



Automated handling in the finishing area

The finishing area has always seen the greatest requirement for labour in the tannery—traditionally, each individual piece of leather had to be presented to, and removed from, each process machine by that most versatile of tools, a pair of human hands. The rising cost of labour in developed countries, and the increasing difficulty of finding workers prepared to do monotonous, repetitive manual work, have been the impetus for many years to seek automated handling solutions.

Mechanical stackers first appeared in primitive forms over twenty years ago, their purpose being to replace the operators at the end of spray lines, for example, whose function was solely to lift the leather from the conveyor and lay it onto a transfer table or drape it over a “horse”. Many early stackers achieved this with a conveyor fixed in the horizontal plane, with a reciprocating carriage that moved a table or horse beneath the conveyor (*Figure 2*). As the leather came off the end of the conveyor, it transferred smoothly onto the table or horse moving beneath. As the stack of leather increased in height, the conveyor was elevated incrementally, either by a screwjack arrangement or by lifting

chains. Reciprocation of the carriage was initiated by photocell or proximity switch mounted on the conveyor system, which detected the leading edge of the leather and initiated the sequence through an adjustable delay timer.

Early stackers were notoriously unreliable and seldom trusted, and it was not unusual to find an operator permanently assigned to watch the stacker and adjust by hand the position of each piece of leather in the stack. It may have saved the operator physical effort, but it certainly did not improve productivity!

So, why should early automatic stackers not stack as they were designed to do?

One problem is that for smooth transfer from conveyor to conveyor, and from conveyor onto table or horse, the relative speeds need to be finely adjusted. Typically, each successive item should run slightly faster than its predecessor, so that the leather is pulled out slightly during the transfer; this keeps the leather flat and avoids creases and wrinkles. With early stackers, speed control was mechanical, and difficult to adjust precisely. Another problem with early stackers was that the reciprocating carriage could not be made to run smoothly, but would start and stop with a jerk—this caused the leather on the table or horse to slide about. Lastly, the photocells and proximity switches used to control the stackers were relatively crude and sometimes erratic in operation. It was possible, with care and patience, to set up an early stacker to produce reasonable piles of leather, but when a different type or size of leather was sent down the line it was often necessary to adjust everything again to get a reasonable result.



Figure 1: Overhead conveyor systems in a finishing shop (Thema)



Figure 2: Early stacker with reciprocating table

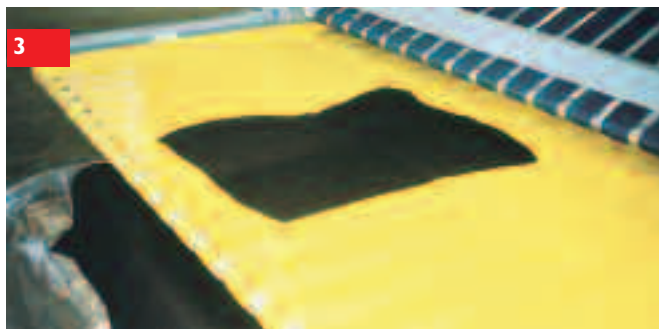


Figure 3: In modern stackers, the final (yellow) conveyor reciprocates



The automatic stacker of today (*Figures 4 & 5*) has been developed into a precise, reliable tool capable of accurate stacking of a variety of leathers onto horses or tables. The reciprocating carriage principle has been largely abandoned in favour of a reciprocating transfer conveyor—this has the optional advantage of enabling the leather to be laid on a table or horse when travelling in the opposite direction. This then gives the options of laying the leather grain up, grain down, or in pairs grain-to-grain. This latter option can avoid transfer of flesh fibres onto the finished grain surface. The conveyor drive motors of the stacker are now controlled through electronic inverters, allowing the very precise and accurate speed control needed for accurate stacking. Inverters used for the reciprocation of the conveyor also allow it to accelerate and decelerate smoothly, preventing the leather from sliding on the conveyor belts. Proximity switches and photo cells are now far more accurate and reliable, and are used in multiples across the width of the leather to accurately detect the leading and trailing edges. Virtually all stackers are now controlled by PLC, enabling all the operating sequence parameters to be easily and quickly adjusted. The PLC will normally be able to memorise “programs” of parameter settings for different leathers, so that the machine can be reset to stack a different leather at the push of a button.

For automatic stacking of whole hides onto horses in the normal manner, with a flank on each side of the horse, it can be seen that the hides will have to pass down the finishing line with the backbone at right angles to the axis of the conveyors. In order to spray or rollercoat hides leading with the neck or butt, a different stacker arrangement is required, with additional transfer conveyors to drape the hide over a horse aligned with the axis of the machine (*Figure 6*).

Stackers are not the only items of automation to be found in the finishing department. Leather is frequently sprayed or roller coated with several coats of pigment and lacquer to build up the desired finish. Traditional practice was to unload the leather from the spray line conveyor manually, and hang it on a rotary stand or “spider” to cool for a while, before stacking onto horse or tables which would be taken back to the head of the line. This practice was semi-automated with the introduction of overhead “airing-off” conveyors (*Figure 1*); these are essentially monorail conveyors suspended from the roof structure or gantries, carrying an endless chain to which are attached hangers for the individual pieces of leather. The conveyor track comes down to head-height at each end of the finishing line, so that the leather can be loaded and unloaded, but rises up into the roof space for the bulk of its length. Here the finish surface can cool and dry before the next layer is applied. Installations of this type can appear to be very complex, but they are essentially simple machines, and highly reliable. There ➤

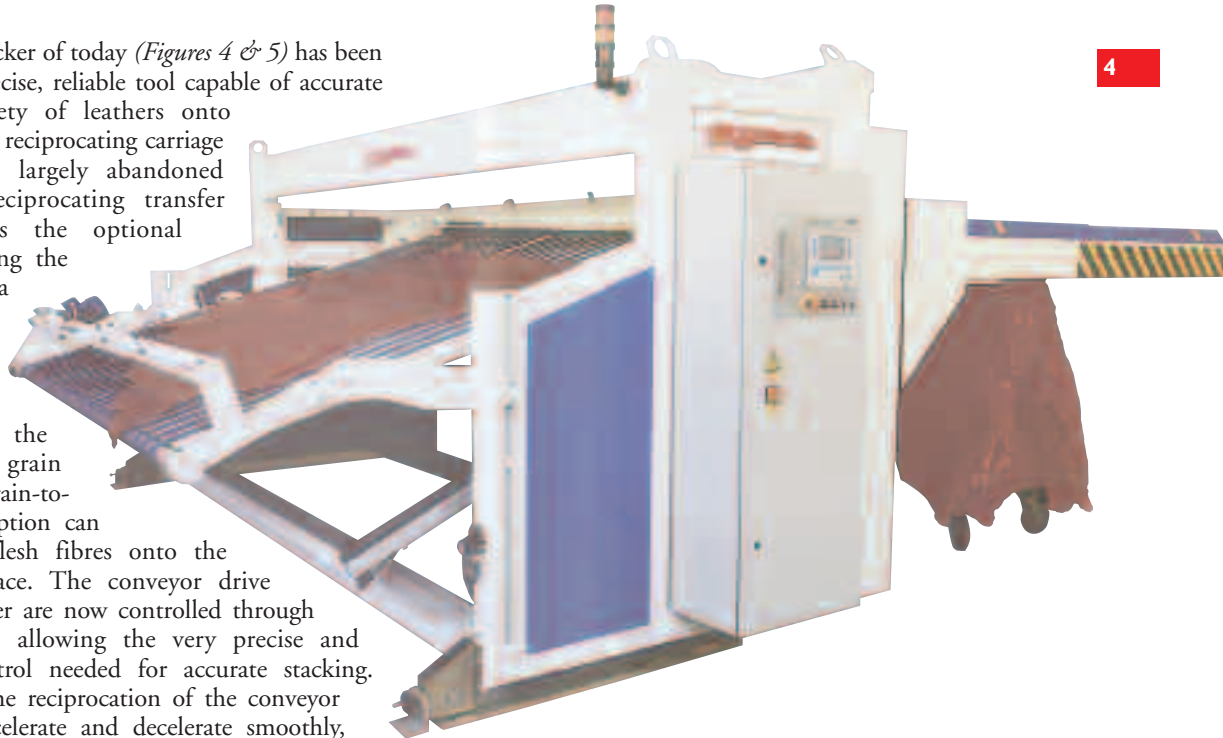


Figure 4: A modern whole hide stacker (Gemata)

Figure 5: Whole hide stacker installed after embossing machine (Gemata)

Figure 6: Whole hides transferred onto longitudinal horse after stacker (Tanmac)



is one drive motor/gearbox unit which moves the chain through a special sprocket, and the speed of travel will be controlled with an inverter. The conveyor can be set to advance one hanger at a time, triggered with a push button, or can run continuously.

The overhead conveyor did not in itself give any productivity improvement—this step required the invention of the automatic loader (Figure 7), to take the leather from the drier conveyor and place it onto the hangers of the overhead conveyor. This allowed the discharge end of the line to run unmanned, but there was the risk that the infed operators would not be aware of any problem at the conveyor loader. The common answer to this problem is now to install a small TV camera at the discharge end, with a screen at the infed position so that the operators can see any problem straight away. Further development of the loader machine has

enabled it to be used as a stacker as well (Figures 8 & 9), so that when the leather completes its last pass down the finishing line the loader conveyor lowers to stack the leather onto a table or horse.

What future developments can we look for in the automation of the finishing area? The hardest nut to crack is undoubtedly infedding leather to embossing, spraying, or rollercoating operations, from horse or tables. For whole hide operations, two pairs of human hands are currently the only practical option. If the tannery has sufficient space and relatively standardised process routes,



individual lines can be linked together with transfer conveyors to avoid handling. A common example is the linking of two- or three-spray cabins and associated drying tunnels with a stacker on the end of the line, enabling the application of base pigment, second coat pigment and final lacquer in one pass with just two operators at the head of the line. A few years ago, one machinery manufacturer proposed a radically different approach to handling leather in the finishing department, with each batch of leather pieces carried on a textile band which was rolled up onto a carrier trolley at the end of each process, like a Swiss roll. The trolley was then wheeled to the head of the next process line, and the textile band fed into the machine through nip rollers, carrying the leather with it. This bold proposal does not seem to have found favour with tanners, probably because of the initial investment and disruption involved in converting all the machines of the finishing department to the system. We are more likely to see the development of multi-axis robotic arms with integral sensors, capable of lifting leather from table or horse and laying it flat on a conveyor.

The technology to do this exists now, but currently the potential savings of pairs of hands cannot justify the considerable cost. The migration of leather production to low labour cost countries at present is stalling such developments—but who knows what the future will bring? 🌐

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Figure 7: Loading an overhead conveyor from the end of a drying tunnel (Thema)

Figure 8: Automatic loader/stacker, stacking onto horse (Thema)

Figure 9: Loader/stacker, loading onto overhead conveyor (Thema)