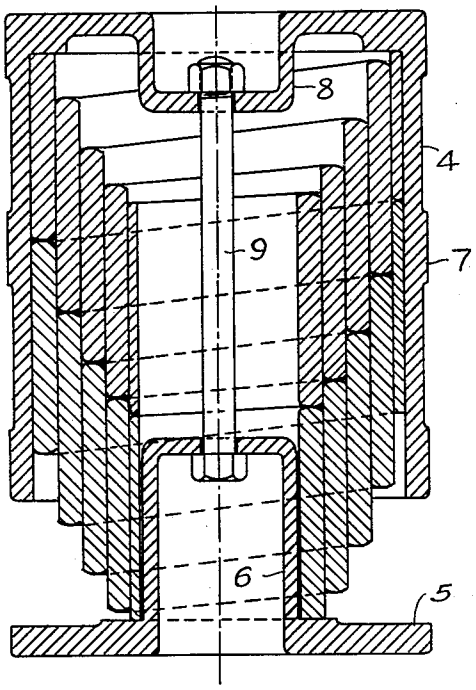
Nov. 5, 1940. T. R. WEBER 2,220,857

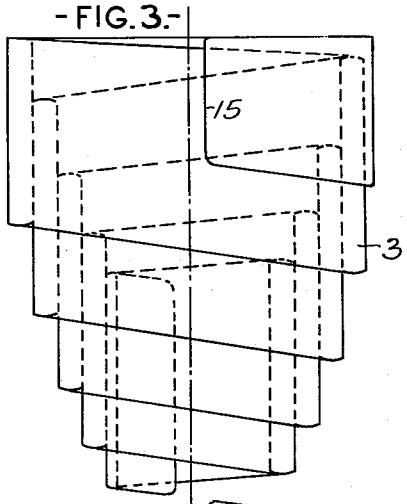
VOLUTE SPRING AND A METHOD OF MAKING SAME

Filed Nov. 24, 1939

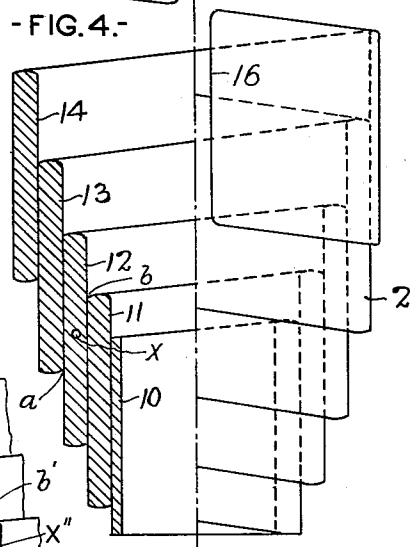
- FIG. 1. -



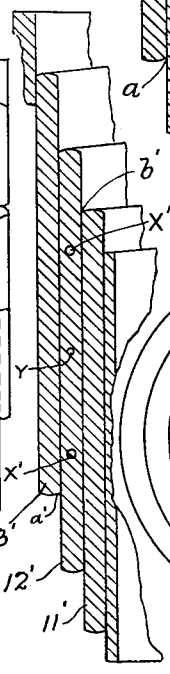
- FIG. 3. -



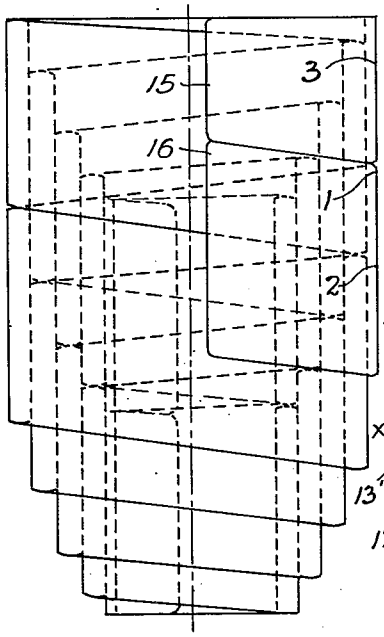
- FIG. 4. -



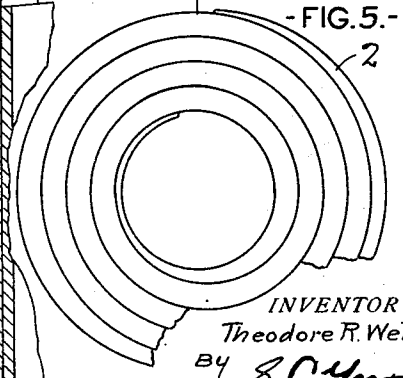
- FIG. 6. -



- FIG. 2. -



- FIG. 5. -



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VOLUTE SPRING AND A METHOD OF MAKING SAME

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6 Claims. (Cl. 267—62)

This invention relates to volute springs and a method of making same.

In a conventional volute spring for supporting heavy load of the type shown in patent to Wine, No. 1,956,336, which is characterized by being made of a single wide strip of metal, it is found that the most satisfactory tempering of the steel of the spring is not attained by the conventional method of quenching. After such a spring is removed from the mandrel upon which it is formed, it must be quenched and given the temper which enables it to operate as a spring. This quenching is accomplished by immersing the hot spring in oil. The oil cools the spring and gives it the proper temper or hardness. However there are portions of the conventional volute spring which the oil cannot reach and which are therefore not most satisfactorily quenched.

The oil cools the outermost and innermost convolutions of the volute spring relatively quickly because one face of each is in direct contact throughout with the oil, and it also cools the portions of each convolution which extend beyond adjacent convolutions and which are therefore in direct contact with the oil over their exposed faces. However there is a portion of each convolution between the innermost and outermost convolutions which is in engagement on both sides with metal of adjacent convolutions and which therefore the oil cannot reach. Such portions, for convenience termed doubly overlapped portions, do not have the most satisfactory tempering as aforesaid, thereby shortening the life of the spring.

It is the object of the present invention to provide a volute spring which has the desirable qualities of the type of spring aforementioned and which may be more satisfactorily quenched to increase its life.

A further object of the invention in the attainment of the above results is the forming of the spring of two or more assembled separate sections and the quenching of each section before the sections are assembled to form the spring.

Other and further objects of and advantages achieved by the present invention will be apparent from the following description thereof and the claims appended hereto.

Referring to the drawing forming part of this application, Figure 1 is a longitudinal central section, in elevation, of the sectional volute spring of the present invention shown in connection with a snubbing device, the spring being under some compression; Fig. 2 is an elevation of the sectional volute spring shown in Fig. 1 uncompressed; Fig. 3 is an elevation of the upper section of the spring of Fig. 2 before setting; Fig. 4 is, on the right side, an elevation, and on the left side, a half section of the lower section of the spring of Fig. 2 before setting; Fig. 5 is a fragmental inverted plan view of the spring of Fig. 2; and Fig. 6 is a fragmentary section of a conventional spring.

The sectional volute spring 1 is formed of an outer conical volute section 2 and an inner conical volute section 3 which interfits in the section 2 and is axially aligned therewith. Sections 2 and 3 have identical pitch and are otherwise identical except that the small end of section 2 is squared and the large end of section 3 is squared thus providing a spring with squared ends as is customary.

The spring is shown in Fig. 1 disposed within the snubber spring housing 4. The housing consists of a base 5, upon which the squared end of the section 2 seats, having a central boss 6 which extends into the small end of section 2, and a telescoping cover 7, housing the spring, engaging the outer convolutions of each section, and providing a seat for the squared end of the inner section, the cover 7 having a central boss 8 which is disposed in the large end of section 3, and is of substantially the diameter of boss 6. A bolt 9 passes through the bosses and holds the sections together under the usual predetermined compression of the spring and allows for compression in service in the usual manner.

The sections 2 and 3, taken individually, resemble ordinary volute springs except their mutually engaging ends are not squared. In the present invention they are combined together to form the sectional volute spring as shown in Fig. 2 so that the combined width of the spring strips of the two sections equals the width of the spring strip of a single conventional volute spring. The assemblage as shown in Fig. 1 for illustrative purposes is adapted for use particularly as a friction snubber and is especially suitable for use with a nest of helical springs for supporting a truck bolster. However the invention is not so limited and the sectional volute spring may be used for many other suitable purposes. Only two sections are shown but it is to be understood that the volute spring may be made up of as many sections as is found desirable.

When the volute sections 2 and 3 were formed upon the mandrel they were of a slightly greater length than shown in Fig. 2, for after a spring is formed and removed from the mandrel, it is

given a set which decreases its over-all length.

Section 3 is shown as formed upon the mandrel in its unset form in Fig. 3, and section 2 in Fig. 4. It will be noted, by reference to Figs. 3 and 4, that the major portion of each convolution of each section will be in direct contact with the oil during the quenching operation, which is carried out before the sections are set and when the sections are at their greatest length to expose the greatest amount of surface for quenching.

The outermost and innermost convolutions of the sections present no problem as to quenching (cooling) as they have one entire surface and a portion of another surface exposed to the oil and no doubly overlapped portions. The problem of cooling is centered at the doubly overlapped portions of the intermediate convolutions of the sections.

The conditions are similar in both spring sections and are well shown in section in Fig. 4 where the convolutions are numbered 10, 11, 12, 13 and 14 in succession from the innermost convolution to the outermost convolution. Convolution 11 has a doubly overlapped portion extending from the top edge of convolution 10 to the bottom edge of convolution 12; convolution 12 has a doubly overlapped portion extending from the top edge of convolution 11 to the bottom edge of convolution 13; and convolution 13 has a doubly overlapped portion extending from the top edge of convolution 12 to the bottom edge of convolution 14, which doubly overlapped portions are not in direct contact with the oil. As shown in the present instance the convolution 11 has the largest doubly overlapped portion and the doubly overlapped portion decreases in each successive convolution. Each intermediate convolution has an upper and a lower end portion having exposed faces in direct contact with the oil and these portions, considering the extent of the relatively small doubly overlapped portion of the convolution, are sufficient in extent to provide highly satisfactory tempering of the doubly overlapped portion as the heat in the doubly overlapped portion is quickly transmitted by conduction to the more rapidly cooling exposed portions and therefrom to the oil.

The lower (outer) exposed faces of section 2 and the upper (inner) exposed faces of section 3 which are in direct contact with the oil are present in the conventional one-piece spring, but the upper (inner) exposed faces of section 2 and the lower (outer) exposed faces of section 3 which are in direct contact with the oil present novel features of the invention, providing multi-fold beneficial results.

Considering the conventional spring shown fragmentally in Fig. 6 and comparing it with the spring section of Fig. 4: Convolution 12 of Fig. 4 corresponds to convolution 12' of Fig. 6 taken in the order of the convolutions of the finished spring. Also convolutions 11 and 13 of Fig. 4 correspond respectively to convolutions 11' and 13' of Fig. 6. The doubly overlapped portion of convolution 12 is that portion between points a and b while the comparable doubly overlapped portion of convolution 12' is that portion between points a' and b'. It will thus be seen that there is a vast difference between the size of these doubly overlapped portions. The heat at the middle point, denated by x (Fig. 4), of the overlapped portion escapes by conduction upwardly and downwardly through the points x—b and x—a (respective half doubly overlapped portions) to the exposed portions of the convolution 12. Points comparable to the point x are denoted on convolution 12' by x'—x''. There is in convolution 12' a relatively large part of the doubly overlapped portion between x'—x'' that is entirely absent in convolution 12. The heat of the middle point, denoted by y, in convolution 12', escapes by conduction upwardly and downwardly not only respectively through the parts x''—b' and x'—a' but also through the parts y—x'' and y—x' respectively. Heat conductivity is thus much more rapid in the doubly overlapped portions of the spring section of the present invention than in the comparable conventional one-piece spring and therefore much more uniform and satisfactory tempering is attained.

After quenching, the sections 2 and 3 may be set by compressing them either individually or after section 3 has been interfitted with section 2.

By interfitting section 3 with section 2, each section supports its portion of the load, that is to say the sections are in parallel so that the resultant strength of the spring comprising the two sections is substantially equal to the strength of the conventional volute spring of the same size. The sections are coiled on the same or similar mandrels and the interfitting helical edges thereof are identical so that the outer helical edge of the section 3, when the section 3 is interfitted in the section 2, engages the inner helical edge of section 2, the small end of section 3 bearing against the inner edge of the smallest convolution of section 2, and the large end of section 2 bearing against the outer edge of the largest convolution of section 3 to insure parallel action. Therefore as there is a continuous helical engagement between section 3 and section 2, the spring functions similarly to a conventional spring of the same size formed of a single strip.

Sections 2 and 3 are preferably aligned as shown at 15 and 16 in Fig. 2. If found necessary they may be relatively slightly rotated about their axis to produce the required interfitting and the aforesaid helical edge engagement. If desired a suitable clip may be utilized to hold the sections in this adjusted position against relative rotation.

While there has been hereinbefore described an approved embodiment of this invention, it will be understood that many and various changes and modifications in form, arrangement of parts and details of construction thereof may be made without departing from the spirit of the invention and that all such changes and modifications as fall within the scope of the appended claims are contemplated as a part of this invention.

The invention claimed and desired to be secured by Letters Patent is:

1. A volute spring comprising two axially aligned conical volute spring sections disposed end to end for parallel action, the end portion of one section interfitting with the adjacent end portion of the other section interiorly thereof.

2. A volute spring comprising a conical volute spring section, and another conical volute spring section fitting within the first mentioned spring section, the outer helical edge of the section fitting within the other section being in engagement throughout with the inner helical edge of said other section.

3. A volute spring comprising a volute section formed of strip material, the convolutions of which being helically stepped exteriorly along an edge of said strip; another volute section formed of strip material, the convolutions of

which being helically stepped interiorly along an edge of its said strip, the steps of the respective sections being complementary to each other and interfitting, the exterior steps fitting within the interior steps, said sections engaging each other at said edges whereby said sections act in parallel when said spring is compressed.

4. A volute spring comprising a volute section formed of strip material, the convolutions of which being helically stepped exteriorly along an edge of said strip; another volute section formed of strip material, the convolutions of which being helically stepped interiorly along an edge of its said strip, the steps of the respective sections being complementary to each other and interfitting, the exterior steps fitting within the interior steps, said sections engaging each other at said edges whereby said sections act in parallel when said spring is compressed, said exteriorly and interiorly stepped sections being further stepped respectively interiorly and exteriorly along the opposite edges of their respective strips.

5. A volute spring comprising a volute spring section formed of strip material, the convolutions of which being helically stepped exteriorly along an edge of said strip; another volute spring section formed of strip material, the convolutions of which being helically stepped interiorly along an edge of its said strip, said sections being disposed end to end in aligned relation with the exterior steps interfitted within the interior steps, said edge of said interiorly stepped section, at the smallest and largest convolutions thereof engaging said edge of said exteriorly stepped section respectively at the smallest and largest convolutions thereof.

6. A volute spring comprising an assemblage of two conical volute spring sections, each section being formed of strip material and each volute section being tempered prior to their assemblage together, each section having its adjacent convolutions associated to frictionally engage one another when the section is compressed, the convolutions of one section being helically stepped interiorly along an edge of its strip and the convolutions of the other section being helically stepped exteriorly along an edge of its strip, said sections being disposed end to end in aligned relation with the exterior steps interfitted within the interior steps and said ends oppositely disposed for supporting engagement when said spring is compressed for coaction of said sections in parallel.

THEODORE R. WEBER.