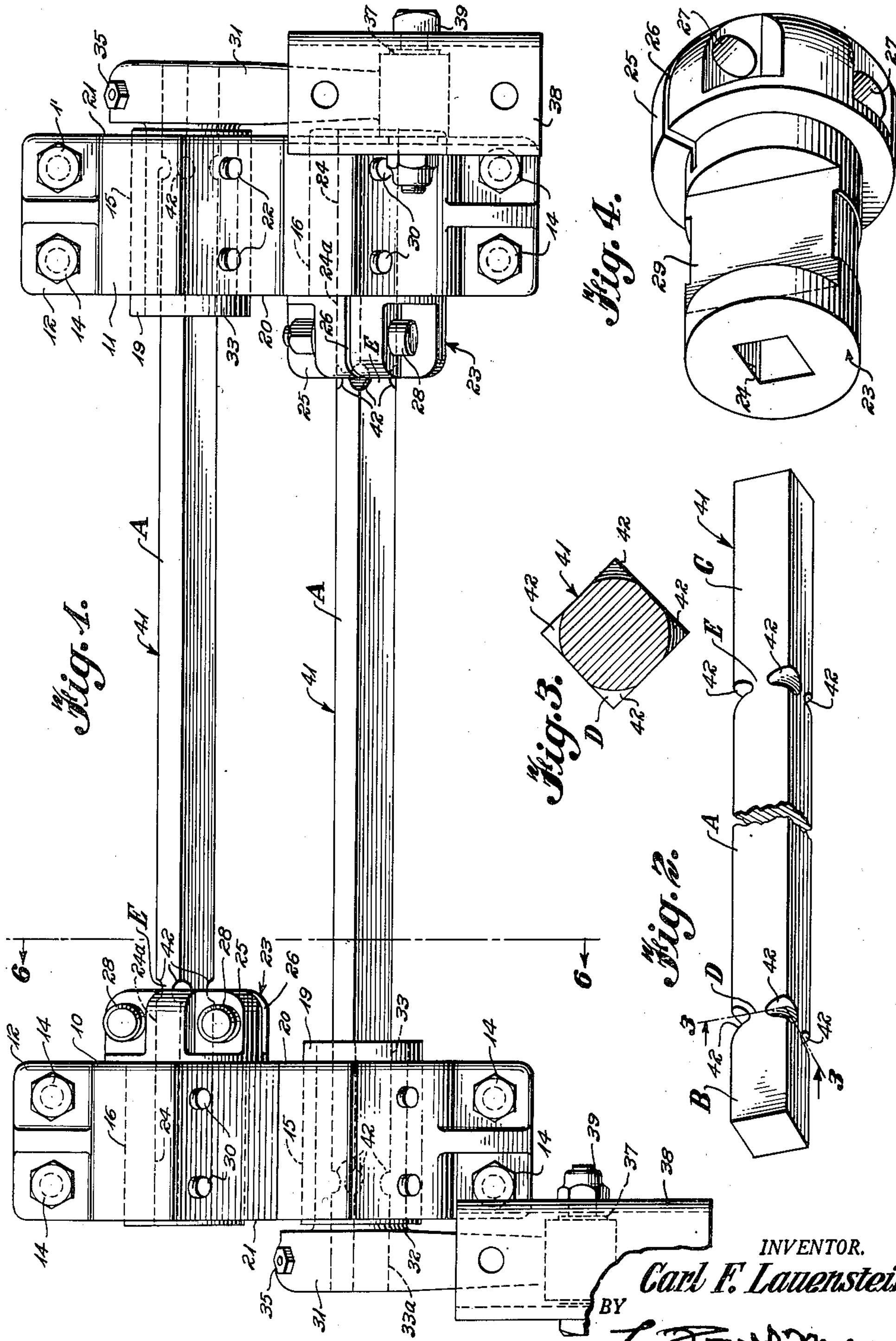
March 4, 1952 — C. F. LAUENSTEIN — 2,588,018

REACTOR ASSEMBLY

Filed March 14, 1950 — 3 Sheets-Sheet 1



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March 4, 1952 C. F. LAUENSTEIN 2,588,018

REACTOR ASSEMBLY

Filed March 14, 1950 3 Sheets-Sheet 2

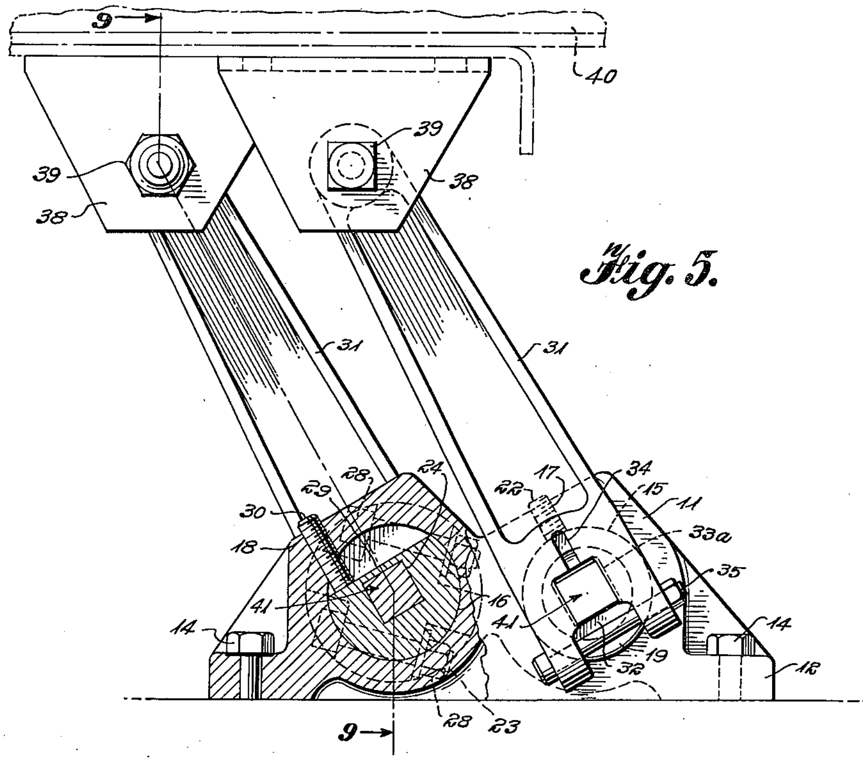


Fig. 5.

Fig. 7.

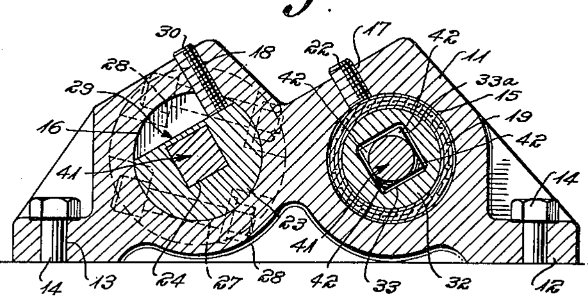
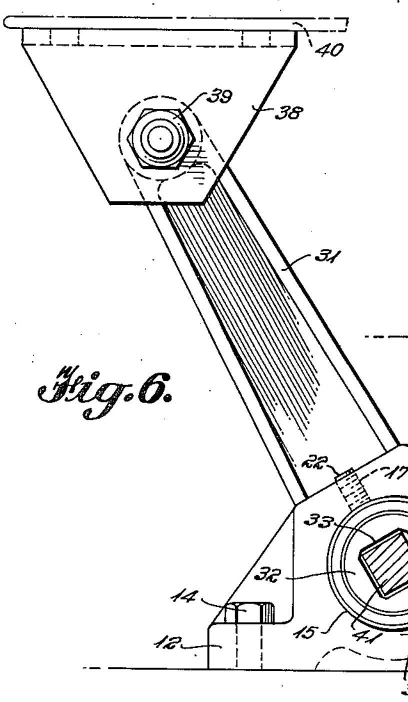
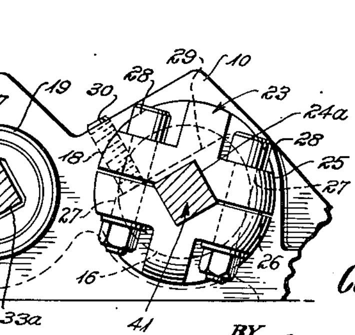


Fig. 6.





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Filed March 14, 1950 3 Sheets-Sheet 3

Fig. 8.

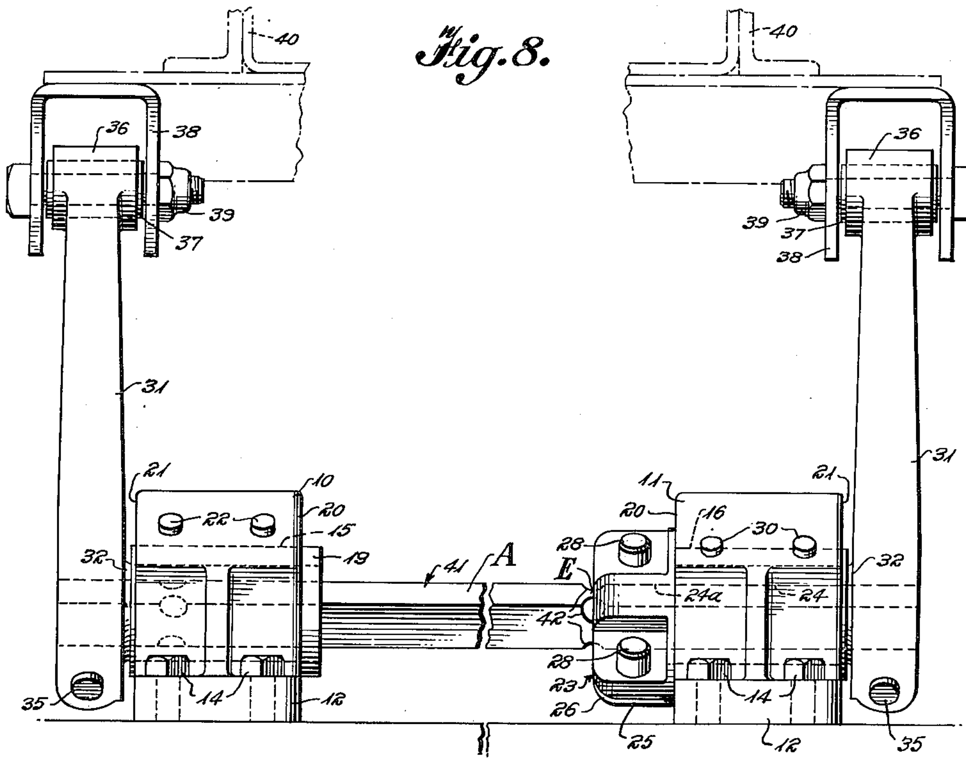
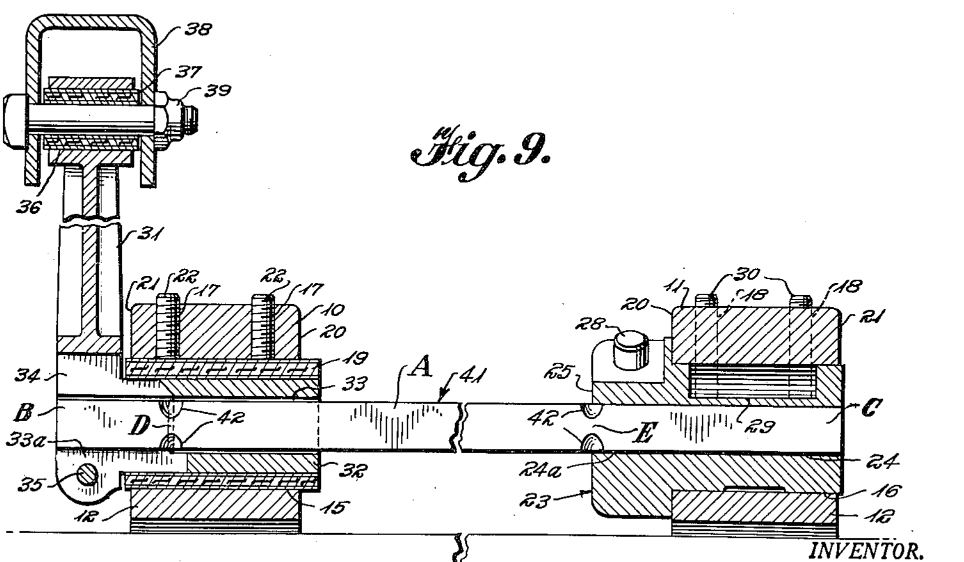


Fig. 9.



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UNITED STATES PATENT OFFICE

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REACTOR ASSEMBLY

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Application March 14, 1950, Serial No. 149,530

9 Claims. (Cl. 267—1)

1

This invention relates to new and useful improvements in reactor assemblies, and deals more particularly with such assemblies for oscillating machinery.

One type of reactor assembly used for oscillating machinery utilizes torsion bars to impart a reaction torque to the oscillating mass. The torsion bars for such an assembly may be of a variety of cross-sectional shapes, but in many respects, square bars are to be preferred.

Some of the advantages of square torsion bars are the availability of the stock from which they are cut, and the ease with which they may be processed for use as torsion bars. Further, as compared with round torsion bars, the square bars are much more easily clamped against rotation relative to the parts of the assembly to which they are connected.

The principal disadvantage in the use of square torsion bars is their susceptibility to fatigue failure. It has been found that the fatigue strength of a square torsion bar subjected to continuously repeated cycles of stress variation is relatively low. It has also been found that fatigue failure is most likely to occur in a plane that is normal to the axis of the torsion bar at the point where the torsion bar enters the fitted opening in a clamping or connecting member.

It is the primary object of this invention to provide a reactor assembly incorporating a reactor element having a greatly increased fatigue strength.

A further object of the invention is to provide a torsion bar capable of withstanding a much greater number of stress cycles at a given load.

A further object of the invention is to provide a torsion bar that is so modified structurally at its critical stress regions as to materially increase the fatigue strength of the bar.

A still further object of the invention is to provide a square torsion bar having modified cross-sections at the regions where fatigue failure is most likely to occur to thereby increase the fatigue strength of the bar.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a top plan view of a reactor assembly embodying the invention,

Figure 2 is a perspective view, partly broken away, of a torsion bar of the type illustrated in Fig. 1;

2

Figure 3 is a transverse sectional view of a torsion bar taken on line 3—3 of Fig. 2,

Figure 4 is a perspective view of one of the bushings illustrated in Fig. 1,

Figure 5 is an end elevational view, partly in section, of the reactor assembly illustrated in Fig. 1,

Figure 6 is a vertical sectional view taken on line 6—6 of Fig. 1,

Figure 7 is a detail sectional view showing the arrangement of the bushing and set screws in a modified embodiment of the invention,

Figure 8 is a side elevational view of the reactor assembly illustrated in Fig. 1, and

Figure 9 is a sectional view taken on line 9—9 of Fig. 5.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of the invention, and first particularly referring to Figs. 1, 5, 6, 8 and 9, reference characters **10** and **11** designate two duplicate housings the construction of each of which will be disclosed by specifically referring to only one.

The housing **10** is provided with a suitable base **12** having openings **13** for receiving the bolts **14** or the like to connect the housing to the supporting floor. Two axially parallel, cylindrical openings **15** and **16** extend through the housing **10**. The tapped holes **17** extend from the upper surface of the housing to the opening **15**, and the tapped holes **18** extend from the upper surface of the housing to the opening **16**. The locations of the tapped holes **18** with respect to their associated opening **16** may be varied, as illustrated in Fig. 7, to modify the function of the housing as will be further explained in a later paragraph.

The opening **15** receives a tightly fitted tubular bushing **19** which extends slightly beyond the inner face **20** and the outer face **21** of the housing. The bushing **19** is held in place in the opening **15** by the set screws **22** which are threaded into the tapped holes **17**.

The opening **16** loosely receives a cylindrical bushing **23** which is provided with a square opening **24** extending axially therethrough. The inner end portion of the bushing **23** extends beyond the inner face **20** of the housing **10** and is enlarged to form a hub **25**. A slot **26**, see Figs. 1, 4 and 6, diametrically divides the hub **25** and extends for a short distance into the body of the bushing **23** to provide a clamping portion *24a* in the opening **24**. The hub **25** is provided with openings 27 normal to the slot 26 and on each side of the clamping portion 24a. These openings 27 receive the bolts 28 which may be tightened to reduce the cross-sectional area of the opening 24.

The cylindrical body of the bushing 23 is provided with an exterior plane area 29 which should be substantially normal to the tapped holes 18 when the bushing is positioned in its opening 16. Set screws 30 are threaded into the tapped holes 18 to contact the area 29. Further tightening of the set screws 30 will cause the bushing 23 to rotate in its associated housing 10 in a clockwise or counter-clockwise direction depending upon the location of the tapped holes 18 relative to the openings 16 as illustrated in Figs. 5 and 7.

The supporting arms 31 are each provided with a cylindrical projection 32 extending from one side at the lower end portion thereof. A square opening 33 extends axially through the projection 32 and the arm 31. The clamping portion 33a of the opening 33 in and adjacent to the supporting arm 31 is of slightly smaller dimensions than the remainder of the opening. The lower end portion of the arm and its projection 32 are divided through the clamping portion 33a of the opening 33 by the cutaway 34. A bolt 35 connects the separated extremities at the lower end portion of the arm 31 so that tightening of the bolt reduces the cross-sectional area of the clamping portion 33a of the opening 33.

The cylindrical projection 32 of each supporting arm 31 is fitted into the tubular bushing 19 of its associated housing 10 or 11 and extends inwardly through the bushing to the inner end portion thereof. The supporting arms 31 are thereby pivotally mounted on the housings 10 and 11 with the openings 33 in transverse alinement with the similarly formed openings 24 in the cylindrical bushings 23.

The upper end portion of each arm 31 is provided with a cylindrical opening 36 for mounting a tubular bushing 37. A bracket 38 is pivotally connected to each arm 31 by a bolt 39 extending through the alined openings on each side of the bracket and through the bushing 37.

As illustrated in Figs. 5, 6 and 8, the brackets 38 are suitably connected to a conveyor trough 40. It is to be understood, however, that other types of oscillating bodies may be connected to the brackets 38 without modifying the function hereafter described.

Torsion bars 41, square in cross-section, are each mounted with one end portion fitted into the opening 33 and the other end portion fitted into the opening 24 of oppositely arranged arms 31 and bushings 23. Each bushing 23, is therefore, connected to an arm 31 through a torsion bar 41. The bolts 35 and 28 are tightened to clamp the torsion bars 41 to their associated arms 31 and bushings 23.

Referring now to Figs. 2, 3 and 9, for a detail discussion of one of the torsion bars 41 and its associated arm 31 and bushing 23, it is noted that relative rotation between the arm and bushing will impart a twist to the unsupported middle portion A of the bar. This twisting of the torsion bar 41 is resisted by torsional stresses set up in the middle portion A. The clamped end portions B and C of the bar, however, cannot be twisted and are subjected primarily to compressive stresses. The resultant stress patterns created in the transverse regions D and E of the torsion bar that are located at and adjacent to the inside margins of the clamping portion 33a of the arm and 24a of the bushing are such that fatigue failures usually occur at these regions. It is for the purpose of increasing the fatigue strength of these two critical regions D and E that the torsion bars 41 are structurally modified in the following manner.

All of the edges of the torsion bar 41 are machined to form a circumferentially alined row of notches 42 at each of the critical regions D and E. Consideration of Fig. 3 shows that the square cross-section of the torsion bar 41 is changed by the notches 42 to a substantially circular cross-section. In other words, the bottom of each notch 42 is arcuately formed both longitudinally and circumferentially, the longitudinal curvature of the bottom surface being concave and the circumferential curvature being convex.

The notches 42 at the critical region D are so located that their mid-points register radially with the inner edge of the clamping portion 33a of the opening 33. The notches 42 at the critical region E are so located that the opening 24a in the hub 25 will receive approximately one-half of the notched portion of the bar. It is to be understood that the exact locations of the notches 42 are important to the extent that the notches should be partially but not entirely included within the clamped portions B and C of the bar.

It is noted that the notches 42 do not reduce the strength of the torsion bar 41 under a static torsional load. This is due to the fact that torsional stresses are directly proportional to their distance from the axis of the torsion member. The longitudinal centerline of each side face of the square torsion bar 41 represents the shortest radial distance from the axis of the bar, and this distance determines the maximum allowable static torsional load which the bar will withstand.

It will be seen by again referring to Fig. 3 that the bottoms of the notches 42 are located at a slightly greater distance from the longitudinal axis of the torsion bar 41 than are the centers of the side faces. It will be seen, therefore, that the strength of the torsion bar 41 under a static load is not reduced by the provision of the notches 42.

It has been determined by the testing of notched torsion bars, under dynamic loading conditions, that the notches do beneficially affect the stress patterns at the critical regions D and E with the result that the fatigue strength of the bar is greatly increased.

It is to be understood that the forms of this invention herewith shown and described are to be taken as preferred examples of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, I claim:

1. A device of the type described, comprising housing means, a bushing adjustably mounted in said housing means, an arm mounted on said housing means for pivotal movement relative thereto, said bushing and said arm each having an opening therethrough in axial alinement with the opening through the other, and a torsion bar of rectangular cross-section having longitudinally spaced portions clamped in said axially alined openings for frequently repeated twisting of its intermediate portion by the pivotal movement of said arm, said bar having stress relieving notches in all of its edges at the inner margins of said clamped portions.

2. A device of the type described, comprising housing means, a bushing adjustably mounted in said housing means, an arm mounted on said housing means for pivotal movement relative thereto, said bushing and said arm each having an opening therethrough in axial alinement with the opening through the other, and a torsion bar of rectangular cross-section having longitudinally spaced portions clamped in said axially alined openings for frequently repeated twisting of its intermediate portion by the pivotal movement of said arm, said bar having circumferentially alined stress relieving notches in all of its edges at the inner margins of said clamped portions.

3. A device of the type described, comprising housing means, a bushing adjustably mounted in said housing means, an arm mounted on said housing means for pivotal movement relative thereto, said bushing and said arm each having an opening therethrough in axial alinement with the opening through the other, and a torsion bar of rectangular cross-section having longitudinally spaced portions clamped in said axially alined openings for frequently repeated twisting of its intermediate portion by the pivotal movement of said arm, said bar having all of its edges notched at the inner margins of said clamped portions, each of said notches being longitudinally concavely curved and transversely convexly curved.

4. A device of the type described, comprising a torsion bar of rectangular cross-section subjected, when in use, to frequently repeated twisting of an intermediate portion thereof, said bar having stress relieving notches in all of its edges at each of the two outer limits of said intermediate portion to provide modified cross-sections at said limits, a bushing clamped to said bar outwardly of one of said limits to prevent rotary movement of the bar, and an arm clamped to said bar outwardly of the other of said limits for applying the twist to said bar.

5. A device of the type described, comprising a torsion bar of rectangular cross-section subjected, when in use, to frequently repeated twisting of an intermediate portion thereof, said bar having all of its edges notched at each of the two outer limits of said intermediate portion, each of said notches being longitudinally concavely curved and transversely convexly curved, a bushing clamped to said bar outwardly of one of said limits to prevent rotary movement of the bar, and an arm clamped to said bar outwardly of the other of said limits for applying the twist to said bar.

6. A device of the type described, comprising

a torsion bar of rectangular cross-section having longitudinally spaced clamping portions and subjected, when in use, to frequently repeated twisting of the portion of said bar intermediate its clamping portions, said bar having stress relieving notches in all of its edges at each of the two outer limits of said intermediate portion to provide modified cross-sections at said limits.

7. A device of the type described, comprising a torsion bar of rectangular cross-section having longitudinally spaced clamping portions and subjected, when in use, to frequently repeated twisting of the portion of said bar intermediate its clamping portions, said bar having circumferentially alined stress relieving notches in all of its edges at each of the two outer limits of said intermediate portion to provide modified cross-sections at said limits.

8. A device of the type described, comprising a torsion bar of rectangular cross-section having longitudinally spaced clamping portions and subjected, when in use, to frequently repeated twisting of the portion of said bar intermediate its clamping portions, said bar having longitudinally concavely curved stress relieving notches in all of its edges at each of the two outer limits of said intermediate portion.

9. A device of the type described, comprising a torsion bar of rectangular cross-section having longitudinally spaced clamping portions and subjected, when in use, to frequently repeated twisting of the portion of said bar intermediate its clamping portions, said bar having stress relieving notches in all of its edges at each of the two outer limits of said intermediate portion, each of said notches being longitudinally concavely curved and transversely convexly curved.

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