FELSS

The smarter way of forming.

IMTEX 2024

Cold forming techniques for lightweight components

THE FELSS GROUP
The Felss Group is represented worldwide.

MACHINE BUILDING

- **Germany** | Königsbach-Stein
- **Germany** | Pforzheim

COMPONENT MANUFACTURING

- **Germany** | Bretten-Gölshausen
- **Slovakia** | Ilava
- **Switzerland** | Triengen
- **USA** | New Berlin
- **China** | Kunshan, Jiangsu Province

SUPPORT

- **Germany** | Pforzheim
- **Germany** | Nesselwang

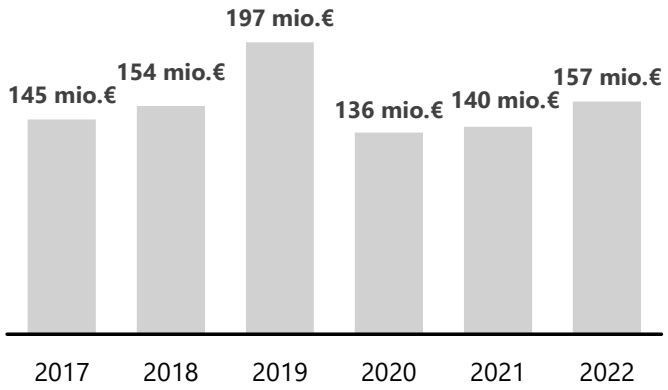
THE FELSS GROUP

The key figures at a glance.

Locations & Employees

4 | Germany	470
1 | Slovakia	40
1 | Switzerland	70
1 | USA	70
1 | China	75

Turnover



approx. 725 Employees

25+ Patents

> 5.000 Satisfied Customers

8 Locations worldwide

> 110 Years of Experience

7 Technologies

1 Vision

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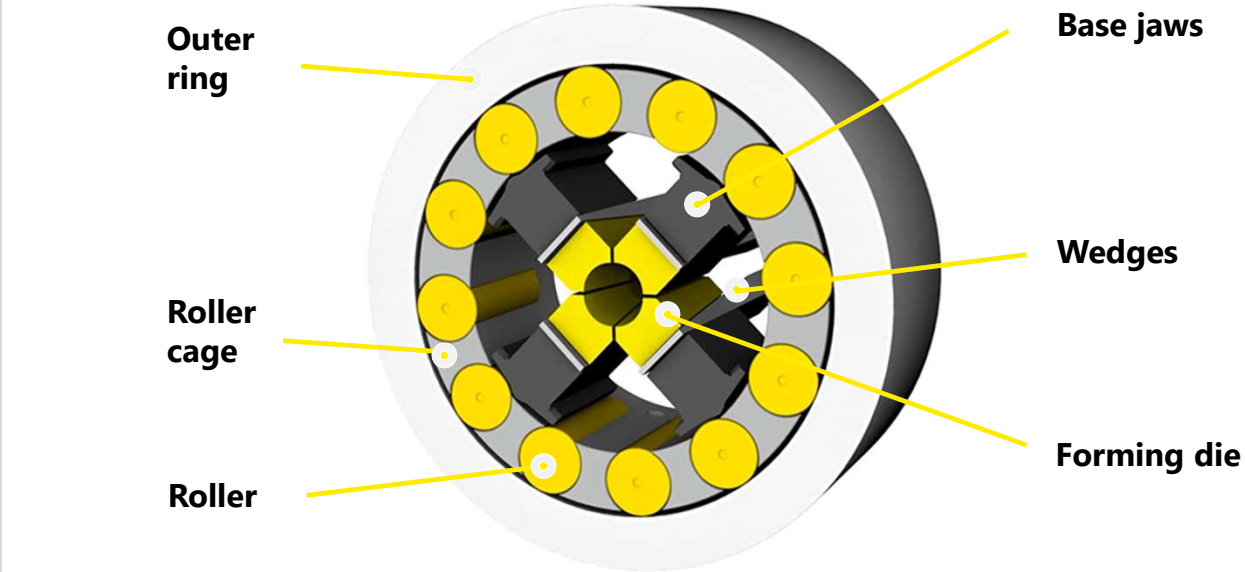
ROTARY SWAGING

Moving parts ...

- The central swaging shaft holding the base jaws, wedges and forming tools represents the first rotating unit.
- The second one is the outer ring.
- The rollers and the roller cage itself are not self-driven, they rotate at the combined speed of the outer ring and the central swaging shaft.



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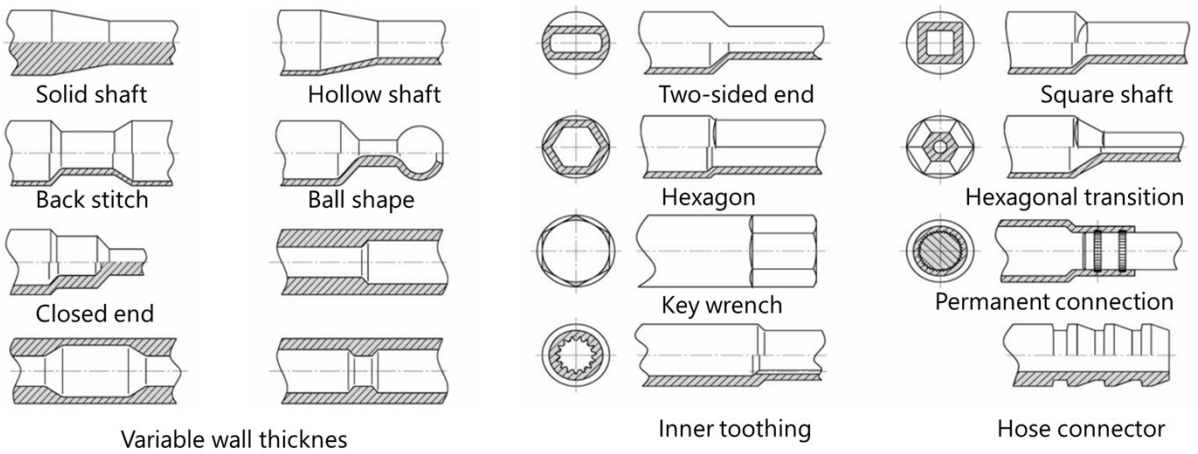
APPLICATION SAMPLE

Material where it is needed …

Characteristics:

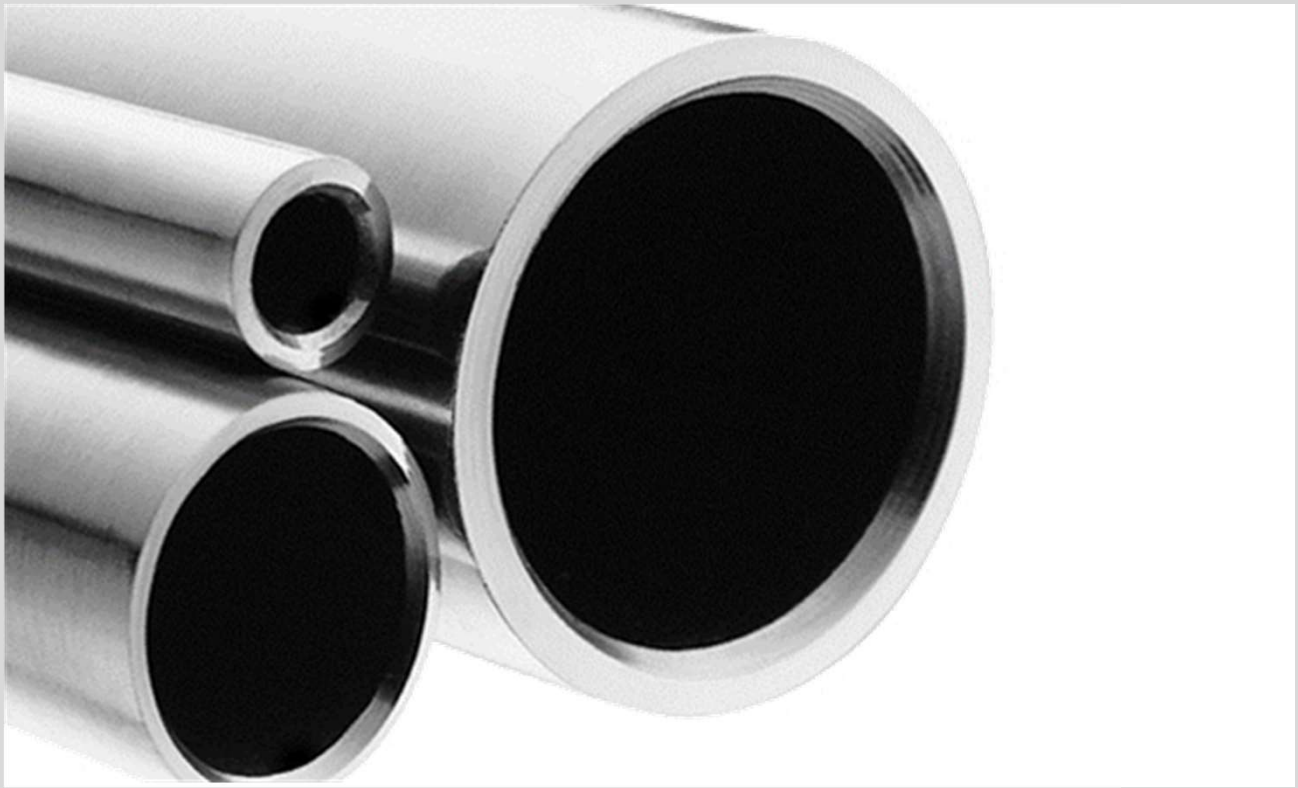
- Reduced diameters
- Variable wall thickness
- Transitions and edgy geometries
- Special inner geometries

Basic applications



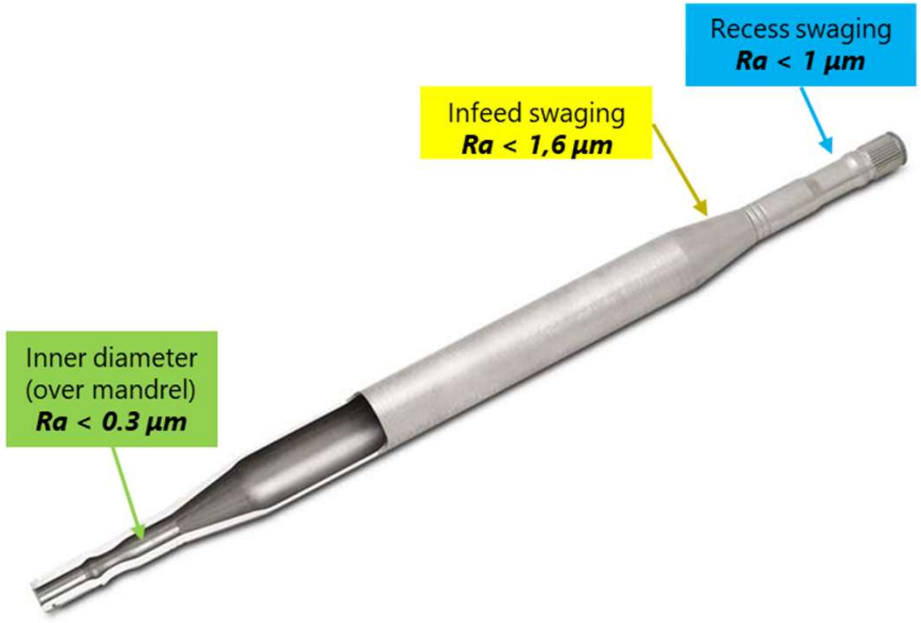
Suitable materials and blanks

- Seamless or welded tubes
- Solid bars
- Tensile strength (Rm) up to 1,100 MPa
- Elongation at fracture (A5) min. 10 %
- Only metal



Dimensional and surface tolerances

		Tolerance grade							
		IT4	IT5	IT6	IT7	IT8	IT9	IT10	IT11
from	to	Tolerance zone width (in µm)							
---	3	3	4	6	10	14	25	40	60
3	6	4	5	8	12	18	30	48	75
6	10	4	6	9	15	22	36	58	90
10	18	5	8	11	18	27	43	70	110
18	30	6	9	13	21	33	52	84	130
30	50	7	11	16	25	39	62	100	160
50	80	8	13	19	30	46	74	120	190
80	120	10	15	22	35	54	87	140	220



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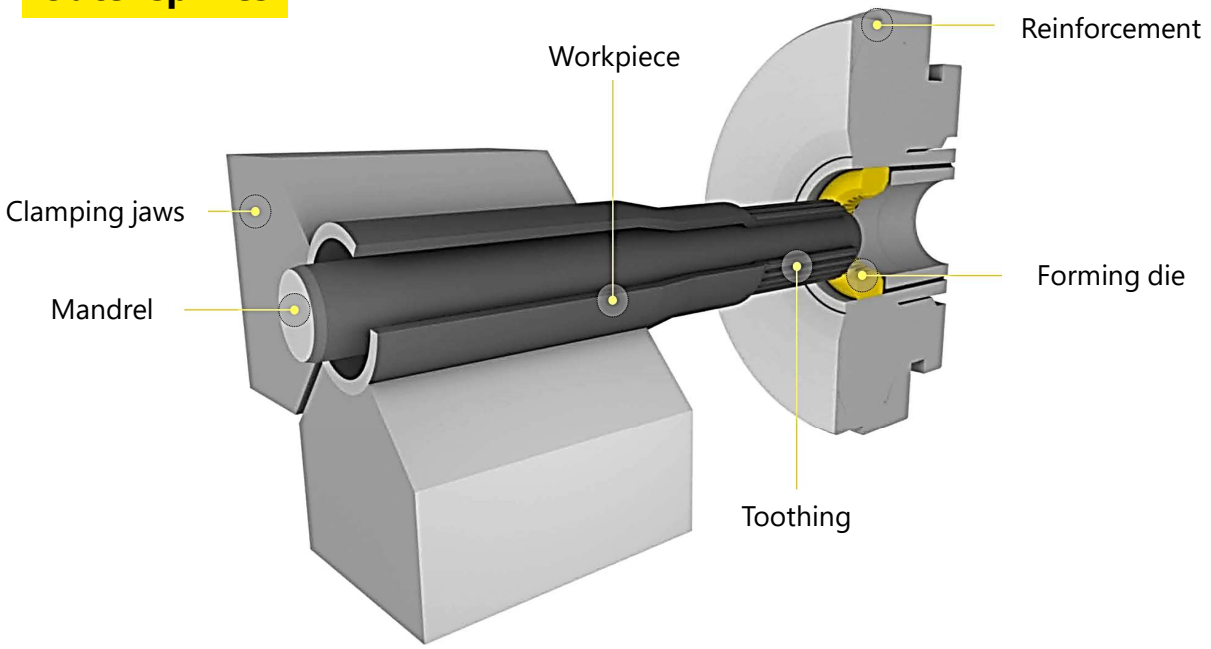
AXIAL FORMING

Basic principle in axial forming: stationary workpiece, moving tool

Characteristics:

- Fixed clamping device
- Mandrel to reenforce the inner diameter
- Moveable forming die
- Helical movement possible

Outer splines

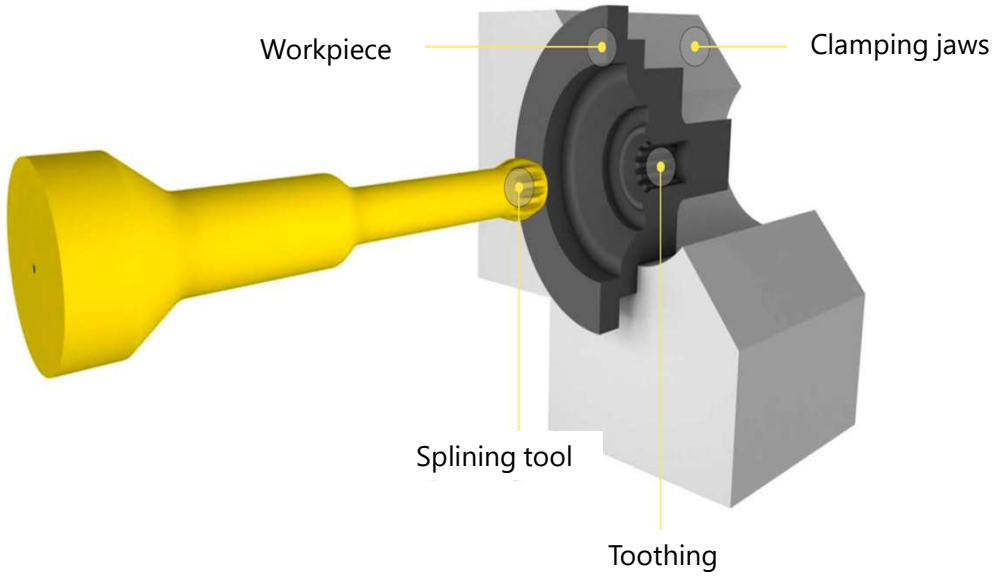


The tool can form outside or inside, the principle always remains the same

Characteristics:

- Same idea
- Inner splining tool
- Workpiece stays fixed in place

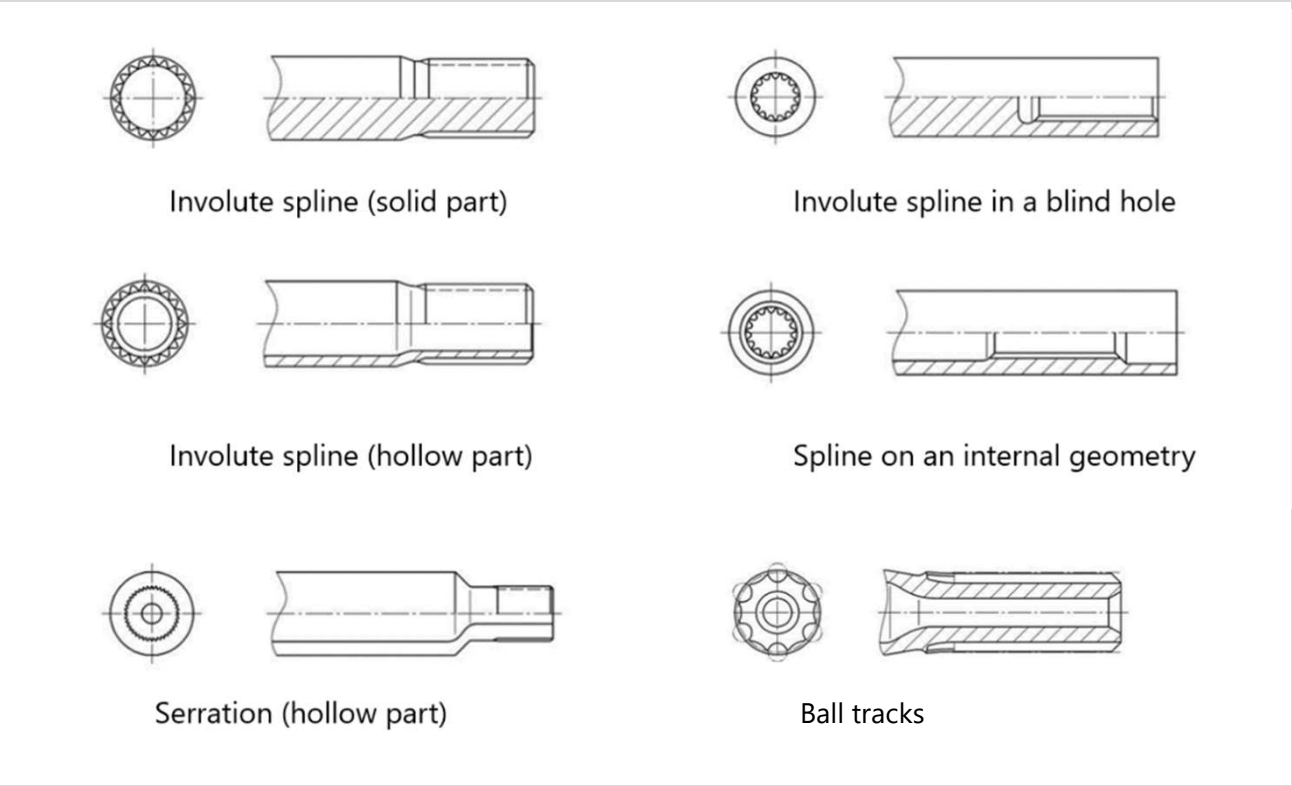
Inner splines



Application samples

Characteristics:

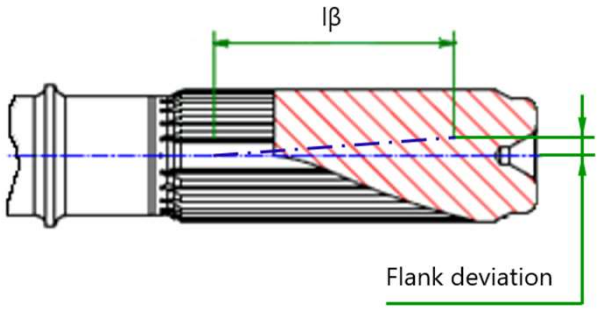
- Solid and hollow parts
- Whether involute splines, serrations, ball tracks ... the essential factor is symmetry in axial direction
- Block voids and block teeth must be separately designed



Dimensional and surface tolerances

Standard	Tolerance class (mod)
ANSI B92.1	5
ISO 4156	5
DIN 5480	8

(mod) → The flank deviation can be higher than specified in the standards because the choice of material and the reinforcement situation can have negative effects



With reference to lβ = 30mm, flank line deviations of 16 µm and better are to be classified as realistic and verifiable results.

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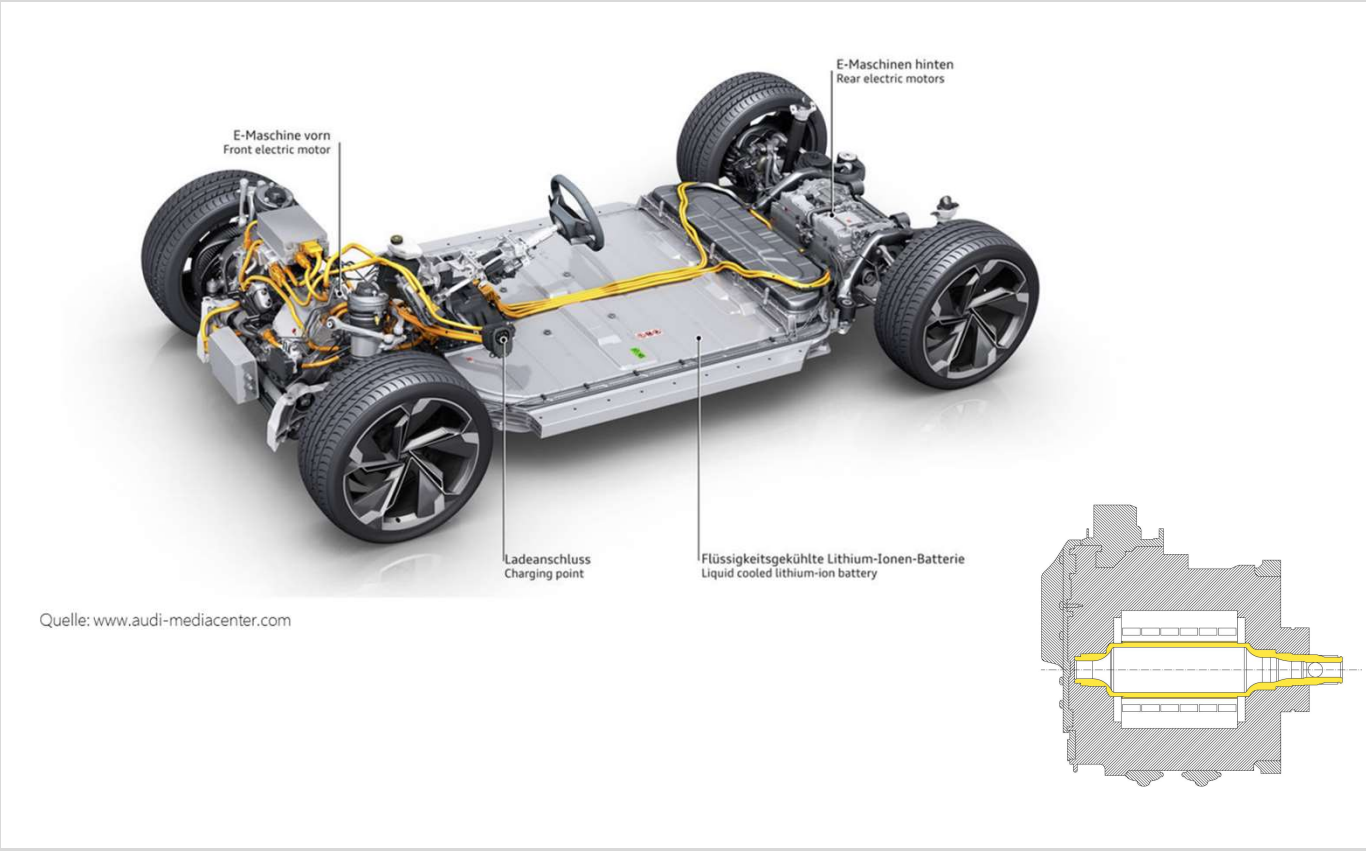
APPLICATION SAMPLE

Rotor shafts

Rotor shafts - core pieces of the electrical drive

- Felss developed more than 50 successful process developments for swaging and forming of rotorshafts
- Rotor shafts currently in mass production at Felss Germany
- Short cycle times have been proven throughout the history of these developments

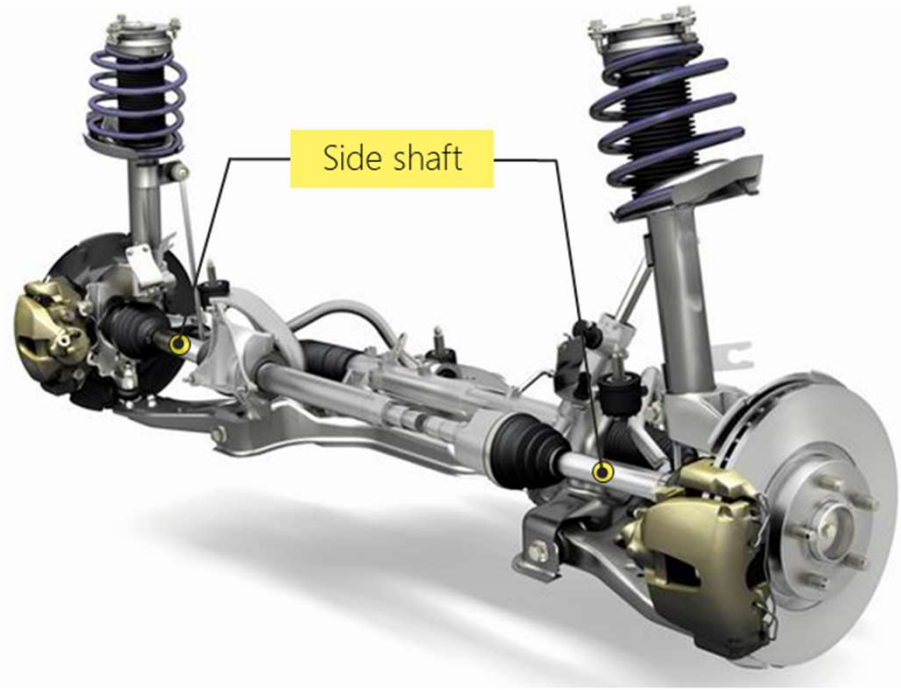


Quelle: www.audi-mediacenter.com

Hollow side shafts

Usage of hollow drive shafts

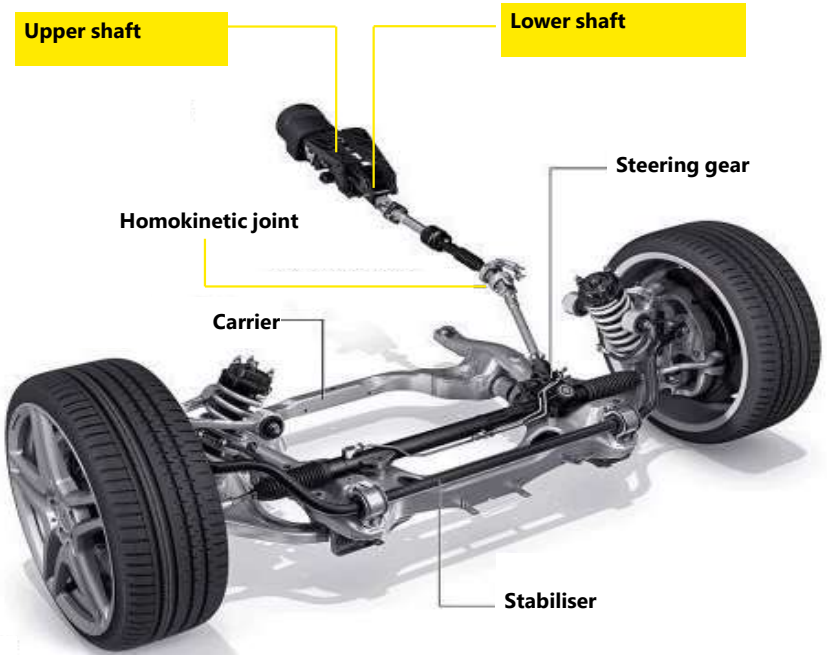
- Transmitting engine power to the wheels
- Felss developed more than 100 shaft designs with OEM's, Tier 1 and Tier 2
- All of these shafts are hollow



Steering shafts

Usage of hollow steering shafts

- Allowing the adjustment of steering components
- Large variety of possible shaft designs with OEM's, Tier 1 and Tier 2
- Approx. 30% weight reduction with optimization of wall thicknesses



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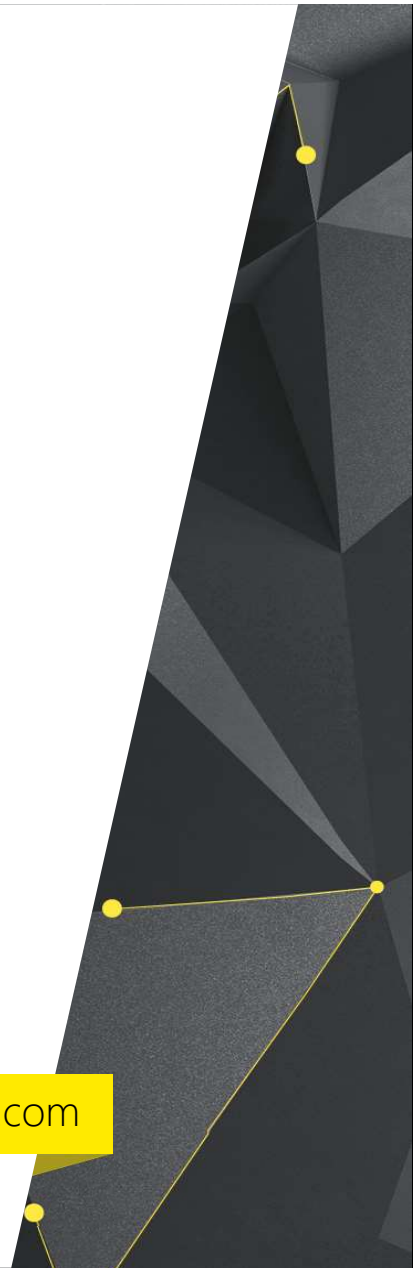
THANK YOU ...

... for your attention.



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