

# Filament winding with increased efficiency

## Ring winding head – multiple pay out device

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### Objectives

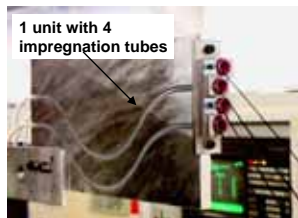
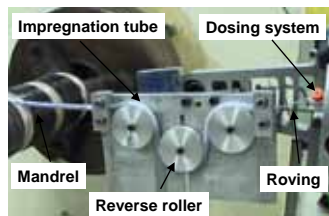
- Development of a high volume production filament winding technique
- Development of an impregnation technique allowing a long processing time without cleaning breaks

### Impregnation unit

#### Advantages:

- Compact and modular construction
- Variable filament guide towards the mandrel
- No limitation due to pot life, resin is fed continuously
- Clean impregnation near the winder, minimized resin leakage
- Easy cleaning of the impregnation device
- Reduced amount of hazardous waste

Prototype of the impregnation unit (test assembly)

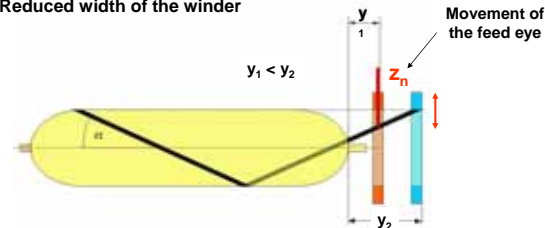


Tube syphon impregnation unit (processing of four 12k CF rovings)

### Multiple payout eye: Demands

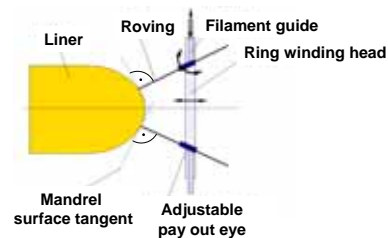
#### Constant free filament length

- Additional axis ( $z_{1-n}$ ) for each payout eye (radial motion)
- Significant reduction of the length of the traverse path
- Reduced width of the winder



#### Arrangement of the payout eyes

- The payout eye must be perpendicular to the surface of the mandrel (symmetry axis)!
- Adjustable payout eyes to deflect the rovings
- Precise laying down of the rovings without buckling or warping



#### Automated double spindle winding machine

- Economical large quantity production (reduction of cycle time)
- Continuous winding of the second structure without interruption

### Acknowledgement

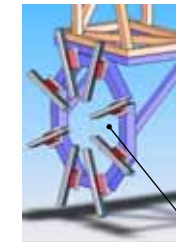
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### Concept - Solution

#### Ring winding head



Design concept

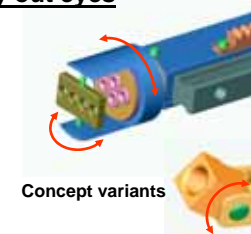


8 movable roving guides

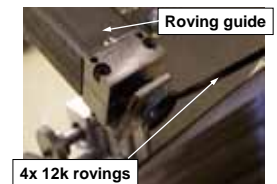


Prototype

#### Movable pay out eyes

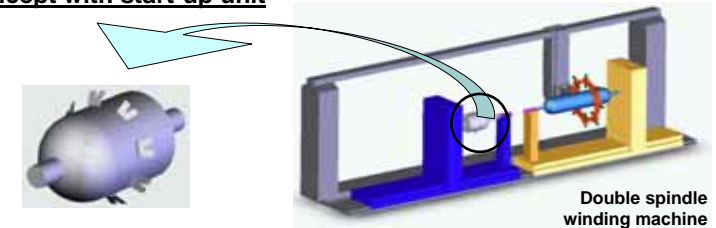


Concept variants



Prototype

#### New concept with start-up unit



Double spindle winding machine

