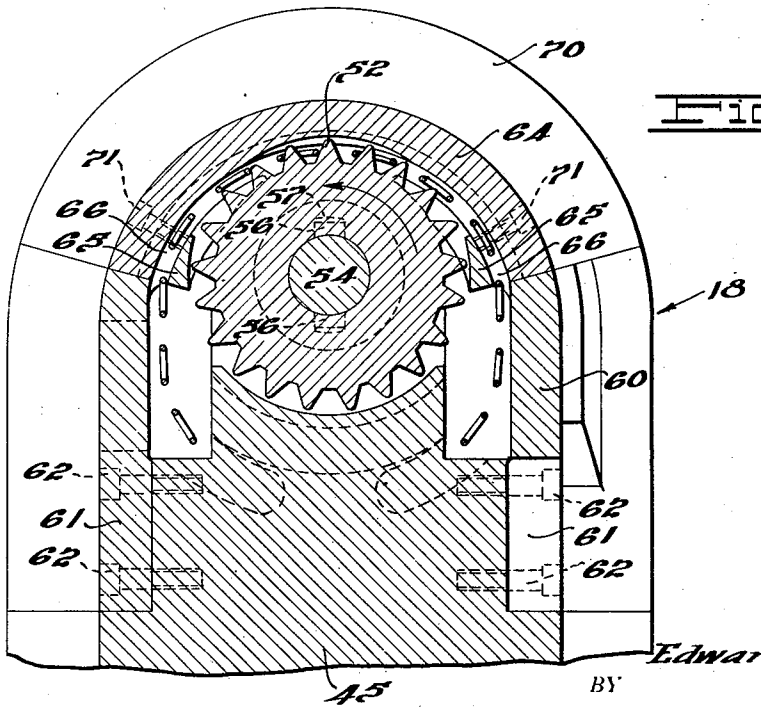


Fig. 7.



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UNITED STATES PATENT OFFICE

2,123,798

APPARATUS FOR FORMING AND TREATING SINUOUS SPRINGS

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Application February 24, 1936, Serial No. 65,402

14 Claims. (Cl. 29—33)

This application relates to spring treating apparatus. More particularly it relates to a novel method and apparatus for treating and forming sinuous arcuate spring elements of the type disclosed in the Kaden Patent No. 2,002,399.

It is a primary object of the present invention to provide automatic, continuously operated apparatus for bending steel wire into a series of similar, adjacent lateral convolutions to form a continuous spring element, subsequently bending the spring element thus formed to an arc of predetermined curvature, and heat treating the spring element to normalize it to this arc. Subsequently means are provided for severing the continuous spring element into predetermined lengths which may be utilized in the preparation of seat constructions such as are shown in the Kaden patent referred to above.

The present invention contemplates the provision of an oven for normalizing the spring element to an arc of predetermined curvature and contemplates the use of a second oven superimposed thereon which is heated by the exhaust gases from the normalizing oven and which may be utilized for the purpose of performing subsequent heat treating operations upon the spring elements or cushion constructions formed from spring elements manufactured by the practices of the present invention.

Primarily, the present invention is concerned with the provision of automatically operable apparatus which may be run substantially continuously in order to produce a substantially uniform product.

The present invention contemplates the provision of a rotary shaft structure which extends through the normalizing oven. Means are provided adjacent one end of the shaft for generating from conventional steel spring wire a continuous spring element formed of a series of adjacent similar lateral convolutions all lying in substantially the same surface. This spring element is then fed helically around the rotary shaft structure which passes through the normalizing oven. Bearings are provided at suitable spaced points along the shaft for supporting it and means are provided adjacent these bearings for feeding the helically disposed spring elements through the bearings substantially continuously as the shaft rotates, without materially disturbing the helical path thereof.

Adjacent the discharge end of the oven, the helical spring element which has been heat treated in the oven is passed through a cooling unit in order to substantially reduce its temperature and subsequently this spring element passes through a cut-off mechanism for severing the spring element into arcuate sections of predetermined lengths. Means are provided for interconnecting this severing mechanism with the spring forming machine at the feed end of the oven in order that these two units may be synchronously operated.

Many other and further objects and advantages of the present invention will become apparent from the following specification when considered in connection with the accompanying drawings forming a part thereof.

In the drawings:

Figure 1 is a more or less diagrammatic vertical sectional view through the apparatus, disclosing the general construction and arrangement of the various units thereof;

Fig. 2 is an enlarged vertical, sectional view, taken substantially on the line 2—2 of Fig. 1, illustrating the superimposed oven structure and the mounting of the conveyor systems therein;

Fig. 3 is an enlarged vertical, sectional view, taken substantially on the line 3—3 of Fig. 1, illustrating in detail the cooling unit and the mechanism by which the helical spring element is fed therethrough;

Fig. 4 is an enlarged transverse, sectional view, taken substantially on the line 4—4 of Fig. 1, illustrating in detail one of the bearings for supporting the feed shaft within the oven;

Fig. 5 is a longitudinal sectional view, taken substantially on the line 5—5 of Fig. 4, illustrating in detail the bearing construction and the manner in which adjacent shaft sections are secured together;

Fig. 6 is a fragmentary top plan view, with portions broken away, showing the bearing construction illustrated in Figs. 4 and 5;

Fig. 7 is a sectional view taken substantially on the line 7—7 of Fig. 6, illustrating in detail the bearing construction and the sprocket member for feeding the spring element in a helical path therethrough.

With more particular reference to the drawings, the specific embodiment of the invention disclosed therein comprises a pair of superimposed ovens 10 and 11, the lower of these ovens 10 may be heated by a suitable series of inwardly directed burners 12 and it will be seen by reference to Fig. 2 that the wall between the ovens 10 and 11 is provided with a suitable series of interconnecting ducts or flues 13 which serve to permit the passage of the exhaust gases from the oven 10 upwardly into the oven 11.

As will hereinafter become more clear, it has been found desirable to produce a temperature of between four and five hundred degrees Fahrenheit in the lower oven 10 and this temperature has been found to produce, as a result of the exhaust therefrom, a temperature of two to three hundred degrees Fahrenheit in the upper oven 11. It will be seen that the upper oven is of considerably larger cross sectional area than the lower oven 10 and consequently an auxiliary supporting framework 14 may be provided for supporting this upper oven with respect to the floor on which the structure as a whole is mounted.

As is conventional in structures of this kind, the oven 10 may be provided along with its front face with a suitable series of doors 15 through which access may be had to the interior of the oven for the purpose of adjusting the bearing construction hereinafter described, or such other purposes as may be desired.

A shaft structure 17, preferably composed of a series of coaxially interconnected sections, extends throughout the entire length of the oven 10 and extends a substantial distance outwardly at either end thereof. This shaft structure and the manner in which the adjacent sections thereof are interconnected is shown in Figs. 4 to 7, inclusive, and described below in detail.

The shaft structure 17 is supported at suitable intervals throughout its length by means of bearing supports 18 which are also shown in detail in Figs. 4 to 7 and described specifically below.

Adjacent one end of the structure as a whole, is mounted a reel of steel wire 20 supplying a spring forming machine 21 which serves to bend the wire into a plurality of adjacent lateral convolutions all lying in substantially the same surface. While this machine may be of any suitable construction desired, I prefer to utilize a machine manufactured in accordance with the teachings of the Horton application, Serial No. 35,705, filed August 12, 1935, assigned to the assignee of the present invention. By reference to this prior co-pending application, it will be seen that the steel wire 20 from the reel is passed through the machine 21 and fed outwardly therefrom as a continuous, sinuous spring, comprising a series of adjacent lateral convolutions, all lying in substantially the same surface. Suitable means, not shown, are provided for slowly rotating the shaft structure 17 at a speed in accordance with the delivery of the spring, and the sinuous spring element 22 is fed thereon in a continuous helix. In order to effect continuous operation of the machine, it has been found desirable, when the reel of wire 20 has become exhausted, to weld wire from an additional reel to the end thereof in order that the machine may operate uninterruptedly.

The spring element 22 is fed substantially continuously along the shaft 17 as this shaft rotates, and as will hereinafter be more clearly seen this spring element is fed through the bearing structures of the shaft and consequently through the entire longitudinal length of the oven and throughout this travel is maintained in a helical path, the diameter of the helix being substantially constant.

Due to the fact that the shaft structure is of substantially uniform diameter throughout its entire length, it will be appreciated that the helical spring element surrounding the shaft will lie in a helix of substantially uniform diameter and consequently the element as a whole will be formed on an arc of substantially uniform radius. It has been found that subjection of this spring element to heat treatment while bent to this predetermined arc serves to normalize and temper the steel wire in such a manner that the spring element has an inherent tendency to maintain the arcuate curvature to which it is bent. By reference to Figs. 1 and 3, it will be seen that after leaving the oven 10, the helix of wire surrounding the shaft structure 17, on which it is carried, passes through a cooling mechanism shown in detail in Fig. 3. While any suitable mechanism may be utilized for the purpose of reducing the temperature of the spring element, I prefer to utilize a chamber 25 through which air may be circulated by means of a fan 26 driven by a suitable electric motor 27. This cooling mechanism serves to reduce the temperature of the spring element and it is clearly seen, by reference to Fig. 1, that after leaving the cooling chamber 25, the shaft and spring element pass into an automatic cut-off mechanism 30, which may be manufactured in accordance with the teachings of the Horton application referred to above.

By reference to this prior Horton application, Serial No. 35,705, it will be apparent that in the structure shown therein the cut-off mechanism for severing the continuous sinuous spring element into sections of predetermined length was built into and formed an integral part of the spring forming mechanism. In the case of the present invention, however, it has been found particularly desirable to normalize the spring element to a predetermined arcuate curvature prior to the severance of the spring element as a whole into individual arcuate sections. Consequently, the structure shown by the Horton application referred to above has been modified to space the cut-off mechanism 30 a substantial distance away from the spring forming mechanism 21. A longitudinally disposed shaft 31 is provided which interconnects this spring forming mechanism with the cut-off mechanism 30 in order that these two mechanisms may be operated in synchronism in order that the lengths of the sections to be cut off may be directly controlled from the spring forming machine.

It will be clearly apparent from the foregoing that the structure herein shown and described provides apparatus which will serve to sever predetermined lengths automatically from the continuous spring element which is fed along the shaft structure 17.

After severance, the individual arcuate spring units may be mounted and tensioned in spring frames and sprayed with a coating of paint as is conventional in cushion constructions of the particular type with which the present apparatus is concerned. After these spring cushions 35 have been sprayed with paint, they may be supported on suitable carriages 36, which serve to convey them longitudinally throughout the entire length of the upper oven 11 on a conveyor trackway 37. As has been explained above, this upper oven 11 has been heated by the exhaust gases from the lower oven 10 and is maintained at a sufficiently high temperature thereby to provide satisfactory means for baking on the paint coating which has been applied to these frames. In this manner it will be seen that the exhaust from the normalizing oven serves to provide means for baking on the paint coating subsequently applied to the spring elements treated in the normalizing oven. Suitable exhaust stacks 38 may be provided in the upper surface or wall of the upper oven 11 in order to conduct the exhaust gases therefrom.

These exhaust stacks 38 may, as is conventional in the art, be controlled by suitable dampers 39 in order that the temperature of the upper oven 11 may be accurately regulated and maintained.

The bearing members for supporting the longitudinally extending shaft structure form a particularly important part of the present invention. This construction is shown in detail views, Figs. 4 to 7, inclusive. The bearing support structure, designated generally by the character 18, comprises a main supporting base 45, which may be suitably secured on the floor of the oven or any other suitable structure exteriorly of the oven, depending upon the particular placement of the bearing which it serves to support. This support structure 45 is provided at its upper end with a transversely extending, cylindrical, bearing opening 46, which, as will more clearly be seen hereinafter, constitutes the journal for the shaft structure 17.

The shaft structure preferably comprises tubular members 47 which are interconnected in coaxial driving relation at each of the bearing structures 45 throughout the longitudinal length of the assembly. One of these members 47 is provided with a casting 50 which is telescoped in the end thereof and permanently secured in position by means of suitable set screws 51. This casting is preformed to provide a sprocket or star wheel 52, the crest diameter of the teeth of this star wheel being greater than the outside diameter of the tubular members 47, and the diameter of the wheel at the root of the teeth being substantially the same as the exterior diameters of tubular members 47. The casting 50 is provided with an axial aperture 53 which is adapted to receive a suitable cylindrical projection 54 formed on a fitting 55 telescoped into the adjacent end of the adjacent tubular member 47. The projection 54 may be provided with radially extending integrally formed keys 56 which serve to cooperate with axially extending slots or splineways 57 formed in the casting 50, in order that a driving relation will be established between the adjacent tubular members 47.

The casting 50 is of reduced diameter at its axial end and is adapted to fit within the cylindrical aperture 46 formed in the upper end of the bearing support structure 45. It will therefore be apparent that this cylindrical aperture 46 serves to provide a journal for permitting rotation of the shaft with respect to this supporting structure.

A generally U-shaped guiding housing 60 serves to surround and enclose the sprocket wheel 52 and provides structure which serves to feed the helically disposed spring element 22 through the bearing structure in the manner hereinafter described in detail. This guiding housing 60 is of generally U-shape and has depending portions 61 which serve to engage complemental surfaces upon the upper portion of the support structure 45 and the housing as a whole is preferably secured thereto by means of suitable screws 62. The portion of this guide housing which extends over the top of the shaft preferably comprises a pair of bars 64, which are spaced apart substantially the width of the spring element which is to be fed through the bearing structure. These bars preferably extend arcuately around the shaft structure as a whole and helically with respect thereto. The bars are preferably mounted in substantially spaced relation on either side of the sprocket wheel 52. On the lateral opposite sides of the sprocket wheel 52, the bars 64 are interconnected by means of suitable bridging members 65 which serve to cooperate with the bars and sprocket wheel to provide a guide chute 66 for feeding the sinuous spring element through the bearing structure. The guide housing is covered by a cover housing 70 which is preferably secured thereto by means of suitable bolts 71 and serves to cooperate with the guide housing and bridging members 65 to complete the passageway or chute through which the sinuous spring element is fed. This cover housing is preferably provided with a pair of arcuately disposed depending flanges 73 which extend arcuately around the shaft structure and are preferably formed upon an arc of considerably greater diameter than that of the shaft structure and it will be seen by reference to Fig. 5 that one of these radially inwardly projecting flanges is disposed on each side of the sprocket wheel 52 and between the sprocket wheel and the arcuately extending guide bars 60. It will therefore be clear that these inwardly directed flanges 73 serve to engage the surface of the sinous spring element being fed through the bearing and force this spring element into engagement with the teeth of the sprocket wheel 52 and as clearly seen in Fig. 7, it will be appreciated that these guide flanges 73 approach a point of maximum proximity to the surface of the shaft structure at substantially the upper side thereof.

It will be apparent that as the shaft structure as a whole is rotated, the spring element 22 will be fed upwardly through the chute 66 on the left hand side in Fig. 7, and will be forced into engagement with the sprocket wheel 52. Inasmuch as the sprocket wheel 52 is an integral part of the shaft structure, it will rotate therewith and feed this sinuous spring element down through the chute 66 on the right hand side of Fig. 7 and out onto a surface 77 of the bearing support structure clearly seen in Fig. 5. From this point, it will be seen that the spring element 22 will extend in a helical path up and around the adjacent cylindrical shaft structure on the opposite side of the bearing. As is clearly seen in Fig. 4, the supporting structure 45 is provided with suitable helically extending rounded recesses 80 which serve to aid in guiding the spring element into the chute 66.

In order to provide means for lubricating the bearing structure, a duct 81 may be drilled downwardly through the supporting housing 70, guide housing 60, and bearing structure 46, to communicate with the bearing surface of the casting 50. Lubricant may be supplied to this bearing by means of a suitable fitting 82.

It will be apparent from the foregoing that the structure which has been disclosed herein will permit of substantially continuous and uninterrupted operation. The speed at which the apparatus is operated may be proportioned in accordance with the length of the particular oven used in order that the heat treatment to which the sinuous spring element is subjected will be sufficient to normalize this element to proper condition at the time it leaves the oven to be cooled. It will further be apparent that throughout the entire time which the spring element is disposed within the oven, it lies in a helical path and consequently it will be apparent that as the spring element leaves the oven, it will be normalized to a curvature of relatively small radius and it may then be cut in suitable lengths particularly adaptable for the use in manufacture of seat cushions in accordance with the teachings of the Kaden patent referred to

above. As will be apparent by reference to this patent, it is highly desirable that the arc upon which the sinuous spring elements are normalized be of substantially less radius than the arc in which the spring elements are disposed when they are in use, in order that the spring elements will necessarily be tensioned substantially when mounted in final position in a seat structure.

The above described construction clearly makes possible the normalizing of a substantial section of spring wire upon an arc of definitely predetermined, relatively short radius.

The above specific embodiment of the invention is merely illustrative of the generic concept defined in the subjoined claims. Many other and further modifications will be apparent to those skilled in the art.

I claim as my invention:

1. In combination, an oven, a shaft extending through said oven, means outside said oven for forming a substantially continuous sinuous spring, means for feeding said spring helically around said shaft to pass the same through said oven.

2. In combination, an oven, a shaft extending through said oven, means outside said oven for forming a substantially continuous sinuous spring, means for feeding said spring helically around said shaft to pass the same through said oven, means for cutting said spring into predetermined lengths upon leaving said oven, and means for operating said spring forming and cut-off means in synchronism.

3. In combination, an oven, a shaft extending through said oven, means outside said oven for forming a substantially continuous sinuous spring, means for feeding said spring helically around said shaft to pass the same through said oven, means for cutting said spring into predetermined lengths upon leaving said oven, and a shaft interconnecting said spring forming means and said spring cut-off means for effecting synchronous operation thereof.

4. In combination, a spring forming machine for generating a substantially continuous spring element formed of a series of adjacent lateral convolutions, an oven, means for feeding said spring element through said oven, means for cooling said spring element upon leaving said oven, means for automatically severing said spring element into predetermined lengths upon leaving said cooling means, and a shaft interconnecting said spring forming means and said cut-off means for operating the same in synchronism.

5. In spring treating apparatus, a rotary shaft, means for driving said shaft, bearings for said shaft, means for feeding a sinuous spring in a continuous helix about said shaft and a sprocket wheel on said shaft in one of said bearings for engaging said spring and feeding the same through said bearing.

6. In spring treating apparatus, a bearing construction comprising a shaft having a sprocket wheel secured thereon coaxially therewith, bearing surfaces engaging said shaft on either side of said sprocket wheel and apertures in said bearing surfaces allowing the passage of a spring element through said bearing.

7. Spring treating apparatus including, in combination, an oven, a plurality of bearing supports in said oven, a shaft mounted in said bearing supports and extending through said oven and means for feeding spring wire helically around said shaft through said oven.

8. Spring treating apparatus including, in combination, an oven, a plurality of bearing supports within said oven, a shaft rotatably mounted in said bearing supports, means for feeding spring wire helically around said shaft through said oven and means associated with each of said supports for guiding said spring wire around said bearings to permit movement thereof along said shaft.

9. Spring treating apparatus including, in combination, an oven, a plurality of supports within said oven, a shaft journaled for rotation on said supports, means for feeding spring wire helically around said shaft through said oven and means associated with each of said bearing supports for guiding said wire along said shaft past said supports.

10. Spring treating apparatus including, in combination, an oven, a plurality of bearing supports within said oven, means for feeding spring wire helically around said shaft through said oven and means on said shaft adjacent each of said bearing supports adapted to engage said spring wire and feed the same along said shaft.

11. Spring treating apparatus including, in combination, an oven, a shaft extending through said oven, means for feeding spring wire helically around said shaft and through said oven, sprocket wheels on said shaft adapted to engage said spring wire and feed the same therealong and means for rotating said shaft.

12. In combination, an oven, a shaft of substantially uniform diameter extending through said oven and projecting from opposite sides thereof, means on one side of said oven to feed sinuous spring wire onto said shaft in a helix therearound, means for feeding said spring wire through said oven while retained in helical form on said shaft, and means on the opposite side of said oven for removing said spring wire from said shaft.

13. Apparatus for normalizing sinuous spring wire comprising an oven, a cooling housing mounted adjacent said oven, a continuous shaft extending through both said oven and cooling unit and means for feeding sinuous spring wire in a continuous helix around said shaft and means for feeding the same serially through said oven and subsequently through said cooling housing while retaining the same in helical form.

14. In combination, an oven and a cooling housing, a shaft extending through said oven and cooling housing, means outside said oven for forming a substantially continuous helical spring and means for feeding said spring around said shaft to pass the same through said oven and cooling housing.

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