CHAPTER 1

HIDES, SKINS AND KIPS LEATHER:

HIDES:

In the tanning trade the outer coverings of large domestic animals are called hides. Hides are large in size, thicker in substance and heavier in weight then skin. In Bangladesh Cattle hides above 25 lbs. in the wet salted conditions are classed as **hides** and those below 15 Ibs. as **calf skins**. Light buffalo hides weighing from 14.5 to 18 lbs. are called **'Katta'** and those weighing from 7-14 lbs. are called buff calves or **'Kattais'**.

Example: Cowhide, Buffalo hide, Horsehide etc.

SKINS:

The outer coverings of small domestic animals and wild animals are called skins. Skins are smaller in size, thinner in substance and lighter in weight than hides.
Example: Goatskin, Sheepskin, Tiger skin, Crocodile skin etc.

KIPS:

A kip is the hides of immature cattle. In the western countries cattle hides weighing between 15 lbs. to 25 lbs. in the wet salted condition are classed as **kips**. It is smaller, lighter and thinner than a hide, but larger, heavier and thicker than a calf skins.

Primitive man covered himself with the skins of animals he killed. They had three major defects:

- They were dump,
- They would putrefy,
- They lost their flexibility and softness upon drying (they dried the skins to stop putrefaction.)

CHEMICAL COMPOSITION OF HIDES & SKINS

The chemical constituents of hides and skins can be divided into four main groups, such as,

1. Protein - 19 % to 33 % on the green weight
2. Water - 60 % to 70 % on the green weight
3. Minerals - 0.36 % to 0.5% on the green weight
4. Fatty matter - 2 % to 30 % on the green weight

E.g. Cattle, calf : 2.0 %
Goat : 2.0-10 %
Sheep : 5.0-30 %

The relative proportions of these materials vary from skin to skin depending upon the species, age, breed, feeding and other habits of the animals.

STRUCTURE OF HIDES AND SKINS:

Most hides and skins consist of three parts, such as

(i) Epidermis,
(ii) Corium or true skin and
(iii) Hypodermic or adipose tissue.

The epidermis is a comparatively thin layer which forms the upper boundary of the skin. This layer measures only 1% the total thickness of the skin and serves to protect the corium which is the most important part of the skins.

The corium is a much thicker layer of connective and other tissues which constitute the true leather forming substance of the hides and skins. The corium is divided into two distinct layers:

ANATOMICAL STRUCTURE OF HIDE/SKIN:

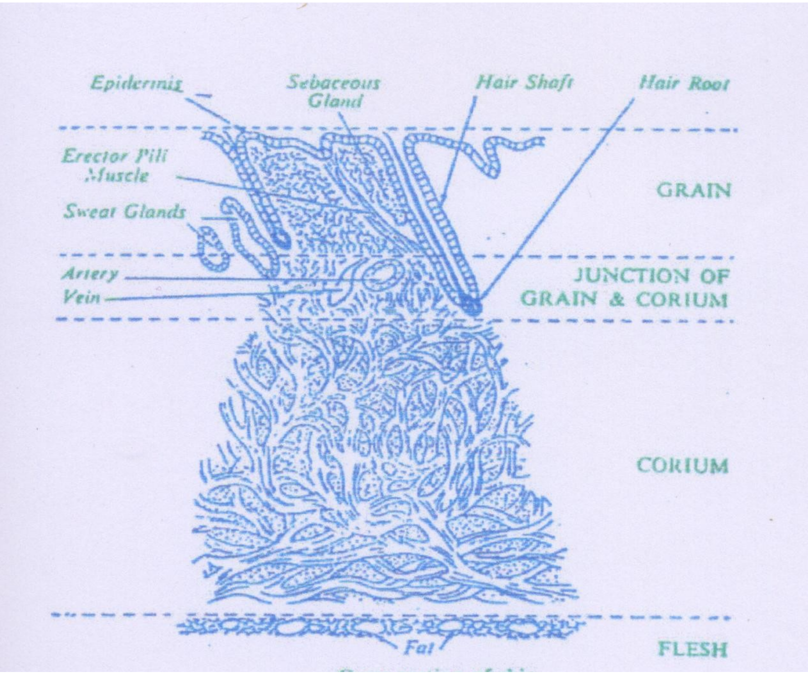


Fig. : Cross section of Hide/ Skin

STRUCTURAL DIFFERENCE BETWEEN HIDES AND SKINS:

PROPERTIES OF HIDE:

1) Fiber length is medium.
2) Number of fibers is huge.
3) The thickness of hair is medium.
4) The fiber bundles of female are more uniform than male.
5) Only one hair grows from one hair follicle.
6) Fiber weaving is parallel.
7) Fiber structure is compact at butt area and lower in neck and belly side.
8) The hair is random, scattered on the grain surface.
9) Fat gland is optimum.
10) The hair root does not fully enter into the corium layer.
11) Grain surface is smooth.

PROPERTIES OF SKIN:

1. The epidermis of calfskin is thinner than cowhide.
2. Grain surface is smooth.
3. Fat content is less than cow.
4. Calf skin has 100% cutting value.
5. The hair follicles are much smaller than cow.
6. Collagen bundles have fine structure as compared to cow hides and useful for the finest of leather.

DEFINITION OF LEATHER

Leather is non-putrecible stabilized material obtained from putrecible raw hides / skins by virtue of tanning. It dries out to a soft and flexible material and dose not swell when wetted back.

Owing to tanning process, a chemical combination takes place between the hide substance (collagen) and the tanning agents & auxiliaries, which determines the quality and characteristics of the finished leather. Leather can be produced as soft as cloth or as hard as harness by controlling parameters, sequencing & methodology of manufacturing process as well as selection of raw materials.

The material that is responsible to produce leather from hides & skins is known as tanning agents. For example:

- Mineral tanning agents like salts of chromium, aluminum, zirconium & iron.
- Vegetable tanning agents like mimosa, quebracho, chestnut etc.
- Oil tanning agents.
- Aldehyde tanning agents
- Synthetic tanning agents.

The ultimate physical and chemical properties of leather chiefly depend on the nature of these tanning materials.

CROSS SECTIONAL BRIEF OF A LEATHER

Leather is nothing but a natural fibrous protein sheet made from raw hide and skin through tanning and finishing in a tannery. Raw hide or skin has the following sections or layers:

	Epidermis	**→ Approximately 1% of the raw hide thickness.**
Derma layer which is 85% of the total raw hide thickness	**Corium minor**	**→ 20% to 50% of the derma thickness.**
	Corium major	**→ 80% to 50% of the derma thickness.**
	Hypodermis	**→ Approximately 15% of the raw hide thickness.**

To convert the raw hides and skins to leather, the epidermis layer is first removed and the remaining section, called derma is tanned. Before tanning, appreciable amount of hypodermic layer also removed during fleshing of pre-tanning operation.

Leather is therefore made from derma only which has mainly two layers:

- Corium minor,
- Corium major.

THE HISTORY OF LEATHER

Leather tanning is one of the oldest human activities. The first rudimental tanning process is mentioned in Assyrian texts and in Homer's Iliad. In the beginnings, skins obtained from hunting and livestock breeding could be used for clothing or tents, but they became stiff at low temperatures and rotted with heat. It was probably then that attempts were made to render them more flexible and stronger by rubbing in animal fats. Another process was smoking, which almost started by accident, and which latter became formaldehyde tanning, as this substance is found in the vapors produced by burning green leaves and branches. It was soon discovered that drying carried out by exposure to sun, or could also stop the rotting process by the dehydrating action of salt. Vegetable tanning was also known in very ancient times, although it is not clear how the tanning action of the tannin contained in the bark of some plants (especially oak) was discovered. Another method known since the earliest time is tanning, based on the use of alum, a mineral that is fairly widespread in nature, particularly in volcanic areas. These methods, which gradually became more refined and efficient, allowed skins to be used in the ancient s world and continued to do so for century after century up to the present day. The fact mat the use of these techniques was widespread in witnessed by numerous written documents and paintings as well as archaeological finds. In Mesopotamia between the fifth and the third millennium B.C., for example, the Sumerians used skins for long dresses and diadems for ladies. The Assyrians used leather for footwear but also for liquid containers and as inflated floats for rafts. The ancient Indian civilization first processed the type of leather known as the "Morocco" today.

The Egyptians also achieved considerable skill in processing leather, which they used for clothing (even for gloves), tools, arms, or simply for ornament. The historian Strobe tells of an interesting use developed by Phoenicians who made water pipes from it. During Roman times, leather was widely used in all the provinces of the empire, and more efficient tanning techniques were introduced where they had not been developed locally.

The Romans used leather for both footwear and clothing and for making shields and harnesses. A tannery was uncovered amid the ruins of Pompeii and the same equipment of the kind (still in use for centuries thereafter) was found in it.

Skipping forward to the 8th century of Spain, then under the dominion of the Moors, we have the development of the production of" Cordovan", a type of leather famous throughout Europe for centuries, thanks to important progress in tanning. That skill in leather tanning was not a prerogative of the western world as recounted by Marco Polo. In this "Travels" he tells us that the Mongols used leather flasks, covers, masks, and caps decorated artistically, and it was him who coined the expression "Russia Leather" to indicate a type with a characteristic fragrance.

In the fourteenth century, leather was being used in combination with wood in chairs, armchairs, and settees with craftsmanship that reached the levels of an art form. This was also the case later on with tapestries, (especially in Venice in the fifteenth and sixteenth centuries), with chests and cases, and of course, with books binding, perhaps the most lasting and refined use of the material. Going back to tanning techniques, it is more of less in the middle Ages that the depilating action of quick lime was discovered, a technique that is still valid and normally used today.

A radical shake- up was provided in the middle of the last century with the discovery of the tanning power of chrome salts which led to a drastic improvement in production and was applied in practice in the industrial production towards the end of the century. Another revolutionary element was the substitution of the tanning pit with the rotating drum, along with the discovery of new types of tannins.

As a result of all theses innovations, the time required for the tanning was shortened incredible from eight month to a year, to a period of a few days today. But let us take a step back again to have a look at the system and tools that were ones used to work leather. We immediately discover that from Paleolithic times, almost to the present day, the processes and tools remained almost unchanged, gaining only in efficiency and comfort. Similar tools for fleshing, scraping, shaving, perching and trimming are found in practically every epoch known to us. This is a further demonstration of the fact leather tanning has gone hand in hand with the history of man kind, maintaining those features of " Craftsmanship" which even today, with increasing automation, are an essential part of the personal sensibility and solid experience of those carry it on.

OPERATIONS INVOLVED IN LEATHER PRODUCTION

In the tanneries raw hides and skins go through different chemicals and mechanical operations and finally come out as finished leathers. The tannery operations can be broadly divided into three sections:

(a) Pre-tanning / Beam House operations
(b) Tanning operations and
(c) Post-tanning or finishing operations.

BEAM HOUSE OPERATIONS:

Before tanning the main important operations for leather manufacturing are done in beam house. Beam house operations consist of Soaking, Liming, Deliming, Bating, Pickling, Depickling and Degreasing (if necessary) etc. The operations and their objects are given bellow:

Trimming and weighing:

First of all the selected tannable hides and skins are trimmed to remove the tail, shoulder, flanks, neck and trimmable portions correctly. Then these are weighted carefully. All the chemicals % based on these weights.

Soaking:

Soaking is the first tannery operation. During curing, hides and skins lost large amount of its physiological content of water and unless the former regains this water during soaking operations, good quality leather cannot be produced.

Objects of Soaking:

1. To remove the dirt, blood and dung from the hides and skins.
2. To remove the curing salts in case of salted hides and skins.
3. To dehydrate the skins proteins.
4. To open up the contracted fibrous structure of the skins.
5. To clean off surface filth.
6. Softening the hides and skins.

Liming:

Liming is a very important operation for leather manufacture. The qualities of the finished leather are largely controlled in liming process. Liming is the operation in which the soaked hides and skins are treated with milk of lime with or without the addition of sharpening agents like sulphides, cyanides, amines, markeptan etc.

Objects of Liming:

1. To remove the hairs, hooves, nails and other keratinous materials.
2. To remove some of the interfibrillary soluble proteins like mucins etc.
3. To swell up and to split up the fibres to the desired extent.
4. To remove the natural grease and fats.
5. To bring the collagen to a proper condition for satisfactory tannages.

Fleshing:

Fleshing is dome on the flesh side of the pelts. It is done by hand fleshing or by fleshing machine.

Objects of fleshing:

1. To remove fats and surplus flesh from lime pelts.
2. To give a cleaner surface.
3. For good penetrations of chemicals.

Deliming:

After liming the unhaired and fleshed hides and skins known as pelt are taken for the next operations called deliming. The alkali present in the pelt is of two types-

(a) Free alkali &
(b) Combined alkali.

The free alkalis can easily be removed by repeated washing with water or by pressing the pelt under the high pressure, but for removal of combined alkali chemical treatment is always necessary.

Objects of Deliming:

1. To remove most of the lime and alkaline materials from the pelts.
2. To reduced the swelling of the pelts.
3. Solubilization of Ca-soap.
4. To remove flesh, scud etc.
5. To adjust the P^H suitable for different tannage.

Bating:

Limed and partially delimed pelts sometimes require additional treatment known as bating, Bating is done to remove rest lime and swelling and plumping.

Objects of Bating:

1. To produce smooth, fine and clean grain by enzyme action.
2. To remove some of the non-structured collagen and other proteins like albumins, globulins etc.
3. The scud or dirt, short hairs, greases and lime soap, dark coloured pigments and traces of epidermis are all loosened and are easily removable by scudding.
4. To allow the splitting up of collagen fibres.
5. To make the final leather soft, pliable and stretchy.

Pickling:

In leather processing pickling is very important and essential operations prior to mineral tannage. The treatment of delimed or bated pelts with a solution of acid and salts is known as pickling which takes the pelts acidic condition to absorb chrome and being down the P^H for chrome fixation.

Objects of Pickling:

1. To bring the delimed and bated pelts to a required degree of acidity before chrome tannage, even vegetable tannage.
2. To reduced the P^H.
3. To modify the fibre structure.
4. To reduce the astringency of chrome tanning agents.
5. To preserve the leathers and to achieve the special effect.

Control of Pickling:

1. Temperature, critical at low P^H 28°C.
2. Salt concentration to be 6°Be after 20’ run.
3. End P^H about 2.8-3.0 for chrome, 4.0-4.5 for vegetable tannage.

TANNING OPERATIONS:

In leather manufacture the most outstanding process is tanning. The process of converting the putrescible hides and skins into non-putrescible leather is called Tanning. The materials which are used for tanning are called Tannins. There is various process of tanning such as-Chrome tanning, Semi-chrome tanning, Vegetable tanning, oil tanning, Zr tanning, alum tanning, White tanning etc.

Objects of Tanning:

1. To convert the putrescible hides and skins into non-putrescible leather.
2. To raise the shrinkage temperature and to increase the resistance to hot water of the leather.
3. To reduce the ability to swell when wet back.
4. To increase the strength properties of leather.
5. To stabilize the leather against enzymatic degrading.

POST TANNING OPERATIONS:

Samming:

To remove the unbound water so that the leather (wet-blue or wet-white) can be split or shaved with even and consistent moisture content.

Splitting:

To split the thick leather through its thickness. It is done by splitting machine.

Shaving:

The final adjustment for thickness (related to orders). An even cutting through a leather with consistent moisture. It is done by shaving machine.

Neutralization:

The process of deacidification or the excess of free or easily liberated strong acid in leather, prior to, retanning, dyeing and fat liquoring, is popularly called neutralization.

Objects of neutralization:

1. To remove the neutral salts and uncombined chromium salts from the leather.
2. Neutralization of free acid in the leather formed by the hydrolysis of the chrome complex.
3. To control the affinity of the leather for anionic materials, particularly dyestuff and anionic oil emulsions by regulating its electrostatic charge.

Reference : Rai B.M Das Bahadur- Hand Book of Tanning, Bulletin No. 63,.

Common Neutralizing agent:

(1) Borax
(2) Sodium bi carbonate
(3) Ammonium bi carbonate
(4) Sodium acetate
(5) Precipitated chalk (calcium carbonate)
(6) Sodium or ammonium thio sulphate
(7) Sodium sulphite

(8) Sodium or calcium formate
(9) Neutral naphthalene syntan
(10) Sodium tetra phosphate
(11) Sodium silicate
(12) Tetra sodium pyrophosphate
(13) Magnesium oxide, magnesium carbonate
(14) Sodium hexametaphosphate.

Re-Tanning:

Mineral tanned leathers-particularly chrome or aluminum tanned leathers-are always retanned with retanning chemicals with a view to modifying the properties of the finished leather to suit modern demand.

Objects of Re-Tanning:

1. To fill the loose and softer parts of the leathers to produce leathers of more uniform physical properties.
2. To allow for the production of unlined footwear.
3. The retanning may improve the chemical stability of the leather, particularly its resistance of alkalis and perspiration.

Dyeing:

To colour the leather as required by the customer. This should be an even colour and should cover any grain defects. The colour should be light fast and wash fast if the finish is not covering.

Fat liquoring:

It is very important operation for leather manufacturing and it depends on the type of leather to be manufactured. The process of fat liquoring entails the treatment of leather with a warm dilute emulsion of oil in water. The function of fat liquoring are; lubrication, adjust of physical properties.

Objects of Fat liquoring:

1. To improve the softness of the leather.
2. To improve the sliding properties of the leather.
3. To improve the toughness, water-repellent properties of the leather.

Samming and Setting out:

Remove as much as possible of the mechanically held water before drying.

Drying:

Remove the water without damaging the leather value.

Staking:

Soften by separating the fibres which have become attached to each other during drying.

Toggling:

Complete the drying to 14 % and obtain the optimum area by stretching the skin with toggles (clips).

Roto press:

For ironing or embossing the surface of leather with pressure and heat producing thermoplastic flow.

CHAPTER 2

SPLIT LEATHER:

A term used to describe the portion of hide or skins, split into two or more thickness, other then the grain or hair side, splits are usually named according to their sequence of production such as

1. Grain split (outer split)
2. Flesh split (inner split)
3. In heavy hides there can also be a middle split.

WHY SPLITING HAS DONE?

1) The outer (hair or grain) layer of a hide from which the under or flesh side has been split to give it a reasonably uniform thickness.

2) Leather made from originally or combination tanned now also chrome tanned.

The leather is dressed according to the purpose required. In France and Germany mainly from cow or bull hides the leather may also be reduced to an even thickness by means other that splitting and pressure applied. Under vacuum conditions, pressure and a very high temperature the finish forms.

As the patterned metal plate has been coated with a non stick silicon rubber, the finished leather can be readily peeled away fro m the mould.

Using this technique develops two other important film properties

1) Adhesion to the split with a bond that reaches into the top fibers of the leather structure.
2) The finish develops a micro porous structure.

This means that finish allows good water vapour permeability, while re-tanning high water repellency.

DIFFERINT TYPES OF SPLIT FINISHING:

Foam finishing systems:

Another move into a more grain leather type finishing method was the application of foam system. Here, three systems exist

i) Chemically induced foams (by the addition of blowing agents)
ii) Foams generated by evaporation of low boiling liquids.
iii) Mechanically produced foams.

The first two methods are not widely accepted in the leather industry due to special requirements and properties of the foam inducing agents. Blowing agents rely on temperature to decompose them, splitting off nitrogen and inducing foam formation. The temperatures required are normally too high for use in leather production.

Initially fluoro-chloro carbons were used as low boiling liquids; now days the use of these chemicals should be avoided, as they are believed to damage the ozone layer in the atmosphere. Further, the storage time of a finished foam mixture is limited due to a steady evaporation of the liquid.

The best system today seems to be mechanically produced foam with several advantages for the resultant finishes:

1. The finish increases the thickness of the split
2. The grain pattern is well foamed
3. The finish has fullness
4. The artificial grain looks like genuine leather

The level of physical properties depends on the polymers applied. Mixtures of acrylates with butadiene copolymers and polyurethane results in a sufficient high level of properties. These splits can be aged in the manufacture of shoes, upholstery etc.

Foil applications:

There been many trials using foils to cover the surface of splits, and both foamed PVC or polyurethane foils have been used for lamination. Foils application consists of first covering the split with an adhesive, normally by roller coating. The split is then transferred to the foil and pressed. Thermoplastic polyurethane foils and PVC foils result in thick-coated split although the properties are comparable with grain leathers. The softness and handle, however, often limits the use of these articles.

During the 1970s two processes were introduced in the leather industry.

1. The coating of splits with a micro porous polyurethane foil
2. The coating of splits by the lever cast process by Bayer.

Both processes are still used today. The marrying of foils to splits results in excel emit physical properties a high water vapour permeability and good softness. The foils are applied in a similar manner to thermoplastic polyurethane of the adhesive coat. Pressing, etc can be done with normal leather finishing equipment.

The levercast process:

The levercast process needs a special machine for its application production requires a spray application of two precursors of polyurethane, mixed directly prior spraying and application. The process is carried out in a transfer process; which means that the products are not sprayed directly on to the split. By the indirect process the products are sprayed on a release paper or a silicon rubber mould. Both the transfer paper (or the silicon rubber mould) carries a grain pattern in a negative from this enables a grain structure to be transferred on to the split. This negative form means that a volley in the negative creates a raised peak in the finish and vice-versa.
After the transfer of the fins to the split, the release paper or silicon mould can be reused. As the film transfer comprises viscous polyurethane in reaction, thee uneven surface of the split is equalized, is water vapour.

Permeable, but less than is found with micro porous foils, Rub fastness and abrasion resistance of this finish is, however, the highest of all leather finishes.

The great advantage of all foil and spray finish laminations is that the split increases in thickness.

POPERTIES OF THE SPLIT FINISHED FILM:

This process creates a different production from other methods used with splits as:

- Thickness of the finished is maintained at less than 0.15mm, there fore meeting the definition required by leather
- Softness and handle are maintained as neither cements nor solvents are used.
- There are no problems created elimination or orange Pell effects.
- There is a full and reproducible colour range to individual customer specification.
- Al most any surface pattern is created.
- New surface textures can he created and replicated.
- Specific handle and fell characteristics can be developed in the finish.

In addition to traditional modifiers and waxes, this can in clued the use of key ingredients as carbon micro-spheres and ceramic particles for enhancing the mechanical strength band to control touch, grip and slip.

USE OF SPLIT FINISHED LEATHER:

In order to remain comparative market leather industry must pay greater attention to the utilization of splits. Normally the splits produced are sued for show upper; clothing sued or resin finished upper leathers to stimulated side uppers with hair cell prints or any tannery prints.

But now a day, it can be seen that these leathers suited for areas that require strong, durable and materials. These include drag areas on tennis shoes, foxing on the Trekking walking boots, and application in the stress area on in line skates. Ice hokey hoots and work boots, soccer and baseball shoes are manufactured with this leather and have proved to work perfectly.

CHAPTER 3

FINISHING OF LEATHER:

The surface of leather or the grain was treated in ancient times with a protective season. The modern finishing however has been developed in the last thirty years to a high performance technology with respect to the chemical composition and to the methods of application.

Generally 'Finishing' is defined as the up-gradation or treatment of the leather surface with finishes and season to impart the special properties desired of leather as commercial product.

FINISHING MAY IMPROVE THE QUALITIES OF LEATHER IN SO FAR AS:

a)Levelness of color on the skin.
b)Uniformity of shade from skin to skin and pack to pack.
c)Changing the color to that, which is required.
d)Imparting color or pattern to un-dyed leather.
e)Adding a transparent film through which the natural appearance of the leather may be viewed.
f)Adding a transparent color film to the leather.
g)Covering the leather with an opaque film in order to obliterate all defects.
h)Alter the surface of the material splits.
i)Improve the scuff resistance of the leather.
j)Improve the water resistance of the leather, i.e. the finish should not discolor or swell and hence protect the leather and retain its good appearance.
k)Give a leather of optimum cutting value.
l)Seal the leather surface so that it remains clean.
m)Render the leather light fast.
n)Render the leather head fast.
o)Render the leather fast to alkalis.

p)Render the leather fast to acids.
q)Render the leather resistant to a light pull up on lasting.

FINISHING WHICH BEST OF THESE QUALITIES TO LEATHERS MUST THEMSELVES HAVE THE QUALITIES OF:

1) Remaining in its original condition of gloss or matt for long perfects.
2) Not make a film on the leather, which is too plastic like in appearance.
3) Not spoil the feel or handle of the leather.
4) The finish should not craze or be easily removed.
5) It should be resistant to the adhesives used in the manufacture of leather goods i.e. solvents adhesives.
6) It must adhere to the leather in damp or wet conditions e.g. moulded leather skin boots and gloves etc.
7) It should resist dry cleaning fluids.
8) Resist heat and not tack.
9) Have resistance to cold crack.
10) Allow the leather to be washed.
11) The finish should not take up color from nearby articles or impart color to it.

It will be concluded that all leathers do not require all the above properties and it must be stressed that all the above properties cannot be achieved the use of one finish only.

The number of coats of finish applied to a leather and the way in which they are applied is very important sometimes more important than the actual constituents of the finish. Most leather should be dyed a slightly darken shade then that they are intended to be finished.

PROPERTIES OF THE FINISH FILM:

An ideal finish film of the leather must deserve the following properties:

1Excellent flexibility and stretchiness.
2Good adhesion.
3Good holding power.
4Fine glossing property.
5Abrasive resistance and fastness.
6Waterproof ness and water vapour permeability

CHARCTERISTICS OF AN IDEAL FINISH FILM:

FLEXIBILITY AND STRETCHINESS:

Leather is a flexible material with certain degree of stretchiness. If the film to the leather surface does not possess these properties to the same extent as leather, it will make the leather hard and the film will crack in course of time.

ADHESION:

The film should be firmly fixed to the leather surface so that the formal does not come out during use. The film should also adhere to the pigment particles and others very firmly.

HOLDING POWER:

The film should have sufficient capacity to hold in it other substances like pigment, plasticizer etc. During drying or film formation no ingredient of the finish should precipitate out. The ideal film will never allow the plasticizer to migrate into the leather.

GLOSS:

The film should glaze by itself or should acquire this quality after glazing under glazing machine or hot plating or brushing.

ABRASIVE RESISTANCE AND FASTNESS:

The film should have sufficient resistance to abrasion for longer life and at the same time, it should hold the coloring materials so tightly that it does not come out when rubbed will a dry or wet cloth.

WATER PROOFNESS AND WATER VAPOUR PERMEABILITY:

The film should repeal water so that it does not spoil the leathery appearance of the finished leather at all but at the same time, the film should hide all the defects in the leather.

THICKNESS:

The film should be as thin as possible so that it does not spoil the leathery appearance of the finished leather at all but at the same time, the film should hide all the defects in the leather.

RESISTANCE TO ACID, ALKALI AND CHEMICALS:

During use the leather comes on contact with dirt,mud, acid and alkaline fumes, sweat etc. this is specially true for leathers used by army in the field. The film on the leather should have therefore,
suffiecient capacity to protect the leather from these.

THEORY OF FINISH FILM FORMATION:

Season, containing film forming materials with other ingredients is applied on the leather surface in the liquid state and its dilution is so adjusted that sufficient time is available of uniform spreading of the season on the leather surface by hand or machine and setting of pigment particles before solvent goes out by evaporation. As evaporation of volatile matters (solvent) continues, the solid content of the season increases with gradual decrease in film thickness till a constant thickness, which again depends on the concentration of non-volatile matters in the season is reached and after which no decrease in thickness is noticed event though evaporation conditions. The molecules of the film forming materials present thus approach each other and since the inter molecular forces, called vender walls is forces are inversely proportional to the sixty powder of the distances between molecules, the force of attraction increases very rapidly with the decrease of molecular distance.

Many practical tanners have the wrong impression that as these molecules comes close to the nearest approach they chemically react (polymerize) and from the film. But this is true when polyurethane linseed mucilage etc. are used for parent leather finishing but which other materials like casein, shellac, acrylic or met acrylic resin, synthetic rubbers based on butadiene, vinyl resins, nitrocellulose lacquers etc. no such chemical reactions take place during film formation. The molecules in such films remain together due to vender walls force of attraction, which is also called residual valence or secondary valence forces. In the liquid or solid state the term internal pressure is also applied. The tensile strength flexibility, water resistance and practically all other physical properties of film naturally depend to a large extent on the strength of this secondary valance force. What is secondary valance force then? This is the force, which keeps the molecules in matters together just like the atoms in molecules remain together by the influence of primary valance force. The forces due to ionic, covalent, co-ordinate, metallic bonds and resonance in the molecules are the primary valance forces or inter known as Vender Wals forces are the secondary valance force Hydrogen bonding is a so kind of secondary valance.

The secondary valance forces are actually due to residual fields left about the molecules as a how after two or more atoms have combined together to a form a molecule through primary valance force. When electrons are transferred from one atom to another, as is in round in ionic bonds to forma molecule, the latter becomes a dipole with permanent dipole moment. Similarly when a molecule with dissimilar atoms is formed through co- violent bonds the canters of actions negative charges. The whole system thus will show a dipole moment. The same rule can be attributed when molecules are formed from atomic stages through other types of bonds.

In a molecules there may be several diploes but the overall dipole moment of the molecules is the resultant of 11 the dipole moments is it. For simplicity let us consider two different arrangements of equal and opposite charges at the corners of a square as shown in figure (a) and (b)

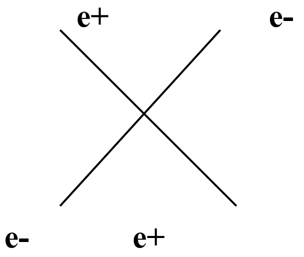


fig-a

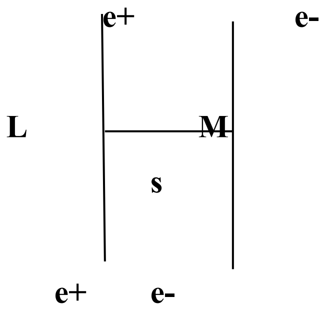


fig-b

In fig (a) the canters of action of both the positive and negative charges are at the point “O” and therefore the dipole moment in zero. But in fig (b) the centers of action of positive and negative charge are L and M respectively. The whole system electrically is thus a rod LM of length S. one end of which is negatively charge which an intensity 2e and the other end positively which the same intensity. The molecules with definite dipole moments are called polar molecules where as no polar molecules have no dipole moments.

Of course, dipole moments can be induced on many no polar molecules are separated from each other; the leathers become no polar again. This is called induction effect.

There is another effect called the dispersion effect by which no polar molecules may gain polarity. This type of secondary valence force Aries from the temporary relative displacements of the nuclei and electrons during the vibration of several parts of molecule with repeat to one another.

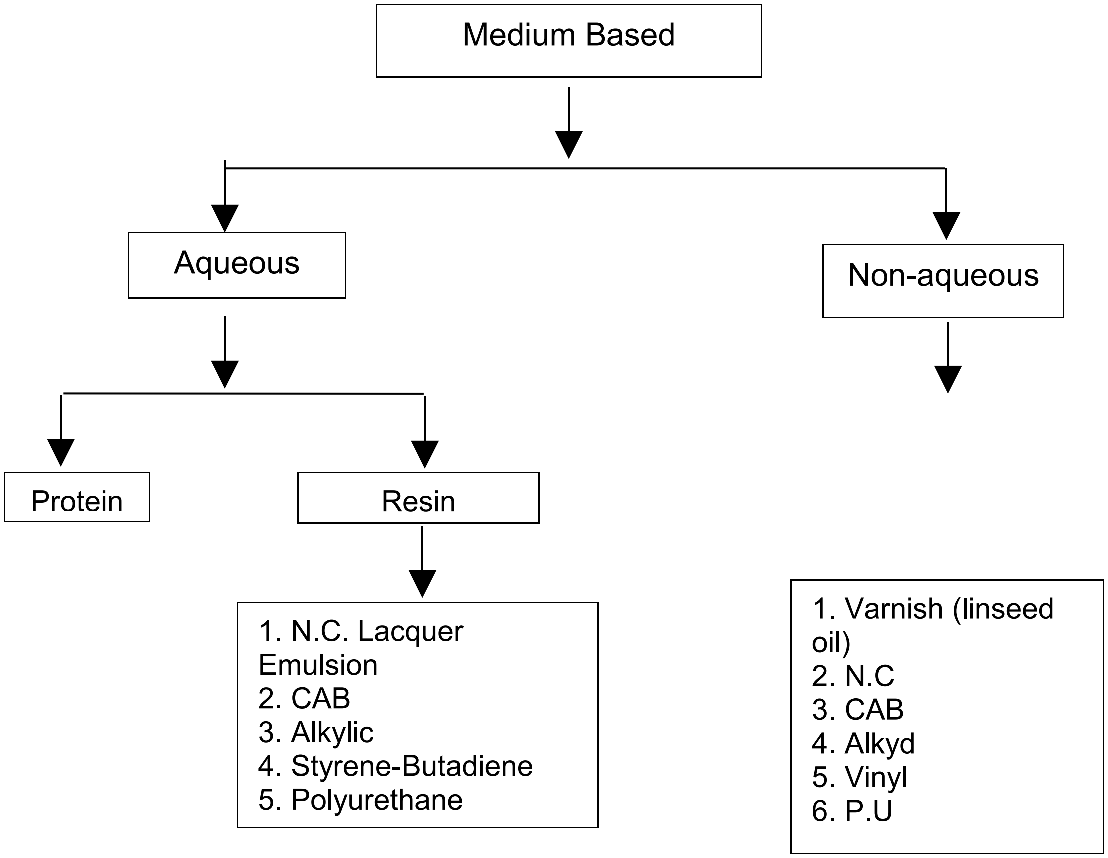
During film formation the dipoles rotate. If necessary and finally arrange themselves in ant parallel arrangements as shown below :

Polar molecule
Intermolecular space
This is called orientation effect.

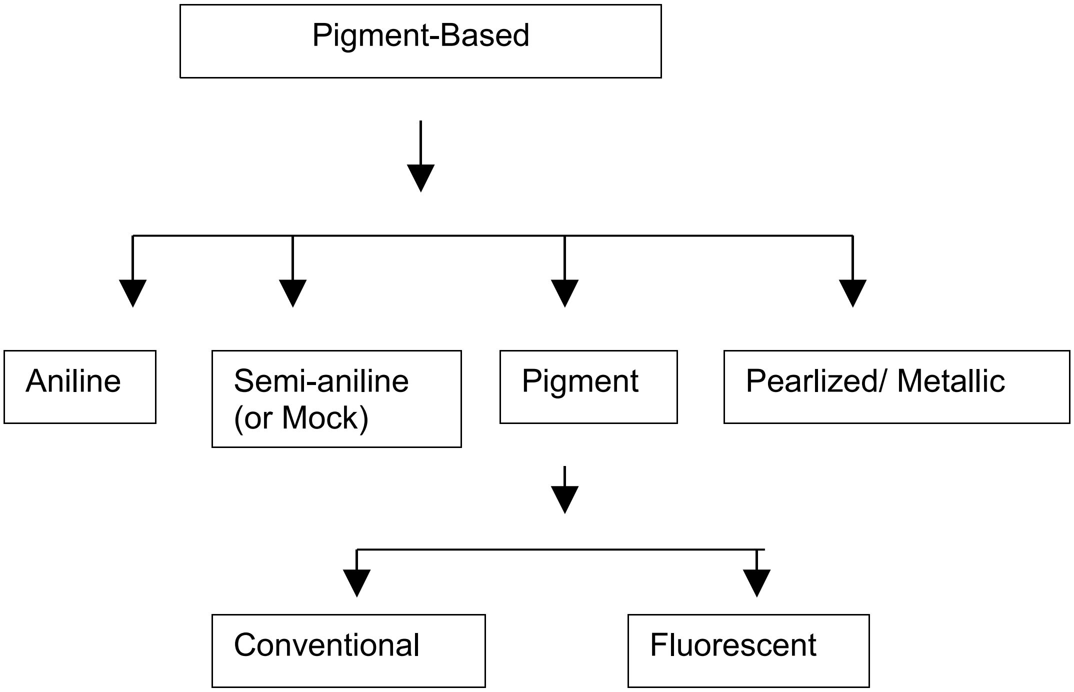
Thermal agitation always tends to upset these alignments, so that this type of secondary valance force is highly dependent upon temperature. In a film, both attractive forces between dissimilar poles and repulsive forces between similar poles play their roles side by side, no doubt but due to orientation effect the average distances between similar poles and therefore overall resultant force is the attractive force, if, on the other hand the resultant force was repulsive, the molecules would behave like a perfect of forming any film.

CLASSIFICATION OF LEATHER FINISHING

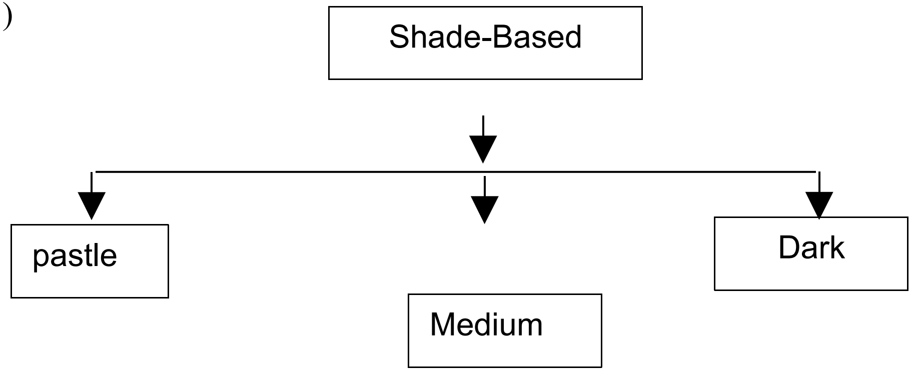
(1)



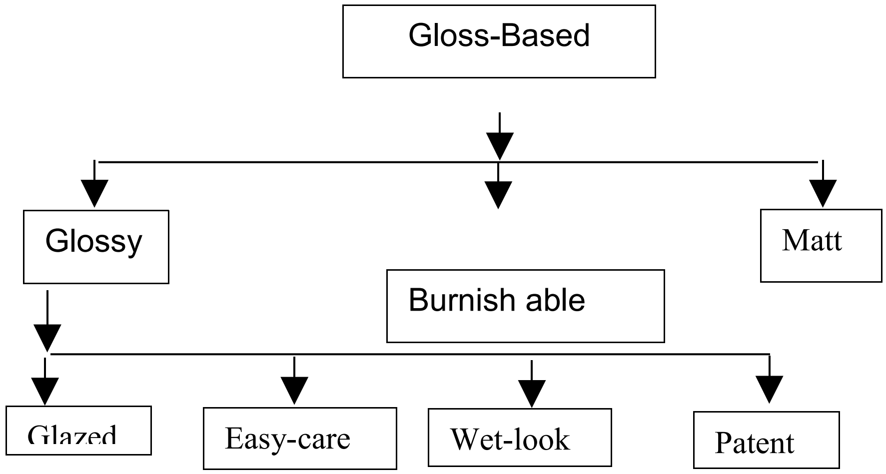
(2)


Pigment-Based
Aniline
Semi-aniline (or Mock)
Pigment
Pearlized/ Metallic
Conventional
Fluorescent

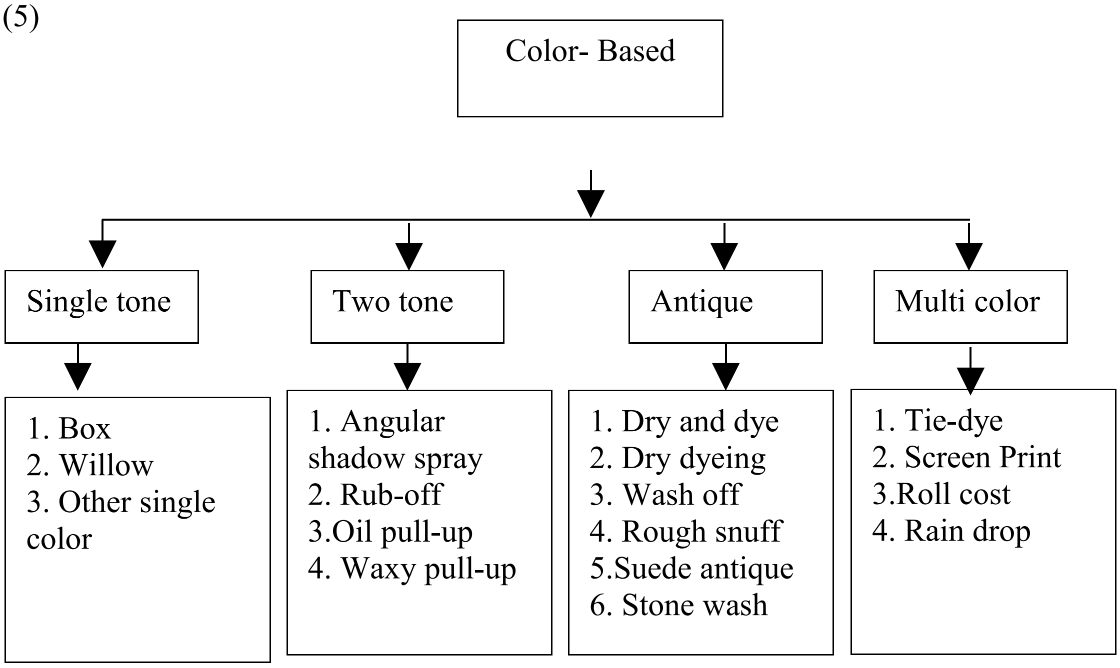
(3)


Shade-Based
pastle
Medium
Dark

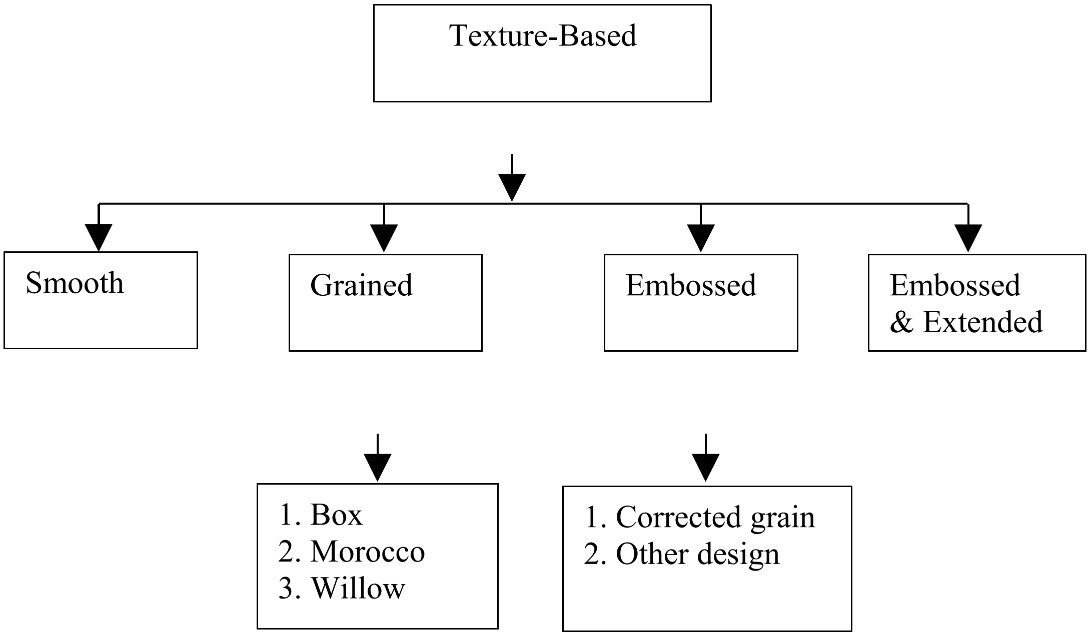
(4)


Gloss-Based
Glossy
Burnish able
Matt
Glazed
Easy-care
Wet-look
Patent

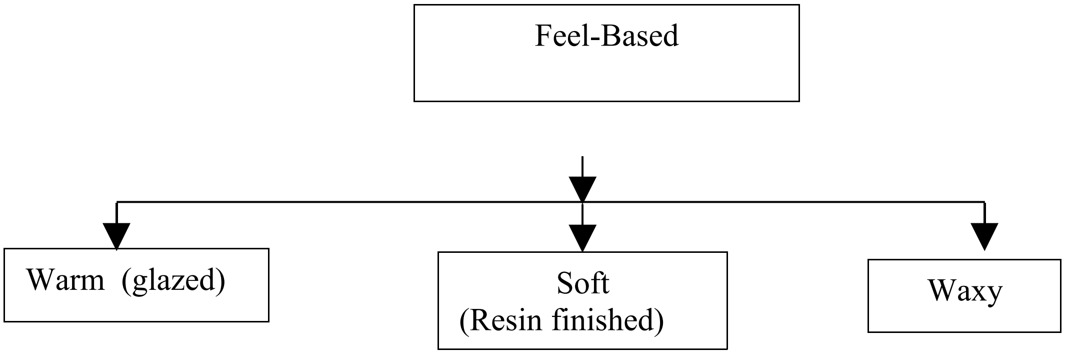
(5)


Color- Based
Single tone
Two tone
Antique
Multi color
1. Box
2. Willow
3. Other single color
1. Angular shadow spray
2. Rub-off
3.Oil pull-up
4. Waxy pull-up
1. Dry and dye
2. Dry dyeing
3. Wash off
4. Rough snuff
5.Suede antique
6. Stone wash
1. Tie-dye
2. Screen Print
3.Roll cost
4. Rain drop

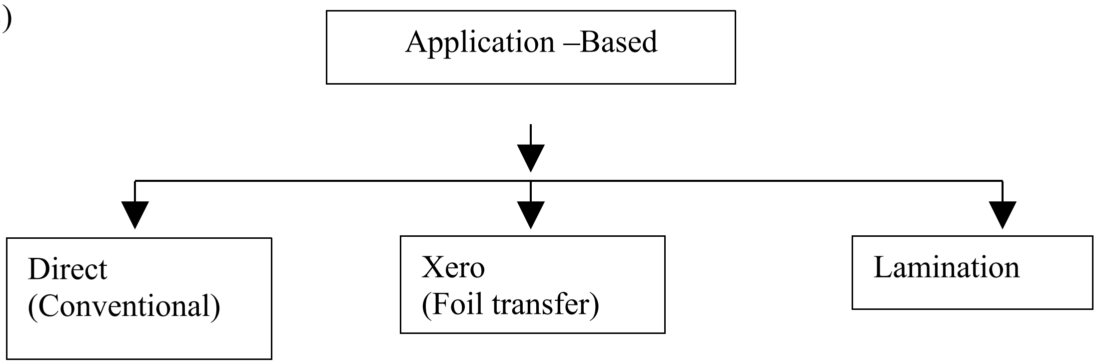
(6)


Texture-Based
Smooth
Grained
Embossed
Embossed & Extended
1. Box
2. Morocco
3. Willow
1. Corrected grain
2. Other design

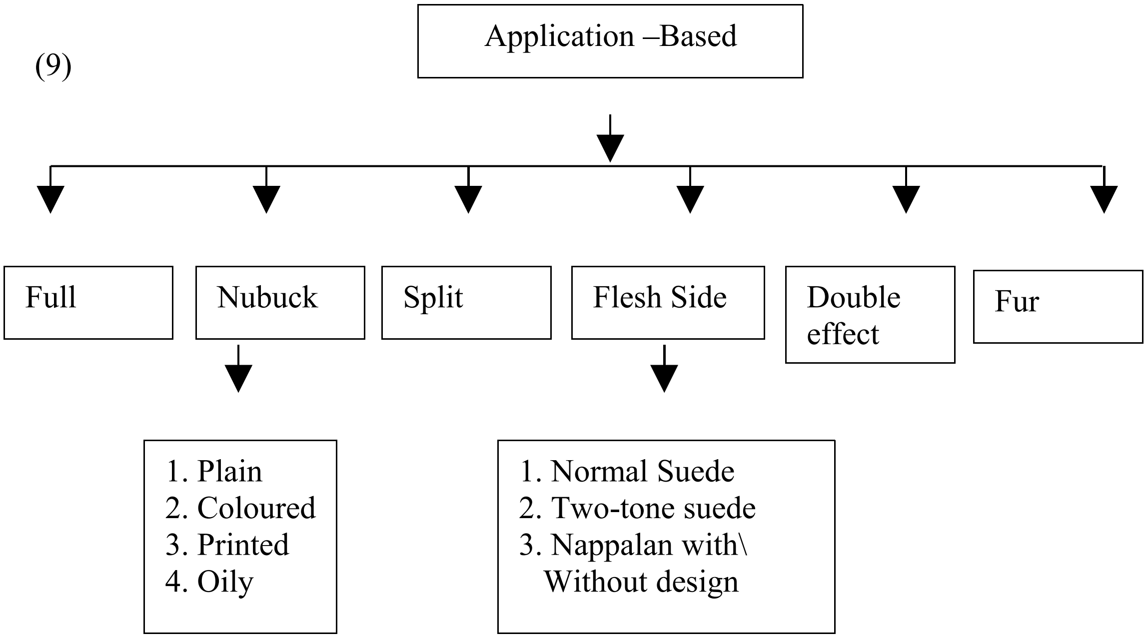
(7)


Feel-Based
Warm (glazed)
Soft (Resin finished)
Waxy

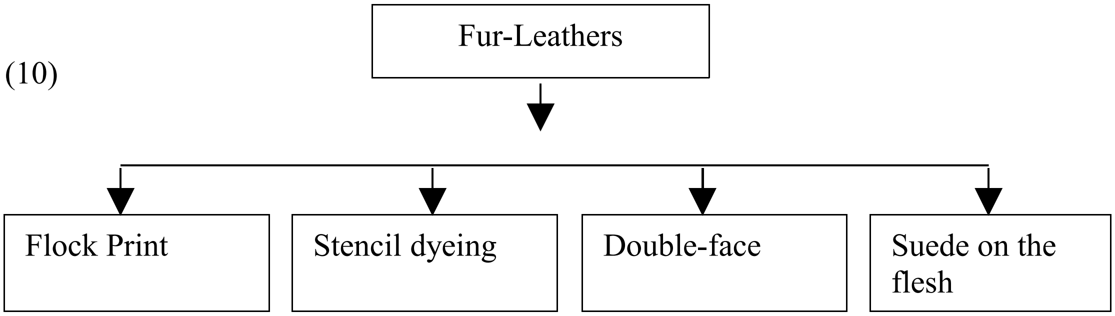
(8)


Application –Based
Direct
(Conventional)
Xero
(Foil transfer)
Lamination

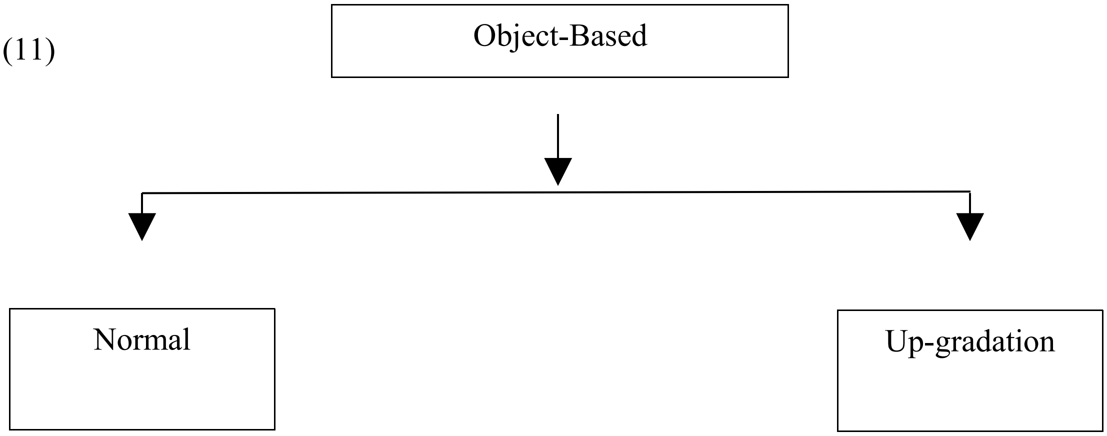
(9)


Application –Based
Full
Nubuck
Split
Flesh Side
Double
effect
Fur
1. Plain
2. Coloured
3. Printed
4. Oily
1. Normal Suede
2. Two-tone suede
3. Nappalan with\
Without design

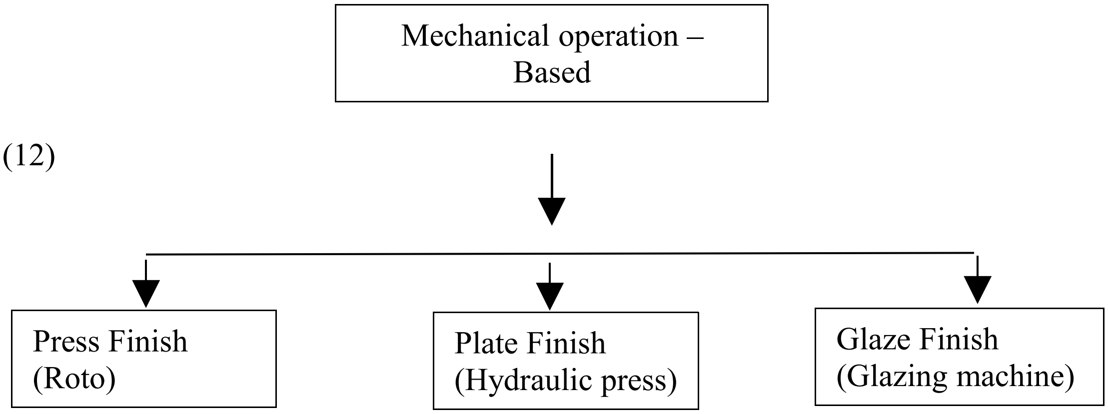
(10)


Fur-Leathers
Flock Print
Stencil dyeing
Double-face
Suede on the flesh

(11)


Object-Based
Normal
Up-gradation

(12)


Mechanical operation – Based
Press Finish (Roto)
Plate Finish (Hydraulic press)
Glaze Finish (Glazing machine)

LAETHER FINISHING SYSTEM:

In general, the finishing of leather is done by application of the finishing materials in three layers, which can be termed as (i) Ground of bottom layer, (ii) top or final layer. The functions of these three layers are quite different and as follows:

(i)Ground or bottom layer of Base Coat:

This layer would form the foundation of the finish and control many of the key properties including adhesion, flexibility, filling and tightness of the grain, concerning of the leather surface defects and general uniformity.

Generally, solution of a suitable film forming material, which mayor may not be colored with both dyestuffs and pigments, is used. The film forming binders must be soft and will plastic zed. The solution used for the bottom layer should have low acidity or alkalinity with pH values within 6 to 7. The main objects for the successive intermediate and top layers and to provide better adhesions between leather surface and the intermediate layer.

(ii)Intermediate or Middle Layer:

This is the layer just above the ground coat and it represents the major portion of the film thickness. The film forming materials used in the intermediate layer should have strong affinity for pigment particles, materials used in ground and top layers. The middle coats are generally a little harder then the ground cots. In protein-finished leather, the casein of the base cote is modified by the addition of albumins, which in resin finishing a harder resin or resin mixture is used.

(iii)Top layer:

The main object of this layer are :

(i)To give required degree of gloss.

(ii)To protect the middle layer from scratch, frictional damages and abrasion and also from other damages due to sweat, acids, alkalis and other injurious materials.

(iii)To make the finish film waterproof, and

(iv)To produce very good feel and attractive appearance. The material used for top must be very hard to make the leather smooth after planting, better resilient and round when bent with grain side out.

The technique of finishing leather differs from tannery to tannery, country to country. In many tanneries top coat is not applied separately and they use more binders in the season for the middle coat. The seasoning coat is generally applied by hand spray after the middle coat, but some times it is often on clear cut difference between the before mentioned various coats and amalgamation of various coats is being wide used now-a-days for ease of application and saving in time

TYPES OF LEATHER FINISHIES:

This are three different types of leather finishes which are commonly used by leather finishers. They are:

1) Water type finishes.
2) Solvent type finishes.
3) Emulsion type finishes.

1)Water type finishes:

This may be based on pigments, protein binders, such as casein, shellac, gelatin, egg, and blood albumin, waxes and mucilaginous substances like decoration of linseed. These finishes are mainly used for glazed finishers, which are required to be glazed by glazing machine.

The binders in the finish are intended to hold the pigments or dyes in suspension and bound firmly on the leather surface. Softness, glazing properties and ‘handle’ are contributed by water soluble plasticisers, waxes and mucilaginous matters.

Recently water type finishes based on pigments or dyes and resin dispersion are increasingly used to achieve especial effect on the finished leather. The use such finishes produced may improvement over the conventional protein based finishes such as better adhesion and flexibility of the finish, improved filling and sealing properties and greater uniformity of the flesh.

2)Solvent Type Finishes:

In contrast to eater type finishes solvent-based finishes contain as a binder polyurethane or collodion (Nitro-cellulose). This finishes are dissolved in organic solvents such as butyl acetate, cyclohexanone , etc. These finishes are widely used for finishing based on vinyl resin instate of nitro cellulose have shown improved resistance to flexing and better flexibility at low temperature . They have been successful used on upholstery leather, case leather, case leather and certain military where low temperature flexibility is necessary.

3)Emulsion Type Finishes:

Emulsion type finishes consist of nitrocellulose or resins. Such emulsions are being widely used to confer combining properties of water and lacquer finish. laquire emulsion top coats for upper, garment and glove leather are gaining wide acceptance .

FILM FORMING /COATING TECHNOLOGY:

The coating applied in leather technology may be divided into four broad classifications:

1. Lacquer systems
2. Drying oil systems
3. Condensation systems and
4. Latex systems

Leather finishing, as applied in practical methods, may be the result of several of theses coating systems. The systems differ from one another in their mechanism of film formation and in the chemical nature of materials involved.

(i)Lacquer Systems:

The formation of a film in a lacquer system is based on the evaporation of the solvent containing a film-forming material. A simple example of this is the dissolving of shellac in alcohol and applying this to a surface, nitro cellulose dissolved in an organic solvent is also an example of this type of coating. This type of high-gloss lacquer is commonly used in household decorative enamels.

(ii)Drying oil Systems:

The second basic group of film forming materials is the drying oils. Into this classification fall the nature drying oil, such as linseed and tung and also any material which will undergo polymerization, upon drying. This is different from a lacquer in that the setting up of the film is not simply a deposition of a high molecular weight material, rather it is chemical reaction –taking place between the dissolved film forming material and atmospheric oxygen. In the drying oils the film forming materials (a binder) is an organic chemical having a high degree of instauration. As the oil absorbs oxygen from the air, the unsaturated material is oxidized and reactive portions of the fatty acid molecule develop which can than polymerize with other fat molecules to form a continuous film on the surface.

(iii)Condensation Systems;

In condensation systems the formation of the film is due to a chemical reaction between the various components of the finish after application. The reaction may form a plastic or polymer in water between two molecules. Such systems are usually heat-activated and may be baked, glazed, or hot pressed. Condensation of polymerization is used in the leather industry though protein-aldehyde reactions and with other resin systems. In this kind of finish the reactive components are usually mixed shortly before application, due to the limited pot life of the components.

(iv)Latex System:

In a latex system the binder is emulsified in water, when the latex is applied, the water evaporates, or sinks into the leather, and eventually a phase inversion takes place. A continuous layer of the binder spreads, on the surface of the material being coated and becomes a continuous film. Latex systems have their advantage in ease of application. The flammability and toxicity of organic solvents are largely avoided; the film can be diluted with water, enabling thin films to be applied.

Through modern techniques for forming copolymers, a wide variety of different lattices can be made which have a broad spectrum of properties. The versatility, low cost and ease of application of such systems have led to their wide spread use in the leather industry .The latex system and dispersions of resins in an emulsion form are by far the largest and most widely used method of preparation in leather finishes today.

CLASSIFICATION OF FINISHES:

According to the finishing materials

1. Casein finish.
2. Resin binder or polymer finish.
3. Nitro-cellulose finish.
4. Polyurethane finish.

According to the finishing technique

1. Glaze finish
2. Glaze/plate finish
3. Plate finish
4. Embossed finish
5. Spray finish
6. Curtain coating finish

According to the finishing effect:

1. Aniline finish
2. Semi-aniline finish
3. Opaque finish
4. Easy care finish
5. Antique finish
6. Fancy finish
7. Two-tone finish

Finishing defects:

Finishing defects on leather:

1. **Marking off:**

   Cause:

   - Excessive quantities of brightening dyes or organic pigments.
   - Insufficient amounts of binder in the pigment finishes.

   Remedy:

   - Avoid the causes.

2. **Cracking off:**

   Cause:

   - Use of polymer binder which are not cold resistant.
   - Very hard pigment finishes or top coats.
   - Inadequate content of plasticizers.
   - Impaired adhesion of the finish coats.

   Remedy:

   - Avoid the causes.

3. **Powdering of surface layer:**

   Cause:

   - Due to hard casein finishes applied in a very thick coat.

   Remedy:

   - Reduce the thickness of the coat.

4. **Stripping of the finish:**

   Cause:

   - Inadequate reswelling of the preceding finish.

- Impaired adhesion of the finish layers when applying the base coat.

Remedy:

- Use a penetrative pretreatment primer to increase absorbing capacity.

5. **Migration of plasticizers:**

Cause:

- Excessive dyeing temperature.
- Direct application of nitro-cellulose floats to the leather without previous base coating.

Remedy:

- Control the dyeing temperature.
- If using nitro-cellulose finishes, apply a barrier layer on the basis of polymer binders.

6. **Chalking:**

Cause:

- Migration of white pigment on expose to light.
- Changes the shade of pastel colors.
- Contact with soft metals produce dark streaks.

Remedy:

- Replace the white pigment by pigments based on zinc white which have slightly reduced covering effect.

7. **Fissures in the finish coat:**

Cause:

- Insufficient drying of polymer binders.
- Inadequate elasticity of the finish coat.

Remedy:

- Use softer, more elastic finishing floats.
- Dry each finish coat thoroughly.

8. **Exudation of plasticizers:**

Cause:

- Use of excessive amounts of non-gelatinizing plasticizers such as castor oil, rape oil, etc.
- By ironing with excessive temperature.

Remedy:

- Reduce the amounts of non-gelatinizing plasticizers.

9. **Leaden appearance:**

Cause:

- Foggy film on the finish surface occurring especially on dark shades.
- Due to highly covering inorganic pigments are used.

Remedy:

- Use appropriate quantity of organic pigment color or brightening in the pigment or top coat.

10. **Bronzing:**

Cause:

- Migration of basic dyes from the pigment coat into the top coat.
- Ironing with excessive temperature.
- Migration of organic pigments by the presence of excessive amount of plasticizers.

Remedy:

- Reduce or change the application quantities.
- Apply polyamide lacquers as barrier layer.
- Do not use finishing float containing solvents.

11. **Fish eye:**

    Cause:

    - Caused by hardly wettable surfaces of the leathers, base and finish coats.
    - Also caused by oil droplets carried along by the compressor in aqueous finishes.

    Remedy:

    - Add penetrators or flow-control agents.
    - Check the air separator.

12. **Grayness:**

    Cause:

    - Caused by uneven refraction of light with coarse hair pores.
    - Very high content of matting agents or Cr salts in the fixation.

    Remedy:

    - Reduce the amount of matting agents.
    - Increase the filling effect of the finishing float.
    - Apply a polishing ground first.
    - Add brightening color to colorless top coat.

13. **Inadequate adhesion:**

    Cause:

- Reduced absorbing capacity of the entire leather surface.
- Incomplete wetting in some section.
- Excessive amount of highly coating polymer binders, very hard casein products.
- The addition of excessive amounts of waxes, plasticizers or fillers.
- Prolonged times of exposure before application.

Remedy:

- Applying finishing by padding or brushing.
- Addition of corresponding quantities of penetrator or flow control agents.
- Addition of adhesion promoters on the basis of polyurethane dispersion.
- Drying at excessive temperature should be avoided.

14. Loose grain:

Cause:

- If the base coat doesn't penetrate adequately into the upper zone.
- If binders have a very high coating effect.

Remedy:

- Use small particle binders for grain impregnation which contain penetrators to achieve maximum depth of penetration.
- With soft leathers grain impregnation by normal spraying is more favorable to avoid calluses of the grain.

15. Migration:

Cause:

- If simple brightening dyes or organic pigments are used in finishing and are in longer contact with PVC material containing plasticizers during storages staining.

Remedy:

- Use less amount of brightening dyes and pigments.

16. **Inadequate rub fastness:**

Cause:

- If top coats are too thin and therefore form no proper film.
- If binders have insufficient water resistance and are too soft.

Remedy:

- Avoid the causes.
- Last top coat shouldn't contain dye or pigments.

17. **Polishability:**

Cause:

- Wetness action on particular sections results in a swelling of the casein coat and leave matt, blind section after dyeing.

Remedy:

- Add saponifiable hard waxes or resins.
- Special matt lacquers on the basis of cellulose.

18. **Wrinkled grain:**

Cause:

- Slightest binding load.
- Finishing floats which are too hard.
- Highly swelled films which have not dried completely.

- Drying of the finished at excessive temperature.

Remedy:

- Avoid the causes.

19. **Creases:**

Cause:

- If leather are not smoothly fed into processing machine.
- By squeezing the leather during plating, graining, buffing, dry splitting, dry shaving, etc.

Remedy:

- Feed the leather smoothly into the machine.
- Improve the slip of finishing film by adding waxes.

Possible defects of application:

1. **Tearing of the finish curtain:**

Cause:

- Caused by insufficient or excessive viscosity of the finishing float.
- Use of polymer binders that are not resistant to electrolytes.
- By foaming and tapped air during recirculation.

Remedy:

- Adjust correct viscosity of stabilizing thickening agents.
- Use binders which are stable to electrolytes.
- Reduce the recirculation speed of the finishing float by diminishing the pump pressure.

2. **Curtain shadow:**

   Cause:

   - Caused by the tearing of the finish curtain.
   - By placing the leather unevenly on the conveyer belt.

   Remedy:

   - Stabilize the finish curtain.
   - Smooth the leather by preliminary ironing.

3. **Crumbling:**

   Cause:

   - Intensive rubbing or beating effect.
   - By the presence of unstable polymer dispersion.

   Remedy:

   - Use stable polymer dispersion to crumbling for the finishing float.

4. **Spray specks:**

   Cause:

   - If the spraying pressure is too high.
   - If the spraying distance is too great.

   Remedy:

   - Avoid the cause.

5. **Spray streaks:**

Cause:

- Caused by irregular overlapping of the webs following each other.

Remedy:

- Adjust each spray jet exactly to the following web.
- Adjust the through feed speed of the leather exactly to the movement of the spray guns and width of the spray jet.

6. **Deposition of dirt and dust:**

Cause:

- Buffing dust on the leather.
- Particles of dirt and dust in the room.
- Dried residues of finishing float in feed-in line.

Remedy:

- Dedust the leathers thoroughly.
- Keep the finishing room, drying devices and machine as clean as possible.

Defects of the finishing products:

1. **Sedimentation:**

Cause:

- During storage, pigment finishes, lacquer emulsion and mixed finishing products having a high specific weight sediment and stick together.

Remedy:

- The products should be thoroughly stirred in the containers before use.

2. **Separation of layers:**

   Cause:

   - Components with different charges and emulsified systems can break and result in phase separation into two or more layers.

   Remedy:

   - The product should be stirred well in the containers before use.
   -

3. **Coagulation:**

   Cause:

   - Finishing products and thermoplastic binders are susceptible to cold.
   - Irreversible coagulation is caused by Faust.

   Remedy:

   - It is necessary to protect the products against cold during transportation and storage.

4. **Foul smell:**

   Cause:

   - Bad odor develops when finishing products containing casein are affected by heat and bacterial attack and are subject to decomposition.

   Remedy:

   - The product should be stored in cool temperature.

5. **Change of pH value:**

   Cause:

   - Acids may be eliminated by saponification in the presence of ester based solvents and water. This reduces pH value, results in cracking or the formation of water insoluble lacquer droplets which produce glossy dots.

Remedy:

- The fineness of emulsion can be restored by adding some drops of ammonia and through mixing.

Defects of the finishing floats:

1. **Agglomeration:**

   Cause:

   - Inadequate ground pigment colors may agglomerate in the finishing float and thus reduce the intensity of color and result in dull shades.

   Remedy:

   - Use well dispersed well-ground pigments.

2. **Flocculation:**

   Cause:

   - If using brightening colors with a high content of extenders.
   - If using binder mixture which have little resistance to electrolytes.

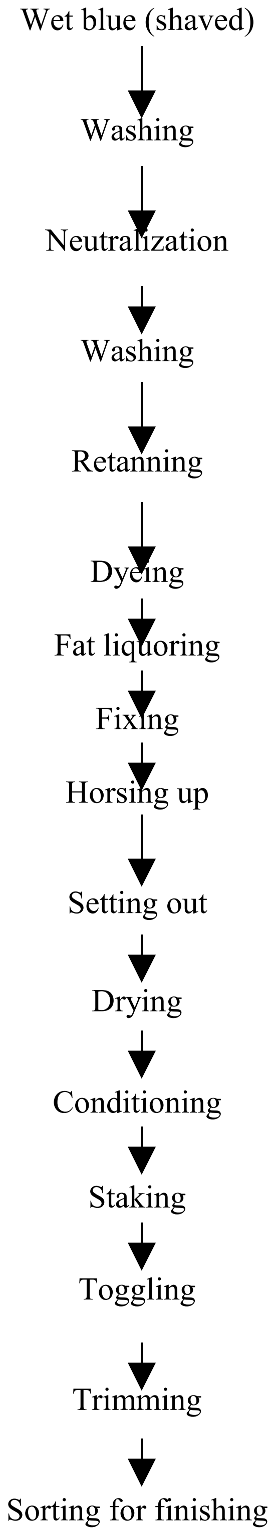
   Remedy:

   - Use liquid dyes which have a low content of neutral salts and binders which are stable to electrolytes.

Some useful information

Sequence of unit operations commonly adopted for processing up to retanning is given bellow:

<u>Wet blue to dry finishing</u>



CHAPTER 4

Crackle finish:

Crackle is an interesting finish that gives the appearance of age on the surface of painted pieces. This finish uses a commercial product and requires two colours of paint – one for the undertones and the other for the top.

A crackle finish, method of forming a crackle finish and a kit for forming a crackle finish. The crackle finish includes a base coat of latex paint or stain on a surface to be treated. A crackle coating is applied over the base coat and dried to tack dry or completely dried. A latex wood filler is applied over the crackle medium. As the latex wood filler dries, it forms islands or domains separated by cracks or valleys revealing glimpses of the underlaying base coat.

A crackle glaze or varnish is a finish which creates a crackled effect. Many people use crackle glazes for antiquing, because peeling, crackled paint has an old-fashioned look which goes especially well with restored furniture. Crackle glazes can be used on a wide range of things including pottery, furniture, picture frames, and even walls. A number of craft stores sell materials for crackle glazing, and you can also accomplish the effect with a few supplies you probably already have around the house.

When a crackle glaze is made, one color is laid down as a base coat and allowed to dry before a crackling medium is painted over it. Once this medium dries, another coat of color is applied, and cracks and peels start to appear almost immediately. To seal a crackle glaze, a clear varnish or polyurethane sealer can be used. This sealer also halts the crackling process so that the second layer of color doesn't flake off entirely.

Since the underlying color shows through, many people try to use coordinating colors when they apply a crackle glaze. Contrasting colors can also work quite nicely, like a dark under layer and a lighter over-layer. If you aren't sure about how two colors will look together, test them on a small area of the piece to make sure that they look good once they dry. You can also use a medium like gold, silver, or copper paint for one of the layers for a more rich look.

If you cannot track down a crackling medium, you can also use white glue. White glue acts as a layer of resist, preventing the second layer of paint from fully adhering. This will create a more mottled effect; you can also use wax as a resist for a crackle finish. If you are working with pottery, use a glaze which has been designed to crack, and follow the directions closely.

The crackle glaze effect is sometimes called craqueleure, and in fine art, it is sometimes used as a tool to date artworks and establish their provenance. Forgers spend lifetimes mastering the art of a properly crackled final layer of paint in the hopes that their works will pass muster by art inspectors; a dedicated forger may infuse a craqueleure with dust and particulates from an old piece of art from the right region in case an art inspector decides to chemically analyze the finish.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a crackle finish for making the surface of an object appear cracked.

2. Brief Description of the Prior Art

Crackle finishes for painted surfaces are created by applying a base coat of a latex paint to a prepared surface. The base coat is dried and a crackle medium applied and dried. A top coat of a different colored latex paint is then applied. As the top coat dries, the crackle medium causes the top coat to crack revealing glimpses of the base color through the cracks. It is an inherent property of a crackle medium to contract when a water-based stain or paint is applied to the dried crackle medium.

Ordinary crackle finishes make the paint look old. In some instances, however, it would be desirable to provide a crackle finish that makes the surface of the object, not just the paint, appear cracked. Such a finish can be used to provide a distressed, antique or aged look to furniture, woodwork or the like. Such finishes are sought to provide a casual country look or to simulate the refined elegance of old European furniture.

BRIEF SUMMARY OF THE INVENTION

In view of the above, it is an object of the present invention to provide a crackle finish for a surface such that the surface appears cracked. It is a further object to provide a method of applying a crackle finish to a surface such that it appears cracked. It is another object to provide such crackle finish as a kit. Other objects and features of the invention will be in part apparent and in part pointed out hereinafter.

In accordance with the invention, a crackle finish for making a surface of an object appear cracked includes a base coat of a latex paint or stain disposed on the surface, a crackle medium disposed on the base coat and a latex wood filler coat disposed on the crackle medium. A method for forming the crackle finish comprises applying the above mentioned layers in the order mentioned. A kit for forming the crackle finish comprises a base coat of a latex paint or stain, a crackle medium and a latex wood filler. The kit may also contain a top coat to be applied over the latex wood filler.

The invention summarized above comprises the constructions and methods hereinafter described, the scope of the invention being indicated by the subjoined claims.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

In the accompanying drawings, in which several of various possible embodiments of the invention are illustrated, corresponding reference characters refer to corresponding parts throughout the several views of the drawings in which:

FIG. 1 is a sectional view showing a crackle coat on a surface in accordance with the present invention;

FIG. 2 is a perspective view of a piece of furniture, partially broken away, showing a rose design embossed into a crackle coat in accordance with the present invention; and,

Objects of Crackle finish:

- To enrich physical outlook of low grade leather.
- To make fashionable article.
- To recover the faults on leather surface Crackle finish is useful and effective.
- To upgrade glossy property.
- The maximum utilization of leather by product(e.g. split) is ensured by crackle finish.
- Improve the scuff resistance of the leather.
- Improve the water resistance of the leather, i.e. the finish should not discolor or swell and hence protect the leather and retain its good appearance.
- Give a leather of optimum cutting value.
- Seal the leather surface so that it remains clean.

- Render the leather light fast.

- Render the leather head fast.
- Render the leather fast to alkalis.

- Render the leather fast to acids.

Procedure of Crackle Finish:

- Acrylic paint in two colours, one for the top colour and another for the base colour that will show through the cracks. This can be any combination, but a dark and light contrast works well.

- Commercial Crackle Glaze (at Michaels in the acrylic paint aisle)
  Apply the base coat of desired acrylic paint. Let dry.

- Brush one coat of crackle glaze over base coat. Let dry for 20 minutes to one hour.

- Brush on the top colour of acrylic. The moisture of the top coat of paint will instantly activate the glaze, and the top coat will crackle. The wetter the top coat, the more crackle. Let dry.

- Make a sample of different colour combinations for future reference. Try adding some water to the top coat of acrylic to see the difference in crackling.

CHAPTER 5

PRODUCTION PROCEDURE

Wet back

Water	200 %	
LD	0 .3%	
Oxalic acid	0.5%	run 30 min

Then drain and wash well

Rechroming

Water	200%	
Formic acid	0.3%	runs 15 min
+Chrom powder	6.0%	
sodium formate	0.5%	
Remsol OCS	1.0%	run 45 min
+Relugan RF	2.0%	run 30min
+Neosoyn RWP	2.0%	run 30min
+Sodium bicarbonate	0.75%	run 60min

P^{H}-3.8

Neutralization:

Water at 45’c	150%	
Neutral syntan(BS3)	2%	
Sodium formate	1%	run 30min
+Sodim bicarbonate	0.5%	run 30min

Check with B.C.G. P^H-4.5

Then drain and wash well

Retanning and dyeing:

Water	200%	
Paramel PA	3.0%	
Remsol B-40	2.0%	run 30min
+Relugan D/P100	4.0%	run 20 min
+Mimosa	5.0%	
Quebracho	3.0%	

Tanigan OS	4.0%	run60min
+formic acid		run 30min

Drain and rinse

Fat liquoring:

Water	200%	
Fillers syntan	2.0%	run 20min
+Remsol B-40	3.0%	
Remsol C-2	2.0%	
Trisul ML	2.0%	run 45min
+Formic acid	1.0%	run30min

Drain, rinse, horse up O/N

Mechanical operation:

Setting

Vacuum

Hang dry

Staking

Toggling

Trimming

Buffing with 600 emery Paper

Then Dedusting

Fnishing:

Impregnation Coat:

Encryl I.M.P	300 parts

Penetrator	100 parts
Water	600 parts

Apply by padding , leave O/N, vacuum dry, re-buffing with 600 emery paper

Base coat:

Pigment mixture	200parts
Luster E	100parts
Filler K	75parts
Wax FF	40 parts
Water	125 parts
Corial binder K-50	150 parts
Corial binder OBN	150 parts
P.U binder	150 parts

Apply by paddig, dry well,

Plain plate at 75’c/100kg pressure, apply by brush padding, dry very well

Season Coat:

Pigment mixture	200parts
Luster E	100parts

Filler K	75parts
Wax FF	40 parts
Water	125 parts
Corial binder K-50	150 parts
Corial binder OBN	150 parts
P.U binder	150 parts

Spray 2-3X, Cover very well, Dry, Fine hair cell
Spray 2X, Dry very well.

Effective Coat:

Encryl Q	700 parts
Melio Top339	50 parts
Pigment	50 parts
Water	200 parts

Spray weighted, Then Dry very well

Top Coat:

NC lacquer	650 parts

Water	350 parts

Spray 2X, Dry well, then finally rotopress at 80’ C/ 70Kg pressure

TECHNICAL INFORMATION ABOUT CHEMICALS USED FOR THE COMPLETION OF THE PROJECT:

1. LD- 600 : Wetting agent, Charge: Non -ionic.
(BASF, Germany)

2. Chromitan B : 33% Basic chromium sulphate
BASF

3. Neosyn RW : Cresylic multipurpose replacement syntan,
Total solids: 92% , P^H (2% solution): 4.0-5.5
(Hodgson, England).

4. Neosyn BS3 : Naphthalene based neutralizing syntan
Total solids: 94% pH (2% solution):7.0- 8.0,
(Hodgson, England).

5. Relgan RE : Acrylic copolymer, Charge: anionic.
P^H: 6.5. Active substance: 40%
(BASF, Germany).

6. Paramel P-100 : Amino resin, Total solids: 94%
P^H (10% solution): 8.5-9.7.
(Hodgson, England).

7. Tanigan OS : Replacement tanning materials.
Concentration: 96-98%
P^H (10% solution):3.5
(Bayer, Germany).

8. Neosyn N : Naphthalene auxiliary dye leveling Syntan.
Total solids: 92% P^H (2% solution): 6.5-8.5
(Hodgson, England.)

9. Trisul ML : Sulphited stabilized fatliquor based on oxidizing
marine oil. Active content: 80 %,
P^H (2% solution): 5.0-6.0
(Hodgson, England.)

10. Lustral E : Transparent binder that enables very
light and very adherent films.
P^H: 7.5± 1. Charge: anionic (ALPA)

11. Paramal PA : Acrylic Resin Binder (Clariant)

12. Quebracho : Vegetable Extract . (ATO)

13. Mimosa : Vegetable Extract, P^H (10% solution):4.4-4.5

14. Synthol O : Synthetic oil, Active matter: 100%,
Clear yellow oil, (Smith & John).

15. Remsol B40 : Sulphited natural/synthetic oils. Anionic,
Active matter: 70 %, (Hodgson, England).

16. Remsol C2 : Stabilized synthetic fatliquor. Anionic,
Active matter: 50 %, P^H (2% solution):7.0-8.0
(Hodgson, England).

CHAPTER 6

PHYSICAL TESTING METHODS

The finished leather samples under the experiments were tested for their various physical properties. These properties indicate about the quality of the finished leathers produced. Due to limitations of time and the availability of instruments, selected physical tests were accomplished and these tests are briefly discussed here.

MEASUREMENT OF TENSILE STRENGTH AND PERCENTAGE ELONGATION AT BREAK

The tensile strength and elongation at break was measured by electronic tensio meter. The process was followed by official method of analysis (1965), Ref./ 4(c)4(d)2, SLP-6, IUP/16.

a) Tensile strength:

Tensile strength is the force (Kg) per unit area of cross section (sq. cm) required to cause a rupture of the test specimen.
So, tensile strength of the specimen was calculated using following formula.

$$\text{Tensile strength} = \frac{\text{Breaking load (Kg)}}{\text{Thickness (cm)} \times \text{Width}}$$

b) Percentage elongation at break:

Elongation at break for these specimens was calculated from the distance of the jaws after breaking was occurred.

$$\text{\% Elongation at break} = \frac{\text{Distance increased by breaking}}{\text{Distance of the two jaws in normal}} \times 100$$

MEASUREMENT OF STITCH TEAR STRENGTH

The double holes stitch tear strength can be defined as the load (Kg) required tearing the sample of the leather between two holes of 2mm. diameter each and whose centers are 6mm apart, expressed on its unit thickness (cm). So, stitch tear strength of the specimen was calculated by the following formula:

$$\text{Stitch tear strength, .Kg/cm} = \frac{\text{Tearing load in Kg}}{\text{Thickness in cm}}$$

The sampling for this test was carried out in both parallel and perpendicular directions to the backbone and the test specimen was a rectangular piece of size: - 50 mm **x** 25 mm.

MEASUREMENT OF TEARING STRENGTH

The tearing strength of leather can be defined as the load in Kg required tearing the leather sample if its thickness was one centimeter.

$$\text{Thus, tearing strength, Kg/cm} = \frac{\text{Tearing load (Kg)}}{\text{Leather thickness (cm)}}$$

For this test also the sampling is done both parallel and perpendicular to the backbone and the mean thickness of the test specimen is determined. A slot or a straight cut of 20 mm length is made on the leather test sample of dimension (50 **x** 25)mm.

TESTS FOR DRY AND WET RUB FASTNESS

The tests were carried out by official's method analysis SLF 5. This is a very useful test for finished leather. A revolving pad is made to rub the leather for a successive number of revolutions and the effects of such rubbing under both the wet and dry conditions are studied using a Grey scale. While a 2.5 kg load is used for dry rubbing a 730 g load used for wet rubbing.

The numbers of revolutions for wet rub fastness are 32, 64, 128, 256, and 1024. Every time a fresh surface of the leather is used for rubbing. For dry rub fastness test the number of revolutions are 32, 64,128, 256, 512 and 1024. The number of revolutions required causing a contrast of grade 1 (if this is 1024 of less) and the contrast grading often 1024 revolutions are found out and a description of the nature such change is record.

TESTS FOR COLOUR FASTNESS OF LEATHER TO PERSPIRATION: SLF 426 (IUA 426)

By fastness of colour of leather to perspiration is meant its resistance to the action of human perspiration.

A piece of specified undyed textile, witted with artificial perspiration, is placed on the side of the specimen to be tested. The specimen is also wetted with artificial perspiration. The composite specimen is then left under pressure for a specific time in an appropriate apparatus. The specimen and the staining of the textile or assessed with standard Grey scale.

CHAPTER 7

COSTING:

COSTING OF LEATHER

(Per Sq.ft.)

Costing is an important matter for any industry. For the production of any product, companies profit or loss can be known from costing. How much will be the product price, which price of product will be profitable, is fixed from calculating different cost related to the industries. Costing is determined in the following way:

Costing = Direct cost + Indirect cost + Profit.
Direct cost = Material cost + Production cost + Electricity / gas / fuel cost + etc.
Indirect cost = Administration cost + Helping equipment or machine tools
+ lighting cost etc.

In leather industries, costing is calculated for hundred or thousand sq. ft. of leather.
From these, costing for per sq. ft. leather can be calculated. Here, given a rough idea about costing for per sq. ft. of leather.

Costing (for per sq. ft. leather)

Purposes		Cost in Taka
1. Raw materials cost	=	12
2. Chemicals cost / pre costing cost:		
i. Crust	=	10
ii. Finishing	=	15
3. Labour cost	=	03
4. Machine depreciation cost	=	10
5. Utility cost	=	03
6. Maintenance cost	=	03
7. Administration cost	=	08
8. Vat / Tax	=	04
9. Others	=	02
10. Profit (20 %)	=	12
Total cost	=	82 Taka

CONCLUSION

Split leathers are a by - products of the tanning industry. Normally the Splits produced are used to manufacture suede. Due to quality and fashion the quantity of splits produced often exceeds customer demand and there has been much experimental work to convert a split into a product looking and behaving like grain leather.

But in our country, there is less room and limited machineries to control the quality of leather.

I hope a lot of steps should be taken which help to occupy the domestic and international market.

SAMPLE ATTACHEMENT

SAMPLE 1

SAMPLE 2

SAMPLE 3

SAMPLE 4

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