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C. E. S. PLACE
RESILIENT HEADLOCK BOLT

2,543,705

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Fig. 1.

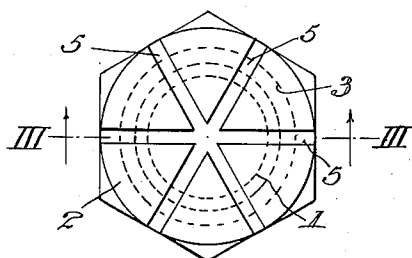


Fig. 6.

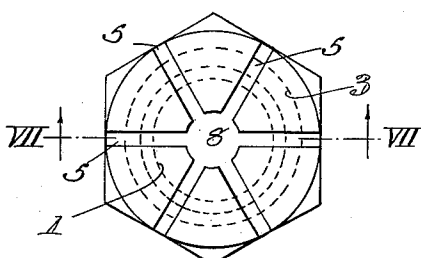


Fig. 2.

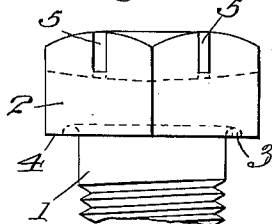


Fig. 7.

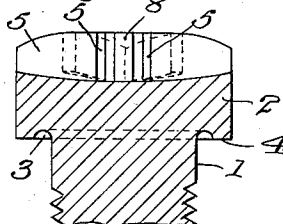


Fig. 3.

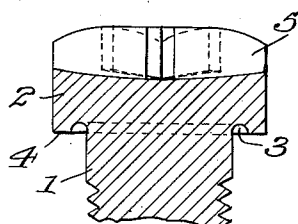


Fig. 8.

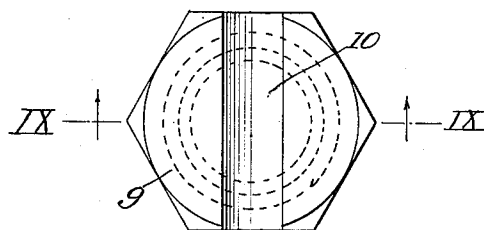


Fig. 4.

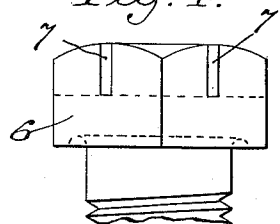


Fig. 9.

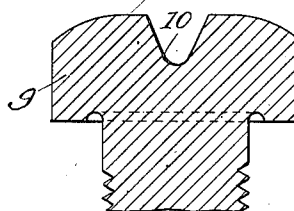
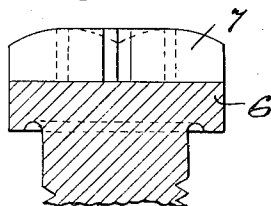


Fig. 5.



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UNITED STATES PATENT OFFICE

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RESILIENT HEAD LOCK BOLT

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4 Claims. (Cl. 151—32)

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This invention relates to an improvement in bolts or cap screws (referred to herein as "bolts"), and has for an object the provision of a bolt which can be made economically in available automatic machines, and which has, as compared to ordinary bolts, a greater resistance to accidental loosening (resulting, for instance, from vibration) and to breakage.

Another object is the provision of such a bolt in which a criterion exists for accurate determination of the axial loading of the bolt independently of the torque with which it is applied.

A further object is the provision of such a bolt which can be made with a low ratio of "rejects" without requiring special grades of steel.

Such bolts are characterized, briefly, by the provision of an annular recess in the under face of the bolt head at its line of juncture with the shank, in combination with the formation of one or more diametrically disposed slots or grooves in the upper face of the head.

Practical embodiments of the invention are shown in the accompanying drawings, in which:

Fig. 1 represents a top plan view of one form of the bolt;

Fig. 2 represents a side elevation of the bolt shown in Fig. 1;

Fig. 3 represents a vertical axial section taken on the line III—III of Fig. 1;

Fig. 4 represents a side elevation of a modified form of bolt, the top plan view of which is the same as Fig. 1;

Fig. 5 represents a vertical axial section of the bolt shown in Fig. 4;

Fig. 6 represents a top plan view of another modified form of the bolt;

Fig. 7 represents a vertical axial section taken on the line VII—VII of Fig. 6;

Fig. 8 represents a top plan view of another modified form of the bolt, and

Fig. 9 represents a vertical axial section taken on the line IX—IX of Fig. 8.

Referring to the drawings, and particularly to Figs. 1, 2 and 3 thereof, the bolt is shown as having a shank 1 and hexagonal head 2, conforming its outside dimensions to standard or accepted bolt design. An annular recess 3 is formed in the under face of the head at the line of juncture with the shank, leaving a generally annular under bearing surface 4 spaced from the shank. The upper part of the head is provided with diametrically disposed vertical slots or grooves 5, shown as extending across each minor diameter of the head (i. e., passing through the middle of each "flat"), and having a depth

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approximately between one-third and one-half the depth of the head. The bottoms of the grooves 5 are curved in profile (Figs. 2 and 3) so that the grooves are deeper at the middle and shallower at each end, this form resulting conveniently from the cutting of the grooves by means of a circular saw toward which the bolt is fed in the direction of the bolt axis. The grooves are relatively narrow, their width being such that the amount of material removed to form them is generally less than the amount of material remaining in the upper part of the head after they are formed.

According to Figs. 4 and 5, the bolt head 6 is provided with slots or grooves 7, disposed in the same manner as the grooves 5 of Figs. 1 to 3, but having flat bottoms parallel to the upper and lower faces of the head. The grooves 7 may conveniently be formed by feeding the bolt blanks sideways along a path tangential to a circular cutter or saw. Desirable limits of depth and width of the grooves are as described above.

Figs. 6 and 7 illustrate a modification of the form of construction shown in Figs. 1 to 3, which is obviously applicable as well to the form shown in Figs. 4 and 5. This modification consists in the removal, as by drilling, of material in the middle of the head to form an enlarged recess 8 at the crossing point of the slots or grooves. This recess may be of the same depth as the grooves (as shown) or may be extended slightly farther into the head if desired.

While the provision of slots or grooves disposed as described above is considered to be preferable, certain of the advantages of the invention can be obtained (in a more economical manner) by the form of construction shown in Figs. 8 and 9. In this case the head 9 is provided with a single diametrically disposed groove 10, extending to a depth of approximately half the head depth, the sides of the groove being more or less tapering or flaring for convenience in manufacture as by a hot or cold shaping operation.

In all cases it will be understood that the under face of the head is formed to provide a bearing surface spaced from the shank, the provision of the annular recess (3, Figs. 1 to 3) being an acceptable way of achieving this result.

Because the under bearing surface is spaced from the shank and the upper part of the head is relieved, particularly at its center, by the formation of a groove or grooves, the material remaining between the lower annular recess and the bottom of the upper groove or grooves acts

as an elastically flexible diaphragm, reinforced by the segments formed between the slots, permitting a substantial increase in elastic elongation of the bolt and preventing it from being loosened accidentally, as by vibration. At the same time the material constituting the diaphragm retains a resistance against shearing stresses greater than that in the threads, so that the effective strength of the bolt is not reduced. Compared to ordinary bolts of the same size and material, the bolts described herein, when applied with the same tightening torque, show less (axial) tensile strain and considerably greater release torque. Thus, if applied up to the same tensile strain, the release torque (and security against loosening) can be increased still more (greater than 50% in some cases).

In making the bolts of Figs. 1 to 7 there are no unusual shaping stresses and the same grades of steel can be used as in ordinary bolts without increasing the number of "rejects." The bolt of Figs. 8 and 9 may require slightly better steel, which is fully compensated for by the reduction in manufacturing steps—the single groove being formed in the same operation or series of operations with the formation of the head itself.

An important advantage of the bolts slotted or grooved as shown resides in the fact that the tightness with which they are applied can be determined in terms of the axial loading of the bolt, instead of the unreliable factor of torque; variations of friction in the threads and seat result in wide variation of loading even when the applying torque is uniform. In the bolts disclosed herein the flexing of the diaphragm, within the elastic limit of the head, causes the sides of the slots or grooves to close toward each other, the amount of such closing being a direct function of the axial loading of the bolt which can be calibrated and accurately gauged.

It appears that substantially the same results can be obtained by forming the slots or grooves through the hexagon corners of the head as by having them terminate in the middle of the flats. The construction shown as applied to hexagonal heads is also adaptable, with the same advantages, to heads of other shapes such as square or round.

What I claim is:

1. A bolt of the character described comprising, a hexagonal head and a threaded shank, the under face of the head being provided with an annular recess adjacent the line of juncture of said face with the shank and having a substantially flat annular bearing surface lying perpendicular to the axis of the bolt and spaced from the shank, the upper face of the head being provided with three intersecting diametrically disposed slots extending vertically into the head a distance not less than approximately one-third of the head depth and not greater than approximately one-half of the head depth and completely across the head through the middle of opposite flats, and the bottoms of said slots forming a substantially continuous surface lying, at least at the axis of the bolt, perpendicular to said axis, whereby the slots and recess will permit elastic distortion of the head when the bolt is tightened.

2. A bolt according to claim 1 in which the bottoms of the slots lie in a plane parallel to the under face of the head.

3. A bolt according to claim 1 in which the bottoms of the slots lie in an arc, the center of which is on the axis of the shank and above the upper face of the head.

4. A bolt according to claim 1 in which an enlarged recess is formed at the crossing point of the slots, the bottom of said recess lying at substantially the level of the bottoms of the slots.

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