The benefits of drawing dies with long reduction cone and forced lubrication

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Speakers:

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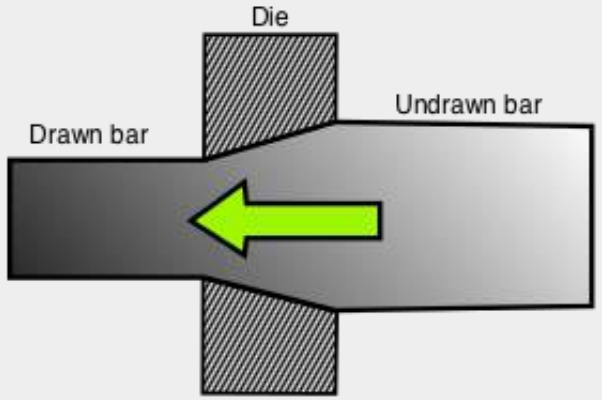
The drawing process

"Drawing is a metalworking process using tensile force to stretch the metal thinner, into a desired shape and thickness."



Bar, tube, and wire drawing all work upon the same principle: the material is drawn through a die to reduce the diameter and increase the length.

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The drawing process

Two forces come into play:

the drawing force to be applied	VS.	the tensile strength of the material

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The drawing process

Thus, the importance to minimize the coefficient of friction (COF)

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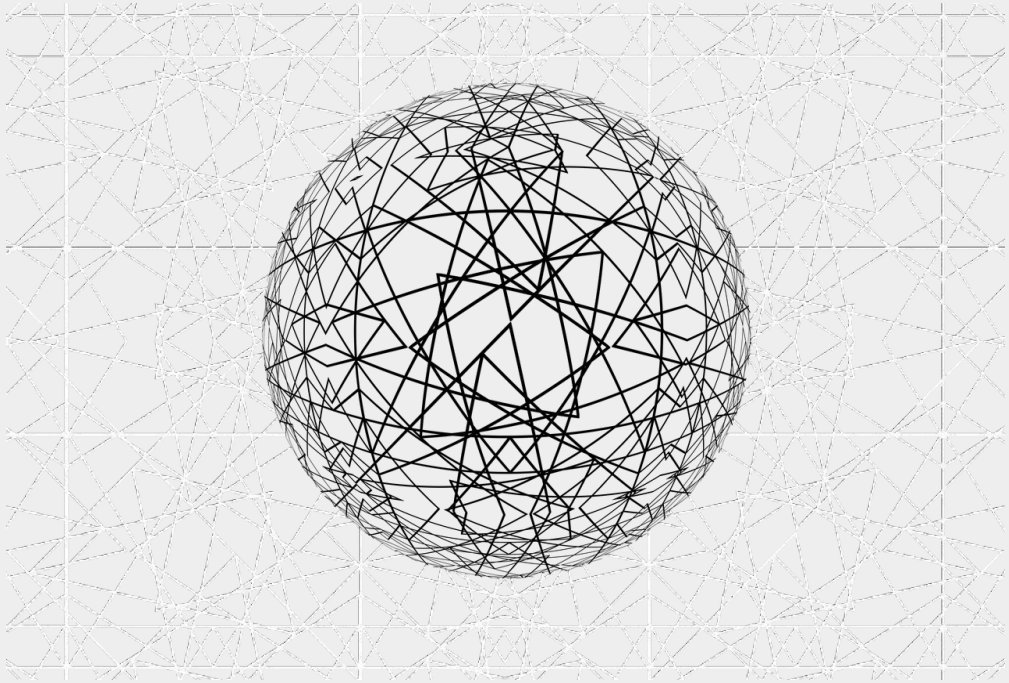
Drawing and system thinking

"System thinking is understanding the bigger picture by seeing the elements, evaluating their interactions, and appreciating causes and effects of these dynamics."

> No spot interventions



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Drawing dies

Dies are the tools used in the drawing process.

Their geometry plays an essential role in drawing wire, tube and bars.

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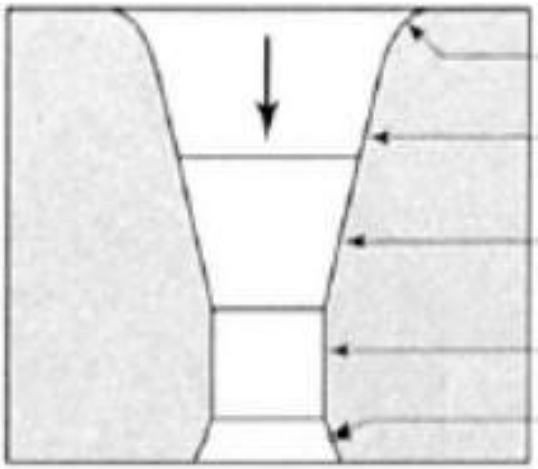
Typical geometry of a drawing die

- Entrance/Bell
- Reduction area
- Bearing
- Exit/Back Relief



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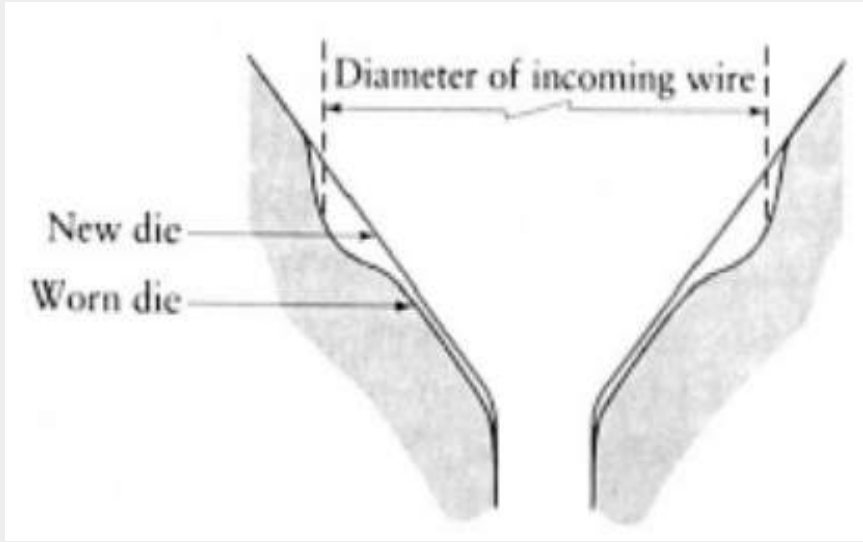
Different applications, different dies

The geometry of the drawing die has to change according to:

- Type of material being drawn (e.g. hard or soft wire)
- Final application of the material
- Desired elongation
- Desired drawing speed

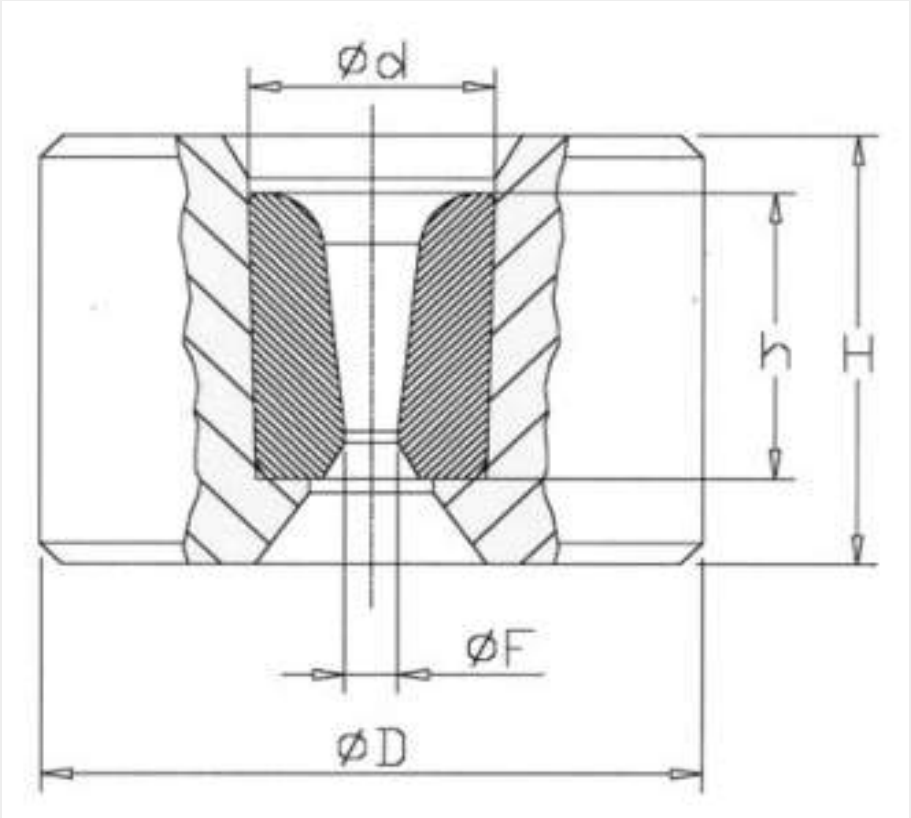
Friction & die wear

Die wear takes place mainly in the reduction zone, where the incoming wire comes into contact with the die



Drawing dies type L

A longer reduction cone with minor inclination reduces die wear



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Less die wear, more advantages

- Longer die life
- Lower machine stops due to minor breaks
- Lower management costs due to less die changes

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Giovanni Battista Venturi [1746 - 1822]

The Venturi effect:

"A fluid flowing through a constricted section of a tube undergoes a decrease in pressure.

As the fluid flows through the constriction, the fluid molecules speed up."

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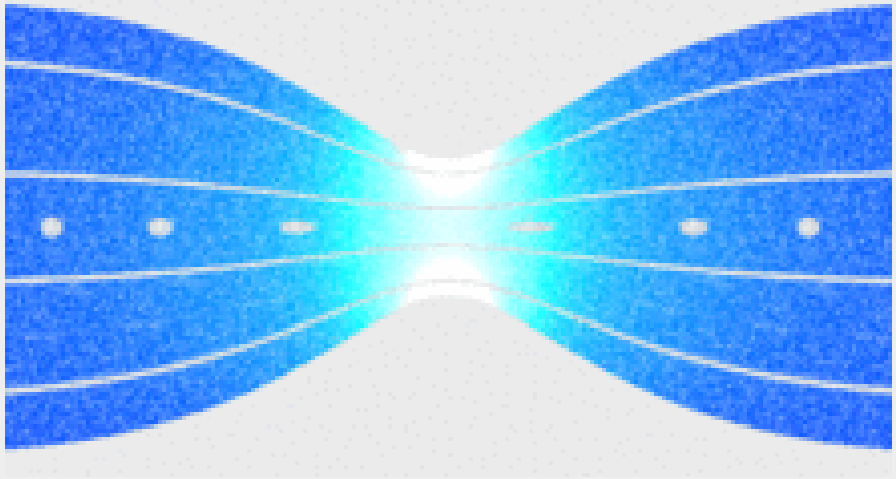
Applying the Venturi effect



Flow of material through a Venturi tube. As the fluid goes through the constriction, it speeds up, and the pressure drops.

The greater length of the reduction cone favors a good "Venturi effect" allowing to create an optimal lubricating film.

Using a pressure die increases lubricant pressure and drawing speed.

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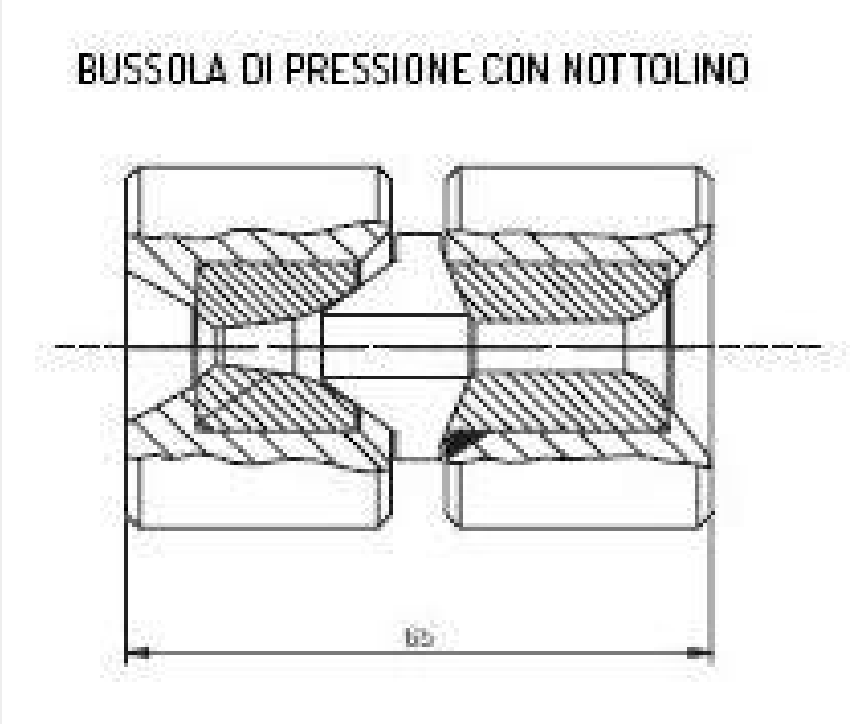
Giuseppe Vassena [1938-2012]

In 1976, the founder of Vassena srl was the first one to apply the Venturi effect on drawing dies.

Anticipating the times with formidable intuition, he revolutionized the drawing process.



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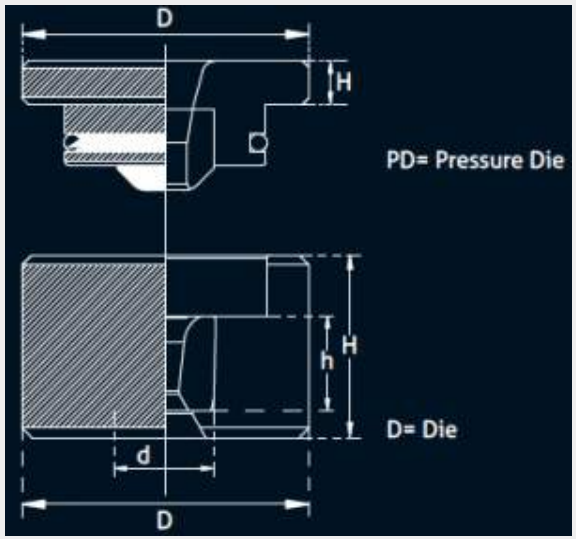
Pressure die + long reduction cone



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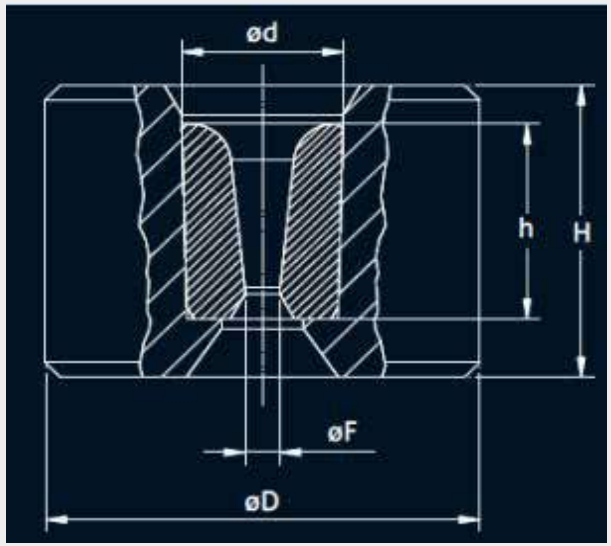

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VG402R.1 + Type L NIB

The **double compression chamber** creates increased pressure, and therefore a better lubrication (also at low speeds)

Fixed and unmovable nib:
no vibrations, less breakages

Well sized depending on the type of material and wire diameter
> longer duration

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VG402R.1 + Type L NIB

- Better coverage of lubricant on wire
- Longer die life
- Higher drawing speeds
- Less COF
- Less energy consumption

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Tests

Drawing tests were carried out with two types of dies:

Vassena Type L size 3^ - Casing 43x30mm – Nib 16x20mm

vs.

Vassena Type NOR size 3^ - Casing 43x30mm – Nib 20x18mm

- Straight drawing machine with capstans D. 600mm and 10 steps
- Carbon steel wire (C = 0.842%) patented and galvanized with 345 gr/m^2 weight
- Wire diameter 1.20mm - Resistance R = 2.450 N/mm^2

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Results The practical tests confirmed the theoretical calculations

	Drawing speed (m/s)	Dies replacements	Final resistance (N/mm^2)
NOR Type	8	2 (final)	2.270
L Type	12	1 (final)	2.335

Drawing with dies type L resulted in a better end quality, because of the minor stress during the process.

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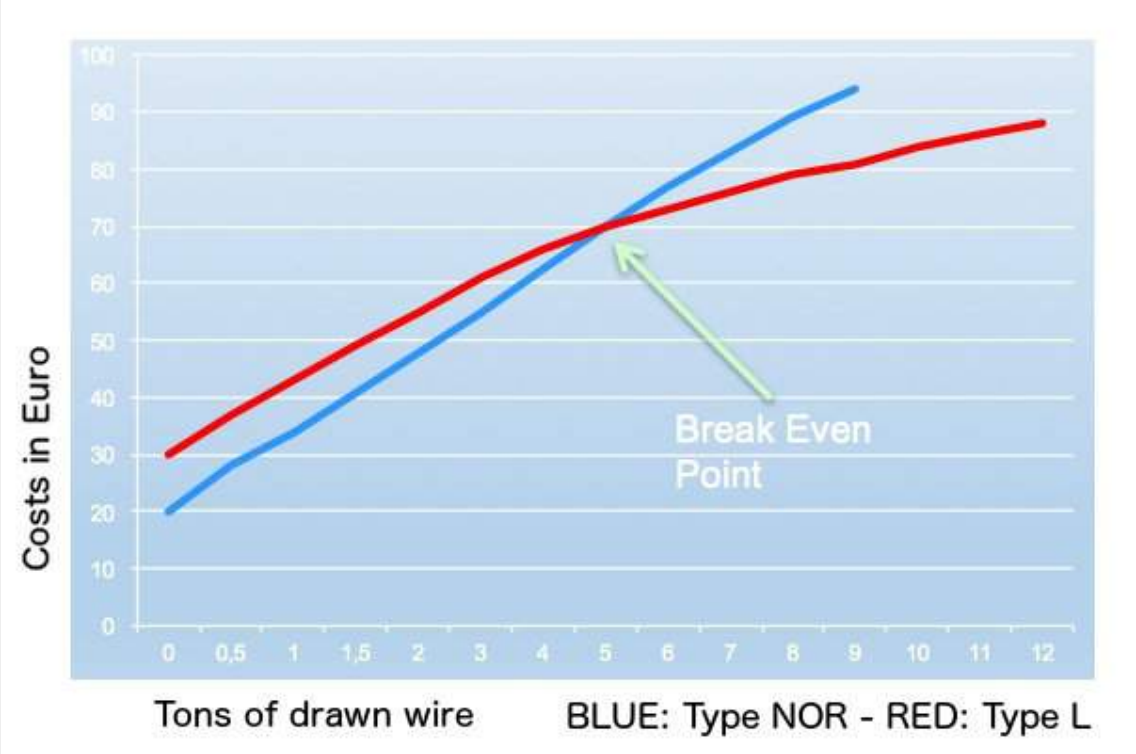
Cost-benefit analysis



The higher purchase cost of the drawing die type L is amortized very soon (lower operating costs).

The cost-benefit curve is self-evident.

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Conclusions

The use of a drawing die with a correct geometry can help in obtaining a stable and high-performance drawing process **avoiding further unnecessary processing and problems** (e.g. wire cleaning)

Compared to a traditional drawing die, one with **long reduction cone** offers:

> technical advantages (durability, reliability, better end quality)

> economic benefits (lower management costs and energy consumption)

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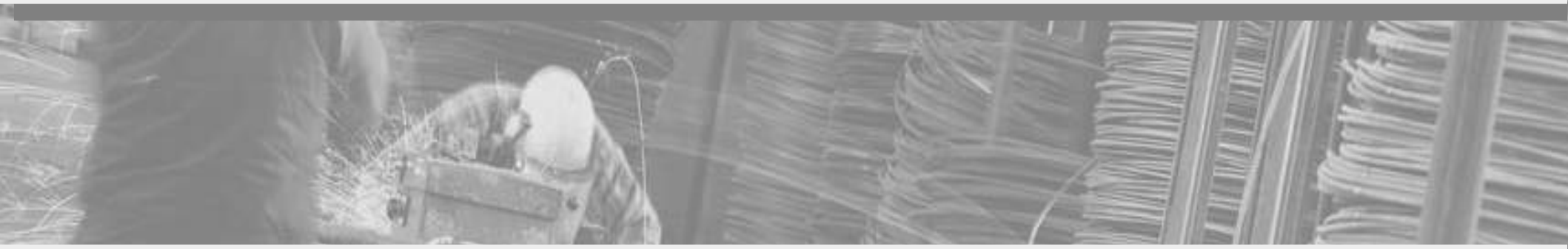
Thanks for your kind attention!

More on www.vassena.it



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