



## Back to Basics: A Framework for Leather Manufacture

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# Hides and skins: The reception of force

The effects of change in the physical state of hides and skins as they progress through wet processing have been discussed in *Essays 1-10*.

Among the various factors considered, temperature has been identified as playing a very important role. The effects on the rate of a chemical or biological process are well known, but temperature induced shifts between softness/firmness and plasticity/elasticity can be considerable.

Temperature not only affects the speed of the reaction, but the rate of both the release of skin components and chemical diffusion throughout a skin structure. Over and above the inherent skin properties this helps to determine the location of chemicals, hence the aesthetic properties of the final leather.

Similarly, important temperature and moisture-related effects are found in machine operations. Essentially shifts between softness/hardness and plasticity/elasticity influence the degree of spread as a piece is presented to an applied force. This influences the outcome in terms of cutting in fleshing and shaving, water release/set in sammying/setting, and slicing in splitting.

### A study of machine operations

Although there is considerable information available on the construction of machines in the tannery, and associated features, this is normally machine specific. There is very little detail available on the engineering principles involved, how machines apply specific forces, or how these forces are received by hides and skins.

Moreover, there is even less information available concerning the way that forces are absorbed by hides and skins under different conditions, and the outcomes from these interactions. The effects of moisture and temperature within major wet-end machine operations have been discussed within the series (*Essays 9 and*

*10*), but this is in broad detail.

To better appreciate these subtle interactions, these are discussed in *Essays 12-16*, where the focus shifts to:

- the way that wet-end machinery works
- the way that forces are applied to skin and leather pieces
- the way that forces are absorbed by skins and leathers
- the outcome according to the characteristics of the piece

### The origins of machines

The manner in which a given tool in a modern machine acts during the conversion of hides and skins into leather has its origins in the simple single hand-held tool. The shaving machine for one illustrates this. The former hand knife has become a series of shaped blades inserted into a rotating cylinder, which then act upon the leather piece presented to it. The concept has been borrowed from wood and metal shaping machinery which employed rotating cutting elements for many years before leather processing began its own industrialisation.

An exception is represented by machine splitting as no satisfactory hand tool ever existed that was capable of separating grain and flesh into separate layers. The practical splitting of leather across its substance was only made possible by the development of the moving band-knife machine in the middle of the 19th century. Whereas spiral bladed cylinder machinery can trace its origins back to hand tools previously performing similar operations, the splitting machine as it eventually appeared was the response to a long standing demand from the leather-making industry.

### Reciprocating multi-roller systems

Fleshing, sammying, setting, samm/setting and shaving machinery belongs to a group of reciprocating multi-roller machines. Reciprocating because at given stages of the machine operating cycle a hinged

#### Panel E11/I

#### The razor-edge of control

It is clear that some advantages in terms of both quality and area may be gained if it is possible to work at higher temperatures in chemical processing and machine operations. These are important matters, but must be taken in the context of producing a good end result.

There are very sharp lines as upper limits within chemical processing, especially in the pre-tanned state. Gains are important, but the closer the process gets to these limits, the more difficult it becomes to manage. Over and above grain damage, greater effects are found in the more open fibred parts compared with the more densely structured areas.

And simple changes to seek improvements may be counter-balanced by losses. For example, a temperature rise will induce a relaxation in liming or bating, thus increasing the area and reducing draw in the belly parts. However, if the process is designed to work at a lower temperature this can easily progress to looseness in the more susceptible parts. Also, if area gains are achieved through process change, there will be losses in the final thickness or substance potential.

Change within any established process always produces an effect within the final leather. If change is contemplated caution is needed.

frame carrying transport and pressure rollers opens and closes to allow the introduction and retrieval of the leathers. Multi-roller because they all have a number of rollers—including transport, support, pressure and spreading rollers—as well as the spiral bladed work cylinder. The shape, configuration and specific function of rollers and cylinders varies with the functions of the machine.



### Panel E1 I/2

#### The changing role of the operator

The inherent characteristics of hides and skins in process, coupled with shifts in plasticity and elasticity, strongly affect the outcome of machine operations. This is discussed in detail in *Essay 10*, but apart from this, the way that the pieces are presented to the operation also has a profound effect.

In the classic manual feed situation, in addition to factors that can be measured, the machine operative takes many other details into account. Over and above the shape and size, these judgements are based on visual appearance, tactile properties, and the level of normality of the piece. Accordingly, the hide or skin is offered to the machine to ensure the best outcome for presentation to the next operation.

#### A WIDER ALLOCATION OF RESPONSIBILITIES

In common with other manufacturing industries, progressive division of labour has evolved over a period of time. Historically, the skilled tanner performed all the operations needed to transform raw skins into finished leather. Later on, operator skill focused on carrying out certain operations using simple machinery.

As more sophisticated and faster machines were developed, much more skill became necessary to set machines up to process varying leathers, and to achieve the required effects. Further skill training and experience became essential to ensure that machines were fed correctly and safely.

This was followed by a period where the rising skill requirement turned downwards both in terms of setting up and the operation

of equipment. This was due to advances in machine development, engineering innovation, and improved monitoring and control systems. However, this was coupled with greater allocation of responsibilities to operators to achieve the desired results in a broader sense, for example:

#### PROCESSING VESSELS

The timing, weighing and the addition of chemicals were in the hands of operators. These people had to have the experience to perform this function, but there was inadequate control over the process. On state-of-the-art installations computers govern these factors. This requires less detailed operator input, but more responsibility for the overall performance of the equipment.

#### SPLITTING MACHINES

Splitting machines have long been regarded as the most sophisticated machines in the tannery, requiring highly experienced people to set them up and run them. However, setting up can now be electronically pre-programmed, either by remotely located technicians or the operator.

Feeding the pieces into the machine needed experience and care, but mechanised feeding arrangements de-skill the operation, and guarantee more uniform results. Similarly on the feed out side of the splitter, mechanical extractors can supersede experienced labour.

#### INCREASED SHOP FLOOR RESPONSIBILITIES

Increased shop floor responsibility takes

effect where the tannery allocates performance control for the output of a department to machine operators. One example is where a shaving machine operator has some jurisdiction over the machine processing prior to shaving.

A different scenario arises where production lines linking several machines are employed. The initial feeding point will be manned by less qualified personnel and feed out will often be automatic onto stacking equipment. In this event the leather transfer and the stacking system may not be totally reliable, making manual monitoring and adjustment necessary. The stacking machinery will fill up and the accumulated leathers need unloading, so a roving operator may be used to attend to these functions.

This is combined with inspection of the processed material at certain points, and if necessary the operator may make adjustments to machine parameter settings or call for them to be made. So here there is a significant extension of skill and experience.

Examples of such in-line production are the feeding into dryers or conditioners, transfer to staking machines and collection by stacking equipment. Also a combination of spraying/rollcoating machinery, drying, conveying and transfer equipment.

In these situations the specific requirements for individual batches of leathers still need taking into close account. These shifts in operating skills apply to much of the tannery equipment in one way or another.

### Through-feed systems

Through-feed samm/setting, which also employs sammying rollers as well as bladed setting rollers, does not fit into the category of reciprocating multi-roller systems. Similarly, the splitting operation employs a through-feed machine configuration.

### Setting and cutting actions

As the animal skin is not a flat piece of material it must be continually spread, pulled and stretched to flatten it out, an operation normally called setting out. One of the most important tools in this process is the spiral bladed cylinder.

The two processes where the primary function is to cut into the skin or leather are fleshing and shaving—being carried out by sharp knives fitted into the rotating spiral bladed cylinder. This pattern of mounting the knives (or

blades) further produces the setting out action where the angle of the blade with reference to the vertical is particularly important.

In sammying and setting the objective is to spread, set and flatten the leather with the ultimate aim to produce flat and relaxed leather. The spiral mounted blades of the setting cylinder have rounded edges so as to produce an intensive pushing action on the leather grain without cutting or causing damage on its surface.

### Processing vessels

The processing vessel is mainly viewed as a reaction vessel. This concept reflects change within the way that wet processing is perceived. Historically, although processing vessels provided mechanical action to speed and

rationalise chemical processing, massive variations are found in types of vessels. These variations encompass different dimensions, internal configurations, speeds of rotation, and feed and draining arrangements within each class of vessel. Moreover, the use of mixtures of vessels for the same element of process is common.

Once commonality in equipment and services is achieved, then the reaction vessel becomes a constant within chemical processing.

These vessels apply significant mechanical force to the goods in process. These forces not only influence the rate and efficiency of the chemical process, but also strongly affect the deformation and shape within the chemical process. In turn quality, area and presentation of the finished leather are affected. ⚙️