



VITRAGES AUTO , FONCTIONS & FABRICATION

*JOURNÉES DE L'USTV
BORDEAUX, 17 & 18 NOVEMBRE 2016*

RENÉ GY
SAINT-GOBAIN RECHERCHE



OUTLINE

From the early
XXth century to
today's huge
market

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market



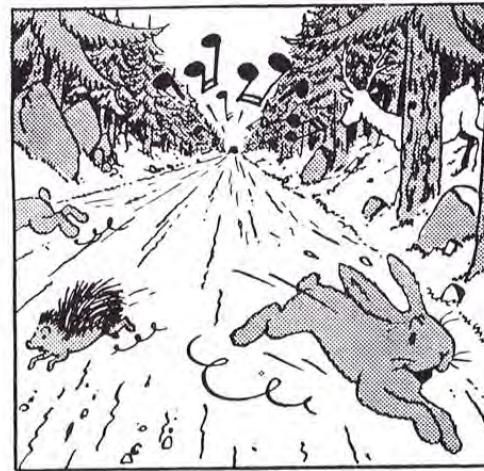
**Edouard
BENEDICTUS
(1878-1930)**



Ford Model T (1919)



Le sceptre d'Ottokar - Hergé
 Le Petit Vingtième (1938)





Studebaker Champion (1947)



Studebaker Starlight (1950)





Ford Fiesta (1974)

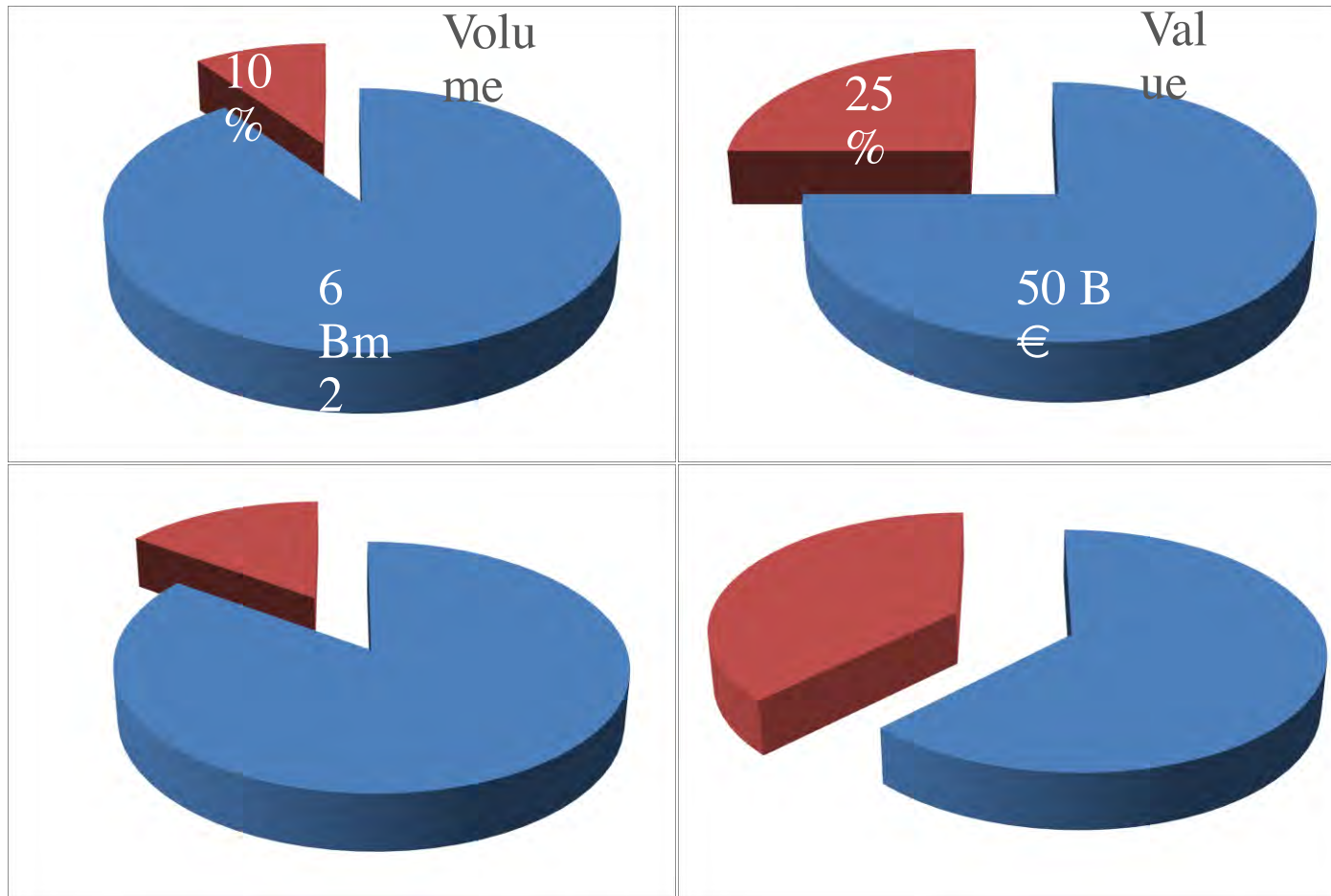




Tesla Model S (2014)



FLAT GLASS END USE MARKET : SHARE OF CAR GLAZING



2010
global

Europe
~ 50 car glass plants

Source: Freedonia. World Flat Glass Market (2011).



OUTLINE

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SEE THROUGH



SEE THROUGH

- Some issues related to the laminated windshield
 - ghost image

PRIUS 2012 – Light Tripling, Bi-Focal, Ghosting, Shadowing effect

Direct image capture (out of an open window)



Prius 2012 – Image captured through front windshield

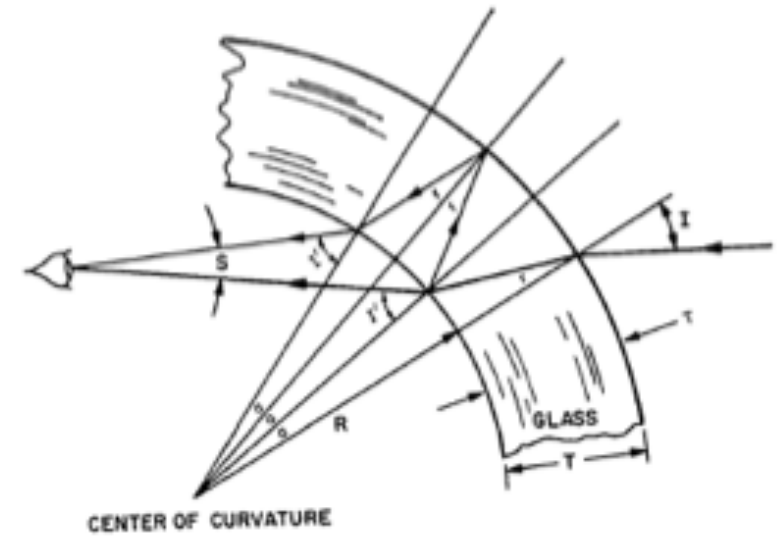
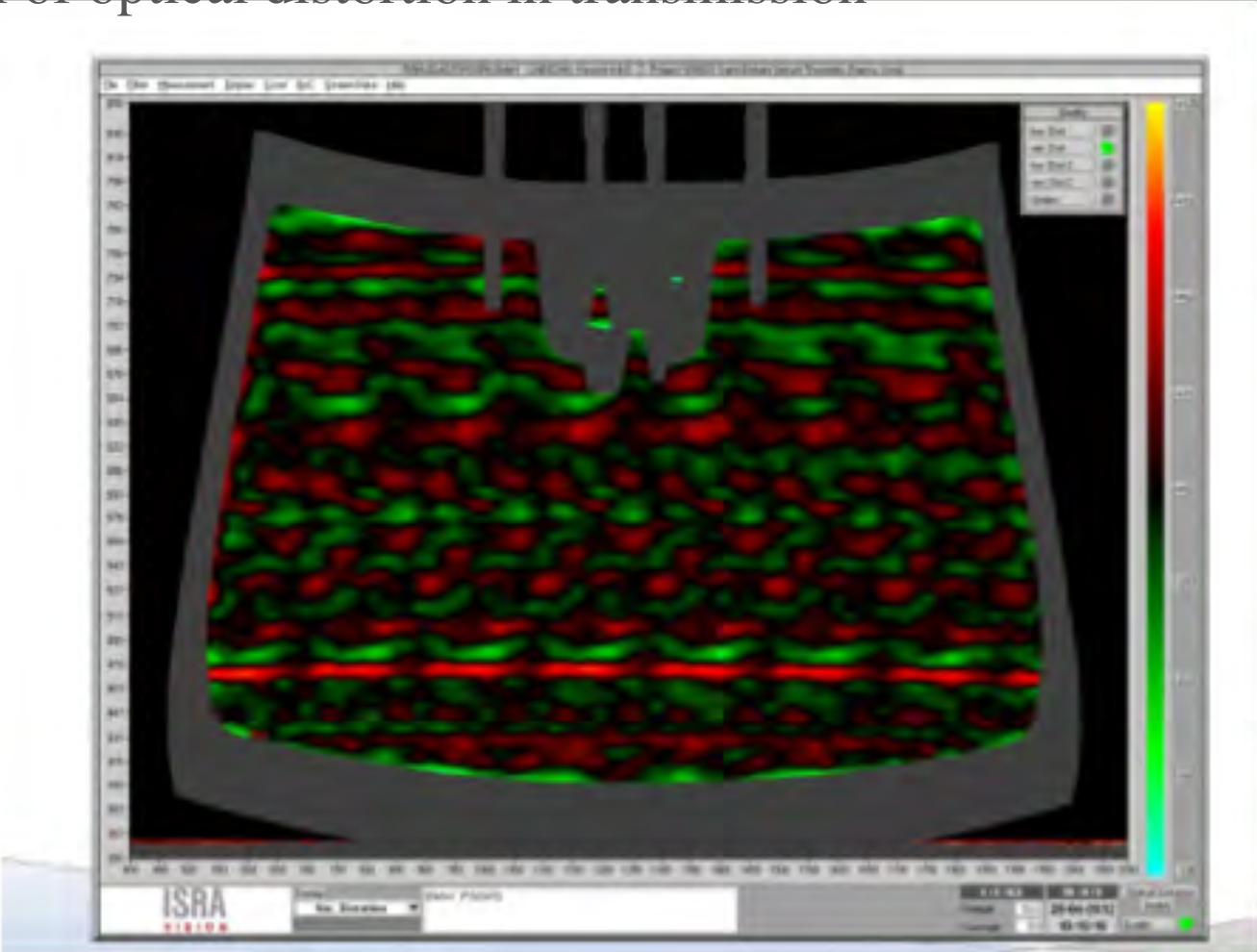


Fig. 4. Simplest case of ghost-image formation by curved glass. Rays irrelevant to the primary and secondary images are omitted.

September 1969 / Vol. 8, No. 9 / APPLIED OPTICS 1781

SEE THROUGH

Control of optical distortion in transmission



SEE THROUGH



Climacoat ®

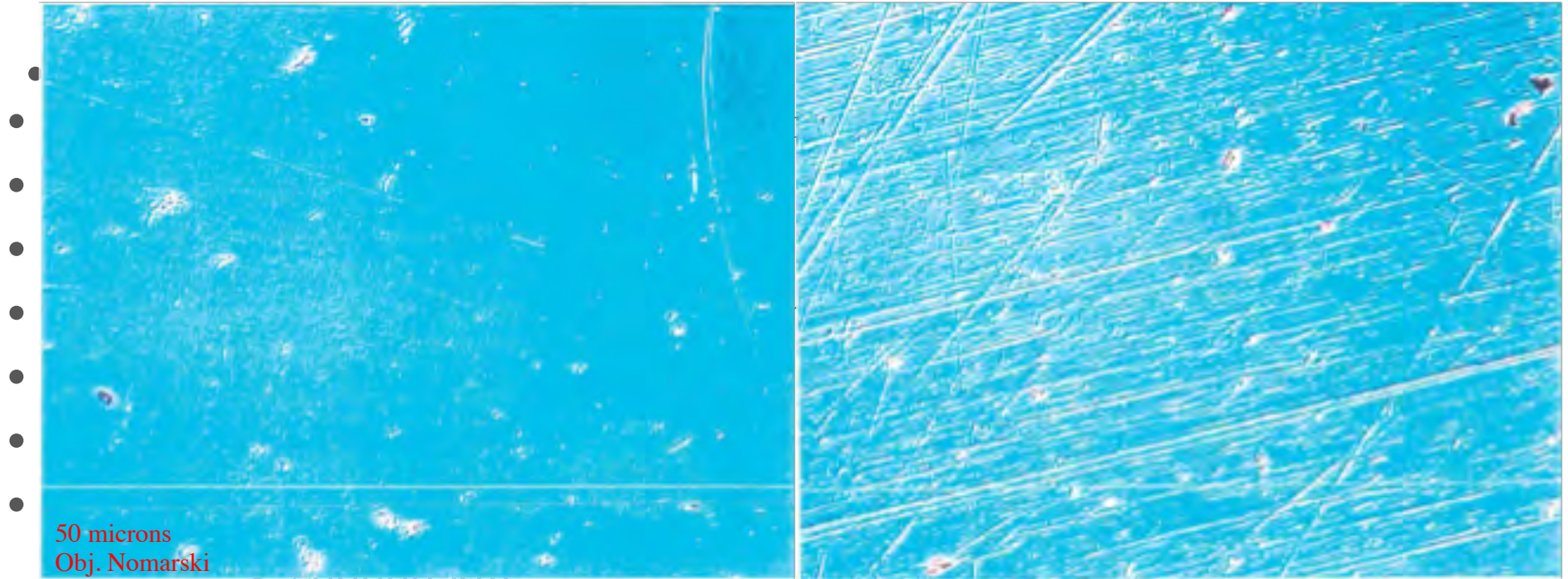


SEE THROUGH



Aquacontrol ®

SEE THROUGH



Zone non balayée

Zone balayée

P. Lehuédé, 1998

SAFETY

Tempered glass vs. Laminated glass



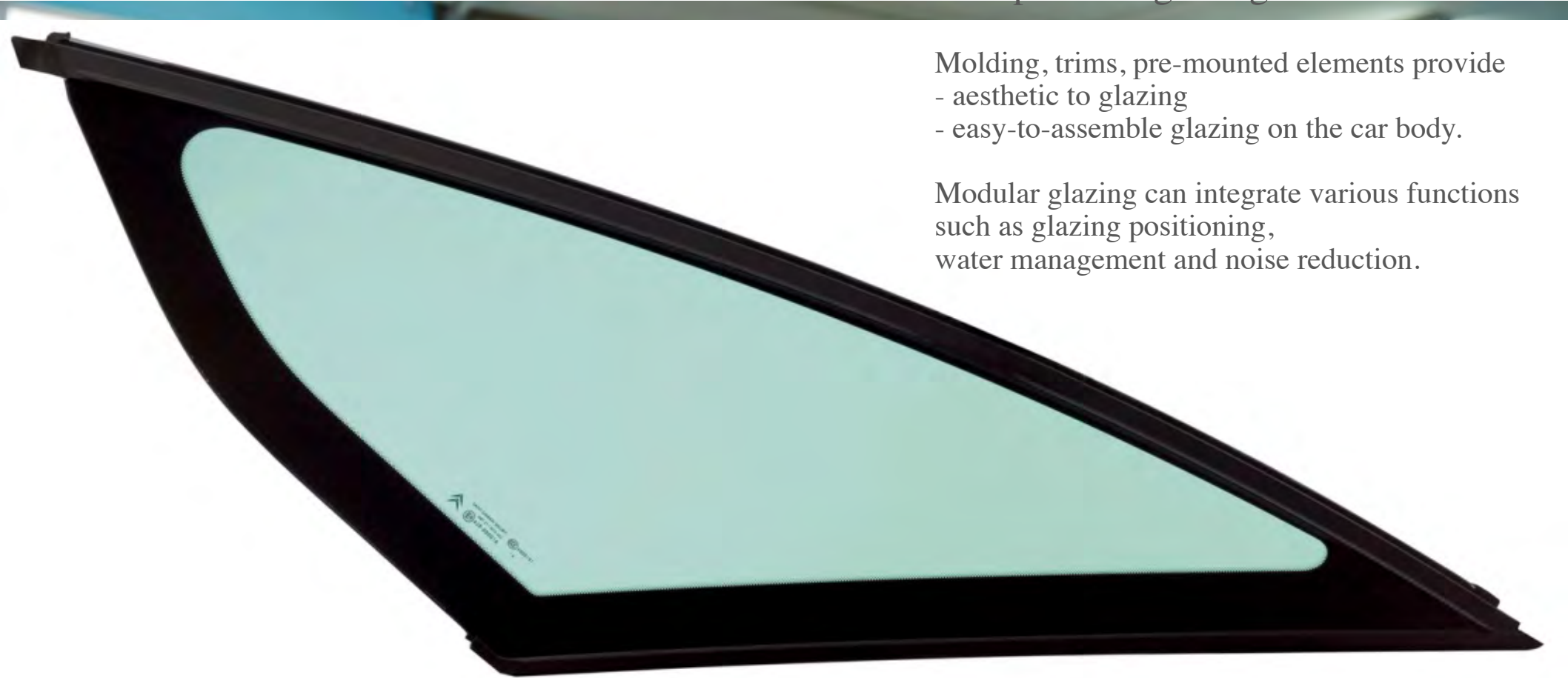
CAR DESIGN, INTEGRATION TO CAR BODY, SYSTEMS

Encapsulated glazing

Molding, trims, pre-mounted elements provide

- aesthetic to glazing
- easy-to-assemble glazing on the car body.

Modular glazing can integrate various functions such as glazing positioning, water management and noise reduction.



COMFORT



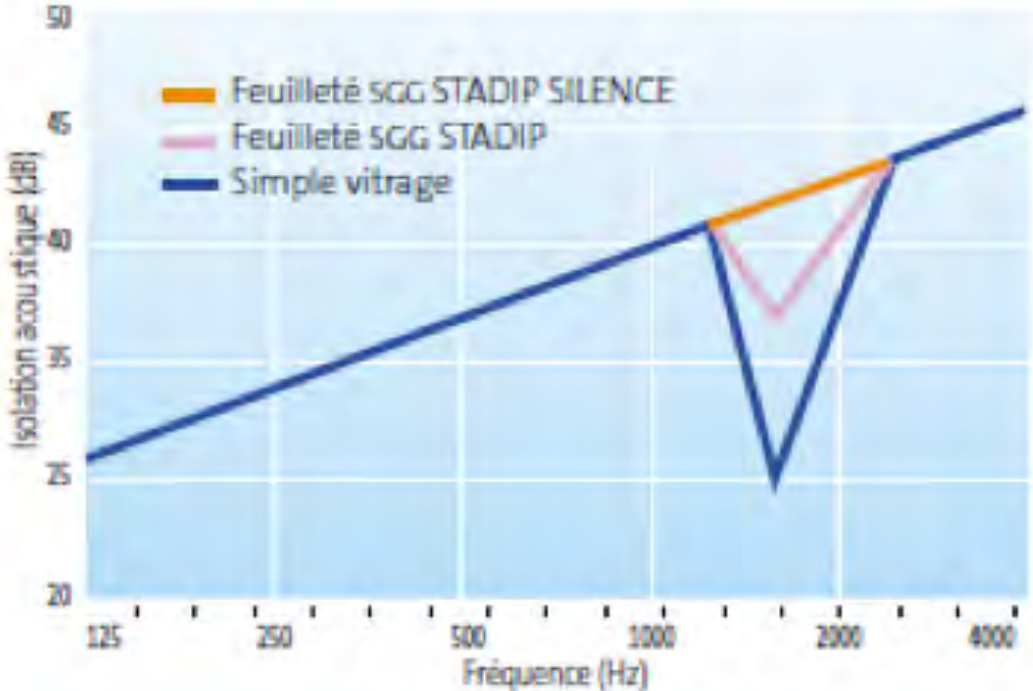
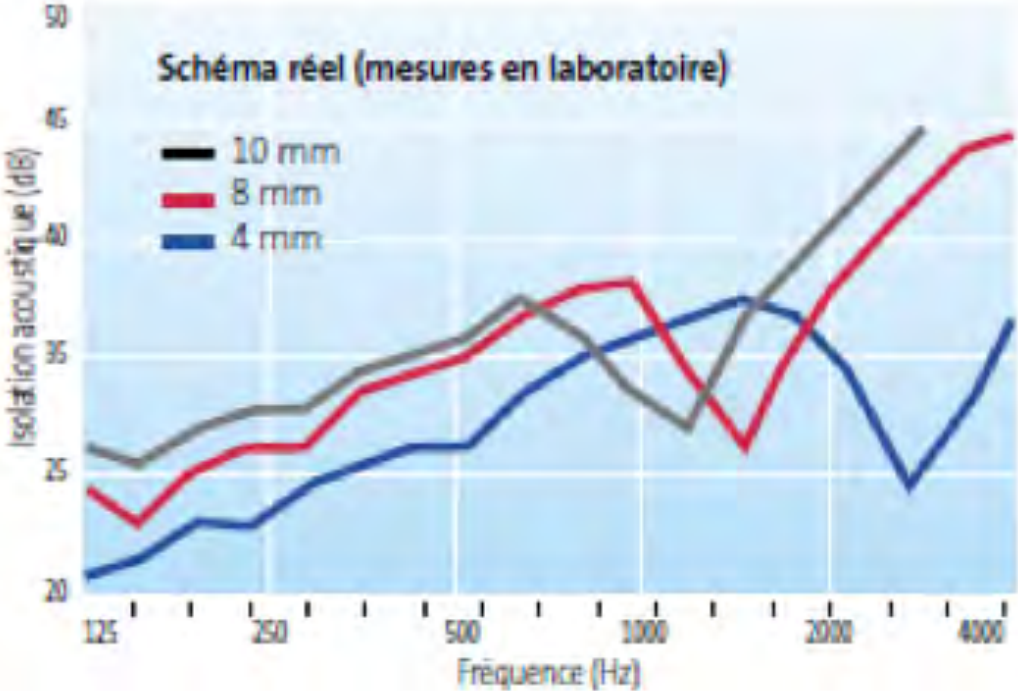
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Source : O. Cintora, Saint-Gobain Recherche



COMFORT

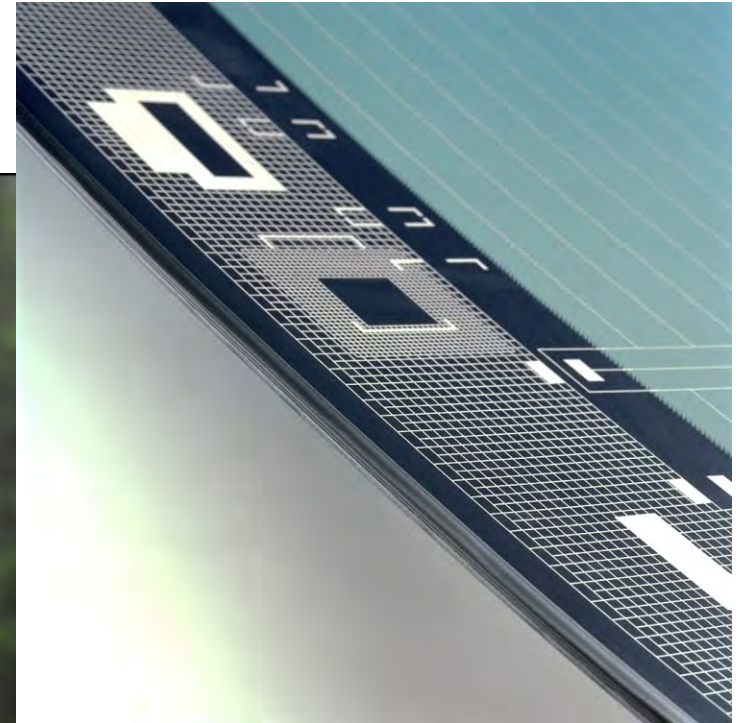


Source : Memento Saint-Gobain Glass



ADVANCED FUNCTIONS

- Car as a connected object: Antenna integrated on glazing
- Assistance to driving: Head-up display



- Signage & Inside lighting (OLED on glass)
- Photovoltaics



RECYCLING AND SUSTAINABILITY ISSUES

End of Live Vehicles

Lead



OUTLINE

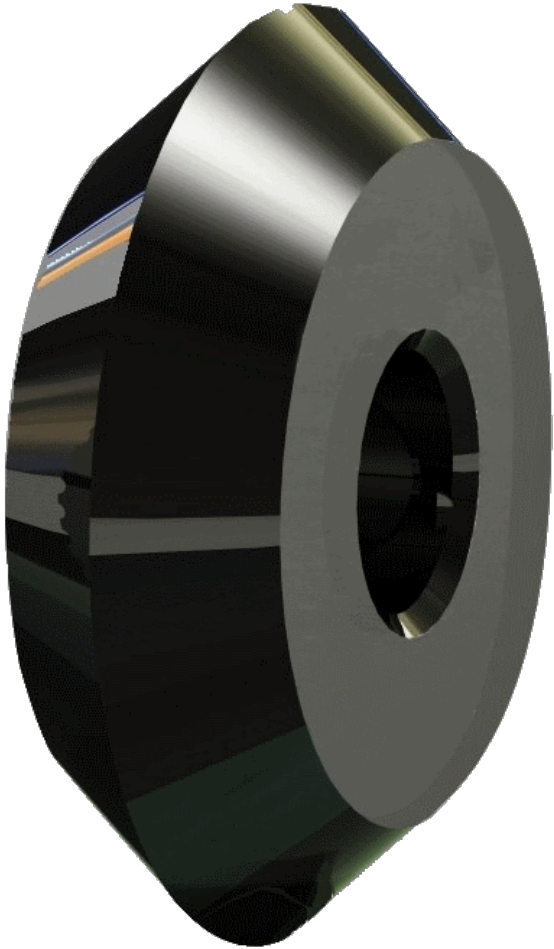
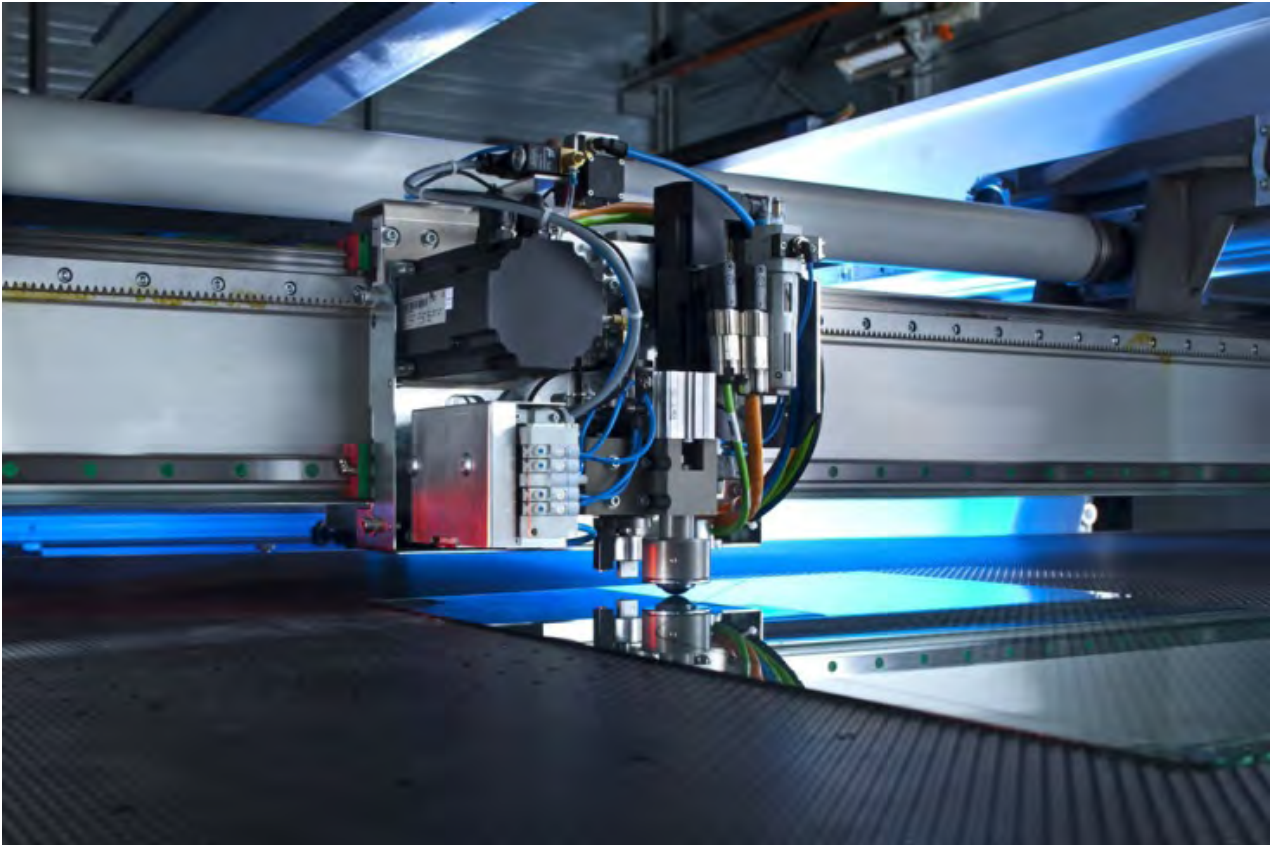
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CUTTING - EDGE MACHINING



**CBG Line
Pre-Processing Line**

CUTTING - EDGE MACHINING





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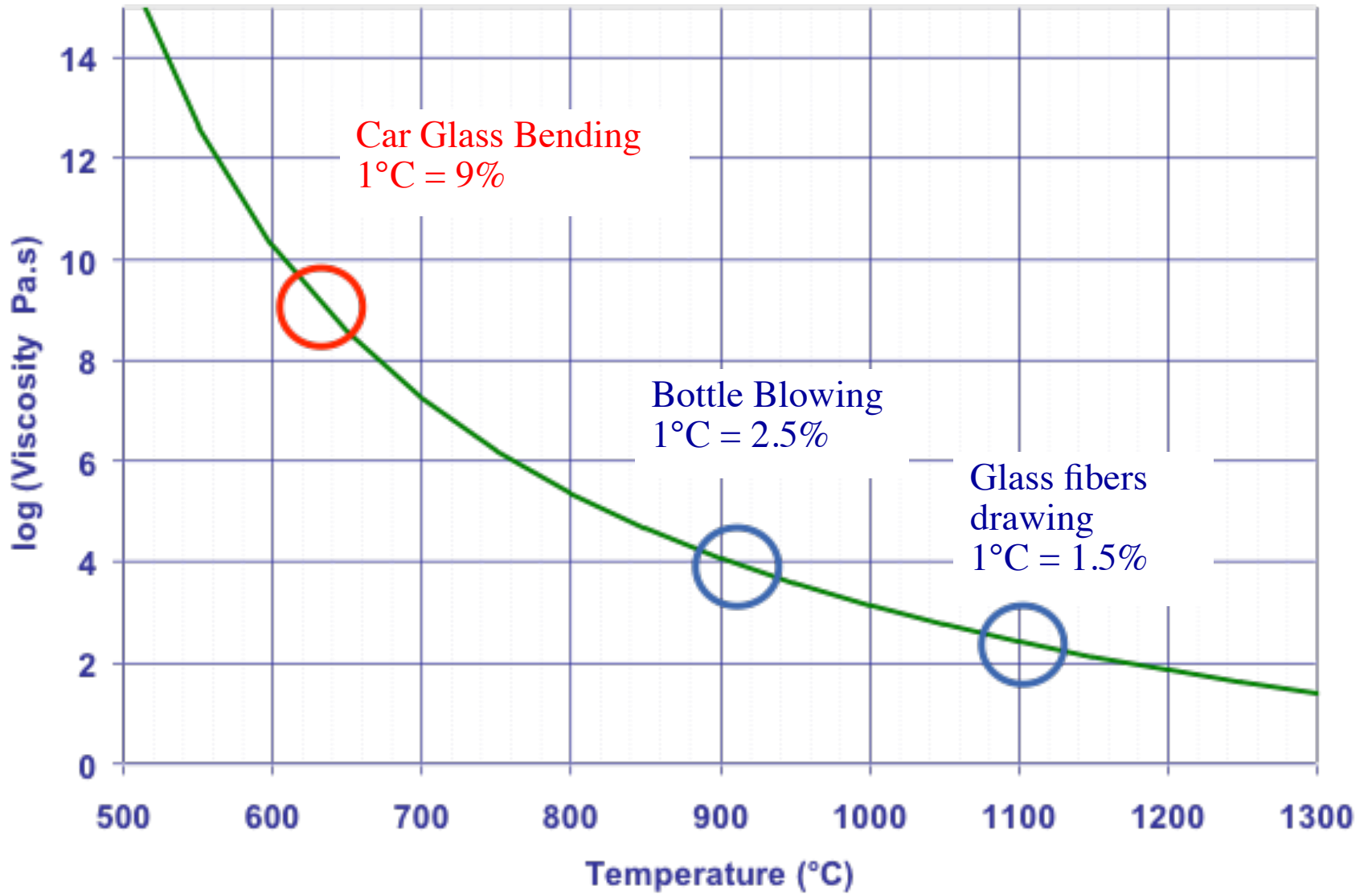
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300



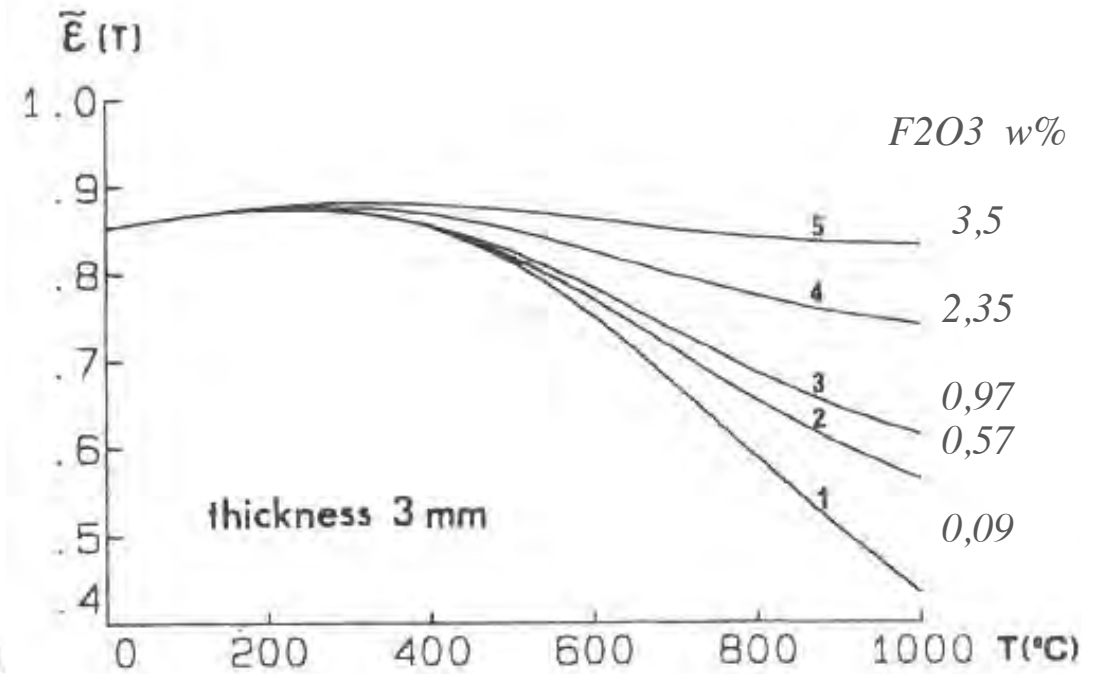
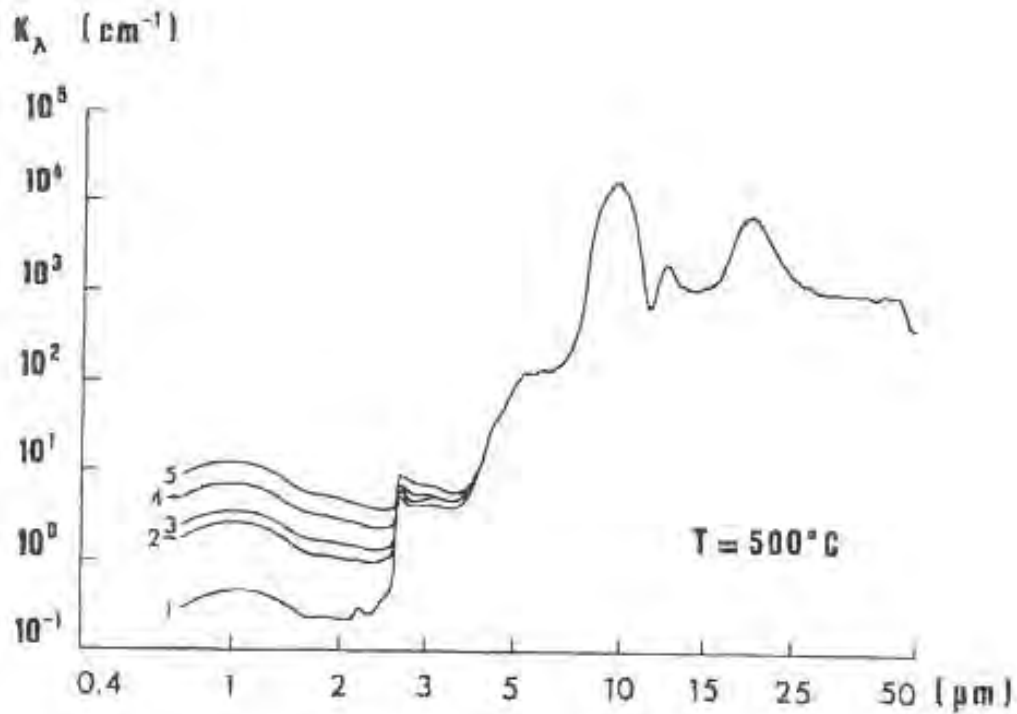
SCREEN PRINTING



HEATING

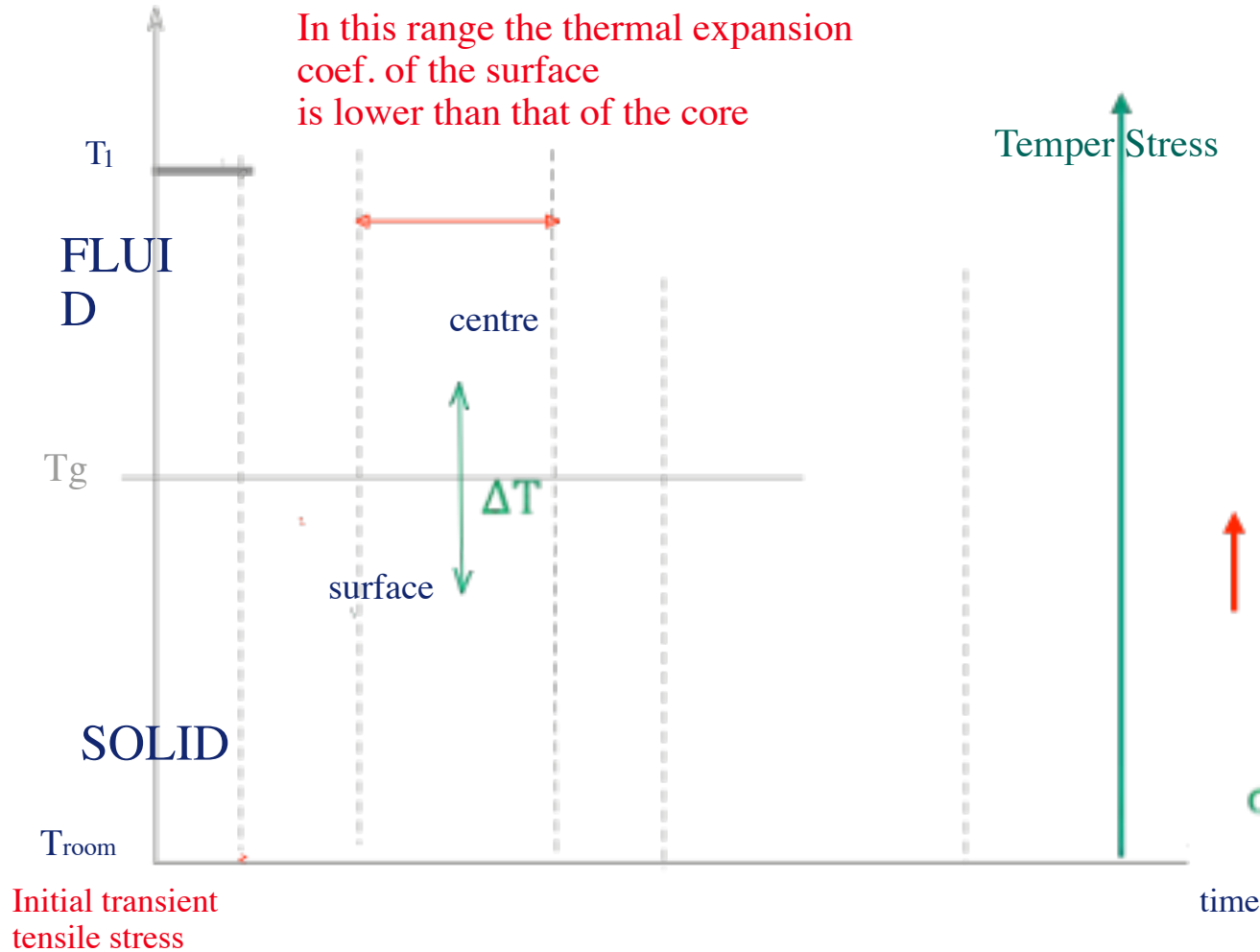


HEATING



Banner, D., & Klarsfeld, S. (1990). Influence of the composition upon the apparent conductivity and emissivity of glass as a function of thickness and temperature. *Thermal Conductivity 21* (pp. 539-551). Plenum Press.

GLASS TEMPERING

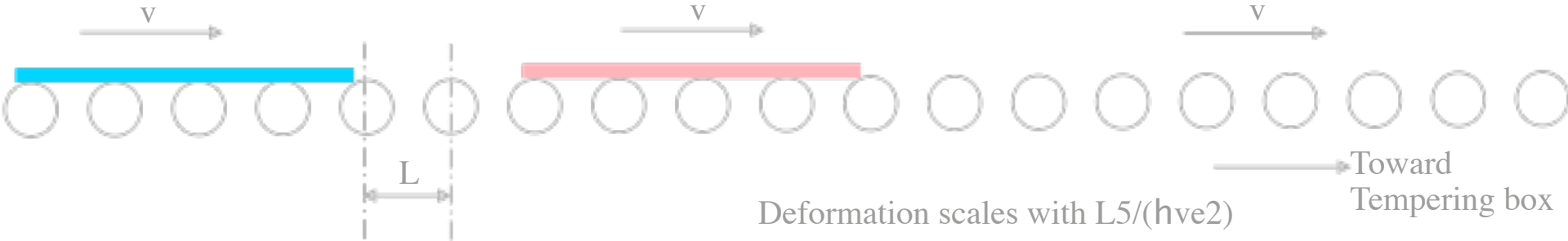


« structural » contribution
Main contribution to the tempering stress

$$\sigma \sim E\alpha\Delta T = \frac{E \alpha (T_{air} - T_g) \frac{h e}{2\lambda}}{2 + \frac{h e}{2\lambda}}$$

HOT GLASS CONVEYING / HANDLING

- Glass tempering: conveying hot glass at 650-670°C on rollers, keeping the flatness (up to some limit!)



TEMPERING & SIMULTANEOUS CYLINDER SHAPING (SIDE LITES)

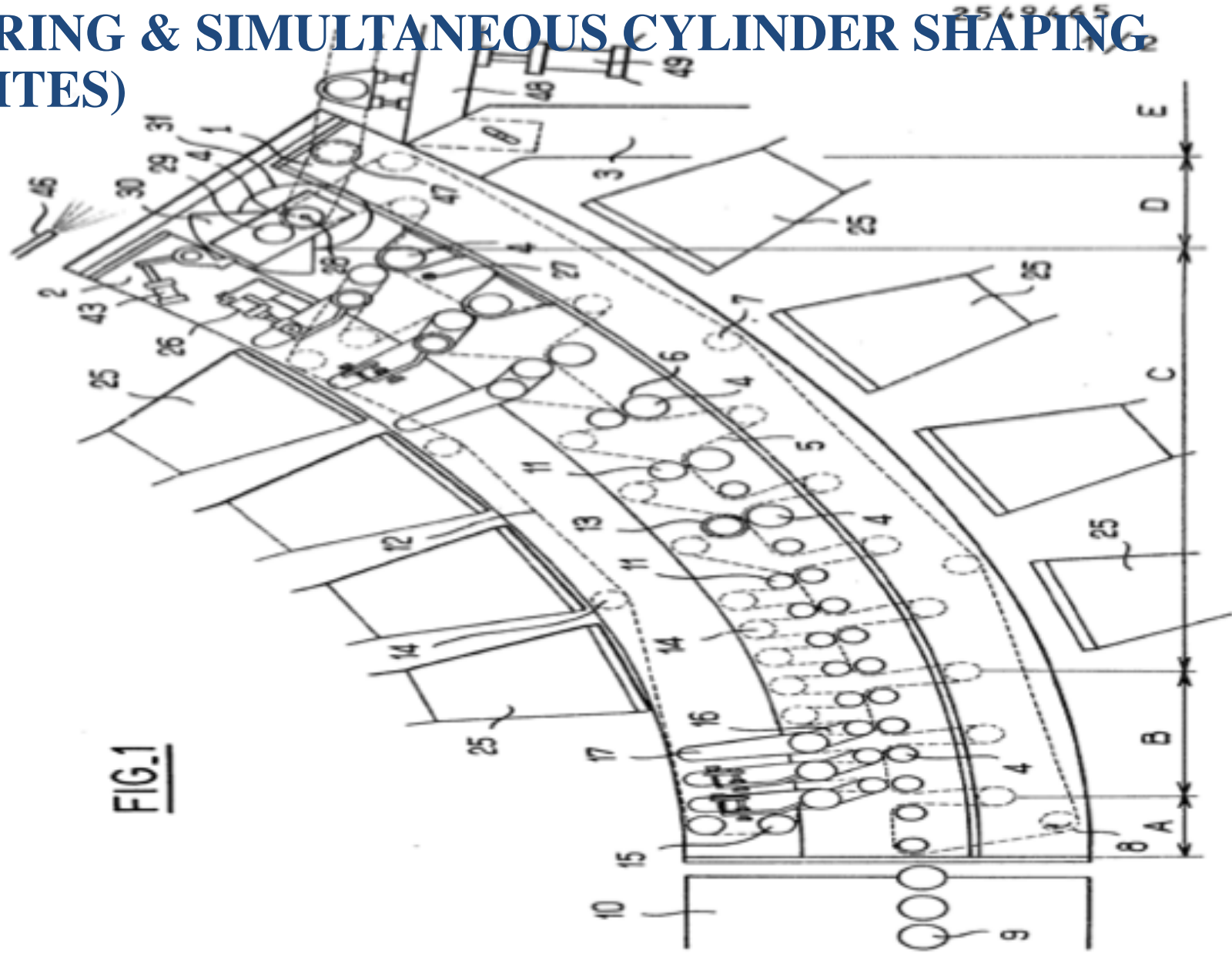


FIG.1

TEMPERING OF COMPLEX SHAPES (BACK LITES)



BHT Tempering furnaces

TEMPERING

‘STRAIN PATTERN’



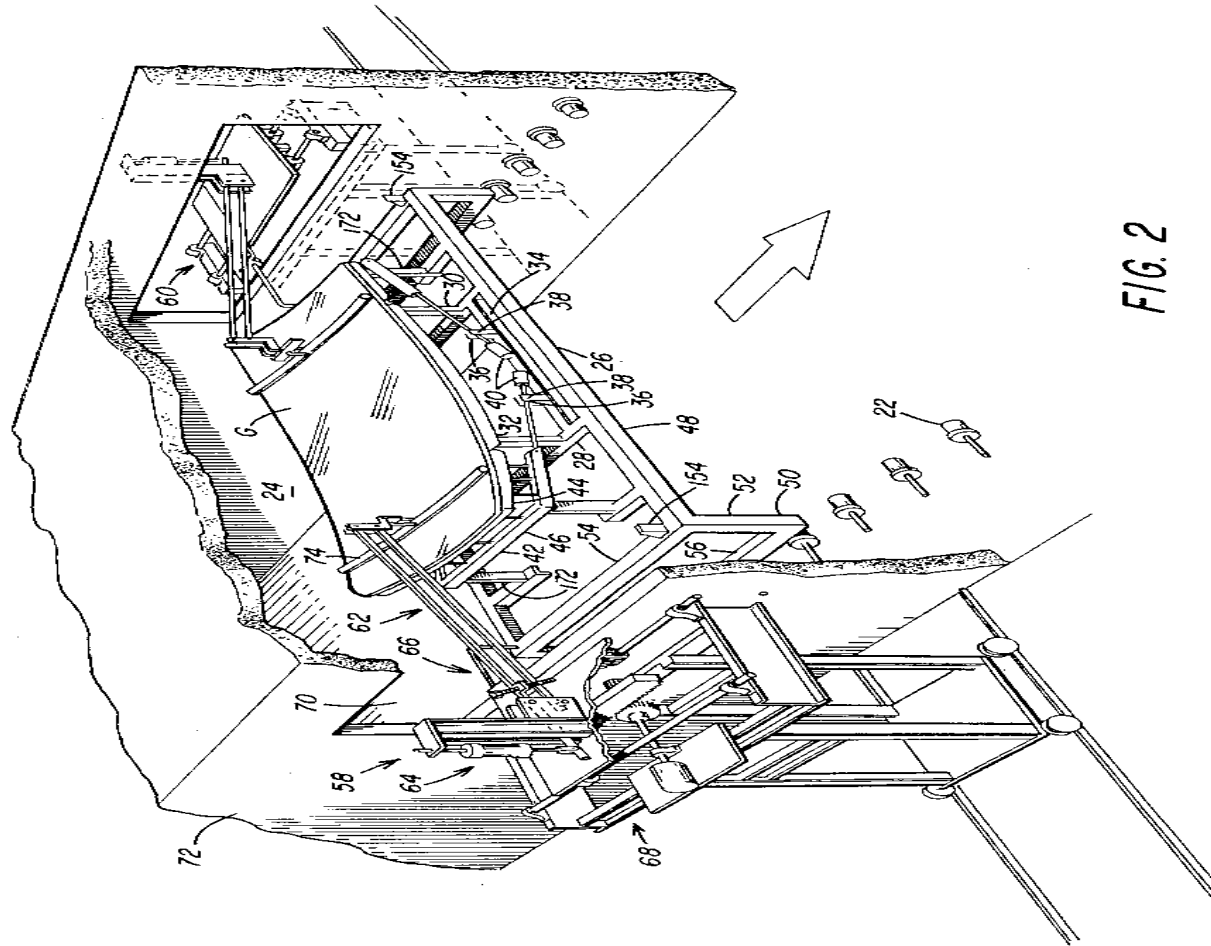
GRAVITY BENDING FOR WINDSHIELDS

U.S. Patent

Feb. 14, 1989

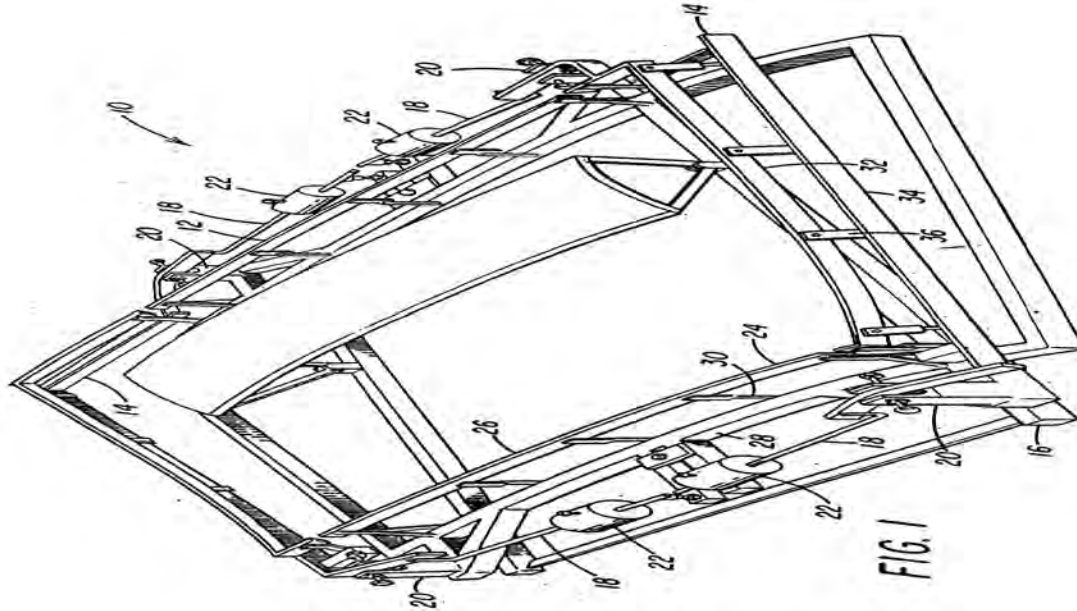
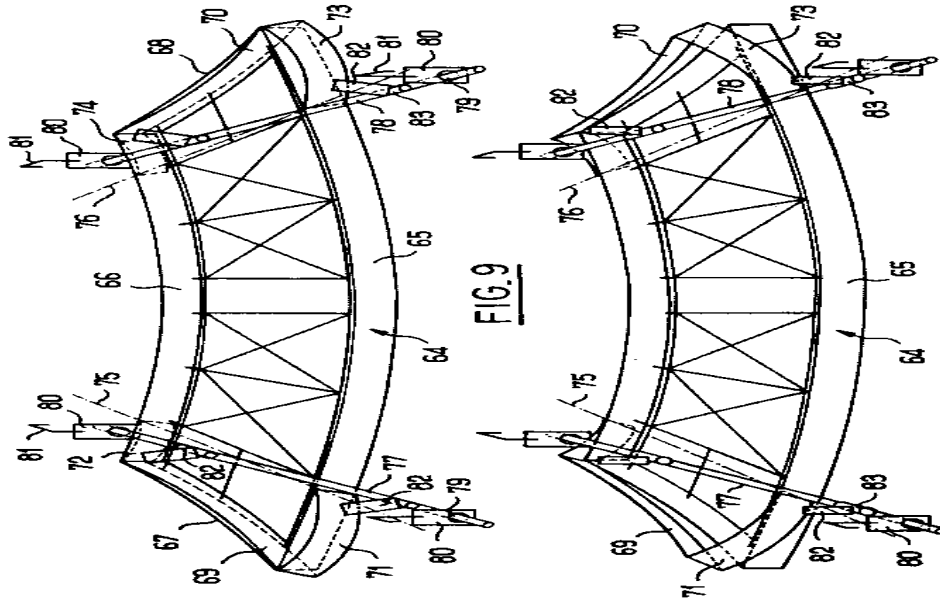
Sheet 2 of 5

4,804,397



GRAVITY BENDING FOR WINDSHIELDS

U.S. Patent Dec. 1, 1924 See 6 of 5 5,117,683



POLYVINYL BUTYRAL



DE AIRING



DE AIRING



AFTER DEAIRING



LAMINATION



LAMINATION



FINAL OPERATIONS



©Saint-Gobain Sekurit



OTHER TRANSPORT APPLICATIONS



CONCLUSION

Glass has proven a remarkable ability to accompany the formidable development of the car industry.

It has met ever tougher technological demands

from the car manufacturers in terms of volumes, quality & cost efficiency, from the final customers, in terms of design and functionalities.

Challenges ahead:

Curbing CO2 emission

Trend toward electric vehicles

Keep meeting safety, comfort and cost requirements

Integrate even more new functionalities

Associations with other materials

Recycling & Sustainability



lightweighting.



**Thank you
for
your attention**

<https://www.youtube.com/watch?v=3RLZcK-63Tc>

