Oct. 21, 1930. W. HOLNESS 1,779,131

PROCESS FOR PRODUCING HELICALLY COILED SPRINGS OF UNIFORM LENGTH

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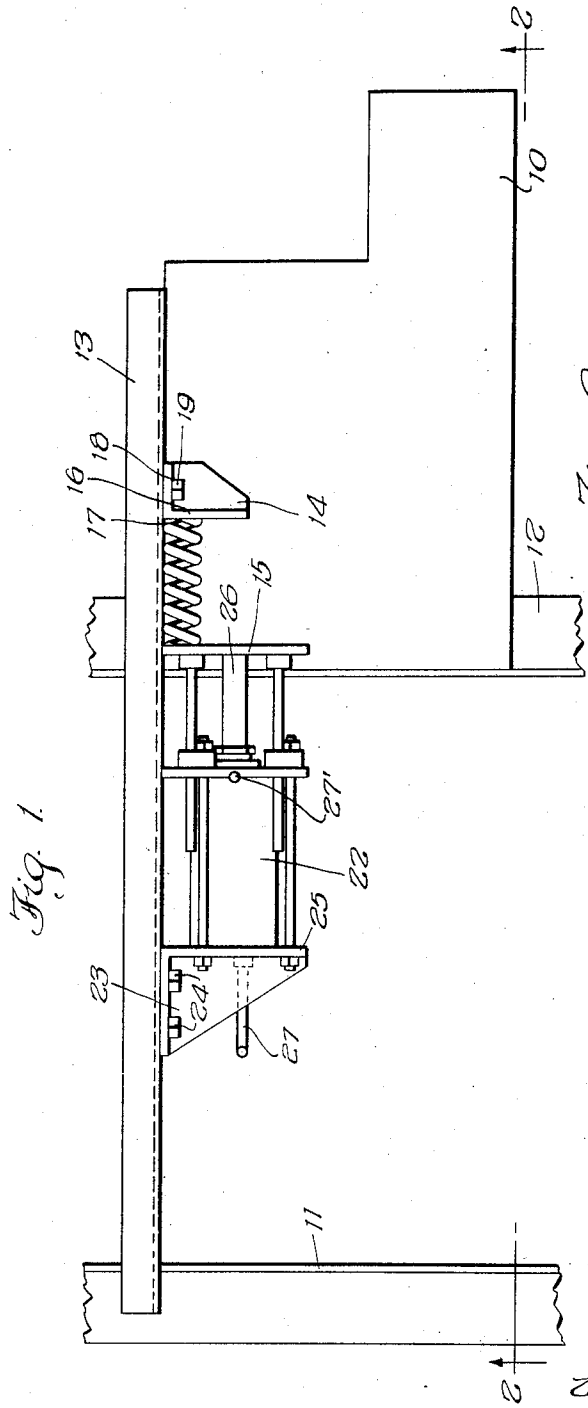


Fig. 1.

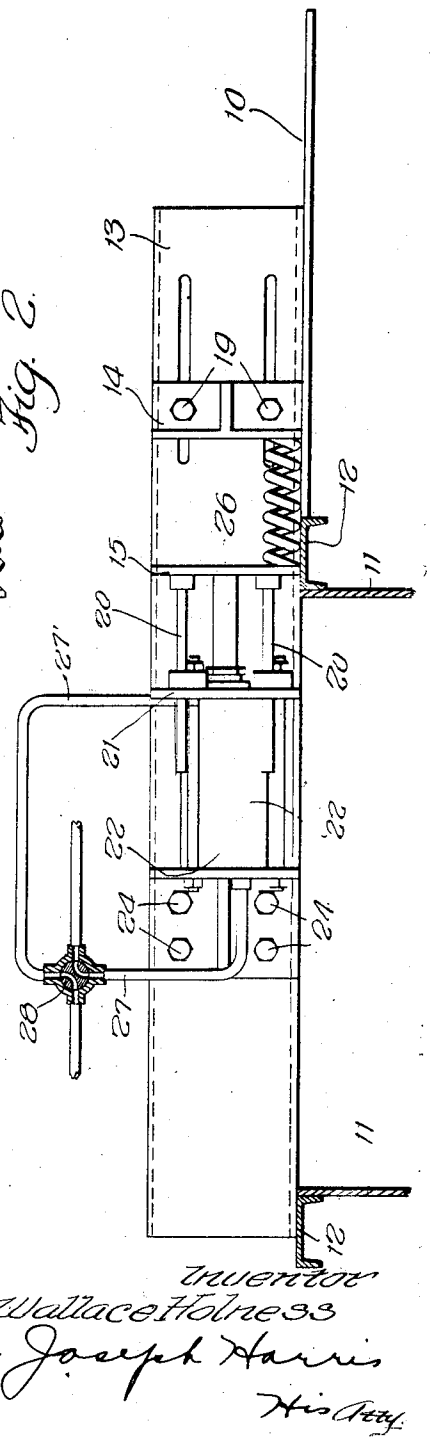


Fig. 2.

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UNITED STATES PATENT OFFICE

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PROCESS FOR PRODUCING HELICALLY-COILED SPRINGS OF UNIFORM LENGTH

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This invention relates to improvements in the process for producing helically coiled springs of uniform length.

In the manufacture of helical springs, it is the usual practice to form the springs from straight bars which are coiled while in a highly heated condition, after which the lengths of coiled springs are subjected to quenching, drawing and cooling operations and are afterward subjected to the action of a bulldozer to break the same down, the lengths being considerably shortened by the bulldozer. Although bars of equal length are employed to manufacture springs of the same size, it has been found that the coils are not of the same uniform length when they leave the bulldozer. These irregularities, it has been found, are due to unavoidable inaccuracies in the coiling operation, the coils not all being of equal length when they are taken from the coiling mandrel.

It is the main object of my invention to overcome the difficulties pointed out by gauging the springs immediately after the coiling operation and shortening the coils which are overlength to such an extent that all of the coiled springs for a certain size will be of the same length before being subjected to the quenching bath, thus assuring the production of springs of uniform length when all of the operations thereon have been completed.

Other and further objects of the invention will more clearly appear from the description and claims hereinafter following.

In the drawing, forming a part of this specification, Figure 1 is a top plan view of my improved combined gauging and compressing mechanism employed in connection with my improved process. And Figure 2 is a longitudinal, vertical sectional view, corresponding substantially to the line 2—2 of Figure 1 and showing the principal parts of the mechanism in elevation.

In carrying out my improved process, which is particularly adapted for springs of high capacity such as used in railway friction draft gears, the bars or rods of which the springs are to be formed, are all cut to a uniform length. The ends of the bars are heated and then tapered so as to provide flat bearings at the ends of the coiled springs when completed. After the ends of the bars have been tapered, the bars are then heated and coiled by any well known or desired coiling machine. Immediately upon completion of the coiling operation and while the coils are still hot, the same are then subjected to the gauging and compressing mechanism hereinafter described, the pressure being applied axially of the coils and with all the turns of the coiled spring free so that the entire length of the coil is subject to the endwise pressure to insure the coil being reduced to the proper overall predetermined length. After being thus gauged to proper length, the coils are thereafter immersed in the quenching bath and subjected to the usual drawing and cooling operations and, finally, when cold, subjected to repeated compression in a bulldozer to break the same down. With reference to the improved means of my invention, the coiling machine will preferably be located closely adjacent the improved gauging and compression mechanism to facilitate quick transfer of the coils from the former to the latter without undue loss of heat before the coils are gauged.

As shown in the drawings, my improved combined gauging and compressing mechanism includes a table 10 for supporting the springs, the table 10 being mounted on supports 11—11 and transverse beams 12—12 fixed to the supports 11. The table 10 is so arranged that the right-hand end thereof, as viewed in the drawings, will be adjacent the coiling mandrel of the coiling machine, so that the coils may be removed from the mandrel and dropped on the table 10.

An upstanding frame member 13 is fixed to the table and has the gauging and compressing means mounted thereon. The gauging and compressing means comprises a fixed abutment member 14 and a reciprocating head 15. The abutment 14 is in the form of a casting having a vertical section 16 presenting a flat abutment surface 17. The casting 14 has a portion 18 disposed at right angles to the vertical section 16 and is supported thereby on the frame member 13, a pair of clamp-

ing bolts 19—19 being employed for this purpose. The bolts 19—19 extend through openings in the casting 14 and longitudinally extending slots in the frame member 13. As will be evident, the casting or abutment member 14 may be moved to various positions and clamped in the required adjusted position by the bolts 19.

The reciprocating head member 15 is in the form of a rectangular plate and is provided with a plurality of guide rods 20—20 extending outwardly therefrom, four such guide rods being employed, as clearly shown in the figures of the drawing. The rods 20 are guided in openings in a plate 21 which forms the inner head of a cylinder 22 which is supported on the frame member 13 by means of a bracket 23 secured to the vertical face of the frame member by bolts 24—24.

The bracket 23 has a plate-like section 25 extending at substantially right angles to the inner face of the frame member 13, said plate-like member forming the outer head of the cylinder 22.

The piston rod 26 is also rigidly connected to the head 15 and is provided with the usual piston, not shown, which works in the cylinder 22. A fluid pressure line 27 communicates with the cylinder to supply fluid pressure for operating the piston. Any well known means may be employed for controlling the flow of the fluid to and from the cylinder, a two-way valve member of well known type being indicated at 28 in Figure 2. The valve communicates with the usual supply line. As will be evident, the reciprocation of the compressing head 15 may be absolutely controlled by the operator through the valve 28, the outward movement of the head being limited by the stroke of the piston, that is, the movement of the piston in a right-hand direction will be arrested by engagement with the end of the cylinder, thus also arresting movement of the head 15. As shown in the drawings, the head 15 is in the outermost position and is thus spaced a definite distance from the abutment member 14, this distance being predetermined so that the compressing and gauging mechanism will properly operate on helically coiled springs of a given size in length. In case it is desired to operate on springs of longer or shorter size, the abutment member 14 is adjusted so as to be spaced the proper distance from the head 15 when the latter is in the outermost position to operate properly on the particular size of spring selected. This adjustment, as hereinbefore pointed out, is effected through the slot and bolt connection with the frame member 13.

The spring coils are removed from the mandrel of the coiling machine while still hot and are dropped on the table 10 and then conveyed along the table to the combined gauging and compressing mechanism proper, the coils being successively interposed between the abutment member 14 and the reciprocating head 15. When a coil is in position between these two members, the valve mechanism is manipulated so as to admit fluid pressure to the cylinder and force the piston rod 26 outwardly, thereby moving the head 15 toward the abutment member 14. If the spring, which is disposed between the abutment member 14 and the head member 15, is of the proper predetermined length, the abutment member will merely engage the corresponding end of the spring when the piston and piston rod 26 reach their outer limit of movement. Under such conditions, the spring will not be compressed or shortened. However, if the spring is over-length, as frequently is the case, the reciprocating head 15 will engage the corresponding end thereof before the piston and the piston rod 26 reach their outer limit of travel, thereby compressing the spring until movement of the piston and rod are limited by engagement with the cylinder head 21. Inasmuch as the spring coils are still in relatively highly heated condition when they reach the combined gauging and compressing mechanism, the springs when compressed will retain the shape which they assume while under pressure, that is, the springs will be shortened to the proper extent to provide helically coiled spring members of uniform length before any other operations are performed on the same. In cases where the springs are of the proper predetermined length, the abutment member 14 and the reciprocating head 15 together act as a gauging means only. However, when the coiled springs are overlength, the same function both as a gauging and compressing means.

My improved mechanism is also adapted to operate on springs of different diameter, the abutment member 14 and the head 15 presenting relatively wide faces so that the same will engage springs of different diameter. In Figures 1 and 2, the abutment and the head are shown as operating upon a spring of relatively small diameter, this spring being moved in the corner against the vertical face of the frame member 13 and the flat horizontal face of the table 10. The coil is thus held with the parts thereof in true alignment. A coil of larger diameter will project a greater distance from the flat vertical face of the member 13 and from the top surface of the table 10, but, as shown, the abutment member and the head of the mechanism are of such a size that they will overlap the ends of the coiled spring of greater diameter.

The quenching tank, in the bath of which the coils are immersed, is preferably located between the supporting beams 12 at the left-hand end of the table 10, so that the coils, after being gauged and shortened, may be removed from between the abutment mem-

ber 14 and the head 15 and slid along the table and conveyed to the quenching bath. The quenching bath is well known and needs no further description. After being quenched, the coiled springs are subjected to the usual drawing operation and are then cooled. After cooling, the same are compressed repeatedly in the usual bulldozer to break them down. As is well known, the coiled springs are materially shortened by the operation of the bulldozer, the amount of shortening being substantially the same for all coils of a given size. As will be evident, if the coiled springs when brought to the bulldozer are not of equal length, they will still be of unequal length when shortened by the bulldozer.

From the preceding description, taken in connection with the drawings, it will be evident that in manufacturing springs in accordance with my improved process, the spring coils are all of the same length when they reach the quenching bath and consequently are of equal length before they are subjected to the bulldozing operation, with the result that all coiled springs of a given size are of precisely the same length when finished.

While I have herein shown and described what I consider the preferred manner of carrying out my invention, the same is merely illustrative and I contemplate all changes and modifications which come within the scope of the claims appended hereto.

I claim:

1. A process of manufacturing springs including the following steps: providing metal bars of predetermined length; heating the bars; forming the highly heated bars into helical coils; then compressing the coils longitudinally while still in highly heated condition to shorten the same to a predetermined overall length; then successively subjecting the coils to quenching, drawing, and cooling operations; and finally, subjecting the coils to repeated heavy compression.

2. A process of manufacturing helical springs including the following steps: providing a plurality of bars of equal length; heating the bars to a high temperature; forming the bars into helical coils while highly heated; gauging the lengths of the helical coils; shortening the helical coils which are overlength while still highly heated; then subjecting the coils successively to quenching, drawing, cooling and breaking down operations.

3. The herein described process of manufacturing coiled springs of heavy capacity which includes: first providing a bar of predetermined length; then tapering the opposite ends thereof; then heating the entire bar and, while hot, coiling the same; then, while the coil is still hot, subjecting the entire coil to endwise pressure and compressing the same to a predetermined overall length to thereby set the spring while hot; and thereafter subjecting the coil successively to quenching, drawing and cooling.

4. A process of manufacturing springs including the following steps: providing metal bars of predetermined length; heating each bar; coiling the bars while hot; and compressing each coiled bar to predetermined overall length before cooling of the same.

5. A process of manufacturing helical springs of predetermined, uniform overall length: providing metal bars of predetermined length; heating said bars to a relatively high temperature; coiling the bars while heated to form helical spring members, gauging each helical coil as to overall length; and compressing those helical coils which are over size in length to said predetermined length.

6. A process of manufacturing helical springs including the following steps: providing a plurality of helically coiled spring members in highly heated condition; gauging each coil as to overall length; and shortening those coils which are over size in length by compression to provide coils of predetermined length.

In witness that I claim the foregoing I have hereunto subscribed my name this 1st day of February, 1929.

WALLACE HOLNESS.