Component Innovations Using Composite Principles

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Abstract: The paper presents the methodology of wound composite structures that are alternative to conventional components. The use of principle is based on the definition of partial functions of compact elements included. For these features are subsequently created elementary components which can be made by other technologies and of materials other than conventional compact construction. Wider properties that have a composite structure, it is advisable to check size and optimize for these composite structures could be used effectively.

Keywords: screw connection; coiled screws; screw connections securing.

1 Introduction

An important structural element is a screw connection. There is known a number of standard types of screw and nuts, where a helical thread is formed, mostly by machining or rolling, directly on the screw shank and the nut body. Such screw shank threads form notches, which significantly reduce the screw load carrying capacity. The innovative design is based on the original production technology of bolted connection form: i) the coiled screw patent of No.304377 [1] and ii) the coiled nut patent of No.304376 [2]. These new structures, see Fig. 1, have a screw thread on the screw shank or in the nut housing coiled of a rod having suitable diameter and a suitable material, which need not be identical with the material of the screw shank or the nut housing. The screw shank, or analogously the nut housing, can have different cross-sectional shapes than the rod forming the helical thread, so it is possible to design screw connections for various purposes with varying shapes or materials. The screw thread can be coiled either freely or with a pre-stress, both on the screw shank and in the nut housing and can be situated either in the slots or tightly connected - by gluing or welding. The rod cross-section, forming the thread, can be of various suitable hollow thin-walled profiles, closed or open. The hollow thread can be used for a direct lubrication or a tempering with a suitable medium. Functional samples of several types of coiled screws and nuts were made. The coiled screws and nuts provide the bolted connections having new usable advantageous properties that do not have the classic bolted connections. These include a significant material savings, because the screw shank and the nut housing can be of thin-walled profiles made of various metallic, non-metallic and composite materials. It offers the possibilities: i) to optimize properties in a wide range of the coiled screws and nuts; ii) to analyze the behavior of them under load; iii) to identify the interaction of the thread structures with the stem screw or nut housing when manufactured with: a) the freely coiled thread; b) the pressed-on thread; c) or the point-welded thread. It is necessary to define the stress state of the connection elements and to assess the knowledge bases necessary for their design and for using their properties in practice.

The usual means for the screw connection securing are standardized. These are the different types of washers (flexible, fan-shaped, toothed, with a nose, with a tab), then the castle nut cotter pins or self-locking nuts containing a friction plastic or a toothed element. The locking washers must be applied under the nut or screw heads just when assembling the bolted connections, which is not advantageous both from the mounting aspect and the securing function, because even a slight screw connection releasing could cause the locking washers stop working. As a perspective system to be used for the screw connections securing, the patent of No.302768 [3] can be applied, Fig.2, which enables the securing system application already before the assembling, or the securing washers can be also pressed on the screw connection after its installation and tightening. There were functional samples of locking washers made. Their locking pins can be designed still longer to secure the bolted connection in a higher stroke for the various tightening, which is suitable for securing them.

At the same time, it is also possible using the simpler shapes of heads of screws and nuts, as for controlling the bolted connection can serve a tool tucked into the gaps between the screw head or the nut and its locking washer.

Flexible couplings of patent No. 3052683 [4] are used to elastic connection of shafts. The inner and outer spring rings are formed by bending the helically wound coil spring after forming a circle in the torus-shaped, and both ends forming a helical spring which forms a ring, are rigidly connected, see Fig. 3. These couplings realized elastic and flexible connection and they can compensate for the large deviations connected shafts. For worm gear designs patent of No. 3052497 [5], the flexible power transmission from the drive shaft of the worm implemented on a worm wheel which is peripherally permanently attached gear teeth formed by a flexible helically coiled spring ring. The spring ring is formed by bending the helically wound coil spring after forming a circle in the torus-shaped, and both ends forming a helical spring which forms a ring, are rigidly connected. Using the principle of composite designs with flexible transmissions gear teeth can be realized escalate worm transmission, see Fig. 4.

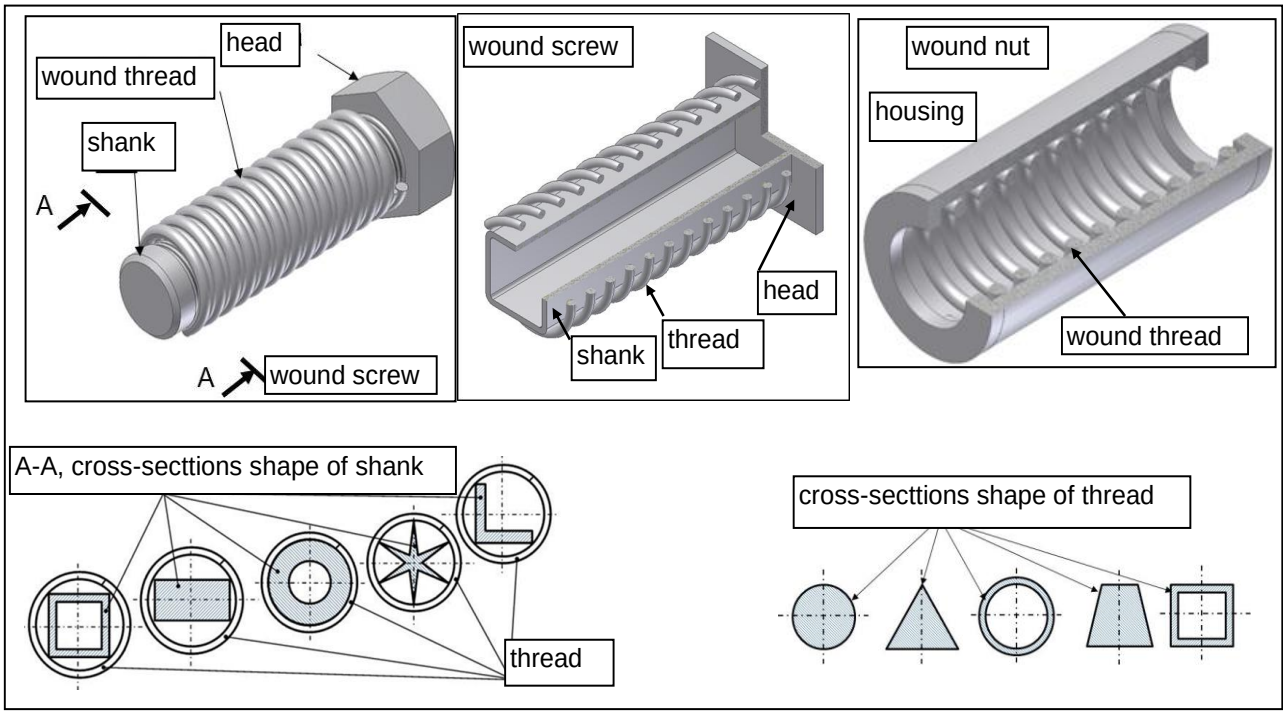

Fig. 1: Principle of wound screw and wount nut.structures .

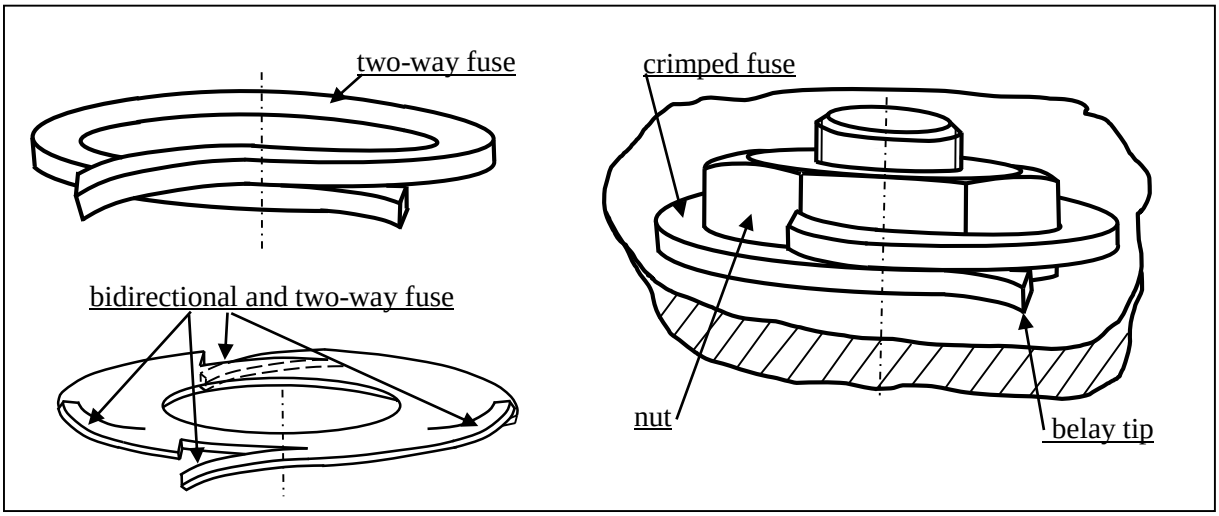

Fig. 2: Principle of assurance system of fixing bolts.

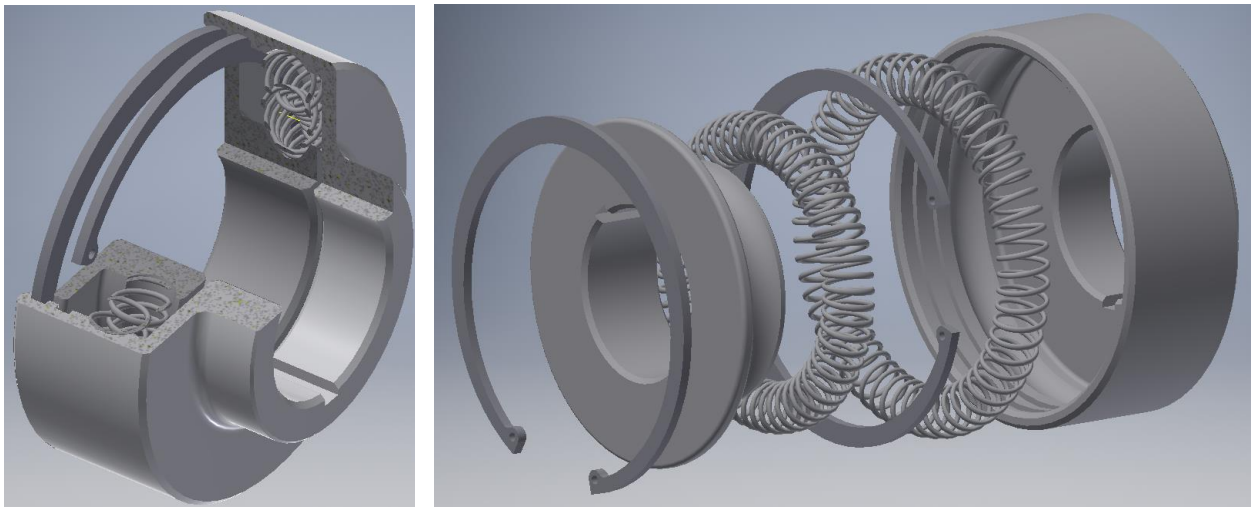

Fig. 3: Flexible coupling.

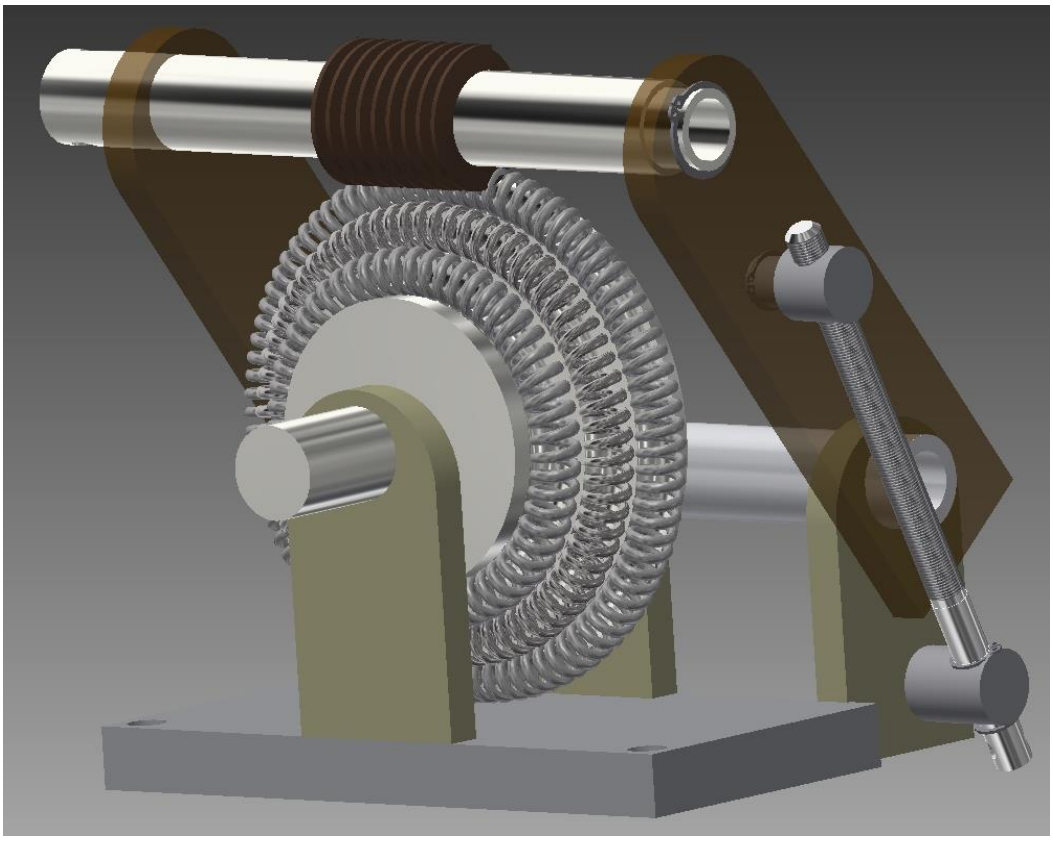

Fig. 4: The coiled worm gear with the gear shift

2 Conclusion

It is useful to analyze the assembly and structure of the locking washer properties to have necessary basic data for the design and the possible use of their more versatile functions in practice.

The inventing also requires continuous monitoring of functions of their components. The Fig. 5 illustrates an implementation of the wound thread mounted on the shaft of the screw, followed by further shown mounting the wound thread within the nut bore and is here also documented the verification of the connection of the bolt with the nut. Similarly, Fig. 6 shows an experimental model of worm gearbox, on which were verified by the basic principles of the patented design.

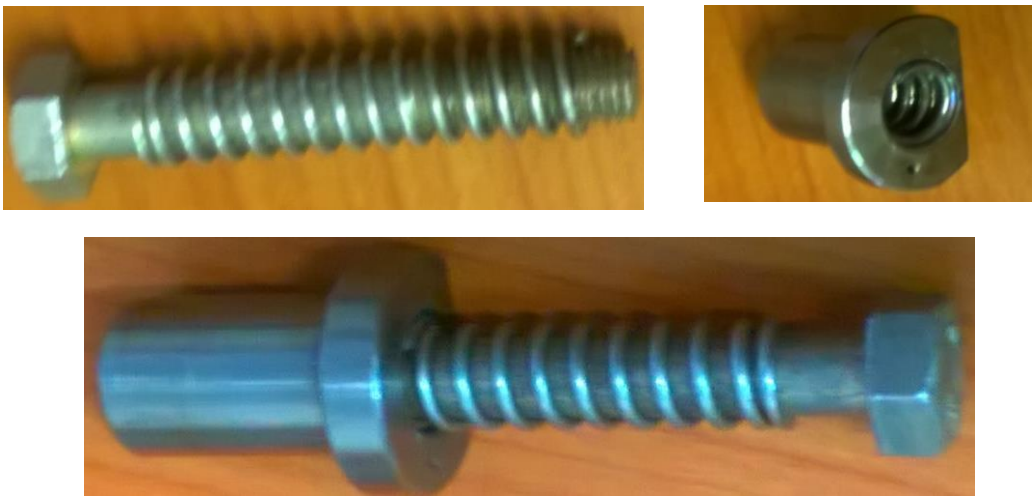

Fig. 5: Experimental model of the wound screw connection.

Fig. 6: The experimental model of worm gear - worm thread engages in the coiled toothing of the worm gear.

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