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Making Leather:
AN OVERVIEW OF MANUFACTURE
Part 10 of 10

Annex

Content

Making Leather: THE TECHNOLOGY OF MANUFACTURE

Author: Richard Daniels

“Overview” is a tool for technicians. It follows the most common methods of converting cattle hides into footwear leathers, then expands into different leather types, including small skin manufacture.

It makes it clear that different raw materials suit different purposes. It provides broad leather making principles, and gives insight into refinements that are required.

However, for making leather, a better understanding of the role of force is needed, and the way that chemical processes are designed and controlled.

This is the objective of “Technology”: it builds upon “Overview” for an improved perception of leather making, its development, and its management. “Technology” is for the Leather Technologist.

Technologists are people who have a good understanding of sciences. However, they apply their knowledge to manufacture instead of taking an academic path. In leather manufacture, these understandings include chemistry, physics and materials science. Other essential areas are sustainability, and the environment. These cannot be separated from responsible manufacture.

Central to “Technology” are the three leather making elements:

i] Hides and skins, and the properties that prevail throughout all procedures.
ii] Force, and its application throughout manufacture.
iii] Chemical processes and their management.

It involves:

i] How these elements interlink.
ii] Their manipulation to advantage in commercial leather manufacture.
iii] Sustainable manufacture: more efficient processing, minimised water and energy use, recycling of residual chemicals, and viewing waste as new raw materials.

Making Leather: FINISHING TECHNOLOGY TO SPECIFICATION

Author: Paul Evans

The intent of "Finishing" is to provide the technology for leather to meet customer requirements. It needs to provide the technologist with knowledge and the ability to meet both aesthetics and performance to specification. This requires a clear-cut perception, since customers want:

- **A blend of surface appearance and uniformity. There should be no skin to skin variation, for both manufacturing and end use.**
- **Individuality: to create appearance specific for a customer.**
- **Correct performance, for both the manufacture and the consumer.**

This is to be provided through delivering:

- **A greater understanding of what leather finishing is able do.**
- **The science needed to change subjective requirements into objective *(or measurable)* detail.**
- **An understanding of customer perceptions: for example, colour, filling, covering, adhesion, brightness, handle and texture.**
- **Some basic manufacturing techniques. This involves some detailing of chemistry within formulations, physics within applications, and requirements for mechanical operations.**
- **Knowledge to be able to balance performance, appearance and economics.**
- **Sustainable clean technology as is understood currently (health and safety, environmental).**

Stages of manufacture and procedures
Bovine hides: chrome tannage: footwear leathers

Schematic 1(a) *"Overview" ©R.P.Daniels*

PROCEDURE

Mechanical operations Chemical processes Observations Options	Drum operations. (many configurations) All chemical processes	- Many internal structures. Drums, mixer-type, tri- - compartmental vessels. Many sizes and designs.
	v	
	v	
	1st Soak	- (weight range specific)
	v	
Stage 1 Removal of unwanted materials from structure and Extension of the structure	Green flesh	
	v	
	2nd Soak	+/- Lime splitting Splitting in the limed state offers the best extension of the structure throughout all procedures until the completion of tannage. Also, maximum choice for use of the flesh split.
	v	
	Unhair + lime	
	v	
	Lime flesh	
	+/- Lime split	-
	v	
	Delime Bate	
	v	
Stage 2 Introduction of new materials into the structure and Extension of the structure	Pickle Chrome tannage	+/- Wet sort (pre-samm). Clear identification of grain defects are possible, due to lack of grain compression and samm indentations. + Blue sort (after samm) Better assessment for area and substance. Easier handling and enables rationalisation.
	v	
	+/- Blue sorting/gradings	-
	v	
	Samm	
	v	
	Side	
	v	
	Selection: Blue sort	-
	v	
	+/- Blue Split	- +/- Blue Splitting Maximum selections for grain quality/substance.
	v	
	Shave	
	v	
	Trim	- (+/- trim pre- soaking and lime splitting operations)
	v	
	Neutralise Dye + fixation Retan Fatliquor/lubricate	(Note: Shave and trim Stage 1 procedures)

v

Details set down for broad information only with variations in procedures according to hide classification, plant and equipment, and end requirements.

Stages of manufacture and procedures
Bovine hides: chrome tannage: footwear leathers

Schematic 1(b) v *"Overview"* ©*R.P.Daniels*

PROCEDURE

Stage 3 **Removal of water** **and** **Reconfiguration Into a flattened form with specific properties**	**Samm/set**	**Preparation for drying.**
	v	
	+/- Side	**(very occasional)**
	v	
	+/- wet stretch/stake	**May be used before drying and within drying.**
	v	
	Vacuum dry in conjunction with suspension dry (tension free)	**Many alternatives and permutations possible within drying and mechanical operations. Temperature, strain and compression significantly influence final properties of leathers.**
	(or)	
	Toggle dry (High strain and tension)	
	(or)	
	Dehumidification dry (light tension)	
	v	
	+/- Conditioning	**Moisture content adjust. May avoid if drying via relative humidity control.**
	v	
	Vibration staking (may be multiple)	**Soften to specification.**
	v	
	Second time drying. (tension free)	**Lowering of water content from staking requirement.**
	v	
	+/- Milling	**Soften/texture if required.**
	v	
	Crust inspection (assessment/evaluation)	**Quality, technical and aesthetic to specification.**
	v	
Stage 4 **Application of finish + Structural amendment**	**Finishing operations** **(multi-permutations) according to specification and end-use**	**Formation of new hybrid grain/finish structure. Grain wetting/drying + compression under heat and pressure. Changes in appearance, structure and properties.**

Details set down for broad information only with variations in procedures according to hide classifications, plant and equipment, and end requirements.

Panel 1 *"Overview" © R.P.Daniels*

Characteristics of different tannages

Tannage	Properties of dried leathers (tanned only)	Shrinkage temperature (saturated) and Charge	Dyeing, retanning and fatliquoring. (anionic products)	Properties of final leathers and End uses
Chrome	Blue-green colour. Hard and thin.	100C. Cationic	Good dye properties. High uptake of retanning agents and fatliquors.	Very versatile. Very soft to firm. Footwear, auto, furniture, bags, leather goods etc.
Glutaraldehyde	Light yellow brown colour. Soft to medium. Thin with poor retention of shape unless heavily supported by syntans/resins.	Approx 75C. Anionic	Poor dye properties. Poor uptake of retanning agents and fatliquors.	Very soft to firm. Good aging properties. Auto use – mouldings and seats if heavily retanned. Footwear, upholstery.
Other tannages (Many options)	White to pastel colours range. Moderately soft / firm.	75C – 85C. Anionic	Poor dye properties. Lower requirements for retanning agents and fatliquors.	Soft to firm. Many variations, with mainly glutaraldehyde – type properties.
Light vegetable	Cream to light brown colour. Moderately soft.	Approx. 85C. Anionic	Poor dye properties. Low requirement for retanning agents and fatliquors.	Soft to firm with good shape retention. Well filled leather suited for shoe linings and leather goods. Anti-bacterial properties and warm handle.
Heavy vegetable	Light to red-brown. Firm, with dense structure.	Approx. 85C. Anionic	Dyeing and retannage mainly not required.	Offers excellent shape retention. Suited for soling, harness, belts, moulding and carving.

Note:

- Information for general guidance only.

Panel 2 *"Overview" ©P. Evans*

Finish variations

Structure	Category		
Full grain	Aniline	Semi-aniline	Pigmented
Corrected grain	Aniline	Semi-aniline	Pigmented