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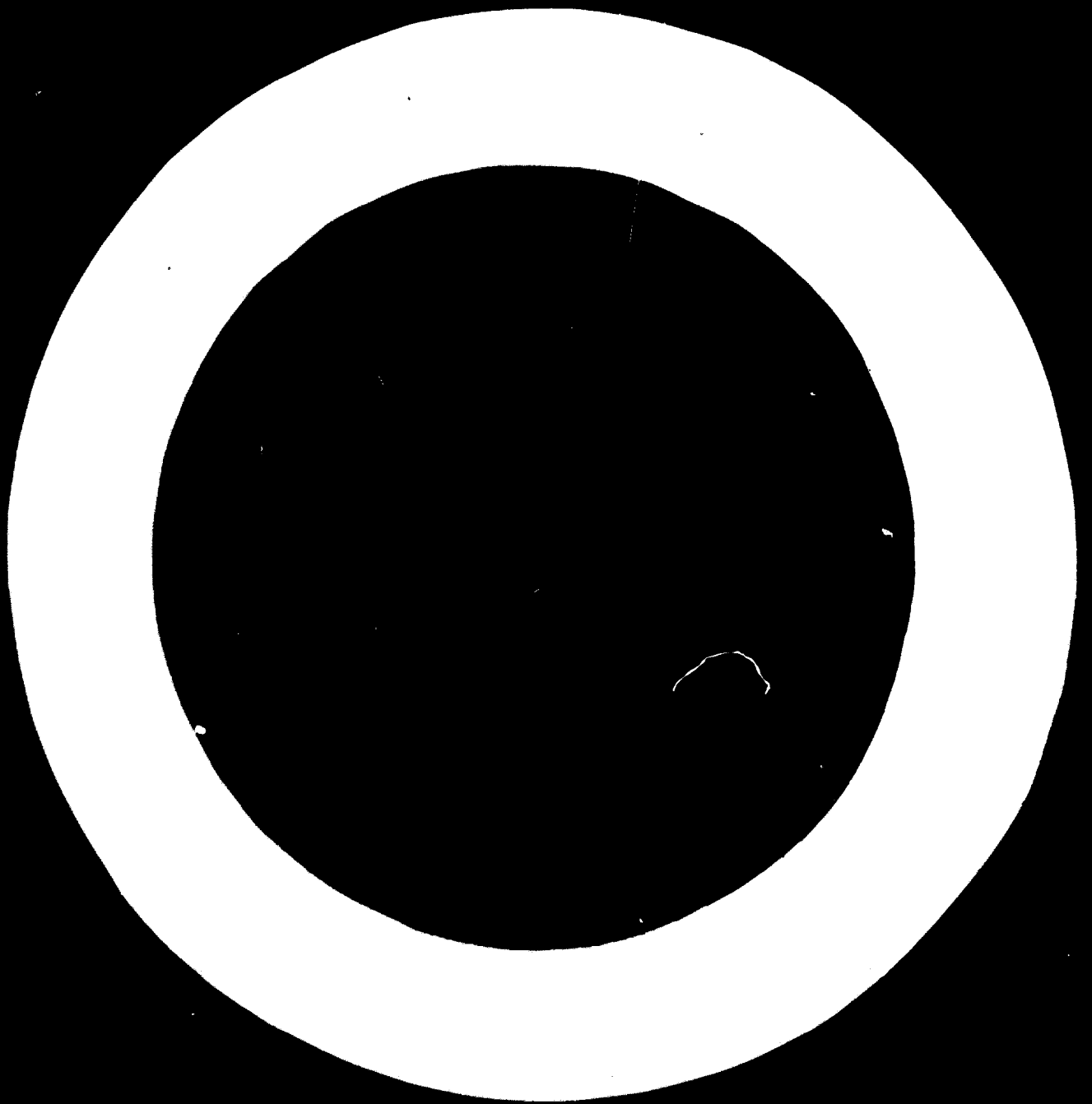
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MODERN PRODUCTION METHODS AND THEIR SUPERVISION  
IN A TANNERY

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The leather industry is in a period of constant progress. There is no longer a clear-cut division line between countries supplying raw hides and skins on the one side and countries producing leather on the other side. The developing countries are increasingly faced with more and more exacting demands on leather quality in their efforts to expand their exports of semi-processed or finished products. The purpose of this paper is to give a brief outline of the technical consequences arising from this development.

#### 1) Chrome leather from hides

##### Production methods

In conventional procedures, soaking and liming cover a period of roughly 65 hours. Nowadays this has frequently been replaced by a brief soak of only 5 hours and a liming process of 16-18 hours. In the U.S.A. there are leather factories which perform both processes in only 12 hours, using a concrete mixer. In view of the effluent problem, processes have been developed in which the quantity of sodium sulphide could be strongly reduced. Another characteristic feature is that the use of non-ionic products that emulsify skin grease has gained general acceptance (1).

(1) e.g. Baymol 4 (Bayer)

## SUPERVISION

Besides the customary checks regarding hair destruction, grain smoothness and lumpiness, usually no other checks are carried out. Some of the bigger factories use a titration of the liming float to determine the alkalinity. The pH of liming solutions lies between 12 and 13. After deliming and bating, however, the following checks are carried out: pH value of the cross section of the pelts with a phenolphthalein solution, and handle of the pelts. Exact, simple chemical methods are not being used, i.e. practical experience is indispensable in this field.

### Pickle and chrome tanning

Production of chrome solutions with tanning effect through reduction of sodium dichromate is carried out very rarely nowadays, whereas the use of ready-to-tan, green chrome salts has become accepted world-wide, as it permits the production of leather of uniform quality by simple and rational methods. Regarding the requirements of the export of wetblues, this is an important factor (2). The use of special chrome products has made it possible recently to omit basification (3).

## SUPERVISION

Required tests: specific gravity of the pickle float (Bé degrees) before addition of the acid and pH at the end of the pickle. Corrections of the latter are frequently required. The transition from the alkaline range of the preceding operations to the acid range required for the following processes is of decisive importance for the final quality of the

(2) e.g. Chromosol Undissolved Process (Bayer)

(3) e.g. Baychron brands (Bayer)

leather. Samples are removed with regularity, and if insufficient, any deviations from the standard should be corrected at this stage. Further tests should be checked and after tannage, with the compulsory tests being all parts of the float, cross section of the drum in the latch parts, and boiling test. The tannage must have fully penetrated the leathers in all sections.

Samming/shavling. The water content of the wetted skins is approximately 55 %. Small fluctuations can be tolerated. Fluctuations exceeding 3-5 % in either direction indicate faulty operation in the beamhouse or during chrome tannage, or are due to inefficiency of the samming machine. The water content of the soaked skins affects the accuracy of the shaving substance and the shaved weight. Irregularities will inevitably lead to fluctuations in subsequent operations and in the quality of the leathers. Checking of the water content is done by the department's foreman by feeling the skins. Another possibility is to cut off a small piece from the shaved skin, which is then weighed, dried to a specific temperature and for a certain time, and subsequently weighed again. The difference in weight indicates the water content.

Neutralization, retannage, drying, and fatliquoring. Modern processes combine these operations to give brief, compact processes. It has even become possible to use only one float, i.e., to add the products together or one after the other. For example, neutralization, retannage, and cycling can all be carried out in 1 hour, fatliquoring being performed in the 2nd hour. The reverse is also being used, i.e. main fatliquoring for 20 minutes with subsequent 60 minute retannage in the same float, to be followed only by a washing or rinsing operation. This means that it is possible today to perform all operations mentioned within 2-3 hours. Consequently, a drum can now be used 2-3 times a day. It is obvious, therefore, that technologies of this type contribute substantially

to cutting production costs, that fewer new drums will have to be purchased, and that money and area can be saved when constructing new factories.

### SUPERVISION

Testing of the pH at certain intervals. Similarly, the leather cross section must be tested with a bromocresol solution. Of considerable importance is the testing of the leathers after fatliquoring, which can be done by bringing about the so-called "pearl effect". Water pearls are produced by pressing the fingers on the flesh side. The water pearls appearing on the grain side should normally remain there for some seconds before they return into the leather on release of pressure.

### Dyeing

The dyestuffs are frequently added into the drum in undissolved form, and it has also become common practice to use them together with the required retanning materials, also added in powder form, in order to improve levelness of dyeing and dye penetration. To achieve the best possible hiding of grain blemishes during dyeing, auxiliaries with cationic charge are being used in many factories. Other advantages of these products are improved colour fastness of the leathers and increased brilliance of dyeing.

### SUPERVISION

Exhaustion of dyebath, accuracy of shade, levelness and penetration of dyeing, pH value of float. Sometimes formic acid must be added if exhaustion has been insufficient. Rapid drying of a leather sample will also frequently be necessary in order to match the desired shade.



### Drying

The transition from moist to dry conditions, too, requires special attention. In paste drying, the relative humidity and the temperature in the individual cells must be checked and controlled. Specific instrumentation (thermoanemometers) is available for this purpose. The leather character, in particular the handle, depends on the adjustment and checking of these instruments.

### Conditioning

The water content of the leathers before staking should also remain within certain limits. Usually it lies between 22 and 28 %. Lower values complicate the opening-up of the fibre structure in the mechanical staking process. Higher water contents may cause the leather to develop loose grain and lead to case hardening.

### S U P E R V I S I O N

The foremen and workers handling material to be staked every day gradually acquire enough practical experience to be able to evaluate the moisture content of the leathers. Where sawdust is used for conditioning, practical experience is also indispensable. In this case, however, it is also possible to determine the water content on the basis of the weight difference obtained by taking samples from the moist sawdust, weighing them, drying and weighing them again. But this method is only valid for the individual factory and cannot be applied, with regard to water content, to other factories. When using conveyor belts for conditioning, the water temperature, opening of the spraying nozzle and the speed of the belt must be kept at constant levels. After conditioning the leathers should always be covered with pvc sheets and stored overnight.

## SUPERVISORY GENERAL

The currently used methods can in principle be subdivided as follows:

- a) checks by skilled personnel in the individual wet processing departments. They should be carried out on the spot and personally by the foremen or leading hands.
- b) where personnel with chemical background and laboratories are available, mostly in big companies, checking will be done by these organs. Analytical examinations will then also be possible. Sometimes random tests are sufficient. They may be employed for double checking intended to supplement or confirm the tests made in the production plant. Not to be neglected is the psychological effect on the workers, as they are not present during the tests in the laboratory.
- c) automatic checking. This involved the use of specific instrumentation for process control. A distinction must be made between semi-automatic and fully automatic systems with punch card control. The individual operations are transferred to punch cards and performed without assistance of a worker. I do not want to discuss details of this now, but it is important to note that automatic process control is being more and more widely used in the leather industry. It brings many advantages. The substantial purchase costs involved are offset, after some time, by the increase in leather quality, the elimination of human sources of error, the saving of water and power, and a great deal of other improvements.

## Finishing

The so-called "one-step" finishing systems are distinguished by simplicity and the limited number of products involved. The most widely used components are pigment, polymer binder and water. This, however, would only satisfy rather low demands on the quality of finish and leather. The numerous fashionable effects and the fastness properties frequently required of a finish film can generally not be achieved in this way. For this reason, serious finishing systems are characterized even today by the use of many individual products and several successive operations. That is why in big companies simple procedures are used besides complicated ones. Which products and technologies are suitable for individual factories in developing countries, will have to be decided by the management or the government authorities involved.

To improve rationalization and productivity, more and more tanneries install so-called finishing lines, which link individual operations to a continuous process by mechanization. Where production capacities are too small or where space is not available, it should at least be tried to couple operations in such a way that little transport is required and easy checking guaranteed.

In recent years the chemical industry has developed polyurethane based finishing methods. Patent leather, as is generally known, is nowadays produced exclusively with these chemicals (4). But other types of leather such as furniture, clothing, and shoe upper leather, too, are to an increasing extent finished with polyurethane products (5). There are two basic systems: one-component and two-component systems, the difference between them being mainly in fastness properties of the finish film and work involved.

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(4) e.g. Baygen Process (Bayer)

(5) e.g. Baydorn Process (Bayer)

## S U P E R F I N I S H I N G

During finishing, the following points should be checked: quantity applied, belt velocity, complete drying of the finish coat before plating, shade, and other factors.

Tests on the finished material: wet and dry adhesion, fastness to flexing, solvent resistance, grain elasticity, and, in some cases, light fastness. Handling of polyurethane products necessitates certain checks even before finishing is started. Details will not be discussed here as all suppliers give detailed instructions.

### 2) Small skins

The comments made at the end of benchwork work and chrome tannage also roughly apply to this field. The zirconium tannage (6), however, deserves special attention. It permits the production of white, lightest, low stretch leathers. On the light-coloured substrate thus obtained, brilliant blue or grey dyeings can be achieved, something which would not be possible on chrome tanned leather. The zirconium tannage thus meets the fashionable trend towards blue speckle leather types with aniline character. Checks here as for chrome tannage.

### 3) Vegetable tannage

Here, too, an interesting change is taking place. More and more factories are giving up their tanning systems with suspenders and pits, replacing them by modern and rational procedures. For this purpose the tanning process has generally been transferred to the drum (7). Remarkable features are that the tannage is carried out practically without flood, and that it does not take longer than roughly 2 days to convert the dressed hides from the tanneries into tanned material. The many advantages regarding economy and adaptability to market situations provided by such systems need not be described in

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(6) e.g. Elmocorol 2N (Bayer)

(7) e.g. S-NTF process (Bayer)

detail in this paper. Commercial companies offering these systems also supply instructions on the checks required. One point worth mentioning is that basically this principle permits the production of all leather types from light goat-skins to heavy hides. It may even be considered an interesting possibility with regard to the export of crust leather.

#### 4) Coated leather

Several years ago leather coating was established as a new type of finishing. The principle of this method is application of microporous foils to corrected grain leathers or splits with the aid of adhesive (8). These foils can be supplied in many fashion shades. In addition, fashionable effects can be produced through subsequent finishing.

Recently another coating process has gained general acceptance. On a machine especially designed for this purpose, a polyurethane film is applied on the leather by a so-called transfer process. Practically any desired grain pattern of hides or skins can be imitated with this process by producing deceptively similar effects on the leather (9).

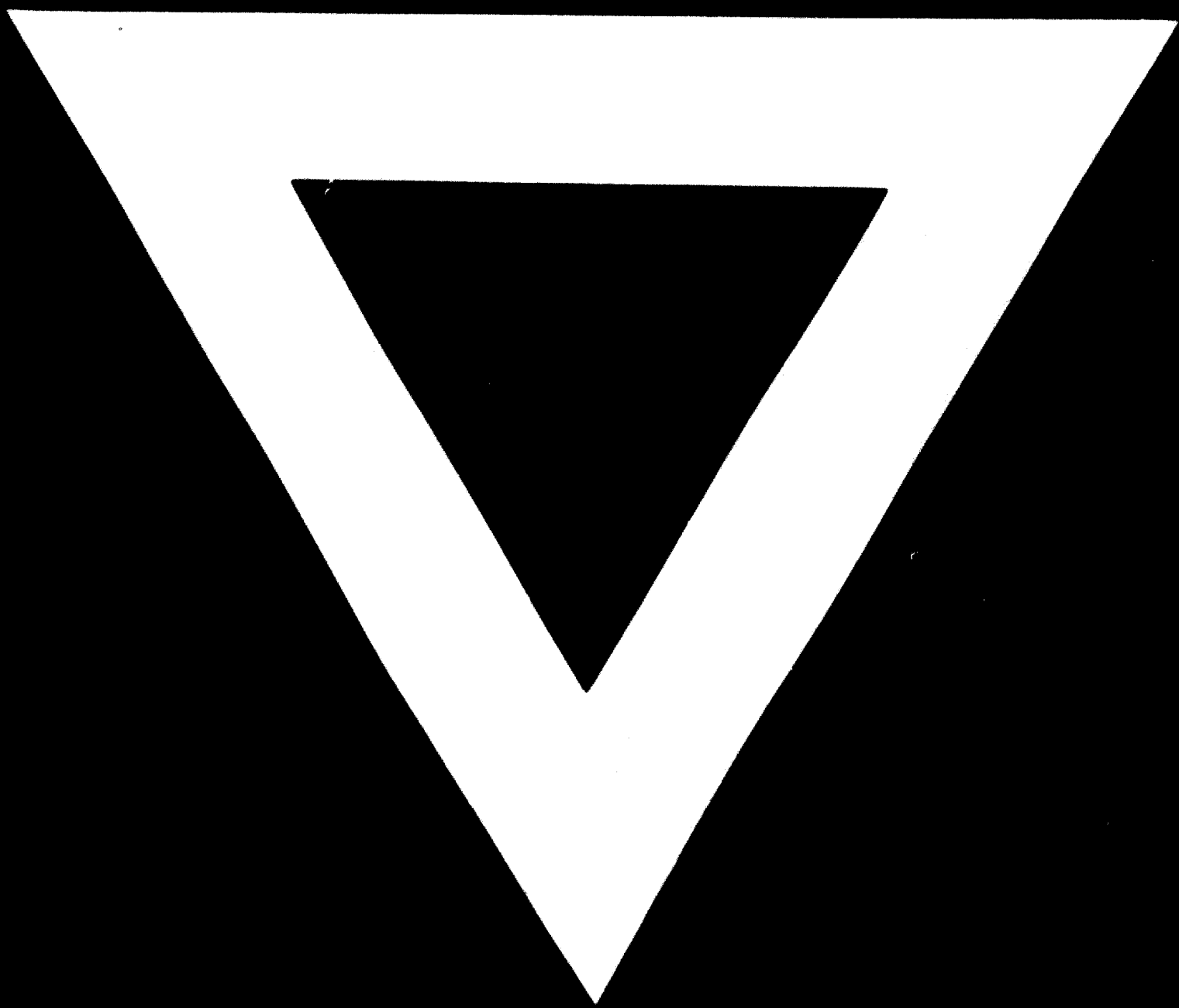
Both processes can be effectively used to upgrade leathers of poor quality. Skilled personnel for the supervision of the processes must be available. They also do the checking.

I have tried to give you a brief outline of modern technologies and their supervision. No doubt further processes will be developed in future. Their benefit for the developing countries will be all the greater, the closer and more open-minded the cooperation of all involved.

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(8) e.g. Desmodern Foile (Bayer)

(9) e.g. Baycoat Process (Bayer)



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