



Evolution of grid making technologies *in lead acid batteries*

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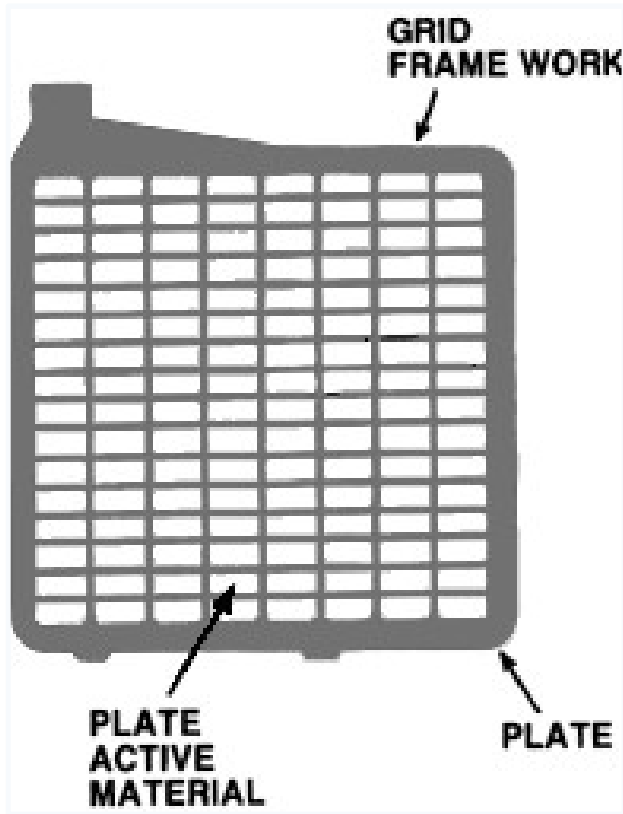


Topics Covered....

- *About 'Grid'*
- *History of grid making technologies*
- *Highlights of each Grid technology*
- *Pro and cons*
- *What Grid is good for what application*
- *Questions if any...*



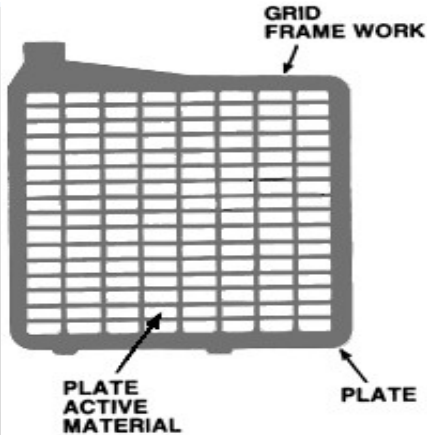
What is a 'Grid' & Why is it required



- The grid is like the skeleton for the Battery
- It supports mechanically and gives shape to the Active material
- It is a solid electrode and acts as a current carrying collector from the Active material.
- It has a lug located on top of the grid frame.
- The Lug collects the current from the Plate's Active material and transfers to the Busbar.
- It is generally made of Lead or any alloy of Lead metal



Requirements of a Battery Grid & it's Equipment



- *Rugged*
- *Good conductor*
- *Corrosion Resistant*
- *No Maintenance*
- *Low weight*

- *Extremely Flexible*
- *Excellent process Consistency*
- *Process the thinnest grids*
- *Low Capex*
- *Very Low Opex*
- *No Skilled Manpower*



HISTORY OF GRID MAKING – Hand Casting

Manual process

Poor process Quality

Lower corrosion resistance

Higher Lead usage



Highly flexible process

Very low Manufacturing cost

Very low Capex requirement

Very Low productivity

No-Skilled manpower



HISTORY OF GRID MAKING – Gravity Casting

Mechanized process

Low Process consistency

Lower corrosion resistance

Higher Lead usage



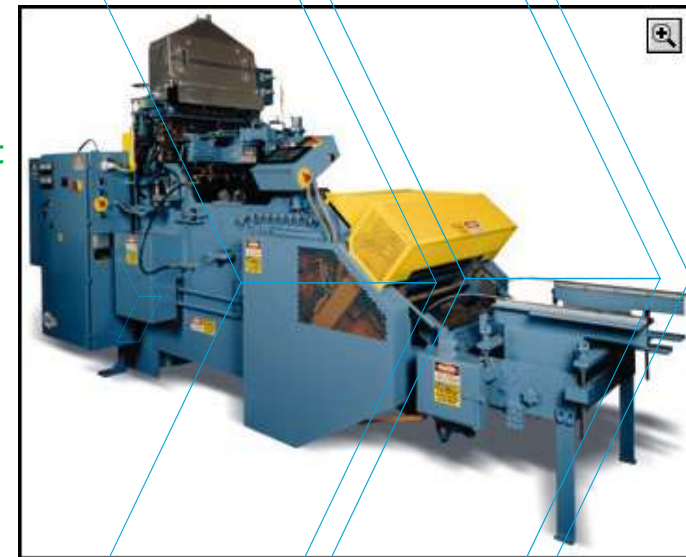
Flexible process

Low Manufacturing cost

Skilled manpower

low Capex requirement

Acceptable productivity



HISTORY OF GRID MAKING – Expanded Grids (ExMet)

Continuous process

Good process Quality

Lower corrosion resistance

Very low Lead usage



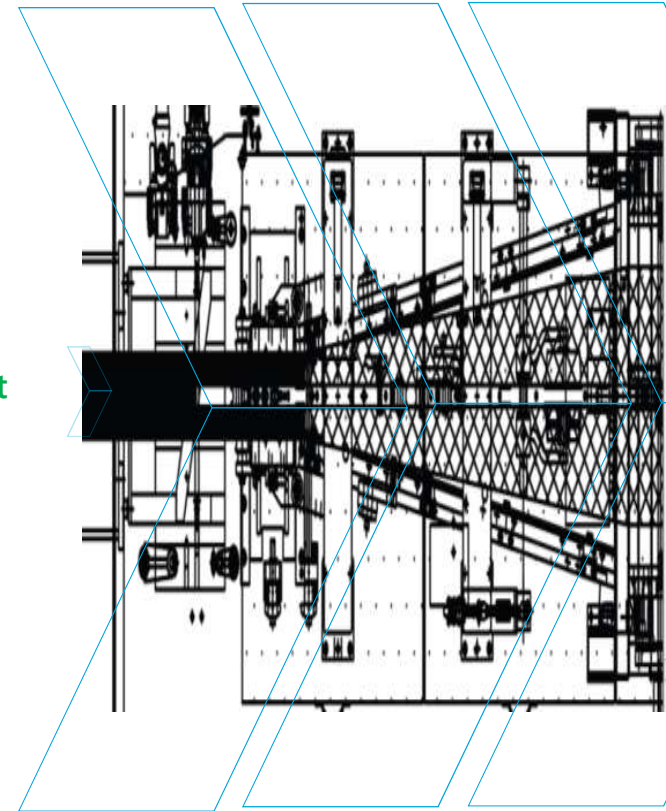
Low flexible process

High Manufacturing cost

High Capex requirement

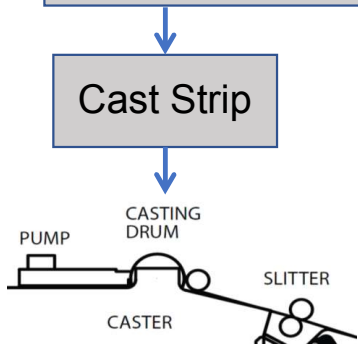
High productivity

Skilled manpower

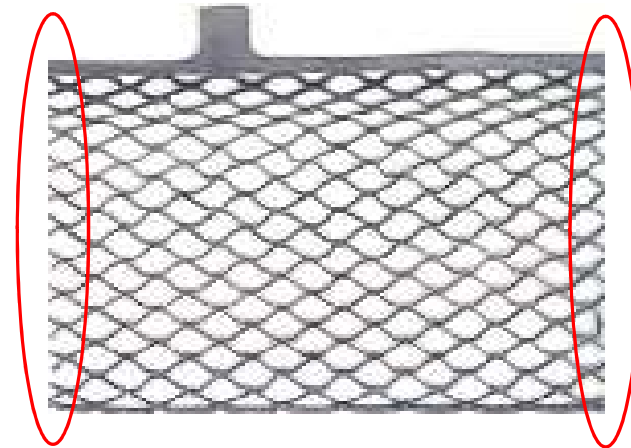
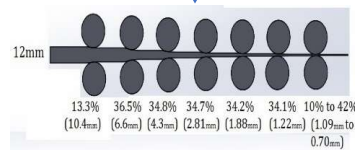


Highlights of 'ExMet' technology

Expanded type continuous plate making
Strip Making



Rolled Strip



Suitable for Negative grids



Suitable for both Positive & Negative grids

- **Thin grids**
(lowest possible grid wrights)
- **Higher speeds**
(500-700 plates per minute)
- **Reliable performance and product quality**
- **Better CO₂ footprint**
- **Expensive equipment**
- **Poor Mechanical strength & Conductivity**
- **Predominantly used for flooded batteries (Negatives)**
- **No Frame on both sides**



HISTORY OF GRID MAKING – Continuous Casting (ConCast)

Continuous process

Good process Quality

Lower corrosion resistance

Higher Lead usage



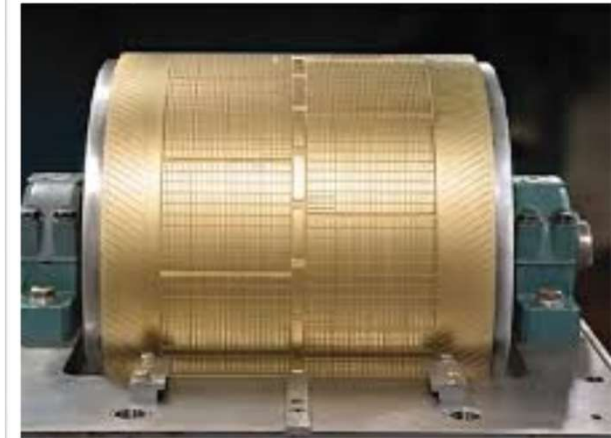
Low flexible process

High Manufacturing cost

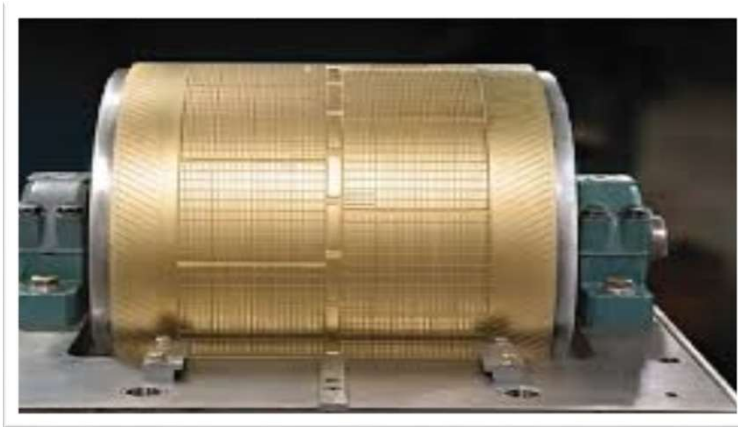
High Capex requirement

High productivity

Skilled manpower



Highlights of 'ConCast' grid technology



Caster drum



Grid casting from a caster drum

This process, instead of casting a strip and expanding it into grids, casts a continuous coil of double panel grids to final shape

- *Frame on all sides grids (unlike expanded)*
- *Light weight grids*
- *Energy efficient process*
- *Reliable performance and product quality*
- *The Paste adhesion is a bit problem.*
- *As expensive as ExMet*



HISTORY OF GRID MAKING – Punched Grids

Fully Automatic process

Highly Rigid process

Highly Skilled Manpower

Very high Capex requirement



Low Material usage

Precise Grid weights (± 1 gm)

Precise Grid Thickness ± 0.005 mm

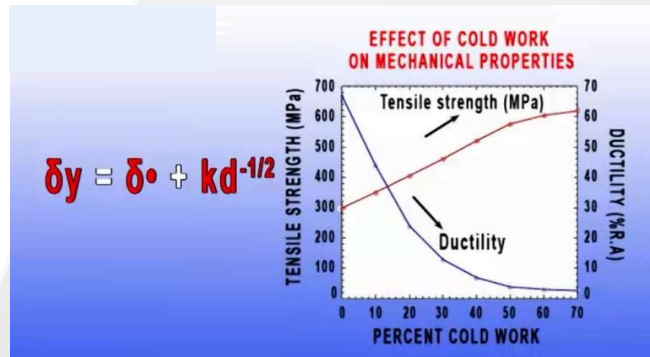
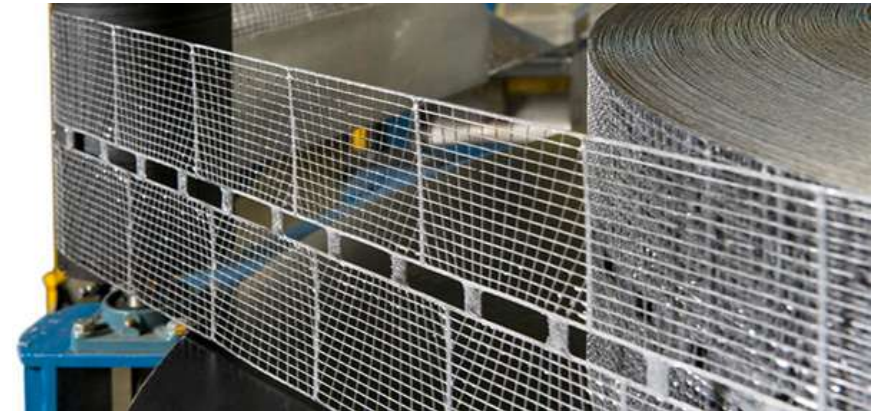
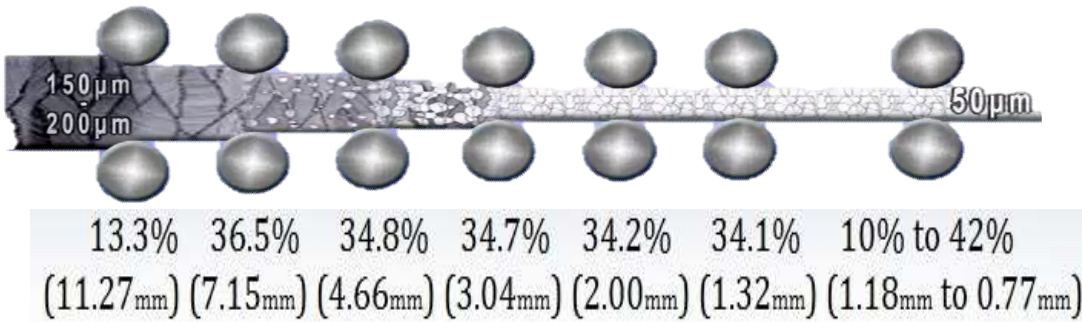
Very high corrosion resistance

High process Consistency

Very high productivity (500 – 900 gpm)



Highlights of 'Punched' grid technology



Source : Sovema strip caster technology

- δy Strength of materials
- d Size of crystals
- k Constant factor based of material

- Cold rolling process for reducing the grain size.
- The best grain size is achieved by rolling the lead strip at a reduction rates between 90 to 99%
- This leads to **higher mechanical strength** as well as **higher corrosion resistance** for grids



Comparison among various Grid methods

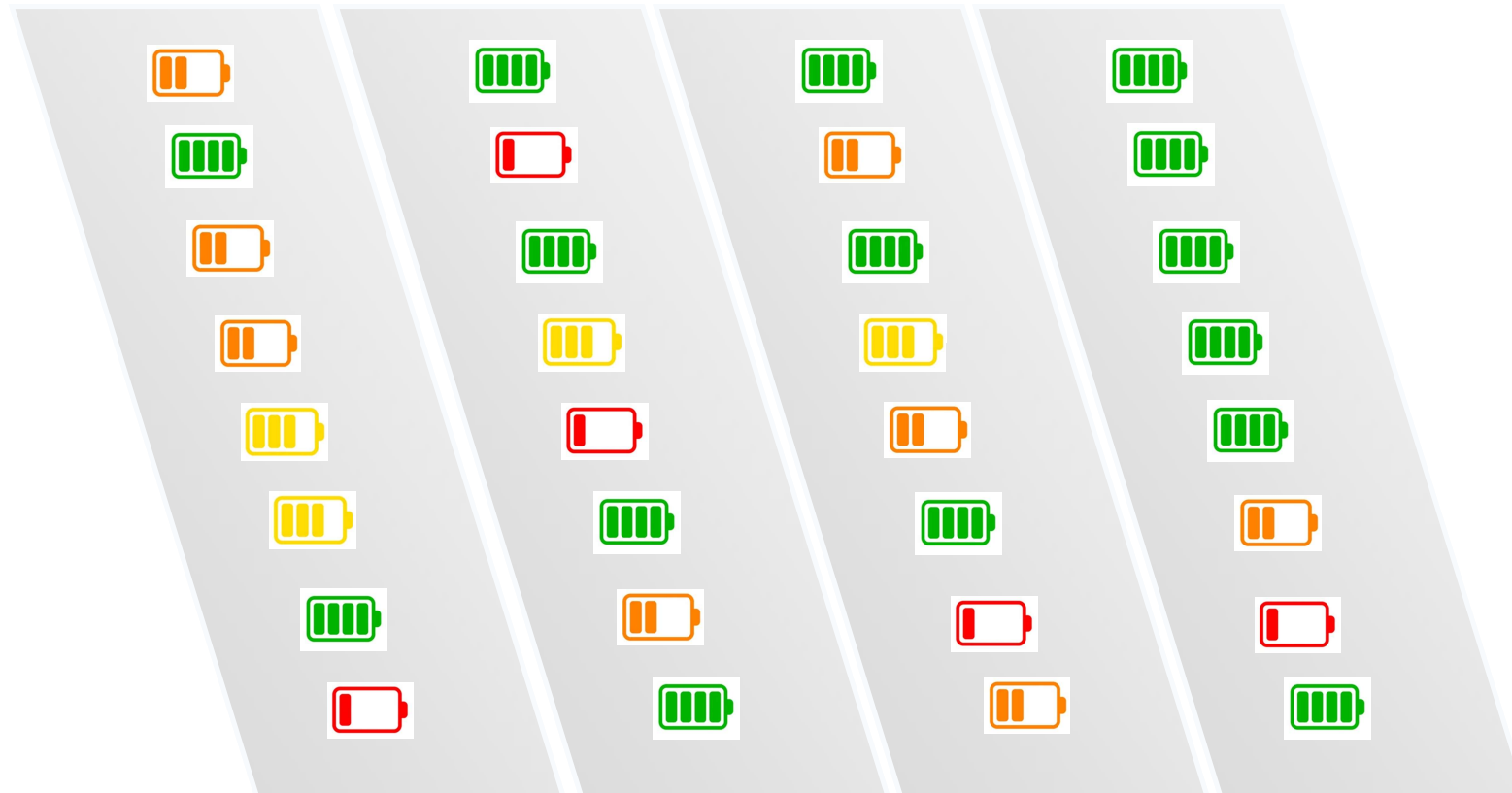
- Manufacturing process
- Conductivity
- Productivity
- Process Quality
- Robustness
- CO₂ footprint
- Adaptability
- Material optimization

• Gravity

• ExMet

• ConCast

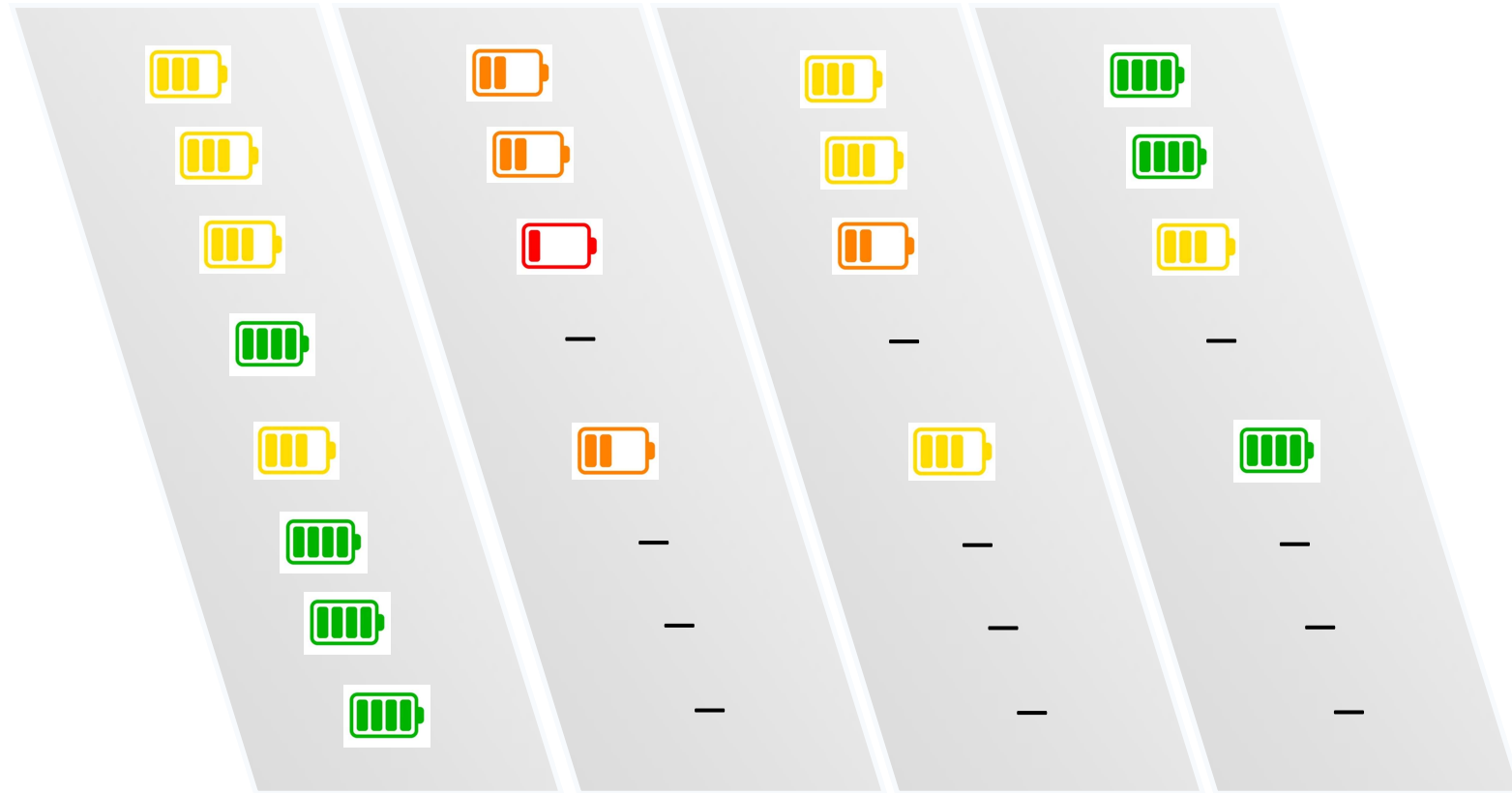
• Punched



Optimal Grid for various Applications

• Gravity • ExMet • ConCast • Punched

- SLI & Start Stop
- Start Stop
- Inverter/E-Rik/Solar (12V Flat)
- Inverter/E-Rik/Solar/ (12V Tubular)
- UPS (12V AGM)
- Telecom (2V AGM)
- Railways (2V AGM)
- Motive power (2V Tubular)





AMARA RAJA
Gotta be a better way

THANK YOU

