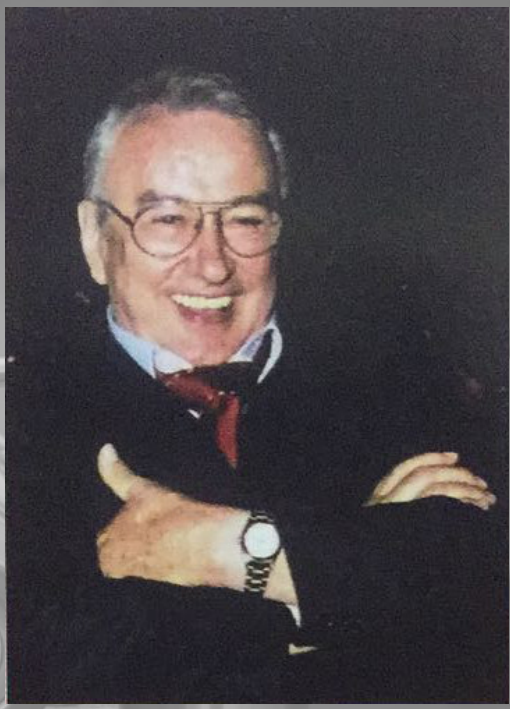
Vassena Filiere.
A reliable partner for the wire industry

Vassena Filiere, Malgrate (LC), Italy

Giuseppe Vassena [1938-2012]

The founder of Vassena srl started his business in 1958.

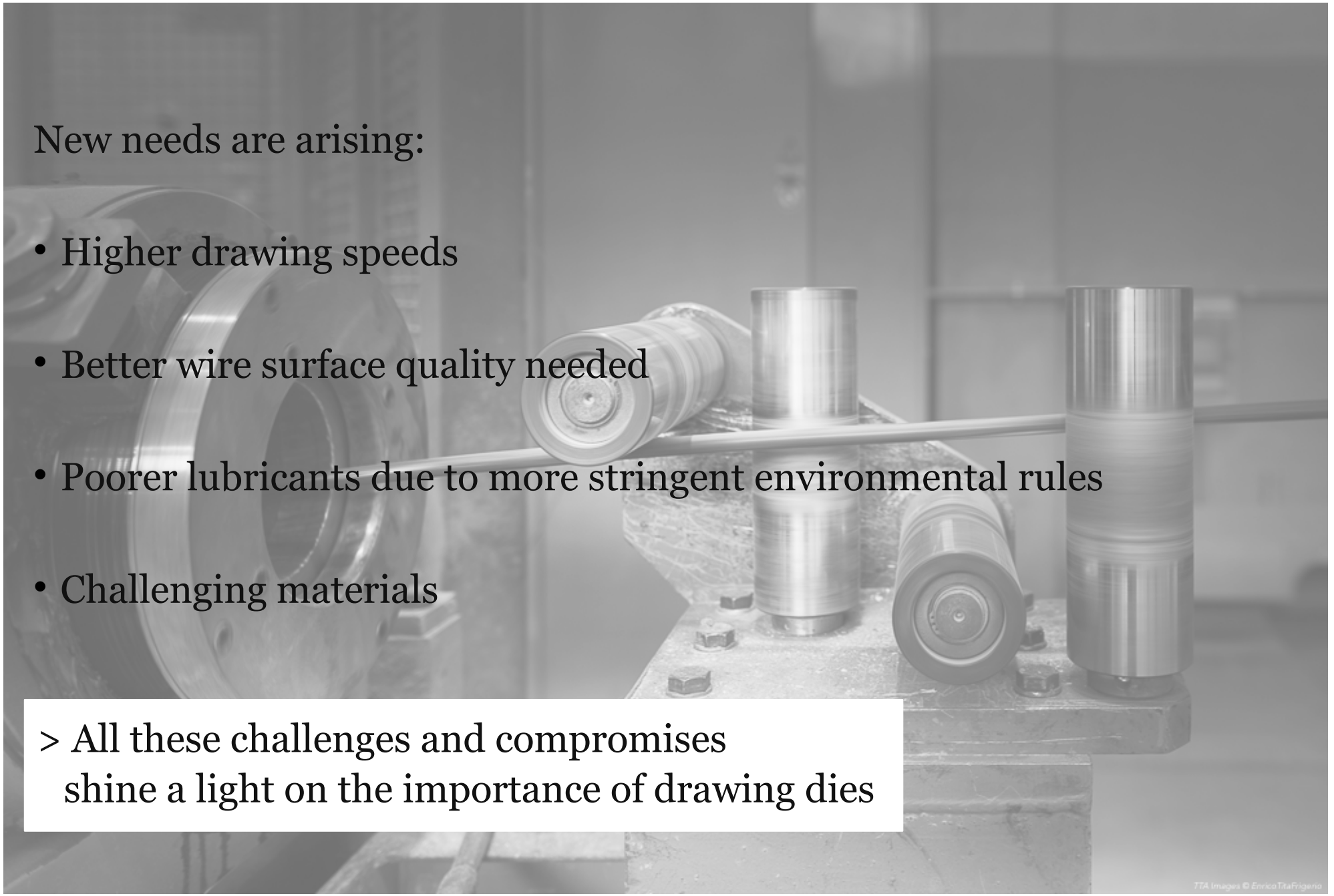
"The drawing die is not just a hole.
It's one of the main actors of the drawing process."



He began to work on customization and on the study of the different geometries needed at the various drawing stages to obtain a homogeneous constant drawing effect.

> a cutting-edge attitude, running counter times when price was the first decisive factor

Are times right now?



New needs are arising:

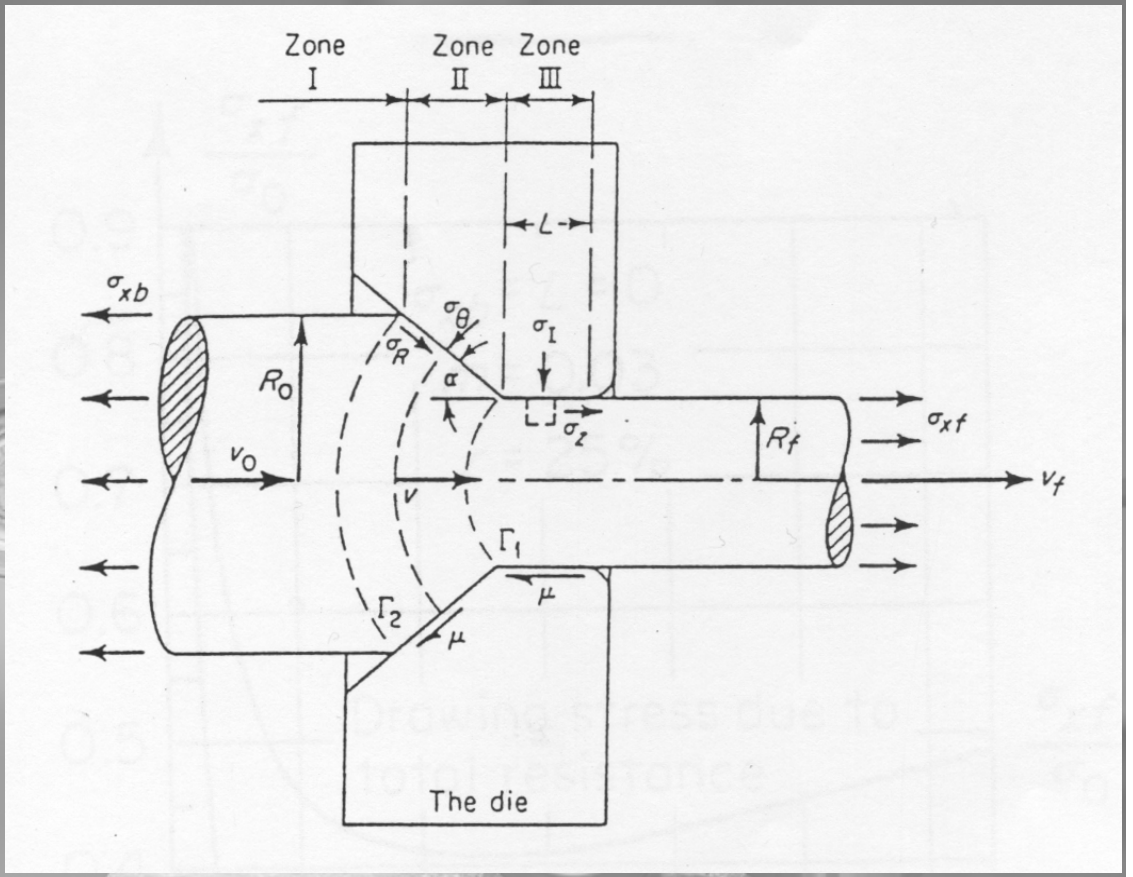
- Higher drawing speeds
- Better wire surface quality needed
- Poorer lubricants due to more stringent environmental rules
- Challenging materials

> All these challenges and compromises
> shine a light on the importance of drawing dies

Mechanics of the drawing process

Process variables in wire drawing:

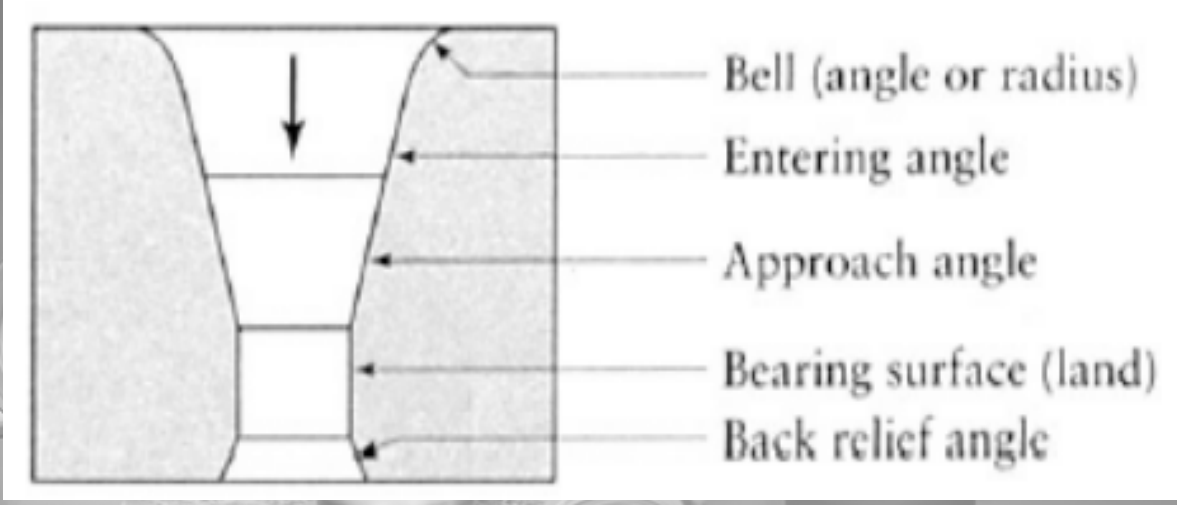
die angle, reduction in cross sectional area per pass, drawing speed, temperature and lubrication all affect F, the drawing force.



> Vassena has been concentrating on the study of die angles in relationship with the section reduction

Typical geometry of a drawing die

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

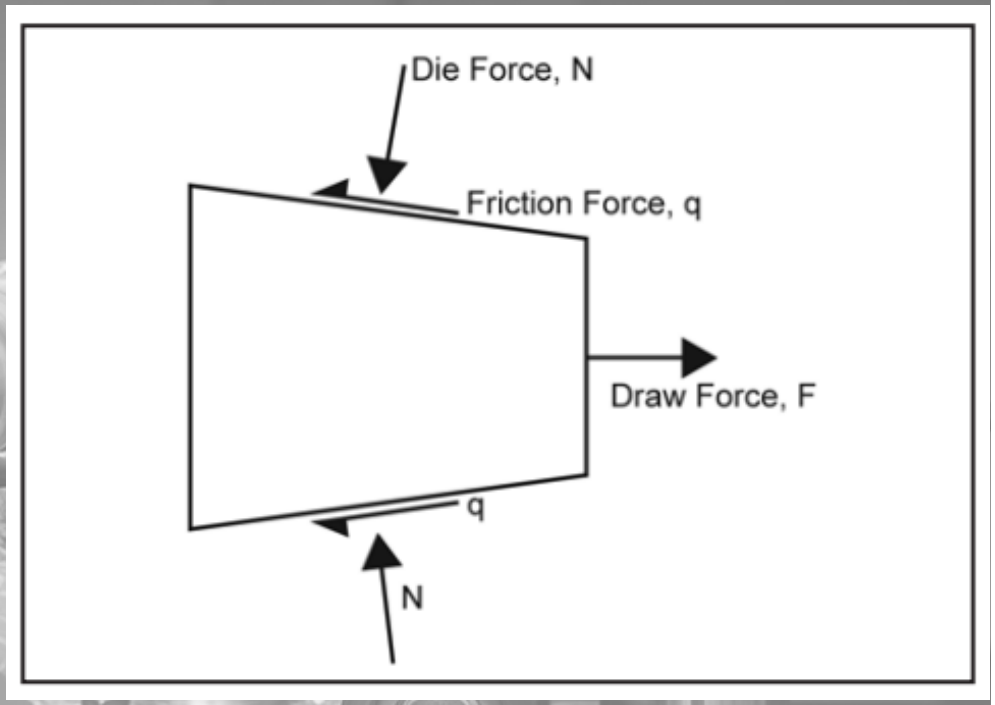


> The geometry of a drawing die has to change according to drawn material, desired elongation, drawing speed etc.

Forces operating in wire drawing

In the drawing process, different forces come into play:

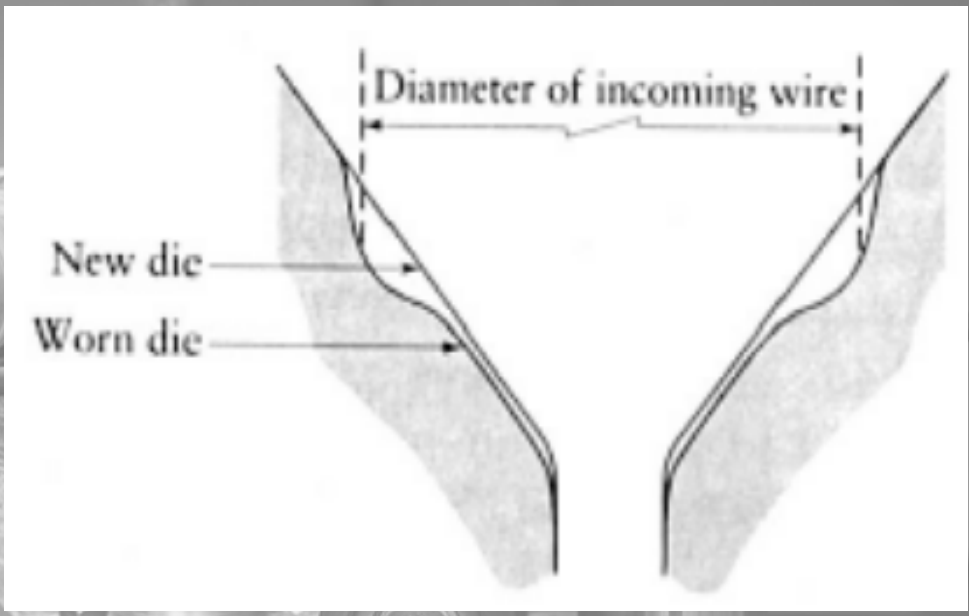
the drawing force to apply against the tensile strength of the material determines FRICTION.



> More friction, more die wear

Friction and die wear

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



> Is there any chance to reduce friction acting on the geometry of the drawing die?

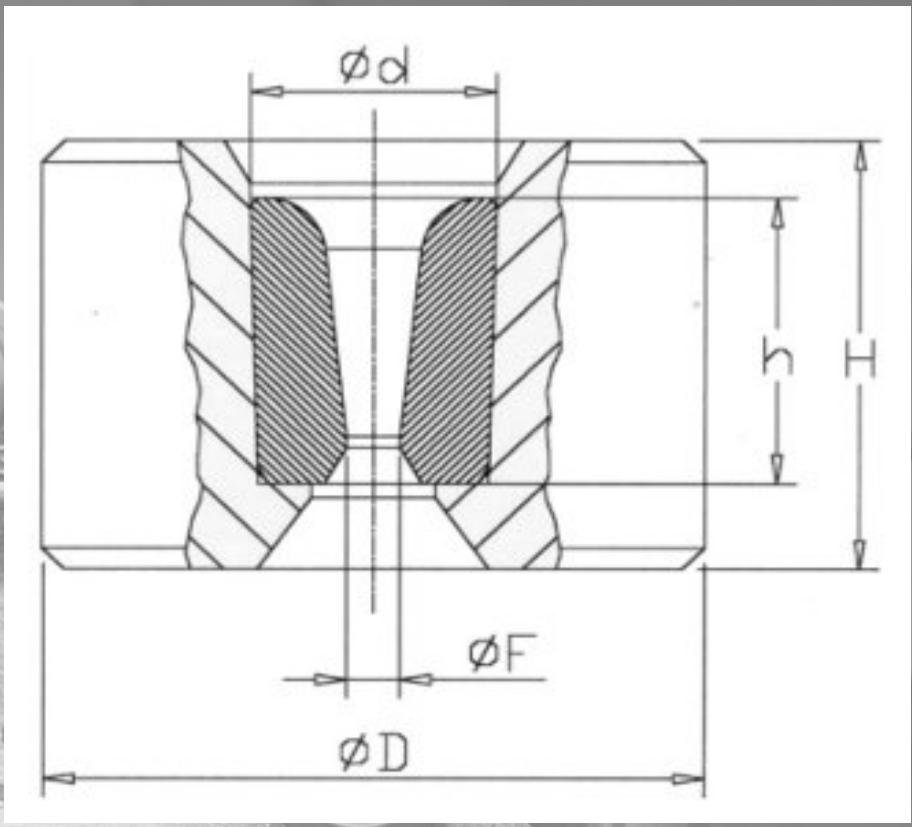
Disadvantages of die wear

- A shorter die life
- More machine stops caused by increased breaks
- Higher management costs due to more die changes

> How to minimize friction and die wear?

A longer reduction zone

Dies with longer reduction cone having minor inclination are less exposed to friction and die wear.



> Drawing dies type L

Giovanni Battista Venturi [1746 - 1822]

The Venturi effect:

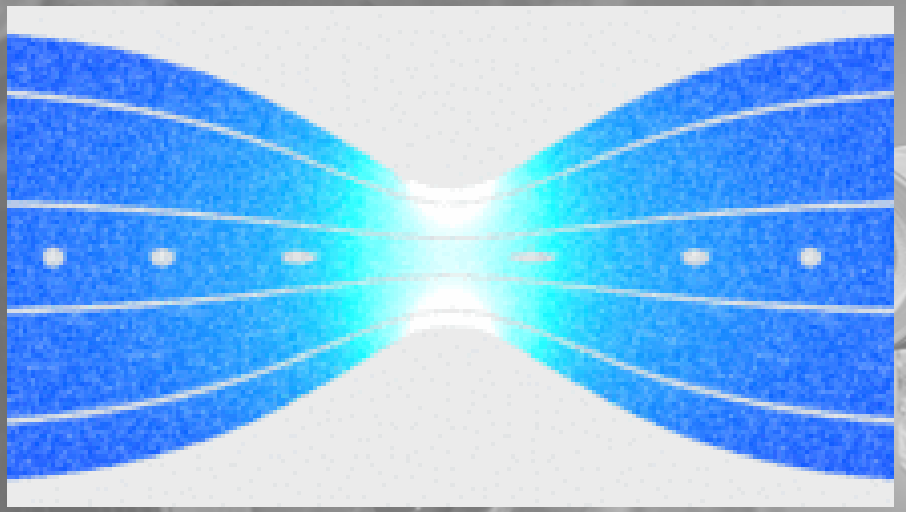
"A fluid flowing through a constricted section of a tube undergoes a decrease in pressure.

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

> How does this apply to drawing dies?

The Venturi effect in wire drawing

Flow of material through a Venturi tube.

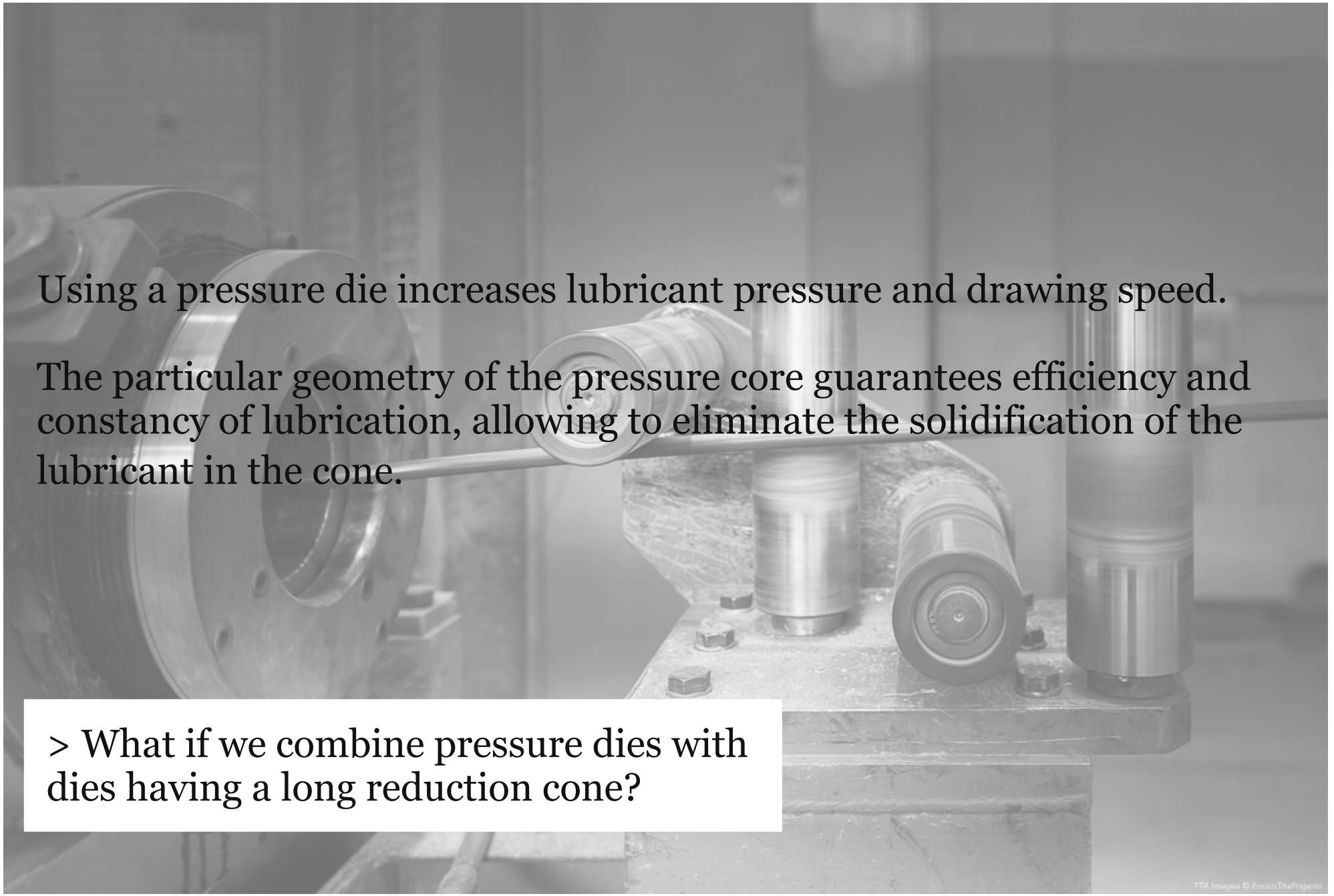


As the fluid goes through the constriction, it speeds up, and the pressure drops. The greater length of the reduction cone favors a good "Venturi effect" allowing to create an optimal lubricating film.

> Forced lubrication

> In 1976, Giuseppe Vassena was the first one to apply the Venturi effect on drawing dies.

Pressure dies

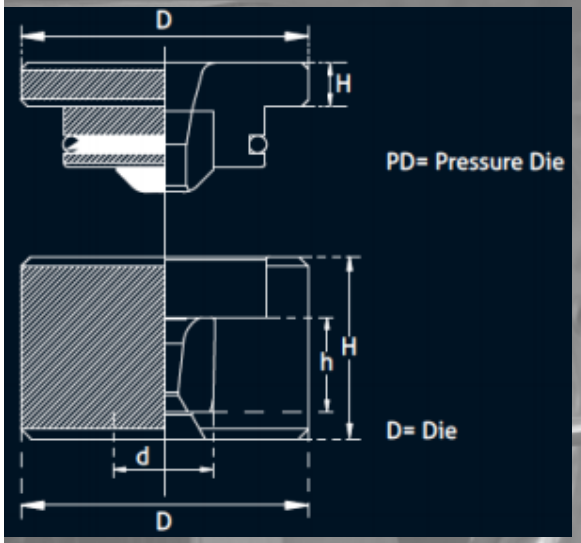


Using a pressure die increases lubricant pressure and drawing speed.

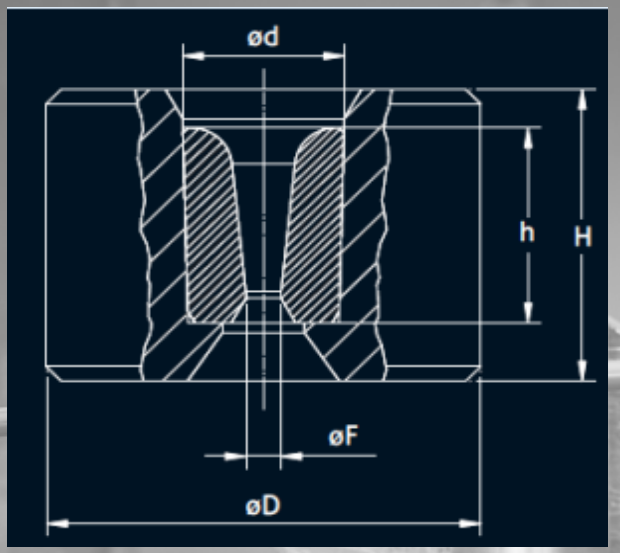
The particular geometry of the pressure core guarantees efficiency and constancy of lubrication, allowing to eliminate the solidification of the lubricant in the cone.

> What if we combine pressure dies with dies having a long reduction cone?

Pressure die + long reduction cone



+



=

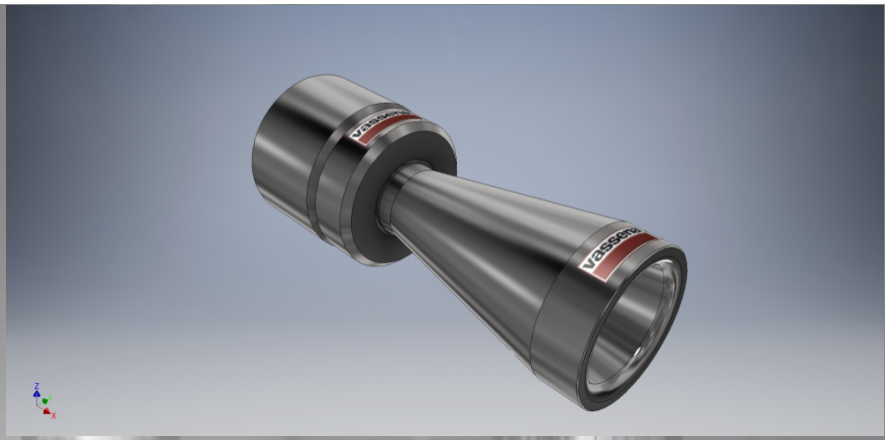
> VG402R.1 + Type L NIB

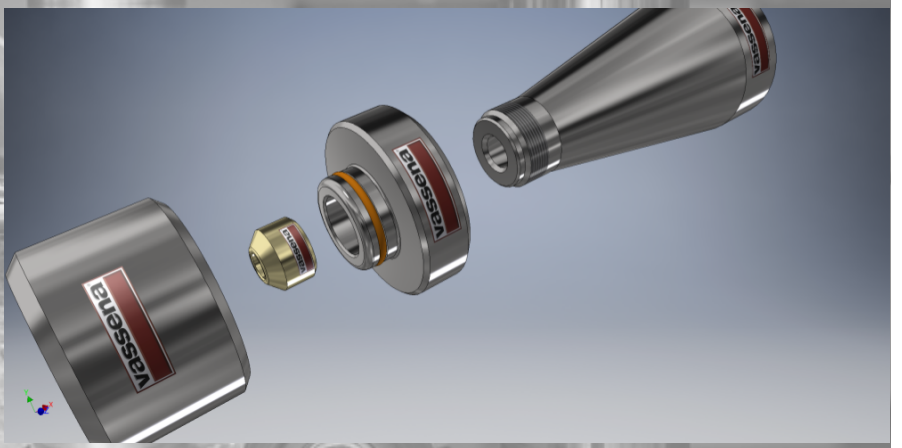
High speeds, long cones

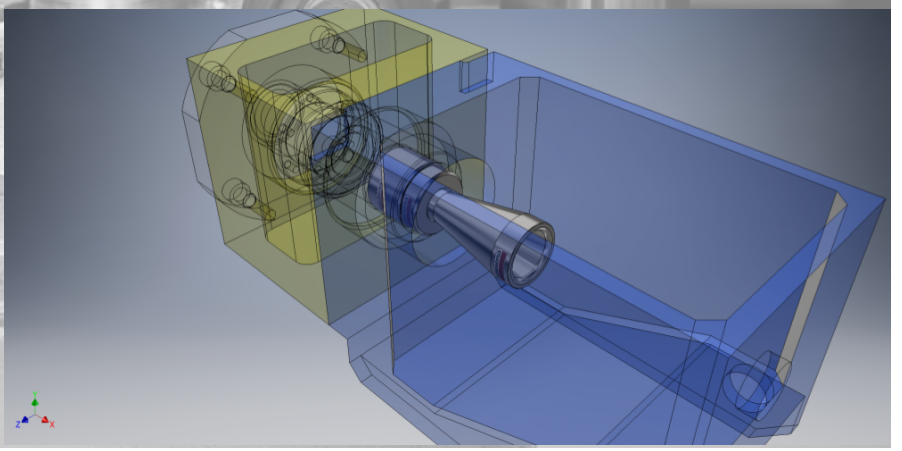
Higher drawing speeds require more advanced dies.

The **VG402R.2** has a special structure, which allows to reduce the friction coefficient ensuring higher drawing speed, better quality of the drawn wire and longer die life.

Other advantages: the elimination of the candle effect in the soap box and a healthier working environment.

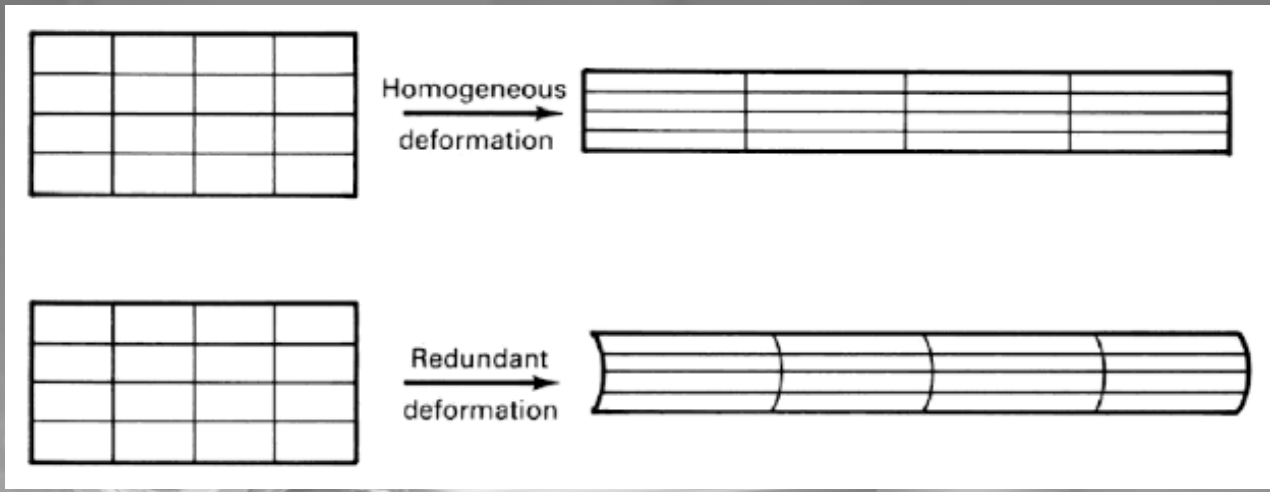






Redundant work

The total work carried out during the drawing process can be partitioned into three components:



Homogeneous work
Frictional work
Redundant work
} have adverse effects on wire's mechanical properties and increase energy needed for drawing.

> The particular geometry of a long-cone die coupled with pressure nib reduces redundant work

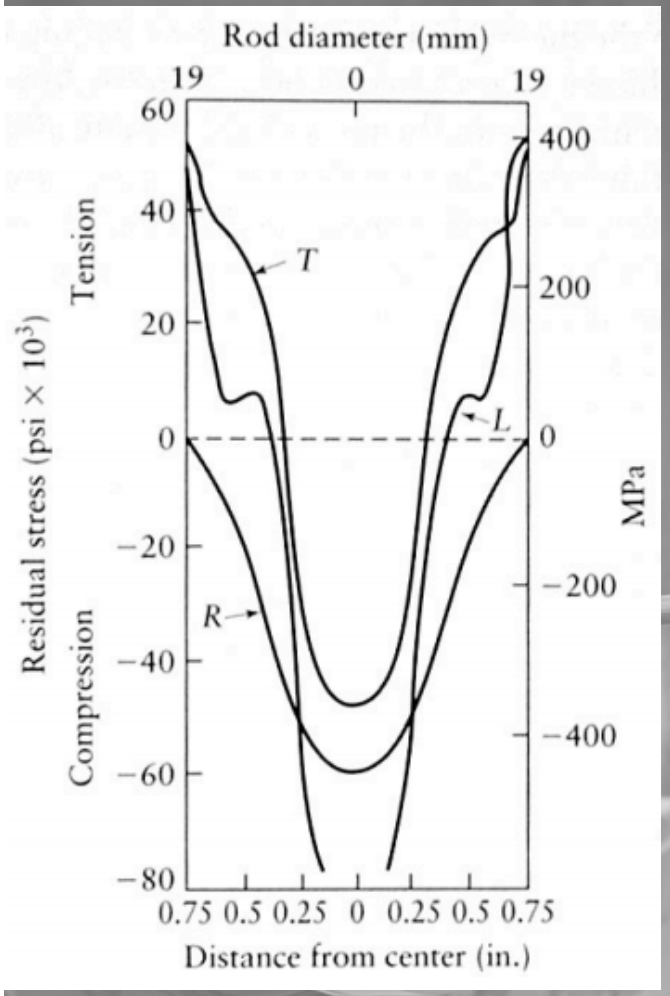
Residual stress

« Residual stresses are stresses that remain in a solid material after the original cause of the stresses has been removed. »

The residual stresses in drawn wires are of great importance, because they influence the mechanical properties.

> They can cause cracks and other defects

Residual stress



Because of the inhomogeneous deformation that the material undergoes, typically residual stresses occur in three directions:

- T tangential direction
- R radial direction
- L longitudinal direction

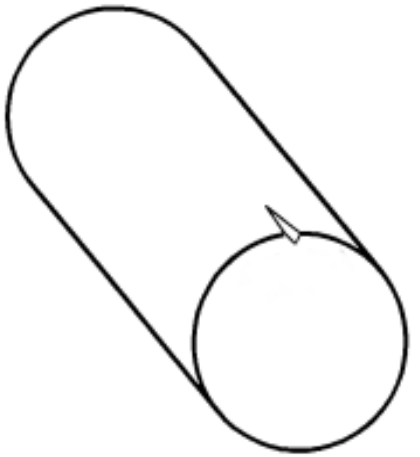
> Using low angle dies dramatically reduces residual stress

Torsion and die angle

Even if all parameters are properly controlled, the torsion behaviour of drawn wire tends to degrade in higher strengths.

So the die geometry becomes particularly important.

Smaller die angles result in better torsional properties.



> Better torsion behaviour, less fractures

VG402R.1 + Type L NIB, the advantages

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

> What if we put the theory to the test?

Tests

Drawing tests were carried out with two types of dies:

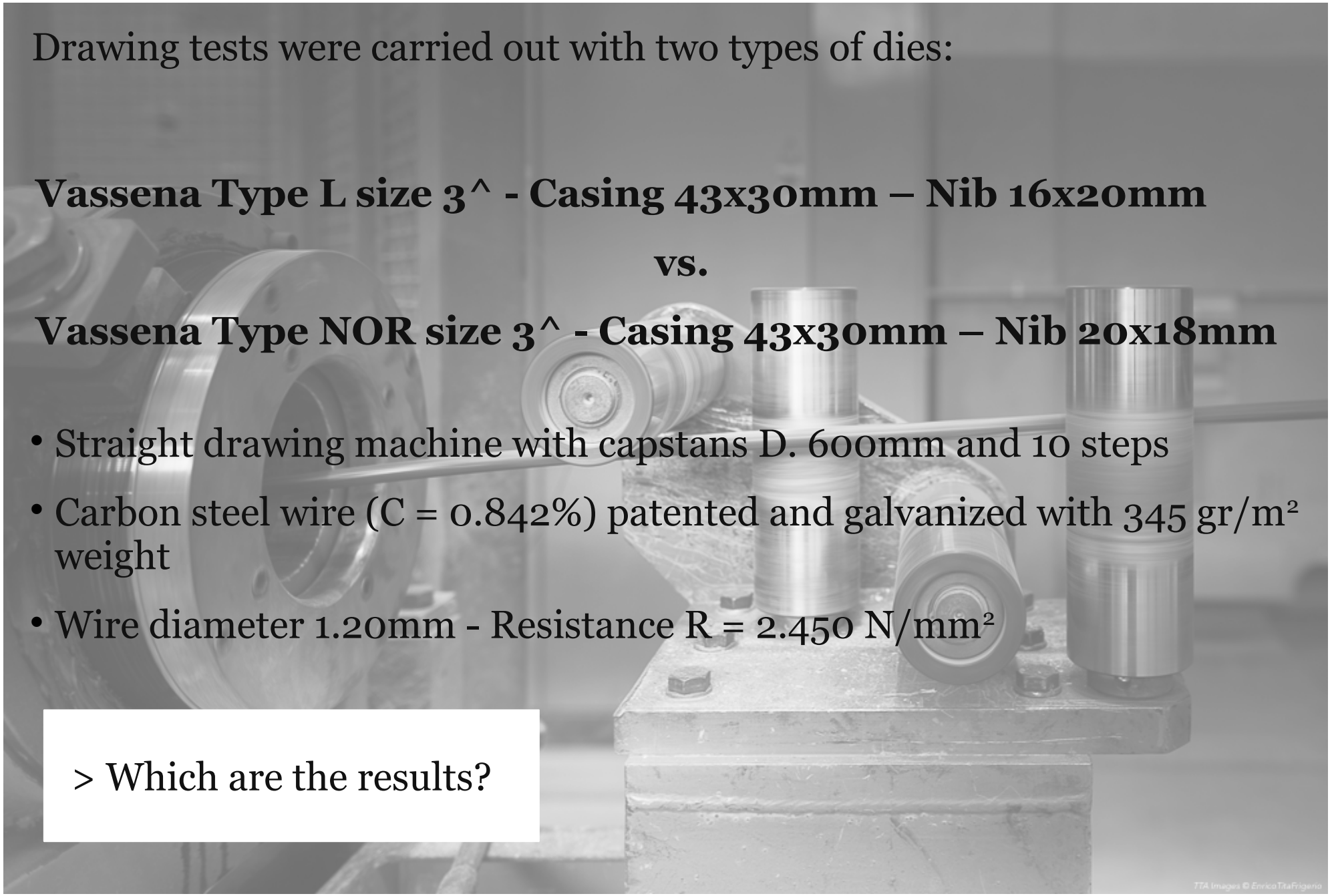
Vassena Type L size 3^ - Casing 43x30mm – Nib 16x20mm

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/m² weight
- Wire diameter 1.20mm - Resistance R = 2.450 N/mm²

> Which are the results?



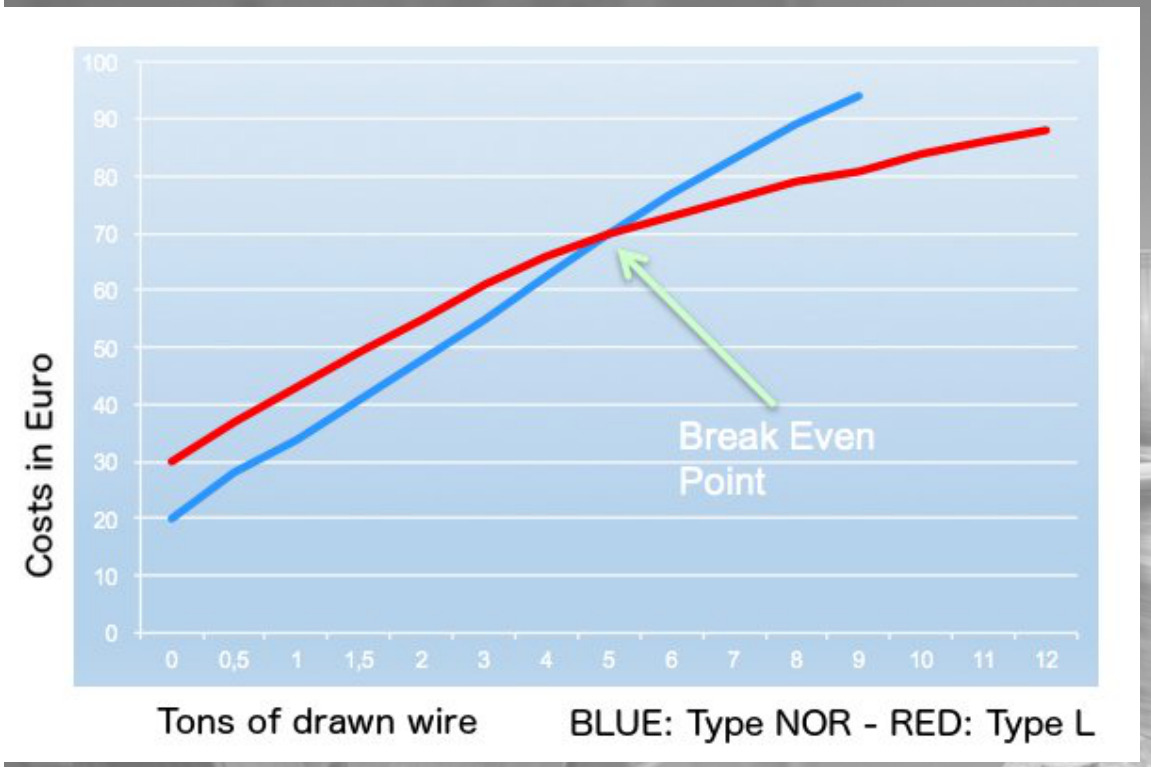
Results

	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.

> The practical tests confirmed the theoretical calculations

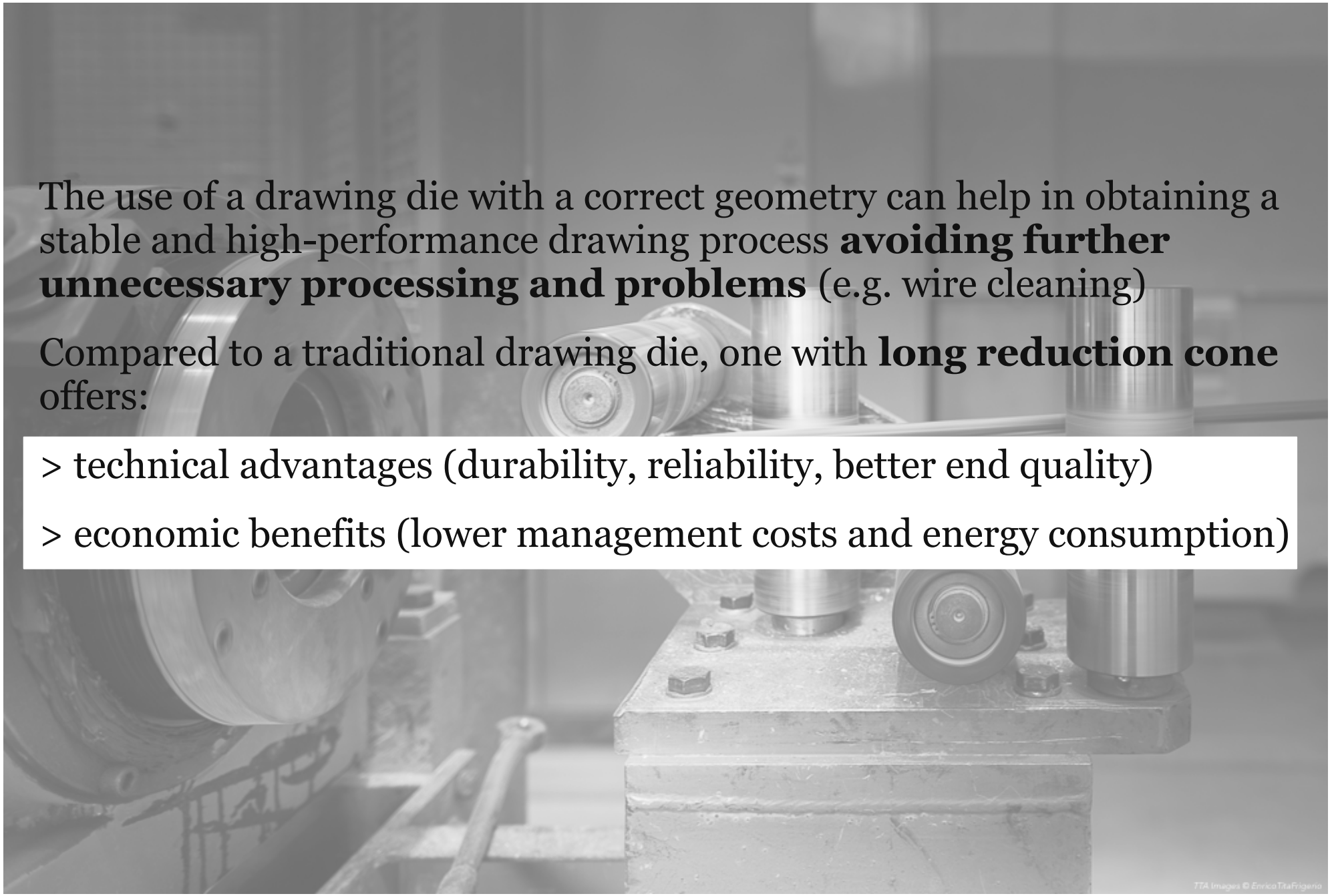
Cost-benefit analysis



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

> The cost-benefit curve shows the economic benefit of drawing with dies type L

All in all



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)

Innovations and cooperations

vassena®

MFL GROUP
BEST PRACTICE MADE PERFECT

Cooperations with the best Italian wire machinery manufacturers helped Vassena to keep up with the times and stimulated a continuous innovation process (MFL Group | Mario Frigerio).

HYPERION Materials & Technologies

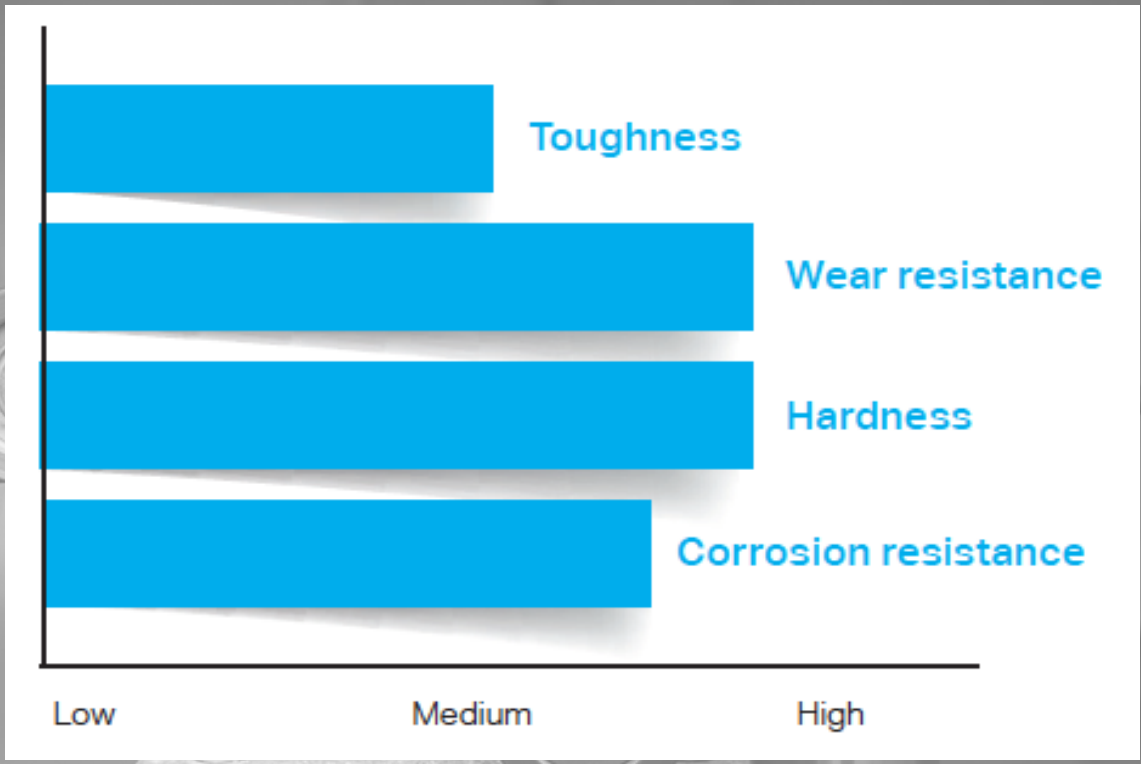
The sinergy with leading hard metal suppliers is fundamental for the study of new materials (tungsten carbide supplied by Hyperion, formerly Sandvik).

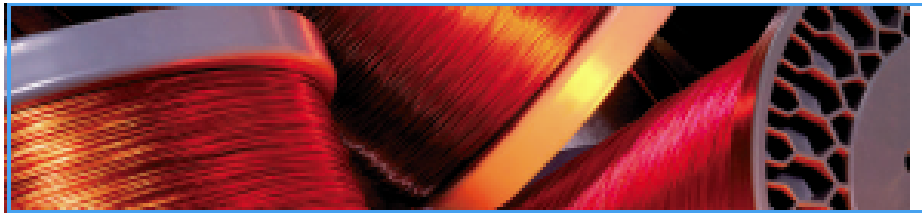
> Examples of innovative material applications?

For wet drawing

Optional:
tungsten carbide
19.49, for max. protection
against corrosion,
friction and wear.

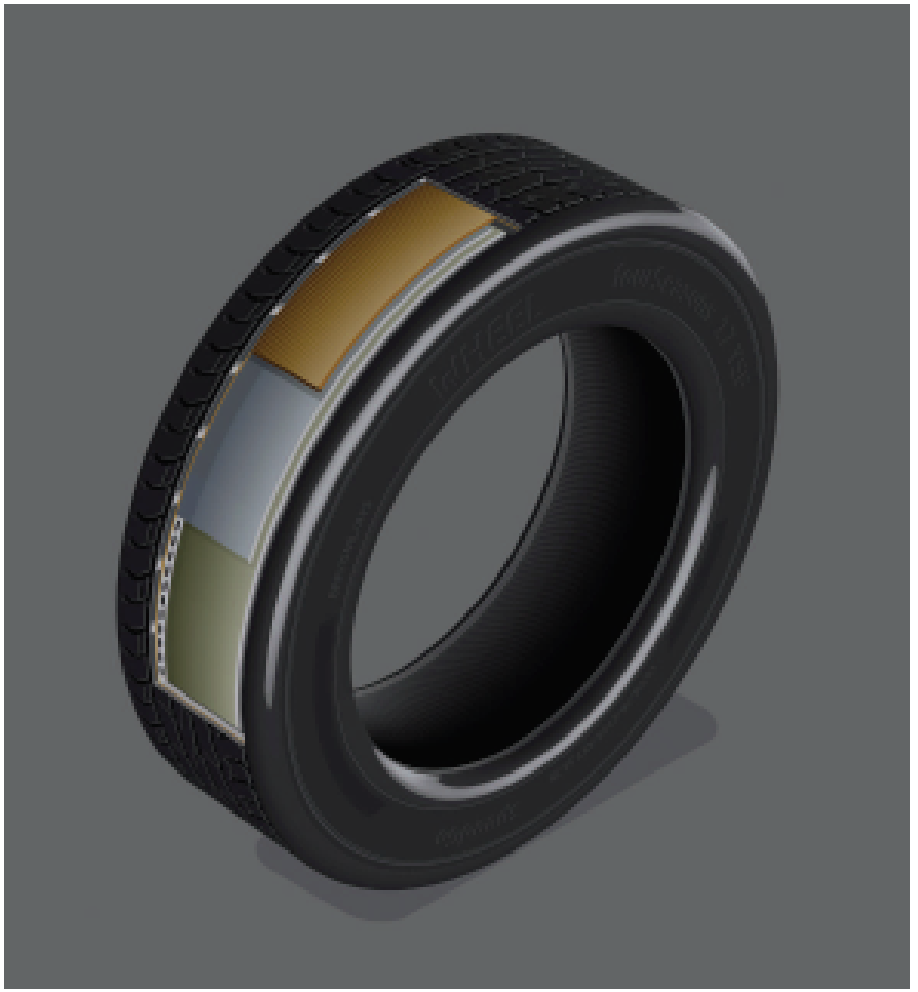
ISO, JIS, DIN
or customized.





19.49 High Performance

19.49 is the high performance grade for fine wire wet drawing.
Ultra fine cemented carbide in combination with special additives maximizes corrosion resistance without loosing toughness.
Sinter-HIP process guarantees premium carbide quality.



Grade 19.49

19.49 high performance drawing process for:

- Saw wire.
- Tire cord.
- All ultra tensile wires.
- Finest wire diameter.

Grade Prevents

19.49 prevents:

- Corrosion wear.
- Friction.
- Wear in small bores.

Grade Benefits

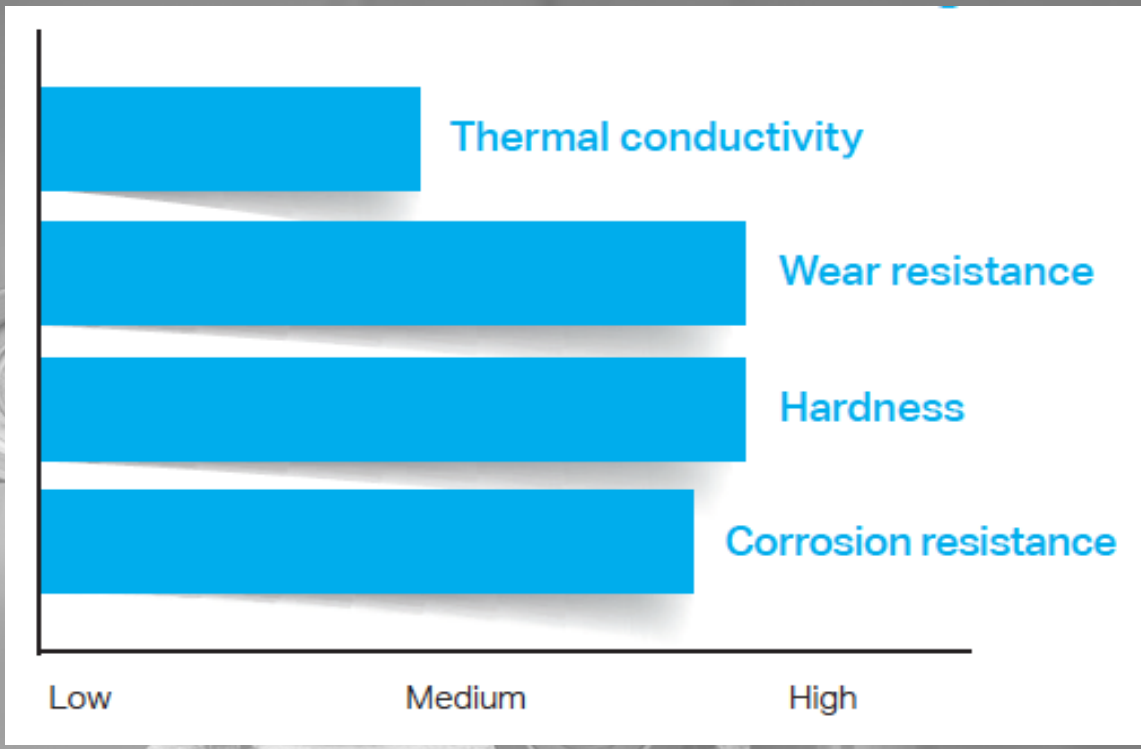
19.49 benefits:

- Increase die life.
- Less energy consumption.
- Longer batch sizes.
- Lower rod quality can be used.

For dry drawing

Available:
tungsten carbide 19.38,
increasing duration of dies
up to 5 times compared to
standard grades.

ISO, JIS, DIN or
customized.



19.38 Super Performance

19.38 is the new super performance grade with never seen properties for tungsten carbide. Ultra ine cemented carbide in combination with special additives, maximizes corrosion resistance and extreme wear resistance.

Sinter-HIP process guarantees premium carbide quality.

Grade 19.38

19.38 super performance drawing for:

- Welding wire.
- Low and high carbon steel.
- PC strand.

Grade Prevents

19.38 prevents corrosion and wear out by:

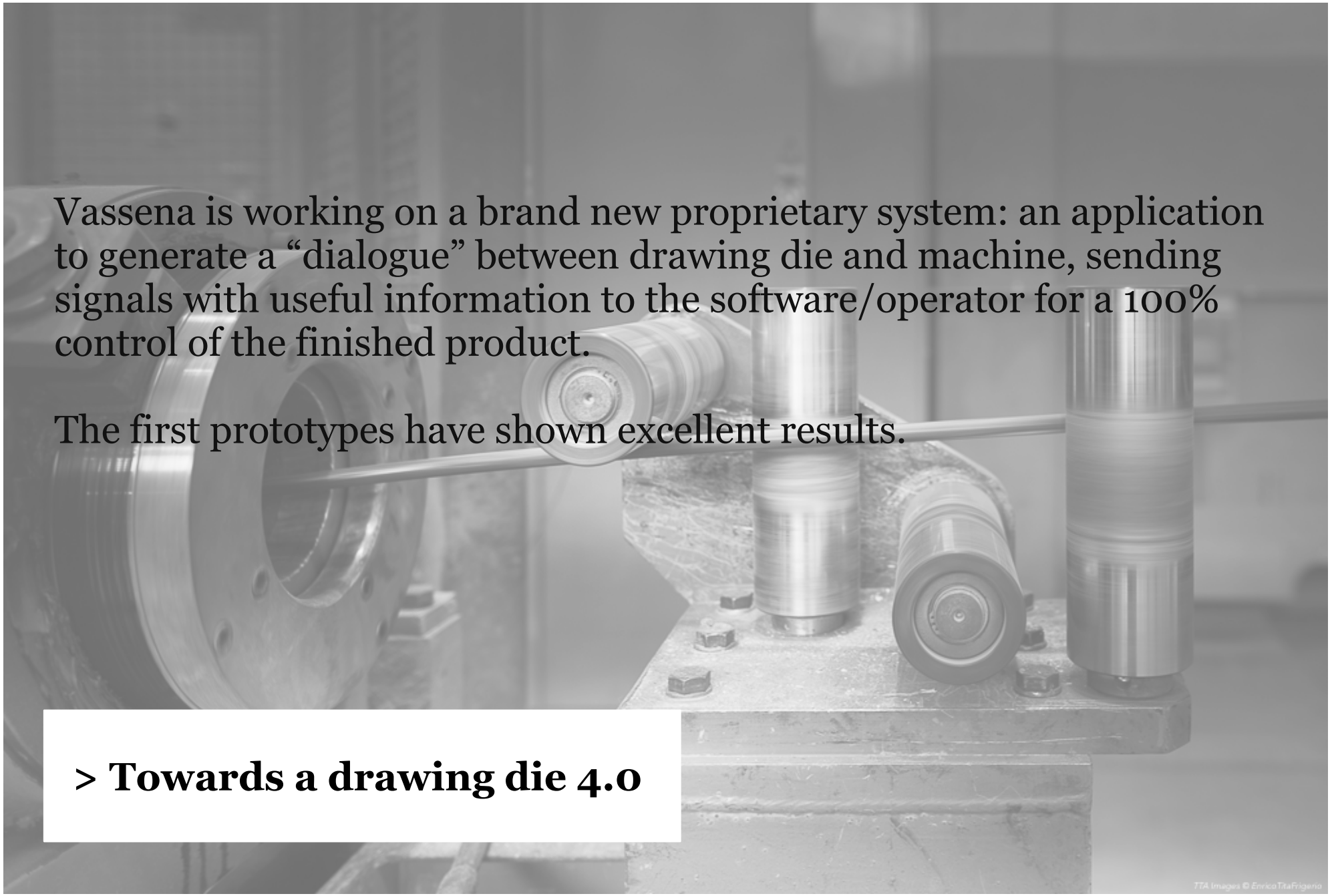
- Very low Co leaching.
- Integrity of the carbide matrix ensures the material wear resistance.

Grade Improvements

Performance improvements:

- Increases die life up to 5 times vs. standard grades.
- Less machine downtime.
- Lower rod quality can be used.
- High polishing speed.

The future: drawing dies 4.0



Vassena is working on a brand new proprietary system: an application to generate a “dialogue” between drawing die and machine, sending signals with useful information to the software/operator for a 100% control of the finished product.

The first prototypes have shown excellent results.

> Towards a drawing die 4.0

Vassena Filiere.
A reliable partner for the wire industry

Thanks for your kind attention!

More on www.vassena.it

Vassena Filiere, Malgrate (LC), Italy