

Rationalization Potential in the Technology of Bolting

by Jozef Domanik

The Assembly Costs of the Bolted Joints and the Saving Possibilities

Various fastening methods are used in mechanical assembly to attach two or more parts together. Mechanical fastening can be divided into methods that allow for easy disassembly - threaded fasteners, and those that do not - rivets for example. According to DIN 8593 "Manufacturing process joining" the screwing is the most widely used method of joining in the mechanical engineering and in the automotive industry (Fig. 1).

There are several reasons why the screwing has a dominant position in the technology of mechanical joining. The simple dismountableness of the joint is one of them, the second is that it can be repeatedly and exactly assembled. Despite the other bolted joints the screws have one notorious disadvantage – they have to overcome the so called idle threads while they start to tighten (see ineffective montage time on the Fig. 2). It is therefore logical that the constructors are constantly looking for the possibility of rationalizing the process of montage of the threaded joints.

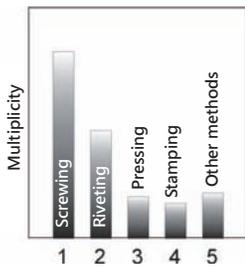


Fig. 1

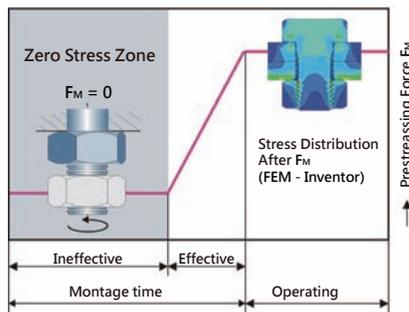


Fig. 2

The most recent attempt at a new form of construction of nuts and easy assembly represent two-piece nuts TWINNUTs useful for long screws and XC-NUT-System (Fig. 3) for plastic soft bolting for example. Although these structures have not found wider application in practice, they suggest some solutions.

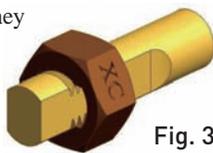


Fig. 3

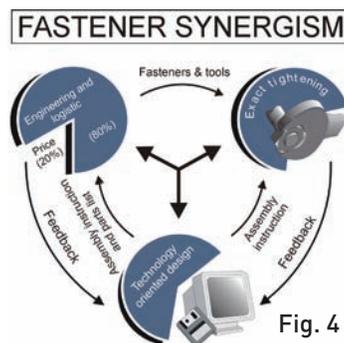


Fig. 4

Fortunately, there are a number of other ways to rationalize the assembly of screw connections.

The reduction of assembly costs generally allows for the following measures in particular:

1. Assembly-oriented design
2. Use of typified respectively unified design elements
3. Minimizing the number of mounting elements and only one mounting direction
4. Application of polyfunctional fasteners elements
5. Minimizing the number of interfaces

Assembly and Logistic-oriented Design

As shown on Fig. 4, ideal construction is the result of symbiosis between design, logistic and assembly. The dominant role plays a constructor in this chain. It depends not only on the function of the construction unit, but also on the economic and environmental parameters of production. It is very important for the designer to receive feedback from logistic and assembly.

Using of Unified Design Elements

Despite the wide scale, the joining elements are precisely unified and the designer has the choice of choosing the optimal variant. Any departure from this unification indicates a complication in production. Therefore it is always preferable to use unified design elements. They are available, cheap and verified.

Minimizing the Number of Mounting Elements, the Number of Interfaces and Mounting Directions

Figure 5 shows three options for solving one and the same construction problem. The differences between them are obvious (see Table Nr. 1).

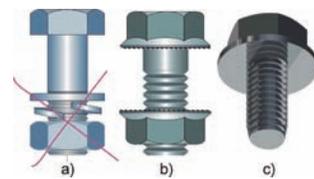


Fig. 5

Paradoxically, the worst option (a) is the most used in common practice. In this case, the designers rely on the locking effect of the DIN 127 elastic washer. Experience shows, however, that this is a very unreliable safety element, therefore the standard DIN 127 as well as DIN 128 have already been withdrawn. Especially for automatic assembly these washers are inappropriate.

Table Nr. 1

Option	Number of elements	Interfaces	Assembly direction
a)	4	3	2
b)	2	2	2
c)	1	1	1

Application of Polyfunctional Fasteners Elements

A typical example of a polyfunctional joining element represents the self-drilling screw or even more sophisticated wing-drilling screw with milling faces (Fig. 6).

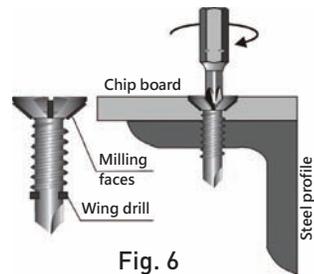


Fig. 6

Very effective polyfunctional joining element are the trilobular screws (see Fig. 5c and Fig. 7). They are able to create an external thread in a no-cut way. They are especially suitable for Al-profiles for electrotechnical components and for thin stainless steel sheets.

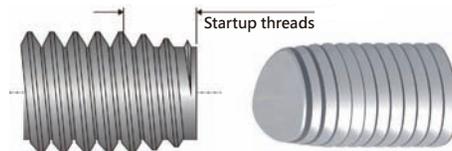


Fig. 7

Conclusion

This article presents some possibilities for rationalizing the assembly of screw connections. Of course, these options are considerably more and it is up to the designer to choose the optimal combination. Choosing the right option is especially important for automatic assembly.