

# Assembly and Technology Compatible Design (ATCD)

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In Computer-Aided Design, the designer needs to know how the part will interface with its technology and assembly possibilities. Experience namely suggests that up to 80% of a product's costs are directly affected by its design. That is why the right choice of components, including screws, is so important.

The costs reduction of the assembly is generally enabled by the following remedies:

1. An assembly-oriented design.
2. Use of the standardized or unified construction elements.
3. As simple ways of fastening as possible.
4. Minimization of the assembly parts number and only one assembly direction.
5. The application of polyfunctional bolted joints.
6. Minimization of the partition lines number.

Although the screw as such is considered a conservative structural element, the current range offers a few exceptions to this rule, but they are relatively little used in practice.

The task of this paper is to point out some modern fasteners assortment that should find greater application in design practice to cost reduction. In particular, the so-called polyfunctional fasteners (fastening elements that combine several functions) could be used on a larger scale.

## About This in Detail

Let's start with the triangle thread rolling screws (**Fig.1**).  
Benefits:

- Quantity reduction of individual pieces
- Faster and safer assembly
- They have the triangle shape, which reduces friction during internal thread forming
- Inherently provides resistance to vibrational loosening
- Advantageous course of the fibers of the material (no cutting - **Fig. 2**)
- No chips are generated during assembly; therefore they are suitable for the field of electrical engineering and electronics
- Increased productivity
- Nutless joint and thereby one assembly direction
- Therefore high ability for automatic assembly



Fig. 1

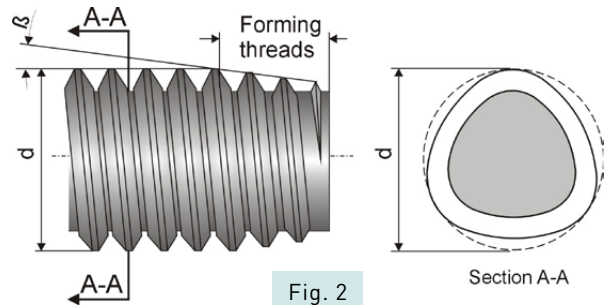


Fig. 2

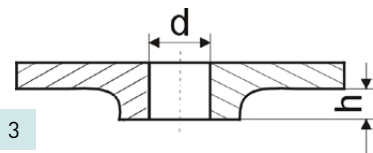


Fig. 3

Triangle thread rolling screws can also be used to join the sheets after the hole has been adjusted accordingly (**Fig. 3**).

The main imperative of ATCD is a team or simultaneous engineering approach, in which all relevant components of the production system are in the mutual symbiosis. This so-called fastener synergism is made up of: technology and assembly oriented design - engineering and logistic - exact tightening (**Fig. 4**). Of course, the environmental aspect must not be forgotten. This also applies to seemingly harmless lock nuts with a nylon ring according to DIN 985. Disposing them in melting furnaces together with a nylon ring is not as

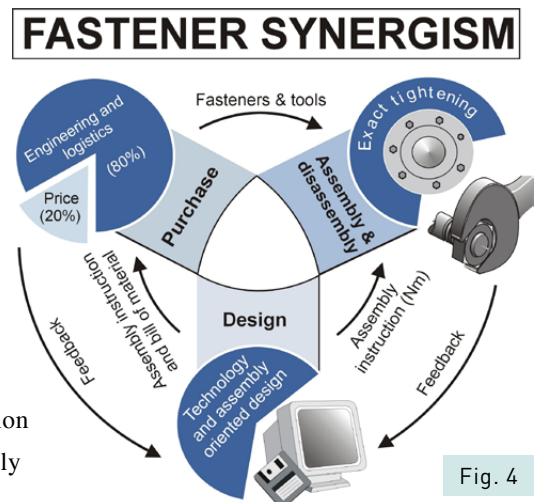


Fig. 4



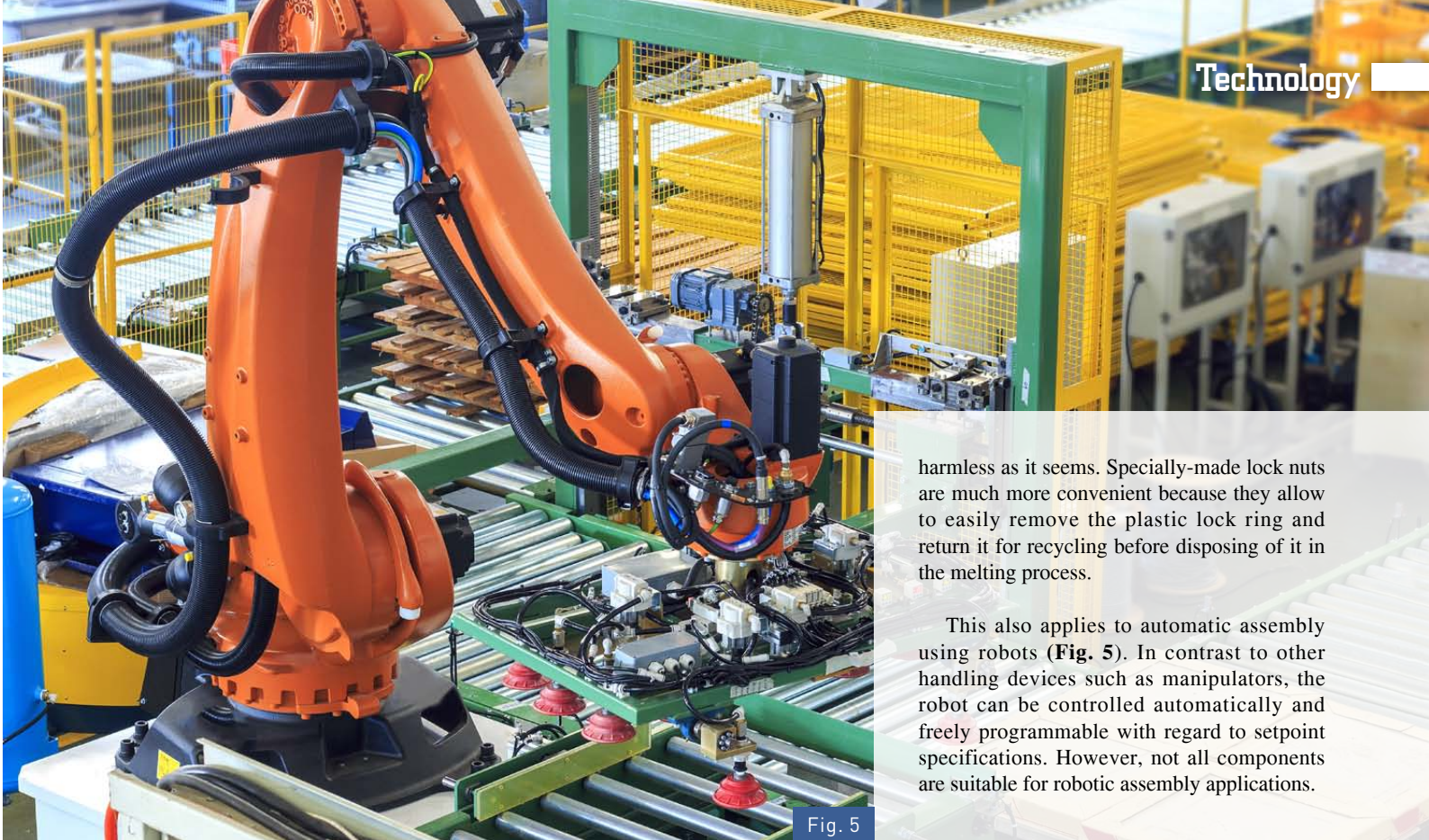


Fig. 5

harmless as it seems. Specially-made lock nuts are much more convenient because they allow to easily remove the plastic lock ring and return it for recycling before disposing of it in the melting process.

This also applies to automatic assembly using robots (Fig. 5). In contrast to other handling devices such as manipulators, the robot can be controlled automatically and freely programmable with regard to setpoint specifications. However, not all components are suitable for robotic assembly applications.

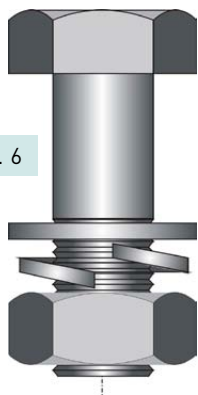


Fig. 6

An example of an absolutely unsuitable screw connection design for automatic assembly is shown in Figure 6. In addition, it contains too many together assembled elements (one nut and two washers), and has two mounting directions - from above and from below. In addition, a spring washer according to DIN 127 is not a good locking element.

Similarly, not all tightening grooves are suitable for automatic assembly (Fig. 7a and 7b). Variant 7a is also more advantageous from a technological point of view, because it can transmit higher torque moments and wear less edges.

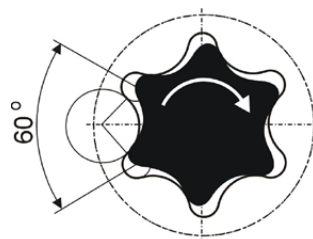


Fig. 7a - proper

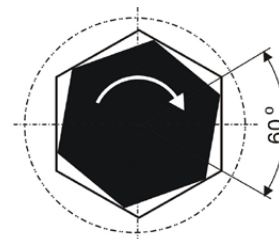


Fig. 7a - wrong

An example of a suitable easy automatic assembly application is shown in Fig. 8. As can be seen in this figure, a separate problem is the supply of screws to the assembly location in the oriented position. This significant operation places increased demands on the geometry of the screws. No vibrating feeder is e.g. able to correctly position the screws shorter than their diameters. Ideally a fastener should have an aspect ratio of 1,5:1,0.

## Conclusion

In the article there were pointed out some possibilities of the assembly and production costs reduction. ATCD provides such an opportunity. Every designer should respect the principle that fasteners should be adapted to production and assembly conditions and not the other way around. This principle and many others represent a significant rationalization potential of bolted joints assembly.

Of course, there are a lot of other options which would deserve our attention. In any case a key for "tightening the costs – cutting the screw" has a constructor in his hands because he is responsible for the whole production economy and thus the products' marketability. ■

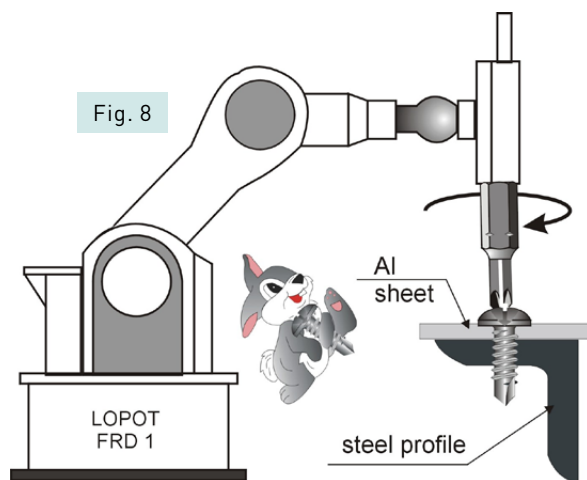


Fig. 8

