Literature Review of Screw Rotor Profiling

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1938 — **First Patent of a Screw Machine by Lysholm**

The field started here. Initial profiles were symmetric and difficult to manufacture with technology of that time. Progress through trial and error followed until late 1960s.

1970 — **First Successful Asymmetric Profile SRM-A**

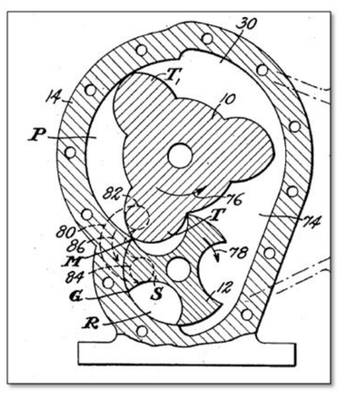
Advancements in manufacturing technology along with invention of asymmetric profiles revolutionised the field of screw compressors making them commercially viable.

1977 — **First Rack Generated Profile by Menssen**

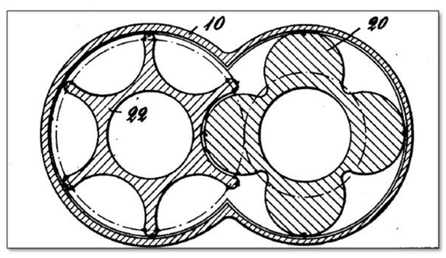
Further development in methods of generation and definition of profiles led to more convenient method of rack generation for profiling. Along with it, literature on mathematics of generating profiles also came out during this period.

1997 — **Invention of N-Profile**

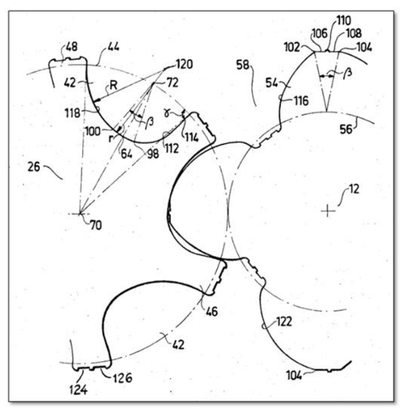
Introduction of computers and CAD into engineering domain revolutionized the field in 1980's and 90's. Better mathematical models as well as tools to calculate profiles led to invention of many efficient profiles such as N-Profile.



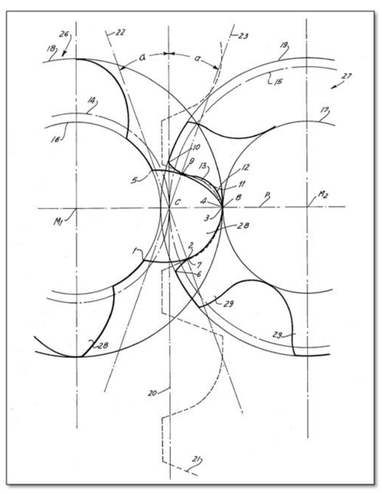
Lysholm [1938]



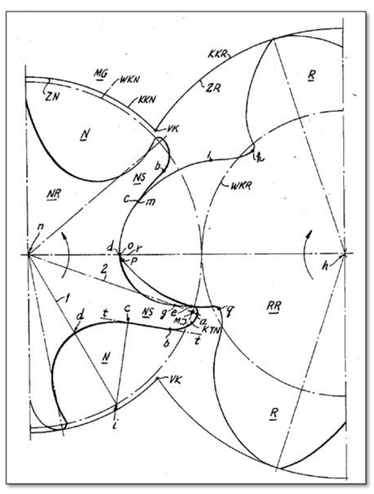
Nilsson [1952]



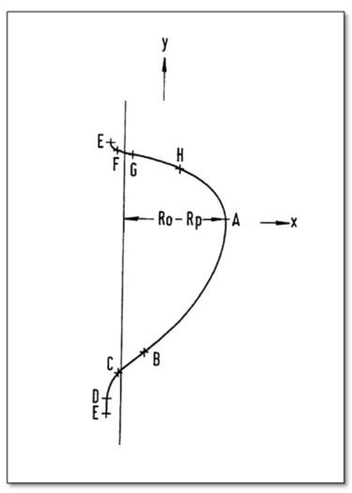
Schibbye [1970]



Menssen [1977]

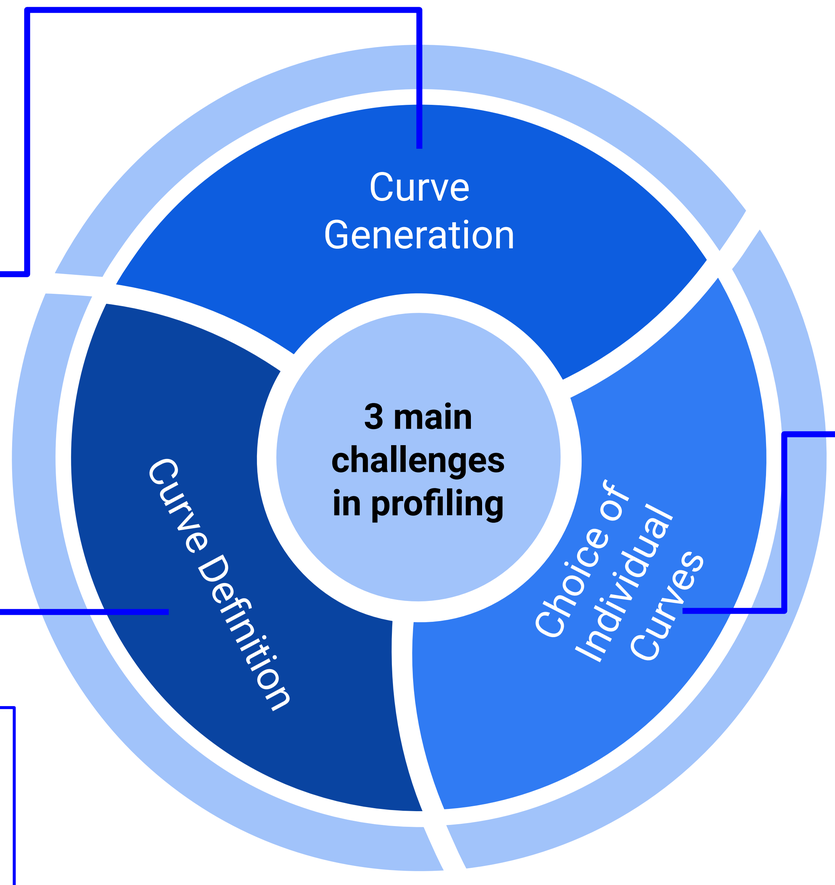


Bammert [1979]



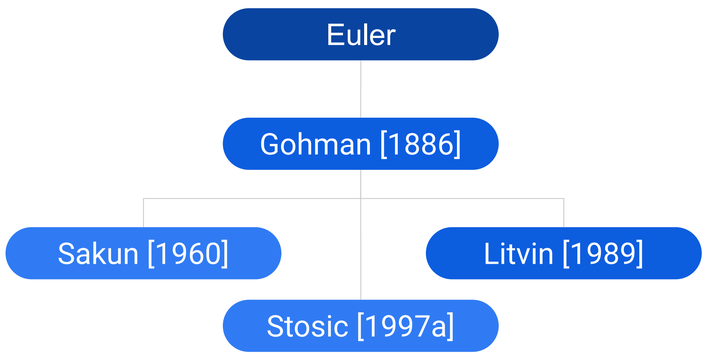
Stosic [1997]

The evolution in profiling is very evident from this timeline. Modern profiles are more complex & incorporate sophisticated methods of design and manufacturing.



The challenge of mathematically determining conjugate curve equations...

- Problem solved using ***"Envelope Theory"***



The challenge of choosing the right coordinate system to define curves in...

- There are 3 ways to define profile curves-

1	2	3
Defining curves on one or the other rotor	Defining curves on an imaginary third rotor (such as rack)	Defining curves on a arbitrary geometric characteristic such as sealing line

- The method of rack generation proves the best.

The challenge of choosing the best profile shape via choice of individual curves (Shape Optimisation)...

Method 1	Method 2

• Use of **shape functions** such as-
  ○ Splines
  ○ Bezier curves
	• Use of **analytical curves** such as-
	  ○ Conic sections
	  ○ Involutes

• **Local control** of curve features	• Local features not under control
• **Search space is wider**	• **Search space is restricted**
• Minor deviations lead to **flaws in meshing**	• Minor deviations in true forms of curves are **tolerable**
• **Slow convergence** and complex consistency check	• Efficient on computation and **fast convergence**
• **Kauder [2002], Hauser [2008]**	• **Stosic [2003], Kim et. al. [2004]**

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