

Thread Rolling Machines and Tooling – Trends and Developments

Videx Machine Engineering is manufacturing Thread Rollers for headed parts, and Fully Automatic Machines for Threaded Studs and Bent Bolts.

The company was founded in 1973, by David Wiesenfeld, who designed and made by his own the first magazine feed thread rollers. Today, Videx is producing over 70 different models of machinery for the Wire and Fastener Industries.

Following is a summary of trends and developments in the Fastener Industry, based on the experience of the Videx engineering team:

Multiple Operations; One machine – Separate stations

One of the major considerations made by a customer, at time of choosing a new machine, is to find an affordable one, which will make his parts at the highest possible rate, with a minimal cost. The chosen machine should combine as many operations and processes as technically possible, to minimize the need in secondary operations.

Nowadays, with the increasing cost of labor and machinery, and decreased product price, it is everyone's desire to try and minimize the operators' intervention in the process, while maximizing the hourly production.

It is Videx's experience, that whenever 2 operations are made on a blank at the same time, they will most probably have a mutual effect on each other. For example: when chamfer rolling and threading at the same time, both operations push the material in opposite directions. Combining both into one die is considerably reducing the quality and the die life. Therefore, it is better if each operation is done in a separate station, so there is no influence of one operation on the other.

Following are a few examples of parts that can be made either the traditional way, by separate machines, or by a multiple operation machines:

- Bolts, which can be headed on a multi-station transfer header and thread rolled on a separate thread roller, can be made fully automatically in a Bolt-maker.
- Engine Studs, which are High Tensile studs, extruded and threaded on both ends. These studs are traditionally extruded on each side separately in an open-die header, and then threaded on a separate horizontal threading machine. A Videx automatic machine will pull, straighten and cut from coil, and then extrude both ends and thread both ends, without operator intervention.
- B7 studs, which require a lot of handling the traditional way: cutting, chamfering, stamping and threading. These parts can now be made by a fully automatic Videx machine (see drawing).

- Hanger Bolts, which are short studs, with wood screw thread on one side, machine thread on the other side, and a flat in the center. These parts can be made fully automatically, at a rate of 150 PPM, by a Videx machine, right from coil.
- U Bolts, that require multiple operations and a lot of handling, and can be made on the Videx fully automatic machine at a rate of 100 parts per minute (See drawing enclosed).
- Wheel Bolts, threaded and knurled under or on the head. These parts are sometimes attempted to be rolled in one pass, on a big flat die machine, with long dies. This operation is problematic, due to the difference in pitch diameters, and the transit between the thread and the knurl. The Videx Dual Spindle Threaders eliminate this problem, by separating the operations, and rolling the knurl in a separate station, using smaller, more economic dies.

Combining operations into one machine is advantageous. Following are some of the benefits that a customer can achieve by using a multiple operation machine:

- a) Save handling costs by receiving finished parts out of the machine.
- b) Eliminate possible human mistakes, such as occasional feeding of wrong parts, or use of improper (too long or too short) parts for the next operation.
A combined, multi station machine is doing one operation after the other, while the first station always feeds the next one. Once the machine is set, the right process is assured, and the machine will always cut, for example, the exact length, required for the next operation. A mistake in length is impossible.
- c) Increased productivity. All operations are done simultaneously, and not one after the other.
- d) Reduction of set-up time. The automatic machine is designed, so that length set-up is done once, and is already affecting all stations.
- e) Save floor space by using one machine, that takes further less floor space than 2 or 3 machines traditionally needed to manufacture the same product.
- f) Less in-process expensive material that requires floor space, and is subject to damage.
- g) No risk of mixing materials. The customer keeps track on the material coming into the machine
- h) Save power. Less power is required for a fully automatic machine, compared to a few semi automatic machines.
- i) Take advantage of the position of the part. For example, in a wheel bolt thread roller, the parts come out of the first station already oriented, ready for the next station.

Rolling rather than cutting

The industry is leaning toward rolling shapes that used to be cut. The reason is not only for the higher quality and better consistency, but also for saving material and achieving faster speeds. Rolling chamfers by the Videx chamfer system, for example, is extending the blanks by 1.5-3.0mm, which is a considerable saving in raw material. The chamfers are rolled by pulling the material out rather than pushing it in, so the chamfer is not hardened, and will not affect the thread rolling die life.

Chamfering by rolling allows a consistent chamfer, which is not subject to the set-up of the tooling, which is necessary when cutting the chamfer, for example

Service

When choosing which machine to buy, the customer should take into consideration also the machine manufacturer's ability to supply service, spare parts and advise. Some companies will also help customers in future design of tooling.

A friendly service and assistance is not only more pleasant. In most cases it will have a great influence on the machine performance.

In-Line Quality Control

Most customers will try to check for part quality during the process, in order to find inconsistency while the operation occurs. This is important to prevent bad parts coming out of the machine, which would have required scanning them later on.

Some process monitors (like Helpro and SK) are already designed today also for planetary systems, and are very accurate and reliable.

Tooling and Thread Rolling dies

Quality: The Fastener Industry is demanding High Performance tooling; thread rolling and knurl dies that provide higher die life. Using better tools extends the period between change-over of dies and is therefore time saving.

Quick-Change: The tooling concept is changing into the use of pre-adjusted, preset tooling for each part. This takes the guess work out of the employee, and leaves less room for mistakes.

Videx threaders are now using preset thread rolling heads and cams per thread. The fully automatic machine are equipped with preset magazines and bending dies.

Whenever adjustments have to be made, these should be done without using wrenches and tooling, using handles and quick clamping devices such as Videx's Hydraulic Clamping.

Why use a Planetary Tread Roller?

There are 3 thread rolling systems on the market, all proven along years of operation:

- A. Planetary dies, with a round rotary die and a stationary segment die.
- B. Flat dies, with one stationary flat die and one moving flat die.
- C. Circular die, with 2 or 3 rotating circular dies.

The question which system to choose depends is not always easy to answer, and in many cases, it has more then one possible answer.

Videx has been solely focusing on the planetary system along its 26 years of activity, and finds it most suitable and versatile for both single station and multi-station machines. Late developments in the planetary system have led to improved thread quality and longer die life. Though there are a few items that will be rolled better on flat or round dies (such as headed wood screws , the majority of the parts will give better results in the planetary system, for the following reasons:

1. Flexible segment length: The length of segment in the planetary system can be changed according to the thread diameter, so smaller diameter parts can use shorter, less expensive dies.
Shorter segments reduce the risk of over-rolling when running small diameters or knurls, where only one pass is required. In the planetary system, no matter what is the length of the segment, the parts will always come out of the dies at the same place, ready for the next station.
2. Longer Rolling path: The rolling path is longer then on flat die machines, allowing rolling harder materials, yet getting good die life.
The enclosed drawings show the Videx V-20 120° die for rolling M-12 and the 150° segment for rolling M-16.
3. When rolling M-12 in a flat die machine with WAT-20 die size (152mm / 171mm), the blank makes 4.5 turns only. In the Videx V-20, the rolling path is 214mm long, giving 6.3 turns of the blank in between the dies, which is 40 % more then on the flat dies.
When rolling M-16 in a flat die machine with WAT-30 die size (191mm / 216mm), the number of revolutions of M-16 is only 4.2, while in the Videx machine, the rolling path is 310mm, giving 6.8 revolutions of the part, which is 60% longer then the flat die machine.
4. Longer period between die change: Due to the longer segment length, the planetary dies last longer then flat dies, and therefore require less frequent change -overs, and less down time. It also enables rolling ghost shifts, by less skilled operators, without stopping to change and match dies .
5. Uniform Thread Diameter: In flat die machines, the ram heats up after a while, due to the friction and the reciprocating operation, causing heating of the tools, and change in the pressure of the thread, and the outer diameter of the part. In the planetary system, there are no moving parts, and there is therefore no heat, and no thread diameter change over the time.

6. Dual-Spindle Rollers: The planetary system features a compact design, enabling to integrate 2 or 3 stations in one machine, while each station is performing a different operation. Videx is offering 2 spindle machine for various applications, with various combinations of spindle sizes.

Separating the operations, as in a transfer header, allows rolling deeper shapes and complex operations that would have otherwise had a negative effect on each other. For example: chamfer and groove.

The separate stations enable rolling of 2 shapes that need thread matching, like knurl and thread. Wheel bolts, for example, have a straight knurl under the head and a thread, and both form need to be matched. Some wheel bolts have 2 threads: one on the shank and one on the head, for a plastic cap. Each one of these threads needs to be matched separately.

Matching 2 different shapes is much more complex in flat dies, where the part is fed into the second die through the first die, and not by a separate introduction system.

7. Parts Orientation: In the Planetary system, the parts come out already oriented, at a slow linear speed, ready for the next station. This fact enables combining 2 heads, or even more in one machine. The facts that parts always come out off the rolling process oriented and at a slow speed is helpful for the purpose of packing and assembly.
8. Slower Rolling speed: The parts processed by the planetary system are rolled at a slower speed than on flat dies. For example:
When rolling M-10 at 480 PPM, we use a nominal spindle speed of 80 RPM, and 6 starts. The surface speed is computed according to the circumference of the rotary die multiplied by the rotary die R.P.M. :
In M-10, the circumferential speed is $3.14 \times \text{Ø}217.5\text{mm} \times 80 \text{ RPM} = 54,663 \text{ mm/minute}$ or 55 meter/minute.
In a flat die machine, running 480 PPM means, that there are 960 back and forth cycles. If the die length is 180mm, then the surface speed is 172,800 mm/minute, or 172.8 meter/minute, which is over 3 times faster than the speed in the planetary system.
9. Longer Threads: The planetary system enables rolling long threads, up to 200mm (8"). The long die length is made possible by supporting the shaft at the end, without any other changes in the machine design.
10. Low Maintenance costs: The Videx Planetary Thread Rollers are not using any slides, so there are no wearing parts, and no maintenance costs. The main Taper-Roller bearings can be re-tightened every few years, and there are no other parts to replace other than ball bearings.

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