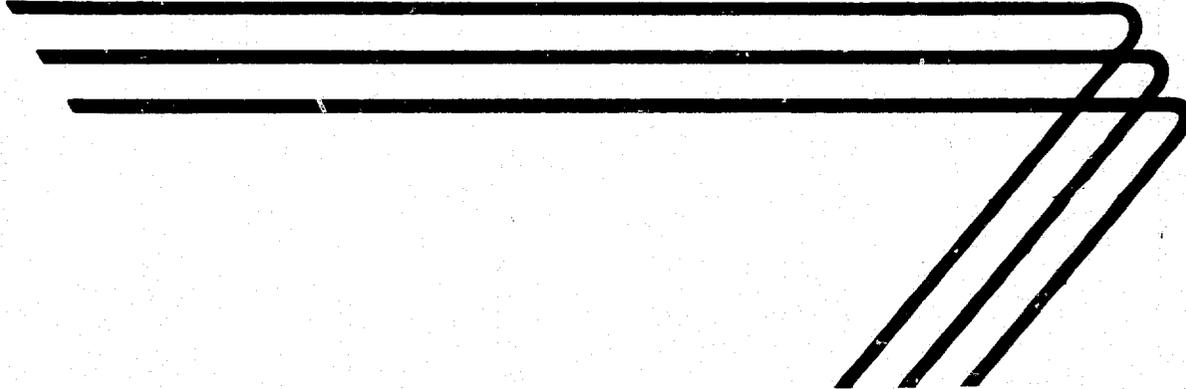


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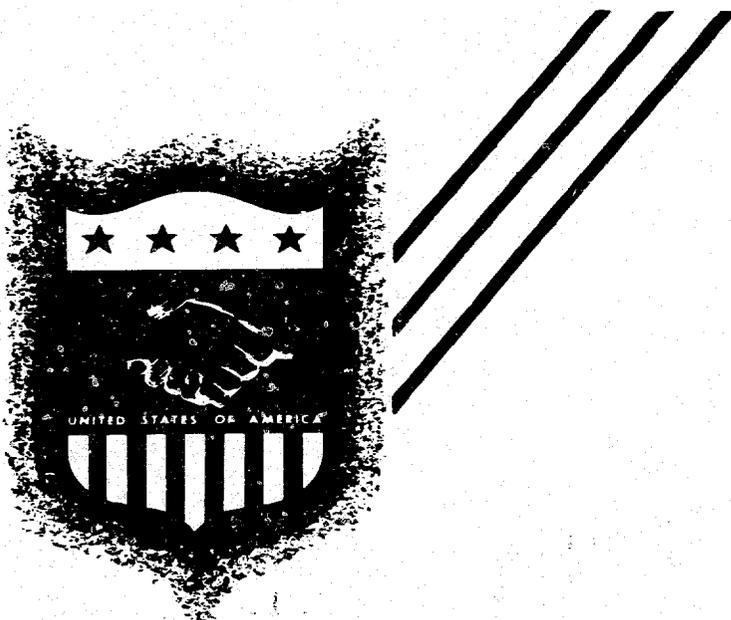
REQUIREMENTS

TO SET UP AND OPERATE A LEATHER TANNERY



TECHNICAL AIDS BRANCH

**INTERNATIONAL COOPERATION
ADMINISTRATION**
Washington, D. C.



REVISED
MAY 1959

U. S. I. D.
Requirements Section
Bureau of Economic Warfare

FOREWORD

This manual is a revision of an earlier report of the same type issued in 1955. This revised version includes current costs of labor, machinery, equipment and supplies, as well as additional information relative to engineering, training, safety, markets, sales, financial and economic factors.

* * * * *

This manual is designed to provide a general picture of the factors which must be considered in establishing and operating a small-scale factory of this type. It should prove useful in creating interest in the subject, and serve to give enough understanding of the related considerations to help government officials, other leaders and businessmen to determine whether the potential deserves more-detailed attention.

However, it is important to note that in most cases plans for the actual development and installation of a plant will require expert engineering and financial advice in order to meet specific local situations. For further information and assistance, readers should contact their local Productivity Center, Industrial Institute, Servicio, or United States Operations Mission.

Mention of the name of any firm, product, or process in this manual is not to be considered a recommendation or endorsement by the International Cooperation Administration, but merely a citation that is typical in its field.

* * * * *

The original report was prepared by the Wolf Management Engineering Company, Chicago, Illinois.

Technical information, as well as review, was provided by R. Poliakoff, Industrial Consultant, 126 Eleventh Avenue, New York 11, New York.

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LEATHER TANNERY

INTRODUCTION

Most tanneries in the United States perform two functions, namely, processing the hide to pelts and tanning the pelts to the finished product, leather. Tanning of leather can be accomplished by any of the six well-known processes: vegetable, alum, chrome, oil, formaldehyde, and sulphur. The two most widely used today are the vegetable and the chrome.

Due to the relatively large demand for upper shoe leather, this manual will be developed on processing hides from their raw state to finished upper leather by using the two-bath chrome tanning process. The most desirable upper leather is secured from light cattle hides which weigh approximately 54 pounds each. These hides are purchased by the pound, the average cost being \$0.13 per pound; the finished leather product is sold on the square footage basis at approximately \$0.35 per square foot, or \$0.298 per pound.

The tannery herein proposed will be capable of processing 16,000 pounds of raw hides to yield 13,500 square feet of finished upper leather per eight-hour day, utilizing about 56 workers, and would be of minimum economic size. Annual cost of hides, 4,000,000 pounds, at \$0.13 per pound = \$520,000.

GENERAL ASSUMPTIONS

1. Costs are based on 1959 prices in the United State. Labor rates are quoted from recent reports of the Bureau of Labor Statistics, United States Department of Labor.
2. Adequate and suitable water, sewage, electrical, and transportation facilities are available at the plant site.
3. The plant will operate one eight-hour shift per day, five days per week, 50 weeks per year.
4. Labor saving devices which would increase investment in capital out of proportion to the corresponding reduction of unit costs have not been included in the equipment requirements.
5. The necessary raw materials are available in suitable quantity, quality and at proper prices.
6. The market is available or can be readily developed, and the time for starting the proposed enterprise is favorable.

7. The following items cannot be estimated realistically:

- A. Land value
- B. Distribution methods and selling costs
- C. In-freight and out-freight
- D. Taxes.

While general estimates will be made of each of these items, for the purpose of completing cost estimates, adjustment should be made in accordance with actual local costs.

In fact, all cost estimates contained in this brochure should be adjusted to conform to local conditions.

To facilitate conversion to local figures and costs, columns headed "actual" are included in the appropriate tables.

HISTOLOGY OF HIDES

A moist hide which has been removed from the animal's carcass is quickly decomposed by bacterial enzymes. If the hide is dried out, it will become extremely hard and practically useless. However, when properly tanned, the hide is impervious to digestion by enzymes, is insoluble in water and may be given whatever degree of softness is desired.

Hides vary considerably, not only in size, thickness and texture, but also in the character and appearance of the grain, the thickness of the fibers and their resistance to depilants.

There are wide variations even among the hides and skins of one species of animal. A skin, or hide, is affected by the breed and origin of the animal, its mode of life, food, general condition, age, and sex, and the season of the year when it is slaughtered, as well as other variable factors.

Cattle hides are by far the most important raw materials employed in the production of industrial leather. They include those of oxen, steers, cows, heifers, kips and calves. A brief description of the hides considered for this study follows:

Oxen

These hides are the most valuable because of the close texture which results in a strong durable leather.

Steers

The hide of a steer is coarse in texture, badly wrinkled in the neck, rather thin in the back, and coarse in the belly. They do not yield as strong a leather as the hides of oxen.

Cows

These hides are invariably poor in quality, loose in texture, thin and lacking in elasticity and strength. Elasticity is lost with age, and the hides are very uneven in substance, being thick in the back.

Heifers

These hides are not as strong as ox hides, but they possess the same even texture and fine grain.

Kips

The largest source of supply of lightweight hides is India. Practically all Indian hides are "kips." Texture is very good, but they are not as strong as ordinary cattle hides.

Calves

Calfskins or milk calfskins are available in most cattle producing countries, but only a few are important. The skins are classified by the feeding and age of the animals producing them. Skins of milk-fed calves have an extraordinarily fine grain and an even texture. Skins of calves fed on hay and cake are somewhat coarser. Female calves produce a much better skin than bull calves due to wrinkles and coarser grain in the latter.

THE MANUFACTURING PROCESS

Preparation for Tanning

The modern preparatory method of processing hides for chrome tanning purposes is as follows:

- | | |
|-------------------------|-------------|
| 1. Receipt of raw stock | 6. Fleshing |
| 2. Drying | 7. Scudding |
| 3. Soaking | 8. Rounding |
| 4. Liming | 9. Deliming |
| 5. Unhairing | 10. Bating |

Receipt of Raw Stock

Immediately upon receipt of raw stock each hide should be weighed and stamped. It should then be removed to a "hidehouse" where it can be stored for one week without danger of spoiling. Ample storage space should be provided which will allow easy access to all piles of stock and freedom of movement of the workmen as they sort, grade and stack. The hidehouse should be kept cool and clean at all times.

If cold storage facilities can be provided, raw stock can be stored for a very long period of time; however, due to the initial expense involved for installation of a cold storage system, it is suggested that allowances for such facilities be omitted at this time. These facilities can be added once the tannery gets under way and is showing a fair margin of profit.

In the hidehouse, individual packs of hides and skins are made up for delivery, by fork-lift truck, to the "beamhouse." Each pack should contain pieces as nearly alike as possible. If the vats in the beamhouse have a total capacity of 2,500 pounds each, it is common practice to make up packs of green, salted stock weighing 5,000 pounds each and packs of dried stock weighing up to 2,500 pounds each.

Drying

The most common and practical method utilized for drying hides is to spread them on the ground under an open shed where they are protected from the scorching rays of the sun. The flesh side of the hides should be painted with a solution containing an arsenic compound to protect them from insect damage. Hides dried in this manner will soak back fairly readily and are protected against damage by insects and bacteria. This method is described as "Dried Arsenicated" or "Patent Cured."

Soaking

The method used for soaking hides is dependent upon the manner in which they were dried.

Fresh market hides merely require cleansing by placing them in a wash drum. This drum is made of cypress wood, has an outside diameter of 8 feet and a width of 5 feet 4 inches. It rotates at a speed of 17 revolutions per minute, and is equipped with a water pipe allowing a heavy flow of water to pass over and through the hides while the drum revolves. The inside of the drum is equipped with wooden pegs which pick up the stock and allow it to drop back repeatedly while the drum is revolving as shown on page 34. The stock is washed until the out-flowing water looks clear and no longer bloody and dirty. The time usually required to reach this stage is five minutes.

After washing, the hides are immersed in a wood vat 10 feet long by 10 feet wide by 5 feet deep containing clear water; they are allowed to remain completely immersed overnight. The next morning they are removed and stacked in a pile for the liming operation.

Dried hides are the most difficult to soak back. They require at least 48 hours of immersion in water containing sodium sulphide or hydroxide; subsequently the soaked product is then drummed in cold running water which completes the cleaning and softening operation. The same type of equipment can be used as is used for salted hides and fresh market hides.

Liming

The epidermis and adipose tissue must be removed from the true hide before it can be tanned. The removal of the epidermis is by chemical action of milk of lime. The hides which were thoroughly soaked in the previous operation can now be immersed in the lime liquor contained in reels or drums of cypress wood. Each reel has a liquid capacity of 900 gallons and holds 300 dry hides. It has a paddle wheel which revolves and keeps the hides in constant motion. Illustrated on page 34.

On alternate days, the hides are removed from the liquor and placed on the edge of the reel; the liquor is then "plunged" to stir up the sediment of lime, and the hides are once again immersed. Usually it requires ten days of liming to destroy the epidermis. The hair is then quite loose and can be pushed off.

Unhairing

At the end of the liming process, the hides are transported by fork-lift truck to the unhairing machines where the hair is completely

removed from the hides. These machines have revolving, blunt, spiral-bladed cylinders and rubber rollers which claw or grip the loose hair, and also squeeze out excess liquid. Illustrated on page 35.

The hair drops to the floor from the machine, is swept up, cleaned, dried and sold to carpet weavers, upholsterers, and cartridge manufacturers.

Fleshing

From the unhairing machines the hides are passed to the fleshing machine, which usually is installed alongside. As each hide is unhaired, it is set on a sawhorse for the fleshing machine operator to pick up and feed directly to the fleshing machine.

Fleshing a hide is the removal of the adipose tissue. The fleshing machine is similar to the unhairing machine, but it has a sharp, spiral-bladed cylinder instead of the blunt type, as shown on page 35.

Scudding

Following fleshing, some hides are "scudded" to make the grain surface clear and clean. Remaining hair, surface cells and dirt are scraped off by a scudding machine which has blades extending from a large revolving cylinder. The hide is placed, grain side up, on a bolster which forces the grain against moving blades. The scudded stock is then washed in running water in an open-face revolving drum for 40 minutes. Illustrated on page 35.

Rounding

As a result of the variation in the texture and substance in the hides, it is necessary to cut the heavy limed hides into shoulders, bellies and butt. The butt is stouter and tougher than the rest of the hide; therefore, different parts require different treatment in their further preparation and tanning. This operation is performed on heavier cattle hides only.

A process sufficient for stout butts would be too much for thin parts. Therefore, it is common practice in tanneries to cut away thin portions of the pelt from the main part, or butt, of the pelt. This operation is usually performed on a stout 4-foot by 8-foot wooden table.

After unhairing, constant inspection and segregation of hides or skins are carried on by qualified hide inspectors. They inspect each hide for quality, thickness and toughness and stamp, mark, and route the hides to individual operations as required.

Deliming

The dehaired, fleshed pelts consist of the true skin or dermis, freed from all nonleather-forming tissues, but containing the liming chemicals. In consequence, they are swollen and plumped; therefore, the chemicals must be removed from the pelts, or at least from the grain, if good color is to be ensured.

The extent to which limed pelts are delimed and the method used depends very much on the type of leather to be produced. Surface deliming may be brought about by a weak solution of acid -- boric, hydrochloric, lactic, sulphurous -- and is usually done by suspending the hides in a pit containing the solution. Increased or full deliming uses greater quantities of acid.

Bating

Bating is a modern process to loosen the "scud" and to remove all plumping. The synthetic bating solution is poured into the bating vats, and the hides are immersed in the solution and kept moving by a revolving paddle wheel. See page 36.

The liquor in the vat must be at 80 to 100 degrees Fahrenheit, depending on the type of hide, the lower temperature being used on the more delicate hides.

Bating is usually done with one-half to one and one-half percent of an artificial bating product which is a mixture of wood flour, ammonium chloride and dried cattle pancreas. Whichever treatment is applied, it is continued until the scud is loose, and the grain of pelts clean and slippery and capable of retaining the impress of the thumb. The bated hides are then rinsed in tepid water and are ready for chrome tanning.

* * *

The operations from Soaking through Bating are performed in the beam-house. As the hides complete the cycle of preparatory operations, they are transported by fork-lift truck to the tannery for the operations required for chrome tanning the hides to finished upper leather.

TANNING PROCESS

The two best methods for tanning leather are vegetable tanning and chrome tanning. This study is concerned with the two-bath method of chrome tanning lightweight cattle hides for shoe uppers.

Chrome tanning is a more rapid and efficient process than vegetable tanning. However, extreme caution must be exercised by the tanner throughout the tanning process. The tan liquors must be modified so that the tannins are not too readily fixed before they have an opportunity for complete penetration. Therefore, it is essential that the tannage be started with a weak solution and gradually increased in strength and astringency until the tannage is complete.

The first chrome liquors are prepared from chrome alum. Later, a suitable chrome tanning liquor is obtained by dissolving sodium bichromate and sulphuric acid in a small quantity of water and adding cane sugar glucose to the solution.

Stock chrome liquor is then added every half hour, and with each addition, the chrome compound in the tan liquor is increased in basicity, i.e., astringency. The low basicity chrome salts insure good penetration and smooth grain. Fixation of chrome is increased with the increase in astringency, so that, in the latter stages of tannage, production of well tanned upper leather is insured.

The operations required to produce finished upper leather are as follows:

- | | |
|----------------------------|-----------------|
| 1. First Tanning | 10. Samming |
| 2. Wringing and Stretching | 11. Staking |
| 3. Second Tanning | 12. Buffing |
| 4. Stamping and Sorting | 13. Seasoning |
| 5. Splitting | 14. Glazing |
| 6. Shaving | 15. Ironing |
| 7. Dyeing and Fatliquoring | 16. Measuring |
| 8. Oiling Off | 17. Grading and |
| 9. Drying | Sorting |

These steps may be explained as follows:

First Tanning

The hides are received from the beamhouse and are loaded into tanning reels or drums. These reels usually are cylinders 8 feet long by 6 feet in diameter and are made of cypress wood. They are mounted on bearings on pillars and connected to a shaft which revolves. See illustration on page 36.

Approximately 1,800 pounds of hides are loaded into the drums containing the tanning liquor. The drums are then set into a revolving motion;

however, the drums must not be revolved too rapidly or the leather will spoil. The strength of the tan liquor can be maintained or gradually strengthened according to standard process.

The average time for the first tanning process generally takes from four to five hours.

Wringing and Stretching

Upon completion of the cycle of time required for first tanning, the hides are dumped from the tanning reel to a portable truck and wheeled to the "setting-out" machines for wringing and stretching. Illustrated on page 36. The function of this machine is to wring out the excess liquor, which soaked into the hide in the first tanning, and to stretch the hide by passing it between a roller and a leather sheet in the machine.

Second Tanning

From the setting-out machines, the hides are gathered and placed in tanning reels, which are the same type as those used for the first tanning process. The process of second tanning follows the same process as first tanning. However, the second tanning changes the combinations of the acids and proteins formed in the first tanning. In other words, it "fixes" it, stopping the chemical action set up in the first tanning. This operation completes the actual liquid tanning process.

Stamping and Sorting

After the hides are removed from the second tanning reels, they are loaded into a portable truck and wheeled to the stamping machines where lot numbers, which identify the type of hide, are stamped. The machines used for this function are operated by placing a corner of the hide on a metal die, which is attached to the surface plate of the machine, and by lowering the stamp by foot treadle, thus perforating the selected lot number in the hide.

After stamping, each hide is thrown over a wooden sawhorse where a qualified sorter or inspector gauges the hides and paints in small numerals and letters to designate the grade, quality, thickness and size of the hide.

Splitting

The purpose of splitting is to produce leather of uniform thickness. The splitting operation divides the stock into two or more layers and is necessary only for heavier hides. Splitting the hides is done on a splitting machine which has a flexible, endless knife which revolves between two pulleys. A series of rollers direct the stock through the machine so that the knife cuts the hide into two layers. The layer with the grain surface produces a fine leather. See illustration on page 37.

The other layer, or "split," is used for leather of medium quality. The grain of calfskins makes the finest shoe uppers; the grain of cattle hides is a somewhat coarser grained leather called "side-upper."

Shaving

The hides are transported to the shaving machines by portable truck to undergo the process of shaving down the back on the flesh side of the hide, wearing away the extra thickness of skin which forms along the backbone. Care must be taken to keep the shaving knife from shaving off too much or too little; the hides must be of uniform thickness when passed on to the next operation, that of dyeing.

The shaving machine has two rubber or leather rollers which grip the hide as it is fed by the operator and shaved by a sharp bladed knife which passes over the flesh surface of the hide. The rollers and knife are either 12, 18, or 24 inches in length, depending on the size of the hide to be shaved. See illustration on page 37.

Dyeing and Fatliquoring

Coming from the shaving operation, approximately 300 hides are loaded into a drum, which is of the same dimension as the tanning reels and which operates on the same principle.

After the hides are placed in the drum, the dye is added, and the drum started in a slow revolving motion. The hides are "sloshed" about for approximately 30 minutes, soaking up a dye that penetrates clear through the hide from the grain side to the flesh side and becoming so impregnated that the color will never fade out.

After being dyed, the hides are fatliquored in the same drum for 30 minutes in order to restore to the chrome tanned leather the fatty oils that were removed as a result of the preparatory process. The fatliquor which contains such materials as emulsified oils, or soap, egg yolks and sometimes clay, makes the leather soft and pliable. See illustration on page 37.

Oiling Off

After being fatliquored in the drums, the hides start on a series of finishing operations, the first of which is oiling off. In the oiling off machine, the hides are fed through two large brass rollers where an emulsion of neatsfoot oil is spread on the grain side. Neatsfoot oil, of course, cannot be used where white or light colors are desired. Another oil emulsion that will not stain is used.

This process renders the hide pliable and soft, covering the hide with an oily sheen. Two men are required to operate the machine properly, and extreme care must be exercised to be sure that the emulsion is spread on evenly and thoroughly.

As the hides emerge from the machine, they are very carefully picked up by one of the operators and set on a table in preparation for drying.

Drying

The skins are dried by hanging them on racks in a drying room in which the air is heated, dehumidified and kept in constant circulation by means of electric fans. Usually they are kept there for a predetermined length of time. Better results follow when the drying operation is fully mechanized. This latter step of refinement can be taken later and is not advised at the outset.

Samming

After drying, the hides are ready for the addition of controlled and uniformly distributed moisture; and this process, although extremely important, amounts to nothing more than packing the leather in dampened sawdust and leaving it there for a day or longer, covered with a heavy canvas blanket so that the leather may absorb just the proper amount of moisture.

Staking

The moistened hides are removed in the morning to the staking machines. See illustration on page 38.

The operator feed the hide to the plunging jaws, holding one end between his leather abdominal pad and a bumper on the machine, spreading the

hide flat and shifting the hide as necessary to make the hide supple and soft. Extreme nimbleness and dexterity are required on the part of the operator, as approximately 2,500 pounds of pressure are exerted by the machine in this pulling operation.

Buffing

Light cattle hides and calfskins are usually buffed to make them uniform in thickness. The buffing machine, which has a 5-foot overshot wheel, wears away all lumps which have been pulled up as a result of staking.

Seasoning

Seasoning produces a finished, uniform texture to the hide, keeping it free from cracking. This operation also prepares the hide for glazing. An application of seasoning compound is swabbed on by hand, and every inch of the grain side of the hide is covered. After swabbing, the hide is hung on a rack for drying.

Glazing

Glazing of a hide is accomplished on a polishing jack, see page 38. This machine generates heat by friction of an agate cylinder passing up and down a leather strap over which the hide is held. Skilled operators are needed for this operation, as the gloss results from the pressure applied to the agate. Too little pressure will dull hides, and too much pressure will burn the hide.

At this point the hides receive a rigid inspection. The perfect hides pass on to the graders, sorters and measuring machine, while hides having wrinkles or creases go to the Ironing Department.

Ironing

The purpose of the ironing machines, which are the roller type and heated by electric elements or steam, is to eliminate the glazing marks, creases, and wrinkles. After the ironing operation, the hides are inspected and dispatched to the graders, sorters and measuring machine.

Grading, Sorting and Measuring

Upon receiving the hides from either the Glazing or Ironing Departments, the grader sorts the leather on the basis of such standards as evenness of color, fineness of grain and general appearance and feel.

Upper leather is sold by the surface area, and because of the irregularities of hides, it would be a lengthy process to determine the number of square feet in each piece of leather without a measuring machine. See illustration on page 38.

The leather is passed under a series of closely spaced wheels which revolve and record the total square footage of the hide on a dial. The accuracy of these machines is within one tenth of a square foot. As the leather leaves the machine, its area is marked on the flesh side, and it is ready to be sold in lots with other finished upper leather of a similar kind, weight, and grade.

* * *

PLANT LAYOUT

A plant layout and a flow chart are shown on pages 14 and 15.

PLANT SITE

To provide for eventual expansion, the land for the plant site should contain at least 50,000 square feet. The site should be level, well drained, and should be located as advantageously as possible with respect to transportation, power, water, fuel, sources of markets and labor. The cost of such a site is estimated at \$2,000.

BUILDING

A one-story building, 120 feet x 150 feet or 18,000 square feet, will provide ample space for all operations, including an office. It may be constructed with any suitable building materials. It is estimated that the complete building, including adequate plumbing and wiring, will cost about \$3.50 per square foot, or a total of about \$63,000.

POWER

About 140 kilowatt hours per day of power will be required. Based on a cost of \$.025 per kilowatt hour, the annual cost of power for all purposes is estimated at \$900.

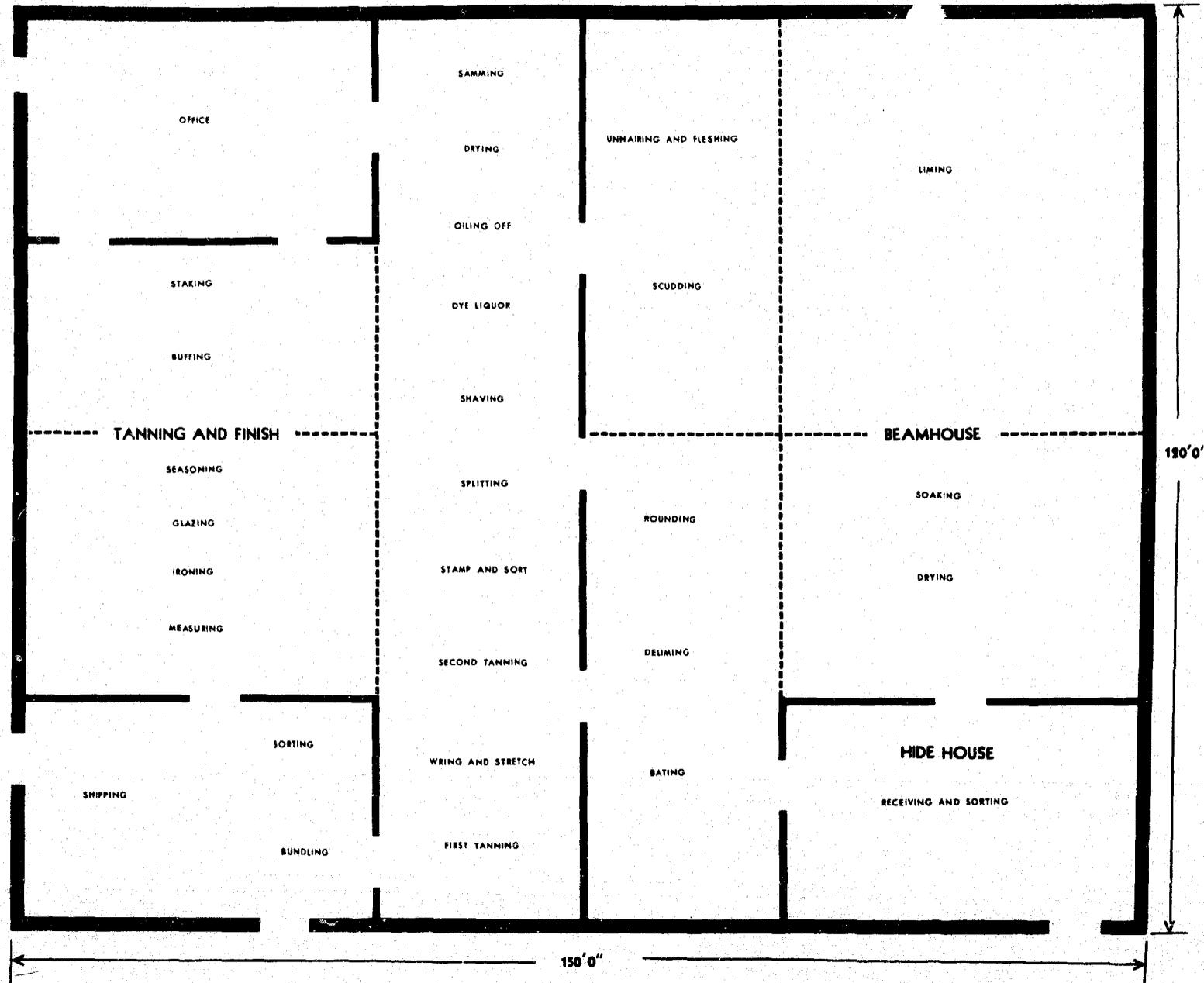
FUEL

It is estimated that the fuel consumption for production, heating and sanitary purposes will amount to about \$700 per year.

WATER

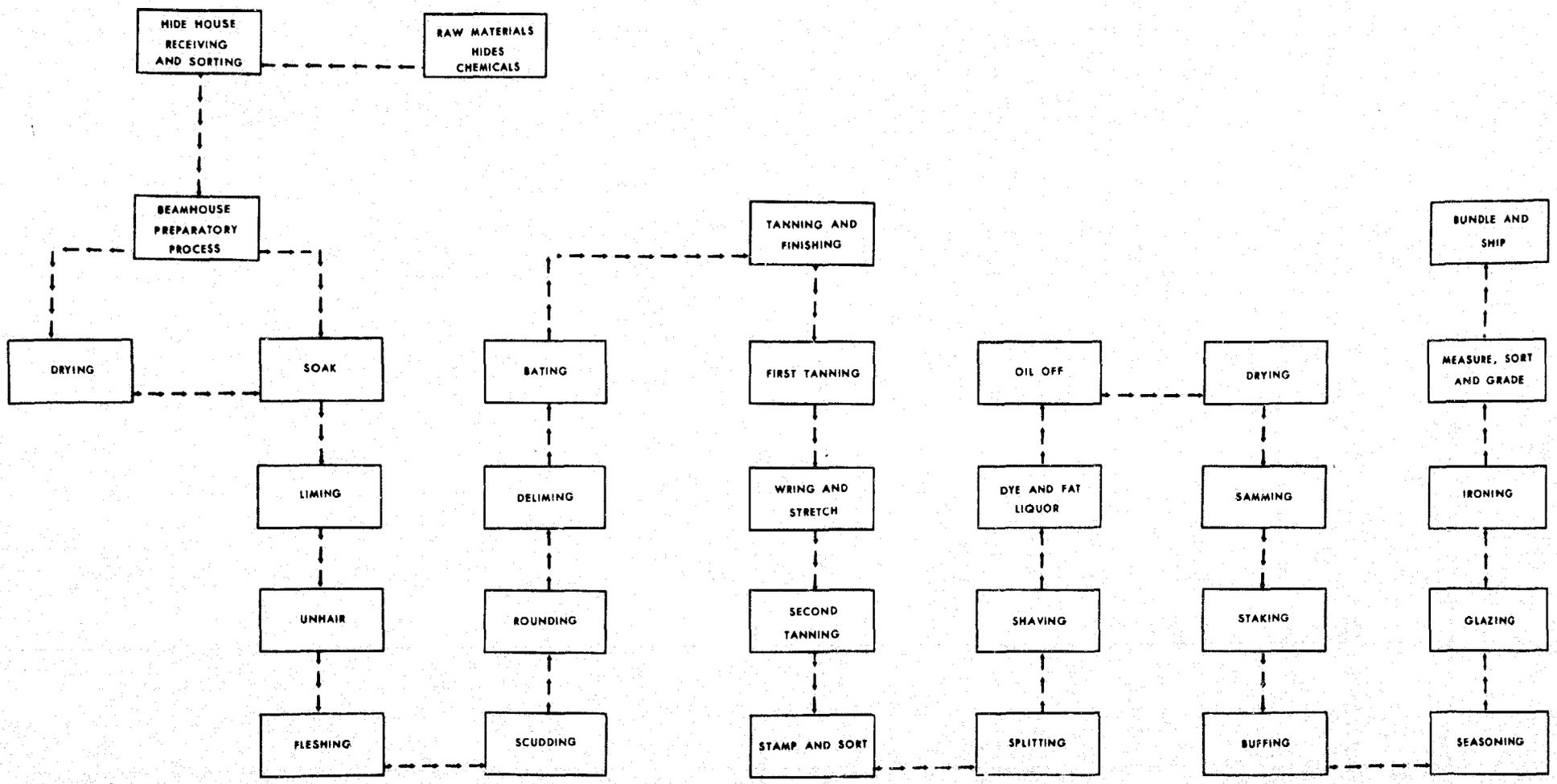
Water requirements for the purposes of production, heat, sanitary facilities, drinking purposes and fire protection is estimated at \$600 per year.

DIAGRAMMATIC LAYOUT OF TANNERY



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SCHEMATIC FLOW-CHART OF TANNERY



- 15 -

EQUIPMENT REQUIREMENTS

The type of equipment utilized in tanneries is fairly well standardized.

<u>Departmental Equipment</u>	<u>Units Needed</u>	<u>Estimated Cost</u>	<u>Actual Cost</u>
<u>Hidehouse</u>			
Monorail system	1	\$ 5,000	_____
Fork-lift truck	1	3,500	_____
Hide scale	1	600	_____
Stamping machine	1	300	_____
Chemical storage bins - homemade	1	500	_____
Total		\$ 9,900	_____
<u>Beamhouse</u>			
Soaking vats - homemade	2	\$ 1,000	_____
Liming reels	15	16,000	_____
Unhairing machines	1	3,000	_____
Fleshing machine	1	3,000	_____
Trimming beams - homemade	2	200	_____
Rounding tables - homemade	2	300	_____
Deliming vat	1	1,000	_____
Bating reel	1	1,000	_____
Portable trucks	5	300	_____
Fork-lift truck	1	3,500	_____
Other equipment - knives, tools, tables		600	_____
Total		\$29,900	_____
<u>Tanning and Finishing</u>			
Tanning drum	1	\$ 1,200	_____
Setting out machine	1	3,500	_____
Second tanning drum	1	1,200	_____
Stamping machine	1	600	_____
Splitting machine	1	4,600	_____
Shaving machine	1	3,000	_____
Dyeing drum	1	1,000	_____
Oiling off machine	1	3,500	_____
Measuring machine	1	6,000	_____
Drying racks and equipment		1,500	_____
Staking machines	2	5,000	_____
Buffing machines	2	6,000	_____
Seasoning benches and equipment		500	_____
Glazing machines	2	2,500	_____
Ironing machine	1	1,200	_____
Other tools, gauges, knives, bins		1,800	_____
Total		\$43,100	_____

TOTAL COST OF EQUIPMENT

<u>Department</u>	<u>Estimated Cost</u>	<u>Actual Cost</u>
Hidehouse	\$ 9,900	
Beamhouse	29,900	
Tanning and Finishing	43,100	
Other Tools and Equipment Maintenance equipment, hand tools, lathe, drill press, grinder	2,500	
Office Equipment Desks, chairs, files, lockers, cabinets, typewriter	<u>1,600</u>	
Total	\$87,000	

SUPPLIES

<u>Description</u>	<u>Estimated Cost</u>	<u>Actual Cost</u>
Milk of lime	\$ 1,500	
Chemicals for tanning	2,000	
Sawdust and wood sweepings	100	
Various dyes	3,000	
Lubricating oils	100	
Neatsfoot oil	1,400	
Fish oil	1,500	
Soap	100	
Burlap, rope and twine	1,000	
Chrome alum	2,000	
Sodium bichromate	1,000	
Sulphuric acid	500	
Cane sugar glucose	400	
Maintenance materials and repair parts	2,400	
Office Supplies	<u>200</u>	
Total	\$16,400	

DEPRECIATION

<u>Item</u>	<u>Estimated Cost</u>	<u>Years' Life</u>	<u>Estimated Per Year</u>	<u>Actual Per Year</u>
Building	\$63,000	20	\$ 3,150	_____
Production Equipment and Tools	82,900	10	8,290	_____
Maintenance Tools	2,500	5	500	_____
Office Equipment	1,600	10	160	_____
Total			\$12,100	_____

DIRECT LABOR

This study has been predicated upon an average size tannery using untrained and unskilled labor wherever feasible.

<u>Occupation</u>	<u>Personnel Required</u>	<u>Hourly Rate</u>	<u>Annual Cost</u>	<u>Actual Cost</u>
<u>Hidehouse</u>				
Inspector	1	\$ 1.80	\$ 3,600	_____
Sorter - raw hides	1	1.60	3,200	_____
Hauler and material handling - dry	1	1.50	3,000	_____
Total	3		\$ 9,800	_____
<u>Beamhouse</u>				
Liquormen, soaking vats	2	\$ 1.60	\$ 6,400	_____
Liquormen, liming reels and bating	3	1.60	9,600	_____
Unhairing machine operator	1	1.60	3,200	_____
Fleshing machine operator	1	1.60	3,200	_____
Trimmer	1	1.70	3,400	_____
Scudding machine operator	1	1.60	3,200	_____
Rounder	1	1.90	3,800	_____
Laborer, material handling - wet	1	1.50	3,000	_____
Hauler	1	1.50	3,000	_____
Inspector	1	1.80	3,600	_____
Total	13		\$ 42,400	_____

Direct Labor - Continued

<u>Occupation</u>	<u>Personnel Required</u>	<u>Hourly Rate</u>	<u>Annual Cost</u>	<u>Actual Cost</u>
<u>Tannery</u>				
Liquormen, first and second tanning, dyeing and fatliquoring	2	\$ 1.60	\$ 6,400	_____
Setting out machine opera- tors, stampers and sorters	2	1.50	6,000	_____
Splitting machine operator	1	1.80	3,600	_____
Shaving machine operator	1	1.90	3,800	_____
Oiling-off machine operator	1	1.60	3,200	_____
Oiling-off machine laborer	1	1.50	3,000	_____
Staker machine operators	2	1.90	7,600	_____
Buffing and glazing machine operators	3	2.00	12,000	_____
Ironing machine operator	1	1.50	3,000	_____
Drying room operator	1	1.60	3,200	_____
Samming man	1	1.50	3,000	_____
Seasoner	1	1.50	3,000	_____
Laborer, material handling - wet	1	1.50	3,000	_____
Laborer, material handling - dry	1	1.50	3,000	_____
Hauler	1	1.50	3,000	_____
Shippers, graders, sorters	2	1.80	7,200	_____
Inspectors	2	1.80	7,200	_____
Total	24		\$ 81,200	_____
Annual Payroll Hidehouse			\$ 9,800	_____
Annual Payroll Beamhouse			42,400	_____
Annual Payroll Tannery			81,200	_____
Total Annual Direct Payroll			\$133,400	_____
Total Direct Employees - 40				

INDIRECT LABOR

<u>Occupation</u>	<u>Personnel Required</u>	<u>Hourly Rate</u>	<u>Annual Cost</u>	<u>Actual Cost</u>
Manager	1		\$ 10,000	
Chemist	1		7,200	
Bookkeeper	1		5,000	
Superintendent	1		7,200	
Stenographer	1		3,000	
Office Clerk	1		3,000	
Janitor	1	\$ 1.50	3,000	
Supervisor	1		5,000	
Maintenance	1	2.00	4,000	
Firemen, stationary boiler	1	1.50	3,000	
Watchman	1	1.50	3,000	
Utility Man	1	1.50	3,000	
Truck Driver	1	1.50	3,000	
Total	13		\$ 59,400	

MANUFACTURING OVERHEAD

<u>Item</u>	<u>Estimated Annual Cost</u>	<u>Actual Annual Cost</u>
Indirect Labor	\$ 59,400	
Supplies	16,400	
Power	900	
Water	600	
Fuel	700	
Depreciation	12,100	
Total	\$ 90,100	

MANUFACTURING COSTS

<u>Item</u>	<u>Estimated Annual Cost</u>	<u>Actual Annual Cost</u>
Direct Labor	\$ 133,400	_____
Cost of Hides	520,000	_____
Manufacturing Overhead	<u>90,100</u>	_____
Total	\$ 743,500	_____

WORKING CAPITAL

<u>Item</u>		<u>Estimated Cost</u>	<u>Actual Cost</u>
Hides in Process	- 30 days	\$ 43,300	_____
Direct Labor	- 30 days	11,100	_____
Manufacturing Overhead	- 30 days	7,500	_____
Reserve for Collections	- 30 days	<u>98,400</u>	_____
Total		\$ 160,300	_____

FIXED ASSETS

<u>Item</u>		<u>Estimated Cost</u>	<u>Actual Cost</u>
Land		\$ 2,000	_____
Building		63,000	_____
Equipment Requirements		82,900	_____
Other Tools and Equipment		2,500	_____
Office Equipment		<u>1,600</u>	_____
Total		\$ 152,000	_____

CAPITAL REQUIREMENTS

<u>Item</u>	<u>Estimated Cost</u>	<u>Actual Cost</u>
Working Capital	\$ 160,300	_____
Fixed Assets	<u>152,000</u>	_____
Total	\$ 312,300	_____

SALES REVENUE

The capacity of this plant is 13,500 square feet of leather per day. Based on 250 working days per year the annual production would amount to 250 x 13,500 square feet or 3,375,000 square feet per year.

The average price of leather of the grade and quality produced in this plant is \$0.35 per square foot. On this basis the annual sales of this plant would be 3,375,000 x \$0.35 or \$1,181,125.

Unused material in the form of scrap and the offal and hair removed from the hides can usually be sold at a profit. The revenue from these sources is not included in the above estimate of sales.

The building shown in this manual has ample space for 100% expansion. The cost additional equipment required to double production should not exceed \$40,000.

RECAPITULATION OF COSTS, SALES AND PROFITS

<u>Item</u>	<u>Estimated Cost</u>	<u>Actual Cost</u>
Direct Labor	\$ 133,400	_____
Cost of Hides	520,000	_____
Manufacturing Overhead	<u>90,100</u>	_____
Total Manufacturing Costs	\$ 743,500	_____
Interest on Loans	\$ 10,000	_____
Insurance	2,000	_____
Legal	2,400	_____
Auditing	3,600	_____
Unforeseen Expense	<u>19,625</u>	_____
Total Administrative Costs	37,625	_____
Sales Commissions, Travel Freight Out, Bad Debts, Discounts and Allowances	100,000	_____
Profit before Taxes	<u>300,000</u>	_____
Total Annual Gross Sales	\$1,181,125	_____

BUDGET CONTROL

A requisition form designed to provide accurate records of procurement and indicate the purpose of procurement with the least amount of time and effort is shown on the following page.

This form has an account number for each type of the various expenditures which the manager will review in detail, monthly or oftener, in order to control his expenses. Some items, such as power and water are usually under contract and are easily checked by reference to monthly bills. For simplification, items (marked with an asterisk below) are omitted from the purchase requisition. Variations in the labor costs are easily reviewed by examination of the payroll vouchers. The simplified type of control thus provided makes certain that the manager can control expenditures promptly.

Following the requisition form, a sample voucher check is shown. Voucher checks should be used for the payment of all expenditures and the appropriate book account number placed on each voucher.

At the end of each month the manager will receive a statement of all expenditures broken down by budget accounts. If the expenditures exceed the budgeted monthly allowances of any of the accounts, the bookkeeper will furnish the manager with a break-down of all expenditures relative to the budgeted accounts exceeded. All these supporting data can be secured by reference to the purchase requisitions and the check vouchers. This reference will enable the manager to determine what caused the over-expenditure and take corrective action.

If at any time during each month it becomes apparent that expenditures will exceed any of the budget accounts, the bookkeeper will bring this to the attention of the manager for his information and action.

BUDGET CONTROL ACCOUNTS

Account Number	Monthly Expense	Monthly Budget	Annual Budget	Actual
10 Administrative	\$ _____	\$ 1,500	\$ 18,000	\$ _____
20 Sales	_____	8,333	100,000	_____
30 Direct Materials	_____	43,333	520,000	_____
40 Supplies	_____	1,366	16,400	_____
51 Power*	_____	75	900	_____
52 Water*	_____	50	600	_____
53 Fuel	_____	58	700	_____
60 Unforeseen Expense (Reserve Account)	_____	1,635	19,625	_____
71 Direct Labor*	_____	11,116	133,400	_____
72 Indirect Labor*	_____	4,866	59,400	_____
80 Depreciation (Reserve Account)	_____	---	12,100	_____

Note: Administrative includes interest on loans, insurance, legal and auditing.

R. W. MITCHELL MANUFACTURING COMPANY

1422 BOSWORTH STREET, S. E.

65-22
514

ANYWHERE, U. S. A. _____ 19____ No. **10000**

PAY _____ DOLLARS \$ _____

TO THE ORDER OF

R. W. MITCHELL MANUFACTURING COMPANY

TO **FIRST NATIONAL BANK**
ANYWHERE, U. S. A.

BY **SAMPLE CHECK**

VICE PRESIDENT

ACCOUNT NUMBER

Sample voucher check to be used for the payment of
all expenditures in connection with Budget Control.

R. W. MITCHELL MANUFACTURING COMPANY

ENGINEERS

The services of professional engineers are desirable in the design of this plant, even though the proposed plant is small.

A correct design is one which provides the greatest economy in the investment of funds and establishes the basis of operation that will be most profitable in the beginning and will also be capable of expansion without expensive alteration.

The addresses of professional engineers who specialize in industrial design, some of whom may be willing to undertake such work on low cost projects overseas, can be secured by reference to the published cards in various engineering magazines. They may also be reached through their national organizations, one of which is the

National Society of Professional Engineers
2029 K Street, Northwest,
Washington 6, D. C.

Manufacturers of industrial equipment employ engineers familiar with the design and installation of their specialized products. These manufacturers are usually willing to give prospective customers the benefit of technical advice by those engineers in determining the suitability of their equipment in any proposed project.

The equipment manufacturers also know, and can recommend, professional engineers in private practice, who are willing and able to provide appropriate consulting services.

TRAINING

Manufacturing an inferior quality of product during the training period could create sales resistance that might be difficult to cope with later. To avoid such possibilities, the quality of the product should be maintained at all times, including the training period.

In some areas skilled operators may be available locally. In other areas all the operators may have to be trained.

If skilled operators are not available, adequate training would be assured by using one or more of the following methods:

- A. If the plant is designed and installed by a competent engineering firm, the contract should be negotiated, if possible, on a turn-key basis. On this basis the contractor agrees to operate the plant and produce the quality and quantity of the product stated in the contract for an agreed period of time. Such a contract would assure adequate personnel training, since full quantity and quality could not be produced with an untrained organization.
- B. The engineering firm that designs and installs the plant can usually make training arrangements to have key personnel placed, for training purposes, in a foreign industry that produces the same type of product. This would provide training for the key personnel while the plant is being installed.
- C. If neither of the above methods is possible, then qualified and experienced individuals should be employed for the key positions, either permanently or temporarily, to perform the key operations and assist in training the organization, even if they must be secured outside the country.
- D. The manager should have years of successful experience in this type of business and be fully qualified in all phases of management, including the training of employees.

SAFETY

There is always danger of accident and injury in any industrial plant. Because of this, the manager should take specific action to bring to the attention of each employee the importance of safety precautions and intelligent first aid.

Practically all machines have safety appliances, and the manager should see that these are in good working condition and that the operators are making full use of them.

In addition to constant watchfulness to make sure that all practicable safety precautions are taken, first aid supplies should be readily available. One complete first aid kit should be maintained near the manager's office, and others at appropriate places throughout the plant. Some of the employees should be trained to provide first aid service.

The use of accident posters in the plant have proved to be of value in reducing accidents. It is recommended that such posters be used, and that some direct special action be taken by the manager, at least once each month, to bring to the attention of all personnel the importance of safety precautions.

A fire brigade should be established and each member trained as to his responsibility in case of fire. Fire drills should be conducted periodically.

It is recommended that the employees be encouraged to offer suggestions or recommendations relative to prevention of accidents, removal of fire hazards and maintaining general interest in all safety factors.

SUMMARY

A small plant, built and operated according to the assumptions made in this manual would be a profitable undertaking.

There are some determinations, however, that should be made before a decision is reached to build and operate such a plant. Among the necessary determinations to be made are those with respect to the following items:

MATERIALS AND SUPPLIES

1. Are all materials and supplies available locally?
2. Is the local material market competitive?
3. Are satisfactory delivery of local materials assured at reasonable prices?
4. What materials and supplies must be imported?
5. Are they available in world markets at competitive prices?
6. Would prompt delivery of imported materials and supplies be assured so that large inventories would not be required?

MARKET FACTORS

1. Is there already a demand for the product?
 - A. Who are the principal consumers?
 - B. Who are possible new consumers?
2. How is demand for the product now satisfied?
 - A. By local production? If so, what is the volume of annual production?
 - B. What percentage of consumption is filled by local production?
 - C. By imports? If so, what is the volume of annual imports?
 - D. What percentage of consumption is met by imports?
 - E. From what areas are imports derived?
3. What is the estimated annual increase in local consumption over the next five years?
 - A. How were such estimates made?
 - B. By reference to official figures on population growth, family budgets, imports, etc.?
 - C. By consultation with trade or industry, ministries, associations, bankers, commercial houses, wholesalers, retailers, industrial consumers, etc.?

SUMMARY (Continued)

4. If the product is already being manufactured, can the existing and estimated future local market absorb production of the new plant without price-cutting or other dislocations?
5. Would the estimated sales price and quality of the new product make it competitive with an imported equivalent?
 - A. After adjusting cost to local conditions, is the estimated sales price of the product so high that tariff protection is necessary to protect it from imports?

EXPORT MARKETS

1. Could the product compete in export markets on the basis of price, quality and dependability of supply?
2. Can export markets for the product be developed?
3. If so, in what areas and in what annual volume?
4. What procedures would be necessary to develop export markets?
5. What would it cost?

MARKETING PROBLEMS

1. In calculating costs of the product, has adequate allowance been made for the expense of a sales department, advertising and promotion that might be required?
2. Do consumer prejudices against locally manufactured products exist?
 - A. If so, why?
 - B. Would they apply to the new product?
 - C. If so, how could they be overcome and what would it cost to do so?
3. Do marketing and distribution facilities for the product exist?
 - A. If not, can they be set up?
 - B. What would it cost to do so?
4. Will the product be sold to:
 - A. Wholesalers?
 - B. Retailers?
 - C. Direct to consumer?
 - D. Other industries?
 - E. Government?

SUMMARY (Continued)

ECONOMIC FACTORS

1. How much foreign exchange (and in what currency) is required to import machinery, equipment and supplies:
 - A. How much foreign exchange (and in what currency) is required for annual interest payments and amortization of any loans contracted to import machinery and equipment, or for payment of royalties and technical services?
 - B. How much foreign exchange (and in what currency) is required for annual import of raw materials and supplies?
 - C. What are estimated annual foreign exchange earnings and in what currencies?
 - D. Has careful consideration been given to the possibility of depreciation in the foreign exchange value of the local currency?
 - E. Has careful consideration been given to the possibility of import controls, or restrictions on availabilities of foreign exchange necessary to operate the business?
 - F. What benefits would the new business bring to the economy in the use of local raw materials: in employment and in technology?
 - G. Do dependable facilities exist for transportation, power, fuel, water and sewage?
 - (1) If not, can existing deficiencies be eliminated satisfactorily?
 - (2) What would be the cost to do so?

PERSONNEL

1. Is there an adequate labor supply near the plant location?
 - A. If not, how can the problem be solved?
2. Can the problem of training competent management and supervisory personnel be solved?
 - A. Also, the training of skilled labor?
 - B. Is technical advice available in the locality?
 - C. If not, where can it be obtained and what will it cost?

LAWS AND REGULATIONS

1. Do existing labor laws, government regulations, laws and taxes favor establishment of new business?
 - A. If not, can existing obstacles be removed?
 - B. If so, how and when?

SUMMARY (Continued)

FINANCIAL FACTORS

1. Technical advice on selection of machinery and equipment.
 - A. In selecting the machinery and equipment for the new plant, have reputable and competent engineers and technicians been consulted?
 - B. Have they been asked for advice on the most suitable types of machinery and equipment for the process and locality?
 - C. Have they carefully compared costs of various suppliers?
 - D. Credit terms offered purchasers?

FINANCIAL REQUIREMENTS OF THE PROJECT

1. In estimating the cost of the project, has careful consideration been given to:
 - A. The effect on costs of delays in construction schedules?
 - B. In delivery and installation of machinery and equipment?
 - C. In import of essential raw materials and supplies?
2. In calculating cash flow and working capital requirements, has careful consideration been given to:
 - A. Maintaining adequate inventories of raw materials?
 - B. Supplies and spare parts?
 - C. Seasonal fluctuations in the business?
 - D. The time required to liquidate credit sales to customers and bad debts?
 - E. The period necessary to get the plant into production?
 - F. Cash required to amortize its principle loans?
3. If the economy is in a period of inflation, has full allowance been made for the influence of rising prices and wages on the cost of the project and on working capital requirements?

SHORT TERM BANK CREDITS

1. Has it been possible to make arrangements with local banks to finance short-time working capital requirements of the business?

FINANCIAL PLAN

1. Has a definite plan to finance the project been worked out?
 - A. Is sufficient capital available locally?
 - B. If not, what is the plan to obtain the required capital?

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Chicago 6, Illinois

Chemistry of Leather Manufacture

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330 West 42nd Street
New York 36, New York

Periodicals

Leather Manufacturing

Shoe Trade and Publishing Co.
683 Atlantic Avenue
Boston 11, Massachusetts

Leather and Shoes

Leather and Shoes
300 West Adams Avenue
Chicago 6, Illinois

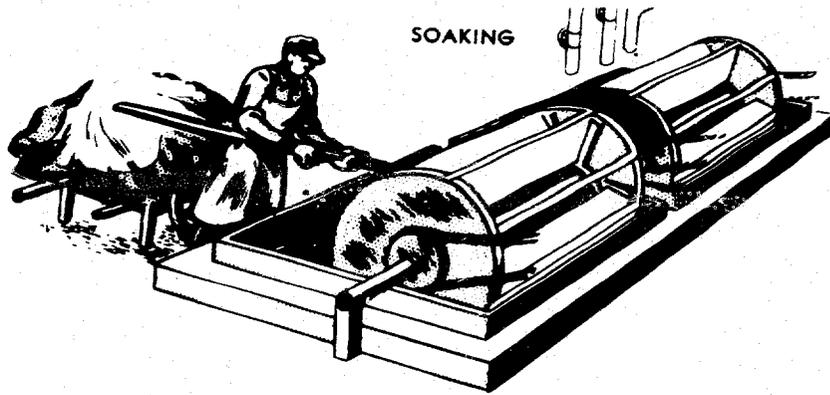
ABBREVIATIONS

' Foot or feet

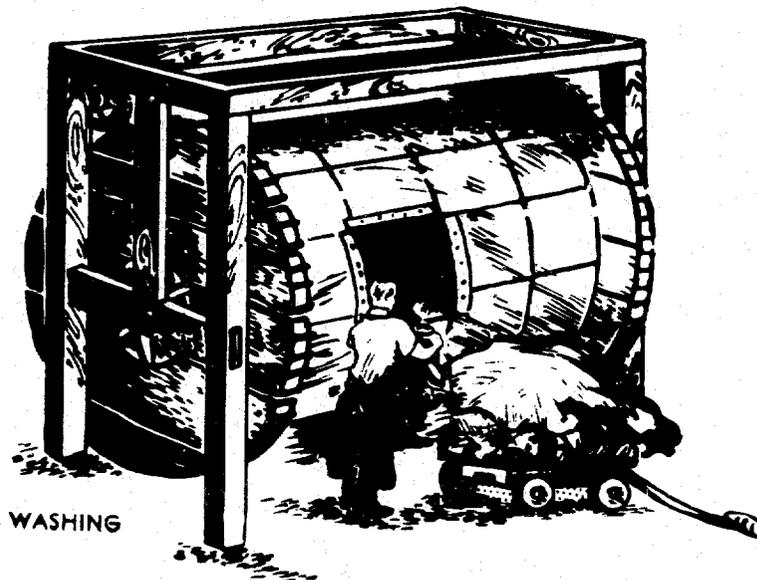
" Inch or inches

‰ Percent

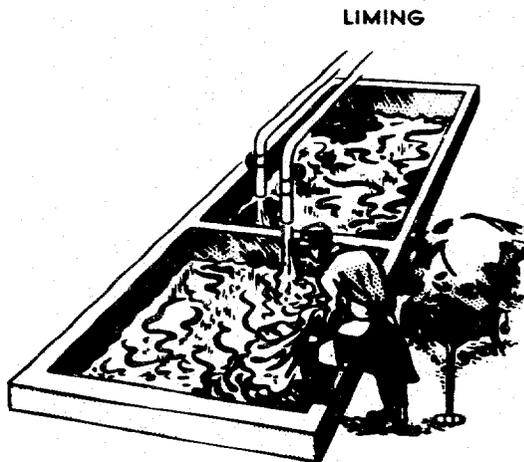
sq. ft. Square foot or feet



No. 1



No. 2

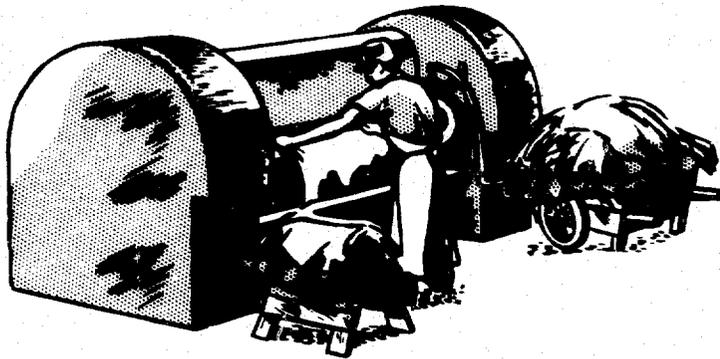


No. 3

UNHAIRING

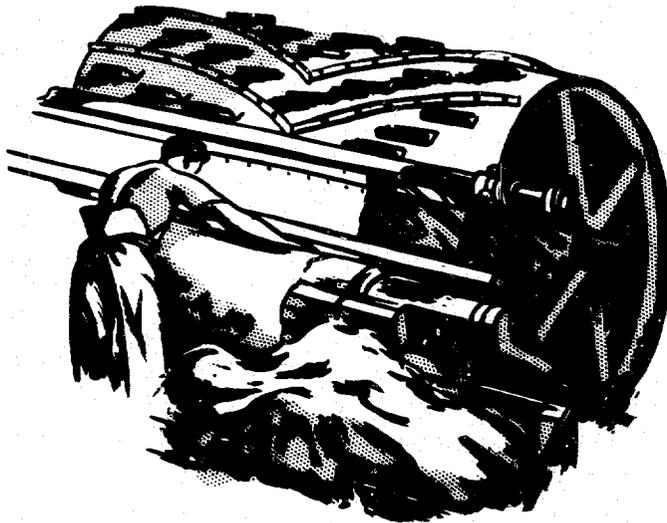


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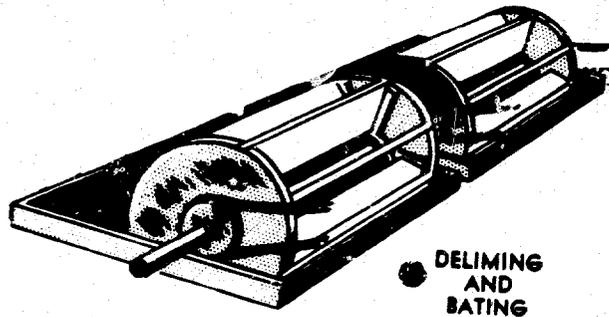
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MACHINE FLESHING

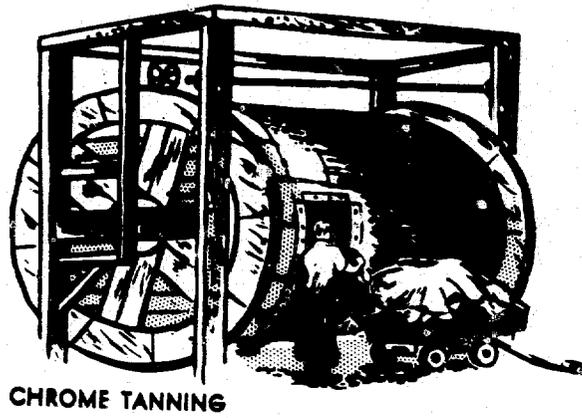


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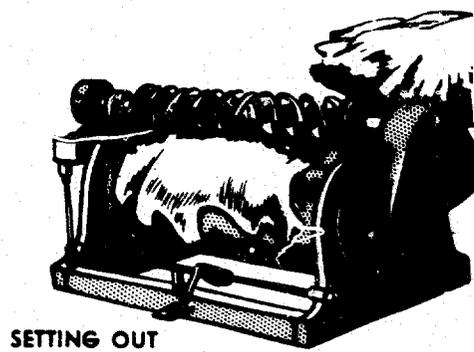
SCUDDING



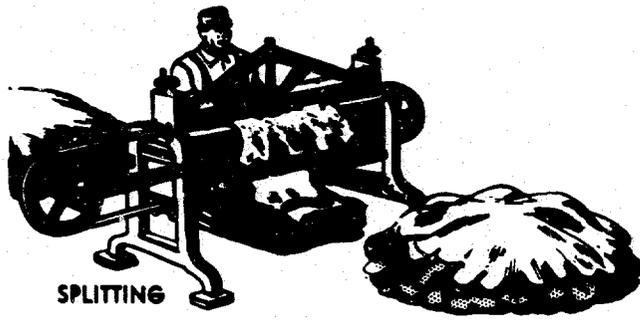
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No. 8



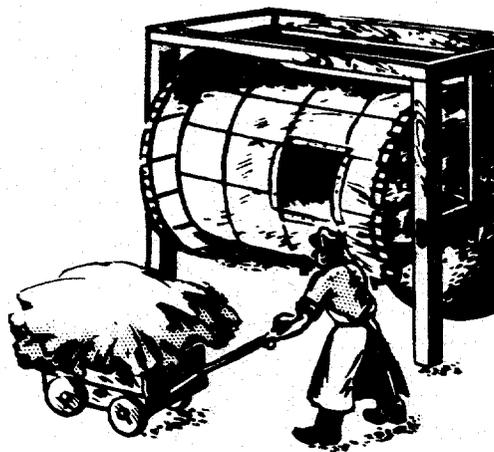
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No. 10



No. 11



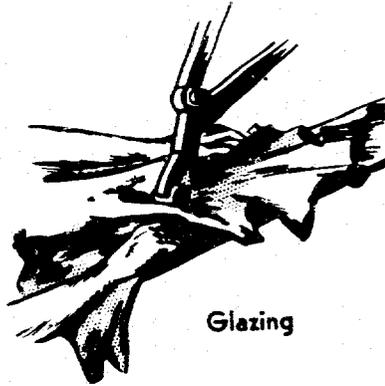
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FATLIQUORING AND
DYEING



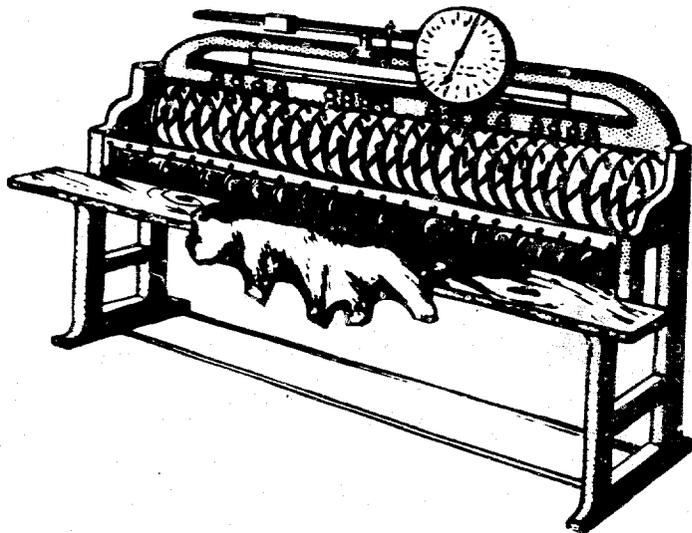
No. 13.

STAKING



No. 14

Glazing



No. 15

Measuring

INTERNATIONAL COOPERATION ADMINISTRATION
SERVICES OF THE
INDUSTRIAL TECHNICAL COOPERATION PROGRAM

TYPE III - TECHNICAL AIDS FOR OVERSEAS

● INDUSTRIAL REPORTS SERVICE

Provides basic information regarding:

1. Data and reference materials relating to private capital mobilization and its application in economic development.
2. Requirements for establishing and operating small factories in basic industries.
3. Man-hour requirements, operational characteristics, and equipment utilization in representative U. S. factories in selected industries.
4. Man-hour and materials savings through standardization, simplification, and specialization studies.
5. Supervisory and other specialized training procedures and techniques.
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● TECHNICAL INQUIRY SERVICE

Provides answers to individual questions relating to products, processes, machinery and equipment, production operations, work techniques, management practices and concepts, factory engineering, and basic requirements for industrial production.

● TRAINING MATERIALS SERVICE

Provides basic materials for use by specialized technicians in the conduct of management, supervisory and specialized training courses in host countries.

● TECHNICAL LITERATURE SERVICE

Provides recommendations and guidance regarding current useful world-wide publications relating to industry and productivity improvement; distributes carefully selected and representative new publications of particular value for program use; and facilitates mission literature procurement.

● U. S. BOOK EXCHANGE SERVICE

Provides, on Mission approval, technical and scientific books and periodicals on exchange basis to overseas libraries.

● VISUALS AND NEW MEDIA

Provides technical advice and guidance to missions on new industrial visuals. Provides for cooperative program adaptation and use a variety of visual materials, including loan exhibits, silk-screen display panels, graphic brochures, slide and sound kits, and related materials.

● TECHNICAL FILM SERVICE

Provides guidance for and facilitates procurement of U. S. technical and training films for program use; provides representative U. S. technical industrial films and filmstrips on loan basis for short-term program requirements; and facilitates adaptation of films into foreign language versions for program use overseas.