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ASSISTANCE IN VEGETABLE TANNING OF GOAT SKINS

SI/JAM/85/801

JAMAICA

Technical report: Small scale goat skin tanning*

Prepared for the Government of Jamaica
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Alfred Lesuisse, Tanning expert

United Nations Industrial Development Organization
Vienna

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Explanatory Notes

References to Jamaican dollars (JAM $) are on the exchange rate beginning December 1985 at 5.4 JAM $ for one U.S. $.

The following abbreviations are used in this report :

JIDC : Jamaica Industrial Development Corporation
FIDCO : Forest Industries Development Company Ltd.
TJ : Things Jamaican

Mention of firm names and commercial products does not imply endorsment by the United Nations Industrial Development Organization (UNIDO)

ACKNOWLEDGMENTS

The expert acknowledges with many thanks the excellent assistance of the manager and staff of Things Jamaican. Special thanks are expressed to Mr. Fitzroy COLE, training coordinator, to Mrs. Jasmine DWYER, coordinator in Mandeville and to Mr. Shevard HENRY who assisted him in the practical work.

CONTENTS

SUMMARY

The objectives of project SI/JAM/85/801, "Assistance in the Vegetable Tanning of Goat Skins" are

(a) Development Objectives :
The long-term objective of the project is to assist the tanning industry of Jamaica in the better utilization of domestic resources by improving the quality and quantity of finished goat leather supplied to the local leather footwear and leather goods industry.

(b) Immediate Objectives :
The immediate objective is to provide artisanal goat skin tanners with on-the-spot guidance on how to upgrade their traditional methods of vegetable tannage so as to achieve the quality level required to strengthen their position in the market.

The project was approved on 25 February 1985 and the expert took up his duties on 18 August 1985 for a duration of two and half months. The project was extended by 1.7 month at the end of October 1985.

During the term of the mission training and assistance were given to existing small scale tanners and to "would be" tanners. Notable improvment of the traditional tanning methods was obtained and new tanning techniques as well as quality control methods were taught. Two small scale units started operation at the end of the mission.

In order to ensure continuity, there is a need for follow up and assistance to improve the quality of the raw material and the collecting of goat skins, to develop the local vegetable tanning materials, to help in supplying of chemicals and technical supervision.

INTRODUCTION

The livestock of Jamaica is not large. The raw goat skins available are not sufficient to sustain an industrial tannery but can feed artisanal units disseminated over the island and using mainly local vegetable tanning materials.

There is a market for various types of vegetable tanned goat leather. Artisanal units producing sandals or light footwear or small leather items for local consumers aswell as for tourist are good customers for leather produced in artisanal tanneries.

To improve the processing methods in small scale tanneries, to promote simple quality control and to widen the range of types of finished leathers a tannery expert was fielded for 4.2 months to carry out the following activities :

(a) assess the tanning techniques presently applied, chemicals used, main characteristics of leather produced, most common faults/defects ;

(b) in co-operation with counterparts arrange and conduct a training seminar on better preservation, tanning and especially finishing methods suitable for artisanal workshops with the tools, equipments and chemicals available to them ;

(c) provide extension services and on-the-spot advice, especially in finishing techniques ; demonstrate proper preparation of chemical solutions, pH and liquors concentration control ;

(d) provide the tanners with reference lists of basic parameters to be controlled.

The Government counterpart Agencies were initially Jamaica Industrial Development Corporation (JIDC) and Small Business Association (SBA). In fact the Counterpart Agency was Things Jamaican Ltd. (Annex 1)

During his mission the expert gave four training courses; one in Kingston, one in Montego Bay and two in Mandeville.

He also prepared a manual on goat skin tanning and provided assistance and guidance to tanners, occasionally to leathergoods manufacturers.

In the course of the project, one local tanner made a determined effort to raise its quality standards and two new tanners started operation.

Processing of new types of leather were demonstrated together with demonstration of the proper way of preservation.

Use of densimeter, pH papers, indicators, weighing scale and measuring cylinders were taught.

Unfortunately, trials with other local vegetable tannins and the making of fleshing knives were not possible due to lack of time, materials and equipments.

1. THE JAMAICAN LEATHER INDUSTRY

1.1. Tannery

There is only one industrial upper leather tannery on the island. The production capacity of the tannery is between 300 to 500 cattle hides per day, but due to the scarcity of hides the daily production ranges around the 100 hides par day. The tannery could also produce about 7,000 goat skins per week but the production is sporadic and reaches with difficulty 1,000 skins per week.

There are two mechanized sole leather tanneries with an output of small quantities of vegetable tanned sole leather. Most of the equipments and machines of those tanneries are idle or out of order.

There are a few goat skin tanners using primitive tanning methods with very simple tools and locally prepared tanning materials. (Annex 2 and Chap.3)

1.2. Footwear

There are several shoe factories producing all the range of footwear from leather shoes to sport and safety boots. As the local upper leather production cannot respond the demand of the shoe industry in quantity, type of leather and quality, upper leather must be imported. In addition most of the components which go into footwear manufacture must also be imported.

For the time being, the Jamaican shoe industry is facing big difficulties due to import of shoes.
(in 1984, 3.8 million JAM $ for legal imports and 21.8 million for illegal imports)

There are also artisanal shoe makers producing sandals with woven uppers, light footwear and slippers.

1.3. Leather goods

Many small units are producing leather items ; wallets, bags, belts, etc. Most of those leather goods are in vegetable tanned leather and carved.

Some small factories are making lady handbags and other leather items in chrome tanned and dyed leather, also more fashion articles and combinations of leather with fibers or textile.

If the design is acceptable, the quality of stitching and edge finishing is generally poor.

2. AVAILABILITY OF HIDES AND SKINS

2.1. Cattle

According to the statistics of the Livestock Association there are 300,000 bovine animals on the island.

The slaughterings were in 1983 10,854 in Kingston and 57.178 in the Parishes. This gives a theoretical disponibility of 68,237 hides for the tannery. Unfortunately, an important part of the cattle hides is processed into food, mostly in the small abattoirs where the weekly slaughterings are around 5 to 10 animals. As there is no control of the commercialization of the by products, an evaluation of the quantity of hides processed into food is difficult. As long there is demand for it hides are going into food and only the surplus goes to the tannery. This for a simple economic reason, a cattle hide is sold at 150 JAM $ for food and 15 to 22 JAM $ for the tanner.

Except for one breed, the Jamaican Hope (crossing between Indian and Jersey) which is not li by ticks, all the other cattle have many ticks defects. In addition the flaying and preservation are very bad.

2.2. Goat skins

The statistics of the Livestock Association give an evaluation of 300,000 goats with a ratio of slaughter of 30% or 90,000 skins per year. The registered slaughterings for 1983 were 5,697 goats in Kingston and 40,092 in the Parishes. The evaluation of non declared slaughterings is around 45,000 goats.

In the rural areas most of the skins are not collected and dumped or buried. The Muslim community, for instance slaughters at home avoiding contact with non Muslim butchers, all those skins are distroyed.

The price of the fresh skin is between 1 and 1.5 JAM $ per piece. Salted or dried skins are sold 2 to 2.5 JAM $ per skin.

Because of the dissemination of home slaughterings, the low value of the skin and the necessity of preservation, the collecting is difficult and could only be profitable if combined with an other activity.

The quality of the skin structure is generally good. Natural defects, wounds and scratches are frequent. Goats of urban areas have many ticks and as result of itching many scratches and scars. There are less ticks on the goats of rural areas. The goats tied up with a rope show a scar which becomes a big hole in the neck of the skin (2-3cm).

To be slaughtered the goats are hanged by the back legs while still living and then sticked. The butcher starts flaying before the end of the convulsive movements of the animal causing uneven ripping and cuts or holes in the bellies. Once the bellies are flayed the skin is pulled of by hand sothat there are no flaying defects in the butts.

The skins are not trimed causing a fast putrefaction mostly in the anus and sexual parts.

The preservation, generally by salting followed by drying is poor.

As the country is green, the goats have always enough food even during the dry season and only adult animals are killed. In the Nubian breed, skins have 6 to 8 squre feet.

3. THE SMALL SCALE TANNERS

The two small scale goat skin tanners are artisans with many years practice. They process without machines batches of 30 to 50 skins in 200 litres barrels. After soaking without changing of water, they unhair in lime with a small addition of caustic soda. The lime bath is used many times and reinforced. It is only when the bath is to dirty and bad smelling or when the skins start to destroy that a new bath is prepared. Scudding and fleshing are done on a beam with a machette. After deliming with amonium sulfate (fertilizer) the tanning starts without bating or pickling. The skins are laid flat in barrels and covered with tannin solutions of increasing density. The skins are tanned after 4 to 5 days, if they are to dark they are bleached with oxalic acid while fatliquoring. As the finished leather is sold by weight there are no stretching or setting out. After drying the skins are staked on a wooden stake and glazed with the bottom of a bottle filled with sand.

The finished leather is uneven in color, has a bad smell and is sometimes hard. The shape of the skins is irregular and the fleshside rough.

The process is to fast to make good and clean leather. The appearance must be improved and also the shape stability to have a finished leather with a minimum of elongation.

The work conditions and environment need also to be changed, it is indeed mostly probable that the young generation will not accept to work further in such dirty and bad smelling conditions.

4. THE LOCAL VEGETABLE TANNINS

The two used tannins are mangrove and divi-divi.

There are two kinds of mangrove : the red and the black. Both give leather with dark color. On the other hand, the divi-divi gives a light brown color nearly yellow, sothat the mixture of the two extracts gives a medium brown natural vegetable color to the leather.

The mangrove trees of the genus Rhizophora or Bruguiera and nammed Avicennia nitida grow in the swamps near the sea. The bark of the mangrove tree grows to a given thickness and starts to peel of the tree. At that time it contains the highest quantity of tannin (16-50%) and it must be harvested. If not the bark looses his tannin what can be observed on the water becomming brown around the tree, rain will fasten the lost of tannin. The bark grows again in a period of 5 years.

The divi-divi tree, Caesalpinia coriaria, gives curled pods containing tannin (25-50%). The green pods are drying on the tree and become black, they must be plucked in that state. The rain and the humidity of the soil will wash out the tannin of the pods fallen from the tree.

There is no organized harvesting of bark or pods, this is only done on request of the tanner without loocking for regrowing or maintenance of the trees.

Other species contain also tannin like pimento leaves, pine bark and wood or bark of a Syncona Wattle tree.

For the leaching, the bark and pods are covered with water in a barrel. In the best conditions an extract of density 4° Baumé is obtained after 7 days. By ageing fermentation starts and a big amount of sludge is generated causing the loose of pure tannin.

5. ACTIVITIES

5.1. Training courses

Four training and demonstration courses were given :

(i) Kingston 26 August - 13 September
17 participants (Annex 3)
production 8 skins

(ii) Mandeville 16 September - 27 September
22 participants (Annex 3)
production 20 skins

(iii) Montego Bay 2 October - 11 October
16 participants (Annex 3)
production 8 skins

(iv) Mandeville 12 November - 5 December
6 participants (Annex 3)
production 20 skins

The program of the three first courses was :

- goatskin defects
- better way for flaying and trimming goat skins
- preservation of goat skins by salting
- Some theory on chemistry :
  - skin chemical and physical composition
  - acidity and alkalinity
  - pH and indicators
  - density of liquids and Baumé
  - temperature
  - swelling phenomena
- beamhouse operations
  - soaking
  - liming and unhairing
    in lime - lime + sodium sulfide - painting
  - scudding and fleshing
  - hair saving, washing and drying

- deliming
- bating
- pickling

- Tanning
  - vegetable tanning with mangrove and divi-divi
  - vegetable tanning with syntan pretanning
  - vegetable tanning with syntan retanning
  - syntan tanning
  - chrome tanning (wet blues)
  - tanning of parchmen leather
- bleaching of vegetable tanned leather
- fatliquoring of vegetable and syntan tanned leather
- drying and finishing of vegetable and syntan tanned leather
- how to sell leather by area. Importance of stretching, setting out and toggling on the yield
- work organization and price calculation

The last course in Mandeville was more practical and included dyeing of vegetable and chrome tanned leather.

5.2. Lay-out of a tannery in Mile Gully
list of equipments, chemicals and work program.
preliminary costing
Lay-out of a tannery in May Pen

5.3. Leaching trials with pine bark

After four soaking in succession a sample of pine bark gave an extract of 2.5 Baumé. That bark came from a sawmill of FIDCO and was taken after a weekend of heavy rains. There is a probability that fresh bark coming straight from the tree would give more tannin.
The Director of FIDCO promised other samples.

5.4. Tannery Tools

To replace the bottel filled with sand which gave uneven glazing, glass slickers were made with thick mirror glass. Toggling nails were also produced.

An attempt to make a fleshing knive with a mechanical saw blade was not succesful because, despite the instructions and drawings the handles were welded to the blade that broke after few hours in work. Recommendation was to fix with rivets two wooden handles.

5.5. Publications

A manual on "Small scale Tanning of Goat skins" was drafted for distribution among the participants of the training courses. A short guide for skin collectors was also prepared.

6. CONCLUSIONS

The local resources in goat skins are not important enough for an industrial tannery but are sufficient to give raw material to small scale tanners located in different parishes of Jamaica.

A small scale tannery (25 to 50 skins per day) can give welfare to a family and work for three to four workers. In addition, the tanner will create an upstream activity for the skin collectors and tannin producers and a downstream activity for leather transformers.

If little can be done with efficiency from the tanners side to improve the animal husbandry, to reduce the natural and slaughtering defects of the skin, the tanner can promote the collecting of hides and improve the preservation.

Local vegetable tannins can be used, but harvesting of bark or pods must be organized to avoid lost of tannin and to make sure that there will be enough in the future. The efficiency of the leaching must also be improved.

The traditional tanning methods must be modified by using better tools like a fleshing knive instead of the machette, it will give a better fleshing and a cleaner fleshside to the finished leather. The use of a glass slicker instead of a bottle will also give better results. Tanning in pits will give more even color to the leather and setting out a smoother grain and a better yield in area.

If a market for hair can be found, saving and treatment of the hair could be profitable.

There is a need for diversification of the traditional vegetable tanned leather. It can be used for tooling and carving and to make typical exotic items.

Those leather goods have a limited market and already now the transformers are asking other types of leather to make more fashion goods. This means an evolution in the technolgy of tanning and finishing, the introduction of mineral tanning and of dyeing.

Despite the low availability of skins the production of wet blue for export is not to exclude.

The small scale tanners need assistance and guidance. Well supported they may move to a higher level.

7. RECOMMENDATIONS

7.1. As further action, to give a follow-up and to keep profit of the present assistance, a local organization should take in charge the promotion and guidance of the local small scale tanners.

Things Jamaican could be the agency to do it.

7.2. There is a need to promote and organize the collection of skins and to improve their preservation.

Beside the valorization of a local natural product, collecting and preservation can be a profitable side activity.

7.3. In spite of the low value of local vegetable tannin, the harvest of bark and pods should be organized to assure a good yield of tannin recovery and to avoid endangering of the species.

Research on the presence of tannin in other trees should be encouraged.

7.4. Some chemicals must be imported (Annex 4) it is recommanded that Things Jamaican should import them to sell them back to the small scale tanners.

7.5. Cleaning and finishing of the flesh side of the skins will remain a problem as this can only be done with a shaving machine. The cost of such a machine is to high to be amortized on productions up to 50 skins per day. (Annex 5)

In the future, the purchase and use in service of a shaving machine could be considered.

ANNEX 1

THINGS JAMAICAN LTD

Things Jamaican Ltd is the Public Sector Corporation responsible for development of the handicraft industry of Jamaica.

The objects for which the Company is established are namely :

- to organize craft development in Jamaica,
- to promote craft work through research, production and marketing of craft goods with a Jamaican characteristic,
- to act as agents for vendors or purchasers of Jamaican craft goods,
- to provide persons in the business of manufacturing or dealing in Jamaican craft goods with :
  - assistance in acquiring financing, desings, material and other facilities for manufacturing or dealing,
  - information and advice on techniques of production and on identification of markets,
  - any services ancillary to such business
- to train persons in the skills of Jamaican craft goods manufacture and/or to promote such training by other institutions,
- to promote by any and all means of publicity an increase in demand for Jamaican craft goods.

The Company is a private Company with a majority of the shares in hands of the Government.

The Development section of Things Jamaican is financed by the Prime Minister Office, the Commercial section is autofinancing.

ANNEX 2

THE JAMAICAN TANNERIES

1. Tanners Limited — 259 Spanish Town Road, Kingston 11

Tanners Limited is part of the ALKALI Group
The other companies of that group are :

- Leather Sales Ltd
- Leather Mode Ltd (shoes and leathergoods)
- Industrial Chemical Co Ltd
- Alkali Ltd
- Caribbean Exporters Ltd

2. Sole Leather Tanneries

- Broadway Tanners Ltd — Spanish Town Road, Kingston 11
- Oates Tannery — St Thomas Road, Bull Bay

3. Small scale Tanneries

- Mr. Clarence Henry — Coffee Crescent 2, Olympic Gardens, Kingston 11
- Mr. Clarke

ANNEX 3

LIST OF PARTICIPANTS

1. Course in Kingston

Training Coordinator : Mr.F.Cole Things Jamaican
Training Officer : Mr.Ch. Watson Things Jamaican

Mr. P. Bodden -	Head Leather Dept. Things Jamaican
Mr. Cl. Henry	Tanner
Mr. Sh. Henry	Tanner
Mr. Ch. Mullings	Tannery worker
Mr. K. Wilson	Tannery worker
Mr. Ch. Henry	Tannery worker
Mr. M. Green	Tannery worker
Mr. C. Letford	Things Jamaican
Mr. C. Brown	Things Jamaican
Ms. A. Wright	Things Jamaican
Ms. M. Robinson	Things Jamaican
Mr. E. Lindsay	Things Jamaican
Mr. L. Thompson	Tannery worker
Mr. W. Williams	Footwear and Leather Craft representative of Small Business Association
Mr. P. Harvey	Things Jamaican

2. Course in Mandeville

Training Coordinator : Mrs. J. Dwyer

Mr. B. Brown
Mr. C. Clarke
Mrs. D. Cowan
Mr. D. Davy
Mr. O. Ellie
Mr. D. Francis
Ms. E. Grant
Mr. L. Hylton
Mr. M. Hall
Mr. L. James

Ms. M. Jackson
Mr. A. Lewis
Mr. S. Morgan
Ms. V. Millwood
Mr. R. Patterson
Mr. R. Pitter
Mrs. S. Porteus
Mr. A. Powell
Mr. C. Rowe
Ms. E. Rodney
Mr. D. Walters

3. Course in Montego Bay

Training Coordinator : Mr. R. Lawrence
The course was introduced by Dr. Kenneth Baugh, Minister of Health.

Mr. W. Drummond
Mr. L. England
Ms. B. Smith
Mr. D. Clarke
Mr. L. Campbell
Mr. M. Hosling
Mr. B. Dunston
Mr. A. Beckford
Mr. M. Robinson
Mr. M. Smith
Mr. M. Campbell
Mr. K. Besley
Ms. J. Davis
Mr. O. Johnson
Mr. P. Pyke
Ms. V. Da Costa

4. Course in Mandeville

Training Coordinator : Mrs. J. Dwyer
Mr. A. Lewis
Mr. E. Whyte
Mr. B. Beverley
Mr. A. Allen
Mr. O. Rowe
Ms. Y. Laing

ANNEX 4

CHEMICALS TO BE IMPORTED

Sodium sulfide Na_2S in flakes 60%

Bating agent, type Oropon Rohm and Haas Philadelphia USA

Chrome salt : basic chromium (III) sulfate, type Chromosal Bayer or Chromitan BASF

Syntan : vegetable replacement tanning agents, type Tanigan Bayer, Basyntan BASF or Trutan A.J. Pillar Newark N.J.

Fatliquor : sulfonated fish oil

Dyestuffs : anionic dyes for leather

Oxalic acid

ANNEX 5

COST OF SHAVING MACHINE

for reconditioned machines :

from Moenus-Turner Germany Type 304 450 mm width
36,250 German Mark at 2.1 = 76.125 JAM $

from Maziak-Norris England Type 603 600 mm width
7,641 Pound Sterling at 7.8 = 59.600 JAM $

from Glenk Germany Type 304 450 mm width
21,000 German mark at 2.1 = 44,100 JAM $
+ 1,695 US $ seafreight at 5.4= 9,153 JAM $
53,253 JAM $

ANNEX 6

1. Lay-out of tannery in Mile Gully

A first lay-out was made for location near an existing building which could be used for office, warehouse and finishing room. A drying room was to be set up at the back of the building.
Using the inclination of the land site, a store room for bark was located under the drying room, followed by the tannery and at the lowest part the beamhouse. This was very convenient for discharge of waste water. Between tannery and beamhouse there is an existing water tank. (fig.1 and 2)
Because of proximity of the street, the location of the tannery was changed near an other existing building at the back of the propriety. A new lay-out was prepared. Figure 3 shows the proposal to put in the existing building a store room for bark (1), a warehouse for finished leather and office (2), a storeroom for chemicals (3) and for skins (4), a finishing room (5) and a drying terrace (6).
Proposal was made to build a shed at the back of the building near an existing water tank to shelter the tannery with 6 leaching pits 0.7 X 0.7 X 1 m. , 6 tanning pits 1 x 1 x 1 m. and a working area.
At the other side of an existing soak away pit it was suggested to put the beamhouse with 6 soaking and liming pits 1 x 1 x 1 m. and working floor.
A shaking device for pits was drafted. The equipments are described in Annex 6.

The fitting of the existing building and construction of two sheds, pits and floor was estimated at 30,000 JAM $.

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first lay out for tannery in Nile Gully

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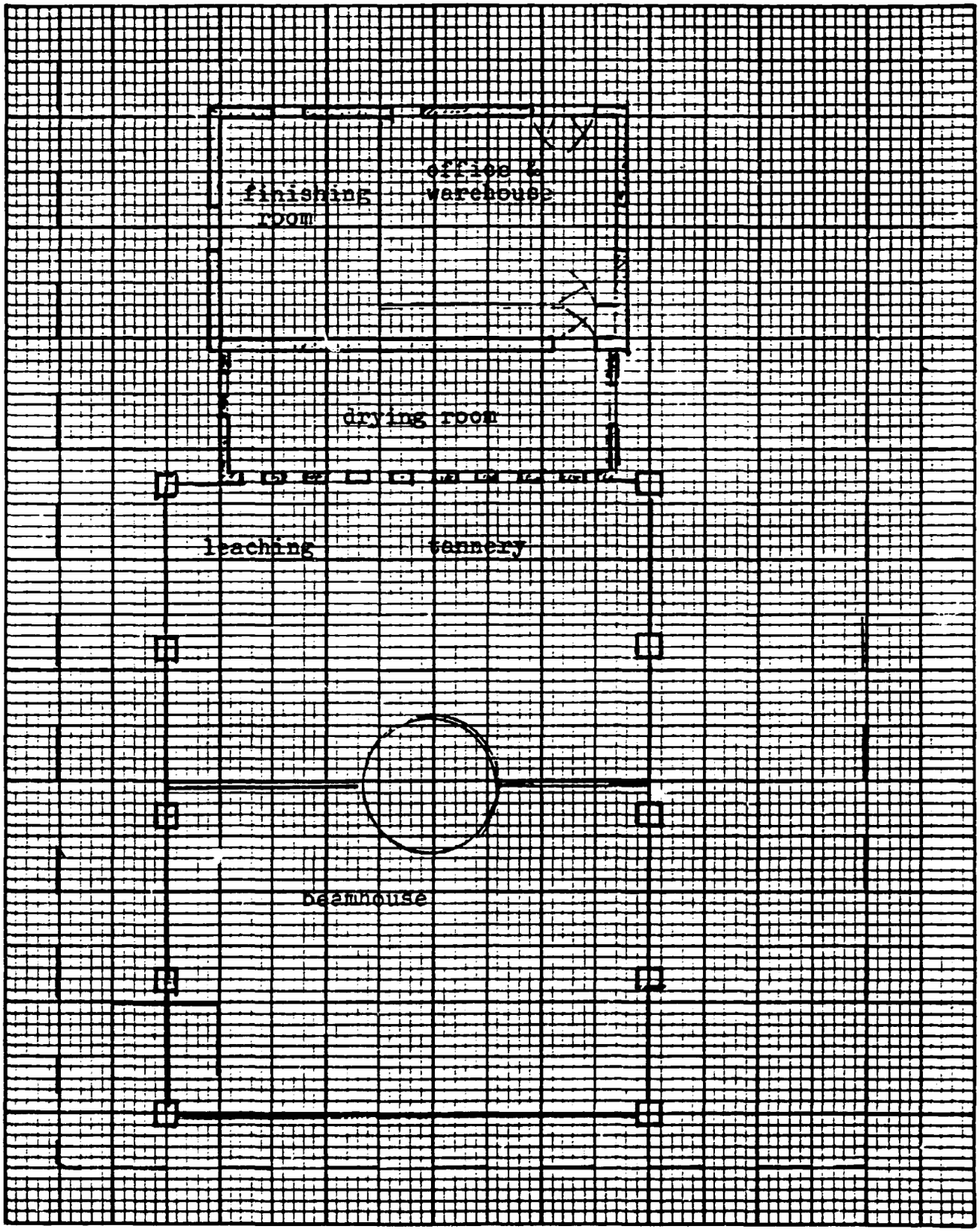

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first lay out for tannery in Mile Gully

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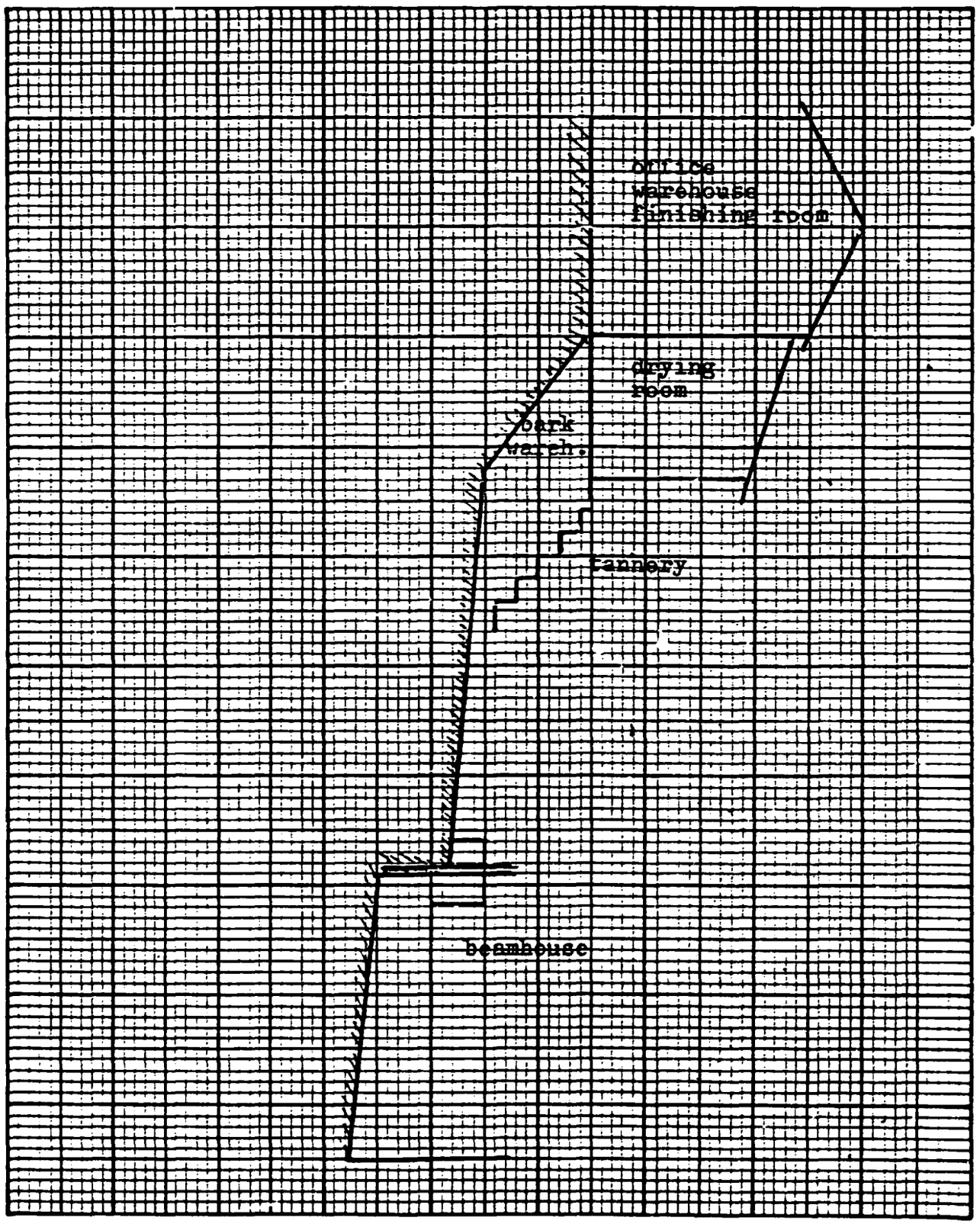

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Second lay out for tannery in Kile Gully

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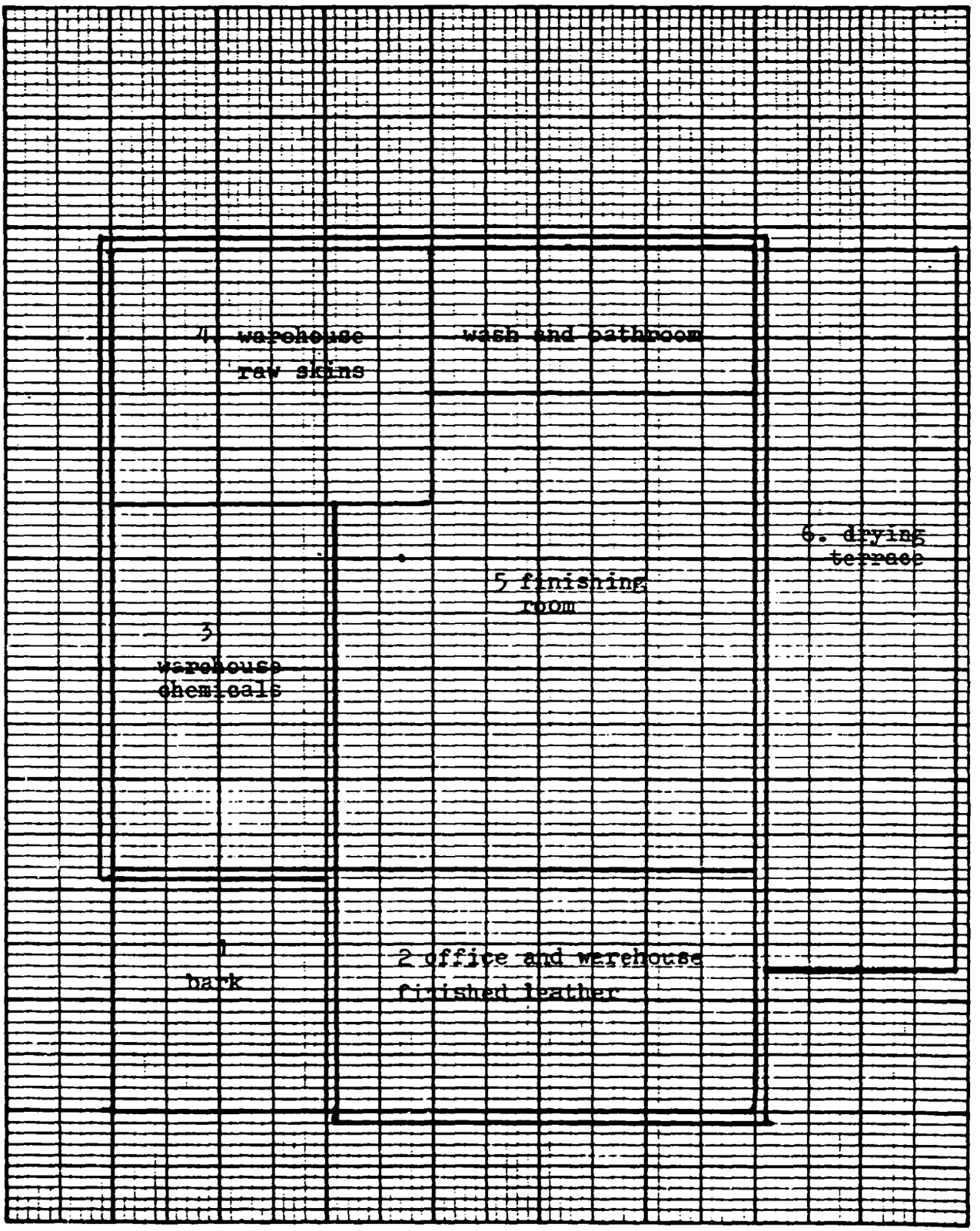

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Shaking machine for pits

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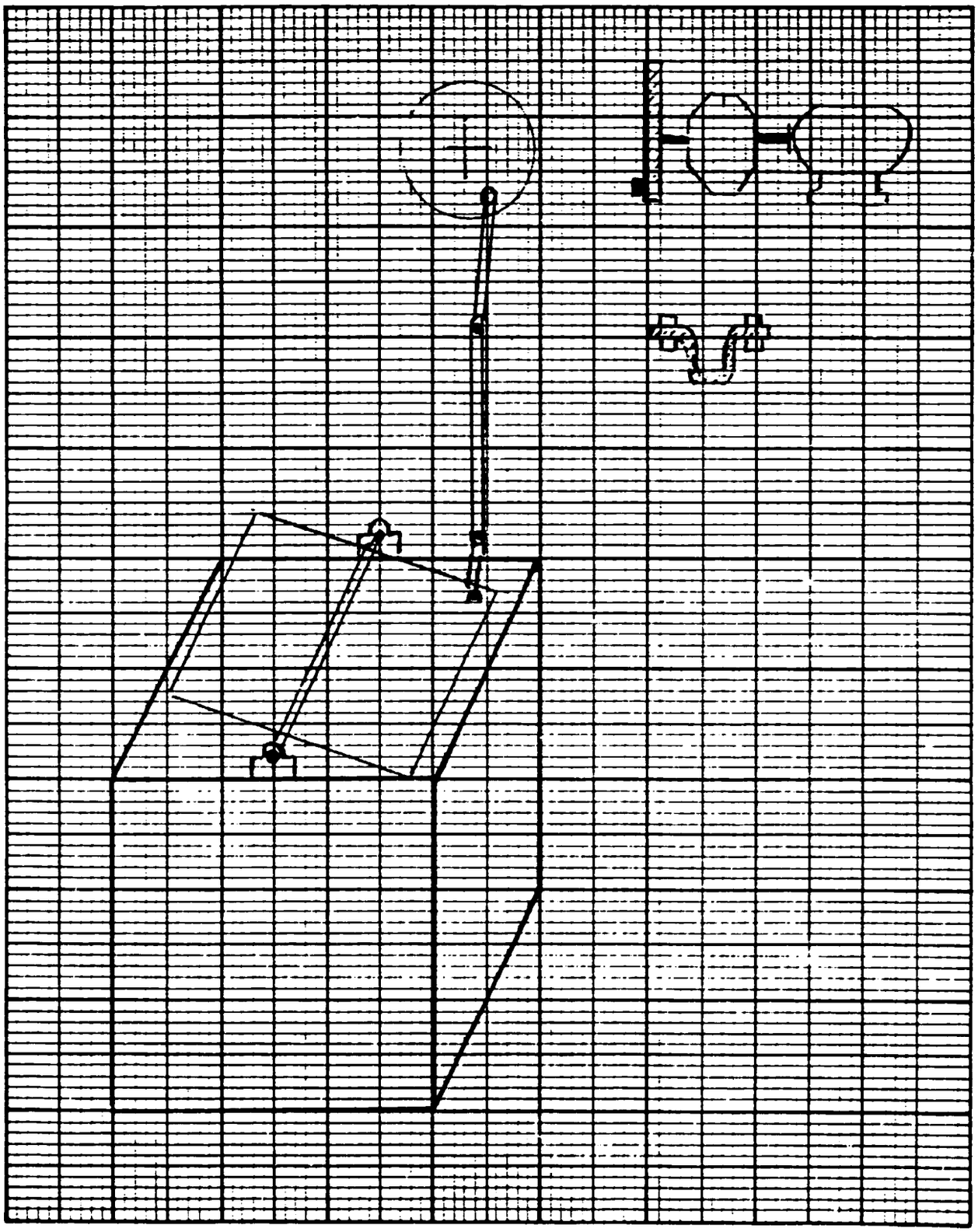

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2. Lay out for tannery in May Pen

A lay out was prepared for the tannery of Mr. James. Here also there was an existing building that could be used for storage of skins (1) and finishing room (2) fig 5.

To reduce the cost of first investment and as the piece of land selected for the tannery is big enough to allow further extension it was decided to start with a small construction being a nucleus around which extension is possible.

Six beamhouse pits and six tanning pits were build with a very small working area in between.

During the first months of activity leaching will be done in barrels.

Later on the working area can be transfered at the other side of the pits allowing a good separation between beamhouse and tannery.

The cost of building, roof and pits is estimated at 10,000 JAM $.

Lay out for tannery in May Pen

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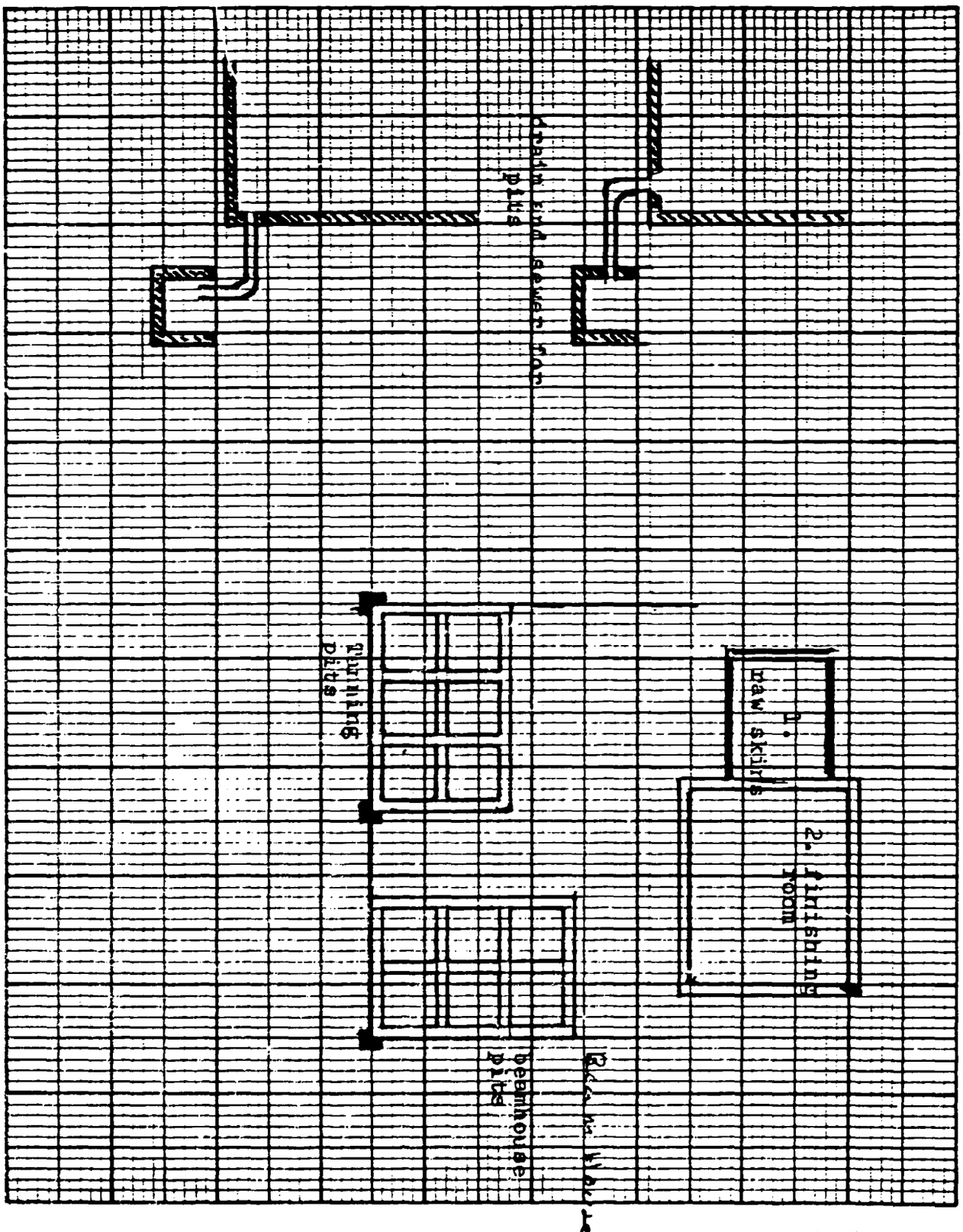

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ANNEX 7

SMALL SCALE GOAT SKIN TANNING

1. INTRODUCTION

The goat skin is a valuable raw material which can be transformed into beautiful leather.

Goatskin leathers are used for footwear, for leather goods and garnments.

Some skins may also be tanned with the hair.

This booklet is intended for small scale tanners operating without machines a production of 25 to 50 skins per day.

2. TANNERY LOCATION

The following factors have to be considered when setting up a small scale tannery :

- Availability of raw skins
  These should be available from sources as near as possible to the tannery.
- A suitable water supply
  large quantities of water are required,
  the water should be soft, sterile and iron free.
- effluent disposal facilities

3. SKIN PRESERVATION

If not protected and left in a warm and wet climate, the skin will soon start to putrify (bacterial attack) and will loose its value.

There are three ways to protect the raw skin :

- by salting
- by drying
- by combination of salting and drying

The preservation must be done quickly and efficiently after slaughtering, in between a few hours and in each case the same day.

The first symptoms of bacterial attack are loosening of the hair followed by discoloration of the flesh side and bad smell.

When the skin has been removed, wash out the blood if any with cold water, cut the remaining flesh or fat and trim.

Trimming (see fig.1) cut the sexual parts (1-2), the legs at the knee (3), the neck (4), the anus (5), the navel (6) and the tail (7).

3.1. Preservation by salting

The skin is spread out, flesh side up, on a concrete floor covered with a thin layer of salt.

The skin is well sprinkled with common salt.

An other skin is spread on the first one and also sprinkled with salt. This is repeated to make a pile of skins up to a hight of not more than 50 cm.

Coarse or round grained salt is preferable to fine salt, as the former spreads better, while the latter forms patchy wet cakes.

3

TRIMMING

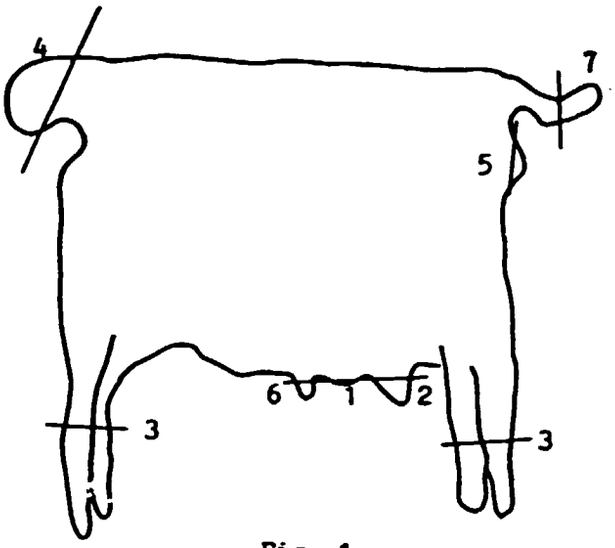

Fig. 1

1. scrotum or
2. udder
3. legs at the knee
4. neck
5. anus
6. navel
7. tail

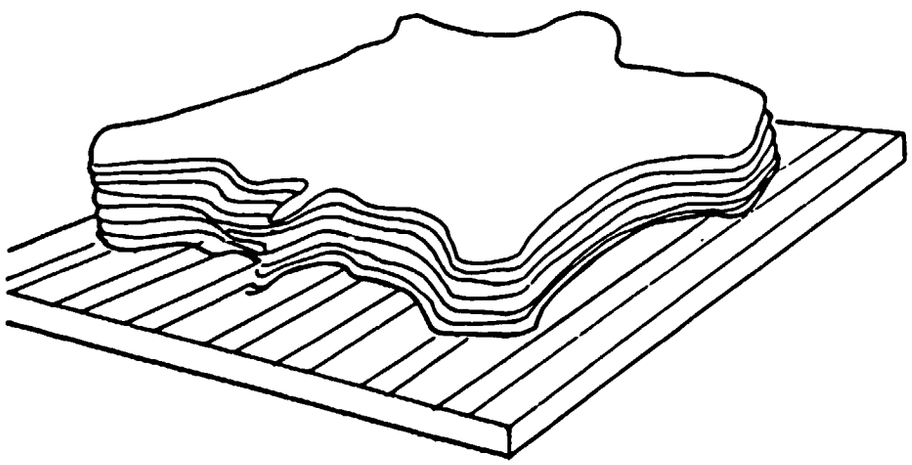

Fig. 2

After two days the salt dissolves in the moisture of the skin and the brine drains out.

Transfer the skins to a wooden platform (fig.2) and sprinkle a new layer of salt.

The total amount of salt shall be 50% of the weight of the skin.

If stored in a cool and well ventilated room the skins can be kept, in hot climate, for more than one month.

3.2. Preservation by drying

The skins are hanged along the backbone line, flesh outside, on a wire or on a wooden pole. The skins are stretched like a tent to have good contact with the air and to avoid folding. After two or three days the drying is completed by laying the skins flat on the floor hair upwards.

The drying place should be well ventilated and in the shade.

To become very flat material, the skins are put and stretched on a frame (fig.3)

Never dry in the sun. Drying in the sun gives overdried skins, difficult even impossible to rewet by the tanner.

3.3. Preservation by salting drying.

After salting (like in 3.1.) The skins are dried on a wire or on a wooden pole, flesh outside in the shade out of the sun.

This is a good method of curing in tropical countries.

3.4. Storage of skins

Skins should be stored in dark and well ventilated room and maintained as cool as possible.

Fumigation or sprinkling the hair of the skins with Mann Powder shall protect from insects.

Mann Powder is a mixture of :

100 parts of gammahexane or DDT
900 parts of talc or Kaolin

3.5. Note

Salted (3.1.) and dry/salted (3.3.) skins are easier to soak and to rewet than dried skins (3.2.).

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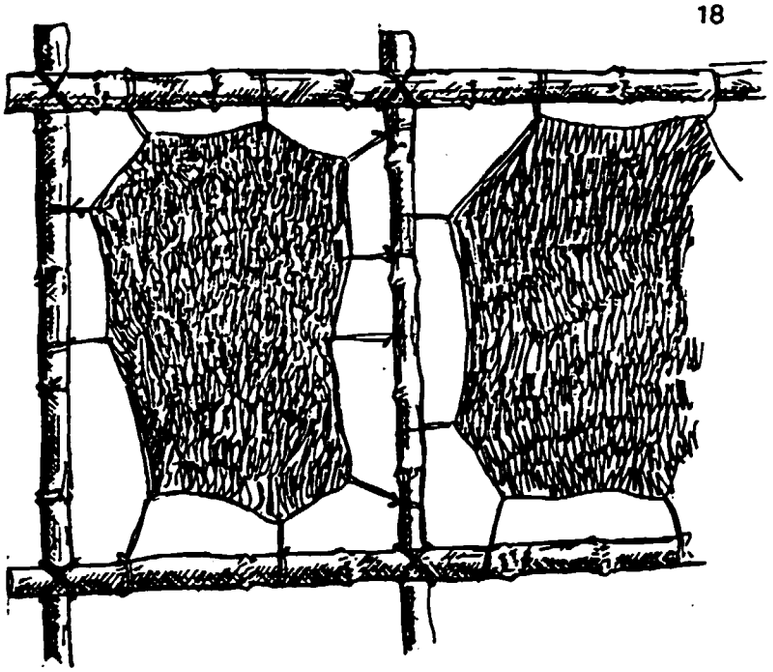

Illustration 8. (Drying Frames)

4. HOW TO TAN GOAT SKINS

To obtain leather of good quality from goat skin, proper tanning procedures must be followed.

Tanning is the process of making leather from raw hide or skin with the use of chemical substances called "tannins".

It may involve one of the following processes :

CHROME TANNING
ALUM TANNING
VEGETABLE TANNING

CHROME tanning is a short and easy process but needs imported chemicals and gives a leather with unattractive aspect that has to be dyed.

However, chrome tanned leather is more flexible, soft and supple and has good resistance to wetting, good resistance to heat and good fastness to light. That's why it will be used for shoe uppers.

ALUM tanning is easy and gives a white, soft and pliable leather. However, its use is limited due to the fact that it has poor resistance to water and some of the alum tannage will wash out to leave the leather hard and brittle when it dries again.

VEGETABLE tanning is a longer process but can be performed with local tannins and gives a leather easy to finish and which can be carved.

Vegetable tanned leather has a poor light fastness and is very sensitive to staining.

5. PREPARATION TO TANNING

The operations of preparation to tanning, called "beamhouse operations", must be done before following any of the tanning processes.

The beamhouse operations are :

- soaking
- unhairing and liming
- scudding and fleshing
- deliming
- bating
- pickling

5.1. Soaking

Soaking has two functions. The first is to remove dirt, blood, dung and curring salts. The second is to rewet the skin to a level similar to that of a freshly flayed skin.

If the skins are fresh (without preservation, coming straight from the butcher)

a. Soak the skins to wash in water for one hour,
b. Scrub all dirt, blood and manure and soak again in water containing 50 gram salt per liter for three hours,
c. drain the skins and weigh to get soaked weight,

If the skins are salted or dry salted

a. Dust of or remove most of the salt (dont reuse that salt it contains bacteries)
b. Soak in water to remove dirt, blood and manure for two hours,
c. Soak overnight in new water containing a desinfectant e.g. sodium trichlorophenate. Amount to be used 0.5 % of the weight of the skins or one gram per liter. Water should be at least four times the the weight of the skins.
d. drain the skins

If the skins are dried

a. soak the skins overnight in water containing
   an antiseptic 1g/liter
   a wetting agent 1g/liter
   The amount of water should be at least 8 times the weight of the skins.
b. the next day, drain the skins,
c. work the skins on the beam with a blunt knive, this to open the fiber structure and facilitate water penetration,
d. soak the skins in a new bath (8 times the weight of the skins) containing :
   one gram sodium sulfide per liter and
   one gram salt per liter
   soak the skins for 24 hours or more until they become soft and thouroughly wetted like a fresh skin
e. drain the skins

5.2. Unhairing and liming

There are different ways to remove the hair from the skin. The strong alkaline chemicals used are lime and sodium sulfide.

Depilation can be carried out with lime only, this is a slow process which can be fastened by help of sodium sulfide.

Unhairing with lime alone

a. Hang the skins in a pit or in a drum containing 1 kg lime per 100 liter water. If the pit is 1m x 1m x 1m = 1.000 liter, the quantity of lime should be 10 kg.
b. Three times a day (morning, noon and evening) take the skins out of the pit, mix thoroughly and hang the skins again in the lime liquor.
c. Repeat this every day until the hair can be easely removed.

If skins are frequently processed, a three pit system is recommended for unhairing.

Unhairing starts in pit n° 1 containing a twice-used liquor (old), n° 2 contains a once-used lime liquor and pit n°3 contains a fresh lime liquor (sharp). After two or three days in pit n°1, the skins are transfered to pit n°2 for two or three days and the old liquor of pit n°1 is run away and replaced by a fresh liquor.
After two or three days in pit n°2 the skins are transfered in pit n°3 and as it was twice-used pit n°2 becomes pit n° 1.
In such a circulating system, every two or three days, an old pit is run away, a new sharp pit is prepared, an a mellow pit becomes n° 1 old. (see fig. 5)

Unhairing with lime and sodium sulfide

a. Hang the skins in a pit or in a drum containing 1 kg lime par 100 liter water. If the pit is 1 x 1 x 1 m = 1,000 liter, the quantity of lime should be 10 kg.
b. add 0.1 kg sodium sulfide per 100 liter lime liquor. If the pit is 1,000 liter or 1 m^3, the amount of sodium sulfide should be 1 kg. The sodium sulfide should be dissolved in ten times its weight of water.
c. Three times a day, take the skins out of the pit, mix thoroughly and hang the skins again in the pit.
d. Repeat this every day until the hair can be easely removed.

Note : Caustic soda is sometimes used in remplacement of sodium sulfide. This is a very dangerous technique because of the risk of swelling that can destroy the skin.
The liming pits can be used several times. The activity of the reused pit will show the amount of lime and sodium sulfide to add.

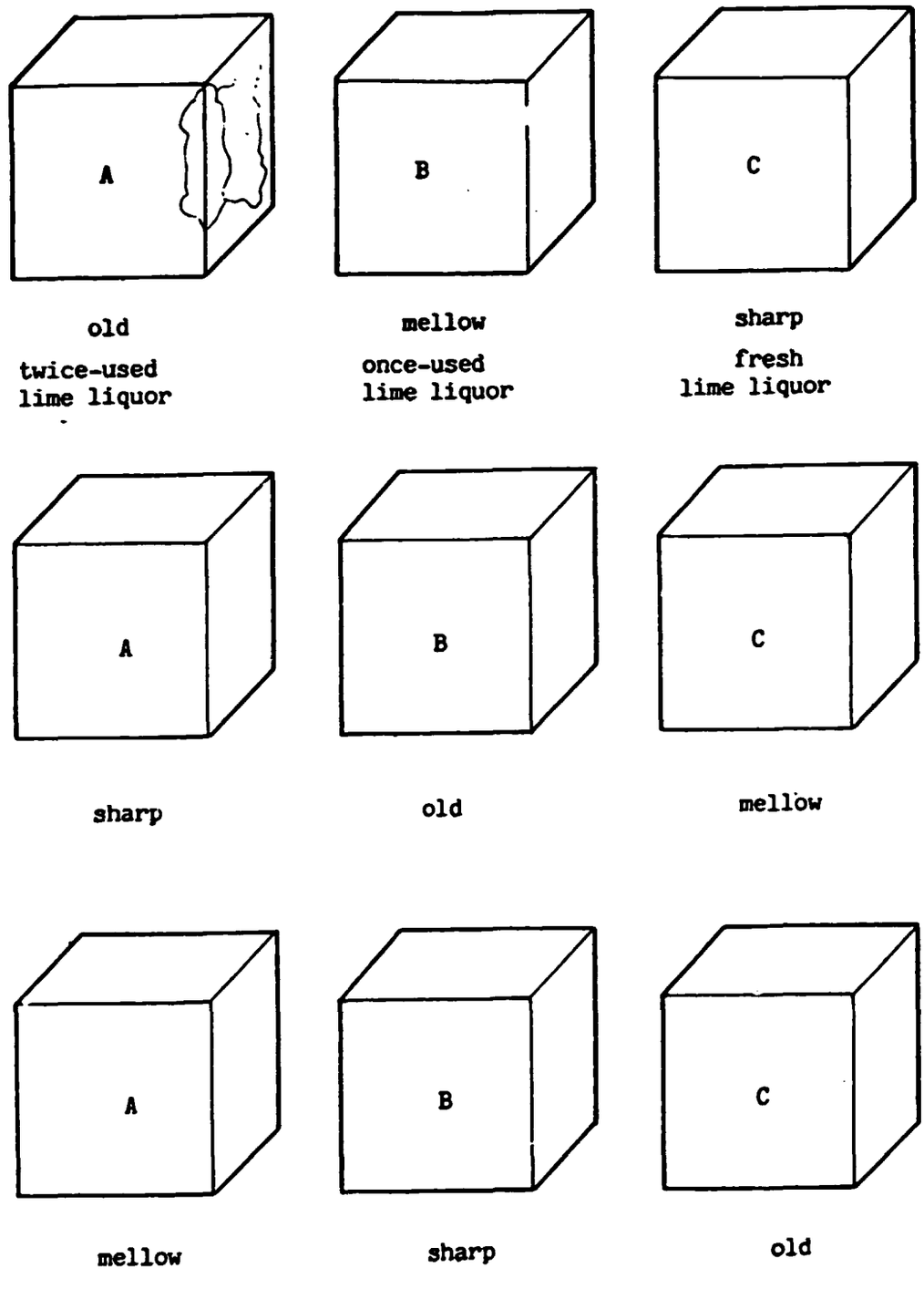

Fig. 5

Three pits unhairing system.

Unhairing by painting

a. Preparation of paint should be done the previous day of painting.
b. mix 6 kg of lime powder with 15 liter of water, dissolve 2 kg of sodium sulfide in 5 liter hot water (60°C). Add the sodium sulfide solution to the lime and mix thoroughly.
c. Pile the skins comming from soaking to drain fleshside upwards. The skins must be well drained.
d. Aplly the paint to the skins on the fleshside with a piece of sacking. Put some more paint in the neck area.
e. fold the skin in two along the backbone line. Pile the folded skins and left overnight.
f. The next morning, scud the skins on a beam and and hang them in a lime pit.

Note : save the hair, wash it and spread it to dry. If you want a thicker paint, add kaolin or chalk to become the good consistency.

5.3. Scudding and fleshing

With a blunt knife scud the hair of the skin on a beam (fig. 4) and at the same time squeeze out further unwanted material such as hair roots and dirt. When the grain of the skin is clean, put the skin again in lime water.
Fleshing is performed with a very sharp knife on the beam. After fleshing put the skin again in lime water until deliming.

7

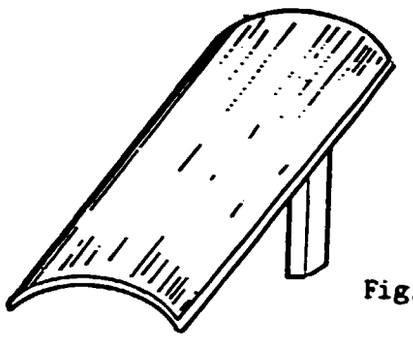

Fig. 4. Beam

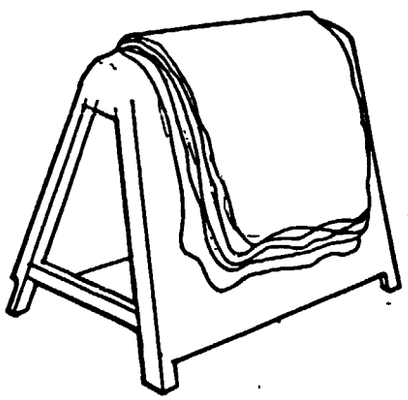

Fig. 3. Piling.

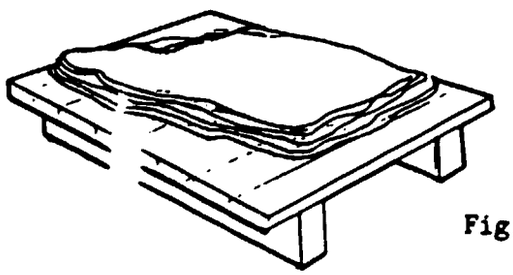

Fig. 3. Piling.

5.4. Deliming

a. Drain the skins on a wooden horse (fig.5) and weigh to record white weight
b. wash well the skins
c. soak the skins in water containing 2 % of ammonium sulfate. The amount of water should be two times the white weight of the skins
d. soak the skins very wellby moving continuously for 15 minutes, from time to time take the skins out of the liquid for a few seconds.
e. during the next two hours, mix thouroughly for five minutes, rest for half an hour, repeat.
f. check deliming with phenolphtaleine indicator. A drop of indicator placed on the cross section of a cut on a thick part of the skin must be colorless.
g. if the indicator becomes red, add 1% of lactic acid and continue soaking until colorless.

5.5. Bating

a. add in the deliming bath, 2% of bating agent and mix thouroughly during 15 minutes.
b. during the next two hours mix well during 5 minutes every half hour.
c. wash the skins and drain

5.6. Pickling

a. prepare the pickling bath with an amount of water equal to two times the white weight of the skins.
b. Weigh an amount of salt equal to 10% of the volume of water, dissolve the salt into the water and check the density, this should be 6 Baumé.
c. soak the skins in the mixture water and salt for 15 minutes. Mix well.
d. add 1.5 % sulfuric acid (based on the white weight of the skins. Dilute the acid in ten times its wt of water. Add the acid little by little while continuously stirring.

e. Be sure to soak the skins very well and mix frequently. See to it that the chemicals are absorbed evenly by the skins.

d. leave the skins overnight in the pickle bath.

Note : Pickling may be omitted for vegetable or alum tanning.

6. TANNING

6.1. Vegetable tanning

Preparation of tanning extract

For leaching of bark or pods, a set of six pits 0.7 X 0.7 X 1m. is needed. Leaching can also be performed in barrels. The pits have a double bottom in wood and a pipe goes from under the wooden bottom up to the top of the pit to syphon the liquid from one pit to the other.
The first pit (n°1) is filled with well chopped bark and covered with water. The bark is soaked during 24 h.

The next day, pit n°2 is filled with bark, the liquid of pit n°1 is syphoned in pit n°2 and pit n°1 is filled with fresh water.

On the third day, pit n°3 is filled with chopped bark, the liquid of pit n°2 is syphoned in pit n°3 and that of n°1 in n°2. Fresh water is again added to pit n°1.

On the fourth day, pit n°4 is filled with chopped bark, the liquid of n°3 is syphoned in n°4, that of n°2 in n°3 and that of n°1 in n°2. Fresh water is added in n°1.

On the fifth day, pit n°5 is filled with chopped bark, the liquid of n°4 is transfered in n°5, that of n°3 in n°4, of n°2 in n°3 and of n°1 in n°2. Usually, the bark of n° 1 is exhausted, it is removed from the pit and after drying the bark may be used as fuel. Pit n°1 becomes free for a new set of leaching.
On the sixt day, the liquid of n° 5 is collected to be stored in pit n°6. The liquid of the other pits is transfered and pit n°2 becomes free.

PAIL No. 1

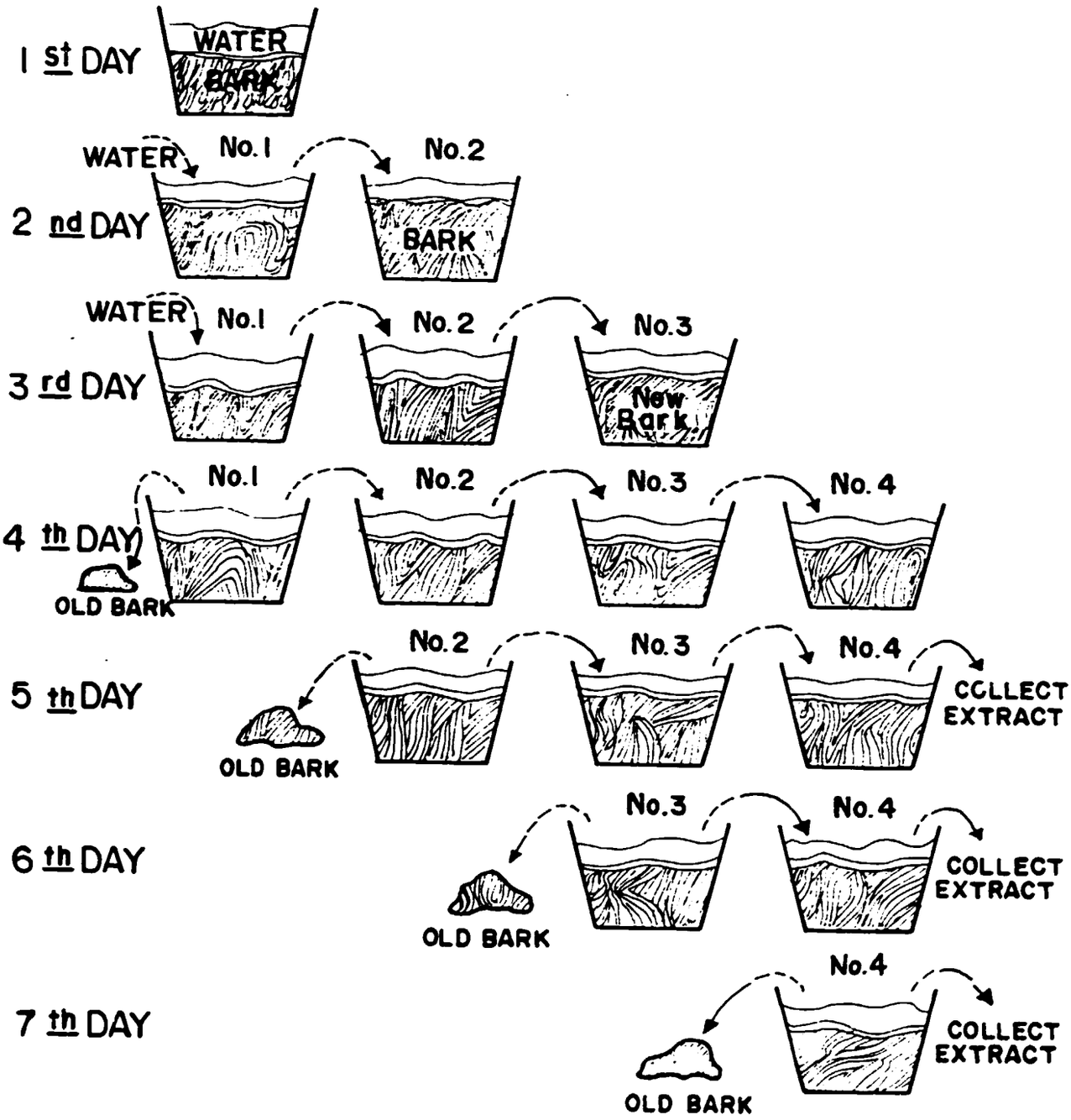
1 st DAY
WATER
BARK
WATER
No. 1
No. 2
2 nd DAY
BARK
WATER
No. 1
No. 2
No. 3
3 rd DAY
New Bark
No. 1
No. 2
No. 3
No. 4
4 th DAY
OLD BARK
No. 2
No. 3
No. 4
5 th DAY
OLD BARK
COLLECT EXTRACT
No. 3
No. 4
6 th DAY
OLD BARK
COLLECT EXTRACT
No. 4
7 th DAY
OLD BARK
COLLECT EXTRACT

Illustration 9 shows a leaching in pails.
It is impossible to syphone and transfer the totality of the liquid of each pit, more fresh water must be added in the first pit to have enough to cover all the set of pits.

Tanning

Vegetable tanning can be performed in a set of 4 to 6 pits 1 x 1 x 1m.

In the first pit mix extract and water to become a liquor of 1 Baumé density. (If the skins are not pickled prepare the liquor at 0.5 Baumé).

Hang the skins in the pit for 24 hours. At least three times during that first day, remove the skins out of the pit and mix well the liquid, hang the skins again. This is to avoid folds and to have a good contact between the skins and the tannin solution.

After 24 hours the cross section of the skins must be completely coloured by the tannin. If not, soak further to allow penetration of the tannin.

Transfer the skins in the second pit prepared by mixing extract and water to have 2 Baumé (or 1 Baumé if not pickled) In the morning, at noon time and in the evening, remove the skins, mix well the liquid and hang the skins again. After 24 hours transfer the skins in pit n°3 containing a tanning solution of Baumé 3. (2 if not pickled). Observe penetration of tannin. Complete the tanning at Baumé 4. To test end of tanning, dry a piece of leather, it must be soft when dry.

Pile the skins on a horse during 4 to 6 days.

Fatliquoring

Wash the skins shortly in fresh water, pile them to drain.

Place one skin on a clean and flat table (e.g.table covered with formica) with the grain side upwards. Stretch the skin with a slikker (brass or plastic sheet 5 to 8 mm thick, 12 cm long and 10 cm wide), this is setting out. Start setting out along the backbone to the neck and to the tail. Stretch then in the direction of the legs and bellies.

Rub on the grain with a clean cloth or sponge dipped into a mixture of one part sulfonated oil and one part water a thin layer of oil.

Turn the skin with fleshside upwards, stretch and set out and rub on the flesh two or three times the same mixture.

If the color of the skin is to dark, rub slightly on the grain before fatliquoring a 10 per cent solution of oxalic acid.

Drying

Hang the skins in a dark and well ventilated room. When half dry, stretch the skin and hang it again until completely dry. Stake the skins on a staker and pile them flat.

Finishing

Clean the flesh side with abrasive paper and apply with a sponge the following mixture :

A. 60 grams methyl cellulose (paper glue powder) add water to make a smooth paste.

B. Dissolve 25 grams of soap flakes in one liter hot water.

Mix A and B

Dry the skin, sprinkle with talc and glaze with a glass slikker.

Glaze the grain side of the skin with a glass slikker.

Chrome tanning

a. Remove the skins from the pickling bath and drain by pilling.
b. Soak into another mixture of salt and water. Water shall be two times the weight of white skins. Salt shall be 10 % of the weight of the water.
c. Soak and mix the skins in the salt brine during 15 minutes.
d. Weigh chrome powder 15% of the weight of white skins.
e. Divide the chrome powder into three equal parts and add separately into the brine at 30 minutes intervals.
f. soak and mix well the skins. When all the chrome powder is added, soak and mix well for two hours. The tannin penetration into the skin must be complete. To check it make a cut on a thick part of the skin, the cross section must be uniformly bluish-green.
g. If the chrome powder is self basifying, keep the skins overnight in the tannin solution.
h. If not, you need to make a basification.

Basification

a. Dissolve 1 per cent sodium carbonate (soda ash) in ½ liter water.
b. add slowly one third of the soda ash solution into the tanning mixture and mix well.
c. after 15 minutes, add the second portion of the soda ash solution, soak and mix well.
d. after 15 minutes, add the last portion of soda ash solution and mix well
e. keep the skins overnight in the tanning solution.

Test for completion of tannage

Do the boiling test to find out if the skins are properly and completely tanned.

The boiling test procedures are outlined bellow :

a. Cut a small piece of the leather,
b. outline its shape with a pencil on paper,
c. dip the piece of leather into boiling water for one minute.
d. compare with the previously-marked paper outline
e. If there is no shrinkage, this means that the leather is fully tanned.
f. If there is shrinkage, then soak the leather again for one hour, repeat the boiling test and continue this procedure until no more shrinkage is observed.

Ageing

a. Remove the skins from the tanning bath. Do not wring them. Pile to drain for at least 24 hours.
b. The skin is now in the so called "WET BLUE" state and can be sold as such to tanners.
c. Take care not to dry out the skins.

Finishing of chrome tanned leather

Chrome tanned leather is acid and needs to be neutralized before finishing.

Neutralization

a. Weigh the skins and record tanned or "wet blue" weight. Do not finish more than 15 skins in one time.
b. Wash the leather for ten minutes and then drain the excess water.
c. Prepare a mixture of water and sodium bicarbonate, the amount of water should be 1.5 times the weight of the tanned skins. The amount of sodium bicarbonate should be 1.5 % of the weight of the skins.

d. soak the leather into the bicarbonate solution and mix well during one hour. See to it that the chemical is evenly absorbed.
e. wash the leather.

Dyeing

a. Put water having a temperature of 60° C in a plastic container. The amount of water should be two times the weight of the leather.
b. Weigh the dyestuff on a piece of glazed paper. The amount of dyestuff should be between 2 and 3 % depending from the color.
c. Put the dyestuff in a cup and add a small quantity of boiling water. Dissolve the dyestuff into a smooth paste. Add more water and mix well.
d. transfer the solution of dye into the container and mix well.
e. Soak the skin into and draw it off from the liquid, repeat this process for 15 minutes.

Fatliquoring

a. Depending from the required softness weigh 4 to 8% of sulfonated oil,
b. add hot water and mix vigorously to obtain a good milky emulsion.
c. Put the emulsion in the dyeing bath and soak the skin for 45 minutes, mix well
d. add 0.5 % formic acid diluted with five times water
e. soak and mix for 10 minutes
f. draw the skins off from the mixture and pile for 24 hours.

Drying

a. Hang the skins in a dark and well ventilated room.
b. During drying stretch the skins and keep them as flat as possible.
c. When completely dried, rewet slightly by sprinkling water on the grain or by rubbing the grain and flesh side with a wet cloth.
d. roll the skins and keep them for 24 hours in a dark and cool room
e. stake the skins on a staker and toggle on a wooden frame.
f. dry again completely

Trimming and buffing

Trim the skins removing torn and worn edges.
Rub a coarse sand paper against the flesh side of the skins to make it clean and smooth.

Finishing

a. Weigh 25 grams of powdered milk and dissolve it in 100 grams of water.
b. With a smooth cloth wet slightly the grain of the skin
c. after drying, glaze with a glass sliker.

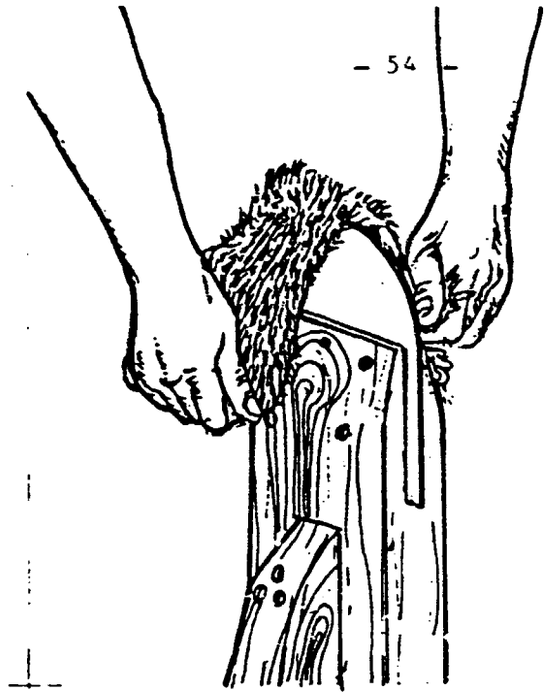

Fig. 7.

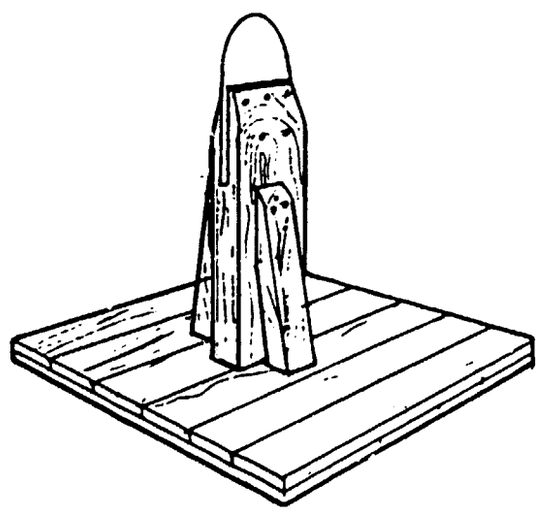

Fig. 6. Staking

6.3. Alum Dressing

Usually, potash alum (potassium aluminium sulfate) is used, but ammonium alum (ammonium aluminium sulfate) is a suitable alternative.

Pretanning

a. Dissolve 1 kilogram alum and 300 grams common salt per 10 liters water.
b. Soak the delimed skins in the alum solution for three days mixing frequently.
c. pile to drain overnight.

Tanning

a. Make a paste adding a small quantity of water to 500 grams alum and 150 grams of common salt.
b. add 4 egg yolks and 500 grams flour. Mix well.
c. place one skin on a clean table with the flesh side upwards.
d. add to the mixture enough water to obtain a paste which is easy to spread
e. apply the paste on the flesh side of the skin and rub to facilitate penetration
f. When the flesh side is well impregnated, spread a layer of paste 3 to 5mm thick
g. after 30 minutes, fold the skin along the backbone and pile it. Cover the pile with a clean wet cloth.
h. allow to stand in a dark room for 5 days, wet the cloth every morning and every evening.
i. dry the skins and brush of the remaining paste. Keep the skins for ageing for one week.

Staking

Stake the skins on the staker. Avoid overstaking the bellies.

Finishing

Rub the fleshside of the skins with a coarse sand paper No finishing of the grain is needed.

SMALL SCALE GOAT SKIN TANNERY

1. Production : 50 skins per day
   if 5 working days : 250 skins per week
   1 to 3 kg hair par day

2. Location : Where water supply of at least 5 m^3/day is available.
   Water must be iron free and sterile of hardness medium/soft, 4-12 English degrees.
   Where at least 5 m^3 waste water can and may be discharged every day.

3. Builing : Shed of 8 x 10 meters on an land area of at least 12 x 14 meters. (fig 1)
   The width of 8 m. is derived from the standard size of the frame for the roof.
   The length is a multiple of the standardized distance between two pillars.
   The land area all around the main building is needed for storage, open air working, changing room and eventually for extension.
   High of building : walls 4 m.
   top of roof 6 m.
   Roof in non corrosive material and to avoid condensation an open sky at the top of the roof is advisable (fig. 2)
   Floor : stones, tiles or concrete, may not be slippery when wet.
   To facilitate water out-flow, floor should have a double inclination from walls to center or from center to walls (fig.3)
   Open sewer or drain covered with a screen is advisable.

4. Equipments : Beamhouse

2 soaking pits 1 x 1 x 1 m.
4 liming pits 1 x 1 x 1 m.
4 barrels 200 liters
2 beams
2 fleshing knives
2 scudding knives
hooks, rope, knives, sticks and pails.

Tannery

6 leaching pits 0.7 X 0.7 X 1 M
or 6 leaching barrels 200 liters
6 tanning pits 1 x 1 x 1 m.
2 wooden horses
hand pump
pails and containers
sticks, rope
one balance or weight scale

Finishing

2 tables 1,1 m x 2 m
frames for drying and toggling nails
2 slikkers in brass or plastic
2 glasslickers
2 stakers

5. Initial investment
- building and land
- equipments
- stock of raw skins
  1,000 skins
- stock of tannin
  500 kg mangrove
  500 kg divi-divi
- stock of chemicals
  300 kg salt
  300 kg lime

200 kg sodium sulfide (§)
50 kg ammonium sulfate
50 kg bating agent (§)
20 kg lactic acid
50 kg sulfuric acid
100 kg syntan (§)
100 kg fatliquor (§)
25 kg oxalic acid (§)

6. Chemicals consumption

	daily	monthly (25 days)
salt	5 kg	125 kg
lime	15 kg	375 kg
sodium sulfide	2 kg	50 kg
ammonium sulfate	0.5kg	12.5 kg
bating agent	0.5kg	12.5 kg
lactic acid	0.5kg	12.5 kg
sulfuric acid	0.7kg	17.5 kg
syntan	1.5kg	37.5 kg
fatliquor	2 kg	50 kg
oxalic acid	0.2kg	5 kg
tannin	50 kg	1,250 kg

7. Monthly processing cost

Skins in processing	1,000 pieces x 2 $	=	2,000 JAU $
Chemicals (§§)	evaluation		1,000
Labour 2 workers			
1 helper	evaluation		1,200
tanners salary			1,500
amortizing			1,000
energy + water			100
overheads			1,000
			7,800

(§) to be imported
(§§) evaluations because no confirmation of CIF and retail prices.

6. Production output

1,000 finished skins at 5 sq.ft. = 5,000 sq.ft.

Assuming that from the 5,000 sq.ft. the grading is as follows :

1,000 first grade	at 5 JAM $	= 5,000	JAM $
3,000 medium gr.	at 4	12,000	
1,000 low grade	at 2	2,000	
		19,000	

STANDARD LAY-OUT FOR A SMALL SCALE TANNERY

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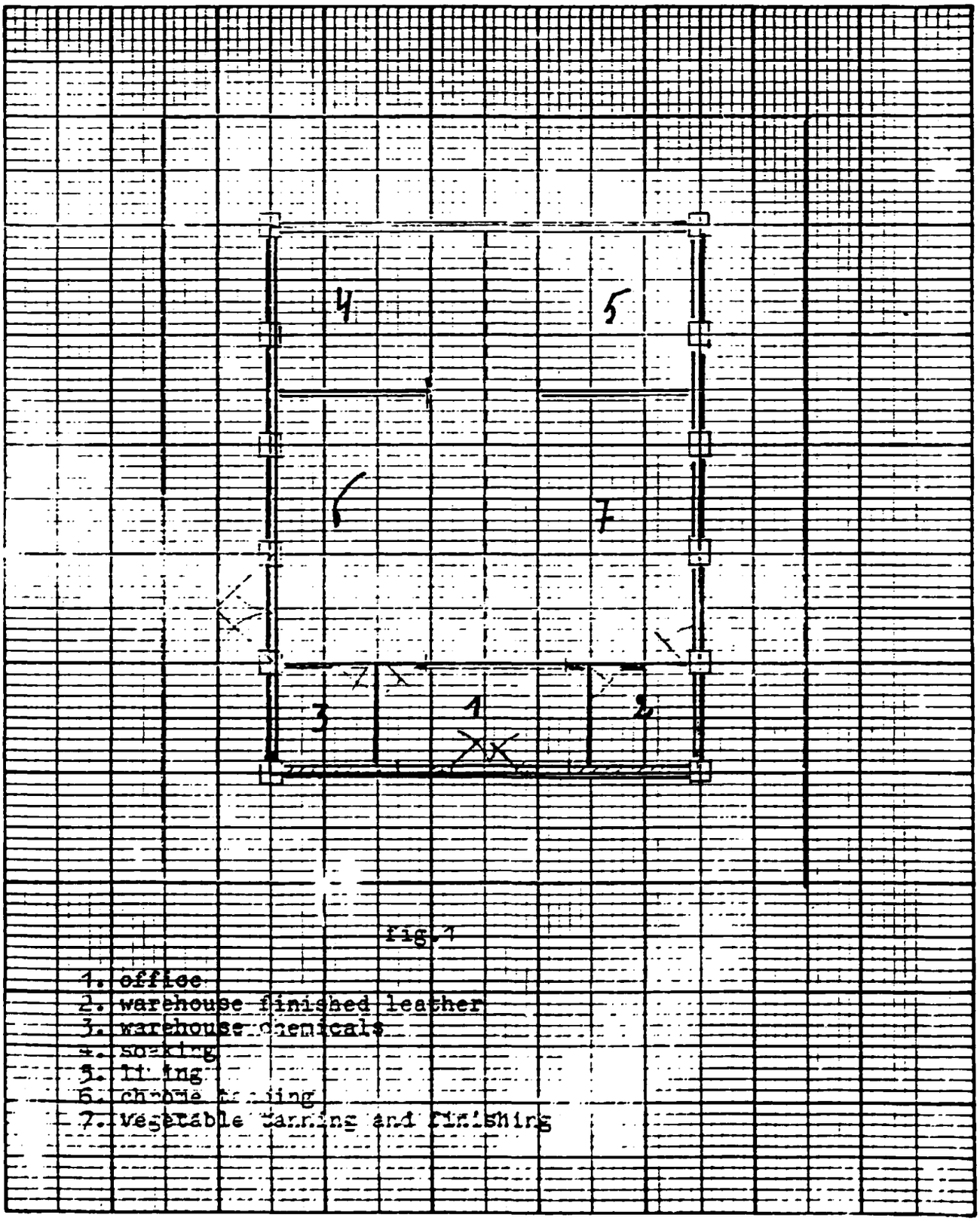

fig. 1

1. office
2. warehouse finished leather
3. warehouse chemicals
4. soaking
5. liming
6. chrome tanning
7. vegetable tanning and finishing

2cm 2mm squares

Manufactured in Jamaica for SHANE Industries Ltd

SMALL SCALE TANNERY ELEVATED VIEW

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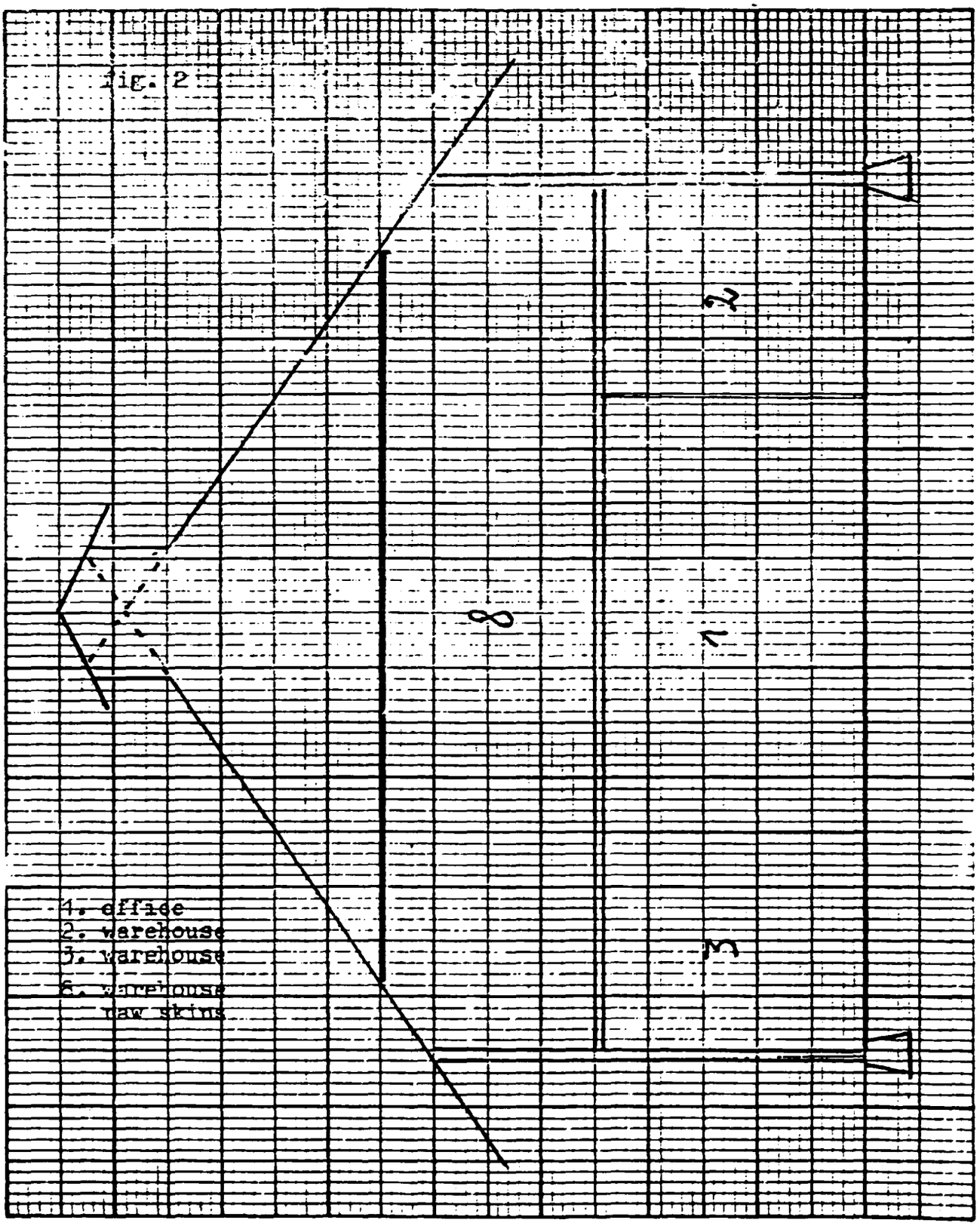

2cm/2mm squares

Manufactured in Jamaica for SHANE Industries Ltd

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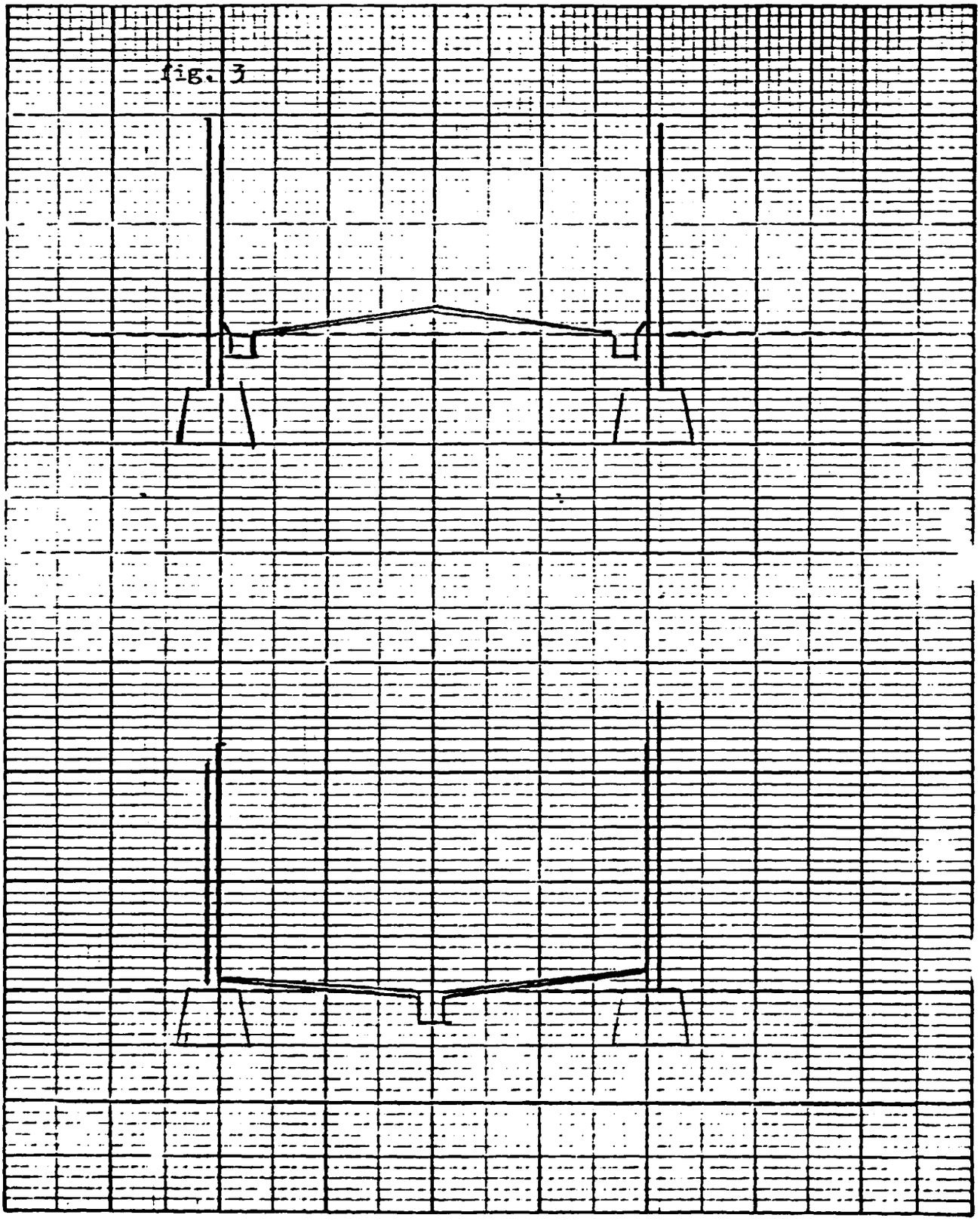

2cm 2mm squares

Manufactured in Jamaica for SHANE Industries Ltd

ANNEX 8

1. New Tanners

Beginning December 1985, Mr.Leslie JAMES, 221 Platinum avenue, Mineral Heights, May Pen started production of goat skin, Fosmore Drive in May Pen (Tel.986-4194) The building will be completed before Christmas, (Annex 7) He already has a stock of around 500 raw skins, mangroove and divi divi, local and imported chemicals.

Mrs. Jasmine DWYER, Heartease, Williamsfield, Manchester started collection and preservation of skins, also tanning on a very small scale in the Secondary School of Mile Gully where she is also making leathergoods.

Mr. Shevard HENRY, 2 Cooffee Crescent Kingston 11 intends to build a new tannery. He is proprietor of a piece of land and is implementing formalities to become a loan.

Mr. Hugh NASH, managing Director of T.J. intends to start a tannery on his propriety in Mile Gully with the help of Mr. Lloyd HYLTON of Mile Gully.

2. Leather Goods Manufacturers

Mr. Winston Williams	: Footwear and Leather Craft 7 Norman Road Kingston 16
Mr. Gerton Brown	: 27 Grape Road Kingston 11
Home Work Ltd.	: 18 Lady Musgrave Road Kingston tel. 77 921
Ital Craft Mrs C.Breakspeare-Tavares	: Twin Gates C Spring Road tel. 926 82 91
Mr. David Kirkwood	: 2 Devon Cl. Kingston tel. 92 202
Mr. Eluis Lindsay	: 9 Moreton Park Terrace Kingston 10 tel. 92 39 741
Mr. William Tavares-Finson	: 1 Belmont Road Kingston 5 tel 926 72 00 Intends to start with leather goods in Tivoli.

3. Other Persons contacted

Mr. J.Paul Thomas Managing Director Gator Ltd (Shoes)
Mr. Richard Hanna R. Hanna and Sons
Mr. Alvin Chapman Jamaican Shoe

Mrs. Deanna Mac Farlan President Small Business Association

Mrs. Wilson assistant Director Women Bureau (goat rearing)
Mr. J. Brooks European Economic Comunity in Jamaica
(goat rearing project of EEC)
Mr. D. Hochstetler Mennonite Economic Development Ass.
(goat rearing)

Mrs. Blair Social Development Commission Craft Center
Mandeville

Mr. Alton Davis Bureau of Standards (testing of leather)